FINAL

ENVIRONMENTAL ASSESSMENT

For

Marine Structure Maintenance and Pile Replacement Activities

Navy Region Northwest

Silverdale, Washington

June 2019

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Abstract

Designation:	Environmental AssessmentEnvironmental Assessment
Title of Proposed Action:	Marine Structure Maintenance and Pile Replacement Activities
Project Location:	Marine waterfront structures at NAVBASE Kitsap Bangor, NAVBASE Kitsap Bremerton, NAVBASE Kitsap Keyport, NAVBASE Kitsap Manchester, Zelatched Point, NAVSTA Everett, and NAVMAG Indian Island
Lead Agency for the EA:	Department of the Navy
Cooperating Agency:	None
Affected Region:	Jefferson County, Kitsap County, Snohomish County, Washington
Action Proponent:	Navy Region Northwest
Point of Contact:	NAVFAC NW, EV21 Attn: NEPA Planner, Maintenance and Pile Replacement Activities 1101 Tautog Circle Silverdale, WA 98315-1101 Email address: NWNEPA@navy.mil
Date:	June 2019

Abstract:

This environmental assessment (EA) evaluates the potential environmental impacts associated with the United States (U.S.) Department of the Navy's (Navy) Proposed Action to perform marine structure maintenance and pile replacement (MPR) activities over a 5-year period at six Navy locations in Puget Sound. The proposed locations include Naval Base (NAVBASE) Kitsap Bangor, NAVBASE Kitsap Bremerton, NAVBASE Kitsap Keyport, NAVBASE Kitsap Manchester, Zelatched Point, and Naval Station (NAVSTA) Everett. The Navy also proposes to perform a single year of marine structure maintenance and pile replacement at Naval Magazine (NAVMAG) Indian Island. The Proposed Action includes maintenance and repairs to piers, wharves, quay walls, and marine pile-supported structures, and repair and replacement of damaged components of these structures. The proposed MPR activities would include removal and replacement of up to 831 structurally unsound piles. General maintenance could include deck resurfacing and recoating corroded metal components. As part of the Navy's mission, maintaining facilities and readiness is a priority. Since the Proposed Action is to conduct repairs and maintenance and replace existing piles, the only alternative would be to not perform maintenance, repairs, or replace piles; therefore, the only two alternatives analyzed in this EA are the Proposed Action and the No Action Alternative. The analysis addresses potential direct and indirect impacts on airborne noise, water resources and marine sediments, biological resources, cultural resources, American Indian traditional resources, and cumulative impacts. There is no cooperating agency for this document.

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Executive Summary

Proposed Action

The United States (U.S.) Department of the Navy (Navy) proposes to conduct maintenance and repair activities at marine waterfront structures over a 5-year period at six Navy locations within Navy Region Northwest (Region). These locations, which are in the Puget Sound region of Washington State, include: Naval Base (NAVBASE) Kitsap Bangor, NAVBASE Kitsap Bremerton, NAVBASE Kitsap Keyport, NAVBASE Kitsap Manchester, Zelatched Point, and Naval Station (NAVSTA) Everett (see Figure 1-1). The Navy also proposes to perform a single year of marine structure maintenance and pile replacement at Naval Magazine (NAVMAG) Indian Island.

Maintenance and repair activities would occur at various piers, wharves, and other marine pile-supported structures. General maintenance could include deck resurfacing and recoating various corroded metal components. Repair activities would be conducted on wetwell concrete spalling, piers (including repairs to piles), and quay walls. Damaged or deteriorated components would be repaired or replaced, including guide piles systems, brow floats, pile caps, safety ladders, cable straps, camel and camel connections, and lighting. The Proposed Action includes removal and replacement of up to 831 structurally unsound piles.

Purpose of and Need for the Proposed Action

The purpose of the Proposed Action is to maintain the structural integrity of marine structures required to execute the Navy's mission at these locations. The Proposed Action is needed to ensure the Navy's marine structures at these locations continue to meet mission requirements. Long-term exposure to harsh marine environmental conditions causes deterioration to components of the existing marine infrastructure, which over time can compromise the structural integrity to the point that it can no longer serve the mission. Also, marine infrastructure is particularly susceptible to damage from unexpected impacts by watercraft vessels and weather-driven conditions.

Alternatives Considered

Since the Proposed Action is to perform marine structure maintenance and repairs, including pile replacement on existing structures, the only alternative would be to not perform maintenance, repairs, or replace piles; therefore, the only two alternatives analyzed in this Environmental Assessment (EA) are the Proposed Action and the No Action Alternative.

Under the No Action Alternative, the Marine Structure Maintenance and Pile Replacement (MPR) activities would not occur at these seven locations to maintain and/or restore structural integrity and mission readiness. The No Action Alternative would not meet the purpose of and need for the Proposed Action but represents the baseline condition against which potential environmental consequences of the Proposed Action can be compared. As required by Council on Environmental Quality (CEQ) regulations, the No Action Alternative is carried forward for analysis in this EA.

Summary of Environmental Resources Evaluated in the EA

CEQ regulations, National Environmental Policy Act (NEPA), and Navy instructions for implementing NEPA, specify that an EA should address those resource areas potentially subject to environmental impacts as a result of the Proposed Action. Based on current knowledge, the following important or potentially significant environmental issues that would be analyzed in this EA are as follows: water resources and marine sediments, airborne noise, biological resources, cultural resources, and American Indian traditional resources. Because potential impacts were considered to be negligible or nonexistent, the following resources were not evaluated in this EA: bathymetry, land use, air quality, visual resources, recreational and commercial fishing, terrestrial vegetation and wildlife, socioeconomics and environmental justice, traffic and transportation, public health and safety, and hazardous materials and waste.

Summary of Potential Environmental Consequences

The following is a summary of the potential direct, indirect, and cumulative environmental consequences of the Proposed Action:

Water Resources and Marine Sediments. Direct discharges of waste would not occur. Construction-related impacts would be limited to short-term and localized changes associated with re-suspension of bottom sediments. These changes would occur at the construction site and within areas immediately adjacent to it. Temporary impacts would not violate applicable state or federal water quality standards. The Navy would implement best management practices (BMPs) and minimization measures to prevent accidental losses or spills of construction debris. Local water quality would be improved where creosote-treated timbers are removed. Therefore, there would be no significant impact to water quality.

Sediment would be disturbed and re-suspended in the water column during pile removal and pile driving activities. However, minimal sediment disturbance is anticipated. Some degree of localized changes in sediment composition would occur. In particular, sediments that are re-suspended would be dispersed by currents and eventually re-deposited on the bottom. Project-related construction activities would not create sediment contamination concentrations or physical changes that violate applicable standards or interfere with beneficial uses of surrounding waters. Therefore, there would be no anticipated significant impacts to sediments.

Airborne Noise. The State of Washington and Jefferson, Kitsap, and Snohomish counties exempt temporary construction noise occurring between 7:00 a.m. and 10:00 p.m. from maximum permissible daytime noise levels. For this reason construction noise would occur between 7:00 a.m. and 10:00 p.m. Based on this timing, construction noise would be exempt from state and local noise regulations. Therefore, no anticipated significant impacts to airborne noise would result from implementation of proposed MPR activities.

Biological Resources. Any vegetative growth on existing piles would be removed along with the piles as they are extracted from the water. However, because piles would be replaced, a similar overall amount of surface area on which marine organisms could colonize would remain. Aquatic vegetation is limited at some locations (e.g., NAVBASE Kitsap Bremerton and NAVSTA Everett), and direct removals caused by anchor and spud placement, and removal of piles should be minimal at these project sites. Impacts to aquatic vegetation due to turbidity would be short-term, temporary, and localized. Aquatic vegetation occurs outside of the project areas and recolonization could occur quickly after pile removal and pile driving activities. The overall health and abundance of macroalgae and eelgrass would not be compromised. Therefore, there would be no anticipated significant impact to aquatic vegetation.

As with aquatic vegetation, benthic organisms attached to extracted piles would be lost, but new piles would provide equivalent attachment sites for development of the benthic community. Benthic organisms directly adjacent to piles would be lost or displaced. There would be minimal impacts to habitat and benthic organisms from turbidity caused by pile removal and installation and anchor placement and removal, but these effects would be temporary and very localized. Impacts at the population, stock, or species level would be negligible. Therefore, there would be no significant impact to benthic invertebrate populations.

In-water construction may expose fish to increased turbidity but exposure would be localized and temporary. The most significant impact to fish that could occur would be from exposure to elevated underwater noise from impact pile driving. The Navy consulted with the National Marine Fisheries Service (NMFS) under Section 7 of the Endangered Species Act (ESA) regarding effects of the Proposed Action on the Puget Sound evolutionary significant unit (ESU) Chinook salmon; Hood Canal summer-run ESU chum salmon; Puget Sound distinct population segment (DPS) steelhead; Puget Sound/Georgia Basin DPSs of bocaccio and yelloweye rockfish; southern DPS Pacific eulachon, southern DPS North American green sturgeon, and critical habitat. The Navy also consulted with the U.S. Fish and Wildlife Service (USFWS) under Section 7 of the ESA regarding effects of the Proposed Action on bull trout. To minimize exposure to noise, pile driving would be conducted during the in-water work window when juvenile salmonids (including ESA-listed salmonids) are least likely to be present. A majority of the steel pile driving would be conducted using a vibratory pile driver and a bubble curtain or other noise attenuation device would be used to attenuate noise during impact pile driving of steel piles. No impact driving would occur at NAVBASE Kitsap Bremerton. Due to the potential for disturbing contaminated sediments, the Navy would assess the use of bubble curtains at NAVBASE Kitsap Keyport and NAVSTA Everett on a project-by-project basis. All impact pile driving would occur intermittently and for an estimated maximum duration of 1.5 hours in a day for steel piles and 4 hours in a day for concrete piles. Therefore, there would be no anticipated significant impacts. The Navy made a determination under the ESA that proposed MPR activities “may affect, but are not likely to adversely affect” ESA-listed fish species and designated critical habitat. USFWS concurred with the Navy’s determination for bull trout with Letters of Concurrence signed on June 27, 2017 for NAVMAG Indian Island and on December 15, 2017 for NAVBASE Kitsap Bangor, NAVBASE Kitsap Bremerton, NAVBASE Kitsap Keyport, NAVBASE Kitsap Manchester, Zelatched Point, and NAVSTA Everett. NMFS did not concur with the Navy’s determination and concluded that the Navy’s proposed MPR activities “may affect, are likely to adversely affect” Puget Sound evolutionary significant unit (ESU) Chinook salmon; Hood Canal summer-run ESU chum salmon; Puget Sound distinct population segment (DPS) steelhead; Puget Sound/Georgia Basin DPSs of bocaccio and yelloweye rockfish; and, designated critical habitat. Section 7 consultation with NMFS was completed with the issuance of a Biological Opinion on April 5, 2019. Supporting documentation for these consultations is in Appendix G.

The action area of proposed MPR activities includes essential fish habitat (EFH) for various life stages of groundfish, coastal pelagic species, and Pacific coast salmon (Chinook, coho, and pink salmon). The Proposed Action would result in a short-term increase in underwater sound-pressure levels from vibratory and impact pile driving. Pile placement and barge anchoring would also have localized impacts on marine vegetation and the benthic epifauna/infauna within the immediate vicinity of each pile or barge anchoring site. The Proposed Action would not result in excessive levels of organic materials, inorganic nutrients, or heat, would not alter physical conditions that could adversely affect water temperature or beach contours, would not remove large woody debris, or other natural beach complexity features, nor would it affect any vegetated shallows. The Navy determined that the Proposed Action may adversely affect EFH by temporarily increasing noise in the water column during pile driving. However, with implementation of protective measures, the Proposed Action is not anticipated to result in significant impacts to EFH. The Navy consulted with NMFS under the Magnuson-

Stevens Fisheries Conservation and Management Act and NMFS concurred with the Navy's determination, but provided Conservation Recommendations to minimize effects to EFH. Consultation with NMFS was completed on April 5, 2019.

Marine birds, including the ESA-listed marbled murrelet, may be exposed to underwater and airborne noise generated by impact pile driving. Construction activities could result in the exposure of marbled murrelets to sound pressure levels above the effects threshold criteria for this species at MPR locations. The Navy consulted with USFWS under Section 7 of the ESA regarding effects on the marbled murrelet. With the implementation of monitoring protocols, pile driving shutdown if a marbled murrelet is detected, and other mitigation measures designed to reduce pile driving noise and limit the timing of pile driving, the Navy has determined that the Proposed Action "may affect, but is not likely to adversely affect" marbled murrelets. Therefore, there would be no anticipated significant impact to marbled murrelets. There is no designated critical habitat for the marbled murrelet near any of the proposed MPR activities locations; therefore, construction activities would not affect designated critical habitat for the species. Consultation with the USFWS on marbled murrelets was completed on June 27, 2017 for NAVMAG Indian Island and on December 15, 2017 for NAVBASE Kitsap Bangor, NAVBASE Kitsap Bremerton, NAVBASE Kitsap Keyport, NAVBASE Kitsap Manchester, Zelatched Point, and NAVSTA Everett, with the USFWS' letters concurring with the Navy's conclusions (Appendix G). Impacts to other marine bird species would be minimized by implementation of the mitigation measures, and there would be no significant impact to marine bird populations.

Eleven marine mammal species have the potential to occur in the vicinity of proposed MPR activities locations, and may be exposed to behavioral harassment, as defined by the Marine Mammal Protection Act (MMPA), due to elevated noise levels resulting from vibratory pile driving. The likelihood of exposure to injurious noise levels (resulting from impact pile driving) is negligible due to the small size of the affected areas and mitigation/monitoring measures that would be implemented, with the exception of harbor seals at NAVBASE Kitsap Bangor and NAVSTA Everett. At these locations, some exposure of harbor seals to injurious noise levels is possible. The Navy would implement a monitoring program and pile driving shutdown zones for marine mammals and other mitigation measures to reduce the likelihood of injury or behavioral harassment. Based on exposure estimates at each location during the 5 years of proposed MPR activities, the Navy requested a Letter of Authorization (LOA) for incidental take of marine mammals. NMFS published a notice of receipt of the LOA application in the Federal Register on August 4, 2017, and published a Final Rule in the Federal Register on April 17, 2019 (Appendix G). The Southern Resident killer whale and some populations of the humpback whale are listed as threatened or endangered under the ESA. The Navy consulted with NMFS under Section 7 of the ESA regarding effects of the Proposed Action. The Navy made a determination under the ESA that that the proposed MPR activities "may affect, and are not likely to adversely affect" humpback whale species, Southern Resident killer whale, and Southern Resident killer whale designated critical habitat. NMFS did not concur with the Navy's determinations and concluded that the Navy's proposed MPR activities "may affect, are likely to adversely affect" humpback whale species, Southern Resident killer whale, and Southern Resident killer whale designated critical habitat. While construction activities may result in a "take" of individual marine mammals as defined by the MMPA, any impacts at the population, stock, or species level would be negligible. Therefore, there would be no significant impact to marine mammal populations. The Navy's consultation with NMFS regarding ESA-listed marine mammals and critical habitat was completed with the issuance of a Biological Opinion on April 5, 2019 (Appendix G).

Cultural Resources. No archaeological or historic properties would be affected by construction or repair at the proposed MPR activities locations. All ground-disturbing activities, including in-water construction, would occur in previously disturbed areas. At NAVBASE Kitsap Keyport, NAVBASE Kitsap Manchester, and NAVMAG Indian Island, there are no resources listed in or eligible for listing in the National Register of Historic Places (NRHP) within the area of potential effect. Although there are NRHP-listed or eligible historic properties at NAVBASE Kitsap Bangor, NAVBASE Kitsap Bremerton, and Zelatched Point, the repairs and replacement activities would not adversely affect any of these resources. The Navy has concluded that there would be no historic properties adversely affected; therefore, there would be no significant impact to cultural resources as a result of the Proposed Action. In compliance with Section 106 of the NHPA, the Navy consulted with the State Historic Preservation Officer (SHPO) and federally recognized tribes regarding the proposed MPR activities locations. Because NAVBASE Kitsap Bremerton includes a National Historic Landmark, the Navy also notified the National Park Service. Appendix E contains copies of consultation documents. The Navy's consultations with SHPO were completed on May 31, 2017 for NAVBASE Kitsap Bangor, NAVBASE Kitsap Keyport, NAVBASE Kitsap Manchester, Zelatched Point, and NAVSTA Everett; on August 2, 2017 for NAVBASE Kitsap Bremerton; and, on April 8, 2019 for NAVMAG Indian Island.

American Indian Traditional Resources. There would be no significant impact to American Indian traditional resources due to the Proposed Action. For all seven sites, there would be minimal loss of benthic invertebrates and their environment as replacement piles would be installed near the location of removed piles. The increase in barge traffic generated by the proposed MPR activities would be negligible when compared to existing marine traffic in the shared waterways of the Salish Sea. Construction activities would not result in discharge to shellfish beds utilized for tribal harvesting or affect tribal access to treaty protected resources at each site. The in-water work window would minimize impacts to juvenile salmonids; therefore, there would be no significant impact to salmonids or benthic invertebrates. The Navy consulted with potentially affected federally recognized tribes (Appendix F), as required by Executive Order (EO) 13175 *Consultation and Coordination with Indian Tribal Governments*, Department of Defense (DoD) policy, and Navy instructions. The Tribes expressed no objections to the proposed MPR activities at NAVSTA Everett. Tribes with treaty-protected resources at NAVBASE Kitsap Bangor, NAVBASE Kitsap Bremerton, NAVBASE Kitsap Keyport, NAVBASE Kitsap Manchester, Zelatched Point, and NAVMAG Indian Island requested that additional project details be provided as they become available in the future. The Suquamish Tribe provided comments on the Revised Draft EA, but determined it was not necessary to meet with the Navy to discuss these comments. As part of continued engagement, the Navy will annually provide summaries of planned pile repair and replacement projects to the Tribes for information and coordination. Accordingly, no significant impacts to American Indian traditional resources would occur with implementation of the Proposed Action.

Public Involvement

The Navy made the Draft EA available for public review and comment for 30 days starting on August 17, 2017, with a notice of availability (NOA) published in the local newspapers (Kitsap Sun, Peninsula Daily News, and Everett Herald). The Draft EA was posted at http://go.usa.gov/tAr4 for review and comment. No comments were received during the public review period.

The Navy made the Revised Draft EA available for a 15-day public review and comment period from May 3, 2019 to May 17, 2019, with an NOA published in local newspapers (Kitsap Sun, Peninsula Daily News, Everett Herald, and Port Townsend Leader). The Revised Draft EA was posted on the internet at https://navfac.navy.mil/NWNEPA for review and comment. The Navy received one comment letter from the Suquamish Tribe. Comments contained in this letter were thoroughly analyzed, and where appropriate, changes have been incorporated into the Final EA.

Environmental Assessment
Marine Structure Maintenance and Pile Replacement Activities
Navy Region Northwest, Silverdale, Washington

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Appendices

Abbreviations and Acronyms

Acronym	*Definition*
°C	degrees Celsius
°F	degrees Fahrenheit
ACZA	ammoniacal copper zinc arsenate
APE	area of potential affect
ATSDR	Agency for Toxic Substances and Disease Registry
BA	Biological Assessment
BiOp	Biological Opinion
BMP	best management practices
CAA	Clean Air Act
CCD	Coastal Consistency Determination
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CSL	Cleanup Screening Levels
CV	coefficient of variation
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
DAHP	Department of Archaeological and Historic Preservation
dB	decibel
dB re 1 μPa	decibels referenced at 1 micropascal
dBA	A-weighted decibel
DIPs	demographically independent populations
DO	dissolved oxygen
DoD	Department of Defense
DPS	distinct population segment
EA	Environmental Assessment
EDNA	environmental designation for noise abatement
EFH	Essential Fish Habitat
EHW-1	Explosives Handling Wharf 1
EHW-2	Explosives Handling Wharf 2
EIS	Environmental Impact Statement
EO	Executive Order
ESA	Endangered Species Act
ESU	evolutionarily significant unit
FMP	Fishery Management Plan
FONSI	Finding of No Significant Impact
FR	Federal Register
ft.	foot/feet
HAPC	Habitat Areas of Particular Concern
HCCC	Hood Canal Coordinating Council
HDPE	high density polyethylene

Abbreviations and Acronyms

Acronym	*Definition*
Hz	hertz
IHA	Incidental Harassment Authorization
in	inch/inches
INRMP	Integrated Natural Resources Management Plan
K/B	Keyport – Bangor
kHz	kilohertz
km	kilometer
L_{max}	maximum sound level
LOA	Letter of Authorization
LWI/SPE	Land-Water Interface/Service Pier Extension
m	meter/meters
MBTA	Migratory Bird Treaty Act
mg/L	milligrams/liter
MHHW	mean higher high water
mi	mile/miles
MLLW	mean lower low water
mm	millimeters
MMPA	Marine Mammal Protection Act
MPN	most probable number
MPR	Marine Structure Maintenance and Pile Replacement
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
NAGPRA	Native American Graves Protection and Repatriation Act
NAVBASE	Naval Base
NAVMAG	Naval Magazine
NAVSTA	Naval Station
Navy	U.S. Department of the Navy
NEPA	National Environmental Policy Act
NHL	National Historic Landmark
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOA	notice of availability
NOAA	National Oceanic and Atmospheric Administration
NRHP	National Register of Historic Places
NTU	Nephelometric Turbidity Unit
NUWC	Naval Undersea Warfare Center
PCE	Primary Constituent Elements
PFMC	Pacific Fisheries Management Council
PNPTT	Point No Point Treaty Tribes
PSB	port security barrier
PTS	permanent threshold shift
PVC	polyvinyl chloride

Abbreviations and Acronyms

Acronym	*Definition*
RDT&E	research, development, testing and evaluation
Region	Navy Region Northwest
RMS	root mean square
ROD	Record of Decision
ROI	Region of Influence
ROV	remotely operated vehicle
sec	second
SECNAVINST	Secretary of the Navy Instruction
SEL	sound exposure level
SHPO	State Historic Preservation Officer
SMS	Sediment Management Standards
SPCC	Spill Prevention Control and Countermeasures
SPL	sound pressure level
sq. mi	square mile(s)
SQS	Sediment Quality Standards
TMDL	total maximum daily load
TTS	temporary threshold shift
U.S.C.	United States Code
U&A	Usual and Accustomed
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
WAC	Washington Administrative Code
WCQ	Water Quality Certification
WDFW	Washington Department of Fish and Wildlife
WDOE	Washington Department of Ecology
WRA	Waterfront Restricted Area
WSDOT	Washington State Department of Transportation

1 Purpose of and Need for the Proposed Action

1.1 Introduction

The United States (U.S.) Department of the Navy (Navy) proposes to conduct maintenance and repair activities on marine waterfront structures over a 5-year period at six Navy locations within Navy Region Northwest (Region). These locations, which are in the Puget Sound region of Washington State, include: Naval Base (NAVBASE) Kitsap Bangor, NAVBASE Kitsap Bremerton, NAVBASE Kitsap Keyport, NAVBASE Kitsap Manchester, Zelatched Point, and Naval Station (NAVSTA) Everett. The Navy also proposes to perform a single year of marine structure maintenance and pile replacement at Naval Magazine (NAVMAG) Indian Island.

Maintaining these structures is vital to sustaining the Navy's mission and ensuring readiness. The Navy has an ongoing waterfront inspection program to identify deficiencies in marine structures. Identified deficiencies are prioritized and then programmed for design and construction. Future waterfront inspections, as well as damage caused by severe weather events and/or incidents caused by vessels, would result in emergent marine structure repairs. This Environmental Assessment (EA) analyzes proposed maintenance and repair activities at these locations for a 5-year period (July 2019 through July 2024).

Maintenance and repair activities would occur at various piers, wharves, and other marine pile-supported structures. General maintenance could include deck resurfacing and recoating various corroded metal components. Repair activities would be conducted on wetwell concrete spalling, piers (including repairs to piles), and quay walls. Damaged or deteriorated components would be repaired or replaced, including guide piles systems, brow floats, pile caps, safety ladders, cable straps, camel and camel connections, and lighting. The Proposed Action includes removal and replacement of up to 831 structurally unsound piles. The existing piles are of various sizes, material (e.g., concrete, treated timber, steel), age, and at various stages of deterioration. A complete list of known and estimated piles to be replaced is provided in Appendix A.

The Navy has prepared this EA in accordance with the National Environmental Policy Act (NEPA), as implemented by the Council on Environmental Quality (CEQ) Regulations and Navy regulations for implementing NEPA.

1.2 Location

The Proposed Action for maintenance and repair activities at marine waterfront structures would occur at NAVBASE Kitsap Bangor, NAVBASE Kitsap Bremerton, NAVBASE Kitsap Keyport, NAVBASE Kitsap Manchester (all located in Kitsap County), Zelatched Point (located in Jefferson County), NAVSTA Everett (located in Snohomish County), and NAVMAG Indian Island (located in Jefferson County) (Figure 1-1). A description of the location and mission of each of these locations is provided below.

1.2.1 Naval Base Kitsap Bangor

NAVBASE Kitsap Bangor is located north of the community of Silverdale in Kitsap County on the Hood Canal (Figure 1-1). NAVBASE Kitsap Bangor supports and maintains a TRIDENT submarine squadron and other ships homeported or moored at the installation, and maintains and operates administrative and personnel support facilities including security, berthing, messing, and recreational services.

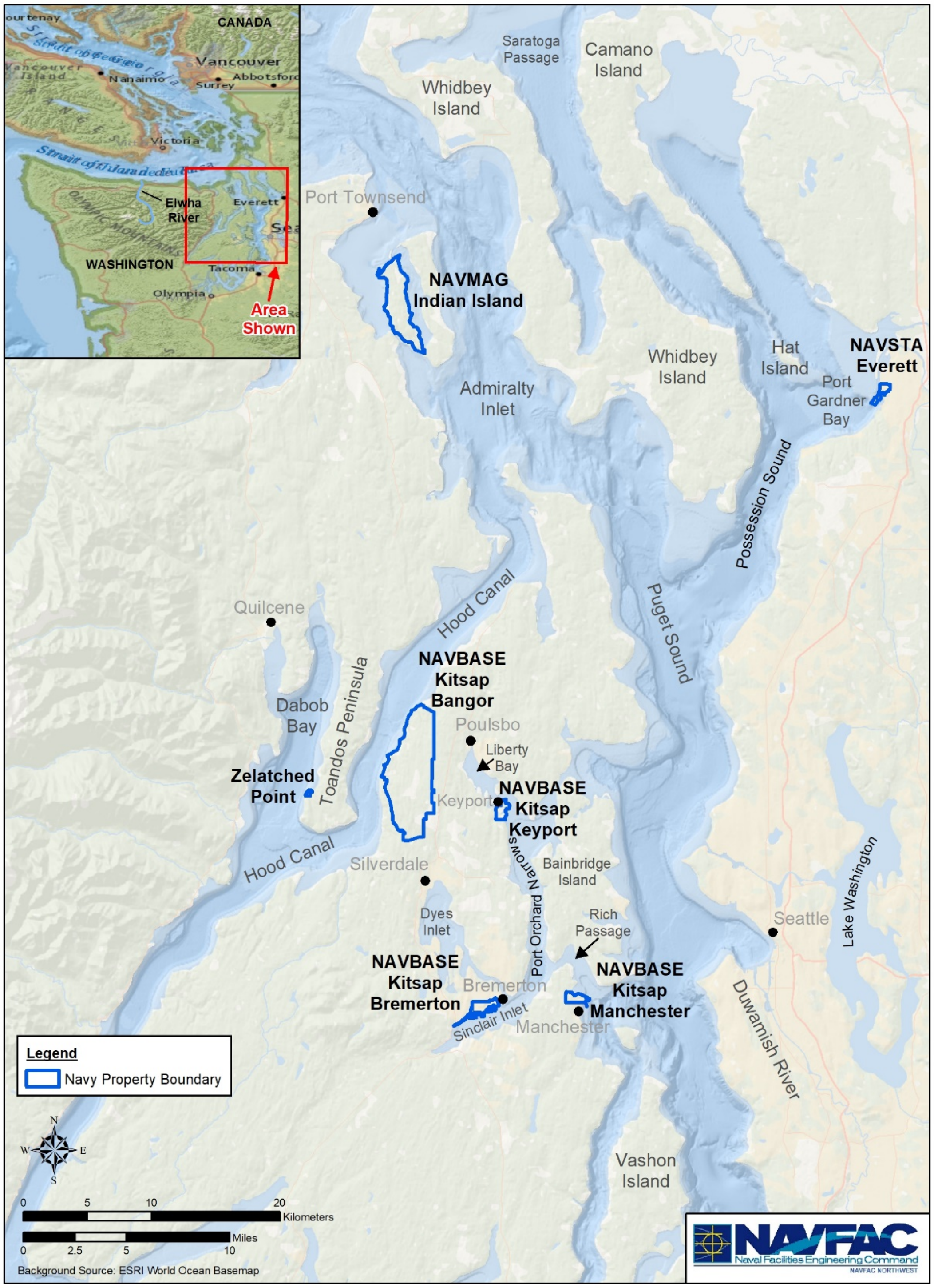

Figure 1-1. Navy Locations Included in Marine Structures Maintenance and Pile Replacement Activities

NAVBASE Kitsap Bangor occupies approximately 5 miles (mi) of shoreline on Hood Canal. There are eight pile-supported structures at NAVBASE Kitsap Bangor waterfront: Carderock Pier, Service Pier, Keyport Bangor (K/B) Dock, Delta Pier, Marginal Wharf, two Explosives Handling Wharfs (EHW-1 and EHW-2), and the Magnetic Silencing Facility Pier. A detailed figure showing marine structures is provided in Section 2.4. There are two areas in which vessel traffic is restricted along the Bangor waterfront, Naval Restricted Areas 1 and 2 (Title 33 of the CFR, Part 334.1220 [33 CFR 334.1220]). Naval Restricted Area 1 covers the area to the north and south along Hood Canal encompassing the Bangor waterfront. The regulation associated with Naval Restricted Area 1 [33 CFR 334.1220(a)(3)(i)] states that, “no person or vessel shall enter this area without permission from the Commander, Naval Submarine Base Bangor, or his/her authorized representative.” Naval Restricted Area 2 encompasses the waters of Hood Canal within a circle 1,000 yards (3,000 feet [ft.]) in diameter centered at the north end of NAVBASE Kitsap Bangor and partially overlapping Naval Restricted Area 1. The regulation associated with Naval Restricted Area 2 [33 CFR 334.1220(a)(3)(ii)D] states that navigation will be permitted within that portion of this circular area not lying within Restricted Area 1 at all times except when magnetic silencing operations are in progress.

1.2.2 Naval Base Kitsap Bremerton

NAVBASE Kitsap Bremerton is located on the north side of Sinclair Inlet within the city of Bremerton in Kitsap County (Figure 1-1). The eastern portion of the base is a fenced, high-security area known as the Controlled Industrial Area. Puget Sound Naval Shipyard and Intermediate Maintenance Facility is the major tenant command of NAVBASE Kitsap Bremerton. NAVBASE Kitsap Bremerton contains multiple dry docks, piers, and wharfs and is capable of overhauling and repairing, constructing, deactivating, and drydocking all types and sizes of ships while also serving as the homeport for an aircraft carrier and other Navy vessels.

NAVBASE Kitsap Bremerton occupies approximately 3 mi of shoreline along Sinclair Inlet. There are 13 pile-supported structures at the installation: Piers 3, 4, 5, 6, 7, and 9, as well as Piers B, C, and D, and a number of mooring piers (A, E, F, and G). A detailed figure showing marine structures is provided in Section 2.4. There are two designated naval restricted areas at the Bremerton waterfront (33 CFR 334.1240). Within Naval Restricted Area No. 1 [33 CFR 334.1240(a)(3)(i)], “No vessel of more than, or equal to, 100 gross tons shall enter this area [identified in 33 CFR 1240(a)(1)] or navigate therein without permission from the enforcing agency [Commander, Navy Region Northwest and designated agents], except Washington State Ferries on established routes.” Naval Restricted Area No. 2 “is for the exclusive use of the United States Navy. No person, vessel, craft, article or thing, except those under supervision of military or naval authority shall enter this area [Naval Restricted Area No. 2, as defined in 33 CFR 1240(a)(2)] without permission from the enforcing agency [Commander, Navy Region Northwest, and such agencies and persons as he/she shall designate].” See 33 CFR 334.1240(3)(ii).

1.2.3 Naval Base Kitsap Keyport

NAVBASE Kitsap Keyport is located on the eastern shore of Kitsap Peninsula abutting Liberty Bay, a branch of Puget Sound (Figure 1-1). It is approximately 15 miles (mi) due west of Seattle and 10 mi north of the city of Bremerton. The nearest communities to NAVBASE Kitsap Keyport are Keyport, Silverdale, and Poulsbo. Naval Undersea Warfare Center (NUWC) Keyport is the major tenant command at NAVBASE Kitsap Keyport and provides cold-water testing and evaluation for undersea warfare systems. In this capacity, Keyport provides depot maintenance and repair, in-service engineering, and fleet industrial support for torpedoes and other undersea warfare systems including mobile mines, unmanned underwater vehicles, and countermeasures. Zelatched Point on Dabob Bay and K/B Dock at NAVBASE Kitsap Bangor also support NUWC Keyport's mission.

NAVBASE Kitsap Keyport occupies approximately 1.5 mi of shoreline on Liberty Bay. There is no designated Naval restricted area at NAVBASE Kitsap Keyport, which has one pier located in the northern portion of the installation. A detailed figure showing marine structures is provided in Section 2.4.

1.2.4 Naval Base Kitsap Manchester

NAVBASE Kitsap Manchester is located on Orchard Point, abutting Clam Bay off Rich Passage to the north and the main basin of Puget Sound to the east (Figure 1-1). It is located in the village of Manchester, approximately 4 mi due east of Bremerton in southern Kitsap County. NAVBASE Kitsap Manchester provides bulk fuel and lubricant support to area Navy afloat and shore activities.

NAVBASE Kitsap Manchester occupies approximately 2 mi of shoreline along Clam Bay and Puget Sound. There are two piers located at the installation: a fuel pier, which provides for offload of bulk fuel from tanker ships, and a finger pier, which is utilized for mooring of small boats. A detailed figure showing marine structures is provided in Section 2.4. There is one designated Naval Restricted Area at NAVBASE Kitsap Manchester identified in 33 CFR 334.1244(a). Pursuant to 33 CFR 334.1244(b), "No person, vessel, craft, article or thing except those under the supervision of the military or naval authority shall enter the area [identified in 33 CFR 334.1244(a)] without the permission of the enforcing agency or his/her designees [in this case, Commander, Navy Region Northwest]. The restriction shall apply during periods when a ship is loading and/or pier operations preclude safe entry. The restricted periods would be identified by the use of quick-flashing beacon lights, which are mounted on poles at the end of the main fuel pier on the south side of Orchard Point at the entrance of Rich Passage. Entry into the area is prohibited when the quick-flashing beacons are in a flashing mode."

1.2.5 Zelatched Point

Zelatched Point is located on the southwestern end of the Toandos Peninsula on Dabob Bay within Hood Canal in Jefferson County (Figure 1-1). It is approximately 4 mi west of the Bangor waterfront on the western facing portion of Toandos Peninsula. The Toandos Peninsula is primarily rural-residential. Zelatched Point supports test and evaluation range activities conducted by NUWC Keyport within Dabob Bay. The Zelatched Point facility occupies approximately 0.4 mi of shoreline along Dabob Bay and contains one pier for range craft. A detailed figure is provided in Section 2.4. There is no designated Naval Restricted Area at Zelatched Point.

1.2.6 Naval Station Everett

NAVSTA Everett is located in the City of Everett in Snohomish County (Figure 1-1). The station is bordered to the north by the mouth of the Snohomish River, to the south and west by Port Gardner Bay, and to the east by East Waterway. The Port of Everett Marina is located to the north and the Port of Everett shipping terminals and former Kimberly-Clark Paper Mill are located southeast of the station. The station provides homeport ship berthing, industrial support, and a Navy administrative center.

NAVSTA Everett occupies approximately 1.9 mi of shoreline along Port Gardner and the East Waterway. There are nine pile-supported structures at NAVSTA Everett installation: five piers (A, B, C, D, and E), two wharfs (North and South), a recreational marina, and a small boat launch. A detailed figure showing marine structures is provided in Section 2.4. There is one designated Naval Restricted Area within the waters of Port Gardner and East Waterway surrounding NAVSTA Everett. The restricted area is designated in 33 CFR 334.1215(a). Pursuant to 33 CFR 334.1215(b), "All persons and vessels are prohibited from entering the waters within the restricted area for any reason without prior written permission from the Commanding Officer of the Naval Station Everett. Mooring, anchoring, fishing and/or recreational boating shall not be allowed within the restricted area without prior written permission from the Commanding Officer, Naval Station Everett."

1.2.7 Naval Magazine Indian Island

NAVMAG Indian Island is located near Port Hadlock in Jefferson County, Washington, southeast of Port Townsend, at the northeast corner of the Olympic Peninsula (Figure 1-1). The island is approximately five miles long and 1.25 miles wide, and comprises approximately 2,716 acres. Indian Island is located between Port Townsend Bay and Kilisut Harbor. The federal government owns the island and provides an easement on a small portion of the southern extent of the island to Washington State Department of Transportation for access to Marrowstone Island along State Route 116. NAVMAG Indian Island is the west coast ammunition ordnance storage center supporting the U.S. Navy Pacific Fleet.

NAVMAG Indian Island occupies approximately 12 mi of shoreline within Port Townsend Bay. There are two piers located at the installation, but only the Ammunition Wharf is addressed in this Environmental Assessment. Its primary mission is to load, offload, and provide storage and logistics management for ordnance used on Navy vessels. A detailed figure showing the Ammunition Wharf is provided in Section 2.4. There is one designated Naval Restricted Area at NAVMAG Indian Island identified in 33 CFR 334.1270(a). Pursuant to 33 CFR 334.1270 (b), "No person, vessel, craft, article or thing shall enter the area [identified in 33 CFR 334.1270(a)] without permission from the enforcing agency. [in this case, Commander, Navy Region Northwest]. The restriction shall apply during periods when ship loading and/or pier operations preclude safe entry. The periods will be identified by flying a red flag from the ship and/or pier."

1.3 Purpose of and Need for the Proposed Action

The purpose of the Proposed Action is to maintain the structural integrity of marine structures required to execute the Navy's mission at these locations. The Proposed Action is needed to ensure the Navy's marine structures at these locations continue to meet mission requirements. Long-term exposure to harsh marine environmental conditions causes deterioration to components of the existing marine infrastructure, which over time can compromise the structural integrity to the point that it can no longer serve the mission. Also, marine infrastructure is particularly susceptible to damage from unexpected impacts by watercraft vessels and weather-driven conditions.

1.4 Scope of Environmental Analysis

This EA includes an analysis of potential environmental impacts associated with the Proposed Action and the No Action Alternative. The environmental resource areas analyzed in this EA include: noise, water resources and marine sediments, biological resources, cultural resources, and American Indian traditional resources.

1.5 Relevant Laws and Regulations

The Navy has prepared this EA based upon federal and state laws, statutes, regulations, and policies that are pertinent to the implementation of the Proposed Action, including the following:

- NEPA (42 United States Code [U.S.C.] sections 4321-4370h), requires an environmental analysis for major federal actions that have the potential to significantly impact the quality of the human environment
- CEQ regulations for implementing the Procedural Provisions of NEPA (40 Code of Federal Regulations [CFR] parts 1500-1508)
- Navy regulations for implementing NEPA (32 CFR part 775), which provides Navy policy for implementing CEQ regulations and NEPA
- Clean Water Act (CWA) (33 U.S.C. section 1251 *et seq*.)
- Rivers and Harbors Act (RHA) (33 U.S.C. 401 *et seq*.)
- Coastal Zone Management Act (CZMA) (16 U.S.C. section 1451 *et seq*.)
- National Historic Preservation Act (NHPA) (54 U.S.C. section 300101 *et seq*.)
- Endangered Species Act (ESA) (16 U.S.C. section 1531 *et seq*.)
- Magnuson-Stevens Fishery Conservation and Management Reauthorization Act (16 U.S.C. section 1801 *et seq.*)
- Marine Mammal Protection Act (MMPA) (16 U.S.C. section 1361 *et seq*.)
- Migratory Bird Treaty Act (MBTA) (16 U.S.C. section 703-712)
- Bald and Golden Eagle Protection Act (16 U.S.C. section 668-668d)
- Comprehensive Environmental Response, Compensation, and Liability Act (42 U.S.C. section 9601 et seq.)
- Executive Order (EO) 12088, Federal Compliance with Pollution Control Standards
- EO 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations
- EO 13045, Protection of Children from Environmental Health Risks and Safety Risks
- EO 13175, Consultation and Coordination with Indian Tribal Governments

A description of the Proposed Action's consistency with these laws, policies and regulations, as amended, as well as the names of regulatory agencies responsible for their implementation, is presented in Chapter 12 (Table 12-1).

1.6 Public and Agency Participation and Intergovernmental Coordination

Regulations from the Council on Environmental Quality (40 CFR 1506.6) direct agencies to involve the public in preparing and implementing their NEPA procedures.

- The Navy made the Draft EA available for public review and comment with a notice of availability (NOA) published in the local newspapers (Kitsap Sun, Peninsula Daily News, and Everett Herald) for a 30-day review period. The Draft EA was posted on August 17, 2017, at http://go.usa.gov/tAr4 for review and comment. No comments were received during the public review period.

- The Navy made the Revised Draft EA available for a 15-day public review and comment period from May 3, 2019 to May 17, 2019, with an NOA published in local newspapers (Kitsap Sun, Peninsula Daily News, Everett Herald, and Port Townsend Leader). The Revised Draft EA was posted on the internet at https://navfac.navy.mil/NWNEPA for review and comment. The Navy received one comment letter from the Suquamish Tribe. Comments provided by the Suquamish Tribe included:
    - Without any proposed order for which facilities will conduct their activities (over the 5 year period), it is impossible to further identify the likely impacts of construction on Tribal fishers and fisheries.
    - Without the use of noise attenuating devices, fish in these areas [Keyport, Bremerton, and Manchester] may be heavily impacted from pile driving and vibratory installation.
    - It is unclear whether there will be an increase in total in-water pile area resulting in a permanent loss of habitat for marine biota. These impacts need to be further discussed with the Tribe and if there is a loss of benthic habitat, these impacts should be mitigated.
    - Because construction activities are ambiguous and have the potential to effect Tribal Treaty fishery activities, the Tribe requests an opportunity to review more project specific information, including an annual, finalized list of activities and notification 30 days prior to the start of construction activities to provide the Tribe an opportunity to comment and/or concur.

  These comments were thoroughly analyzed, and where appropriate, changes have been incorporated into the Final EA.
- The Final EA and decision document will be made available to the public. The NOA will be published in local newspapers, and the Final EA and decision document will be posted on the internet.

To comply with Section 106 of the NHPA, the Navy consulted with the Washington State Historic Preservation Officer (SHPO) and affected tribes on the Proposed Action (Appendix E). The Navy's consultations with SHPO were completed on May 31, 2017 for NAVBASE Kitsap Bangor, Keyport, Manchester, Zelatched Point, and NAVSTA Everett; on August 2, 2017 for NAVBASE Kitsap Bremerton; and, on April 8, 2019 for NAVMAG Indian Island. Because NAVBASE Kitsap Bremerton includes a historic district, the Navy also notified the National Park Service. The Navy consulted with potentially affected federally recognized tribes with traditional resources at the seven locations in accordance with DoD and Navy policy and instructions.

The Navy consulted with USFWS under the ESA for federally threatened and endangered species that may be affected by the Proposed Action. Consultation with the USFWS on marbled murrelets and bulltrout was completed on June 27, 2017 for NAVMAG Indian Island and on December 15, 2017 for NAVBASE Kitsap Bangor, NAVBASE Kitsap Bremerton, NAVBASE Kitsap Keyport, NAVBASE Kitsap Manchester, Zelatched Point, and NAVSTA Everett, with the USFWS' letters concurring with the Navy's conclusions (Appendix G). The Navy consulted with the National Marine Fisheries Service on ESA-listed salmon, steelhead, rockfish species, humpback whale, Southern Resident killer whale, and critical habitat for these species. ESA and Magnuson-Stevens Fisheries Conservation and Management Act consultations were completed with NMFS issuing a Biological Opinion (BiOp) on April 5, 2019 (Appendix G).

NMFS published a notice of receipt of the Letter of Authorization (LOA) application in the Federal Register on August 4, 2017, and published a Final Rule in the Federal Register on April 17, 2019 (Appendix G).

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2 Proposed Action and Alternatives

2.1 Proposed Action

The Navy is proposing to conduct maintenance and repair activities at marine waterfront structures at seven locations including replacement of up to 831 structurally unsound piles. These activities would occur over a 5-year period (July 2019 through July 2024). The Proposed Action includes individual actions currently planned as well as estimates for emergent requirements at NAVBASE Kitsap Bangor, NAVBASE Kitsap Bremerton, NAVBASE Kitsap Keyport, NAVBASE Kitsap Manchester, Zelatched Point, NAVSTA Everett, and Naval Magazine Indian Island.

The Navy's existing waterfront inspection program identifies marine structure deficiencies and prioritizes, designs, and constructs maintenance and repairs. The inspection program also addresses structural repairs (emergent projects) required due to unforeseen events such as weather and vessel incidents. Because construction details are unknown for all emergent projects, estimated numbers of piles to be installed are based on a 1:1 replacement ratio assuming that all piles are removed and replaced with new piles. However, some existing piles may be repaired in place with no new piles installed. The actual number of piles replaced may be more or less than 1:1 due to pile material, pile size, and/or structural requirements. In all cases, the total number of piles installed per location would not exceed the numbers shown in Table 2-1.

The Proposed Action includes best management practices (BMPs) for construction and minimization measures that would be implemented to avoid or minimize potential environmental impacts as described in Section 2.5. Noise attenuation measures and marine mammal and marbled murrelet monitoring would be utilized as described in Section 2.5.3. Measures are dependent on location, timing, construction method, and anticipated effects.

2.2 Alternatives

NEPA's implementing regulations provide guidance on the consideration of alternatives to a federal proposed action and require rigorous exploration and objective evaluation of reasonable alternatives. Only those alternatives determined to be reasonable and meet the purpose and need require detailed analysis. Since the Proposed Action is to perform marine structure maintenance and repairs, including pile replacement at seven locations, the only alternative would be to not perform maintenance and repairs; therefore, no practical or feasible action alternatives were identified. Consequently, this EA analyzes the Proposed Action and No Action Alternative.

2.3 No Action Alternative

Under the No Action Alternative, no maintenance, repair, or pile replacement would occur at these seven locations to maintain and/or restore structural integrity and mission readiness. The No Action Alternative would not meet the purpose of and need for the Proposed Action, but represents the baseline condition against which potential environmental consequences of the Proposed Action can be compared and analyzed. The No Action Alternative is carried forward for analysis in this EA.

2.4 Marine Structure Maintenance and Pile Replacement Activities (Preferred Alternative)

Under the Marine Structure Maintenance and Pile Replacement (MPR) activities, the Navy would conduct maintenance and repair actions at existing marine structures and replace in-water piles. The methods in this section are representative of typical Navy in-water/overwater construction methods that may be utilized. Elements of the proposed MPR activities are described below.

2.4.1 Marine Structure Maintenance

2.4.1.1 Demolition of Deck Portions

A wire saw or other equipment would be used to cut timber or concrete decks into sections. Sections would be removed with a crane. Debris would be captured using debris curtains/sheeting and removed from a project area. Deck pieces would be hauled to a barge and on to an upland disposal site. Large concrete deck areas requiring repair would be cast-in-place with formwork and smaller areas would be performed using hand trowels. The concrete debris would be captured using debris curtains/sheeting and removed from the project area.

2.4.1.2 Wetwell Repair

A wetwell is a reinforced concrete encasement for a sanitary sewer lift station pump. Repairs would occur by removing failed and delaminated concrete. The reinforced steel substructure would then be repaired and new concrete applied. Large areas requiring concrete would be cast-in-place with formwork and smaller areas would be performed using hand trowels. The concrete debris would be captured using debris curtains/sheeting and removed from the project area.

2.4.1.3 Recoat Piles and Mooring Fittings

Piles and mooring fittings would be cleaned prior to coating. All coatings would be applied to dry surfaces and limited to areas above mean sea level (6.5 ft. mean lower low water). Coatings would be inorganic, non-toxic, and free of volatile organic compounds.

2.4.1.4 Passive Cathodic Protection System

A passive cathodic protection system is a metallic rod (anode) attached to a metal object to protect it from corrosion. The more easily oxidized metal of the anode corrodes first, protecting the primary structure from corrosion damage. These would be banded to newly installed steel piles to reduce the rate of corrosion of the metallic surfaces due to saline conditions.

2.4.1.5 Repair or Replacement of Pile Caps

Pile caps are situated on the tops of piles located directly beneath a structure and function as a load transfer mechanism between the superstructure and the piles. Replacement concrete pile caps may be cast-in-place. Concrete framework may be located below mean higher high water. The concrete debris would be captured using curtains/sheeting and removed from the project area.

2.4.1.6 Concrete Spalling Repairs

Concrete spalling occurs when concrete becomes chipped, scaled or flaked. Repair of spalled concrete involves removal of damaged sections and installation of new concrete. Concrete debris would be captured using curtains/sheeting and removed from the project area.

2.4.1.7 Foundation Mud-line Repair

The Hammerhead Crane foundation on Pier 6 at NAVBASE Kitsap Bremerton is supported by concrete pilings, which are bell-shaped at the bottom, that are installed on top of timber pilings. The timber pilings are completely embedded into the substrate, and the bottom 4–5 ft. of the concrete pilings are covered by additional substrate that forms a "mud-line." At one concrete pile, the mud-line has receded and timber pilings are partially exposed. Additional material (up to 5 cubic yards) would be added to cover both the timber piling and the bottom of the concrete piling. Work would include: importing additional clean substrate and depositing the material via bag or clamshell with the use of crane or davit to lower to the seafloor and re-building the mud-line around the base of the concrete piling. This work is expected to occur at one concrete pile in the foundation no more than one time in 5 years.

2.4.1.8 Mooring Foundation and Substructure Repair

Repairs may involve removal and replacement of concrete mooring foundations and concrete substructure on piers, wharfs, and quay walls. Work may include preservation of rebar, and injection of epoxy as required. Sheet pile or cofferdams would be installed as needed to isolate water from concrete surfaces.

2.4.1.9 Repair or Replacement of Components

Structural and non-structural components of waterfront structures would be repaired or replaced as required. Replacement of components would involve removal of existing components and installation of new components. Components may include, but are not limited to:

- Timber wave breaks
- Cross bracing members
- Fender components, including but not limited to camels, chocks, and whalers
- Hand rails
- Splash guards
- Safety ladders
- Electrical conduit and wiring
- Light poles
- Guide pile systems for floats. These systems are used to secure a floating dock or barge to a pile but allow the floating dock or barge to move up and down with tidal changes.
- Brows or gangways. Brows are small, movable, bridge-like structures used to board or leave a vessel.

2.4.1.10 Rewrap/Replace Steel Cable Straps on Dolphins

Dolphins are groups of piles used to guide vessels and hold them in place while docked or berthed. Straps are used to hold pile groupings together.

2.4.2 Pile Repair

Several methods of pile repair may be used including stubbing, wrapping, pile encapsulation, and welding. Pile stubbing is a process in which an existing, damaged length of timber pile above the ground line is removed and replaced with a new length of timber pile. Wrapping may be utilized on existing timber piles to protect against marine borers. Typically, flexible polyvinyl chloride material is wrapped around the entire pile from the mud-line to above the water line. Epoxy-grout-filled fiberglass jackets may also be used. There are different methods of pile encapsulation, but in general, encapsulation refers to the process of encasing piles in concrete. Encapsulation is used when a pile is damaged, but still retains some load-bearing capacity. Welding may be used if a steel pile is damaged above the water line. The damaged section of the steel pile may be cut out/off and a new pile section welded on. These processes do not involve pile driving.

All of the above repair activities would occur overwater or involve only minor in-water work, and would be conducted with the appropriate Spill Prevention Control and Countermeasures Plan and other BMPs identified in Section 2.5.

2.4.3 Pile Replacement

Most in-water structures are pile-supported; therefore, repair of these structures typically involves removal of existing piles and installation of new piles or repair of existing piles in-place (see previous section for pile repair description). In addition, fender piles (or guide piles) protect in-water structures from direct contact with vessels. In-water piles may be treated timber, steel, pre-stressed concrete, or high-density polyethylene (HDPE) plastic. Existing timber piles are generally treated with creosote or ammoniacal copper zinc arsenate (ACZA) to preserve the wood. New timber piles proposed for installation would not contain creosote. Steel piles may be hollow or filled with concrete following installation. Below is a description of the various pile replacement methods that may be used under the Proposed Action.

2.4.3.1 Pile Removal

Four methods of pile removal (vibratory extraction, cutting/chipping, clamshell removal, and direct pull) may be used depending on site conditions. In some cases, piles may be cut at or below the mud-line, with the below-mud-line portion of the pile left in place.

All materials and waste would be disposed of in accordance with applicable federal and state requirements. Creosote-treated piles would be cut into smaller segments in a manner that precludes further use and disposed of at an appropriate upland location (USEPA, 2016). With the exception of creosote-treated piles, the Navy would evaluate if it would be possible to reclaim or recycle the materials. The four pile removal methods are described below.

2.4.3.1.1 Vibratory Extraction

Vibratory extraction is a common method for removing all pile types. A barge-mounted crane operates from the water adjacent to the pile during removal activities. A vibratory driver is a large mechanical device (5–16 tons) suspended from a crane by a cable and positioned on top of a pile. The pile is then loosened from the sediments by activating the driver and slowly lifting up on the driver with the aid of the crane. Once the pile is released from the sediments, the crane continues to raise the driver and pull the pile from the sediment. The driver is typically shut off once the pile is loosened from the sediments. The pile is then pulled from the water and placed on a barge. Vibratory extraction is expected to take approximately 1 to 30 minutes per pile depending on the pile size, type, and substrate conditions.

2.4.3.1.2 Cutting/Chipping

Concrete piles may be removed with a pneumatic chipping hammer or another similar tool capable of cutting through concrete. Pneumatic hammers are used for drilling and the chipping of brick, concrete, and other masonry. A pneumatic chipping hammer is similar to an electric power tool, but uses the energy of compressed air instead of electricity. The pneumatic chipping hammer consists of a steel piston that is reciprocated (moved backward and forward alternately) in a steel barrel by compressed air. On its forward stroke, the piston strikes the end of the chisel. The reciprocating motion of the piston occurs at such a rate that the chisel edge vibrates against the concrete with enough force to fragment or splinter the pile. Large pieces are removed from the substrate. Some inert concrete pebbles would remain.

2.4.3.1.3 Clamshell Bucket

In some cases, removal with a vibratory driver is not possible because the pile may break apart from the force of the clamp and the vibration. If piles break or are damaged, a clamshell apparatus may be lowered from the crane in order to remove pile stubs. A clamshell is a hinged steel apparatus that operates similar to a set of steel jaws. The bucket is lowered from a crane and the jaws grasp the pile stub as the crane pulls upward. The use and size of the clamshell bucket would be minimized to reduce the potential for turbidity during pile removal.

2.4.3.1.4 Direct Pull

Based on site conditions, piles may be removed by wrapping the piles with a cable or chain and pulling them directly from the sediment with a crane. In some cases, depending on access and location, piles may be cut at or below the mud-line. The removal of broken piles below the mud-line is contingent on Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) agreements at each applicable location.

2.4.3.2 Pile Installation

The primary methods of pile installation would be vibratory and impact pile driving, depending on site conditions. A third method, water jetting, may also be used.

The vibratory pile driver method is a technique that may be used in pile installation where the substrate allows. Use of this technique may be limited in very hard or liquefiable substrates. This process begins by placing a choker cable around a pile and lifting it into vertical position with a crane. The pile is then lowered into position and set in place at the mud-line. The pile is held steady while the vibratory driver installs the pile to the required tip elevation. In some substrates, a vibratory driver may be unable to advance a pile until it reaches the required depth. In these cases, an impact hammer may be used to entirely advance the pile to the required depth. For load-bearing structures, an impact hammer is typically required to strike a pile a number of times to ensure it has met the load-bearing specifications; this is referred to as “proofing.”

Impact hammers may be used to install steel, concrete, plastic, or timber piles. Impact hammers have guides that hold the hammer in alignment with the pile while a heavy piston moves up and down striking the top of the pile and driving the pile into the substrate from the downward force of the hammer. To drive the pile, a pile is first moved into position and set into the proper location by placing a choker cable around a pile and lifting it into vertical position with the crane. A vibratory driver may be used to set the pile in place at the mud-line. Once the pile is properly positioned, pile installation typically takes from approximately 1 minute to 60 minutes depending on pile type, pile size, and conditions (i.e., bedrock, loose soils, etc.) to reach the required tip elevation.

Because impact driving of steel piles can produce underwater noise levels that have been known to be harmful to fish and wildlife, piles would be advanced to the extent practicable with a vibratory driver and only impact driven when required for proofing or when a pile cannot be advanced with a vibratory driver due to hard substrate conditions. When impact driving steel piles, a bubble curtain or other noise attenuation device capable of achieving at least 8 dB of attenuation would be employed for all pile strikes when water depths are deep enough for propagation (0.67 m) with the possible exception of short periods when the device is turned off to test the effectiveness of the noise attenuation device. [1] A bubble curtain is usually a ring or series of stacked rings that are placed around a pile along the pile's entire length. The rings are made of tubing which has small puncture holes through which compressed air is pumped. As the compressed air bubbles flow from the tubing, they create an air barrier that impedes the sound produced during pile driving. As discussed in subsequent sections of this EA, contaminated marine sediments are present at and near NAVBASE Kitsap Bremerton, NAVBASE Kitsap Keyport, and NAVSTA Everett. Bubble curtains would not be used at NAVBASE Kitsap Bremerton. At NAVBASE Kitsap Keyport and NAVSTA Everett, the Navy would assess the use of bubble curtains on a project-by-project basis.

Water jetting may be used to aid the penetration of a pile into a dense sand or sandy gravel stratum. Water jetting utilizes a carefully directed and pressurized flow of water at the pile tip, which disturbs a ring of soils directly beneath it. The jetting technique liquefies the soils at the pile tip during pile placement, reducing the friction and interlocking between adjacent sub-grade soil particles around the water jet. Load-bearing piles installed with water jetting would still need to be proofed with an impact pile driver. Water jetting would not be used at NAVBASE Kitsap Bremerton, NAVBASE Kitsap Keyport, and NAVSTA Everett, to minimize disturbance of contaminated sediments.

2.4.3.2.1 Pile Driving Information by Pile Type

Pile type has been identified for 633 of the 831 piles anticipated to be installed during the 5 years of proposed MPR activities, as discussed in the following sections and summarized in Appendix A. Pile type has not been determined for 189 of the piles included in the proposed MPR activities.

Steel Piles

A maximum of 121 of the total 831 piles planned for replacement have been identified as steel piles. These piles would be installed over the duration of the proposed MPR activities at NAVBASE Kitsap Bremerton, NAVBASE Kitsap Keyport, and NAVSTA Everett (Appendix A). An additional 139 piles that would be installed at NAVBASE Kitsap Bangor (119) and Zelatched Point (20) could be steel, concrete, timber, or HDPE. This analysis assumes these 139 piles would be installed as steel piles. This is a conservative assumption because steel pile installation has the potential to cause the highest underwater sound pressure levels if they require installation with an impact driver. Therefore, for analysis of project impacts at these locations, it is assumed that a total of 260 steel piles would be installed. Steel piles would be a maximum of 36-inch (in) diameter except at Bremerton where they would be a maximum of 14-in diameter. To minimize noise levels to marine mammals, marine fish, and marine birds from impact installation of steel piles, steel piles would be driven with a vibratory driver to the extent practicable. The vibratory driver would install the new piles to a point of refusal or, if the load-bearing capacity of the pile needs to be verified, within approximately 5 ft. of the final tip elevation. To further minimize noise levels from impact installation of steel piles, a bubble curtain or

[1] The protocol for monitoring the effectiveness of a bubble curtain is to turn it off periodically during the driving of one or more piles (Fisheries Hydroacoustic Working Group, 2013). However, to protect foraging marbled murrelets, the USFWS may require the noise attenuation device to remain on at all times at some locations.

other noise attenuation device would be used when impact driving steel piling (except a bubble curtain would not be used at NAVBASE Kitsap Bremerton due to potential resuspension of contaminated sediments). Similarly, due to the potential for disturbing contaminated sediments, the Navy would assess the use of bubble curtains at NAVBASE Kitsap Keyport and NAVSTA Everett on a project-by-project basis.

Concrete Piles

A maximum of 521 of the 831 total piles planned for replacement have been identified as concrete piles. These piles would be installed at NAVBASE Kitsap Bremerton (435), NAVSTA Everett (77), and NAVMAG Indian Island (9). An additional 50 piles at NAVBASE Kitsap Manchester could be concrete, timber, or HDPE plastic. For analysis purposes, we assume that these piles would be concrete. This is a conservative assumption because concrete pile installation has the potential to cause greater underwater sound pressure levels than timber or HDPE plastic. At all locations, concrete piles would be a maximum of 24-in diameter.

Vibratory driving is less efficient at driving concrete piles than steel piles because concrete piles are solid and do not have a cutting edge. Therefore, all concrete piles are anticipated to be fully impact driven or water jetted (due to contaminated sediments, water jetting would not be utilized at NAVBASE Kitsap Bremerton). Because of the relatively low underwater noise levels associated with these piles when impact driven, or water jetted, bubble curtains are not proposed during impact installation or water jetting of concrete piles.

HDPE Plastic and Timber Piles

A portion of the 189 piles could be HDPE plastic or timber piles (Appendix A). Timber piles could be installed at NAVBASE Kitsap Bangor, NAVBASE Kitsap Manchester, Zelatched Point, and NAVSTA Everett. Currently HDPE piles are only anticipated at NAVBASE Kitsap Manchester. Timber piles are typically not used as replacement piles at Navy locations due to the superior longevity of steel and concrete piles, but some structures could use timber piles to be consistent with the nature of historic structures. Timber piles would be pre-treated with a water-borne preservative (ACZA) as defined in the American Wood Preservers Association usage standard UC5A for wood subject to marine borers. Timber/HDPE plastic piles would be a maximum of 18-in diameter. Both HDPE and timber piles are anticipated to be fully impact driven, but could be installed with a vibratory driver. Because of the low underwater noise levels associated with these piles when impact driven, bubble curtains are not proposed during installation.

Sheet Steel Piles

Sheet steel piles would be installed using a vibratory pile driver. Impact pile driving would follow if the pile cannot reach the required depth using a vibratory pile driver. Because of their shape and attachment to each other, sheet steel piles transmit energy differently than hollow round steel piles and bubble curtains are not proposed for sheet steel pile installation.

2.4.4 Construction Access and Project Staging

Barges would be used as platforms for conducting in-water work activities and to haul materials and equipment to and from work sites. Barges would be moored with spuds or anchors and not allowed to ground out. Other than barges, no staging sites have been identified. If staging areas for equipment and materials are identified at a future date, they would occur in currently developed lots or managed fields.

2.4.5 Project Duration and Timing

Pile repair and replacement activities would be conducted from July 2018 through July 2023. Timing restrictions (or "in-water work windows") would be complied with to conduct activities when juvenile salmonids are least likely to be present. The timing restrictions are defined by Washington Administrative Code (WAC) 220-660-330 and are typically imposed by the United States Army Corps of Engineers (USACE), USFWS, and the National Marine Fisheries Service (NMFS) to protect ESA-listed salmon and steelhead species. These restrictions and timing restrictions to protect foraging marbled murrelets are described in Section 2.5.3.1, Timing Restrictions. In addition, construction activities would only be conducted between 7:00 a.m. and 10:00 p.m.

No in-water work would begin at a project site until the Navy has received all required permits and approvals, as required.

2.4.6 In-Water Structures for Maintenance and Pile Replacement by Location

As described in Section 2.4, various maintenance and repair activities and methods would be conducted at the seven MPR locations. A list of programmed and contingent maintenance and repair activities by location can be found in Appendix A.

A description of pile replacement activities at each location is discussed in the sections below. Estimated numbers of new piles for each location are a worst-case scenario and include temporary (or "false work") piles required during construction. Pile size, material, and installation and removal method would vary by location. In some cases, piles may not be placed in the same location as the previous pile; however, the amount of overwater coverage (or footprint) of existing structures would not change. Table 2-1 provides pile size, material, and estimated numbers to be removed and installed at each location during the 5 years of proposed MPR activities.

2.4.6.1 NAVBASE Kitsap Bangor

There are eight pile-supported structures at the NAVBASE Kitsap Bangor waterfront (Figure 2-1). Over the 5 years of proposed MPR activities, up to 44 piles are anticipated to be replaced at Explosives Handling Wharf #1 (EHW-1) and a total of up to 75 piles could be replaced at any of the other existing pile-supported structures.

2.4.6.2 NAVBASE Kitsap Bremerton

There are thirteen pile-supported structures located at NAVBASE Kitsap Bremerton (Figure 2-2). Two pile repair and replacement projects are planned at NAVBASE Kitsap Bremerton at Piers 4 and 5. The project at Pier 4 would involve replacing missing or broken timber fender piles with 80 steel fender piles. Steel piles would be up to 14-in diameter and installed with a vibratory driver and only impact driven if they cannot be advanced to tip elevation using a vibratory driver. Prior projects at Piers 4 and 5 indicate steel piles would be able to be vibratory driven. The project at Pier 5 would replace an existing primarily timber fendering system, with 360 concrete piles ranging in size of up to 24-in diameter. All concrete piles are anticipated to be impact driven. Projects at Piers 5, 6, 7, Mooring A and Dry Dock 5 would include removal of timber piles and installation of sheet steel piles. These projects are anticipated to begin in 2018. In addition, up to 75 total concrete piles could be replaced at any of the existing pile-supported during the 5 years of proposed MPR activities.

Table 2-1. Pile Types and Maximum Number to Be Replaced at Each Location

Location	*Existing Pile Types to Be Removed*	*Anticipated Pile Types to Be Installed* [1]	*Maximum Number of New Piles to Be Installed* [2]
NAVBASE Kitsap Bangor	119 Steel, concrete, timber	119 Steel or concrete	119
NAVBASE Kitsap Bremerton	75 Steel and/or timber 460 Timber	100 Steel (14-in diameter and sheet steel piles) 435 Concrete	535
NAVBASE Kitsap Keyport	20 Steel and/or concrete	20 Steel	20
NAVBASE Kitsap Manchester	50 Timber and/or HDPE plastic	50 Concrete, timber and/or HDPE plastic	50
Zelatched Point	20 Timber	20 Steel, concrete, and/or timber	20
NAVSTA Everett	1 Steel 2 Concrete 75 Timber	1 Steel 77 Concrete and/or timber	78
Naval Magazine Indian Island	9 Concrete	9 Concrete	9
Total	831	831	N/A

Key: HDPE = high density polyethylene; in = inch

Notes:

1. These are anticipated pile types to be installed. Where the type is not known, several types that may be installed are listed in the cell. Steel piles would be a maximum of 36-in diameter except at Bremerton where they would be a maximum of 14-in diameter. At all locations, concrete piles would be a maximum of 24-in diameter and timber/HDPE piles would be a maximum of 18-in diameter.
2. Includes piles planned for replacement and estimates for emergent needs. Assumes a 1:1 replacement ratio. However, depending on pile material, pile size, and/or structural requirements, the actual number installed may be more or less than 1:1. In all cases, the total number of piles installed per location would not exceed the numbers shown in this table.

2.4.6.3 NAVBASE Kitsap Keyport

There is one pier, Keyport Pier, in the northern portion of NAVBASE Kitsap Keyport (Figure 2-3). There are no planned pile repair and replacement projects at NAVBASE Kitsap Keyport. Replacement of up to 20 piles (approximately four piles per year) is anticipated during the 5 years of proposed MPR activities.

2.4.6.4 NAVBASE Kitsap Manchester

There are two pile-supported structures located at NAVBASE Kitsap Manchester. The primary pile-supported structures at NAVBASE Kitsap Manchester are the 1,280-ft. fuel pier and the finger pier with a barge mooring platform and a small boat float (Figure 2-4). Repair/replacement of up to 50 total concrete, timber, or HDPE plastic piles at the fuel pier or finger pier is anticipated during the 5 years of proposed MPR activities.

2.4.6.5 Zelatched Point

Zelatched Point contains a single pier used for mooring small craft and float planes during Navy range activities in Dabob Bay (Figure 2-5). The pier is approximately 300-ft. long with a 10-ft. wide timber deck. Two dolphins are located at the outboard end of the facility, and each consists of three timber piles. Replacement of up to 20 piles of any type is anticipated during the 5 years of proposed MPR activities.

2.4.6.6 NAVSTA Everett

There are nine pile-supported structures located at NAVSTA Everett, including Piers A, B, C, D, and E; North Wharf and South Wharf; the recreational marina; and the small boat launch (Figure 2-6). Additionally, there are fender piles along the waterfront areas. Replacement of up to 75 concrete or timber piles and one steel pile is anticipated during the 5 years of proposed MPR activities.

2.4.6.7 NAVMAG Indian Island

NAVMAG Indian Island contains one pile-supported structure, known as the Ammunition Wharf (Figure 2-7). Construction of the Ammunition Wharf was completed in 1979 and there is a total of 1,770 piles in the Ammunition Wharf structure; 1378 structural piles, 307 fender piles and 85 Operations Building piles. Replacement of nine structural concrete piles is proposed during the 2019/2020 in-water work window.

2.5 Best Management Practices and Minimization Measures

General BMPs, mitigation and minimization measures that may be implemented for all in-water repair and replacement activities are presented below. These BMPs are routinely used by the Navy during marine structure maintenance, repair, and pile replacement activities. BMPs are intended to avoid and minimize potential environmental impacts. Additional minimization measures, such as the use of noise attenuation devices during installation of steel piles with an impact hammer, have been added to protect ESA-listed and other sensitive species and designated critical habitats. Specific mitigation measures, such as timing restrictions and species monitoring, would be applied as described in Section 2.5.3 of this EA.

BMPs are included in construction contract plans and specifications for individual projects and become requirements that the contractor must implement.

2.5.1 General Construction Best Management Practices

- Comply with water quality restrictions imposed by Washington Department of Ecology (WDOE) (Chapter 173-201A Washington Administrative Code [WAC]), which specify a mixing zone beyond which water quality standards cannot be exceeded. Compliance with WDOE's standards is intended to ensure protection of fish and aquatic life to the extent feasible and practicable.
- Navy would adhere to performance conditions imposed as part of the CWA, Section 404, Permit and 401, Water Quality Certification. No in-water work would be conducted until the CWA authorization process has been completed.
- An Environmental Protection Plan would be prepared prior to the start of construction activities. The plan would identify construction planning elements and recognize spill sources at the sites. The plan would outline BMPs, responsive actions in the event of a spill or release, and notification and

reporting procedures. The plan would also outline contractor management elements such as personnel responsibilities, project site security, site inspections, and training.

- No petroleum products, fresh cement, lime, fresh concrete, chemicals, or other toxic or harmful materials would be allowed to enter surface waters.
- Washwater resulting from washdown of equipment or work areas would be contained for proper disposal, and would not be discharged unless authorized.
- Equipment that enters surface water would be maintained to prevent any visible sheen from petroleum products.
- There would be no discharge of oil, fuels, or chemicals to surface waters, or onto land where there is a potential for re-entry into surface waters. Fuel hoses, oil drums, oil or fuel transfer valves, fittings, etc., would be checked regularly for leaks. Materials would be maintained and stored properly to prevent spills.
- No cleaning chemicals or solvents would be discharged to ground or surface waters.
- Construction materials would not be stored where high tides, wave action, or upland runoff could cause materials to enter surface waters.
- Barge operations may be restricted to tide elevations adequate to prevent grounding of a barge.
- Where eelgrass is present in the work area, the Navy would provide the contractor with plan sheets showing eelgrass boundaries. The following restrictions would apply to areas designated as having eelgrass:
  - Construction barges would avoid grounding in eelgrass beds during construction activities. This would be conducted through the use of spuds that would elevate barges during low tides.
  - Shallow draft, lower horsepower tugboats would be used in the nearshore area and for extended operations in areas shallower than 40 ft. below MLLW, where feasible.
  - No scouring of sediments would occur within eelgrass beds.
  - Construction barges would avoid shading eelgrass beds for extended periods of time.

2.5.2 Pile Repair, Removal, and Installation Best Management Practices

2.5.2.1 Creosote Pile Removal

- A containment boom surrounding the work area would be used during creosote-treated pile removal to contain and collect any floating debris and sheen. In some cases, the boom may be lined with oil-absorbing material to absorb released creosote.
- Oil-absorbent materials would be used in the event of a spill if any oil product is observed in the water.
- All creosote-treated material and associated sediments would be disposed of in a landfill approved for this type of waste.
- Used creosote piles would be cut into 4-ft. lengths to prevent re-use.

2.5.2.2 General Pile Removal and Replacement

- Removed piles and associated sediments (if any) would typically be contained on a barge. If a barge is not utilized, piles and sediments may be stored in a containment area near the construction sites.

- Piles that break or are already broken below the waterline may be removed by wrapping the piles with a cable or chain and pulling them directly from the sediment with a crane. If this is not possible, piles would be removed with a clamshell bucket. To minimize disturbance to bottom sediments and splintering of piling, the contractor would use the minimum size bucket required to pull out piles based on pile depth and substrate. The clamshell bucket would be emptied of piling and debris on a contained barge before it is lowered into the water. If the bucket contains only sediment, the bucket would remain closed and be lowered to the mud-line and opened to redeposit the sediment. In some cases (depending on access, location, etc.), piles may be cut below the mud-line.
- Any floating debris generated during removal or installation would be retrieved. Any debris in a containment boom would be removed by the end of the work day or when the boom is removed, whichever occurs first. Retrieved debris would be disposed of at an upland disposal site.
- If steel piles are filled with concrete, the tube used to fill steel piles with concrete would be placed inside and toward the bottom of the pile to prevent splashing and overflow.
- Whenever activities that generate sawdust, drill tailings, concrete fragments, or wood chips from treated timbers are conducted, tarps or other containment material would be used to prevent debris from entering the water.
- Timber piles would be pre-treated with a water-born preservative (ACZA) as defined in the American Wood Preservers Association usage standard UC5A for wood subject to marine borers.
- To ensure that leaching of the preservative is minimized, the piles would be produced and pre-treated in compliance with the “Best Management Practices for the Use of Treated Wood in Aquatic and Other Sensitive Environments” published by the “Supporting Organizations,” (Western Wood Preservers Institute et al.) August 1, 2006 or the most current version, including published amendments.
- The piles used would be certified by an independent third party inspection agency as having been produced in compliance with the BMPs referenced above.
- If excavation around piles to be repaired or replaced is necessary, hand tools or a siphon dredge would be used to excavate around piles. If siphon dredges are used, any contaminated sediment must be accounted for as waste and disposed of properly.

2.5.3 Minimization Measures for Protected Species

2.5.3.1 Timing Restrictions

To minimize exposure of ESA-listed salmonids to underwater noise and other construction disturbance, in-water work would occur during the following in-water work windows when ESA-listed salmonids are least likely to be present in each Tidal Reference Area (USACE, 2015).

- NAVBASE Kitsap Bangor and Zelatched Point (Tidal Reference Area 13): July 16–January 15[2]

[2] The USACE window for Tidal Reference Area 13 ends March 1, but the Navy observes an end date of January 15 to be protective of ESA-listed Hood Canal summer-run chum juvenile outmigrants.

- NAVBASE Kitsap Bremerton, NAVBASE Kitsap Manchester, and NAVBASE Kitsap Keyport (Tidal Reference Area 5): July 16–February 15
- NAVSTA Everett (Tidal Reference Area 7): July 16–February 15
- NAVMAG Indian Island (Tidal Reference Area 10): October 1–January 15[3]

To protect foraging marbled murrelets during the nesting season the following restrictions would be followed:

- All in-water construction activities would occur during daylight hours (sunrise to sunset) except from July 16 to September 23 when impact pile driving would only occur starting 2 hours after sunrise and ending 2 hours before sunset. Sunrise and sunset are to be determined based on the National Oceanic and Atmospheric Administration (NOAA) data, which can be found at http://www.esrl.noaa.gov/gmd/grad/solcalc/.

2.5.3.2 Acoustic Minimization Measures

- Vibratory installation would be used to the extent possible to drive steel piles to minimize high sound pressure levels associated with impact pile driving.
- A bubble curtain or other noise attenuation device would be employed during impact installation or proofing of steel piles where water depths are greater than 0.67 meters (m) (2 ft.). A noise attenuation device is not required during vibratory pile driving. Bubble curtains would not be used at NAVBASE Kitsap Bremerton to minimize disturbance of contaminated sediments. Similarly, due to the potential for disturbing contaminated sediments, the Navy would assess the use of bubble curtains at NAVBASE Kitsap Keyport and NAVSTA Everett on a project-by-project basis.
- If a bubble curtain or similar measure is used, it would distribute air bubbles around 100 percent of the piling perimeter for the full depth of the water column. Any other attenuation measure must provide 100 percent coverage in the water column for the full depth of the pile. The lowest bubble ring would be in contact with the mud-line for the full circumference of the ring. The weights attached to the bottom ring would ensure 100 percent mud-line contact. No parts of the ring or other objects would prevent full mud-line contact.
- A performance test of the noise attenuation device would be conducted prior to initial use for impact pile driving. If a bubble curtain or similar measure is utilized, the performance test would confirm the calculated pressures and flow rates at each manifold ring. The contractor would also train personnel in the proper balancing of air flow to the bubblers. The contractor would submit an inspection/ performance report to the Navy for approval within 72 hours following the performance test. Corrections to the noise attenuation device to meet the performance stands would occur prior to use for impact driving.

[3] The USACE window for Tidal Reference Area 10 runs from July 16 through February 15, but the Navy observes a more restrictive window to be protective of ESA-listed finfish species.

2.5.3.3 Species Monitoring and Shutdown

The following measures would be implemented during pile driving to avoid marine mammal and marbled murrelet exposure to injurious noise levels generated from impact pile driving.

- A Marine Mammal Monitoring Plan and a Marbled Murrelet Monitoring Plan (see Appendix D for monitoring plan templates) for each project would be developed in coordination with NMFS and USFWS and approved by these agencies prior to initiation of in-water work. Implementation of these plans would prevent exposure to potentially injurious noise levels.
- Trained observers would be placed at the best vantage point(s) practicable to monitor for marine mammals and marbled murrelets and implement shutdown/delay procedures when applicable. Separate observers would be dedicated for monitoring marine mammals and marbled murrelets.
- In accordance with the Plans, monitoring would occur within pre-determined shutdown zones for purposes of avoiding injurious effects. Marine mammal monitoring would take place from 15 minutes prior to initiation through 30 minutes post-completion of pile driving. Marbled murrelet monitoring would take place from 30 minutes prior to initiation through 30 minutes post-completion of impact pile driving. Should a marine mammal or marbled murrelet enter the shutdown zone, pile driving would be immediately halted until the marine mammal or marbled murrelet has left the area.

2.5.3.4 Soft Start

The Navy would utilize a “soft start” procedure to provide a warning and/or give animals in close proximity to pile driving the opportunity to leave the area prior to an impact driver operating at full capacity thereby, exposing fewer animals to loud underwater and airborne sounds. A soft start procedure would be used for impact pile driving at the beginning of each day’s in-water pile driving or any time pile driving has ceased for more than 30 minutes.

For impact pile driving, the following soft start procedures would be conducted:

- If a bubble curtain is used for impact pile driving, the contractor would start the bubble curtain prior to the initiation of impact pile driving to flush fish from the zone near the pile where sound pressure levels (SPLs) are highest.
- The contractor would provide an initial set of strikes from the impact hammer at reduced energy, followed by a 30-second waiting period, followed by two subsequent sets of strikes. (The reduced energy of an individual hammer cannot be quantified because they vary by individual drivers. Further, the number of strikes would vary at reduced energy because raising the hammer at less than full power and then releasing it results in the hammer “bouncing” as it strikes the pile resulting in multiple “strikes.”)

2.5.3.5 Limits on Changes to Structure Footprint

In some cases, piles may not be placed in the same location as the previous pile; however, the overwater coverage (or footprint) of existing structures is not anticipated to change. Changes to overwater coverage would most likely occur from associated fender system structures or utility repairs, and would be limited to less than two percent of the original overwater coverage of each structure.

2.5.3.6 Submerged Aquatic Vegetation Surveys

Where a nearshore submerged aquatic vegetation (SAV) survey has not been completed within five years of any year's anticipated work, the Navy shall complete a nearshore SAV survey. SAV surveys will be completed in spring and summer months.

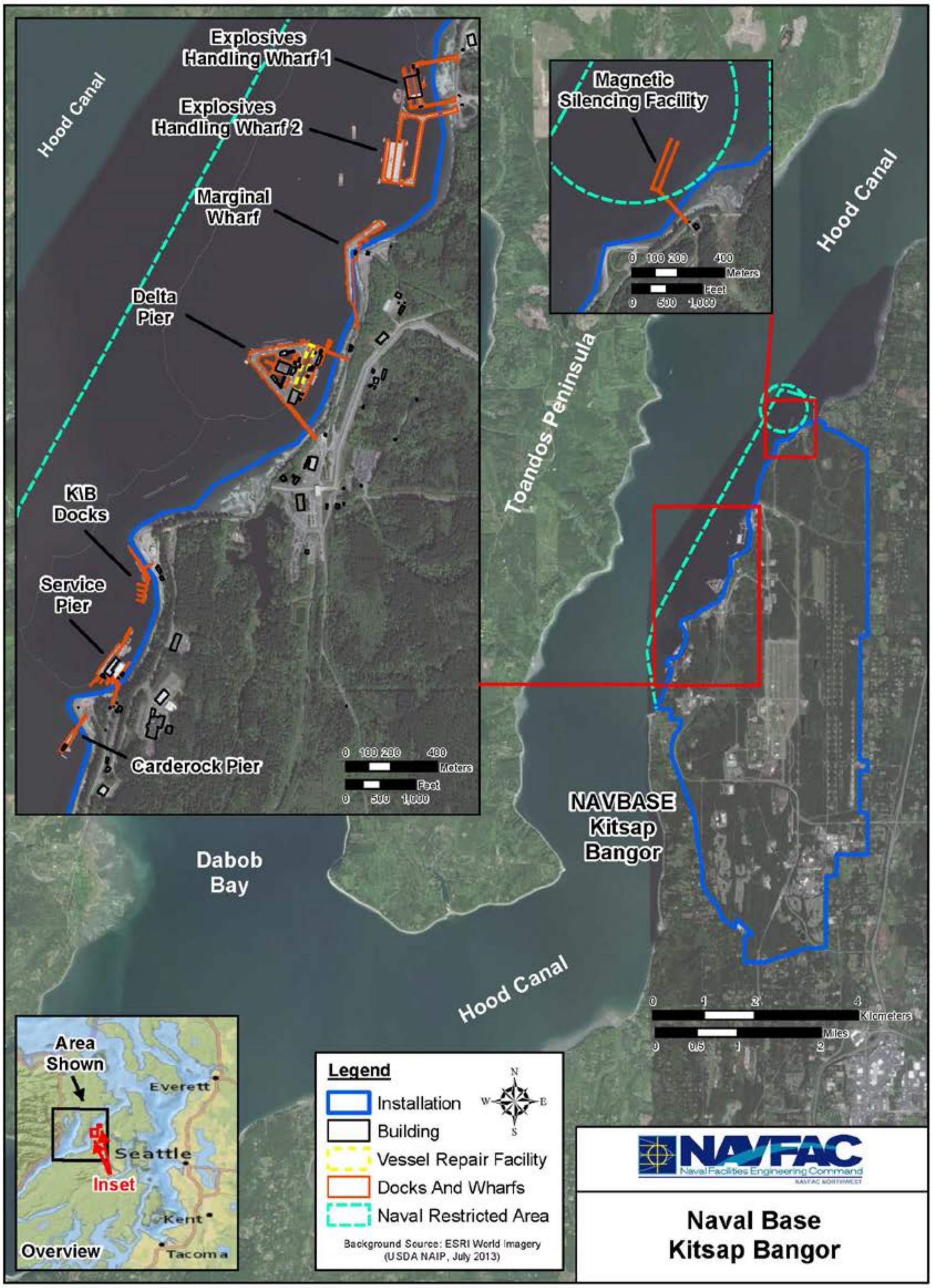

Figure 2-1. Naval Base Kitsap Bangor

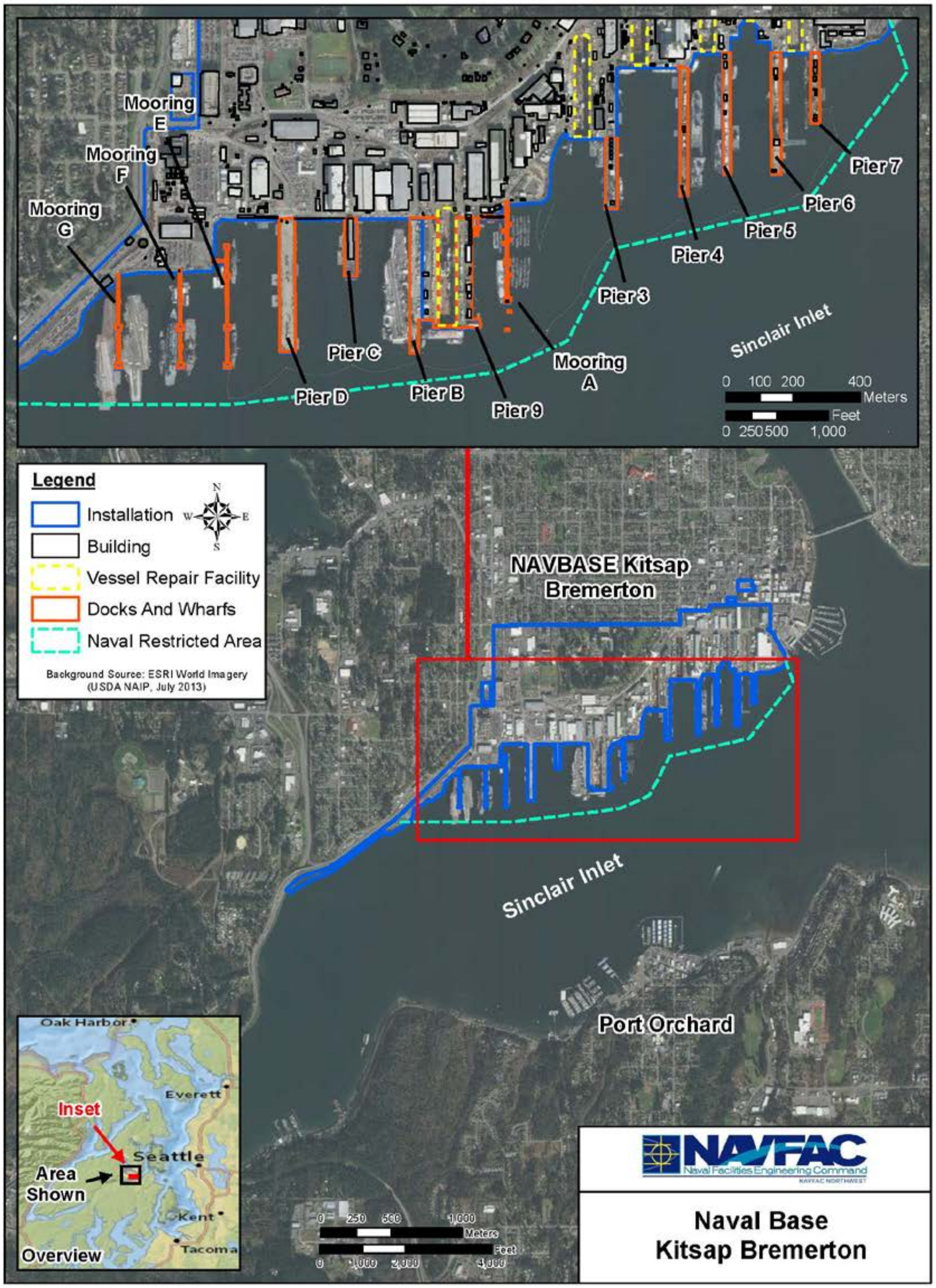

Figure 2-2. Naval Base Kitsap Bremerton

Figure 2-3. Naval Base Kitsap Keyport

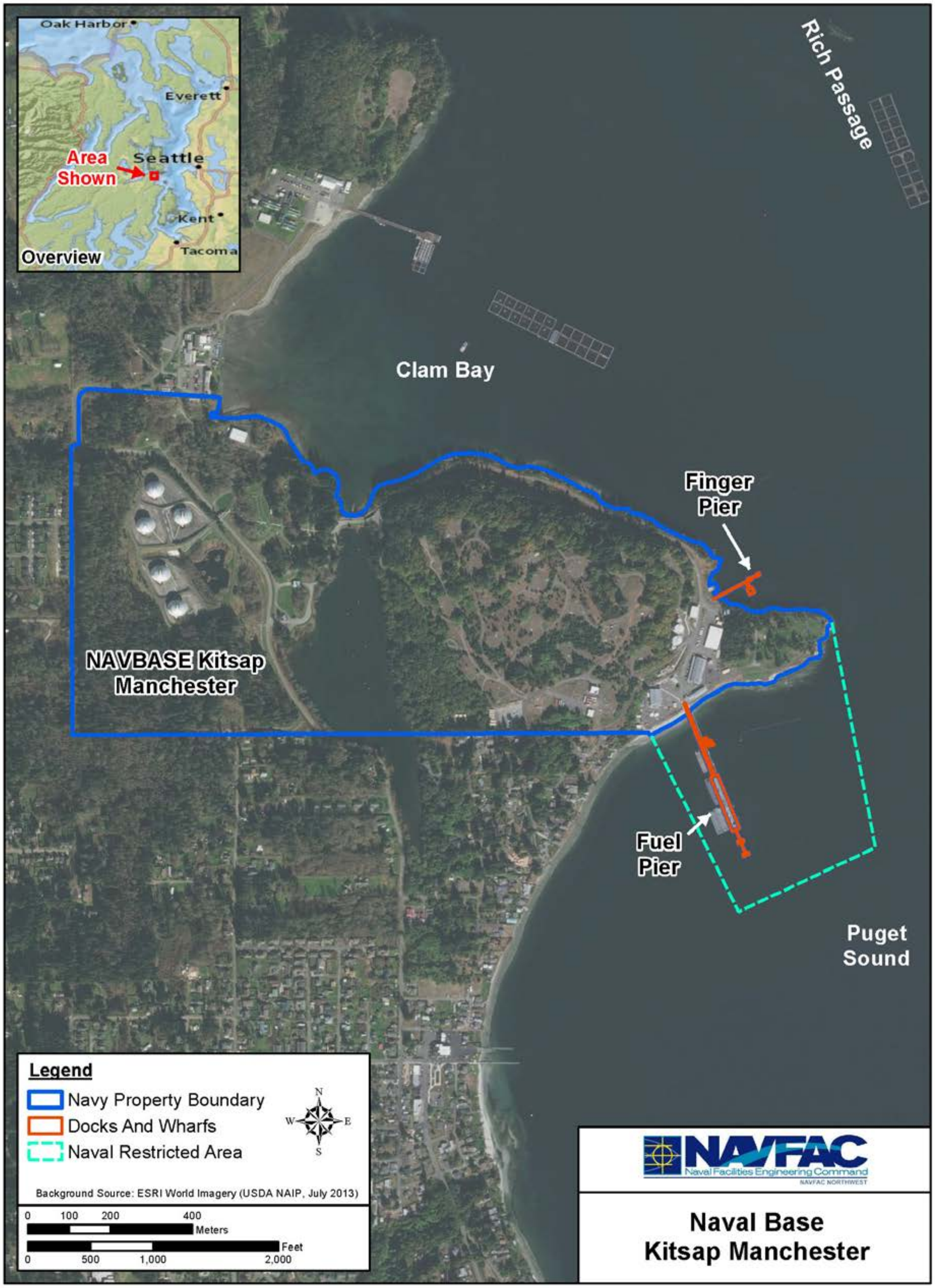

Figure 2-4. Naval Base Kitsap Manchester

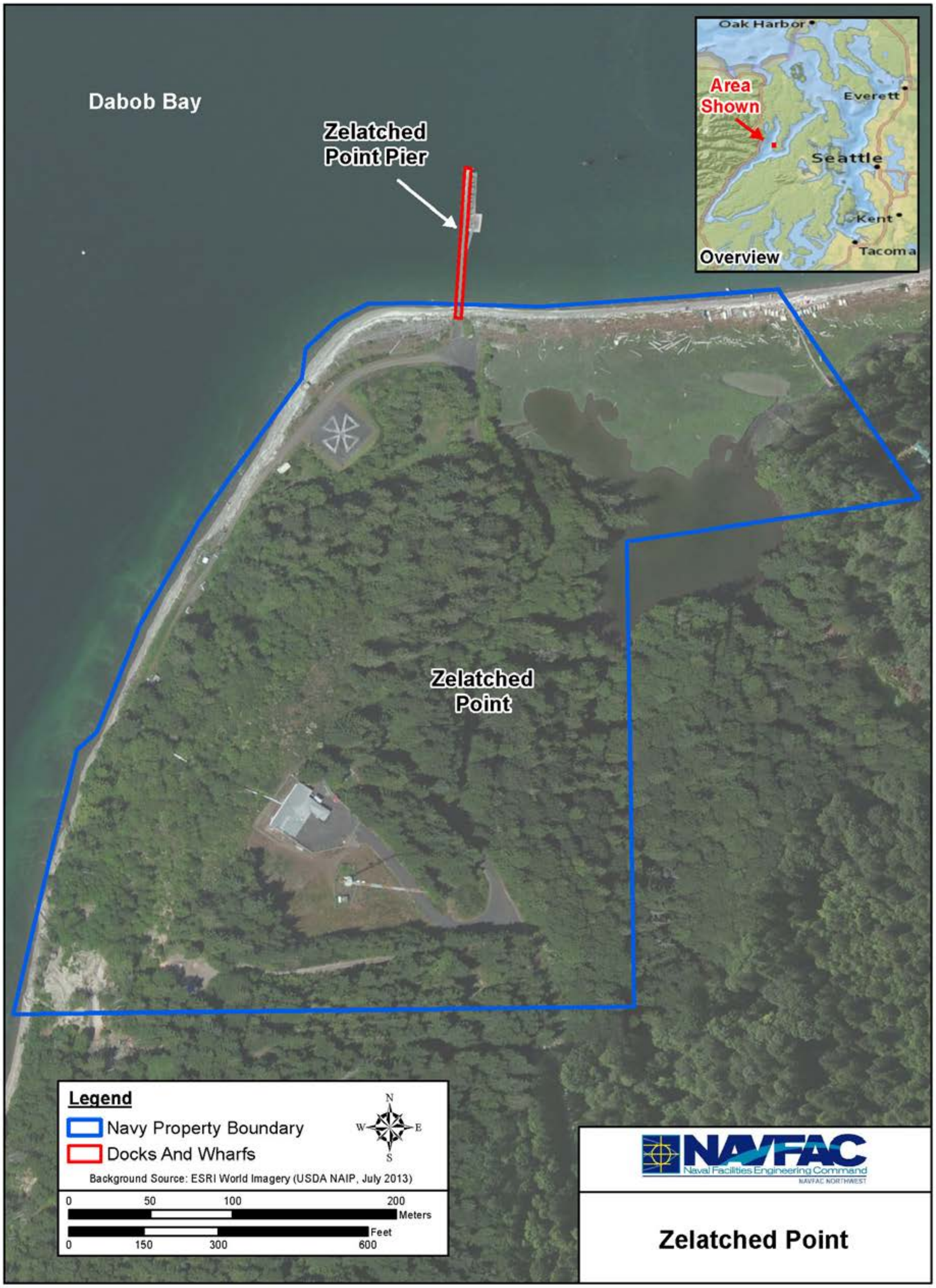

Figure 2-5. Zelatched Point

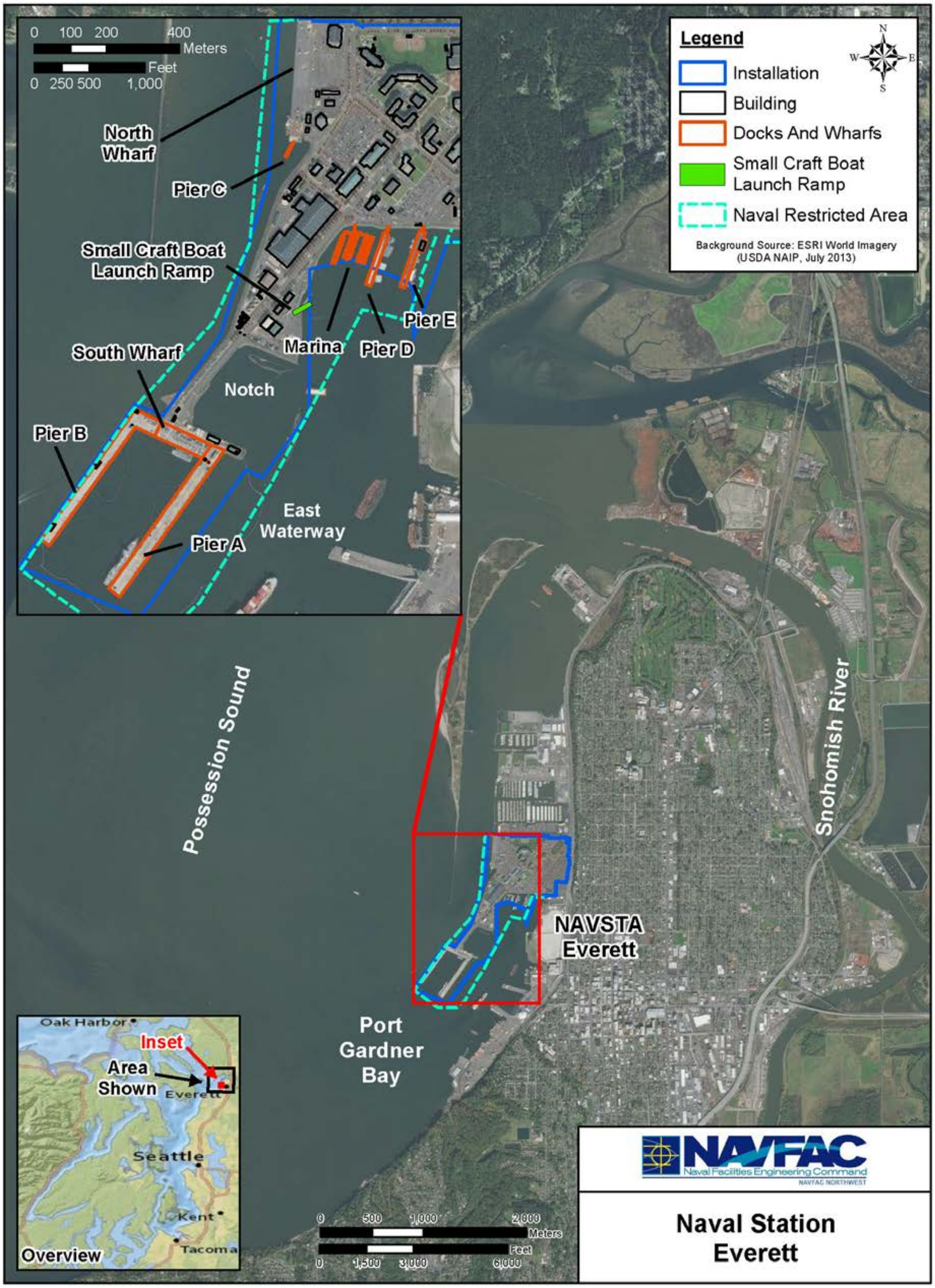

Figure 2-6. Naval Station Everett

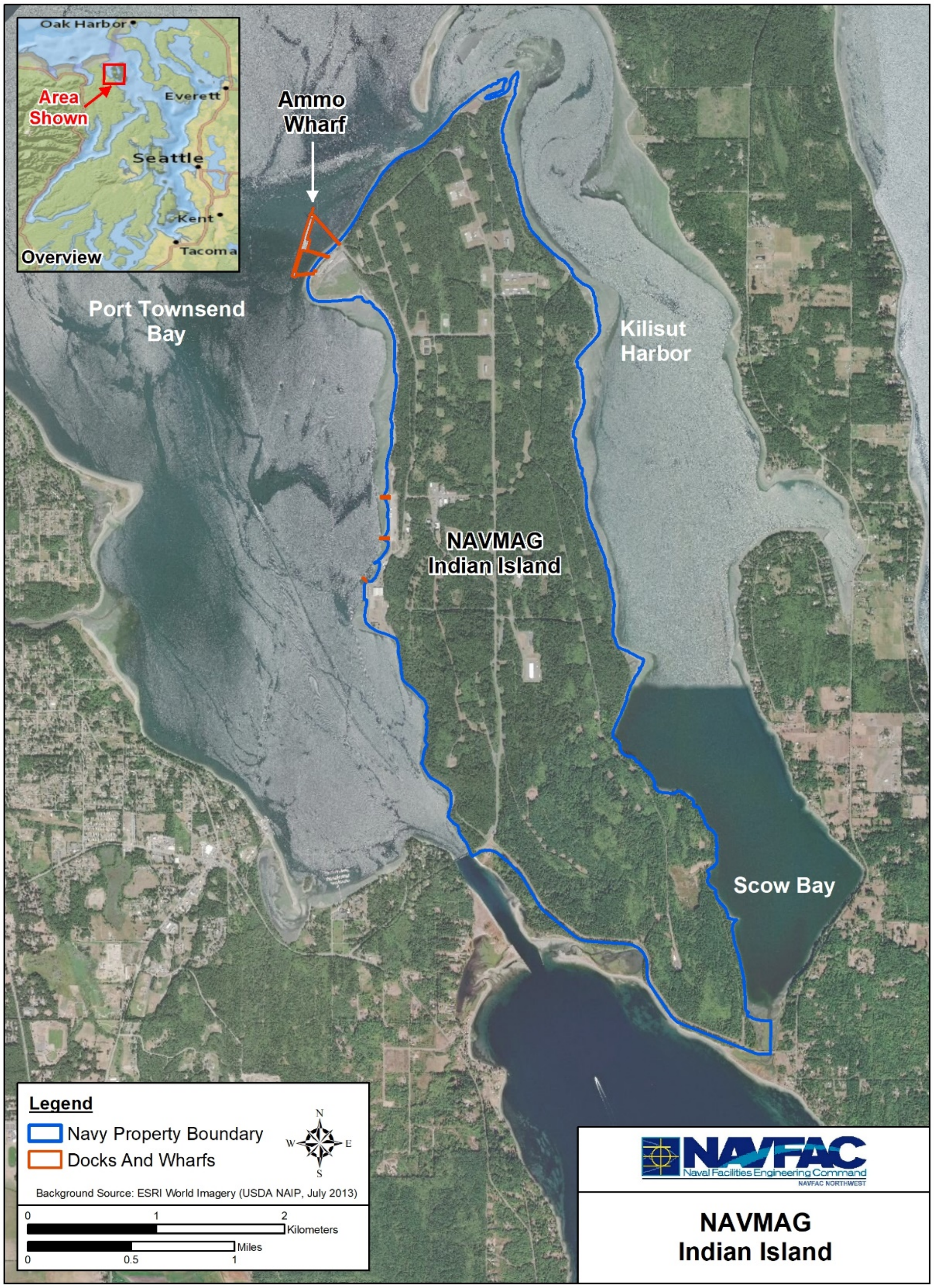

Figure 2-7. NAVMAG Magazine Indian Island

3 Resource Areas

This chapter describes the resource areas potentially affected by the Proposed Action and the baseline and regulatory requirements that are common to all locations. The overall Study Area discussed in certain resource area analyses is defined as the Puget Sound and encompasses all of the locations considered in this document. Detailed descriptions of resources at MPR locations are provided in Chapters 4 through 10.

The potential impacts to the following resource areas are considered to be negligible or non-existent so they were not analyzed in detail in this EA:

- **Bathymetry:** Changes to bathymetry (seafloor topography) would not occur as the Proposed Action is replacing existing piles and structures in highly localized and disturbed areas. The project sites have been substantially modified by construction and operation of the existing structures. Any mounding and displacement or movement of sediments would be temporary because of the limited scope of the Proposed Action and natural processes that would occur following completion of the construction activities would return the seafloor to near its original profile over time without intervention.
- **Air Quality:** Effects on air quality from the implementation of the Proposed Action would be negligible due to the classification of attributed air sources and the attainment designation of Kitsap, Jefferson or Snohomish County in relation to the National Ambient Air Quality Standards. As described in 40 CFR Part 51, Determining Conformity of General Federal Actions to State or Federal Implementation Plans (the "General Conformity Rule"), all federal actions occurring in air basins designated in nonattainment or in a maintenance area must conform to an applicable implementation plan. Since Kitsap County and Jefferson County are designated as attainment areas for all criteria pollutants, the General Conformity Rule does not apply to NAVBASE Kitsap Bangor, Bremerton, Keyport, and Manchester, or Zelatched Point. Snohomish County is designated as a maintenance area for ozone and carbon monoxide (Washington Department of Ecology [WDOE], undated). The activities associated with the Proposed Action are limited to mobile sources and sources excluded from Notice of Construction requirements per Puget Sound Clean Air Agency Regulation I Article 6.03; therefore, New Source Review and Prevention of Significant Deterioration requirements do not apply.
- **Land Use:** Implementation of the Proposed Action would not alter existing land use on or off of the seven locations. All project activities would be conducted in previously disturbed areas at or adjacent to existing structures. Implementation of the Proposed Action would have no impact to the quality of nearby residential areas, parklands, or prime farmlands. The Proposed Action would have no impact on local or regional development patterns.
- **Visual Resources:** Visual resources are the natural and man-made features that give a particular environment its aesthetic qualities. The Proposed Action includes replacement of piles and maintenance of in-water structures. The Proposed Action would not change the appearance of these structures; therefore, no impacts to visual resources would occur.
- **Recreational and Commercial Fishing:** Proposed pile driving activities could have an impact on the behavior of fish species. Fish could flee the immediate areas as a result of the Proposed Action, but would be expected to return to the area after the pile driving activities concluded. However, recreational and commercial fishing does not occur inside the NAVSTA Everett restricted area near

the affected structures, per 33 CFR 334, Danger Zone and Restricted Area Regulations. Also by this regulation, access by the general public to the Naval Restricted Areas is prohibited at NAVBASE Kitsap Bangor, Bremerton, Manchester, and NAVMAG Indian Island, without the permission of the Commanding Officer. Therefore, the activities described under the Proposed Action would have no impact on recreational and commercial fishing or shellfish harvesting.

- **Terrestrial Vegetation and Wildlife:** The Proposed Action would occur within the marine waters in which the affected structures are located and does not have a terrestrial component. Proposed MPR activities would not adversely impact terrestrial habitats, and sound associated with the action would not harm native terrestrial wildlife due to the distance from terrestrial habitats. Therefore, the activities described under the Proposed Action would have no impact on terrestrial wildlife.
- **Socioeconomics:** Implementation of the Proposed Action would not result in displacement of people or businesses and would not change the economic character or stability of the adjacent counties and cities. Work would be conducted by contractors. The socioeconomic impacts related to temporary construction employment, if needed, would occur over a 6-month period. The Proposed Action may create a small number of temporary jobs and contribute minimally to local earnings and spending. Any additional population associated with this temporary employment would not create undue demand on housing, schools, or other social services. As such, no socioeconomic impacts are anticipated as a result of the Proposed Action.
- **Environmental Justice and Protection of Children:** Environmental justice concerns related to construction activity typically include: exposure to noise, safety hazards, pollutants, and other hazardous materials. Although low income and minority populations are present in the surrounding areas, none reside near the project sites and, thus, would not be subject to any disproportionate adverse impacts. There would be no disproportionately high and adverse effect on low-income or minority communities. There are no residences, schools, or other facilities used by children within the waterfront areas. The replacement of piles and other maintenance activities at the affected structures would not cause environmental health risks and safety risks, such as products and substances that children could come in contact with or ingest, that may disproportionately affect children.
- **Traffic and Transportation:** The volume of traffic would temporarily increase during pile replacement and maintenance activities with the presence of contractor vehicles and marine vessels arriving and working on-site. The influx of vehicles and marine vessels would be negligible when compared to existing marine and vehicle traffic at the locations. Pile delivery and disposal would generally be conducted via barge.
- **Public Health and Safety:** The waterfront areas of the seven locations are restricted from public access. Construction contractors and Navy employees would adhere to all applicable regulations with respect to environmental and safety regulations.
- **Hazardous Materials and Wastes:** Discussion of contaminated marine sediments in the vicinity of the affected piers, and potential releases of contaminants from spills or from sediments during pile driving is addressed in sections on water resources and marine sediments. Because access to the locations is restricted, the risk to public health from hazardous materials and waste is minimal. All waste material would be disposed of in a state approved landfill or recycled. Creosote-treated material would be disposed of in a landfill approved for this type of waste. Therefore, hazardous materials and wastes are not covered as a separate resource area in this EA.

3.1 Airborne Noise

3.1.1 Regulatory Setting

Section 4(b) of the Noise Control Act of 1972 (42 U.S.C. 4901 *et seq.*) directs federal agencies to comply with applicable federal, state, and local noise requirements with respect to the control and abatement of environmental noise. Washington State has standards and regulations to control and abate environmental noise. Washington Administrative Code (WAC) Chapter 173-60 sets maximum permissible noise levels based on the environmental noise designation for noise abatement (EDNA). There are three classes of EDNA:

- Class A: Lands where human beings reside and sleep.
- Class B: Lands involving uses requiring protection against noise interference with speech. Includes but is not limited to retail services, banks and office buildings, community services, and dining establishments.
- Class C: Lands involving economic activities of such a nature that higher noise levels are anticipated. Worker safety is protected under the Department of Labor and Industries health and safety programs. Includes but is not limited to warehouses, distribution facilities, industrial facilities, and agriculture.

The maximum permissible daytime noise levels listed in WAC 173-60 are shown below in Table 3-1. WAC 173-60 exempts sounds originating from temporary construction sites as a result of construction activity, provided the sound generating activity occurs between the hours of 7:00 a.m. and 10:00 p.m.

Table 3-1. Washington Maximum Permissible Environmental Noise Levels (dBA)

Noise Source	Receiving Property		
	A – Residential (Day/Night)	B – Commercial	C – Industrial
A – Residential	55/45	57	60
B – Commercial	57/47	60	65
C – Industrial (including Military)	60/50	65	70

Source: WAC 197-60-040

Washington noise regulations limit the noise levels from a Class C noise source that affect a Class A receiving property to 60 A-weighted decibels (dBA) (daytime) and 50 dBA (nighttime). Under the WAC, daytime hours are 7:00 a.m. to 10:00 p.m. and nighttime hours are 10:00 p.m. to 7:00 a.m. However, temporary construction activities are exempt from these noise levels during all hours when received by industrial or commercial zones and during daytime hours when received in residential areas.

3.1.2 Affected Environment

Airborne sound at the locations is produced by common industrial equipment, including trucks, cranes, compressors, generators, pumps, and other equipment that might typically be employed along industrial waterfronts; and airborne sound is produced by other sounds such as sea lions present at some of the locations. Sound levels are highly variable based on the types and operational states of equipment at the recording location, and sound levels may even vary within a single location, with some piers/wharfs very loud and others relatively quiet. Site-specific data from airborne ambient sound measurements are currently available for NAVBASE Kitsap Bangor and NAVSTA Everett. The Navy has used these data to estimate ambient sound levels at a broad scale for all of the project areas.

In general, sound pressure levels decrease as distance from the sound source increases (i.e., over a hard surface, such as water, doubling in distance results in a 6 dB reduction). Maximum noise levels produced by common construction equipment, including trucks, cranes, generators, pumps, and other equipment that might typically be employed are 90 dBA (Washington State Department of Transportation [WSDOT], 2018). Presuming multiple sources of noise may be present at one time, maximum combined levels may be as high as 94 dBA. This assumes that multiple co-located sources combined together increase noise levels as much as 3 to 4 dB over the level of a single piece of equipment by itself. These maximum noise levels are intermittent in nature, and not present at all times.

Construction activities would generate noise, with the greatest levels produced during the pile driving operation. Airborne noise levels from impact pile driving are estimated at 110 dBA referenced at 20 micropascal (re 20 µPa) at a distance of 50 ft. from the pile, and 101 dBA re 20 µPa at 50 ft. when using a vibratory driver. Table 3-2 summarizes representative noise levels of anticipated construction equipment.

Table 3-2. Maximum Airborne Noise Levels at 50 Feet for Common Construction Equipment

Equipment Type	*Maximum Noise Level*
Impact Pile Driver	110
Vibratory Pile Driver	101
Concrete Saw	90
Scraper	84
Backhoe	78
Crane	81
Pumps	81
Generator	81
Front End Loader	79
Air Compressor	78

Source: WSDOT, 2018
Note: Maximum Sound Pressure Levels in dBA re 20 µPa (A-weighted)

3.1.3 Approach to Analysis

The assessment of impacts from airborne noise considers noise generated by pile driving (both impact hammer and vibratory methods), and noise from vessel and boat traffic and construction equipment. Standard noise transmission models are used to estimate dissipation of noise over distance from the expected noise source locations and operating conditions. Noise analyses described herein include differences in site topography and use appropriate noise dissipation factors for noted conditions. Changes in acoustic propagation due to wind, humidity, temperature and other atmospheric factors are not modeled. Appendix B describes the source levels and methodology used to model airborne noise propagation from pile driving.

3.2 Water Resources and Marine Sediments

3.2.1 Regulatory Setting

3.2.1.1 Water Quality

The Clean Water Act (CWA) establishes federal limits, through the National Pollutant Discharge Elimination System program, on the amounts of specific pollutants that can be discharged into surface waters to restore and maintain the chemical, physical, and biological integrity of the water. The National Pollutant Discharge Elimination System program regulates the discharge of point (i.e., end of pipe) and nonpoint sources (i.e., stormwater) of water pollution.

Section 404 of the CWA authorizes the Secretary of the Army, acting through the Chief of Engineers, to issue permits for the discharge of dredge or fill into wetlands and other Waters of the United States. Any discharge of dredge or fill into Waters of the United States requires a permit from the USACE.

Section 10 of the Rivers and Harbors Act provides for USACE permit requirements for any in-water construction. USACE and some states require a permit for any in-water construction. Permits are required for construction of piers, wharfs, bulkheads, pilings, marinas, docks, ramps, floats, moorings, and like structures; construction of wires and cables over the water, and pipes, cables, or tunnels under the water; dredging and excavation; any obstruction or alteration of navigable waters; depositing fill and dredged material; filling of wetlands adjacent or contiguous to waters of the U.S.; construction of riprap, revetments, groins, breakwaters, and levees; and transportation of dredged material for dumping into ocean waters.

Washington surface water quality standards contained in WAC 173-210A provide the basis for protecting and regulating the quality of surface waters in Washington State. The standards implement portions of the federal CWA by specifying the designated and potential uses of waterbodies in the state. They set water quality criteria to protect those uses and acknowledge limitations. The standards also contain policies to protect high-quality waters (antidegradation) and specify how criteria are to be implemented. WAC 173-201A establishes four water body quality classifications as summarized in Table 3-3.

The federal CWA requires that all states restore their waters to be “fishable and swimmable.” Section 303(d) of the Clean Water Act established a process to identify and clean up polluted waters. Every 2 years, all states are required to perform a water quality assessment of the quality of surface waters in the state, including all the rivers, lakes, and marine waters where data available. WDOE compiles its own water quality data, and invites other groups to submit water quality data they have collected.

Water quality assessment categories range from Category 1, waters that meet tested standards for clean waters, to Category 5, waters that fall short of state surface water quality standards and are not expected to improve within the next 2 years. The 303(d) list is comprised of those waters that have been designated as Category 5, impaired. Waters placed on the 303(d) list require the preparation of a water cleanup plan, like a total maximum daily load (TMDL). The TMDL identifies how much pollution needs to be reduced or eliminated to achieve clean water. It identifies the maximum amount of a pollutant to be allowed to be released into a water body so that the beneficial uses of the water are not impaired.

Table 3-3. Marine Water Quality Criteria

Water Quality Classification	*Water Quality Criteria*			
Aquatic Life	**Temperature**[1]	**Dissolved Oxygen**[2]	**Turbidity**[3]	**pH**
Extraordinary Quality	13°C (55°F)	7.0 mg/L	+5 NTU or +10%[4]	7.0–8.5[6]
Excellent Quality	16°C (61°F)	6.0 mg/L	+5 NTU or +10%[4]	7.0–8.5[7]
Good Quality	19°C (66°F)	5.0 mg/L	+10 NTU or +20%[5]	7.0–8.5[7]
Fair Quality	22°C (72°F)	4.0 mg/L	+10 NTU or +20%[5]	6.5–9.0[7]
	Coliform Bacteria			
Shellfish Harvesting	Geometric mean not to exceed 14 MPN/100 mL fecal coliforms[8]			
Recreation				
Primary Contact	Geometric mean not to exceed 14 MPN/100 mL fecal coliforms[8]			
Secondary Contact	Geometric mean not to exceed 70 MPN/100 mL enterococci [9]			

Source: WAC 173-201A-210, as amended in May 2011
Key: °C = degrees Celsius; DO = dissolved oxygen; °F = degrees Fahrenheit; mg/L = milligrams per liter; mL = milliliter; MPN = most probable number; NTU = Nephelometric Turbidity Unit
Notes:

1. One-day maximum (°C [°F]). Temperature measurements should be taken to represent the dominant aquatic habitat of the monitoring site. Measurements should not be taken at the water's edge, the surface, or shallow stagnant backwater areas.
2. One-day minimum (mg/L). When DO is lower than the criteria or within 0.2 mg/L, then human actions considered cumulatively may not cause the DO to decrease more than 0.2 mg/L. DO measurements should be taken to represent the dominant aquatic habitat of the monitoring site. Measurements should not be taken at the water's edge, the surface, or shallow stagnant backwater areas.
3. Measured in NTU; point of compliance for non-flowing marine waters — turbidity not to exceed criteria at a radius of 150 ft. from activity causing the exceedance.
4. 5 NTU over background when the background is 50 NTU or less; or 10 percent increase in turbidity when background turbidity is more than 50 NTU.
5. 10 NTU over background when the background is 50 NTU or less; or 20 percent increase in turbidity when the background turbidity is more than 50 NTU.
6. Human-caused variation within range must be less than 0.2 units.
7. Human-caused variation within range must be less than 0.5 units.
8. No more than 10 percent of all samples used to calculate geometric mean may exceed 43 MPN/100 mL; when averaging data, it is preferable to average by season and include five or more data collection events per period.
9. No more than 10 percent of all samples used to calculate geometric mean may exceed 208 MPN/100 mL; when averaging data, it is preferable to average by season and include five or more data collection events per period.

Water quality assessment Categories 1 through 5 with definitions are provided below:

- Category 1 – Waters that meet tested standards for clean waters
- Category 2 – Waters of concern (some evidence of a problem but not enough to require a water quality improvement [WQI] project)
- Category 3 – Insufficient data
- Category 4A – Waters that have a total maximum daily load (TMDL) in place and actively implemented
- Category 4B – Waters that have a pollution control program
- Category 4C – Waters impaired by a non-pollutant (impaired by causes that cannot be addressed by a TMDL)
- Category 5 – Polluted waters that require a TMDL or other WQI (303(d) list)

3.2.1.2 Marine Sediments

The Washington State Sediment Management Standards (SMS) (WAC 173-204) provide the framework for the long-term management of marine sediment quality. The SMS establishes standards for the quality of sediments as the basis for management and reduction of pollutant discharges by providing a management and decision-making process for contaminated sediments.

The Marine Sediment Quality Standards (SQS) established by the SMS define the lower limit of sediment quality expected to cause no adverse impacts to biological resources. The SMS Cleanup Screening Levels (CSL) represents cleanup thresholds. Concentrations between the SQS and CSL values would require further investigation to determine whether actual adverse impacts exist at the site due to contaminated sediments.

Washington State's Water Quality Assessment (WQA) and 303(d) list includes an assessment of sediments in the state's waterbodies. The USEPA approved the current assessment and 303(d) list in July 2016 (WDOE, 2016). Assessed sediments are classified into six categories:

- Category 1 – Sediments that meet tested standards
- Category 2 – Sediments of concern
- Category 3 – Insufficient data
- Category 4A – Sediments that have a total maximum daily load (TMDL)
- Category 4B – Sediments that have a pollution control plan
- Category 4C – Sediments impaired by a non-pollutant
- Category 5 – Polluted sediments/303(d) list

3.2.2 Affected Environment

3.2.2.1 Water Quality

Water quality describes the chemical and physical composition of water as affected by natural conditions and human activities. Water quality parameters include temperature and salinity, which affect density layering and stratification, as well as chemical characteristics such as dissolved oxygen (DO), nutrients, pH, turbidity/water clarity, and contaminant levels that affect the suitability of the water body as habitat for marine organisms and other beneficial uses.

All of the Proposed Action locations are in Puget Sound. According to the Puget Sound Partnership's 2015 *State of the Sound –Report on the Puget Sound Vital Signs*, marine water quality is relatively good in some bays, and safe for harvesting shellfish and for swimming, but in other bays, water quality is very poor and not meeting standards (Hamel et al., 2015). Overall, the report concluded that trends for marine water quality in Puget Sound have been generally getting worse. For example, human contributions to oxygen depletion (from increased nitrogen inputs) are not meeting targets in several parts of Puget Sound. Low dissolved oxygen can create problems such as fish kills. Contaminants and excess nutrients enter the marine environment from many sources, particularly stormwater runoff. Figure 3-1 shows the water quality designations for Washington State waters including the project locations.

3.2.2.2 Marine Sediments

Sediment consists of solid fragments of organic matter derived from biological organisms in the overlying water column and inorganic matter from the weathering of rock that are transported by water, wind, and ice (glaciers) and deposited at the bottom of bodies of water. Sediments range in size from cobble (2.5–10 in), to pebble (0.15–2.5 in), to granule (0.08–0.15 in), to sand (0.002-0.08 in), to silt (0.00008–0.0002 in), and to clay (less than 0.00008 in).

Most sediments in nearshore areas are land-derived aluminum silicates deposited at rates of more than 3.9 in per 1,000 years. Sediments may also be produced locally by nonliving particulate organic matter (detritus) that sinks to the bottom. Many substances in the water column attach to particles that, through the downward movement of organic and inorganic particles in the water column, are incorporated into bottom sediments (Chapman et al., 2003; Kszos et al., 2003).

The quality of sediments is influenced by their physical, chemical, and biological components; by where they are deposited; by the properties of seawater; and by other inputs and sources of contamination. These factors interact to some degree, so the characteristics of sediments tend to be dynamic and are not easily generalized. For this discussion, "contaminant" means biological, chemical, or physical materials, which, when present at concentrations higher than natural conditions, can impact marine processes. According to the Puget Sound Partnership's 2015 *State of the Sound –Report on the Puget Sound Vital Signs*, sediment quality is not uniform in Puget Sound, with sediments in urban bays typically being contaminated with toxic chemicals (Hamel et al., 2015). However, the Marine Sediment Chemistry Index and Marine Sediment Triad Index (an indicator of sediment toxicity) indicators are nearly meeting their 2020 targets. Currently, five of eight regions and four of six urban bays sampled since 1997 meet target values for the Sediment Quality Triad Index. In addition, Sediment Chemistry Index scores for all regions, and most bays either meet or exceed the target value.

Location-specific conditions are discussed in the respective chapters.

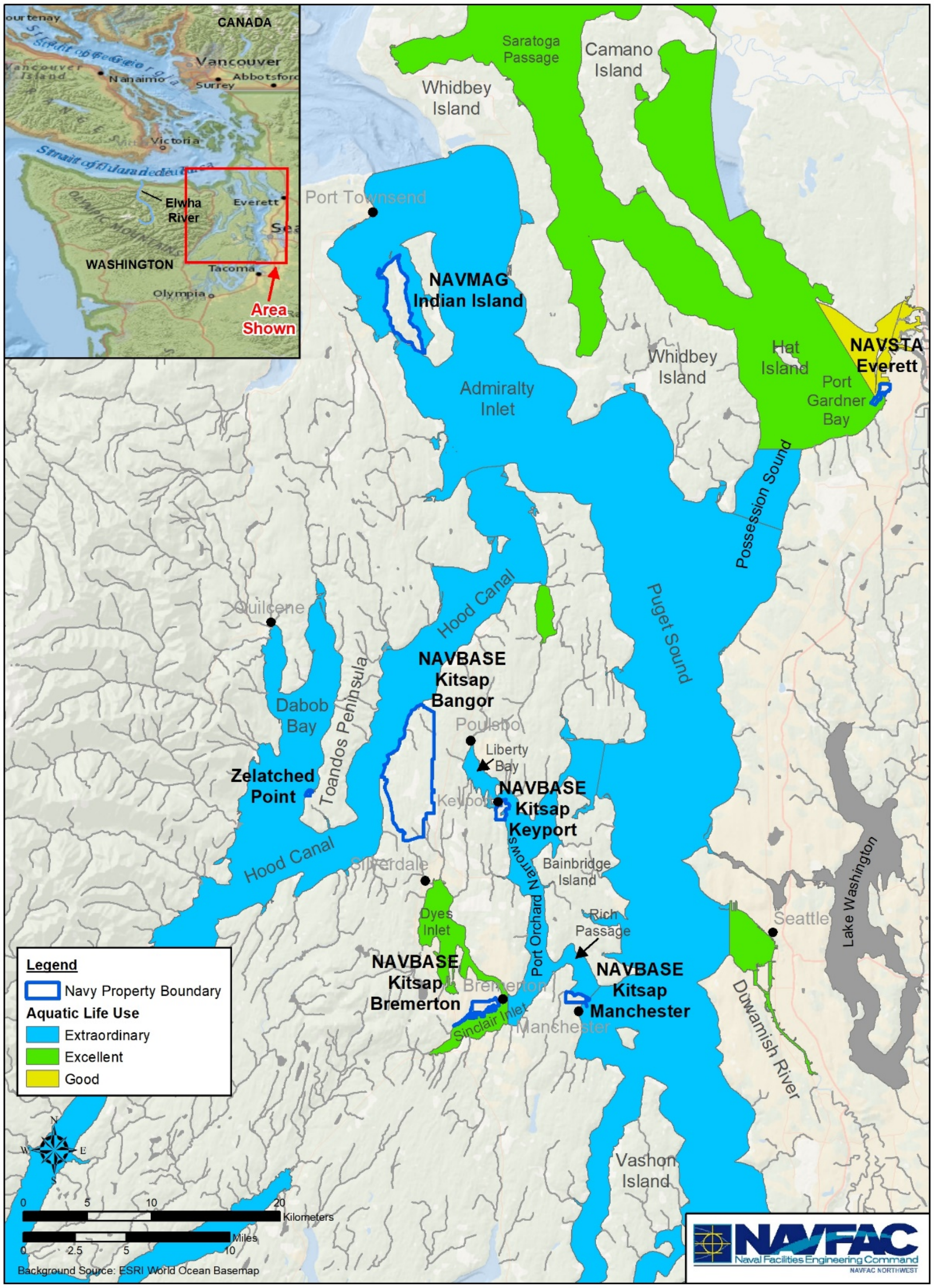

Figure 3-1. Washington State Department of Ecology Water Quality Standards for Marine Waters

3.2.3 Approach to Analysis

The evaluation of impacts on marine water quality considers whether and to what extent project-related activities would create conditions that violate state water quality standards or interfere with beneficial uses of the water body.

The evaluation of impacts on marine sediments considers whether project-related activities would create conditions, such as sediment contaminant concentrations or physical changes, which exceed marine sediment quality standards or interfere with beneficial uses of the water body. Measures to minimize potential impacts on sediment quality would be the same as those to minimize impacts on water quality and include BMPs and current practices identified in Section 2.5.

3.3 Biological Resources

Biological resources include living, native, or naturalized plant and animal species and the habitats within which they occur. Plant associations are referred to generally as vegetation, and animal species are referred to generally as wildlife. Habitat can be defined as the resources and conditions present in an area that support a plant or animal.

Within this EA, biological resources are divided into five major categories: (1) aquatic vegetation, (2) benthic invertebrates, (3) marine fish, (4) birds, and (5) marine mammals. Threatened, endangered, and other special status species are discussed in their respective categories. Table 3-4 lists all special status species that are potentially present.

Table 3-4. ESA-Listed Species Potentially Present Within the Action Area, Status, and Designated Critical Habitats

<table>
<tr><th>Common Name
(Scientific name)</th><th>ESA
Status</th><th>Designated Critical Habitat
Within Action Area</th></tr>
<tr><td>Puget Sound ESU Chinook salmon
(Oncorhynchus tshawytscha)</td><td>T</td><td rowspan="2">DoD lands and associated easements and right-of-ways exempt from designation because of implementation of INRMPs that outline species protection measurements. Critical habitat designated in security zones identified at 33 CFR 334 that are outside the areas described above within a narrow nearshore zone from the line of extreme high tide down to the line of MLLW. Designation includes shoreline outside the boundaries to a depth of 30 m MLLW (70 FR 52630) at all locations for Chinook and at NAVBASE Kitsap Bangor, NAVMAG Indian Island, and Zelatched Point for chum.</td></tr>
<tr><td>Hood Canal summer-run ESU chum salmon
(O. keta)</td><td>T</td></tr>
<tr><td>Puget Sound DPS steelhead
(O. mykiss)</td><td>T</td><td>Designated in freshwater only. Streams with potential steelhead presence are not designated at NAVBASE Kitsap (81 FR 9252). No streams are present at NAVSTA Everett and NAVMAG Indian Island.</td></tr>
</table>

Table 3-4. ESA-Listed Species Potentially Present Within the Action Area, Status, and Designated Critical Habitats (continued)

<table>
<tr><th>Common Name
(Scientific name)</th><th>ESA Status</th><th>Designated Critical Habitat
Within Action Area</th></tr>
<tr><td>Bocaccio rockfish, Puget Sound/Georgia Basin DPS
(Sebastes paucispinis)</td><td>E</td><td rowspan="2">Waters within Navy location boundaries exempt at all NAVBASE Kitsap locations and NAVMAG Indian Island (including the Manchester Naval Restricted Area, Hood Canal and Dabob Bay Naval non-explosive Torpedo Testing Area, Dabob Bay, Whitney Point Naval Restricted Area, and Port Orchard), but is designated outside boundaries in nearshore areas adjacent to NAVBASE Kitsap Bangor, NAVBASE Kitsap Bremerton, NAVBASE Kitsap Keyport, Manchester, and Zelatched Point; and NAVMAG Indian Island, for juvenile bocaccio and in waters deeper than 30 m for adult bocaccio and juvenile and adult yelloweye rockfish adjacent to NAVBASE Kitsap Bangor, Bremerton, Manchester, and Zelatched Point (79 FR 68042; 82 FR 7711).</td></tr>
<tr><td>Yelloweye rockfish, Puget Sound/Georgia Basin DPS
(S. ruberrimus)</td><td>T</td></tr>
<tr><td>Southern DPS Pacific eulachon
(Thaleichthys pacificus)</td><td>T</td><td>Designated, but none occurs within the Action Area.</td></tr>
<tr><td>Southern DPS North American green sturgeon
(Acipenser medirostris)</td><td>T</td><td>Designated, but none occurs within the Action Area.</td></tr>
<tr><td>Humpback whale, Mexico DPS
(Megaptera novaeangliae)</td><td>T</td><td>None Designated.</td></tr>
<tr><td>Humpback whale, Central America DPS</td><td>E</td><td>None Designated.</td></tr>
<tr><td>Southern Resident killer whale
(Orcinus orca)</td><td>E</td><td>Waters within Navy location boundaries excluded, but designation includes other waters of Puget Sound within Action Area, except for Hood Canal (71 FR 69054).</td></tr>
<tr><td>Bull trout
(Salvelinus confluentus)</td><td>T</td><td>Waters within the boundaries of NAVSTA Everett exempt and waters within the boundaries of the open water training and testing areas in Dabob Bay and connecting waters of the Dabob Bay Range Complex at Zelatched Point excluded (75 FR 63945). Critical habitat was not proposed or designated at NAVBASE Kitsap Bangor, Keyport, Bremerton, Manchester, or NAVMAG Indian Island (75 FR 63945). Critical habitat includes nearshore areas extending out to a depth of 33 ft. (10 m) outside location boundaries (75 FR 63898).</td></tr>
<tr><td>Marbled murrelet
(Brachyramphus marmoratus)</td><td>T</td><td>Designated, but none occurs within the Action Area.</td></tr>
</table>

Key: DPS = distinct population segment; E = Endangered; ESU = evolutionarily significant unit; FR = Federal Register; MLLW = mean lower low water; T = Threatened

3.3.1 Regulatory Setting

3.3.1.1 Aquatic Vegetation

Eelgrass is protected under several federal laws, such as the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA), CWA, and CZMA. The MSFCMA established procedures designed to identify, conserve, and enhance essential fish habitat (EFH) including eelgrass for those species regulated under a federal Fishery Management Plan (FMP). EFH protects waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity for federally managed (commercially harvested) fisheries.

3.3.1.2 Benthic Invertebrates

Benthic invertebrates that constitute food for salmon or rockfish listed under the ESA are indirectly protected. Activities that alter or eliminate benthic invertebrates or their habitats are evaluated for their significance to federally listed species during ESA consultations with the National Marine Fisheries Service (NMFS). The MSFCMA, through the EFH provision, protects substrate necessary for federally managed fisheries. In this context, "substrate" includes the associated benthic communities that make these areas suitable fish habitats.

3.3.1.3 Marine Fish

3.3.1.3.1 ESA-Listed Species and Critical Habitat

The purpose of the Endangered Species Act (ESA) is to provide a means to conserve the ecosystems upon which threatened and endangered species depend and create a program to conserve endangered and threatened species. Section 7 of the ESA requires Federal Agencies to consult with either the U.S. Fish and Wildlife Service (USFWS) or National Oceanic and Atmospheric Administration's (NOAA) NMFS, depending on the species, to ensure that their actions are not likely to jeopardize the continued existence of federally listed threatened and endangered species, or result in the destruction or adverse modification of designated critical habitat. Critical habitat cannot be designated on any areas owned, controlled, or designated for use by the Department of Defense (DoD) where an Integrated Natural Resources Management Plan (INRMP) has been developed that, as determined by the Department of Interior or Department of Commerce Secretary, provides a benefit to the species subject to critical habitat designation. Eight listed fish species occur within the waters of the proposed MPR activities: bull trout is regulated by USFWS and seven fish species (Puget Sound evolutionary significant unit [ESU] Chinook salmon; Hood Canal summer-run ESU chum salmon; Puget Sound distinct population segment [DPS] steelhead; Puget Sound/Georgia Basin DPSs of bocaccio and yelloweye rockfish; southern DPS Pacific eulachon, and southern DPS North American green sturgeon) are regulated by NMFS. For those species that have designated critical habitat, DoD lands at the MPR locations have INRMPs in place and are therefore exempt from critical habitat designation. In addition, other Navy ranges or restricted areas may be exempt from final critical habitat designation. Table 3-4 lists ESA-listed species in the proposed MPR activities action area. The Navy consulted with NMFS regarding ESA-listed salmon, steelhead, and rockfish species. Consultation with NMFS was completed with the issuance of a BiOp on April 5, 2019 (Appendix G). The Navy consulted with the USFWS regarding bull trout, and received Letters of Concurrence signed on June 27, 2017 for NAVMAG Indian Island and on December 15, 2017 for NAVBASE Kitsap Bangor, NAVBASE Kitsap Bremerton, NAVBASE Kitsap Keyport, NAVBASE Kitsap Manchester, Zelatched Point, and NAVSTA Everett. (Appendix G).

3.3.1.3.2 Essential Fish Habitat

The MSFCMA provides for the conservation and management of the fisheries. Under the Act, essential fish habitat (EFH) consists of the waters and substrate needed by fish to spawn, breed, feed, or grow to maturity. Pursuant to the MSFCMA, the Pacific Fisheries Management Council has designated EFH for federally managed species within the waters of Washington. The waters of the greater Puget Sound, including waters of the proposed MPR activities, are designated EFH for Pacific Coast groundfish, coastal pelagic species, and Pacific Coast salmon. EFH was evaluated and submitted to NMFS with the biological assessment. Consultation on EFH was completed on April 5, 2019 (Appendix G).

3.3.1.4 Birds

Proposed MPR activities would take place in the marine environment; therefore, this discussion focuses on marine birds and species that utilize the marine shoreline.

3.3.1.4.1 ESA-Listed Species and Critical Habitat

The marbled murrelet is listed as threatened under the ESA. The ESA is discussed under the marine fish resource, Section 3.3.1.3.1. Critical habitat for nesting was designated for the marbled murrelet in 1996 (61 FR 26256) and revised in 2011 (76 FR 61599). No designated critical habitat occurs with the proposed MPR activities area. The Navy consulted with the USFWS regarding marbled murrelet, and received Letters of Concurrence signed on June 27, 2017 for NAVMAG Indian Island and on December 15, 2017 for NAVBASE Kitsap Bangor, NAVBASE Kitsap Bremerton, NAVBASE Kitsap Keyport, NAVBASE Kitsap Manchester, Zelatched Point, and NAVSTA Everett (Appendix G).

3.3.1.4.2 Migratory Bird Treaty Act (MBTA)

Birds, both migratory and most native-resident bird species, are protected under the MBTA, and their conservation by federal agencies is guided by EO 13186 (Responsibilities of Federal Agencies to Protect Migratory Birds). Under the MBTA it is, "unlawful at any time, by any means or in any manner, to pursue, hunt, take, capture, kill, attempt to take, capture, or kill, possess, offer for sale, sell, offer to barter, barter, offer to purchase, purchase, deliver for shipment, ship, export, import, cause to be shipped, exported, or imported, deliver for transportation, transport or cause to be transported, carry or cause to be carried, or receive for shipment, transportation, carriage, or export, any migratory bird, any part, nest, or egg of any such bird, or any product" unless permitted by regulation.

3.3.1.4.3 Bald and Golden Eagle Protection Act

Bald and golden eagles are protected by the Bald and Golden Eagle Protection Act. This act prohibits anyone, without a permit issued by the Secretary of the Interior, from taking bald eagles, including their parts, nests, or eggs. The Act defines "take" as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb." Bald eagles regularly occur throughout Puget Sound.

3.3.1.5 Marine Mammals

3.3.1.5.1 ESA-Listed Species and Critical Habitats

In Puget Sound, the Southern Resident killer whale and two populations of the humpback whale (the Mexico and Central American DPSs) are listed as endangered or threatened under the ESA. There is no designated critical habitat for humpback whales. Designated critical habitat for the Southern Resident killer whale includes 2,560 sq. mi in three specific marine areas (71 FR 69054):

- Summer Core Area in Haro Strait and waters around the San Juan Islands
- Puget Sound
- Strait of Juan de Fuca

Puget Sound waters deeper than 20 ft. below extreme high tide are included in designated critical habitat. However, eighteen sites owned or controlled by the Department of Defense are excluded from critical habitat designation pursuant to amendments to Section 4(a)(3)(B)(i) of the ESA, including Navy locations within Puget Sound. These sites are subject to integrated natural resources management plans prepared under section 101 of the Sikes Act. Hood Canal was not designated as critical habitat.

The Navy consulted with NMFS under Section 7 of the ESA regarding effects of the Proposed Action on humpback whales and Southern Resident killer whales. Consultation with NMFS was completed with the issuance of a BiOp on April 5, 2019 (Appendix G).

3.3.1.5.2 Marine Mammal Protection Act

All marine mammals are protected under the provisions of the MMPA. The MMPA prohibits any person or vessel from “taking” marine mammals in the United States or the high seas without authorization. The MMPA defines “take” to mean “to harass, hunt, capture, or kill or attempt to harass, hunt, capture, or kill any marine mammal.” An Incidental Harassment Authorization (IHA) or Letter of Authorization (LOA) may be issued for projects involving taking of marine mammals due to harassment. The Navy requested an LOA under the MMPA for marine mammals, including two ESA-listed marine mammals, that may be behaviorally harassed incidental to noise generated from pile removal and installation that would occur as part of the proposed MPR activities. NMFS published a notice of receipt of the LOA application in the Federal Register on August 4, 2017, and published a Final Rule in the Federal Register on April 17, 2019 (Appendix G).

3.3.2 Affected Environment

3.3.2.1 Aquatic Vegetation

Aquatic vegetation includes emergent or submerged rooted vegetation and algae. Vascular plants that occur in Puget Sound include emergent sea asparagus (*Salicornia* spp.), submerged eelgrasses (*Zostera* spp.), and submerged intertidal surfgrasses (*Phyllospadix* spp.). Algae are a diverse group of simple plant-like organisms that are mainly aquatic. These organisms are capable of photosynthesis and range in size from single-celled organisms (i.e., phytoplankton) to large seaweeds (i.e., macroalgae). Macroalgae lack true roots, stems, and leaves. Macroalgae are divided into three groups based upon their dominant photosynthetic pigmentation: brown, green, and red (Lamb & Hanby, 2005).

Seagrasses are submerged aquatic vegetation that form underwater meadows (or beds). Eelgrass (*Zostera marina*) grows in shallow, subtidal, or intertidal sediments, and surfgrass (*Phyllospadix* spp.) grows on wave-beaten rocky shores (Mumford, 2007). In Puget Sound, surfgrasses occur primarily on the southern shores of the San Juan Islands and western shores of Whidbey Island and would not be expected to be present at any of the Proposed Action locations (Figure 3-2). Therefore surfgrasses are not discussed further in this document. The extensive root systems of eelgrass form dense and tough below ground mats that function to anchor them and absorb nutrients while their above ground stalks provide habitat and structure to otherwise flat environments. Seagrasses provide an important element in the sustainability of coastlines, fisheries, benthic invertebrates, and waterfowl. Seagrass beds slow

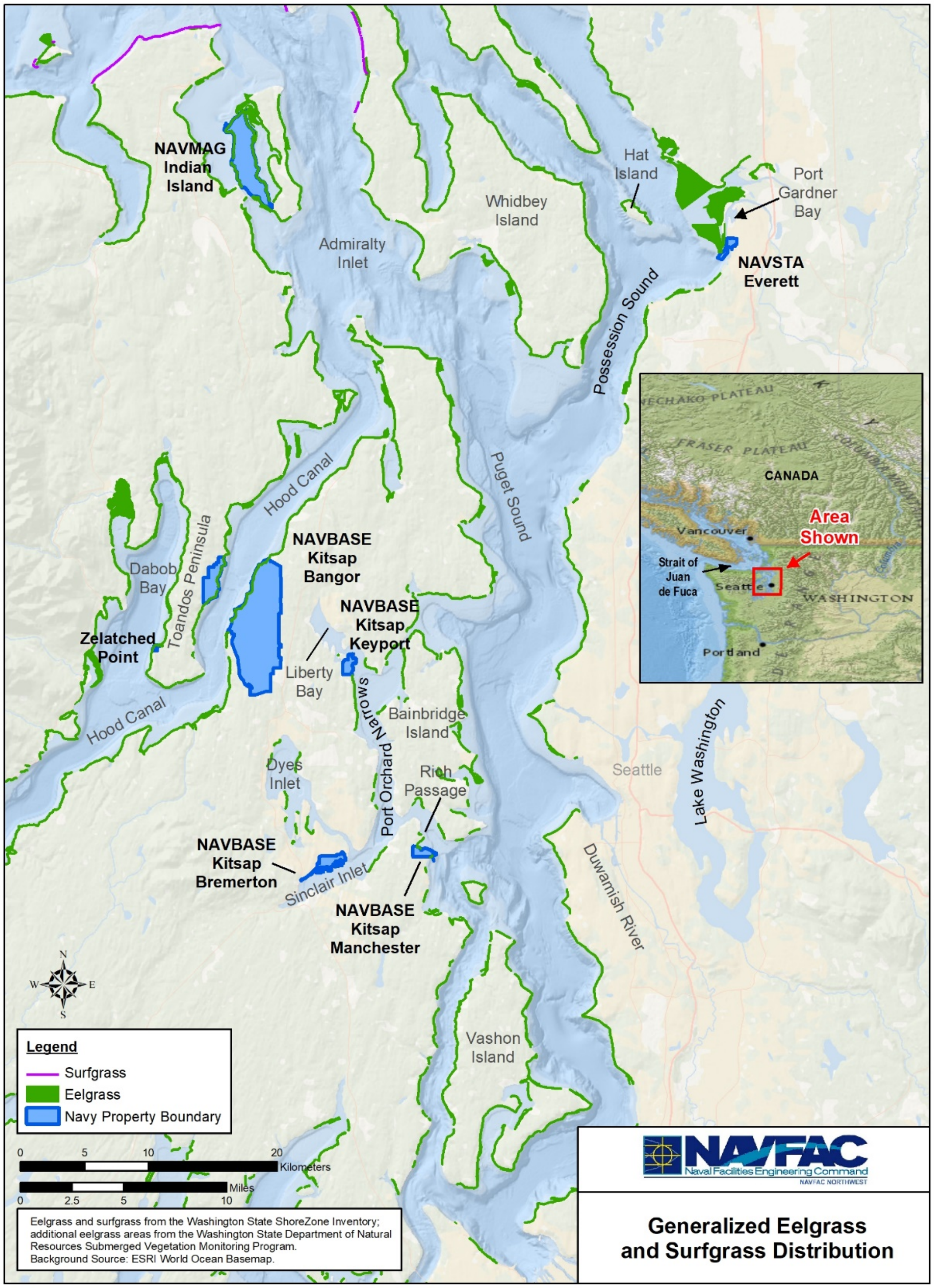

Figure 3-2. Generalized Eelgrass and Surfgrass Distribution in Puget Sound

currents and waves, which prevents coastline erosion by stabilizing sediments and promoting sedimentation. In addition, seagrass beds improve water quality by filtering sediments, excess nutrients, and pollutants from terrestrial run-off (MIT Sea Grant, undated). In Puget Sound, the recent long-term (2000–2013) average native seagrass[4] area is 54,400 acres (WDNR, 2015a).

Sea lettuce (*Ulva* spp.) is a common green alga in Puget Sound. It grows from the lower-intertidal zone to depths of more than 50 ft. below mean lower low water (MLLW) in sheltered areas. Sea lettuce has a high nutrient value (Kirby, 2001) which, when it dies and decomposes, provides an important source of marine nitrogen that supports eelgrass growth. Red algae of the genera *Endocladia*, *Mastocarpus*, *Ceramium*, *Porphyra*, and *Gracilaria* are found in Puget Sound and are ecologically important as primary producers and for providing structural habitat for other marine organisms. Brown algae are found in a variety of forms, including encrusting, filamentous, and leafy varieties on rocks and boulders. A key brown alga, the understory kelp (*Saccharina* spp.) is discussed below under kelp.

Kelp in Puget Sound can grow up to 131 ft. in length in nearshore areas of 6 to 100 ft. in depth (Mumford, 2007). The stems and blades of kelp can form canopies on the water's surface and provide unique habitat for underlying plant and animal communities. Kelp can grow up to 4 in per day and is among the most productive of marine plants. In Puget Sound, kelp forests provide refuge, forage, and nursery areas to support commercial and sport fish, invertebrates, marine mammals, and marine birds. In addition to the primary habitat that kelp forests provide, kelp also provides secondary habitats via drift kelp (detached kelp). Drift kelp carried into nearshore areas provides important nutrients to beach and rocky intertidal communities. Floating kelp masses are important habitats for fishes because they provide a source of food and shelter. Figure 3-3 depicts the generalized distribution of macroalgae, including kelp, in Puget Sound.

A non-native brown algae species, wireweed or sargassum (*Sargassum muticum*), was first documented in Washington State waters in the 1950s and was likely introduced from Japan when Pacific oysters were planted in the early 1900s. Similar to native species of kelp, the complex branching of sargassum provides habitat for invertebrates such as amphipods; however, where it overlaps with native marine vegetation, sargassum outcompetes them and decreases the overall biodiversity of the ecosystem (Whatcom County Marine Resources Committee, 2005). Sargassum is thought to negatively affect water movement, light penetration, sediment accumulation, and DO concentrations at night (Williams et al., 2001). Sargassum is common along the shorelines of the Hood Canal, the San Juan Archipelago, and the Strait of Georgia; it is least common along the outer coast, and it often disappears during the winter season (Navy, 2002). Figure 3-3 depicts the generalized distribution of macroalgae, including sargassum, in Puget Sound. Location-specific aquatic vegetation communities are discussed in the respective chapters.

[4] The WDNR study includes two native *Phyllospadix* species which are difficult to distinguish from *Zostera* in underwater videography.

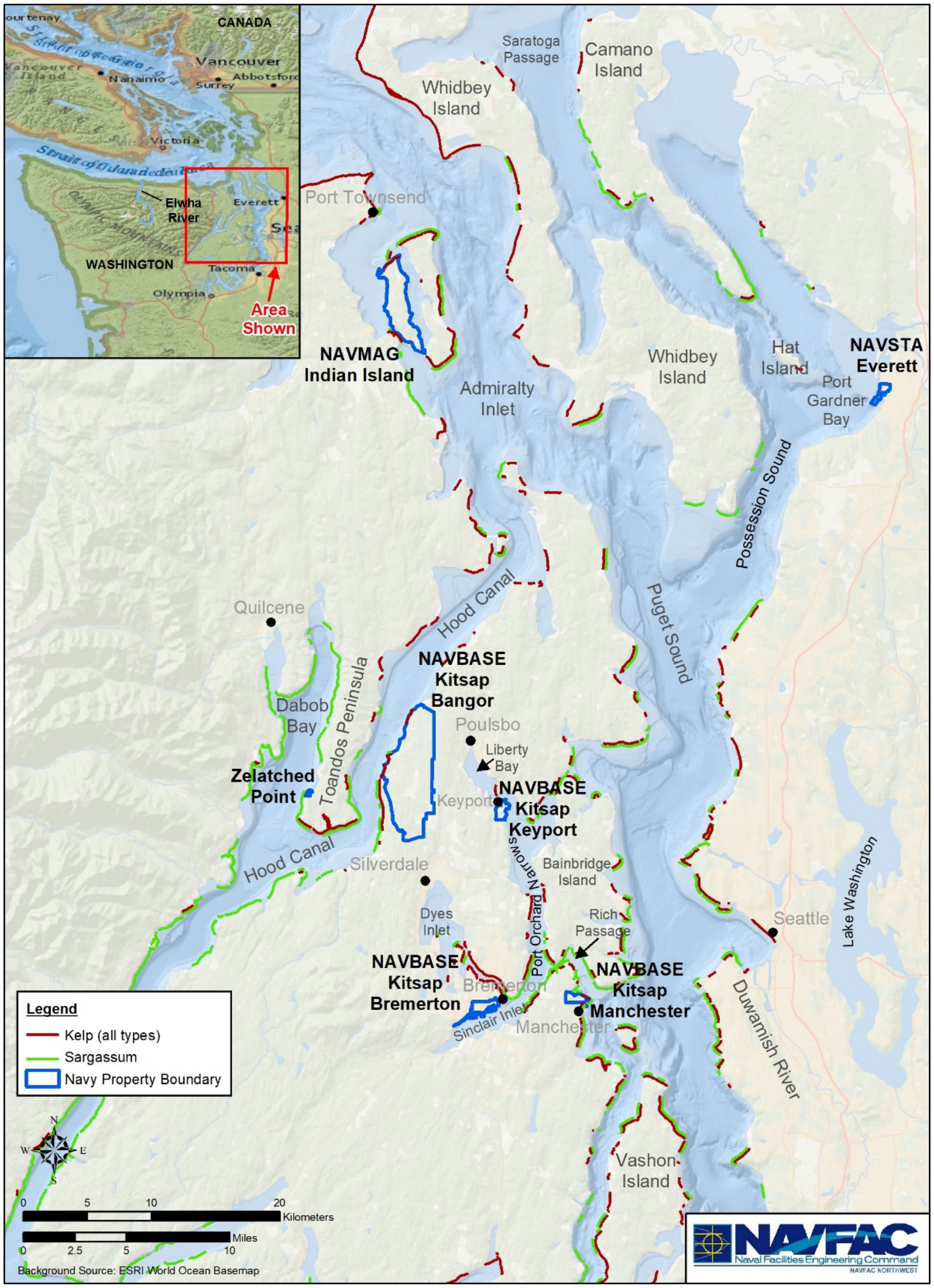

Figure 3-3. Generalized Macroalgae Distribution in Puget Sound

3.3.2.2 Benthic Invertebrates

Benthic invertebrates are bottom dwelling animals that live burrowing or buried in soft marine sediments (infauna), and those that live attached to hard bottom substrates (epifauna). Four major groups (phyla) are found in the Puget Sound: marine worms (Annelids); snails and bivalves (Molluscs); crabs and other crustaceans (Arthropods); and sea stars and sea urchins (Echinoderms). The types and numbers of benthic organisms are closely linked to sediment grain size (gravel, sand, silt, clay, etc.), levels of DO and the amount of total organic carbon. The organic carbon content is itself strongly correlated with sediment grain size; it is higher in more fine-grained sediments than in coarser sediments.

Mussels and oysters attach to hard substrate, while clams live partially buried in the substrate. Oysters and many species of clams are filter feeders on plankton. Some clams also may feed on organic matter at the sediment surface. Gastropods live on the substrate surface and may feed on vegetation and organic matter at the sediment surface, and/or prey on other invertebrates. Clams and cockles as well as crab, oyster, sea anemones, and barnacles are most associated with a hard substrate bottom. Sea anemones and barnacles adhere to rocks and other hard structures found in the intertidal areas. The most abundant (in terms of biomass) bivalve in the subtidal benthic habitat is the Pacific geoduck. Geoducks occur in soft bottom habitat from the intertidal zone to the deep subtidal zone. In Puget Sound they have been found as deep as 360 ft. (Bradbury et al., 2000).

Crustaceans, such as shrimps, crabs, barnacles, and amphipods, are associated with all soft-bottom and hard substrate habitats and also occur in the water column. Dungeness crab occurs throughout Puget Sound, both intertidally and subtidally on a variety of substrates; juveniles and subadults are often associated with eelgrass (Fisher & Velasquez, 2008).

Annelid and polychaete worms are a major component of the benthic community and occupy intertidal and subtidal soft- and hard-bottom habitats (Weston, 2006). Sessile polychaetes are often tube-building while other species may be active burrowers (Kozloff, 1983). Polychaetes are typically more abundant in the nearshore subtidal zone than in the intertidal zone (Weston, 2006; WDOE, 2007). Several species of polychaetes live among fouling organisms (any aquatic organism with a sessile adult stage that attaches to substrates) on man-made structures.

Other common invertebrates found in the nearshore regions of Puget Sound include echinoderms. Echinoderms are a group of marine invertebrates that usually have symmetry of five appendages and skin typically covered in spines. Examples include starfish, sea urchins, and sea cucumbers. Location-specific conditions and consequences will be discussed in the respective chapters.

3.3.2.3 Marine Fish

The discussion of marine fish is separated into *Non-ESA-Listed Fish Species, ESA-Listed Fish Species and Critical Habitat*, and *Essential Fish Habitat*. This chapter presents a comprehensive discussion of non-ESA-listed fish species, a description and general life history for each ESA-listed fish species, and Essential Fish Habitat (EFH) occurring within the greater Puget Sound, including the waters in the Proposed Action area (Figures 3-4 through 3-6).

Details of specific occurrence and timing, presence of designated critical habitat for each ESA-listed species (if applicable), and presence of EFH is further discussed in Chapters 4 through 10 for each location.

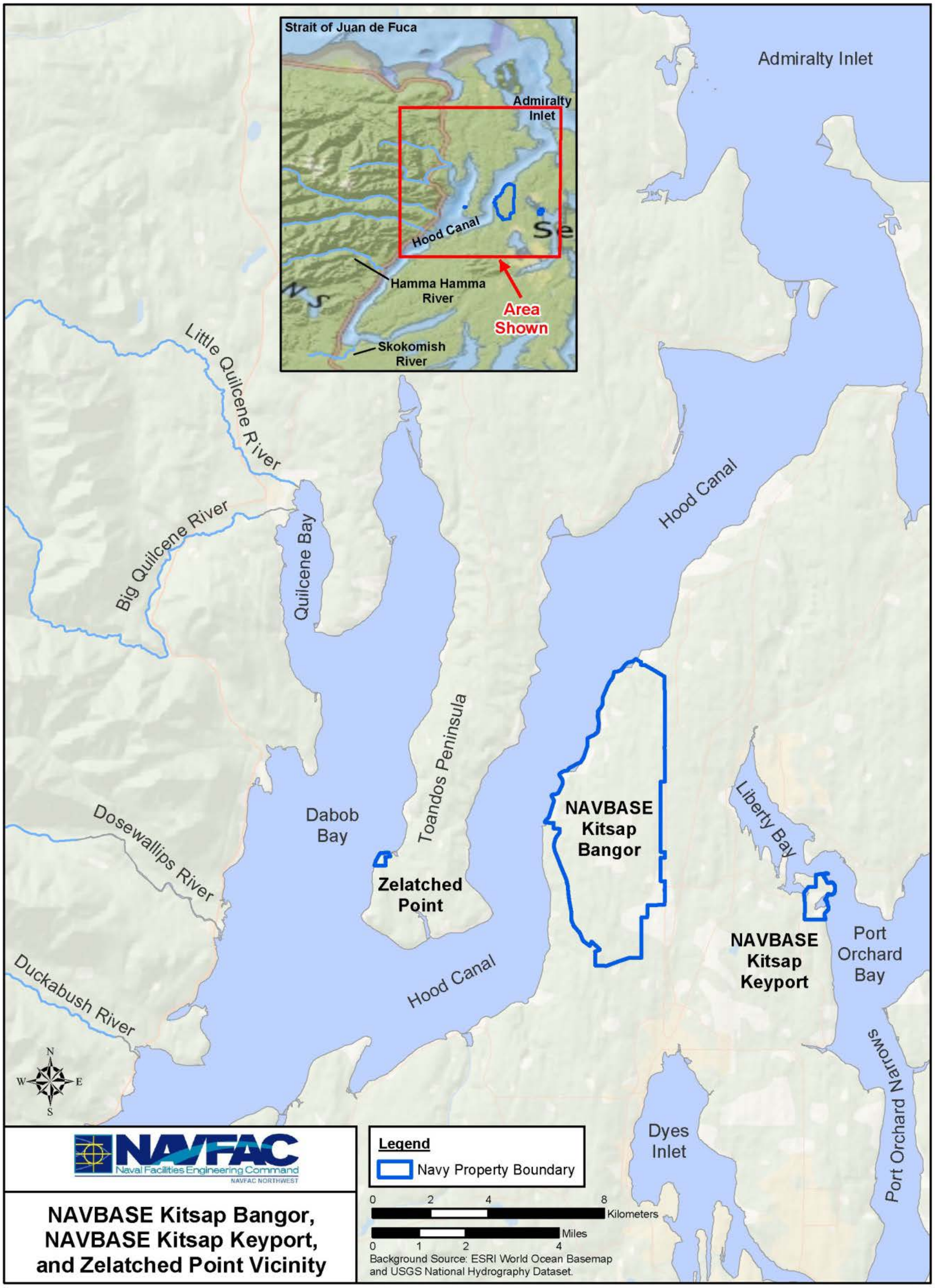

Figure 3-4. NAVBASE Kitsap Bangor, NAVBASE Kitsap Keyport, and Zelatched Point Vicinity

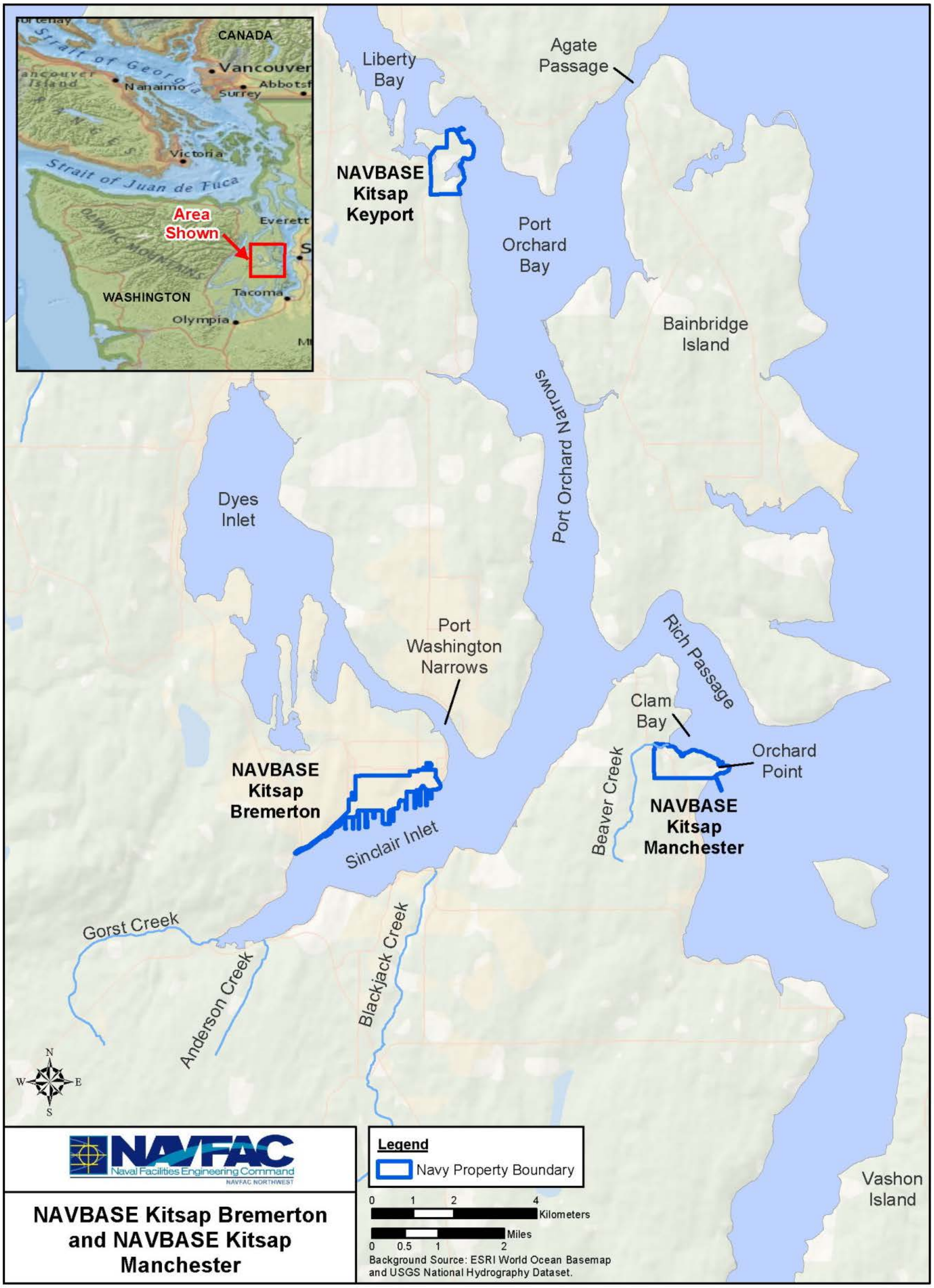

Figure 3-5. NAVBASE Kitsap Bremerton and NAVBASE Kitsap Manchester Vicinity

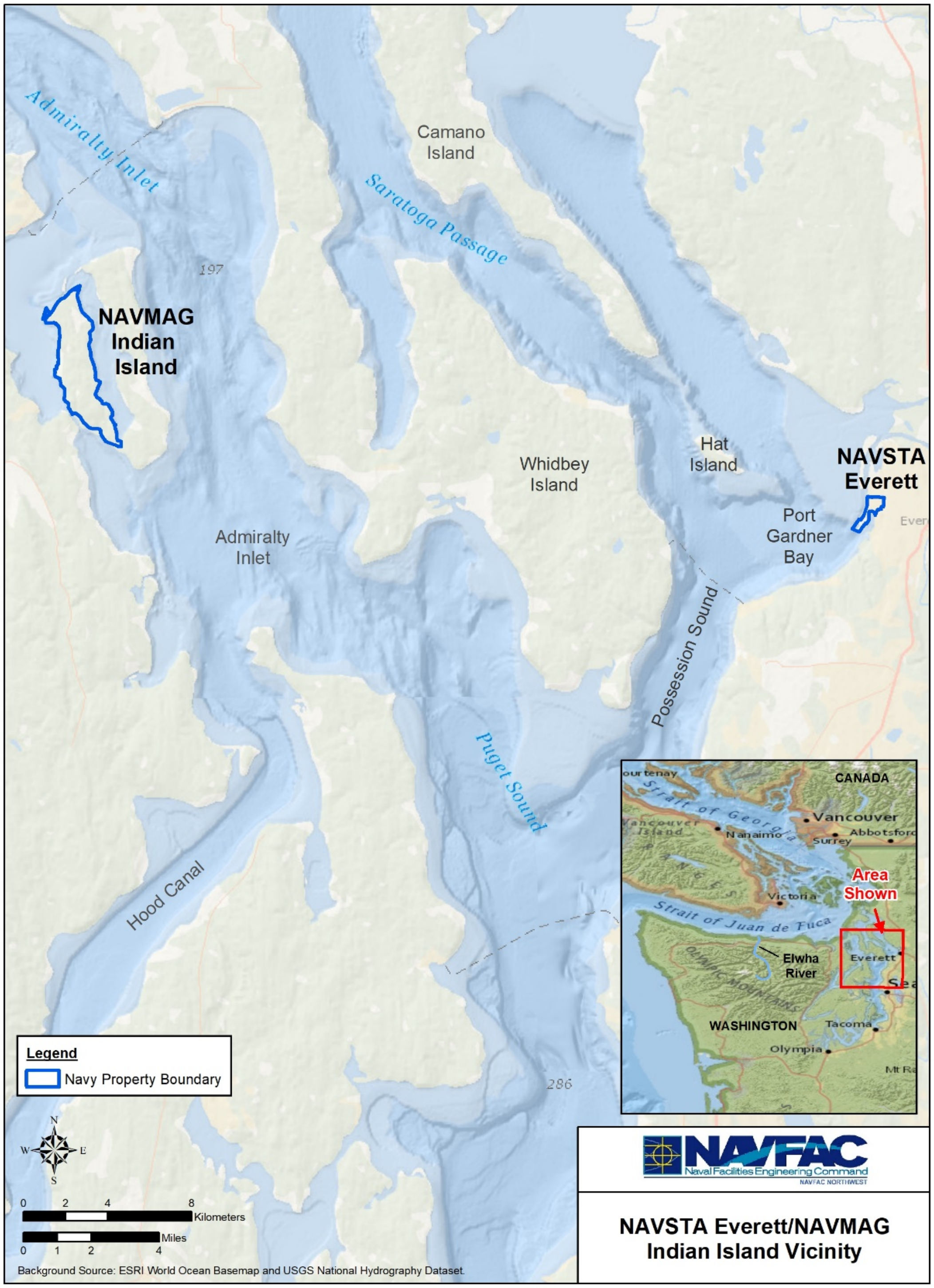

Figure 3-6. NAVSTA Everett and NAVMAG Indian Island Vicinity

3.3.2.3.1 Non-ESA-Listed Fish Species

There are more than 200 species of fish that occur within the demersal and pelagic habitats of the greater Puget Sound. Fish species include salmonids such as Chinook salmon, chum salmon, coho salmon (*O. kisutch*), sockeye salmon (*O. nerka*), pink salmon (*O. gorbuscha*), cutthroat trout (*O. clarki clarki*), anadromous steelhead trout, and bull trout. Commercial groundfish species that occur within Puget Sound include but are not limited to Pacific hake *(Merluccius productus)*, Pacific cod *(Gadus microcephalus)*, lingcod *(Ophiodon elongates)*, English sole *(Parophrys vetulus)*, spiny dogfish *(Squalus acanthias)*, and various species of rockfish (*Sebastes* spp.).

Forage fish species such as Pacific herring (*Clupea harengus pallasi*), surf smelt (*Hypomesus pretiosus*), and Pacific sand lance (*Ammodytes hexapterus*) are the most common forage fish that occur within Puget Sound. Forage fish are important as prey for a large variety of other marine organisms, including birds, fish, marine mammals, and Pacific salmonids. Forage fish species occupy every marine and estuarine habitat in Puget Sound including the waters of all Navy locations in Navy Region Northwest (Navy, 2014, 2016a).

Pacific herring, surf smelt, and Pacific sand lance all utilize intertidal and shallow subtidal areas within the Puget Sound Basin as spawning habitat. The majority of spawning by herring in Washington State waters occurs annually from late January through early April (Bargmann, 1998). Herring deposit their transparent eggs on intertidal and shallow subtidal eelgrass and marine algae. Surf smelt are believed to spawn throughout the year with the heaviest spawn occurring from mid-October through December. Sand lance spawning activity occurs annually from early November through mid-February. Both surf smelt and sand lance spawn at high tide, depositing eggs on a range of nearshore substrates, from soft, pure, fine sand beaches to beaches armored with gravel (Bargmann, 1998). As with other forage fish, the Pacific sand lance is an important part of the trophic link between zooplankton and larger predators in local marine food webs (Penttila, 2007). Bargmann (1998) indicates that 35 percent of all juvenile salmon diets and 60 percent of the juvenile Chinook diets, in particular, are sand lance. Other regionally important species (such as Pacific cod, Pacific hake, and dogfish) feed heavily on juvenile and adult sand lance.

Occurrence of other fish species by location is discussed in Chapters 4 through 10.

3.3.2.3.2 ESA-Listed Species and Critical Habitat

Puget Sound ESU Chinook

The Puget Sound evolutionarily significant unit (ESU) Chinook salmon was listed as threatened under the ESA in 1999 (64 Federal Register [FR] 14308) with the threatened status reaffirmed in 2005 (70 FR 37160). The listing includes all naturally spawned populations of Chinook salmon from rivers and streams flowing into Puget Sound including the Strait of Juan de Fuca from the Elwha River eastward, including rivers and streams flowing into Hood Canal, South Sound, North Sound and the Strait of Georgia in Washington as well as 26 artificial propagation programs (NMFS, 2011a; 81 FR 72759).

Critical habitat was designated for the Puget Sound ESU Chinook salmon in February 2000 and re-designated September 2005 (70 FR 52630). In marine waters, designated critical habitat includes all nearshore marine areas (including areas adjacent to islands) of the Strait of Georgia (south of the international border), Puget Sound, Hood Canal, and the Strait of Juan de Fuca (to the western end of the Elwha River delta) from the line of extreme high tide out to a depth of 30 m. DoD lands and associated easements and right-of-ways were exempted from designation because of implementation of

INRMPs that outline species protection measurements. Critical habitat is designated in security zones identified at 33 CFR 334 that are outside of DoD lands within a narrow nearshore zone from the line of extreme high tide down to the line of mean lower low water (MLLW). Designated critical habitat for the Puget Sound ESU Chinook salmon occurs outside DoD lands out to -30 m MLLW.

Of the five Primary Constituent Elements (PCEs) identified as essential for conserving Puget Sound Chinook, two PCEs occur in marine waters (NMFS, 2005). These include:

(1) Estuarine areas free of obstruction and excessive predation with: (i) water quality and quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater; (ii) natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders side channels; and (iii) juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation;

(2) Nearshore marine areas free of obstruction and excessive predation with: (i) water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and (ii) natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels; and

PCEs that occur within the Action Area are identified in Chapters 4 through 10.

Chinook salmon juveniles out-migrate from natal rivers and streams as sub-yearlings or yearlings, and return to spawn as adults, generally after 3 to 5 years of marine residence. Most Puget Sound Chinook head to coastal waters, but some remain in Puget Sound for a portion or all of their marine residence (Pressey, 1953). Smaller outmigrants tend to migrate in schools along nearshore areas (Nightingale & Simenstad, 2001). Larger outmigrants are not associated with the nearshore. In nearshore areas of Puget Sound, juvenile Chinook salmon outmigration peaks in June and July, and then slowly decreases through the fall (Fresh, 2006).

Hood Canal Summer-Run ESU Chum Salmon

The Hood Canal summer-run ESU chum salmon was listed as threatened in June 2005 (70 FR 37160). The listing includes all naturally spawned populations of summer-run chum salmon in Hood Canal and its tributaries, as well as populations in Olympic Peninsula rivers between Hood Canal and Dungeness Bay, Washington, and eight artificial propagation programs (72 FR 29121; 81 FR 72759). However, all Hood Canal summer chum hatchery programs except Lilliwaup and Tahuya were terminated by 2014. The last supplementation-origin spawners, outside of Lilliwaup River, are expected to return to the Tahuya River in 2018 (Northwest Fisheries Science Center, 2015; NMFS, 2016a).

The Puget Sound Technical Review Team designated two independent populations for the Hood Canal summer ESU chum, one that includes spawning aggregations from rivers and creeks draining into the Strait of Juan de Fuca and one that includes spawning aggregations within Hood Canal proper (Ford, 2011). The Strait of Juan de Fuca summer chum population is composed of five spawning aggregations. Three are extant (Jimmycomelately Creek, Salmon Creeks, and Snow Creek). One aggregation is extinct but was reintroduced with natural spawning in 1999 (Chimacum Creek). The Dungeness River aggregation has shown returns but they have been very low (Point No Point Treaty Tribes [PNPTT] and WDFW, 2014).

The Hood Canal summer-run chum population is composed of nine extant runs that include Big Quilcene River, Little Quilcene River, Dosewallips River, Duckabush River, Hamma Hamma River, Lilliwaup Creek, Union River, Big Beef Creek, and Tahuya River.

All adult returns of summer-run chum salmon to Hood Canal and Strait of Juan de Fuca were natural-origin fish prior to 1992 when supplementation-origin (hatcheries) programs began. Data compiled from 2005 through 2013 (PNPTT and WDFW, 2014) showed that hatchery contribution varied between the two populations. The Strait of Juan de Fuca population had the highest in hatchery-origin returns (8.4 to 62.8 percent) as compared to the Hood Canal populations (5.8 to 40.2 percent) (PNPTT and WDFW, 2014).

Critical habitat was designated for the Hood Canal summer-run ESU chum salmon in February 2000 and re-designated September 2005 (70 FR 52630). Designated critical habitat includes nearshore marine areas (including areas adjacent to islands) of Hood Canal and the Strait of Juan de Fuca (to Dungeness Bay) from the line of extreme high tide out to a depth of 30 m MLLW. DoD lands and associated easements and right-of-ways were exempted from designation because of implementation of INRMPs that outline species protection measurements. Critical habitat is designated in security zones identified at 33 CFR 334 that are outside the areas described in 70 FR 52630 within a narrow nearshore zone from the line of extreme high tide down to the line of MLLW. Designated critical habitat for the Hood Canal summer run ESU chum salmon occurs outside DoD lands out to -30 m MLLW.

Two PCEs occur in marine waters, as described above for the Puget Sound ESU Chinook salmon, which are essential to conserving the Hood Canal summer-run ESU chum salmon (NMFS, 2005).

PCEs that occur within the Action Area are identified in Chapters 4 through 10.

Summer-run chum salmon adults return to Hood Canal from as early as August through the first week in October (Washington Department of Fisheries et al., 1993; WDFW and PNPTT, 2000). Adult summer-run chum salmon stocks spawn within the first few weeks of entering freshwater, with 90 percent of spawning complete by mid-October for the Big/Little Quilcene, Lilliwaup Creek, Hamma Hamma, Duckabush, Dosewallips, and Union systems. Approximately 1-month separates peak spawn timing of the early (summer) and later (fall) runs of chum salmon in Hood Canal (Johnson et al., 1997).

Puget Sound DPS Steelhead

The Puget Sound DPS steelhead was listed in May 2007 under the ESA as threatened (72 FR 26722). The DPS includes all naturally spawned anadromous winter-run and summer-run *O. mykiss* (steelhead) populations originating below natural and manmade impassible barriers from rivers flowing into Puget Sound from the Elwha River (inclusive) eastward, including rivers in Hood Canal, South Sound, North Sound and the Strait of Georgia. Six artificial propagation programs are also included in this DPS (81 FR 72759).

The Puget Sound Technical Recovery Team identified three major population groups in the Puget Sound DPS steelhead (Myers et al., 2015). These include (1) Northern Cascades, (2) Central and South Puget Sound, and (3) Hood Canal and Strait of Juan de Fuca. These major population groups are composed of 32 steelhead demographically independent populations (DIPs) in Puget Sound (Table 3-5).

Table 3-5. Demographically Independent Populations in Puget Sound DPS Steelhead

MPG	*Number of Winter-Run DIPs*	*Number of Summer/Winter-Run DIPs[1]*	*Number of Summer-Run DIPs*
Northern Cascades	8	3	5
Central and South Puget Sound	8	0	0
Hood Canal and Strait of Juan de Fuca	7	1	0

Source: Myers et al., 2015
Note:
1. Overlap of summer-run and winter-run steelhead spawning. Considered one demographically independent population (DIP) where noted in Myers et al. (2015) until further genetic analysis is conducted.

Critical habitat for Puget Sound steelhead was designated in February 2016 for freshwater and estuarine habitat in Puget Sound, but is not designated near any of the locations (81 FR 9252). Naval Base Kitsap locations overlap with streams occupied by Puget Sound steelhead; however, critical habitat was not designated for these locations due to implementation of an INRMP that outlines species protection measurements that would also apply to the Puget Sound DPS steelhead.

Puget Sound steelhead typically rear in freshwater for 2 or 3 years. Migration to marine waters is generally from mid-April through late May when smolts are approximately 150–220 millimeters (mm) (Ward et al., 1989, as cited by Moore et al., 2010a). Studies reviewed by NMFS indicated that "steelhead migratory behavior strongly suggests that juveniles spend little time (a matter of hours in some cases) in estuarine and nearshore areas and do not favor migration along shorelines" (Moore et al., 2010a,b). Early offshore movement of steelhead after entry into Puget Sound marine waters was concluded from a study of Green River steelhead (Goetz et al., 2015).

Rockfish Species

Puget Sound/Georgia Basin DPSs of bocaccio and yelloweye rockfish were federally listed under the ESA in 2010 (75 FR 22276) (Table 3–4). Bocaccio were listed as endangered and yelloweye rockfish were listed as threatened. The listing includes bocaccio occupying all waters of Puget Sound/Georgia basin to the Northern boundary of the Northern Strait of Georgia along the southern contours of Quadra Island and the Western boundary of the U.S. side of the Strait of Juan de Fuca in a straight line to the Canadian side. For yelloweye rockfish, the listing includes those residing within Puget Sound/Georgia Basin, inclusive of the Queen Charlotte Channel to Malcom Island and the Western Boundary of the U.S. side in the Strait of Juan de Fuca in a straight line to the Canadian side (NMFS, 2017).

Critical habitat for bocaccio and yelloweye rockfish of the Puget Sound/Georgia Basin DPS was designated November 2014. Deepwater critical habitat for both rockfish species and nearshore critical habitat for bocaccio is designated within the counties of San Juan, Whatcom, Skagit, Island, Clallam, Jefferson, Snohomish, King, Pierce, Kitsap, Thurston, and Mason in Washington state (79 FR 68042).

NMFS has listed the following as essential features to the conservation of adult bocaccio and adult and juvenile yelloweye rockfish:

- Benthic habitats or sites deeper than 30 m that possess or are adjacent to areas of complex bathymetry consisting of rock and/or highly rugose habitat as these features support growth, survival, reproduction, and feeding opportunities by providing the structure for rockfish to avoid predation, seek food, and persist for decades. Attributes of these essential features include:

- Quantity, quality, and availability of prey species to support individual growth, survival, reproduction, and feeding opportunities;
- Water quality and sufficient levels of dissolved oxygen to support growth, survival, reproduction, and feeding opportunities; and
- The type and amount of structure and rugosity that supports feeding opportunities and predator avoidance.

NMFS has also listed the following essential features to conserve juvenile bocaccio:

- Juvenile settlement habitats located in the nearshore with substrates such as sand, rock, and/or cobble compositions that also support kelp (families Chordaceae, Alariaceae, Lessoniacea, Costariaceae, and Laminaricea) are essential for conservation because these features enable forage opportunities and refuge from predators and enable behavioral and physiological changes needed for juveniles to occupy deeper adult habitats. Attributes of the essential features include:
  - Quantity, quality, and availability of prey species to support individual growth, survival, reproduction, and feeding opportunities; and
  - Water quality and sufficient levels of dissolved oxygen to support growth, survival, reproduction, and feeding opportunities.

Critical habitat was not designated at all NAVBASE Kitsap locations and at NAVMAG Indian Island because INRMPs (including the Manchester Naval Restricted Area, Hood Canal and Dabob Bay Naval non-explosive Torpedo Testing Area, Dabob Bay, Whitney Point Naval Restricted Area, and Port Orchard) are in place that address listed rockfish habitat and contain measures that provide benefits to these DPSs (79 FR 68042). Although NAVSTA Everett is covered by an INRMP that would benefit listed rockfishes, the nearshore at this location does not overlap with essential features for listed rockfishes and is not designated as critical habitat. Habitat meeting the statutory definition of critical habitat is not present at all NAVBASE Kitsap locations; however an INRMP is in place that addresses listed rockfish habitat and contain measures that provide benefits to these DPSs (79 FR 68042).

Puget Sound/George Basin DPS Bocaccio

Bocaccio are found from Stepovac Bay on the Alaska Peninsula to Punta Blanca in central Baja California. (NMFS, 2014a). Information on habitat requirements for most rockfishes is limited despite years of research, and even less is known about bocaccio in Puget Sound (Palsson et al., 2009; Drake et al., 2010). Much of the information presented below on bocaccio life history and habitat use is derived from other areas where bocaccio occurs. In general, most subadult/adult bocaccio occur at variable depths from 30 to 425 m within rocky habitats or complex structures and occasionally in non-rocky substrates such as sand, mud, and other unconsolidated sediments (NMFS, 2016b). Larval and juvenile stages of some rockfishes utilize open water and nearshore habitats as they grow. Reviews of rockfish habitat utilization in Puget Sound indicate that nearshore vegetated habitats are particularly important for some species and serve as nursery areas for juveniles (Palsson et al., 2009; NMFS, 2014a). Juvenile bocaccio settle to shallow, algae covered rocky areas or to eelgrass and sand (Love et al., 1991). Palsson et al. (2009) indicate that in Puget Sound waters, recruitment habitats may include nearshore vegetated habitats, or deep-water habitats consisting of soft and low relief rocky substrates.

Larval rockfish are pelagic and occur within the surface waters in two peaks (early spring, late summer), coinciding with the main primary production peaks in Puget Sound (NMFS, 2014a). Depending on the location, larval rockfish peak in abundance in April-May (South Sound, Hood Canal, and Whidbey Basins) or August-September (Main Puget Sound Basin and San Juan/Strait of Juan de Fuca Basin). Beginning in November, larval rockfish are typically absent from the surface waters (Greene & Godersky, 2012).

Bocaccio have historically been the least encountered of the two ESA-listed rockfish species. Palsson et al. (2009) reviewed Puget Sound rockfish species distributions and the relative number of occurrences. This review relied heavily on Miller and Borton (1980) data, but also included the review of historical literature, fish collections, unpublished log records, and other sources. Palsson et al. (2009) noted bocaccio were only recorded 110 times in their review of historical studies, with most records associated with sport catches from the 1970s in Tacoma Narrows and Appletree Cove (near Kingston). In northern Puget Sound, bocaccio comprised less than 0.2 percent of recreational rockfish catch between 1980 and 2007 and comprised this same percentage in southern Puget Sound during the 1980s but prior to 1996. Bocaccio has been documented in Hood Canal, Possession Sound, and west side of Bainbridge Island (NMFS, 2014a). Recent sightings of bocaccio have been confirmed in Puget Sound and the San Juan Islands, but none from Hood Canal. These observations are from WDFW remotely operated vehicle (ROV) surveys and a NOAA genetic study using hook-and-line gear. All of the Puget Sound sightings were in the vicinity of Edmonds and Mukilteo with all sightings recorded at depths greater than 150 ft. and with several within the 600-ft. depth range (Pacunski, 2017).

Puget Sound/Georgia Basin DPS Yelloweye Rockfish

Recent reviews of Puget Sound rockfish species and their habitats (Palsson et al., 2009; Drake et al., 2010; NMFS, 2014a) suggest little distinction between these rockfish species in terms of habitat use in Puget Sound. Adult/subadult yelloweye rockfish have been documented in rocky and non-rocky substrates such as sand, mud, and other unconsolidated sediments but have also been recorded in areas of mud/cobble habitat (NMFS, 2016b). Both juveniles and adults occur at depths of at least 90 ft. and adults can occur as deep as 1,394 ft. (NMFS, 2016b). NMFS states in a 2014 review that juvenile yelloweye rockfish are rarely found in nearshore waters less than 98 ft. (30 m) (NMFS, 2014a). Therefore, consistent with the discussion for adult bocaccio, adult yelloweye rockfish are considered associated with deeper, high-relief, rocky habitats, and larval stages may use open water and nearshore habitats, but juveniles are not anticipated to be in shallow nearshore habitats.

NMFS (2014b) documented occurrence of yelloweye rockfish mainly at the southern end of Hood Canal, in Possession sound at Everett and south of Everett, and south of Manchester near Vashon Island. Palsson et al. (2009) noted 113 documented Puget Sound yelloweye rockfish historical records associated with recreational catch. Of these records, 14 occurred in Hood Canal waters: one in the 1930s and 13 in the 1960s (Miller & Borton, 1980). Yelloweye rockfish accounted for 1 percent and 1.4 percent of recreational catch in northern and southern Puget Sound, respectively, from 1996 to 2002 when their retention was prohibited (Palsson et al., 2009). Recent WDFW ROV surveys and a NOAA genetic study using hook-and-line gear found that yelloweye rockfish were well distributed within the central portion of Hood Canal and the San Juan Islands, and in select locations in the main basin of Puget Sound. They were always found in association with very specific habitats that include steep slopes/walls with high complexity (Pacunski, 2017).

WDFW conducted rockfish surveys within Puget Sound with specific surveys directed along Navy location waterfronts at NAVBASE Kitsap Bangor, Bremerton, Keyport, Manchester, Zelatched Point, NAVSTA Everett, NAVMAG Indian Island, and Naval Air Station Whidbey Island waterfronts. No ESA-listed rockfish were recorded during any of these surveys (Frierson et al. 2016a-f).

Southern DPS Pacific Eulachon

The southern DPS Pacific eulachon was listed as threatened under the ESA in March 2010 (NMFS, 2010a). This DPS includes all eulachon originating from the Skeena River in British Columbia south to and including the Mad River in northern California.

Critical habitat has been designated for the southern DPS eulachon (NMFS, 2011b) but does not overlap within the Action Area.

Eulachon inhabit nearshore waters to a depth of 1,000 ft. They spend 3 to 5 years in saltwater before returning to freshwater to spawn. Eulachon spawn in lower reaches of larger snowmelt-fed rivers in water temperatures between 39 and 50 degrees Fahrenheit (°F). Spawning occurs over sand or coarse gravel substrates and most adults die after spawning. Eggs are fertilized in the water column and sink following fertilization where they then adhere to the river bottom. Eggs hatch in 20–40 days, and larvae are then carried downstream and disperse into estuarine and ocean currents. Juvenile eulachon move from shallow nearshore areas to mid-depth areas and both juveniles and adults commonly forage within depths ranging from 66 to 292 ft. (NMFS, 2014c).

The nearest eulachon spawning river to Puget Sound is the Elwha River draining into the Strait of Juan de Fuca. Prior to dam removal in the Elwha River, eulachon had been rare in the Elwha River system for the past 60 years and only occasional spawning had been reported (Gustafson et al., 2010). Removal of the dam has restored eulachon habitat that was altered by the dam. In January 2015, seining surveys in the lower Elwha River estuary collected hundreds of egg-bearing and spent eulachon, indicating that local spawning was occurring (Coastal Watershed Institute, 2015). Although eulachon have documented occurrence in the Elwha and hence could access interior Puget Sound, they are not likely to occur. Penttila (2007) stated there is no life history information for Pacific eulachon in Puget Sound and Gustafson et al. (2010) stated historical reports of eulachon in Puget Sound are likely misidentified smelt species. A recent review of the distribution of Pacific eulachon by the Eulachon Biological Review Team did not identify any current populations of this species in Puget Sound (Gustafson et al., 2010). Although some historical records of the species in Puget Sound were found in the review, many of these records were thought to be misidentifications or potential confusion with use of the common name “hooligan” or “candlefish” for longfin smelt, surf smelt, or sand lance (Gustafson et al., 2010). A Nooksack River smelt population, originally identified by several authors as eulachon, was recently confirmed to be longfin smelt (Gustafson et al., 2010). Lastly, no spawning rivers for Pacific eulachon occur in Puget Sound including Hood Canal. The nearest spawning rivers are the Elwha River in the Strait of Juan de Fuca (Gustafson et al., 2010; Coastal Watershed Institute, 2015) and the Frasier River in British Columbia (Gustafson et al., 2010). Occurrence of Pacific eulachon in Puget Sound would be considered very rare.

Southern DPS North American Green Sturgeon

The southern DPS North American green sturgeon was listed under the ESA as threatened in April 2006 (NMFS, 2006a). This DPS includes all green sturgeon originating from the Sacramento River basin and from coastal rivers south of the Eel River in northern California.

Critical habitat for the southern DPS green sturgeon was designated in October 2009 but does not occur within the Action Area (NMFS, 2009).

Green sturgeon are the most wide ranging and most marine-oriented species of the sturgeon family and are believed to spend a majority of their lives in nearshore oceanic waters, bays, and estuaries. They typically spawn every 3 to 4 years and primarily within the Sacramento River, California. Adult Southern DPS green sturgeon enter San Francisco Bay in late winter through early spring and spawn from April through early July (NMFS, 2015). Juveniles rear in the Sacramento River and the Delta and bays for 6 months to 2 years before migrating out to sea as subadults (NMFS, 2015). While at sea, green sturgeon inhabit coastal bays and estuaries and coastal marine waters from the Bering Sea to southern California, primarily occurring within 360-ft. depth (NMFS, 2010b).

Subadult and adult green sturgeon make annual migrations along the coast in the spring and fall, spending winters in the marine waters north of Vancouver Island and south of southeast Alaska, and summers in coastal waters, bays and estuaries of Washington, Oregon and California. Green sturgeon have been found in high concentrations along the Washington coast in Willapa Bay, Grays Harbor, and the Columbia River estuary during summer and fall. No green sturgeon have been reported in Washington coastal and Puget Sound recreational fisheries (outside of Willapa Bay and Grays Harbor) since the 2007 closure (NMFS, 2015). This is based on anglers reporting only fish they have kept and not those released. The extent to which green sturgeon use Puget Sound is unknown but occurrence has been documented. Adams et al. (2002) noted incidental capture of few adult and/or subadult green sturgeon in fisheries in Puget Sound, predominately from trawl fisheries. Two tagged southern DPS green sturgeon originating from San Pablo Bay were detected south of Whidbey Island in 2006 (pers. comm. with Mary Moser, NMFS, March 7, 2008 as cited in NMFS, 2009) of which, one of those was detected over several months over a 2-year period in the area possibly foraging, holding, or resting. No tagged green sturgeon southern DPS have been detected in Hood Canal (pers. comm. with Mary Moser, NMFS, February 24–25, 2008 as cited in NMFS, 2009). Occurrence of green sturgeon within the interior Puget Sound waters is possible but expected to be rare.

Bull Trout

Bull trout was listed under the ESA as threatened in 1999 (USFWS, 1999). They are listed as a single DPS within the five-state (Idaho, Montana, Nevada, Oregon, and Washington) area of the coterminous United States. This DPS is subdivided into six biologically-based recovery units that have been "documented as necessary to both the survival and recovery of the species in a final recovery plan." The recovery units are identified in the final recovery plan as the following: (1) Coastal Recovery Unit; (2) Klamath Recovery Unit; (3) Mid-Columbia Recovery Unity; (4) Upper Snake Recovery Unit; (5) Columbia Headwaters Recovery Unit; and (6) Saint Mary Recovery Unit (USFWS, 2015a).

The Coastal Recovery Unit encompasses Washington and western Oregon. Within Washington, the major geographic regions containing this unit include the Olympic Peninsula, Puget Sound, and Lower Columbia River basins. The Olympic Peninsula and Puget Sound geographic regions also include their associated marine waters (Puget Sound, Hood Canal, Strait of Juan de Fuca, and Pacific Coast). The Puget Sound region contains eight core areas (Chilliwack River, Nooksack River, Upper Skagit River, Lower Skagit River, Stillaguamish River, Snohomish and Skokomish Rivers, Chester Morse Lake, and Puyallup River). The Olympic Peninsula Region contains six core areas (Dungeness River, Elwha River, Hoh River, Queets River, Quinault River, and Skokomish River). The only core areas currently supporting anadromous populations of bull trout are located within the Puget Sound and Olympic Peninsula regions (USFWS, 2015b).

Critical habitat was originally designated for bull trout in September 2005 (USFWS, 2005), with a revision to the designation published in October 2010 (USFWS, 2010a). The Olympic Peninsula designated critical habitat unit is bordered by Hood Canal to the east, Strait of Juan de Fuca to the north, the Pacific Ocean to the west, and the lower Columbia River basins and Puget Sound to the south. In the marine nearshore areas of the Action Area, the inshore extent of designated critical habitat is the mean higher high water (MHHW) line, including the uppermost reach of the saltwater wedge within tidally influenced, freshwater heads of estuaries. Designated critical habitat extends offshore to a depth of 33 ft. relative to MLLW (USFWS, 2010a). NAVSTA Everett was exempt from critical habitat designation because of implementation of an INRMP that outlines species protection measures and it was excluded at Zelatched Point because of national security reasons (Dabob Bay Range Complex and connecting waters) (75 FR 63945). Critical habitat was not proposed or designated at NAVBASE Kitsap Bangor, Keyport, Bremerton, Manchester, or NAVMAG Indian Island (75 FR 63945).

Of the nine PCEs identified as essential for conserving bull trout, five PCEs occur in marine waters (USFWS, 2010a). These include:

(1) Migratory habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats, including, but not limited to permanent, partial, intermittent or seasonal barriers;

(2) An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish;

(3) Complex river, stream, lake, reservoir, and marine shoreline aquatic environments and processes with features such as large wood, side channels, pools, undercut banks and substrates, to provide a variety of depths, gradients, velocities, and structure;

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

(5) Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.

Bull trout typically spawn from late July to December, with peak spawning in September for most populations and late October for the Coastal Recovery Unit core populations. Juvenile migratory bull trout rear 1 to 4 years in natal streams before migrating either to a river, lake/reservoir, or nearshore marine area to mature. Resident and migratory forms or mixed migratory forms may all be found together, and either form may give rise to offspring exhibiting either resident or migratory behaviors (USFWS, 1999).

3.3.2.3.3 Essential Fish Habitat

The Pacific Fishery Management Council (PFMC) is responsible for designating EFH for all federally managed species occurring in the coastal and marine waters off the coasts of Washington, Oregon, and California, including Puget Sound. The PFMC designated EFH for these species within the FMPs for each of the four fisheries that they manage: Coastal Pelagic Species, West Coast Fisheries for Highly Migratory Species, Pacific Coast Groundfish, and Pacific Coast Salmon (PFMC, 2016a-d). Of these fisheries, three (coastal pelagic species, Pacific coast groundfish, and Pacific coast salmon) contain species for which EFH has been designated within the greater Puget Sound (PFMC, 2016a-c).

Coastal Pelagic Species

The Pacific Council's Coastal Pelagic Species FMP specifies a management framework for northern anchovy (*Engraulis mordax*), market squid (*Loligo opalescens*), Pacific sardine (*Sardinops sagax*), Pacific (chub) mackerel (*Scomber japonicas*), and jack mackerel (*Trachurus symmetricus*). In October 2006, the Coastal Pelagic Species FMP was amended to include all krill species. In July 2009, Amendment 12 to the Coastal Pelagic Species FMP prohibited the harvest of krill within California, Oregon, and Washington waters (74 FR 33372). EFH for non-krill coastal pelagic species addresses five pelagic species that are treated as a single species complex because of similarities in life histories and habitat requirements: Northern anchovy, Pacific sardine, Pacific mackerel, jack mackerel, and market squid. Three of these coastal pelagic species are known to occur in the greater Puget Sound: northern anchovy, Pacific mackerel, and market squid. A table of these species/life stages and their designated habitat is contained within Appendix C. The definition for coastal pelagic species EFH is based on the geographic range and in-water temperatures where these species are present during a particular life stage (67 FR 2343-2383). EFH for these species includes all estuarine and marine waters above the thermocline where sea surface temperatures range from 50 to 68 °F. These boundaries include the waters of all seven proposed MPR activities locations.

Pacific Coast Groundfish

Pacific coast groundfish species are considered sensitive to overfishing, the loss of habitat, and water and sediment quality (PFMC, 2016b). The groundfish EFH consists of the aquatic habitat necessary to allow for groundfish production to support long-term sustainable fisheries for groundfish and for groundfish contributions to a healthy ecosystem (PFMC, 2016b). The PFMC (2016b) identifies the overall area designated as groundfish EFH for all species covered in the FMP as all waters and substrate within "depths less than or equal to 3,500 m [~ 11,500 ft.] to MHHW level or the upriver extent of saltwater intrusion, defined as upstream and landward to where ocean-derived salts measure less than 0.5 parts per thousand during the period of average annual low flow." Furthermore, the PFMC (2016b) has also designated EFH for each individual groundfish species by life stage. These designations are contained within Appendix B of the FMP (PFMC, 2005a,b). Using the Pacific Habitat Use Relational Database developed by the PFMC, it was determined which groundfish species and life stages have EFH designated within the Action Area (Appendix C). The management unit in the Pacific Coast Groundfish FMP includes over 90 groundfish species (PFMC, 2016b). Of these, 37 were identified through the analysis of the Habitat Use Relational Database as having EFH designated in the greater Puget Sound, within the vicinity of all seven proposed MPR activities locations.

Based on the analysis, the primary habitats designated as EFH for groundfish include:

- The epipelagic zone of the water column, including macrophyte canopies and "drift algae";
- Unconsolidated sediments consisting of mud, sand, or mixed mud/sand;
- Hard-bottom habitats composed of boulder, bedrock, cobble, gravel, or mixed gravel/cobble;
- Mixed sediments composed of sand and rocks; and
- Vegetated bottoms consisting of algal beds, macrophytes, or rooted vascular plants.

Pacific Coast Salmon

The Pacific salmon management unit includes Chinook, coho, and pink salmon. The EFH designation for the Pacific salmon fishery in estuarine and marine environments in the state of Washington extends from nearshore and tidal submerged environments within state territorial waters out to the full extent of the exclusive economic zone (200 mi) offshore (PFMC, 2014). In addition to marine and estuarine waters, salmon species have a defined freshwater EFH, which includes all lakes, streams, ponds, rivers, wetlands, and other bodies of water that have been historically accessible to salmon (PFMC, 2014).

Pacific salmon EFH is primarily affected by the loss of suitable spawning habitat, barriers to fish migration (habitat access), reduction in water and sediment quality, changes in estuarine hydrology, and decreases in prey food source (PFMC, 2014). The most abundant Puget Sound forage fish species for salmonids include Pacific herring, surf smelt, and Pacific sand lance.

The current salmon FMP includes 19 subsequent amendments. As discussed above, prey (forage fish species) are included as EFH. Amendment 19 (PFMC, 2015) contains the final recommendations by the PFMC to protect unfished and unmanaged forage fish species. Amendment 18 was updated to reflect new information on EFH, including criteria for impassable barriers; addition of Habitat Areas of Particular Concern (HAPCs); adjustments to geographic extent of EFH; and addition of non-fishing activities and conservation measures (PFMC, 2016c). As indicated in the 2008 Final Rule that codified Pacific coast salmon EFH (73 FR 60987), all streams, estuaries, marine waters, and other water bodies occupied or historically accessible to salmon in Washington, Oregon, Idaho, and California are included within the EFH description.

Habitat Areas of Particular Concern Designations

Designated HAPCs are regarded as essential for protection of federally managed species. HAPCs may be more vulnerable to degradation than the more general EFH designated by the PFMC. HAPCs are designated based on four criteria: rarity of the habitat type, ecological importance to EFH species, sensitivity of the habitat to human-induced environmental degradation, and whether and to what extent development will stress the habitat type. Categorization as HAPC does not confer additional protection or restrictions to the designated area.

Four HAPCs designated for groundfish include: (1) Seagrass; (2) canopy kelp; (3) rocky reef; and (4) estuarine habitats along the Pacific coast, including Puget Sound (PFMC, 2016a). The estuarine habitats HAPC extends landward to MHHW or the upriver extent of saltwater intrusion. The seagrasses HAPC includes eelgrass beds in estuaries. Five HAPCs have been designated for Pacific coast salmon. These include: (1) complex channels and floodplain habitats; (2) thermal refugia; (3) spawning habitat; (4) estuaries; and (5) marine and estuarine submerged aquatic vegetation (PFMC, 2014). Eelgrass and kelp provide important nursery, foraging, and shelter habitats to a variety of fish species including salmon as well as spawning substrate to Pacific herring which is an important prey species for all marine life stages of Pacific salmon. Juvenile salmon utilize eelgrass beds as migratory corridors as they transition to the open ocean, and the beds provide both refuge from predators and an abundant food supply.

No HAPCs have been formally designated for coastal pelagic species.

3.3.2.4 Birds

Proposed MPR activities would take place in the marine environment; therefore, this discussion focuses on marine birds and species that utilize the shoreline. Major groupings of birds that occur in the project region include shorebirds, wading birds, marine waterfowl, raptors, and seabirds (Table 3–6). In Puget Sound, bird densities are typically highest in the winter; large numbers of marine waterfowl occur at this time. These seasonal fluctuations reflect the migratory nature of most bird species occurring there. Birds use manmade structures on waterfronts and trees along the shoreline for perching, resting, and (for a few species) nesting, and some of the bird species discussed in this section use upland areas for nesting. In general, the focus is on birds' use of marine and shoreline habitats (including estuarine habitat, shorelines, intertidal and subtidal zones of the nearshore marine, and marine deeper water habitat) and food resources.

3.3.2.4.1 Marbled Murrelet

The Washington, Oregon, and California DPS of the marbled murrelet was federally listed as threatened in 1992 by the USFWS (57 FR 45328). Critical habitat for nesting was designated for the marbled murrelet in 1996 (61 FR 26256) and revised in 2011 (76FR 61599). No designated critical habitat occurs in the Action Area for the proposed MPR activities.

Marbled murrelets are pursuit-diving seabirds that spend most of their lives in the marine environment and nest in mature and old-growth forests (USFWS, 1997). Murrelets can occur year round in Puget Sound, although their flock size, density, and distribution vary by season (Nysewander et al., 2005; Falxa et al., 2008). Murrelets use the marine environment for courtship, loafing, and foraging (USFWS, 2010b). Habitat selection in the marine environment depends on both terrestrial and marine resources. During the breeding season, nearshore marine locations in proximity to nesting habitat with cool water temperatures are most likely to be occupied (Lorenz et al., 2016). Additionally a lower human footprint, a factor that combines fishing activity, pollution, shipping traffic, human population density, light pollution, transportation infrastructure, and other variables, was also predictive of marbled murrelet use of marine habitats.

In this region, the nesting season is asynchronous between April 1 and September 23. During the breeding season, murrelets tend to forage in well-defined areas along the shoreline in relatively shallow marine waters. Throughout their range, marbled murrelets are opportunistic feeders and utilize prey of diverse sizes and species. Prey species in Washington coastal and inland waters have not been well documented, but include sand lance, anchovy, immature Pacific herring, shiner perch, and small crustaceans (especially euphausiids) (review by Burkett, 1995). Invertebrates are a primary prey source in the non-breeding season, whereas fish are a source year round. Murrelets typically forage in pairs during the summer, with singles and flocks of three or more birds occurring less often (Strachan et al., 1995; Merizon et al., 1997). During the pre-basic (post-breeding season) molt, murrelets are essentially flightless and must select foraging sites that provide adequate prey resources within swimming distance (Carter, 1984; Carter & Stein, 1995). During the non-breeding season, murrelets typically disperse and are found farther from shore (Strachan et al., 1995).

Table 3-6. Marine Bird Groupings and Families of Puget Sound

Marine Bird Grouping	*Marine Bird Families*	*Season(s) of Occurrence*	*Preferred Habitats*	*Preferred Prey*
Shorebirds and Wading Birds	Plovers, sanderlings, dowitchers, sandpipers, yellowlegs, and phalaropes Great blue heron	Killdeer: year round Spotted sandpiper: summer Phalaropes: during migration Great blue heron: year round All other species: winter and during spring and/or fall migration	Shorebirds: Intertidal zone, mudflats, beaches Great blue heron: shoreline, shallow marine and freshwater	Shorebirds: marine worms, insect larvae, aquatic insects Great blue heron: crustaceans, small fishes
Marine Waterfowl	Diving ducks (goldeneye, scoters, bufflehead), mergansers, dabbling ducks (mallard, wigeon), and geese Grebes, loons	Canada goose, red-necked and hooded mergansers, and some dabbling ducks: year round Surf and white-winged scoters: primarily winter and in non-breeding flocks during summer All other species: winter and/or during migration (spring and/or fall migration)	Canada goose, mergansers, dabbling ducks: marine and freshwater shorelines, eelgrass beds, and shallow water Scoters, goldeneyes: marine nearshore and deeper water, near piles Grebes, loons: marine nearshore and deeper water	Canada goose: vegetation Mergansers: small fishes Dabbling ducks: marine and freshwater vegetation, freshwater and marine larvae, aquatic and terrestrial insects Scoters, goldeneyes: molluscs, barnacles, crustaceans, other invertebrates, small fishes Grebes, loons: small fishes
Seabirds	Pursuit divers: auklets, murres, murrelets, guillemots, and cormorants Surface feeders: gulls and terns	Gulls: glaucous-winged gulls: year round; Ring-billed gull: year round; mew gull: winter, migrant; Bonaparte's gull: fall and spring migrant; other species: winter Terns: Caspian terns: summer; common tern: fall migrant All other species: year round	Pursuit divers: marine nearshore and deeper water Surface feeders (gulls, terns): shoreline, marine nearshore, and deeper water	Pursuit divers: small fishes, invertebrates, zooplankton Surface feeders: small fishes, molluscs, crustaceans, garbage, carrion

Sources: Smith et al., 1997; Opperman, 2003; Larsen et al., 2004; Wahl et al., 2005; WDFW, 2005

Murrelet presence in Puget Sound has been documented through a number of sources and survey efforts, including surveys of the Puget Sound Ambient Monitoring Program conducted by WDFW (Nysewander et al., 2005) from 1992 to 1999 and breeding season surveys conducted by the Northwest Forest Plan Marbled Murrelet Effectiveness Program (Miller et al., 2006; Raphael et al., 2007; annual reports available at http://www.reo.gov/monitoring/reports/marbled-murrelet-reports-publications.shtml). WDFW conducted at-sea surveys for 3 years beginning in the winter of 2012/2013 to obtain fall/winter/early spring density estimates for areas of Puget Sound near Navy locations (Pearson & Lance, 2013, 2014, 2015, 2016). These and other surveys, construction-period monitoring efforts, and opportunistic observations have documented the presence of this species in the vicinity of NAVBASE Kitsap Bangor, Manchester, Zelatched Point, NAVMAG Indian Island, and NAVSTA Everett. The WDFW surveys of Navy locations are not adequate to estimate marbled murrelet densities, and encounter rates were highly variable. WDFW surveys detected marbled murrelets in the vicinity of NAVBASE Kitsap Bangor, Zelatched Point, NAVMAG Indian Island, and NAVSTA Everett. Marbled murrelets were not reported in WDFW surveys at NAVBASE Kitsap Keyport, Manchester, and Bremerton, but they have been detected in other surveys in the vicinity (Puget Sound Ambient Monitoring Program [Nysewander et al., 2005]), and forage fish habitat at these locations could attract foraging murrelets.

3.3.2.4.2 Bald Eagles

The bald eagle was delisted from the federally threatened species list in 2007, but remains protected under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (16 U.S.C. 668), which prohibits the taking, possession of, or commerce in bald and golden eagles.

Bald eagles in the Pacific Northwest include resident birds and winter migrants that breed farther north. Migration patterns in general are timed to track the availability of spawning salmonids (Buehler, 2000). Bald eagles are present year round in Puget Sound. Many resident eagles in the Pacific Northwest migrate in late summer, when juveniles and adults move north up the coast to meet salmon runs in Alaska. At the end of these salmon runs in late fall, Alaskan and Pacific Northwest eagles move south, again following salmon runs (Watson & Pierce, 1998). Adults reach wintering grounds in Pacific Northwest states in November or December, followed by juveniles in January. Washington's wintering eagles begin to arrive in October from northern breeding territories in Alaska and Canada. The winter distribution of bald eagles in Washington is similar to the breeding distribution, but more concentrated at salmon spawning streams and waterfowl wintering areas. Winter ranges are considerably larger and more variable than breeding ranges (Buehler, 2000). Eagles that breed in more northern latitudes return to their breeding grounds during spring migration from January to March, depending on food resources and weather conditions. The last comprehensive survey of eagle territories was performed in 2005, when 1,125 bald eagle territories in Washington were identified. Seventy-five percent of the territories were occupied (WDFW, 2007).

3.3.2.4.3 Shorebirds

Shorebirds likely to occur within the project area are mainly present during winter and/or migration, depending on species life history. Exceptions include the killdeer, which is present year round, and the spotted sandpiper, a summer resident and potential breeder at several proposed MPR activities locations. Shorebirds primarily rely on resources in the Study Area for foraging during the non-breeding season when overwintering or as a stopover during spring and fall migrations (Buchanan, 2004). Both the killdeer and spotted sandpiper may nest close to water (Opperman, 2003). Many shorebirds such as plovers, sandpipers, sanderlings, and dowitchers forage on larvae and aquatic insects (Buchanan, 2004).

Other food sources include amphipods, copepods, crustaceans, and molluscs. Some roosting habitats used by shorebirds include salt flats or grassy areas adjacent to intertidal foraging areas, higher elevation sand beaches, log rafts, piles, and other floating structures, particularly when natural roost sites are limited (Buchanan, 2004).

3.3.2.4.4 Waterfowl

Most marine waterfowl species occur during the winter in the proposed MPR activities area and migrate north during their breeding season. However, common and hooded mergansers, Canada geese, and some dabbling duck species can be observed year round. Marine waterfowl primarily forage in the nearshore environment, including near man-made structures, but are also found in deeper marine waters. The primary forage resources of marine waterfowl include molluscs, crustaceans, and plant material. Other secondary food sources in the nearshore environment are aquatic larvae and invertebrates. In the Puget Sound, eelgrass beds are important foraging zones for dabbling ducks (Lovvorn & Baldwin, 1996). Mergansers, such as the common merganser, nest close to water in rock crevices, tree cavities, or under tree roots (Opperman, 2003) and may nest along shoreline habitat during summer. Marine waterfowl also rest on shore and in the intertidal zone.

3.3.2.4.5 Seabirds

Two primary guilds of seabirds occur within the Study Area: surface feeders and pursuit divers. Depending on individual species life history, surface-feeding seabirds occur in the Study Area during different seasons. Gulls and terns forage on small schooling fish (e.g., Pacific herring, Pacific sand lance, and juvenile salmonids) visible from the water surface in the nearshore and deeper marine waters. Additional forage resources taken opportunistically by gulls include objects gleaned on the water's surface, garbage on shore or inland, scavenged carrion, and small birds and eggs. Gulls can also forage in the intertidal zone. For example, some species feed on molluscs by dropping them from the air to break them on a hard surface on the ground.

Pursuit-diving seabirds can occur year round in the Study Area; however, numbers of some species are greater during winter months (e.g., pelagic cormorants, common murres, and pigeon guillemots). Cormorants, such as the double-crested cormorant, primarily nest in colonies along the outer coast of Washington, while non-breeding cormorants are found year round in the Puget Sound. Cormorants roost on buoys and other structures in Navy locations' waterfront areas. Pursuit-diving seabirds are found in nearshore and deeper marine waters where they capture prey underwater. They are also found near man-made structures where algal and invertebrate communities have become established on underwater piles. Similar to surface feeders, the primary forage resources of the pursuit divers include small schooling fish such as Pacific sand lance and Pacific herring. Pigeon guillemots forage more opportunistically on epibenthic fish and invertebrates (Vermeer et al., 1987).

3.3.2.5 Marine Mammals

Ten marine mammal species managed by NMFS have a reasonable potential to occur within Puget Sound (Table 3-7). A reasonable potential was defined as species with any regular occurrence in Puget Sound since 1995. Two of these species are listed under the ESA: the Southern Resident killer whale and two populations of the humpback whale, discussed further below. The following sections provide general accounts of the occurrence of marine mammal species in Puget Sound, including a qualitative summary of the likelihood of encountering each of these species at each proposed MPR activities location (Table 3-8).

Table 3-7. Marine Mammals Potentially Present Within Puget Sound

Species and Stock/DPS	***Stock Abundance[1]***	***ESA Status***
Humpback whale[2] (*Megaptera novaeangliae*) (1) Hawaii DPS (2) Mexico DPS (3) Central America DPS	(1) 11,398 (2) 3,264 (3) 411 See note below	(1) None (2) Threatened (3) Endangered
Minke whale (*Balaenoptera acutorostrata*) California–Oregon–Washington stock	636[3] (CV = 0.72)	None
Gray whale (*Eschrichtius robustus*) Eastern North Pacific stock	20,990[4] (CV = 0.05)	None
Killer whale (*Orcinus orca*) (1) West Coast Transient stock (2) Eastern North Pacific Southern Resident DPS	(1) 243[5] (2) 78[6]	(1) None (2) Endangered
Harbor porpoise (*Phocoena phocoena*) Washington Inland Waters stock	11,233[3] (CV = 0.37)	None
Dall's porpoise (*Phocoenoides dalli)* California–Oregon–Washington stock	25,750[3] (CV = 0.45)	None
Steller sea lion *(Eumetopias jubatus)* Eastern United States DPS	52,139[7]	None
California sea lion *(Zalophus californianus)* United States stock	296,750[4]	None
Northern elephant seal *(Mirounga angustirostris)* California Breeding stock	179,000[4]	None
Harbor seal *(Phoca vitulina)* (1) Washington Northern Inland Waters stock (2) Hood Canal stock (3) Southern Puget Sound stock	(1) 11,036[8] (CV = 0.15) (2) 2,009[9] (CV = 1.18) (3) 1,568[8] (CV = 0.15)	None

Note: Population estimate for humpback whales feeding on the California/Oregon coasts and Washington/southern British Columbia coasts is 1,918 (CV = 0.03).

Sources:

1. NMFS marine mammal stock assessment reports at: http://www.nmfs.noaa.gov/pr/sars/species.htm
2. Wade et al., 2016
3. Carretta et al., 2017
4. Carretta et al., 2014 as presented in Carretta et al., 2016
5. Allen & Angliss, 2011 as presented in Muto et al., 2017

6. Center for Whale Research, 2017
7. Muto et al., 2017
8. Carretta et al., 2014 as presented in Carretta et al., 2016
9. Jefferson et al., 2017

Key: CV = coefficient of variation; DPS = Distinct Population Segment

Table 3-8. Relative Occurrence of Marine Mammals at MPR Activities Locations

Species	*NAVBASE Kitsap Bangor (Hood Canal)*	*Zelatched Point (Hood Canal, Dabob Bay)*	*NAVBASE Kitsap Bremerton (Sinclair Inlet)*	*NAVBASE Kitsap Keyport (Liberty Bay)*	*NAVBASE Kitsap Manchester (Rich Passage/ Main Basin Puget Sound)*	*NAVSTA Everett (Port Gardner Bay/Possession Sound)*	*NAVMAG Indian Island (Port Townsend Bay)*
Humpback whale	Rare	Rare	Rare	Rare	Rare	Rare	Rare
Minke whale	Rare[1]	Rare	Rare	Rare	Infrequent	Rare	Rare
Gray whale	Rare	Rare	Rare	Rare	Rare	Seasonal	Rare
Transient killer Whale	Rare	Rare	Infrequent	Infrequent	Infrequent	Likely	Rare
Southern Resident killer whale	Rare	Rare	Rare	Rare	Infrequent September – April	Seasonal September – April	Rare
Harbor porpoise	Likely	Likely	Rare	Rare	Rare	Likely	Infrequent
Dall's porpoise	Rare	Rare	Rare	Rare	Rare	Rare	Rare
Steller sea lion	Haulout on site September – May	September – May	Rare	Rare	Haulout nearby September – May	Rare	Rare
California sea lion	Haulout on site August – early June	August – early June	Haulout on site August – early June	Rare	Haulout nearby August – early June	Haulout on site August – early June	Infrequent August – early June
Northern elephant seal	Rare	Rare	Rare	Rare	Rare	Rare	Rare
Harbor seal	Likely haulout on site	Likely	Likely	Likely	Likely	Likely haulout nearby	Likely haulout nearby

Notes:

Sightings of the species:

Rare = The distribution of the species is near enough to the area that the species could occur there or there are a few confirmed sightings.

Infrequent = Confirmed, but irregular sightings.

Likely = Confirmed and regular sightings of the species in the area year round.

Seasonal = Confirmed and regular sightings of the species in the area on a seasonal basis.

1. No historical occurrences reported.

More detailed location-specific information for each species, including available survey results, is presented in location-specific Chapters 4 through 10.

3.3.2.5.1 Threatened and Endangered Species

Humpback Whale

The Mexico and Central America distinct population segments of humpback whales are listed as depleted under the MMPA and threatened or endangered, respectively, under the ESA. Critical habitat has not been designated for humpback whales. A number of take reduction and recovery plans, as well as research and monitoring efforts are currently in place for the humpback whale.

The stock structure of humpback whales was defined by the NMFS based on feeding areas because of the species' fidelity to feeding grounds (Carretta et al., 2014). However, NMFS reclassified the humpback whale into 14 DPSs in 2016 (81 FR 62260), although stock structure has not yet been revised (Carretta et al., 2017). The DPSs are generally defined by breeding areas; most humpback whales migrate elsewhere to feed. Two of the humpback whale DPSs migrate and feed along the west coast of California, Oregon, and Washington: the Mexico DPS is listed as threatened and Central America DPS is listed as endangered. The California, Oregon, and Washington humpback whale stock occurs within Puget Sound and partially or fully coincides with the ESA-listed Mexico and Central America DPSs.

Humpback whales are distributed worldwide in all major oceans and most seas. They are typically found during the summer on high-latitude feeding grounds and during the winter in the tropics and subtropics around islands, over shallow banks, and along continental coasts where calving occurs (Calambokidis et al., 2008; Barlow et al., 2011). The California, Oregon, and Washington stock of humpback whales calve and mate in coastal Central America and Mexico and migrate up the coast in the summer and fall to feed (Carretta et al., 2007). Photo-identification studies suggest that whales feeding in the northwest are part of a small sub-population that primarily feeds from central Washington to southern Vancouver Island (Calambokidis et al., 2004, 2008).

Although humpback whales were common in inland Washington waters prior to the whaling period, few sightings had been reported in this area before 2002 (Scheffer & Slipp, 1948; Calambokidis & Steiger, 1990; Pinnell & Sandilands, 2004). Most sightings occur in the Strait of Juan de Fuca and in the San Juan Island area. In Puget Sound, Calambokidis et al. (2002) recorded only six individuals between 1996 and 2001. However, from January 2003 through July 2012 there were over 60 sightings reported to Orca Network, some of which could be the same individuals. A small number of humpback whales (based on concurrent sightings of one to four individuals, including a cow/calf pair) was present in Puget Sound from September 2015 to early 2017 (Orca Network, 2017). Most of the sightings reported to Orca Network since 2003 were in the main basin of Puget Sound with numerous sightings in the waters between Point No Point and Whidbey Island, Possession Sound, and southern Puget Sound in the vicinity of Point Defiance. Therefore, humpback whales are considered to be regular but not frequent visitors to Puget Sound, especially south of Admiralty Inlet. Puget Sound opportunistic sightings primarily occur April through July, but sightings are reported in every month of the year. Humpback whales usually occur in Puget Sound as individuals or in pairs (Orca Network, 2016). Humpback whales are expected to be rarely present at any of the seven proposed MPR activities locations, as described in Chapters 4 through 10, and the number that might occur is expected to be very low in any month.

Killer Whale, Eastern North Pacific Southern Resident Stock

The Southern Resident stock contains three pods (J, K, and L pods), considered one stock under the MMPA and as a "distinct population segment" (therefore, "species") under the ESA. The Southern

Resident stock is protected and designated as depleted under the MMPA and listed as endangered under the ESA.

In 2006, NMFS designated approximately 2,560 square miles (sq. mi) of critical habitat in three specific marine areas:

- Summer Core Area in Haro Strait and waters around the San Juan Islands
- Puget Sound
- Strait of Juan de Fuca

Puget Sound waters deeper than 20 ft. below extreme high tide are included in designated critical habitat, except that eighteen sites owned or controlled by the Department of Defense are excluded from critical habitat designation, including Navy locations within Puget Sound. Hood Canal is not included in designated critical habitat.

The Eastern North Pacific Southern Resident stock is a transboundary stock that occurs in inland waters of Washington and British Columbia. They regularly visit coastal sites off Washington state and Vancouver Island (Ford et al., 1994) and are known to travel as far south as central California (Black, 2011), but less is known of these offshore movements. Photo-identification of individual whales in the stock through the years has resulted in a substantial understanding of this stock's structure, behaviors, and movements in inland waters. Southern Resident killer whales are most frequently observed in the inland waters of Washington State and British Columbia during the late spring, summer, and fall (Hanson & Emmons, 2011). In Washington inland waters Southern Residents are most often observed in Haro Strait, along the west side of San Juan Island, and in the Strait of Juan de Fuca (see review in Kriete, 2007; NMFS 2008a; Hanson & Emmons, 2011). Southern Residents occasionally occur in Puget Sound typically in the fall or winter months (NMFS, 2006b) when in-water construction would occur.

Southern Resident killer whales are expected to occur occasionally in the waters surrounding all of the proposed MPR activities locations with the exception of NAVBASE Kitsap Bangor and Zelatched Point because they have not been reported in Hood Canal, including Dabob Bay, since 1995 (NMFS, 2006b) (as described in Chapters 4 through 10).

Pod sizes of Southern Resident killer whales range from approximately 19 (in K pod) to 35 (in L pod) individuals (Center for Whale Research, 2017). Group sizes encountered can be smaller or larger if pods temporarily separate or join together. Therefore, some exposure to groups of up to 20 individuals or more could occur over the duration of the proposed MPR activities.

3.3.2.5.2 Other Marine Mammal Species

Minke Whale

Minke whales are protected under the MMPA, but they are not designated as depleted, nor are they listed under the ESA. Because minke whales from California to Washington appear behaviorally distinct from migratory whales further north and are considered "resident," minke whales in coastal waters of California, Oregon, and Washington (including Washington inland waters) are considered a separate stock (Carretta et al., 2013).

Minke whales appear to establish home ranges in the inland waters of Washington (Dorsey, 1983; Dorsey et al., 1990). Minke whales are reported in the inland waters year round, although the majority of the records are from March through November (Calambokidis & Baird, 1994). Minke whales are sighted primarily in the San Juan Islands and Strait of Juan de Fuca but are relatively rare in Puget Sound south of Admiralty Inlet (Stern, 2005; Orca Network, 2016). Approximately 55 minke whale opportunistic sightings were recorded with Orca Network between January 2005 and August 2012. The majority of those sightings (41) were in Admiralty Inlet. The 14 records that were in Puget Sound, but not in the Admiralty Inlet portion, occurred from March through October. No sightings were reported in the vicinity of NAVBASE Kitsap Bremerton and Keyport (Rich Passage through the Agate Passage including Sinclair Inlet and Dyes Inlet) or NAVBASE Kitsap Bangor or Zelatched Point (Hood Canal). Minke whales typically occur as lone individuals or in small groups of two or three (Orca Network, 2016).

Based on the information presented, minke whales are expected to be rarely present at any of the proposed MPR activities locations, and the number is expected to be very low in any month.

Gray Whale

Two North Pacific populations of gray whales are formally recognized: the Western Pacific subpopulation (also known as the Western North Pacific or the Korean-Okhotsk population) that is critically endangered and shows no apparent signs of recovery, and the Eastern Pacific population (also known as the Eastern North Pacific or the California-Chukchi population) that appears to have recovered from exploitation and was removed from listing under the ESA in 1994 (Carretta et al., 2016). All populations of the gray whale are protected under the MMPA; the Western Pacific subpopulation is listed as endangered under the ESA and is depleted under the MMPA, but there is no designated critical habitat for this species.

Weller et al. (2013) and the NMFS stock assessment (Carretta et al., 2016) report observations of a small number of gray whales feeding in the western Pacific waters and wintering in eastern North Pacific waters. It is uncertain which stock these individuals belong to, and none of them have been observed in Puget Sound; therefore, it is unlikely that any members of the endangered western Pacific stock occur in the vicinity of MPR locations.

A group of a few hundred gray whales known as the Pacific Coast Feeding Group feeds along the Pacific coast between southeastern Alaska and southern California throughout the summer and fall (Calambokidis et al., 2002). This group of whales has generated uncertainty regarding the stock structure of the Eastern North Pacific population (Carretta et al., 2013). Photo-identification, telemetry, and genetic studies suggest that the Pacific Coast Feeding Group may be demographically distinct (Calambokidis et al., 2010; Mate et al., 2010; Frasier et al., 2011). However, the NMFS Task Force on gray whale stock structure (Weller et al., 2013) was not able to provide definitive advice as to whether the Pacific Coast Feeding Group is a separate population stock under MMPA guidelines, and the group has no formal status under the MMPA, International Union for Conservation (of Nature and Natural Resources), or ESA. Currently, the Pacific Coast Feeding Group is not treated as a distinct stock in the NMFS stock assessment reports, but this may change in the future based on new information (Weller et al., 2013; Carretta et al., 2016).

Gray whales are observed in Washington Inland waters, including Puget Sound in all months of the year (Calambokidis et al., 2010; Orca Network, 2016) with peak numbers from March through June (Calambokidis et al., 2010). Fewer than 20 gray whales are documented in the inland waters of Washington and British Columbia each year beginning in January (WDFW, 2012). Most whales sighted are part of a small regularly occurring group of 6 to 10 gray whales that use mudflats in the Whidbey Island and the Camano Island area as a springtime feeding area (Calambokidis et al., 2010). Observed feeding areas are located in Saratoga Passage between Whidbey and Camano Islands including

Crescent Harbor, and in Port Susan Bay located between Camano Island and the mainland north of Everett (Orca Network, 2016). Gray whales feed on benthic invertebrates, including dense aggregations of ghost shrimp and tubeworms (Weitkamp et al., 1992; Richardson, 1997).

Gray whales that are not identified with the regularly occurring group in the Whidbey Island and Camano Island area are occasionally sighted in Puget Sound. These whales are not associated with feeding areas and are often emaciated (WDFW, 2012). There are typically from 2 to 10 stranded gray whales per year in Washington (Cascadia Research, 2012).

Gray whales are expected to be infrequently present in the waters near NAVSTA Everett and would rarely occur in the vicinity of any other proposed MPR activities locations, as described in Chapters 4 through 10. Gray whales are expected to occur primarily from March through June when in-water construction work would not occur.

Killer Whale, West Coast Transient Stock

Among the genetically distinct assemblages of killer whales in the northeastern Pacific, the West Coast Transient stock, which occurs from California to southeastern Alaska, is one of two stocks that may occur in the proposed MPR activities area. The other is the Southern Resident killer whale population, which is addressed below. Killer whales belonging to the West Coast Transient stock are protected under the MMPA, but not listed under the ESA.

Transient killer whales in the Pacific Northwest spend most of their time along the outer coast of British Columbia and Washington, but visit inland waters in search of harbor seals, sea lions, and other prey. Transients may occur in inland waters in any month (Orca Network, 2016). During the period 2004–2010, transient killer whales occurred in Washington inland waters most frequently in August–September with a strong second peak in April–May (Houghton et al., 2015).

The number of West Coast Transient killer whales in Washington inland waters at any one time was considered likely to be fewer than 20 individuals (Wiles, 2004). Recent research suggests that the transient killer whales use of inland waters from 2004 through 2010 has increased and the trend is likely due to increasing prey abundance (Houghton et al., 2015). Transient killer whales may occur in the vicinity of proposed MPR activities locations, although they are less likely to be present at the two locations in Hood Canal (NAVBASE Kitsap Bangor and Zelatched Point).

West Coast Transient killer whales most often travel in small pods of up to four individuals (Baird & Dill, 1996). Houghton et al. (2015) reported that the group size most often observed in the Salish Sea was four whales for 2004–2010, is larger than the size most often observed from 1987–1993, and that group size appeared to be increasing from 2004–2010. According to unpublished data (Houghton, 2012), the most commonly observed group size in Puget Sound from 2004 to 2010 was six whales (Houghton, 2012).

Harbor Porpoise

Harbor porpoises are protected under the MMPA, but not listed under the ESA. NMFS conservatively recognizes two stocks in Washington waters: the Oregon/Washington Coast stock and the Washington Inland Waters stock (Carretta et al., 2013). Individuals from the Washington Inland Waters stock are expected to occur in Puget Sound.

In Washington inland waters, harbor porpoise are known to occur in the Strait of Juan de Fuca and the San Juan Island area year round (Calambokidis and Baird, 1994; Osmek et al., 1996; Carretta et al., 2012). Harbor porpoises were historically one of the most commonly observed marine mammals in Puget Sound (Scheffer and Slipp, 1948); however, there was a significant decline in sightings beginning in the 1940s (Everitt et al., 1979; Calambokidis et al., 1992). Only a few sightings were reported between the 1970s and 1980s (Calambokidis et al., 1992; Osmek et al., 1996; Suryan & Harvey, 1998), and no harbor porpoise sightings were recorded during multiple ship and aerial surveys conducted in Puget Sound (including Hood Canal) in 1991 and 1994 (Calambokidis et al., 1992; Osmek et al., 1996). Incidental sightings of marine mammals during aerial bird surveys conducted as part of the Puget Sound Ambient Monitoring Program (PSAMP) detected few harbor porpoises in Puget Sound between 1992 and 1999 (Nysewander et al., 2005). However, these sightings may have been negatively biased due to the low elevation of the plane, which may have caused an avoidance behavior. Since 1999, PSAMP data, stranding data, and aerial surveys conducted from 2013 to 2015 documented increasing numbers of harbor porpoise in Puget Sound, indicating that the species is increasing in the area (Nysewander, 2008; Jeffries, 2013; Jefferson et al., 2016; Smultea et al., 2017).

Harbor porpoises could be present in waters in the vicinity of any of the proposed MPR activities locations (as described in Chapters 4 through 10).

Dall's Porpoise

Dall's porpoises are protected under the MMPA and are not listed under the ESA. The California, Oregon, and Washington stock occurs in Washington inland waters (Carretta et al., 2011 as presented in Carretta et al., 2016).

Dall's porpoises may occur in Washington inland waters year round, but are considered to be a more pelagic species (Carretta et al., 2012). Dall's porpoise are most frequently observed in the Strait of Juan de Fuca and Haro Strait between San Juan Island and Vancouver Island (Nysewander et al., 2005; Orca Network, 2016). Tagging studies suggest Dall's porpoises seasonally move between the Haro Straight area and the Strait of Juan de Fuca or farther west (Hanson et al., 1998).

Dall's porpoise sightings in Puget Sound were reported from aerial surveys during winter (1993–2008) and summer (1992–1999) as part of the PSAMP (Nysewander et al., 2005; Evenson et al., 2016), with additional observations reported to Orca Network (2016). Dall's porpoise have been sighted in Puget Sound as far south as Carr Inlet in southern Puget Sound and as far north as Saratoga Passage, north of NAVSTA Everett. One detection in Hood Canal was reported in deeper water near NAVBASE Kitsap Bangor in summer 2008 (Tannenbaum et al., 2009a). In recent years, several vessel line-transect surveys and other monitoring efforts have been completed in Hood Canal (including Dabob Bay), and Dall's porpoise were not seen (HDR, 2012). Extensive aerial surveys conducted in Puget Sound and Hood Canal in all seasons from 2013–2015 logged only one sighting of one individual in April 2015 (Jefferson et al., 2016). Only four Dall's porpoise were detected in aerial surveys of the northern inland waters of Washington (Strait of Juan de Fuca, San Juan Islands, Strait of Georgia) during spring 2015 (Smultea et al., 2017). Dall's porpoises were not documented in aerial surveys of Rich Passage to Agate Passage area in the vicinity of NAVBASE Kitsap Bremerton or Keyport (Nysewander et al., 2005). Dall's porpoises were documented in Possession Sound near Naval Station Everett, with all but one sighting occurring in the winter (Nysewander et al., 2005).

Dall's porpoises could be present in waters in the vicinity of any of the proposed MPR activities locations but are considered rare. They can be expected in groups of up to 25 individuals and are more likely to occur during winter months than summer months.

Steller Sea Lion

The Eastern DPS (stock) of Steller sea lions was removed from listing under the ESA in April 2012 because it was stable or increasing throughout the northern portion of its range (Southeast Alaska and British Columbia) and stable or increasing slowly in the central portion of its range (Oregon through northern California) (77 FR 23209, NMFS, 2012a). Critical habitat has been designated for the Steller sea lion (58 FR 45269); however, there is no designated critical habitat for the species in Washington State.

The eastern stock of Steller sea lions is found along the coasts of southeast Alaska to northern California where they occur at rookeries and numerous haulout locations along the coastline (Jeffries et al., 2000; Scordino, 2006; NMFS, 2012b). Male Steller sea lions often disperse widely outside of the breeding season from breeding rookeries in northern California (St. George Reef) and southern Oregon (Rogue Reef) (Scordino, 2006; Wright et al., 2010).

In Washington, Steller sea lions use haulout sites primarily along the outer coast from the Columbia River to Cape Flattery, as well as along the Vancouver Island side of the Strait of Juan de Fuca (Jeffries et al., 2000). A major winter haulout is located in the Strait of Juan de Fuca at Race Rocks, British Columbia, Canada (Canadian side of the Strait of Juan de Fuca) (Edgell & Demarchi, 2012). Numbers vary seasonally in Washington with peak numbers present during the fall and winter months and a decline in the summer months that corresponds to the breeding season at coastal rookeries (approximately late May to early June) (Jeffries et al., 2000). In Puget Sound, Jeffries (2012) identified five winter haulout sites used by adult and subadult (immature or pre-breeding animals) Steller sea lions, ranging from immediately south of Port Townsend (near Admiralty Inlet) to Olympia in southern Puget Sound (see Figure 3-7). Numbers of animals observed at these sites ranged from a few to less than 100 (Jeffries, 2012). In addition, Steller sea lions opportunistically haul out on various navigational buoys in Admiralty Inlet south through southern Puget Sound near Olympia (Jeffries, 2012). One or two animals occur on these buoys.

The Navy conducts surveys at its locations in Puget Sound that have sea lion haulouts (Navy, 2016b). Steller sea lion haulouts are located at NAVBASE Kitsap Bangor and near NAVBASE Kitsap Manchester (figures provided in location-specific chapters). Occurrence and abundance of Steller sea lions at proposed MPR activities locations is described in greater detail in Chapters 4 through 10.

California Sea Lion

California sea lions are protected under the MMPA and are not listed under the ESA. NMFS has defined one stock for California sea lions (U.S. Stock), with five genetically distinct geographic populations. Animals from the Pacific Temperate population range north into Canadian waters, and movement of animals between U.S. waters and Baja California waters has been documented (Carretta et al., 2013).

During the summer, California sea lions breed on islands from the Gulf of California to the Channel Islands and seldom travel more than about 31 mi from the islands. In the nonbreeding season, adult and subadult males migrate northward along the coast to central and northern California, Oregon, Washington, and Vancouver Island, and return south in the spring. California sea lions also enter bays, harbors, and river mouths and often haul out on man-made structures such as piers, jetties, offshore buoys, and oil platforms.

Jeffries et al. (2000) and Jeffries (2012) identified dedicated, regular haulouts used by adult and subadult California sea lions in Washington inland waters (Figure 3-7). Main haulouts occur at NAVBASE Kitsap Bangor, NAVBASE Kitsap Bremerton, and NAVSTA Everett, as well as in Rich Passage near Manchester,

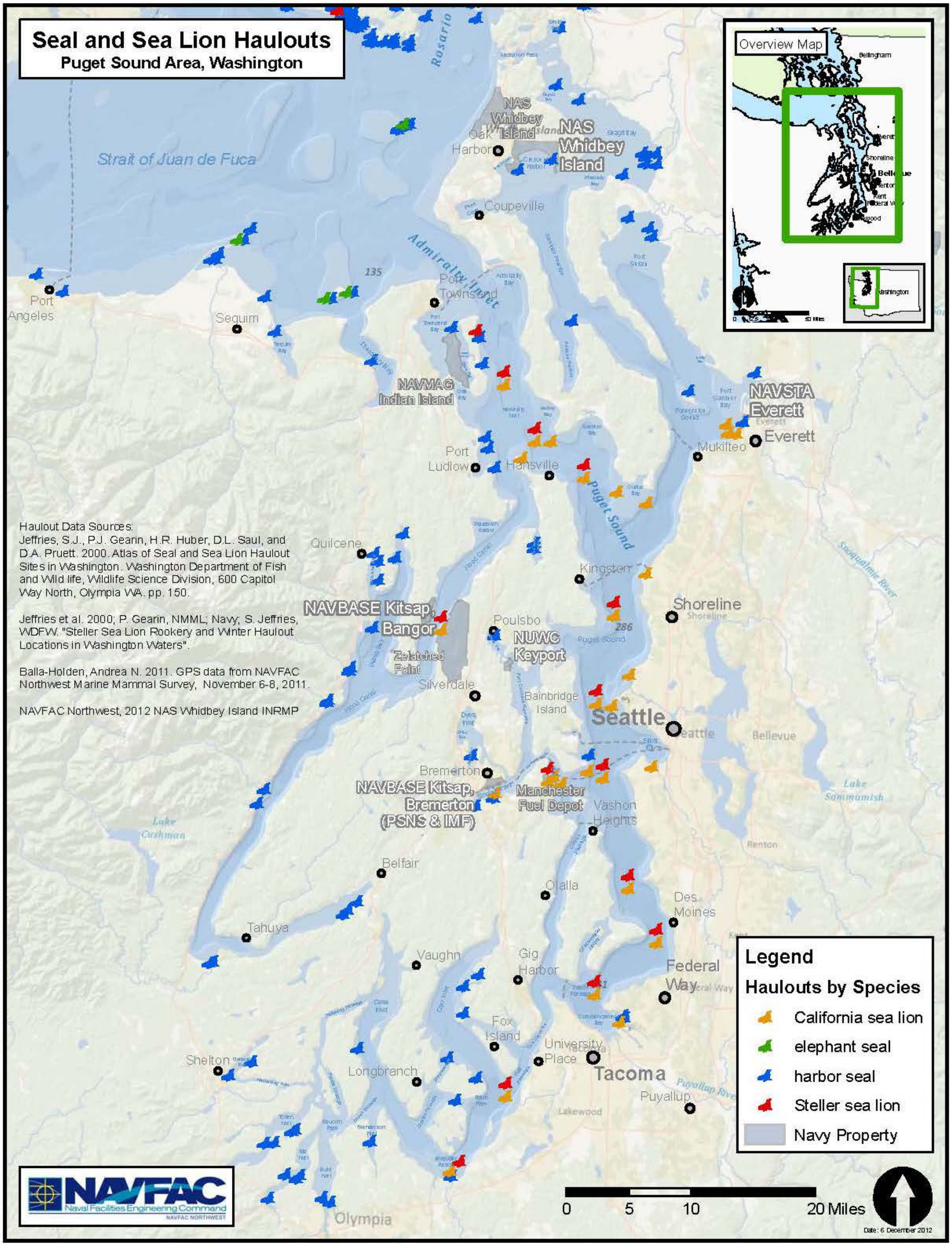

Figure 3-7. Pinniped Haulouts in the Vicinity of the MPR Project Areas

Seattle (Shilshole Bay), south Puget Sound (Commencement Bay, Budd Inlet), and numerous navigation buoys south of Whidbey Island to Olympia in south Puget Sound (Jeffries et al., 2000; Jeffries, 2012) (Figure 3-7).

California sea lions are typically present between August and early June in Washington inland waters, with peak abundance numbers between October and May (NMFS, 1997; Jeffries et al., 2000). California sea lions would be expected to forage within the area, following local prey availability. During summer months and associated breeding periods, the inland waters would not be considered a high-use area by California sea lions, as they would be returning to rookeries in California waters. However, as described below, surveys at Bangor indicate that a few individuals are present through mid-June and have arrived as early as August with at least one individual remaining in July 2014 (Navy, 2016b). Surveys at NAVSTA Everett in 2012 and 2013 indicate a few individuals may remain year round (Thompson, 2012; Navy, 2016b). The Navy conducts surveys at its locations in Puget Sound that have sea lion haulouts (Navy, 2016b), which include NAVBASE Kitsap Bangor, NAVBASE Kitsap Bremerton, NAVBASE Kitsap Manchester, and NAVSTA Everett. Occurrences and abundances of sea lions at these locations are discussed in greater detail in Chapters 4 through 10.

Northern Elephant Seal

Northern elephant seals are protected under the MMPA and are not listed under the ESA. NMFS has defined one stock for the northern elephant seal, the California Breeding stock, which may occur in Puget Sound.

The northern elephant seal occurs almost exclusively in the eastern and central North Pacific. Rookeries are located from central Baja California, Mexico, to northern California (Stewart & Huber, 1993). Adult elephant seals engage in two long migrations per year, one following the breeding season, and another following the annual molt (Stewart & DeLong, 1995; Robinson et al., 2012). Their foraging range extends thousands of miles offshore into the central North Pacific and along the Aleutian Islands (Robinson et al., 2012). Adults tend to stay offshore, but juveniles and subadults are often seen along the coasts of Oregon, Washington, and British Columbia (Condit & Le Boeuf, 1984; Stewart & Huber, 1993; Le Boeuf et al. 1996).

In Washington inland waters, there are regular haulout sites at Smith and Minor Islands, Dungeness Spit, and Protection Island in the Strait of Juan de Fuca that are thought to be used year round (Jeffries et al., 2000; Jeffries, 2012) (Figure 3-7). Pupping has occurred at these sites, as well as Race Rocks on the British Columbia side of the Strait of Juan de Fuca (Jeffries, 2012). Typically these sites have small numbers of 2 to 10 individuals present.

No haulouts occur in Puget Sound with the exception of individual elephant seals occasionally hauling out for two to four weeks to molt, usually during the spring and summer and typically on sandy beaches (Calambokidis & Baird, 1994; Norberg, 2012). These animals are usually yearlings or subadults and their haulout locations are unpredictable (Norberg, 2012). The National Stranding Network database reported one male subadult elephant seal hauled out to molt at Manchester Fuel Depot in February 2004. Although regular haulout occur in the Strait of Juan de Fuca, the occurrence of elephant seals in Puget Sound is unpredictable and rare.

Harbor Seal

Harbor seals are not listed as depleted under the MMPA, nor are they listed under the ESA. Three stocks occur in Washington’s inland waters: Hood Canal, Northern Inland Waters, and Southern Puget Sound.

Based on radiotelemetry results, interchange between inland and coastal stocks is unlikely (Jeffries et al., 2003).

Harbor seals are a coastal species, rarely found more than 12 mi. from shore, and frequently occupy bays, estuaries, and inlets (Baird, 2001). Ideal harbor seal habitat includes haulout sites, shelter during the breeding periods, and sufficient food (Bjørge, 2002). Haulout areas can include intertidal and subtidal rock outcrops, sandbars, sandy beaches, peat banks in salt marshes, and man-made structures such as log booms, docks, and recreational floats (Wilson, 1978; Prescott, 1982; Schneider & Payne, 1983, Gilbert & Guldager, 1998; Jeffries et al., 2000; Lambourn et al., 2010). Harbor seals do not make extensive pelagic migrations, though some long distance movement of tagged animals in Alaska (108 mi) and along the U.S. west coast (up to 342 mi) have been recorded (Brown & Mate, 1983; Womble & Gende, 2013). Harbor seals have also displayed strong fidelity to haulout sites.

Harbor seals are the most common, widely distributed marine mammal found in Washington marine waters and are frequently observed in the nearshore marine environment. They occur year round and breed in Washington. Numerous harbor seal haulouts occur in Washington inland waters (Figure 3-7). Haulouts include intertidal and subtidal rock outcrops, beaches, reefs, sandbars, log booms, and floats. Numbers of individuals at haulouts range from a few to between 100 and 500 individuals (Jeffries et al., 2000). The Navy conducts surveys at its locations in Puget Sound that have harbor seal haulouts (Navy 2016b), which include NAVBASE Kitsap Bangor and NAVSTA Everett. Occurrences and abundances of seals at these locations are discussed in greater detail in Chapters 4 through 10.

Harbor seals are expected to occur year round at all locations with the greatest numbers expected at NAVSTA Everett where there is a large nearby haulout site.

3.3.3 Approach to Analysis

The evaluation of impacts to biological resources and their habitats considers whether the species is listed under the ESA or afforded federal protection under other regulations (i.e., MMPA, Bald and Golden Eagle Protection Act, and MBTA). Also considered is whether the species has a particular sensitivity to stressors of the Proposed Action and/or a substantial or important component of the species' habitat would be lost as a result of the Proposed Action. The main stressor to biological resources would be elevated noise and vibrations within the airborne and aquatic habitat during impact and vibratory pile driving. Appendix B discusses airborne and underwater noise evaluation criteria for marine fish, marine birds, and marine mammals, provides a detailed analysis of noise-related impacts, and discusses physiological and behavioral responses to airborne and underwater noise. Site-specific analysis is summarized in Chapters 4 through 10 of this EA.

3.4 Cultural Resources

Cultural resources are historic districts, sites, buildings, structures, or objects considered important to a culture, subculture, or community for scientific, traditional, religious, or other purposes. They include archaeological resources, historic era architectural/engineering resources, and traditional resources. Cultural resources that are eligible for listing in the National Register of Historic Places (NRHP) are referred to as historic properties and subject to Section 106 of the National Historic Preservation Act (NHPA). In addition, some cultural resources, such as Native American sacred sites or traditional resources may not be historic properties, but they are also evaluated under NEPA for potential adverse effects from a federal action. These resources are identified through consultation with appropriate Native American or other interested groups.

3.4.1 Regulatory Setting

Cultural resources are governed by federal laws and regulations, including, but not limited to, the NHPA, Archeological and Historic Preservation Act, American Indian Religious Freedom Act, Archaeological Resources Protection Act of 1979, and the Native American Graves Protection and Repatriation Act of 1990; and, applicable state laws. Federal agencies' responsibility for protecting historic properties is defined primarily by sections 106 and 110 of the NHPA. Section 106 requires federal agencies to take into account the effects of their undertakings on historic properties. Section 110 of the NHPA requires federal agencies to establish—in conjunction with the Secretary of the Interior—historic preservation programs for the identification, evaluation, and protection of historic properties.

Section 106 requires the Navy to identify historic properties within the proposed project's area of potential effect, determine potential effects the proposed project may have on identified historic properties, and consult with the SHPO on the APE, determinations of eligibility and findings of effects.

Under federal law, impacts to cultural resources (whether the resources are archaeological, architectural, or traditional) may be considered adverse if the resources are listed in, or are eligible for listing in, the NRHP (i.e., are historic properties) and the impact affects the NRHP eligibility of the resource, or if the resource is important to traditional cultural groups, such as American Indians. An action results in adverse impacts to a historic property when it alters the resource's characteristics that make the historic property eligible for the NRHP, including relevant features of its environment or use.

3.4.2 Affected Environment

Historic properties identified at, or near the individual project sites are discussed in the location-specific chapters. Pursuant to regulations governing cultural resources, the inadvertent discovery of potentially significant archaeological resources during construction would compel the Navy to stop work in the immediate area and then follow the Section 106 process for subsequent discovery (36 CFR 800.13), including evaluating the effects to such resources through consultation with the SHPO, affected American Indian tribes, and other interested parties. Similarly, if American Indian human remains, funerary items, sacred objects, or items of cultural patrimony are encountered, the Navy must comply with the Native American Graves Protection and Repatriation Act (NAGPRA) and state laws, as applicable.

3.4.3 Approach to Analysis

The assessment of impacts to cultural resources considers both direct and indirect impacts. Direct impacts may occur by physically altering, damaging, or destroying all or part of a resource; altering characteristics of the surrounding environment that contribute to the resource's importance; introducing visual or audible elements that are out of character with the property or alter its setting; or neglecting the resource to the extent that it deteriorates or is destroyed. Direct impacts can be assessed by identifying the types and locations of activities and determining the exact location of cultural resources that could be impacted. Indirect impacts could result from project-related features that lead to effects that are removed in time or space from the action. Indirect impacts are derived from the possible future outcome of activities, such as improved access that could lead to more visits to a historic property, potentially resulting in changes to the resource.

For NAVBASE Kitsap Bangor, NAVBASE Kitsap Bremerton, NAVBASE Kitsap Keyport, NAVBASE Kitsap Manchester, Naval Station Everett, and Zelatched Point, the Navy initiated Section 106 consultation with the SHPO (letter dated May 12, 2016) and requested concurrence with the definition of the areas of potential effect (APE); the Navy received SHPO concurrence (letter dated June 1, 2016), and consulted with the SHPO on determinations of eligibility and findings of effect of the Proposed Action on historic properties at each Navy location (letter dated April 17, 2017). The Navy has determined there is no adverse effect on any historic property: i.e., no cultural resource that is listed, or eligible for listing, in the NRHP would be adversely affected by the Proposed Action. The SHPO concurred with the Navy's determination of no adverse effect from proposed MPR activities in letters dated May 31, 2017 (NAVBASE Kitsap Bangor, NAVBASE Kitsap Keyport, NAVBASE Kitsap Manchester, Naval Station Everett, and Zelatched Point) and August 2, 2017 (NAVBASE Kitsap Bremerton) (Appendix E). The Navy notified the National Park Service of potential impacts to the National Historic Landmark District at NAVBASE Kitsap Bremerton (Appendix E). The National Park Service did not object to the action. The Navy consulted with the Jamestown S'Klallam Tribe, Lower Elwha Tribal Community, Lummi Tribe, Port Gamble S'Klallam Tribe, Skokomish Indian Tribe, Stillaguamish Tribe, Suquamish Tribe, Swinomish Indian Tribal Community, Tulalip Tribes, and the Swinomish Indian Tribal Community as required by the implementing regulations of Section 106 of the NHPA (36 CFR 800.4(a)(4)).

For NAVMAG Indian Island, the Navy initiated Section 106 consultation with the SHPO (letter dated March 29, 2019) and requested concurrence with the definition of the APE and findings of effect of the Proposed Action on historic properties. The Navy has determined there is no adverse effect on any historic property: i.e., no cultural resource that is listed, or eligible for listing, in the NRHP would be adversely affected by the Proposed Action. The SHPO concurred with the Navy's APE and determination of no adverse effect in a letter dated April 8, 2019. The Navy consulted with the Jamestown S'Klallam Tribe, Lower Elwha Tribe, Port Gamble S'Klallam Tribe, and Suquamish Tribe as required by the implementing regulations of Section 106 of the NHPA (36 CFR 800.4(a)(4)).

3.5 American Indian Traditional Resources

3.5.1 Regulatory Setting

3.5.1.1 DoD and Navy Policies

On October 21, 1998, the DoD promulgated its *Native American and Alaska Native Policy*, emphasizing the importance of respecting and consulting with federally recognized tribal governments on a government-to-government basis (explanatory text was added on November 21, 1999). The policy requires an assessment, through consultation, of the effects of proposed DoD actions that may have the potential to significantly affect protected tribal resources (including traditional subsistence resources such as shellfish and fisheries), tribal rights (such as access to fisheries), and American Indian lands before decisions are made by the DoD.

In 2005, the Navy updated its policy for consultation with federally recognized American Indian tribes. SECNAVINST 11010.14A, *Department of the Navy Policy for Consultation with Federally Recognized Indian Tribes*, implements DoD policy within the Navy and encourages ongoing consultation and communication. Subsequent updates to SECNAVINST 5090.8a (*Policy for Environmental Protection, Natural Resources, and Cultural Resources Programs* 2006) also mandate American Indian consultation.

Commander, Navy Region Northwest Instruction 11010.14, *Policy for Consultation with Federally Recognized American Indian and Alaska Native Tribes* (November 10, 2009), sets forth policy, procedures, and responsibilities for consultations with federally recognized American Indian and Alaska Native Tribes in the Navy Region Northwest area of responsibility. The goal of the policy is to establish permanent working relationships built upon respect, trust, and openness with tribal governments.

3.5.1.2 Laws, Executive Orders, and Memoranda Mandating Consultation

Other federal laws, executive orders (EOs), and memoranda include policies requiring consultation with American Indians regarding concerns specific to native interests. These include the following: NHPA, American Indian Religious Freedom Act, the Archaeological Resources Protection Act, NAGPRA, EO 12898 Environmental Justice, EO 13007 Indian Sacred Sites, EO 13175 Consultation and Coordination with Indian Tribal Governments, Presidential Memorandum dated November 5, 2009, emphasizing agencies' need to comply with EO 13175, and the Presidential Memorandum dated April 29, 1994, *Government-to-Government Relations with Native American Governments*.

3.5.1.3 Government-to-Government Consultation

In accordance with DoD and Navy policy, the Navy invited tribes to initiate government-to-government consultation (Appendix F). There are nine federally recognized American Indian tribes that have treaty reserved rights in the project area of the Proposed Action: Jamestown S'Klallam Tribe, Lower Elwha Tribal Community, Lummi Tribe, Port Gamble S'Klallam Tribe, Skokomish Indian Tribe, Stillaguamish Tribe, Suquamish Tribe, Swinomish Indian Tribal Community, and Tulalip Tribes.

3.5.2 Affected Environment

Protected tribal resources, as defined in DoD Instruction 4710.02, *DoD Interactions with Federally-Recognized Tribes*, are "those natural resources and properties of traditional or customary religious or cultural importance, either on or off Indian lands, retained by or reserved by or for Indian Tribes through treaties, statutes, judicial decisions, or EOs, including tribal trust resources." Tribal trust resources include plants, animals, and locations associated with hunting, fishing, and gathering activities for subsistence or ceremonial use. For the purposes of this section, the term "traditional resources" will be used to encompass protected tribal resources.

In 1855, Territorial Governor Isaac Stevens negotiated treaties with 24 of the 29 modern-day federally recognized tribes located in Washington State. The treaties included language pronouncing that "[T]he right of taking fish at usual and accustomed (U&A) grounds and stations is further secured to said Indians in common with all citizens of the Territory ... together with the privilege of hunting and gathering roots and berries on open and unclaimed lands." Subsequent legal decisions have identified U&A areas and afforded tribes the right to up to fifty percent of all fish and shellfish present or passing through the tribe's historical U&A areas, including on and off-reservation areas where tribes engaged in fishing, hunting and gathering of food, as well as access to historical fishing grounds and stations as identified in treaties and other documents. Because many of the U&A areas are co-located with waters owned or used by the Navy in the COMNAVREG NW AOR, consultation with potentially affected tribes is required. In accordance with DoD and Navy policy, the Navy invites government-to-government consultation with federally recognized tribal governments when a proposed action may have the potential to significantly affect tribal rights, protected resources, or Indian lands.

The tribes with treaty reserved rights at NAVBASE Kitsap requested that additional project details be provided as they become available in the future. Additionally, the Suquamish Tribe provided comments on the Revised Draft EA, but determined it was not necessary to meet with the Navy to discuss these comments (Baxter, 2019). NAVSTA Everett has completed consultation with the Tribes at NAVSTA Everett. Tribes with protected treaty resources at NAVMAG Indian Island declined to request government-to-government consultation. Government-to-government consultation with the Tribes is complete.

American Indian traditional cultural properties (i.e., American Indian cultural resources that are eligible for listing in the NRHP under the NHPA) are discussed in Section 3.4 (Cultural Resources).

3.5.3 Approach to Analysis

The evaluation of impacts on traditional resources considers whether the resource itself is affected or if there is a change in access to the resource. Impacts may be clearly identified, as when a known traditional resource is directly affected or access is changed. Consultation with potentially affected tribal governments of federally recognized American Indian tribes may be necessary so the Navy can carefully consider and evaluate the extent of any potential effects and to reach agreement on appropriate treaty mitigation projects and/or measures.

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4 NAVBASE Kitsap Bangor Affected Environment and Environmental Consequences

4.1 Airborne Noise

4.1.1 Affected Environment

Airborne sound measurements were taken at Delta Pier within the waterfront industrial area at NAVBASE Kitsap Bangor during a 2-day period in October 2010. During this period, daytime sound levels ranged from 60 A-weighted decibel (dBA) to 104 dBA, with average values of approximately 64 dBA. Evening and nighttime levels ranged from 64 to 96 dBA, with an average level of approximately 64 dBA. Thus, daytime maximum levels were higher than nighttime maximum levels, but average nighttime and daytime levels were similar (Navy, 2010). More recent measurements, taken during the Navy's Test Pile Program located near EHW-1 at NAVBASE Kitsap Bangor, indicated an average airborne ambient sound level of 55 dBA (Illingworth & Rodkin, 2012). Maximum sound levels from the 2010 recordings were produced by a combination of sources including heavy trucks, forklifts, cranes, marine vessels, mechanized tools and equipment, and other sound-generating industrial/military activities. Maximum sound levels were intermittent in nature and not present at all times. Based on the sound levels measured at the highly industrial location at Delta Pier, the Navy estimated that maximum airborne sound levels at other Bangor pier locations with a high level of industrial activity may reach as high as 104 dBA due to trucks, forklifts, cranes, and other industrial activities. Sound levels would vary by time and location, but average background sound levels are expected to range from approximately 55 dBA (average from Test Pile Program at NAVBASE Kitsap Bangor) to 64 dBA (average levels measured at Delta Pier at NAVBASE Kitsap Bangor) (Navy, 2010; Illingworth & Rodkin, 2012).

The closest sensitive noise receptors at Bangor include residences located just north of the northern property boundary, approximately 1.5 mi from the Bangor waterfront. The waterfront is about 2.5 mi southwest of the nearest school and 13 mi north of the nearest hospital. Tribal shellfish harvesting is permitted at Devil's Hole Beach located on the waterfront, but is used only intermittently. The closest community west of the base across Hood Canal is approximately 4 mi away, and the closest on-base residence is 3.75 mi away.

4.1.2 Environmental Consequences

4.1.2.1 No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to baseline airborne noise. Therefore, no significant impacts to airborne noise would occur with implementation of the No Action Alternative.

4.1.2.2 MPR Activities (Preferred Alternative) Potential Impacts

The proposed MPR activities would result in temporarily elevated underwater and airborne noise levels. Noise would be generated from support vessels, small boat traffic, and barge-mounted equipment, such as generators, and pile extraction and installation equipment. Noise levels from all activities except pile driving would typically not exceed ambient sound levels resulting from routine waterfront operations in the vicinity of any of the structures in the proposed MPR activities locations. The highest project-related noise source would be impact pile driving of steel piles (WSDOT, 2018).

Construction noise would be temporary between July 16 and February 15 over 5 years for a total of 119 pile driving days. The maximum duration of pile driving in a single day would be up to 1.5 hours of impact pile driving or 4.5 hours of vibratory pile driving. Elevated noise levels during impact pile driving may be noticeable in residential areas but, as stated above, temporary construction noise is exempt from maximum permissible noise levels under the WAC and Kitsap County noise regulations.

4.2 Water Resources and Marine Sediments

4.2.1 Affected Environment

4.2.1.1 Water Quality

NAVBASE Kitsap Bangor is located in northern Hood Canal. WAC 173-201A-612 has established designated uses for Hood Canal as follows: extraordinary (aquatic life uses); primary contact (recreation); shellfish harvesting; and wildlife habitat, commerce/navigation, boating, and aesthetics (miscellaneous uses). Applicable water quality criteria for Hood Canal are listed in Table 3-3. The current 303(d) list includes two grid segments along the Bangor Waterfront impaired by low DO levels. One is adjacent to Marginal Wharf and Delta Pier; the other is to the south of Service Pier (WDOE, 2017a). Waters of Hood Canal immediately south of the proposed project sites and approximately 0.5 mi north of the base boundary are on the current 303(d) list for low DO. No TMDL has been developed by WDOE for this area. Areas of Hood Canal near the base have also been listed as Category 2, waters of concern, for isolated exceedances of bacteria (fecal coliform) and pH.

The Navy has sampled the waters off NAVBASE Kitsap Bangor numerous times for water quality parameters (temperature, salinity, DO, and turbidity) (Hafner & Dolan, 2009; Phillips et al., 2009). This sampling has shown that these waters are consistently within the Washington State standards for extraordinary water quality for each of these parameters (Hafner & Dolan, 2009; Phillips et al., 2009). An exception to these findings was temperature, which typically met extraordinary water quality levels in the winter months and excellent water quality standards in the summer months. Waters south of EHW-1 and further offshore showed similar results with the exception of DO, which typically ranged from excellent to extraordinary.

4.2.1.2 Marine Sediments

Sediment found along the eastern shore of Hood Canal is primarily from natural erosion of bluffs (by wind or wave action). No rivers or large watersheds feed into Hood Canal along the east shore; however, numerous small drainages along the Bangor waterfront do feed Hood Canal, contributing to a secondary source of sedimentation. Existing marine sediments at the proposed project sites are composed of gravelly sands with some cobbles in the intertidal zone, transitioning to silty sands in the subtidal zone (Hammermeister & Hafner, 2009). The presence of glacial till approximately 6 ft. below mud line in the intertidal zone, increasing to over 10 ft. in the subtidal zone was found in subsurface coring studies performed in 1994 (URS, 1994).

NAVBASE Kitsap Bangor sediment composition varies by location along the waterfront. Sediments at the EHW-2 site consist of fine sands and silt/clay with little hydrogen sulfide odor. Sediments north of EHW-1 and at K/B Dock contain medium sand and organic matter with a slight hydrogen sulfide odor. The sediments at the Cattail Lake delta and at Floral Point are a mix of cobble, sand, and silt/clay. Other sites sampled along the waterfront (at the Magnetic Silencing Facility, Delta Pier, Devil’s Hole delta, and Service Pier) are a mix of fine and medium sands and silt/clay.

NAVBASE Kitsap Bangor has been listed twice on the CERCLA National Priorities List for investigation and, if necessary, cleanup of past waste disposal sites. In January 1990, the Navy and the USEPA entered into a Federal Facilities Agreement to ensure that environmental impacts associated with past practices at the base are investigated and remedial actions are completed as needed to protect human health and the environment. As of 2005, all required actions were complete for sediments. WDOE concurred that no further sampling was required (Madakor, 2005). No new information, changed conditions, regulations, or uses have occurred since that would require additional monitoring or other actions in the vicinities of Carderock Pier, Service Pier, Keyport Bangor (K/B) Dock, Delta Pier, Marginal Wharf, two Explosives Handling Wharfs (EHW-1 and EHW-2), and the Magnetic Silencing Facility Pier.

4.2.2 Environmental Consequences

4.2.2.1 No Action Alternative

4.2.2.1.1 Water Quality

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to baseline water quality. Therefore, no significant impacts to water quality would occur with implementation of the No Action Alternative.

4.2.2.1.2 Marine Sediments

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to baseline marine sediments. Therefore, no significant impacts to marine sediment would occur with implementation of the No Action Alternative.

4.2.2.2 MPR Activities (Preferred Alternative) Potential Impacts

4.2.2.2.1 Water Quality

There would be no direct discharges of waste to the marine environment as a result of proposed MPR activities. Construction-related impacts to water quality would be limited to short-term, temporary and localized changes associated with re-suspension of bottom sediments from pile installation and barge and tug operations, such as anchoring and propeller wash. These changes would be spatially limited to the construction corridor, including areas immediately adjacent to the pile locations. Re-suspended bottom sediments are not expected to violate applicable state or federal water quality standards.

The proposed MPR activities at Bangor would not impact water temperature because pile driving and removal activities would not discharge wastewaters. Temperature increases resulting from turbidity would be negligible, since turbidity would be temporary because most of the disturbed sediments are sand, gravel, shell, clay, and hard silt, which resettle quickly. Heat generated from boat engines and the friction of pile driving and removal would not elevate water temperatures in the project area beyond the excellent water quality standard set forth by the Revised Code of Washington 90.48.

The proposed MPR activities at Bangor would not discharge any wastes containing materials with an oxygen demand into Hood Canal. However, pile removal and installation would re-suspend bottom sediments immediately adjacent to the piles, which may contain chemically reduced organic materials. Subsequent oxidation of sulfides, reduced iron, and organic matter associated with the suspended sediments would consume some DO in the water column. The amount of oxygen consumed would depend on the magnitude of the oxygen demand associated with suspended sediments (Jabusch et al., 2008). Considering the modest amount of sediment that would be suspended and currents and dilution, the impacts of sediment re-suspension from pile removal and installation on DO concentrations would be minimal.

Installation of piles would re-suspend bottom sediments within the immediate construction area, resulting in short-term and localized increases in suspended sediment concentrations that, in turn, would cause increases in turbidity levels. Barge and tug operations could also re-suspend bottom sediments. The suspended sediment/turbidity plumes would be generated periodically, in relation to the level of in-water construction activities. The disturbed sediments would be a mix of soft and hard silt, clay, sand, gravel, and shell. The majority of these sediments, including clay, sand, gravel, and shell would resettle within minutes of disturbance. Hard silt would settle next, followed by soft silt. Construction activities would not result in persistent increases in turbidity levels or cause changes that would violate water quality standards because processes that generate suspended sediments, which result in turbid conditions, would be short-term and localized and suspended sediments would disperse and/or settle rapidly.

In general, impacts would be temporary and localized, and would not violate any state or federal water quality standards. In addition, removal of existing creosote-treated timber piles would improve localized water quality conditions in the project area. Therefore, the proposed MPR activities would not result in significant impacts to water quality at NAVBASE Kitsap Bangor.

4.2.2.2.2 Marine Sediments

During proposed MPR activities, sediment would be disturbed and subsequently suspended in the water column. The use of the vibratory hammer and impact hammer could cause the very fine soft sandy silt layers located above the hard glacial deposits to be susceptible to liquefaction and subsequent contraction. As a result, the sediments would quickly settle back to the bottom at the project site or be carried out with tidal flow. Such suspension would be localized to the immediate area of the pile being driven and removed.

Construction activities would not alter the chemical composition of bottom sediments. Nor would construction activities result in the discharge of contaminants. Grain size may be coarsened temporarily by the mixing of coarser grained sediments from below with the fine grained sediments on the surface, mainly during the removal of the piles.

Project-related construction activities would not create sediment contamination concentrations or physical changes that violate state standards or interfere with beneficial uses of Hood Canal. Therefore, there would be no significant impact to sediments.

4.3 Biological Resources

4.3.1 Affected Environment

4.3.1.1 Aquatic Vegetation

The waterfront of NAVBASE Kitsap Bangor has been surveyed for marine vegetation, including macroalgae and eelgrass (SAIC, 2009; Anchor QEA, 2012; Navy, 2015a). The dominant types of vegetation along NAVBASE Kitsap Bangor are red algae, green algae, brown algae, and eelgrass (Table 4-1). Red algae of the genera *Callophyllis*, *Ceramium*, *Chondracanthus*, *Endocladia*, *Gracilaria*, *Mastocarpus*, *Mazzaella*, *Porphyra*, and other unidentified red algae are present along the NAVBASE

Kitsap Bangor waterfront (Pentec, 2003; Navy, 2015a). Red algae, particularly *Gracilaria*, are most abundant at water depths between 10 ft. and 25 ft. below MLLW (Table 4-1). Sea lettuce (*Ulva* spp.) is the predominant species among green algae along the NAVBASE Kitsap Bangor waterfront. Boulders in the nearshore zone off NAVBASE Kitsap Bangor are often encrusted with sea lettuce (Pentec, 2003). Brown algae occur in a variety of forms along the NAVBASE Kitsap Bangor waterfront, including encrusting, branching, leafy, and filamentous, or hair-like, algae. Several leafy species (e.g., *Egregia* spp.) and branching species (e.g., *Fucus* spp.) are commonly found attached to rocks in the upper intertidal zone.

Several species of kelp, including flattened acid kelp (*Desmarestia ligulata*), witches hair (*D. aculeata*), and understory kelp (*Saccharina* spp.) are found at the NAVBASE Kitsap Bangor waterfront. There is a narrow band of understory kelp present that is approximately 1,600 ft. long and covers 2.3 acres. Canopy-forming kelp beds (e.g., bull kelp) do not occur near the project sites (SAIC, 2009).

Two large sargassum mats, and other small pockets of sargassum, occur near the Bangor waterfront in the vicinity of the project sites (SAIC, 2009). Along the shoreline adjacent to EHW-1, the native *Zostera marina* is the dominant eelgrass species and occurs along a narrow depth band roughly parallel to shore from 2 ft. below to 20 ft. below MLLW (Garono & Robinson, 2002; SAIC, 2009). According to underwater video surveys performed at NAVBASE Kitsap Bangor, eelgrass beds were present at EHW North Trestle, EHW South Trestle, Delta Pier South, and Devil's Hole South, and beaches along the waterfront (SAIC, 2009).

Table 4-1. NAVBASE Kitsap Bangor Waterfront Marine Vegetation Coverage

<table>
<tr><th colspan="3">Zone</th><th>Vegetation Type</th><th>Percent of Linear Shoreline[1]</th></tr>
<tr><td rowspan="7">Upper Intertidal</td><td></td><td rowspan="2"></td><td>Brown Algae[2] (Fucus)</td><td>60.4</td></tr>
<tr><td rowspan="6">Lower-Intertidal</td><td>Red Algae (Gracilaria)</td><td>76.8</td></tr>
<tr><td rowspan="5">Nearshore Marine (subtidal photic zone)</td><td>Mixed Red Algae[2] (Ceramium, Endocladia, Gracilaria, Mastocarpus, Mazzaella, Porphyra)</td><td>Interspersed</td></tr>
<tr><td>Green Algae (Ulva)</td><td>97.4</td></tr>
<tr><td>Brown Algae (Desmarestia)</td><td>15.9</td></tr>
<tr><td>Eelgrass (Zostera marina)</td><td>81.9</td></tr>
<tr><td>Brown Algae (Saccharina)</td><td>75.8</td></tr>
</table>

Sources: WDNR, 2006; SAIC, 2009

Notes:

1. Percent represented by proportionate amount in sampled area.
2. Macroalgae coverage data obtained by SAIC in 2007 were concentrated in the lower intertidal and shallow (less than 70 ft. MLLW) zones along the NAVBASE Kitsap Bangor shoreline. *Fucus* distribution and density based upon the Washington State Shore Zone Inventory (WDNR, 2006). Mixed red algae distribution from WDNR, 2006.

4.3.1.2 Benthic Invertebrates

Benthic organisms are abundant and diverse at NAVBASE Kitsap Bangor and are more abundant in the subtidal zone than in the intertidal zone (WDOE, 2007). There is no dominant species among molluscs, crustaceans, and polychaetes, but as a larger group, molluscs are dominant in the subtidal zone.

Echinoderms comprise only a small percentage (about 6 percent) of the benthic community along the waterfront.

Oyster beds occur along approximately 72 percent of the Bangor waterfront and occasionally co-occur with beds of mussels (Delwiche et al., 2008). There is currently no recreational shellfish harvesting at Bangor. Pursuant to a Memorandum of Agreement between the Navy and Tribes, shellfish harvesting by the Skokomish and Klallam Tribes is permitted at Devil's Hole south of Delta Pier.

4.3.1.3 Marine Fish

4.3.1.3.1 Non-ESA-Listed Fish Species

Fish surveys were conducted within the Bangor Naval Restricted Area by WDFW from 2014 through 2016 using a variety of sampling methods that included a remotely operated vehicle (ROV), split-beam echosounder (hydroacoustics), scuba diving, lighted fish traps, and beach seining (Frierson et al. 2016a, 2017a). Beach seining targeted forage fish and juvenile salmonids in the nearshore whereas the other remaining survey methods targeted rockfish and species occurrence offshore.

Surveys using an ROV at depths between 15 meters (m) and 77 m observed just over 900 fish that included various unidentified fish (<5cm), flatfish (Order: Pleuronectiformes), eelpouts (Family: Zoarcidae), pricklebacks (Family: Stichaeidae), codfish (Family: Gadidae), sculpins (Family: Cottidae), and rockfish (Sebastes spp). Specific fish species recorded included English sole; rockfish (copper [*Sebastes caurinus*], brown [*Sebastes auriculatus*], and yellowtail [*Sebastes flavidus*]); spotted ratfish (*Hydrolagus colliei*); flatfish (rock sole [*Lepidopsetta bilineata*], Dover sole [*Solea solea*], starry flounder [*Platichthys stellatus*]); Sculpin (great [*Myoxocephalus polyacanthocephalus*], buffalo [*Enophrys bison*], Pacific staghorn [*Leptocottus armatus*]); lingcod; Pacific sand lance; Pacific sanddab (*Citharichthys sordidus*); and blackbelly eelpout (*Lycodes pacificus*) (Frierson et al., 2016a). Flatfish and eelpout were the most common species recorded at 33 percent and 14 percent, respectively.

Beach seine surveys were conducted along the NAVBASE Kitsap Bangor shoreline from 2005 through 2008 (SAIC, 2006; Bhuthimethee et al., 2009) and more recent surveys were conducted at the northern and southern end of the Bangor Naval Restricted Area at Floral Point and Carlson Spit, respectively (Frierson et al., 2016a, 2017a). Shiner perch (*Cymatogaster aggregata*) was consistently one of the most abundant fish collected during each survey year effort (SAIC 2006; Bhuthimethee et al., 2009; Frierson et al., 2016a, 2017a). Salmonid species collected included Chinook, coho, chum, pink salmon, and cutthroat trout (SAIC 2006, Bhuthimethee et al., 2009, Frierson et al., 2016a, 2017a). Steelhead trout were collected in small numbers in earlier survey efforts (SAIC 2006 and Bhuthimethee) but not collected during 2015 and 2016 surveys (Frierson et al., 2016a, 2017a). Eight groundfish species (Dover sole, English sole, kelp greenling [*Hexagrammos decagrammus*], lingcod, Pacific sanddab, rex sole [*Glyptocephalus zachirus*], sand sole [*Psettichthys melanostictus*], and starry flounder) as well as unidentified flatfishes/sole species, and unidentified juvenile rockfish (*Sebastes* spp.) were recorded within the nearshore area of this location (SAIC 2006; Bhuthimethee et al., 2009; Frierson et al., 2016a).

Forage fish (Pacific sand lance, Pacific herring, and surf smelt) were greatly represented through all sampling years. Surveys recorded small numbers of Pacific herring during the winter months and large numbers during the summer months (SAIC 2006; Bhuthimethee et al., 2009; Frierson et al., 2016a). Beach seine efforts during the month of August collected an estimated 100,000 Pacific herring (Frierson et al. 2017a). Surf smelt are expected to be present within the nearshore areas of NAVBASE Kitsap Bangor year round. A high abundance of surf smelt was recorded during the late spring through early summer and juvenile surf smelt were observed within the nearshore areas of EHW-1 from January through mid-summer months. However, very few were collected during the spring and summer months in 2016 (Frierson et al., 2017a). Juvenile sand lance were also observed from January through mid-summer months within nearshore cove areas mixed in with larval sand lance and surf smelt (SAIC, 2006; Bhuthimethee et al., 2009) and high abundance of sand lance was recorded during beach seining efforts in mid-June (Frierson et al., 2017a). All life stages of sand lance are expected to be present along the Naval Base Kitsap Bangor waterfront.

Large spawning areas of Pacific herring have been observed in Hood Canal (Stick and Lindquist 2009; Stick et al., 2014). However, spawning grounds for both Pacific herring and surf smelt have not been historically documented along the NAVBASE Kitsap Bangor shoreline and are largely absent from north-central portion of Hood Canal in general (Frierson et al. 2017a). WDFW surveys conducted in December 1995, November 1996, and January 1997 documented sand lance spawning along the shoreline including beaches adjacent to Carderock Pier, Service Pier, Keyport Bangor Dock, Delta Pier, Marginal Wharf, Explosives Handling Wharf #1 (EHW-1), and the Magnetic Silencing Facility Pier (WDFW, 2017). Sand lance spawning areas are located north and south of the service pier based on these surveys conducted in the 1990s (WDFW, 2017).

Spawning surveys conducted in 2014 - 2018 occurred at six distinct beaches and transects encompassing approximately 1.25 mi of shoreline (Navy, 2014, 2016a, 2018a). Pacific Sand Lance were documented along the stretch of beach from Marginal Wharf to EHW-1 in November 2017. Sand lance were also detected at Carlson Spit November 2017 and January 2018, and near Keyport Bangor Dock in February 2018.

4.3.1.3.2 <u>ESA-Listed Fish and Critical Habitat</u>

ESA-listed fish species that occur along or within the vicinity of NAVBASE Kitsap Bangor waterfront include Puget Sound ESU Chinook salmon; Hood Canal summer-run ESU chum; and Puget Sound DPS steelhead. Bull trout, the southern DPS Pacific eulachon, and the Puget Sound/Georgia Basin DPSs of bocaccio and yelloweye rockfish are unlikely to occur along or within the vicinity of NAVBASE Kitsap Bangor.

Puget Sound Chinook salmon outmigrating from streams and hatcheries occur most frequently along the Bangor waterfront from late May to early July (SAIC, 2006; Bhuthimethee et al., 2009). Juvenile Chinook were collected during seining at Floral Point and Carlson Spit, with peak collection in June (Frierson et al., 2016a, 2017a). Adult Chinook enter Hood Canal waters from August to October and would likely pass by NAVBASE Kitsap Bangor, within the deeper offshore waters, on their way to natal streams to spawn (Figure 3-4).

Hood Canal summer-run chum fry were collected in high abundance during outmigration from the Duckabush and Hamma Hamma Rivers with peak numbers in mid-March and run declared complete by the second week of April (Weinheimer, 2013). Juvenile chum were collected during beach seine surveys in June of 2015 at Carlson Spit but were not definitively identified as Hood Canal Summer-run chum. Beach seining in 2016 also collected a high abundance of juvenile chum from January to April with peak catch occurring in April and quick decline in May (Frierson et al., 2017a). Genetic analysis confirmed that 97 percent of chum collected in January and February were ESA-listed Hood Canal summer-run chum and 84 percent of chum collected March through May were fall-run chum (Frierson et al., 2017a). No chum were collected during surveys from July through September in 2015 (Frierson et al., 2016a) and only one was collected during that same timeframe in 2016 (Frierson et al., 2017a). Based on

Weinheimer (2013) and Frierson et al. (2016a, 2017a), juvenile chum may be present along the Bangor waterfront from late January to early June and thus are not expected within the project areas during the in-water work window. Adult summer-run chum may be present within the offshore waters of Hood Canal during their migration period August through October (Washington Department of Fisheries et al., 1993; WDFW and PNPTT, 2000). However, their presence would be expected to be brief (passing by NAVBASE Kitsap Bangor) and offshore within deeper waters.

Steelhead do not occur in large numbers along the NAVBASE Kitsap Bangor waterfront and were only collected in small numbers with peaks in late spring and summer months. Small numbers of steelhead were collected during earlier surveys and accounted for less than one percent of the salmonid catch (SAIC, 2006; Bhuthimethee et al., 2009). Recent beach seine surveys conducted in 2015 and 2016 did not record any steelhead (Frierson et al., 2016a, 2017a). Acoustic telemetry studies conducted on downstream migrating steelhead smolts from Big Beef Creek did not detect any smolts within southern Hood Canal, confirming rapid migration to sea (Moore et al., 2010b). Therefore, Puget Sound steelhead would be rare and unlikely to occur within the NAVBASE Kitsap Bangor waterfront.

The only core areas currently supporting anadromous populations of bull trout are located within the Puget Sound and Olympic Peninsula regions (USFWS, 2015b). Bull trout occurrence at NAVBASE Kitsap Bangor is anticipated to be rare. Bull trout require cold, clean, complex, and connected habitat of which do not occur within the streams at NAVBASE Kitsap Bangor. The only drainage to Hood Canal utilized by bull trout is the Skokomish River (WDFW, 2004; USFWS 2015b). In a 2011 BiOp, the USFWS noted summaries of recent tagging studies indicated that bull trout in the South Fork Skokomish River are not anadromous, and Cushman Dam currently blocks all upstream access and most downstream access to the marine environment for bull trout in the North Fork of the Skokomish River (USFWS, 2011). However, historical observations of bull trout in accessible anadromous reaches of several west Hood Canal tributaries (Big Quilcene, Dosewallips, Duckabush, and Hamma Hamma Rivers) are noted from the 1980s (Hilgert in litt. 2000, as cited by USFWS 2009a). Spawning was not believed to occur in these rivers and bull trout were presumed to use Hood Canal marine waters as a migration corridor (USFWS, 2009a). Further, no bull trout have been collected or observed during historic surveys or during more recent survey efforts conducted near NAVBASE Kitsap Bangor using beach seines, lampara seines, tow nets, ROV, or scuba (Schreiner et al., 1977; Salo et al., 1980; Bax, 1983; SAIC, 2006; Bhuthimethee et al., 2009; Frierson et al., 2016a, 2017a). Based on this information and the lack of documented anadromy from the Skokomish River core population, USFWS considered bull trout unlikely to migrate through the NAVBASE Kitsap Bangor waterfront from the Skokomish River (USFWS, 2011).

Adult Puget Sound/Georgia Basin DPSs of bocaccio and yelloweye rockfish as well as juvenile yelloweye rockfish typically occur in waters deeper than 30 m. As discussed in Section 3.3.2.3.2, bocaccio have historically been the least encountered of the three ESA-listed rockfish species. Occurrence is documented within the mid Hood Canal and Southern Hood Canal Basin, approximately 10 mi and 25 mi, respectively, of NAVBASE Kitsap Bangor (NMFS, 2014b). WDFW remotely operated vehicle dive and light trap surveys of the Bangor waterfront in 2014 and 2015 did not detect any ESA-listed rockfish species. The benthic marine fish composition observed was typical of soft-bottomed, low-complexity habitats in the areas surveyed with the exception of the Magnetic Silencing Facility Structure located approximately three miles north of the Service Pier along the waterfront. WDFW concluded for the areas surveyed, that although high-relief rocky habitat can be patchy on a scale that often eludes detection by a single survey method, the variety of sampling methods employed during the surveys provided a nearly comprehensive assessment of available habitat and little adult rockfish critical habitat exists in the vicinity of NAVBASE Kitsap Bangor (Frierson et al., 2016a). Based on historical rockfish fishing occurrence locations and local ecological knowledge, no specific bocaccio fishing areas ("hot spots") were identified in Hood Canal (Natural Resource Consultants, Inc., 2016). Surveys conducted by WDFW and NOAA did not document bocaccio in Hood Canal; however, they did document the species in other parts of Puget Sound and the San Juan Islands. All sightings were at depths >150 ft., with several in the 600-ft. range (Pacunski, 2017).

Although potential juvenile rearing habitat critical for bocaccio exists in the nearshore eelgrass beds adjacent to the project site, no juvenile bocaccio have been documented (Frierson et al., 2016a; Pacunski, 2017). Because of the limited historical presence of documented bocaccio or known "hot spots" in Hood Canal, presence of juvenile bocaccio rockfish would be unlikely.

WDFW conducted rockfish surveys within Puget Sound and found that yelloweye rockfish were well-distributed within the central portion of Hood Canal. They were always found in association with very specific habitats that include steep slopes/walls with high complexity (Pacunski, 2017). The closest sightings to the NAVBASE Kitsap Bangor waterfront were approximately 4.3 km south (Pacunski, 2017).

Presence of the southern DPS Pacific eulachon in Hood Canal is expected to be rare. NMFS (2010a) reported no historical catch records of eulachon in Hood Canal. Eight records of eulachon in beach seine catches conducted from 2005 through 2008 were reported from NAVBASE Kitsap Bangor waterfront in Hood Canal (6 fish total caught in six different weeks in 2006 and two fish total caught in two different weeks in 2008) (SAIC 2006; Bhuthimethee et al., 2009). However, only one record of eulachon in Hood Canal was presented in the Biological Review Team's review as compiled by Monaco et al. (1990) (Gustafson et al., 2010). Therefore, it is highly probable that the eulachon collected along the Bangor waterfront were misidentified. Further, eulachon are most commonly found in schools rather than individually or in small numbers as recorded during these earlier Bangor shoreline surveys (Longenbaugh, 2010). Surveys conducted in 2014 through 2016 also did not record any eulachon (Frierson et al., 2016a, 2017a). Based on this information, Pacific eulachon are not expected to occur in Hood Canal. Additionally, there are no eulachon spawning rivers in Puget Sound. The nearest regular eulachon spawning habitats are the Elwha River on the Olympic Peninsula and the Fraser River in British Columbia.

Critical Habitat

Puget Sound Chinook and Hood Canal summer-run chum have designated critical habitat in Hood Canal adjacent to NAVBASE Kitsap Bangor. However, the DoD lands are exempt by federal law (70 FR 52630). Critical habitat is designated, but outside NAVBASE Kitsap Bangor boundaries. Section 3.3.2.3.2 lists the designated critical habitat Primary Constituent Elements (PCEs) for these species.

Nearshore critical habitat for bocaccio and deepwater critical habitat for bocaccio and yelloweye rockfish is designated in Hood Canal. As stated above for Puget Sound Chinook and Hood Canal summer-run chum, the DoD lands are exempt from critical habitat designation (79 FR 68042). Critical habitat is designated, but outside NAVBASE Kitsap Bangor boundaries. Section 3.3.2.3.2 lists the designated critical habitat attributes of the nearshore and deepwater essential features for these ESA-listed rockfish species.

4.3.1.3.3 Essential Fish Habitat

Coastal pelagic EFH designations are based on the geographic range and in-water temperatures where these species are present during a particular life stage (PFMC, 2016c) and these boundaries include the waters of NAVBASE Kitsap Bangor. Northern anchovy and market squid have both been documented in Hood Canal (Bhuthimethee et al., 2009; Frierson et al., 2016a) and Pacific mackerel has a tendency to school with northern anchovy, utilizing the same habitat (Crone et al., 2009). The mix of fine sands, silt/clay as well as presence of vegetated bottoms along areas of the NAVBASE Kitsap Bangor waterfront and offshore deep rocky reef habitat provide Pacific coast groundfish EFH for various life stages of species of groundfish (PFMC, 2016b). The marine environment of NAVBASE Kitsap Bangor provides Pacific coast salmon EFH for various life stages of Chinook, pink, and coho salmon (PFMC, 2014b).

Eelgrass and kelp are HAPCs for Pacific coast groundfish and Pacific Coast salmon. The rocky reef habitat within the offshore of NAVBASE Kitsap Bangor is also HAPC for Pacific coast groundfish.

4.3.1.4 Birds

Migratory marine birds encountered at NAVBASE Kitsap Bangor include those described in Section 3.3.2.4 (Table 3-6). Marine bird occurrence was documented in transect-based vessel surveys from 2008 through 2010 (Tannenbaum et al., 2009b, 2011a). The most frequently observed resident species included great blue heron, common merganser, Canada goose, glaucous-winged gull, double-crested cormorant, bald eagle, and belted kingfisher. Several migrant and over-wintering species were present in large flocks in nearshore waters including dunlin and western sandpiper, goldeneye species, surf scoter, Bonaparte’s gull, ring-billed gull, and pigeon guillemot.

4.3.1.4.1 Bald Eagle

An active bald eagle nest was located south of Devil’s Hole near the waterfront; this nest produced two eaglets in 2013 but was damaged later in the year (Navy, 2016d). A new nest was built nearby in 2014. This nest was monitored during the breeding season between 2014 and 2017. In 2017, the nest produced two chicks and remained active through mid-September (Navy 2018b). Regular monitoring did not occur in 2018 and although the nest appeared to be active, it is unknown if the nest produced chicks. Bald eagles have been observed perching, roosting and loafing at various locations on the Bangor shoreline year round (Agness and Tannenbaum, 2009a; Tannenbaum et al., 2009b). Bald eagles nest along the shoreline of Dabob Bay on the Bolton Peninsula and along the shoreline of Quilcene Bay, west of Dabob Bay in the Hood Canal.

4.3.1.4.2 Marbled Murrelet

Marbled murrelets have been documented in the nearshore and deeper waters adjacent to NAVBASE Kitsap Bangor since 2001 (Kitsap Audubon Society, 2008; Agness and Tannenbaum, 2009a; Navy, 2009a; Tannenbaum et al., 2009b, 2011a; Hart Crowser, 2013a, 2014a; Pearson & Lance, 2013, 2014, 2015, 2016). Their abundance in the action area is expected to be greatest in fall and winter months (Falxa et al., 2015; Pearson & Lance, 2016). The Navy has evaluated potential nesting habitat at NAVBASE Kitsap Bangor using criteria that define nest platforms (Harke, 2013). Marbled murrelets nest solitarily in trees with features typical of coniferous old-growth (stand age from 200 to 250 years old trees with multi-layered canopy). Although old- growth forest is the preferred habitat for nesting, this species also is known to nest in mature second-growth forest with trees as young as 180 years old (Hamer & Nelson, 1995). The WDFW Priority Habitat and Species Maps interactive website does not indicate the presence of marbled murrelet nests in the upland areas including and adjacent to NAVBASE Kitsap Bangor (WDFW, 2017). Although forest stand inventories on NAVBASE Kitsap Bangor indicate that stands are typically less than 110 years old, some relict old-growth trees can be found near Devil’s Hole, and a small old-growth stand is present at the northern portion of the base (International Forestry Consultants, 2001; Jones 2010). The Navy and USFWS identified potential marbled murrelet nesting habitat, defined by the presence of suitable nest platforms, in the conifer forest stand upland from Carderock Pier. Eight trees with a total of 10 platforms appear to be marginally suitable for nesting within this stand (Harke, 2013). The Navy initiated surveys within the conifer stand near Carderock Pier in 2016. One marbled murrelet was detected flying above the canopy during one of the non-protocoled surveys (Hamer, 2016). In accordance with the Pacific Seabird Group (Evans Mack, 2003) survey protocol, habitat assessments and occupancy surveys were initiated in 2017 and will continue in 2018.

4.3.1.5 Marine Mammals

Any of the species listed in Table 3-8 has the potential to occur in the vicinity of NAVBASE Kitsap Bangor. The species most likely to occur during proposed MPR activities are the Steller sea lion, California sea lion, harbor seal, and harbor porpoise. None of these species are listed under the ESA.

Steller sea lions have been seasonally documented in shore-based surveys at NAVBASE Kitsap Bangor in Hood Canal since 2008 with up to 13 individuals observed hauled out on submarines at Delta Pier and on port security barrier (PSB) floats (Figure 4-1) (Navy, 2016b). Surveys at NAVBASE Kitsap Bangor indicate Steller sea lions begin arriving in September and depart by the end of May (Navy, 2016b).

California sea lions have been documented during shore-based surveys at NAVBASE Kitsap Bangor in Hood Canal since 2008 in all survey months, with as many as 122 individuals observed at one time (in November 2013) hauled out on submarines at Delta Pier and on PSB floats (Figure 4-1) (Navy, 2016b).

The closest major haulouts to NAVBASE Kitsap Bangor that are regularly used by harbor seals are the mouth of the Dosewallips River located approximately 8.2 mi away. A small haulout occurs at NAVBASE Kitsap Bangor under Marginal Wharf and small numbers of harbor seals are known to routinely haul out around the Carderock pier (Figure 2-1). Boat-based surveys and monitoring indicate that harbor seals regularly swim in the waters at NAVBASE Kitsap Bangor. Hauled-out adults, mother/pup pairs, and neonates have been documented occasionally but quantitative data are limited. Incidental surveys in August and September 2016 recorded as many as 26 harbor seals hauled out under Marginal Wharf or swimming in adjacent waters. Assuming a few other individuals may be present elsewhere on the Bangor waterfront, the Navy estimates that 35 harbor seals may be present near the installation during summer and early fall months. Based on survey data from a large haulout location at NAVSTA Everett (Navy, 2016b), the number of harbor seals present at Bangor is likely to be lower in late fall and winter months. No harbor seal haulout have been seen on the shoreline opposite Bangor (the east-side of the Toandos Peninsula) during 2015 and 2016 beach seine surveys.

NAVBASE Kitsap Bangor reported harbor seals in every month of surveys (Agness & Tannenbaum, 2009b; Tannenbaum et al., 2009a, 2011b). Harbor seals were routinely seen during marine mammal monitoring for two waterfront construction projects (HDR, 2012; Hart Crowser, 2013b, 2014b, 2015).

Following increased pinniped surveys on the waterfront and increased contact with waterfront personnel who have had lengthy careers at Bangor (Navy, 2016b), information has become available on harbor seal births and the presence of neonates at the NAVBASE Kitsap Bangor. Known harbor seal births include one on the Carderock wave screen in August 2011 and at least one on a small 10 x 10 ft. floating dock at EHW-2 in fall 2013 as reported by EHW-2 construction crew, and afterbirth on a float at Magnetic Silencing Facility with an unknown date. In addition, Navy biologists learned that harbor seal pupping has occurred on a section of the Service Pier since approximately 2001 according to the Port Operations vessel crews. Harbor seal mother and pup sets were observed in 2014 hauled out on the Carderock wavescreen and swimming in nearby waters, and swimming in the vicinity of Delta Pier (Navy, 2016b).

Harbor porpoises are likely to occur near NAVBASE Kitsap Bangor. Harbor porpoise sightings in Hood Canal north of the Hood Canal Bridge have increased in recent years (Calambokidis, 2010; Smultea et al., 2017). During line transect surveys conducted in Hood Canal in 2011 near NAVBASE Kitsap Bangor and Dabob Bay (HDR, 2012), an average of six harbor porpoises were sighted per day in the deeper waters. Group sizes ranged from 1 to 10 individuals (HDR, 2012). Raum-Suryan and Harvey (1998) reported a mean group size of 1.9 (range 1–8 individuals) in the San Juan Islands. Mean group size of harbor porpoises for each survey season in the 2013–2016 aerial surveys was 1.7 (Smultea et al., 2017).

Other cetacean and pinniped species are not expected to occur in the vicinity of NAVBASE Kitsap Bangor. Minke whales have not been documented in Hood Canal. Gray whales have been sighted in Hood Canal south of the Hood Canal Bridge on six occasions since 1999, including a stranded whale at Belfair State Park (Calambokidis, 2013). The most recent report in Hood Canal was of characteristic blows (air exhaled through the whale's blowhole) in the waters near Lilliwaup in November 2010 (Calambokidis, 2013). Transient killer whales were observed for lengthy periods in Hood Canal in 2003 (59 days) and 2005 (172 days) between the months of January and July (London, 2006), but were not observed again until 2 days in March, 1 day in April, and 8 days in May 2016. On at least one of the days in May 2016, these whales were seen in Dabob Bay (Orca Network, 2016). Dall's porpoise could also occasionally occur in Hood Canal (Jeffries, 2006); but there is only reported observation, in deeper water near NAVBASE Kitsap Bangor in summer 2008 (Tannenbaum et al., 2009a). Vessel line-transect surveys in 2011 near NAVBASE Kitsap Bangor and Dabob Bay and other monitoring efforts at NAVBASE Kitsap Bangor did not detect Dall's porpoises (HDR, 2012; Jefferson et al., 2016). Northern elephant seals have not been reported in Hood Canal (Orca Network, 2016).

ESA-listed marine mammals that have been documented in Hood Canal include the humpback whale and Southern Resident killer whale. Humpback whales are not expected to occur in the waters near NAVBASE Kitsap Bangor because very few sightings have been documented in Hood Canal. In Hood Canal, where NAVBASE Kitsap Bangor and Zelatched Point are located, single humpback whales were observed for several weeks in January and February 2012 (Calambokidis, 2012; Orca Network, 2015a), and in 2015 (Orca Network, 2015b). One sighting in Hood Canal was reported in January 2016 (Orca Network, 2017). Review of the 2012 sightings information indicated they were on one individual (Calambokidis, 2012). Prior to the 2012 sightings, there were no confirmed reports of humpback whales entering Hood Canal (Calambokidis, 2012).

Southern Resident killer whales (ESA Endangered) are not expected to occur in the waters near NAVBASE Kitsap Bangor because they have not been reported in Hood Canal since 1995 (NMFS, 2006b). Southern Resident killer whales (ESA endangered) were historically documented in Hood Canal by sound recordings in 1958 (Ford, 1991), a photograph from 1973, sound recordings in 1995 (Unger, 1997). Other anecdotal accounts of historical use may have been transient whales (NMFS, 2006b; Orca Network, 2016).

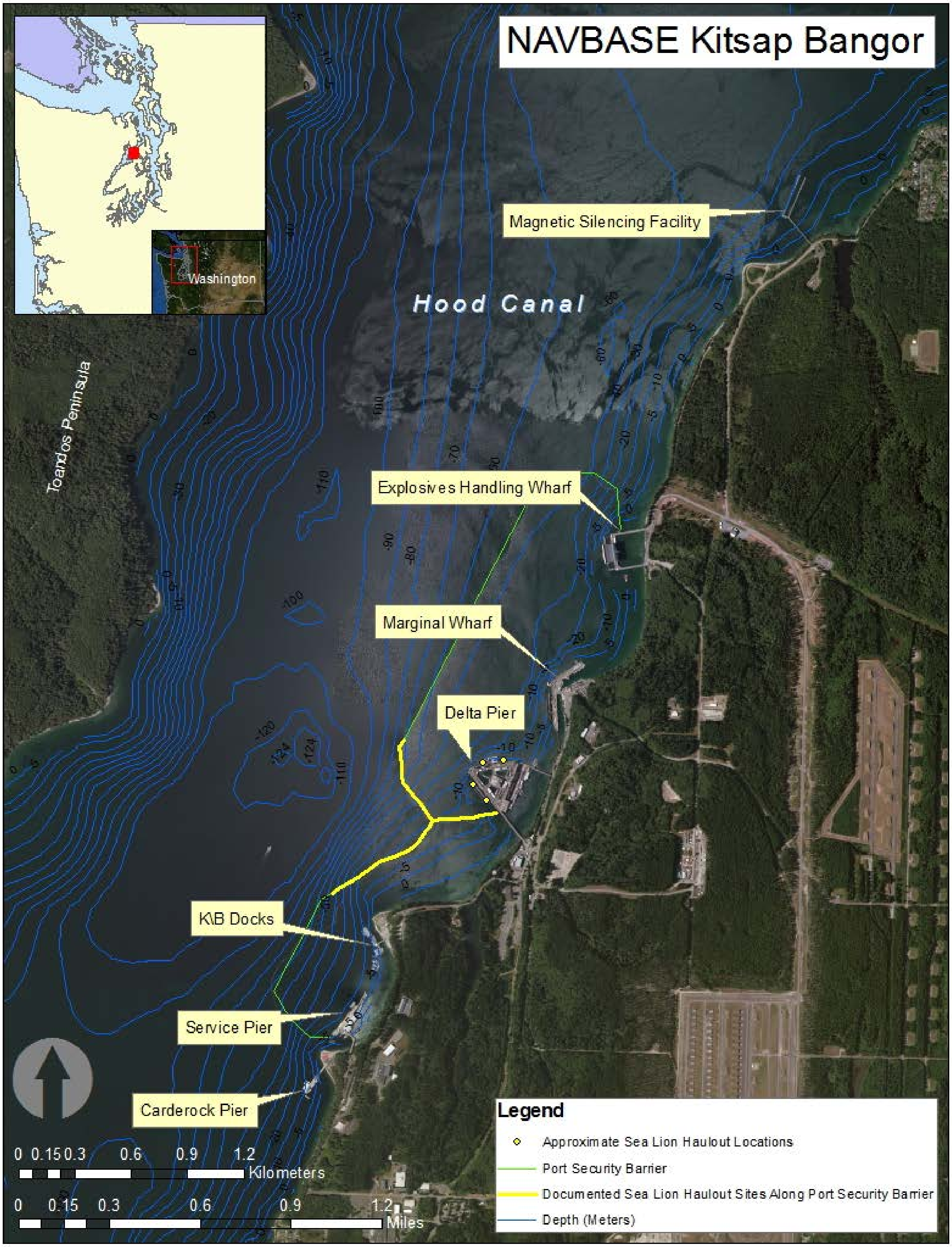

Figure 4-1. Pinniped Haulouts at NAVBASE Kitsap Bangor

4.3.2 Environmental Consequences

4.3.2.1 No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to baseline biological resources. Therefore, no impacts to biological resources would occur with implementation of the No Action Alternative.

4.3.2.2 MPR Activities (Preferred Alternative) Potential Impacts

4.3.2.2.1 Aquatic Vegetation

During proposed MPR activities, any debris from pile removal (i.e., wood or concrete fragments) would be collected, disposed of in a state-approved landfill or recycled, and would not impact marine vegetation. Shading of existing vegetation would not change as no expansion of existing structures or new over-water structures is proposed; therefore shading of existing vegetation is not discussed. Any shading from barges would be temporary in nature and would have no significant effect on marine vegetation.

Decreased water and sediment quality can impede the growth of marine vegetation important to fish and other animals, and promote the growth of harmful algae. As indicated in Section 4.2.2.2, pile driving-related impacts to water quality from the proposed MPR activities would be limited to temporary and localized changes associated with re-suspension of bottom sediments during construction. With the exception of the area at K/B Dock, sediments at NAVBASE Kitsap Bangor are not contaminated with trace metal or organic contaminants so suspension of sediments would not introduce contaminants into the environment that could affect marine vegetation. Similarly, pile driving activities would not discharge contaminants or otherwise appreciably alter the concentrations of trace metal or organic contaminants in bottom sediments. Sediments would settle back in the general vicinity from which they rose. Indirect effects to macroalgae and eelgrass from changes in sediment quality and sedimentation during construction would be minor, temporary, and would not affect the overall health or distribution of marine vegetation near the project area.

Direct removal of marine vegetation could occur through anchor and spud placement, and removal of up to 119 deteriorating piles. Where possible, anchors and spuds would not be placed in existing eelgrass beds. Any vegetative growth found on existing piles would be removed when those piles are extracted from the water but because piles would be replaced, ultimately a similar amount of surface area on which marine organisms could colonize would exist. Additionally, because marine vegetation is distributed outside of the project area, re-colonization could occur, and the overall health and abundance of macroalgae and eelgrass would not be compromised. Therefore, the proposed MPR activities would have no significant direct or indirect impacts on marine vegetation.

4.3.2.2.2 Benthic Invertebrates

The proposed MPR activities at NAVBASE Kitsap Bangor would impact benthic communities through the disruption of the sediment surface and subsurface during the installation and removal of each pile, and from anchor and spud placement for the barges, if required. Depending upon the species, impacts to individual benthic organisms could range from temporary disturbance to mortality. Some benthic organisms would be physically crushed and lost within the footprint of the piles, as well as from barge anchors and spuds.

Indirect impacts to habitat and benthic organisms are likely to result from turbidity caused by driving and removing barge anchors, spuds, and piles. The area near the pile replacement footprint would have higher levels of turbidity. Disturbed sediments would eventually redeposit upon the existing benthic community. Impacts from increased turbidity levels would likely result in short-term loss of localized areas of the benthic community. Most affected areas would experience some reduction in diversity and abundance of benthic species. However, benthic organisms, particularly annelids, are very resilient to habitat disturbance and are likely to recover to pre-disturbance levels in less than 2 years (CH2M Hill, 1995; Parametrix, 1994, 1999; Romberg et al., 1995; Anchor Environmental, 2002). In addition, removal of existing creosote-treated timber piles would improve localized water quality conditions in the project area. Therefore, the proposed MPR activities would have no significant impacts on benthic invertebrates.

4.3.2.2.3 Marine Fish

Non-ESA-Listed Marine Fish

Turbidity

Resident marine fish as well as all life stages of forage fish are expected to be present within the vicinity of the project area and are likely to occur during the in-water work window established for juvenile salmonid avoidance. In-water work could produce measurable, temporary increases in turbidity and sedimentation, and that could cause fish to temporarily avoid the areas near construction. However, construction activities would not result in persistent increases in turbidity levels or cause changes that would violate water quality standards because processes that generate suspended sediments, which result in turbid conditions, would be short-term and localized and would disperse and/or settle rapidly (within a period of minutes to hours after construction activities cease). This also applies to resuspension of existing contaminated sediments during construction as these would be localized, short--term, and settle rapidly. Further, removal of existing creosote-treated timber piles would improve localized water quality conditions in the project area. Effects would be short-term and small in scale during construction and, if creosote piles are removed, beneficial to water quality post-construction. Further, the localized disturbance would not impact forage fish spawning areas identified within the vicinity of the project area. Therefore, no impacts from turbidity to forage fish spawning are anticipated. Placement of the piles and associated disturbance activities (i.e., support vessels, construction barge) may cause a loss to benthic prey either existing within the pile footprint or disturbance from turbidity which may impact fish use of that area for seeking prey. Impacts would be short-term, localized, and limited to the duration of pile installation and would not be expected to significantly impact fish ability to seek prey outside of the project areas. With implementation of impact avoidance and minimization measures (see Section 2.5), no significant impacts to non-ESA-listed marine fish from turbidity and sedimentation (including potential resuspension of contaminated sediments) are anticipated to result from proposed MPR activities.

Underwater Noise

The proposed MPR activities would result in increased underwater noise levels. Noise would be generated from support vessels, small boat traffic, and barge-mounted equipment, such as generators, and pile extraction and installation. Noise levels from all activities except pile driving would typically not exceed underwater sound levels resulting from existing routine waterfront operations along the NAVBASE Kitsap Bangor waterfront. The most significant underwater noise potentially affecting fish would be from impact pile driving of steel piles. To minimize impacts to fish, piles would be installed initially with a vibratory pile driver until either the pile hits refusal, necessitating an impact hammer to reach required depth, or for proofing piles to verify structural capacity. Since vibratory pile drivers typically generate noise levels from 10 to 20 dB lower than impact pile driving and do not produce waveforms with sharp rise times like impact pile driving, vibratory driving is considered a preferable method of steel pile installation (PFMC, 2016c).

A maximum of 119 steel or concrete piles could be installed at NAVBASE Kitsap Bangor during the 5 years of proposed MPR activities if all estimated emergent pile replacement projects occur. As shown in Appendix B, impact pile driving of a 36-in diameter steel pile would create underwater noise that could expose fish to injurious levels above the peak threshold as well as the cumulative sound exposure level (SEL) thresholds. Fish would be expected to be exposed differently to elevated noise levels and they could behave differently in their reaction to noise. Some fish are migrating through the area and may pass through the thresholds above the behavioral disturbance zone. Other fish are resident to the area and may not move away and thus would be exposed to injurious noise levels for the duration of pile driving activity (Hastings & Popper, 2005). To minimize exposure to noise above the injurious and behavioral disturbance thresholds, a bubble curtain or other noise attenuation device would be used during impact pile driving of steel piles and all pile driving would be conducted during the in-water work window of July 16 through January 15 when juvenile salmonids are least likely to be present. With implementation of these minimization measures and those listed in Section 2.5, no significant impacts to non-ESA-listed fish from underwater noise would result from the proposed MPR activities.

ESA-Listed Fish and Critical Habitat

<u>Turbidity</u>

As discussed above, in-water work could produce measurable, temporary increases in turbidity and sedimentation, and that could cause ESA-listed fish and their forage fish to temporarily avoid the areas near construction. Because, in-water work would occur during the approved in-water work window of July 16 through January 15, juvenile ESA-listed salmonids are least likely to be present. Adult life stages of Chinook, chum, steelhead, bocaccio and yelloweye rockfish, and juvenile yelloweye rockfish, if present, would occur further offshore and beyond any impacts associated with suspended sediment and turbidity during in-water construction. Juvenile bocaccio have the potential to utilize the nearshore aquatic vegetation (eelgrass and kelp) as rearing habitat. However, canopy kelp habitats are not present near structures proposed for pile driving and bocaccio have had no recent documented occurrences in Hood Canal (Frierson et al., 2016a, 2017a; Pacunski, 2017) thus localized turbidity impacts would be discountable. Peak rockfish larvae occurrence in Hood Canal occurs outside the in-water work window in April to May with small presence during the early part of the work window and absence from surface waters by November (Green & Godersky, 2012). Bull trout and eulachon are not expected to occur within the vicinity of the project area and thus no impacts from turbidity and suspended sediment would result. With implementation of impact avoidance and minimization measures, no significant impacts to ESA-listed fish or their forage base from turbidity and sedimentation, including temporary and localized exposure to suspended contaminated sediments, would result with implementation of the proposed MPR activities.

<u>Underwater Noise</u>

In-water work would occur during a period when juvenile salmonids are least likely to be present and thus exposure of ESA-listed salmonids at this life stage to injurious noise thresholds would not occur.

Juvenile bocaccio have the potential to rear near the project area because eelgrass and some kelp occur along the waterfront. However, the lack of canopy kelp habitats adjacent to structures proposed for pile driving work, the intermittent nature of impact pile driving, and that bocaccio have not been documented along the NAVBASE Kitsap waterfront (Frierson et al., 2016a, 2017a; Pacunski, 2017) would preclude measurable impacts to juvenile bocaccio. Bull trout and Pacific eulachon are not expected within the vicinity of the project area and thus no impacts from the proposed MPR activities would occur. Forage fish may be temporarily exposed to injurious thresholds but impacts would be short-term (estimated maximum duration of 1.5 hours of impact pile driving in a day) and insignificant. Larger juvenile salmonids as well as adult life stages of Chinook and chum, bocaccio and yelloweye rockfish as well as juvenile yelloweye rockfish may be exposed to noise above the cumulative SEL injury thresholds (Appendix B) as these zones would extend offshore and over deeper water where these life stages may be present. However, steel piles would be installed using a vibratory pile driver to the extent practicable with impact pile driving primarily used for proofing piles. A bubble curtain or other noise attenuation device would be used during impact pile driving of steel piles of which would occur intermittently and for an estimated maximum duration of 1.5 hours in a day. Further, ESA-listed rockfish are not expected to be present.

ESA-listed rockfish and salmonids occurring within 2,500 m of a steel pile being struck by an impact hammer would be exposed to underwater noise levels above the behavioral disturbance threshold (Appendix B). However, exposure would be temporary and short-term as impact pile driving would be intermittent, last an estimated maximum duration of 1.5 hours in a day, and would produce immeasurable impacts to behavior.

Concrete piles could be installed; however, the area in which noise would be generated above the injury and behavioral thresholds is significantly smaller than for steel piles. Impact pile driving concrete piles is estimated to last a maximum duration of 4 hours per day or an average of 1.5 hours a day. However, there are no known documented incidents of fish injury occurring from pile driving of concrete piles (NMFS, 2012c). By installing piles within the in-water work window and limited number of piles (for all pile types) during the 5 years of proposed MPR activities, only behavioral effects are anticipated and these effects are not anticipated to be significant to an individual fish.

In conclusion, no significant impacts to ESA-listed fish from underwater noise would result from the proposed MPR activities.

Critical Habitat

The estuarine and nearshore marine areas PCEs for Puget Sound Chinook and Hood Canal summer-run chum would be affected by underwater noise from impact pile driving steel piles. Pile driving would produce noise above the fish behavioral thresholds during vibratory and impact pile driving in the vicinity of NAVBASE Kitsap Bangor that contains designated critical habitat. However, impacts to the function of these PCEs would be temporary and short-term and occur during a time when juvenile Chinook and chum are not expected to be within the nearshore and estuarine environments. The ability for the nearshore marine PCE to provide forage base for larger juveniles and adults may be effected in the short-term due to exposure of injurious impacts to forage fish in the nearshore. Impacts to this PCE would be an estimated total of 1.5 hours of intermittent impact pile driving in a day.

The Navy determined that the Proposed Action “may affect, but is not likely to adversely affect” ESA-listed fish species and designated critical habitat. USFWS concurred with the Navy’s determination for bull trout with a Letter of Concurrence signed on December 15, 2017. NMFS did not concur with the

Navy's determination and concluded that the Navy's proposed MPR activities "may affect, are likely to adversely affect" Puget Sound evolutionary significant unit (ESU) Chinook salmon; Hood Canal summer-run ESU chum salmon; Puget Sound distinct population segment (DPS) steelhead; Puget Sound/Georgia Basin DPSs of bocaccio and yelloweye rockfish; and, designated critical habitat. Section 7 consultation with NMFS was completed with the issuance of a BiOp on April 5, 2019.

Essential Fish Habitat

As was discussed above for marine fish in general and ESA-listed fish, elements of the proposed MPR activities would create turbidity and suspended sediment but these impacts would be short-term, localized, and small in scale without causing measureable impacts to EFH. Removal and installation of piles and anchoring would have a localized impact on marine vegetation and benthic epifauna/infauna within the immediate vicinity of each pile or anchoring site but these impacts would be minimal, localized, and expected to recover to pre-disruption levels within a few growing seasons. The primary impact during proposed MPR activities would be increased sound energy in the marine fish habitat. Increased sound would affect the water column, which has been designated as EFH for numerous species (see Appendix C). Impacts to the water column could result in disturbance depending on fish species, size, orientation, received noise level and type of noise. To avoid injurious effects from impact pile driving, the Navy would implement minimization measures to reduce the level of noise in the water column. The primary minimization measure would be to install piles with a vibratory pile driver to the extent practicable and follow with impact hammer pile driving to verify load-bearing capacity (proofing). To attenuate noise during impact pile driving of steel piles, a bubble curtain or other noise attenuation device would be used.

A maximum of 119 steel or concrete piles could be installed at NAVBASE Kitsap Bangor during the 5 years of proposed MPR activities. The potential behavioral disturbance threshold would extend out a modeled distance of approximately 2,500 m intersecting with the west side of Hood Canal. Coastal pelagic, Pacific coast groundfish, and Pacific coast salmon EFH present within this threshold would be exposed to noise above the behavioral disturbance threshold by way of noise in the water column. The injury threshold distances may impact EFH as these distances would extend over existing eelgrass in the project area. Pacific coast salmon EFH would be exposed to noise above injurious levels; however, pile driving would be conducted during the in-water work window when juvenile salmonids are least likely to be present within the nearshore habitat.

Concrete piles could be installed at NAVBASE Kitsap Bangor. However, the area in which noise would be generated above the injury and behavioral thresholds is significantly smaller than for steel piles and thus not expected to degrade the function of EFH. Impact pile driving concrete piles is estimated to last a maximum duration of 4 hours per day or an average of 1.5 hours a day.

The Navy determined that the Proposed Action may adversely affect EFH by temporarily increasing noise in the water column during pile driving. However, implementation of minimization measures applied to ESA-listed species would be sufficient for minimizing effects to EFH. The Navy consulted with NMFS under the Magnuson-Stevens Fisheries Conservation and Management Act and NMFS concurred with the Navy's determination, but provided Conservation Recommendations to minimize effects to EFH. Consultation with NMFS was completed on April 5, 2019.

Overall, due to the temporary nature of the activities, proposed minimization measures and the minimal level of impact to water column noise levels, benthic flora and fauna, water quality, and sediment quality, no significant impacts to EFH would occur with implementation of the proposed MPR activities.

4.3.2.2.4 Birds

Resident and migrant birds are expected to be present within the vicinity of proposed MPR activities during the in-water work window established for juvenile salmonid avoidance (Section 2.5.3). Proposed MPR activities have the potential to impact marine birds through visual disturbance, changes in prey availability, and elevated underwater and airborne noise. Pile extraction and installation projects, and other repair projects on the existing marine structures would intermittently increase human activity levels on the waterfront, potentially resulting in visual disturbance and increasing ambient noise levels due to use of construction equipment. A bald eagle nest is present on the shoreline of Hood Canal on NAVBASE Kitsap Bangor (Navy, 2016d). Bald eagles that nest and forage along the marine shoreline may experience the increase in human activity, depending on proximity of project construction to existing and future nest sites and foraging areas. However, pile driving activity would not begin, at the earliest, until the end of the nesting season (August 15); therefore, no incidental takes are anticipated. Project sites currently have high levels of ongoing human activity, and project work involving repairs to marine structures would be within the baseline condition. Therefore, there would be no significant impact to marine birds due to increased human activity.

As discussed in Sections 4.3.2.2.2 and 4.3.2.2.3, in-water work could temporarily affect the availability of forage fish and benthic invertebrates, which are the prey base of many marine birds, in a limited area. Removal of existing creosote-treated timber piles would improve localized water quality conditions in the project area. Turbidity effects and potential resuspension of contaminated sediments are not expected to affect the prey base, as these changes would be short-term and small scale during construction. Therefore, there would be no significant impact to marine birds due to prey availability.

Effects of Elevated Noise Levels on Birds

Proposed MPR activities would result in increased underwater noise levels. Noise would be generated from small vessels and barge-mounted equipment such as generators, and pile extraction and installation. Noise levels from all activities except pile driving would typically not exceed underwater sound levels resulting from existing routine waterfront operations along the Bangor waterfront. The most significant underwater noise source would be impact pile driving of steel piles. Impacts of elevated noise levels due to pile driving were evaluated in the context of established criteria for ESA consultation with the USFWS on the threatened marbled murrelet. No criteria have been established for determining impacts of elevated noise levels on other marine bird species, some of which forage underwater like the marbled murrelet, and general conclusions about impacts on marbled murrelets were applied to other species.

Pursuit-diving birds (i.e., birds that pursue and capture their prey underwater using their wings to swim) include cormorants, grebes, and alcids (murres, murrelets, and pigeon guillemots). While actively foraging they dive repeatedly into waters of various depths and would potentially be exposed to elevated underwater noise during pile driving. When startled by loud sounds, their foraging patterns may be altered, and birds may flush or dive and swim away underwater. While underwater they would be susceptible to injury or behavioral disturbance due to elevated sound pressure waves generated by pile driving. Dabbling and diving ducks may also be susceptible to elevated underwater sound. Birds that feed on the surface such as gulls, shorebirds, and wading birds are unlikely to be affected by elevated underwater sound.

Actively foraging marbled murrelets dive repeatedly into waters ranging up to approximately 160 ft. in depth for periods ranging up to 60 seconds (Nelson et al., 2006). Foraging bouts typically last over a period of 27 to 33 minutes, with approximately 50 percent of the time spent underwater (Jodice & Collopy, 1999). When startled by loud sounds, the foraging pattern may be altered, and birds may flush or dive and swim away underwater. While underwater they would be susceptible to injury or behavioral disturbance due to elevated sound pressure waves generated by pile driving.

As described in detail in Appendix B, the USFWS uses underwater noise thresholds developed by the Marbled Murrelet Hydroacoustic Science Panel (SAIC, 2011) to determine the zones around a driven pile in which two general forms of injury might occur to diving marbled murrelets: (1) auditory injury (generally damage to sensory cells of the ear) beginning at 202 dB SEL cumulative, and (2) non-auditory injury (trauma to non-auditory body tissues/organs) beginning at 208 dB SEL cumulative. Since the underwater criterion for auditory injury was the lower of the two thresholds, this was the criterion used for assessing injurious impacts to the marbled murrelet in this analysis. Currently there are no thresholds or guidelines for installation and extraction of piles with a vibratory driver. Because the sound levels generated by vibratory drivers are typically 20-30 dB lower than impact pile driving and do not produce waveforms with sharp rise times like impact pile driving, the affected areas would be discountably small and potential impacts on marbled murrelets would be discountable.

A maximum of 119 steel or concrete piles could be installed at Bangor during the 5 years of proposed MPR activities. As shown in Appendix B, potentially the most injurious noise levels may extend up to 63 m from a driven 30-in steel pile and 10 m from a driven 24-in concrete pile during project construction at Bangor (see Figure 4-2 for a representative scenario of the extent of potentially injurious underwater noise from steel pile installation). Since estimates of the distances to thresholds involve the cumulative energy of all impact strikes over a 24-hour period, the affected area represents the maximum extent of potential auditory injury effects. Earlier in the construction day, the injury zone would be smaller, and only reach the maximum extent after all the pile strikes have been completed.

Airborne noise levels from the proposed MPR activities are not expected to be injurious to birds within the study area because the source levels for airborne noise from pile driving (vibratory: 96 dBA at 15 m; impact: 110 dBA at 11 m) are well below those known to cause injury to birds in laboratory situations (Dooling & Popper, 2007). However, the USFWS (2013) has determined that airborne noise due to impact pile driving may behaviorally affect foraging marbled murrelets, based on the findings of the Marbled Murrelet Hydroacoustic Science Panel regarding non-injurious thresholds for pile driving noise (SAIC, 2012). Marbled murrelets typically perform foraging dives in pairs and are highly vocal when they are above the surface (Strachan et al., 1995). On the water's surface, birds typically stay within 100 ft. of their partners during foraging bouts. This behavior is thought to play a role in foraging efficiency, and therefore airborne noise that masks their vocalizations has the potential to affect foraging success (Carter & Sealy 1990; Strachan et al., 1995). Unlike other noise effects criteria established for injury, the distance from a pile driving source within which communications would be masked is dependent upon ambient noise levels and therefore is site-specific. Masking effects cease immediately when the masking noise stops.

Under typical conditions on the waterfront, communication between foraging murrelets would be compromised by pile driving noise within 42m of the murrelets. This is based on noise produced by impact pile driving <36-in steel piles (USFWS, 2013). Acoustic monitoring during construction at NAVBASE Kitsap Bangor (Illingworth & Rodkin, 2013) indicated that average airborne source levels during impact driving of 36-in steel piles were the same as, and in some cases lower than, 24-in steel piles. Therefore, the masking distance for 24-in steel piles was applied to all steel pile sizes. Representative scenarios of areas affected by masking effects are shown in Figure 4-2.

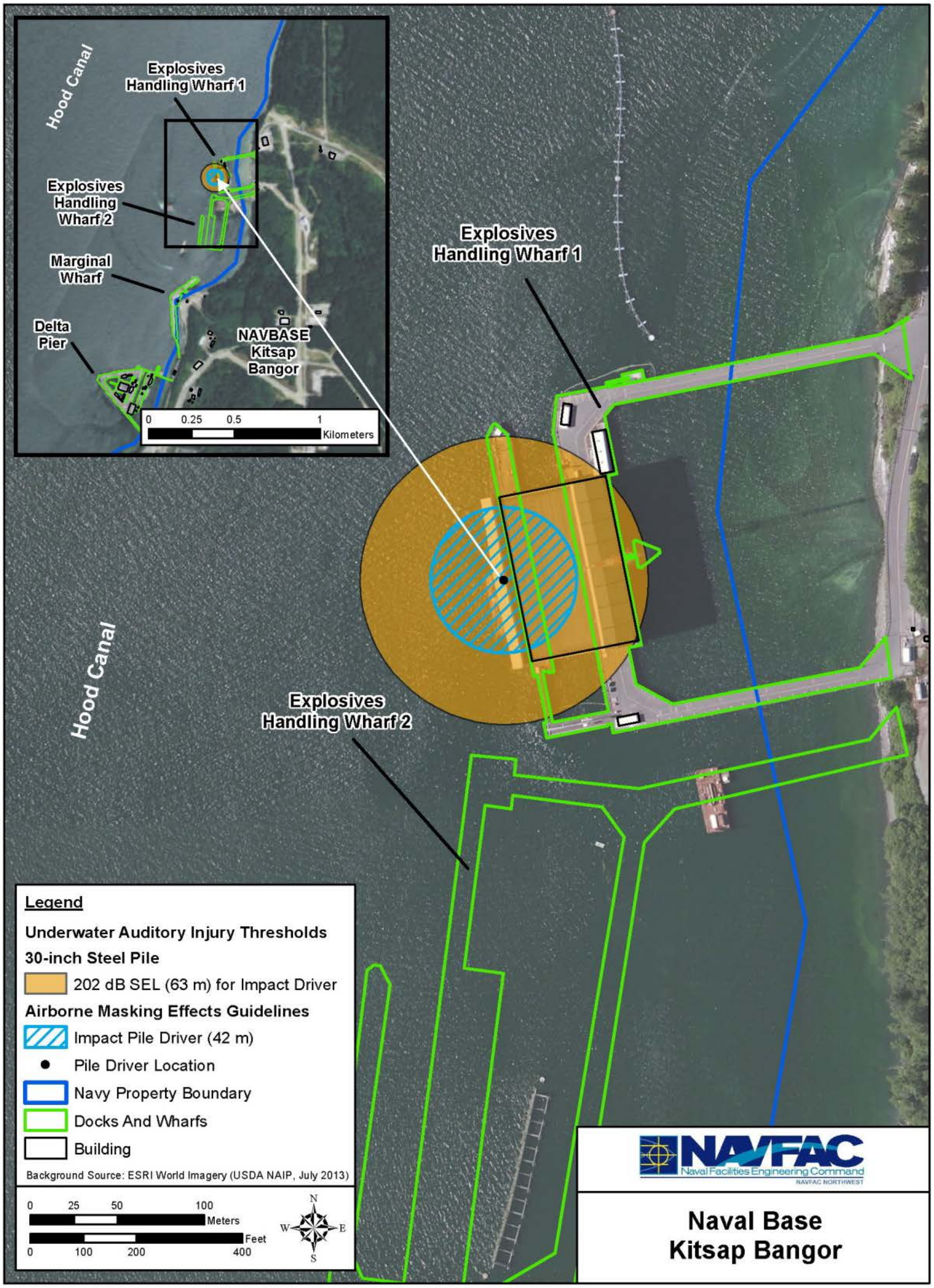

Figure 4-2. Representative Affected Areas for Pile Driving Noise for Marbled Murrelets at NAVBASE Kitsap Bangor

The USFWS (2013) has provided guidance on evaluating the significance of airborne masking effects for pile driving projects. “Typical” pile driving projects involve:

- Installation of 24-in or 36-in steel piles,
- Use of vibratory pile drivers,
- Use of impact pile drivers for proofing only, and
- Adherence to a 2-hour timing restriction (i.e., no pile driving within 2 hours after sunrise and within 2 hours before sunset during the breeding season).

Typical pile driving projects do not result in measurable effects on marbled murrelets because the use of impact hammers is intermittent and of short duration, the 2-hour timing restriction protects murrelets during their most active foraging periods, and murrelet vocalizations are adapted to overcome the effects of ambient noise (USFWS, 2013).

Steel pile driving during proposed MPR activities would be “typical” because all piles would be 36-in or less, vibratory drivers would be used to install the piles, with limited proofing, and the timing restrictions would be observed. The USFWS guidance does not cover concrete piles, but the potential masking effects of concrete pile installation are likely to be much smaller because impact installation of concrete pile generates lower SPLs than steel pile installation (Appendix B).

To prevent exposure to injurious or masking noise levels in the action area for projects at NAVBASE Kitsap Bangor, the Navy would implement the minimization measures and BMPs described in Section 2.5. The Navy would actively monitor the underwater auditory injury zone for impact pile driving up to 63 m or the 42-m masking zone (Figure 4-2), whichever is larger, depending on the pile type. The likelihood of marbled murrelet exposure to injurious or masking noise from impact pile driving is discountable because these zones are small and can be effectively monitored during pile driving, and pile driving would cease if monitors detect marbled murrelets (see Appendix D for details) within the threshold distance.

With the implementation of minimization and monitoring actions (Section 2.5), the Navy has determined the Proposed Action “may affect, but is not likely to adversely affect” ESA-listed marbled murrelets. USFWS concurred with the Navy’s determination in a letter dated December 15, 2017. Proposed MPR activities would have no significant impacts on marbled murrelets or other marine bird species due to temporarily elevated underwater and airborne sound levels resulting from impact or vibratory pile driving of all pile types.

Critical Habitat

Because the closest marbled murrelet designated critical habitat to NAVBASE Kitsap Bangor is about 7 mi to the west, no noise resulting from the proposed MPR activities would reach it. Therefore, a no effect determination was made for designated critical habitat in the vicinity of NAVBASE Kitsap Bangor.

4.3.2.2.5 Marine Mammals

Pile installation and removal activities at NAVBASE Kitsap Bangor would result in temporarily increased human activity levels and changes in prey availability during project construction. However, project construction would take place at existing marine structures that have relatively high levels of human activity under daily operations, and prey availability changes would be short-term and highly localized, as described in Section 4.3.2.2.3. Because vessels would be operating at slow speeds, no vessel strikes would be expected. Therefore, there would be no significant impact to marine mammals due to increased human activity levels, changes in prey availability, or the potential for vessel strikes.

Effects of Elevated Noise Levels on Marine Mammals

Underwater and airborne noise generated during pile installation and removal has the potential to disrupt the behavior of marine mammals that may be traveling through, foraging, or resting in the vicinity of the project area, as described in detail in Appendix B. The Navy estimates potential impacts to marine mammals by considering the likelihood that each species may be present at the location during pile driving, determining the sound levels generated by various pile types and installation methods, and applying acoustic threshold criteria (expressed in decibels, dB) established by NMFS for evaluating the potential for injury or behavioral impacts. A detailed explanation of the analytical methods is presented in Appendix B, and the following sections summarize results of the underwater noise analysis.

A maximum of 119 steel or concrete piles could be installed at Bangor during the 5 years of proposed MPR activities. The highest underwater source levels for pile driving would result from impact driving of 30-in steel piles. As described in detail in Appendix B, the Navy estimated the distances to the various NMFS underwater noise thresholds for injurious and behavioral effects on marine mammals (Appendix B). These distances were estimated by taking into account the source levels for impact and vibratory pile driving of piles at NAVBASE Kitsap Bangor, sound propagation over distance from the driven pile, and acoustic impacts thresholds for the various species groups. Figure 4-3 depicts a representative scenario of the extent of potentially injurious and behaviorally harassing underwater noise from steel pile installation. The area encompassed by the threshold values decreases the closer to shore pile driving occurs and is truncated where shallow water and land block noise transmission.

The likelihood of injury due to pile driving noise is discountable for marine mammals at NAVBASE Kitsap Bangor, with the exception of harbor seal, for several reasons. Marine mammals are unlikely to be present in the small areas affected by injurious noise levels. These areas would be fully monitored by marine mammal observers during pile driving. As described in Appendix D, pile driving would cease if monitors detect a marine mammal approaching or entering the injury zone. In addition, most steel piles would be installed with a vibratory driver, which affects a smaller area with injurious noise levels than impact pile driving. Where impact pile driving of steel pile is required, use of a noise attenuation device such as a bubble curtain would reduce source noise levels and therefore the area affected by potentially injurious noise levels. The greatest radius of potentially injurious noise from impact pile driving is expected to be no greater than 736 m, with the use of a noise attenuation device. The exception at NAVBASE Kitsap Bangor is the harbor seal. As described in Chapter 4.3.1.5, a small number of harbor seals may haul out under Marginal Wharf where it may be difficult for marine mammal monitors to detect them during pile driving. For this reason, some individuals may inadvertently be exposed to injurious noise levels.

Pile driving would produce noise above the underwater behavioral harassment threshold during impact and vibratory pile driving. The loudest impact pile driving noise, resulting from installation of 30-in steel piles, is estimated to affect an area up to 631 m from the driven pile. However, impact pile driving noise is not expected to result in behavioral harassment of marine mammals, with the possible exception of harbor seals under Marginal Wharf, because affected areas can be fully monitored and pile driving would cease if a marine mammal approaches the affected area.

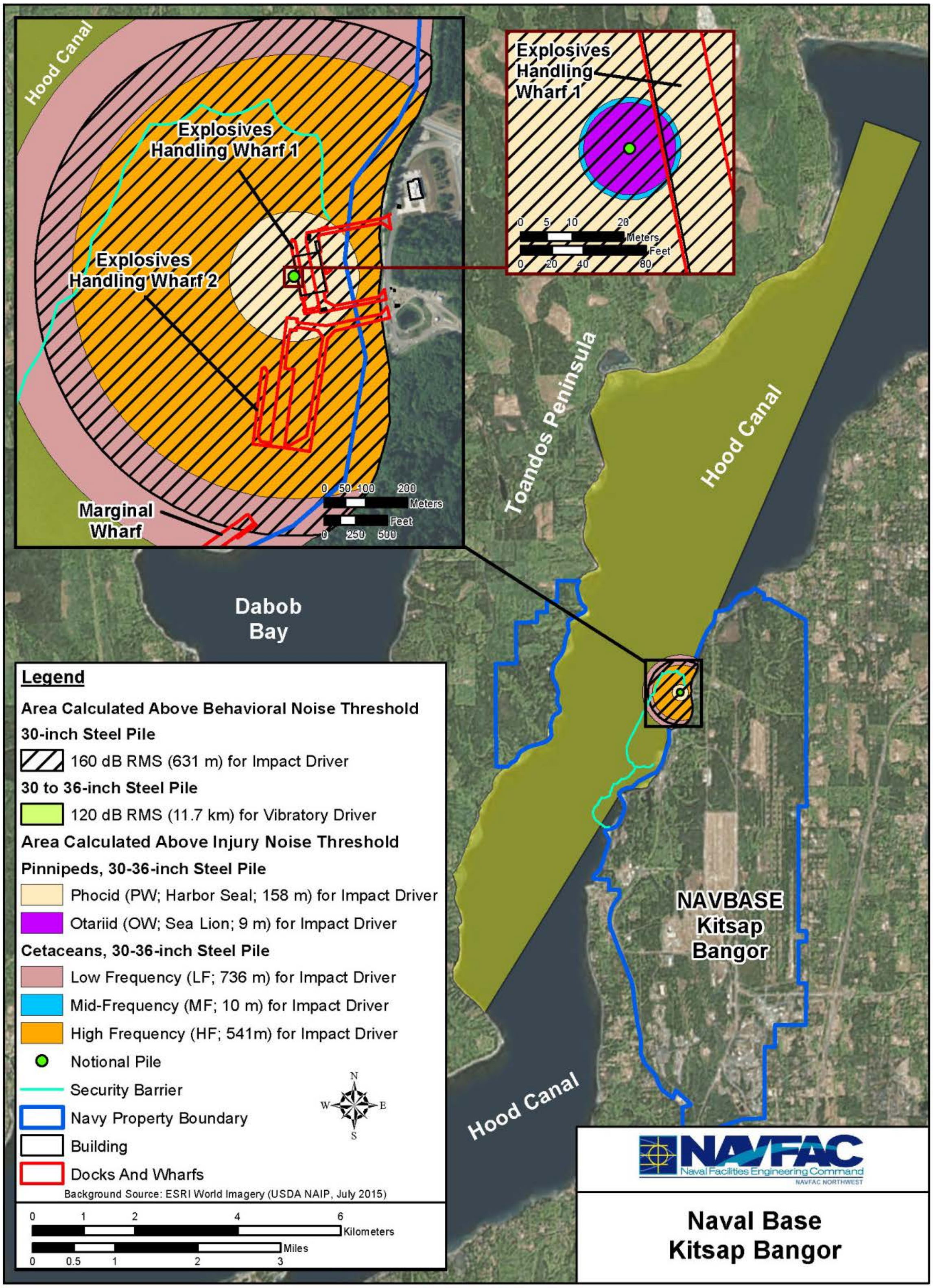

Figure 4-3. Representative Affected Areas for Pile Driving Noise for Marine Mammals at NAVBASE Kitsap Bangor

However, installation of steel piles would utilize a vibratory pile driver to the extent practicable in order to reduce adverse impacts to fish species, and the affected area due to the vibratory pile driver would be much larger than the area affected by impact pile installation (due to the low behavioral harassment threshold for continuous sound [120 dB RMS versus 160 dB RMS for impulsive sound]). The greatest risk of exposing marine mammals to behavioral harassment during pile driving would be during vibratory installation of steel piles because the affected areas would be too large to be fully monitored by marine mammal observers (for details see Appendix D). The affected area could extend up to 11.7 km from the driven pile at this location.

To assess the potential exposure of marine mammals to above-threshold noise levels during in-water work windows during the 5 years of proposed MPR activities, the likelihood of occurrence of each species was considered along with the number of pile driving days. The Navy used one of three methods for species at this location, depending on (1) whether site-specific abundance was known, (2) regional densities were known, or (3) the species is so infrequently encountered that densities cannot be determine and other reasoning must be applied. Potential exposures of Steller sea lions, California sea lions, and harbor seals were estimated based on known abundances determined by on-site monitoring; exposures of harbor porpoises were estimated based on density estimates from Smultea et al. (2017); and exposures of the remaining species were estimated through analysis of historical occurrence. Details of the exposure analysis are presented in Appendix B, and results are summarized in Tables B-19 and B-20.

Based on the exposure estimates in Tables B-19 and B-20, the species most likely to be impacted are the harbor porpoise, Steller sea lion, California sea lion, and harbor seal. The Navy would implement a variety of BMPs and mitigation measures, including noise attenuation devices and marine mammal observers that are expected to reduce the estimated impacts. These measures are fully described in Appendix D and summarized in Section 2.5.

Individual responses of marine mammals to pile driving noise are expected to be variable. Some individuals may occupy the project area during pile driving without apparent effect, but others may be displaced with undetermined effects. In general, cetaceans like harbor porpoise infrequently transit the waters in the vicinity of NAVBASE Kitsap Bangor and they do not tend to remain there. If they encounter pile driving noise they would likely avoid affected areas. Avoidance of the affected area during pile driving operations would potentially reduce access to foraging areas and inhibit movement through the area. The likelihood of exposure to behavioral disturbance due to pile driving noise would be limited by the infrequent occurrence of cetacean species in the vicinity, and monitoring and shutdown of pile driving if monitors detect cetaceans, as described in Appendix D.

Based on the low likelihood of occurrence of ESA-listed species in Table 3-8, and the use of BMPs and mitigation measures that are likely to reduce potential impacts, the Navy concludes that the proposed MPR activities at NAVBASE Kitsap, Bangor:

- "may affect, and are not likely to adversely affect" humpback whales and Southern Resident killer whales because they are considered rare in the Hood Canal; and
- would not affect Southern Resident killer whale designated critical habitat.

NMFS did not concur with the Navy's determinations and concluded that the Navy's proposed MPR activities "may affect, are likely to adversely affect" humpback whale species, Southern Resident killer whale, and Southern Resident killer whale designated critical habitat. The Navy's consultation with

NMFS regarding ESA-listed marine mammals and critical habitat was completed with the issuance of a BiOp on April 5, 2019 (Appendix G).

Acoustic exposure estimates from pile driving operations summarized in Appendix B, Tables B-19 and B-20, indicate there is the potential for Level A injury, which has the potential to affect marine mammals through hearing loss (referred to as permanent threshold shift, or PTS) of harbor seals and Level B harassment, which has the potential to disrupt animal behavior, of harbor seals and other species as defined by MMPA. Other construction activities not associated with pile installation and removal would not result in Level A or B harassment under the MMPA. The Navy consulted with NMFS in compliance with the ESA and the MMPA, and obtained an LOA for Level A injury and Level B harassment of marine mammals. The Final Rule for the LOA was published in the Federal Register on April 17, 2019. The exposures are expected to result in behavioral impacts on an intermittent basis for most marine mammal species, and long term or permanent impacts potentially may affect a small number of harbor seals.

The analysis presented above indicates that proposed MPR activities at NAVBASE Kitsap Bangor may impact individual marine mammals, but any impacts observed at the population, stock, or species level would be negligible. Therefore, there would be no significant impact to marine mammal populations.

4.4 Cultural Resources

4.4.1 Affected Environment

The APE for the Proposed Action at NAVBASE Kitsap Bangor consists of seven facilities (Table 4-2). All work would occur in or over-water. No on-shore work is planned, and any staging required would occur in previously disturbed or developed areas.

Table 4-2. Proposed Action at NAVBASE Kitsap Bangor

Structure Name	*Year Built*	*NRHP Status*	*SHPO Concurrence Date*	*DAHP Log #*	*Note*
Carderock Pier	2008	N/A			Post-dates Cold War
Service Pier	1980	Not Eligible	2/16/2012	030911-62-USN	
Keyport – Bangor (K/B) Dock	1965	Not Eligible	2/16/2012	030911-62-USN	
Delta Pier	1979	Eligible	2/16/2012 & 4/20/2011	030911-62-USN	
Marginal Wharf	1945	Not Eligible	4/20/2011	030911-58-USN	
Explosives Handling Wharf 1 (EHW-1) (#7501)	1975	Eligible	4/20/2011	030911-58-USN	
Magnetic Silencing Facility	1978	Eligible	3/13/2013	031313-13-USN	

Key: DAHP = Department of Archaeological and Historic Preservation; NRHP = National Register of Historic Places

Of the seven facilities projected for pier repair or replacement, either programmed or contingency (Table 4-2), only three Cold War era facilities, the Delta Pier, EHW-1, and Magnetic Silencing Facility are considered eligible for listing in the NRHP based on their Cold War context (Sackett, 2010). The SHPO has concurred with the determinations of eligibility (February 16, 2012, April 20, 2011 and March 13, 2013). The Carderock Pier is too recent to be considered eligible for listing in the National Register of Historic Places (NRHP), and has not achieved exceptional significance as required by Criteria

Consideration G. The Service Pier and Keyport-Bangor (K/B) Dock date to the Cold War Era, but are not eligible for listing (the State Historic Preservation Officer [SHPO] concurred February 16, 2012). The Marginal Wharf, dating to the end of World War II, is not eligible (SHPO concurred April 20, 2011). A survey performed in 2010 identified no prehistoric or ethno-historic cultural materials or sites. This survey covered all of the areas above the water line, including the beach (Stell Environmental & Cardno TEC, 2013). There are no recorded submerged historic properties, downed aircraft, or shipwrecks in the APE. The probability of prehistoric archaeological deposits or features buried within the substrate of this coastline is very low due to Holocene sea level changes and associated erosion of glacial deposits found along the shoreline of Hood Canal. No historic properties or anomalies have been encountered by diver, remotely operated vehicle, or remote sensing surveys near NAVBASE Kitsap Bangor. National Oceanic and Atmospheric Administration (NOAA) nautical charts show no submerged ships or shipwrecks in the vicinity of NAVBASE Kitsap Bangor (NOAA, 2016).

4.4.2 Environmental Consequences

4.4.2.1 No Action Alternative

Under the No Action Alternative, the proposed pile repair and replacement activities would not be conducted. Therefore, no impacts to cultural resources would occur with implementation of the No Action Alternative.

4.4.2.2 MPR Activities (Preferred Alternative) Potential Impacts

Implementation of proposed MPR activities at Bangor would not adversely affect any known NRHP-eligible architectural or archaeological sites. The replacement of existing piles in accordance with the *Secretary of the Interior's Standards for the Rehabilitation of Historic Properties* would maintain and preserve the functionality of three structures that are considered eligible for listing in the NRHP based on Cold War importance: Delta Pier, EHW-1, and Magnetic Silencing Facility. Pier pilings do not embody key elements of the historic properties, and changes to these elements would not adversely affect their NRHP eligibility or contribution to a district.

No submerged archaeological sites are expected to exist in the proposed action area. Construction activities would take place in previously disturbed areas at the existing piles. Piles would be installed in the same or similar locations from which they were removed, and no submerged resources have been identified in the APE. Because of the extent and nature of modern marine activity, it is unlikely that unrecorded submerged historic resources exist along the shoreline. However, pursuant to the implementing regulation of Section 106 of the NHPA, other applicable federal laws, and DoD and Navy regulations, the "inadvertent discovery" of potentially significant archaeological resources would compel the Navy to stop work in the immediate area and then follow the Section 106 process for inadvertent discovery, including evaluating the effects to such resources through consultation with the SHPO, affected American Indian tribes, and other interested parties. Similarly, if American Indian human remains, funerary items, sacred objects, or items of cultural patrimony are encountered, the Navy must comply with the NAGPRA. The Navy has determined that the Proposed Action would have no adverse effect on historic properties at NAVBASE Kitsap Bangor, and the SHPO has concurred in a letter dated May 31, 2017. There would be no significant impact to cultural resources.

4.5 American Indian Traditional Resources

4.5.1 Affected Environment

NAVBASE Kitsap Bangor property and the controlled waterfront Naval Restricted Area are co-located in the adjudicated U&A fishing area for the Skokomish Indian Tribe, Port Gamble S'Klallam Tribe, Jamestown S'Klallam Tribe and Lower Elwha Klallam Tribe. The Skokomish have primary rights in Hood Canal south of the Hood Canal Bridge and the Suquamish have secondary rights. Pursuant to a 1997 Memorandum of Agreement between the Navy and Tribes, shellfish harvesting by the Skokomish and Klallam Tribes is permitted at Devil's Hole south of Delta Pier. The project area is within the Naval Restricted Area; finfishing is not allowed within the restricted area or the port security barrier due to security requirements.

4.5.2 Environmental Consequences

4.5.2.1 No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to baseline American Indian traditional resources. Therefore, no impacts to American Indian traditional resources would occur with implementation of the No Action Alternative.

4.5.2.2 MPR Activities (Preferred Alternative) Potential Impacts

In accordance with Executive Order 13175 and DOD and Navy instructions, the Navy invited the Skokomish, Port Gamble S'Klallam, Jamestown S'Klallam, Lower Elwha Klallam, and Suquamish Tribes to initiate government-to-government consultation regarding proposed MPR activities and potential impacts to tribal treaty rights. The Tribes requested that additional project details be provided as they become available in the future. Additionally, the Suquamish Tribe provided comments on the Revised Draft EA, but determined it was not necessary to meet with the Navy to discuss these comments (Baxter, 2019). Government-to-government consultation with the Tribes is complete.

With implementation of proposed MPR activities, there would be no changes to the status quo regarding tribal access to traditional resources. There would be minimal loss of benthic invertebrates and their environment as replacement piles would be installed near the location of the removed piles.

There would be a temporary increase in the volume of barge traffic during pile replacement and maintenance activities as pile delivery and disposal would generally be conducted via barge. However, the increase in barge traffic generated by the proposed MPR activities would be negligible when compared to existing marine traffic in Hood Canal and at NAVBASE Kitsap Bangor.

Construction would not result in any discharge to shellfish beds utilized for tribal harvesting or affect tribal access to treaty protected resources at each site; therefore, there would be no effect on the quality of these beds. The project would not impact the shellfish beds south of Delta Pier where tribes gather shellfish. The in-water work window for each construction year would minimize impacts to all juvenile salmonid species; therefore, significant impacts to juvenile salmonids are not expected. There would be minimal loss of benthic invertebrates and their environment as replacement piles would be installed near the location of removed piles. Construction activities would not result in discharge to shellfish beds utilized for tribal harvesting or affect tribal access to treaty protected resources at each site. The in-water work window would minimize impacts to juvenile salmonids; therefore, there would be no significant impact to salmonids or benthic invertebrates. As part of continued engagement, the

Navy will annually provide summaries of planned pile repair and replacement projects to the Tribes for information and coordination. There would be no significant impact to American Indian traditional resources.

4.6 Summary of Potential Environmental Consequences

Table 4-3. Summary of Environmental Impacts at NAVBASE Kitsap Bangor

Section/ Resource Area	*Environmental Impacts*
Airborne Noise	Temporary construction noise during daytime hours is exempt from maximum permissible noise levels under the WAC and Kitsap County noise regulations. Recreational users on Hood Canal could experience noise disturbance but not at levels sufficient to cause adverse effects. Therefore, there would be no significant impact to the ambient sound environment.
Water Quality	Direct discharges of waste would not occur. Construction-related impacts would be limited to short-term and localized changes associated with re-suspension of bottom sediments. These changes would be spatially limited to the construction site and areas immediately adjacent. Temporary impacts would not violate applicable state or federal water quality standards. The Navy would implement BMPs and minimization measures to prevent accidental losses or spills of construction debris. Removal of creosote-treated timber piles would improve local water quality. Therefore, there would be no significant impact to water quality.
Sediments	Sediment would be disturbed and re-suspended in the water column during pile removal and pile driving activities. Some degree of localized changes in sediment composition would occur. In particular, sediments that are re-suspended would be dispersed by currents and eventually re-deposited on the bottom. Project-related construction activities would not create sediment contamination concentrations or physical changes that violate state standards or interfere with beneficial uses of Hood Canal. Therefore, there would be no significant impact to sediments.
Aquatic Vegetation	Any vegetative growth on existing piles would be removed when those piles are extracted from the water but because piles would be replaced, ultimately a similar amount of surface area on which marine organisms could colonize would exist. Because aquatic vegetation does not occur densely at depths greater than about 25 ft. below MLLW at NAVBASE Kitsap Bangor, direct removals should be minimal. Impacts due to turbidity would be short-term, temporary, and localized. Additionally, because aquatic vegetation is distributed outside of the project area, recolonization could occur quickly, and the overall health and abundance of macroalgae and eelgrass would not be compromised. Therefore, there would be no significant impact to aquatic vegetation.
Benthic Invertebrates	As with aquatic vegetation, benthic organisms attached to removed piles would be lost, but new piles would provide equivalent attachment sites for development of the benthic community. Benthic organisms directly adjacent to piles would be lost or displaced. There would be minimal impacts to habitat and benthic organisms from turbidity caused by pile removal and installation and anchor placement and removal, but these effects would be temporary and very localized. Impacts at the population, stock, or species level would be negligible. Therefore, there would be no significant impact to benthic invertebrate populations.

Table 4-3. Summary of Environmental Impacts at NAVBASE Kitsap Bangor (continued)

Section/ Resource Area	*Environmental Impacts*
Marine Fish and EFH	In-water construction may expose fish to increased turbidity but exposure would be localized and temporary. The most significant impact to fish that could occur would be from exposure to elevated underwater noise from impact pile driving. To minimize exposure to noise, pile driving would be conducted during the in-water work window when juvenile salmonids (including ESA-listed salmonids) are least likely to be present. A majority of the pile driving would be conducted using a vibratory pile driver and a bubble curtain or other noise attenuation device would be used to attenuate noise during impact pile driving of steel piles. All impact pile driving would occur intermittently and for an estimated maximum duration of 1.5 hours in a day for steel piles and 4 hours for concrete. The Navy has determined that the Proposed Action “may affect, but is not likely to adversely affect” ESA-listed fish species and designated critical habitat and “may adversely affect” EFH. The USFWS concurred with the Navy’s conclusions regarding bull trout. NMFS concluded that the Navy’s proposed MPR activities “may affect, are likely to adversely affect” Puget Sound evolutionary significant unit (ESU) Chinook salmon; Hood Canal summer-run ESU chum salmon; Puget Sound distinct population segment (DPS) steelhead; Puget Sound/Georgia Basin DPSs of bocaccio and yelloweye rockfish; designated critical habitat; and, EFH. With implementation of minimization measures, there would be no significant impacts to marine fish (including ESA-listed fish) and EFH.
Birds	Construction activities may result in the exposure of marbled murrelets to sound pressure levels above the behavioral guidance criterion. Mitigation measures would be used to reduce the adverse impacts to marbled murrelets, also benefiting other marine birds. No designated critical habitat for the marbled murrelet is located near Bangor; therefore construction activities would not affect designated critical habitat for the species. The Navy has determined that the Proposed Action “may affect, but is not likely to adversely affect” the marbled murrelet, and the USFWS has concurred with the Navy’s conclusions. No significant impacts to other marine birds are expected.
Marine Mammals	Pile driving at NAVBASE Kitsap Bangor may expose marine mammals to injurious (harbor seal only) or behavioral disturbance due to elevated underwater noise. Mitigation measures would be used to reduce the adverse impacts to marine mammals. The Navy determined that the Proposed Action “may affect, but is not likely to adversely affect” ESA-listed humpback whales and Southern Resident killer whales; but was “not likely adversely affect” Southern Resident killer whale designated critical habitat. NMFS concluded that the Navy’s proposed MPR activities “may affect, are likely to adversely affect” humpback whale species, Southern Resident killer whale, and Southern Resident killer whale designated critical habitat. The Navy consulted with NMFS and will obtain an LOA under the MMPA. While construction activities may impact individual marine mammals, any impacts observed at the population, stock, or species level would be negligible. Therefore, there would be no significant impact to marine mammal populations.

Table 4-3. Summary of Environmental Impacts at NAVBASE Kitsap Bangor (continued)

Section/ Resource Area	*Environmental Impacts*
Cultural Resources	Implementation of proposed MPR activities at Bangor would not adversely affect any known NRHP-eligible architectural or archaeological sites. The replacement in kind of existing piles and meeting the *Secretary of the Interior's Standards for the Rehabilitation of Historic Properties* would retain the eligibility of three structures that are considered eligible for listing in the NRHP based on Cold War importance: Delta Pier, EHW-1, and Magnetic Silencing Facility. Construction activities would take place in previously disturbed areas at or near the locations from which the existing piles have been removed. The Navy has determined that the Proposed Action would have no adverse effect on historic properties and the SHPO has concurred. Therefore, there would be no significant impact to cultural resources.
American Indian Traditional Resources	There would be no changes to the status quo regarding tribal access to traditional resources as a result of proposed MPR activities. Construction activities could result in the potential loss of benthic organisms at the immediate project location; however, replacement piles would be installed near the location of the removed piles, minimizing the direct loss of benthic invertebrates. Construction would not result in any discharge to shellfish beds or their environs; therefore, there would be no effect on the quality of these beds. The project would not impact the shellfish beds south of Delta Pier where tribes gather shellfish. The in-water work window for each construction year would minimize impacts to all juvenile salmonid species; significant impacts to juvenile salmonids are not expected. Therefore, there would be no significant impact to American Indian traditional resources.

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5 NAVBASE Kitsap Bremerton Affected Environment and Environmental Consequences

5.1 Airborne Noise

5.1.1 Affected Environment

NAVBASE Kitsap Bremerton is located in an urban setting with marine industrial uses characterized by noise from truck and automobile traffic; marine vessel traffic; ship-loading cranes; diesel-powered equipment; railroad traffic; continuously operating transmission lines for steam, water, and fuel; and compressors. The primary concentration of these types of noise sources is along the shore. Noise is also generated by commercial vehicles (e.g., tugs, barges, and fishing vessels), ferry traffic, and recreational vessels operating on Sinclair Inlet. Other sources of noise include air traffic, wind, and surf. Depending on the noise-generating activities and distance from those activities, industrial shipyard noise is typically between 60 and 90 dBA. Noise levels at NAVBASE Kitsap Bangor ranged between 60 and 104 dBA with an average of 64 dBA (Section 4.1.1). However, NAVBASE Kitsap Bremerton is more industrialized, with more concentrated facilities, urban areas and activities in the vicinity, than NAVBASE Kitsap Bangor. The piers are located on the industrial shore of the base and generate noise during maintenance periods. At these times, noise is generated by the use of skiffs and small vessels, occasional use of tugs, transfer of equipment to and from the pier, and motor vehicle traffic to and from the piers.

The closest off-base sensitive receptors are single family residences located approximately 1 mi from the project sites, west of the base along Callow Avenue and north of Coontz Avenue. This residential area is well buffered by distance from most of the industrial noise sources on the base waterfront and is exposed to noise levels typical of an urban residential neighborhood which are approximately 50 to 70 dBA. Forest Ridge Park is located in a residential area west of Callow Avenue, approximately 1 mi from the project sites. Other nearby sensitive receptors include single family residences across Sinclair Inlet in Port Orchard (1.5 mi).

The State of Washington and the cities of Bremerton and Port Orchard have developed maximum permissible environmental noise levels for receiving properties. However, both Washington and these cities have exempted noise generated by temporary construction activities. Permissible noise levels and exceedance allowances are discussed in Section 3.1.

5.1.2 Environmental Consequences

5.1.2.1 No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to baseline airborne noise. Therefore, no significant impacts to airborne noise would occur with implementation of the No Action Alternative.

5.1.2.2 MPR Activities (Preferred Alternative) Potential Impacts

Construction associated with the proposed MPR activities would result in temporarily elevated underwater and airborne noise levels. Noise would be generated from support vessels, small boat traffic, and barge-mounted equipment, such as generators, and pile extraction and installation equipment. Noise levels from all activities except pile driving would typically not exceed ambient sound levels resulting from routine waterfront operations in the vicinity of any of the structures in the proposed MPR activities locations. The most significant project-related noise source would be impact pile driving of steel piles (WSDOT, 2018).

Construction noise would be temporary between July 16 and February 15 over 5 years for a total of 168 pile driving days. The maximum duration of pile driving in a single day would be up to 1.5 hours of impact pile driving or 4.5 hours of vibratory pile driving. Elevated noise levels during pile driving may be noticeable in residential areas but, as stated above, temporary construction noise is exempt from maximum permissible noise levels under the WAC and cities of Bremerton and Port Orchard noise regulations.

5.2 Water Resources and Marine Sediments

5.2.1 Affected Environment

5.2.1.1 Water Quality

The project sites are located within Sinclair Inlet, a poorly flushing estuary with freshwater input from Gorst, Blackjack, Ross, Anderson, Sacco, and Karcher creeks. WAC 173-201A-612 has established designated uses for Sinclair Inlet as follows: excellent (aquatic life uses); primary contact (recreation); and wildlife habitat, harvesting, commerce/navigation, boating, and aesthetics (miscellaneous uses). Sinclair Inlet is closed to shellfish harvest due to pollutant levels.

Waters in the western portions of the waterfront area (covering Moorings E, F and G) are classified as Category 2 for fecal coliform. One grid segment covering the area between Mooring A and Pier 5 is classified as Category 4B (Waters that have a pollution control plan) for polychlorinated biphenyls in tissue (Lizon, 2015). Waters between Mooring E and Mooring A, and from Pier 6 eastward are located in grid segments that are not classified in any category for water quality. Several areas within Sinclair Inlet outside of the immediate Bremerton waterfront area are classified as Category 5 for fecal coliform and DO and Category 2 for temperature. Multiple creeks emptying into the southern and western reaches of Sinclair Inlet are classified at Category 5 and Category 2 for multiple contaminants.

Sinclair Inlet experiences isolated events of low DO associated with elevated nutrient concentrations and phytoplankton blooms (URS and SAIC, 1999). For at least one nearby grid segment, WDOE concluded that “these excursions could be attributed to natural conditions (i.e., this location is subject to intrusions of upwelled, low DO water), but may also be exacerbated by human activity” (WDOE, 2017a). Water quality has been detrimentally affected by runoff and sediment contamination from the surrounding watersheds, including such land uses as forest land, highways, urban development, commercial development and industrial development.

5.2.1.2 Marine Sediments

The waterfront area at Bremerton has been significantly altered by artificial fill deposits and facility development. These fill deposits overlie beach and estuarine soils at varying depths. Sinclair Inlet exhibits a weak estuarine flushing, clockwise current pattern, and sediment deposition along the northern shoreline (URS and SAIC, 1999). Weak tide currents move water in and out of the inlet with a maximum velocity of 0.2 to 0.3 knots (URS and SAIC, 1999). This effect and the generally weak nature of these currents make the inlet more depositional than erosional for both mud (silt and clay) and sand-sized particles. Currents are generally not capable of re-suspending bottom sediments. Existing sedimentation rates are 0.2 to 0.8 in per year (URS and SAIC, 1999).

Sediment contamination within Sinclair Inlet, including the project areas, has been well documented and includes a variety of metals and organic chemicals originating from human sources (USEPA, 2000). The marine sediments have been affected by past shipyard operations, leaching from creosote-treated piles, and other activities in Sinclair Inlet. A 2000 CERCLA Record of Decision (ROD) for Operable Unit B Marine documents the Navy's decision to cleanup sediment contamination by a combination of sediment removal and disposal in a Confined Aquatic Disposal site located on Navy property, sediment capping, and natural attenuation. The ROD was developed in cooperation with the USEPA and WDOE. In 2010 mercury risk to subsistence seafood consumers was reassessed to take into account a Suquamish Tribe fish consumption survey. From that basis, the Navy has continued to investigate the nature and extent of mercury contamination in Sinclair Inlet, and consider whether, and which, remedial measures should be taken. In 2014, remedial goals for PCBs were met. Sediments at the project sites and adjacent to the piers at Bremerton are classified by WDOE as Category 4B (Sediments that have a pollution control plan) for various metals, polycyclic aromatic hydrocarbons, polychlorinated biphenyls, and other semivolatile organic compounds (WDOE, 2017a).

5.2.2 Environmental Consequences

5.2.2.1 No Action Alternative

5.2.2.1.1 Water Quality

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to baseline water quality. Therefore, no significant impacts to water quality would occur with implementation of the No Action Alternative.

5.2.2.1.2 Marine Sediments

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to baseline marine sediments. Therefore, no significant impacts to marine sediment would occur with implementation of the No Action Alternative.

5.2.2.2 MPR Activities (Preferred Alternative) Potential Impacts

5.2.2.2.1 Water Quality

Direct discharges of waste to the marine environment would not occur during proposed MPR activities. Impacts to water quality would be limited to short-term and localized changes associated with re-suspension of bottom sediments from pile removal and installation and barge and tug operations, such as anchoring and propeller wash. These changes would be spatially limited to the construction site and areas immediately adjacent.

Construction-related impacts would not violate applicable state or federal water quality standards discussed in Section 3.2. BMPs and minimization measures, discussed in Section 2.5, would be implemented to prevent accidental losses or spills of construction debris into Sinclair Inlet. In addition, removal of existing creosote-treated timber piles would improve localized water quality conditions in the project area. Therefore, no significant impacts to water quality are expected.

5.2.2.2.2 Marine Sediments

Proposed MPR activities would result in disturbance of bottom sediments through pile removal and installation and the anchoring of barges and vessels, as required. Impacts to sediment contaminant levels are unlikely. There would be no direct discharges of wastes to the marine environment during construction. Therefore, construction-related impacts to sediment quality would be limited to localized changes associated with disturbances of bottom sediments from replacement of up to 535 piles during the 5 years of proposed MPR activities. Setting spuds and anchors for the barges, and propeller wash from tugs used for pile removal and installation represent other construction-related sources for disturbances of bottom sediments. Propeller wash would not differ from day-to-day activities occurring in this area.

Some degree of localized changes in sediment composition would occur as a result of in-water construction activities. In particular, sediments that are re-suspended by pile installation and removal activities would be dispersed by currents and eventually re-deposited on the bottom. Depending on the distance suspended sediments would be transported from shallow to deeper portions of the project sites or fine-grained sediments would be transported from deeper to shallower areas. The distance over which suspended sediments are dispersed would depend on a number of factors, such as the sediment characteristics, current speeds, and distance above the bottom.

The risk of sediment re-suspension would be avoided or reduced through the implementation of BMPs during construction. Given the low currents in the area and the use of BMPs, distribution of the bottom sediments would be modified slightly, but the effects would be retained within the confines of the work area, allowing suspended sediments to settle at the work site. In-water work would not occur during the times of juvenile salmon out migration thus avoiding direct effects of suspended sediments to migratory salmonids.

The replacement piles would be located at the same location or near the existing piles, immediately adjacent to other large industrial facilities, and in a low-energy depositional environment. Proposed MPR activities would not substantially alter sediment re-suspension or deposition patterns near the project sites. The Navy would coordinate with CERCLA program managers before construction to confirm conformance with CERCLA requirements for these locations. The Navy has performed pre- and post-construction sediment monitoring for five previous pier repair and pile replacement projects and found no significant change in contaminant concentrations.

Based on adherence to BMPs and applicable plans and procedures, adverse effects to marine sediments would be avoided. Therefore, no significant impacts to marine sediments would occur as a result of implementation of proposed MPR activities at NAVBASE Kitsap Bremerton.

5.3 Biological Resources

5.3.1 Affected Environment

5.3.1.1 Aquatic Vegetation

The shoreline at NAVBASE Kitsap Bremerton is characterized by quaywalls and armor rock forming steep-sloped intertidal and subtidal zones. Past surveys have shown that marine aquatic vegetation is sparse throughout NAVBASE Kitsap Bremerton (Navy, 2012a). In 2008, an underwater survey was conducted near Pier B for a proposed construction project. Vegetation observed in the western and central transects included sparse amounts of sea lettuce (*Ulva* sp.) and red algae species

(*Porphyra* spp.). Vegetation along the mole wall of Dry Dock 6 was generally in very low abundance and limited to only a few species. Vegetation observed along this transect included sparse macroalgae growing on riprap and debris and included iridescent seaweed (*Iridaea cordata*) (Navy, 2008).

5.3.1.2 Benthic Invertebrates

Marine bivalve species utilizing the sand/mud habitat in the action area and surrounding waters of Sinclair Inlet include cockles, horse mussels, piddocks, littleneck clams, butter clams, geoducks, and horse clams (as summarized in WSDOT, 2014). As throughout Puget Sound, Dungeness crabs occur both intertidally and subtidally on a variety of substrates; juveniles and subadults are often associated with eelgrass (Fisher & Velasquez, 2008).

In addition to their utilization of subtidal habitat, clams and cockles inhabit the intertidal areas within the vicinity of the action area. Other invertebrates found in the intertidal and subtidal areas include shrimp, tunicates, crab, barnacles, sun star, sea cucumber, and sea anemones. Invertebrate species captured in 2014 during ROV and lighted trap surveys at NAVBASE Kitsap Bremerton outside the floating security barrier include: Dungeness, cancer, graceful, and red rock crabs, sea stars, California sea cucumber, green sea urchins, and three shrimp species (crangon, stout, and dock). Dungeness crab was the most abundant benthic invertebrate species captured during the surveys. Numerous anemones were observed during these surveys (Frierson et al., 2016b).

5.3.1.3 Marine Fish

5.3.1.3.1 <u>Non-ESA-Listed Fish Species</u>

Fish surveys using an ROV, a split-beam echosounder, lighted fish traps, and hook and line were conducted between 2013 and 2015 at NAVBASE Kitsap Bremerton, just outside the Sinclair Inlet Naval Restricted Area. The surveys focused on observing fish presence at depths > 10 m and recorded presence of surfperches (Family: Embiotocidae), forage fish (Family: Clupeidae or Osmeridae), unidentified fish <5 cm, pricklebacks (Family: Stichaeidae), flatfish (Order: Pleuronectiformes), and sculpins (Family: Cottidae). Specific species identified included Starry flounder, brown rockfish, English sole, Great sculpin, and shiner perch (Frierson et al., 2016b). Recreational dive surveys conducted between 2010 and 2015 just off of Waterman Point (located approximately 5 km northeast of NAVBASE Kitsap Bremerton) recorded observations of painted greenling (*Oxylebius pictus*), kelp greenling, scalyhead sculpin (*Artedius harringtoni*), buffalo sculpin, brown and copper rockfish, wolf eel (*Anarrhichthys ocellatus*), and lingcod (Reef.org, 2015). All species collected between the two surveys represent nearshore and offshore fish typically occurring within the greater Puget Sound.

There are no documented herring spawning grounds near NAVBASE Kitsap Bremerton (Stick et al., 2014). The nearest surf smelt spawning beach is located approximately 2,500 m southwest of Pier D and along the south side of Sinclair Inlet, across from NAVBASE Kitsap Bremerton (WDFW, 2017). Sand lance spawning occurs along the south side of Sinclair Inlet (WDFW, 2017). However, more than 1,000 unidentified forage fish were observed during the ROV survey in 2014 (Frierson et al., 2016b) and thus occur near the project area.

5.3.1.3.2 <u>ESA-Listed Fish and Critical Habitat</u>

ESA-listed fish species that occur along or within the vicinity of NAVBASE Kitsap Bremerton waterfront are Puget Sound Chinook salmon and Puget Sound steelhead. Bull trout; bocaccio and yelloweye rockfish; North American green sturgeon southern DPS; and Pacific eulachon southern DPS are unlikely to occur along or within the vicinity of NAVBASE Kitsap Bremerton.

Surveys conducted in 2001 and 2002 in Sinclair Inlet collected juvenile Chinook salmon from April to September with peak abundance occurring from June to July (Fresh et al., 2006). Approximately 10 percent of juvenile Chinook collected were unmarked subyearlings and possibly of natural origin whereas the remaining Chinook collected were caught following hatchery release from Gorst Creek (see Figure 3-5) (Fresh et al., 2006). Chinook spawning is documented in Blackjack Creek on the south side of Sinclair Inlet (WDFW, 2015a). One Chinook was recorded during hook and line sampling but was not from the Puget Sound ESU (Frierson et al., 2016b). Puget Sound Chinook outmigrants from other Puget Sound watersheds likely utilize the littoral habitats of Sinclair Inlet and could be present between April and September.

Puget Sound steelhead can be found in Sinclair Inlet as there is documented presence of steelhead in Anderson Creek and spawning in Blackjack Creek (see Figure 3-5) which are located on the south side of Sinclair Inlet (WDFW, 2015a). Steelhead are not typically found within nearshore environments but rather move rapidly from their freshwater and estuarine environments out to sea (Moore et al., 2010b).

Bull trout do not utilize any of the East Kitsap drainages for spawning due to a lack of suitable habitat. The closest rivers containing populations of bull trout are located within the Puyallup River, south of Seattle, in drainages into Lake Union and Lake Washington, and within the South Fork of the Skokomish River (USFWS, 2015b). Bull trout presence in Sinclair Inlet is expected to be rare and no bull trout were recorded during recent surveys (Frierson et al., 2016b).

Adult Puget Sound/Georgia Basin DPSs of bocaccio and yelloweye rockfish and juvenile yelloweye rockfish typically occur in waters deeper than depths within the shipyard and recent surveys conducted did not identify any of these species at NAVBASE Kitsap Bremerton (Frierson et al., 2016b). Further, juvenile bocaccio habitat is not present within the shipyard. Based on the lack of suitable rearing habitat, juvenile ESA-listed rockfish are not expected to be there. Unidentified larvae were recorded in Sinclair Inlet in July, occurring within the offshore surface waters (Green & Godersky, 2012). Larvae are not likely to be present within the shipyard.

The southern DPS Pacific eulachon and southern DPS North American green sturgeon are expected to be rare near the project site and within Sinclair Inlet in general. There are no spawning rivers or aggregation sites for either species nearby, and there are few records of these species in Puget Sound. The nearest regular eulachon spawning habitats are the Elwha River on the Olympic Peninsula and the Fraser River in British Columbia.

Critical Habitat

Puget Sound Chinook salmon have designated critical habitat in Sinclair Inlet. However, the DoD boundaries of NAVBASE Kitsap Bremerton are exempt by federal law (70 FR 52630). Critical habitat is designated, but outside NAVBASE Kitsap Bremerton boundaries. Section 3.3.2.3.2 lists the designated critical habitat PCEs for this species.

Nearshore critical habitat for bocaccio and deepwater critical habitat for bocaccio and yelloweye rockfish is designated in Sinclair Inlet. As stated above for Puget Sound Chinook, the DoD lands are exempt from critical habitat designation (79 FR 68042). However, habitat at NAVBASE Kitsap Bremerton generally does not meet the statutory definition of designated critical habitat for ESA-listed rockfish (see Section 3.3.2.3.2). Critical habitat is designated, but outside NAVBASE Kitsap Bremerton boundaries.

5.3.1.3.3 Essential Fish Habitat

Coastal pelagic EFH designations are based on the geographic range and in-water temperatures where these species are present during a particular life stage (PFMC, 2016a) and these boundaries include Sinclair Inlet. Market squid is recreationally fished for from late May until February at Waterman Point Pier located on the south side of Sinclair Inlet and approximately 5 km northeast of NAVBASE Kitsap Bremerton (WDFW, 2015b). They likely occur within the surface water habitat near NAVBASE Kitsap Bremerton. Anchovy are known to spawn in southern Puget Sound and any life stage could occur within the marine habitat of Sinclair Inlet (Penttila, 2007). The mix of mud and shell bottom substrate along NAVBASE Kitsap Bremerton waterfront provides Pacific coast groundfish EFH for species of groundfish (PFMC, 2016b). Sinclair Inlet provides Pacific coast salmon EFH for various life stages of Chinook, pink, and coho salmon (PFMC, 2014). Chinook and coho utilize Sinclair Inlet as a migration corridor to spawning and rearing streams located on the south side of Sinclair Inlet and likely other areas in Puget Sound. There are no streams near NAVBASE Kitsap Bremerton (WDFW, 2015a).

There are no HAPCs for Pacific Coast Groundfish or Pacific Coast salmon in Sinclair Inlet.

5.3.1.4 Birds

Migratory birds encountered at NAVBASE Kitsap Bremerton include those described in Section 3.3.2.4 for the overall Study Area. A bald eagle nest located north of Pier B in a residential area approximately 2,500 ft. from the waterfront was monitored in 2015 and 2016 (Navy, 2016d). The presence of eaglets was confirmed in 2015 by the NAVBASE Kitsap Bremerton biologist. Eaglets could not be seen in the 2016 surveys, but one or two adults were seen near the waterfront by Pier 6.

The WDFW Priority Habitat and Species Maps interactive website does not indicate the presence of marbled murrelet nests in the upland areas including and adjacent to NAVBASE Kitsap Bremerton (WDFW, 2017). WDFW at-sea surveys of central Puget Sound, including Sinclair Inlet, did not detect any marbled murrelets during the in-water work window (Pearson & Lance, 2013, 2014, 2015). However, they have been detected in other surveys (Puget Sound Ambient Monitoring Program [Nysewander et al., 2005]), and forge fish habitat occurs in Sinclair Inlet, which could attract foraging murrelets.

5.3.1.5 Marine Mammals

Any of the species listed in Table 3-7 has the potential to occur within the vicinity of NAVBASE Kitsap Bremerton. The species most likely to be encountered are harbor seals and California sea lions. California sea lions have been documented during shore-and boat-based surveys at NAVBASE Kitsap Bremerton since 2010, with as many as 314 individuals hauled out at one time (November 2015) on PSB floats (Figure 5-1) (Navy, 2016b). A known harbor seal haulout is located 0.7 mi south of NAVBASE Kitsap Bremerton across Sinclair Inlet. According to data from WDFW, harbor seal pupping occurs from late June through September in this area of the Puget Sound. This site is used by less than 100 individuals (Jeffries 2012). Shore-based surveys at NAVBASE Kitsap Bremerton have not detected Steller sea lions (Navy, 2016b). A Steller sea lion was sighted on a float on the floating security barrier during a vessel survey in November 2012 (Lance, 2012) and others were detected during aerial surveys conducted by WDFW in spring 2013 (Jeffries, 2013).

Figure 5-1. Pinniped Haulouts at NAVBASE Kitsap Bremerton

Little information is available on harbor porpoise occurrence outside of Hood Canal and no site-specific information is available for NAVBASE Kitsap Bremerton. Transient killer whales have been seen infrequently near NAVBASE Kitsap Bremerton (e.g., sightings in May 2010, April and June 2013, and June 2015 in Dyes Inlet, and June 2015 in Sinclair Inlet; reported in Orca Network, 2017).

ESA-listed marine mammals that have been known to visit or have the potential to occur in Sinclair Inlet include the Southern Resident killer whale (seasonal visitor), and the humpback whale (very rare visitor). A few sightings of possible humpback whales were reported by Orca Network in the waters near NAVBASE Kitsap Bremerton (Rich Passage to Agate Passage area including Sinclair and Dyes Inlet) between January 2003 and December 2015 (Orca Network, 2015). Humpback whales were sighted in the vicinity of Manette Bridge in Bremerton in March and May 2016, and May 2017 (Orca Network, 2017), and a carcass was found under a dock at NAVBASE Kitsap Bremerton in June 2016 (Cascadia Research, 2016). Examination did not reveal a clear cause of death. Southern Resident killer whales occasionally occur in the main basin of central Puget Sound, primarily in the fall and early winter months; i.e., during the in-water work windows for proposed MPR activities locations. They may occur near NAVBASE Kitsap Bremerton but their presence is unlikely; the last confirmed sighting in Dyes Inlet was in 1997.

Other cetacean and pinniped species are not expected to occur in the vicinity of NAVBASE Kitsap Bremerton.

5.3.2 Environmental Consequences

5.3.2.1 No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to baseline biological resources. Therefore, no significant impacts to biological resources would occur with implementation of the No Action Alternative.

5.3.2.2 MPR Activities (Preferred Alternative) Potential Impacts

5.3.2.2.1 Aquatic Vegetation

Marine surveys at NAVBASE Kitsap Bremerton have shown that red and green algae are present near pier locations, but in low densities due to the light limitations caused by existing over-water structures at the project area, limiting potential impacts. Shading of existing vegetation would not change as no expansion of existing structures or new over-water structures is proposed; therefore shading of existing vegetation is not discussed. Any shading that occurs would be from barges and would be temporary in nature, and would have no significant effect on marine vegetation. Decreased water and sediment quality can impede the growth of marine vegetation important to fish and other animals, and promote the growth of harmful algae.

Pile driving-related impacts to water quality during proposed MPR activities would be limited to temporary and localized changes associated with re-suspension of bottom sediments during construction. As indicated in Section 5.2.1.2 above, sediment in the project area is classified by WDOE as Category 4B (sediments that have a pollution control plan). Pile driving activities would not discharge contaminants or otherwise appreciably alter the concentrations of trace metal or organic contaminants in bottom sediments. Sediments would settle back in the general vicinity from which they rose. Low tidal flow rates into and out of the Sinclair Inlet mean that any sediments not contained would be unlikely to be transported outside of the project area. While some contaminated sediments might be suspended by pile driving, the sparse amount of vegetation in the area, BMPs, and the low transport rates indicate that effects to macroalgae and external seagrass beds from changes in sediment quality and sedimentation during construction would be limited and would not affect the overall health or distribution of marine vegetation in the area.

Section 5.2.1.1 above notes that several waters in the nearby area fall within the 303(d) list between Category 2 and 5 for pH, DO, and temperature. Proposed MPR activities would result in no measurable change to existing DO, pH or temperature levels in Sinclair Inlet, and would not affect the 303(d) listed areas. Proposed MPR activities would not result in violations of water quality standards and would, therefore, maintain water quality for marine vegetation in the vicinity of the project area.

Direct removal of marine vegetation during proposed MPR activities could occur through anchor and spud placement, and removal of piles. Any vegetative growth found on existing piles would be removed when those piles are extracted from the water but because piles would be replaced, ultimately a similar amount of surface area on which marine organisms could colonize would exist. Because marine vegetation does not occur densely in the area, direct removals should be minimal. Additionally, because marine vegetation is distributed outside of the project area, the overall health and abundance of macroalgae and eelgrass would not be compromised. Therefore, proposed MPR activities would have no significant direct or indirect impacts on marine vegetation.

5.3.2.2.2 Benthic Invertebrates

Proposed MPR activities at Bremerton would impact benthic communities through the disruption of the sediment surface and subsurface during the installation and removal of each pile, and from anchor and spud placement for the barges. Depending upon the species, impacts to individual benthic organisms could range from temporary disturbance to mortality. Some benthic organisms would be physically crushed and lost within the footprint of the piles, as well as from barge anchors and spuds.

Indirect impacts to habitat and benthic organisms are likely to result from turbidity caused by driving and removing barge anchors, spuds, and piles. The area near the pile replacement footprint could have higher levels of turbidity. Disturbed sediments would eventually redeposit upon the existing benthic community. Impacts from increased turbidity levels would likely result in short-term loss of localized areas of the benthic community. Most affected areas would experience some reduction in diversity and abundance of benthic species. However, benthic organisms, particularly annelids, are very resilient to habitat disturbance and are likely to recover to pre-disturbance levels in less than 2 years (CH2M Hill, 1995; Parametrix, 1994, 1999; Romberg et al., 1995; Anchor Environmental, 2002). Therefore, proposed MPR activities would have no significant impacts on benthic invertebrates.

5.3.2.2.3 Marine Fish

Non-ESA-Listed Marine Fish

Turbidity

Resident marine fish are expected to be present within the vicinity of the project area and are likely to occur during the in-water work window established for juvenile salmonid avoidance. In-water work could produce measurable, temporary increases in turbidity and sedimentation, and that could cause fish to temporarily avoid the areas near construction. However, construction activities would not result in persistent increases in turbidity levels or cause changes that would violate water quality standards because processes that generate suspended sediments, which result in turbid conditions, would be short-term and localized and would disperse and/or settle rapidly (within a period of minutes to hours after construction activities cease). This also applies to resuspension of existing contaminated sediments during construction as these would be localized, short-term, and settle rapidly. Further, removal of existing creosote-treated timber piles would improve localized water quality conditions in the project area. Effects would be short-term and small in scale during construction and, if creosote piles are removed, beneficial to water quality post-construction. Placement of the piles and associated disturbance activities (i.e., support vessels, construction barge) may cause a loss to benthic prey either existing within the pile footprint or disturbance from turbidity which may impact fish use of that area for seeking prey. Impacts would be short-term, localized, and limited to the duration of pile installation and would not be expected to significantly impact fish ability to seek prey outside of the project areas. With implementation of impact avoidance and minimization measures (see Section 2.5), no significant impacts to non-ESA-listed marine fish from turbidity and sedimentation (including potential resuspension of contaminated sediments) are anticipated from the proposed MPR activities.

Underwater Noise

Construction activity associated with proposed MPR activities would result in increased underwater noise levels. Noise would be generated from support vessels, small boat traffic, and barge-mounted equipment, such as generators, and pile extraction and installation. Noise levels from all activities except pile driving would typically not exceed underwater sound levels resulting from existing routine waterfront operations along NAVBASE Kitsap Bremerton. The most significant underwater noise potentially affecting fish would be from impact pile driving of steel piles. To minimize impacts to fish, piles would be installed initially with a vibratory pile driver until either the pile hits refusal, necessitating an impact hammer to reach required depth, or for proofing piles to verify structural capacity. Since vibratory pile drivers typically generate noise levels from 10 to 20 dB lower than impact pile driving and do not produce waveforms with sharp rise times like impact pile driving, impacts on fish are typically not observed in association with vibratory pile driving (WSDOT, 2018).

A maximum of 80 steel pipe piles and up to 20 sheet piles would be installed at NAVBASE Kitsap Bremerton during the 5 years of proposed MPR activities if all estimated emergent pile replacement projects occur. The largest steel pile that would be installed is a 14-in diameter pile. This size pile produces a SPL of 200 dB peak, 184 dB RMS, and 174 dB SEL re 1 μPa (Appendix B). Underwater noise generated from impact pile driving this size pile could expose fish to injurious levels above the peak threshold as well as the cumulative SEL thresholds (Appendix B). Fish would be expected to be exposed differently to elevated noise levels and they could behave differently in their reaction to noise. Some fish are migrating through the area and may pass through the thresholds above the behavioral disturbance zone (estimated to 1,800 m). Other fish are resident to the area and may not move away and thus would be exposed to injurious noise levels for the duration of pile driving activity (Hastings & Popper, 2005). However, all steel piles proposed for installation are fender piles that are anticipated to be fully vibratory driven based on prior projects. Impact pile driving would not be needed for proofing. If impact pile driving is required (due to substrate conditions) to fully advance a pile to depth, the maximum estimated amount of impact pile driving to occur would be 1.5 hours during the 5 years of proposed MPR activities and would be conducted intermittently. To minimize exposure to noise above the injurious and behavioral disturbance thresholds, all pile driving would be conducted during the in-water work window when juvenile salmonids are least likely to be present. With implementation of these minimization measures and including those listed in Section 2.5, no significant impacts to non-ESA-listed fish from underwater noise would result from the proposed MPR activities.

ESA-Listed Fish and Critical Habitat

Turbidity

As discussed above, in-water work could produce measurable, temporary increases in turbidity and sedimentation, and that could cause ESA-listed fish and their forage fish to temporarily avoid the areas near construction. Because, in-water work would occur during the approved in-water work window of July 16 through February 15, juvenile ESA-listed salmonids are least likely to be present. Adult Chinook, steelhead, rockfish, and juvenile yelloweye rockfish, if present, would occur further offshore and beyond any impacts associated with turbidity during in-water construction. Juvenile bocaccio rearing habitat is absent from the project area and from Sinclair Inlet in general and thus juveniles are not expected to be present and exposed to turbidity. Bull trout, Pacific eulachon, and green sturgeon are not expected to occur within the vicinity of NAVBASE Kitsap Bremerton. With implementation of impact avoidance and minimization measures, no significant impacts to ESA-listed fish or their forage base from turbidity and sedimentation, including temporary and localized exposure to suspended contaminated sediments, would result with implementation of proposed MPR activities.

Underwater Noise

In-water work would occur during a period when juvenile salmonids are least likely to be present and thus exposure to injurious noise thresholds would not occur. As previously stated, rearing habitat for juvenile bocaccio is absent from the project area and thus juveniles would not be present and potentially exposed to noise above the injury thresholds. Bull trout, green sturgeon, and eulachon are not expected to occur within the vicinity of Naval Base Kitsap Bremerton and thus no exposure to injurious noise impacts would occur. Larger juvenile Chinook and juvenile yelloweye rockfish as well as adult life stages of Chinook, steelhead, and bocaccio and yelloweye rockfish may be exposed to noise above the cumulative SEL injury thresholds as these zones would extend offshore and over deeper water where these species may be present. As discussed above, all steel piles are fender piles that are anticipated to be fully vibratory driven and if impact pile driving is required it would only occur intermittently and for an estimated maximum of 1.5 hours total for the installation of 80 steel piles during the 5 years of proposed MPR activities.

ESA-listed rockfish and salmonids occurring within 1,800 m of a steel pile being struck by an impact hammer would be exposed to underwater noise above the behavioral disturbance threshold (Appendix B). However, exposure would be temporary and short-term (1.5 hours) and unlikely to be significant to fish species at this distance for the short duration it could occur.

The largest concrete pile to be installed would be a 24-in diameter pile. Modeled threshold distances are significantly smaller (Appendix B) as compared to steel piles. Impact pile driving concrete piles is estimated to last an estimated maximum duration of 4 hours or an average of 1.5 hours during the 5 years of proposed MPR activities. However, there are no known documented incidents of fish injury occurring from pile driving of concrete piles (NMFS, 2012c). By installing piles within the in-water work window and limited number of piles (for all pile types) during the 5 years of proposed MPR activities, only behavioral effects are anticipated and these effects are not anticipated to be significant to an individual fish.

In conclusion, no significant impacts to ESA-listed fish from underwater noise would result from the proposed MPR activities.

Critical Habitat

Critical habitat PCEs (estuarine and nearshore marine areas) within designated critical habitat adjacent to NAVBASE Kitsap Bremerton for Puget Sound Chinook and the essential features for conserving ESA-listed rockfish would not be affected from turbidity or injurious pile driving noise. Turbidity and pile driving noise from installing 14-in diameter steel piles and 24-in concrete piles would be localized and short-term in the areas exempt from critical habitat designation. The behavioral threshold zone from impact pile driving steel piles and concrete piles would extend out and over deeper water and may temporarily impact the critical habitat PCEs for Puget Sound Chinook and deepwater ESA-listed rockfish designated critical habitat. However, effects to these PCEs and essential feature would be short-term (1.5 hours during the 5 years of proposed MPR activities) and would not be significant. Therefore, no significant impacts to designated critical habitat for Chinook and ESA-listed rockfish would result from the proposed MPR activities.

The Navy determined that the Proposed Action “may affect, but is not likely to adversely affect” ESA-listed fish species and designated critical habitat. USFWS concurred with the Navy’s determination for bull trout with a Letter of Concurrence signed on December 15, 2017. NMFS did not concur with the Navy’s determination and concluded that the Navy’s proposed MPR activities “may affect, are likely to adversely affect” Puget Sound evolutionary significant unit (ESU) Chinook salmon; Hood Canal summer-run ESU chum salmon; Puget Sound distinct population segment (DPS) steelhead; Puget Sound/Georgia Basin DPSs of bocaccio and yelloweye rockfish; and, designated critical habitat. Section 7 consultation with NMFS was completed with the issuance of a BiOp on April 5, 2019.

Essential Fish Habitat

As was discussed above for marine fish in general and ESA-listed fish, elements of the proposed MPR activities would create turbidity and suspended sediment but these impacts would be short-term, localized, and small in scale without causing measureable impacts to EFH. Removal and installation of piles and anchoring would have a localized impact on benthic epifauna/infauna within the immediate vicinity of each pile or anchoring site but these impacts would be minimal, localized, and expected to recover to pre-disturbed levels within a few growing seasons. The primary impact during proposed MPR activities would be increased sound energy in the marine fish habitat. Increased sound would affect the water column, which has been designated as EFH for numerous species (see Appendix C). Impacts to the water column could result in disturbance depending on fish species, size, orientation, received noise level and type of noise. To avoid injurious effects from impact pile driving, the Navy would implement minimization measures to reduce the level of noise in the water column. The primary minimization measure would be to install piles with a vibratory pile driver to the extent practicable and follow with impact hammer pile driving to verify load-bearing capacity (proofing).

A maximum of 80 steel piles and up to 20 sheet piles would be installed at NAVBASE Kitsap Bremerton during the 5 years of proposed MPR activities. The largest size steel pile would be 14-in diameter. Noise above the peak and cumulative SEL injury threshold would extend over unconsolidated sediments and artificial structures that may be used as groundfish EFH. Due to a lack of vegetation and pile driving within the in-water work window, these thresholds would not impact Pacific coast salmon EFH. Noise above the behavioral zone would extend out over deeper water of Sinclair Inlet, exposing EFH to elevated noise levels (Appendix B). However, all steel piles to be installed are fender piles that are anticipated to be fully vibratory driven based on prior projects. If impact pile driving is required (due to substrate conditions) to fully advance a pile to depth, the maximum estimated amount of impact pile driving to occur would be 1.5 hours total for the installation of 80 steel piles during the 5 years of proposed MPR activities and would be conducted intermittently.

In addition to steel, concrete piles would also be installed which would generate lower SPLs than steel. Therefore, noise generated above the injury and behavioral thresholds by concrete piles is significantly smaller as compared to steel piles. Only groundfish EFH is present within the behavioral zone and any impacts to the EFH would be temporary and short-term and would not significantly degrade EFH. Impact pile driving concrete piles is estimated to last a maximum duration of 4 hours or an average of 1.5 hours during the 5 years of proposed MPR activities.

The Navy determined that the Proposed Action may adversely affect EFH by temporarily increasing noise in the water column during pile driving. However, implementation of minimization measures applied to ESA-listed species would be sufficient for minimizing effects to EFH. The Navy consulted with NMFS under the Magnuson-Stevens Fisheries Conservation and Management Act and NMFS concurred with the Navy's determination, but provided Conservation Recommendations to minimize effects to EFH. Consultation with NMFS was completed on April 5, 2019.

Overall, due to the temporary nature of the activities, proposed minimization measures and the minimal level of impact to water column noise levels, benthic flora and fauna, water quality, and sediment quality, no significant impacts to EFH would occur with implementation of the proposed MPR activities.

5.3.2.2.4 Birds

Resident and migrant birds are expected to be present within the vicinity of proposed MPR activities during the in-water work window established for juvenile salmonid avoidance (Section 2.5.3.1). Proposed MPR activities have the potential to impact marine birds through visual disturbance, changes in prey availability, and elevated underwater and airborne noise. Pile extraction and installation projects, and other repair projects on the existing marine structures would intermittently increase human activity levels on the waterfront, potentially resulting in visual disturbance and increasing ambient noise levels due to use of construction equipment. A bald eagle nest is located in a residential area near Pier 6 (Navy, 2016d). Nesting bald eagles are unlikely to be disturbed by human activity at NAVBASE Kitsap Bremerton project sites because of the distance from the nest to the project sites; also, pile driving would occur, at the earliest, toward the end of the nesting season (August 15). In addition, there is no suitable foraging habitat near project sites. No incidental takes of bald eagles are anticipated. Project sites currently have high levels of ongoing human activity, and project work involving repairs to marine structures would be within the baseline condition. Therefore, project effects to marine birds due to human activity levels would be insignificant.

As discussed in Sections 5.3.2.2.2 and 5.3.2.2.3, in-water work could temporarily affect the availability of forage fish and benthic invertebrates, which are the prey base of many marine birds, in a limited area. Removal of existing creosote-treated timber piles would improve localized water quality conditions in the project area. Turbidity effects and potential resuspension of contaminated sediments are not expected to affect the prey base, as these changes would be short-term and small scale during construction. Therefore, proposed MPR activities would have no significant impacts on prey availability for marine birds.

Effects of Elevated Noise Levels on Birds

Proposed MPR activities would result in increased underwater noise levels. Noise would be generated from small vessels and barge-mounted equipment such as generators, and pile extraction and installation. Noise levels from all activities except pile driving would typically not exceed underwater sound levels resulting from existing routine waterfront operations along the Bremerton waterfront. The most significant underwater noise source would be impact pile driving of steel piles. Impacts of elevated noise levels due to pile driving were evaluated in the context of established criteria for ESA consultation with the USFWS on the threatened marbled murrelet. No criteria have been established for determining impacts of elevated noise levels on other marine bird species, some of which forage underwater like the marbled murrelet, so the analysis methods for impacts on marbled murrelets were applied to other species.

Pursuit-diving birds (i.e., birds that pursue and capture their prey underwater using their wings to swim) include cormorants, grebes, and alcids (murres, murrelets, and pigeon guillemots). While actively foraging they dive repeatedly into waters of various depths and would potentially be exposed to elevated underwater noise during pile driving. When startled by loud sounds, their foraging patterns may be altered, and birds may flush or dive and swim away underwater. While underwater they would be susceptible to injury or behavioral disturbance due to elevated sound pressure waves generated by pile driving. Dabbling and diving ducks may also be susceptible to elevated underwater sound. Birds that feed on the surface such as gulls, shorebirds, and wading birds are unlikely to be affected by elevated underwater sound.

Actively foraging marbled murrelets dive repeatedly into waters ranging up to approximately 160 ft. in depth for periods ranging up to 60 seconds (Nelson et al., 2006). Foraging bouts typically last over a period of 27 to 33 minutes, with approximately 50 percent of the time spent underwater (Jodice & Collopy, 1999). When startled by loud sounds, the foraging pattern may be altered, and birds may flush or dive and swim away underwater. While underwater they would be susceptible to injury or behavioral disturbance due to elevated sound pressure waves generated by pile driving.

As described in detail in Appendix B, the USFWS uses underwater noise thresholds developed by the Marbled Murrelet Hydroacoustic Science Panel (SAIC, 2011) to determine the zones around a driven pile in which two general forms of injury might occur to diving marbled murrelets: (1) auditory injury (generally damage to sensory cells of the ear) beginning at 202 dB SEL cumulative, and (2) non-auditory injury (trauma to non-auditory body tissues/organs) beginning at 208 dB SEL cumulative. Since the underwater criterion for auditory injury was the lower of the two thresholds, this was the criterion used for assessing injurious impacts to pursuit-diving marine birds in this analysis. Currently there are no thresholds or guidelines for installation and extraction of piles with a vibratory driver. Because the sound levels generated by vibratory drivers are typically 20-30 dB lower than impact pile driving and do not produce waveforms with sharp rise times like impact pile driving, the affected areas would be discountably small and potential impacts on marine birds would be discountable.

A maximum of 535 piles could be installed at Bremerton during the 5 years of proposed MPR activities, of which up to 80 could be 14-in steel, 20 could be sheet steel, and 435 could be 24-in concrete. As shown in Appendix B, potentially injurious noise levels may extend up to 10 m from either pile type during project construction (see Figure 5-2 for a representative scenario of the extent of potentially injurious underwater noise from steel pile installation). Since estimates of the distances to thresholds involve the cumulative energy of all impact strikes over a 24-hour period, the affected area represents the maximum extent of potential auditory injury effects. Earlier in the construction day, the injury zone would be smaller, and only reach the maximum extent after all the pile strikes have been completed.

Airborne noise levels from proposed MPR activities are not expected to be injurious to birds within the study area because the source levels for airborne noise from pile driving (vibratory: 96 dBA at 15 m; impact: 110 dBA at 11 m) are well below those known to cause injury to birds in laboratory situations (Dooling & Popper, 2007). However, the USFWS (2013) has determined that airborne noise due to impact pile driving may behaviorally affect foraging marbled murrelets, based on the findings of the Marbled Murrelet Hydroacoustic Science Panel regarding non-injurious thresholds for pile driving noise (SAIC, 2012). Marbled murrelets typically perform foraging dives in pairs and are highly vocal when they are above the surface (Strachan et al., 1995). On the water's surface, birds typically stay within 100 ft. of their partners during foraging bouts. This behavior is thought to play a role in foraging efficiency, and therefore airborne noise that masks their vocalizations has the potential to affect foraging success (Carter & Sealy, 1990; Strachan et al., 1995). Unlike other noise effects criteria established for injury, the distance from a pile driving source within which communications would be masked is dependent upon ambient noise levels and therefore is site-specific. Masking effects cease immediately when the masking noise stops. Under typical conditions on the Bremerton waterfront, the maximum distance within which pile driving noise for steel piles <36 in is expected to compromise communication between foraging murrelets would be 42 m (USFWS, 2013). Acoustic monitoring during construction at NAVBASE Kitsap Bangor (Illingworth & Rodkin, 2013) indicated that average airborne source levels during impact driving of 36-in steel piles were the same as, and in some cases lower than, 24-in steel piles. Therefore, the masking distance for 24-in steel piles was applied to all steel pile sizes. Representative scenarios of areas affected by masking effects are shown in Figure 5-2.

The USFWS (2013) has provided guidance on evaluating the significance of airborne masking effects for pile driving projects. "Typical" pile driving projects involve:

- Installation of 24-in or 36-in steel piles,
- Use of vibratory pile drivers,
- Use of impact pile drivers for proofing only, and
- Adherence to a 2-hour timing restriction (i.e., no pile driving within 2 hours after sunrise and within 2 hours before sunset during the breeding season).

Typical pile driving projects do not result in measurable effects on marbled murrelets because the use of impact hammers is intermittent and of short duration, the 2-hour timing restriction protects murrelets during their most active foraging periods, and murrelet vocalizations are adapted to overcome the effects of ambient noise (USFWS, 2013). No guidance has been developed for 14-in steel pile, which is the largest size that would be installed at NAVBASE Kitsap Bremerton, so it is reasonable to assume that pile driving projects at this location would be "typical" if minimization actions are implemented.

To prevent exposure to injurious or masking noise levels in the action area for projects at NAVBASE Kitsap Bremerton, the Navy would implement the minimization measures and BMPs described in Section 2.5. The Navy would actively monitor the underwater auditory injury zone for impact pile driving or the 42-m masking zone (Figure 5-2), whichever is larger, depending on the pile type. The likelihood of marbled murrelet exposure to injurious or masking noise from impact pile driving is discountable because these zones are small and can be effectively monitored during pile driving, and pile driving would cease if monitors detect marbled murrelets (see Appendix D for details) within the threshold distance.

With the implementation of minimization and monitoring actions (Section 2.5), the Navy has determined the Proposed Action "may affect, but is not likely to adversely affect" ESA-listed marbled murrelets. USFWS concurred with the Navy's determination in a letter dated December 15, 2017. Proposed MPR activities would have no significant impacts on marbled murrelets or other marine bird species due to temporarily elevated underwater and airborne sound levels resulting from impact or vibratory pile driving of all pile types.

Critical Habitat

Because the closest marbled murrelet designated critical habitat to NAVBASE Kitsap Bremerton is about 24 mi to the west, no noise resulting from proposed MPR activities would reach it. Therefore, a no effect determination was made for designated critical habitat in the vicinity of NAVBASE Kitsap Bremerton.

5.3.2.2.5 Marine Mammals

Pile installation and removal during proposed MPR activities at NAVBASE Kitsap Bremerton would result in temporarily increased human activity levels and changes in prey availability during project construction. However, project construction would take place at existing marine structures that have relatively high levels of human activity under daily operations, and prey availability changes would be short-term and highly localized, as described in Section 5.3.2.2.3. Because vessels would be operating at slow speeds, no vessel strikes would be expected. Therefore, there would be no significant impact to marine mammals due to increased human activity levels, changes in prey availability, or the potential for vessel strikes.

Effects of Elevated Noise Levels on Marine Mammals

Underwater and airborne noise generated during pile installation and removal has the potential to disrupt the behavior of marine mammals that may be traveling through, foraging, or resting in the vicinity of the project area, as described in detail in Appendix B. The Navy estimates potential impacts to marine mammals by considering the likelihood that each species may be present at NAVBASE Kitsap Bremerton during pile driving, determining the sound levels generated by various pile types and installation methods, and applying acoustic threshold criteria (expressed in decibels, dB) established by NMFS for evaluating the potential for injury or behavioral impacts. A detailed explanation of the analytical methods is presented in Appendix B, and the following sections summarize results of the underwater noise analysis.

A maximum of 535 piles could be installed at Bremerton during the 5 years of proposed MPR activities, of which up to 80 could be 14-in steel and 435 could be 24-in concrete. The highest underwater source levels for pile driving would result from impact driving of 14-in steel piles. As described in detail in Appendix B, the Navy estimated the distances to the various NMFS underwater noise thresholds for injurious and behavioral effects on marine mammals. These distances were estimated by taking into account the source levels for impact and vibratory pile driving of piles at NAVBASE Kitsap Bremerton, sound propagation over distance from the driven pile, and acoustic impacts thresholds for the various species groups. Figure 5-3 depicts a representative scenario of the extent of potentially injurious and behaviorally harassing underwater noise from steel and concrete pile installation. The area encompassed by the threshold values decreases the closer to shore pile driving occurs and is truncated where shallow water and land block noise transmission.

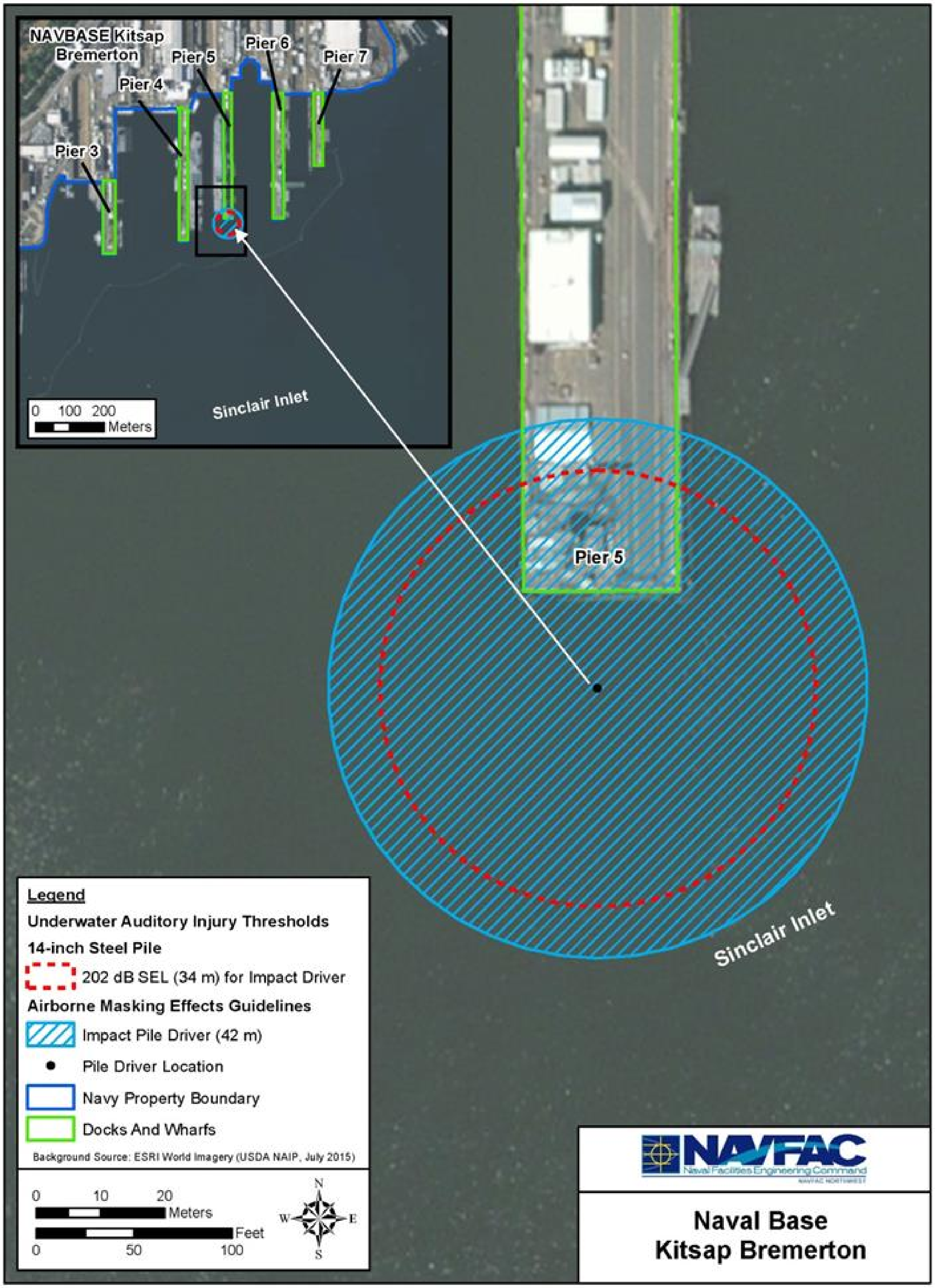

Figure 5-2. Representative Affected Areas for Pile Driving Noise for Marbled Murrelets at NAVBASE Kitsap Bremerton

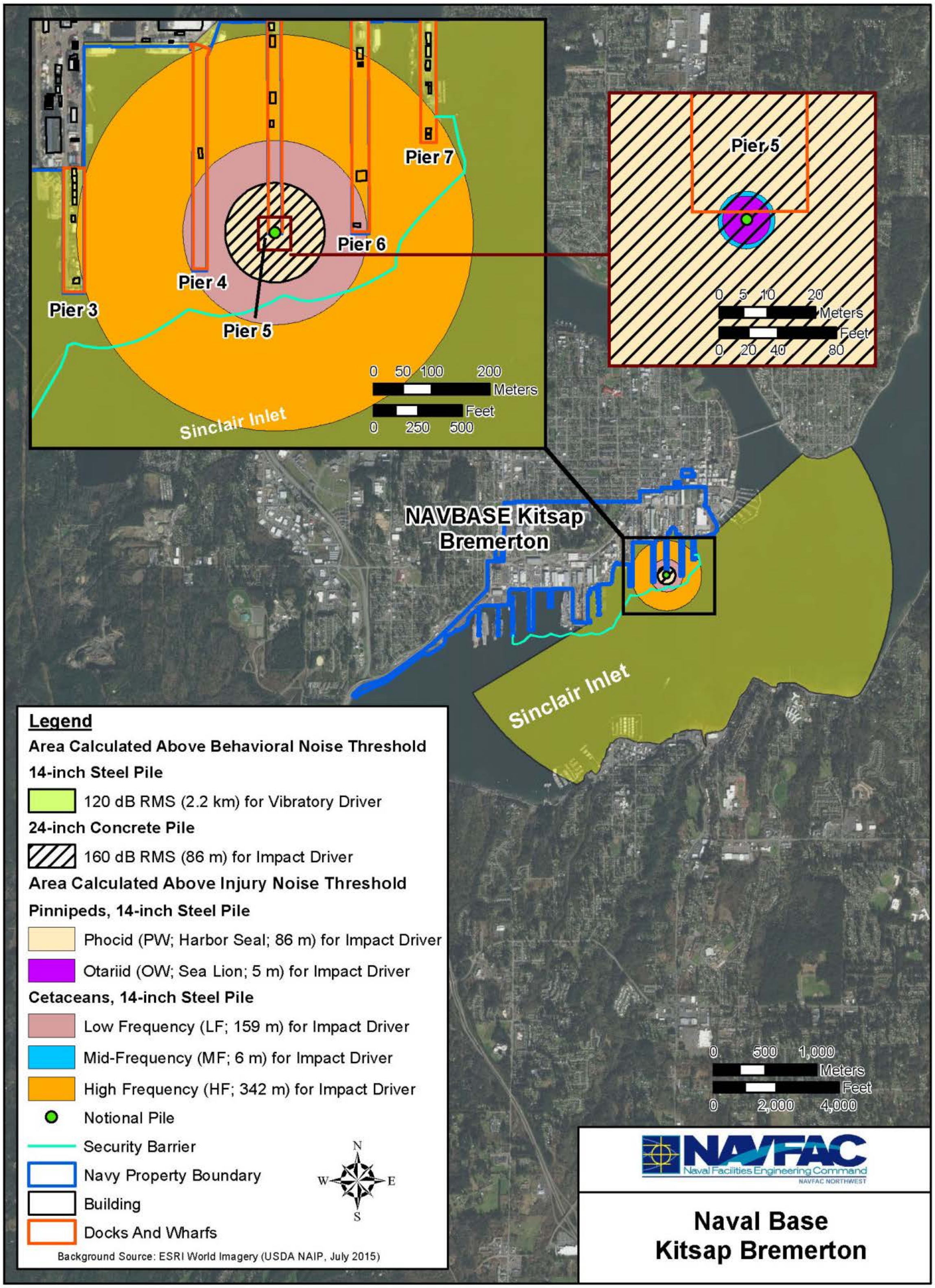

Figure 5-3. Representative Affected Areas for Pile Driving Noise for Marine Mammals at NAVBASE Kitsap Bremerton

The likelihood of injury due to pile driving noise is discountable for marine mammals at NAVBASE Kitsap Bremerton because marine mammals are unlikely to be present in the small affected areas, which would be fully monitored by marine mammal observers during pile driving. In addition, most steel piles would be installed with a vibratory driver, which affects a smaller area with injurious noise levels than impact pile driving (Appendix B). As described in Appendix B, pile driving would cease if monitors detect a marine mammal approaching or entering the injury zone.

Pile driving would produce noise above the underwater behavioral harassment threshold during impact and vibratory pile driving (Appendix B). The loudest impact pile driving noise, resulting from installation of 14-in steel pile, is estimated to affect an area up to 398 m from the driven pile. However, impact pile driving noise is not expected to result in behavioral harassment of marine mammals because affected areas can be fully monitored and pile driving would cease if a marine mammal approaches the affected area.

However, installation of steel piles would utilize a vibratory pile driver to the extent practicable in order to reduce adverse impacts to fish species, and the affected area due to the vibratory pile driver would be much larger than the area affect by impact pile installation (due to the low behavioral harassment threshold for continuous sound [120 dB RMS versus 160 dB RMS for impulsive sound]). The greatest risk of exposing marine mammals to behavioral harassment during pile driving would be during vibratory installation of steel pile because the affected areas would be too large to be fully monitored by marine mammal observes (for details see Appendix D). The affected area could extend up to 2.2 km from the driven pile at NAVBASE Kitsap Bremerton.

To assess the potential exposure of marine mammals to above-threshold noise levels during in-water work windows during the 5 years of proposed MPR activities, the likelihood of occurrence of each species was considered along with the number of pile driving days. The Navy used one of three methods for species at NAVBASE Kitsap Bremerton, depending on (1) whether site-specific abundance was known, (2) regional densities were known, or (3) the species is so infrequently encountered that densities cannot be determine and other reasoning must be applied. Potential exposures of California sea lions and harbor seals were estimated based on known abundances determined by on-site monitoring; exposures of Steller sea lions, and harbor porpoises were estimated based on regional density data (Navy, 2015a, Marine Species Density Database); and exposures of the remaining species were estimated through analysis of historical occurrence. Details of the exposure analysis are presented in Appendix B, and results are summarized in Table B-19.

Based on the exposure estimates in Table B-19, the species most likely to be impacted are the harbor porpoise, California sea lion, and harbor seal. The Navy would implement a variety of BMPs and mitigation measures, including noise attenuation devices and marine mammal observers that are expected to reduce the estimated impacts. These measures are fully described in Appendix D and summarized in Section 2.5.

Individual responses of marine mammals to pile driving noise are expected to be variable. Some individuals may occupy the project area during pile driving without apparent effect, but others may be displaced with undetermined effects. In general, cetaceans like harbor porpoise infrequently transit the waters in the vicinity of NAVBASE Kitsap Bremerton and they do not tend to remain there. If they encounter pile driving noise they would likely avoid affected areas. Avoidance of the affected area during pile driving operations would potentially reduce access to foraging areas and inhibit movement through the area. The likelihood of exposure to behavioral disturbance due to pile driving noise would be limited by the infrequent occurrence of cetacean species in the vicinity, and monitoring and shutdown of pile driving if monitors detect cetaceans, as described in Appendix D.

Based on the low likelihood of occurrence of ESA-listed species in Table 3-8, and the use of BMPs and mitigation measures that are likely to reduce potential impacts, the Navy concludes that proposed MPR activities at NAVBASE Kitsap Bremerton:

- "may affect, and are not likely to adversely affect" humpback whales and Southern Resident killer whales because they are considered rare in Sinclair Inlet; and
- "may affect, but are not likely to adversely affect" Southern Resident killer whale designated critical habitat.

NMFS did not concur with the Navy's determinations and concluded that the Navy's proposed MPR activities "may affect, are likely to adversely affect" humpback whale species, Southern Resident killer whale, and Southern Resident killer whale designated critical habitat. The Navy's consultation with NMFS regarding ESA-listed marine mammals and critical habitat was completed with the issuance of a BiOp on April 5, 2019 (Appendix G).

Acoustic exposure estimates from pile driving operations summarized in Table B-19 indicate there is the potential for Level B harassment, which has the potential to disrupt animal behavior, as defined by MMPA. No marine mammals would be exposed at levels that would result in injury or mortality. Other construction activities not associated with pile installation and removal would not result in Level A or B harassment under the MMPA. The Navy consulted with NMFS in compliance with the ESA and the MMPA, and obtained an LOA for Level A injury and Level B harassment of marine mammals. The Final Rule for the LOA was published in the Federal Register on April 17, 2019. Since the exposures are only expected to result in behavioral impacts on an intermittent basis, no long term or permanent impacts are anticipated.

The analysis presented above indicates that proposed MPR activities at NAVBASE Kitsap Bremerton may impact individual marine mammals, but any impacts observed at the population, stock, or species level would be negligible. Therefore, there would be no significant impact to marine mammal populations.

5.4 Cultural Resources

5.4.1 Affected Environment

The APE for the Proposed Action at NAVBASE Kitsap Bremerton consists of up to 16 facilities (Table 5-1). All work would occur in or over-water. No on-shore work is planned, and any staging required would occur in previously disturbed or developed areas.

Four National Register of Historic Places (NRHP) Historic Districts and one National Historic Landmark (NHL) Historic District have been established at NAVBASE Kitsap Bremerton. The Historic Districts, all located outside of the pier repair and replacement project APE, are: Officers' Row; Puget Sound Radio Station District; Marine Reservation District; and Hospital Reservation. The oldest of the four districts is Officers' Row which contains homes dating back to 1896. Structures of nearly equal age are present in the Puget Sound Radio Station District which is immediately north of Officers' Row.

The largest historical resource at NAVBASE Kitsap Bremerton is the Navy Yard Puget Sound NHL, associated with the World War II-era dry dock and pier facilities near the southeastern corner of the base. The contributing building and structures of the NHL are significant for their direct support of the warship repair and construction efforts during WWII. It is comprised of buildings as well as piers and dry docks, which have retained much of their original function, maintaining their historical integrity. Piers 3, 4, 5, 6 and 7, Dry Dock 5, and the Hammer Head Crane are contributing historic properties to the NHL (USDI/NPS, 1990). The SHPO concurred with this finding (December 20, 1990). Because of the special status of NHLs, consultation regarding adverse impacts resulting from pile replacement at Bremerton must include not only the SHPO, and the Advisory Council on Historic Preservation, but also the Secretary of the Interior (acting through the Director of the National Park Service), if the National Park Service elects to participate. The remaining structures are either: unevaluated (Pier 9 and Mooring Pier A), or have been recommended as not eligible for listing in the NRHP because they lack significance under any of the NRHP criteria (Piers B, C, and D, Mooring Piers E, F, and G and Quay Wall) (Table 5-1). A new survey and NRHP evaluation of buildings and structures within the shipyard would be completed before any work proceeds.

Areas regarded as having a high potential for archaeological sites at NAVBASE Kitsap Bremerton are the relatively undisturbed portions of the shipyard (distant from the in-water project sites along the original shoreline and lowland), or along the ravine near the center of the shipyard. The proposed pier repair and replacement construction sites are in a highly disturbed, industrial area. New piles would be installed adjacent to where existing piles were removed.

Shoreline structures at Bremerton, including the piers proposed for repair or pile replacement, or contingency repair, are constructed on fill, and the current shoreline where these structures are located does not reflect the original coast line. There are no recorded submerged historic properties, downed aircraft, or shipwrecks, in the NAVBASE Kitsap Bremerton APE.

5.4.2 Environmental Consequences

5.4.2.1 No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to the baseline cultural resources. Therefore, no significant impacts to cultural resources would occur with implementation of the No Action Alternative.

5.4.2.2 MPR Activities (Preferred Alternative) Potential Impacts

Implementation of proposed MPR activities at Bremerton would not affect any known NRHP-eligible archaeological sites. Construction activities would take place in previously disturbed underwater areas along or near the shoreline, with a substrate consisting of fill. The probability of prehistoric archaeological deposits or features buried within the substrate is very low due to Holocene sea level changes and associated erosion of glacial deposits found along the shoreline.

Nevertheless, pursuant to the NHPA implementing regulations, other applicable federal laws, and DoD and Navy regulations, if construction activities inadvertently encounter archaeological resources, the Navy would stop work in the immediate area and then follow the Section 106 process for inadvertent discovery (36 CFR 800.13), including evaluating the NRHP-eligibility of the resources, and considering the effects to such resources through consultation with the SHPO, affected American Indian tribes, and other interested parties. Similarly, if American Indian human remains, funerary items, sacred objects, or items of cultural patrimony are encountered, the Navy must comply with NAGPRA.

Table 5-1. Proposed Action at NAVBASE Kitsap Bremerton

Structure Name	*Year Built*	*NRHP Status*	*SHPO Concurrence Date*	*DAHP Log #*	*Notes*
Pier 3 (#713)	1943	Eligible; Contributing	12/20/1990		NHL
Pier 4 (#714)	1932	Eligible; Contributing	12/20/1990		NHL
Pier 5 (#715)	1923	Eligible; Contributing	12/20/1990		NHL
Pier 6 (#716)	1926	Eligible; Contributing	12/20/1990		NHL
Pier 7 (#717)	1943	Eligible; Contributing	12/20/1990		NHL
Pier (Wharf) 9 (#823)	1962	Unevaluated			Outside NHL
Pier B (#722A)	2012	Not Eligible			Outside NHL, original pier replaced
Pier C (#723)	1941	Not Eligible			Outside NHL
Pier D (#724A)	2004	Not Eligible			Outside NHL, original pier replaced
Mooring Pier A (#721)	1949	Unevaluated			Outside NHL
Mooring Pier E (#726)	1946	Not Eligible		120110-05-USN	Outside NHL
Mooring Pier F (#727)	1949	Not Eligible		120110-05-USN	Outside NHL
Mooring Pier G (#728)	1949	Not Eligible		120110-05-USN	Outside NHL
Hammer Head Crane Foundation (#709)	1933	Eligible	12/20/1990		Repairs; NHL
Dry Dock 5	1941	Contributing	12/20/1990		Within NHL
Quay Wall (#730)	1942	Not Eligible			Within NHL; Hampton & Burkett, 2011

Key: NHL = National Historic Landmark

The replacement of existing piles at Bremerton, whether programmed or as a result of emergent/emergency contingent repairs, would have no adverse impact on the buildings, structures, or landscape features which contribute to the identified historic properties (the four historic districts which are outside the APE, and the NHL). Although Piers 3, 4, 5, 6, and 7 are contributing elements of the NHL, the pier pilings do not embody key elements of the historic properties, and changes to these elements would not adversely affect the NRHP eligibility of the contributing elements or of the overall NHL. Similarly, maintenance and repair of Dry Dock 5 would not affect its NRHP status within the NHL. Therefore, there would be no significant impact to cultural resources. The Navy has determined that the Proposed Action would have no adverse effect on historic properties at NAVBASE Kitsap Bremerton, and the SHPO has concurred in a letter dated August 2, 2017. Because NAVBASE Kitsap Bremerton includes a historic district, the Navy also notified the National Park Service.

5.5 American Indian Traditional Resources

5.5.1 Affected Environment

NAVBASE Kitsap Bremerton property and the controlled waterfront Naval Restricted Areas (1 and 2) are co-located in the adjudicated U&A fishing area for the Suquamish Tribe. The Suquamish Tribe harvests fish throughout Sinclair Inlet, which continues to be a culturally and economically important area for the Tribe. However, the Suquamish Tribe does not fish within the Sinclair Inlet Naval Restricted Area No.2. Shellfish harvesting is prohibited throughout Sinclair Inlet due to pollution (Washington Department of Health, 2016).

5.5.2 Environmental Consequences

5.5.2.1 No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to baseline American Indian traditional resources. Therefore, no significant impacts to American Indian traditional resources would occur with implementation of the No Action Alternative.

5.5.2.2 MPR Activities (Preferred Alternative) Potential Impacts

In accordance with Executive Order 13175 and DOD and Navy instructions, the Navy invited the Suquamish Tribe to initiate government-to-government consultation regarding proposed MPR activities and potential impacts to tribal treaty rights. The Tribe requested that additional project details be provided as they become available in the future. Additionally, the Tribe provided comments on the Revised Draft EA, but determined it was not necessary to meet with the Navy to discuss these comments (Baxter, 2019). Government-to-government consultation with the Tribe is complete.

There would be no changes to the status quo regarding tribal access to traditional resources from proposed MPR activities. Construction activities could result in loss of benthic organisms at the immediate project site; however replacement piles would be installed near the location of the removed piles, minimizing the direct loss of benthic invertebrates and the possible effect on traditional resources that rely on the benthic environment for survival.

There would be a temporary increase in the volume of barge traffic during pile replacement and maintenance activities as pile delivery and disposal would generally be conducted via barge. However, the increase in barge traffic generated by the proposed MPR activities would be negligible when compared to existing marine traffic in Puget Sound and at NAVBASE Kitsap Bremerton.

The in-water work window for each construction year would minimize impacts to all juvenile salmonid species; therefore, significant impacts to juvenile salmonids are not expected. As part of continued engagement, the Navy will annually provide summaries of planned pile repair and replacement projects to the Tribe for information and coordination. Therefore, there would be no significant impact to American Indian traditional resources.

5.6 Summary of Potential Environmental Consequences

Table 5-2. Summary of Environmental Impacts at NAVBASE Kitsap Bremerton

Section/ Resource Area	*Environmental Impacts*
Airborne Noise	Temporary construction noise during daytime hours is exempt from maximum permissible noise levels under the WAC and cities of Bremerton and Port Orchard noise regulations. Recreational users on Sinclair Inlet could experience noise disturbance but not at levels sufficient to cause adverse effects. Therefore, there would be no significant impact to the ambient sound environment.
Water Quality	Direct discharges of waste would not occur. Construction-related impacts would be limited to short-term and localized changes associated with re-suspension of bottom sediments. These changes would be spatially limited to the construction site and areas immediately adjacent. Temporary impacts would not violate applicable state or federal water quality standards. The Navy would implement BMPs and minimization measures to prevent accidental losses or spills of construction debris. Removal of creosote-treated timber piles would improve local water quality. Therefore, there would be no significant impact to water quality.
Sediments	Sediment would be disturbed and re-suspended in the water column during pile removal and pile driving activities. Some degree of localized changes in sediment composition would occur. In particular, sediments that are re-suspended would be dispersed by currents and eventually re-deposited on the bottom. Project-related construction activities would not create sediment contamination concentrations or physical changes that violate state standards or interfere with beneficial uses of Sinclair Inlet. The Navy would coordinate with CERCLA program managers before construction to confirm conformance with CERCLA requirements for Operable Unit-B Marine. Therefore, there would be no significant impact to sediments.
Aquatic Vegetation	Vegetative growth found on existing piles would be removed when those piles are extracted from the water but because piles would be replaced, ultimately a similar amount of surface area on which marine organisms could colonize would exist. Because very little aquatic vegetation occurs in the area, direct removals should be minimal. No eelgrass occurs at NAVBASE Kitsap Bremerton. Impacts due to turbidity would be short-term, temporary, and localized. Therefore, there would be no significant impact to marine vegetation.
Benthic Invertebrates	As with aquatic vegetation, benthic organisms attached to removed piles would be lost, but new piles would provide equivalent attachment sites for development of the benthic community. Benthic organisms directly adjacent to piles would be lost or displaced. There would be minimal impacts to habitat and benthic organisms from turbidity caused by pile removal and installation and anchor placement and removal, but these effects would be temporary and very localized. Impacts at the population, stock, or species level would be negligible. Therefore, there would be no significant impact to benthic invertebrate populations.

Table 5-2. Summary of Environmental Impacts at NAVBASE Kitsap Bremerton (continued)

Section/ Resource Area	*Environmental Impacts*
Marine Fish and EFH	In-water construction may expose fish to increased turbidity but exposure would be localized and temporary. The most significant impact to fish that could occur would be from exposure to elevated underwater noise from impact pile driving. To minimize exposure to noise, pile driving would be conducted during the in-water work window when juvenile salmonids (including ESA-listed salmonids) are least likely to be present. A majority of the pile driving would be conducted using a vibratory pile driver. All impact pile driving would occur intermittently and for an estimated maximum duration of 1.5 hours for steel piles and 4 hours per day for concrete during the 5 years of proposed MPR activities. Implementation of these minimization measures would also reduce potential impacts to EFH. The Navy has determined that the Proposed Action “may affect, but is not likely to adversely affect” ESA-listed fish species and designated critical habitat and “may adversely affect” EFH. The USFWS has concurred with the Navy’s conclusions regarding bull trout. NMFS concluded that the Navy’s proposed MPR activities “may affect, are likely to adversely affect” Puget Sound evolutionary significant unit (ESU) Chinook salmon; Hood Canal summer-run ESU chum salmon; Puget Sound distinct population segment (DPS) steelhead; Puget Sound/Georgia Basin DPSs of bocaccio and yelloweye rockfish; designated critical habitat; and, EFH. With implementation of minimization measures, there would be no significant impacts to marine fish (including ESA-listed fish) and EFH.
Birds	Construction activities may result in the exposure of marbled murrelets to sound pressure levels above the behavioral guidance criterion. Mitigation measures would be used to reduce potential adverse impacts to marbled murrelets, also benefiting other marine birds. No designated critical habitat for the marbled murrelet is located near Bremerton; therefore construction activities would not affect designated critical habitat for the species. The Navy has determined that the Proposed Action “may affect, but is not likely to adversely affect” the marbled murrelet, and the USFWS has concurred with the Navy’s conclusions. No significant impacts to other marine birds are expected.
Marine Mammals	Vibratory pile driving at NAVBASE Kitsap Bremerton may expose marine mammals to behavioral disturbance due to elevated underwater noise. Mitigation measures would be used to reduce the adverse impacts to marine mammals. The Navy determined that the Proposed Action “may affect, but is not likely to adversely affect” ESA-listed humpback whales and Southern Resident killer whales because they are considered rare in the vicinity; and “may affect, but is not likely to adversely affect” Southern Resident killer whale designated critical habitat. NMFS concluded that the Navy’s proposed MPR activities “may affect, are likely to adversely affect” humpback whale species, Southern Resident killer whale, and Southern Resident killer whale designated critical habitat. The Navy consulted with NMFS and will obtain an LOA under the MMPA. While construction activities may impact individual marine mammals, any impacts observed at the population, stock, or species level would be negligible. Therefore, there would be no significant impact to marine mammal populations.
Cultural Resources	The proposed MPR activities at Bremerton would not affect any known NRHP-eligible archaeological sites. Implementation of construction activities would take place in previously disturbed underwater areas along or near the shoreline, with a substrate consisting of fill. Piers 3, 4, 5, 6, 7, and Dry Dock 5 are contributing elements of the NHL; there would be no adverse impact to these historic properties or to other buildings, structures or landscape features which contribute to the historic districts or NHL. The Navy has determined that proposed MPR activities would have no adverse effect on historic properties, and the SHPO has concurred. The Navy notified the National Park Service. Therefore, there would be no significant impact to cultural resources.

Table 5-2. Summary of Environmental Impacts at NAVBASE Kitsap Bremerton (continued)

Section/ Resource Area	*Environmental Impacts*
American Indian Traditional Resources	There would be no changes to the status quo regarding tribal access to traditional resources as a result of proposed MPR activities. The in-water work window for each construction year would minimize impacts to all juvenile salmonid species; significant impacts to juvenile salmonids are not expected. Therefore, there would be no significant impact to American Indian traditional resources.

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6 NAVBASE Kitsap Keyport Affected Environment and Environmental Consequences

6.1 Airborne Noise

6.1.1 Affected Environment

NAVBASE Kitsap Keyport does not have the level of industrial activity of Bremerton (Section 5.1.1) or Bangor (Section 4.1.1); however, it supports ship and small boat traffic, ship maintenance, and other industrial activities, as well as vehicular traffic. Low-density residential areas are located throughout the perimeter of Port Orchard Reach. Existing noise levels characteristic of the semi-rural residential setting of the area are expected to range between 45 and 50 dBA (WSDOT, 2018). Cavanaugh and Tocci (1998) found that noise levels in urban residential areas averaged 65 dBA. Major sources of noise near the project site include vehicles on SR 305, seaplanes, power boats motoring through Port Orchard Reach, and waves breaking on the shoreline. In consideration of the above, ambient noise levels at the project site are expected to be between 50 and 65 dBA. Sensitive receptors are mainly located to the north and east of the project site on the opposite shore across Port Orchard Reach. Residences are located on the shore opposite the project site. West Sound Academy is located approximately 1 mi northeast of the project site. Good Shepherd Montessori School is located approximately 1.5 mi east of the project site. North Kitsap High School is located approximately 2 mi north of the project site.

The State of Washington and Kitsap County have developed maximum permissible environmental noise levels for receiving properties. However, both Washington and Kitsap County have exempted noise generated by temporary construction activities. Permissible noise levels and exceedance allowances are discussed in Section 3.1.

6.1.2 Environmental Consequences

6.1.2.1 No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to baseline airborne noise. Therefore, no significant impacts to airborne noise would occur with implementation of the No Action Alternative.

6.1.2.2 MPR Activities (Preferred Alternative) Potential Impacts

Construction associated with the proposed MPR activities would result in temporarily elevated underwater and airborne noise levels. Noise would be generated from support vessels, small boat traffic, and barge-mounted equipment, such as generators, and pile extraction and installation equipment. Noise levels from all activities except pile driving would typically not exceed ambient sound levels resulting from routine waterfront operations in the vicinity of any of the structures in the proposed MPR activities locations. The most significant project-related noise source would be impact pile driving of steel piles (WSDOT, 2018).

Construction noise would be temporary between July 16 and February 15 over 5 years for a total of 20 pile driving days. The maximum duration of pile driving in a single day would be up to 1.5 hours of impact pile driving or 4.5 hours of vibratory pile driving. Elevated noise levels during pile driving may be noticeable in residential areas but, as stated above, temporary construction noise is exempt from maximum permissible noise levels under the WAC and Kitsap County noise regulations.

6.2 Water Resources and Marine Sediments

6.2.1 Affected Environment

6.2.1.1 Water Quality

WAC 173-201A-612 has established designated uses for Liberty Bay as follows: extraordinary (aquatic life uses); primary contact (recreation); shellfish harvesting; and wildlife habitat, commerce and navigation, boating, and aesthetics (miscellaneous uses). The waters of Liberty Bay at the project site and east of NAVBASE Kitsap Keyport are classified as Category 2 (Waters of Concern) by WDOE for temperature (WDOE, 2017a). The waters in Liberty Bay west of the project site are classified as Category 5 (Polluted Waters) for fecal coliform and Category 2 for DO and temperature.

6.2.1.2 Marine Sediments

The substrates at NAVBASE Kitsap Keyport are shell hash and mud-sand complexes, with occasional pebble and cobble substrates and various anthropogenic debris (e.g., anchor blocks, pipes, tires, bottles) throughout (Frierson et al., 2016c). The sediment at and near Keyport in Liberty Bay is classified as Category 4B (Sediments with a Pollution Control Plan) for multiple heavy metals, polychlorinated aromatic hydrocarbons, phthalates, and various other semivolatile organic compounds. No further action was required in accordance with an existing ROD in place under CERCLA for the Keyport Range (URS and SAIC, 1994).

Between 1989 and 1992, samples of marine sediments were collected from Keyport Landfill and approximately 5,000 ft. of shoreline at Keyport, including nearshore areas around two piers which have since been removed. The existing pier is to the north. Keyport Landfill did not have a liner or leachate containment system in place; therefore, there was potential of contaminants from years of landfill use migrating into marine sediments. Waste contaminants generated and potentially deposited into the landfill included cadmium, chromium, copper, cyanide, lead, nickel, tin, zinc, carbon tetrachloride, methyl ethyl ketone, and trichloroethylene. Results from sampling determined that metals, chlorinated pesticides, and dichlorodiphenyl dichloroethylene existed in marine sediments near the landfill but at very low concentrations (URS Consultants et al., 1993). Based on these sampling results, the ROD for the landfill required removal of PCB-impacted sediment and approximately 75 tons of PCB-impacted sediment was removed in 1999.

Over 65 years, metals such as chromium, cadmium, and lead have been discharged into Liberty Bay (URS and SAIC, 1994). Benzoic acid, bis(2-ethyhexyl) phthalate, phenol, and arsenic were detected in low concentrations during sampling. Anchors, weights, and guidance wires used by Navy activities in the Keyport Range site contain cadmium, lithium, lead, zinc, and zirconium. These expended materials sit in the sediments where potential leaching of these heavy metals may occur. In 2013, the Agency for Toxic Substances and Disease Registry (ATSDR) evaluated four rounds of shellfish monitoring data collected between 1996 and 2008 from the Operable Unit 2 Area 8 beach. Clam tissue samples were analyzed for semivolatile organic compounds and inorganic metals (ATSDR, 2013). ATSDR concluded that, although Pacific littleneck clams collected near seeps on the beach exceeded health-based screening levels for several heavy metals and could present a health hazard to subsistence and recreational shellfish consumers, shellfish from the near-shore area of the Operable Unit 2 Area 8 beach are not being collected; therefore, there is no current actual health hazard.

6.2.2 Environmental Consequences

6.2.2.1 No Action Alternative

6.2.2.1.1 Water Quality

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to baseline water quality. Therefore, no significant impacts to water quality would occur with implementation of the No Action Alternative.

6.2.2.1.2 Marine Sediments

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to baseline marine sediments. Therefore, no significant impacts to marine sediment would occur with implementation of the No Action Alternative.

6.2.2.2 MPR Activities (Preferred Alternative) Potential Impacts

6.2.2.2.1 Water Quality

Direct discharges of waste to the marine environment would not occur during proposed MPR activities. Impacts to water quality would be limited to short-term and localized changes associated with re-suspension of bottom sediments from pile removal and installation and barge and tug operations, such as anchoring and propeller wash. These changes would be spatially limited to the construction area and areas immediately adjacent.

Construction-related impacts would not violate applicable state or federal water quality standards discussed in Section 3.2. BMPs and minimization measures, discussed in Section 2.5, would be implemented to prevent accidental losses or spills into Liberty Bay. Therefore, no significant impacts to water quality are expected.

6.2.2.2.2 Marine Sediments

There would be no direct discharges of waste to the marine environment during proposed MPR activities. Impacts to sediment quality would be limited to localized changes associated with disturbances of bottom sediments from replacement of up to 20 piles over a 5-year period. Setting spuds and anchors for the barges, and propeller wash from tugs used for pile removal and installation represent other construction-related sources for disturbances of bottom sediments.

Some degree of localized changes in sediment composition would occur as a result of in-water construction activities. In particular, sediments that are re-suspended by pile installation and removal activities would be dispersed by currents and eventually re-deposited on the bottom. Depending on the distance suspended sediments would be transported from shallow to deeper portions of the project site or fine-grained sediments would be transported from deeper to shallower areas. The distance over which suspended sediments are dispersed would depend on a number of factors, such as the sediment characteristics, current speeds, and distance above the bottom.

Project-related construction activities would not create sediment contamination concentrations or physical changes that violate state standards or interfere with beneficial uses of Liberty Bay near Keyport. Therefore, there would be no significant impact to sediments.

6.3 Biological Resources

6.3.1 Affected Environment

6.3.1.1 Aquatic Vegetation

Substrates for marine aquatic plants and algae in the NAVBASE Kitsap Keyport area consist of riprap along the shorelines of Liberty Bay as well as tide flats, marshes, and a shallow lagoon. The subtidal and intertidal areas in the vicinity of NAVBASE Kitsap Keyport area are dominated by brown and green algae, although macroalgae was sparse during an October 2014 ROV survey (Frierson et al., 2016c). The WDNR shorezone inventory documented only *Ulva* at this location and the shoreline to the south; *Ulva* and *Gracilaria* were documented at the shoreline to west. Eelgrass occurs in continuous beds on the Port Madison Reservation across the channel approximately 550 m from the NUWC Keyport facility site but have a patchy distribution along the western shoreline (Frierson et al., 2016; WDNR, 2018). Neither eelgrass nor kelp occurs in large quantities at the Keyport shoreline.

6.3.1.2 Benthic Invertebrates

Lighted fish trap surveys conducted in April 2015 at three locations along the NAVBASE Kitsap Keyport waterfront documented crangon and dock shrimp, graceful crabs, northern kelp crabs, and blackeye hermit crabs. ROV surveys conducted in October 2014 documented numerous Dungeness crabs and California sea cucumbers, as well as sea stars and cancer crabs. Numerous anemones were observed during these surveys (Frierson et al., 2016c). Other benthic species likely to occur at NAVBASE Kitsap Keyport would be similar to those described generally for Puget Sound in Section 3.3.2.2.

6.3.1.3 Marine Fish

6.3.1.3.1 Non-ESA-Listed Fish Species

Surveys were conducted in 2013 using ROV within the Port Orchard Naval Restricted Area at Naval Base Kitsap Keyport and again in 2014 and 2015 using additional survey methods to include split-beam echosounder, lighted fish traps, and scuba. Marine fish species recorded included surfperches (Family: Stichaeidae), flatfish (Order: Pleuronectiformes), sculpins (Family: Cottidae), gunnels (Family: Pholidae), eelpouts (Family: Zoarcidae), and greenlings (Family Hexagrammidae). Specific species identified were Starry flounder, Great sculpin, rock sole, and whitespotted greenling (*Hexagrammos stelleri*) that were recorded at depths ranging from 4 m to 22 m (Frierson et al., 2016c). Unidentified perch were the most abundant fish species recorded during the surveys.

There are documented herring spawning grounds (Georgia Basin DPS) in Port Orchard Bay and Port Madison, referred to as the Port Orchard/Madison stock (WDFW, 2017). The stock abundance showed a dramatic decrease in 2012 since surveys conducted in 2009 and the stock is considered depressed (Stick et al., 2014). Herring were recorded during scuba surveys in October 2014 (Frierson et al., 2016c).

WDFW identified surf smelt breeding areas along the shoreline and nearshore areas of Keyport Pier (WDFW, 2017). No sand lance areas were identified (WDFW, 2017).

6.3.1.3.2 ESA-Listed Fish and Critical Habitat

ESA-listed fish species that occur along or within the vicinity of NAVBASE Kitsap Keyport waterfront are Puget Sound Chinook and Puget Sound steelhead. Bocaccio and yelloweye rockfish; bull trout; southern

DPS Pacific eulachon; and southern DPS North American green sturgeon are unlikely to occur within the vicinity of NAVBASE Kitsap Keyport.

Returning adult Puget Sound Chinook salmon are potentially present in marine waters of Port Madison Bay and Port Orchard Narrows from May through the end of September. Spawning generally occurs in September and October (Myers et al., 1998). Outmigrating juvenile Chinook salmon are present primarily in shallow nearshore areas of Port Orchard Narrows from February through October, with a few individuals remaining longer (Dorn & Namtvedt-Best, 2005; Fresh et al., 2006). Chinook are most common in spring (Navy, 2009b). There have been no recent surveys conducted within Liberty Bay that targeted salmonids.

The winter run of the Puget Sound DPS steelhead near NAVBASE Kitsap Keyport are found in two unnamed streams, approximately 3 km to the northwest (WDFW, 2015a). Returning adult steelhead and outmigrating smolts may be present in the area. Although there have been no recent surveys conducted within Liberty Bay that targeted salmonids, their presence would be expected to be brief (Moore et al., 2010b).

Adult Puget Sound/Georgia Basin DPSs of bocaccio and yelloweye rockfish and juvenile yelloweye rockfish typically occur in waters deeper than the pier depth, so no adult ESA-listed rockfish or juvenile yelloweye rockfish are anticipated to be in the immediate project area. Larval rockfish live near the surface and could occur within the vicinity of NAVBASE Kitsap Keyport from August to September with absence from surface waters by November (Green & Godersky, 2012). Juvenile rockfish have the potential to occur near pierside locations, if their preferred bottom type or kelp habitat is nearby. Patchy distribution of kelp and eelgrass occur along the shoreline within the vicinity but not within the pier structures. Dense kelp beds are located across the channel, approximately 1,800 ft. east of the Keyport pier. WDFW conducted a thorough survey of the area and based on results, concluded that neither the habitats nor depths were consistent with association of ESA-listed rockfish species (Frierson et al., 2016c). Further, no rockfish species were recorded during surveys and it was concluded that the area is unlikely to support ESA-listed rockfish species at any life history stage or their preferred habitats.

Bull trout do not utilize any of the East Kitsap drainages for spawning due to a lack of suitable habitat. The closest rivers containing populations of bull trout are located within the Puyallup River, south of Seattle, in drainages into Lake Union and Lake Washington, and within the South Fork of the Skokomish River (USFWS, 2015b). There have been no recent surveys conducted within Liberty Bay that targeted salmonids, however; bull trout use of the bay for foraging or migrating is expected to be rare.

The southern DPS Pacific eulachon and southern DPS North American green sturgeon are unlikely to occur in Liberty Bay and surrounding waters because there are no spawning rivers or aggregation sites for either species in Puget Sound, and there are few records of these species in Puget Sound. The nearest regular eulachon spawning habitats are the Elwha River on the Olympic Peninsula and the Fraser River in British Columbia.

Critical Habitat

Puget Sound Chinook salmon have designated critical habitat in the waters of Liberty Bay. However, the DoD boundaries of NAVBASE Kitsap Keyport are exempt by federal law (70 FR 52685). Critical habitat is designated, but outside NAVBASE Kitsap Keyport boundaries. Section 3.3.2.3.2 lists the designated critical habitat PCEs for this species.

Nearshore critical habitat for juvenile bocaccio is designated in the waters of Liberty Bay. As stated above for Puget Sound Chinook, critical habitat is designated outside the exempt boundaries within the nearshore areas adjacent to NAVBASE Kitsap Keyport (79 FR 68041). Section 3.3.2.3.2 lists the designated critical habitat attributes of the nearshore essential feature for these ESA-listed rockfish species.

6.3.1.3.3 Essential Fish Habitat

Coastal pelagic EFH designations are based on the geographic range and in-water temperatures where these species are present during a particular life stage (PFMC, 2016a) and these boundaries include the waters of Liberty Bay. Northern anchovies are abundant in bays during the spring, summer, and fall (PFMC, 2016a) and could be present within the marine habitat of Liberty Bay. Market squid are recreationally fished for between February and May and could also be present in the surface waters of Liberty Bay. The unconsolidated sediment substrate and aquatic vegetation along the NAVBASE Kitsap Keyport waterfront provide Pacific coast groundfish EFH for various life stages of species of groundfish (PFMC, 2016b). The marine environment of NAVBASE Kitsap Keyport provides Pacific coast salmon EFH for various life stages of Chinook, pink, and coho salmon (PFMC, 2014). Coho salmon utilize two streams located approximately 3 km to the north in Liberty Bay as rearing and spawning habitat (WDFW, 2015a). These fish utilize the marine habitat near NAVBASE Kitsap Keyport for migration to and from these streams. Returning Chinook or outmigrants from drainages east of Keyport (i.e., Duwamish, Cedar, and Puyallup rivers) could occur within the offshore area of NAVBASE Kitsap Keyport. Odd-year pink salmon from the Duwamish River may also occur within the offshore waters of NAVBASE Kitsap Keyport.

Eelgrass and kelp are HAPCs for Pacific coast groundfish and Pacific coast salmon. These HAPCs are present along the shoreline, near and across (approximately 1,800 ft.) from NAVBASE Kitsap Keyport. However, distribution is patchy or absent from pier structures at NAVBASE Kitsap Keyport. Freshwater spawning habitat located approximately 3 km to the north of NAVBASE Kitsap Keyport is a HAPC for Pacific coast salmon.

6.3.1.4 Birds

A number of migratory bird species may be encountered at NAVBASE Kitsap Keyport. See Section 3.3.2.4 for a description of the species potentially present in the area. One bald eagle nest is located approximately 780 m from the location of the proposed pile repair and replacement activities, but productivity has not been determined. An osprey nest located on a light post at the base soccer field has produced chicks since 2013 (Navy, 2016d).

The WDFW Priority Habitat and Species Maps interactive website does not indicate the presence of marbled murrelet nests in the upland areas including and adjacent to NAVBASE Kitsap Keyport (WDFW, 2017). WDFW at-sea surveys from mid-September to April in the vicinity of NAVBASE Kitsap Keyport did not detect any marbled murrelets (Pearson & Lance, 2013, 2014, 2015). However, they have been detected in other surveys (Puget Sound Ambient Monitoring Program [Nysewander et al., 2005]), and forge fish habitat occurs in the vicinity of NAVBASE Kitsap Keyport, which could attract foraging murrelets.

6.3.1.5 Marine Mammals

Any of the species listed in Table 3-7 has the potential to occur near NAVBASE Kitsap Keyport. The marine mammal species most likely to be encountered is the harbor seal. No haulouts have been identified at NAVBASE Kitsap Keyport, and the closest documented haulout is in Liberty Bay at the Poulsbo Marina approximately 2 mi northwest of the Keyport Pier. This haulout is estimated to have less than 100 individuals (Jeffries, 2012).

Sightings of transient killer whales in the vicinity of NAVBASE Kitsap Keyport have been infrequent (most recently July 2013) but the species may be an infrequent visitor. Other cetacean and pinniped species are not expected to occur in the vicinity of NAVBASE Kitsap Keyport. No Steller sea lion or California sea lion haulouts are known in the vicinity of NAVBASE Kitsap Keyport; therefore, no shore-based surveys have been conducted at this location. No opportunistic sightings have been reported at NAVBASE Kitsap Keyport. The nearest Steller sea lion and California sea lion haulouts to NAVBASE Kitsap Keyport are navigation buoys that can support at most two individuals, located over 9.5 mi away in Puget Sound (Jeffries, 2012). Therefore, the sea lion species are not expected to frequent waters off NAVBASE Kitsap Keyport.

ESA-listed marine mammals that have been known to visit or have the potential to occur in the vicinity include the Southern Resident killer whale (a seasonal visitor), and the humpback whale (very rare visitor). Humpback whales may occur near NAVBASE Kitsap Keyport, but their presence is unlikely. Most sightings of this species in Washington inland waters occur in the Strait of Juan de Fuca and the San Juan Island area. Humpback whales occurred regularly during 2015 in south Puget Sound and the main basin of central Puget Sound, but to date there have been few detections in the vicinity of NAVBASE Kitsap Keyport (Orca Network, 2016). The number of humpback whales in Puget Sound is expected to be very low. Southern Resident killer whales occasionally occur in the main basin of central Puget Sound, primarily in the fall and early winter months; i.e., during the in-water work windows for proposed MPR activities locations.

6.3.2 Environmental Consequences

6.3.2.1 No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to baseline biological resources. Therefore, no significant impacts to biological resources would occur with implementation of the No Action Alternative.

6.3.2.2 MPR Activities (Preferred Alternative) Potential Impacts

6.3.2.2.1 Aquatic Vegetation

Any debris from pile removal would be collected, disposed of in a state-approved landfill or recycled, and would not impact marine vegetation. Shading of existing vegetation would not change as no expansion of existing structures or new over-water structures is proposed; therefore shading of existing vegetation is not discussed. Any temporary shading that occurs would be from barges and would be for short periods of time that would cause no significant effects on marine vegetation. As discussed in Section 2.4.3, it is estimated that up to 20 piles would require replacement at Keyport over a 5-year period. Shading of vegetation would not be discussed as all work would be performed on existing structures. Decreased water and sediment quality can impede the growth of marine vegetation important to fish and other animals, and promote the growth of harmful algae.

Marine surveys in the vicinity of NAVBASE Kitsap Keyport have shown that eelgrass, green algae, and kelp are present in the surrounding areas, but in low densities near the pier itself, limiting potential impacts.

As indicated in Section 6.2.2.2, pile driving-related impacts to water quality from proposed MPR activities would be limited to temporary and localized changes associated with re-suspension of bottom sediments during construction. The sediment at and near Keyport in Liberty Bay is listed in the CWA 303(d) list of assessed sediments. The sediment in the project area is classified as Category 4B (Sediments with a Pollution Control Plan) for multiple heavy metals. Suspension of sediments could introduce contaminants into the environment that could potentially affect marine vegetation. Pile driving activities would not discharge contaminants or otherwise appreciably alter the concentrations of trace metal or organic contaminants in bottom sediments. Sediments would settle back in the general vicinity from which they rose. Because of this, and the small number of piles being driven at this project area, indirect effects to macroalgae and eelgrass from changes in sediment quality and sedimentation during construction would be temporary and would not affect the overall health or distribution of marine vegetation near the project area. Proposed MPR activities would not result in violations of water quality standards and would, therefore, maintain water quality for marine vegetation in the vicinity of the project area.

Direct removal of marine vegetation during proposed MPR activities could occur through anchors and spud placement and removal of up to 20 piles. Any vegetative growth found on existing piles would be removed when those piles are extracted from the water but because piles would be replaced, ultimately a similar amount of surface area on which marine organisms could colonize would exist. Because marine vegetation does not occur densely in the area, direct removals should be minimal. Additionally, because marine vegetation is distributed outside of the project area, the overall health and abundance of macroalgae and eelgrass would not be compromised. Therefore, proposed MPR activities would have no significant direct or indirect impacts on marine vegetation.

6.3.2.2.2 Benthic Invertebrates

Proposed MPR activities at NAVBASE Kitsap Keyport would impact benthic communities through the disruption of the sediment surface and subsurface during the installation and removal of each pile, and from anchor and spud placement for the barges. Depending upon the species, impacts to individual benthic organisms could range from temporary disturbance to mortality. Some benthic organisms would be physically crushed and lost within the footprint of the piles, as well as from barge anchors and spuds.

Indirect impacts to habitat and benthic organisms are likely to result from turbidity caused by driving and removing barge anchors, spuds, and piles. The area near the pile replacement footprint would have higher levels of turbidity. Disturbed sediments would eventually redeposit upon the existing benthic community. Impacts from increased turbidity levels would likely result in short-term loss of localized areas of the benthic community. Most affected areas would experience some reduction in diversity and abundance of benthic species. However, benthic organisms, particularly annelids, are very resilient to habitat disturbance and are likely to recover to pre-disturbance levels in less than 2 years (CH2M Hill, 1995; Parametrix, 1994, 1999; Romberg et al., 1995; Anchor Environmental, 2002). Therefore, proposed MPR activities would have no significant impacts on benthic invertebrates.

6.3.2.2.3 Marine Fish

Non-ESA-Listed Fish

Turbidity

Resident marine fish are expected to be present within the vicinity of the project area and are likely to occur during the in-water work window established for juvenile salmonid avoidance. In-water work could produce measurable, temporary increases in turbidity and sedimentation, and that could cause fish to temporarily avoid the areas near construction. However, construction activities would not result in persistent increases in turbidity levels or cause changes that would violate water quality standards because processes that generate suspended sediments, which result in turbid conditions, would be short-term and localized and would disperse and/or settle rapidly (within a period of minutes to hours after construction activities cease). This also applies to resuspension of existing contaminated sediments during construction as these would be localized, short-term, and settle rapidly. Further, the localized disturbance would not impact forage fish spawning areas identified within the vicinity of the project area. Therefore, no impacts from turbidity to forage fish spawning are anticipated. Placement of the piles and associated disturbance activities (i.e., support vessels, construction barge) may cause a loss to benthic prey either existing within the pile footprint or disturbance from turbidity which may impact fish use of that area for seeking prey. Impacts would be short-term, localized, and limited to the duration of pile installation and would not be expected to significantly impact fish ability to seek prey outside of the project areas. With implementation of impact avoidance and minimization measures (see Section 2.5), no significant impacts to non-ESA-listed marine fish from turbidity and sedimentation (including potential resuspension of contaminated sediments) are anticipated from the proposed MPR activities.

Underwater Noise

Proposed MPR activities would result in increased underwater noise levels. Noise would be generated from support vessels, small boat traffic, and barge-mounted equipment, such as generators, and pile extraction and installation. Noise levels from all activities except pile driving would typically not exceed underwater sound levels resulting from existing routine waterfront operations along the NAVBASE Kitsap Keyport waterfront. The most significant underwater noise potentially affecting fish would be from impact pile driving of steel piles. To minimize impacts to fish, piles would be installed initially with a vibratory pile driver until either the pile hits refusal, necessitating an impact hammer to reach required depth, or for proofing piles to verify structural capacity. Since vibratory pile drivers typically generate noise levels from 10 to 20 dB lower than impact pile driving and do not produce waveforms with sharp rise times like impact pile driving, impacts on fish are typically not observed in association with vibratory pile driving (WSDOT, 2018).

A maximum of 20 steel piles would be installed at NAVBASE Kitsap Keyport during the 5 years of proposed MPR activities if all estimated emergent pile replacement projects occur. Impact pile driving of a 30-in diameter steel pile would create underwater noise that could expose fish to injurious levels above the peak threshold as well as the cumulative SEL thresholds (Appendix B). Fish would be expected to be exposed differently to elevated noise levels and they could behave differently in their reaction to noise. Some fish are migrating through the area and may pass through the thresholds above the potential behavioral disturbance zone. Other fish are resident to the area and may not move away and thus would be exposed to injurious noise levels for the duration of pile driving activity (Hastings & Popper, 2005). To minimize exposure to noise above the injurious and behavioral disturbance thresholds, a bubble curtain or other noise attenuation device would be used during impact pile driving of steel piles[5] and all pile driving would be conducted during the in-water work window when juvenile salmonids are least likely to be present. With implementation of these minimization measures and including those listed in Section 2.5, no significant impacts to non-ESA-listed fish would result from the proposed MPR activities.

ESA-Listed Fish and Critical Habitat

Turbidity

As discussed above, in-water work could produce measurable, temporary increases in turbidity and sedimentation, and that could cause ESA-listed fish and their forage fish to temporarily avoid the areas near construction. Because, in-water work would occur during the approved in-water work window of July 16 through February 15, juvenile ESA-listed salmonids are least likely to be present. Adult life stages of Chinook and steelhead would occur further offshore and beyond any impacts associated with turbidity during in-water construction. Adult life stages of bocaccio and yelloweye rockfish and juvenile yelloweye rockfish are not expected to be present within the deeper water of the injury zone as habitat for these species is not present (Frierson et al., 2016c). Juvenile bocaccio have the potential to utilize the nearshore aquatic vegetation as rearing habitat. However, vegetation is patchy along the shorelines and the closest kelp habitat is located across the channel (approximately 1,800 ft.). Peak rockfish larvae occurrence in the main Puget Sound basin occurs from August to September with small presence during the early part of the work window and absence from surface waters by November (Green & Godersky, 2012). Bull trout, eulachon, and green sturgeon are not expected to occur within the vicinity of NAVBASE Kitsap Keyport. With implementation of impact avoidance and minimization measures, no significant impacts to ESA-listed fish or their forage base from turbidity and sedimentation (including temporary and localized exposure to suspended contaminated sediments) are anticipated from the proposed MPR activities.

Underwater Noise

In-water work would occur during a period when juvenile salmonids are least likely to be present and thus exposure to injurious thresholds would not occur. Juvenile bocaccio are not likely to be present within the injury thresholds as rearing habitat for this species is not present. Bull trout, green sturgeon, and Pacific eulachon are not expected within the vicinity of NAVBASE Kitsap Keyport and thus no impacts from proposed MPR activities would occur. Forage fish for ESA-listed salmonids may be temporarily exposed to noise above the injury thresholds but impacts would be short-term (estimated maximum duration of 1.5 hours of impact pile driving in a day) and insignificant. Larger juvenile Chinook as well as adult Chinook and steelhead may be exposed to noise levels above the cumulative SEL injury thresholds as these zones would extend offshore and over deeper water where these life stages may be present.

Adult life stages of bocaccio and yelloweye rockfish and juvenile yelloweye rockfish are not expected to be present within the deeper water of the injury zone as habitat for these species is not present (Frierson et al., 2016c). Steel piles would be installed using a vibratory pile driver to the extent practicable with impact pile driving primarily used for proofing piles. A bubble curtain or other noise

[5] Due to the potential presence of contaminated sediments at the Keyport Pier, the Navy would assess the use of bubble curtains on a project-by-project basis.

attenuation device would be used during impact pile driving of which would occur intermittently and for an estimated maximum duration of 1.5 hours in a day. Exposure to noise above the cumulative SEL injurious threshold would be unlikely to occur to fish migrating through the effect zone because, if present, they would be unlikely to remain long enough to accumulate energy from intermittent pile strikes and in this limited pile driving time.

Adult migrating Chinook and steelhead may pass by the area and through the behavioral disturbance zone (Appendix B). However, exposure is expected to be short-term and temporary as these species would move through the area relatively quickly and impact pile driving (if required) would last an estimated maximum duration of 1.5 hours in a day. Adult ESA-listed rockfish and juvenile yelloweye rockfish are not expected to be present within the deeper water of the behavioral disturbance zone as habitat for these species is not present (Frierson et al., 2016c). Kelp is located approximately 1,800 ft. east of Keyport pier and thus juvenile bocaccio could be present and exposed to noise above the behavioral disturbance zone. However, exposure would be short-term and not likely to result in measurable changes to rockfish behavior. By installing piles within the in-water work window and limited number of piles (for all pile types) during the 5 years of proposed MPR activities, only behavioral effects are anticipated and these effects are not anticipated to be significant to an individual fish.

In conclusion, no significant impacts to ESA-listed fish from underwater noise would result from the proposed MPR activities.

Critical Habitat

The estuarine and nearshore marine areas PCEs for Puget Sound Chinook would be affected by underwater noise from impact pile driving steel piles. Pile driving would produce noise above the fish behavioral thresholds during vibratory and impact pile driving in the vicinity of NAVBASE Kitsap Keyport that contains designated critical habitat. However, impacts to the function of these PCEs would be temporary and short-term and occur during a time when juvenile Chinook are not expected to be within the nearshore and estuarine environments. The ability for the nearshore marine PCE to provide forage base for larger juveniles and adults may be effected in the short- term. However, impacts would not be significant to the overall forage base.

Nearshore critical habitat is designated for juvenile bocaccio outside the exempt DoD boundary of NAVBASE Kitsap Keyport, however, exposure of the attributes of the nearshore essential feature to noise above the cumulative SEL injury thresholds would be short-term and localized to the areas exempt from critical habitat designation. Therefore, impacts to nearshore designated critical habitat for juvenile bocaccio from noise above the injury thresholds would not occur. The behavioral disturbance threshold would extend into areas of designated critical habitat that are not exempt and thus may impact juvenile bocaccio that may be in the area. However, impacts would be short-term and temporary, estimated to last a maximum of 1.5 hours in a day. Therefore, no significant impacts to designated critical habitat for Chinook and ESA-listed rockfish would result from the proposed MPR activities.

The Navy determined that the Proposed Action “may affect, but is not likely to adversely affect” ESA-listed fish species and designated critical habitat. USFWS concurred with the Navy’s determination for bull trout with a Letter of Concurrence signed on December 15, 2017. NMFS did not concur with the Navy’s determination and concluded that the Navy’s proposed MPR activities “may affect, are likely to adversely affect” Puget Sound evolutionary significant unit (ESU) Chinook salmon; Hood Canal summer-run ESU chum salmon; Puget Sound distinct population segment (DPS) steelhead; Puget Sound/Georgia Basin DPSs of bocaccio and yelloweye rockfish; and, designated critical habitat. Section 7 consultation with NMFS was completed with the issuance of a BiOp on April 5, 2019. Per Terms and Conditions 2.b. contained in the BiOp, the Navy must restrict impact driving steel piles to the period between July 16 and October 14, annually.

Essential Fish Habitat

As was discussed above for marine fish in general and ESA-listed fish, elements of the proposed MPR activities would create turbidity and suspended sediment but these impacts would be short-term, localized, and small in scale without causing measureable impacts to EFH. Removal and installation of piles and anchoring would have a localized impact on marine vegetation and benthic epifauna/infauna within the immediate vicinity of each pile or anchoring site but these impacts would be minimal, localized, and expected to recover to pre-disturbed levels within a few growing seasons. The primary impact during proposed MPR activities would be increased sound energy in the marine fish habitat. Increased sound would affect the water column, which has been designated as EFH for numerous species (see Appendix C). Impacts to the water column could result in disturbance depending on fish species, size, orientation, received noise level and type of noise. To avoid injurious effects from impact pile driving, the Navy would implement minimization measures to reduce the level of noise in the water column. The primary minimization measure would be to install piles with a vibratory pile driver to the extent practicable and follow with impact hammer pile driving to verify load-bearing capacity (proofing). To attenuate noise during impact pile driving of steel piles, a bubble curtain[6] or other noise attenuation device would be used.

A maximum of 20 steel piles would be installed at NAVBASE Kitsap Keyport during the 5 years of proposed MPR activities. The potential behavioral disturbance threshold would extend out a modeled distance of approximately 2,900 m extending across until hitting land, north into a portion of Liberty Bay, and south into the Port Orchard Narrows (Appendix B). Coastal pelagic, Pacific coast groundfish, and Pacific coast salmon EFH present within this threshold would be exposed to noise above the behavioral disturbance threshold by way of increased noise in the water column. The injury threshold distances may impact Pacific coast groundfish and coastal pelagic EFH as these distances would extend over consolidated sediments and pelagic water column habitat. Pacific coast salmon EFH would be exposed to noise above the injury thresholds; however, pile driving would be conducted during the in-water work window when juvenile salmonids are least likely to be present utilizing EFH.

In addition to minimization measures discussed above, conducting impact pile driving intermittently and for an estimated maximum duration of 1.5 hours in a day throughout the 5 years of proposed MPR activities, would further reduce potential impacts to EFH.

The Navy determined that the Proposed Action may adversely affect EFH by temporarily increasing noise in the water column during pile driving. However, implementation of minimization measures applied to ESA-listed species would be sufficient for minimizing effects to EFH. The Navy consulted with NMFS under the Magnuson-Stevens Fisheries Conservation and Management Act and NMFS concurred with the Navy's determination, but provided Conservation Recommendations to minimize effects to EFH. Consultation with NMFS was completed on April 5, 2019.

[6] Due to the potential presence of contaminated sediments at the Keyport Pier, the Navy would assess the use of bubble curtains on a project-by-project basis.

Overall, due to the temporary nature of the activities, proposed minimization measures and the minimal level of impact to water column noise levels, benthic flora and fauna, water quality, and sediment quality, no significant impacts to EFH would occur with implementation of the proposed MPR activities.

6.3.2.2.4 Birds

Resident and migrant birds are expected to be present within the vicinity of proposed MPR activities during the in-water work window established for juvenile salmonid avoidance (Section 2.5.3). Proposed MPR activities have the potential to impact marine birds through visual disturbance, changes in prey availability, and elevated underwater and airborne noise. Pile extraction and installation projects, and other repair projects on the existing marine structures would intermittently increase human activity levels on the waterfront, potentially resulting in visual disturbance and increasing ambient noise levels due to use of construction equipment. Bald eagles that nest at NAVBASE Kitsap Keyport and forage along the marine shoreline may experience the increase in human activity, depending on proximity of project construction to existing and future nest sites and foraging areas. However, no incidental takes are anticipated. Project sites currently have ongoing human activity, and project work involving repairs to marine structures would be within the baseline condition. Therefore, project effects due to human activity levels would be insignificant.

As discussed in Sections 6.3.2.2.2 and 6.3.2.2.3, in-water work could temporarily affect the availability of forage fish and benthic invertebrates, which are the prey base of many marine birds, in a limited area. Turbidity effects and potential resuspension of contaminated sediments are not expected to affect the prey base, as these changes would be short-term and small scale during construction. Therefore, proposed MPR activities would have no significant impacts on prey availability for marine birds.

Effects of Elevated Noise Levels on Birds

Proposed MPR activities would result in increased underwater noise levels. Noise would be generated from small vessels and barge-mounted equipment such as generators, and pile extraction and installation. Noise levels from all activities except pile driving would typically not exceed underwater sound levels resulting from existing routine waterfront operations along the NAVBASE Kitsap Keyport waterfront. The most significant underwater noise source would be impact pile driving of steel piles. Impacts of elevated noise levels due to pile driving were evaluated at other proposed MPR activities locations in the context of established criteria for ESA consultation with the USFWS on the threatened marbled murrelet. No criteria have been established for determining impacts of elevated noise levels on other marine bird species, some of which forage underwater like the marbled murrelet, so the analysis methods for impacts on marbled murrelets were applied to other species.

Pursuit-diving birds (i.e., birds that pursue and capture their prey underwater using their wings to swim) include cormorants, grebes, and alcids (murres, murrelets, and pigeon guillemots). While actively foraging they dive repeatedly into waters of various depths and would potentially be exposed to elevated underwater noise during pile driving. When startled by loud sounds, their foraging patterns may be altered, and birds may flush or dive and swim away underwater. While underwater they would be susceptible to injury or behavioral disturbance due to elevated sound pressure waves generated by pile driving. Dabbling and diving ducks may also be susceptible to elevated underwater sound. Birds that feed on the surface such as gulls, shorebirds, and wading birds are unlikely to be affected by elevated underwater sound. Actively foraging marbled murrelets dive repeatedly into waters ranging up to approximately 160 ft. in depth for periods ranging up to 60 seconds (Nelson et al., 2006). Foraging bouts typically last over a period of 27 to 33 minutes, with approximately 50 percent of the time spent underwater (Jodice & Collopy, 1999). When startled by loud sounds, the foraging pattern may be altered, and birds may flush or dive and swim away underwater. While underwater they would be susceptible to injury or behavioral disturbance due to elevated sound pressure waves generated by pile driving.

As described in detail in Appendix B, the USFWS uses underwater noise thresholds developed by the Marbled Murrelet Hydroacoustic Science Panel (SAIC, 2011) to determine the zones around a driven pile in which two general forms of injury might occur to diving marbled murrelets: (1) auditory injury (generally damage to sensory cells of the ear) beginning at 202 dB SEL cumulative, and (2) non-auditory injury (trauma to non-auditory body tissues/organs) beginning at 208 dB SEL cumulative. Since the underwater criterion for auditory injury was the lower of the two thresholds, this was the criterion used for assessing injurious impacts to pursuit-diving marine birds in this analysis. Currently there are no thresholds or guidelines for installation and extraction of piles with a vibratory driver. Because the sound levels generated by vibratory drivers are typically 20-30 dB lower than impact pile driving and do not produce waveforms with sharp rise times like impact pile driving, the affected areas would be discountably small and potential impacts on marine birds would be discountable.

A maximum of 20 steel piles could be installed at Keyport during the 5 years of proposed MPR activities. As shown in Appendix B, potentially the most injurious noise levels may extend up to 63 m from an impact-driven 30-in steel pile during project construction (see Figure 6-1 for a representative scenario of the extent of potentially injurious underwater noise from steel pile installation). Since estimates of the distances to thresholds involve the cumulative energy of all impact strikes over a 24-hour period, the affected area represents the maximum extent of potential auditory injury effects. Earlier in the construction day, the injury zone would be smaller, and only reach the maximum extent after all the pile strikes have been completed.

Airborne noise levels from proposed MPR activities are not expected to be injurious to birds within the study area because the source levels for airborne noise from pile driving (vibratory: 96 dBA at 15 m; impact: 110 dBA at 11 m) are well below those known to cause injury to birds in laboratory situations (Dooling & Popper, 2007). However, the USFWS (2013) has determined that airborne noise due to impact pile driving may behaviorally affect foraging marbled murrelets, based on the findings of the Marbled Murrelet Hydroacoustic Science Panel regarding non-injurious thresholds for pile driving noise (SAIC, 2012). Marbled murrelets typically perform foraging dives in pairs and are highly vocal when they are above the surface (Strachan et al., 1995). On the water's surface, birds typically stay within 100 ft. of their partners during foraging bouts. This behavior is thought to play a role in foraging efficiency, and therefore airborne noise that masks their vocalizations has the potential to affect foraging success (Carter & Sealy 1990; Strachan et al., 1995). Unlike other noise effects criteria established for injury, the distance from a pile driving source within which communications would be masked is dependent upon ambient noise levels and therefore is site-specific. Masking effects cease immediately when the masking noise stops.

Under typical conditions on the Keyport waterfront, the maximum distance within which pile driving noise for steel piles <36 in is expected to compromise communication between foraging murrelets would be 42 m (USFWS, 2013). Acoustic monitoring during construction at NAVBASE Kitsap Bangor (Illingworth & Rodkin, 2013) indicated that average airborne source levels during impact driving of 36-in steel piles were the same as, and in some cases lower than, 24-in steel piles. Therefore, the masking distance for 24-in steel piles was applied to all steel pile sizes. Representative scenarios of areas affected by masking effects are shown in Figure 6-1.

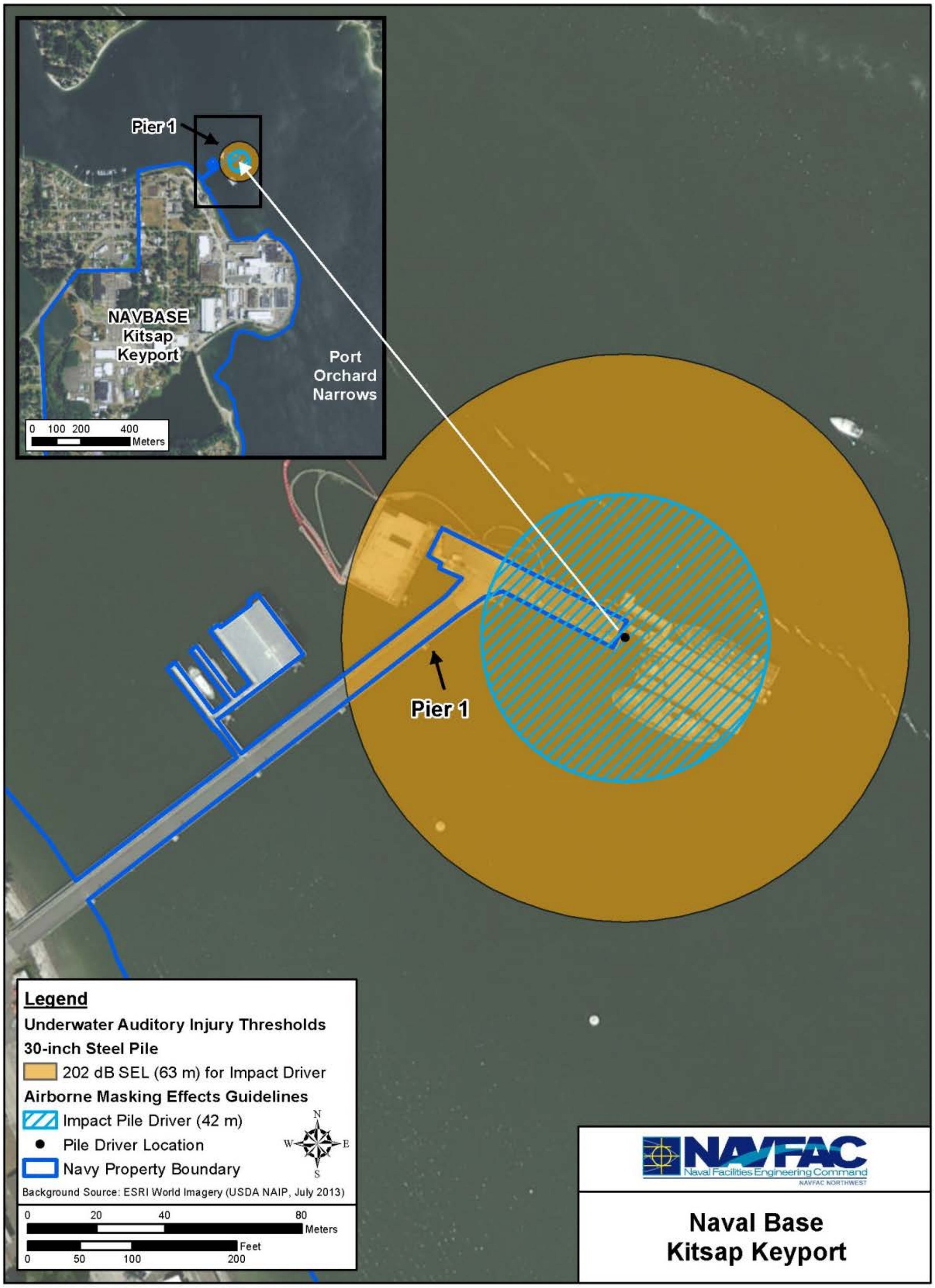

Figure 6-1. Representative Affected Areas for Pile Driving Noise for Marbled Murrelets at NAVBASE Kitsap Keyport

The USFWS (2013) has provided guidance on evaluating the significance of airborne masking effects for pile driving projects. "Typical" pile driving projects involve:

- Installation of 24-in or 36-in steel piles,
- Use of vibratory pile drivers,
- Use of impact pile drivers for proofing only, and
- Adherence to a 2-hour timing restriction (i.e., no pile driving within 2 hours after sunrise and within 2 hours before sunset during the breeding season).

Typical pile driving projects do not result in measurable effects on marbled murrelets because the use of impact hammers is intermittent and of short duration, the 2-hour timing restriction protects murrelets during their most active foraging periods, and murrelet vocalizations are adapted to overcome the effects of ambient noise (USFWS, 2013).

Steel pile driving during proposed MPR activities would fit into the "typical" category because all piles would be 36-in or less, vibratory drivers would be used to install the piles, with limited proofing, and the timing restrictions would be observed. The USFWS guidance does not cover concrete piles, but the potential masking effects of concrete pile installation are likely to be much smaller because impact installation of concrete pile generates lower SPLs than steel pile installation (Appendix B, Table B-4).

To prevent exposure to injurious or masking noise levels in the action area for projects at NAVBASE Kitsap Keyport, the Navy would implement the minimization measures and BMPs described in Section 2.5. The Navy would actively monitor the underwater auditory injury zone for impact pile driving up to 63 m or the 42-m masking zone (Figure 6-2), whichever is larger, depending on the pile type. The likelihood of marbled murrelet exposure to injurious or masking noise from impact pile driving is discountable because these zones are small and can be effectively monitored during pile driving, and pile driving would cease if monitors detect marbled murrelets (see Appendix D for details) within the threshold distance.

With the implementation of minimization and monitoring actions (Section 2.5), the Navy has determined the Proposed Action "may affect, but is not likely to adversely affect" ESA-listed marbled murrelets. USFWS concurred with the Navy's determination in a letter dated December 15, 2017. Proposed MPR activities would have no significant impacts on marbled murrelets or other marine bird species due to temporarily elevated underwater and airborne sound levels resulting from impact or vibratory pile driving of all pile types.

Critical Habitat

Because the closest marbled murrelet designated critical habitat to NAVBASE Kitsap Keyport is about 19 mi to the west, no noise resulting from proposed MPR activities would reach it. Therefore, a no effect determination was made for designated critical habitat in the vicinity of NAVBASE Kitsap Keyport.

6.3.2.2.5 Marine Mammals

Pile installation and removal activities at NAVBASE Kitsap Keyport would result in temporarily increased human activity levels and changes in prey availability during project construction. However, project construction would take place at an existing marine structure that has relatively high levels of human activity under daily operations, and prey availability changes would be short-term and highly localized, as described in Section 6.3.2.2.3. Because vessels would be operating at slow speeds, no vessel strikes

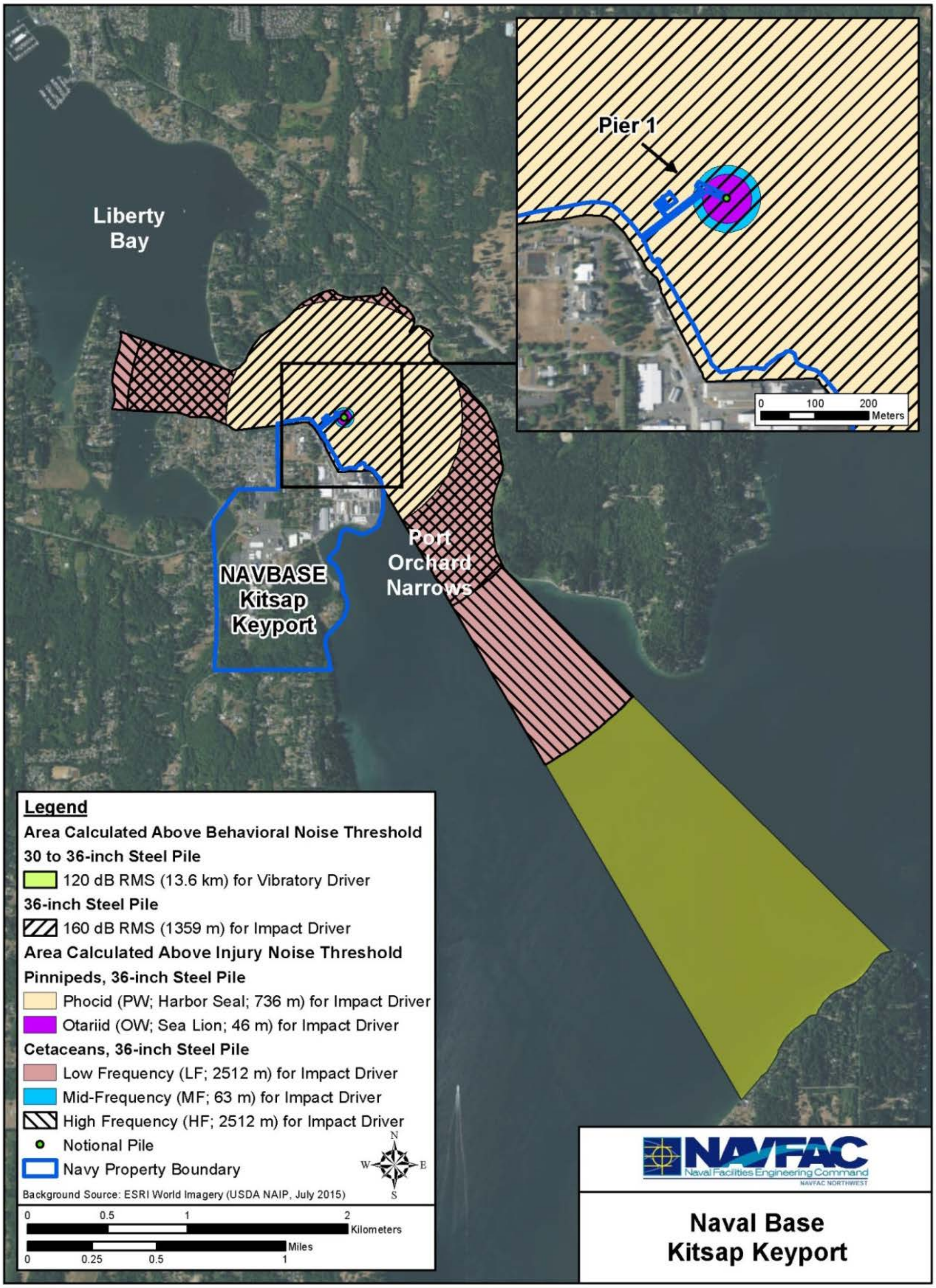

Figure 6-2. Representative Affected Areas for Pile Driving Noise for Marine Mammals at NAVBASE Kitsap Keyport

would be expected. Therefore, there would be no significant impact to marine mammals due to increased human activity levels, changes in prey availability, or the potential for vessel strikes.

Effects of Elevated Noise Levels on Marine Mammals

Underwater and airborne noise generated during pile installation and removal has the potential to disrupt the behavior of marine mammals that may be traveling through, foraging, or resting in the vicinity of the project area, as described in detail in Appendix B. The Navy estimates potential impacts to marine mammals by considering the likelihood that each species may be present at NAVBASE Kitsap Keyport during pile driving, determining the sound levels generated by various pile types and installation methods, and applying acoustic threshold criteria (expressed in decibels, dB) established by NMFS for evaluating the potential for injury or behavioral impacts. A detailed explanation of the analytical methods is presented in Appendix B, and the following sections summarize results of the underwater noise analysis.

A maximum of 20 steel piles could be installed at Keyport during the 5 years of proposed MPR activities. As described in detail in Appendix B, the Navy estimated the distances to the various NMFS underwater noise thresholds for injurious and behavioral effects on marine mammals. These distances were estimated by taking into account the source levels for impact and vibratory pile driving of piles at this location, sound propagation over distance from the driven pile, and acoustic impacts thresholds for the various species groups. Figure 6-2 depicts a representative scenario of the extent of potentially injurious and behaviorally harassing underwater noise from steel pile installation. The area encompassed by the threshold values decreases the closer to shore pile driving occurs and is truncated where shallow water and land block noise transmission.

The likelihood of injury due to pile driving noise is discountable because marine mammals are unlikely to be present in the small affected areas, which would be fully monitored by marine mammal observers during pile driving. In addition, most steel piles would be installed with a vibratory driver, which affects a smaller area with injurious noise levels than impact pile driving (Appendix B). As described in Appendix D, pile driving would cease if monitors detect a marine mammal approaching or entering the injury zone.

Pile driving would produce noise above the underwater behavioral harassment threshold during impact and vibratory pile driving. The loudest impact pile driving noise, resulting from installation of 30-in steel pile, is estimated to affect an area up to 631 m from the driven pile. However, impact pile driving noise is not expected to result in behavioral harassment of marine mammals because affected areas can be fully monitored and pile driving would cease if a marine mammal approaches the affected area.

However, installation of steel piles would utilize a vibratory pile driver to the extent practicable in order to reduce adverse impacts to fish species, and the affected area due to the vibratory pile driver would be much larger than the area affected by impact pile installation (due to the low behavioral harassment threshold for continuous sound [120 dB RMS versus 160 dB RMS for impulsive sound]). The greatest risk of exposing marine mammals to behavioral harassment during pile driving would be during vibratory installation of steel pile because the affected areas would be too large to be fully monitored by marine mammal observers (for details see Appendix D). The affected area could extend up to 13.6 km from the driven pile at NAVBASE Kitsap Keyport.

To assess the potential exposure of marine mammals to above-threshold noise levels during in-water work windows during the 5 years of proposed MPR activities, the likelihood of occurrence of each species was considered along with the number of pile driving days. The Navy used one of two methods for species at NAVBASE Kitsap Keyport, depending on (1) whether regional densities were known, or (2) the species is so infrequently encountered that densities cannot be determine and other reasoning must be applied. Potential exposures of Steller sea lions, California sea lions, harbor seal, and Dall's porpoise were estimated based on regional density data (Navy, 2015a, Marine Species Density Database); exposures of harbor porpoises were based on density estimates from Smultea et al. (2017); and exposures of the remaining species were estimated through analysis of historical occurrence. Details of the exposure analysis are presented in Appendix B, and results are summarized in Table B-19.

Based on the exposure estimates in Tables B-19 the species most likely to be impacted is the harbor seal. The Navy would implement a variety of BMPs and mitigation measures, including noise attenuation devices and marine mammal observers that are expected to reduce the estimated impacts. These measures are fully described in Appendix D and summarized in Section 2.5.

Individual responses of marine mammals to pile driving noise are expected to be variable. Some individuals may occupy the project area during pile driving without apparent effect, but others may be displaced with undetermined effects. In general, cetaceans like harbor porpoise infrequently transit the waters in the vicinity of NAVBASE Kitsap Keyport and they do not tend to remain there. If they encounter pile driving noise they would likely avoid affected areas. Avoidance of the affected area during pile driving operations would potentially reduce access to foraging areas and inhibit movement through the area. The likelihood of exposure to behavioral disturbance due to pile driving noise would be limited by the infrequent occurrence of cetacean species in the vicinity, and monitoring and shutdown of pile driving if monitors detect cetaceans, as described in Appendix D.

Based on the low likelihood of occurrence of ESA-listed species in Table 3-8, and the use of BMPs and mitigation measures that are likely to reduce potential impacts, the Navy concludes that the proposed MPR activities at NAVBASE Kitsap Keyport:

- "may affect, and are not likely to adversely affect" humpback whales and Southern Resident killer whales because they are considered rare in Liberty Bay; and
- "may affect, but are not likely to adversely affect" Southern Resident killer whale designated critical habitat.

NMFS did not concur with the Navy's determinations and concluded that the Navy's proposed MPR activities "may affect, are likely to adversely affect" humpback whale species, Southern Resident killer whale, and Southern Resident killer whale designated critical habitat. The Navy's consultation with NMFS regarding ESA-listed marine mammals and critical habitat was completed with the issuance of a BiOp on April 5, 2019 (Appendix G).

Acoustic exposure estimates from pile driving operations as shown in Table B-19 indicate there is the potential for Level B harassment, which has the potential to disrupt animal behavior, as defined by MMPA. No marine mammals would be exposed at levels that would result in injury or mortality. Other construction activities not associated with pile installation and removal would not result in Level A or B harassment under the MMPA. The Navy consulted with NMFS in compliance with the ESA and the MMPA, and obtained an LOA for Level A injury and Level B harassment of marine mammals. The Final Rule for the LOA was published in the Federal Register on April 17, 2019. Since the exposures are only expected to result in behavioral impacts on an intermittent basis, no long term or permanent impacts are anticipated.

The analysis presented above indicates that proposed MPR activities at NAVBASE Kitsap Keyport may impact individual marine mammals, but any impacts observed at the population, stock, or species level would be negligible. Therefore, there would be no significant impact to marine mammal populations.

6.4 Cultural Resources

6.4.1 Affected Environment

The APE for the Proposed Action at NAVBASE Kitsap Keyport consists of one facility (Table 6-1). Keyport Pier, the single structure scheduled for repair, was built in 2002, and is not eligible for listing in the NRHP, primarily because of its recent construction date, and its lack of extraordinary significance as evaluated under Criteria Consideration G (Table 6-1).

All work would occur in or over-water. No on-shore work is planned, and any staging required would occur in previously disturbed or developed areas.

NAVBASE Kitsap Keyport contains two NRHP-eligible districts. The industrial district is comprised of ten buildings that were involved in torpedo development, manufacturing, underwater exploration/recovery technology, and undersea technology associated with U.S. involvement in WWI and WWII. The residential district is comprised of residential-style buildings associated with WWI and WWII. Two contributing buildings are also individually eligible for the NRHP. No sites are listed in the NRHP.

Two archaeological sites at Keyport are potentially eligible for the NRHP, but neither is within the proposed MPR activities APE. No prehistoric archaeological resources have been identified in the offshore areas at Keyport. Multiple shipwrecks are located within or near the Keyport Range site, but there are no recorded submerged historic properties, downed aircraft, or shipwrecks, within the pier repair and replacement APE. The probability of prehistoric archaeological deposits or features buried within the substrate at the pier location is very low due to Holocene sea level changes and associated erosion of glacial deposits found along the shoreline.

Table 6-1. Proposed Action at NAVBASE Kitsap Keyport

Structure Name	*Year Built*	*NRHP Status*	*SHPO Concurrence Date*	*DAHP Log #*	*Note*
Keyport Pier	2002	N/A			Post-dates Cold War

6.4.2 Environmental Consequences

6.4.2.1 No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to the baseline cultural resources. Therefore, no significant impacts to cultural resources would occur with implementation of the No Action Alternative.

6.4.2.2 MPR Activities (Preferred Alternative) Potential Impacts

Implementation of proposed MPR activities at NAVBASE Kitsap Keyport would not affect any known NRHP-eligible archaeological sites. Contingent construction activities would take place in a previously disturbed underwater area along or near the shoreline. The probability of prehistoric archaeological deposits or features buried within the substrate is very low due to Holocene sea level changes and associated erosion of glacial deposits found along the shoreline.

Nevertheless, pursuant to the NHPA implementing regulation, other applicable federal laws, and DoD and Navy regulations, if construction activities inadvertently encountered archaeological resources, the Navy would stop work in the immediate area and then follow the Section 106 process for inadvertent discovery (36 CFR 800.13), including evaluating the NRHP-eligibility of the resources, and considering the effects to such resources through consultation with the SHPO, affected American Indian tribes, and other interested parties. Similarly, if American Indian human remains, funerary items, sacred objects, or items of cultural patrimony are encountered, the Navy must comply with the NAGPRA.

The Keyport Pier was constructed in 2002, and is not eligible for listing in the NRHP under any criteria. The Navy has determined that no historic properties would be affected by proposed MPR activities at NAVBASE Kitsap Keyport and the SHPO has concurred in a letter dated May 31, 2017. Therefore, there would be no significant impact to cultural resources.

6.5 American Indian Traditional Resources

6.5.1 Affected Environment

NAVBASE Kitsap Keyport property is co-located in the adjudicated U&A fishing area for the Suquamish Tribe. There are no designated Naval Restricted Areas at NAVBASE Kitsap Keyport. The Suquamish Tribe does not currently harvest resources from the beaches/waters of NAVBASE Kitsap Keyport.

6.5.2 Environmental Consequences

6.5.2.1 No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to baseline American Indian traditional resources. Therefore, no significant impacts to American Indian traditional resources would occur with implementation of the No Action Alternative.

6.5.2.2 MPR Activities (Preferred Alternative) Potential Impacts

In accordance with Executive Order 13175 and DOD and Navy instructions, the Navy invited the Suquamish Tribe to initiate government-to-government consultation regarding proposed MPR activities and potential impacts to tribal treaty rights. The Tribe requested that additional project details be provided as they become available in the future. Additionally, the Tribe provided comments on the Revised Draft EA, but determined it was not necessary to meet with the Navy to discuss these comments (Baxter, 2019). Government-to-government consultation with the Tribe is complete.

There would be no changes to the status quo regarding tribal access to traditional resources as a result of proposed MPR activities. Construction activities could result in loss of benthic organisms at the immediate project site; however replacement piles would be installed near the location of the removed pile, minimizing the direct loss of benthic invertebrates.

There would be a temporary increase in the volume of barge traffic during pile replacement and maintenance activities as pile delivery and disposal would generally be conducted via barge. However, the increase in barge traffic generated by proposed MPR activities would be negligible when compared to existing marine traffic in Puget Sound and at NAVBASE Kitsap Keyport.

The in-water work window for each construction year would minimize impacts to all juvenile salmonid species; therefore, significant impacts to juvenile salmonids are not expected. As part of continued engagement, the Navy will annually provide summaries of planned pile repair and replacement projects to the Tribe for information and coordination. Therefore, there would be no significant impact to American Indian traditional resources.

6.6 Summary of Potential Environmental Consequences

Table 6-2. Summary of Environmental Impacts at NAVBASE Kitsap Keyport

Section/ Resource Area	*Environmental Impacts*
Airborne Noise	Temporary construction noise during daytime hours is exempt from maximum permissible noise levels under the WAC and Kitsap County noise regulations. Recreational users on Liberty Bay could experience noise disturbance but not at levels sufficient to cause adverse effects. Therefore, there would be no significant impact to the ambient sound environment.
Water Quality	Direct discharges of waste would not occur. Construction-related impacts would be limited to short-term and localized changes associated with re-suspension of bottom sediments. These changes would be spatially limited to the construction site and areas immediately adjacent. Temporary impacts would not violate applicable state or federal water quality standards. The Navy would implement BMPs and minimization measures to prevent accidental losses or spills of construction debris. Therefore, there would be no significant impact to water quality.
Sediments	Sediment would be disturbed and re-suspended in the water column during pile removal and pile driving activities. Some degree of localized changes in sediment composition would occur. In particular, sediments that are re-suspended would be dispersed by currents and eventually re-deposited on the bottom. Project-related construction activities would not create sediment contamination concentrations or physical changes that violate state standards or interfere with beneficial uses of Port Orchard Reach. Therefore, there would be no significant impact to sediments.
Aquatic Vegetation	Vegetative growth found on existing piles would be removed when those piles are extracted from the water but because piles would be replaced, ultimately a similar amount of surface area on which marine organisms could colonize would exist. Because aquatic vegetation does not occur densely in the area, direct removals should be minimal. Impacts due to turbidity would be short-term, temporary, and localized. Additionally, because aquatic vegetation is distributed outside of the project area, recolonization could occur quickly, and the overall health and abundance of aquatic vegetation would not be compromised. Therefore, there would be no significant impact to aquatic vegetation.
Benthic Invertebrates	As with aquatic vegetation, benthic organisms attached to removed piles would be lost, but new piles would provide equivalent attachment sites for development of the benthic community. Benthic organisms directly adjacent to piles would be lost or displaced. There would be minimal impacts to habitat and benthic organisms from turbidity caused by pile removal and installation and anchor placement and removal, but these effects would be temporary and very localized. Impacts at the population, stock, or species level would be negligible. Therefore, there would be no significant impact to benthic invertebrate populations.

Table 6-2. Summary of Environmental Impacts at NAVBASE Kitsap Keyport (continued)

Section/ Resource Area	*Environmental Impacts*
Marine Fish and EFH	In-water construction may expose fish to increased turbidity but exposure would be localized and temporary. The most significant impact to fish that could occur would be from exposure to elevated underwater noise from impact pile driving. To minimize exposure to noise, pile driving would be conducted during the in-water work window when juvenile salmonids (including ESA-listed salmonids) are least likely to be present. A majority of the pile driving would be conducted using a vibratory pile driver and use of a bubble curtain or other noise attenuation device to attenuate noise during impact pile driving of steel piles would be evaluated on a project-by-project basis. All impact pile driving would occur intermittently and for an estimated maximum duration of 1.5 hours in a day. The Navy has determined that the Proposed Action “may affect, but is not likely to adversely affect” ESA-listed fish species and designated critical habitat and “may adversely affect” EFH. The USFWS has concurred with the Navy’s conclusions regarding bull trout. NMFS concluded that the Navy’s proposed MPR activities “may affect, are likely to adversely affect” Puget Sound evolutionary significant unit (ESU) Chinook salmon; Hood Canal summer-run ESU chum salmon; Puget Sound distinct population segment (DPS) steelhead; Puget Sound/Georgia Basin DPSs of bocaccio and yelloweye rockfish; designated critical habitat; and, EFH. Per Terms and Conditions 2.b. contained in the NMFS’ BiOp, the Navy must restrict impact driving steel piles to the period between July 16 and October 14, annually. With implementation of minimization measures, there would be no significant impacts to marine fish (including ESA-listed fish) and EFH.
Birds	Construction activities may result in the exposure of marbled murrelets to sound pressure levels above the behavioral guidance criterion. Mitigation measures would be used to reduce potential adverse impacts to marbled murrelets, also benefiting other marine birds. No designated critical habitat for the marbled murrelet is located near Keyport; therefore construction activities would not affect designated critical habitat for the species. The Navy has determined that the Proposed Action “may affect, but is not likely to adversely affect” the marbled murrelet, and the USFWS has concurred with the Navy’s conclusions. No significant impacts to other marine birds are expected.
Marine Mammals	Vibratory pile driving at NAVBASE Kitsap Keyport may expose marine mammals to behavioral disturbance due to elevated underwater noise. Mitigation measures would be used to reduce the adverse impacts to marine mammals. The Navy determined that the Proposed Action “may affect, but is not likely to adversely affect” ESA-listed humpback whales and Southern Resident killer whales because they are considered rare in the vicinity; and “may affect, but is not likely to adversely affect” Southern Resident killer whale designated critical habitat. NMFS concluded that the Navy’s proposed MPR activities “may affect, are likely to adversely affect” humpback whale species, Southern Resident killer whale, and Southern Resident killer whale designated critical habitat. The Navy consulted with NMFS and will obtain an LOA under the MMPA. While construction activities may impact individual marine mammals, any impacts observed at the population, stock, or species level would be negligible. Therefore, there would be no significant impact to marine mammal populations.
Cultural Resources	Implementation of proposed MPR activities at Keyport would not affect any known NRHP-eligible architectural or archaeological sites. Contingent construction activities would take place in a previously disturbed underwater area along or near the shoreline. The Navy has determined that the Proposed Action would have no effect on historic properties and the SHPO has concurred. Therefore, there would be no significant impact to cultural resources.

Table 6-2. Summary of Environmental Impacts at NAVBASE Kitsap Keyport (continued)

Section/ Resource Area	*Environmental Impacts*
American Indian Traditional Resources	There would be no changes to the status quo regarding tribal access to traditional resources as a result of proposed MPR activities. Construction activities could result in the loss of benthic organisms at the immediate project site; however, replacement piles would be installed near the location of the removed piles, minimizing the direct loss of benthic invertebrates. The in-water work window for each construction year would minimize impacts to all juvenile salmonid species; significant impacts to juvenile salmonids are not expected. Therefore, there would be no significant impact to American Indian traditional resources.

7 NAVBASE Kitsap Manchester Affected Environment and Environmental Consequences

7.1 Airborne Noise

7.1.1 Affected Environment

Existing noise levels characteristic of the semi-rural residential setting of the area are expected to range between 45 and 50 dBA (WSDOT, 2018). Cavanaugh and Tocci (1998) found that noise levels in urban residential areas averaged 65 dBA. Although NAVBASE Kitsap Manchester is somewhat isolated and does not have the level of industrial activity of NAVBASE Kitsap Bremerton (Section 5.1.1) or Bangor (Section 4.1.1), it is visited by fuel barges and tugboats and there are associated fueling operations. This location also experiences vehicular and small boat traffic. It is also close to the Seattle to Bremerton ferry lanes. As a result, the main sound sources are periodic. In consideration of the above, average sound levels are expected to be in the 55–65 dBA range.

Sensitive noise receptors include the residential areas to the south of NAVBASE Kitsap Manchester. Blake Island State Marine Park, a marine camping park only accessible by boat, is located approximately 2 mi southeast of the project construction site. Manchester State Park is a 111-acre camping park with 3,400 ft. of saltwater shoreline on Clam Bay and Rich Passage, about 1 mi northwest of the project construction site. The nearest school is Manchester Elementary, approximately 1.3 mi southwest of the fuel pier.

The State of Washington and Kitsap County have developed maximum permissible environmental noise levels for receiving properties. However, both Washington and Kitsap County have exempted noise generated by temporary construction activities. Permissible noise levels and exceedance allowances are discussed in Section 3.1.

7.1.2 Environmental Consequences

7.1.2.1 No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to baseline airborne noise. Therefore, no significant impacts to airborne noise would occur with implementation of the No Action Alternative.

7.1.2.2 MPR Activities (Preferred Alternative) Potential Impacts

Construction associated with proposed MPR activities would result in temporarily elevated underwater and airborne noise levels. Noise would be generated from support vessels, small boat traffic, and barge-mounted equipment, such as generators, and pile extraction and installation equipment. Noise levels from all activities except pile driving would typically not exceed ambient sound levels resulting from routine waterfront operations in the vicinity of any of the structures in the proposed MPR activities locations. The most significant project-related noise source would be impact pile driving of steel piles (WSDOT, 2018).

Construction noise would be temporary between July 16 and February 15 over 5 years for a total of 50 pile driving days. The maximum duration of impact pile driving in a single day would be up to 4 hours of impact pile driving or 4.5 hours of vibratory pile driving. Elevated noise levels during pile driving may be noticeable in residential areas but, as stated above, temporary construction noise is exempt from maximum permissible noise levels under the WAC and Kitsap County noise regulations.

7.2 Water Resources and Marine Sediments

7.2.1 Affected Environment

7.2.1.1 Water Quality

Beaver Creek runs along the northern boundary of NAVBASE Kitsap Manchester. Little Clam Bay (a tidal lagoon) covers 17 acres in the west central portion of NAVBASE Kitsap Manchester. Little Clam Bay is connected to Clam Bay, thence Rich Passage, through a culvert. WAC 173-201A-612 has established designated uses for Clam Bay and adjoining waters of Puget Sound as follows: extraordinary (aquatic life uses); primary contact (recreation); shellfish harvesting; and wildlife habitat, commerce and navigation, boating, and aesthetics (miscellaneous uses). Areas to the east and northeast of Manchester are classified as Category 2 for pH, DO, and fecal coliform (WDOE, 2017a). Areas south of Manchester are classified as Category 5 for DO. Duncan Creek, which empties into Puget Sound south of Manchester, is classified as Category 5 for fecal coliform and DO.

7.2.1.2 Marine Sediments

The shoreline at NAVBASE Kitsap Manchester varies from rocky outcroppings to gravelly sand and mud. In 2000, sediment in the vicinity of the fuel pier was sampled and generally the sediment constituent concentrations did not exceed the sediment quality standards (Hart Crowser, 2000).

7.2.2 Environmental Consequences

7.2.2.1 No Action Alternative

7.2.2.1.1 <u>Water Quality</u>

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to baseline water quality. Therefore, no significant impacts to water quality would occur with implementation of the No Action Alternative.

7.2.2.1.2 <u>Marine Sediments</u>

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to baseline marine sediments. Therefore, no significant impacts to marine sediment would occur with implementation of the No Action Alternative.

7.2.2.2 MPR Activities (Preferred Alternative) Potential Impacts

7.2.2.2.1 <u>Water Quality</u>

Direct discharges of waste to the marine environment would not occur during proposed MPR activities. Construction-related impacts to water quality would be limited to short-term and localized changes associated with re-suspension of bottom sediments from pile removal and installation and barge and tug operations, such as anchoring and propeller wash. These changes would be spatially limited to the construction area and areas immediately adjacent.

Construction-related impacts would not violate applicable state or federal water quality standards discussed in Section 3.2. BMPs and minimization measures, discussed in Section 2.5, would be implemented to prevent accidental losses or spills. In addition, removal of existing creosote-treated timber piles would improve localized water quality conditions in the project area. Therefore, no significant impacts to water quality are expected.

7.2.2.2.2 Marine Sediments

Some degree of localized changes in sediment composition would occur as a result of in-water construction activities. In particular, sediments that are re-suspended by pile installation and removal activities would be dispersed by currents and eventually re-deposited on the bottom. Depending on the distance suspended sediments would be transported from shallow to deeper portions of the fuel pier project site or fine-grained sediments would be transported from deeper to shallower areas. The distance over which suspended sediments are dispersed would depend on a number of factors, such as the sediment characteristics, current speeds, and distance above the bottom.

There would be no direct discharges of wastes, to the marine environment during construction. Therefore, construction-related impacts to sediment quality would be limited to localized changes associated with disturbances of bottom sediments from removal and installation of up to 50 piles over a 5-year period. Setting spuds and anchors for the barges, and propeller wash from tugs used for pile removal and installation represent other construction-related sources for disturbances of bottom sediments.

Project-related construction activities would not create sediment contamination concentrations or physical changes that violate state standards or interfere with beneficial uses of Puget Sound near Manchester. Therefore, there would be no significant impact to sediments.

7.3 Biological Resources

7.3.1 Affected Environment

7.3.1.1 Aquatic Vegetation

Eelgrass beds are scattered along the subtidal margins of Clam Bay on the north side of NAVBASE Kitsap Manchester, and on both sides of the fuel pier (Navy, 2009c). Eelgrass surveys were conducted in the 1990s and again in 2010 (Sound Dive Center, 2010). The 2010 surveys showed significant growth in eelgrass area from the 1990s surveys. Eelgrass was present at the fuel pier (though not at the small boat pier). Abundant algae (including *Saccharina* [kelp] species called *Laminaria* in the report, *Ulva*, and red algae species) were documented at both pier locations, though not under the small boat pier. The WDNR Shorezone Inventory indicates *Ulva*, sargassum, and red algae occur along areas of the NAVBASE Kitsap Manchester shoreline (WDNR, 2015b).

7.3.1.2 Benthic Invertebrates

A marine inventory of the Clam Bay shoreline was conducted by NOAA in 1985. The beach area supports several hardshell clam species, including horse, butter, and manila clams, as well as Pacific oyster, Olympia oyster, cockle and bay mussel. The shoreline habitat of the beach in the action area was described as similar to that of Clam Bay and, therefore, the benthic community would be expected to be similar to what was found at Clam Bay, with various clam and oyster species. NAVBASE Kitsap Manchester participates with the Puget Sound Restoration Fund, a nonprofit organization that restores marine and watershed habitats throughout Puget Sound, to plant Olympia oysters (*Ostrea conchaphila*) in the NAVBASE Kitsap Manchester tidelands (Navy, 2009c).

7.3.1.3 Marine Fish

7.3.1.3.1 Non-ESA-Listed Fish Species

Surveys were conducted adjacent to the Manchester Fuel Department Naval Restricted Area in 2015 and 2016 using scuba and beach seine methods (Frierson et al., 2016d, 2017b). Scuba surveys were conducted near Orchard Point during the month of October at an average depth of 10 m (Figure 3-5). Species recorded during the survey included brown rockfish, copper rockfish, quillback rockfish (*Sebastes maliger*), lingcod, kelp greenling, painted greenling, great sculpin, shiner perch, pile perch (*Rhacochilus vacca*), striped seaperch (*Embiotoca lateralis*), kelp perch (*Brachyistius frenatus*), and tubesnout (*Aulorhynchus flavidus*) (Frierson et al., 2016d). Beach seine surveys were conducted from May through September along the shore of the Manchester Fuel Pier and a pocket beach northwest of Orchard Point. Approximately 30 fish species and species-groups were recorded during both sampling years with shiner perch accounting for 16.3 percent of the total catch in 2015 and three-spined stickleback accounting for 53.2 percent of the total catch in 2016. Salmonids collected included Chinook, chum, coho, cutthroat trout, and pink salmon (Frierson et al., 2016d, 2017b).

Forage fish (Pacific sand lance and surf smelt) were collected during beach seine surveys (Frierson et al., 2016d, 2017b). Peak sand lance catch occurred during the month of May but was sparse in the months before and following May. Surf smelt was collected in high densities at Clam Bay from May through August with peak catch occurring in August (Frierson et al., 2017b). WDFW surveys in 1996 recorded a sand lance breeding area at NAVBASE Kitsap Manchester on an approximately 1,000-ft. stretch of beach south of Orchard Point, at the fuel pier (WDFW, 2017). Monthly spawning surveys conducted by the Navy in 2014 documented presence of sand lance along the fuel pier beach in March 2014 and December 2016 (Navy, 2018a). There are no documented surf smelt spawning sites at NAVBASE Kitsap Manchester (Navy, 2014). The closest surf smelt spawning site is located approximately 0.3 mi south of the Navy property line (WDFW, 2017). Spawning areas for herring are not located within the vicinity of NAVBASE Kitsap Manchester; however, WDFW documents concentration of Pacific herring within the offshore area of the fuel pier (WDFW, 2017). Pacific sand lance, surf smelt, and Pacific herring are all likely to be present within the project area.

7.3.1.3.2 ESA-Listed Fish and Critical Habitat

ESA-listed fish species that may occur along or within the vicinity of NAVBASE Kitsap Manchester include Puget Sound Chinook; Puget Sound steelhead; and Puget Sound/Georgia Basin DPSs of bocaccio and yelloweye rockfish. ESA-listed fish species that are unlikely to occur within the vicinity of this location include bull trout, North American green sturgeon, and Pacific eulachon.

Puget Sound Chinook were recorded during beach seine surveys with peak occurrence in June (Frierson et al., 2016d) and was the only confirmed ESA-listed species collected during 2016 sampling with peak catch in May recorded at 11 percent the peak rate recorded the year before (2015) (Frierson et al., 2017b). Chinook outmigrants may come from the Gorst Creek hatchery. The nearest river utilized by the Puget Sound ESU Chinook is located across Puget Sound (approximately 10 km) in the Duwamish River (WDFW, 2015b). However, juvenile Chinook outmigrant presence is likely from multiple systems especially those to the south of Manchester in Puget Sound.

Surveys conducted in the early 1990s during the months of March through July documented presence of juvenile steelhead along the nearshore intertidal areas of NAVBASE Kitsap Manchester (Weitkamp, 1994). However, the total abundance was generally low (e.g., three steelhead were captured by beach seine and none were captured by purse seine in 1993) which is similar to other surveys that indicate nearshore areas are not heavily used by steelhead. Puget Sound steelhead (winter run) has documented presence in Curley Creek, approximately 4 km to the south, and documented spawning in Blackjack Creek, in Port Orchard (WDFW, 2015a). Juvenile and adult Puget Sound steelhead may be present within the project area, but are unlikely to be present during the in-water work window. Steelhead were not recorded during beach seine surveys conducted in 2015 and 2016 (Frierson et al., 2016d, 2017b). This is likely due to the fact that steelhead are not nearshore oriented and typically exhibit early offshore movement after entering Puget Sound (Moore et al., 2010a,b, 2014; Goetz et al., 2015).

Bull trout do not utilize any of the East Kitsap drainages for spawning habitat. The closest rivers containing populations of bull trout are located within the Puyallup River, south of Seattle, in drainages into Lake Union and Lake Washington, and within the South Fork of the Skokomish River (USFWS, 2015b). Bull trout may forage or overwinter in the bay but presence is expected to be rare. Further, no bull trout were recorded during 2015 surveys (Frierson et al., 2016d).

Adult Puget Sound/Georgia Basin DPSs of bocaccio and yelloweye rockfish and juvenile yelloweye rockfish typically occur in waters deeper than the project depth and thus are not anticipated to be in the immediate project area. Larval rockfish live near the surface and could occur near NAVBASE Kitsap Manchester. Juvenile rockfish have the potential to occur near pierside locations, if their preferred bottom type or kelp habitat is nearby. Kelp is present within the project area but not specifically within the pier locations. Eelgrass is present within the nearshore on both sides of the fuel pier. Therefore, juvenile bocaccio may be present.

The southern DPS Pacific eulachon and southern DPS North American green sturgeon are unlikely to occur near the project site or surrounding waters as there are no spawning rivers or aggregation sites for either species nearby, and there are few records of these species in Puget Sound. The nearest regular eulachon spawning habitats are the Elwha River on the Olympic Peninsula and the Fraser River in British Columbia.

Critical Habitat

Critical habitat is designated for Puget Sound Chinook salmon and ESA-listed rockfish, but outside NAVBASE Kitsap Manchester boundaries because DoD lands are exempt from critical habitat designation (70 FR 52685, 79 FR 68041). Critical habitat for Puget Sound Chinook is designated outside these exempt areas within a narrow nearshore zone from the line of extreme high tide to a depth of 30 m MLLW. Nearshore critical habitat for bocaccio and deepwater critical habitat for bocaccio and yelloweye rockfish species is designated outside these exempt areas, adjacent to NAVBASE Kitsap Manchester. Section 3.3.1.3.1 lists the designated critical habitat PCEs for Puget Sound Chinook and the essential features for ESA-listed rockfish species.

7.3.1.3.3 Essential Fish Habitat

Coastal pelagic EFH designations are based on the geographic range and in-water temperatures where these species are present during a particular life stage (PFMC, 2016a) and these boundaries include the waters of NAVBASE Kitsap Manchester. Market squid are recreationally fished for between February and

May and could also be present in the surface waters of Clam Bay, near the finger pier as well as south within the open waters on the fuel pier side.

The nearshore of NAVBASE Kitsap Manchester is composed of gravelly sand and mud substrate as well vegetated bottoms and offshore habitat consisting of boulder bedrock substrates that provide Pacific coast groundfish EFH for various life stages of species of groundfish (PFMC, 2016b). Scuba surveys conducted near Orchard Point during the month of October recorded six groundfish species (brown rockfish, copper rockfish, quillback rockfish, lingcod, kelp greenling, and painted greenling) occurring on the boulder and bedrock substrates between 10 m and 20 m deep. Nearshore seining within the course gravel and pebble with mixed sand substrates collected various flatfish species, including rock sole, English sole, and starry flounder (Frierson et al., 2016d, 2017b). Juvenile rockfish likely utilize the eelgrass and kelp that is present in the project area as rearing habitat.

The marine environment of NAVBASE Kitsap Manchester provides Pacific coast salmon EFH for various life stages of Chinook, pink, and coho salmon (PFMC, 2014). Coho have documented rearing and spawning habitat in Beaver Creek, located within the NAVBASE Kitsap Manchester boundary. They are also documented within an unnamed creek approximately 1 km south of the Fuel pier (WDFW, 2015a). Fall Chinook utilize Curley Creek, located approximately 4.5 km to the south, as spawning habitat (WDFW, 2015a). Coho and Chinook utilize the marine habitat near Manchester Fuel Department as a migration corridor to or from these creeks and other freshwater habitats in the main basin of Puget Sound. Odd-year pink salmon runs from the Duwamish River may use EFH near Manchester. All three Pacific coast salmon species were recorded during beach seine surveys in 2015 and 2016 (Frierson et al., 2016d, 2017b).

Eelgrass and kelp are HAPCs for Pacific coast groundfish and Pacific coast salmon. Spawning habitat that are present near NAVBASE Kitsap Manchester are HAPCs for Pacific Coast salmon.

7.3.1.4 Birds

Migratory birds encountered at Manchester include those described in Section 3.3.2.4. There is one known bald eagle nest platform on the Manchester Fuel Department that is monitored for occupancy annually during the nesting season (Navy 2016d). Pairs at this nest produced chicks every year from 2013 to 2016. This nest is over 350 m west of the location of the proposed pile repair and replacement activities. Eagles are observed feeding and roosting within NAVBASE Kitsap Manchester.

The WDFW Priority Habitat and Species Maps interactive website does not indicate the presence of marbled murrelet nests in the upland areas including and adjacent to Manchester Fuel Department (WDFW, 2017). Marbled murrelets may occur in the waters near NAVBASE Kitsap Manchester, as WDFW surveys of central Puget Sound, including Rich Passage and Clam Bay from mid-September to April detected low numbers of marbled murrelets during the in-water work window (Pearson & Lance, 2013, 2014, 2015, 2016).

7.3.1.5 Marine Mammals

Any of the species listed in Table 3-7 has the potential to occur in the vicinity of NAVBASE Kitsap Manchester. The species most likely to be encountered are harbor seals, Steller sea lions, and California sea lions. Steller sea lions and California sea lions haul out on floating platforms in Clam Bay approximately 0.5 mi offshore from the Manchester Fuel Depot's finger pier (Figure 7-1). The platforms appear associated with a fish farming net pen in Clam Bay. The Navy conducted surveys of sea lions on

Figure 7-1. Pinniped Haulouts near NAVBASE Kitsap Manchester

the floats from November 2012 through June 2016 except for September 2013 through November 2013 (Navy, 2016b). Steller sea lions were seen in all surveyed months except for June, July, and August with as many as 42 individuals present in one survey in November 2014. Aerial surveys were conducted by WDFW from March–April 2013, July–August 2013, November 2013, and February 2014. These surveys detected Steller sea lions on the floating platforms during all survey months except July and August, with up to 37 individuals present on one survey in November 2013.

California sea lions were seen in every survey month except July and August, with as many as 130 individuals present in one survey in November 2014. Aerial surveys were conducted by WDFW from March–April 2013, July–August 2013, November 2013, and February 2014. These surveys detected California sea lions on the floating platforms during all survey months except July, with up to 54 individuals present on one survey in November 2013.

No harbor seal haulouts have been identified at the Manchester Fuel Depot. The nearest documented haulout is Blakely Rocks approximately 3.5 mi away on the east side of Bainbridge Island. This haulout is estimated to have less than 100 individuals (Jeffries, 2012). Harbor seal occurrence at Manchester has not been reported but the species is likely to be present, given that it ranges year round in Puget Sound waters.

ESA-listed marine mammals that have been known to visit or have the potential to occur in the vicinity include the Southern Resident killer whale (a seasonal visitor), and the humpback whale (very rare visitor). Humpback whales may occur near NAVBASE Kitsap Manchester, but their presence is infrequent. Most sightings of this species occur in the Strait of Juan de Fuca and the San Juan Island area. Some detections were reported in or near Rich Passage and Yukon Harbor (Navy, 2009c). Humpback whales occurred regularly during 2015 and early 2016 in south Puget Sound, the main basin of central Puget Sound, and Colvos Passage (Orca Network, 2016). The number of humpback whales potentially near this location is expected to be very low in any month. Southern Resident killer whales occasionally occur in the main basin of central Puget Sound, primarily in the fall and early winter months; i.e., during the in-water work window for proposed MPR activities locations. They may occur near NAVBASE Kitsap Manchester but their presence is unlikely; the last confirmed sighting in Dyes Inlet, which may be accessed by passing by Manchester, was in 1997.

Other cetaceans and pinnipeds are not expected to occur in the vicinity of NAVBASE Kitsap Manchester, as there have been infrequent sightings of these species in Rich Passage.

7.3.2 Environmental Consequences

7.3.2.1 No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to baseline biological resources. Therefore, no significant impacts to biological resources would occur with implementation of the No Action Alternative.

7.3.2.2 MPR Activities (Preferred Alternative) Potential Impacts

7.3.2.2.1 Aquatic Vegetation

Any debris from pile removal during proposed MPR activities would be collected, disposed of in a state-approved landfill or recycled, and would not impact marine vegetation. Shading of existing vegetation would not change as no expansion of existing structures or new over-water structures is proposed;

therefore shading of existing vegetation is not discussed. Any shading that occurs from barges would be temporary in nature, and would have no significant effect on marine vegetation. Marine surveys have shown that eelgrass is present in Clam Bay and that subtidal algal species may occur in the area. Decreased water and sediment quality can impede the growth of marine vegetation important to fish and other animals, and promote the growth of harmful algae.

Pile driving-related impacts to water quality from proposed MPR activities would be limited to temporary and localized changes associated with re-suspension of bottom sediments during construction. As indicated in Section 7.2.1.2 above, no sediments in the area have been assessed as contaminated. Pile driving activities would not discharge contaminants or otherwise appreciably alter the concentrations of trace metal or organic contaminants in bottom sediments. Sediments would settle back in the general vicinity from which they rose. Indirect effects to macroalgae and eelgrass from changes in sediment quality and sedimentation during construction would be temporary and would not affect the overall health or distribution of marine vegetation near the project area.

Section 7.2.1.1 above notes that several waters near the project area are classified between Category 2 and 5 for temperature on the 303(d) list. These areas occur in Clam Bay, an area of low tidal outflow, and not at pier locations where the proposed MPR activities would occur. Proposed MPR activities would not result in measurable changes to existing temperature levels in the project area, and would not affect the 303(d) listed waters in Clam Bay. Proposed MPR activities would not result in violations of water quality standards and would, therefore, maintain water quality for marine vegetation in the vicinity of the project area.

Direct removal of marine vegetation during proposed MPR activities could occur through anchor and spud placement, and removal of up to 50 deteriorating piles. Where possible, anchors and spuds would not be placed in existing eelgrass beds. Any vegetative growth found on existing piles would be removed when those piles are extracted from the water but because piles would be replaced, ultimately a similar amount of surface area on which marine organisms could colonize would exist. Because marine vegetation does not occur densely in the area, direct removals should be minimal. Additionally, because marine vegetation is distributed outside of the project area, the overall health and abundance of macroalgae and eelgrass would not be compromised. Therefore, proposed MPR activities would have no significant direct or indirect impacts on marine vegetation.

7.3.2.2.2 Benthic Invertebrates

Proposed MPR activities at NAVBASE Kitsap Manchester would impact benthic communities through the disruption of the sediment surface and subsurface during the installation and removal of each pile, and from anchor and spud placement for the barges. Depending upon the species, impacts to individual benthic organisms could range from temporary disturbance to mortality. Some benthic organisms would be physically crushed and lost within the footprint of the piles, as well as from barge anchors and spuds.

Indirect impacts to habitat and benthic organisms are likely to result from turbidity caused by driving and removing barge anchors, spuds, and piles. The area near the pile replacement footprint would have higher levels of turbidity. Disturbed sediments would eventually redeposit upon the existing benthic community. Impacts from increased turbidity levels would likely result in short-term loss of localized areas of the benthic community. Most affected areas would experience some reduction in diversity and abundance of benthic species. However, benthic organisms, particularly annelids, are very resilient to habitat disturbance and are likely to recover to pre-disturbance levels in less than 2 years (CH2M Hill, 1995; Parametrix, 1994, 1999; Romberg et al., 1995; Anchor Environmental, 2002). Therefore, proposed MPR activities would have no significant impacts on benthic invertebrates.

7.3.2.2.3 Marine Fish

Non-ESA-Listed Fish

Turbidity

Resident marine fish as well as all life stages of forage fish are expected to be present within the vicinity of the project area and are likely to occur during the in-water work window established for juvenile salmonid avoidance. In-water work could produce measurable, temporary increases in turbidity and sedimentation, and that could cause fish to temporarily avoid the areas near construction. However, construction activities would not result in persistent increases in turbidity levels or cause changes that would violate water quality standards because processes that generate suspended sediments, which result in turbid conditions, would be short-term and localized and would disperse and/or settle rapidly (within a period of minutes to hours after construction activities cease). Further, removal of existing creosote-treated timber piles would improve localized water quality conditions in the project area. Effects would be short-term and small in scale during construction and, if creosote piles are removed, beneficial to water quality post-construction. Localized disturbance would not impact forage fish spawning areas identified within the vicinity of the project area. Placement of the piles and associated disturbance activities (i.e., support vessels, construction barge) may cause a loss to benthic prey either existing within the pile footprint or disturbance from turbidity which may impact fish use of that area for seeking prey. Impacts would be short-term, localized, and limited to the duration of pile installation/extraction and would not be expected to significantly impact fish ability to seek prey outside of the project areas. With implementation of impact avoidance and minimization measures (see Section 2.5), no significant impacts to non-ESA-listed marine fish from turbidity and sedimentation (including potential resuspension of contaminated sediments) are anticipated from proposed MPR activities.

Underwater Noise

Proposed MPR activities would result in increased underwater noise levels. Noise would be generated from support vessels, small boat traffic, and barge-mounted equipment, such as generators, and pile extraction and installation. Noise levels from all activities except pile driving would typically not exceed underwater sound levels resulting from existing routine waterfront operations at NAVBASE Kitsap Manchester. No steel piles would be installed at NAVBASE Kitsap Manchester. Concrete, timber and/or HDPE plastic piles could be installed of which concrete would generate the highest SPLs. Modeled threshold distances are significantly smaller (Appendix B) as compared to steel piles. Impact pile driving concrete piles is estimated to last a maximum duration of 4 hours per day or an average of 1.5 hours a day during the 5 years of proposed MPR activities. However, there are no known documented incidents of fish injury occurring from pile driving of concrete piles (NMFS, 2012c). By installing piles within the in-water work window and limited number of piles (for all pile types) during the 5 years of proposed MPR activities, only behavioral effects are anticipated and these effects are not anticipated to be significant to an individual fish. Therefore, no significant impacts to non-ESA-listed fish from underwater noise would result from the proposed MPR activities.

ESA-Listed Fish and Critical Habitat

Turbidity

As discussed above, in-water work could produce measurable, temporary increases in turbidity and sedimentation, and that could cause ESA-listed fish and their forage fish to temporarily avoid the areas near construction. Because, in-water work would occur during the approved in-water work window of July 16 through February 15, juvenile ESA-listed salmonids are least likely to be present. Adult life stages of Chinook, steelhead, bocaccio and yelloweye rockfish as well as juvenile yelloweye rockfish, if present, would occur further offshore and beyond any impacts associated with turbidity during in-water construction. Rearing habitat for juvenile bocaccio is present within the project area with some patchy distribution of eelgrass and kelp within or adjacent to the structure locations. However, turbidity impacts would be localized, short-term, and insignificant. Bull trout, green sturgeon, and eulachon are not expected to occur within the vicinity of the installation and steelhead are not nearshore oriented and hence would not be present. In conclusion, no significant impacts to ESA-listed fish or their forage base from turbidity would result with implementation of proposed MPR activities.

Underwater Noise

In-water work would occur during the work window when juvenile Chinook and steelhead are least likely to be present. Adult Chinook, steelhead, adult bocaccio, and adult and juvenile yelloweye rockfish may be exposed to noise above the behavioral threshold for impact pile driving concrete piles but this zone would be smaller as compared to steel piles (see Table B-9 of Appendix B) and exposure would be intermittent with impact pile driving lasting a maximum of 4 hours per day or average 1.5 hours a day during the 5 years of proposed MPR activities. Bull trout, green sturgeon, and eulachon are not expected to occur within the vicinity of NAVBASE Kitsap Manchester and thus no impacts to these species from underwater noise would be expected. Therefore, no significant impacts to ESA-listed fish from underwater noise would result from the proposed MPR activities.

Critical Habitat

Critical habitat is designated outside the exempt boundary of NAVBASE Kitsap Manchester for Puget Sound Chinook and ESA-listed rockfish. However, nearshore marine areas and estuarine PCEs for Chinook designated critical habitat and the attributes of the nearshore designated critical habitat essential feature for bocaccio would not be affected from turbidity or pile driving noise as turbidity and pile driving noise from installing 24-in concrete piles would be localized and short-term to the areas exempt from critical habitat designation. The third attribute for deepwater designated critical habitat essential feature for ESA-listed rockfish would be temporarily affected by behavioral noise extending over deeper water. However, impacts would not be significant. Therefore, no significant impacts to designated critical habitat for Chinook and ESA-listed rockfish would result from the proposed MPR activities.

The Navy made a determination under the ESA that proposed MPR activities “may affect, but are not likely to adversely affect” ESA-listed fish species and designated critical habitat. USFWS concurred with the Navy’s determination for bull trout with a Letter of Concurrence signed on December 15, 2017. NMFS did not concur with the Navy’s determination and concluded that the Navy’s proposed MPR activities “may affect, are likely to adversely affect” Puget Sound evolutionary significant unit (ESU) Chinook salmon; Hood Canal summer-run ESU chum salmon; Puget Sound distinct population segment (DPS) steelhead; Puget Sound/Georgia Basin DPSs of bocaccio and yelloweye rockfish; and, designated critical habitat. Section 7 consultation with NMFS was completed with the issuance of a BiOp on April 5, 2019.

Essential Fish Habitat

As was discussed above for marine fish in general and ESA-listed fish, elements of the proposed MPR activities would create turbidity and suspended sediment but these impacts would be short-term, localized, and small in scale without causing measureable impacts to EFH. Removal and installation of piles and anchoring would have a localized impact on marine vegetation and benthic epifauna/infauna within the immediate vicinity of each pile or anchoring site but these impacts would be minimal, localized, and expected to recover to pre-disruption levels within a few growing seasons. The primary impact during proposed MPR activities would be increased sound energy in the marine fish habitat. Increased sound would affect the water column, which has been designated as EFH for numerous species (see Appendix C). Impacts to the water column could result in disturbance depending on fish species, size, orientation, received noise level and type of noise. No steel piles would be installed at NAVBASE Kitsap Manchester. There would be a total of 50 piles installed during the 5 years of proposed MPR activities that could be concrete. Noise above the behavioral disturbance threshold zone from impact pile driving concrete piles may extend over Pacific coast groundfish EFH (Appendix B). The injury thresholds modeled would be significantly smaller but may affect coastal pelagic and/or Pacific coast groundfish EFH. Because all pile driving would be conducted within the in-water work window to avoid impacts to juvenile salmonids that would otherwise utilize the nearshore marine EFH, exposure of Pacific coast salmon EFH to noise above the injury thresholds would not be expected.

Impacts to EFH would be minimized by the short-duration of any projects because only 50 piles (for all pile types) total would be installed and an estimated maximum of 4 hours per day of pile driving or an average of 1.5 hours a day would occur during the 5 years of proposed MPR activities.

The Navy determined that the Proposed Action may adversely affect EFH by temporarily increasing noise in the water column during pile driving. However, implementation of minimization measures applied to ESA-listed species would be sufficient for minimizing effects to EFH. The Navy consulted with NMFS under the Magnuson-Stevens Fisheries Conservation and Management Act and NMFS concurred with the Navy's determination, but provided Conservation Recommendations to minimize effects to EFH. Consultation with NMFS was completed on April 5, 2019. Overall, due to the temporary nature of the activities, proposed minimization measures and the minimal level of impact to water column noise levels, benthic flora and fauna, water quality, and sediment quality, no significant impacts to EFH would occur with implementation of proposed MPR activities.

7.3.2.2.4 Birds

Resident and migrant birds are expected to be present within the vicinity of proposed MPR activities projects during the in-water work window established for juvenile salmonid avoidance (Section 2.5.3). Proposed MPR activities have the potential to impact marine birds through visual disturbance, changes in prey availability, and elevated underwater and airborne noise. Pile extraction and installation projects, and other repair projects on the existing marine structures would intermittently increase human activity levels on the waterfront, potentially resulting in visual disturbance and increasing ambient noise levels due to use of construction equipment. A bald eagle nest is present on the north shoreline at NAVBASE Kitsap Manchester and potentially suitable foraging habitat is available near the project sites (Navy, 2016d). Bald eagles that nest at NAVBASE Kitsap Manchester and forage along the marine shoreline may experience the increase in human activity, depending on proximity of project construction to existing and future nest sites and foraging areas. However, pile driving would take place, at the earliest, toward the end of the nesting period; therefore, no incidental takes are anticipated. Project sites currently have ongoing human activity, and project work involving repairs to marine structures would be within the baseline condition. Therefore, project effects due to human activity levels would be insignificant.

As discussed in Sections 7.3.2.2.2 and 7.3.2.2.3, in-water work could temporarily affect the availability of forage fish and benthic invertebrates, which are the prey base of many marine birds, in a limited area. Removal of existing creosote-treated timber piles would improve localized water quality conditions in the project area. Turbidity effects and potential resuspension of contaminated sediments are not expected to affect the prey base, as these changes would be short-term and small scale during construction. Therefore, proposed MPR activities would have no significant impacts on prey availability for marine birds.

Effects of Elevated Noise Levels on Birds

Proposed MPR activities would result in increased underwater noise levels. Noise would be generated from small vessels and barge-mounted equipment such as generators, and pile extraction and installation. Noise levels from all activities except pile driving would typically not exceed underwater sound levels resulting from existing routine waterfront operations along the Bangor waterfront. The most significant underwater noise source would be impact pile driving of concrete piles. Impacts of elevated noise levels due to pile driving were evaluated in the context of established criteria for ESA consultation with the USFWS on the threatened marbled murrelet. No criteria have been established for determining impacts of elevated noise levels on other marine bird species, some of which forage underwater like the marbled murrelet, and general conclusions about impacts on marbled murrelets were applied to other species.

Marbled murrelets are pursuit-diving predators, i.e., they pursue and capture their prey underwater using their wings to swim. While actively foraging they dive repeatedly into waters ranging up to approximately 160 ft. in depth for periods ranging up to 60 seconds (Nelson et al., 2006). Foraging bouts typically last over a period of 27 to 33 minutes, with approximately 50 percent of the time spent underwater (Jodice & Collopy, 1999). When startled by loud sounds, the foraging pattern may be altered, and birds may flush or dive and swim away underwater. While underwater they would be susceptible to injury or behavioral disturbance due to elevated sound pressure waves generated by pile driving.

As described in detail in Appendix B, the USFWS uses underwater noise thresholds developed by the Marbled Murrelet Hydroacoustic Science Panel (SAIC, 2011) to determine the zones around an impact- driven pile in which two general forms of injury might occur to diving marbled murrelets: (1) auditory injury (generally damage to sensory cells of the ear) beginning at 202 dB SEL cumulative, and (2) non-auditory injury (trauma to non-auditory body tissues/organs) beginning at 208 dB SEL cumulative. Since the underwater criterion for auditory injury was the lower of the two thresholds, this was the criterion used for assessing injurious impacts to the marbled murrelet in this analysis. Currently there are no thresholds or guidelines for installation and extraction of piles with a vibratory driver. Because the sound levels generated by vibratory drivers are typically 20–30 dB lower than impact pile driving and do not produce waveforms with sharp rise times like impact pile driving, the affected areas would be discountably small and potential impacts on marbled murrelets would be discountable.

A maximum of 50 concrete, timber, or HDPE plastic piles could be installed at NAVBASE Kitsap Manchester during the 5 years of proposed MPR activities. As shown in Table B-9 of Appendix B, potentially the most injurious noise levels would extend up to 10 m from an impact-driven 24-in concrete pile (see Figure 7-2 for a representative scenario of the extent of potentially injurious underwater noise from concrete pile installation). Since estimates of the distances to thresholds involve the cumulative energy of all impact strikes over a 24-hour period, the affected area represents the maximum extent of potential auditory injury effects. Earlier in the construction day, the injury zone would be smaller, and only reach the maximum extent after all the pile strikes have been completed.

Impact installation of timber and HDPE plastic would produce sound levels much lower than for steel or concrete pile (Appendix B), with affected areas that would be discountably small.

Airborne noise levels from proposed MPR activities are not expected to be injurious to birds within the study area because the source levels for airborne noise from pile driving (vibratory: 96 dBA at 15 m; impact: 110 dBA at 11 m) are well below those known to cause injury to birds in laboratory situations (Dooling & Popper, 2007). However, the USFWS (2014) has determined that airborne noise due to impact pile driving may behaviorally affect foraging marbled murrelets, based on the findings of the Marbled Murrelet Hydroacoustic Science Panel regarding non-injurious thresholds for pile driving noise (SAIC, 2012). Marbled murrelets typically perform foraging dives in pairs and are highly vocal when they are above the surface (Strachan et al., 1995). On the water's surface, birds typically stay within 100 ft. of their partners during foraging bouts. This behavior is thought to play a role in foraging efficiency, and therefore airborne noise that masks their vocalizations has the potential to affect foraging success (Carter & Sealy, 1990; Strachan et al., 1995). Unlike other noise effects criteria established for injury, the distance from a pile driving source within which communications would be masked is dependent upon ambient noise levels and therefore is site-specific. Masking effects cease immediately when the masking noise stops.

Under typical conditions on the waterfront, communication between foraging murrelets would be compromised by pile driving noise within 42m of the murrelets. This is based on noise produced by impact pile driving <36-in steel piles (USFWS, 2013). The masking zone has not been calculated for 24-in concrete pile, so the masking distance for 24-in steel piles was conservatively applied to 24-in concrete piles. Representative scenarios of areas affected by masking effects are shown in Figure 7-2.

The USFWS (2013) has provided guidance on evaluating the significance of airborne masking effects for pile driving projects. "Typical" pile driving projects involve:

- Installation of 24-in or 36-in steel piles,
- Use of vibratory pile drivers,
- Use of impact pile drivers for proofing only, and
- Adherence to a 2-hour timing restriction (i.e., no pile driving within 2 hours after sunrise and within 2 hours before sunset during the breeding season).

Typical pile driving projects do not result in measurable effects on marbled murrelets because the use of impact hammers is intermittent and of short duration, the 2-hour timing restriction protects murrelets during their most active foraging periods, and murrelet vocalizations are adapted to overcome the effects of ambient noise (USFWS, 2013).

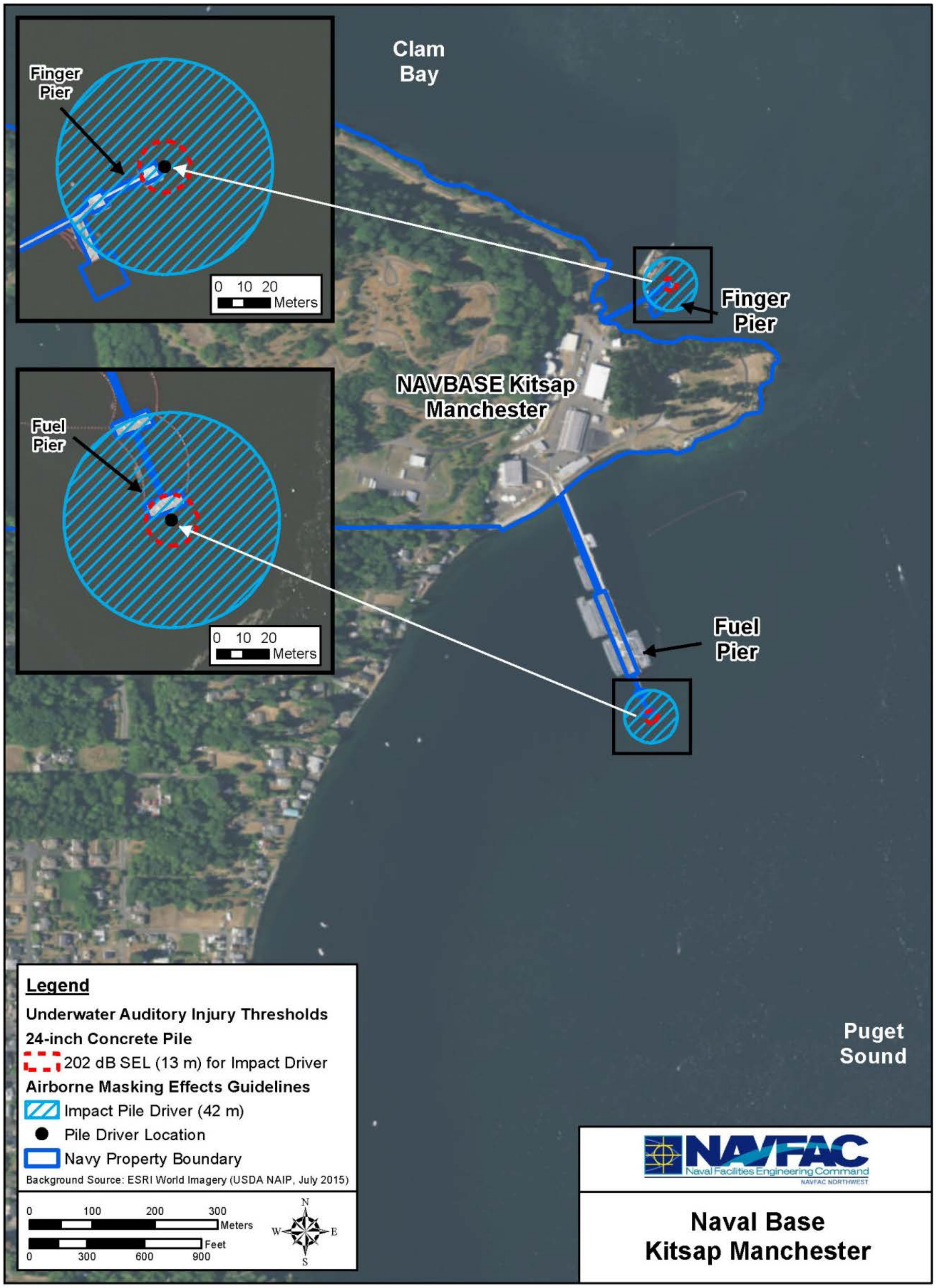

Figure 7-2. Representative Affected Areas for Pile Driving Noise for Marbled Murrelets at NAVBASE Kitsap Manchester

The USFWS guidance does not cover concrete piles, and the potential masking effects of concrete pile installation are likely to be smaller because impact installation of concrete pile generates lower SPLs than steel pile installation (Appendix B, Table B-4).

To prevent exposure to injurious or masking noise levels in the action area for projects at NAVBASE Kitsap Manchester, the Navy would implement the minimization measures and BMPs described in Section 2.5. The Navy would actively monitor the 42-m masking zone (Figure 7-2) because it is larger than the 10-m auditory injury zone for concrete pile installation. The likelihood of marbled murrelet exposure to injurious or masking noise from impact pile driving is discountable because these zones are small and can be effectively monitored during pile driving, and pile driving would cease if monitors detect marbled murrelets (see Appendix D for details) within the threshold distance.

With the implementation of minimization and monitoring actions (Section 2.5), the Navy has determined the Proposed Action “may affect, but is not likely to adversely affect” ESA-listed marbled murrelets. USFWS concurred with the Navy’s determination in a letter dated December 15, 2017. Proposed MPR activities would have no significant impacts on marbled murrelets or other marine bird species due to temporarily elevated underwater and airborne sound levels resulting from impact or vibratory pile driving of all pile types.

Critical Habitat

Because the closest marbled murrelet designated critical habitat to NAVBASE Kitsap Manchester is about 30 mi to west, no noise resulting from proposed MPR activities would reach it. Therefore, a no effect determination was made for designated critical habitat in the vicinity of NAVBASE Kitsap Manchester.

7.3.2.2.5 Marine Mammals

Pile installation and removal during proposed MPR activities at NAVBASE Kitsap Manchester would result in temporarily increased human activity levels and changes in prey availability during project construction. However, project construction would take place at existing marine structures that have relatively high levels of human activity under daily operations, and prey availability changes would be short-term and highly localized, as described in Section 7.3.2.2.3. Because vessels would be operating at slow speeds, no vessel strikes would be expected. Therefore, there would be no significant impact to marine mammals due to increased human activity levels, changes in prey availability, or the potential for vessel strikes.

Effects of Elevated Noise Levels on Marine Mammals

Underwater and airborne noise generated during pile installation and removal has the potential to disrupt the behavior of marine mammals that may be traveling through, foraging, or resting in the vicinity of the project area, as described in detail in Appendix B. The Navy estimates potential impacts to marine mammals by considering the likelihood that each species may be present at NAVBASE Kitsap Manchester during pile driving, determining the sound levels generated by various pile types and installation methods, and applying acoustic threshold criteria (expressed in decibels, dB) established by NMFS for evaluating the potential for injury or behavioral impacts. A detailed explanation of the analytical methods is presented in Appendix B, and the following sections summarize results of the underwater noise analysis.

A maximum of 50 concrete, timber, or HDPE plastic piles could be installed at NAVBASE Kitsap Manchester during the 5 years of proposed MPR activities. As described in detail in Appendix B, the Navy estimated the distances to the various NMFS underwater noise thresholds for injurious and behavioral effects on marine mammals. These distances were estimated by taking into account the source levels for impact and vibratory pile driving of piles at this location, sound propagation over distance from the driven pile, and acoustic impacts thresholds for the various species groups. Figure 7-3 depicts a representative scenario of the extent of potentially injurious and behaviorally harassing underwater noise from concrete pile installation. The area encompassed by the threshold values decreases the closer to shore pile driving occurs and is truncated where shallow water and land block noise transmission.

The likelihood of injury due to pile driving noise is discountable because marine mammals are unlikely to be present in the small affected areas, which would be fully monitored by marine mammal observers during pile driving. As described in Appendix D, pile driving would cease if monitors detect a marine mammal approaching or entering the injury zone.

Pile driving would produce noise above the underwater behavioral harassment threshold during impact and vibratory pile extraction. The loudest impact pile driving noise, resulting from installation of 18-in timber pile, is estimated to affect an area up to 398 m from the driven pile. Impact pile driving noise is not expected to result in behavioral harassment of marine mammals because affected areas can be fully monitored and pile driving would cease.

However, extraction of timber piles would utilize a vibratory pile driver, and the affected area due to the vibratory pile driver would be much larger than the area affected by impact pile installation (due to the low behavioral harassment threshold for continuous sound [120 dB RMS versus 160 dB RMS for impulsive sound]). The greatest risk of exposing marine mammals to behavioral harassment during pile driving would be during vibratory extraction of timber pile because the affected areas would be too large to be fully monitored by marine mammal observes (for details see Appendix D). The affected area could extend up to 2.2 km from the driven pile at NAVBASE Kitsap Manchester.

To assess the potential exposure of marine mammals to above-threshold noise levels during in-water work windows during the 5 years of proposed MPR activities, the likelihood of occurrence of each species was considered along with the number of pile driving days. The Navy used one of three methods for species at NAVBASE Kitsap Manchester, depending on (1) whether site-specific abundance was known, (2) regional densities were known, or (3) the species is so infrequently encountered that densities cannot be determine and other reasoning must be applied. Potential exposures of California sea lions and Steller sea lions were estimated based on known abundances determined by on-site monitoring; exposures of Dall's porpoises, and harbor seals were estimated based on regional density data (Navy, 2015a, Marine Species Density Database); exposures of harbor porpoises were based on density estimates from Smultea et al. (2017); and exposures of the remaining species were estimated through analysis of historical occurrence. Details of the exposure analysis are presented in Appendix B.

Based on the exposure estimates in Table B-19, the species most likely to be impacted are the Steller sea lion, California sea lion, and harbor seal. The Navy would implement a variety of BMPs and mitigation measures, including noise attenuation devices and marine mammal observers that are expected to reduce the estimated impacts. These measures are fully described in Appendix D and summarized in Section 2.5.

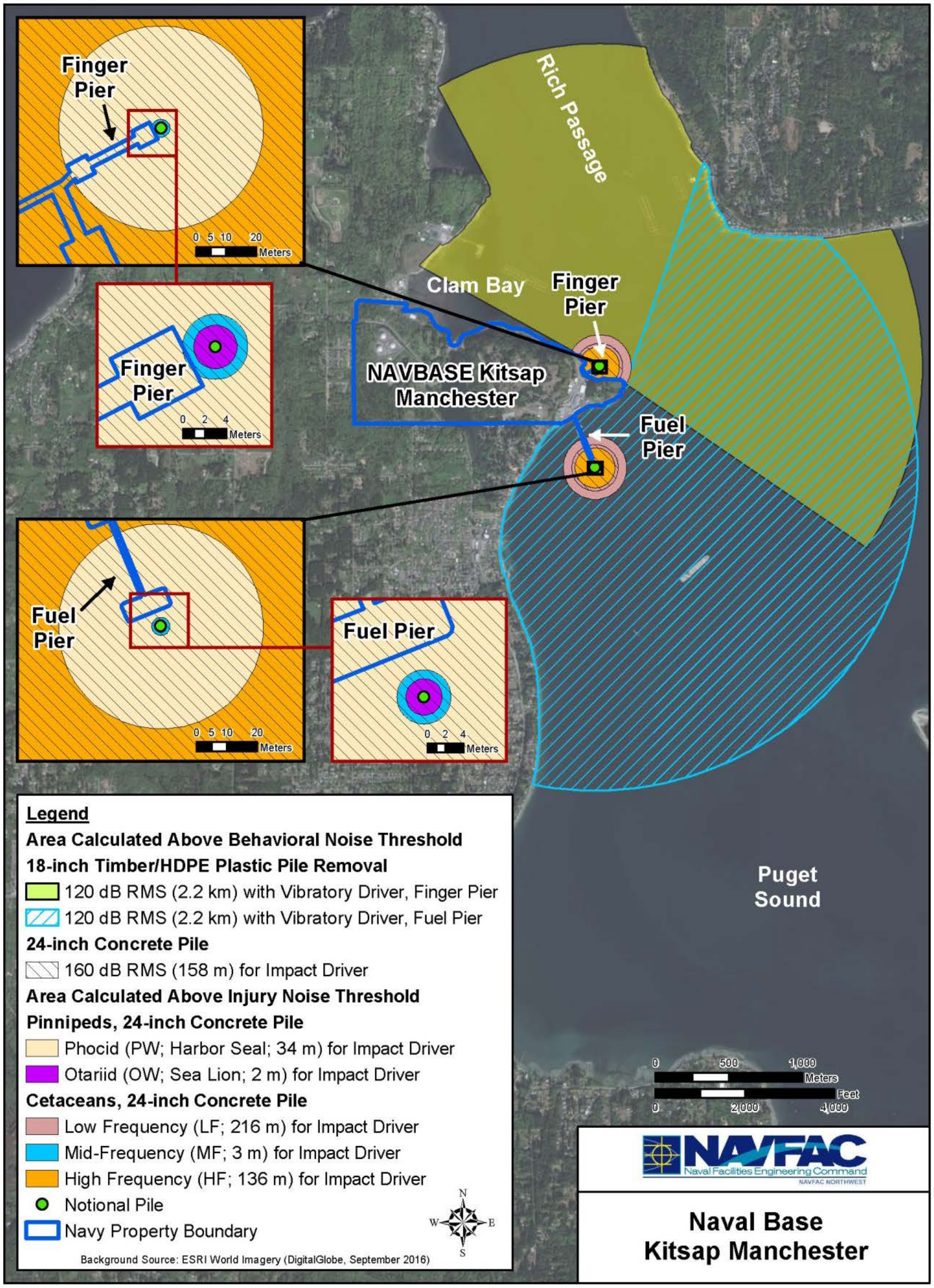

Figure 7-3. Representative Affected Areas for Pile Driving Noise for Marine Mammals at NAVBASE Kitsap Manchester

Individual responses of marine mammals to pile driving noise are expected to be variable. Some individuals may occupy the project area during pile driving without apparent effect, but others may be displaced with undetermined effects. In general, cetaceans like harbor porpoise infrequently transit the waters in the vicinity of NAVBASE Kitsap Manchester and they do not tend to remain there. If they encounter pile driving noise they would likely avoid affected areas. Avoidance of the affected area during pile driving operations would potentially reduce access to foraging areas and inhibit movement through the area. The likelihood of exposure to behavioral disturbance due to pile driving noise would be limited by the infrequent occurrence of cetacean species in the vicinity, and monitoring and shutdown of pile driving if monitors detect cetaceans, as described in Appendix D.

Although ESA-listed cetacean species are infrequently present in the vicinity of NAVBASE Kitsap Manchester, it is possible that they may occur in the behavioral harassment zone undetected by marine mammal observers. Therefore, the Navy concludes that proposed MPR activities at NAVBASE Kitsap Manchester:

- "may affect, and are likely to adversely affect" humpback whales and Southern Resident killer whales because they are infrequently present in the vicinity; and
- "may affect, but are not likely to adversely affect" Southern Resident killer whale designated critical habitat.

NMFS concurred with the Navy's affect determinations for ESA-listed marine mammals, but determined that the Navy's proposed MPR activities "may affect, are likely to adversely affect" Southern Resident killer whale designated critical habitat. The Navy's consultation with NMFS regarding ESA-listed marine mammals and critical habitat was completed with the issuance of a BiOp on April 5, 2019 (Appendix G).

Acoustic exposure estimates from pile driving operations summarized in Appendix B indicate there is the potential for Level B harassment, which has the potential to disrupt animal behavior, as defined by the MMPA. No marine mammals would be exposed at levels that would result in injury or mortality. Other construction activities not associated with pile installation and removal would not result in Level A or B harassment under the MMPA. The Navy consulted with NMFS in compliance with the ESA and the MMPA, and obtained an LOA for Level A injury and Level B harassment of marine mammals. The Final Rule for the LOA was published in the Federal Register on April 17, 2019. Since the exposures are only expected to result in behavioral impacts on an intermittent basis, no long term or permanent impacts are anticipated.

The analysis presented above indicates that proposed MPR activities at NAVBASE Kitsap Manchester may impact individual marine mammals, but any impacts observed at the population, stock, or species level would be negligible. Therefore, there would be no significant impact to marine mammal populations.

7.4 Cultural Resources

7.4.1 Affected Environment

The APE for the Proposed Action at NAVBASE Kitsap Manchester consists of up to two facilities (Table 7-1). All work would occur in or over-water. No on-shore work is planned, and any staging required would occur in previously disturbed or developed areas.

The Finger Pier, built in 1978 and recently reconstructed, has been determined to be not individually eligible for listing in the NRHP (EDAW, 1996) (SHPO concurred with eligibility finding on April 7, 2014).

The fuel pier at Manchester was replaced in 1993 and has not been surveyed for eligibility for the NRHP as it is less than 50 years old, post-dates the Cold War era, and lacks extraordinary significance (Table 7-1).

Most of the land at Manchester has been disturbed through the construction of underground storage tanks and other facilities; therefore, it is unlikely that archaeological resources exist in developed areas. Portions of Manchester, however, have not been disturbed by Navy activities. The undisturbed areas are primarily along the undeveloped shoreline, which is a high probability location for archaeological sites. An archeological survey was conducted in 1995 and three sites were identified. Ground-disturbing activities within the vicinity of these sites would trigger further study to determine the sites' eligibility for the NRHP. The sites are located in a restricted area of Manchester that is not used during normal operations, and is outside the APE for the Proposed Action of contingency pier repair and replacement. There are no recorded submerged historic properties, downed aircraft, or shipwrecks in the APEs. The probability of prehistoric archaeological deposits or features buried within the substrate is very low due to Holocene sea level changes and associated erosion of glacial deposits found along the shoreline of Puget Sound.

Table 7-1. Proposed Action at NAVBASE Kitsap Manchester

Structure Name	*Year Built*	*NRHP Status*	*SHPO Concurrence Date*	*DAHP Log #*	*Note*
Manchester Fuel Pier	1993	N/A			Post-dates Cold War
Manchester Finger Pier	1978	Not Eligible	4/7/2014	040714-12-USN	

7.4.2 Environmental Consequences

7.4.2.1 No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to the baseline cultural resources. Therefore, no significant impacts to cultural resources would occur with implementation of the No Action Alternative.

7.4.2.2 MPR Activities (Preferred Alternative) Potential Impacts

Implementation of proposed MPR activities at NAVBASE Kitsap Manchester would not affect any known NRHP-eligible architectural or archaeological resources. If required, contingency construction activities would take place in previously disturbed areas at the existing Manchester Fuel Pier and Manchester Finger Pier, neither of which is eligible for listing in the NRHP.

In the unlikely event that previously unrecorded archaeological sites were encountered during the construction process, the Navy would stop work in the immediate area and then follow the Section 106 process for inadvertent discovery (36 CFR 800.13), including evaluating the sites for NRHP eligibility, in consultation with the SHPO, affected American Indian tribes, and other interested parties, pursuant to the implementing regulation of the NHPA, other applicable federal laws, and DoD and Navy regulations. Similarly, if American Indian human remains, funerary items, sacred objects, or items of cultural patrimony are encountered, the Navy must comply with the NAGPRA.

Therefore, there would be no impact to cultural resources. The Navy determined that no historic properties at NAVBASE Kitsap Manchester would be affected by the Proposed Action and the SHPO has concurred in a letter dated May 31, 2017.

7.5 American Indian Traditional Resources

7.5.1 Affected Environment

The NAVBASE Kitsap Manchester project site is co-located in the adjudicated U&A fishing area for the Suquamish Tribe. There is a designated Naval Restricted Area at NAVBASE Kitsap Manchester that restricts access during periods when a ship is loading and/or when pier operations preclude safe entry. The Suquamish Tribe does not currently harvest resources from the beaches/waters of NAVBASE Kitsap Manchester.

7.5.2 Environmental Consequences

7.5.2.1 No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to baseline American Indian traditional resources. Therefore, no significant impacts to American Indian traditional resources would occur with implementation of the No Action Alternative.

7.5.2.2 MPR Activities (Preferred Alternative) Potential Impacts

In accordance with Executive Order 13175 and DOD and Navy instructions, the Navy invited the Suquamish Tribe to initiate government-to-government consultation regarding proposed MPR activities and potential impacts to tribal treaty rights. The Tribe requested that additional project details be provided as they become available in the future. Additionally, the Tribe provided comments on the Revised Draft EA, but determined it was not necessary to meet with the Navy to discuss these comments (Baxter, 2019). Government-to-government consultation with the Tribe is complete.

There would be no changes to the status quo regarding tribal access to traditional resources as a result of proposed MPR activities. Construction activities could result in loss of benthic organisms at the immediate project site; however replacement piles would be installed near the location of the removed pile, minimizing the direct loss of benthic invertebrates.

There would be a temporary increase in the volume of barge traffic during pile replacement and maintenance activities as pile delivery and disposal would generally be conducted via barge. However, the increase in barge traffic generated by the proposed MPR activities would be negligible when compared to existing marine traffic in Puget Sound and at NAVBASE Kitsap Manchester.

The in-water work window for each construction year would minimize impacts to all juvenile salmonid species; therefore, significant impacts to juvenile salmonids are not expected. As part of continued engagement, the Navy will annually provide summaries of planned pile repair and replacement projects to the Tribe for information and coordination. Therefore, there would be no significant impact to American Indian traditional resources.

7.6 Summary of Potential Environmental Consequences

Table 7-2. Summary of Environmental Impacts at NAVBASE Kitsap Manchester

Section/ Resource Area	*Environmental Impacts*
Airborne Noise	Temporary construction noise during daytime hours is exempt from maximum permissible noise levels under the WAC and Kitsap County noise regulations. Recreational users on Puget Sound and Rich Passage could experience noise disturbance but not at levels sufficient to cause adverse effects. Therefore, there would be no significant impact to the ambient sound environment.
Water Quality	Direct discharges of waste would not occur. Construction-related impacts would be limited to short-term and localized changes associated with re-suspension of bottom sediments. These changes would be spatially limited to the construction site and areas immediately adjacent. Temporary impacts would not violate applicable state or federal water quality standards. The Navy would implement BMPs and minimization measures to prevent accidental losses or spills of construction debris. Removal of creosote-treated timber piles would improve local water quality. Therefore, there would be no significant impact to water quality.
Sediments	Sediment would be disturbed and re-suspended in the water column during pile removal and pile driving activities. Some degree of localized changes in sediment composition would occur. In particular, sediments that are re-suspended would be dispersed by currents and eventually re-deposited on the bottom. Project-related construction activities would not create sediment contamination concentrations or physical changes that violate state standards or interfere with beneficial uses of Puget Sound near Manchester. Therefore, there would be no significant impact to sediments.
Aquatic Vegetation	Vegetative growth found on existing piles would be removed when those piles are extracted from the water but because piles would be replaced, ultimately a similar amount of surface area on which marine organisms could colonize would exist. Impacts due to turbidity would be short-term, temporary, and localized. Additionally, because aquatic vegetation is distributed outside of the project area, recolonization could occur quickly, and the overall health and abundance of macroalgae and eelgrass would not be compromised. Therefore, there would be no significant impact to aquatic vegetation.
Benthic Invertebrates	As with aquatic vegetation, benthic organisms attached to removed piles would be lost, but new piles would provide equivalent attachment sites for development of the benthic community. Benthic organisms directly adjacent to piles would be lost or displaced. There would be minimal impacts to habitat and benthic organisms from turbidity caused by pile removal and installation and anchor placement and removal, but these effects would be temporary and very localized. Impacts at the population, stock, or species level would be negligible. Therefore, there would be no significant impact to benthic invertebrate populations.

Table 7-2. Summary of Environmental Impacts at NAVBASE Kitsap Manchester (continued)

Section/ Resource Area	*Environmental Impacts*
Marine Fish and EFH	In-water construction may expose fish to increased turbidity but exposure would be localized and temporary. The most significant impact to fish that could occur would be from exposure to elevated underwater noise from impact pile driving. To minimize exposure to noise, pile driving would be conducted during the in-water work window when juvenile salmonids (including ESA-listed salmonids) are least likely to be present. No steel piles are proposed to be installed at Manchester and thus impact pile driving of concrete piles would be conducted intermittently and for an average of 1.5 hours in a day. The Navy has determined that the Proposed Action "may affect, but is not likely to adversely affect" ESA-listed fish species and designated critical habitat and "may adversely affect" EFH. The USFWS has concurred with the Navy's conclusions regarding bull trout. NMFS has concurred with the Navy's conclusions regarding listed salmon, steelhead, and rockfish and EFH. With implementation of minimization measures, there would be no significant impacts to marine fish (including ESA-listed fish) and EFH.
Birds	Construction activities may result in the exposure of marbled murrelets to sound pressure levels above the behavioral guidance criterion. Mitigation measures would be used to reduce the adverse impacts to marbled murrelets, also benefiting other marine birds. No designated critical habitat for the marbled murrelet is located near Manchester; therefore construction activities would not affect designated critical habitat for the species. The Navy has determined that the Proposed Action "may affect, but is not likely to adversely affect" the marbled murrelet, and the USFWS has concurred with the Navy's conclusions. No significant impacts to other marine birds are expected.
Marine Mammals	Vibratory pile extraction at NAVBASE Kitsap Manchester may expose marine mammals to behavioral disturbance due to elevated underwater noise. Mitigation measures would be used to reduce the adverse impacts to marine mammals. The Navy determined that the Proposed Action "may affect, and is likely to adversely affect" ESA-listed humpback whales and Southern Resident killer whales because they are occasionally present in the vicinity; and "may affect, but is not likely to adversely affect" Southern Resident killer whale designated critical habitat. NMFS concluded that the Navy's proposed MPR activities "may affect, are likely to adversely affect" humpback whale species, Southern Resident killer whale, and Southern Resident killer whale designated critical habitat. The Navy consulted with NMFS and will obtain an LOA under the MMPA. While construction activities may impact individual marine mammals, any impacts observed at the population, stock, or species level would be negligible. Therefore, there would be no significant impact to marine mammal populations.
Cultural Resources	Implementation of proposed MPR activities at NAVBASE Kitsap Manchester would not affect any known NRHP-eligible architectural or archaeological resources. If required, contingency construction activities would take place in previously disturbed areas at the existing Manchester Fuel Pier and Manchester Finger Pier, neither of which is eligible for listing in the NRHP. The Navy has determined that the Proposed Action would have no effect on historic properties and the SHPO has concurred. Therefore, there would be no impact to cultural resources.

Table 7-2. Summary of Environmental Impacts at NAVBASE Kitsap Manchester (continued)

Section/ Resource Area	*Environmental Impacts*
American Indian Traditional Resources	There would be no changes to the status quo regarding tribal access to traditional resources as a result of proposed MPR activities. The Suquamish Tribe does not currently harvest resources from the beaches/waters of NAVBASE Kitsap Manchester. Construction activities could result in the loss of benthic organisms at the immediate project site; however, replacement piles would be installed near the location of the removed piles, minimizing the direct loss of benthic invertebrates. The in-water work window for each construction year would minimize impacts to all juvenile salmonid species; significant impacts to juvenile salmonids are not expected. Therefore, there would be no significant impact to American Indian traditional resources.

8 Zelatched Point Affected Environment and Environmental Consequences

8.1 Airborne Noise

8.1.1 Affected Environment

Airborne sound at the Zelatched Point Pier is primarily produced by intermittent vessel traffic and is anticipated to be relatively quiet the majority of time. Weather conditions such as wind or rainfall are variable and can increase ambient sound levels in undeveloped areas, but these are rarely accounted for in models (WSDOT, 2018). Airborne ambient sound measurements have not been measured at Zelatched Point Pier. Rural noise levels are around 35 to 40 dBA (WSDOT, 2018). Noise analyses on rural sites in the San Juan Islands, which are similar to Zelatched Point in their level of development, identified an ambient level of about 35 dBA, with regular noise intrusions from traffic and aircraft overflights ranging from 45 to 72 dBA (WSDOT, 1994 as cited in WSDOT, 2018).

No sensitive noise receptors have been identified near Zelatched Point. Dosewallips State Park and the eastern boundary of Olympic National Park are approximately 3 mi from Zelatched Point. Residential development is sparse and generally one residence per 5 acres or more. Operations at Zelatched Point are not continuous and are only performed when research, development, testing and evaluation (RDT&E) activities occur in Dabob Bay. Recreational activities such as boating, kayaking, shellfish harvesting, and fishing in Dabob Bay occur adjacent to the project site.

The State of Washington and Jefferson County have developed maximum permissible environmental noise levels for receiving properties. However, both Washington and Jefferson County have exempted noise generated by temporary construction activities. Permissible noise levels and exceedance allowances are discussed in Section 3.1.

8.1.2 Environmental Consequences

8.1.2.1 No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to baseline airborne noise. Therefore, no significant impacts to airborne noise would occur with implementation of the No Action Alternative.

8.1.2.2 MPR Activities (Preferred Alternative) Potential Impacts

Construction associated with proposed MPR activities would result in temporarily elevated underwater and airborne noise levels. Noise would be generated from support vessels, small boat traffic, and barge-mounted equipment, such as generators, and pile extraction and installation equipment. Noise levels from all activities except pile driving would typically not exceed ambient sound levels resulting from routine waterfront operations in the vicinity of any of the structures in the proposed MPR activities locations. The most significant project-related noise source would be impact pile driving of steel piles (WSDOT, 2018).

Construction noise would be temporary between July 16 and February 15 over 5 years for a total of 20 pile driving days. The maximum duration of pile driving in a single day would be up to 1.5 hours of impact pile driving or 4.5 hours of vibratory pile driving. Elevated noise levels during pile driving may be noticeable in residential areas but, as stated above, temporary construction noise is exempt from maximum permissible noise levels under the WAC and Jefferson County noise regulations.

8.2 Water Resources and Marine Sediments

8.2.1 Affected Environment

8.2.1.1 Water Quality

WDOE has established designated uses for Dabob Bay as follows: extraordinary (aquatic life uses); primary contact (recreation); shellfish harvesting; and wildlife habitat, commerce and navigation, boating, and aesthetics (miscellaneous uses) (WAC 173-201A-612). Several areas within Dabob Bay are listed in the WDOE 303(d) list of impaired waters for fecal coliform (WDOE, 2017a). The main sources of fecal coliform affecting these areas include failing sewage systems and/or poor pasture management. However, no waters at or near Zelatched Point are assessed or on the 303(d) list as impaired. The closest area classified is off Pulali Point about 1.7 mi northwest of Zelatched Point (Category 2 for fecal coliform).

The Navy conducts test activities within the nearshore environment and cause short-term, temporary increases in turbidity. However, these disturbances do not permanently disrupt nearshore sediments, and hazardous constituents are not associated with these activities. In 2001, NUWC Keyport commissioned a field study to document water and sediment quality conditions in Dabob Bay (Battelle, 2001). Laboratory analysis results for seawater and sediment samples indicated that metal concentrations were low in Dabob Bay, compared to background levels present in non-urban portions of Puget Sound. Water quality is also sampled in the vicinity of the project at shellfish farms by the Washington Department of Health. Farms met the 2014 Approved classification for commercial shellfish harvest direct marketing based on data from 2010 through 2014 (Washington Department of Health, 2015). This classification is based on marine water samples collected throughout the year and less frequent shoreline surveys.

8.2.1.2 Marine Sediments

The nearshore substrates at Zelatched Point include mud, sand, and shell hash (Frierson et al., 2016e). No marine sediments at or near Zelatched Point are assessed or listed in the current WDOE 303(d) impaired list (WDOE, 2017a). In 2001, sediments were collected at 14 deep-water locations in Dabob Bay (Battelle, 2001). Sediments were characterized as fine grained (muddy), and contained silt (ranging from 35 to 58 percent), clay (approximately 50 to 65 percent, with one station at only 14 percent), and sand (all stations but one less than 2.5 percent). None of the sediment samples tested exceeded the SQS. In 2001, sediment samples collected in Dabob Bay revealed that metal concentrations in the sediment were consistent with concentrations present in other non-urban bays in Puget Sound.

8.2.2 Environmental Consequences

8.2.2.1 No Action Alternative

8.2.2.1.1 Water Quality

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to baseline water quality. Therefore, no significant impacts to water quality would occur with implementation of the No Action Alternative.

8.2.2.1.2 Marine Sediments

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to baseline marine sediments. Therefore, no significant impacts to marine sediment would occur with implementation of the No Action Alternative.

8.2.2.2 MPR Activities (Preferred Alternative) Potential Impacts

8.2.2.2.1 Water Quality

Direct discharges of waste to the marine environment would not occur during proposed MPR activities. Impacts to water quality would be limited to short-term and localized changes associated with re-suspension of bottom sediments from pile removal and installation and barge and tug operations, such as anchoring and propeller wash. These changes would be spatially limited to the construction site and areas immediately adjacent.

Construction-related impacts would not violate applicable state or federal water quality standards discussed in Section 3.2. BMPs and minimization measures, discussed in Section 2.5, would be implemented to prevent accidental losses or spills of construction debris into Dabob Bay. In addition, removal of existing creosote-treated timber piles would improve localized water quality conditions in the project area. Therefore, no significant impacts to water quality are expected.

8.2.2.2.2 Marine Sediments

Some degree of localized changes in sediment composition would occur as a result of in-water construction during proposed MPR activities. In particular, sediments that are re-suspended by pile installation and removal activities would be dispersed by currents and eventually re-deposited on the bottom. Depending on the distance suspended sediments would be transported from shallow to deeper portions of the fuel pier project site or fine-grained sediments would be transported from deeper to shallower areas. The distance over which suspended sediments are dispersed would depend on a number of factors, such as the sediment characteristics, current speeds, and distance above the bottom.

There would be no direct discharges of wastes, to the marine environment during construction. Therefore, construction-related impacts to sediment quality would be limited to localized changes associated with disturbances of bottom sediments from replacement of up to 20 piles over a 5-year period. Setting spuds and anchors for the barges, and propeller wash from tugs used for pile removal and installation represent other construction-related sources for disturbances of bottom sediments.

Project-related construction activities would not create sediment contamination concentrations or physical changes that violate state standards or interfere with beneficial uses of Dabob Bay near Zelatched Point. Therefore, there would be no significant impact to sediments.

8.3 Biological Resources

8.3.1 Affected Environment

8.3.1.1 Aquatic Vegetation

Eelgrass and sargassum beds were documented at depths of 16 ft. and 33 ft. at Zelatched Point during a scuba survey conducted in February 2015 (Frierson et al., 2016e). Eelgrass is abundant along the intertidal and subtidal areas of the entire Hood Canal as well as Dabob Bay. Sparse and patchy distribution of eelgrass occurs on the west side of Dabob Bay.

Representative macroalgae found within the littoral zone of Hood Canal and Dabob Bay include *Ulva* and *Fucus*. Sargassum is also present but is absent during winter. In the subtidal zone, the flora is dominated by a host of red algal species. As with intertidal algae, kelp is poorly represented in the area and is characterized by *Saccharina* spp., *Agarum fimbriatum*, and *Costaria costata*. Kelp is patchily distributed along the coastline of Dabob Bay, and few areas of continuous kelp beds can be found. In the areas where kelp is found, it usually occurs to a depth of approximately 66 ft., depending on light levels (Mumford, 2007). From the available data, eelgrass beds in the vicinity of Zelatched Point would be expected to be present in both patchy and continuous areas, along with some red and green algae, with kelp largely absent.

8.3.1.2 Benthic Invertebrates

No benthic invertebrate sampling has been conducted at Zelatched Point; however, a 2015 ROV fish survey around the pier documented numerous anemones attached to the pier piles and clam shells on the substrate beneath the pier (Frierson et al., 2016e). Benthic invertebrates found in waters of Zelatched Point are comparable to those generally found throughout Puget Sound and at the other locations. Species likely to occur in Puget Sound are described in Section 3.3.2.2.

8.3.1.3 Marine Fish

8.3.1.3.1 Non-ESA-Listed Fish Species

Fish surveys were conducted at Zelatched Point in February of 2015 using scuba and split-beam echosounder methods. A single scuba survey was concentrated within the depths ranging from 5 m to 15 m and the echosounder survey ran parallel to shore at depths from 15 m to 160 m deep. Only three adult copper rockfish were observed during the surveys (Frierson et al., 2016e).

Beach seine surveys were conducted in 2016 along the eastern shoreline of Zelatched Point pier between February and September (except April) and very high densities of chum salmon were encountered (Frierson et al., 2017c). A total of 18 fish species were collected with northern anchovy accounting for 65 percent of the total catch over the 7 months of sampling. Chum (11.5 percent), shiner perch (11.3 percent), and pink salmon (6.4 percent) were also collected in high densities (Frierson et al., 2017c).

Only small numbers of post larval forage fish (sand lance, surf smelt, and Pacific herring) were collected during the 2003 surveys. Forage fish spawning occurs along the shorelines of northern Dabob Bay and Quilcene Bay, approximately 12 km and 10 km, respectively, north of Zelatched Point (Figure 3-4) (Bahls, 2004). During 2016 beach seine surveys one Pacific herring was collected and one large catch (as previously noted) of northern anchovy (Frierson et al., 2017c). Herring spawning grounds are documented in Quilcene Bay as well as across from Zelatched Point along the west side of Dabob Bay (Stick et al., 2014). There have been no recent forage fish surveys conducted within the vicinity of Zelatched Point. WDFW does not identify presence of surf smelt or sand lance spawning areas at or near Zelatched Point (WDFW, 2017).

8.3.1.3.2 ESA-Listed Fish and Critical Habitat

ESA-listed fish species that may occur along or within the vicinity of Zelatched Point include Puget Sound Chinook salmon; Hood Canal summer-run chum salmon; Puget Sound steelhead; and Puget Sound/Georgia Basin DPSs of bocaccio and yelloweye rockfish. Bull trout, southern DPS Pacific eulachon, and southern DPS North American green sturgeon are unlikely to occur within the vicinity of Zelatched Point.

Two genetically distinct populations of Puget Sound Chinook Salmon occur in Hood Canal, which include the Skokomish River stock and the Mid-Hood Canal stock that is composed of the Hamma Hamma, Duckabush, and Dosewallips subpopulations (Weinheimer, 2015). Documented spawning and rearing occur in these river systems which are located on the west side of Hood Canal, across from Zelatched Point (WDFW, 2015a). The Mid-Hood Canal population status is currently rated as critical. The Skokomish Chinook population is currently rated as depressed because of chronically low natural escapements (Weinheimer, 2015). Juvenile Chinook outmigration studies found that smolts were primarily found in nearshore areas on the east side of Hood Canal in the top few meters of water column (Schreiner et al., 1977; Bax et al., 1978, 1980). During beach seine surveys in 2016, small numbers of Chinook were collected (Frierson et al., 2017c).

There is documented presence of Hood Canal summer-run chum in Fulton and Anderson Creeks. Spawning occurs in the Dosewallips and Duckabush rivers, and the Big Quilcene River is utilized by the Hood Canal summer-run ESU chum for spawning and rearing (Figure 3-4) (WDFW, 2015a). Juveniles and adults occur near Zelatched Point as recorded during beach seine surveys where the months of March and April were high density months (Frierson et al., 2017c).

Within the Puget Sound DPS steelhead, the West Hood Canal Winter-Run steelhead demographically independent population occurs within the waters near Zelatched Point. It is composed of winter steelhead from the Hamma Hamma, Duckabush, and Dosewallips rivers, and Quilcene River/Dabob Bay (Weinheimer, 2015). This population likely consists of only a few hundred fish based on recent stream surveys (Weinheimer, 2015). There is documented presence of Puget Sound winter steelhead in the Little Quilcene, Big Quilcene, Dosewallips, and Duckbush River as well as Indian George Creek, Spencer Creek, and presumed presence within an unnamed creek southeast of Zelatched Point. Spawning occurs in Little and Big Quilcene Rivers and in the Duckabush River. Steelhead rear in Big Quilcene, Dosewallips, and Duckabush rivers (WDFW, 2015a). Juvenile and adult Puget Sound steelhead are likely to occur near Zelatched Point. Given their brief nearshore residence time (Moore et al., 2010b), they are likely to occur in small numbers.

The only core areas currently supporting anadromous populations of bull trout are located within the Puget Sound and Olympic Peninsula regions (USFWS, 2015b). Occurrence of Bull trout near Zelatched Point is anticipated to be rare. Bull trout require cold, clean, complex, and connected habitat of which do not occur at this location. The only drainage to Hood Canal utilized by bull trout is the Skokomish River (WDFW, 2004; USFWS, 2015b). However, in a recent BiOp, the USFWS noted summaries of recent tagging studies indicated that bull trout in the South Fork Skokomish River are not anadromous, and Cushman Dam currently blocks all upstream access and most downstream access to the marine environment for bull trout in the North Fork of the Skokomish River (USFWS, 2011). However, historical observations of bull trout in accessible anadromous reaches of several west Hood Canal tributaries (Big Quilcene, Dosewallips, Duckabush, and Hamma Hamma Rivers) are noted from the 1980s (Hilgert in litt. 2000, as cited by USFWS, 2009a). Spawning was not believed to occur in these rivers and bull trout were presumed to use Hood Canal marine waters as a migration corridor (USFWS, 2009a). Further, no bull trout have been collected during historic surveys or during more recent survey efforts conducted in Hood Canal using beach and lampara seines and tow nets (Schreiner et al., 1977; Salo et al., 1980; Bax, 1983; SAIC, 2006; Bhuthimethee et al., 2009; Frierson et al., 2016a,e, 2017a,c). Based on this information and the lack of documented anadromy from the Skokomish River core population, bull trout are unlikely to migrate past Zelatched Point from the Skokomish River (USFWS, 2011).

Adult Puget Sound/Georgia Basin DPSs of bocaccio and yelloweye rockfish, as well as juvenile yelloweye rockfish typically occur in waters deeper than 30 m that have habitat composed of complex bathymetry with slopes and areas of high rugosity. These areas occur within Hood Canal but were absent from Dabob Bay, near Zelatched Point during hydroacoustic surveys between 15 m and 160 m depths (Frierson et al., 2016e). Historical sightings of bocaccio in Hood Canal have been very low (NMFS 2014b). Recent sightings of bocaccio have been confirmed in Puget Sound, but none from Hood Canal. These observations are from WDFW ROV surveys and a NOAA genetic study using hook-and-line gear. Recent WDFW ROV surveys and a NOAA genetic study using hook-and-line gear found that yelloweye rockfish were well-distributed within the central portion of Hood Canal and including areas near Zelatched Point and south. They were always found in association with very specific habitats that include steep slopes/walls with high complexity (Pacunski, 2017). No bocaccio were recorded during surveys in Dabob Bay (Frierson et al., 2016e). Further, the shallow areas of Dabob Bay as well as the deltas of the Hamma Hamma, Quilcene, Duckabush, and Dosewallips Rivers are relatively muddy habitats, lacking holdfast for kelp where juvenile bocaccio would occur (NMFS, 2014a). Eelgrass, which is also habitat utilized by juvenile rockfish is present underneath the Zelatched Point pier and although bocaccio juveniles could utilize this habitat, recent surveys (primarily focused on adults) have not documented bocaccio in Hood Canal (Frierson et al., 2016e; Pacunski, 2017).

Occurrence of southern DPS Pacific eulachon and southern DPS North American green sturgeon in Hood Canal and Dabob Bay is expected to be rare. NMFS (2010) reported no historical catch records of eulachon in Hood Canal. Although very low numbers of eulachon were caught during Hood Canal shoreline surveys from 2005 through 2008, it is suspected that these fish were misidentified and were actually smelt that were collected. Further, eulachon are most commonly found in schools rather than individually or in small numbers as recorded during the Hood Canal shoreline surveys (Longenbaugh, 2010). Surveys conducted in 2014, 2015, and 2016 also did not record any presence of eulachon (Frierson et al., 2016a, 2017c). Additionally, there are no eulachon spawning rivers in Puget Sound. The nearest regular eulachon spawning habitats are the Elwha River on the Olympic Peninsula and the Fraser River in British Columbia. As discussed in 3.3.2.3.2, no green sturgeon have been documented in Hood Canal and likely would not occur in Dabob Bay. Based on this information, Pacific eulachon and green sturgeon are not expected in Dabob Bay, near Zelatched Point or in Hood Canal in general.

Critical Habitat

Puget Sound Chinook and Hood Canal summer-run chum have designated critical habitat in Dabob Bay. However, the DoD lands are exempt by federal law (70 FR 52630). Critical habitat is designated, but outside Zelatched Point boundaries. Section 3.3.2.3.2 lists the designated critical habitat PCEs for these species.

Nearshore critical habitat for bocaccio and deepwater critical habitat for both listed rockfish species is designated in Dabob Bay. As stated above for Puget Sound Chinook and Hood Canal summer-run chum, DoD lands are exempt from critical habitat designation (79 FR 68041). Critical habitat is designated, but outside Zelatched Point boundaries. Section 3.3.2.3.2 lists the designated critical habitat attributes of the nearshore and deepwater essential features for these ESA-listed rockfish species.

Critical habitat is designated for bull trout in Dabob Bay along the nearshore areas extending out to a depth of 33 ft. (75 FR 63898); however, it is excluded from designation within open water training and testing areas in Dabob Bay and connecting waters of Dabob Bay Range Complex at Zelatched Point (75 FR 63945). Section 3.3.2.3.2 lists designated critical habitat PCEs for bull trout.

8.3.1.3.3 Essential Fish Habitat

Coastal pelagic EFH designations are based on the geographic range and in-water temperatures where these species are present during a particular life stage (PFMC, 2016a) and these boundaries include the waters of Zelatched Point. The nearshore substrates composed of mud, sand, and shell hash as well as presence of vegetated bottoms along the Zelatched Point waterfront provide Pacific coast groundfish EFH for various life stages of species of groundfish (PFMC, 2016b). The marine environment of Zelatched Point provides Pacific coast salmon EFH for various life stages of Chinook, pink, and coho salmon (PFMC, 2014). Fall Chinook utilize the Dosewallips, Duckabush, and Big Quilcene rivers for spawning and rearing habitat. Fall Chinook utilize Tarboo Creek for spawning as well. Coho utilize several creeks on the opposite site of Dabob Bay for rearing and spawning habitat. One unnamed creek, accessed from the south side of the point, is utilized by coho. Odd year pink salmon spawn in the Dosewallips and Duckabush rivers (WDFW, 2015a). All three Pacific Coast salmon species could use the marine habitat near Zelatched Point on their way to or from these freshwater systems.

Eelgrass is an HAPC for Pacific Coast groundfish and Pacific Coast salmon and is present within the project area.

8.3.1.4 Birds

Migratory birds encountered at Zelatched Point include those described in Section 3.3.2.4. Several bald eagle nests have been documented in the northern portion of Dabob Bay since the mid-1990s. The current status of all nest sites is unknown, however at least three are known to have been active in 2005. Eagles also concentrate in the area for feeding during salmon, sand lance and midshipman spawning seasons (spring and fall) (WDFW, 2011).

The WDFW Priority Habitat and Species Maps interactive website does not indicate the presence of marbled murrelet nests in the upland areas including and adjacent to Zelatched Point (WDFW, 2017). Marbled murrelets may occur in the waters near Zelatched Point, as WDFW surveys of Hood Canal, including Dabob Bay, detected marbled murrelets during the in-water work window (Pearson & Lance, 2013, 2014, 2015, 2016).

8.3.1.5 Marine Mammals

Any of the species listed in Table 3-7 has the potential to occur in the vicinity of Zelatched Point. The harbor porpoise and harbor seal are likely to occur at this location. No shore-based surveys have been conducted for harbor seal at this location, but vessel surveys reported them (HDR, 2012). Known haulouts occur on the west side of Hood Canal at the mouth of the Dosewallips River and on the western and northern shorelines in Dabob Bay located approximately 2.3 mi away from Zelatched Point

(Figure 3-7). According to data from WDFW, harbor seal pupping occurs from June to August in this area of the Puget Sound. Sightings of harbor porpoise in Hood Canal (Figure 1-1) north of the Hood Canal Bridge have increased in recent years (Calambokidis, 2010). During line transect vessel surveys conducted in the Hood Canal in 2011 for the Test Pile Program near NAVBASE Kitsap Bangor and Dabob Bay in the vicinity of Zelatched Point (HDR, 2012), an average of six harbor porpoises were sighted per day in the deeper waters. Group sizes ranged from 1 to 10 individuals. Haulouts of Steller sea lion and California sea lion at NAVBASE Kitsap Bangor are over 8.5 mi from Zelatched Point. Therefore, the sea lion species are not expected to frequent waters off of Zelatched Point.

The remaining species are considered relatively uncommon or rare at this location. Humpback whales are not expected to occur in the waters near Zelatched Point because very few sightings have been documented in Hood Canal. Single humpback whales were observed in Hood Canal for several weeks in January and February 2012 (Calambokidis, 2012; Orca Network, 2016) and in 2015 (Orca Network, 2016). One sighting in Hood Canal was reported in January 2016 (Orca Network, 2017). Review of the 2012 sightings information indicated they were of one individual (Calambokidis, 2012). Prior to the 2012 sightings, there were no confirmed reports of humpback whales entering Hood Canal (Calambokidis, 2012). Construction of the Hood Canal Bridge occurred in 1961 and could have contributed to the lack of historical sightings (Calambokidis, 2010).

Southern Resident killer whales are not expected to occur in the waters near Zelatched Point because they have not been reported in Hood Canal, including Dabob Bay, since 1995 (NMFS, 2006b). Southern Resident killer whales were historically documented in Hood Canal by sound recordings in 1958 (Ford, 1991), a photograph from 1973, sound recordings in 1995 (Unger, 1997). Other anecdotal accounts of historical use may have been transient whales (NMFS, 2006b; Orca Network, 2016). Transient killer whales were observed for lengthy periods in Hood Canal in 2003 (59 days) and 2005 (172 days) between the months of January and July (London, 2006), but were not observed again until 2 days in March, 1 day in April, and 8 days in May 2016. On at least one of the days in May 2016, these whales were seen in Dabob Bay (Orca Network, 2016).

8.3.2 Environmental Consequences

8.3.2.1 No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to baseline biological resources. Therefore, no significant impacts to biological resources would occur with implementation of the No Action Alternative.

8.3.2.2 MPR Activities (Preferred Alternative) Potential Impacts

8.3.2.2.1 Aquatic Vegetation

Any debris from pile removal during proposed MPR activities would be collected, disposed of in a state-approved landfill or recycled, and would not impact marine vegetation. Shading of existing vegetation would not change as no expansion of existing structures or new over-water structures is proposed; therefore, shading of existing vegetation is not discussed. Any shading that occurs from barges would be temporary in nature, and would have no significant effect on marine vegetation. Marine surveys have shown that eelgrass is present in Dabob Bay and that subtidal algal species occur in the area. Decreased water and sediment quality can impede the growth of marine vegetation important to fish and other animals, and promote the growth of harmful algae.

Pile driving-related impacts to water quality during proposed MPR activities would be limited to temporary and localized changes associated with re-suspension of bottom sediments during construction. As indicated in Section 8.2.1.3 above, no sediments in the area have been assessed as contaminated. Pile driving activities would not discharge contaminants or otherwise appreciably alter the concentrations of trace metal or organic contaminants in bottom sediments. Sediments would settle back in the general vicinity from which they rose. Indirect effects to macroalgae and eelgrass from changes in sediment quality and sedimentation during construction would be temporary and would not affect the overall health or distribution of marine vegetation near the project area. Proposed MPR activities would not result in violations of water quality standards and would, therefore, maintain water quality for marine vegetation in the vicinity of the project area.

Direct removal of marine vegetation during proposed MPR activities could occur through anchor and spud placement, and removal of up to 20 deteriorating piles. Where possible, anchors and spuds would not be placed in existing eelgrass beds. Any vegetative growth found on existing piles would be removed when those piles are extracted from the water but because piles would be replaced, ultimately a similar amount of surface area on which marine organisms could colonize would exist. Because marine vegetation does not occur densely in the area, direct removals should be minimal. Additionally, because marine vegetation is distributed outside of the project area, the overall health and abundance of macroalgae and eelgrass would not be compromised. Therefore, proposed MPR activities would have no significant direct or indirect impacts on marine vegetation.

8.3.2.2.2 Benthic Invertebrates

Proposed MPR activities at Zelatched Point would impact benthic communities through the disruption of the sediment surface and subsurface during the installation and removal of each pile, and from anchor and spud placement for the barges. Depending upon the species, impacts to individual benthic organisms could range from temporary disturbance to mortality. Some benthic organisms would be physically crushed and lost within the footprint of the piles, as well as from barge anchors and spuds.

Indirect impacts to habitat and benthic organisms are likely to result from turbidity caused by driving and removing barge anchors, spuds, and piles. The area near the pile replacement footprint would have higher levels of turbidity. Disturbed sediments would eventually redeposit upon the existing benthic community. Impacts from increased turbidity levels would likely result in short-term loss of localized areas of the benthic community. Most affected areas would experience some reduction in diversity and abundance of benthic species. However, benthic organisms, particularly annelids, are very resilient to habitat disturbance and are likely to recover to pre-disturbance levels in less than 2 years (CH2M Hill, 1995; Parametrix, 1994, 1999; Romberg et al., 1995; Anchor Environmental, 2002). Therefore, proposed MPR activities would have no significant impacts on benthic invertebrates.

8.3.2.2.3 Marine Fish

Non-ESA-Listed Fish

Turbidity

Resident marine fish are expected to be present within the vicinity of the project area and are likely to occur during the in-water work window established for juvenile salmonid avoidance. In-water work could produce measurable, temporary increases in turbidity and sedimentation, and that could cause fish to temporarily avoid the areas near construction. However, construction activities would not result in persistent increases in turbidity levels or cause changes that would violate water quality standards because processes that generate suspended sediments, which result in turbid conditions, would be short-term and localized and would disperse and/or settle rapidly (within a period of minutes to hours after construction activities cease). Further, removal of existing creosote-treated timber piles would improve localized water quality conditions in the project area. Effects would be short-term and small in scale during construction and, if creosote piles are removed, beneficial to water quality post-construction. Eelgrass and other vegetation is present under the pier at Zelatched Point. Exposure of this vegetation and benthic invertebrates to pile repair and replacement activities would be temporary and limited to discrete areas of pile removal/replacement. Placement of the piles and associated disturbance activities (i.e., support vessels, construction barge) may cause a loss to benthic prey either existing within the pile footprint or disturbance from turbidity which may impact fish use of that area for seeking prey. Impacts would be short-term, localized, and limited to the duration of pile installation and would not be expected to significantly impact fish ability to seek prey outside of the project areas. With implementation of impact avoidance and minimization measures (see Section 2.5), no significant impacts to non-ESA-listed marine fish from turbidity and sedimentation are anticipated from the proposed MPR activities.

Underwater Noise

Proposed MPR activities would result in increased underwater noise levels. Noise would be generated from support vessels, small boat traffic, and barge-mounted equipment, such as generators, and pile extraction and installation. Noise levels from all activities except pile driving would typically not exceed underwater sound levels resulting from existing routine operations at Zelatched Point. The most significant underwater noise potentially affecting fish would be from impact pile driving of steel piles. To minimize impacts to fish, piles would be installed initially with a vibratory pile driver until either the pile hits refusal, necessitating an impact hammer to reach required depth, or for proofing piles to verify structural capacity. Since vibratory pile drivers typically generate noise levels from 10 to 20 dB lower than impact pile driving and do not produce waveforms with sharp rise times like impact pile driving, impacts on fish are typically not observed in association with vibratory pile driving (WSDOT, 2018).

A maximum of 20 steel, concrete, or timber piles could be installed at Zelatched Point during the 5 years of proposed MPR activities if all estimated emergent pile replacement projects occur. Impact pile driving of a 30-in diameter steel pile would create underwater noise that could expose fish to noise above the peak threshold as well as the cumulative SEL thresholds (Table B-9 of Appendix B). Fish would be expected to be exposed differently to elevated noise levels and they could behave differently in their reaction to noise. Some fish are migrating through the area and may pass through the thresholds above the behavioral disturbance zone (estimated to 2,900 m). Other fish are resident to the area and may not move away and thus would be exposed to injurious noise levels for the duration of pile driving activity (Hastings & Popper, 2005). To minimize exposure to noise above the injurious and behavioral disturbance thresholds, a bubble curtain or other noise attenuation device would be used during impact pile driving of steel piles and all pile driving would be conducted during the in-water work window of July 16 through January 15 when juvenile salmonids are least likely to be present. With implementation of these minimization measures and those listed in Section 2.5, no significant impacts to non-ESA-listed fish from underwater noise would result from the proposed MPR activities.

ESA-Listed Fish and Critical Habitat

<u>Turbidity</u>

As discussed above, in-water work could produce measurable, temporary increases in turbidity and sedimentation, and that could cause ESA-listed fish and their forage fish to temporarily avoid the areas near construction. Because, in-water work would occur during the approved in-water work window of July 16 through January 15, juvenile ESA-listed salmonids are least likely to be present. Adult life stages of Chinook, chum, steelhead, bocaccio and yelloweye rockfish as well as juvenile yelloweye rockfish, if present, would occur further offshore and beyond any impacts associated with turbidity during in-water construction. Juvenile bocaccio have the potential to utilize the nearshore aquatic vegetation (eelgrass and kelp) as rearing habitat. However, these species have not been documented in recent surveys in Hood Canal (Frierson et al., 2016e; Pacunski, 2017). Peak rockfish larvae occurrence in Hood Canal occurs outside the in-water work window in April to May with small presence during the early part of the work window and absence from surface waters by November (Green & Godersky, 2012). Bull trout, green sturgeon, and eulachon are not expected to occur in the vicinity of Zelatched Point. Therefore, no significant impacts to ESA-listed fish or their forage base from turbidity would result from the proposed MPR activities.

<u>Underwater Noise</u>

In-water work would occur during a period when juvenile salmonids are least likely to be present and thus exposure to injurious impacts is not expected. Juvenile bocaccio and canary rockfish have the potential to rear within the vicinity of Zelatched Point because eelgrass and some kelp are present. However, the lack of canopy kelp habitats adjacent to structures proposed for pile driving work and intermittent nature of impact pile driving would preclude measurable impacts to juvenile bocaccio. Bull trout presence near Zelatched Point is expected to be rare and Pacific eulachon are not expected within the vicinity. Larger juveniles as well as adult life stages of Chinook, chum, bocaccio, and yelloweye rockfish as well as juvenile yelloweye rockfish may be exposed to noise above the cumulative SEL injury thresholds as these zones would extend offshore and over deeper water where these life stages may be present. However, steel piles would be installed using a vibratory pile driver to the extent practicable with impact pile driving primarily used for proofing piles. A bubble curtain or other noise attenuation device would be used during impact pile driving of which would occur intermittently and for an estimated maximum duration of 1.5 hours in a day. Exposure to noise above the cumulative SEL injurious threshold would be unlikely to occur to fish migrating through the effected zone because, if present, they would be unlikely to remain long enough to accumulate energy from intermittent pile strikes and in this limited pile driving time. Rockfish that may be present and remain stationary would likely not encounter any measurable impacts as the limited time required for impact pile driving steel piles in a day would only accumulate enough energy to fully extend out to the maximum distance if all strikes were needed in a day.

Concrete and/or timber piles could also be installed; of the two, concrete would generate the highest SPLs. However, the area in which noise would be generated above the injury and behavioral thresholds is significantly smaller than for steel piles. Impact pile driving concrete piles is estimated to last a maximum duration of 4 hours per day or an average of 1.5 hours a day. However, there are no known documented incidents of fish injury occurring from pile driving of concrete piles (NMFS, 2012c). By installing piles within the in-water work window and limited number of piles (for either pile types) during the 5 years of proposed MPR activities, only behavioral effects are anticipated and these effects are not anticipated to be significant to an individual fish.

In conclusion, no significant impacts to ESA-listed fish from underwater noise would result from the proposed MPR activities.

<u>*Critical Habitat*</u>

The estuarine and nearshore marine areas PCEs for Puget Sound Chinook and Hood Canal summer-run chum would be affected by underwater noise from impact pile driving steel piles. Pile driving would produce noise above the fish behavioral thresholds during vibratory pile driving and above the behavioral and injury thresholds during impact pile driving in the vicinity of Zelatched Point that contains designated critical habitat. However, impacts to the function of these PCEs would be temporary and short-term and occur during a time when juvenile Chinook and chum are not expected to be within the nearshore and estuarine environments. The ability for the nearshore marine PCE to provide forage base for larger juveniles and adults may be effected in the short-term (1.5 hours per day). However, impacts would not be significant.

In the vicinity of Zelatched Point where designated critical habitat for Puget Sound/Georgia Basin DPSs of bocaccio and yelloweye occurs, the project would not significantly affect the following attributes to the two essential features: *(1) Water quality and sufficient levels of DO to support growth, survival, reproduction, and feeding opportunities;* and *(2) Quantity, quality, and availability of prey species to support individual growth, survival, reproduction, and feeding opportunities.* The behavior disturbance threshold would extend out over deeper water but would not impact the following attribute for adult rockfish and juvenile yelloweye rockfish because this attribute is not present in Dabob Bay (Frierson et al., 2016e): *(3) The type and amount of structure and rugosity that supports feeding opportunities and predator avoidance*. Elevated noise would be short-term (1.5 hours per day) and would not significantly impact essential features for conserving adult bocaccio and yelloweye rockfish and juvenile yelloweye rockfish (deepwater designated critical habitat).

The migratory habitats PCE for bull trout would also be exposed to noise above injurious and behavioral thresholds during vibratory and impact pile driving. The temporary change in the environment from increased noise would not impair the habitat’s function as a migratory corridor. With implementation of minimization measures discussed above for ESA-listed salmon and rockfish designated critical habitat impacts to the migratory habitats PCE would be insignificant.

Therefore, no significant impacts to designated critical habitat for Chinook, chum, bull trout and ESA-listed rockfish would result from the proposed MPR activities.

The Navy made a determination under the ESA that proposed MPR activities “may affect, but are not likely to adversely affect” ESA-listed fish species and designated critical habitat. USFWS concurred with the Navy’s determination for bull trout with a Letter of Concurrence signed on December 15, 2017. NMFS did not concur with the Navy’s determination and concluded that the Navy’s proposed MPR activities “may affect, are likely to adversely affect” Puget Sound evolutionary significant unit (ESU) Chinook salmon; Hood Canal summer-run ESU chum salmon; Puget Sound distinct population segment (DPS) steelhead; Puget Sound/Georgia Basin DPSs of bocaccio and yelloweye rockfish; and, designated critical habitat. Section 7 consultation with NMFS was completed with the issuance of a BiOp on April 5, 2019.

Essential Fish Habitat

As was discussed above for marine fish in general and ESA-listed fish, elements of the proposed MPR activities would create turbidity and suspended sediment but these impacts would be short-term, localized, and small in scale without causing measureable impacts to EFH. Removal and installation of piles and anchoring would have a localized impact on marine vegetation and benthic epifauna/infauna within the immediate vicinity of each pile or anchoring site but these impacts would be minimal, localized, and expected to recover to pre-disturbed levels within a few growing seasons. The primary impact during proposed MPR activities would be increased sound energy in the marine fish habitat. Increased sound would affect the water column, which has been designated as EFH for numerous species (see Appendix C). Impacts to the water column could result in disturbance depending on fish species, size, orientation, received noise level and type of noise. To avoid injurious effects from impact pile driving, the Navy would implement minimization measures to reduce the level of noise in the water column. The primary minimization measure would be to install piles with a vibratory pile driver to the extent practicable and follow with impact hammer pile driving to verify load-bearing capacity (proofing). To attenuate noise during impact pile driving of steel piles, a bubble curtain or other noise attenuation device would be used.

A maximum of 20 steel piles would be installed. The behavioral disturbance threshold would extend out a modeled distance of approximately 2,900 m extending out to the middle of Dabob Bay as well as north and south within the Bay (Appendix B). Coastal pelagic, Pacific coast groundfish, and Pacific coast salmon EFH could be exposed to noise levels above the behavioral threshold by way of noise in the water column. The injury threshold distances may impact EFH as these distances would extend over consolidated sediments, rocky reef, pelagic water column habitat, and eelgrass.

In addition to minimization measures discussed above, conducting impact pile driving intermittently with an estimated maximum duration of 1.5 hours in a day throughout the 5 years of proposed MPR activities would minimize impacts to coastal pelagic species, Pacific coast groundfish, and Pacific coast salmon EFH.

The Navy determined that the Proposed Action may adversely affect EFH by temporarily increasing noise in the water column during pile driving. However, implementation of minimization measures applied to ESA-listed species would be sufficient for minimizing effects to EFH. The Navy consulted with NMFS under the Magnuson-Stevens Fisheries Conservation and Management Act and NMFS concurred with the Navy's determination, but provided Conservation Recommendations to minimize effects to EFH. Consultation with NMFS was completed on April 5, 2019. Overall, due to the temporary nature of the activities, proposed minimization measures and the minimal level of impact to water column noise levels, benthic flora and fauna, water quality, and sediment quality, no significant impacts to EFH would occur with implementation of the proposed MPR activities.

8.3.2.2.4 <u>Birds</u>

Resident and migrant birds are expected to be present within the vicinity of proposed MPR activities during the in-water work window established for juvenile salmonid avoidance (Section 2.5.3). Proposed MPR activities have the potential to impact marine birds through visual disturbance, changes in prey availability, and elevated underwater and airborne noise. Pile extraction and installation projects, and other repair projects on the existing marine structures would intermittently increase human activity levels on the waterfront, potentially resulting in visual disturbance and increasing ambient noise levels due to use of construction equipment. Bald eagles that nest at Zelatched Point and forage along the marine shoreline may experience the increase in human activity, depending on proximity of project construction to existing and future nest sites and foraging areas. However, no incidental takes are anticipated. Project sites currently have ongoing human activity, and project work involving repairs to marine structures would be within the baseline condition. Therefore, project effects due to human activity levels would be insignificant.

As discussed in Sections 8.3.2.2.2 and 8.3.2.2.3, in-water work could temporarily affect the availability of forage fish and benthic invertebrates, which are the prey base of many marine birds, in a limited area. Removal of existing creosote-treated timber piles would improve localized water quality conditions in the project area. Turbidity effects and potential resuspension of contaminated sediments are not expected to affect the prey base, as these changes would be short-term and small scale during construction. Therefore, proposed MPR activities would have no significant impacts on prey availability for marine birds.

Effects of Elevated Noise Levels on Birds

Proposed MPR activities would result in increased underwater noise levels. Noise would be generated from small vessels and barge-mounted equipment such as generators, and pile extraction and installation. Noise levels from all activities except pile driving would typically not exceed underwater sound levels resulting from existing routine operations at Zelatched Point. The most significant underwater noise source would be impact pile driving of steel piles. Impacts of elevated noise levels due to pile driving were evaluated in the context of established criteria for ESA consultation with the USFWS on the threatened marbled murrelet. No criteria have been established for determining impacts of elevated noise levels on other marine bird species, some of which forage underwater like the marbled murrelet, and general conclusions about impacts on marbled murrelets were applied to other species.

Pursuit-diving birds (i.e., birds that pursue and capture their prey underwater using their wings to swim) include cormorants, grebes, and alcids (murres, murrelets, and pigeon guillemots). While actively foraging, they dive repeatedly into waters of various depths and would potentially be exposed to elevated underwater noise during pile driving. When startled by loud sounds, their foraging patterns may be altered, and birds may flush or dive and swim away underwater. While underwater they would be susceptible to injury or behavioral disturbance due to elevated sound pressure waves generated by pile driving. Dabbling and diving ducks may also be susceptible to elevated underwater sound. Birds that feed on the surface such as gulls, shorebirds, and wading birds are unlikely to be affected by elevated underwater sound.

Actively foraging marbled murrelets dive repeatedly into waters ranging up to approximately 160 ft. in depth for periods ranging up to 60 seconds (Nelson et al., 2006). Foraging bouts typically last over a period of 27 to 33 minutes, with approximately 50 percent of the time spent underwater (Jodice & Collopy, 1999). When startled by loud sounds, the foraging pattern may be altered, and birds may flush or dive and swim away underwater. While underwater they would be susceptible to injury or behavioral disturbance due to elevated sound pressure waves generated by pile driving.

As described in detail in Appendix B, the USFWS uses underwater noise thresholds developed by the Marbled Murrelet Hydroacoustic Science Panel (SAIC, 2011) to determine the zones around a driven pile in which two general forms of injury might occur to diving marbled murrelets: (1) auditory injury (generally damage to sensory cells of the ear) beginning at 202 dB SEL cumulative, and (2) non-auditory injury (trauma to non-auditory body tissues/organs) beginning at 208 dB SEL cumulative. Since the underwater criterion for auditory injury was the lower of the two thresholds, this was the criterion used for assessing injurious impacts to the marbled murrelet in this analysis.

A maximum of 20 steel, timber, and/or concrete piles could be installed at Zelatched Point during the 5 years of proposed MPR activities. As shown in Table B-9 of Appendix B, potentially the most injurious noise levels would extend up to 63 m from a driven 30-in steel pile (see Figure 8-1 for a representative scenario of the extent of potentially injurious underwater noise from steel pile installation). Since estimates of the distances to thresholds involve the cumulative energy of all impact strikes over a 24-hour period, the affected area represents the maximum extent. Earlier in the construction day, the injury zone would be smaller, and only reach the maximum extent after all the pile strikes have been completed.

Airborne noise levels from proposed MPR activities are not expected to be injurious to birds within the study area because the source levels for airborne noise from pile driving (vibratory: 96 dBA at 15 m; impact: 110 dBA at 11 m) are well below those known to cause injury to birds in laboratory situations (Dooling & Popper 2007). However, the USFWS (2014) has determined that airborne noise due to impact pile driving may behaviorally affect foraging marbled murrelets, based on the findings of the Marbled Murrelet Hydroacoustic Science Panel regarding non-injurious thresholds for pile driving noise (SAIC, 2012). Marbled murrelets typically perform foraging dives in pairs and are highly vocal when they are above the surface (Strachan et al., 1995). On the water's surface, birds typically stay within 100 ft. of their partners during foraging bouts. This behavior is thought to play a role in foraging efficiency, and therefore airborne noise that masks their vocalizations has the potential to affect foraging success (Carter & Sealy, 1990; Strachan et al., 1995). Unlike other noise effects criteria established for injury, the distance from a pile driving source within which communications would be masked is dependent upon ambient noise levels and therefore is site-specific. Masking effects cease immediately when the masking noise stops.

Under typical conditions on the waterfront, communication between foraging murrelets would be compromised by pile driving noise within 42 m of the murrelets. This is based on noise produced by impact pile driving <36-in steel piles (USFWS, 2013). Acoustic monitoring during construction at NAVBASE Kitsap Bangor (Illingworth & Rodkin, 2013) indicated that average airborne source levels during impact driving of 36-in steel piles were the same as, and in some cases lower than, 24-in steel piles. Therefore, the masking distance for 24-in steel piles was applied to all steel pile sizes. Representative scenarios of areas affected by masking effects are shown in Figure 8-1.

The USFWS (2013) has provided guidance on evaluating the significance of airborne masking effects for pile driving projects. "Typical" pile driving projects involve:

- Installation of 24-in or 36-in steel piles,
- Use of vibratory pile drivers,
- Use of impact pile drivers for proofing only, and
- Adherence to a 2-hour timing restriction (i.e., no pile driving within 2 hours after sunrise and within 2 hours before sunset during the breeding season).

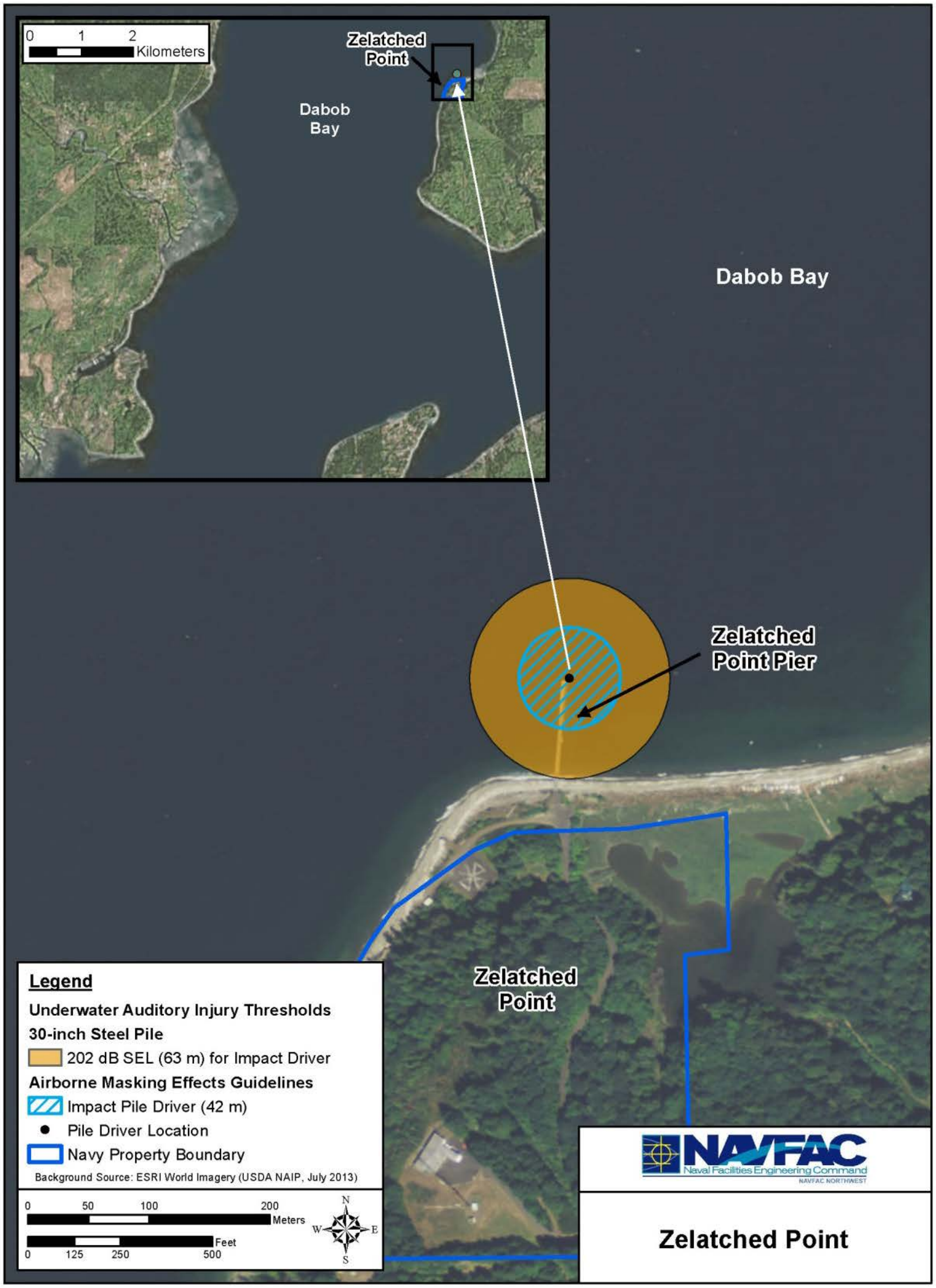

Figure 8-1. Representative Affected Areas for Pile Driving Noise for Marbled Murrelets at Zelatched Point

Typical pile driving projects do not result in measurable effects on marbled murrelets because the use of impact hammers is intermittent and of short duration, the 2-hour timing restriction protects murrelets during their most active foraging periods, and murrelet vocalizations are adapted to overcome the effects of ambient noise (USFWS, 2013).

Steel pile driving during proposed MPR activities would fit into the "typical" category because all piles would be 36-in or less, vibratory drivers would be used to install the piles, with limited proofing, and the timing restrictions would be observed. The USFWS guidance does not cover concrete piles, but the potential masking effects of concrete pile installation are likely to be much smaller because impact installation of concrete pile generates lower SPLs than steel pile installation (Appendix B).

To prevent exposure to injurious or masking noise levels in the action area for projects at Zelatched Point, the Navy would implement the minimization measures and BMPs described in Section 2.5. The Navy would actively monitor the underwater auditory injury zone for impact pile driving up to 63 m or the 42-m masking zone (Figure 8-1), whichever is larger, depending on the pile type. The likelihood of marbled murrelet exposure to injurious or masking noise from impact pile driving is discountable because these zones are small and can be effectively monitored during pile driving, and pile driving would cease if monitors detect marbled murrelets (see Appendix D for details) within the threshold distance.

With the implementation of minimization and monitoring actions (Section 2.5), the Navy has determined the Proposed Action "may affect, but is not likely to adversely affect" ESA-listed marbled murrelets. USFWS concurred with the Navy's determination in a letter dated December 15, 2017. Proposed MPR activities would have no significant impacts on marbled murrelets or other marine bird species due to temporarily elevated underwater and airborne sound levels resulting from impact or vibratory pile driving of all pile types.

Critical Habitat

Because the closest designated marbled murrelet critical habitat to Zelatched Point is about 6 mi to the west, no noise resulting from proposed MPR activities would reach it. Therefore, a no effect determination was made for designated critical habitat in the vicinity of Zelatched Point.

8.3.2.2.5 Marine Mammals

Pile installation and removal during proposed MPR activities at Zelatched point would result in temporarily increased human activity levels and changes in prey availability during project construction. However, project construction would take place at existing marine structures that have relatively high levels of human activity under daily operations, and prey availability changes would be short-term and highly localized, as described in Section 8.3.2.2.3. Because vessels would be operating at slow speeds, no vessel strikes would be expected. Therefore, there would be no significant impact to marine mammals due to increased human activity levels, changes in prey availability, or the potential for vessel strikes.

Effects of Elevated Noise Levels on Marine Mammals.

Underwater and airborne noise generated during pile installation and removal has the potential to disrupt the behavior of marine mammals that may be traveling through, foraging, or resting in the vicinity of the project area, as described in detail in Appendix B. The Navy estimates potential impacts to marine mammals by considering the likelihood that each species may be present at Zelatched Point during pile driving, determining the sound levels generated by various pile types and installation methods, and applying acoustic threshold criteria (expressed in decibels, dB) established by NMFS for evaluating the potential for injury or behavioral impacts. A detailed explanation of the analytical methods is presented in Appendix B, and the following sections summarize results of the underwater noise analysis.

A maximum of 20 steel, concrete, or timber piles could be installed at Zelatched Point during the 5 years of proposed MPR activities. The highest underwater source levels for pile driving would result from impact driving of 30-in steel pile. As described in detail in Appendix B, the Navy estimated the distances to the various NMFS underwater noise thresholds for injurious and behavioral effects on marine mammals (Appendix B). These distances were estimated by taking into account the source levels for impact and of vibratory pile driving of piles at Zelatched Point, sound propagation over distance from the driven pile, and acoustic impacts thresholds for the various species groups. Figure 8-2 depicts a representative scenario of the extent of potentially injurious and behaviorally harassing underwater noise from steel pile installation. The area encompassed by the threshold values decreases the closer to shore pile driving occurs and is truncated where shallow water and land block noise transmission.

The likelihood of injury due to pile driving noise is discountable for marine mammals at Zelatched Point for several reasons. Marine mammals are unlikely to be present in the small areas affected by injurious noise levels. This area would be fully monitored by marine mammal observers during pile driving. As described in Appendix D, pile driving would cease if monitors detect a marine mammal approaching or entering the injury zone. In addition, most steel piles would be installed with a vibratory driver, which affects a smaller area with injurious noise levels than impact pile driving (Appendix B). Where impact pile driving of steel pile is required, use of a noise attenuation device such as a bubble curtain would reduce source noise levels and, therefore, the area affected by potentially injurious noise levels. The greatest radius of potentially injurious noise from impact pile driving is expected to be no greater than 736 m, with use of a noise attenuation device.

Pile driving would produce noise above the underwater behavioral harassment threshold during impact and vibratory pile driving. The loudest impact pile driving noise, resulting from installation of 30-in steel pile, is estimated to affect an area up to 631 m from the driven pile. However, impact pile driving noise is not expected to result in behavioral harassment of marine mammals because affected areas can be fully monitored and pile driving would cease if a marine mammal approaches the affected area.

However, installation of steel piles would utilize a vibratory pile driver to the extent practicable in order to reduce adverse impacts to fish species, and the affected area due to the vibratory pile driver would be much larger than the area affected by impact pile installation (due to the low behavioral harassment threshold for continuous sound [120 dB RMS versus 160 dB RMS for impulsive sound]). The greatest risk of exposing marine mammals to behavioral harassment during pile driving would be during vibratory installation of steel pile because the affected areas would be too large to be fully monitored by marine mammal observes (for details see Appendix D). The affected area could extend up to 13.6 km from the driven pile at Zelatched Point.

To assess the potential exposure of marine mammals to above-threshold noise levels during in-water work windows over 5 years of proposed MPR activities, the likelihood of occurrence of each species was considered along with the number of pile driving days. The Navy used one of two methods for species at Zelatched Point, depending on (1) whether regional densities were known, or (2) the species is so infrequently encountered that densities cannot be determine and other reasoning must be applied. Potential exposures of Steller sea lions, California sea lions, and harbor seals were estimated based on regional density data (Navy, 2015a, Marine Species Density Database); exposures of harbor porpoises

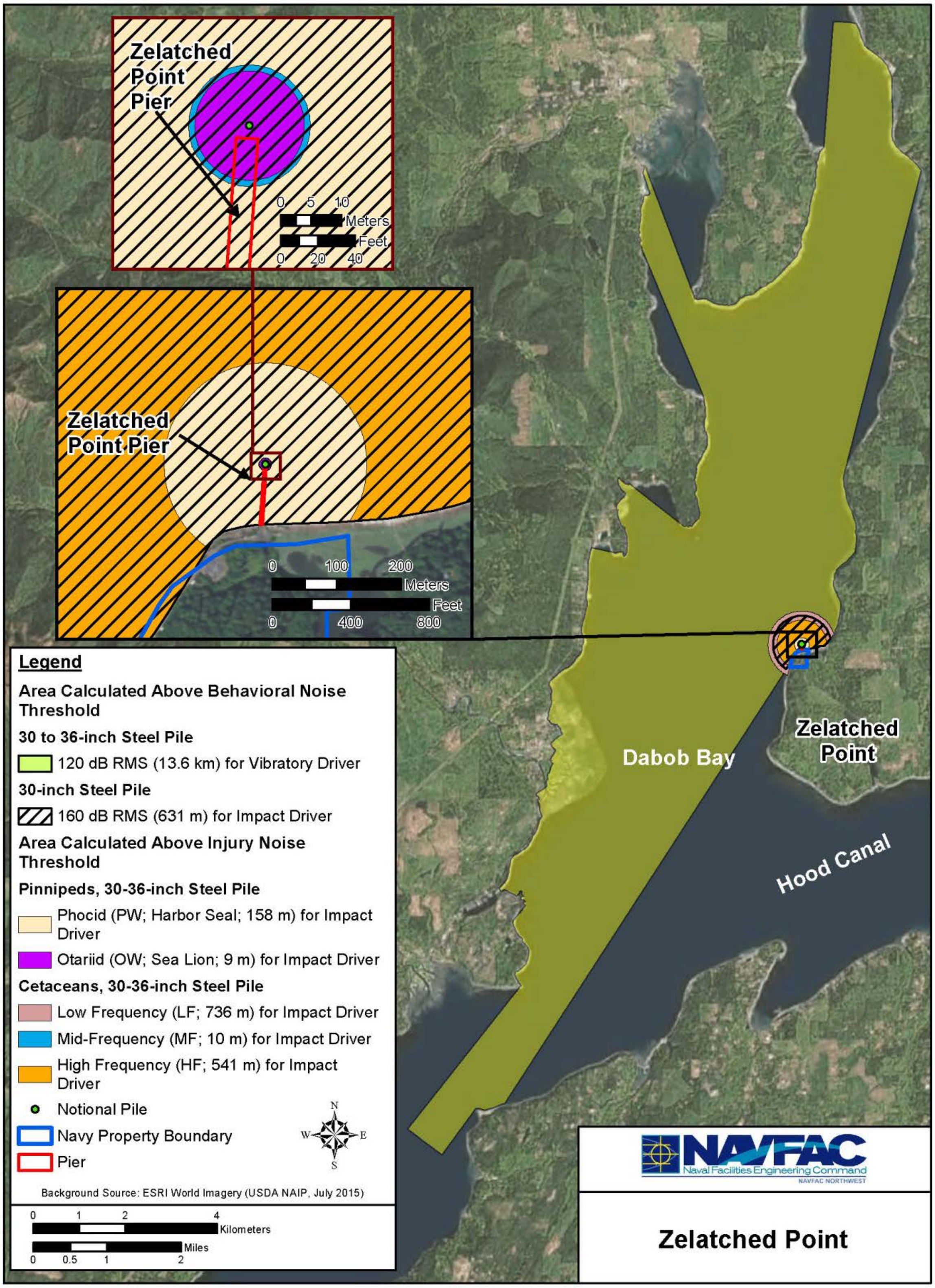

Figure 8-2. Representative Affected Areas for Pile Driving Noise for Marine Mammals at Zelatched Point

were based on density estimates from Smultea et al. (2017); and exposures of the remaining species were estimated through analysis of historical occurrence. Details of the exposure analysis are presented in Appendix B, and results are summarized in Table B-19.

Based on the exposure estimates in Table B-19, the species most likely to be impacted are the harbor porpoise, California sea lion, and harbor seal. The Navy would implement a variety of BMPs and mitigation measures, including noise attenuation devices and marine mammal observers that are expected to reduce the estimated impacts. These measures are fully described in Appendix D and summarized in Section 2.5.

Individual responses of marine mammals to pile driving noise are expected to be variable. Some individuals may occupy the project area during pile driving without apparent effect, but others may be displaced with undetermined effects. In general, cetaceans like harbor porpoise infrequently transit the waters in the vicinity of Zelatched Point and they do not tend to remain there. If they encounter pile driving noise they would likely avoid affected areas. Avoidance of the affected area during pile driving operations would potentially reduce access to foraging areas and inhibit movement through the area. The likelihood of exposure to behavioral disturbance due to pile driving noise would be limited by the infrequent occurrence of cetacean species in the vicinity, and monitoring and shutdown of pile driving if monitors detect cetaceans, as described in Appendix D.

Based on the low likelihood of occurrence of ESA-listed species in Table B-19, and the use of BMPs and mitigation measures that are likely to reduce potential impacts, the Navy concludes that proposed MPR activities at Zelatched Point:

- "may affect, and are not likely to adversely affect" humpback whales and Southern Resident killer whales because they are considered rare in the Hood Canal; and
- would not affect Southern Resident killer whale designated critical habitat.

NMFS did not concur with the Navy's determinations and has determined that the Navy's proposed MPR activities "may affect, are likely to adversely affect" humpback whale species, Southern Resident killer whale, and Southern Resident killer whale designated critical habitat. The Navy's consultation with NMFS regarding ESA-listed marine mammals and critical habitat was completed with the issuance of a BiOp on April 5, 2019 (Appendix G).

Acoustic exposure estimates from pile driving operations as shown in Table 3-8 indicate there is the potential for Level B harassment, which has the potential to disrupt animal behavior, as defined by MMPA. No marine mammals would be exposed at levels that would result in injury or mortality. Other construction activities not associated with pile installation and removal would not result in Level A or B harassment under the MMPA. The Navy consulted with NMFS in compliance with the ESA and the MMPA, and obtained an LOA for Level A injury and Level B harassment of marine mammals. The Final Rule for the LOA was published in the Federal Register on April 17, 2019. Since the exposures are only expected to result in behavioral impacts on an intermittent basis, no long term or permanent impacts are anticipated.

The analysis presented above indicates that proposed MPR activities at Zelatched Point may impact individual marine mammals, but any impacts observed at the population, stock, or species level would be negligible. Therefore, there would be no significant impact to marine mammal populations.

8.4 Cultural Resources

8.4.1 Affected Environment

The APE for the Proposed Action at NAVBASE Kitsap Zelatched Point consists of one pier facility (Table 8-1). All work would occur in or over-water. No on-shore work is planned, and any staging required would occur in previously disturbed or developed areas.

The Zelatched Point Pier, facility 477, is a contributing element to the NRHP-eligible Zelatched Point Historic District (Sackett, 2012) (SHPO concurred with the eligibility status of the pier on July 11, 2012). Currently the pier is not in use due to the deteriorated condition of the pier's float systems.

No known NRHP-eligible archaeological sites are located at Zelatched Point. Review of previous archaeological studies, ethnographic data, and project area landforms indicates a moderate probability for hunter-fisher-gatherer and historic archaeological resources in undisturbed areas along the shoreline at Zelatched Point (Grant and Kretser, 2010). Shell midden sites and historic deposits demonstrate the types of archaeological materials that can occur on the shoreline of Dabob Bay. There are no recorded submerged historic properties, downed aircraft, or shipwrecks in the Zelatched Point APE.

Table 8-1. Proposed Action at NAVBASE Kitsap Zelatched Point

Structure Name	*Year Built*	*NRHP Status*	*SHPO Concurrence Date*	*DAHP Log #*	*Note*
Zelatched Point Pier (#477)	1965	Eligible	7/11/2012	042412-10-USN	Historic District; Sackett, 2012

8.4.2 Environmental Consequences

8.4.2.1 No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to the baseline cultural resources. Therefore, no significant impacts to cultural resources would occur with implementation of the No Action Alternative.

8.4.2.2 MPR Activities (Preferred Alternative) Potential Impacts

Implementation of proposed MPR activities at Zelatched Point would not affect any known NRHP-eligible archaeological sites. Construction activities consisting of contingent repairs would take place in previously disturbed areas along the shoreline. The probability of prehistoric archaeological deposits or features buried within the substrate is very low due to Holocene sea level changes and associated erosion of glacial deposits found along the shoreline.

In the unlikely event that previously unrecorded archaeological sites were encountered during the construction process, the Navy would stop work in the immediate area and then follow the Section 106 process for inadvertent discovery, including complying with Section 106 of the NRHP and evaluating the sites for NRHP eligibility, in consultation with the SHPO, affected American Indian tribes, and other interested parties, pursuant to the implementing regulation of the NHPA, other applicable federal laws, and DoD and Navy regulations. Similarly, if American Indian human remains, funerary items, sacred objects, or items of cultural patrimony are encountered, the Navy must comply with the NAGPRA.

Proposed MPR activities consist of contingent pier repair and replacement activities at the Zelatched Point Pier, a contributing resource of the NRHP-eligible Zelatched Point National Register Historic District. However, the pier is deteriorated and unusable without some repair and/or maintenance. Pier pilings do not embody key elements of the historic properties, and changes to these elements would not adversely affect their NRHP eligibility or contribution to a district. Completion of the proposed MPR activities would be an effect, but not an adverse effect on a historic property as long as work on the pier meets the *Secretary of the Interior's Standards for the Rehabilitation of Historic Properties*. For this reason, the Navy has determined that the proposed MPR activities would have no adverse effect on historic properties or resources and the SHPO has concurred in a letter dated May 31, 2017. Therefore, there would be no significant impact to cultural resources.

8.5 American Indian Traditional Resources

8.5.1 Affected Environment

Zelatched Point property is co-located in the adjudicated U&A fishing area for the Skokomish Tribe, Port Gamble S'Klallam Tribe, Jamestown S'Klallam Tribe, Lower Elwha Klallam Tribe and the Suquamish Tribe. There are no designated Naval Restricted Areas at Zelatched Point. The Tribes do not currently harvest resources from the beaches/waters of Zelatched Point.

8.5.2 Environmental Consequences

8.5.2.1 No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to baseline American Indian traditional resources. Therefore, no significant impacts to American Indian traditional resources would occur with implementation of the No Action Alternative.

8.5.2.2 MPR Activities (Preferred Alternative) Potential Impacts

In accordance with Executive Order 13175 and DOD and Navy instructions, the Navy invited the Skokomish, Port Gamble S'Klallam, Jamestown S'Klallam, Lower Elwha Klallam, and Suquamish Tribes to initiate government-to-government consultation regarding proposed MPR activities and potential impacts to tribal treaty rights. The Tribes requested that additional project details be provided as they become available in the future. Additionally, the Suquamish Tribe provided comments on the Revised Draft EA, but determined it was not necessary to meet with the Navy to discuss these comments (Baxter, 2019). Government-to-government consultation with the Tribes is complete.

There would be no changes to the status quo regarding tribal access to traditional resources as a result of proposed MPR activities. Construction activities could result in loss of benthic organisms at the immediate project site; however, replacement piles would be installed near the location of the removed pile, minimizing the direct loss of benthic invertebrates.

There would be a temporary increase in the volume of barge traffic during pile replacement and maintenance activities as pile delivery and disposal would generally be conducted via barge. However, the increase in barge traffic generated by the proposed MPR activities would be negligible when compared to existing marine traffic in Hood Canal and at Zelatched Point.

The in-water work window for each construction year would minimize impacts to all juvenile salmonid species; therefore, significant impacts to juvenile salmonids are not expected. As part of continued engagement, the Navy will annually provide summaries of planned pile repair and replacement projects to the Tribes for information and coordination. Therefore, there would be no significant impact to American Indian traditional resources.

8.6 Summary of Potential Environmental Consequences

Table 8-2. Summary of Environmental Impacts at Zelatched Point

Section/ Resource Area	*Environmental Impacts*
Airborne Noise	Temporary construction noise during daytime hours is exempt from maximum permissible noise levels under the WAC and Jefferson County noise regulations. Recreational users in Dabob Bay could experience noise disturbance but not at levels sufficient to cause adverse effects. Therefore, there would be no significant impact to the ambient sound environment.
Water Quality	Direct discharges of waste would not occur. Construction-related impacts would be limited to short-term and localized changes associated with re-suspension of bottom sediments. These changes would be spatially limited to the construction site and areas immediately adjacent. Temporary impacts would not violate applicable state or federal water quality standards. The Navy would implement BMPs and minimization measures to prevent accidental losses or spills of construction debris. Removal of creosote-treated timber piles would improve local water quality. Therefore, there would be no significant impact to water quality.
Sediments	Sediment would be disturbed and re-suspended in the water column during pile removal and pile driving activities. Some degree of localized changes in sediment composition would occur. In particular, sediments that are re-suspended would be dispersed by currents and eventually re-deposited on the bottom. Project-related construction activities would not create sediment contamination concentrations or physical changes that violate state standards or interfere with beneficial uses of Dabob Bay. Therefore, there would be no significant impact to sediments.
Aquatic Vegetation	Vegetative growth found on existing piles would be removed when those piles are extracted from the water but because piles would be replaced, ultimately a similar amount of surface area on which marine organisms could colonize would exist. Impacts due to turbidity would be short-term, temporary, and localized. Additionally, because aquatic vegetation is distributed outside of the project area, recolonization could occur quickly, and the overall health and abundance of macroalgae and eelgrass would not be compromised. Therefore, there would be no significant impact to aquatic vegetation.
Benthic Invertebrates	As with aquatic vegetation, benthic organisms attached to removed piles would be lost, but new piles would provide equivalent attachment sites for development of the benthic community. Benthic organisms directly adjacent to piles would be lost or displaced. There would be minimal impacts to habitat and benthic organisms from turbidity caused by pile removal and installation and anchor placement and removal, but these effects would be temporary and very localized. Impacts at the population, stock, or species level would be negligible. Therefore, there would be no significant impact to benthic invertebrate populations.

Table 8-2. Summary of Environmental Impacts at Zelatched Point (continued)

Section/ Resource Area	*Environmental Impacts*
Marine Fish and EFH	In-water construction may expose fish to increased turbidity but exposure would be localized and temporary. The most significant impact to fish that could occur would be from exposure to elevated underwater noise from impact pile driving. To minimize exposure to noise, pile driving would be conducted during the in-water work window when juvenile salmonids (including ESA-listed salmonids) are least likely to be present. A majority of the pile driving would be conducted using a vibratory pile driver and a bubble curtain or other noise attenuation device would be used to attenuate noise during impact pile driving of steel piles. All impact pile driving would occur intermittently and for an estimated maximum duration of 1.5 hours in a day for steel piles and 4 hours for concrete during the 5 years of proposed MPR activities. The Navy has determined that the Proposed Action “may affect, but is not likely to adversely affect” ESA-listed fish species and designated critical habitat and may “adversely affect” EFH. The USFWS has concurred with the Navy’s conclusions regarding bull trout. NMFS concluded that the Navy’s proposed MPR activities “may affect, are likely to adversely affect” Puget Sound evolutionary significant unit (ESU) Chinook salmon; Hood Canal summer-run ESU chum salmon; Puget Sound distinct population segment (DPS) steelhead; Puget Sound/Georgia Basin DPSs of bocaccio and yelloweye rockfish; designated critical habitat; and, EFH. With implementation of minimization measures, there would be no significant impacts to marine fish (including ESA-listed fish) and EFH.
Birds	Construction activities may result in the exposure of marbled murrelets to sound pressure levels above the behavioral guidance criterion. Mitigation measures would be used to reduce the adverse impacts to marbled murrelets, also benefiting other marine birds. No designated critical habitat for the marbled murrelet is located near Zelatched Point; therefore construction activities would not affect designated critical habitat for the species. The Navy has determined that the Proposed Action “may affect, but is not likely to adversely affect” the marbled murrelet, and the USFWS has concurred with the Navy’s conclusions. No significant impacts to other marine birds are expected.
Marine Mammals	Vibratory pile driving at Zelatched Point may expose marine mammals to behavioral disturbance due to elevated underwater noise. Mitigation measures would be used to reduce the adverse impacts to marine mammals. The Navy determined that the Proposed Action “may affect, but is not likely to adversely affect” ESA-listed humpback whales and Southern Resident killer whales because they are considered rare in Hood Canal; and would not affect Southern Resident killer whale designated critical habitat. NMFS concluded that the Navy’s proposed MPR activities “may affect, are likely to adversely affect” humpback whale species, Southern Resident killer whale, and Southern Resident killer whale designated critical habitat. The Navy consulted with NMFS and will obtain an LOA under the MMPA. While construction activities may impact individual marine mammals, any impacts observed at the population, stock, or species level would be negligible. Therefore, there would be no significant impact to marine mammal populations.

Table 8-2. Summary of Environmental Impacts at Zelatched Point (continued)

Section/ Resource Area	***Environmental Impacts***
Cultural Resources	Implementation of proposed MPR activities at Zelatched Point would not affect any known NRHP-eligible archaeological sites. Construction activities consisting of contingent repairs and replacement would take place in previously disturbed areas. Zelatched Point Pier, an NRHP-eligible historic property and a contributing element to the Zelatched Point Historic District, would be affected by the proposed MPR activities, but the replacement in kind of existing piles and meeting the *Secretary of the Interior's Standards for the Rehabilitation of Historic Properties* would retain the eligibility of this structure that is considered eligible for listing in the NRHP based on Cold War importance. The Navy has determined that the proposed MPR activities would have no adverse effect on historic properties and the SHPO has concurred. Therefore, there would be no significant impact to cultural resources.
American Indian Traditional Resources	There would be no changes to the status quo regarding tribal access to traditional resources as a result of proposed MPR activities. The Skokomish Tribe, Port Gamble S'Klallam Tribe, Jamestown S'Klallam Tribe, Lower Elwha Klallam Tribe and the Suquamish Tribe do not currently harvest resources from the beaches/waters of Zelatched Point. Construction activities could result in the loss of benthic organisms at the immediate project site; however, replacement piles would be installed near the location of the removed piles, minimizing the direct loss of benthic invertebrates. The in-water work window for each construction year would minimize impacts to all juvenile salmonid species; significant impacts to juvenile salmonids are not expected. Therefore, there would be no significant impact to American Indian traditional resources.

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9 NAVSTA Everett Affected Environment and Environmental Consequences

9.1 Airborne Noise

9.1.1 Affected Environment

A baseline noise assessment study was conducted in 2010 to support the proposed docking of a sea-based X-band radar vessel at NAVSTA Everett. Time-weighted community noise metrics were collected at 17 locations in Everett. The city has a day-night level of 65 dBA established as the land use recommendation for residential areas. Noise levels measured at NAVSTA Everett indicate that day-to-day activities at this location are not significant contributors to the surrounding noise environment. The loudest continuous noise source (an exhaust fan on a ship) measured 72 dBA at 125 ft. from the source (ManTech, 2010). Residential noise in Everett, east of the base, was recorded between 47 and 51 dBA. Aside from NAVSTA Everett, other contributors to the noise environment surrounding the project area include the Port of Everett, and a major vehicle and railroad transportation corridor along Marine View Drive. The transportation corridor contributes the highest day-night level at 72.7 dBA. The use of heavy equipment commonly occurs sporadically throughout daytime hours given the industrial location of NAVSTA Everett. In consideration of the above and the fact that industrial activity at the base is intermediate between that of NAVBASE Kitsap Bremerton (Section 5.1.1) and NAVBASE Kitsap Bangor (Section 4.1.1), average ambient noise levels are expected to be in the 65-75 dBA range.

The closest sensitive noise receptors on base are a medical clinic and the Child Development Center (CDC). The nearest sensitive noise receptor to the east is a residential area along a bluff above NAVSTA Everett. This distance is approximately 0.5 mi and includes the former Kimberly-Clark Paper Mill and a major traffic corridor (Highway 529) between the source of the pile driving and the residential area.

The State of Washington, Snohomish County, and the City of Everett have developed maximum permissible environmental noise levels for receiving properties. However, the State of Washington, Snohomish County, and Everett have exempted noise generated by temporary construction activities. Permissible noise levels and exceedance allowances are discussed in Section 3.1.

9.1.2 Environmental Consequences

9.1.2.1 No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to baseline airborne noise. Therefore, no significant impacts to airborne noise would occur with implementation of the No Action Alternative.

9.1.2.2 MPR Activities (Preferred Alternative) Potential Impacts

Construction associated with proposed MPR activities would result in temporarily elevated underwater and airborne noise levels. Noise would be generated from support vessels, small boat traffic, and barge-mounted equipment, such as generators, and pile extraction and installation equipment. Noise levels from all activities except pile driving would typically not exceed ambient sound levels resulting from routine waterfront operations in the vicinity of any of the structures in the proposed MPR activities locations. The most significant project-related noise source would be impact pile driving of steel piles (WSDOT, 2018).

Construction noise would be temporary between July 16 and February 15 over 5 years for a total of 79 pile driving days. The maximum duration of pile driving in a single day would be up to 1.5 hours of impact pile driving or 4.5 hours of vibratory pile driving. Elevated noise levels during pile driving may be noticeable in residential areas but, as stated above, temporary construction noise is exempt from maximum permissible noise levels under the WAC, Snohomish County, and City of Everett noise regulations.

9.2 Water Resources and Marine Sediments

9.2.1 Affected Environment

9.2.1.1 Water Quality

WDOE has established designated uses for Everett Harbor as follows: good (aquatic life uses); secondary contact (recreation); shellfish harvesting; and wildlife habitat, commerce/navigation, boating, and aesthetics (miscellaneous uses) (WAC 173-201A-612). WDOE classifies the waters surrounding NAVSTA Everett as Category 2 for fecal coliform and DO (WDOE, 2017a). Water quality and sediments of East Waterway have historically been of concern primarily due to industrial discharges. Stormwater runoff from NAVSTA Everett enters into the basewide drainage system that collects into four oil-water separators before discharging through four outfalls into the Snohomish River.

9.2.1.2 Marine Sediments

Marine sediments in the nearshore areas surrounding NAVSTA Everett are characterized as unconsolidated silt and clay, with hard sandy bottom. Riprap boulders are present along the breakwater pier and occasional shell hash is present along the floating security barrier (Frierson et al., 2016f). There is also a substantial accumulation of woody debris in the East Waterway from historic operations of an old Kimberly-Clark facility, log storage, and other sources. The sediments in the waterways surrounding NAVSTA Everett have been polluted from historical industrial discharge; the nearshore environment is made up of shallow waters which were classified as polluted waters by WDOE. Areas in the inner Everett Harbor are classified as Category 5 (Polluted Sediments) and Category 2 (Sediments of Concern) for sediment bioassay (WDOE, 2017a). Sediments south of Pier C and at the marina are classified as Category 2 for benzoic acid. During construction of NAVSTA Everett the Navy conducted navigational dredging of East Waterway to allow for the construction and use of the carrier pier. The dredge prisms modeled for this effort, based on numerous sediment cores, indicated dredging would remove the contaminated sediment from all but two areas.

Sediments from north Possession Sound near Everett have historically had high contamination levels. Many chemical contaminants (such as arsenic, copper, mercury, cadmium, lead, benzoic acid, 2-methylphenol, and others), which are known to be biologically harmful, are present in this region. Sediments in Port Gardner and the East Waterway are also contaminated. Results from chemical analyses, bioassays and other toxicity tests from a comprehensive sediment characterization study indicated the sediments of the Everett Harbor area contain levels of organic and inorganic chemicals that are toxic to test organisms (WDOE, 2009). Results from a range of studies complement and support WDOE’s decision to focus cleanup and restoration efforts in Port Gardner Bay, specifically the East Waterway. WDOE has recently signed Agreed Orders with potentially liable parties around East Waterway to proceed with investigation and cleanup. The Navy is supporting this effort.

9.2.2 Environmental Consequences

9.2.2.1 No Action Alternative

9.2.2.1.1 Water Quality

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to baseline water quality. Therefore, no significant impacts to water quality would occur with implementation of the No Action Alternative.

9.2.2.1.2 Marine Sediments

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to baseline marine sediments. Therefore, no significant impacts to marine sediment would occur with implementation of the No Action Alternative.

9.2.2.2 MPR Activities (Preferred Alternative) Potential Impacts

9.2.2.2.1 Water Quality

Direct discharges of waste to the marine environment would not occur during proposed MPR activities. Existing water quality would be temporarily impacted as potentially contaminated sediments would be disturbed and mixed in the water column during pile removal and driving activities. During pile driving, the surface sediments immediately surrounding the base of the pile are likely to become re-suspended in the water column; however, they are likely to settle back down to the bottom when pile driving ceases. Turbidity would be localized to the nearshore area for the brief duration of the in-water activities. The short-term and temporary disturbance would cease following the completion of the construction and there would be no significant impacts to water quality.

Compliance with applicable permit conditions and construction practices, including measures described in Section 2.5, would minimize these consequences of construction and avoid degradation of water quality. Washington State Water Quality Standards (WAC 173-201A-210) allow elevated turbidity levels (above standards) during in-water construction activities. Removal of existing creosote-treated timber piles would improve localized water quality conditions in the project area.

9.2.2.2.2 Marine Sediments

There would be no direct discharges of wastes to the marine environment during proposed MPR activities. Impacts to sediment quality would be limited to localized changes associated with disturbances of bottom sediments from removal and installation of up to 78 piles over 5 years. Setting spuds and anchors for the barges, and propeller wash from tugs used for pile removal and installation represent other construction-related sources for disturbances of bottom sediments. BMPs and minimization measures, discussed in Section 2.5, would be implemented to prevent accidental losses or spills of construction debris.

The risk of sediment re-suspension would be avoided or reduced through the implementation of BMPs during construction. Given the low currents in the East Waterway and the use of BMPs, distribution of the bottom sediments would be modified slightly, but the effects would be retained within the confines of the work area, allowing suspended sediments to settle at the work site.

The replacement piles would be located at the same location or near the existing piles, immediately adjacent to other large industrial facilities, and in a low-energy depositional environment. Proposed MPR activities would not substantially alter sediment re-suspension or deposition patterns near the project sites.

Project-related construction activities would not create sediment contamination concentrations or physical changes that violate state standards or interfere with beneficial uses of waters near NAVSTA Everett. Therefore, there would be no significant impact to sediments.

9.3 Biological Resources

9.3.1 Affected Environment

9.3.1.1 Aquatic Vegetation

NAVSTA Everett lacks natural tidal shorelines, and other habitat features such as tidelands, salt marshes, sand and mud flats, blind tidal channels. The shoreline riprap extends to the silt/sand seafloor. The substrate under the piers at the project locations is primarily silt and sand, and devoid of vegetation (Navy, 2015b). The area was dredged in the past to accommodate homeported vessels. Eelgrass beds occur in the general area of Port Gardner and Possession Sound but there are no known eelgrass beds within the water boundary of the Station. Ulvoids, large algal macrophytes, are common in Puget Sound, occurring in nearly every nearshore habitat (Frankenstein, 2000), and would be expected to occur in suitable locations at the Station.

9.3.1.2 Benthic Invertebrates

A benthic infauna study performed for the initial planning of the Naval Station concluded that the East Waterway benthic communities were environmentally stressed, as measured by indicators. The authors concluded this was most likely due to: (1) the effects of wood waste derived from log storage in the East Waterway, (2) organic enrichment from a pulp mill outfall and a combined sewer overflow, and (3) toxic substances from other sources. At all of the East Waterway stations, the dominant organisms were found to be the polychaete worm (*Capitella capitata*) and nematodes. Both *Capitella capitata* and nematodes are considered indicator species for organic enrichment and/or pollution (Smithsonian Institution, 2008). ROV surveys conducted just outside the floating security barrier in April and September 2015 documented cancer crabs, Dungeness crabs, sea stars, California sea cucumbers, and various anemones (Frierson et al., 2016f).

In May 1993, as part of the baseline year sampling for the Everett Waterfront Site water and sediment quality certification monitoring effort, ten sediment quality stations and one reference station inside the East Waterway and in the near vicinity were sampled for benthic infauna as well as for sediment quality. More recently, in 2010 SAIC published a sediment characterization study for the purpose of guiding future WSDOE remediation actions. The results of the 2010 study generally confirm the results and conclusions of earlier studies, in particular finding that: (1) the inner East Waterway stations had lower abundance of benthic infauna than found in the outer waterway stations; (2) the inner waterway stations had proportionately more polychaetes and crustaceans that the outer waterway stations, and fewer bivalves, indicating greater disturbance; and (3) the inner waterway stations showed a decrease in species richness and diversity compared to those found in the outer waterway stations (Dames & Moore, 1994; SAIC, 2010).

The nearshore areas of the East Waterway and other areas of the Everett harbor are utilized as habitat by epibenthic invertebrates that live immediately above the bottom. These organisms are preyed upon by juvenile salmon during their outward migration from the Snohomish River, in the spring and early summer of each year. While resident in the Snohomish River estuary before going out to deeper water and the Pacific Ocean, juvenile salmon feed upon the epibenthic invertebrates in the nearshore areas of the estuary. These prey organisms undergo a distinct population increase just prior to the juvenile salmonid out migration and estuary residence time. This period of time, during which the fish undergo physiological adaptation to saltwater, is considered a critical phase in the life history success of the Snohomish River salmon runs (EDAW, 1994).

9.3.1.3 Marine Fish

9.3.1.3.1 Non-ESA-Listed Fish Species

Fish surveys were conducted within the Port Gardner Naval Restricted Area in 2015 using ROV, split-beam echosounder, and beach seine methods. The ROV and echosounder targeted survey depths greater than 10 m deep and recorded presence of pricklebacks (Family: Stichaeidae), flatfishes (Order: Pleuronectiformes), surfperches (Family: Embiotocidae), eelpouts (Family: Zoarcidae), sculpins (Family: Cottidae), rockfishes (Sebastes spp.), greenlings (Family: Hexagrammidae), codfishes (Family: Gadidae), and skates (Family: Rajidae). Shiner perch was the most abundant species recorded and other species identified included snake prickleback, copper rockfish, brown rockfish, starry flounder, rock sole, English sole, lingcod, and kelp greenling (Frierson et al., 2016f). Beach seine surveys conducted in 2016 recorded a total of 16 fish species of which pink salmon accounted for 24.1 percent of the total catch followed by forage fish (Pacific herring and sand lance), and chum salmon (Frierson et al., 2017d). Recreational dive surveys conducted between 2010 and 2015 just off of Gedney/Hat Island (Figure 3-6), located approximately 6 km to the west, recorded the same or species from the same families (shiner surfperch, striped seaperch, roughback sculpin (*Chitonotus pugetensis*), rockfish species (yellowtail, copper, black [*Sebastes melanops*]), painted greenling, and lingcod (Reef.org, 2015).

The Snohomish River estuary, north of NAVSTA Everett, serves as nursery grounds for many larval and juvenile fish and invertebrates. Tidal flats formed from fluvial sediment load as it is pushed into Port Gardner Bay by the Snohomish River serve as viable habitat for forage fish such as Pacific herring, surf smelt, and sand lance. Pacific herring accounted for 45.6 percent of the total catch during monthly beach seine surveys at NAVSTA Everett from May through September of 2015 and 20.6 percent from March through September of 2016 (Frierson et al., 2016f, 2017d). There are herring spawning grounds documented in Port Susan, north of NAVSTA Everett (Stick et al., 2014). Estimated biomass of herring was recorded as low during surveys in 2012 and the stock status is considered depressed (Stick et al., 2014). Surf smelt collected during 2015 and 2016 beach seine surveys had peak collection in June. Sand lance had peak collection during the months of August in 2015 and May in 2016 (Frierson et al., 2016f, 2017d). A surf smelt breeding area was identified along the shoreline areas, approximately 1,800 m south of Pier A. No sand lance breeding areas were identified within the vicinity of or at NAVSTA Everett (WDFW, 2017).

Migrating adult salmon and trout returning from the ocean move through the estuary on their way to their spawning habitat up the Snohomish River and on into the tributaries. Several species of juvenile salmon out-migrating from spawning and rearing areas in the river and estuary utilize the feeding and rearing grounds before moving on to the more saline waters of Possession Sound. Spring and summer/fall coho, pink, Chinook, and chum salmon are likely to be present in the project area during various times of the year. As mentioned above, pink salmon were the most abundant fish collected during 2016 beach seine surveys (Frierson et al., 2017d). Coho, Chinook, and chum were all collected during beach seine survey in 2015 and 2016 with peak catch occurring in late May for all three species in 2015 and chum collection peaked during April in 2016 (Frierson et al., 2016f, 2017d). The Snohomish River supports two pink salmon spawning stocks, one in odd years and the other in even years (WDFW, 2015a). Pink salmon spend the least amount of time rearing in the estuary and they were not recorded during 2015 beach seine surveys but accounted for 24 percent of the catch during 2016 beach seine surveys (Frierson et al., 2016f, 2017d). Therefore, they may be near the project area for a brief time during March through May.

9.3.1.3.2 ESA-Listed Fish and Critical Habitat

ESA-listed fish species that occur within the vicinity of NAVSTA Everett include Puget Sound Chinook salmon; Puget Sound steelhead; bull trout; and Puget Sound/Georgia Basin DPSs of bocaccio and yelloweye rockfish. North American green sturgeon and Pacific eulachon are expected to be rare in the area.

The Snohomish River is one of the main rivers in Puget Sound for Puget Sound Chinook salmon. The Snohomish River estuary is an important and highly utilized nursery area for juvenile fish species. Adult Puget Sound Chinook return to the Snohomish River watershed to spawn beginning in July. Juvenile peak outmigration occurs between April and June. Adult and juvenile spring and summer/fall Chinook are expected to be in the estuary and nearby waters from March to early July and adult and sub-adults may be present within the vicinity of NAVSTA Everett throughout the year, occurring in deeper waters. Juvenile Puget Sound Chinook were collected during beach seine surveys with peak numbers between late May and late June (Frierson et al., 2016f, 2017c).

Puget Sound steelhead forage within the Snohomish River estuary (NMFS, 2007). Adult steelhead typically enter the river in October and may be present near Port Gardner Bay around that time. Steelhead are not nearshore oriented and thus would not be expected within the project area. Further, steelhead were not recorded during 2015 and 2016 beach seine surveys (Frierson et al., 2016f, 2017d).

Bull trout are known to inhabit the Snohomish River, use the Snohomish estuary for rearing, and may be present near the project area. They are opportunistic feeders and have been observed foraging on juvenile salmon and forage fish during the spring months along the northern end of Jetty Island, adjacent to NAVSTA Everett (Snohomish Basin Salmon Recovery Forum, 2005; Port of Everett, 2006). Adults return to the Snohomish River in late spring to early-mid-summer and most outmigration from the river to the estuary and nearshore areas occurs in March and April. Bull trout were not recorded during fish surveys conducted in 2015 and 2016 (Frierson et al., 2016f, 2017d).

Adult Puget Sound/Georgia Basin DPSs of bocaccio and yelloweye rockfish and juvenile yelloweye rockfish typically occur in waters deeper than the depths where the pile replacement or repairs would occur, so no adult rockfish or juvenile yelloweye rockfish are anticipated to be in the immediate project area. The closest recording of yelloweye rockfish was in Mukilteo, approximately 6 km south of NAVSTA Everett (Pacunski, 2017). Larval rockfish live near the surface and were recorded within the offshore of Port Gardner Bay (Green & Godersky, 2012). They are not likely to occur within the project area. Rearing habitat for juvenile bocaccio is absent from NAVSTA Everett and so are unlikely to be within the project area. Further, flow from the Snohomish River on the north side of NAVSTA Everett in combination with the shallow and flat bathymetry of the delta does not support holdfasts for kelp, and rock and cobble areas for rearing juvenile bocaccio nor is the area deep enough for adult ESA-listed rockfish and juvenile yelloweye rockfish. Therefore, ESA-listed rockfish are not expected on the north side of NAVSTA Everett. WDFW conducted a survey of rockfish species and habitats in the area outside the Port Security Barrier in 2015 at NAVSTA Everett. They concluded that the area surveyed did not contain ESA-listed rockfish preferred habitats, was unlikely to support ESA-listed rockfish at any life stage, and did not record any observations of ESA-listed rockfish (Frierson et al., 2016f).

The southern DPS Pacific eulachon and southern DPS North American green sturgeon are unlikely to occur near the project site or surrounding waters because there are no spawning rivers or aggregation sites for either species nearby, and there are few records of these species in Puget Sound. The nearest regular eulachon spawning habitats are the Elwha River on the Olympic Peninsula and the Fraser River in British Columbia.

Critical Habitat

Puget Sound Chinook salmon have designated critical habitat in the waters near NAVSTA Everett. However, the DoD boundaries of NAVSTA Everett are exempt by federal law (70 FR 52685). Critical habitat is designated, but outside NAVSTA Everett boundaries. Section 3.3.2.3.2 lists the designated critical habitat PCEs for this species.

Bull trout have designated critical habitat in the waters near NAVSTA Everett that includes the nearshore marine areas extending out to a depth of 33 ft.; however waters within boundaries of NAVSTA Everett are exempt from designation (75 FR 63898). Section 3.3.2.3.2 lists designated critical habitat PCEs for bull trout.

The nearshore of NAVSTA Everett does not overlap with essential features for listed rockfishes and is not designated as critical habitat (79 FR 68041).

9.3.1.3.3 Essential Fish Habitat

The unconsolidated silt and clay, with hard sandy bottom habitat that is present within the nearshore and tidal submerged environments of NAVSTA Everett provides Pacific coast groundfish EFH for various life stages of species of groundfish (PFMC, 2016b). The marine environment of NAVSTA Everett as well as the Snohomish River Estuary, located to the north, provide Pacific coast salmon EFH for various life stages of Chinook, pink, and coho salmon (PFMC, 2014). The Snohomish River estuary is a HAPC for Pacific Coast salmon. There are no HAPCs identified within the vicinity of NAVSTA Everett for Pacific coast groundfish.

9.3.1.4 Birds

Migratory birds encountered at NAVSTA Everett include those described in Section 3.3.2.4. Jetty Island, just offshore from NAVSTA Everett, provides foraging and/or resting habitat for bald eagles. Four pairs of bald eagles have nested close to the Snohomish River estuary, and seven of the eight adults have been observed on Jetty Island in the past (Port of Everett, 2006).

The WDFW Priority Habitat and Species Maps interactive website does not indicate the presence of marbled murrelet nests in the upland areas including and adjacent to NAVSTA Everett (WDFW, 2017). Marbled murrelets may occur year round in the waters near NAVSTA Everett. WDFW surveys from mid-September to April in Possession Sound detected low numbers of marbled murrelets during the in-water work window (Pearson & Lance, 2013, 2014, 2015, 2016). Marbled murrelets have been detected during the mid-May through late-July surveys conducted by WDFW in accordance with the Northwest Forest Plan Effectiveness Monitoring Program.

9.3.1.5 Marine Mammals

Any of the species listed in Table 3-7 has the potential to occur in the vicinity of NAVSTA Everett. The most likely species to occur at Everett are harbor seals and California sea lion. There are no beaches owned by Naval Station Everett, and the perimeter of this location is all rip-rap, though California sea lions are known to haul out on the port security barrier. California sea lions have been documented during shore-based surveys at NAVSTA Everett from 2012 through June 2016 in all survey months, with as many as 215 individuals hauled out at one time (April 2016) on PSB floats (Figure 9-1) (Navy, 2016b). Navy surveys have documented up to 491 harbor seals hauling out adjacent to NAVSTA Everett on log rafts in Notch Basin in the East Waterway (Figure 9-1) (Navy, 2016b). Harbor seals occupy the waters and haulout sites near NAVSTA Everett year round. The log rafts are privately owned and their location can vary within the East Waterway, which ranges from approximately 700 to 900 ft. wide. According to data from WDFW, harbor seal pupping occurs from June through August in this area of the Puget Sound.

Humpback whales may occur near NAVSTA Everett, but their presence is unlikely. Most sightings of this species in Washington inland waters occur in the Strait of Juan de Fuca and the San Juan Island area. The number of humpback whales potentially near this location is expected to be very low in any month.

Gray whales occur in northern Puget Sound seasonally to feed in Saratoga Passage and in Port Susan Bay near NAVSTA Everett (Calambokidis et al., 2010; Orca Network, 2016). Southern Resident killer whales have been detected during winter months in Saratoga Passage and Possession Sound (Orca Network, 2016). Transient killer whales have been observed in Possession Sound near NAVSTA Everett (Orca Network 2016). Harbor porpoises have been seen infrequently at NAVSTA Everett (L. Wagoner, 2016). Shore-based surveys at NAVSTA Everett did not detect Steller sea lions (Navy 2014). However, NOAA staff have reported that they occasionally see Steller sea lions, one or two at a time, hauled out on the PSBs (L. Wagoner, 2016). Other than these detections on the NAVSTA Everett PSBs, the nearest known Steller sea lion haulout is 14 mi away; therefore, Steller sea lions are not expected to occur in waters off NAVSTA Everett.

9.3.2 Environmental Consequences

9.3.2.1 No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to baseline biological resources. Therefore, no significant impacts to biological resources would occur with implementation of the No Action Alternative.

9.3.2.2 MPR Activities (Preferred Alternative) Potential Impacts

9.3.2.2.1 Aquatic Vegetation

There are no planned and funded replacement projects as part of the proposed MPR activities at NAVSTA Everett; however, contingency planning for pier protection (fender) pile replacement is estimated to be up to 15 piles per year. Any debris from pile removal would be collected, disposed of in a state-approved landfill or recycled, and would not impact marine vegetation.

Figure 9-1. Pinniped Haulouts at and near NAVSTA Everett

Decreased water and sediment quality can impede the growth of marine vegetation important to fish and other animals, and promote the growth of harmful algae. The localized nature of any impacts to sediment or water quality would not extend to marine vegetation outside of the project area. Since marine vegetation is largely absent from the project area, no significant direct or indirect impacts from proposed MPR activities are anticipated.

9.3.2.2.2 Benthic Invertebrates

Proposed MPR activities at NAVSTA Everett would impact individual benthic invertebrates through the disruption of the sediment surface and subsurface during the installation and removal of each pile, and from anchor and spud placement for the barges. Depending upon the species, impacts to individual benthic organisms could range from temporary disturbance to mortality. Some benthic organisms would be physically crushed and lost within the footprint of the piles, as well as from barge anchors and spuds.

Indirect impacts to habitat and benthic organisms are likely to result from turbidity caused by driving and removing barge anchors, spuds, and piles. The area near the pile replacement footprint would have higher levels of turbidity. Disturbed sediments would eventually redeposit upon the existing benthic community. Impacts from increased turbidity levels would likely result in short-term loss of localized areas of the benthic community. Most affected areas would experience some reduction in diversity and abundance of benthic species. However, benthic organisms, particularly annelids, are very resilient to habitat disturbance and are likely to recover to pre-disturbance levels in less than 2 years (CH2M Hill, 1995; Parametrix, 1994, 1999; Romberg et al., 1995; Anchor Environmental, 2002). Therefore, proposed MPR activities would have no significant impacts on benthic invertebrates.

9.3.2.2.3 Marine Fish

Non-ESA-Listed Fish

Turbidity

Resident marine fish as well as all life stages of forage fish are expected to be present within the vicinity of the project area and are likely to occur during the in-water work window established for juvenile salmonid avoidance. In-water work could produce measurable, temporary increases in turbidity and sedimentation, and that could cause fish to temporarily avoid the areas near construction. However, construction activities would not result in persistent increases in turbidity levels or cause changes that would violate water quality standards because processes that generate suspended sediments, which result in turbid conditions, would be short-term and localized and would disperse and/or settle rapidly (within a period of minutes to hours after construction activities cease). This also applies to resuspension of existing contaminated sediments during construction as these would be localized, short-term, and settle rapidly. Further, removal of existing creosote-treated timber piles would improve localized water quality conditions in the project area. Effects would be short-term and small in scale during construction and, if creosote piles are removed, beneficial to water quality post-construction. Further, the localized disturbance would not impact forage fish spawning areas identified within the vicinity of the project area. Therefore, no impacts from turbidity to forage fish spawning are anticipated. Placement of the piles and associated disturbance activities (i.e., support vessels, construction barge) may cause a loss to benthic prey either existing within the pile footprint or disturbance from turbidity which may impact fish use of that area for seeking prey. Impacts would be short-term, localized, and limited to the duration of pile installation and would not be expected to significantly impact fish ability to seek prey outside of the project areas. With implementation of impact avoidance and minimization measures (see Section 2.5), no significant impacts to non-ESA-listed marine fish from turbidity and sedimentation (including potential resuspension of contaminated sediments) are anticipated from the proposed MPR activities.

Underwater Noise

Proposed MPR activities would result in increased underwater noise levels. Noise would be generated from support vessels, small boat traffic, and barge-mounted equipment, such as generators, and pile extraction and installation. Noise levels from all activities except pile driving would typically not exceed underwater sound levels resulting from existing routine waterfront operations at NAVSTA Everett. The most significant underwater noise potentially affecting fish would be from impact pile driving of one steel pile. To minimize impacts to fish, the pile would be installed initially with a vibratory pile driver until either the pile hits refusal, necessitating an impact hammer to reach required depth, or for proofing the pile to verify structural capacity. Since vibratory pile drivers typically generate noise levels from 10 to 20 dB lower than impact pile driving and do not produce waveforms with sharp rise times like impact pile driving, impacts on fish are typically not observed in association with vibratory pile driving (WSDOT, 2018).

A total of 78 piles would be replaced at NAVSTA Everett during the 5 years of proposed MPR activities, of which only one would be a steel pile. Impact pile driving of a 30-in diameter steel pile would create underwater noise that could expose fish to injurious levels above the peak threshold as well as the cumulative SEL thresholds (Appendix B). Fish would be expected to be exposed differently to elevated noise levels and they could behave differently in their reaction to noise. Some fish are migrating through the area and may pass through the behavioral disturbance threshold (estimated to 2,900 m). Other fish are resident to the area and may not move away and thus would be exposed to injurious noise levels for the duration of pile driving activity (Hastings and Popper, 2005). To minimize exposure to noise above the injurious and behavioral disturbance thresholds, a bubble curtain or other noise attenuation device would be used during impact pile driving of the steel pile[7] and all pile driving (for all pile types) would be conducted during the in-water work window of July 16 through February 15 when juvenile salmonids are least likely to be present. A surf smelt spawning beach is located approximately 1,800 m south of Pier A and spawning would coincide with the in-water work window. Surf smelt at the beach site may be exposed to noise levels above the behavioral threshold zone during impact pile driving of the steel pile but exposure would be brief, last an estimated maximum duration of 30 minutes, and would be insignificant. With implementation of these minimization measures and those included in Section 2.5, no significant impacts to non-ESA-listed fish from underwater noise would result from the proposed MPR activities.

ESA-Listed Fish and Critical Habitat

Turbidity

As discussed above, in-water work could produce measurable, temporary increases in turbidity and sedimentation, and that could cause ESA-listed fish and their forage fish to temporarily avoid the areas near construction. Because, in-water work would occur during the approved in-water work window of

[7] Due to the potential for contaminated sediments at NAVSTA Everett, the Navy would assess the use of bubble curtains on a project-by-project basis.

July 16 through February 15, juvenile ESA-listed salmonids and bull trout are least likely to be present. Adult life stages of Chinook, steelhead, bocaccio, and yelloweye rockfish as well as juvenile yelloweye rockfish, if present, would occur further offshore and beyond any impacts associated with turbidity during in-water construction. Habitat to support rearing juvenile bocaccio is absent from the project area and so they would not be present. Green sturgeon and eulachon are not expected to occur within the vicinity of NAVSTA Everett and thus impacts from turbidity and suspended sediment would not occur. The Navy has determined the Proposed Action “may affect, but is not likely to adversely affect” ESA-listed fish species.

With implementation of impact avoidance and minimization measures, no significant impacts to ESA-listed fish or their forage base from turbidity and sedimentation (including temporary and localized exposure to suspended contaminated sediments) would result with implementation of proposed MPR activities.

Underwater Noise

In-water work would occur during a time period when juvenile salmonids and bull trout are least likely to be present. Juvenile bocaccio would not be present within the nearshore areas of the project area and thus would not be exposed to injurious thresholds. Green sturgeon and Pacific eulachon are unlikely to be within the vicinity of NAVSTA Everett and thus no impacts from noise are expected. Forage fish may be present during pile driving and could be exposed to injurious thresholds; however, impacts would be temporary, short-term, and insignificant. Larger juveniles as well as adult life stages of Chinook, steelhead, bull trout, bocaccio and yelloweye rockfish, as well as juvenile yelloweye rockfish may be exposed to noise above the cumulative SEL injury thresholds as they would extend offshore and over deeper water where these life stages may be present. However, the steel pile would be installed using a vibratory pile driver to the extent practicable with impact pile driving durations estimated to last a maximum of 30 minutes.

ESA-listed rockfish and salmonids occurring within 2,900 m of the single steel pile being struck by an impact hammer would be exposed to underwater noise levels above the behavioral disturbance threshold (Appendix B). However, exposure would be temporary and short-term (30 minutes) and insignificant.

All 77 remaining piles would be concrete or timber piles; of the two, concrete would generate the highest SPLs. However, the area in which noise would be generated above the injury and behavioral thresholds is significantly smaller than for steel piles. Impact pile driving concrete piles is estimated to last a maximum duration of 4 hours per day or an average of 1.5 hours a day. However, there are no known documented incidents of fish injury occurring from pile driving of concrete piles (NMFS, 2012c). By installing piles within the in-water work window and limited number of piles (for all pile types) during the 5 years of proposed MPR activities, only behavioral effects are anticipated and these effects are not anticipated to be significant to an individual fish.

Therefore, no significant impacts to ESA-listed fish from underwater noise would result from proposed MPR activities.

Critical Habitat

The estuarine and nearshore marine areas PCEs for Puget Sound Chinook and abundant food base PCE for bull trout would be affected by exposing prey (forage fish) to underwater noise during pile driving. Pile driving would produce noise above the fish behavioral thresholds during vibratory pile driving, above the behavioral and injury thresholds during impact pile driving of the steel pile, and above the behavioral threshold during impact pile driving concrete piles in the vicinity of NAVSTA Everett that contains designated critical habitat. However, impacts to the function of these PCEs would be temporary and short-term (estimated maximum duration of 30 minutes for impact pile driving of a steel pile and 4 hours for concrete) and insignificant. Therefore, no significant impacts to designated critical habitat for Chinook and bull trout would result from the proposed MPR activities.

Because of the lack of rockfish habitat present at NAVSTA Everett, effects to rockfish are not anticipated to be significant.

The Navy made a determination under the ESA that proposed MPR activities “may affect, but are not likely to adversely affect” ESA-listed fish species and designated critical habitat. USFWS concurred with the Navy’s determination for bull trout with a Letter of Concurrence signed on December 15, 2017. NMFS did not concur with the Navy’s determination and concluded that the Navy’s proposed MPR activities “may affect, are likely to adversely affect” Puget Sound evolutionary significant unit (ESU) Chinook salmon; Hood Canal summer-run ESU chum salmon; Puget Sound distinct population segment (DPS) steelhead; Puget Sound/Georgia Basin DPSs of bocaccio and yelloweye rockfish; and, designated critical habitat. Section 7 consultation with NMFS was completed with the issuance of a BiOp on April 5, 2019. Per Terms and Conditions 2.b. contained in the BiOp, the Navy must restrict impact driving steel piles to the period between July 16 and October 14, annually.

Essential Fish Habitat

As was discussed above for marine fish in general and ESA-listed fish, elements of the proposed MPR activities would create turbidity and suspended sediment but these impacts would be short-term, localized, and small in scale without causing measureable impacts to EFH. Removal and installation of piles and anchoring would have a localized impact on benthic epifauna/infauna within the immediate vicinity of each pile or anchoring site but these impacts would be minimal, localized, and expected to recover to pre-disturbed levels within a few growing seasons. The primary impact during proposed MPR activities would be increased sound energy in the marine fish habitat. Increased sound would affect the water column, which has been designated as EFH for numerous species (see Appendix C). Impacts to the water column could result in disturbance depending on fish species, size, orientation, received noise level and type of noise. To avoid injurious effects from impact pile driving, the Navy would implement minimization measures to reduce the level of noise in the water column. The primary minimization measure would be to install piles with a vibratory pile driver to the extent practicable and follow with impact hammer pile driving to verify load-bearing capacity (proofing). To attenuate noise during impact pile driving of steel piles, a bubble curtain[8] or other noise attenuation device would be used.

Only one steel pile and a maximum of 77 concrete piles would be installed during the 5 years of proposed MPR activities. Noise from installing one steel pile would expose EFH to noise above the behavioral disturbance threshold. The injury threshold distances modeled are small and within the immediate project area where Pacific coast groundfish EFH occurs. However, installing one steel pile is

[8] Due to the potential for contaminated sediments at NAVSTA Everett, the Navy would assess the use of bubble curtains on a project-by-project basis.

anticipated to last up to 30 minutes of which the area would be exposed to noise above the injurious threshold. The temporary exposure above this threshold would not significantly degrade EFH.

All other piles would be concrete or timber, of which the concrete would generate the highest SPLs of the two non-steel pile types installed. However, noise generated above the injury and behavioral thresholds are significantly smaller than steel piles. Only groundfish EFH is present within the behavioral zone and elevated noise levels above this zone would be temporary and short-term. Impact pile driving concrete piles is estimated to last a maximum duration of 4 hours per day or an average of 1.5 hours a day.

The Navy determined that the Proposed Action may adversely affect EFH by temporarily increasing noise in the water column during pile driving. However, implementation of minimization measures applied to ESA-listed species would be sufficient for minimizing effects to EFH. The Navy consulted with NMFS under the Magnuson-Stevens Fisheries Conservation and Management Act and NMFS concurred with the Navy's determination, but provided Conservation Recommendations to minimize effects to EFH. Consultation with NMFS was completed on April 5, 2019. Overall, due to the temporary nature of the activities, proposed minimization measures and the minimal level of impact to water column noise levels, benthic flora and fauna, water quality, and sediment quality, no significant impacts to EFH would occur with implementation of the proposed MPR activities.

9.3.2.2.4 Birds

Resident and migrant marine birds are expected to be present within the vicinity of proposed MPR activities during the in-water work window established for juvenile salmonid avoidance (Section 2.5.3). Proposed MPR activities have the potential to impact marine birds through visual disturbance, changes in prey availability, and elevated underwater and airborne noise. Pile extraction and installation projects, and other repair projects on the existing marine structures would intermittently increase human activity levels on the waterfront, potentially resulting in visual disturbance and increasing ambient noise levels due to use of construction equipment. Bald eagles that nest near NAVSTA Everett and forage along the marine shoreline are unlikely to experience the increase in human activity at project sites, given the distance to foraging areas and existing nest sites. In general, project sites currently have ongoing human activity, and project work involving repairs to marine structures would be within the baseline condition. Therefore, project effects due to human activity levels would be insignificant.

As discussed in Sections 9.3.2.2.2 and 9.3.2.2.3, in-water work could temporarily affect the availability of forage fish and benthic invertebrates, which are the prey base of many marine birds, in a limited area. Removal of existing creosote-treated timber piles would improve localized water quality conditions in the project area. Turbidity effects and potential resuspension of contaminated sediments are not expected to affect the prey base, as these changes would be short-term and small scale during construction. Therefore, proposed MPR activities would have no significant impacts on prey availability for marine birds.

Effects of Elevated Noise Levels on Birds

Proposed MPR activities would result in increased underwater noise levels. Noise would be generated from small vessels and barge-mounted equipment such as generators, and pile extraction and installation. Noise levels from all activities except pile driving would typically not exceed underwater sound levels resulting from existing routine waterfront operations along the NAVSTA Everett waterfront.

The most significant underwater noise source would be impact pile driving of steel piles. Impacts of elevated noise levels due to pile driving were evaluated in the context of established criteria for ESA consultation with the USFWS on the threatened marbled murrelet. No criteria have been established for determining impacts of elevated noise levels on other marine bird species, some of which forage underwater like the marbled murrelet, and general conclusions about impacts on marbled murrelets were applied to other species. Pursuit-diving birds (i.e., birds that pursue and capture their prey underwater using their wings to swim) include cormorants, grebes, and alcids (murres, murrelets, and pigeon guillemots). While actively foraging they dive repeatedly into waters of various depths and would potentially be exposed to elevated underwater noise during pile driving. When startled by loud sounds, their foraging patterns may be altered, and birds may flush or dive and swim away underwater. While underwater they would be susceptible to injury or behavioral disturbance due to elevated sound pressure waves generated by pile driving. Dabbling and diving ducks may also be susceptible to elevated underwater sound. Birds that feed on the surface such as gulls, shorebirds, and wading birds are unlikely to be affected by elevated underwater sound.

Actively foraging marbled murrelets dive repeatedly into waters ranging up to approximately 160 ft. in depth for periods ranging up to 60 seconds (Nelson et al., 2006). Foraging bouts typically last over a period of 27 to 33 minutes, with approximately 50 percent of the time spent underwater (Jodice and Collopy 1999). When startled by loud sounds, the foraging pattern may be altered, and birds may flush or dive and swim away underwater. While underwater they would be susceptible to injury or behavioral disturbance due to elevated sound pressure waves generated by pile driving.

As described in detail in Appendix B, the USFWS uses underwater noise thresholds developed by the Marbled Murrelet Hydroacoustic Science Panel (SAIC, 2011) to determine the zones around an impact- driven pile in which two general forms of injury might occur to diving marbled murrelets: (1) auditory injury (generally damage to sensory cells of the ear) beginning at 202 dB SEL cumulative, and (2) non-auditory injury (trauma to non-auditory body tissues/organs) beginning at 208 dB SEL cumulative. Since the underwater criterion for auditory injury was the lower of the two thresholds, this was the criterion used for assessing injurious impacts to the marbled murrelet in this analysis. Currently there are no thresholds or guidelines for installation and extraction of piles with a vibratory driver. Because the sound levels generated by vibratory drivers are typically 20-30 dB lower than impact pile driving and do not produce waveforms with sharp rise times like impact pile driving, the affected areas would be discountably small and potential impacts on marbled murrelets would be discountable.

A maximum of 78 piles could be installed at NAVSTA Everett during the 5 years of proposed MPR activities, of which only one would be steel, and the remainder would be concrete or timber. As shown in Table B-9 of Appendix B, potentially the most injurious noise levels may extend up to 63 m from the impact driven 30-in steel pile and 10 m from an impact-driven 24-in concrete pile (see Figure 9-2 for a representative scenario of the extent of potentially injurious underwater noise from steel pile installation). Since estimates of the distances to thresholds involve the cumulative energy of all impact strikes over a 24-hour period, the affected area represents the maximum extent of potential auditory injury effects. Earlier in the construction day, the injury zone would be smaller, and only reach the maximum extent after all the pile strikes have been completed. Since estimates of the distances to thresholds involve the cumulative energy of all impact strikes over a 24-hour period, the affected area represents the maximum extent.

Figure 9-2. Representative Affected Areas for Pile Driving Noise for Marbled Murrelets at NAVSTA Everett

Airborne noise levels from proposed MPR activities are not expected to be injurious to birds within the study area because the source levels for airborne noise from pile driving (vibratory: 96 dBA at 15 m; impact: 110 dBA at 11 m) are well below those known to cause injury to birds in laboratory situations (Dooling & Popper, 2007). However, the USFWS (2014) has determined that airborne noise due to impact pile driving may behaviorally affect foraging marbled murrelets, based on the findings of the Marbled Murrelet Hydroacoustic Science Panel regarding non-injurious thresholds for pile driving noise (SAIC, 2012). Marbled murrelets typically perform foraging dives in pairs and are highly vocal when they are above the surface (Strachan et al., 1995). On the water's surface, birds typically stay within 100 ft. of their partners during foraging bouts. This behavior is thought to play a role in foraging efficiency, and therefore airborne noise that masks their vocalizations has the potential to affect foraging success (Carter & Sealy, 1990; Strachan et al., 1995). Unlike other noise effects criteria established for injury, the distance from a pile driving source within which communications would be masked is dependent upon ambient noise levels and therefore is site-specific. Masking effects cease immediately when the masking noise stops.

Under typical conditions on the waterfront, communication between foraging murrelets would be compromised by pile driving noise within 42m of the murrelets. This is based on noise produced by impact pile driving <36-in steel piles (USFWS, 2013). Acoustic monitoring during construction at NAVBASE Kitsap Bangor (Illingworth & Rodkin, 2013) indicated that average airborne source levels during impact driving of 36-in steel piles were the same as, and in some cases lower than, 24-in steel piles. Therefore, the masking distance for 24-in steel piles was applied to all steel pile sizes. Representative scenarios of areas affected by masking effects are shown in Figure 9-2.

The USFWS (2013) has provided guidance on evaluating the significance of airborne masking effects for pile driving projects. "Typical" pile driving projects involve:

- Installation of 24-in or 36-in steel piles,
- Use of vibratory pile drivers,
- Use of impact pile drivers for proofing only, and
- Adherence to a 2-hour timing restriction (i.e., no pile driving within 2 hours after sunrise and within 2 hours before sunset during the breeding season).

Typical pile driving projects do not result in measurable effects on marbled murrelets because the use of impact hammers is intermittent and of short duration, the 2-hour timing restriction protects murrelets during their most active foraging periods, and murrelet vocalizations are adapted to overcome the effects of ambient noise (USFWS, 2013).

Steel pile driving during proposed MPR activities would fit into the "typical" category because all piles would be 36-in or less, vibratory drivers would be used to install the piles, with limited proofing, and the timing restrictions would be observed. The USFWS guidance does not cover concrete piles, but the potential masking effects of concrete pile installation are likely to be much smaller because impact installation of concrete pile generates lower SPLs than steel pile installation (Appendix B).

To prevent exposure to injurious or masking noise levels in the action area for projects at NAVSTA Everett, the Navy would implement the minimization measures and BMPs described in Section 2.5. The Navy would actively monitor the underwater auditory injury zone for impact pile driving up to 63 m or the 42-m masking zone (Figure 9-2), whichever is larger, depending on the pile type. The likelihood of marbled murrelet exposure to injurious or masking noise from impact pile driving is discountable because these zones are small and can be effectively monitored during pile driving, and pile driving would cease if monitors detect marbled murrelets (see Appendix D for details) within the threshold distance.

With the implementation of minimization and monitoring actions (Section 2.5), the Navy has determined the Proposed Action “may affect, but is not likely to adversely affect” ESA-listed marbled murrelets. USFWS concurred with the Navy’s determination in a letter dated December 15, 2017. Proposed MPR activities would have no significant impacts on marbled murrelets or other marine bird species due to temporarily elevated underwater and airborne sound levels resulting from impact or vibratory pile driving of all pile types.

Critical Habitat

Because the closest marbled murrelet designated critical habitat to NAVSTA Everett is about 24 mi to the northeast, no noise resulting from proposed MPR activities would reach it. Therefore, a no effect determination was made for designated critical habitat in the vicinity of NAVSTA Everett.

9.3.2.2.5 Marine Mammals

Pile installation and removal during proposed MPR activities at NAVSTA Everett would result in temporarily increased human activity levels and changes in prey availability during project construction. However, project construction would take place at existing marine structures that have relatively high levels of human activity under daily operations, and prey availability changes would be short-term and highly localized, as described in Section 9.3.2.2.3. Because vessels would be operating at slow speeds, no vessel strikes would be expected. Therefore, there would be no significant impact to marine mammals due to increased human activity levels, changes in prey availability, or the potential for vessel strikes.

Effects of Elevated Noise Levels on Marine Mammals

Underwater and airborne noise generated during pile installation and removal has the potential to disrupt the behavior of marine mammals that may be traveling through, foraging, or resting in the vicinity of the project area, as described in detail in Appendix B. The Navy estimates potential impacts to marine mammals by considering the likelihood that each species may be present at NAVSTA Everett during pile driving, determining the sound levels generated by various pile types and installation methods, and applying acoustic threshold criteria (expressed in decibels, dB) established by NMFS for evaluating the potential for injury or behavioral impacts. A detailed explanation of the analytical methods is presented in Appendix B, and the following sections summarize results of the underwater noise analysis.

A maximum of 78 steel, concrete, or timber piles could be installed at Everett during the 5 years of proposed MPR activities, of which only one would be steel. The highest underwater source levels for pile driving would result from impact driving of the single 30-in steel pile. As described in detail in Appendix B, the Navy estimated the distances to the various NMFS underwater noise thresholds for injurious and behavioral effects on marine mammals. These distances were estimated by taking into account the source levels for impact and vibratory pile driving of piles at NAVSTA Everett, sound propagation over distance from the driven pile, and acoustic impacts thresholds for the various species groups. Figure 9-3a depicts a representative scenario of the extent of potentially injurious and behaviorally harassing underwater noise from steel pile installation. This scenario depicts the affected area for the sole steel pile proposed at this location, but the majority of impact pile driving would involve concrete pile (Figure 9-3b), and timber pile (Figure 9-3c). for which the modeled injury and behavioral disturbance extents are much smaller. In all scenarios, the area encompassed by the threshold values decreases the closer to shore pile driving occurs and is truncated where shallow water and land block noise transmission.

The likelihood of injury due to pile driving noise is discountable for marine mammals at NAVSTA Everett, with the exception of harbor seal, for several reasons. Marine mammals are unlikely to be present in the small areas affected by injurious noise levels. The greatest radius of potentially injurious noise from impact pile driving is expected to be no greater than 736 m for the 30 in steel pile and 216 m for the concrete piles. These areas would be fully monitored by marine mammal observers during pile driving. In addition, only one steel pile would be installed and a vibratory driver would be used, which would affect a smaller area with injurious noise levels than impact pile driving (Appendix B). As described in Appendix D, pile driving would cease if monitors detect a marine mammal approaching or entering the injury zone. The exception at NAVSTA Everett is the harbor seal, where there is a potential for injurious exposure to noise due to impact driving of the single steel pile. As described in Chapter 9.3.1.5, there is an abundant local seal population.

The injury zone would be monitored and a shutdown zone would be implemented, but Level A exposure could occur to some portion of the harbor seal population that may swim into, and remain undetected in, the injury zone during the approximate 30-minute duration of steel pile driving. The Navy estimates that 5 percent of the population may enter the injury zone during impact installation of the steel pile without shutdown occurring, resulting in exposure of individuals to hearing loss. Because the seals are unlikely to remain underwater in the injury zone during the duration of pile driving, the likelihood of this type of exposure is not great.

Pile driving would produce noise above the underwater behavioral harassment threshold during impact and vibratory pile driving. The loudest impact pile driving noise, resulting from installation of the sole 30-in steel pile, is estimated to produce behavioral disturbance in an area up to 631 m from the driven pile. Impact installation of the majority of piles (24-in concrete) would affect a distance of only 159 m from the driven pile. Impact pile driving noise is not expected to result in behavioral harassment of marine mammals because affected areas can be fully monitored and pile driving would cease if a marine mammal approaches the affected area.

However, installation of the steel pile would utilize a vibratory pile driver to the extent practicable in order to reduce adverse impacts to fish species, and the affected area due to the vibratory pile driver would be much larger than the area affected by impact pile installation (due to the low behavioral harassment threshold for continuous sound [120 dB RMS versus 160 dB RMS for impulsive sound]). Exposure of marine mammals to behavioral harassment during vibratory installation of the sole steel pile could extend up to 13.6 km from the driven pile at NAVSTA Everett. Also, up to 75 timber piles would be extracted using vibratory pile drivers, resulting in potential behavioral disturbance as much as 2.2 km from the driven pile. These affected areas would be too large to be fully monitored by marine mammal observers (for details see Appendix D).

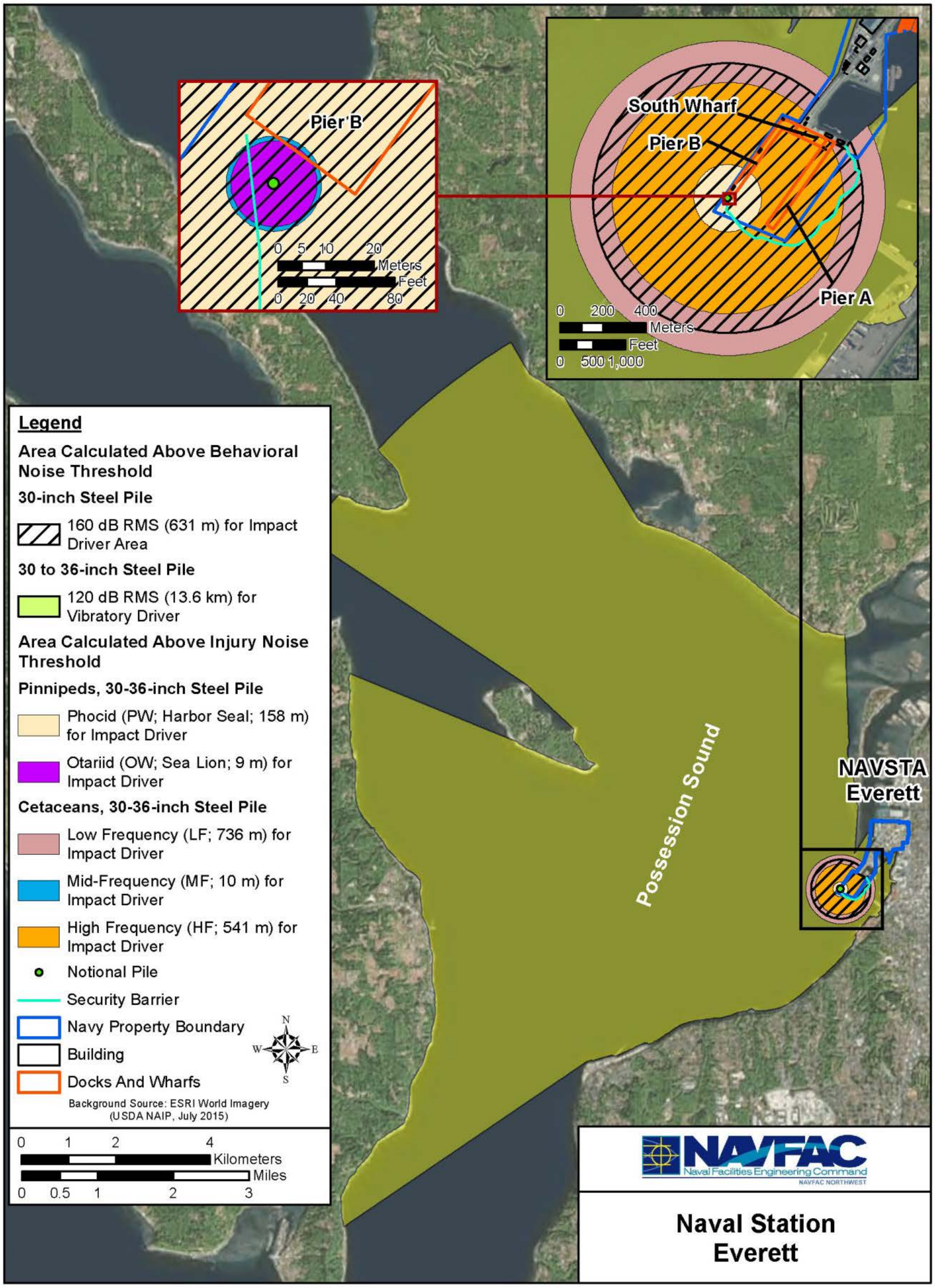

Figure 9-3a. Representative Affected Areas for Pile Driving Noise (Steel Pile) for Marine Mammals at NAVSTA Everett

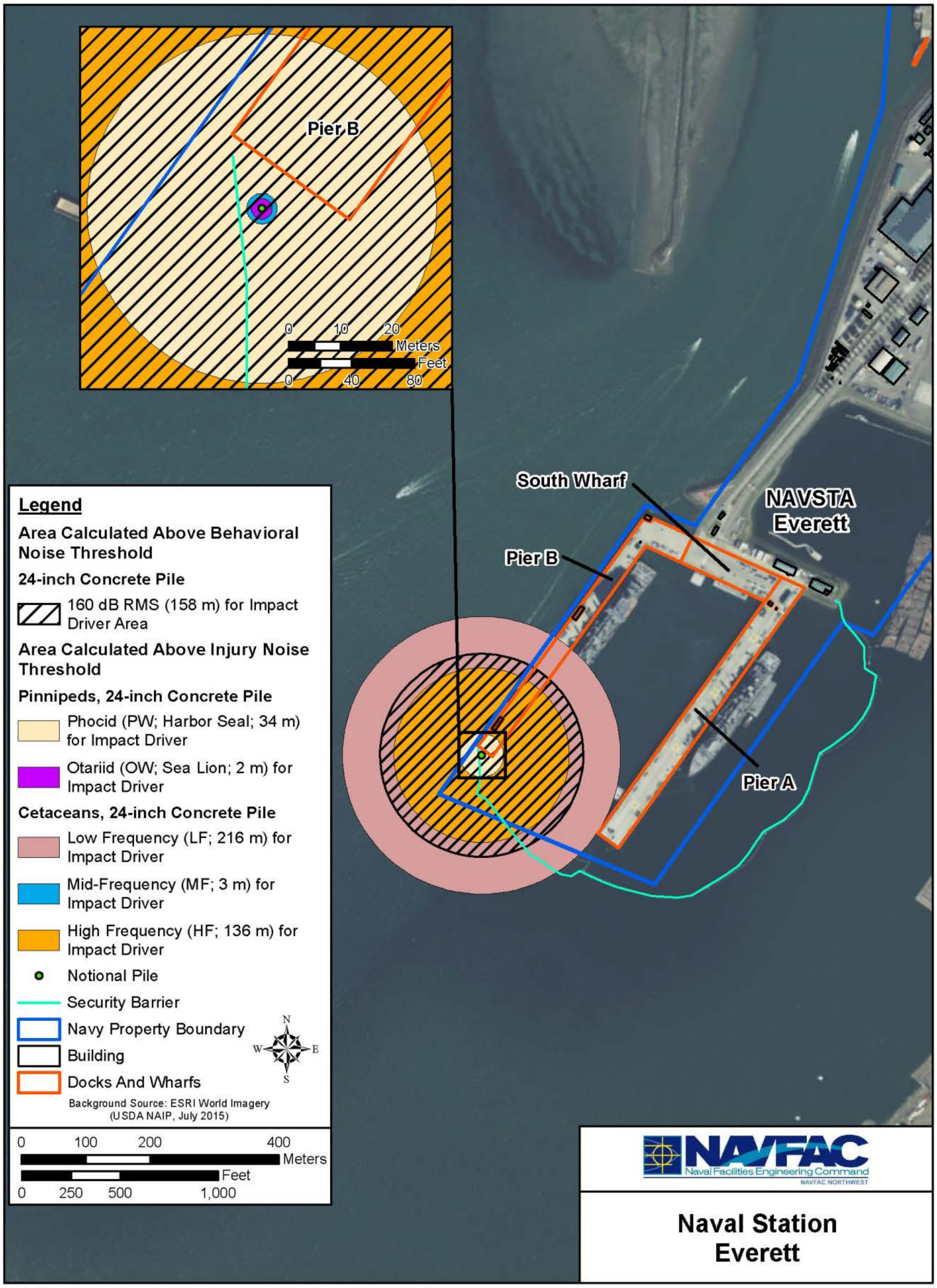

Figure 9-3b. Representative Affected Areas for Pile Driving Noise (Concrete Pile) for Marine Mammals at NAVSTA Everett

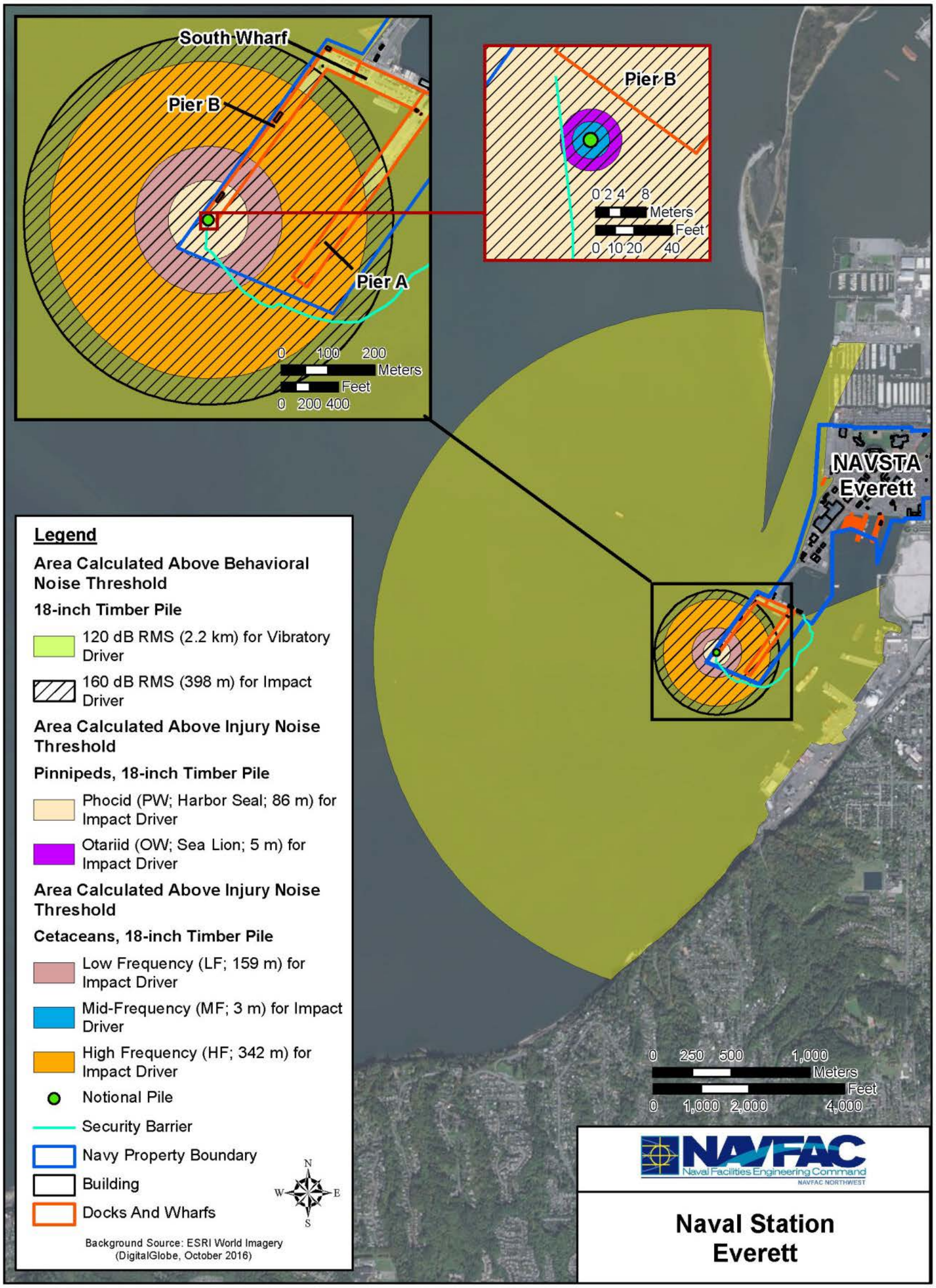

Figure 9-3c. Representative Affected Areas for Pile Driving Noise (Timber Pile) for Marine Mammals at NAVSTA Everett

The analysis of exposure of marine mammals to above-threshold noise assumed the scenario involving vibratory extraction of timber piles. To assess the potential exposure of marine mammals during in-water work windows during the 5 years of proposed MPR activities, the likelihood of occurrence of each species was considered along with the number of pile driving days. The Navy used one of three methods for species at NAVSTA Everett, depending on (1) whether site-specific abundance was known, (2) regional densities were known, or (3) the species is so infrequently encountered that densities cannot be determine and other reasoning must be applied. Potential exposures of California sea lions and harbor seals were estimated based on known abundances determined by on-site monitoring; exposures of Steller sea lions, and Dall's porpoises were estimated based on regional density data (Navy, 2015a, Marine Species Density Database); exposures of harbor porpoises were based on density estimates from Smultea et al. (2017); and exposures of the remaining species were estimated through analysis of historical occurrence. Details of the exposure analysis are presented in Appendix B, and results are summarized in Tables B-19 and B-20.

Based on the exposure estimates in Tables B-19 and B-20, the species most likely to be impacted are the California sea lion, and harbor seal. The Navy would implement a variety of BMPs and mitigation measures, including noise attenuation devices and marine mammal observers that are expected to reduce the estimated impacts. These measures are fully described in Appendix D and summarized in Section 2.5.

Individual responses of marine mammals to pile driving noise are expected to be variable. Some individuals may occupy the project area during pile driving without apparent effect, but others may be displaced with undetermined effects. In general, cetaceans like harbor porpoise infrequently transit the waters in the vicinity of NAVSTA Everett and they do not tend to remain there. If they encounter pile driving noise they would likely avoid affected areas. Avoidance of the affected area during pile driving operations would potentially reduce access to foraging areas and inhibit movement through the area. The likelihood of exposure to behavioral disturbance due to pile driving noise would be limited by the infrequent occurrence of cetacean species in the vicinity, and monitoring and shutdown of pile driving if monitors detect cetaceans, as described in Appendix D.

Although ESA-listed cetacean species in Table 3-8 are infrequently present in the vicinity of NAVSTA Everett, it is possible that they may occur in the behavioral harassment zone undetected by marine mammal observers. Therefore, the Navy concludes that proposed MPR activities at NAVSTA Everett:

- "may affect, and are likely to adversely affect" humpback whales and Southern Resident killer whales because they are infrequently present in the vicinity; and
- "may affect, but are not likely to adversely affect" Southern Resident killer whale designated critical habitat.

NMFS did not concur with the Navy's affect determinations for ESA-listed marine mammals, and determined that the Navy's proposed MPR activities "may affect, are likely to adversely affect" the humpback whale and Southern Resident killer whale, and their designated critical habitat. The Navy's consultation with NMFS regarding ESA-listed marine mammals and critical habitat was completed with the issuance of a BiOp on April 5, 2019 (Appendix G).

Acoustic exposure estimates from pile driving operations summarized in Appendix B Table B-19 indicate there is the potential for Level A injury, which has the potential to affect marine mammals through hearing loss (referred to as permanent threshold shift, or PTS) of harbor seals and Level B harassment, which has the potential to disrupt animal behavior, or harbor seals and other species, as defined by

MMPA. Other construction activities not associated with pile installation and removal would not result in Level A or B harassment under the MMPA. The Navy consulted with NMFS in compliance with the ESA and the MMPA, and obtained an LOA for Level A injury and Level B harassment of marine mammals. The Final Rule for the LOA was published in the Federal Register on 17 April, 2019. The exposures are only expected to result in behavioral impacts on an intermittent basis for most marine mammal species, and long-term or permanent impacts potentially may affect a small number of harbor seals.

The analysis presented above indicates that proposed MPR activities at NAVSTA Everett may impact individual marine mammals, but any impacts observed at the population, stock, or species level would be negligible. Therefore, there would be no significant impact to marine mammal populations.

9.4 Cultural Resources

9.4.1 Affected Environment

The APE for the Proposed Action at NAVSTA Everett consists of up to nine facilities (Table 9-1). All work would occur in or over-water. No on-shore work is planned, and any staging required would occur in previously disturbed or developed areas.

The facilities at NAVSTA Everett have been documented and evaluated for NRHP eligibility (Sackett, 2014). No facilities pre-date World War II. Of the structural resources that lie within the APE, Piers D and E date to World War II (Table 9-1), but do not retain the integrity necessary to be considered eligible for listing in the NRHP. Piers C, D and E date to the Cold War era but have no significant associations, and are not eligible for listing in the NRHP. Piers A and B, North and South Wharves, the Recreational Marina, and the Small Boat Launch date to the 1990s or later. In accordance with the NHPA, all resources that are less than 50 years of age that are evaluated under Criteria Consideration G must have achieved “exceptional importance” within the last 50 years in order to be considered eligible for inclusion in the NRHP. These resources are not eligible for the NRHP as they have not achieved the exceptional significance necessary for resources that are younger than 50 years of age. The SHPO has concurred with the determinations of eligibility (June 23, 2013).

NAVSTA Everett is constructed on fill materials, deposited in stages since the 19th century, and completed in the 1970s when the Port of Everett acquired the land for development. No archaeological historic properties have been identified within the project APE, which consists of four piers, two wharfs a recreational marina and a small boat launch, all located along a shoreline that does not reflect the original coastline at NAVSTA Everett. There are no recorded submerged historic properties, downed aircraft, or shipwrecks in the NAVSTA Everett APE. The probability of prehistoric archaeological deposits or features buried within the substrate is very low due to Holocene sea level changes and associated erosion of glacial deposits found along the shoreline of Puget Sound.

Table 9-1. Proposed Action at NAVSTA Everett

Structure Name	*Year Built*	*NRHP Status*	*SHPO Concurrence Date*	*DAHP Log #*	*Note*
Pier A	1993	Not Eligible	6/23/2013	062314-31-USN	Post-Cold War-era
Pier B	1998	Not Eligible	6/23/2013	062314-31-USN	Post-Cold War-era
Pier C	1940s	Not Eligible	6/23/2013	062314-31-USN	
Pier D	1941	Not Eligible	6/23/2013	062314-31-USN	
Pier E	1941	Not Eligible	6/23/2013	062314-31-USN	
North Wharf	1992	Not Eligible	6/23/2013	062314-31-USN	Post-Cold War-era
South Wharf	1992	Not Eligible	6/23/2013	062314-31-USN	Post-Cold War-era
Recreational Marina	1995	Not Eligible	6/23/2013	062314-31-USN	Post-Cold War-era
Small Boat Launch	2011				

9.4.2 Environmental Consequences

9.4.2.1 No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to the baseline cultural resources. Therefore, no significant impacts to cultural resources would occur with implementation of the No Action Alternative.

9.4.2.2 MPR Activities (Preferred Alternative) Potential Impacts

Implementation of proposed MPR activities at NAVSTA Everett would not affect historic properties listed or eligible for listing in the NRHP. Pier pilings do not embody key elements of the historic properties, and changes to these elements would not adversely affect their NRHP eligibility or contribution to a district. The SHPO has concurred with the determinations of eligibility and the Navy's determination of no historic properties affected in a letter dated May 31, 2017.

The probability of archaeological deposits or features is considered low due to the landform having been created from fill on a former mudflat. Although there is potential for pre-contact and historic-period deposits or features below the fill, there are no reasonable means to identify them prior to construction. Therefore, there would be no significant impact to cultural resources.

9.5 American Indian Traditional Resources

9.5.1 Affected Environment

The project area is within the reserved treaty rights of the Tulalip Tribe. The Navy and the Tulalip Tribes of Washington signed a Memorandum of Agreement in 1987 that provided for cooperation in fish and water quality protection and support of tribal resource enhancement efforts. The Suquamish Tribe, Lummi Tribe, and the Swinomish Indian Tribal Community have treaty fishing rights at the mouth of the Snohomish River which flows to the west of NAVSTA Everett. The Stillaguamish Tribe have requested that they be informed of projects that have the potential to impact the Tulalip Tribe's U&A fishing rights. Finfishing is allowed at NAVSTA Everett, and tribal fishermen can fish or drop crab pots up to the Port Security Barrier, unless a ship is present within the restricted area.

9.5.2 Environmental Consequences

9.5.2.1 No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to baseline American Indian traditional resources. Therefore, no significant impacts to American Indian traditional resources would occur with implementation of the No Action Alternative.

9.5.2.2 MPR Activities (Preferred Alternative) Potential Impacts

In accordance with Executive Order 13175 and DOD and Navy instructions, the Navy invited the Tulalip Tribe, Suquamish Tribe, Lummi Tribe, and Swinomish Indian Tribe to initiate government-to-government consultation regarding proposed MPR activities and potential impacts to tribal treaty rights. The Tribes expressed no objections to the proposed MPR activities at NAVSTA Everett. The Suquamish Tribe also provided comments on the Revised Draft EA, but determined it was not necessary to meet with the Navy to discuss these comments (Baxter, 2019). Government-to-government consultation with the Tribes is complete.

There would be no changes to the status quo regarding tribal access to traditional resources as a result of proposed MPR activities. Construction activities could result in loss of benthic organisms at the immediate project site; however replacement piles would be installed near the location of the removed pile, minimizing the direct loss of benthic invertebrates.

There would be a temporary increase in the volume of barge traffic during pile replacement and maintenance activities as pile delivery and disposal would generally be conducted via barge. However, the increase in barge traffic generated by proposed MPR activities would be negligible when compared to existing marine traffic in Puget Sound and at NAVSTA Everett.

Construction would not result in any discharge to shellfish beds utilized for tribal harvesting; therefore, there would be no effect on the quality of these beds. The in-water work window for each construction year would minimize impacts to all juvenile salmonid species; therefore, significant impacts to juvenile salmonids are not expected. As part of continued engagement, the Navy will annually provide summaries of planned pile repair and replacement projects to the Tribes for information and coordination. Therefore, there would be no significant impact to American Indian traditional resources.

9.6 Summary of Potential Environmental Consequences

Table 9-2. Summary of Environmental Impacts at NAVSTA Everett

Section/ Resource Area	*Environmental Impacts*
Airborne Noise	Temporary construction noise during daytime hours is exempt from maximum permissible noise levels under the WAC and Snohomish County and Everett noise regulations. Recreational users in Port Gardner could experience noise disturbance but not at levels sufficient to cause adverse effects. Therefore, there would be no significant impact to the ambient sound environment.
Water Quality	Direct discharges of waste would not occur. Construction-related impacts would be limited to short-term and localized changes associated with re-suspension of bottom sediments. These changes would be spatially limited to the construction site and areas immediately adjacent. Temporary impacts would not violate applicable state or federal water quality standards. The Navy would implement BMPs and minimization measures to prevent accidental losses or spills of construction debris. Removal of creosote-treated timber piles would improve local water quality. Therefore, there would be no significant impact to water quality.
Sediments	Sediment would be disturbed and re-suspended in the water column during pile removal and pile driving activities. Some degree of localized changes in sediment composition would occur. In particular, sediments that are re-suspended would be dispersed by currents and eventually re-deposited on the bottom. Project-related construction activities would not create sediment contamination concentrations or physical changes that violate state standards. Therefore, there would be no significant impact to sediments.
Aquatic Vegetation	No eelgrass occurs at NAVSTA Everett and aquatic vegetation is limited. Vegetative growth found on existing piles would be removed when those piles are extracted from the water but because piles would be replaced, ultimately a similar amount of surface area on which marine organisms could colonize would exist. Because aquatic vegetation does not occur densely in the area, direct removals should be minimal. Impacts due to turbidity would be short-term, temporary, and localized. Additionally, because aquatic vegetation is distributed outside of the project area, recolonization could occur quickly, and the overall health and abundance of aquatic vegetation would not be compromised. Therefore, there would be no significant impact to aquatic vegetation.
Benthic Invertebrates	As with aquatic vegetation, benthic organisms attached to removed piles would be lost, but new piles would provide equivalent attachment sites for development of the benthic community. Benthic organisms directly adjacent to piles would be lost or displaced. There would be minimal impacts to habitat and benthic organisms from turbidity caused by pile removal and installation and anchor placement and removal, but these effects would be temporary and very localized. Impacts observed at the population, stock, or species level would be negligible. Therefore, there would be no significant impact to benthic invertebrate populations.

Table 9-2. Summary of Environmental Impacts at NAVSTA Everett (continued)

Section/ Resource Area	*Environmental Impacts*
Marine Fish and EFH	In-water construction may expose fish to increased turbidity but exposure would be localized and temporary. The most significant impact to fish that could occur would be from exposure to elevated underwater noise from impact pile driving. To minimize exposure to noise, pile driving would be conducted during the in-water work window when juvenile salmonids (including ESA-listed salmonids) are least likely to be present. Only one steel pile is proposed to be installed at NAVSTA Everett and due to the potential for contaminated sediments, the Navy will consider whether a bubble curtain or other noise attenuation device to attenuate noise can be used during impact pile driving. Concrete piles would be installed with an impact pile driver with pile driving conducted intermittently and for an average of 1.5 hours in a day during the 5 years of proposed MPR activities. The Navy has determined that the Proposed Action "may affect, but is not likely to adversely affect" ESA-listed fish species and designated critical habitat and "may adversely affect" EFH. The USFWS has concurred with the Navy's conclusions regarding bull trout. NMFS concluded that the Navy's proposed MPR activities "may affect, are likely to adversely affect" Puget Sound evolutionary significant unit (ESU) Chinook salmon; Hood Canal summer-run ESU chum salmon; Puget Sound distinct population segment (DPS) steelhead; Puget Sound/Georgia Basin DPSs of bocaccio and yelloweye rockfish; designated critical habitat; and, EFH. Per Terms and Conditions 2.b. contained in the NMFS' BiOp, the Navy must restrict impact driving steel piles to the period between July 16 and October 14, annually. With implementation of minimization measures, there would be no significant impacts to marine fish (including ESA-listed fish) and EFH.
Birds	Construction activities may result in the exposure of marbled murrelets to sound pressure levels above the behavioral guidance criterion. Mitigation measures would be used to reduce the adverse impacts to marbled murrelets, also benefiting other marine birds. No designated critical habitat for the marbled murrelet is located near Everett; therefore construction activities would not affect designated critical habitat for the species. The Navy has determined that the Proposed Action "may affect, but is not likely to adversely affect" the marbled murrelet, and the USFWS has concurred with the Navy's conclusions. No significant impacts to other marine birds are expected.
Marine Mammals	Pile driving at NAVSTA Everett may expose marine mammals to injurious (harbor seal only) or behavioral disturbance due to elevated underwater noise. Mitigation measures would be used to reduce the adverse impacts to marine mammals. The Navy determined that the Proposed Action "may affect, and is likely to adversely affect" ESA-listed humpback whales and Southern Resident killer whales because they are occasionally present in the vicinity; and "may affect, but is not likely to adversely affect" Southern Resident killer whale designated critical habitat. NMFS concluded that the Navy's proposed MPR activities "may affect, are likely to adversely affect" humpback whale species, Southern Resident killer whale, and Southern Resident killer whale designated critical habitat. The Navy consulted with NMFS and will obtain an LOA under the MMPA. While construction activities may impact individual marine mammals, any impacts observed at the population, stock, or species level would be negligible. Therefore, there would be no significant impact to marine mammal populations.
Cultural Resources	Implementation of proposed MPR activities at NAVSTA Everett would not affect historic properties listed or eligible for listing in the NRHP. The Navy has determined that the Proposed Action would have no effect on historic properties and the SHPO has concurred. Therefore, there would be no significant impact to cultural resources.

Table 9-2. Summary of Environmental Impacts at NAVSTA Everett (continued)

Section/ Resource Area	***Environmental Impacts***
American Indian Traditional Resources	There would be no changes to the status quo regarding tribal access to traditional resources. Construction activities could result in the loss of benthic organisms in the immediate project site; however, replacement piles would be installed near the location of the removed piles, minimizing the direct loss of benthic invertebrates. Construction would not result in any discharge to shellfish beds utilized for tribal harvesting; therefore, there would be no effect on the quality of these beds. The in-water work window for each construction year would minimize impacts to all juvenile salmonid species; significant impacts to juvenile salmonids would not be expected. Therefore, there would be no significant impact to American Indian traditional resources.

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10 Naval Magazine Indian Island Affected Environment and Environmental Consequences

10.1 Airborne Noise

10.1.1 Affected Environment

Airborne sound at the NAVMAG Indian Island Ammunition Wharf is primarily produced by movement of marine vessels and shore-based vehicles, and operation of equipment (generators, cranes, and forklifts). During ordnance operations at the Ammunition Wharf, the primary noise producer is a track crane, with minor levels produced by forklifts. Noise levels from a track crane typically range from 75-85 dBA at 50 feet (Canter, 1996). Weather conditions such as wind or rainfall are variable and can increase ambient sound levels in undeveloped areas, but these are rarely accounted for in models (WSDOT, 2018).

There are no residences on NAVMAG Indian Island and the nearest sensitive receptors are private residences located approximately 1.5 miles to the west at Kala Point.

The State of Washington and Jefferson County have developed maximum permissible environmental noise levels for receiving properties. However, both Washington and Jefferson County have exempted noise generated by temporary construction activities. Permissible noise levels and exceedance allowances are discussed in Section 3.1.

10.1.2 Environmental Consequences

10.1.2.1 No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to baseline airborne noise. Therefore, no significant impacts to airborne noise would occur with implementation of the No Action Alternative.

10.1.2.2 MPR Activities (Preferred Alternative) Potential Impacts

Construction associated with proposed MPR activities would result in temporarily elevated underwater and airborne noise levels. Noise would be generated from support vessels, small boat traffic, and barge-mounted equipment, such as generators, and pile extraction and installation equipment. Noise levels from all activities except pile driving would typically not exceed ambient sound levels resulting from routine waterfront operations in the vicinity of any of the structures in the proposed MPR activities locations. The most significant project-related noise source would be impact pile driving of concrete piles (WSDOT, 2018).

Construction noise would be temporary between October 1 and January 15 and limited to a single year at NAVMAG Indian Island. The maximum duration of pile driving in a single day would be up to 1.5 hours of impact pile driving. Elevated noise levels during pile driving may be noticeable in residential areas but, as stated above, temporary construction noise is exempt from maximum permissible noise levels under the WAC and Jefferson County noise regulations. Therefore, no significant impacts to airborne noise are expected.

10.2 Water Resources and Marine Sediments

10.2.1 Affected Environment

10.2.1.1 Water Quality

NAVMAG Indian Island's Ammunition Wharf is located in the northeastern portion of Port Townsend Bay. WDOE has established designated uses for Port Townsend Bay as follows: extraordinary (aquatic life uses); primary contact (recreation); shellfish harvesting; and wildlife habitat, commerce and navigation, boating, and aesthetics (miscellaneous uses) (WAC 173-201A-612). Waters located directly north of NAVMAG Indian Island are included in the WDOE 303(d) list of impaired waters for Bacteria (WDOE, 2017a). Several areas in Port Townsend Bay, near the Port Townsend Ferry Terminal are included in the WDOE 303(d) list for Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Chrysene, Dibenzo(a,h)anthracene, Indeno(1,2,3-c,d)pyrene, and Polychlorinated Biphenyls (PCBs). However, no waters near the Ammunition Wharf are on the WDOE 303(d) list.

10.2.1.2 Marine Sediments

No marine sediments at or near the Ammunition Wharf are assessed or listed in the current WDOE 303(d) impaired list (WDOE, 2017a). Marine sediments south of the project area have been listed as Category 2, sediments of concerns, for Benzoic Acid, Benzyl Alcohol, and Phenol. While these sediments have exceeded Sediment Management Standards at least once in previous samplings, no action is required.

10.2.2 Environmental Consequences

10.2.2.1 No Action Alternative

10.2.2.1.1 <u>Water Quality</u>

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to baseline water quality. Therefore, no significant impacts to water quality would occur with implementation of the No Action Alternative.

10.2.2.1.2 <u>Marine Sediments</u>

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to baseline marine sediments. Therefore, no significant impacts to marine sediment would occur with implementation of the No Action Alternative.

10.2.2.2 MPR Activities (Preferred Alternative) Potential Impacts

10.2.2.2.1 <u>Water Quality</u>

Direct discharges of waste to the marine environment would not occur during proposed MPR activities. Impacts to water quality would be limited to short-term and localized changes associated with re-suspension of bottom sediments from pile removal and installation and barge and tug operations, such as anchoring and propeller wash. These changes would be spatially limited to the construction site and areas immediately adjacent.

Construction-related impacts would not violate applicable state or federal water quality standards discussed in Section 3.2. BMPs and minimization measures, discussed in Section 2.5, would be implemented to prevent accidental losses or spills of construction debris into Port Townsend Bay. Therefore, no significant impacts to water quality are expected.

10.2.2.2.2 Marine Sediments

Some degree of localized changes in sediment composition would occur as a result of in-water construction during proposed MPR activities. In particular, sediments that are re-suspended by pile installation and removal activities would be dispersed by currents and eventually re-deposited on the bottom. Depending on the distance suspended sediments would be transported from shallow to deeper portions of the Ammunition Wharf project site or fine-grained sediments would be transported from deeper to shallower areas. The distance over which suspended sediments are dispersed would depend on a number of factors, such as the sediment characteristics, current speeds, and distance above the bottom.

There would be no direct discharges of wastes, to the marine environment during construction. Therefore, construction-related impacts to sediment quality would be limited to localized changes associated with disturbances of bottom sediments from replacement of nine concrete piles. Setting spuds and anchors for the barges, and propeller wash from tugs used for pile removal and installation represent other construction-related sources for disturbances of bottom sediments.

Project-related construction activities would not create sediment contamination concentrations or physical changes that violate state standards or interfere with beneficial uses of Port Townsend Bay near the Ammunition Wharf. Therefore, there would be no significant impact to sediments.

10.3 Biological Resources

10.3.1 Affected Environment

10.3.1.1 Aquatic Vegetation

The bottom habitat around the NAVMAG Indian Island is composed of featureless mud, sand, and shells (NOAA Nautical Chart 18464; Washington Marine Spatial Planning, 2018). Eelgrass and macroalgal beds (e.g., Ulvales, Laminariales) occur along the shoreline on pebble and cobble substrate (Washington Marine Spatial Planning, 2018).

Kelp is poorly represented in the area and is characterized by *Saccharina* spp., *Agarum fimbriatum*, and *Costaria costata*. Kelp is patchily distributed along the coastline outside of Port Townsend Bay (Washington Marine Spatial Planning, 2018). In the areas where kelp is found, it usually occurs to a depth of approximately 20 m, depending on light levels (Mumford, 2007). From the available data, eelgrass beds in the vicinity of NAVMAG Indian Island Ammunition Wharf would be expected to be present but are patchy rather than continuous along the shoreline (Washington Marine Spatial Planning, 2018). The shaded substrate beneath the Ammunition Wharf is largely devoid of aquatic vegetation (Kalina, 2019).

10.3.1.2 Benthic Invertebrates

No benthic invertebrate sampling has been conducted around the NAVMAG Indian Island Ammunition Wharf; however, a 2015-2016 ROV fish survey in the vicinity of the Ammunition Wharf documented numerous anemones attached to the anchor blocks and clam shells on the substrate (Frierson et al., 2017e). Benthic invertebrates found in waters of NAVMAG Indian Island are comparable to those generally found throughout Puget Sound and at the other locations. Species likely to occur in Puget Sound are described in Section 3.3.2.2.

10.3.1.3 Marine Fish

10.3.1.3.1 Non-ESA-Listed Fish Species

Fish surveys were conducted at the NAVMAG Indian Island Ammunition Wharf area in May to September of 2015 and January to September of 2016, using beach seine, lighted fish traps, remotely operated vehicle, scuba, and split-beam echo sounder methods (Frierson et al., 2017e). In 2015 beach seines caught total of 38 fish species were collected with shiner pearch accounting for 21.7 percent and sand lance for 18.0 percent of the total catch. Salmonids only made up 3.0 percent of the total catch (Frierson et al., 2017e). In 2016 beach seines caught a total of 33 fish species were collected with Salmonids making up 41.4 percent of the total catch. Shiner pearch accounted for 18.8 percent and surf smelt for 1.0 percent of the total catch (Frierson et al., 2017e).

10.3.1.3.2 ESA-Listed Fish and Critical Habitat

ESA-listed fish species that may occur along or within the vicinity of NAVMAG Indian Island include Puget Sound Chinook salmon, Hood Canal summer-run chum salmon, and Puget Sound steelhead. Bull trout, southern DPS Pacific eulachon, southern DPS North American green sturgeon, and Puget Sound/Georgia Basin DPSs of bocaccio and yelloweye rockfish are unlikely to occur within the vicinity of NAVMAG Indian Island Ammunition Wharf.

Indian Island does not contain any streams with salmonids (SAIC 2001); however, salmonids from other areas of Puget Sound may occur near the NAVMAG Indian Island area (Frierson et al., 2017e). Historically, Chimacum Creek which is located on the western shores of Port Townsend Bay near Port Hadlock supported chum salmon spawning, but recent spawning surveys do not mention chum in Chimacum Creek, suggesting that the run may be near extinction (SAIC 2001). Recent restoration and stocking efforts have resulted in low numbers (<55 individuals) of chum escapement in 1999 (SAIC 2001) to 558 individuals in 2003 (WDFW 2005). WDFW has rated the population of Chimacum Creek as extinct because there is no information that a natural-producing population is established in the creek (WDFW 2005). During beach seine surveys at NAVMAG Indian Island in 2015 and 2016, chum salmon accounted for 2.7 percent and 13.8 percent of the total catch, respectively (Frierson et al., 2017e). No Pink salmon were caught in 2015 but in 2016 they made up 26.1 percent of the total catch and only small numbers of Chinook and Coho salmon were collected (<2.0 percent of the total catch) (Frierson et al., 2017e).

There is documented presence of Hood Canal summer-run chum and chinook from beach seines conducted just north and south of the Ammunition Wharf (Frierson et al., 2017e). Juveniles and adults occur near NAVMAG Indian Island as recorded during beach seine surveys where the months of March and April were high density months (Frierson et al., 2017e).

Juvenile and adult Puget Sound steelhead may be present within the project area, but are unlikely to be present during the in-water work window. Steelhead were not recorded during beach seine surveys conducted in 2015 and 2016 (Frierson et al., 2017e). This is likely due to the fact that steelhead are not nearshore oriented and typically exhibit early offshore movement after entering Puget Sound (Moore et al., 2010a, b, 2014; Goetz et al., 2015). Given their brief nearshore residence time (Moore et al., 2010b), if they do occur in near NAVMAG Indian Island, they are likely to occur in small numbers.

Occurrence of Bull trout near NAVMAG Indian Island is anticipated to be rare. Bull trout require cold, clean, complex, and connected habitat of which does not occur at this location.

Adult Puget Sound/Georgia Basin DPSs of bocaccio and yelloweye rockfish, as well as juvenile yelloweye rockfish typically occur in deep waters that have habitat composed of complex bathymetry with slopes and areas of high rugosity. These areas were absent around the NAVMAG Indian Island Ammunition Wharf during hydroacoustic surveys between 15 m and 160 m depths (Frierson et al., 2016). Recent sightings of bocaccio have been confirmed in Puget Sound from WDFW ROV surveys and a NOAA genetic study using hook-and-line gear. They were always found in association with very specific habitats that include steep slopes/walls with high complexity (Pacunski, 2017). Eelgrass, which is also habitat utilized by juvenile rockfish is present along the shoreline adjacent to the NAVMAG Indian Island Ammunition Wharf. Although bocaccio and yelloweye juveniles could utilize this habitat, recent surveys (primarily focused on adults) have not documented bocaccio or yelloweye rockfish in this area (Frierson et al., 2017e, 2018; Pacunski, 2017).

Occurrence of southern DPS Pacific eulachon and southern DPS North American green sturgeon NAVMAG Indian Island is expected to be rare. No eulachon were caught during beach seines in 2015-2016 at the NAVMAG Indian Island Ammunition Wharf. Additionally, there are no eulachon spawning rivers in Puget Sound. The nearest regular eulachon spawning habitats are the Elwha River on the Olympic Peninsula and the Fraser River in British Columbia. As discussed in Section 3.3.2.3.2, few green sturgeon have been documented in Puget Sound and likely would not occur around the NAVMAG Indian Island. Based on this information, Pacific eulachon and green sturgeon are not expected NAVMAG Indian Island.

Critical Habitat

Puget Sound Chinook and Hood Canal summer-run chum have designated critical habitat in Port Townsend Bay. However, the DoD lands are exempt by federal law (70 FR 52630). Critical habitat is designated, but outside NAVMAG Indian Island boundaries. Section 3.3.2.3.2 lists the designated critical habitat PCEs for these species.

Nearshore critical habitat for bocaccio and yelloweye rockfish is designated in Port Townsend Bay. As stated above for Puget Sound Chinook and Hood Canal summer-run chum, the DoD lands are exempt from critical habitat designation (79 FR 68041). Critical habitat is designated, but outside NAVMAG Indian Island boundaries. Section 3.3.2.3.2 lists the designated critical habitat attributes of the nearshore essential features for these ESA-listed rockfish species.

Critical habitat is designated for bull trout in 2010 within certain marine waters in Washington State but not in Port Townsend Bay or in the waters around NAVMAG Indian Island (75 FR 63898).

10.3.1.3.3 <u>Essential Fish Habitat</u>

Coastal pelagic EFH designations are based on the geographic range and in-water temperatures where these species are present during a particular life stage (PFMC, 2016a) and these boundaries include the waters of NAVMAG Indian Island. The nearshore substrates composed of mud, sand, and shell hash as well as presence of vegetated bottoms only along the shoreline provide Pacific coast groundfish EFH for various life stages of species of groundfish (PFMC, 2016b). The marine environment of NAVMAG Indian

Island provides Pacific coast salmon EFH for various life stages of Chinook, pink, and coho salmon (PFMC, 2014). All three Pacific Coast salmon species could use the marine habitat near NAVMAG Indian Island on their way to or from these freshwater systems.

Eelgrass is an HAPC for Pacific Coast groundfish and Pacific Coast salmon and is present along the shoreline adjacent to the NAVMAG Indian Island Ammunition Wharf.

10.3.1.4 Birds

Migratory birds encountered at NAVMAG Indian Island include those described in Section 3.3.2.4. Several bald eagle nests have been documented on NAVMAG Indian Island (Navy 2016f). Bald eagles also concentrate in the area for feeding during salmon, sand lance and midshipman spawning seasons (spring and fall) (WDFW, 2011).

The Navy conducted marble murrelet ground surveys from December 2014 to April 2015 and found one potential nest platform site but no nesting birds were observed (Navy 2016f). The WDFW Priority Habitat and Species Maps interactive website does not indicate the presence of marbled murrelet nests in the upland areas including and adjacent to Indian Island (WDFW, 2018). Marbled murrelets may occur in the waters near Indian Island, as WDFW surveys detected marbled murrelets foraging within Port Townsend Bay (Pearson & Lance, 2013, 2014, 2015, 2016).

10.3.1.5 Marine Mammals

Any of the species listed in Table 3-7 has the potential to occur in the vicinity of Indian Island. The harbor seal is most likely to occur at this location based on monitoring during pile driving in 2015 and 2016 (Navy 2016g). No shore-based surveys have been conducted for harbor seals at this location, but monitoring surveys for pile driving reported them (Navy 2016g). Known haulouts occur north of Indian Island on Rat Island i.e., small sand island) located approximately 1.3 km away from the Ammunition Wharf (Figure 3-7). According to data from WDFW, harbor seal pupping occurs from June to August in this area of the Puget Sound.

Sightings of harbor porpoise off Indian Island are rare and no harbor porpoise were observed during pile driving monitoring from October 2015 to January 2016 (Navy 2016g). Haulouts of California sea lions occur on buoys or offshore rocks near Whidbey Island and are over 16 km from the NAVMAG Indian Island Ammunition Wharf. There are no Steller sea lion haulout sites near NAVMAG Indian Island; therefore, the sea lion species are not expected to frequent waters off of the NAVMAG Indian Island Ammunition Wharf.

Humpback whales are considered uncommon at this location. Humpback whales are not expected to occur in the waters near Indian Island because very few sightings have been documented in Port Townsend Bay (Orcanet 2019).

Southern Resident killer whales are not expected to occur in the waters in Port Townsend Bay near Indian Island because they have not been reported recently in the area although transient killer whales have been observed (Orcanet 2019).

10.3.2 Environmental Consequences

10.3.2.1 No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to baseline biological resources. Therefore, no significant impacts to biological resources would occur with implementation of the No Action Alternative.

10.3.2.2 MPR Activities (Preferred Alternative) Potential Impacts

10.3.2.2.1 Aquatic Vegetation

Any debris from pile removal during proposed MPR activities would be collected, disposed of in a state-approved landfill or recycled, and would not impact marine vegetation. Shading of existing vegetation would not change as there is little vegetation under the Ammunition Wharf and no expansion of existing structures or new over-water structures is proposed; therefore, shading of existing vegetation is not discussed. Any shading that occurs from barges would be temporary in nature, and would have no significant effect on marine vegetation. Marine surveys have shown that eelgrass is present along the shoreline near the NAVMAG Indian Island Ammunition Wharf and that subtidal algal species occur in the area. Decreased water and sediment quality can impede the growth of marine vegetation important to fish and other animals, and promote the growth of harmful algae.

Pile driving-related impacts to water quality during proposed MPR activities would be limited to temporary and localized changes associated with re-suspension of bottom sediments during construction. As indicated in Section 10.2.1.2 above, no sediments in the area have been assessed as contaminated. Pile driving activities would not discharge contaminants or otherwise appreciably alter the concentrations of trace metal or organic contaminants in bottom sediments. Sediments would settle back in the general vicinity from which they rose. Indirect effects to macroalgae and eelgrass from changes in sediment quality and sedimentation during construction would be temporary and would not affect the overall health or distribution of marine vegetation near the project area. Proposed MPR activities would not result in violations of water quality standards and would, therefore, maintain water quality for marine vegetation in the vicinity of the project area.

Direct removal of marine vegetation during proposed MPR activities could occur through anchor and spud placement, and removal of up to nine deteriorating piles; however, eelgrass beds are along the shore and not near the Ammunition Wharf (Washington Marine Spatial Planning, 2018). Where possible, anchors and spuds would not be placed in existing eelgrass beds. Any vegetative growth found on existing piles would be removed when those piles are extracted from the water but because piles would be replaced, ultimately a similar amount of surface area on which marine organisms could colonize would exist. Because marine vegetation does not occur densely in the area, direct removals should be minimal. Additionally, because marine vegetation is distributed outside of the project area, the overall health and abundance of macroalgae and eelgrass would not be compromised. Therefore, proposed MPR activities would have no significant direct or indirect impacts on marine vegetation.

10.3.2.2.2 Benthic Invertebrates

Proposed MPR activities at the NAVMAG Indian Island Ammunition Wharf would impact benthic communities through the disruption of the sediment surface and subsurface during the installation and removal of each pile, and from anchor and spud placement for the barges. Depending upon the species, impacts to individual benthic organisms could range from temporary disturbance to mortality. Some benthic organisms would be physically crushed and lost within the footprint of the piles, as well as from barge anchors and spuds.

Indirect impacts to habitat and benthic organisms are likely to result from turbidity caused by driving and removing barge anchors, spuds, and piles. The area near the pile replacement footprint would have higher levels of turbidity. Disturbed sediments would eventually redeposit upon the existing benthic community. Impacts from increased turbidity levels would likely result in short-term loss of localized areas of the benthic community. Most affected areas would experience some reduction in diversity and abundance of benthic species. However, benthic organisms, particularly annelids, are very resilient to habitat disturbance and are likely to recover to pre-disturbance levels in less than 2 years (CH2M Hill, 1995; Parametrix, 1994, 1999; Romberg et al., 1995; Anchor Environmental, 2002). Therefore, proposed MPR activities would have no significant impacts on benthic invertebrates.

10.3.2.2.3 Marine Fish

Non-ESA-Listed Fish

Turbidity

Resident marine fish are expected to be present within the vicinity of the project area and are likely to occur during the in-water work window established for juvenile salmonid avoidance. In-water work could produce measurable, temporary increases in turbidity and sedimentation, and that could cause fish to temporarily avoid the areas near construction. However, construction activities would not result in persistent increases in turbidity levels or cause changes that would violate water quality standards because a silt curtain would be used and the processes that generate suspended sediments, which result in turbid conditions, would be short-term and localized and would disperse and/or settle rapidly (within a period of minutes to hours after construction activities cease). Eelgrass and other vegetation is not present under the pier at NAVMAG Indian Island. Placement of the piles and associated disturbance activities (i.e., support vessels, construction barge) may cause a loss to benthic prey either existing within the pile footprint or disturbance from turbidity which may impact fish use of that area for seeking prey. Impacts would be short-term, localized, and limited to the duration of pile installation and would not be expected to significantly impact fish ability to seek prey outside of the project areas. With implementation of impact avoidance and minimization measures (see Section 2.5), no significant impacts to non-ESA-listed marine fish from turbidity and sedimentation are anticipated from the proposed MPR activities.

Underwater Noise

Proposed MPR activities would result in increased underwater noise levels. Noise would be generated from support vessels, small boat traffic, and barge-mounted equipment, such as generators, and pile extraction and installation. Noise levels from all activities except pile driving would typically not exceed underwater sound levels resulting from existing routine operations at NAVMAG Indian Island. The most significant underwater noise potentially affecting fish would be from impact pile driving of concrete piles. To minimize impacts to fish, piles would be installed initially with a jetting device until either the pile hits refusal, necessitating an impact hammer to reach required depth, or for proofing piles to verify structural capacity. Since jetting typically generate noise levels from 20 to 30 dB lower than impact pile driving and do not produce waveforms with sharp rise times like impact pile driving, impacts on fish are typically not observed in association with jetting to drive piles (WSDOT, 2018).

A maximum of nine concrete piles could be installed at the NAVMAG Indian Island Ammunition Wharf. Impact pile driving of a 24-in diameter concrete pile would create underwater noise that could expose fish to noise above the peak threshold as well as the cumulative SEL thresholds (Table B-9 of Appendix B). Fish would be expected to be exposed differently to elevated noise levels and they could behave differently in their reaction to noise. Some fish are migrating through the area and may pass through the thresholds above the behavioral disturbance zone (estimated to 736 m). Other fish are resident to the area and may not move away and thus would be exposed to injurious noise levels for the duration of pile driving activity (Hastings & Popper, 2005). To minimize exposure to noise above the injurious and behavioral disturbance thresholds, all pile driving would be conducted during the in-water work window of October 1 through January 15 when juvenile salmonids are least likely to be present. With implementation of these minimization measures and those listed in Section 2.5, no significant impacts to non-ESA-listed fish from underwater noise would result from the proposed MPR activities.

ESA-Listed Fish and Critical Habitat

<u>Turbidity</u>

As discussed above, in-water work could produce measurable, temporary increases in turbidity and sedimentation, and that could cause ESA-listed fish and their forage fish to temporarily avoid the areas near construction. Because, in-water work would occur during the approved in-water work window of October 1 through January 15, juvenile ESA-listed salmonids are least likely to be present. Adult life stages of Chinook, chum, steelhead, bocaccio and yelloweye rockfish as well as juvenile yelloweye rockfish, if present, would occur further offshore and beyond any impacts associated with turbidity during in-water construction. Juvenile bocaccio have the potential to utilize the nearshore aquatic vegetation (eelgrass and kelp) as rearing habitat but have not been observed at NAVMAG Indian Island (Frierson et al., 2017e). Bull trout, green sturgeon, and eulachon are not expected to occur in the vicinity of NAVMAG Indian Island. Therefore, no significant impacts to ESA-listed fish or their forage base from turbidity would result from the proposed MPR activities.

<u>Underwater Noise</u>

In-water work would occur during a period when juvenile salmonids are least likely to be present and thus exposure to injurious impacts is not expected. Juvenile bocaccio and canary rockfish have the potential to rear within the vicinity of NAVMAG Indian Island because eelgrass and some kelp are present. However, the lack of canopy kelp habitats adjacent to structures proposed for pile driving work and intermittent nature of impact pile driving would preclude measurable impacts to juvenile bocaccio. Bull trout presence near NAVMAG Indian Island is expected to be rare and Pacific eulachon are not expected within the vicinity. Larger juveniles as well as adult life stages of Chinook, chum, bocaccio, and yelloweye rockfish as well as juvenile yelloweye rockfish would not be exposed to noise above the cumulative SEL injury thresholds. Concrete piles would be installed using a jetting to the extent practicable with impact pile driving used to drive piles to the required depth. Impact pile driving would be primarily used for proofing piles, which would occur intermittently and for an estimated maximum duration of 1.5 hours in a day. Rockfish that may be present and remain stationary would likely not encounter any measurable impacts as the limited time required for impact pile driving concrete piles in a day would only accumulate enough energy to fully extend out to the maximum distance if all strikes were needed in a day.

The area in which noise from impact driving of concrete piles would be generated above the injury and behavioral thresholds is significantly smaller than for steel piles. Impact pile driving concrete piles is estimated to last a maximum duration of 4 hours per day or an average of 1.5 hours a day. However, there are no known documented incidents of fish injury occurring from pile driving of concrete piles (NMFS, 2012c). By installing piles within the in-water work window and limited number of piles (nine concrete piles), only behavioral effects are anticipated and these effects are not anticipated to be significant to an individual fish.

In conclusion, no significant impacts to ESA-listed fish from underwater noise would result from the proposed MPR activities.

Critical Habitat

The estuarine and nearshore marine areas PCEs for Puget Sound Chinook and Hood Canal summer-run chum would not be affected by underwater noise from impact pile driving concrete piles. Pile driving would produce noise below the fish behavioral thresholds during jetting pile driving and below the behavioral and injury thresholds during impact pile driving in the vicinity of NAVMAG Indian Island that contains designated critical habitat (outside of the boundaries of NAVMAG Indian Island). However, minor impacts to the function of these PCEs would be temporary and short-term, and occur during a time when juvenile Chinook and chum are not expected to be within the nearshore and estuarine environments. The ability for the nearshore marine PCE to provide forage base for larger juveniles and adults may be effected in the short-term (1.5 hours per day). However, impacts would not be significant.

Critical habitat for Hood Canal Summer-Run chum salmon in Puget Sound was designated in 2005 (70 FR 52630) but was not proposed for the waters surrounding NAVMAG Indian Island.

The NAVMAG Indian Island Ammunition Wharf area is exempt from the critical habitat designation for bocaccio and yelloweye rockfish (79 FR 68041). In the vicinity of Port Townsend Bay where designated critical habitat for Puget Sound/Georgia Basin DPSs of bocaccio and yelloweye occurs, the project would not significantly affect the following attributes to the two essential features: *(1) Water quality and sufficient levels of DO to support growth, survival, reproduction, and feeding opportunities;* and *(2) Quantity, quality, and availability of prey species to support individual growth, survival, reproduction, and feeding opportunities.* The behavior disturbance threshold would extend out over deeper water but would not impact the following attribute for adult rockfish and juvenile yelloweye rockfish because this attribute is not present in Port Townsend Bay (Frierson et al., 2016e): *(3) The type and amount of structure and rugosity that supports feeding opportunities and predator avoidance*. Elevated noise would be short-term (1.5 hours per day) and would not significantly impact essential features for conserving adult bocaccio and yelloweye rockfish and juvenile yelloweye rockfish (deepwater designated critical habitat).

The migratory habitats PCE for bull trout would not be exposed to noise above injurious and behavioral thresholds during jetting and impact pile driving. The temporary change in the environment from increased noise would not impair the habitat's function as a migratory corridor. With implementation of minimization measures discussed above for ESA-listed salmon and rockfish designated critical habitat impacts to the migratory habitats PCE would be insignificant.

Critical habitat for steelhead in Puget Sound was proposed in 2016 (81 FR 9251) but was not proposed for Port Townsend Bay or the waters surrounding NAVMAG Indian Island.

Therefore, no significant impacts to designated critical habitat for Chinook, chum, bull trout and ESA-listed rockfish would result from the proposed MPR activities at NAVMAG Indian Island.

The Navy determined that the Proposed Action “may affect, but is not likely to adversely affect” ESA-listed fish species and designated critical habitat. USFWS concurred with the Navy’s determination for bull trout with a Letter of Concurrence signed on June 27, 2017. NMFS did not concur with the Navy’s determination and concluded that the Navy’s proposed MPR activities “may affect, are likely to adversely affect” Puget Sound evolutionary significant unit (ESU) Chinook salmon; Hood Canal summer-run ESU chum salmon; Puget Sound distinct population segment (DPS) steelhead; Puget Sound/Georgia Basin DPSs of bocaccio and yelloweye rockfish; and, designated critical habitat. Section 7 consultation with NMFS was completed with the issuance of a BiOp on April 5, 2019.

Essential Fish Habitat

As was discussed above for marine fish in general and ESA-listed fish, elements of the proposed MPR activities would create turbidity and suspended sediment but these impacts would be short-term, localized, and small in scale without causing measureable impacts to EFH. Removal and installation of piles and anchoring would have a localized impact on marine vegetation and benthic epifauna/infauna within the immediate vicinity of each pile or anchoring site but these impacts would be minimal, localized, and expected to recover to pre-disturbed levels within a few growing seasons. The primary impact during proposed MPR activities would be increased sound energy in the marine fish habitat. Increased sound would affect the water column, which has been designated as EFH for numerous species (see Appendix C). Impacts to the water column could result in disturbance depending on fish species, size, orientation, received noise level and type of noise. To avoid injurious effects from impact pile driving, the Navy would implement minimization measures to reduce the level of noise in the water column. The primary minimization measure would be to install concrete piles with water jetting to the extent practicable and follow with impact hammer pile driving to verify load-bearing capacity (proofing).

A maximum of nine concrete piles would be installed. The behavioral disturbance threshold would extend out a modeled distance of approximately 736 m extending out into Port Townsend Bay (Appendix B). Coastal pelagic, Pacific coast groundfish, and Pacific coast salmon EFH could be exposed to noise levels above the behavioral threshold by way of noise in the water column. The injury threshold distances may impact EFH as these distances would extend over consolidated sediments, rocky reef, pelagic water column habitat, and eelgrass.

In addition to minimization measures discussed above, conducting impact pile driving intermittently with an estimated maximum duration of 1.5 hours in a day would minimize impacts to coastal pelagic species, Pacific coast groundfish, and Pacific coast salmon EFH.

The Navy determined that the Proposed Action may adversely affect EFH by temporarily increasing noise in the water column during pile driving. However, implementation of minimization measures applied to ESA-listed species would be sufficient for minimizing effects to EFH. The Navy consulted with NMFS under the Magnuson-Stevens Fisheries Conservation and Management Act and NMFS concurred with the Navy’s determination, but provided Conservation Recommendations to minimize effects to EFH. Consultation with NMFS was completed on April 5, 2019. Overall, due to the temporary nature of the activities, proposed minimization measures and the minimal level of impact to water column noise levels, benthic flora and fauna, water quality, and sediment quality, no significant impacts to EFH would occur with implementation of the proposed MPR activities.

10.3.2.2.4 Birds

Resident and migrant birds are expected to be present within the vicinity of proposed MPR activities during the in-water work window established for juvenile salmonid avoidance (Section 2.5.3). Proposed MPR activities have the potential to impact marine birds through visual disturbance, changes in prey availability, and elevated underwater and airborne noise. Pile extraction and installation projects, and other repair projects on the existing marine structures would intermittently increase human activity levels on the waterfront, potentially resulting in visual disturbance and increasing ambient noise levels due to use of construction equipment. Bald eagles that nest at NAVMAG Indian Island and forage along the marine shoreline may experience the increase in human activity, depending on proximity of project construction to existing and future nest sites and foraging areas. However, no incidental takes are anticipated. Project sites currently have ongoing human activity, and project work involving repairs to marine structures would be within the baseline condition. Therefore, project effects due to human activity levels would be insignificant.

As discussed in Sections 10.3.2.2.2 and 10.3.2.2.3, in-water work could temporarily affect the availability of forage fish and benthic invertebrates, which are the prey base of many marine birds, in a limited area. Turbidity effects and potential resuspension of contaminated sediments are not expected to affect the prey base, as these changes would be short-term and small scale during construction. Therefore, proposed MPR activities would have no significant impacts on prey availability for marine birds.

Effects of Elevated Noise Levels on Birds

Proposed MPR activities would result in increased underwater noise levels. Noise would be generated from small vessels and barge-mounted equipment such as generators, and pile extraction and installation. Noise levels from all activities except pile driving would typically not exceed underwater sound levels resulting from existing routine operations at NAVMAG Indian Island. The most significant underwater noise source would be impact pile driving of concrete piles. Impacts of elevated noise levels due to pile driving were evaluated in the context of established criteria for ESA consultation with the USFWS on the threatened marbled murrelet. No criteria have been established for determining impacts of elevated noise levels on other marine bird species, some of which forage underwater like the marbled murrelet, and general conclusions about impacts on marbled murrelets were applied to other species.

Pursuit-diving birds (i.e., birds that pursue and capture their prey underwater using their wings to swim) include cormorants, grebes, and alcids (murres, murrelets, and pigeon guillemots). While actively foraging, they dive repeatedly into waters of various depths and would potentially be exposed to elevated underwater noise during pile driving. When startled by loud sounds, their foraging patterns may be altered, and birds may flush or dive and swim away underwater. While underwater they would be susceptible to injury or behavioral disturbance due to elevated sound pressure waves generated by pile driving. Dabbling and diving ducks may also be susceptible to elevated underwater sound. Birds that feed on the surface such as gulls, shorebirds, and wading birds are unlikely to be affected by elevated underwater sound.

Actively foraging marbled murrelets dive repeatedly into waters ranging up to approximately 160 ft. in depth for periods ranging up to 60 seconds (Nelson et al., 2006). Foraging bouts typically last over a period of 27 to 33 minutes, with approximately 50 percent of the time spent underwater (Jodice & Collopy, 1999). When startled by loud sounds, the foraging pattern may be altered, and birds may flush or dive and swim away underwater. While underwater they would be susceptible to injury or behavioral disturbance due to elevated sound pressure waves generated by pile driving.

As described in detail in Appendix B, the USFWS uses underwater noise thresholds developed by the Marbled Murrelet Hydroacoustic Science Panel (SAIC, 2011) to determine the zones around a driven pile in which two general forms of injury might occur to diving marbled murrelets: (1) auditory injury (generally damage to sensory cells of the ear) beginning at 202 dB SEL cumulative, and (2) non-auditory injury (trauma to non-auditory body tissues/organs) beginning at 208 dB SEL cumulative. Since the underwater criterion for auditory injury was the lower of the two thresholds, this was the criterion used for assessing injurious impacts to the marbled murrelet in this analysis.

A total of nine concrete piles could be installed at NAVMAG Indian Island. As shown in Table B-9 of Appendix B, potentially the most injurious noise levels would extend up to 10 m from a driven 24-in concrete pile (see Figure 10-1 for a representative scenario of the extent of potentially injurious underwater noise from concrete pile installation). Since estimates of the distances to thresholds involve the cumulative energy of all impact strikes over a 24-hour period, the affected area represents the maximum extent. Earlier in the construction day, the injury zone would be smaller, and only reach the maximum extent after all the pile strikes have been completed.

Airborne noise levels from proposed MPR activities are not expected to be injurious to birds within the study area because the source levels for airborne noise from pile driving (vibratory: 96 dBA at 15 m; impact: 110 dBA at 11 m) are well below those known to cause injury to birds in laboratory situations (Dooling & Popper 2007) and would be less for the jetting and impact driving of 24-inch concrete piles. However, the USFWS (2014) has determined that airborne noise due to impact pile driving may behaviorally affect foraging marbled murrelets, based on the findings of the Marbled Murrelet Hydroacoustic Science Panel regarding non-injurious thresholds for pile driving noise (SAIC, 2012). Marbled murrelets typically perform foraging dives in pairs and are highly vocal when they are above the surface (Strachan et al., 1995). On the water’s surface, birds typically stay within 100 ft (30 m) of their partners during foraging bouts. This behavior is thought to play a role in foraging efficiency, and therefore airborne noise that masks their vocalizations has the potential to affect foraging success (Carter & Sealy, 1990; Strachan et al., 1995). Unlike other noise effects criteria established for injury, the distance from a pile driving source within which communications would be masked is dependent upon ambient noise levels and therefore is site-specific. Masking effects cease immediately when the masking noise stops.

Under typical conditions on the waterfront, communication between foraging murrelets would be compromised by pile driving noise within 42 m of the murrelets. This is based on noise produced by impact pile driving 24-in concrete piles (USFWS, 2013). Acoustic monitoring during construction at Representative scenarios of areas affected by masking effects are shown in Figure 10-1.

The USFWS (2013) has provided guidance on evaluating the significance of airborne masking effects for pile driving projects. “Typical” pile driving projects involve:

- Installation of 24-in or 36-in steel piles,
- Use of vibratory pile drivers,
- Use of impact pile drivers for proofing only, and
- Adherence to a 2-hour timing restriction (i.e., no pile driving within 2 hours after sunrise and within 2 hours before sunset during the breeding season).

Typical pile driving projects do not result in measurable effects on marbled murrelets because the use of impact hammers is intermittent and of short duration, the 2-hour timing restriction protects murrelets

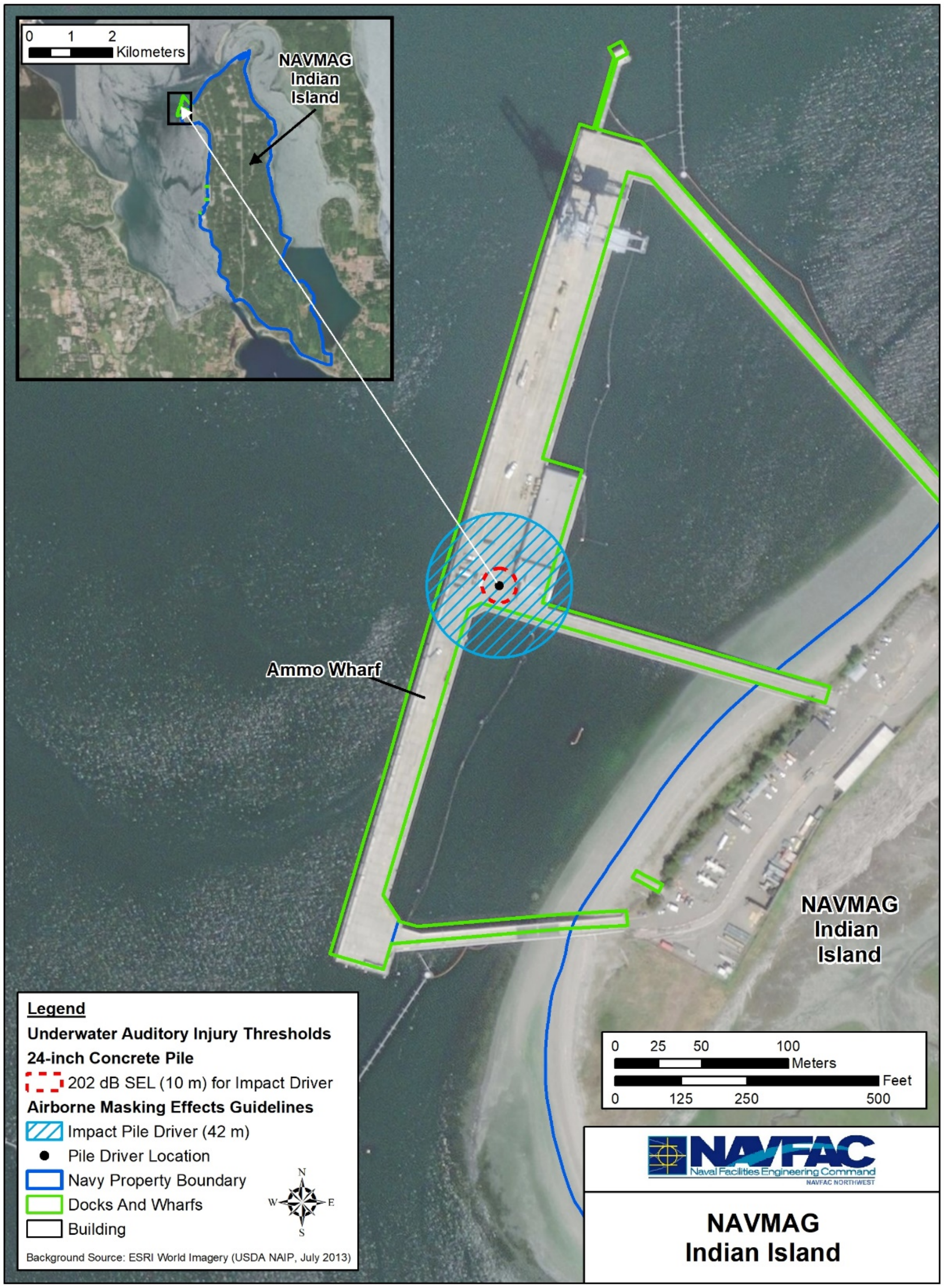

Figure 10-1. Representative Affected Areas for Pile Driving Noise for Marbled Murrelets at NAVMAG Indian Island

during their most active foraging periods, and murrelet vocalizations are adapted to overcome the effects of ambient noise (USFWS, 2013).

The USFWS guidance does not cover concrete piles, but the potential masking effects of concrete pile installation are likely to be much smaller because impact installation of concrete piles generates lower SPLs than steel pile installation (Appendix B).

To prevent exposure to injurious or masking noise levels in the action area for projects at NAVMAG Indian Island, the Navy would implement the minimization measures and BMPs described in Section 2.5. The Navy would actively monitor the underwater auditory injury zone for impact pile driving up to 10 m or the 42 m masking zone (Figure 10-1). The likelihood of marbled murrelet exposure to injurious or masking noise from impact pile driving is discountable because these zones are small and can be effectively monitored during pile driving, and pile driving would cease if monitors detect marbled murrelets (see Appendix D for details) within the threshold distance.

With the implementation of minimization and monitoring actions (Section 2.5), the Navy has determined the Proposed Action “may affect, but is not likely to adversely affect” ESA-listed marbled murrelets. USFWS concurred with the Navy’s determination in a letter dated June 27, 2017. Proposed MPR activities would have no significant impacts on marbled murrelets or other marine bird species due to temporarily elevated underwater and airborne sound levels resulting from jetting and impact pile driving of concrete piles.

Critical Habitat

Because the closest designated marbled murrelet critical habitat to NAVMAG Indian Island is about 6 mi to the west, no noise resulting from proposed MPR activities would reach it. Therefore, a no effect determination was made for designated critical habitat in the vicinity of NAVMAG Indian Island.

10.3.2.2.5 Marine Mammals

Pile installation and removal during proposed MPR activities at NAVMAG Indian Island would result in temporarily increased human activity levels and changes in prey availability during project construction. However, project construction would take place at existing marine structures that have relatively high levels of human activity under daily operations, and prey availability changes would be short-term and highly localized, as described in Section 8.3.2.2.3. Because vessels would be operating at slow speeds, no vessel strikes would be expected. Therefore, there would be no significant impact to marine mammals due to increased human activity levels, changes in prey availability, or the potential for vessel strikes.

Effects of Elevated Noise Levels on Marine Mammals.

Underwater and airborne noise generated during pile installation and removal has the potential to disrupt the behavior of marine mammals that may be traveling through, foraging, or resting in the vicinity of the project area, as described in detail in Appendix B. The Navy estimates potential impacts to marine mammals by considering the likelihood that each species may be present at NAVMAG Indian Island during pile driving, determining the sound levels generated by various pile types and installation methods, and applying acoustic threshold criteria (expressed in decibels, dB) established by NMFS for evaluating the potential for injury or behavioral impacts. A detailed explanation of the analytical methods is presented in Appendix B, and the following sections summarize results of the underwater noise analysis.

A total of nine concrete piles would be installed at NAVMAG Indian Island. As described in detail in Appendix B, the Navy estimated the distances to the various NMFS underwater noise thresholds for injurious and behavioral effects on marine mammals (Appendix B). These distances were estimated by taking into account the source levels for impact pile driving of concrete piles at NAVMAG Indian Island, sound propagation over distance from the driven pile, and acoustic impacts thresholds for the various species groups. Figure 10-2 depicts a representative scenario of the extent of potentially injurious and behaviorally harassing underwater noise to marine mammals from concrete pile installation. The area encompassed by the threshold values decreases the closer to shore pile driving occurs and is truncated where shallow water and land block noise transmission.

The likelihood of injury due to pile driving noise from concrete piles is discountable for marine mammals at NAVMAG Indian Island for several reasons. Marine mammals are unlikely to be present in the small areas affected by injurious noise levels (i.e., 3 to 88 m, depending on the functional hearing group). These areas would be fully monitored by marine mammal observers during pile driving. As described in Appendix D, pile driving would cease if monitors detect a marine mammal approaching or entering the injury zone. In addition, most concrete piles would be installed with jetting first, which affects a smaller area with injurious noise levels than impact pile driving (Appendix B). Where impact pile driving of concrete piles is required, the greatest radius of potentially injurious noise from impact pile driving is expected to be no greater than 88 m for high frequency cetaceans (e.g. Harbor porpoise).

Pile driving would produce noise above the underwater behavioral harassment threshold during impact pile driving. However, impact pile driving noise is not expected to result in behavioral harassment of marine mammals because affected areas can be fully monitored and pile driving would cease if a marine mammal approaches the affected area.

To assess the potential exposure of marine mammals to above-threshold noise levels during in-water work windows over one year of proposed activities at NAVMAG Indian Island, the likelihood of occurrence of each species was considered along with the number of pile driving days. The Navy used one of two methods for species at NAVMAG Indian Island, depending on (1) whether regional densities were known, or (2) the species is so infrequently encountered that densities cannot be determine and other reasoning must be applied. Potential occurrence of Steller sea lions, harbor porpoises, Southern Resident and transient killer whales, humpback whales, California sea lions, and harbor seals were estimated through analysis of historical occurrence at NAVMAG Indian Island. Details of the exposure analysis are presented in Appendix B, and results are summarized in Table B-19.

Based on the low occurrence of most marine mammals, with the exception of harbor seals which occurs regularly in the waters of the Ammunition Wharf but does not haulout on wharf structures or the security barrier, around the NAVMAG Indian Island Ammunition Wharf, and the relatively small monitoring and shutdown zones for marine mammals, the exposure estimates in Table B-19 show that it is unlikely that any marine mammals would be impacted by impact pile driving of concrete piles. The Navy would implement a variety of BMPs and mitigation measures, including primarily using a jetting device to drive piles, noise attenuation devices (e.g., wooden block on the top of the concrete pile) and marine mammal observers that are expected to reduce the estimated impacts. These measures are fully described in Appendix D and summarized in Section 2.5.

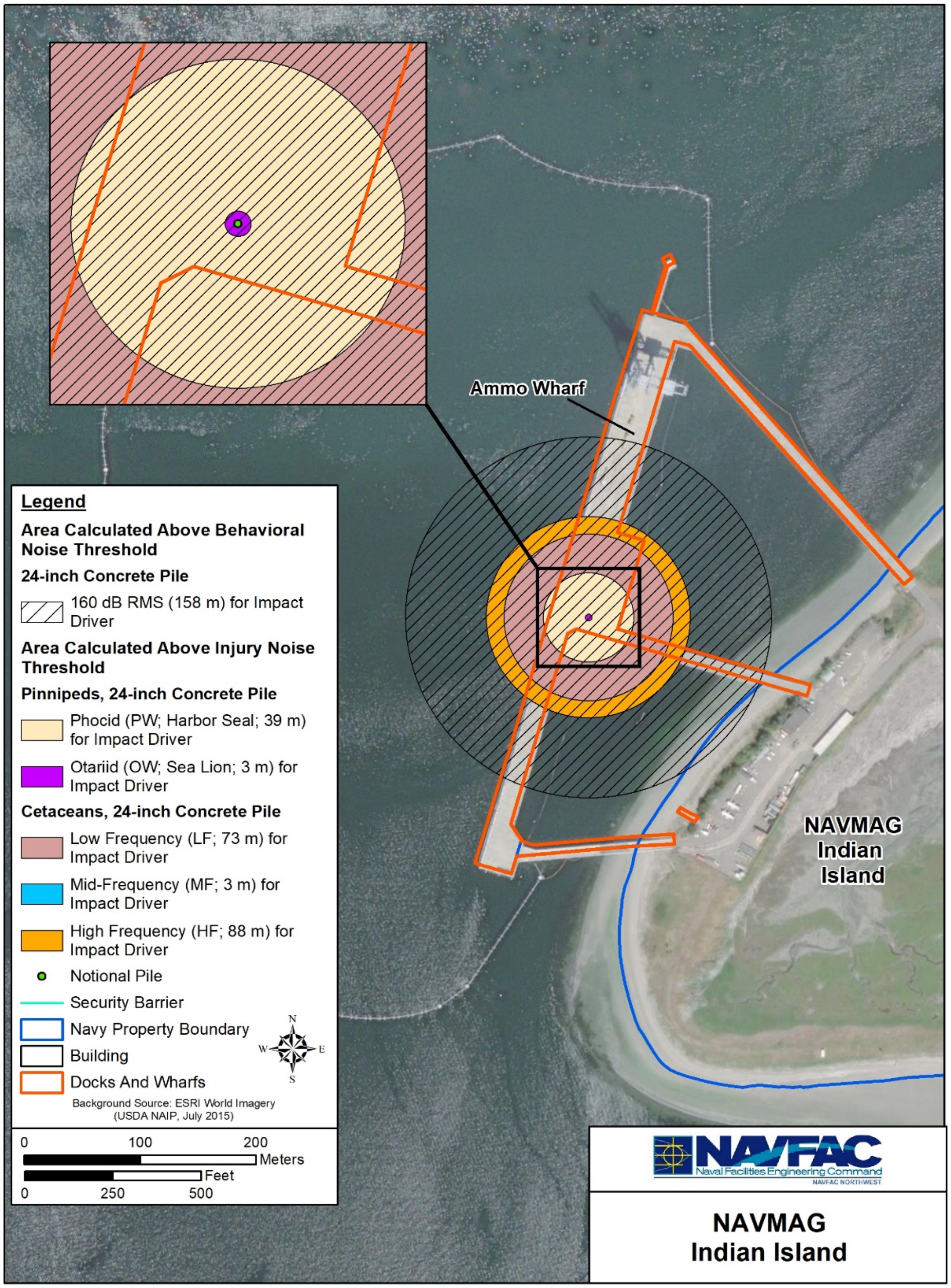

Figure 10-2. Representative Affected Areas for Pile Driving Noise for Marine Mammals at NAVMAG Indian Island

Individual responses of marine mammals to pile driving noise are expected to be variable. Some individuals may occupy the project area during pile driving without apparent effect, but others may be displaced with undetermined effects. In general, cetaceans like the harbor porpoise infrequently transit the waters in the vicinity of NAVMAG Indian Island and they do not tend to remain there. If they encounter pile driving noise they would likely avoid affected areas. Avoidance of the affected area during pile driving operations would potentially reduce access to foraging areas and inhibit movement through the area. The likelihood of exposure to behavioral disturbance due to pile driving noise would be limited by the infrequent occurrence of cetacean species in the vicinity, and monitoring and shutdown of pile driving if monitors detect cetaceans, as described in Appendix D.

Based on the low likelihood of occurrence of ESA-listed species in Table B-19, and the use of BMPs and mitigation measures that are likely to avoid potential impacts, the Navy concludes that proposed MPR activities at NAVMAG Indian Island:

- "may affect, and are not likely to adversely affect" humpback whales (Mexico and Central American DPSs) and Southern Resident killer whales because they are considered rare in the area, and monitoring and the use of shutdown zones would be implemented; and
- would not affect Southern Resident killer whale designated critical habitat.

NMFS did not concur with the Navy's determinations and has determined that the Navy's proposed MPR activities "may affect, are likely to adversely affect" humpback whale species, Southern Resident killer whale, and Southern Resident killer whale designated critical habitat. The Navy's consultation with NMFS regarding ESA-listed marine mammals and critical habitat was completed with the issuance of a BiOp on April 5, 2019 (Appendix G).

Monitoring and the use of shutdown zones would prevent marine mammals from being exposed at levels that would result in Level B harassment behavioral disturbance, as defined by MMPA. No marine mammals would be exposed at levels that would result in injury or mortality. Other construction activities not associated with pile installation and removal would not result in Level A or B harassment under the MMPA.

The analysis presented above indicates that proposed MPR activities at NAVMAG Indian Island would not likely impact individual marine mammals, or at the population, stock, or species level. Therefore, there would be no significant impact to marine mammal populations.

10.4 Cultural Resources

10.4.1 Affected Environment

The APE for the Proposed Action at NAVMAG Indian Island consists of one pier facility (Table 10-1). All work would occur in or over-water. No on-shore work is planned, and any staging required would occur in previously disturbed or developed areas.

The Ammunition Wharf, facility 832, has been determined not-eligible for listing in the NRHP (SHPO concurred with the eligibility status of the wharf on March 27, 2018).

Submerged historic properties, downed aircraft, shipwrecks, traditional fishing features, and other structures can be eligible for listing in the NRHP. No structures extending above the sediment; however, have been observed by divers inspecting the pilings under the wharf. In addition, the probability of prehistoric archaeological deposits or features buried within the substrate is very low due to Holocene sea level changes, associated erosion of glacial deposits found along the shoreline, and disturbance from pile driving from initial wharf construction.

An Archaeological Resources Survey conducted in 1999 at NAVMAG Indian Island determined that no archaeological resources exist at the site of the proposed project. However, Walan Point is the location of 45JE16, a seasonal village site occupied by the Chimacum Tribe excavated in 1974 – 1975 in an archaeological study conducted by Washington State University (Washington Archaeological Research Center, 1976) and investigated further during subsequent human remain recovery and repatriation, archaeological testing, and construction monitoring.

Table 10-1. Proposed Action at NAVMAG Indian Island

Structure Name	*Year Built*	*NRHP Status*	*SHPO Concurrence Date*	*DAHP Log #*	*Note*
Ammunition Wharf (#477)	1976-1979	Not Eligible	3/27/2018	2018-03-01683	Less than 50 years old

10.4.2 Environmental Consequences

10.4.2.1 No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to the baseline cultural resources. Therefore, no significant impacts to cultural resources would occur with implementation of the No Action Alternative.

10.4.2.2 MPR Activities (Preferred Alternative) Potential Impacts

Implementation of proposed MPR activities at NAVMAG Indian Island would not affect any known NRHP-eligible historic properties. Planned construction activities would take place in a previously disturbed footprint, underwater at distances roughly 600 to 900 ft from the shoreline.

Though the presence of historic properties is unlikely, pursuant to the NHPA implementing regulation, other applicable federal laws, and DoD and Navy regulations, if construction activities inadvertently encounter archaeological resources, the Navy would stop work in the immediate area and follow the Section 106 process for post-review discovery (36 CFR 800.13). These include, but are not limited to, evaluating the NRHP-eligibility of the resources, and considering the effects to such resources through consultation with the SHPO, affected American Indian tribes, and other interested parties. Similarly, if American Indian human remains, funerary items, sacred objects, or items of cultural patrimony are encountered, the Navy must comply with applicable laws and regulations and determine final disposition through government-to-government consultation with the affected tribes.

The Ammunition Wharf was constructed in 1979 and is not eligible for listing in the NRHP under any criteria. The Navy determined there would be No Historic Properties Affected with implementation of proposed MPR activities and the SHPO concurred in a letter dated April 8, 2019. Therefore, there would be no significant impact to cultural resources.

10.5 American Indian Traditional Resources

10.5.1 Affected Environment

NAVMAG Indian Island property and the controlled waterfront Naval Restricted Area are co-located in the adjudicated U&A fishing area for the Port Gamble S'Klallam Tribe, Jamestown S'Klallam Tribe, Lower Elwha Klallam Tribe, and Suquamish Tribe. The Navy and Suquamish Tribe signed a Memorandum of Agreement on September 14, 2009 that sets forth the responsibilities of the Parties and the conditions providing the Tribe access and permissible fishing activity within the Force Protection Barrier (i.e. Naval Restricted Area).

10.5.2 Environmental Consequences

10.5.2.1 No Action Alternative

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to baseline American Indian traditional resources. Therefore, no significant impacts to American Indian traditional resources would occur with implementation of the No Action Alternative.

10.5.2.2 MPR Activities (Preferred Alternative) Potential Impacts

In accordance with Executive Order 13175 and DOD and Navy instructions, the Navy invited the Port Gamble S'Klallam, Jamestown S'Klallam, Lower Elwha Klallam, and Suquamish Tribes to initiate government-to-government consultation regarding proposed MPR activities and potential impacts to tribal treaty rights. The Port Gamble S'Klallam, Jamestown S'Klallam, Lower Elwha Klallam, and Suquamish Tribes declined to request government-to-government consultation. The Tribes requested that additional project details be provided as they become available in the future. Additionally, the Suquamish Tribe provided comments on the Revised Draft EA, but determined it was not necessary to meet with the Navy to discuss these comments (Baxter, 2019). Government-to-government consultation with the Tribes is complete.

There would be no changes to the status quo regarding tribal access to traditional resources as a result of proposed MPR activities. Construction activities could result in loss of benthic organisms at the immediate project site; however replacement piles would be installed near the location of the removed pile, minimizing the direct loss of benthic invertebrates.

There would be a temporary increase in the volume of barge traffic during pile replacement and maintenance activities as pile delivery and disposal would generally be conducted via barge. However, the increase in barge traffic generated by the proposed MPR activities would be negligible when compared to existing marine traffic in Port Townsend Bay.

Observance of the in-water work window would minimize impacts to all juvenile salmonid species; therefore, significant impacts to juvenile salmonids are not expected. As part of continued engagement, the Navy will annually provide summaries of planned pile repair and replacement projects to the Tribes for information and coordination. Therefore, there would be no significant impact to American Indian traditional resources.

10.6 Summary of Potential Environmental Consequences

Table 10-2. Summary of Environmental Impacts at NAVMAG Indian Island

Section/ Resource Area	*Environmental Impacts*
Airborne Noise	Temporary construction noise during daytime hours is exempt from maximum permissible noise levels under the WAC and Jefferson County noise regulations. Therefore, there would be no significant impact to the ambient sound environment.
Water Quality	Direct discharges of waste would not occur. Construction-related impacts would be limited to short-term and localized changes associated with re-suspension of bottom sediments. These changes would be spatially limited to the construction site and areas immediately adjacent. Temporary impacts would not violate applicable state or federal water quality standards. The Navy would implement BMPs and minimization measures to prevent accidental losses or spills of construction debris. Removal of creosote-treated timber piles would improve local water quality. Therefore, there would be no significant impact to water quality.
Sediments	Sediment would be disturbed and re-suspended in the water column during pile removal and pile driving activities. Some degree of localized changes in sediment composition would occur. In particular, sediments that are re-suspended would be dispersed by currents and eventually re-deposited on the bottom. Project-related construction activities would not create sediment contamination concentrations or physical changes that violate state standards or interfere with beneficial uses of Port Townsend Bay. Therefore, there would be no significant impact to sediments.
Aquatic Vegetation	Vegetative growth found on existing piles would be removed when those piles are extracted from the water but because piles would be replaced, ultimately a similar amount of surface area on which marine organisms could colonize would exist. Impacts due to turbidity would be short-term, temporary, and localized. Additionally, because aquatic vegetation is distributed outside of the project area, recolonization could occur quickly, and the overall health and abundance of macroalgae and eelgrass would not be compromised. Therefore, there would be no significant impact to aquatic vegetation.
Benthic Invertebrates	As with aquatic vegetation, benthic organisms attached to removed piles would be lost, but new piles would provide equivalent attachment sites for development of the benthic community. Benthic organisms directly adjacent to piles would be lost or displaced. There would be minimal impacts to habitat and benthic organisms from turbidity caused by pile removal and installation and anchor placement and removal, but these effects would be temporary and very localized. Impacts at the population, stock, or species level would be negligible. Therefore, there would be no significant impact to benthic invertebrate populations.

Table 10-2. Summary of Environmental Impacts at NAVMAG Indian Island (continued)

Section/ Resource Area	*Environmental Impacts*
Marine Fish and EFH	In-water construction may expose fish to increased turbidity but exposure would be localized and temporary. The most significant impact to fish that could occur would be from exposure to elevated underwater noise from impact pile driving. To minimize exposure to noise, pile driving would be conducted during the in-water work window when juvenile salmonids (including ESA-listed salmonids) are least likely to be present. A majority of the pile driving would be conducted using a water jetting to minimize noise during installation of concrete piles. All impact pile driving would occur intermittently and for an estimated maximum duration of 4 hours for concrete during installation of piles. The Navy has determined that the Proposed Action "may affect, but is not likely to adversely affect" ESA-listed fish species and designated critical habitat and may "adversely affect" EFH. The USFWS has concurred with the Navy's conclusions regarding bull trout. NMFS concluded that the Navy's proposed MPR activities "may affect, are likely to adversely affect" Puget Sound evolutionary significant unit (ESU) Chinook salmon; Hood Canal summer-run ESU chum salmon; Puget Sound distinct population segment (DPS) steelhead; Puget Sound/Georgia Basin DPSs of bocaccio and yelloweye rockfish; designated critical habitat; and, EFH. With implementation of minimization measures, there would be no significant impacts to marine fish (including ESA-listed fish) and EFH.
Birds	Construction activities may result in the exposure of marbled murrelets to sound pressure levels above the behavioral guidance criterion. Mitigation measures would be used to reduce the adverse impacts to marbled murrelets, also benefiting other marine birds. No designated critical habitat for the marbled murrelet is located near Indian Island; therefore construction activities would not affect designated critical habitat for the species. The Navy has determined that the Proposed Action "may affect, but is not likely to adversely affect" the marbled murrelet, and the USFWS has concurred with the Navy's conclusions. No significant impacts to other marine birds are expected.
Marine Mammals	Limited impact pile driving of concrete piles at NAVMAG Indian Island are unlikely to expose marine mammals to behavioral disturbance due to monitoring and shutdown measures that would be used to reduce the adverse impacts to marine mammals. The Navy determined that the Proposed Action "may affect, but is not likely to adversely affect" ESA-listed humpback whales and Southern Resident killer whales because they are considered rare in Port Townsend Bay; and would not affect Southern Resident killer whale designated critical habitat. NMFS concluded that the Navy's proposed MPR activities "may affect, are likely to adversely affect" humpback whale species, Southern Resident killer whale, and Southern Resident killer whale designated critical habitat. While construction activities may impact individual marine mammals, any impacts observed at the population, stock, or species level would be negligible. Therefore, there would be no significant impact to marine mammal populations.
Cultural Resources	Implementation of proposed MPR activities at NAVMAG Indian Island would not affect any known NRHP-eligible archaeological sites. Construction activities consisting of contingent repairs and replacement would take place in previously disturbed areas. The Ammunition Wharf was constructed in 1979 and is not eligible for listing in the NRHP under any criteria. The Navy determined there would be No Historic Properties Affected with implementation of proposed MPR activities and the SHPO concurred on 8 April, 2019. Therefore, there would be no significant impact to cultural resources.

Table 10-2. Summary of Environmental Impacts at NAVMAG Indian Island (continued)

Section/ Resource Area	*Environmental Impacts*
American Indian Traditional Resources	There would be no changes to the status quo regarding tribal access to traditional resources as a result of proposed MPR activities. Construction activities could result in the loss of benthic organisms at the immediate project site; however, replacement piles would be installed near the location of the removed piles, minimizing the direct loss of benthic invertebrates. The in-water work window for each construction year would minimize impacts to all juvenile salmonid species; significant impacts to juvenile salmonids are not expected. Therefore, there would be no significant impact to American Indian traditional resources.

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11 Cumulative Impacts

CEQ regulations implementing the procedural provisions of NEPA define cumulative impacts as:

"…the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time" (40 CFR 1508.7).

Each resource, ecosystem, and human community must be analyzed in terms of its ability to accommodate additional effects, based on its own time and space parameters. Therefore, cumulative effects analysis normally would encompass a Region of Influence (ROI) or geographic boundaries beyond the immediate area of the Proposed Action, and a time frame including past actions and foreseeable future actions, to capture these additional effects.

For the Marine Structure Maintenance and Pile Replacement (MPR) activities to have a cumulatively significant impact to an environmental resource, two conditions must be met. First, the combined effects of all identified past, present, and reasonably foreseeable projects, activities, and processes on a resource, including the effects of the Proposed Action, must be significant. Second, the Proposed Action must make a substantial contribution to that significant cumulative impact. In order to analyze cumulative effects, a cumulative effects region must be identified for which effects of the Proposed Action and other past, present, and reasonably foreseeable actions would occur.

The cumulative impacts analysis for the proposed MPR activities considers known past, present, and reasonably foreseeable future actions located within each location's ROI, that is, sufficiently close to have interacting impacts. Additionally, direct/indirect impacts and unavoidable/irretrievable impacts are considered in this analysis. The level of detail required for cumulative effects analysis presented in this EA is appropriate and in context with the scope and magnitude of the Proposed Action because of the limited extent and temporary nature of the Proposed Action.

Each MPR location subsection lists the past, present, and reasonably foreseeable future Navy actions that have had, continue to have, or would be expected to have some impact to the natural and human environment. Past projects in this analysis are limited to those implemented in the last 5 years or those with ongoing contributions to environmental effects.

ROI descriptions used for resource areas in the cumulative impacts analysis are as follows:

- Airborne Noise. The region in which proposed MPR activities would generate noise levels exceeding ambient levels.
- Water Quality and Marine Sediments. The locally defined water body within which MPR impacts could add to impacts from other actions, such as northern Hood Canal or Sinclair Inlet.
- Aquatic Vegetation and Benthic Invertebrates. The locally defined water body within which MPR impacts could add to impacts from other actions, such as northern Hood Canal or Sinclair Inlet.
- Fish. The largest area in which proposed MPR activities would affect marine fish through noise effects.
- Birds. The largest area in which proposed MPR activities would affect marbled murrelets through noise effects.

- Marine Mammals. The largest area in which proposed MPR activities would affect marine mammals through noise effects.
- Cultural Resources. The area of potential effect (APE) as defined by Section 106 of the NHPA (36 CFR 800.16(d)). This is the "geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. The area of potential effects is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking" (36 CFR 800.16(d)).
- American Indian Traditional Resources. The largest area in which proposed MPR activities would affect traditional American Indian resources, including fisheries and other aquatic resources.

11.1 NAVBASE Kitsap Bangor

11.1.1 Past, Present, and Reasonably Foreseeable Future Actions

This analysis depends on the availability of data and the relevance of effects of past, present, and future actions. Although certain data (e.g., extend of forest cover) may be available for extensive periods in the past (i.e., decades), other data (e.g., water quality) may be available for much shorter periods. Because specific information and data on past projects and action are usually scarce, the analysis of past effects is often qualitative (CEQ, 1997).

Table 11-1 lists the past, present, and reasonably foreseeable future actions within the NAVBASE Kitsap Bangor ROI that have had, continue to have, or would be expected to have some impact to the natural and human environment. Projects with measureable contributions to impacts within the ROI for a resource area were included in the cumulative analysis.

Table 11-1. Past, Present, and Reasonably Foreseeable Future Projects Within the NAVBASE Kitsap Bangor ROI

Project	*Project Description*	*Project Timeframe*		
		Past	*Present*	*Future*
NAVBASE Kitsap Bangor Waterfront Operations	Waterfront operations include the overall integration of all port operations along the NAVBASE Kitsap Bangor waterfront. Activities include vessel traffic movement and management, personnel clearance and tracking, and ingress/egress within the restricted areas.	X	X	X
NAVBASE Kitsap Bangor Waterfront Facilities Maintenance	Common maintenance activities include pressure washing of waterfront piers to remove bird fecal material, marine fouling organisms (e.g., mussels, algae) and foreign materials (e.g., dirt). Maintenance area includes walkways and approaches to the piers. Other maintenance activities may involve repair and replacement of structures or facilities as needed.	X	X	X
EHW-1 Maintenance	This multi-year project involves replacing deteriorated piles. The most recent phase installed twenty-nine 30-in steel piles. Phased repair of this structure is expected to continue until 2024.	X	X	X
CSDS-5 Support Facilities	At the existing Service Pier, the Navy improved barge mooring capacity by replacing an existing research barge with a new research barge and installing new mooring piles to anchor the new research barge. This work occurred in summer of 2013 and involved installation of 18 new piles over a 3-week period.	X		
Mission Support Facilities	Mission support facilities may include activities or projects such as the addition of power booms, captivated camels, and piles for support or attachment; installation of emergency power generation capability; and other activities to support facilities or operations.	X	X	X

Table 11-1. Past, Present, and Reasonably Foreseeable Future Projects Within the NAVBASE Kitsap Bangor ROI (continued)

Project	Project Description	Project Timeframe		
		Past	Present	Future
Waterfront Security Enclave and Security Barriers	Construction of enclave fencing for the entire NAVBASE Kitsap Bangor Naval Restricted Area and construction of an associated parking area and other facilities. Mitigation action is restoring tidal influence to Cattail Lake, thereby increasing intertidal habitat. Construction was completed in June 2013.	X		
TRIDENT Second Explosives Handling Wharf (EHW-2)	Construction and operation of a second EHW adjacent to the existing EHW. The main wharf lies approximately 600 ft. offshore with piles at a depth of 60–100 ft. and would include an operations support building and facility support equipment such as heavy duty cranes, power utility booms, six lightning protection towers, and camels. Pile supported entrance and exit trestles connecting the wharf to shore were constructed. In-water construction began in 2012 and concluded in 2015; other construction is ongoing. To compensate for unavoidable impacts on aquatic resources and ensure no net loss of these resources, the Navy purchased credits from the Hood Canal in-Lieu Fee Program. To restore temporarily disturbed construction areas, the Navy will implement a revegetation plan for construction laydown areas and temporarily disturbed areas. To improve scientific understanding of marine species, the Navy will fund research studies on: (1) ocean acidification and (2) Hood Canal chum salmon. To improve salmon production and harvest opportunities in Hood Canal, the Navy will fund improvements at three existing fish hatcheries on Hood Canal and replacement of one finfish spawning facility on Hood Canal. To improve shellfish production and harvest opportunities, the Navy will fund: (1) improvements to beach substrate and 3 years of shellfish seeding on 24 acres of beach; (2) 5 years of shellfish seeding on priority shellfish enhancement areas in Hood Canal and adjacent Admiralty Inlet; (3) construction of a shellfish wet lab, education, and training building at Port Gamble; (4) construction of a floating shellfish nursery at Port Gamble; and (5) geoduck surveys and a geoduck pilot research study. In addition, the Navy will fund acquisition and preservation of upland habitat at Port Gamble.	X	X	X

Table 11-1. Past, Present, and Reasonably Foreseeable Future Projects Within the NAVBASE Kitsap Bangor ROI (continued)

Project	Project Description	Project Timeframe		
		Past	*Present*	*Future*
Swimmer Interdiction Security System In-water Structure and Support Facilities	The Navy has implemented a Swimmer Interdiction Security System to meet special U.S. Government security requirements for military installations in response to the terrorist attacks of September 11, 2001. The system protects waterside Navy assets and sailors, and would remain in operation as long as valuable naval assets were located on NAVBASE Kitsap Bangor. Specially trained marine mammals and their human handlers respond rapidly to security alerts by detecting, classifying, and marking the location of underwater objects or intruders. Humans work aboard small power boats, and marine mammals would be in enclosures. A Draft EIS was made available to the public for comment in December 2008, with a Record of Decision signed in 2009.	X	X	X
Relocate Floats to Delta Pier	The project removed and disposed of an existing wooden float on the south side of the Delta Pier, and relocated two existing concrete floats from the Marginal Wharf to the location of the wooden float at the Delta Pier. Six concrete piles were installed to secure the concrete floats at the Delta Pier. Five creosote-treated piles, no longer required at the Marginal Wharf, were removed. A single concrete pile was installed to secure the end of the floats, which remain at the Marginal Wharf. There was a net reduction of 741 sq. ft. in over-water coverage. The project was completed in 2015.	X		
Northwest Training and Testing (NWTT)	The Navy's Proposed Action is to conduct training and testing activities primarily within existing range complexes, operating areas, testing ranges, and select Navy pier side locations in the Pacific Northwest. The Proposed Action includes pier side sonar testing and maintenance conducted as part of overhaul, modernization, maintenance, and repair activities at NAVBASE Kitsap Bangor.	X	X	X
Bangor Transit Protection Program (TPP) Pier	This project consists of a new floating pier with finger piers, connected to the shore by a trestle and ramp. Total overwater area is approximately 1.6 acres. On-land facilities would include a new operations and headquarters building with a footprint of 9,000 sq. ft., and parking lots totaling 22,000 sq. ft.			X
Electromagnetic Measurement Range	The proposed Electromagnetic Measurement Range Sensor System equipment project includes installation of sensor equipment, including an underwater instrument array, data/power cables, a pile-supported platform, an in-water navigation aid, and an upland monitoring system on NAVBASE Kitsap Bangor.			X

Table 11-1. Past, Present, and Reasonably Foreseeable Future Projects Within the NAVBASE Kitsap Bangor ROI (continued)

Project	Project Description	Project Timeframe		
		Past	Present	Future
Land Water Interface	Objective is to provide security upgrades for the Naval Restricted Area by constructing two Land-Water Interface barriers, which would connect both ends of the onshore Restricted Area enclave to the existing floating barriers. The Land-Water Interface barriers would extend from the high water mark to the terminations of the Port Security Barriers. Construction is planned to occur from August 2016 to August 2018. The Final EIS was published in July 2016.		X	X
Service Pier Extension	Construction of an extension to the Service Pier (33,000 sq. ft.), a new Pier Services and Compressor Building (2,100 sq. ft.) on the existing pier, upland Maintenance Support Facility (50,000 sq. ft.), and an approximately 420-car parking lot with associated outdoor storage (4,000 sq. ft.). The Final EIS was published in July 2016 and a Supplemental Draft EIS was published in August 2017.		X	X
Olympic View Marina	In January 2010, Olympic View Marina, LLC began replacing the abandoned Seabeck Marina located on Seabeck Bay approximately 7 mi south of NAVBASE Kitsap Bangor on the east side of Hood Canal. The original construction plan included installation of 72,510 sq. ft. of piers, floats, and gangways for the moorage of approximately 200 boats but the replacement is smaller than originally designed. In order to permit rebuilding of the marina, the shoreline designation of the old Seabeck marina in the Kitsap County Shoreline Management Master Program was amended from "conservancy" to "rural" in April 2009. Although workers began installing pilings for the docks in 2010, construction was put on hold from February 15 until July 16 to comply with the fish window. Removal of concrete debris from the beach was completed in October 2010. A 600-ft. breakwater was installed in 2014. Additional moorage slips may be added as demand increases.	X	X	X
Pleasant Harbor Marina and Golf Resort	The Statesman Group of Companies is upgrading facilities and constructing a new master planned development at Pleasant Harbor south of Brinnon. The project would be located on the west side of Hood Canal approximately 9 mi southwest of NAVBASE Kitsap Bangor. An existing 300-slip boat marina has been refurbished and resort facilities have been developed including parking lots, retail, and paved roads (Jefferson County Department of Community Development, 2015a,b). The 256-acre development, when complete, would include resort housing, a hotel, a restaurant, a spa, a clubhouse, a 9-hole golf course and 3-hole practice course, and other resort-type facilities The Final Supplemental EIS was published in December 2015.		X	X

Table 11-1. Past, Present, and Reasonably Foreseeable Future Projects Within the NAVBASE Kitsap Bangor ROI (continued)

Project	Project Description	Project Timeframe		
		Past	Present	Future
Port Gamble Dock	The Olympic Property Group has applied for a permit for a dock at a former mill site in Port Gamble. The proposed dock would be 365 ft. (111 m) in length with an area of about 4,800 sq. ft. (446 sq. m), and would include an abutment, pier, truss, and gangway, as well as a primary float, seaplane float, and kayak launching float. The dock would accommodate up to nine boats.			X
Port Gamble Sewage Treatment Plant	The old treatment plant discharges its effluent into Hood Canal and would be replaced with a new treatment plant that discharges to groundwater through an upland drain field. The new plant would have a membrane bioreactor, a type of filtering system capable of producing effluent close to the quality of drinking water. The new plant would treat up to 100,000 gallons of sewage per day and would be built and operated by Kitsap Public Utility District.			X
Port Gamble Bay Cleanup	The Port Gamble Bay and Mill Site consists of the fill on which the former sawmill was located, the adjacent uplands and most of Port Gamble Bay. Historical operations on this property resulted in the release of pollutants from wood waste and pilings. Some of these contaminants have been found in soil surrounding the mill and in sediments and shellfish tissue in Port Gamble Bay. The first year of Port Gamble Bay cleanup is complete (WDOE, 2016). Cleanup construction in the bay began in September 2015 and will be completed by January 2017. Within the first year, cleanup crews: removed 3,312 pilings; excavated 19,098 cubic yards of intertidal sediments; dredged 22,360 cubic yards; removed and recycled 3,063 tons of steel, concrete and other debris; delivered 69,051 tons of clean capping and habitat materials. Also underway are efforts to improve marine and shoreline habitat and restore native species such as oysters.	X	X	X
Hood Canal Coordinating Council (HCCC) Projects	The HCCC is a council of governments formed in 1985 in response to community concerns about water quality problems and related natural resource issues in the Hood Canal watershed. Completed, ongoing and future projects include salmon recovery efforts, habitat enhancement and restoration, water quality protection, and climate adaptation.	X	X	X

Sources for Port Gamble sewage treatment plant: http://pugetsoundblogs.com/waterways/tag/port-gamble/; http://www.kpud.org/wastewater.php

11.1.2 Assessment of Cumulative Impacts by Resource

This section describes, by resource, the expected cumulative impacts of the proposed MPR activities when considered in conjunction with past, present, and reasonably foreseeable future actions.

11.1.2.1 Airborne Noise

Future Navy and non-Navy actions would generate noise. The impact of these noise sources would depend on their location relative to sensitive receptors, but it is likely that some of these future actions would produce temporary noise. Assessments of pile driving noise for the EHW-2 and Land-Water Interface/Service Pier Extension (LWI/SPE) projects at NAVBASE Kitsap Bangor indicated that pile driving would not result in noise levels exceeding WAC thresholds in nearby residential areas (Navy, 2012b, 2016e). It therefore is unlikely that proposed MPR activities would exceed such levels. In addition, temporary construction noise is exempt from state and local limits. Therefore, the proposed MPR activities would not contribute to cumulative noise impacts when considered with other past, present, and future actions.

11.1.2.2 Water Resources and Marine Sediments

11.1.2.2.1 Water Quality

Water quality in Hood Canal has been and is being impacted by past and present in-water and upland actions. In-water development has impacted water quality from: (1) incidental spills associated with boat operations, such as fueling, or other activities conducted on piers, wharfs, and floats; (2) sediment disturbance and turbidity from propeller wash in shallow areas; (3) use of materials, such as treated wood pilings that, over time, leak toxins into the marine waters; and (4) stormwater runoff. Most of these events, except for treated materials, result in periodic inputs of pollutants (i.e., fuel, oil, and other contaminants) directly to Hood Canal, which can impact turbidity, pH, temperature, salinity, DO, and biochemical oxygen demand.

Unless there is a major spill of material such as fuel, oil, or other toxic material transported or associated with boat traffic that would impact water quality conditions, incidental spills usually do not result in long-term cumulative impacts. Hood Canal is a large enough water body that it can absorb small spills, such as those that may occur when fueling vessels, without any long-term impacts to water quality.

Propeller wash in shallow areas impacts water quality by disturbing sediment and causing turbidity. However, this is typically a short-term impact and does not usually result in a cumulative impact to water quality because sediment settles out fairly rapidly.

Upland development has caused localized deterioration in the water quality in Hood Canal, mainly from uncontrolled stormwater runoff, failing septic systems, and mismanagement of animal wastes. Stormwater runoff can carry contaminants, such as heavy metals and oils from hard surfaces such as roads, and nitrogen and phosphorus from lawn fertilizers into streams that empty into Hood Canal. While irregular in nature, stormwater-related inputs to water quality may be relatively intense during storm events. Contaminants in the stormwater runoff can adversely impact DO, BOD, pH, and other water quality parameters in localized areas.

Most development in Hood Canal watershed (except NAVBASE Kitsap Bangor) uses septic systems, and many older systems have failed over time. Fecal coliform bacteria and nutrients are periodically discharged into Hood Canal through stormwater runoff from areas with inadequate septic systems.

Though fecal coliform bacteria are not harmful to humans, the presence of fecal coliform indicates the possible presence of pathogenic viruses or bacteria. Fecal coliform bacteria can also be absorbed and concentrated in shellfish making them unsuitable for human consumption.

On the positive side, various HCCC projects have had and would continue to have beneficial effects on water quality conditions in Hood Canal.

Although there are continuing water quality issues in Hood Canal, proposed MPR activities would have very localized and temporary impacts on water quality. Therefore, proposed MPR activities, in combination with Navy and non-Navy past, present, and reasonably foreseeable future actions would not have a significant cumulative impact on water quality.

11.1.2.2.2 Sediments

Past and present actions involving in-water construction (i.e., pile driving and shoreline modification) in Hood Canal have caused or are causing short-term disturbances to sediment. In-water structures create accretion of sediments in some locations and erosion of sediments on the down-drift side of these structures. As a result of some of these in-water projects, the assumption has been made that some slight changes in sedimentation have occurred over time. Future Navy and non-Navy actions could result in erosion and accretion of shoreline sediments. Design elements and construction BMPs for MPR projects are expected to largely control erosion resulting from these actions. Therefore, proposed MPR activities, in combination with Navy and non-Navy past, present, and reasonably foreseeable future actions would not have a significant cumulative impact on sediments.

11.1.2.3 Biological Resources

11.1.2.3.1 Aquatic Vegetation

Aquatic vegetation along the Bangor shoreline has been or could potentially be disturbed by past and present placement of in-water structures such as pilings and anchors, dredging, underwater fills, and construction of overwater structures. These impacts include temporary and/or permanent loss of aquatic vegetation, reduced productivity, and changes in the type or abundance. Important marine habitat, such as eelgrass, has decreased over the last few decades in Hood Canal as indicated by trend data. Recent monitoring by WDNR, however, showed an increase in eelgrass between 2010 and 2014, especially in lower Hood Canal (Christaen et al., 2016). Habitat enhancement and restoration projects carried out by the HCCC have improved and would continue to improve aquatic vegetation conditions in Hood Canal. The proposed MPR activities do not include new over-water structures or expansion of existing structures. BMPs and mitigation measures would be employed for each potential MPR project to minimize any direct impacts to aquatic vegetation. With BMPs, the proposed MPR activities would have minimal impacts on aquatic vegetation. Therefore, despite past and continuing impacts to aquatic vegetation in Hood Canal, the potential for the proposed MPR activities to contribute to cumulative impacts is negligible.

11.1.2.3.2 Benthic Invertebrates

Past and present actions involving placement of pilings and anchors have resulted in the direct loss of the natural benthic soft-bottom habitat. This habitat is replaced by the hard surfaces of pilings and anchors, and as a result, the types of benthic organisms have changed and are changing in these localized areas. Hard surfaces create sites for colonization by species adapted to these surfaces such as mussels and sea anemones. Thus, the impact of in-water structures has been to replace native soft-bottom habitat with hard-surface habitat over time. This has adversely impacted some species (including prey species for juvenile salmonids), while benefiting others.

Future in-water structures would similarly result in a direct loss of benthic habitat and organisms. Shading can impact the abundance of some benthic organisms and lighting can increase predation rates. Shading and loss/alteration of soft-bottom habitat has impacted the type and abundance of benthic organisms that occur in the vicinity of these structures. In addition, in-water structures have resulted in accretion of sediments in some areas and possibly erosion in others. Any areas of erosion would result in adverse impacts to sediment-dwelling species. These changes would adversely affect foraging by juvenile salmon, which prefer species typical of fine-grained sediments and eelgrass beds, as well as food for marine mammals, fish, birds and humans.

Pile replacement during proposed MPR activities would temporarily remove attachment sites for benthic species, and would disrupt the benthic community of the immediate pile site. However, these impacts would be temporary and localized. Therefore, despite past on continuing impacts to the benthic community in Hood Canal, proposed MPR activities would not contribute to any permanent cumulative losses to benthic communities.

11.1.2.3.3 Marine Fish

Past actions have adversely impacted populations of salmonids (salmon, steelhead, cutthroat, and bull trout, including federally threatened and endangered species) in Hood Canal and tributaries through loss of foraging and refuge habitat in shallow areas, reduced function of migratory corridors, loss and degradation of spawning habitat in streams, interfering with migration, adverse impacts to forage fish habitat and spawning, contamination of water and sediments, and depletion of DO. Another factor that has resulted in adverse impacts to salmonid abundance is the overharvest by fisheries and hatcheries. The impact has been greatest on native stocks. Practically all chum salmon, most Chinook, and all sockeye salmon spawning in Hood Canal stream systems are derived from naturalized hatchery stock. Populations of pink salmon, coho salmon, bull trout, and steelhead are also in decline. The net result is that several Hood Canal salmonid species have been listed as threatened under the ESA. Existing Navy structures have affected salmonid and forage fish habitat, and have probably impeded and continue to impede juvenile salmon migration to some degree. Current and future waterfront projects at Bangor would be designed and implemented to minimize impacts to salmonid habitat and migration, and to forage fish.

The placement of in-water structures by the Navy and from non-Navy actions has changed and would continue to change fish habitat in and around these structures. Water quality has been and is being impacted by past and present actions and could be impacted by potential future development. In particular, DO levels in Hood Canal are chronically impacted by nutrient levels from development activities that have increased over time. Nutrients can cause algal blooms that deplete DO and result in fish kills. Many of the other types of past and ongoing impacts described above for salmonids also apply to other marine species. Trend data have shown a decrease in some fish species such as rockfish, spiny dogfish, Pacific cod, and hake, as well as increased toxins in the tissues of some species such as Chinook salmon (Puget Sound Action Team, 2007).

Future Navy and non-Navy actions have the potential to have some of the same impacts as described above for past actions, notably habitat loss or alteration, and the decreased function of migratory corridors. However, federal or federally funded actions that have occurred since legislation, such as the

ESA, MMPA, and NEPA, was enacted have been considering and are required to consider environmental impacts to federally threatened and endangered species, prepare analysis (including a biological assessment), and consult with federal oversight agencies to minimize project impacts. Future actions are also required to go through this same process. Future actions at NAVBASE Kitsap Bangor would be designed and implemented to minimize impacts to salmonids.

Currently, efforts are being made to reverse the decline of fish populations by regulating development and restoring fish habitat. Numerous salmon preservation and restoration groups have proposed and constructed habitat restoration projects in Hood Canal. HCCC projects have improved and would continue to improve fish habitat conditions in Hood Canal and assist with salmon recovery. Efforts to reduce construction impacts to salmonids and other fish have resulted in a schedule of in-water work periods that all projects must adhere to if authorized by state (WDFW) or federal (USACE) regulatory authorities. The work windows help minimize adverse impacts to migrating and spawning fish in freshwater and juvenile salmon in marine waters.

The protective measures taken to minimize impacts during construction activities, and the design elements that reduce long-term impacts to nearby habitats, as well as strengthened environmental review of recent and future actions, is expected to reduce impacts to fish populations. Future actions, including Navy actions, would be designed and implemented to minimize impacts to fish and their habitat. In addition, many of the habitat restoration projects discussed above for salmonids would also benefit non-salmonid fish species.

Implementation of the proposed pile replacement activities would have insignificant effects on fish. Past, present, and future development projects have had, have, and would have the potential to result in many of the impacts to salmonids, and add to declining population trends. Although there are ongoing and future actions and plans intended to improve conditions for salmonids in Hood Canal (described above), the impacts of the proposed MPR activities would result in short-term increases in underwater noise and turbidity therefore potentially contributing to past and ongoing cumulative impacts to these species. However, because impacts are short-term and localized if actual construction schedules for projects involving pile driving do not overlap, resulting cumulative impacts would be reduced accordingly.

With BMPs and minimization measures in place, cumulative impacts would not significantly affect fish populations in the proposed project area. Nevertheless, the proposed MPR activities and other future actions would contribute incrementally to cumulative fish impacts in the Hood Canal overall. Continued adherence to the requirements of the ESA would limit disturbance to fish and ensure that important habitats do not become degraded. Furthermore, existing regulatory mechanisms and minimization measures would protect fish and further decrease the likelihood of potential cumulative impacts to these species. Therefore, proposed MPR activities when considered in conjunction with other past, present and reasonably foreseeable future actions, would not have significant cumulative impacts on marine fish.

11.1.2.3.4 Birds

Construction and operation of past and present waterfront projects, as well as non-Navy actions, has resulted in increased human presence, underwater and airborne noise, boat movement, and other activities, which has likely deterred some water-dependent wildlife such as marine birds from these areas. Marine birds typically avoid areas with continuous activity or that produce periodic impacts such as loud noises. Often, birds would return to these areas when human presence is lower or there is less activity. There may also be some benefits as some birds may use these in-water structures for roosting or nesting.

Trend data for Puget Sound indicate that some marine bird populations have increased or remained stable (Ward et al., 2015), but others appear to be in decline including tufted puffin, (Hanson & Wiles, 2015), white-winged scoter, brant, western grebe, and red-necked grebe (Ward et al., 2015). Possible reasons for the declines include impacts of derelict fishing gear, toxins, habitat loss, decreases in forage fish availability, increased predation by pinnipeds and bald eagles, and disturbance to breeding grounds in the Arctic). The marbled murrelet, listed as threatened under the ESA, declined 3.9 percent per year in the Strait of Juan de Fuca, San Juan Islands, and Puget Sound, from the 2000 to 2013 (Falxa et al., 2015). The principal reason for the decline is loss of nesting habitat (old-growth forest), but prey abundance in the marine environment may also play an important role.

Future Navy and non-Navy waterfront projects may have similar impacts to those of the past and present actions including increased anthropogenic sound (both airborne and underwater), increased human presence, increased boat movements, and other associated activities. These actions could result in behavioral impacts to local populations of marbled murrelets and other birds, such as temporary avoidance of habitat, decreased time spent foraging, increased or decreased time spent resting (depending on the activity), and other minor behavioral impacts. Most impacts would be unlikely to affect the overall fitness of the animals. Impacts to marbled murrelets and other birds are still expected to primarily result from behavioral disturbance from underwater sound pressure levels; however indirect impacts to marbled murrelets may occur as a result of impacts to their prey base (fish) during construction and the ultimate operation of projects. Potential impacts to their prey base could include habitat disturbance during construction and overwater shading from completed structures during their operational life. Impacts during construction are expected to be temporary.

Overwater shading would be a long-term impact, but the effect to marbled murrelet and other bird populations would be minimal. Overwater shading may result in a reduction in the amount or quality of submerged aquatic vegetation which may in turn affect forage fish due to a reduction in quality habitat. However, the reduction in forage fish habitat would be minimal in comparison to the total habitat available in Hood Canal. Therefore, any reduction in forage fish populations would not be expected to have an adverse impact to marbled murrelets or other birds or their overall fitness. Additionally, proposed projects along the Bangor waterfront at NAVBASE would occur in an area that already has industrial uses with higher than normal activity and noise levels. Thus, marine birds in the area may be somewhat used to these higher levels of activity and less impacted by ongoing waterfront development.

As described in Section 4.3.2.2.4 (Birds), implementation of pile driving and pile removal at the project area would have no significant effect on migratory bird populations, and is not expected to significantly impact the marbled murrelet. The proposed MPR activities would likely have underwater and airborne noise impacts to birds, but most effects would be limited to localized, temporary disturbances to birds in the project area.

Past, present, and future development projects have had, are having, and would have the potential to result in many of the impacts to marine birds described above, and add to past or current declining population trends. Because marine birds are highly mobile, the noise impacts of the proposed MPR activities could be cumulative with underwater and airborne noise impacts to marine birds from other actions and activities in Hood Canal region. However, because the expected impacts of the proposed

MPR activities on marine birds in general would be temporary, cumulative impacts to marine birds associated with pile driving noise are considered unlikely.

Cumulative impacts to marbled murrelets have the greatest potential to occur during simultaneous pile driving exposure events from the proposed MPR activities and other projects in the vicinity. Of greatest concern to bird safety (including the marbled murrelet) would be the potential for their acoustic injury zones to overlap spatially and temporally. Spatially, the zones are not large enough to overlap. With regard to impact pile driving, the proposed MPR activities at Bangor is limited to impact pile driving of six piles per day, with a maximum of 1.5 hours of pile driving per day. Behavioral disturbance zones from vibratory pile driving have the potential to overlap as a result of concurrent vibratory pile driving that may occur between multiple projects. When two closely located pile driving projects occur at the same time, noise levels could increase by as much as 3 dB at sites roughly equidistant between the multiple pile driving rigs. The current use of vibratory hammers may result in a slight increase in the zone of behavioral harassment, but these impacts would be temporary.

With BMPs and minimization measures in place (i.e., sound attenuation devices, visual surveillance, the use of shutdown zones), cumulative impacts would not significantly affect marbled murrelet or other bird populations in the proposed project area. Nevertheless, the proposed MPR activities and other future actions would contribute incrementally to cumulative disturbance of marbled murrelets and other birds in Hood Canal overall. Continued adherence to the requirements of EO 13186 and the Bald and Golden Eagle Protection Act by NAVBASE Kitsap Bangor would limit disturbance to the bald eagle and other migratory birds, and ensure that important habitats do not become degraded. Furthermore, existing regulatory mechanisms and minimization measures (Section 2.5) would protect bald eagles and the ESA-listed marbled murrelet and further decrease the likelihood of potential cumulative impacts to these species. Therefore, proposed MPR activities when considered in conjunction with other past, present and reasonably foreseeable future actions, would not have significant cumulative impacts on birds.

11.1.2.3.5 Marine Mammals

Construction and operation of past and present waterfront projects, as well as non-Navy actions, have resulted in increased human presence, underwater and airborne noise, boat movement, fishing, and other activities, which has likely impacted some water-dependent wildlife such as marine mammals in the area. Increased anthropogenic noise in the marine environment has the potential to cause behavioral reactions in marine mammals including avoidance of certain areas. However, the abundance and coexistence of these species with existing anthropogenic activities suggests that cumulative effects have not been significant. Population trend data for Hood Canal indicate that most of the marine mammal species expected to be in the project area are either stable or increasing in recent years based on NMFS stock assessment reports despite past and present actions (Allen & Angliss, 2015; Carretta et al., 2015). For instance, the U.S. stock of California sea lions is nearly at its carrying capacity, harbor seals within the inland waters of Washington are at their optimum sustainable population level, and the Eastern stock of Steller sea lions was proposed for removal from the ESA based on an increase in population size of ~3.0 percent per year since 1970 (NMFS, 2008b). Continued regulation of marine mammal exposures to anthropogenic disturbance by NMFS under the MMPA, coupled with stock assessments, documentation of mortality causes, and research into acoustic effects, ensure that cumulative effects would be minimized. The regulatory process also ensures that each project that may result in exposure of marine mammals is assessed in light of the status of the species and other actions affecting it in the same region.

Future Navy and non-Navy waterfront projects may have similar impacts to past and present actions including increased anthropogenic sound (both airborne and underwater), increased human presence, increased boat movements and other associated activities. These actions could result in behavioral impacts to local populations of marine mammals, such as temporary avoidance of habitat, decreased time spent foraging, increased or decreased time spent hauled out (depending on the activity), and other minor behavioral impacts. Most impacts would likely be short-term and temporary in nature and unlikely to affect the overall fitness of the animals. Impacts to marine mammals would result primarily from behavioral disturbance from underwater sound pressure levels; however indirect impacts to marine mammals may occur as a result of impacts to their prey base (fish) during construction and the ultimate operation of projects. Potential impacts to their prey base could include habitat disturbance during construction and overwater shading from completed structures during their operational life. Impacts during construction are expected to be temporary. Overwater shading would be a long-term impact, but the effect to marine mammal populations would usually be minimal. Overwater shading may result in a reduction in the amount or quality of submerged aquatic vegetation which may in turn affect forage fish due to a reduction in quality habitat. However, the reduction in forage fish habitat would be minimal in comparison to the total habitat available in Hood Canal. Therefore, any reduction in forage fish populations would not be expected to have an adverse impact to marine mammals or their overall fitness. Additionally, proposed projects along the NAVBASE Kitsap Bangor waterfront would occur in an area that already has industrial uses with higher than normal activity and noise levels. Thus, marine mammals in the area may be habituated to these higher levels of ongoing activity and less impacted by ongoing waterfront development.

Implementation of pile driving activities (including pneumatic chipping) would have insignificant effects on marine mammals, and would not likely adversely affect the ESA-listed southern resident killer whale or humpback whale. The proposed MPR activities may result in behavioral disturbance to marine mammals from underwater sounds associated with pile driving; however, these effects would be limited to localized, temporary disturbances to marine mammals within the project area.

Past, present, and future development projects have had, are having, and would have the potential to result in many of the impacts to mammals described above, and could also have additional impacts to the species, their habitat, and prey. For instance, fishing operations in the area could reduce local abundance of forage fish or result in by-catch of marine mammals. Because marine mammals are highly mobile, the noise impacts of the proposed MPR activities could be cumulative with underwater and airborne noise impacts to marine mammals from other actions and activities in Hood Canal region. However, because the expected impacts of the proposed MPR activities on marine mammals in general would be temporary, cumulative impacts to marine mammals associated with pile driving noise are considered unlikely.

With BMPs and minimization measures in place (i.e., sound attenuation devices, visual surveillance, the use of shutdown zones), cumulative impacts would not significantly affect marine mammal populations in the proposed project area. Nevertheless, the proposed MPR activities and other future actions would contribute incrementally to cumulative marine mammal disturbance impacts in Hood Canal overall. Continued adherence to the requirements of the ESA and MMPA by NAVBASE Kitsap Bangor would limit disturbance to marine mammals and ensure that important habitats do not become degraded. Furthermore, existing regulatory mechanisms and minimization measures (Section 2.5) would protect marine mammals and further decrease the likelihood of potential cumulative impacts to these species. Therefore, proposed MPR activities when considered in conjunction with other past, present and reasonably foreseeable future actions, would not have significant cumulative impacts on marine mammals.

11.1.2.4 Cultural Resources

The ROI for cumulative impacts to cultural resources consists of the waterfront area where the marine structures are located. The replacement of existing piles would not adversely affect known NRHP-eligible historic districts, architectural resources, or archaeological sites. Proposed MPR activities would take place in and over water. The Navy has determined that the proposed MPR activities would have no adverse effect.

Future Navy or non-Navy actions may impact cultural resources. Surveys performed at NAVBASE Kitsap Bangor have provided detailed accounts of the cultural resources located on the base. Although the potential to encounter cultural resources during construction exists, the Navy would ensure the proper consultations and procedures are followed. As such, the Navy minimizes impacts to cultural resources occurring on the base.

The past actions at the NAVBASE Kitsap Bangor waterfront listed in Table 11-1 did not have adverse effects on cultural resources within the ROI. For the Proposed Action there would be no adverse effect on historic properties. Therefore, proposed MPR activities when considered in conjunction with other past, present and reasonably foreseeable future actions, would not have significant cumulative impacts on marine fish on cultural resources.

11.1.2.5 American Indian Traditional Resources

The S’Klallam Tribes have expressed concern over the cumulative nature of impacts from Navy activity in the Hood Canal, particularly on access to resources. The proposed MPR activities, because of their temporary nature (July 16 to January 15 over multiple years) would not impact treaty-reserved resources, and there would be no change to tribal access to tribal resources. Therefore, the proposed MPR activities would not result in cumulative impacts to tribal resources and access when combined with other past, present, and reasonably foreseeable future actions.

11.2 NAVBASE Kitsap Bremerton

11.2.1 Past, Present, and Reasonably Foreseeable Future Actions

Table 11-2 identifies the recent past, present, and reasonably foreseeable future actions that could have cumulative impacts with the proposed MPR activities at NAVBASE Kitsap Bremerton.

Table 11-2. Past, Present, and Reasonably Foreseeable Future Projects Within the NAVBASE Kitsap Bremerton ROI

		Project Timeframe		
Project	***Project Description***	***Past***	***Present***	***Future***
Security Barriers	Extend floating Port Security Barrier to the shore at the eastern edge of the installation. Project completion date to be determined.			X
Piers Pile Replacement	In 2011, 70 creosote-treated timber piles at Piers 5 and 6 were replaced with concrete piles.	X		
Northwest Training and Testing (NWTT)	The Navy's Proposed Action is to conduct training and testing activities primarily within existing range complexes, operating areas, testing ranges, and select Navy pier side locations in the Pacific Northwest. The Proposed Action includes pier side sonar maintenance and testing conducted as part of overhaul, modernization, maintenance, and repair activities at PSNS & IMF in Bremerton.	X	X	X
Pier B Construction	In 2012, the Navy completed construction of the aircraft carrier Maintenance Wharf, replacing the existing Pier B. The new concrete pile supported pier (165,000 sq. ft.) was constructed to support vessel overhaul and maintenance.	X		
Pier B Mitigation	As mitigation for construction of Pier B, Pier 8 on the east side of the installations was demolished. Additional mitigation funding was provided for restoration efforts on Chico Creek which improved fish passage and purchased/preserved two properties. Also, a culvert over upper Carpenter Creek is being replaced with a 150-ft. bridge.	X	X	
Pier 6 Pile Replacement	From 2013–2015, the Navy removed approximately 380 creosote-treated timber piles and 20 steel piles from Pier 6 and replaced them with approximately 330 pre-stressed concrete piles.	X		
Piers 4 and 5 Fender Pile Replacement	The Navy will remove and replace fender piles at Piers 4 and 5. The Proposed Action is planned to begin in 2016 and will take approximately 6-12 weeks to complete, including approximately four weeks of in-water work. On Pier 4, approximately 80 creosote-treated timber fender piles will be removed and replaced with approximately eighty 12- to 14-in hollow steel fender piles. On Pier 5, 12 existing creosote-treated timber fender piles will be replaced with twelve 12- to 14-in steel piles.	X		

Table 11-2. Past, Present, and Reasonably Foreseeable Future Projects Within the NAVBASE Kitsap Bremerton ROI (continued)

Project	Project Description	Project Timeframe		
		Past	Present	Future
Port Orchard Boat Launch	In 2013, the City of Port Orchard installed a new floating pier with steel piles at the public boat launch in Port Orchard.	X		
Bremerton Ferry Terminal Maintenance	In 2014, Washington Department of Transportation started removal of 112 creosote treated piles and installation of 20 steel piles in support of the Bremerton Ferry Terminal.	X		

11.2.2 Assessment of Cumulative Impacts by Resource

11.2.2.1 Airborne Noise

Noise at NAVBASE Kitsap Bremerton is dominated by shipyard operations. Noise levels tend to be fairly low outside the developed area of Bremerton. Any future Navy and non-Navy actions would also generate noise, temporary or long-term. The impact of these noise sources would depend on their location relative to sensitive receptors, but it is likely that some of these future actions would produce nuisance noise during construction.

Any effect to the ambient airborne noise from proposed MPR activities would be temporary in nature; temporary construction noise is exempt from state and local limits. Therefore, the proposed MPR activities would not result in cumulative noise impacts when considered with other past, present, and reasonably foreseeable future actions.

11.2.2.2 Water Resources and Marine Sediments

11.2.2.2.1 Water Quality

Past actions at Bremerton may have impacted water quality from: (1) incidental spills associated with boat operations, such as fueling, or other activities conducted on piers; (2) sediment disturbance and turbidity from propeller wash in shallow areas; (3) use of materials, such as treated wood pilings that, over time, leak toxins into the marine waters; and (4) stormwater runoff.

Most of these events, except for treated materials, result in periodic inputs of pollutants (i.e., fuel, oil, and other contaminants) directly to Sinclair Inlet, which can impact turbidity, pH, temperature, salinity, DO, and biochemical oxygen demand. Unless there is a major spill of material such as fuel, oil, or other toxic material transported or associated with boat traffic that would impact water quality conditions, incidental spills usually do not result in long-term cumulative impacts.

Most of the waterfront structures at Bremerton and other existing non-Navy sites are supported by pilings, many of which were treated with creosote, which is now known to contain toxic chemicals. Other wood materials historically used to construct docks, boathouses, and other facilities included pressure treated wood, which is now known to leach chromated copper arsenate and other pesticides. Over time, these materials are no longer being used and are being replaced with environmentally neutral materials that do not leak toxins. Thus, the impacts to water quality from this source have decreased over time.

Stormwater runoff can carry contaminants, such as heavy metals and oils from hard surfaces such as roads, and nitrogen and phosphorus from lawn fertilizers into streams that empty into Sinclair Inlet. While irregular in nature, stormwater-related inputs to water quality may be relatively intense during storm events. Contaminants in the stormwater runoff can adversely impact DO, BOD, pH, and other water quality parameters in localized areas.

Future Navy actions would be designed to minimize water quality impacts and be conducted in accordance with CERCLA requirements. Proposed MPR activities would have temporary and localized impacts on water quality. Therefore, despite past and ongoing water quality issues in Sinclair Inlet, proposed MPR activities in combination with past, present, and reasonably foreseeable future events would not have a significant cumulative impact on water quality.

11.2.2.2.2 Sediments

Past and present actions involving in-water construction (i.e., pile driving and dredging) in Sinclair Inlet have caused short-term disturbances to sediment. Pile replacement at the existing piers and shoreline armoring have resulted in erosion and coarsening of shoreline sediments in some areas. Waterfront monitoring of sediment grain size has shown a slight coarsening from 2013 to 2014.

Future Navy actions could result in erosion and accretion of shoreline sediments. The industrial waterfront at Bremerton has a heavily disturbed and altered seafloor. BMPs are expected to minimize sediment impacts resulting from proposed MPR activities and future actions. Therefore, the potential for the proposed MPR activities to result in cumulative impacts on sediments is minimal.

11.2.2.3 Biological Resources

11.2.2.3.1 Aquatic Vegetation

Aquatic vegetation along the Bremerton shoreline in Sinclair Inlet has been or could potentially be disturbed by past and present placement of in-water structures such as pilings and anchors, dredging, underwater fills, and construction of overwater structures. These impacts include temporary and/or permanent loss of aquatic vegetation, reduced productivity, and changes in the type or abundance. These impacts are expected to be limited by the fact that little vegetation occurs along the NAVBASE Kitsap Bremerton waterfront. In addition, BMPs and mitigation measures would be employed for each potential project to minimize any direct impacts to aquatic vegetation. Therefore, proposed MPR activities in combination with past, present and reasonably foreseeable future actions would not result in significant cumulative impacts to aquatic vegetation.

11.2.2.3.2 Benthic Invertebrates

Past and present actions involving placement of pilings and anchors have resulted in the direct loss of the natural benthic soft-bottom habitat. This habitat is replaced by the hard surfaces of pilings and anchors, and as a result, the types of benthic organisms have changed and are changing in these localized areas. Hard surfaces create sites for colonization by species adapted to these surfaces such as mussels and sea anemones. Thus, the impact of in-water structures has been to replace native soft-bottom habitat with hard-surface habitat over time. This has adversely impacted some species (including prey species for juvenile salmonids), while benefiting others.

Any areas of erosion would result in adverse impacts to sediment-dwelling species. These changes would adversely affect foraging by juvenile salmon, which prefer species typical of fine-grained sediments and eelgrass beds, as well as food for marine mammals, fish, birds and humans. Nevertheless the impacts of proposed MPR activities would be temporary and localized and would not result in significant permanent cumulative impacts to benthic communities when considered along with other past, present and reasonably foreseeable future actions.

11.2.2.3.3 Marine Fish

Past actions have adversely impacted populations of salmonids (salmon, steelhead, and trout, including federally threatened and endangered species) in Sinclair Inlet and tributaries through loss of foraging and refuge habitat in shallow areas, reduced function of migratory corridors, loss and degradation of spawning habitat in streams, interfering with migration, adverse impacts to forage fish habitat and spawning, contamination of water and sediments, and depletion of DO. Another factor that has resulted in adverse impacts to salmonid abundance is the overharvest by fisheries and hatcheries. The impact has been greatest on native stocks. Current and future in-water projects at Bremerton would be designed and implemented to minimize impacts to salmonid habitat and migration, and to forage fish.

The placement of in-water structures has changed and would continue to change fish habitat in and around these structures. Future Navy and non-Navy actions have the potential to have some of the same impacts as past actions, notably habitat loss or alteration, and the decreased function of migratory corridors. However, federal or federally funded actions that have occurred since legislation, such as the ESA, MMPA, and NEPA, was enacted have been considering and are required to consider environmental impacts to federally threatened and endangered species, prepare analysis (including a biological assessment), and consult with federal oversight agencies to minimize project impacts. Future actions are also required to go through this same process. Future actions at NAVBASE Kitsap Bremerton would be designed and implemented to minimize impacts to salmonids.

The protective measures taken to minimize impacts during construction activities, and the design elements that reduce long-term impacts to nearby habitats, as well as strengthened environmental review of recent and future actions, is expected to reduce direct and cumulative impacts to fish populations.

With BMPs and mitigation, cumulative impacts would not significantly affect fish populations in the proposed project area. Nevertheless, the proposed MPR activities and other future actions would contribute incrementally to cumulative fish impacts in Sinclair Inlet overall. The MPR’s contribution to cumulative noise impacts to fish would be limited by its installation of only concrete and smaller steel piles. Continued adherence to the requirements of the ESA, by MPR and other actions, would limit disturbance to fish and ensure that important habitats do not become further degraded. Furthermore, existing regulatory mechanisms and mitigation measures would protect fish and further decrease the likelihood of potential cumulative impacts to these species. Therefore, proposed MPR activities would not have cumulative impacts on marine fish when considered in conjunction with other past, present, and reasonably foreseeable future actions.

11.2.2.3.4 Birds

Past and present waterfront projects have resulted in increased human presence, underwater and airborne noise, boat movement, and other activities, which has likely deterred some water-dependent wildlife such as marine birds from these areas. Marine birds typically avoid areas with continuous activity or that produce periodic impacts such as loud noises. Often, birds would return to these areas when human presence is lower or there is less activity.

Future Navy projects may have increased anthropogenic sound (both airborne and underwater), increased human presence, increased boat movements, and other associated activities. These actions could result in behavioral impacts to local populations of marbled murrelets and other birds, such as temporary avoidance of habitat, decreased time spent foraging, increased or decreased time spent resting (depending on the activity), and other minor behavioral impacts. Most impacts would be unlikely to affect the overall fitness of the animals.

As described in Section 5.3.2.2.4, implementation of pile driving and pile removal at the project sites would have no significant effect on migratory bird populations, and is not expected to significantly impact the marbled murrelet. The proposed MPR activities would likely have underwater and airborne noise impacts to birds, but most effects would be limited to localized, temporary disturbances to birds in the project area.

Cumulative impacts to marbled murrelets have the greatest potential to occur during simultaneous pile driving exposure events from the proposed MPR activities and other projects in the vicinity. Of greatest concern to bird safety (including the marbled murrelet) would be the potential for their acoustic injury zones to overlap spatially and temporally.

With BMPs and minimization measures in place, cumulative impacts would not significantly affect marbled murrelet or other bird populations in the proposed project area. Nevertheless, the proposed MPR activities and other future actions would contribute incrementally to cumulative disturbance of marbled murrelets and other birds in Sinclair Inlet overall. Continued adherence to the requirements of EO 13186 and the Bald and Golden Eagle Protection Act by NAVBASE Kitsap would limit disturbance to the bald eagle and other migratory birds, and ensure that important habitats do not become degraded. Furthermore, existing regulatory mechanisms and mitigation measures (Section 2.5) would protect bald eagles and the ESA-listed marbled murrelet and further decrease the contribution of MPR to cumulative impacts. Therefore, MPR is not expected to result in significant cumulative impacts to birds when considered in conjunction with other past, present and reasonably foreseeable future actions.

11.2.2.3.5 Marine Mammals

Construction and operation of past and present waterfront projects, as well as non-Navy actions, have resulted in increased human presence, underwater and airborne noise, boat movement, and other activities, which have likely impacted some water-dependent wildlife such as marine mammals in the area. Increased anthropogenic noise in the marine environment has the potential to cause behavioral reactions in marine mammals including avoidance of certain areas. However, the abundance and coexistence of these species with existing anthropogenic activities suggests that cumulative effects have not been significant. The regulatory process under the MMPA ensures that each project with potential exposure of marine mammals is assessed in light of the status of the species and other actions affecting it in the same region.

Future Navy projects may have similar impacts to past and present actions including increased sound (both airborne and underwater), increased human presence, increased boat movements and other associated activities. These actions could result in behavioral impacts to local populations of marine mammals, such as temporary avoidance of habitat, decreased time spent foraging, increased or decreased time spent hauled out (depending on the activity), and other minor behavioral impacts. Most impacts would likely be short-term and temporary in nature and unlikely to affect the overall fitness of the animals.

The proposed MPR activities may result in behavioral disturbance to marine mammals from underwater sounds associated with pile driving; however, these effects would be limited to localized, temporary disturbances to marine mammals within the project area.

Past, present, and future development projects have had, are having, and would have the potential to result in many of the impacts to mammals described above, and could also have additional impacts to the species, their habitat, and prey. Because marine mammals are highly mobile, the noise impacts of the proposed MPR activities could be cumulative with underwater and airborne noise impacts to marine mammals from other actions and activities in the Bremerton area. However, because the expected impacts of the proposed MPR activities on marine mammals in general would be temporary, cumulative impacts to marine mammals associated with pile replacement noise are considered unlikely.

Cumulative impacts to marine mammals have the greatest potential to occur during simultaneous pile driving exposure events from the proposed MPR activities and other projects in the vicinity. Of greatest concern to marine mammal safety would be the potential for their acoustic injury zones to overlap spatially and temporally.

With BMPs and minimization measures, cumulative impacts would not significantly affect marine mammal populations in the proposed project area. Nevertheless, the proposed MPR activities and other future actions would contribute incrementally to cumulative marine mammal disturbance impacts in Sinclair Inlet overall. Continued adherence to the requirements of the ESA and MMPA by NAVBASE Kitsap would limit disturbance to marine mammals and ensure that important habitats do not become degraded. Furthermore, existing regulatory mechanisms, best management practices, and mitigation measures would protect marine mammals and further decrease the contribution of MPR to cumulative impacts. Therefore, proposed MPR activities when considered in conjunction with other past, present and reasonably foreseeable future actions, would not have significant cumulative impacts on marine mammals.

11.2.2.4 Cultural Resources

The ROI for cumulative impacts to cultural resources consists of the waterfront area where the marine structures are located. Implementation of proposed MPR activities would not affect any known NRHP-eligible archaeological sites or the buildings, structures, or landscape features which contribute to the four historic districts and NHL. The past actions at the NAVBASE Kitsap Bremerton waterfront listed in Table 11-2 did not have adverse effects on cultural resources within the ROI. For the Proposed Action there would be no adverse effect on historic properties and therefore the proposed MPR activities would not result in cumulative effects on cultural resources when considered in conjunction with other past, present and reasonably foreseeable future actions.

11.2.2.5 American Indian Traditional Resources

There would be no changes to the status quo regarding tribal resources or access to traditional resources in Sinclair Inlet; therefore, the proposed MPR activities would not contribute to cumulative impacts when considered with past, present, and future projects.

11.3 NAVBASE Kitsap Keyport

11.3.1 Past, Present, and Reasonably Foreseeable Future Actions

Table 11-3 identifies the recent past, present, and reasonably foreseeable future projects that could have cumulative impacts with the proposed MPR activities at NAVBASE Kitsap Keyport.

Table 11-3. Past, Present, and Reasonably Foreseeable Future Projects Within the NAVBASE Kitsap Keyport ROI

Project	*Project Description*	*Project Timeframe*		
		Past	*Present*	*Future*
Keyport Pier UUV Upgrade	The project installed a new float system on the southwest side of the Keyport Pier. The floats were delivered to the site pre-fabricated and can be removed as needed. The new floats move vertically with the tide by attaching to existing guide piles by pile brackets or equivalent; and therefore, no bottom-mounted structures or pile driving is required. The new floats have a length of approximately 140 ft., a width of 12 ft., and a depth of 8.5 ft. The float material is steel (coated and/or galvanized), concrete and/or plastic. The project created approximately 1,680 sq. ft. of over-water coverage. With the implementation of BMPs, impacts to water quality were minimal. Project completed in 2013.	X		
Pile Maintenance at Keyport Pier	This project is to clean and re-coat all steel guide and batter piles (total of 18 piles) at the Keyport Pier. The piles would be coated with either Denso SS Splash Zone or Splash Zone epoxy coating from the mud-line to the top of the pile.		X	
Northwest Training and Testing (NWTT)	The Navy's Proposed Action is to conduct training and testing activities primarily within existing range complexes, operating areas, testing ranges, and select Navy pier side locations in the Pacific Northwest. At Keyport this would include Pierside Integrated Swimmer Defense testing, which ensures that systems can effectively detect, characterize, verify and engage swimmer and diver threats in harbor environments.	X	X	X
City of Poulsbo Anderson Parkway Project	The Anderson Parkway project installed 1,584 sq. ft. of bioretention cells and four Filterra concrete box filtration units. An estimated 114 million gallons per day (350 acre-ft.) of stormwater will be treated, removing an estimated 330 pounds per year of petroleum hydrocarbons, metals, and toxic organic chemicals from the stormwater entering Liberty Bay.	X	X	

Source for Anderson Parkway Project: https://fortress.wa.gov/ecy/publications/documents/1410007.pdf

11.3.2 Assessment of Cumulative Impacts by Resource

11.3.2.1 Airborne Noise

No past, present, or future projects have been identified that contribute noise, temporary or permanent, to the ambient environment. In addition, sound levels resulting from pile replacement and other proposed MPR activities at Keyport would be temporary, and thus exempt from state and local limits. Therefore, proposed MPR activities would not result in cumulative noise impacts when considered with other past, present and reasonably foreseeable future actions.

11.3.2.2 Water Resources and Marine Sediments

11.3.2.2.1 Water Quality

Past actions may have impacted water quality from: (1) incidental spills associated with boat operations, such as fueling, or other activities conducted on piers; (2) sediment disturbance and turbidity from propeller wash in shallow areas; (3) use of materials, such as treated wood pilings that, over time, leak toxins into the marine waters; and (4) stormwater runoff.

Most of these events, except for treated materials, result in periodic inputs of pollutants (i.e., fuel, oil, and other contaminants) directly to Liberty Bay, which can impact turbidity, pH, temperature, salinity, DO, and biochemical oxygen demand. Unless there is a major spill of material such as fuel, oil, or other toxic material transported or associated with boat traffic that would impact water quality conditions, incidental spills usually do not result in long-term cumulative impacts.

Propeller wash in shallow areas impacts water quality by disturbing sediment and causing turbidity. However, this is typically a short-term impact and does not usually result in a cumulative impact to water quality because sediment settles out fairly rapidly.

No future projects have been identified that could result in water quality impacts and proposed MPR activities would have very localized and temporary impacts on water quality near Keyport. It is assumed that any future actions would be designed to minimize water quality impacts. Therefore, despite past impacts to water quality, proposed MPR activities would not have significant cumulative impacts on water quality when considered in conjunction with other past, present and reasonably foreseeable future actions.

11.3.2.2.2 Sediments

Past and present actions involving in-water construction in Liberty Bay have caused short-term disturbances to sediment. Range activities and shoreline development have resulted in erosion and coarsening of shoreline sediments in some areas. In general, in-water structures create accretion of sediments in some locations and erosion of sediments on the down-drift side of these structures. As a result the assumption has been made that some slight changes in sedimentation have occurred over time. No future projects have been identified that could result in erosion and accretion of shoreline sediments. Therefore, the potential for the proposed MPR activities to contribute to cumulative impacts is minimal. Despite past impacts to sediments, proposed MPR activities would not have significant cumulative impacts on sediments when considered in conjunction with other past, present and reasonably foreseeable future actions.

11.3.2.3 Biological Resources

11.3.2.3.1 Aquatic Vegetation

No past, present, or future projects have been identified that would impact aquatic vegetation near Keyport. Therefore, the proposed MPR activities would not contribute to cumulative impacts to aquatic vegetation near Keyport. It is assumed that any future actions would be designed to minimize direct impacts to aquatic vegetation. Therefore, proposed MPR activities would not have significant cumulative impacts on aquatic vegetation when considered in conjunction with other past, present and reasonably foreseeable future actions.

11.3.2.3.2 Benthic Invertebrates

No past, present, or future projects have been identified that would impact benthic communities near Keyport, and the impacts of proposed MPR activities would be very localized and temporary. Therefore, proposed MPR activities would not have significant cumulative impacts on benthic invertebrates when considered in conjunction with other past, present and reasonably foreseeable future actions.

11.3.2.3.3 Marine Fish

No past, present, or future projects have been identified that would impact fish species near Keyport, and the impacts of proposed MPR activities would be temporary and localized. Therefore, the proposed MPR activities would not contribute to cumulative impacts to fish species near Keyport. Continued adherence to the requirements of the ESA would limit disturbance to fish and ensure that important habitats do not become degraded. Furthermore, existing regulatory mechanisms and mitigation measures would protect fish and further decrease the likelihood of potential cumulative impacts to species. Therefore, proposed MPR activities would not have significant cumulative impacts on marine fish when considered in conjunction with other past, present and reasonably foreseeable future actions.

11.3.2.3.4 Birds

No past, present, or future projects have been identified that would impact bird species near Keyport, and the impacts of proposed MPR activities would be temporary and localized. Therefore, the proposed MPR activities would not contribute to cumulative impacts to bird species near Keyport. Continued adherence to the requirements of the ESA, MBTA, EO 13186, and the Bald and Golden Eagle Protection Act would limit disturbance to the bald eagle and other migratory birds, and ensure that important habitats do not become degraded. Furthermore, existing regulatory mechanisms and mitigation measures (Section 2.5) would protect bald eagles and the ESA-listed marbled murrelet and further decrease the likelihood of potential cumulative impacts to these species. Therefore, proposed MPR activities would not have significant cumulative impacts on birds when considered in conjunction with other past, present and reasonably foreseeable future actions.

11.3.2.3.5 Marine Mammals

No past, present, or future projects have been identified that would impact marine mammal species near Keyport, and the impacts of proposed MPR activities would be temporary and localized. Therefore, the proposed MPR activities would not contribute to cumulative impacts to marine mammal species near Keyport. Continued adherence to the requirements of the ESA and MMPA would limit disturbance to marine mammals and ensure that important habitats do not become degraded. Furthermore, existing regulatory mechanisms, BMPs, and minimization measures would protect marine mammals and further decrease the likelihood of potential cumulative impacts to these species. Therefore, proposed MPR activities would not have significant cumulative impacts on marine mammals when considered in conjunction with other past, present and reasonably foreseeable future actions.

11.3.2.4 Cultural Resources

The ROI for cumulative impacts to cultural resources consists of the waterfront area where the marine structure is located. No past, present, or future projects have been identified that would impact cultural resources near Keyport. The past actions at the NAVBASE Kitsap Keyport waterfront listed in Table 11-3 did not have adverse effects on cultural resources within the ROI. For the Proposed Action there would be no effect on historic properties and therefore the proposed MPR activities would not result in cumulative effects on cultural resources when considered with other past, present and reasonably foreseeable future actions.

11.3.2.5 American Indian Traditional Resources

There are no changes to the status quo regarding tribal resources or access to traditional resources at Keyport; therefore, the proposed MPR activities would not result in cumulative impacts when considered with past, present, and reasonably foreseeable future projects.

11.4 NAVBASE Kitsap Manchester

11.4.1 Past, Present, and Reasonably Foreseeable Future Actions

Table 11-4 lists recent past, present, and reasonably foreseeable actions at and in the vicinity of NAVBASE Kitsap Manchester.

Table 11-4. Past, Present, and Reasonably Foreseeable Future Projects Within the NAVBASE Kitsap Manchester ROI

Project	*Project Description*	*Project Timeframe*		
		Past	*Present*	*Future*
Fuel Pier Fender Pile Replacement	The Navy replaced 22 plastic fender piles with 22 new plastic piles; inspected, cleaned, and painted the steel fender pile framing; and completed minor concrete repairs to the pier. Worked performed 2013-2014.	X		
Barge Mooring Pier Repairs	The Navy demolished portions of the Barge Mooring Pier, replaced creosote-treated timber support piles with new concrete or plastic piles; replaced decking, walkways, and handrails; replaced the shoreline abutment; repaired existing platforms and piles; and replaced lighting. This action increased habitat and improved water quality by removing creosote pilings, reducing the number of in-water pilings, reducing the width of the gangway, and installing grated decking. Work performed 2014-2015.	X		
Installation of Waterfront Platform	The Navy would install a new platform on pre-cast concrete blocks along the waterfront above the Mean Higher High Water line.			X
Inventory and removal of noxious, non-native invasive weeds	The Navy would identify, map, and apply treatment to areas of noxious invasive weeds. The primary removal method would be mechanical methods (i.e., mowing and hand-pulling); approved herbicides would be used if mechanical methods are not feasible.			X
Yukon Harbor Collection System Improvement District	Kitsap County has received a grant from the Washington Department of Ecology for construction of a sewer line and pump station to service over 100 residences on Yukon Harbor, south of Manchester, which are currently on septic systems. The new line would carry sewage to the Manchester sewage treatment plant. This project would help protect water quality in Yukon Harbor and the surrounding areas in Puget Sound and safeguard existing shellfish protection areas. This project would also improve marine water quality in the area, with benefits for fish and wildlife occurring in the area.			X

Sources for Yukon Harbor: http://www.kitsapgov.com/press/2015/NR15-015.htm, http://pugetsoundblogs.com/waterways/tag/kitsap-county/

11.4.2 Assessment of Cumulative Impacts by Resource

11.4.2.1 Airborne Noise

Identified past, present, or future projects have had or would have minor and temporary impacts on the ambient noise environment. The sound levels associated with proposed pile replacement and other proposed MPR activities at Manchester would be temporary, and therefore exempt from state and local limits. Therefore, the proposed MPR activities would not result in cumulative noise impacts when considered with other past, present and reasonably foreseeable future actions.

11.4.2.2 Water Resources and Marine Sediments

11.4.2.2.1 Water Quality

Past actions may have impacted water quality from: (1) incidental spills associated with boat operations, such as fueling, or other activities conducted on piers; (2) sediment disturbance and turbidity from propeller wash in shallow areas; (3) use of materials, such as treated wood pilings that, over time, leak toxins into the marine waters; and (4) stormwater runoff.

Most of these events, except for treated materials, result in periodic inputs of pollutants (i.e., fuel, oil, and other contaminants) directly to Puget Sound, which can impact turbidity, pH, temperature, salinity, DO, and biochemical oxygen demand. Unless there is a major spill of material such as fuel, oil, or other toxic material transported or associated with boat traffic that would impact water quality conditions, incidental spills usually do not result in long-term cumulative impacts.

Propeller wash in shallow areas impacts water quality by disturbing sediment and causing turbidity. However, this is typically a short-term impact and does not usually result in a cumulative impact to water quality because sediment settles out fairly rapidly.

No future projects have been identified that could result in water quality impacts; with BMPs, the Navy projects described in Table 11-4 would not have adverse impacts on water quality. The Barge Mooring Pier Repairs and Yukon Harbor Collection System Improvement District projects would improve water quality. It is assumed that any future actions would be designed to minimize water quality impacts. Similarly, the proposed MPR activities would have minimal, temporary impacts on water quality. Therefore the proposed MPR activities would not result in significant cumulative water quality impacts when considered in conjunction with other past, present and reasonably foreseeable actions.

11.4.2.2.2 Sediments

Sediment quality near Manchester has been affected by the past actions described above under Water Quality. With BMPs, the projects described in Table 11-4 would not have adverse impacts on sediment quality. The Barge Mooring Pier Repairs and Yukon Harbor Collection System Improvement District projects would improve sediment quality. It is assumed that any future actions would be designed to minimize sediment impacts. With BMPs, the proposed MPR activities also would not have adverse impacts on sediment quality. Therefore, the proposed MPR activities would not result in significant cumulative impacts on sediment quality when considered in conjunction with other past, present and reasonably foreseeable actions.

11.4.2.3 Biological Resources

11.4.2.3.1 Aquatic Vegetation

No past, present, or future projects have been identified that would impact aquatic vegetation near Keyport. In addition, the proposed MPR activities would not adversely affect aquatic vegetation. Therefore, the proposed MPR activities would not result in cumulative impacts to aquatic vegetation near Manchester. It is assumed that any future actions would be designed to minimize direct impacts to aquatic vegetation.

11.4.2.3.2 Benthic Invertebrates

No past, present, or future projects have been identified that would impact benthic communities near Manchester. With BMPs, the Navy projects listed in Table 11-4 would not adversely affect benthic invertebrates. The Barge Mooring Pier Repairs and Yukon Harbor Collection System Improvement District projects would improve water and habitat quality. The proposed MPR activities would have temporary and very localized impacts on benthic invertebrates. Therefore, the proposed MPR activities would not result in cumulative impacts to benthic communities near Manchester when considered in conjunction with other past, present and reasonably foreseeable future actions.

11.4.2.3.3 Marine Fish

No past, present, or future projects have been identified that would impact fish species near Manchester. With BMPs, the projects listed in Table 11-4 would not adversely affect fish. Similarly, with BMPs the proposed MPR activities would not adversely affect fish. Therefore, the proposed MPR activities would not contribute to cumulative impacts to fish species near Manchester. Continued adherence to the requirements of the ESA would limit disturbance to fish and ensure that important habitats do not become degraded. Furthermore, existing regulatory mechanisms and mitigation measures would protect fish and further decrease the likelihood of potential cumulative impacts to species. Therefore, the proposed MPR activities would not result in cumulative impacts to marine fish when considered in conjunction with other past, present and reasonably foreseeable future actions.

11.4.2.3.4 Birds

No past, present, or future projects have been identified that would impact bird species near Manchester. The two Navy projects described in Table 11-4 would not adversely affect birds. Similarly, with BMPs the proposed MPR activities would not adversely affect birds. Therefore, the proposed MPR activities would not contribute to cumulative impacts to bird species near Manchester. Continued adherence to the requirements of the ESA, MBTA, EO 13186, and the Bald and Golden Eagle Protection Act would limit disturbance to the bald eagle and other migratory birds, and ensure that important habitats do not become degraded. Furthermore, existing regulatory mechanisms and mitigation measures (Section 2.5) would protect bald eagles and the ESA-listed marbled murrelet and further decrease the likelihood of potential cumulative impacts to these species. Therefore, the proposed MPR activities would not result in cumulative impacts to birds when considered in conjunction with other past, present and reasonably foreseeable future actions.

11.4.2.3.5 Marine Mammals

No past, present, or future projects have been identified that would impact marine mammal species near Manchester. BMPs, the projects listed in Table 11-4 would not adversely affect marine mammals.

Similarly, with BMPs the proposed MPR activities would not adversely affect marine mammals. Therefore, the proposed MPR activities would not contribute to cumulative impacts to marine mammal species near Manchester. Continued adherence to the requirements of the ESA and MMPA would limit disturbance to marine mammals and ensure that important habitats do not become degraded. Furthermore, existing regulatory mechanisms, BMPs, and minimization measures would protect marine mammals and further decrease the likelihood of potential cumulative impacts to these species. Therefore, the proposed MPR activities would not result in cumulative impacts to marine mammals when considered in conjunction with other past, present and reasonably foreseeable future actions.

11.4.2.4 Cultural Resources

The ROI for cumulative impacts to cultural resources consists of the waterfront area where the marine structures are located. The past actions at the NAVBASE Kitsap Manchester waterfront listed in Table 11-4 did not have adverse effects on cultural resources within the ROI. For the Proposed Action there would be no effect to historic properties and therefore the proposed MPR activities would not result in cumulative effects on cultural resources when considered with other past, present and reasonably foreseeable future actions.

11.4.2.5 American Indian Traditional Resources

There would be no changes to the status quo regarding tribal resources or access to traditional resources at Manchester; therefore, the proposed MPR activities would not result in cumulative impacts when considered with past, present, and reasonably foreseeable future actions.

11.5 Zelatched Point

11.5.1 Past, Present, and Reasonably Foreseeable Future Actions

Table 11-5 identifies the recent past, present, and reasonably foreseeable future projects that could have potential impacts with the proposed MPR activities at Zelatched point.

Table 11-5. Past, Present, and Reasonably Foreseeable Future Projects Within the Zelatched Point ROI

Project	*Project Description*	*Project Timeframe*		
		Past	*Present*	*Future*
Zelatched Pier Repair	The Navy would remove five existing creosote timber piles (maximum of 16-in diameter) and replace with new ACZA treated timber piles of equal size, and remove one creosote timber cap beam and replace with an ACZA-treated timber cap beam of equal size.			X
Northwest Training and Testing (NWTT)	The Navy's Proposed Action is to conduct training and testing activities primarily within existing range complexes, operating areas, testing ranges, and select Navy pier side locations in the Pacific Northwest Although no pierside activities occur at Zelatched Point, the Navy conducts a variety of testing in Dabob Bay waters.	X	X	X
Quilcene and Dabob Bay Pollution Identification and Control	Jefferson County Public Health department was offered funding for this 3-year project from WDOE and the Jefferson County Clean Water District. Non-point sources of pollution would be identified in Quilcene and Dabob Bays, both high-priority areas of Hood Canal. Fecal bacteria and nutrient inputs would be analyzed and shoreline septic systems would be assessed through sanitary surveys. Correction activities would be performed to repair all high-risk failing systems. The project would result in improved water quality in Quilcene and Dabob Bay.	X	X	X
Dabob Bay Conservation and Restoration	In 2009, WDNR expanded the Dabob Bay Natural Area's proposed boundaries from 280 acres to 6,284 acres of saltmarsh and forested shorelines around the bay to better protect the estuarine ecosystem. Since then WDNR, the Northwest Watershed Institute and other partners have been acquiring land from willing landowners and restoring properties. In 2011, The Nature Conservancy purchased a total of 400 acres within the Dabob Bay Natural Area. This acquisition will be transferred to WDNR who will maintain it as part of the larger natural area, with opportunities for low-impact public use.	X	X	X

Table 11-5. Past, Present, and Reasonably Foreseeable Future Projects Within the Zelatched Point ROI (continued)

Project	Project Description	Project Timeframe		
		Past	*Present*	*Future*
Hood Canal Coordinating Council (HCCC) Projects	The HCCC is a council of governments formed in 1985 in response to community concerns about water quality problems and related natural resource issues in the Hood Canal watershed. Completed, ongoing and future projects include salmon recovery efforts, habitat enhancement and restoration, water quality protection, and climate adaptation.	X	X	X

Sources for the Quilcene/Dabob Bay project: https://fortress.wa.gov/ecy/publications/documents/1510027.pdf and http://www.ptleader.com/news/health/new-program-to-address-water-quality-problems-in-quilcene-dabob/article_a93860b6-3d7d-11e6-ae33-87da71c55b55.html

11.5.2 Assessment of Cumulative Impacts by Resource

11.5.2.1 Airborne Noise

Operations at Zelatched Point are not continuous and are only performed when RDT&E activities occur in Dabob Bay. No present or future projects have been identified that contribute noise, temporary or permanent, to the ambient environment at Zelatched Point. In addition, sound levels resulting from pile replacement and other proposed MPR activities at Zelatched Point would be temporary, and therefore exempt from state and local limits. Therefore, the proposed MPR activities would not result in cumulative noise impacts when considered with other past, present and future actions.

11.5.2.2 Water Resources and Marine Sediments

11.5.2.2.1 Water Quality

Past actions have impacted water quality from: (1) sediment disturbance and turbidity from propeller wash in shallow areas; (2) use of materials, such as treated wood pilings that, over time, leak toxins into the marine waters; (3) stormwater runoff; and (4) failing septic systems. Unless there is a major spill of material such as fuel, oil, or other toxic material transported or associated with boat traffic that would impact water quality conditions, incidental spills usually do not result in long-term cumulative impacts. Propeller wash in shallow areas impacts water quality by disturbing sediment and causing turbidity. However, this is typically a short-term impact and does not contribute to cumulative impacts to water quality because sediment settles out rapidly.

Stormwater runoff can carry contaminants, such as heavy metals and oils from hard surfaces such as roads, and nitrogen and phosphorus from lawn fertilizers into streams that empty into Hood Canal. While irregular in nature, stormwater-related inputs to water quality may be relatively intense during storm events. Contaminants in the stormwater runoff can adversely impact DO, BOD, pH, and other water quality parameters in localized areas. Failing septic systems result in inputs of bacteria, nutrients and BOD.

The Quilcene and Dabob Bays Pollution Identification and Control program described above is expected to reduce inputs from failing septic systems and stormwater runoff, with benefits to water quality. Various HCCC projects have improved and would continue to improve water quality in Hood Canal. The impacts of the proposed MPR activities on water quality would be temporary and localized. Therefore, the proposed MPR activities would not have a significant cumulative impact on water quality when considered in conjunction with other actions in the project area.

11.5.2.2.2 Sediments

Navy testing operations in Dabob Bay and Hood Canal have caused short-term disturbances to marine sediment. The Quilcene and Dabob Bays Pollution Identification and Control program described above is expected to reduce inputs from failing septic systems and stormwater runoff, with benefits to sediment quality. The impacts of the proposed MPR activities on sediment quality would be temporary and localized. Therefore, the proposed MPR activities would not have a significant cumulative impact on sediment quality when considered in conjunction with other actions in the project area.

11.5.2.3 Biological Resources

11.5.2.3.1 Aquatic Vegetation

No past, present, or future projects have been identified that would impact aquatic vegetation near Zelatched Point. The Dabob Bay Conservation and Restoration program would prevent some potential future impacts to aquatic vegetation. Habitat enhancement and restoration projects carried out by the HCCC have improved and would continue to improve aquatic vegetation conditions in Hood Canal. The proposed MPR activities would have temporary and very localized impacts on aquatic vegetation. Therefore, the proposed MPR activities would not have cumulative impacts on aquatic vegetation when considered in conjunction with other actions in the project area.

11.5.2.3.2 Benthic Invertebrates

No past, present, or future projects have been identified that would impact benthic invertebrates near Zelatched Point. The Dabob Bay Conservation and Restoration program would prevent some potential future impacts to benthic communities. The proposed MPR activities would have temporary and very localized impacts on benthic invertebrates. Therefore, the proposed MPR activities would not have cumulative impacts on benthic invertebrates when considered in conjunction with other actions in the project area.

11.5.2.3.3 Marine Fish

No past, present, or future projects have been identified that would impact fish species near Zelatched Point. The Quilcene and Dabob Bays Pollution Identification and Control program and the Dabob Bay Conservation and Restoration program would prevent some potential future impacts to fish habitat. HCCC projects have improved and would continue to improve fish habitat conditions in Hood Canal and assist with salmon recovery. With BMPs, the proposed MPR activities would not have adverse impacts on fish. Therefore, the proposed MPR activities would not contribute to cumulative impacts to fish species near Zelatched Point. Continued adherence to the requirements of the ESA would limit disturbance to fish and ensure that important habitats do not become degraded. Furthermore, existing regulatory mechanisms and mitigation measures would protect fish and further decrease the likelihood of potential cumulative impacts to species. Therefore, the proposed MPR activities would not result in cumulative impacts to marine fish when considered in conjunction with other actions in the project area.

11.5.2.3.4 Birds

No past, present, or future projects have been identified that would impact bird species near Zelatched Point. Proposed MPR activities would not adversely impact bird species near Zelatched Point. Continued adherence to the requirements of the ESA, MBTA, EO 13186, and the Bald and Golden Eagle Protection Act would limit disturbance to the bald eagle and other migratory birds, and ensure that important habitats do not become degraded. Furthermore, existing regulatory mechanisms and mitigation measures (Section 2.5) would protect bald eagles and the ESA-listed marbled murrelet and further decrease the likelihood of potential cumulative impacts to these species. Therefore, proposed MPR activities would not result in cumulative impacts to birds when considered in conjunction with other actions in the project area.

11.5.2.3.5 Marine Mammals

No past, present, or future projects have been identified that would impact marine mammal species near Zelatched Point. Proposed MPR activities would not adversely impact marine mammal species near Zelatched Point. Continued adherence to the requirements of the ESA and MMPA would limit disturbance to marine mammals and ensure that important habitats do not become degraded. Furthermore, existing regulatory mechanisms, BMPs, and minimization measures would protect marine mammals and further decrease the likelihood of potential cumulative impacts to these species. Therefore, proposed MPR activities would not result in cumulative impacts to marine mammals when considered in conjunction with other actions in the project area.

11.5.2.4 Cultural Resources

The ROI for cumulative impacts to cultural resources consists of the waterfront area where the marine structure is located. Implementation of proposed MPR activities at Zelatched Point would not affect any known NRHP-eligible archaeological sites. Construction activities would take place in and over the water. The past actions at Zelatched Point waterfront listed in Table 11-5 did not have adverse effects on cultural resources within the ROI. For the Proposed Action there would be no adverse effect on historic properties and therefore the proposed MPR activities would not result in cumulative effects on cultural resources when considered with other actions in the project area.

11.5.2.5 American Indian Traditional Resources

The S'Klallam Tribes have expressed concern over the cumulative nature of impacts from Navy activity in the Hood Canal, particularly on access to resources. There would be no changes to the status quo regarding tribal access to tribal resources near Zelatched Point. Therefore, the proposed MPR activities would not result in cumulative impacts to tribal resources and access when considered with other actions in the project area.

11.6 NAVSTA Everett

11.6.1 Past, Present, and Reasonably Foreseeable Future Actions

Table 11-6 identifies the recent past, present, and reasonably foreseeable future projects that could have cumulative impacts with the proposed MPR activities at NAVSTA Everett.

Table 11-6. Past, Present, and Reasonably Foreseeable Future Projects Within the NAVSTA Everett ROI

Project	Project Description	Project Timeframe		
		Past	Present	Future
Construction and Operation of Small Craft Launch	In 2012, the Navy completed construction of a small craft launch at NAVSTA Everett. The project involved excavation of the shoreline, addition of fill, installation of a concrete ramp and concrete piles, and design modifications to the existing wash-down facility. To mitigate for impacts to aquatic resources, the Navy removed a derelict pier and 106 creosote-treated wood pilings from the eastern shoreline of the East Waterway at the Everett Kimberly-Clark facility.	X		
Pier A and B Fender Panel Replacements	The Navy is proposing to replace up to five fender panels each year over the 5-year period from 2015–2019. Existing damaged panels with wooden vertical timbers would be removed in their entirety and replaced with similar panel structures that have high density polyethylene (HDPE) plastic verticals. Associated steel support piles would be treated to address corrosion and sleeved with a HDPE plastic sleeve.		X	X
Northwest Training and Testing	The Navy's Proposed Action is to conduct training and testing activities primarily within existing range complexes, operating areas, testing ranges, and select Navy pier side locations in the Pacific Northwest. The Proposed Action includes pier side sonar maintenance and testing conducted as part of overhaul, modernization, maintenance, and repair activities at NAVSTA Everett.	X	X	X
Port of Everett Waterfront Place Redevelopment	Multi-use redevelopment project would include new parks, housing, stores, restaurants, and upgrades to the existing marina. The Port has partnered with the Department of Ecology to restore and clean up over 200 acres of upland property.			X
Everett Shipyard Cleanup	Cleanup involved removal of contaminated soil from uplands and in-water contaminated sediments, and demolition of aging in-water infrastructure. Phase I of the cleanup was completed in late 2015.	X	X	X

Table 11-6. Past, Present, and Reasonably Foreseeable Future Projects Within the NAVSTA Everett ROI (continued)

Project	Project Description	Project Timeframe		
		Past	Present	Future
Port of Everett Environmental Cleanup Projects	The Port of Everett has underway or planned several environmental cleanup projects including the Ameron Hulbert Site, Bay Wood Site, and the South Terminal Mill A Site. Cleanup of these properties would improve the environmental quality of Port Gardner Bay and adjacent waters.		X	X
Smith Island / Union Slough Restoration	The joint City of Everett and Corps of Engineers project is restoring riverine and tidal influence to 93 acres of intertidal riverine habitat. The project is divided into 35 acres as part of the cost-shared Federal Section 1135 project, and 58 acres as a mitigation project of the City of Everett. The project is designed to restore intertidal salmon rearing habitat that historically existed along Union Slough.	X	X	X
WDOE-led Cleanup of East Waterway	WDOE is working with PLPs to carry out investigation and cleanup of East Waterway.		X	X

Sources for non-Navy projects: http://www.portofeverett.com/real-estate/development-waterfront-place-central; http://snohomishcountywa.gov/1150/Smith-Island-Restoration-Project; http://www.portofeverett.com/your-port/projects/active-environmental-cleanup-projects/puget-sound-initiative-south-terminal-mill-a; http://www.portofeverett.com/your-port/projects/active-environmental-cleanup-projects/puget-sound-initiative-everett-shipyard-site

11.6.2 Assessment of Cumulative Impacts by Resource

11.6.2.1 Airborne Noise

Future Navy and non-Navy actions would generate noise. The impact of these noise sources would depend on their location relative to sensitive receptors, but it is likely that some of these future actions would produce temporary nuisance noise. Any noise generated by proposed MPR activities would be temporary in nature and therefore exempt from state and local limits. This action in combination with other past, present, and reasonably foreseeable actions would not contribute to a substantial increase in ambient noise for Everett and the surrounding communities. Therefore, the proposed MPR activities would not result in cumulative noise impacts when considered with to other past, present, and future actions.

11.6.2.2 Water Resources and Marine Sediments

11.6.2.2.1 Water Quality

Past actions may have impacted water quality from: (1) sediment disturbance and turbidity from propeller wash in shallow areas; (2) use of materials, such as treated wood pilings that, over time, leak toxins into the marine waters; and (3) stormwater runoff. Propeller wash in shallow areas impacts water quality by disturbing sediment and causing turbidity. However, this is typically a short-term impact and does not usually result in a cumulative impact to water quality because sediment settles out fairly rapidly.

Stormwater runoff can carry contaminants, such as heavy metals and oils from hard surfaces such as roads, and nitrogen and phosphorus from lawn fertilizers into streams that empty into the East Waterway, Port Gardner Bay, and Possession Sound. While irregular in nature, stormwater-related inputs to water quality may be relatively intense during storm events. Contaminants in the stormwater runoff can adversely impact DO, BOD, pH, and other water quality parameters in localized areas.

With BMPs, the projects described in Table 11-6 would not have adverse impacts on water quality. The cleanup and pile replacement projects would improve water quality. It is assumed that any future actions would be designed to minimize water quality impacts. With BMPs, the proposed MPR activities also would not have adverse impacts on water quality; impacts would be very temporary and localized. Therefore, despite past and ongoing impacts to water quality in the region, proposed MPR activities would not have cumulative impacts on water quality when considered other actions in the project area.

11.6.2.2.2 Sediments

Sediment quality near Everett has been affected by the past actions described above under Water Quality. With BMPs, the projects described in Table 11-6 would not have adverse impacts on sediment quality. The cleanup and pile replacement projects would improve sediment quality. It is assumed that any future actions would be designed to minimize sediment impacts. With BMPs, the proposed MPR activities also would not have adverse impacts on sediment quality. Therefore, despite past and ongoing impacts to sediments in the region, proposed MPR activities would not have cumulative impacts on sediment quality when considered with other actions in the project area.

11.6.2.3 Biological Resources

11.6.2.3.1 Aquatic Vegetation

Aquatic vegetation is limited at NAVSTA Everett. The base in built on a parcel of man-made landfill and rock riprap. The shoreline is heavily modified, with a steep slope. The substrate under the piers is primarily silt and sand, devoid of vegetation. Therefore, the proposed MPR activities at Everett would not impact aquatic vegetation and, despite past impacts to vegetation in the region, would not contribute to cumulative impacts when considered with other actions in the project area.

11.6.2.3.2 Benthic Invertebrates

Past and present actions involving pile driving have resulted in the direct loss of the natural benthic soft-bottom habitat. This habitat is replaced by the hard surfaces of pilings and as a result, the types of benthic organisms have changed and are changing in these localized areas. Hard surfaces create sites for colonization by species adapted to these surfaces such as mussels and sea anemones. Thus, the impact of in-water structures has been to replace native soft-bottom habitat with hard-surface habitat over time. This has adversely impacted some species (including prey species for juvenile salmonids), while benefiting others. In addition, in-water structures have resulted in accretion of sediments in some areas and possibly erosion in others. Any areas of erosion would result in adverse impacts to sediment-dwelling species. The impacts of the proposed MPR activities on the benthic community would be temporary and very localized and despite past impacts to benthic communities in the region, would not contribute to any permanent cumulative impacts to benthic communities when considered with other actions in the project area.

11.6.2.3.3 Marine Fish

Current and future in-water projects at NAVSTA Everett would be designed and implemented to minimize impacts to salmonid habitat and migration, and to forage fish. The placement of in-water structures has changed and would continue to change fish habitat in and around these structures. Future Navy and non-Navy actions have the potential to have some of the same impacts as past actions, notably habitat loss or alteration, and the decreased function of migratory corridors. However, federal or federally funded actions that have occurred since legislation, such as the ESA, MMPA, and NEPA, was enacted have been considering and are required to consider environmental impacts to federally threatened and endangered species, prepare analysis (including a biological assessment), and consult with federal oversight agencies to minimize project impacts to listed species and designated critical habitats. Future actions are also required to go through this same process. In addition, the cleanup and pile replacement projects would improve the quality of fish habitat, and the Smith Island/Union Slough Restoration would restore intertidal salmon rearing habitat. These projects would counteract the adverse effects of past actions on fish habitat.

The protective measures taken to minimize impacts during construction activities, and the design elements that reduce long-term impacts to nearby habitats, as well as strengthened environmental review of recent and future actions, are expected to reduce direct and cumulative impacts to fish populations. Past, present, and future development projects have had, have, and would have the potential to result in many of the impacts to salmonids, and add to declining population trends. The impacts of the proposed MPR activities would result in short-term increases in underwater noise and turbidity therefore potentially contributing to past and ongoing cumulative impacts to these species. However, because impacts are short-term and localized if actual construction schedules for projects involving pile driving do not overlap, resulting cumulative impacts would be reduced accordingly.

With BMPs and minimization measures (i.e., sound attenuation devices, visual surveillance, the use of shutdown zones), cumulative impacts would not significantly affect fish populations in the proposed project area. Nevertheless, the proposed MPR activities and other future actions would contribute incrementally to cumulative fish impacts overall. Continued adherence to the requirements of the ESA would limit disturbance to fish and ensure that important habitats do not become degraded. Furthermore, existing regulatory mechanisms and minimization measures would protect fish and further decrease the likelihood of potential cumulative impacts to these species. Therefore, proposed MPR activities are not expected to result in significant cumulative impacts to marine fish when considered with other actions in the project area.

11.6.2.3.4 Birds

Past and present waterfront projects, as well as non-Navy actions, have resulted in increased human presence, underwater and airborne noise, boat movement, and other activities, which has likely deterred some water-dependent wildlife such as marine birds from these areas. Marine birds typically avoid areas with continuous activity or that produce periodic impacts such as loud noises. Often, birds would return to these areas when human presence is lower or there is less activity.

Future construction actions would have a temporary increase in anthropogenic sound (both airborne and underwater), increased human presence, increased boat movements, and other associated activities. These actions could result in behavioral impacts to individuals of marbled murrelets and other birds, such as temporary avoidance of habitat, decreased time spent foraging, increased or decreased time spent resting (depending on the activity), and other minor behavioral impacts. Most impacts would be unlikely to affect the overall fitness of the animals.

Past, present, and future development projects have had, are having, and would have the potential to result in many of the impacts to marine birds described above, and add to past or current declining population trends. Because marine birds are highly mobile, the noise impacts of the proposed MPR activities could be cumulative with underwater and airborne noise impacts to marine birds from other actions and activities in the Everett area. However, because the expected impacts of the proposed MPR activities on marine birds in general would be temporary, cumulative impacts to marine birds associated with pile driving noise are considered unlikely.

Cumulative impacts to marbled murrelets have the greatest potential to occur during simultaneous pile driving exposure events from the proposed MPR activities and other projects in the vicinity. Of greatest concern to bird safety (including the marbled murrelet) would be the potential for their acoustic injury zones to overlap spatially and temporally.

With BMPs and minimization measures in place (i.e., sound attenuation devices, visual surveillance, the use of shutdown zones), cumulative impacts would not significantly affect marbled murrelet or other bird populations in the proposed project area. Nevertheless, the proposed MPR activities and other future actions would contribute incrementally to cumulative disturbance of marbled murrelets and other birds overall. Continued adherence to the requirements of EO 13186 and the Bald and Golden Eagle Protection Act by would limit disturbance to the bald eagle and other migratory birds, and ensure that important habitats do not become degraded. Furthermore, existing regulatory mechanisms and proposed MPR activities minimization measures (Section 2.5) would protect bald eagles and the ESA-listed marbled murrelet and further decrease the likelihood of potential cumulative impacts to these species. Therefore, proposed MPR activities are not expected to result in significant cumulative impacts to birds when considered in conjunction with other actions in the project area.

11.6.2.3.5 Marine Mammals

Past and present waterfront projects, as well as non-Navy actions have resulted in increased human presence, underwater and airborne noise, boat movement, and other activities, which have likely impacted marine mammals in the area. However, the abundance and coexistence of these species with existing anthropogenic activities suggests that cumulative effects have not been significant. The regulatory process under the MMPA also ensures that each project proposing take of marine mammals is assessed in light of the status of the species and other actions affecting it in the same region.

Future Navy and non-Navy waterfront projects may have similar impacts to past and present actions including increased sound (both airborne and underwater), increased human presence, increased boat movements and other associated activities. These actions could result in behavioral impacts to local populations of marine mammals, such as temporary avoidance of habitat, decreased time spent foraging, increased or decreased time spent hauled out (depending on the activity), and other minor behavioral impacts. Most impacts would likely be short-term and temporary in nature and unlikely to affect the overall fitness of the animals.

Past, present, and future development projects have had, are having, and would have the potential to result in many of the impacts to mammals described above, and could also have additional impacts to the species, their habitat, and prey. Because marine mammals are highly mobile, the noise impacts of the proposed MPR activities could be cumulative with underwater and airborne noise impacts to marine mammals from other actions and activities near Everett. However, because the expected impacts of the proposed MPR activities on marine mammals in general would be temporary, cumulative impacts to marine mammals associated with pile replacement noise are considered unlikely.

With BMPs and minimization measures, cumulative impacts would not significantly affect marine mammal populations near Everett. Nevertheless, the proposed MPR activities and other projects would contribute incrementally to cumulative marine mammal disturbance impacts overall. Continued adherence to the requirements of the ESA and MMPA would limit disturbance to marine mammals and ensure that important habitats do not become degraded. Furthermore, existing regulatory mechanisms, BMPs, and minimization measures would protect marine mammals and further decrease the likelihood of potential cumulative impacts to these species. Therefore, proposed MPR activities are not expected to result in cumulative impacts to marine mammals when considered in conjunction with other actions in the project area.

11.6.2.4 Cultural Resources

The ROI for cumulative impacts to cultural resources consists of the waterfront area where the marine structures are located. The past actions at the NAVSTA Everett waterfront listed in Table 11-6 did not have adverse effects on cultural resources within the ROI. For the Proposed Action there would be no effect on historic properties and therefore the proposed MPR activities is not making a significant contribution to cumulative effects on cultural resources. Therefore, proposed MPR activities would not result in cumulative impacts to cultural resources when considered in conjunction with other actions in the project area.

11.6.2.5 American Indian Traditional Resources

There would be no changes to the status quo regarding tribal resources or access to traditional resources near Everett; therefore, the proposed MPR activities would not result in cumulative impacts when considered with past, present and future projects.

11.7 NAVMAG Indian Island

11.7.1 Past, Present, and Reasonably Foreseeable Future Actions

Table 11-7 identifies the recent past, present, and reasonably foreseeable future projects that could have cumulative impacts with the proposed MPR activities at NAVMAG Indian Island.

Table 11-7. Past, Present, and Reasonably Foreseeable Future Projects Within the NAVMAG Indian Island ROI

Project	*Project Description*	*Project Timeframe*		
		Past	*Present*	*Future*
Ammunition Wharf Electrical Upgrade and Small Craft Pier Extension (P-349)	Installed generators to provide power for submarines during ordnance loading operations, and extended the small craft pier to provide sufficient mooring for two tugboats required to maneuver submarines into the pier.	X		
Installation of Force Protection Barrier	Installed a floating security barrier to clearly mark waterfront restricted areas and to improve security operations.	X		
Ammunition Wharf Piling Replacement	Following completion of the Ammunition Wharf construction is 1979, the Navy learned the method of forming and curing many of the concrete piles during construction left them susceptible to Delayed Ettringite Formation (DEF). The Navy completed the last phase of a six-phase pile replacement effort in 2015. Future phases will be addressed in a Programmatic EA, with the next proposed pile replacement project occurring in 2022. It is anticipated that no more than 24 piles would be replaced annually.	X	X	X
Upgrade and Replace Mobile Utilities Support Equipment Generators at Ammunition Wharf (Bldg. 832)	Replacement of three Cummins 1750 KW Diesel Electric Generators with two upgraded/replacement Cummins 2000 KW Diesel Electric Generators in the same footprint.	X		
Fort Road Restoration Project	Restored a riparian wetland corridor consisting of a stream channel, riparian area, and jurisdictional wetland located in the vicinity of Fort Road, and re-established forest on adjacent upland areas.	X		
Creosote Pile Removal	WDFW removed abandoned/deteriorated creosote pilings associated with the old ferry landing below the mean low water mark.	X		
Aboveground Shore Power to Ammunition Wharf	Once complete, would supply permanent shore-based power to submarines while they are berthed at the NAVMAG Indian Island Ammunition Wharf.	X		
Missile Magazines, NAVMAG Indian Island	Proposes to replace three outdated magazines with state-of-the-art storage facilities.		X	X
Kilisut Harbor Restoration	Proposed Mitigation Project would remove the causeway between Marrowstone and Indian Islands and replace it with a bridge to improve salmon migration.			X

11.7.2 Assessment of Cumulative Impacts by Resource

11.7.2.1 Airborne Noise

Future Navy and non-Navy actions would generate noise. The impact of these noise sources would depend on their location relative to sensitive receptors, but it is likely that some of these future actions would produce temporary nuisance noise. Any noise generated by proposed MPR activities would be temporary in nature and therefore exempt from state and local limits. Future pile replacement work at the Ammunition Wharf would be temporary and therefore exempt from state and local limits. The Proposed Action in combination with other past, present, and reasonably foreseeable actions would not contribute to a substantial increase in ambient noise for NAVMAG Indian Island and the surrounding communities. Therefore, the proposed MPR activities would not result in cumulative noise impacts when considered with to other past, present, and future actions.

11.7.2.2 Water Resources and Marine Sediments

11.7.2.2.1 Water Quality

Past actions may have impacted water quality from: (1) sediment disturbance and turbidity from propeller wash in shallow areas; (2) use of materials, such as treated wood pilings that, over time, leak toxins into the marine waters; and (3) stormwater runoff. Propeller wash in shallow areas impacts water quality by disturbing sediment and causing turbidity. However, this is typically a short-term impact and does not usually result in a cumulative impact to water quality because sediment settles out fairly rapidly.

Stormwater runoff can carry contaminants, such as heavy metals and oils from hard surfaces such as roads, and nitrogen and phosphorus from lawn fertilizers into streams that empty into Port Townsend Bay. While irregular in nature, stormwater-related inputs to water quality may be relatively intense during storm events. Contaminants in the stormwater runoff can adversely impact DO, BOD, pH, and other water quality parameters in localized areas.

With BMPs, the projects described in Table 11-7 would not have adverse impacts on water quality. Similar to the Proposed Action, it is assumed that any future pile replacement work would be designed to minimize water quality impacts. With BMPs, the proposed MPR activities would not have adverse impacts on water quality; impacts would be very temporary and localized. Therefore, despite past and ongoing impacts to water quality in the region, proposed MPR activities would not have cumulative impacts on water quality when considered other actions in the project area.

11.7.2.2.2 Sediments

Past and present actions involving in-water construction in Port Townsend Bay have caused short-term disturbances to sediment. Shoreline development and armoring have resulted in erosion and coarsening of shoreline sediments in some areas. In general, in-water structures create accretion of sediments in some locations and erosion of sediments on the down-drift side of these structures. As a result, the assumption has been made that some slight changes in sedimentation have occurred over time. No future projects have been identified that could result in erosion and accretion of shoreline sediments. Therefore, the potential for the proposed MPR activities to contribute to cumulative impacts is minimal. Despite past impacts to sediments, proposed MPR activities would not have significant cumulative impacts on sediments when considered in conjunction with other past, present and reasonably foreseeable future actions.

11.7.2.3 Biological Resources

11.7.2.3.1 Aquatic Vegetation

Construction of the Small Craft Pier Extension involving placement of pilings and anchors has impacted aquatic vegetation in the project area. However, no present or future projects have been identified that would impact aquatic vegetation near the Ammunition Wharf. Therefore, the proposed MPR activities would not contribute to cumulative impacts to aquatic vegetation near NAVMAG Indian Island. It is assumed that any future actions would be designed to minimize direct impacts to aquatic vegetation. Therefore, proposed MPR activities would not have significant cumulative impacts on aquatic vegetation when considered in conjunction with other past, present and reasonably foreseeable future actions.

11.7.2.3.2 Benthic Invertebrates

Past and present actions involving pile driving have resulted in the direct loss of the natural benthic soft-bottom habitat. This habitat is replaced by the hard surfaces of pilings and as a result, the types of benthic organisms have changed and are changing in these localized areas. Hard surfaces create sites for colonization by species adapted to these surfaces such as mussels and sea anemones. Thus, the impact of in-water structures (including the Small Craft Pier Extension) has been to replace native soft-bottom habitat with hard-surface habitat over time. This has adversely impacted some species (including prey species for juvenile salmonids), while benefiting others. In addition, in-water structures have resulted in accretion of sediments in some areas and possibly erosion in others. Any areas of erosion would result in adverse impacts to sediment-dwelling species. The impacts of the proposed MPR activities on the benthic community would be temporary and very localized and despite past impacts to benthic communities in the region, would not contribute to any permanent cumulative impacts to benthic communities when considered with other actions in the project area.

11.7.2.3.3 Marine Fish

Current and future in-water projects at NAVMAG Indian Island would be designed and implemented to minimize impacts to salmonid habitat and migration, and to forage fish. Past placement of in-water structures has changed fish habitat in and around these structures. No future projects have been identified that would impact fish species. With BMPs, the proposed MPR activities would not have adverse impacts on fish. Therefore, the proposed MPR activities would not contribute to cumulative impacts to fish species near NAVMAG Indian Island. Continued adherence to the requirements of the ESA would limit disturbance to fish and ensure that important habitats do not become degraded. Furthermore, existing regulatory mechanisms and mitigation measures would protect fish and further decrease the likelihood of potential cumulative impacts to species. Therefore, the proposed MPR activities would not result in cumulative impacts to marine fish when considered in conjunction with other actions in the project area.

11.7.2.3.4 Birds

No past, present, or future projects have been identified that would impact bird species near NAVMAG Indian Island. Proposed MPR activities would not adversely impact bird species near NAVMAG Indian Island. Continued adherence to the requirements of the ESA, MBTA, EO 13186, and the Bald and Golden

Eagle Protection Act would limit disturbance to the bald eagle and other migratory birds, and ensure that important habitats do not become degraded. Furthermore, existing regulatory mechanisms and mitigation measures (Section 2.5) would protect bald eagles and the ESA-listed marbled murrelet and further decrease the likelihood of potential cumulative impacts to these species. Therefore, proposed MPR activities would not result in cumulative impacts to birds when considered in conjunction with other actions in the project area.

11.7.2.3.5 Marine Mammals

Past waterfront projects, as well as non-Navy actions have resulted in increased human presence, underwater and airborne noise, boat movement, and other activities, which have likely impacted marine mammals in the area. However, the abundance and coexistence of these species with existing anthropogenic activities suggests that cumulative effects have not been significant. The regulatory process under the MMPA also ensures that each project proposing take of marine mammals is assessed in light of the status of the species and other actions affecting it in the same region.

No future projects have been identified that would impact marine mammal species near NAVMAG Indian Island. Proposed MPR activities would not adversely impact marine mammal species and no level A or B take would occur at NAVMAG Indian Island. Continued adherence to the requirements of the ESA and MMPA would limit disturbance to marine mammals and ensure that important habitats do not become degraded. Furthermore, existing regulatory mechanisms, BMPs, and minimization measures would protect marine mammals and further decrease the likelihood of potential cumulative impacts to these species. Therefore, proposed MPR activities would not result in cumulative impacts to marine mammals when considered in conjunction with other actions in the project area.

11.7.2.4 Cultural Resources

The ROI for cumulative impacts to cultural resources consists of the waterfront area where the Ammunition Wharf is located. The past actions at the NAVMAG Indian Island listed in Table 11-7 did not have adverse effects on cultural resources within the ROI. For the Proposed Action there would be no effect on historic properties and therefore the proposed MPR activities is not making a significant contribution to cumulative effects on cultural resources. Therefore, proposed MPR activities would not result in cumulative impacts to cultural resources when considered in conjunction with other actions in the project area.

11.7.2.5 American Indian Traditional Resources

There would be no changes to the status quo regarding tribal resources or access to traditional resources near NAVMAG Indian Island; therefore, the proposed MPR activities would not result in cumulative impacts when considered with past, present and future projects.

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12 Other Considerations Required by NEPA

In accordance with 40 CFR Section 1502.16(c), analysis of environmental consequences shall include discussion of possible conflicts between the Proposed Action and the objectives of Federal, regional, State and local land use plans, policies, and controls. Table 12-1 identifies the principal federal and state laws, regulations, and policies that are applicable to the Proposed Action, and describes briefly how compliance with these laws and regulations would be accomplished.

Table 12-1. Principal Federal and State Laws, Regulations and Policies Applicable to the Proposed Action

Federal and State Laws, Regulations and Policies	***Status of Compliance***
National Environmental Policy Act (NEPA) (42 U.S.C. §4321 *et seq.*); CEQ NEPA implementing regulations (40 CFR 1500-1508); Navy procedures for Implementing NEPA (32 CFR Part 775 and OPNAV M-5090.1, Chapter 10)	Preparation of this EA has been conducted in compliance with NEPA and in accordance with CEQ regulations and the Navy's NEPA procedures.
Clean Air Act (42 U.S.C. section 7401 *et seq.*)	The USEPA has established NAAQS for seven pollutants. Since Kitsap County and Jefferson County are designated as attainment areas for all criteria pollutants, the General Conformity Rule does not apply to NAVBASE Kitsap Bangor, Bremerton, Keyport, and Manchester, or Zelatched Point. Snohomish County is designated as a maintenance area for ozone and carbon monoxide. Emissions for the Proposed Action would come from temporary, mobile sources and would be well below applicable thresholds. As a result, the Proposed Action would comply with the requirements of the Clean Air Act, as amended.
Clean Water Act (Sections 401 and 404, 33 U.S.C. 1251 *et seq.*)	A permit under Section 404 of the CWA is required for the discharge of fill into Waters of the U.S. The Proposed Action meets the requirements of a Nationwide Permit (NWP) 3 for Maintenance (82 Federal Register 1860). The Proposed Action also meets the WDOE 401 General Conditions contained in the User's Guide and is therefore certified in compliance with Section 401 of the CWA. The Navy would comply with all NWP 3 conditions and where applicable, the Navy would submit a Joint Aquatic Resource Permit Application (JARPA) to the USACE, which serves as the preconstruction notification required under NWP 3.
Coastal Zone Management Act (16 U.S.C. 1451 *et seq.*)	The Proposed Action meets the conditions of a NWP 3 and WDOE has certified that this type of action is consistent with Washington's Coastal Zone Management Program's Enforceable Policies if the action does not require State Section 401 review (WDOE, 2017b).

Table 12-1. Principal Federal and State Laws, Regulations and Policies Applicable to the Proposed Action (continued)

Federal and State Laws, Regulations and Policies	*Status of Compliance*
Rivers and Harbors Act (RHA) (33 U.S.C. 401 *et seq.*)	A permit under Section 10 of the Rivers and Harbors Act is required for the removal and replacement of pilings in navigable waters. The Proposed Action, which would replace deteriorated piles in marine waters, meets the requirements of a NWP 3 for Maintenance (82 Federal Register 1860). The Navy would comply with all NWP 3 conditions and where applicable, the Navy would submit a Joint Aquatic Resource Permit Application (JARPA) to the USACE, which serves as the preconstruction notification required under NWP 3.
National Historic Preservation Act (Section106, 54 U.S.C. 306108 *et seq.*)	The Navy determined that the Proposed Action would not adversely affect properties eligible for inclusion in the National Register of Historic Places (NRHP). At NAVBASE Kitsap Keyport, NAVBASE Kitsap Manchester, and NAVMAG Indian Island, there are no resources listed in or eligible for listing in the NRHP within the area of potential effect. Although there are NRHP-listed or eligible historic properties at NAVBASE Kitsap Bangor, NAVBASE Kitsap Bremerton, and Zelatched Point, the repairs and replacement activities would not adversely affect any of these resources. At NAVSTA Everett, the State Historic Preservation Officer (SHPO) has concurred that the affected properties are not eligible for inclusion in the NRHP. The Navy has concluded that there would be no significant impact to cultural resources as a result of the Proposed Action so that overall, there would be no historic properties adversely affected. The Navy initiated Section 106 consultation with the SHPO (letter dated May 12, 2016). The SHPO concurred with the Navy's determination of no adverse effect from proposed MPR activities in letters dated May 31, 2017 (NAVBASE Kitsap Bangor, NAVBASE Kitsap Keyport, NAVBASE Kitsap Manchester, Naval Station Everett, and Zelatched Point), August 2, 2017 (NAVBASE Kitsap Bremerton), and April 8, 2019 (NAVMAG Indian Island).
Native American Graves Protection and Repatriation Act (NAGPRA) (25 U.S.C. 3001 *et seq.*)	If the Navy were to encounter human remains, funerary objects, sacred objects, or objects of cultural patrimony as defined by NAGPRA, the Navy would comply with NAGPRA and Navy instructions and consult with the SHPO, affected American Indian tribes, USACE, and other interested parties.
Endangered Species Act (16 U.S.C. 1531 *et seq.*)	In accordance with ESA Section 7 requirements, the Navy consulted with USFWS and NMFS to address potential affects to ESA listed species. The Navy concluded the Proposed Action is not likely to affect listed fish species or marbled murrelet, but is likely to affect Southern resident killer whale and humpback whale. In letters dated June 27, 2017 and December 15, 2017, USFWS concurred with the Navy's determinations regarding bull trout and marbled murrelet. In a BiOp dated April 5, 2019, NMFS concluded that the Navy's proposed MPR activities "may affect, are likely to adversely affect" Puget Sound evolutionary significant unit (ESU) Chinook salmon; Hood Canal summer-run ESU chum salmon; Puget Sound distinct population segment (DPS) steelhead; Puget Sound/Georgia Basin DPSs of bocaccio and yelloweye rockfish; Southern Resident killer whale; humpback whale species; and associated designated critical habitat.

Table 12-1. Principal Federal and State Laws, Regulations and Policies Applicable to the Proposed Action (continued)

Federal and State Laws, Regulations and Policies	*Status of Compliance*
Marine Mammal Protection Act (16 U.S.C. 1361 *et seq.*)	Based on potential impacts to marine mammals, the Navy prepared an LOA application to request take for level "A" injury (to harbor seals only) and "B" harassment (to harbor seals and other marine mammals). The LOA application was submitted to NMFS on April 24, 2017 and a notice of receipt of application was published in the Federal Register on August 4, 2017. NMFS published a Final Rule in the Federal Register on April 17, 2019. In compliance with the MMPA, the Navy would implement all LOA conditions.
Magnuson-Stevens Fishery Conservation and Management Reauthorization Act (16 U.S.C. section 1801 *et seq.*)	The Navy determined that the Proposed Action may adversely affect EFH. The Navy consulted with the NMFS, who concurred with the Navy's determination, but provided Conservation Recommendations to minimize effects to EFH. Consultation with NMFS was completed on April 5, 2019.
Migratory Bird Treaty Act (16 U.S.C. 703-712 *et seq.*)	Exposure to underwater sounds from pile replacement could cause behavioral disturbance to migratory birds, but would not be anticipated to result in injury or mortality. Therefore, the Proposed Action is not likely to take migratory birds.
Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds	The Proposed Action is not likely to adversely affect migratory bird populations and would be in compliance with EO 13186.
Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d *et seq.*)	The Proposed Action would not take, possess, or transport bald or golden eagles, their nests or eggs and would therefore be in compliance with the Bald and Golden Eagle Protection Act.
Executive Order 12088, Federal Compliance with Pollution Control Standards	EO 12088 requires federal facilities to comply with all applicable pollution control standards. The Proposed Action would contribute only minor amounts of pollution, during construction and maintenance activities. Solid waste requiring disposal would be generated during construction and would be disposed of in accordance with federal and state requirements.
Executive Order 12898, Federal Actions to Address Environmental Justice in Minority and Low-income Populations	No disproportionately high or adverse impacts to minority and low-income communities would be expected from the Proposed Action.
Executive Order 13045, Protection of Children From Environmental Health Risks and Safety Risks	There are no residences, schools, or other facilities used by children within the waterfront areas. The replacement of piles and other maintenance activities at the affected structures would not cause environmental health risks and safety risks, such as products and substances that children could come in contact with or ingest, that may disproportionately affect children.
Executive Order 13175, Consultation and Coordination with Indian Tribal Governments	The Navy consulted with the Jamestown S'Klallam Tribe, Lower Elwha Tribe, Lummi Tribe, Port Gamble S'Klallam Tribe, Skokomish Indian Tribe, Stillaguamish Tribe, Suquamish Tribe, Swinomish Indian Tribal Community, and Tulalip Tribe.

12.1 Irreversible or Irretrievable Commitment of Natural or Depletable Resources

Resources that are irreversibly or irretrievably committed to a project are those that are used on a long-term or permanent basis. This includes the use of non-renewable resources such as metal and fuel, and natural or cultural resources. These resources are irretrievable in that they would be used for this project when they could have been used for other purposes. Human labor is also considered an irretrievable resource. Another impact that falls under this category is the unavoidable destruction of natural resources that could limit the range of potential uses of that particular environment.

Implementation of the Proposed Action would involve commitment of a range of natural, physical, human, and fiscal resources. Raw materials, such as steel for pilings, fossil fuel, and labor would be expended in pile replacement activities. Natural resources and labor would also be used to fabricate the new piles to be installed. These materials and labor, as well as the expenditure of funds, would be irreversibly committed to the project. However, these types of construction materials and labor are not in short supply and implementation of the Proposed Action would not result in significant irreversible or irretrievable commitment of resources.

12.2 Relationship between Local Short-Term Use of the Human Environment and Maintenance and Enhancement of Long-Term Natural Resource Productivity

NEPA requires an analysis of the relationship between a project's short-term impacts on the environment and the effects that these impacts may have on the maintenance and enhancement of the long-term productivity of the affected environment. Impacts that narrow the range of beneficial uses of the environment are of particular concern. This refers to the possibility that choosing one development site reduces future flexibility in pursuing other options, or that using a parcel of land or other resources often eliminates the possibility of other uses at that site.

In the short-term, effects to the human environment with implementation of the Proposed Action would primarily relate to the in-water construction activity itself. Water quality, marine sediment, and airborne noise would all be impacted in the short-term. In the long-term, productivity of the action areas would remain the same, as replacement of piles and other maintenance activities at the project sites would not change the overall productivity of the areas. The Proposed Action would not result in any impacts that would reduce environmental productivity or permanently narrow the range of beneficial uses of the environment.

12.3 Means to Mitigate and/or Monitor Adverse Environmental Impacts

The Proposed Action would not result in any significant adverse environmental impacts with implementation of best management practices and minimization measures identified in Section 2.5.

12.4 Any Probable Adverse Environmental Effects That Cannot Be Avoided and Are Not Amenable To Mitigation

This EA has determined that the Proposed Action would not result in any significant impacts; therefore, there are no probable adverse environmental effects that cannot be avoided or are not amenable to mitigation.

13 References

Adams, P. B., Grimes, C. B., Hightower, J. E., Lindley, S. T., & Moser, M. L. (2002). *Status review for North American green sturgeon, Acipenser medirostris.* National Marine Fisheries Service, Southwest Fisheries Science Center, Santa Cruz, CA, North Carolina Cooperative Fish and Wildlife Research Unit, Raleigh, NC, and NMFS Northwest Fisheries Science Center, Seattle, WA. June.

Agness, A. M., & Tannenbaum, B. R. (2009a). *Naval Base Kitsap at Bangor marine bird resource report.* Prepared by Science Applications International Corporation, Bothell, WA. Prepared for BAE Systems Applied Technologies, Inc., Rockville, MD.

Agness, A. M., & Tannenbaum, B. R. (2009b). *Naval Base Kitsap at Bangor marine mammal resource report.* Prepared by Science Applications International Corporation, Bothell, WA. Prepared for BAE Systems Applied Technologies, Inc., Rockville, MD.

Allen, B. M., & Angliss, R. P. (2011). *Alaska marine mammal stock assessments, 2010.* (NOAA Technical Memo NMFS-AFSC-223). U.S. Department of Commerce, NOAA/NMFS, Seattle, WA. May 2011.

Allen, B. M., & Angliss, R. P. (2015). *Alaska marine mammal stock assessments, 2014.* (NOAA Technical Memo NMFS-AFSC-301). U.S. Department of Commerce, NOAA/NMFS, Seattle, WA. June 2015. http://www.nmfs.noaa.gov/pr/sars/pdf/alaska2014_final.pdf

Anchor Environmental. (2002). *Interim remedial action: Log Pond cleanup/habitat restoration-Year 2 monitoring report.* Prepared by Anchor Environmental, LLC, Seattle, WA. Prepared for Georgia Pacific West, Inc., Bellingham, WA.

Anchor QEA. (2012). Eelgrass survey data report, Naval Base Kitsap, Bangor, P-834, SSN Pier Extension and Ship Support Building. Prepared by Anchor QEA, LLC, Seattle, WA, on behalf of KPFF Consulting Engineers. Prepared for Naval Base Kitsap Bangor, Bangor, WA. November 2012.

ATSDR. (2013). *Health Consultation - Operable Unit 2 Area 8 Shellfish Evaluation: Naval Base Kitsap, Keyport (formerly known as Naval Undersea Warfare Center, Keyport) Keyport, Kitsap County, Washington*. U.S. Department of Health and Human Services Agency for Toxic Substances and Disease Registry, Atlanta, GA. February 25, 2013. http://www.atsdr.cdc.gov/HAC/pha/NavalBaseKitsapKeyport/NavalBaseKitsapKeyportHCFinal02252013.pdf

Bahls, P. (2004). *Fish Distribution and Abundance in Shallow Intertidal Habitats of Tarboo and North Dabob Bays*. Prepared for Jefferson County Marine Resources Committee by Northwest Watershed Institute. Portland, OR.

Baird, R. W. (2001). Status of harbour seals, *Phoca vitulina*, in Canada. *The Canadian Field-Naturalist, 115*(4), 663–675.

Bargmann, G. (1998). *Forage fish management plan.* (Washington State Department of Fish and Wildlife). Olympia, WA. http://wdfw.wa.gov/publications/00195/wdfw00195.pdf

Barlow, J., Calambokidis, J., Falcone, E. A., Baker, C. S., Burdin, A. M., Clapham, P. J., Mattila, D. K. (2011). Humpback whale abundance in the North Pacific estimated by photographic capture-recapture with bias correction from simulation studies. *Marine Mammal Science, 27*(4), 793–818.

Battelle. (2001). Concentrations of metals in sediment and water of Dabob bay. Prepared for NAVSEA Undersea Warfare Center Division, Keyport, WA. March.

Bax, N. J. (1983). The early marine migration of juvenile chum salmon (Oncorhynchus keta) through Hood Canal: Its variability and consequences. (Ph.D. dissertation), University of Washington, Seattle, Seattle, WA.

Bax, N. J., Salo, E. O., Snyder, B. P., Simenstad, C. A., & Kinney, W. J. (1978). *Salmonid outmigration studies in Hood Canal. Final report, Phase III, January to July 1977.* (FRI-UW-7819). Fisheries Research Institute, College of Fisheries, University of Washington, Seattle, WA.

Baxter, A. (2019). [Anne Baxter, Ecologist, Suquamish Tribe Environmental Program]. Personal communication via voice mail to Ben Keasler, NEPA Project Manager, NAVFAC Northwest, re: determined no need to meet to dicuss comments on the Revised Draft EA. May 29, 2019.

Bhuthimethee, M., Hunt, C., Ruggerone, G., Nuwer, J., & Hafner, W. (2009). *NAVBASE Kitsap Bangor fish presence and habitat use, Phase III field survey report, 2007-2008.* Prepared by Science Applications International Corporation, Bothell, WA, and Natural Resources Consultants, Inc. (Ruggerone), Seattle, WA. Prepared for BAE Systems Applied Technologies, Inc., Rockville, MD.

Bjørge, A. (2002). How persistent are marine mammal habitats in an ocean of variability? Pages 63-91 in Evans, P.G.H. and J.A. Raga, eds. Marine mammals: Biology and Conservation. New York, New York: Kluwer Academic/Plenum Publishers.

Black, N. (2011, February 22). Fish-eating (resident) killer whales sighted in Monterey Bay on February 10, 2011. Retrieved from http://www.montereybaywhalewatch.com/Features/PugetSoundKillerWhales1102.htm

Bradbury, A., Sizemore, B., Rothaus, D., & Ulrich, M. (2000). *Stock Assessment of Subtidal Geoduck Clams (Panopea abrupta) in Washington.* Marine Resources Unit, Fish Management Division, Fish Program, Olympia, WA. http://wdfw.wa.gov/publications/00224/wdfw00224.pdf

Brown, R. F., & Mate, B. R. (1983). Abundance, movements, and feeding habits of harbor seals, *Phoca vitulina*, at Netarts and Tillamook Bays, Oregon. *Fishery Bulletin, 81*(2), 291–301.

Buchanan, J. R. (2004). Shorebirds: Plovers, oystercatchers, avocets and stilts, sandpipers, snipes, and phalaropes. In E. M. Larsen, J. M. Azerrad, & N. Nordstrom (Eds.), *Management recommendations for Washington's priority species, Volume IV: Birds*. Olympia: Washington Department of Fish and Wildlife.

Buehler, D. A. (2000). Bald eagle (*Haliaeetus leucocephalus*). The Birds of North America Online database Retrieved August 20, 2008, from Cornell Laboratory of Ornithology http://bna.birds.cornell.edu/bna.

Burkett, E. E. (1995). Marbled murrelet food habits and prey ecology. In C. J. Ralph, G. L. Hunt, Jr., M. G. Raphael, & J. F. Piatt (Eds.), *Ecology and conservation of the marbled murrelet, General Technical Report PSW-152* (pp. 223–246). U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station.

Calambokidis, J. (2010, May 25). [John Calambokidis, senior marine mammal biologist and co-founder of Cascadia Research, Olympia, WA]. Personal communication with Bernice Tannenbaum, Senior Environmental Scientist, Science Applications International Corporation, re: marine mammal occurrence in Hood Canal.

Calambokidis, J. (2012, February 16). [John Calambokidis, senior marine mammal biologist and co-founder of Cascadia Research, Olympia, WA]. Personal communication with Sharon Rainsberry, Fisheries Biologist, NAVFAC Northwest, re: humpback whales historical use of Hood Canal and January/February 2012 humpback sighting.

Calambokidis, J. (2013, February 15–22, 2013). [John Calambokidis, senior marine mammal biologist and co-founder of Cascadia Research, Olympia, WA]. Personal communication with Andrea Balla-Holden, NAVFAC Northwest, re: gray whale occurrences in Hood Canal.

Calambokidis, J., Darling, J. D., Deeke, V., Gearin, P., Gosho, M., Megill, W., . . . Gisborne, B. (2002). Abundance, range and movements of a feeding aggregation of gray whales (*Eschrictius robustus*) from California to southeastern Alaska in 1998. *Journal of Cetacean Research and Management, 4*(3), 267–276.

Calambokidis, J., Evenson, J. R., Cubbage, J. C., Gearin, P., & Osmek, S. D. (1992). *Harbor porpoise distribution and abundance off Oregon and Washington from aerial surveys in 1991 - Final.* Prepared by Cascadia Research, Olympia, WA. Prepared for National Marine Mammal Laboratory, Alaska Fisheries Center, National Marine Fisheries Service, Seattle, WA. April.

Calambokidis, J., Falcone, E., Quinn, T., Burdin, A. M., Clapham, P. J., Ford, J. K. B., . . . Maloney, N. (2008). *SPLASH: Structure of Populations, Levels of Abundance and Status of Humpback Whales in the North Pacific.* Prepared by Cascadia Research, Olympia, WA. Prepared for U.S. Department of Commerce, Western Administrative Center, Seattle, WA. May 2008. http://www.cascadiaresearch.org/SPLASH/SPLASH-contract-Report-May08.pdf

Calambokidis, J., Laake, J. L., & Klimek, A. (2010). *Abundance and population structure of seasonal gray whales in the Pacific Northwest, 1998-2008.* (IWC Working Paper SC/62/BRG32. Submitted to IWC Scientific Committee). June 2010.

Calambokidis, J., & Steiger, G. H. (1990). Sightings and movements of humpback whales in Puget Sound. *Northwestern Naturalist, 71*(2), 45-49. Retrieved from http://www.jstor.org/stable/3536589

Calambokidis, J., Steiger, G. H., Ellifrit, D. K., Troutman, B. L., & Bowlby, C. E. (2004). Distribution and abundance of humpback whales (*Megaptera novaeangliae*) and other marine mammals off the northern Washington coast. *Fishery Bulletin, 102*(4), 563–580.

Canter, Larry W. (1996). Environmental Impact Assessment, Second Edition, 1996, Larry W. Canter (McGraw-Hill, Inc).

Carretta, J. V., Forney, K. A., Lowry, M. S., Barlow, J., Baker, J., Hanson, B., & Muto, M. M. (2007). *U.S. Pacific marine mammal stock assessments: 2007.* (NOAA TM NMFS-SWFSC-414). National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center, La Jolla, CA. http://swfsc.noaa.gov/publications/TM/SWFSC/NOAA-TM-NMFS-SWFSC-414.pdf

Carretta, J. V., Forney, K. A., Oleson, E., Martien, K., Muto, M. M., Lowry, M. S., . . . Hill, M. C. (2011). *U.S. Pacific marine mammals stock assessments: 2010.* (NOAA Technical Memorandum NMFS-SWFSC-476). National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center. June 2011.

Carretta, J. V., Forney, K. A., Oleson, E. M., Weller, D. W., Lang, A. R., Baker, J., . . . Brownell Jr., R. L. (2017). *U.S. Pacific marine mammals stock assessments, 2016.* (NOAA Technical Memorandum NMFS-SWFSC-577). National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center. June 2017. http://www.nmfs.noaa.gov/pr/sars/pdf/pacific_2016_final.pdf.

Carretta, J. V., Oleson, E., Baker, J., Weller, D. W., Lang, A. R., Forney, K. A., . . . Brownell Jr., R. L. (2016). *U.S. Pacific marine mammals stock assessments, 2015.* (NOAA Technical Memorandum NMFS-SWFSC-561). National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center, Seattle, WA. May 2016. http://www.nmfs.noaa.gov/pr/sars/pdf/pacific2015_final.pdf.

Carretta, J. V., Oleson, E., Weller, D. W., Lang, A. R., Forney, K. A., Baker, J., . . . Hill, M. C. (2013). *U.S. Pacific marine mammals stock assessments: 2012.* (NOAA Technical Memorandum NMFS-SWFSC-504). National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center. January 2013. http://www.nmfs.noaa.gov/pr/sars/pdf/po2012.pdf

Carretta, J. V., Oleson, E., Weller, D. W., Lang, A. R., Forney, K. A., Baker, J., . . . Mattila, D. K. (2014). *U.S. Pacific marine mammals stock assessments, 2013.* (NOAA Technical Memorandum NMFS-SWFSC-532). National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center. August 2014. http://www.nmfs.noaa.gov/pr/sars/pdf/pacific2013_final.pdf.

Carretta, J. V., Oleson, E., Weller, D. W., Lang, A. R., Forney, K. A., Baker, J., . . . Brownell Jr., R. L. (2015). *U.S. Pacific marine mammals stock assessments, 2014.* (NOAA Technical Memorandum NMFS-SWFSC-549). National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center. August 2015. http://www.nmfs.noaa.gov/pr/sars/pdf/pacific_sars_2014_final_noaa_swfsc_tm_549.pdf.

Carter, H. R. (1984). At-sea biology of the marbled murrelet (Brachyramphus marmoratus) in Barkley Sound, British Columbia. (M.S. thesis), University of Manitoba, Winnipeg, Manitoba.

Carter, H. R., & Sealy, S. G. (1990). Daily foraging behavior of marbled murrelets. *Studies in Avian Biology, 14*, 93–102.

Carter, H. R., & Stein, J. L. (1995). Molts and plumages in the annual cycle of the marbled murrelet. In C. J. Ralph, G. L. Hunt, Jr., M. G. Raphael, & J. F. Piatt (Eds.), *Ecology and conservation of the marbled murrelet, General Technical Report PSW-152* (pp. 99–109). Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station.

Cascadia Research. (2012). Examination of stranded gray whale found floating in Saratoga Passage on 22 April 2012. Olympia, WA: Cascadia Research Collective. Retrieved from http://www.cascadiaresearch.org/examination_of_stranded_gray_whale-23April2012.htm. (Accessed November 12, 2015).

Cascadia Research (2016). Examination of dead humpback whale – Bremerton, 4 June 2016. Cascadia Research Collective. Retrieved from: http://www.cascadiaresearch.org/washington-state-stranding-response/examination-dead-humpback-whale-bremerton-4-june-2016. (Accessed April 12, 2017).

Cavanaugh, W., & Tocci, G. C. (1998). Environmental noise: the invisible pollutant. *Environmental Excellence in South Carolina (E2SC), 1*(1).

Center for Whale Research. (2017). Southern Resident killer whale population. Retrieved from: https://www.whaleresearch.com/orca-population. (Accessed April 12, 2017).

CEQ (Council on Environmental Quality). (1997). *Considering cumulative effects under the National Environmental Policy Act.* Washington, DC. January 1997. http://ceq.hss.doe.gov/nepa/ccenepa/ccenepa.htm.

CH2M Hill. (1995). *South Cap monitoring report, Seattle Ferry Terminal.* (Task 4, Amendment No. O, Agreement Y-5637). Washington Department of Transportation, Olympia, WA.

Chapman, P. M., Wang, F., Janssen, C. R., Goulet, R. R., & Kamunde, C. N. (2003). Conducting ecological risk assessments of inorganic metals and metalloids: Current status. *Human and Ecological Risk Assessment, 9*(4), 641–697.

Christaen, B., Dowty, P., Ferrier, L., Gaeckle, J., Berry, H., Stowe, J., & Sutton, E. (2016). Puget Sound Submerged Vegetation Monitoring Program 2014 Report. Washington Department of Natural Resources Nearshore Habitat Program, Aquatic Resources Division, Olympia, WA. March 5. http://file.dnr.wa.gov/publications/aqr_nrsh_svmp_report_2014.pdf.

Coastal Watershed Institute. (2015). Forage fish of the Elwha and Dungeness nearshore: world class restoration and protection in the upper left hand corner of the United States. Coastal Watershed Institute Blog. http://www.coastalwatershedinstitute.org/blog/?p=192.

Condit, R., & LeBoeuf, B. 1984. Feeding habits and feeding grounds of the northern elephant seal. *Journal of Mammalogy, 65*(2), 281–290.

Crone, P. R., Hill, K. T., McDaniel, J. D., & Lo, N. C. H. (2009). Pacific mackerel (*Scomber japonicas*) stock assessment for USA management in the 2009-10 fishing year. Pacific Fishery Management Council, Portland, OR.

Dames & Moore. (1994). Baseline Year Water and Sediment Quality Certification Monitoring Report; Volume I.

Delwiche, L., Wallin, J. M., Nakayama, J., & Vedera, G. (2008). *NAVBASE Kitsap Bangor qualitative shellfish resources field assessment data report.* Prepared by Science Applications International Corporation, Bothell, WA. Prepared for Naval Base Kitsap Bangor, Silverdale, WA. October 17, 2008.

Dooling, R., & Popper, A. N. (2007). *The effects of highway noise on birds.* Prepared by Environmental BioAcoustics LLC, Rockville, MD, under contract to Jones and Stokes Associates, Sacramento, CA. Prepared for California Department of Transportation Division of Environmental Analysis, Sacramento, CA. September 20, 2007.

Dorn, P. D., & Namtvedt-Best, P. (2005). *Integration of Joint City of Bainbridge Island/Suquamish Tribal Beach Seining Results into Shoreline Management and Salmon Recovery Efforts in Kitsap County, Washington*. Proceedings of the 2005 Puget Sound Georgia Basin Research Conference. Puget Sound Action Team. Seattle, Washington.

Dorsey, E. M. (1983). Exclusive adjoining ranges in individually identified minke whales (*Balaenoptera acutorostrata*) in Washington state. *Canadian Journal of Zoology*, *61*(1), 174–181.

Dorsey, E. M., Stern, S. J., Hoelzel, A. R., & Jacobsen, J. (1990). Minke Whales (*Balaenoptera acutorostrata*) from the West Coast of North America: Individual Recognition and Small-Scale Site Fidelity. *Report of the International Whaling Commission, Special Issue 12*, 357–368.

Drake, J. S., Berntson, E. A., Gustafson, R. G., Holmes, E. E., Levin, P. S., Tolimieri, N., . . . Cope, J. M. (2010). Status review of five rockfish species in Puget Sound, Washington: Bocaccio (Sebastes paucispinis), canary rockfish (S. pinniger), yelloweye rockfish (S. ruberrimus), greenstriped rockfish (S. elongatus), and redstripe rockfish (S. proriger). (NOAA Technical Memorandum NMFS-NWFSC-108). National Marine Fisheries Service Northwest Fisheries Science Center, Seattle, WA. December 2010.

EDAW. (1994). *Environmental Assessment; Project Development Along the East Waterway; Naval Station Everett; Everett, Washington*. Seattle, WA: EDAW, Inc. for U.S. Department of the Navy, Engineering Field Activity Northwest. Silverdale, WA.

EDAW, Inc. (1996). Survey of Historic Resources: Manchester Fuel Department, Fleet and Industrial Supply Center Puget Sound, United States Navy. Prepared for Engineering Field Activity Northwest, Naval Facilities Engineering Command. February.

Edgell, T. C., & Demarchi, M. W. (2012). California and Steller sea lion use of a major winter haulout in the Salish Sea over 45 years. *Marine Ecology Progress Series, 467*, 253–262.

Evans Mack, D., Ritchie, W. P., Nelson, S. K., Kuo-Harrison, E., Harrison, P., & Hamer, T. E. (2003). *Methods for surveying marbled murrelets in forests: a revised protocol for land management and research.* (Pacific Seabird Group Technical Publication Number 2.). http://www.pacificseabirdgroup.org/publications/PSG_TechPub2_MAMU_ISP.pdf

Evenson, J. R., Anderson, D., Murphie, B. L., Cyra, T. A., & Calambokidis, J. (2016). *Disappearance and Return of Harbor Porpoise to Puget Sound: 20 Year Pattern Revealed from Winter Aerial Surveys.* Washington Department of Fish and Wildlife, Wildlife Program and Cascadia Research Collective, Olympia, WA.

Everitt, R. D., Fiscus, C. H., & DeLong, R. L. (1979). *Marine mammals of northern Puget Sound and the Strait of Juan de Fuca: A report on investigations November 1, 1977–October 31, 1978.* (NOAA Technical Memorandum ERL MESA-41). NOAA Environmental Research Laboratories, Marine Ecosystems Analysis Program, Boulder, CO. January.

Falxa, G., Baldwin, J., Lance, M., Lynch, D., Nelson, S. K., Pearson, S. F., . . . Young, R. (2014). *Marbled murrelet effectiveness monitoring, Northwest Forest Plan: 2013 summary report.* May 2014

Falxa, G., Baldwin, J., Lance, M., Lynch, D., S. K., Pearson, S. F., . . . Young, R. (2015). *Marbled murrelet effectiveness monitoring, Northwest Forest Plan: 2014 summary report.* August 2015.

Falxa, G., Baldwin, J., Lynch, D., Nelson, S. K., Miller, S. L., Pearson, S. F., . . . Huff, M. H. (2008). *Marbled murrelet effectiveness monitoring, Northwest Forest Plan: 2004–2007 summary report.* Northwest Forest Plan Interagency Regional Monitoring Program. September 2008. http://www.reo.gov/monitoring/reports/murrelet/MAMU_EM_08_Report.pdf

Fisher, W., & Velasquez, D. (2008). *Management Recommendations for Washington's Priority Habitats and Species: Dungeness Crab, Cancer magister.* Washington Department of Fish and Wildlife, Olympia, WA. December 2008. http://wdfw.wa.gov/publications/00028/wdfw00028.pdf

Ford, J. K. (1991). Vocal traditions among resident killer whales (*Orcinus orca*) in coastal waters of British Columbia. *Canadian Journal of Zoology, 69*(6), 1454–1483.

Ford, J. K. B., Ellis, G. M., & Balcomb, K. C. (1994). Killer whales: the natural history and genealogy of Orcinus orca in British Columbia and Washington. Vancouver, B.C.: UBC Press.

Ford, M. J. (2011). *Status review update for Pacific salmon and steelhead listed under the Endangered Species Act: Pacific Northwest*. Tech Memo NMFS-NWFSC-113. Seattle, WA: National Marine Fisheries Service, Northwest Fisheries Science Center.

Frankenstein, G. (2000). *Blooms of ulvoids in Puget Sound.* Prepared for the Puget Sound Water Quality Action Team, Office of the Governor, Olympia, WA. November 2000.

Frasier, T. R., Koroscil, S. M., White, B. N., & Darling, J. D. (2011). Assessment of population substructure in relation to summer feeding ground use in the eastern North Pacific gray whale. *Endangered Species Research, 14*, 39–48.

Fresh, K. L. (2006). *Juvenile Pacific salmon in Puget Sound.* (Puget Sound Nearshore Partnership Technical Report 2006-06). U.S. Army Corps of Engineers Seattle District, Seattle, Washington.

Fresh, K. L., Small, D. J., Kim, H., Waldbillig, C., Mizell, M., Carr, M. I., & Stamatiou, L. (2006). *Juvenile salmon use of Sinclair Inlet, Washington in 2001 and 2002*. Olympia, WA: Washington State Department of Fish & Wildlife, Fish Program, Science Division.

Frierson, T. N., Dezan, W., Lowry, D., Pacunski, R. E., LeClair, L., Blaine, J., . . . Campbell, P. (2016a). *Final Assessment of Threatened and Endangered Marine and Anadromous Fish Presence and Their Critical Habitat Occurrence Adjacent to Naval Base Kitsap – Bangor: 2014–15 Survey Results.* Prepared by Washington Department of Fish and Wildlife. Prepared for Naval Facilities Engineering Command Northwest (NAVFAC NW), Silverdale, WA.

Frierson, T. N., Dezan, W., Lowry, D., Pacunski, R. E., LeClair, L., Blaine, J., . . . Campbell, P. (2016b). *Final Assessment of Threatened and Endangered Marine and Anadromous Fish Presence and Their Critical Habitat Occurrence Adjacent to Naval Base Kitsap at Bremerton: 2013–15 Survey Results.* Prepared by Washington Department of Fish and Wildlife. Prepared for Naval Facilities Engineering Command Northwest (NAVFAC NW), Silverdale, WA.

Frierson, T. N., Dezan, W., Lowry, D., Pacunski, R. E., LeClair, L., Blaine, J., . . . Campbell, P. (2016c). *Final Assessment of Threatened and Endangered Rockfish (Sebastes spp.) Presence and Their Critical Habitat Adjacent to Naval Undersea Warfare Center at Keyport: 2013–15 Survey Results.* Prepared by Washington Department of Fish and Wildlife. Prepared for Naval Facilities Engineering Command Northwest (NAVFAC NW), Silverdale, WA.

Frierson, T. N., Dezan, W., Lowry, D., Pacunski, R. E., LeClair, L., Blaine, J., . . . Campbell, P. (2016d). *Final Assessment of Threatened and Endangered Marine and Anadromous Fish Presence and Their Critical Habitat Occurrence Adjacent to Manchester Fuel Department: 2015 Survey Results.* Prepared by Washington Department of Fish and Wildlife. Prepared for Naval Facilities Engineering Command Northwest (NAVFAC NW), Silverdale, WA.

Frierson, T. N., Dezan, W., Lowry, D., Pacunski, R. E., LeClair, L., Blaine, J., . . . Campbell, P. (2016e). *Final Assessment of Threatened and Endangered Rockfish (Sebastes spp.) Presence and Their Critical Habitat Adjacent to Zelatched Point Pier: 2015 Survey Results.* Prepared by Washington Department of Fish and Wildlife. Prepared for Naval Facilities Engineering Command Northwest (NAVFAC NW), Silverdale, WA.

Frierson, T. N., Dezan, W., Lowry, D., Pacunski, R. E., LeClair, L., Blaine, J., . . . Campbell, P. (2016f). *Final Assessment of Threatened and Endangered Marine and Anadromous Fish Presence and Their Critical Habitat Occurrence Adjacent to Naval Station Everett: 2015 Survey Results.* Prepared by Washington Department of Fish and Wildlife. Prepared for Naval Facilities Engineering Command Northwest (NAVFAC NW), Silverdale, WA.

Frierson, T., Dezan, W., Lowry, D., LeClair, L., Hillier, L., Pacunski, R., Blaine, Hennings, A., Phillips, A., Campbell, P. (2017a). Final assessment of threatened and endangered marine and anadromous fish presence adjacent to the NAVBASE Kitsap Bangor: 2015-16 beach seine survey results. Final report to NAVFAC NW. Washington Department of Fish and Wildlife. Olympia, WA.

Frierson, T., Dezan, W., Lowry, D., LeClair, L., Hillier, L., Pacunski, R., Blaine, Hennings, A., Phillips, A., Campbell, P. (2017b). Final assessment of threatened and endangered marine and anadromous fish adjacent to Manchester Fuel Department: 2015-16 beach seine survey results. Final report to NAVFAC NW. Washington Department of Fish and Wildlife. Olympia, WA.

Frierson, T., Dezan, W., Lowry, D., LeClair, L., Hillier, L., Pacunski, R., Blaine, Hennings, A., Phillips, A., Campbell, P. (2017c). Final assessment of threatened and endangered marine and anadromous fish adjacent to Zelatched Point: 2016 beach seine survey results. Final report to NAVFAC NW. Washington Department of Fish and Wildlife. Olympia, WA.

Frierson, T., Dezan, W., Lowry, D., LeClair, L., Hillier, L., Pacunski, R., Blaine, Hennings, A., Phillips, A., Campbell, P. (2017d). Final assessment of threatened and endangered marine and anadromous fish adjacent to the NAVSTA Everett: 2015-16 beach seine survey results. Final report to NAVFAC NW. Washington Department of Fish and Wildlife. Olympia, WA.

Frierson, T., Dezan, W., Lowry, D., LeClair, L., Hillier, L., Pacunski, R., Blaine, J., Hennings, A., Phillips, A., and Campbell, P. (2017e). Final Assessment of Threatened and Endangered Marine and Anadromous Fish Presence Adjacent to the NAVMAG Indian Island: 2015-16 Beach Seine Survey Results. Final report to NAVFAC NW. Washington Department of Fish and Wildlife. Olympia, WA.

Frierson, T., Hillier, L., LeClair, L., Lowry, D., Bean, J., Blaine, J., . . . Wright, E. (2015, January 28). [Washington Department of Fish and Wildlife Marine Fish Science Unit, Olympia, WA]. Personal communication with Naval Facilities Engineering Command Northwest, re: Assessment of ESA-listed rockfish (*Sebastes* spp.) and other rockfish presence, abundance, habitat, and prey base adjacent to NBK-Bremerton, NUWC-Keyport, NBK-Bangor, NAVMAG-Indian Island, NAS-Whidbey Island: 2014 Initial Survey Results.

Frierson, T., Lowry, D. LeClair, L., Hillier, L., Pacunski, R., Blaine, J. Hennings, A., Phillips, A., and M. Millard. (2018). Final assessment of Threatened and Endangered juvenile rockfish presence and their nearshore Critical Habitat occurrence adjacent to the NAVBASE Kitsap Bangor& NAVMAG Indian Island: 2017 survey results. Prepared for Naval Facilities Engineering Command Northwest.

Garono, R. J., & Robinson, R. (2002). *Assessment of estuarine and nearshore habitats for threatened salmon stocks in the Hood Canal and Eastern Strait of Juan de Fuca, Washington State. Focal areas 1-4*. CASI vegetation grids (electronic data and supporting document). Prepared by Wetland & Watershed Assessment Group, Earth Design Consultants, Inc. in cooperation with Charles Simenstad, Wetland Ecosystem Team, University of Washington. Prepared for Point No Point Treaty Council, Corvallis, OR. July 2002.

Gilbert, J. R., & Guldager, N. (1998). *Status of harbor and gray seal populations in northern New England.* Prepared by University of Maine, Department of Wildlife Ecology, Orono, ME. Prepared for National Marine Fisheries Service Northeast Fisheries Science Center, Woods Hole, MA. February 1998.

Goetz, F. A., Jeanes, E., Moore, M. E., & Quinn, T. P. (2015). Comparative migratory behavior and survival of wild and hatchery steelhead (*Oncorhynchus mykiss*) smolts in riverine, estuarine, and marine habitats of Puget Sound, Washington. *Environmental Biology of Fishes, 98*(1), 357–375.

Grant, D., & Kretser, A. (2010). Historic Properties Assessment for Zelatched Point in Jefferson County, Washington. NAVFAC NW, Silverdale, WA.

Greene, C., & Godersky, A. (2012). *Larval Rockfish in Puget Sound surface waters.* Northwest Fisheries Science Center, Seattle, WA. December 27, 2012.

Grulich Architecture & Planning Services. (1986). *Historic Survey of Puget Sound Naval Shipyard Bremerton, Washington*.

Gustafson, R. G., Ford, M. J., Teel, D., & Drake, J. S. (2010). *Status Review of Eulachon (Thaleichthys pacificus) in Washington, Oregon, and California.* (NOAA Technical Memorandum NMFS-NWFSC-105). National Marine Fisheries Service Northwest Fisheries Science Center, Seattle, WA.

Hafner, W., & Dolan, B. (2009). Naval Base Kitsap at Bangor Water Quality. Phase I survey report for 2007 – 2008. Rockville, MD: BAE Systems Applied Technologies, Inc.

Hamel, N., Joyce, J., Fohn, M., James, A., Toft, J., Lawver, A., . . . Naughton, M. (Eds.). (2015). *2015 State of the Sound - Report on the Puget Sound Vital Signs*. Olympia, WA: Puget Sound Partnership.

Hamer, T.E. (2016). 2016 Marbled Murrelet survey results. Hamer Environmental. September 26, 2016

Hamer, T. E., & Nelson, S. K. (1995). Nesting chronology of the Marbled Murrelet. In C. J. Ralph, G. L. Hunt, J. Piatt, & M. Raphael (Eds.), *Conservation Assessment for the Marbled Murrelet, USDA Forest Service General Technical Report PSW-152.* Arcata, CA: U.S.D.A. Forest Service, Redwood Sciences Laboratory.

Hammermeister, T., & Hafner, W. (2009). NAVBASE Kitsap Bangor sediment quality investigation: data report. January 2009. Prepared by Science Applications International Corporation, Bothell, WA. Prepared for BAE Systems Applied Technologies, Inc., Bothell, WA.

Hanson, B., & Emmons, C. (2011). *Spatial and temporal distribution of southern resident killer whales*. Paper presented at the Workshop on the effects of salmon fisheries on southern resident killer whales, Seattle, WA. National Marine Fisheries Service and Fisheries and Oceans Canada. September 21–23, 2011. Retrieved from http://www.nwr.noaa.gov/publications/protected_species/marine_mammals/cetaceans/killer_whales/esa_status/hanson-emmons.pdf.

Hanson, M. B., Baird, R.W., & DeLong, R.L. (1998). Movements of tagged Dall's porpoises in Haro Strait, Washington. Pages 111–119 in Marine Mammal Protection Act and Endangered Species Act Implementation Program. AFSC Processed Report 98-10.

Hanson, T., & Wiles, G. (2015). Washington State status report for the Tufted Puffin. *Washington Department of Fish and Wildlife, Olympia*.

Harke, V. (2013, June 25). [Vince Harke, Biologist, U.S. Fish and Wildlife Service Washington Fish and Wildlife Office, Lacey, WA]. Personal communication with Cindi Kunz, Biologist, NAVFAC Northwest, re: potential marbled murrelet nesting trees in the LWI-SPE parking area site.

Hart Crowser. (2000). *Groundwater and Sediment Characterization Report, Sites 303 and 304, FISC, Fuel Department, Manchester, Washington*. September 26.

Hart Crowser. (2013a). *Naval Base Kitsap-Bangor Explosives Handling Wharf 2: Year 1 Marbled Murrelet Monitoring Report (2012–2013), Bangor, Washington*. Prepared by Hart Crowser. Prepared for NAVFAC Northwest, Silverdale, WA. May 2013.

Hart Crowser. (2013b). *Naval Base Kitsap-Bangor Explosives Handling Wharf 2: Year 1 Marine Mammal Monitoring Report (2012–2013), Bangor, Washington.* Prepared by Hart Crowser. Prepared for NAVFAC, Silverdale, WA. April 2013.

Hart Crowser. (2014a). *Naval Base Kitsap-Bangor Explosives Handling Wharf 2: Year 2 Marbled Murrelet Monitoring Report (2013–2014), Bangor, Washington*. Prepared by Hart Crowser. Prepared for NAVFAC Northwest, Silverdale, WA. March 2014.

Hart Crowser. (2014b). *Naval Base Kitsap-Bangor Explosives Handling Wharf 2: Final Year 2 Marine Mammal Monitoring Report (2013–2014), Bangor, Washington*. Prepared by Hart Crowser. Prepared for NAVFAC Northwest, Silverdale, WA. June 2014.

Hart Crowser. (2015). *Naval Base Kitsap-Bangor Explosives Handling Wharf 2: Year 3 Marine Mammal Monitoring Report (2014–2015), Bangor, Washington.* Prepared by Hart Crowser. Prepared for NAVFAC Northwest, Silverdale, WA. March 2015.

Hastings, M. C., & Popper, A. N. (2005). *Effects of sound on fish.* Prepared by Jones & Stokes. Prepared for California Department of Transportation, Sacramento, CA. http://www.dot.ca.gov/hq/env/bio/files/Effects_of_Sound_on_Fish23Aug05.pdf

HDR. (2012). *Naval Base Kitsap at Bangor Test Pile Program Final Marine Mammal Monitoring Report, Bangor, Washington.* Prepared by HDR. Prepared for Naval Facilities Engineering Northwest, Silverdale, WA. April 2012.

Holmberg, E. K., DiDonato, G. S., Pasquale, N., & Laramie, R. E. (1962). Research report on the Washington trawl fishery 1960 and 1961: Washington Department of Fisheries, Research Division. Technical Report, unpublished.

Houghton, J., Baird, R. W., & Emmons, C. K. (2015). Changes in the occurrence and behavior of mammal-eating killer whales in southern British Columbia and Washington state from 1987–2010. *Northwest Science, 89*(2), 154–169.

Illingworth & Rodkin. (2012). *Acoustic monitoring report. Test Pile Program.* Prepared by Illingworth & Rodkin, Petaluma, CA. Prepared for Naval Base Kitsap, Bangor, WA. April 27, 2012.

Illingworth & Rodkin. (2013). *Naval Base Kitsap at Bangor Trident Support Facilities Explosives Handling Wharf (EHW-2) Project. Acoustic Monitoring Report. Bangor, WA*. Prepared for Naval Base Kitsap at Bangor, WA. May 15, 2013

International Forestry Consultants. (2001). *Timber inventory: Naval Submarine Base, Bangor, WA; Naval Magazine, Indian Island; Naval Undersea Warfare Station, Keyport, WA*; Jim Creek Radio Station; Whidbey Island Naval Air Station; and Naval Observatory Flagstaff and Detachment, Bayview, ID. Prepared by International Forestry Consultants, Bothell, WA. Prepared for Department of the Navy, Silverdale, WA.

Jabusch, T., Melwani, A., Ridalfi, K., & Connor, M. (2008). *Effects of short-term water quality impacts due to dredging and disposal on sensitive fish species in San Francisco Bay.* (Contribution No. 560). Prepared by The San Francisco Estuary Institute, Oakland, CA. Prepared for U.S. Army Corps of Engineers, San Francisco District, San Francisco.

Jefferson, T. A., Smultea, M. A., Courbis, S. S., & Campbell, G. S. (2016). Harbor porpoise (*Phocoena phocoena*) recovery in the inland waters of Washington: estimates of density and abundance from aerial surveys, 2013–2015. *Canadian Journal of Zoology, 94*(7), 505–515.

Jefferson, T. A., Smultea, M. A., & Ampela, K. (2017). *Harbor Seals (Phoca vitulina) in Hood Canal: Estimating Density and Abundance to Assess Impacts of Navy Activities.* (Report of a Workshop Held on 15 and 16 October 2015 at National Marine Mammal Laboratory, Alaska Fisheries Science Center, NOAA Western Regional Center, Seattle, WA). Prepared by Clymene Enterprises (Lakeside, CA), Smultea Environmental Sciences (Preston, WA), and HDR (San Diego, CA). Prepared for Commander, U.S. Pacific Fleet, Naval Facilities Engineering Command Pacific, Pearl Harbor, HI. July.

Jeffries, S. (2006, December 14, 2006). [Steve Jeffries, Marine Mammal Specialist, Washington Department of Fish and Wildlife]. Personal communication with Alison Agness, Marine Biologist, Science Applications International Corporation, re: occurrence of marine mammals in Hood Canal.

Jeffries, S. (2012, August 2012). [Steve Jeffries, Marine Mammal Specialist, Washington Department of Fish and Wildlife]. Personal communication with Andrea Balla-Holden, Marine Biologist, Naval Facilities Engineering Command Northwest, re: Information regarding Steller sea lion haul-out sites and numbers in Puget Sound.

Jeffries, S. J. (2013) Aerial Surveys of Pinniped Haulout Sites in Pacific Northwest Inland Waters.

Jeffries, S. J., Gearin, P. J., Huber, H. R., Saul, D. L., & Pruett, D. A. (2000). *Atlas of seal and sea lion haulout sites in Washington.* Washington State Department of Fish and Wildlife, Wildlife Science Division, Olympia, WA. http://wdfw.wa.gov/publications/00427/wdfw00427.pdf.

Jeffries, S., Huber, H., Calambokidis, J., & Laake, J. L. (2003). Trends and status of harbor seals in Washington State: 1978-1999. *The Journal of Wildlife Management, 67*(1), 208–219.

Jodice, P. G. R., & Collopy, M. W. (1999). Diving and foraging patterns of Marbled Murrelets (*Brachyramphus marmoratus*): testing predictions from optimal-breathing models. *Canadian Journal of Zoology, 77*(9), 1409-1418.

Johnson, O. W., Grant, W. S., Kope, R. G., Neely, K., Waknitz, F. W., & Waples, R. S. (1997). *Status review of chum salmon from Washington, Oregon, and California.* (NOAA technical memorandum NMFS-NWFSC-32). U.S. Department of Commerce, [Seattle, Wash.]; Springfield, VA. http://www.nwfsc.noaa.gov/publications/techmemos/tm32/.

Jones, T. (2010, July 8). [Terri Jones, Navy Forester, Naval Base Kitsap Bangor, Silverdale, WA]. Personal communication with Cindi Kunz, Navy Wildlife Biologist, NAVFAC NW, re: Old growth delineation at Naval Base Kitsap Bangor.

Kalina, W. (2019). [William Kalina, Environmental Site Manager, NAVMAG Indian Island, WA]. Personal communication with Ben Keasler, NEPA Project Manager, NAVFAC Northwest, re: absence of vegetation beneath the Ammunition Wharf. May 23, 2019.

Kirby, A. (2001). *Ulva*, the sea lettuce (Marine Botany course project from Monterey Bay Aquarium Research Institute). Moss Landing, CA: Monterey Bay Aquarium Research Institute Retrieved from http://www.mbari.org/staff/conn/botany/greens/anna/frontpages/default.htm. (Accessed July 23, 2008).

Kitsap Audubon Society. (2008). *Kitsap Audubon Society Christmas Bird Counts, 2001-2007. Area 8: NAVBASE Kitsap Bangor. Data provided by Nancy Ladenberger, Area 8 Leader, Kitsap Audubon, Poulsbo, WA*.

Kozloff, E. N. (1983). *Seashore life of the northern Pacific coast: an illustrated guide to northern California, Oregon, Washington, and British Columbia. Seattle, WA*: University of Washington Press.

Kriete, B. (2007). Orcas in Puget Sound. Puget Sound Nearshore Partnership Report No. 2007-01. Published by Seattle District, U.S. Army Corps of Engineers, Seattle, Washington.

Kszos, L. A., Beauchamp, J. J., & Stewart, A. J. (2003). Toxicity of lithium to three freshwater organisms and the antagonistic effect of sodium. *Ecotoxicology*, 12(5), 427–437.

Lamb, A., & Hanby, B. P. (2005). *Marine life of the Pacific Northwest: a photographic encyclopedia of invertebrates, seaweeds and selected fishes. Madeira Park, BC*: Harbour Publishing.

Lambourn, D. M., Jeffries, S. J., & Huber, H. R. (2010). *Observations of Harbor Seals in Southern Puget Sound during 2009.* (Contract Report for PO AB133F09SE2836F). Washington Department of Fish and Wildlife, Wildlife Program, Wildlife Science Division Lakewood, WA.

Larsen, E. M., Azerrad, J. M., & Nordstrom, N. (Eds.). (2004). *Management recommendations for Washington's priority species. Volume IV: Birds*. Olympia, WA: Washington Department of Fish and Wildlife.

Le Boeuf, B.J., Morris, P.A., Blackwell, S.B., Crocker, D.E., & Costa, D.P. (1996). Diving behavior of juvenile northern elephant seals. Canadian Journal of Zoology, 74, 1632-1644.

Lizon, P. (2015, October 26, 2015). [Patrick Luzon, Water Quality Assessment Coordinator, Olympia, WA]. Personal communication (Email) with Jennifer M. Wallin, Environmental Scientist, Leidos, re: water quality assessment - 4B grid at Bremerton Naval Base.

London, J. M. (2006). *Harbor seals in Hood Canal: Predators and prey.* (Ph.D. dissertation), University of Washington, Seattle, WA. Retrieved from http://www.sitkawhalefest.org/LondonFinal.pdf

Longenbaugh, M. (2010, June 30). [Matt Longenbaugh, Central Puget Sound Branch Chief, National Marine Fisheries Service]. Personal communication with Bill Kalina, Environmental Site Manager, NAVMAG Indian Island, re: clarification on effect determination for eulachon for Hood Canal and Puget Sound.

Lorenz, T. J., Raphael, M. G., & Bloxton Jr., T. D. (2016). Marine habitat selection by marbled murrelets (*Brachyramphus marmoratus*) during the breeding season. *PLoS One, 11*(9), e0162670.

Love, M. S., Carr, M. H., & Haldorson, L. J. (1991). The ecology of substrate-associated juveniles of the genus *Sebastes*. *Environmental Biology of Fishes, 30*, 225–243.

Lovvorn, J. R., & Baldwin, J. R. (1996). Intertidal and farmland habitats of ducks in the Puget Sound region: A landscape perspective. *Biological Conservation, 77*(1), 97–114.

Madakor, N. (2005, November 21, 2005). [Nnamdi Madakor, Project Manager, Washington State Department of Ecology]. Personal communication (letter) with Said Seddiki, Department of the Navy Naval Facilities Engineering Command Northwest, re: Site 26/Floral Point sediment and clam tissue sampling results.

ManTech, (2010). Naval Station Everett Baseline Noise Assessment. Final Report. Prepared for U.S. Army Space and Missile Defense Command, Missile Defense Agency. August.

Mate, B., Lagerquist, B., & Irvine, L. (2010). *Feeding habitats, migration, and winter reproductive range movements derived from satellite-monitored radio tags on eastern North Pacific gray whales.* (Report SC/62/BRG21 presented to the International Whaling Commission). Marine Mammal Institute, Oregon State University, Hatfield Marine Science Center, Newport, OR.

Merizon et al. 1997. *Seabird Surveys in Puget Sound 1996*. Report to Northwest Indian Fisheries Commission.

Miller, B. S., & Borton, S. F. (1980). *Geographical distribution of Puget Sound fishes: maps and data source sheets* (Vol. 2: Family Percichthyidae (Temperate Basses) through Family Hexagrammidae (greenlings)). Seattle, WA: Fisheries Research Institute, College of Fisheries, University of Washington.

Miller, S. L., Ralph, C. J., Raphael, M. G., Strong, C., Thompson, C. W., Baldwin, J., . . . Falxa, G. A. (2006). At-sea monitoring of marbled murrelet population status trend in the Northwest Forest Plan area. In M. H. Huff, M. G. Raphael, S. L. Miller, S. K. Nelson, & J. Baldwin (Eds.), *Northwest Forest Plan—The first 10 years (1994-2003): Status and trends of populations and nesting habitat for the marbled murrelet. Gen. Tech. Rep. PNW-GTR-650*. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.

MIT Sea Grant. (Undated). Why is eelgrass important? Cambridge, MA: Massachusetts Institute of Technology Sea Grant Program. Retrieved from http://seagrant.mit.edu/eelgrass/eelgrassscience/importance.html. (Accessed October 20, 2015).

Moore, M., Berejikian, B., Goetz, F., Quinn, T., Hodgson, S., Connor, E., & Berger, A. (2014). *Early marine survival of steelhead smolts in Puget Sound*. Paper presented at the 2014 Salish Sea Ecosystem Conference, Seattle, WA. May 1. Retrieved from http://cedar.wwu.edu/cgi/viewcontent.cgi?article=1325&context=ssec.

Moore, M. E., Berejikian, B. A., & Tezak, E. P. (2010a). Early marine survival and behavior of Steelhead smolts through Hood Canal and the Strait of Juan de Fuca. *Transactions of the American Fisheries Society, 139*(1), 49-61.

Moore, M. E., Goetz, F. A., Van Doornik, D. M., Tezak, E. P., Quinn, T. P., Reyes-Tomassini, J. J., & Berejikian, B. A. (2010b). Early marine migration patterns of wild coastal cutthroat trout (*Oncorhynchus clarki clarki*), steelhead trout (*Oncorhynchus mykiss*), and their hybrids. *PLoS One, 5*(9), e12881.

Mumford, T. F. (2007). *Kelp and eelgrass in Puget Sound.* (Puget Sound Nearshore Partnership Report No. 2007-05.). Seattle District, U.S. Army Corps of Engineers, Seattle, WA.

Muto, M. M., Helker, V. T., Angliss, R. P., Allen, B. A., Boveng, P. L., Breiwick, J. M., . . . Zerbini., A. N. (2017). *Alaska marine mammal stock assessments, 2016.* (NOAA Tech. Memo. NMFSAFSC-355). National Marine Mammal Laboratory, Alaska Fisheries Science Center, Seattle, WA. June. http://www.nmfs.noaa.gov/pr/sars/pdf/alaska2016_final__SARS_June.pdf.

Natural Resources Consultants. (2016). *Identifying Rockfish Hot Spot Areas in Puget Sound through a Spatial Analysis of "Grey" Data.* (Prepared for NOAA Protected Resources Division and Northwest Straits Foundation). Seattle, WA. September 30.

Navy (U.S. Department of the Navy). (2002). *Environmental assessment for the ongoing and future operations at U.S. Navy Dabob Bay and Hood Canal military operating areas*. Prepared by EDAW, Inc., Seattle, Washington and Polaris Applied Sciences, Kirkland, Washington. Prepared for: Engineering Field Activity Northwest, Naval Facilities Engineering Command, Poulsbo, Washington.

Navy. (2008). *Environmental Assessment – CVN Maintenance Wharf Puget Sound Naval Shipyard and Intermediate Maintenance Facility. Naval Base Kitsap at Bremerton, WA*. April 2008.

Navy. (2009a). Naval Base Kitsap (NBK) – Bangor Carderock Wave Screen Installation (MILCON P-364) Marbled Murrelet Survey Report, January 16, 2009–January 22, 2009. Department of the Navy, Naval Base Kitsap, Bremerton, WA. April 24, 2009.

Navy. (2009b). NAVSEA NUWC Keyport Range Complex Extension. Environmental Impact Statement/Overseas Environmental Impact Statement. Final. Prepared for Naval Undersea Warfare Center, Keyport.

Navy. (2009c). Manchester Integrated Natural Resource Management Plan. NAVFAC Northwest, Silverdale, WA.

Navy. (2010). Naval Base Kitsap Bangor Airborne noise measurements – October 2010. Silverdale, WA.

Navy. (2012a). Puget Sound Naval Shipyard and Intermediate Maintenance Facility Underwater Survey of Pier 6, Naval Base Kitsap Bremerton (Video). October 2012.

Navy. (2012b). Final Environmental Impact Statement TRIDENT Support Facilities Explosives Handling Wharf (EHW-2). NAVFAC Northwest, Silverdale, WA.

Navy. (2014). Navy Region Northwest 2013–2014 Surf Smelt and Pacific Sand Lance Spawning Inventory. NAVFAC Northwest, Silverdale, WA. August 2014.

Navy. (2015a). Pacific Navy Marine Species Density Database, Revised Final Northwest Training and Testing Technical Report. May 4, 2015. Naval Facilities Engineering Command Pacific, Pearl Harbor, HI.

Navy. (2015b). Naval Station Everett Integrated Natural Resource Management Plan. NAVFAC Northwest, Silverdale, WA.

Navy. (2016a). 2015–2016 Surveys for Spawning Surf Smelt and Pacific Sand Lance at Naval Base Kitsap Bangor, Manchester Fuel Depot, and Naval Magazine Indian Island. NAVFAC Northwest, Silverdale, WA. May 2016.

Navy. (2016b). Pinniped surveys at Naval Base Kitsap Bangor, Naval Base Kitsap Bremerton, Manchester Fuel Department, and Naval Station Everett: summary through June 2016. Naval Facilities Engineering Command Northwest, Silverdale, WA.

Navy. (2016c). *Eelgrass survey report*. (Transit Protection System Project resource survey). Prepared by Grette Associates, Tacoma, WA. Prepared for Naval Base Kitsap, Silverdale, WA.

Navy. (2016d). *2016 Nest monitoring report: Investigating nest occupancy and productivity of bald eagle and osprey nests at Naval Base Kitsap Bangor, Manchester Fuel Department, Naval Undersea Warfare Center Keyport and Naval Base Kitsap Bremerton.* NAVFAC Northwest, Silverdale, WA.

Navy. (2016e). Final Environmental Impact Statement Land-Water Interface and Service Pier Extension at Naval Base Kitsap Bangor, Silverdale, Washington.

Navy. (2016f). Integrated Natural Resources Management Plan Naval Magazine Indian Island. NAVFAC Northwest, Silverdale, WA. 136 pp.

Navy. (2016g). Naval Magazine Indian Island Ammunition Wharf Piling Replacement Marine Mammal Monitoring Report October 5, 2015 – January 4, 2016. Prepared by NAVMAG Indian Island. 7 pp.

Navy. (2018a). 2017–2018 Surveys for Spawning Surf Smelt and Pacific Sand Lance at Naval Base Kitsap Bangor, Manchester Fuel Department and Naval Air Station Whidbey Island, NAVFAC Northwest, Silverdale, WA. December 2018.

Navy. (2018b). *2017 Nest monitoring report: Investigating nest occupancy and productivity of bald eagle and osprey nests at Naval Base Kitsap Bangor, Manchester Fuel Depot, Naval Base Kitsap Keyport, Naval Hospital Bremerton, and Naval Base Kitsap Bremerton.* NAVFAC Northwest, Silverdale, WA. February 2018.

Nelson, S. K., Huff, M. H., Miller, S. L., & Raphael, M. G. (2006). Chapter 2: Marbled murrelet biology: habitat relations and populations. In M. H. Huff, M. G. Raphael, S. L. Miller, S. K. Nelson, & J. Baldwin (Eds.), *Northwest Forest Plan: the first 10 years (1994–2003): status and trends of populations and nesting habitat for the marbled murrelet* (pp. 9–30). Portland, OR: General Technical Report PNW-GTR-650. U.S. Dept. of Agriculture, Forest Service, Pacific Northwest Research Station.

Nightingale, B., & Simenstad, C. A. (2001). *Overwater structures: Marine issues.* Prepared by University of Washington, Wetland Ecosystem Team, School of Aquatic and Fishery Sciences. Prepared for Washington Department of Fish and Wildlife, Washington Department of Ecology, Washington Department of Transportation, Seattle, WA.

NMFS (National Marine Fisheries Service). (1997). *Investigations of scientific information on the impacts of California sea lions and Pacific harbor seals on salmonids and on the coastal ecosystems of Washington, Oregon, and California*. (NOAA Technical Memorandum NMFS-NWFSC-28). U.S. Department of Commerce, Washington, DC.

NMFS. (2005). Endangered and Threatened Species; Designation of Critical Habitat for 12 Evolutionarily Significant Units of West Coast Salmon and Steelhead in Washington, Oregon, and Idaho; Final Rule. Federal Register 70: 52630–52858.

NMFS. (2006a). Endangered and Threatened Wildlife and Plants: Threatened Status for Southern Distinct Population Segment of North American Green Sturgeon; Final Rule. Federal Register 71: 17757–17766.

NMFS. (2006b). Designation of critical habitat for Southern Resident Killer Whales: Biological Report. October 2006. National Marine Fisheries Service, Northwest Region, Seattle, WA.

NMFS. (2007). Endangered and Threatened Species: Final Listing Determination for Puget Sound Steelhead. Federal Register 72:26722–26735.

NMFS. (2008a). Recovery plan for southern resident killer whales (*Orcinus orca*). National Marine Fisheries Service, Northwest Regional Office. Retrieved from http://www.nmfs.noaa.gov/pr/pdfs/recovery/whale_killer.pdf

NMFS. (2008b). Recovery Plan for the Steller Sea Lion (*Eumetopias jubatus*). Revision. National Marine Fisheries Service, Silver Spring, MD.

NMFS. (2009). *Designation of Critical Habitat for the threatened Southern Distinct Population Segment of North American Green Sturgeon: Final Biological Report. National Marine Fisheries Service, Southwest Region Protected Resources Division, Long Beach, CA*. October 2009.

NMFS. (2010a). Endangered and Threatened Wildlife and Plants: Threatened Status for Southern Distinct Population Segment of Eulachon; Final Rule. Federal Register 75: 13012–13024

NMFS. (2010b). Endangered and Threatened Wildlife and Plants: Final Rulemaking to Establish Take Prohibitions for the Threatened Southern Distinct Population Segment of North American Green Sturgeon. Federal Register 75: 30714–30730.

NMFS. (2011a). 5-Year Review: Summary & Evaluation of Puget Sound Chinook, Hood Canal Summer Chum, Puget Sound Steelhead. Northwest Region, Portland, OR.

NMFS. (2011b). Endangered and Threatened Species; Designation of Critical Habitat for the Southern Distinct Population Segment of Eulachon; Final Rule. Federal Register 76: 65324–65352.

NMFS. (2012a). *Memorandum re: Regional and overall trends and trend analysis of the Eastern Distinct Population Segment (DPS) of Steller Sea Lion.* National Marine Fisheries Service Alaska Fisheries Science Center, Juneau, AK. April 10. https://alaskafisheries.noaa.gov/sites/default/files/memo_ssltrends0412.pdf.

NMFS (2012b). Draft status review of the Eastern Distinct Population Segment of Steller sea lion (*Eumetopias jubatus*). Protected Resources Division, Alaska Region, National Marine Fisheries Service, Juneau, AK

NMFS. (2012c). *Letter of Concurrence regarding ESA Section 7 Informal Consultation and MSA EFH Consultation for the Pier 6 Fender System Repairs, Bremerton, Kitsap County, Washington*. National Marine Fisheries Service, Seattle, WA. December 20, 2012.

NMFS. (2014a). Endangered and Threatened Species; Designation of Critical Habitat for the Puget Sound/Georgia Basin Distinct Population Segments of Yelloweye Rockfish, Canary Rockfish, and Bocaccio; Final Rule. Federal Register 79: 68042–68087.

NMFS. (2014b). *Designation of Critical Habitat for the Distinct Population Segments of Yelloweye Rockfish, Canary Rockfish, and Bocaccio: Biological report.* National Marine Fisheries Service West Coast Region, Protected Resources Division. November 2014. http://www.westcoast.fisheries.noaa.gov/publications/protected_species/other/rockfish/rockfish_ch_biological_report.pdf.

NMFS. (2014c.) Eulachon (*Thaleichthys pacificus*). Available at: http://www.nmfs.noaa.gov/pr/species/fish/pacificeulachon.htm. Last updated March 25, 2014; accessed March 2015.

NMFS. (2015). Southern Distinct Population Segment of the North American Green Sturgeon (*Acipenser medirostris*). 5-Year Review: Summary and Evaluation. National Marine Fisheries Service, West Coast Region, Long Beach, CA.

NMFS. (2016a). 2016 5-Year review: Summary and evaluation of Puget Sound Chinook salmon, Hood Canal summer-run chum salmon, Puget Sound steelhead. National Marine Fisheries Service, West Coast Region, Portland, Or.

NMFS. (2016b). Draft Rockfish Recovery Plan. Puget Sound/Georgia Basin, Yelloweye Rockfish (*Sebastes ruberrimus*) and Bocaccio (*Sebastes paucispinis*). Prepared by the Office of Protected Resources, West Coast Regional Office.

NMFS. (2017). Endangered and Threatened Species; Removal of the Puget Sound/Georgia Basin Distinct Population segment of Canary Rockfish from the Federal List of Threatened and Endangered Species and Removal of Designated Critical Habitat, and update and Amend to the Listing Descriptions for Yelloweye Rockfish DPS and Bocaccio DPS. 82 Federal Register 7711–7731.

NOAA (National Oceanic and Atmospheric Administration). (2016). Chart 18458: Hood Canal, South Point to Quatsop Point, including Dabob Bay. Last correction 7/1/2015. National Oceanic and Atmospheric Administration. Retrieved from http://www.charts.noaa.gov/OnLineViewer/18458.shtml. (Accessed January 25, 2016).

Norberg, B. (2012, July 30). Personal communication by telephone between Brent Norberg, National Marine Mammal Laboratory Biologist and Sharon Rainsberry, Biologist Naval Facilities Engineering Command Northwest, Silverdale, WA.

Northwest Fisheries Science Center. (2015). Status review update for Pacific salmon and steelhead listed under the Endangered Species Act: Pacific Northwest. December 21, 2015.

Nysewander, D. R., Evenson, J. R., Murphie, B. L., & Cyra, T. A. (2005). *Report of marine bird and marine mammal component, Puget Sound ambient monitoring program, for July 1992 to December 1999 period*. Prepared by Washington State Department of Fish and Wildlife, Wildlife Management Program. Prepared for Washington State Department of Fish and Wildlife and Puget Sound Action Team, Olympia, WA.

Nysewander, D. (2008). Personal communication (email) between Matt Vasquez, WSDOT biologist and Dave Nysewander, Project Leader, Wildlife Biologist, Marine Bird and Mammal Component, Puget Sound Ambient Monitoring Program. April 9, 2008.

Opperman, H. N., & Washington Ornithological Society. (2003). *A birder's guide to Washington*. Colorado Springs, CO: American Birding Association.

Orca Network. (2016). February 2016. Orca Network Sightings Archives. http://www.orcanetwork.org/Archives/index.php?categories_file=Sightings%20Archives%20Home (Accessed February 15, 2016).

Orca Network. (2017). April 2017. Orca Network Sightings Archives. http://www.orcanetwork.org/Archives/index.php?categories_file=Sightings%20Archives%20Home (Accessed April 17, 2017).

Osmek, S. D., Calambokidis, J., Laake, J., Gearin, P., Delong, R., Scordino, J., . . . Brown, R. F. (1996). *Assessment of the status of harbor porpoise (Phocoena phocoena) in Oregon and Washington Water.* (NOAA Technical Memorandum NMFS-AFSC-76). U. S. Department of Commerce.

Pacunski, Robert. (2017). Personal communication via email between Robert Pacunski, WDFW ROV Operations Manager and Sharon Rainsberry, NAVFAC NW Biologist regarding presence of bocaccio and yelloweye rockfish in Hood Canal and Puget Sound in general. March 17.

Palsson, W. A., Tsou, T. S., Bargmann, G. G., Buckley, R. M., West, J. E., Mills, M. L., . . . Pacunski, R. E. (2009). *The biology and assessment of rockfishes in Puget Sound.* (FPT 09-04). Fish Management Division, Fish Program, Washington Department of Fish and Wildlife, Olympia, WA. September 2009. http://wdfw.wa.gov/publications/00926/wdfw00926.pdf

Parametrix. (1994). *Metro North Beach epibenthic operational monitoring program, 1994 surveys.* Prepared by Parametrix, Inc., Kirkland, WA. Prepared for King County Department of Metropolitan Services, Seattle, WA.

Parametrix. (1999). *St. Paul Waterway area remedial action and habitat restoration project. 1998 monitoring report.* Prepared by Parametrix, Inc., Kirkland, WA. Prepared for Simpson Tacoma Kraft Co., Tacoma, WA.

Pearson, S. F. and Lance, M. M. (2013). Fall-winter 2012/2013 marbled murrelet at-sea densities for four strata associated with U.S. Navy facilities: Annual Research Progress Report. Washington Department of Fish and Wildlife, Wildlife Science Division. Olympia, WA.

Pearson, S. F. and Lance, M. M. (2014). Fall-winter 2013/2014 marbled murrelet at-sea densities for four strata associated with U.S. Navy facilities: Annual Research Progress Report. Washington Department of Fish and Wildlife, Wildlife Science Division. Olympia, WA.

Pearson, S. F. and Lance, M. M. (2015). Fall-spring 2014/2015 marbled murrelet at-sea densities for four strata associated with U.S. Navy facilities: Annual Research Progress Report. Washington Department of Fish and Wildlife, Wildlife Science Division. Olympia, WA.

Pentec. (2003). Final Report. *Marine and terrestrial resources, Security force facility and enclave fencing at Naval Submarine Base Bangor, WA*. Prepared by Pentec Environmental. Prepared for SRI International.

Penttila, D. E. (2007). *Marine forage fishes in Puget Sound.* (Puget Sound Nearshore Partnership Report No. 2007-03). Seattle District, U.S. Army Corps of Engineers, Seattle, WA.

PFMC (Pacific Fishery Management Council). (2005a). *Pacific Coast Groundfish Fishery Management Plan, for the California, Oregon, and Washington Groundfish Fishery*. Appendix B, Part 4 Habitat Suitability Probability Maps for Individual Groundfish Species and Life History Stages.

PFMC. (2005b). *Pacific Coast Groundfish Fishery Management Plan, for the California, Oregon, and Washington Groundfish Fishery*. Appendix B, Part 2 Groundfish Life History Descriptions.

PFMC. (2014). *Appendix A to the Pacific Coast Salmon Fishery Management Plan* as modified by Amendment 18 to the Pacific Coast Salmon Plan. Identification and Description of Essential Fish Habitat, Adverse Impacts, and Recommended Conservation Measures for Salmon. September.

PFMC. (2015). Amendment 19 to the Pacific Coast Salmon Fishery Management Plan. Letter from Will Stelle, National Marine Fisheries Services. Pacific Fishery Management Council Recommendations on Comprehensive Ecosystem Based Amendment 1: Protecting Unfished and Unmanaged Forage Fish Species. December 2015.

PFMC. (2016a). *Coastal Pelagic Species Fishery Management Plan as amended through Amendment 15.* Pacific Fishery Management Council, Portland, OR. February 2016. http://www.pcouncil.org/coastal-pelagic-species/fishery-management-plan-and-amendments/.

PFMC. (2016b). *Pacific Coast Groundfish Fishery Management Plan for the California, Oregon, and Washington Groundfish Fishery, as amended through Amendment 25.* Pacific Fishery Management Council, Portland, OR. March. http://www.pcouncil.org/groundfish/fishery-management-plan/#gfFMPfull.

PFMC. (2016c). *Pacific Coast Salmon Fishery Management Plan as Revised through Amendment 19.* Pacific Fisheries Management Council, Portland, OR. March. http://www.pcouncil.org/wp-content/uploads/2016/03/FMP-through-A-19_Final.pdf.

PFMC. (2016d). *Fishery Management Plan for U.S. West Coast highly migratory species as amended through Amendment 3.* Pacific Fishery Management Council, Portland, OR. March. http://www.pcouncil.org/highly-migratory-species/fishery-management-plan-and-amendments/#hms_fmp.

Phillips, C., Dolan, B., & Hafner, W. (2009). *Water Quality along the Naval Base Kitsap at Bangor shorelines. Phase I survey report for 2005-2006.* Prepared by Science Applications International Corporation, Bothell, WA. Prepared for BAE Systems Applied Technologies, Inc., Rockville, MD.

Pinnell, N., & Sandilands, D. (2004). Humpbacks pay a rare visit to the Strait of Georgia. *Sightings. The Newsletter of the B.C. Cetacean Sightings Network July/August (17),* 5.

Point No Point Treaty Tribes and Washington Department of Fish and Wildlife (PNPTT and WDFW). (2014). Five-year Review of the Summer Chum Conservation Initiative for the Period 2005 through 2013: Supplemental Report No. 8, Summer Chum Salmon Conservation Initiative – An Implementation Plan to Recover Summer Chum in the Hood Canal and Strait of Juan de Fuca Region, September 2014. Wash. Dept. of Fish and Wildlife. Olympia, WA. 237 pp., including Appendices.

Port of Everett. 2006. Jetty Island Management Plan.

Prescott, R. (1982). Harbor seals: Mysterious lords of the winter beach. *Cape Cod Life, 3*(4), 24–29.

Pressey, R. T. (1953). *The sport fishery for salmon on Puget Sound.* (Fisheries Research Papers 1:33–48). Washington Department of Fisheries.

Puget Sound Action Team. (2007). *2007 Puget Sound Update: Ninth report of the Puget Sound assessment and monitoring.* (PSAT 07-02). Office of the Governor, Olympia, WA.

Raphael, M. G., Baldwin, J., Falxa, G. A., Huff, M. H., Lance, M., Miller, S. L., . . . Thompson, C. (2007). *Regional population monitoring of the marbled murrelet: field and analytical methods.* (General Technical Report PNW-GTR-716). U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, Portland, OR.

Raum-Suryan, K. L., & Harvey, J. T. (1998). Distribution, abundance, and habitat use of harbor porpoise (*Phocoena phocoena*) off the northern San Juan Islands, Washington. *Fishery Bulletin, 96*(4), 808–822.

Reef.org. (2015). Recreational Dive Survey logs. Observations from Gedney/Hat Island (Possession Sound, Everett) and Waterman Point (Sinclair Inlet).

Richardson, S. A. (1997). *Washington State status report for the gray whale.* Washington Department of Fish and Wildlife, Olympia, WA.

Robinson, P. W., Costa, D. P., Crocker, D. E., Gallo-Reynoso, J. P., Champagne, C. D., Fowler, M. A., . . . Yoda, K. (2012). Foraging Behavior and Success of a Mesopelagic Predator in the Northeast Pacific Ocean: Insights from a Data-Rich Species, the Northern Elephant Seal. *PLoS One, 7*(5), e36728.

Romberg, P., Homan, C., & Wilson, D. (1995, January 12–14, 1995). *Monitoring at two sediment caps in Elliott Bay.* Paper presented at the Puget Sound Research '95, Bellevue, WA.

Sackett, R. (2010). *Architectural inventory and evaluation of eligibility of buildings within EHW-2 Area of Potential Effect - Naval Base Kitsap Bangor, Washington.* NAVFAC Northwest, Silverdale, WA. November 2010.

Sackett, R. (2012). *Navy's Zelatched Point Facility. DAHP Historic Inventory Report.*

Sackett, R. (2014). *Architectural Survey and Evaluation: Naval Station Everett, United States Navy.* Naval Facilities Engineering Command.

SAIC (Science Application International Corporation). (2001). Biological assessment, Naval Magazine Indian Island ammunition wharf piling replacements, Indian Island, Port Hadlock, Washington. Prepared for Naval Magazine Indian Island, Port Hadlock, Washington.

SAIC. (2006). *Naval Base Kitsap-Bangor fish presence and habitat use. Combined phase I and II field survey report (Draft).* Prepared by Science Applications International Corporation, Bothell, WA. Prepared for BAE Systems Applied Technologies, Inc., Rockville, MD.

SAIC. (2009). Naval Base Kitsap at Bangor comprehensive eelgrass survey field survey report. Prepared by Science Applications International Corp., Bothell, WA. Prepared for BAE Systems Applied Technologies, Inc., Rockville, MD.

SAIC. (2010). *Sediment Characterization Study in Port Gardner and Lower Snohomish Estuary Port Gardner, WA*. Bothell, WA: Science Applications International Corporation.

SAIC. (2011). *Final Summary Report: Environmental Sound Panel for Marbled Murrelet Underwater Noise Injury Threshold. Science Panel convened July 27-29, 2011, attended by representatives of the U.S. Fish and Wildlife Service, National Marine Fisheries Service, U.S. Navy, National Marine Mammal Foundation, and other experts.* Prepared by Science Applications International Corporation, Bothell, WA. Prepared for NAVFAC Northwest, Silverdale, WA. September 7, 2011.

SAIC. (2012). *Final Summary Report: Marbled Murrelet Hydroacoustic Science Panel II*. Panel conducted March 28-30, 2012, attended by representatives of the U.S. Fish and Wildlife Service, U.S. Geological Survey, National Marine Fisheries Service, U.S. Navy, and other experts. Prepared by Bernice Tannenbaum, Science Applications International Corporation, Bothell, WA. Prepared for NAVFAC Northwest, Silverdale, WA. September 4, 2012.

Salo, E. O., Bax, N. J., Prinslow, T. E., Whitmus, C. J., Snyder, B. P., & Simenstad, C. A. (1980). *The effects of construction of Naval facilities on the outmigration of juvenile salmonids from Hood Canal, Washington. Final report*. Prepared by Fisheries Research Institute, College of Fisheries, University of Washington. Prepared for U.S. Navy, OICC Trident, Seattle, WA. April 1980.

Scheffer, V. B., & Slipp, J. W. (1948). The whales and dolphins of Washington State with a key to the cetaceans of the west coast of North America. *American Midland Naturalist, 39*(2), 257–337.

Schneider, D. C., & Payne, P. M. (1983). Factors Affecting Haul-Out of Harbor Seals at a Site in Southeastern Massachusetts. *Journal of Mammalogy, 64*(3), 518–520.

Schreiner, J. U., Salo, E. O., Snyder, B. P., & Simenstad, C. A. (1977). *Salmonid outmigration studies in Hood Canal. Final report, Phase II.* (FRI-UW-7715). Prepared by Fisheries Research Institute, College of Fisheries, University of Washington. Prepared for U.S. Department of the Navy, Seattle, WA.

Scordino, J. (2006). *Steller Sea Lions (Eumetopias jubatus) of Oregon and Northern California: Seasonal Haulout Abundance Patterns, Movements of Marked Juveniles, and Effects of HotIron Branding on Apparent Survival of Pups at Rogue Reef.* (Master of Science), Oregon State University, Corvalis, OR.

Smith, M. R., Mattocks, P. W., & Cassidy, K. M. (1997). Breeding birds of Washington State: location data and predicted distributions (Vol. 4). Washington State Gap Analysis final report. Seattle, WA: Seattle Audubon Society.

Smithsonian Institution. (2008, October 1). Species Name: *Capitella capitata*. Retrieved December 21, 2012, from Smithsonian Marine Station at Fort Pierce: Species Name: *Capitella capitata.*

Smultea, M. A., Lomac-MacNair, K., Campbell, G., Courbis, S., & Jefferson, T. A. (2017). Aerial Surveys of Marine Mammals Conducted in the Inland Puget Sound Waters of Washington, Summer 2013 through Winter 2016. Final Report. Prepared by Smultea Sciences for Commander, U.S. Pacific Fleet and Naval Sea Systems Command. Submitted to Naval Facilities Engineering Command Northwest (NAVFAC NW), Pearl Harbor, Hawaii under Contract No. N62470-15-D-8006 issued to HDR, Inc., San Diego, CA. June.

Snohomish Basin Salmon Recovery Forum. (2005). Snohomish River Basin Salmon Conservation Plan. Snohomish County Department of Public Works, Surface Water Management Division. Everett, WA. June.

Sound Dive Center. (2010). *Manchester Fuel Depot: 2010 Orchard Point Eelgrass Survey.* Sound Dive Center Scientific Research Division, Bremerton, WA. September 2010.

Stern, J. (2005). Personal communication between Dr. Jon Stern (The Northeast Pacific Minke Whale Project, San Rafael, California) and Ms. Dagmar Fertl (Geo-Marine Inc., Plano, Texas) via email 11 November regarding minke whale occurrence in the study area. November 11.

Stewart, B. S., & DeLong, R. L. (1995). Double migrations of the northern elephant seal, *Mirounga angustirostris*. *Journal of Mammalogy, 76*(1), 196-205.

Stewart, B. S., & Huber, H. R. (1993). *Mirounga angustirostris*. *Mammalian Species Archive, 449*, 1–10.

Stick, K. C., & Lindquist, A. (2009). *2008 Washington State herring stock status report.* (Stock Status Report No. FPA 09-05). Washington Department of Fish and Wildlife Fish Program, Fish Management Division, Olympia, WA. November.

Stick, K. C., Lindquist, A., & Lowry, D. (2014). *2012 Washington State herring stock status report.* (Fish Program Technical Report No. FPA 14-01). Washington Department of Fish and Wildlife Fish Program, Fish Management Division, Olympia, WA. July 2014. http://wdfw.wa.gov/publications/01628/wdfw01628.pdf

Strachan, G., McAllister, M., & Ralph, C. J. (1995). Marbled murrelet at-sea and foraging behavior. In C. J. Ralph, G. L. Hunt, M. G. Raphael, & J. F. Piatt (Eds.), *Ecology and conservation of the marbled murrelet* (pp. 247−253). Albany, CA U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station. PSW-GTR-152.

Tannenbaum, B. R., Bhuthimethee, M., Delwiche, L., Vedera, G., & Wallin, J. M. (2009a). *Naval Base Kitsap at Bangor 2008 marine mammal survey report.* Prepared by Science Applications International Corporation, Bothell, WA. Prepared for BAE Systems Applied Technologies, Inc., Rockville, MD. June 24, 2009.

Tannenbaum, B. R., Bhuthimethee, M., Delwiche, L., Vedera, G., & Wallin, J. M. (2009b). *Naval Base Kitsap at Bangor 2008 marine bird survey report.* Prepared by Science Applications International Corporation, Bothell, WA. Prepared for BAE Systems Applied Technologies, Inc., Rockville, MD. June 24, 2009.

Tannenbaum, B. R., Hafner, W., Wallin, J. M., Delwiche, L., & Vedera, G. (2011a). *Naval Base Kitsap at Bangor 2009–2010 marine bird survey report.* Prepared by Science Applications International Corporation, Bothell, WA. Prepared for Naval Facilities Engineering Command Northwest, Naval Base Kitsap at Bangor, Silverdale, WA. December 2011.

Tannenbaum, B. R., Hafner, W., Wallin, J. M., Delwiche, L., & Vedera, G. (2011b). *Naval Base Kitsap at Bangor 2009–2010 marine mammal survey report.* Prepared by Science Applications International Corporation, Bothell, WA. Prepared for Naval Facilities Engineering Command Northwest, Naval Base Kitsap at Bangor, Silverdale, WA. December 2011.

Thompson, J. (2012, August 15). Information about regarding pinniped use of haulouts near NAVSTA Everett, WA. Personal communication by telephone between James Thompson, Environmental Protection Specialist/Natural Resource Manager, NAVSTA Everett, WA, and Andrea Balla-Holden, Marine Mammal and Fisheries Biologist, Naval Facilities Engineering Command, Silverdale, WA.

Unger, S. (1997). *Identification of Orcinus orca by underwater acoustics in Dabob Bay*. Paper presented at the Oceans '97 MTS/IEE, Halifax, Nova Scotia. Marine Technology Society and The Institute of Electrical and Electronics Engineers. October 6–9, 1997.

URS Consultants Inc. (1994). *Final remedial investigation report for the Comprehensive Long-Term Environmental Action Navy (CLEAN) Program, Northwest Area, Remedial investigation for Operable Unit 7*. Prepared by URS Consultants Inc. Prepared for Engineering Field Activity, Northwest, Western Division, Naval Facilities Engineering Command, Silverdale, WA. June 13, 1994.

URS, & SAIC. (1994). *Final Record of Decision for the Comprehensive Long-Term Environmental Action Navy (CLEAN) Northwest Area, Operable Unit 2, Areas 2, 3, 5, 8, and 9*. Naval Undersea Warfare Center Division Keyport Contract Task Order No. 0010. Prepared for USEPA by URS Consultants and Science Applications International Corporation.

URS, & SAIC. (1999). *Sinclair Inlet existing conditions data compilation.* URS Greiner, Inc., Seattle, WA, with Science Applications International Corporation (SAIC), Bothell, WA. January 13, 1999.

URS Consultants, Science Applications International Corporation, & Shannon & Wilson. (1993). *Final Remedial Investigation Report for the Comprehensive Longterm Environmental Action Navy (CLEAN) Northwest Area: Naval Undersea Warfare Center, Division Keyport.* Prepared by URS, SAIC, and Shannon & Wilson. Prepared for Engineering Field Activity, Northwest Western Division, Naval Facilities Engineering Command, Silverdale, WA. October 25, 1993.

USACE (U.S. Army Corps of Engineers). (2012). User's Guide For nationwide Permits in Washington State. Prepared by USACE Seattle District. June 15.

USACE. (2014). *Third Five-Year Review Report Old Navy Dump/Manchester Annex, Manchester, Washington.* Prepared by U.S. Army Corps of Engineers, Seattle District, Seattle, WA. Prepared for U.S. Army Corps of Engineers, Kansas City District, Kansas City, MO. September 2014.

USACE. (2015). Approved work windows for all marine/estuarine areas excluding the mouth of the Columbia River (Baker Bay). July 28. Retrieved from: http://www.nws.usace.army.mil/Portals/27/docs/regulatory/ESA%20forms%20and%20templates/Appendix%20D%20-revised%20Marine%20Fish%20Work%20Windows%207-28-15.pdf

USDI/NPS. (1990). Navy Yard Puget Sound/Bremerton Navy Yard/Puget Sound Naval Shipyard, National Register of Historic Places Registration Form.

USEPA (U.S. Environmental Protection Agency). (2000). Declaration of the Record of Decision: Bremerton Naval Complex Operable Unit B Marine, Bremerton, WA. U.S. Navy CLEAN Contract, Engineering Field Activity, Northwest.

USFWS (U.S. Fish and Wildlife Service). (1997). *Recovery Plan for the Threatened Marbled Murrelet (Brachyramphus marmoratus) in Washington, Oregon, and California. Portland, Oregon*. U.S. Fish and Wildlife Service Region 1, Portland, OR.

USFWS. (1999). Federal Register: Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for the Bull Trout in the Coterminous United States; Final Rule Notice of Intent to Prepare a Proposed Special Rule Pursuant to Section 4(d) of the Endangered Species Act for the Bull Trout; Proposed Rule.

USFWS. (2005). Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Bull Trout; Final Rule. Federal Register 70: 56212–56311.

USFWS. (2009a). *Bull trout proposed critical habitat justification: Rationale for why habitat is essential, and documentation of occupancy.* U.S. Fish and Wildlife Service Idaho Fish and Wildlife Office, Boise, ID, and Pacific Region, Portland, OR. November. http://www.fws.gov/pacific/bulltrout/pdf/Justificationdocfinal.pdf.

USFWS. (2010a). Endangered and Threatened Wildlife and Plants; Revised Designation of Critical Habitat for Bull Trout in the Coterminous United States; Final Rule. Federal Register 75:63898–64070.

USFWS. (2010b). *Biological Opinion for the United States Commander, U.S. Pacific Fleet Northwest Training Range Complex (NWTRC) in the Northern Pacific Coastal Waters off the States of Washington, Oregon and California and activities in Puget Sound and Airspace over the State of Washington, USA*. U.S. Fish and Wildlife Service Washington Fish and Wildlife Office, Lacey, WA.

USFWS. (2011). *Second Explosives Handling Wharf at Naval Base Kitsap Bangor Endangered Species Act Section 7 Formal Consultation – Biological Opinion.* U.S. Fish and Wildlife Service Washington Fish and Wildlife Office, Lacey, WA. November 16, 2011.

USFWS. (2013). *Conducting masking analysis for marbled murrelets & pile driving projects.* (Presentation for WSDOT Biologists and Consultants by Emily Teachout). U.S. Fish and Wildlife Service, Washington Fish and Wildlife Office Transportation Branch, Lacey, WA. November 19, 2013.

USFWS. (2015a). Recovery Plan for the Coterminous United States Population of Bull Trout (*Salvelinus confluentus*). Pacific Region, USFWS Portland, Oregon. September 28, 2015.

USFWS. (2015b.) Coastal Recovery Unit Implementation Plan for Bull Trout (*Salvelinus confluentus*). Prepared by USFWS Washington Fish and Wildlife Office, Lacy, WA and Oregon Fish and Wildlife Office, Portland, OR. September.

Vermeer, K., Sealy, S. G., & Sanger, G. A. (1987). Feeding ecology of Alcidae in the eastern North Pacific Ocean. In J. P. Croxall (Ed.), *Seabirds: Feeding ecology and role in marine ecosystems* (pp. 189–227). Cambridge [Cambridgeshire]; New York: Cambridge University Press.

Wade, P. R., Quinn II, T. J., Barlow, J., Baker, C. S., Burdin, A. M., Calambokidis, J., . . . Yamaguchi, M. (2016). Estimates of abundance and migratory destination for North Pacific humpback whales in both summer feeding areas and winter mating and calving areas. Paper SC/66b/1A/21 presented to the International Whaling Commission Scientific Committee. Available at https://iwc.int/home

Wagoner, L. (2016, January 14). [Linda Wagoner, Environmental Protection Specialist, Naval Station Everett, WA]. Personal communication with Bernice Tannenbaum, Senior Environmental Scientist, Leidos, re: comments on draft Letter of Authorization.

Wahl, T. R., Tweit, B., & Mlodinow, S. G. (2005). *Birds of Washington*. Corvallis: Oregon State University Press.

Ward, B., Slaney, P., Facchin, A., & Land, R. (1989). Size-biased survival in steelhead trout (*Oncorhynchus mykiss*): back-calculated lengths from adults' scales compared to migrating smolts at the Keogh River, British Columbia. *Canadian Journal of Fisheries and Aquatic Sciences, 46*(11), 1853–1858.

Ward, E. J., Marshall, K. N., Ross, T., Sedgley, A., Hass, T., Pearson, S. F., . . . Faucett, R. (2015). Using citizen-science data to identify local hotspots of seabird occurrence. *PeerJ, 3*, e704.

Washington Archaeological Research Center. (1976). "Archaeological Excavations at Site 45JE16, Indian Island, Jefferson County, Washington". Washington State University, Pullman.

Washington Department of Fisheries, Washington Department of Wildlife, & Western Washington Treaty Indian Tribes. (1993). *1992 Washington State salmon and steelhead stock inventory (SASSI).* Washington Department of Fisheries, Olympia, WA.

Washington Marine Spatial Planning. (2018). Marine Life and Habitat Mapping Application. Accessed on December 28, 2018 at http://mapview.msp.wa.gov/default.aspx

Washington State Department of Archaeology and Historic Preservation. (2014). *Letter from Russell Holter, Project Compliance Reviewer, to Jennifer Sullivan, NAVSTA Everett Cultural Resources Manager regarding eligibility of seven properties at Naval Station Everett.* Olympia, WA. June 23, 2014.

Washington State Department of Health. (2015). *Annual Growing Area Review (year ending December 31, 2014): Dabob Bay*. Washington State Department of Health Office of Environmental Health and Safety. Retrieved from http://www.doh.wa.gov/Portals/1/Documents/4400/dabob.pdf. (Accessed November 4, 2015).

Washington State Department of Health. (2016). Commercial and Recreational Shellfish Growing Areas January 1, 2016. Retrieved from http://www.doh.wa.gov/Portals/1/Documents/4400/ai-map.pdf. (accessed May 7, 2016).

Watson, J. W., & Pierce, D. J. (1998). *Migration, diets, and home ranges of bald eagles breeding along Hood Canal and at Indian Island, Washington. Final Report.* Washington State Department of Fish and Wildlife, Olympia, WA.

WDFW (Washington Department of Fish and Wildlife). (2004). *Washington State salmonid stock inventory. Bull trout/Dolly Varden.* Washington Department of Fish and Wildlife, Olympia, WA. http://wdfw.wa.gov/fish/sassi/bulldolly.pdf

WDFW. (2005). *Washington's comprehensive wildlife conservation strategy. Final draft.* Washington Department of Fish and Wildlife, Olympia, WA. September 15, 2005.

WDFW. (2007). *Washington State Status Report for the Bald Eagle.* Washington Department of Fish and Wildlife, Olympia, WA.

WDFW. (2010). *Priority habitats and species data request for the project area at NBK Bangor.* Washington Department of Fish and Wildlife, Priority Habitats and Species, Olympia, WA. May 11, 2010.

WDFW. (2011). *Final Environmental impact statement for the Puget Sound Rockfish Conservation Plan (including preferred range of actions).* G.G. Bargmann, W.A. Palsson, C. Burley, D. Friedel, and T. Tsou, Washington Department of Fish and Wildlife, Olympia, WA. March 2011.

WDFW. (2012). *State of Washington Threatened and Endangered Wildlife: Annual Report 2011.* Washington Department of Fish and Wildlife, Wildlife Diversity Division, Wildlife Program, Olympia, WA.

WDFW. 2015a. Salmonscape. http://apps.wdfw.wa.gov/salmonscape/map.html

WDFW. 2015b. Squid Identification and Information. http://wdfw.wa.gov/fishing/shellfish/squid/.

WDFW. 2017. Priority Habitat and Species Maps. Online interactive mapper. http://apps.wdfw.wa.gov/phsontheweb/. Accessed April 20, 2017.

WDFW. 2018. Priority Habitat and Species Maps. Online interactive mapper. http://apps.wdfw.wa.gov/phsontheweb/. Accessed December 28, 2018.

WDFW and PNPTT. (2000). *Summer chum salmon conservation initiative: An implementation plan to recover summer chum in the Hood Canal and Strait of Juan de Fuca Region*. Report for WDFW and Point-No-Point Treaty Tribes. Washington Department of Fish and Wildlife, Olympia, WA. http://wdfw.wa.gov/fish/chum/chum.htm

WDNR (Washington State Department of Natural Resources). (2006). Washington State shorezone inventory shapefiles (electronic vector data). February 2001. Rev. December 2006. Washington State Department of Natural Resources, Nearshore Habitat Program, Aquatic Resources Division., Olympia, WA.

WDNR. (2015a). *Puget Sound Submerged Vegetation Monitoring Program 2010–2013 Report.* Washington State Department of Natural Resources Nearshore Habitat Program Aquatic Resources Division, Olympia, WA. February 27, 2015. http://www.eopugetsound.org/sites/default/files/DNR_SVMP_2013_03_13.pdf

WDNR. (2015b). Washington marine vegetation atlas. Washington State Department of Natural Resources. Retrieved from http://www.dnr.wa.gov/programs-and-services/aquatics/aquatic-science/washington-marine-vegetation-atlas. (Accessed October 2015).

WDNR. (2018). Washington Marine Vegetation Atlas – view of Keyport area eelgrass. Olympia, WA: WDNR Nearshore Habitat Section. Retrieved from http://mva.apphb.com/index.html#.

WDOE (Washington State Department of Ecology). (undated). Air Quality Maps of Maintenance Areas. Olympia, WA: Washington Department of Ecology. Retrieved from http://www.ecy.wa.gov/programs/air/other/namaps/web_map_intro.htm. (Accessed February 25, 2016).

WDOE. (2001). *Managing Washington's Coast: Washington State's Coastal Zone Management Program*. (Publication 00-06-029). Washington Department of Ecology, Olympia, WA.

WDOE. (2007). *Relationships between benthos, sediment quality, and dissolved oxygen in Hood Canal: Task IV – Hood Canal Dissolved Oxygen Program*. (Publication No. 07-03-040). Washington State Department of Ecology, Environmental Assessment Program, Olympia, WA. http://www.ecy.wa.gov/apps/eap/marinewq/mwdataset.asp

WDOE. (2009). *Sediment Characterization Study in Port Gardner and Lower Snohomish Estuary Port Gardner, WA. Final Data Report.* Prepared by Science Applications International Corporation (SAIC), Bothell, WA. Prepared for Washington State Department of Ecology, Lacey, WA. July 10, 2009.

WDOE. (2016). Washington State's Current Water Quality Assessment; approved by USEPA on July 22nd, 2016. Retrieved from http://www.ecy.wa.gov/programs/wq/303d/currentassessmt.html.

WDOE. (2017a). Washington State's Current Water Quality Assessment maps for segments in the MPR project areas. Retrieved from https://fortress.wa.gov/ecy/wqamapviewer/map.aspx. (Accessed April 12, 2017).

WDOE. (2017b). State of Washington Coastal Zone Management Act Consistency Determinations in response to Department of the Army, Corps of Engineers "Notice of Reissuance of Nationwide Permits," published in the Federal Register January 6, 2017. March 20, 2017.

WDOE. (2019). Washington State Coastal Atlas map for distribution of eelgrass and kelp. Retreived from https://fortress.wa.gov/ecy/coastalatlas/tools/Map.aspx

Weinheimer, J. (2013). *Mid-Hood Canal juvenile salmonid evaluation: Duckabush and Hamma Hamma 2012.* (FPA 13-04). Washington Department of Fish and Wildlife, Fish Program, Science Division, Wild Salmon Production/Evaluation, Olympia, WA. August 2013. http://wdfw.wa.gov/publications/01536/wdfw01536.pdf.

Weinheimer, J. (2015). Mid-Hood Canal Juvenile Salmonid Evaluation: Duckabush River 2014. Washington Department of Fish and Wildlife, Fish Program Science. June 2015.

Weitkamp, L. A. (1994). *Environmental monitoring of the Manchester Naval Fuel pier replacement, Puget Sound, Washington, 1993*. Report of the National Marine Fisheries Services to the U.S. Naval Facilities Engineering Command, Western Division.

Weitkamp, L. A., Wissmar, R. C., Simenstad, C. A., Fresh, K. L., & Odell, J. G. (1992). Gray whale foraging on ghost shrimp (*Callianassa californiensis*) in littoral sand flats of Puget Sound, USA. *Canadian Journal of Zoology, 70*(11), 2275–2280.

Weller, D. W., Bettridge, S., Brownell Jr., R. L., Laake, J. L., Moore, J. E., Rosel, P. E., . . . Wade, P. R. (2013). *Report of the National Marine Fisheries Service Gray Whale Stock Identification Workshop.* (NOAA Technical Memorandum NMFS-SWFSC-507). Southwest Fisheries Science Center, La Jolla, CA. March 2013.

Weston. (2006). *Benthic community assessment in the vicinity of the Bangor Naval Facility, Hood Canal. Draft report. June 2006.* Prepared by Weston Solutions, Inc., Port Gamble, WA. Prepared for Science Applications International Corporation, Bothell, WA.

Whatcom County Marine Resources Committee. (2005). *Sargassum (Sargassum muticum).* (Marine life in Whatcom County: vegetation series). March 2005. http://www.whatcom-mrc.wsu.edu/Fact_Sheets/Sargassum.pdf

Wiles, G. J. (2004). *Washington State status report for the killer whale.* Washington Department Fish and Wildlife, Olympia, WA.

Williams, G. D., Thom, R. M., Starkes, J. E., Brennan, J. S., Houghton, J. P., Woodruff, D., . . . Blackmore, L. (2001). *Reconnaissance Assessment of the State of the Nearshore Ecosystem: Eastern Shore of Central Puget Sound, Including Vashon and Maury Islands (WRIA's 8 and 9)*. J.S. Brennan, ed. Report prepared for King County Department of Natural Resources, Seattle, WA. http://www.kingcounty.gov/environment/watersheds/central-puget-sound/nearshore-environments/reconnaissance-assessment.aspx

Wilson, S. C. (1978). *Social organization and behavior of harbor seals, Phoca vitulina concolor, in Maine.* (MMC-76/10). Prepared by Office of Zoological Research, National Zoological Park, Smithsonian Institution, Washington, DC. Prepared for U.S. Marine Mammal Commission, Washington, DC. Submitted October 1977, Published April 1978.

Womble, J. N., & Gende, S. M. (2013). Post-breeding season migrations of a top predator, the harbor seal (Phoca vitulina richardii), from a marine protected area in Alaska. *PLoS One, 8*(2), e55386.

Wright, B. E., Brown, R. F., & Tennis, M. J. (2010). Movements of male California sea lions captured in the Columbia River. *Northwest Science, 84*(1), 60–72.

WSDOT (Washington State Department of Transportation). (2014). *Final Environmental Assessment – Issuance of an Incidental Harassment Authorization to the Washington State Department of Transportation to Take Marine Mammals by Harassment Incidental to Wingwalls Replacement Project at Bremerton Ferry Terminal, Washington, in 2014*. Submitted to National Marine Fisheries Service, Office of Protected Resources. Olympia, WA. February.

WSDOT. (2018). *Biological Assessment Preparation for Transportation Projects – Advanced Training Manual.* (Version 2018). Washington State Department of Transportation, Olympia, WA. January 2018. http://www.wsdot.wa.gov/Environment/Biology/BA/BAguidance.htm#Manual

Wydoski, R. S., & Whitney, R. R. (2003). *Inland fishes of Washington*: American Fisheries Society.

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APPENDIX A

PLANNED PILE REPLACEMENT AND CONTINGENCY PILE ESTIMATES

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Table A-1. Planned Pile Replacement and Contingency Pile Estimates

Project	Piles by Construction Year[1]					Pile Extraction				Pile Installation			
	1	2	3	4	5	Pile Type	Size (in)	Qty	Method	Pile Type	Size (in)	Qty	Method
NBK Bangor													
Contingency	75					Steel Timber Concrete	Up to 36	75	Vibratory or cut at mudline	Steel Concrete	Up to 36	75	Impact or vibratory
EHW-1	12	8	8	8	8	Steel Timber Concrete	Up to 36	44	Vibratory or cut at mudline	Steel Concrete	Up to 36	44	Impact or vibratory
Zelatched Point													
Contingency	20					Timber	12	20	Vibratory or cut at mudline	Steel Timber Concrete	Up to 36	20	Impact or vibratory
NBK Bremerton													
Contingency	75					Steel Timber	Up to 24 Up to 14	75	Vibratory/ choke & pull	Concrete	Up to 24	75	Impact
RM021-05 Replace Fender Pile Pier 5	-	360	-	-	-	Timber	Up to 14	360	Vibratory/ choke & pull	Concrete	Up to 24	360	Impact
RM1114785 Piers 5, 6, 7, Mooring A & Dry Dock 5	-	-	-	-	20	Timber	Various	20	Vibratory/ choke & pull	Sheet steel	Various	20	Vibratory
Pier 4, Replace Fender Piles	-	80	-	-	-	Timber	Up to 14	80	Vibratory/ choke & pull	Steel	Up to 14	80	Vibratory

Table A-1. Planned Pile Replacement and Contingency Pile Estimates

Project	Piles by Construction Year[1]					Pile Extraction				Pile Installation			
	1	2	3	4	5	Pile Type	Size (in)	Qty	Method	Pile Type	Size (in)	Qty	Method
NBK Keyport													
Contingency	4	4	4	4	4	Concrete Steel	Up to 18	20	Vibratory	Steel	Up to 36	20	Impact or vibratory
NBK Manchester													
Contingency	50					Timber Plastic	Up to 18	50	Vibratory/ choke & pull	Timber Plastic Concrete	Up to 18 Up to 24	50	Impact
NAVSTA Everett													
Contingency	76					Steel Timber	Various	1 75	Vibratory/ choke & pull	Steel Concrete Timber	36 Up to 24	1 75	Impact or vibratory
RM10-7403 North Wharf Repairs	-	-	2	-	-	Concrete	-	2	TBD	Concrete	-	2	Impact
NAVMAG Indian Island													
Ammunition Wharf	9	0				Concrete	24	9	Cutting/Chipping	Concrete	24	9	Jetting or impact

[1] Pile construction is anticipated in these years but potentially could be moved to a different year.

APPENDIX B

NOISE IMPACTS ANALYSIS METHODS

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1 Introduction

Bioacoustics, or the study of how sound affects living organisms, is a complex interdisciplinary field that includes the physics of sound production and propagation, the source characteristics of sounds, and the perceptual capabilities of receivers. This appendix is intended to introduce the reader to the basics of sound measurements and sound propagation and describe the methods used to analyze potential noise impacts to marine fish, marine birds, and marine mammals. Analysis methods and impacts related to human receptors are discussed in the Environmental Assessment (EA).

Sound may be purposely created to convey information, communicate, or obtain information about the environment. Examples of such sounds are vocalizations, echolocation, and tones used in hearing experiments. Noise is undesired sound (Acoustical Society of America, 1994). Whether a sound is noise depends on the receiver (i.e., the animal or system that detects the sound). For example, sonar pings used to locate a submarine are useful sounds to sailors engaged in anti-submarine warfare, but may be considered undesirable noise by marine mammals. Noise also refers to sound sources that may interfere with detection of a desired sound; the combination of all of the sounds at a particular location is referred to as ambient noise.

Sound is a physical phenomenon consisting of minute vibrations that travel through a medium, such as water. Sound is generally characterized by several factors, including frequency and intensity. Frequency describes the sound's pitch and is measured in hertz (Hz), while intensity describes the sound's loudness. Due to the wide range of pressure and intensity encountered during measurements of sound, a logarithmic scale is used. In acoustics, the word "level" denotes a sound measurement in decibels. A decibel (dB) expresses the logarithmic strength of a signal relative to a reference. Because the decibel is a logarithmic measure, each increase of 20 dB reflects a ten-fold increase in signal amplitude (whether expressed in terms of pressure or particle motion), i.e., 20 dB means ten times the amplitude, 40 dB means one hundred times the amplitude, 60 dB means one thousand times the amplitude, and so on. Because the decibel is a relative measure, any value expressed in decibels is meaningless without an accompanying reference.

The sound levels in this document are given as sound pressure level (SPL). When describing underwater sound pressure, the standard reference value is 1 microPascal (µPa, or 10^{-6} Pascals), and is expressed as "dB re 1 µ Pa." For in-air sound pressure, the standard reference value is 20 µPa and is expressed as "dB re 20 µPa." Sound levels measured in air and water are not directly comparable, and it is thus important to note which reference value is associated with a given sound level.

Table B-1 summarizes common acoustic terminology. Two common descriptors are the instantaneous peak SPL and the root mean square (RMS) SPL (dB RMS) during the pulse or over a defined averaging period. The peak pressure is the instantaneous maximum or minimum overpressure observed during each pulse or sound event and is presented in Pascals (Pa) or dB referenced to a pressure of 1 microPascal (dB re 1 µPa) for underwater sound. The RMS level is the square root of the energy divided by a defined time period.

Table B-1. Definitions of Common Acoustical Terms

Term	*Definition*
Decibel (dB)	A unit describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure. The reference pressure for water is 1 microPascal (µPa) and for air is 20 µPa (approximate threshold of human audibility).
Sound Pressure Level (SPL)	Sound pressure is the force per unit area, usually expressed in microPascals (or 20 micro Newtons per square meter), where 1 Pascal is the pressure resulting from a force of 1 Newton exerted over an area of 1 square meter. The sound pressure level is expressed in decibels as 20 times the logarithm to the base 10 of the ratio between the pressure exerted by the sound to a reference sound pressure. Sound pressure level is the quantity that is directly measured by a sound level meter.
Frequency (Hz)	Frequency is expressed in terms of oscillations, or cycles, per second. Cycles per second are commonly referred to as hertz (Hz). Typical human hearing ranges from 20 Hz to 20,000 Hz.
Peak Sound Pressure (unweighted), dB re 1 µPa	Peak sound pressure level is based on the largest absolute value of the instantaneous sound pressure over the frequency range from 20 Hz to 20,000 Hz. This pressure is expressed in this application as dB re 1 µPa.
Root-Mean-Square (RMS), dB re 1 µPa	The RMS level is the square root of the energy divided by a defined time period. For pulses, the RMS has been defined as the average of the squared pressures over the time that comprise that portion of waveform containing 90 percent of the sound energy for one impact pile driving impulse.
Sound Exposure Level (SEL), dB re 1 $\mu Pa^2 \bullet sec$	The amount, e.g., "dose" of acoustic energy normalized to a one-second time interval. SEL is computed as the cumulative sum of sound pressure squared normalized to a one-second duration. All single strike SEL energy in a workday is summed to calculate the cumulative SEL.
Waveforms, µPa over time	A graphical plot illustrating the time history of positive and negative sound pressure of individual pile strikes shown as a plot of µPa over time (i.e., seconds).
A-Weighting Sound Level (dBA)	The sound pressure level in decibels as measured on a sound level meter using the A- or C-weighting filter network. The A-weighting filter de-emphasizes the low and high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective human reactions to noise.
Ambient Noise Level	The background sound level, which is a composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.

1.1 Ambient Underwater Sound

Ambient underwater sound is a composite of sounds from multiple sources, including environmental events, biological sources, and anthropogenic activities. Physical noise sources include waves at the surface, precipitation, earthquakes, ice, and atmospheric noise, among other events. Biological sources include marine mammals, fish, and invertebrates. Anthropogenic sounds are produced by vessels (small and large), dredging, aircraft overflights, construction activities, geophysical explorations, commercial and military sonars, and other activities. Known noise levels and frequency ranges associated with anthropogenic sources similar to those that will be used for this project are summarized in Table B-2.

Baseline underwater noise levels were measured during a 30-day period along the developed portion of the Bangor waterfront (Slater, 2009), and at a test pile site in 2011 (Illingworth & Rodkin, 2012). The primary source of noise was due to industrial activity along the waterfront, small boat traffic, and wind-driven wave noise. For the purposes of noise analyses for projects at Naval Base (NAVBASE) Kitsap Bangor, the average background underwater noise level was considered to be 114 dB RMS re 1 µPa between 100 kHz and 20 kHz. No on-site underwater sound measurements are available for the NAVBASE Kitsap Bremerton, Keyport, Manchester, Zelatched Point, NAVMAG Indian Island, or NAVSTA Everett. This analysis uses data from NAVBASE Kitsap Bangor to estimate ambient sound levels at a broad scale for all of the Marine Structure Maintenance and Pile Replacement (MPR) activities locations.

Table B-2. Representative Underwater Noise Levels of Anthropogenic Sources

Noise Source	*Source Level*	*Frequency Range*	*Reference*
Dredging	161 – 186 dB RMS re: 1 µPa at 1 meter	1 – 500 Hz	Richardson et al., 1995; DEFRA, 2003; Götz et al., 2009; Reine et al., 2014
Wind Turbine	100 – 120 dB RMS re: 1 µPa at 100 meters	30 – 200 Hz	Betke, 2006; Nedwell et al., 2007
Small Vessel	141 – 175 dB RMS re: 1 µPa at 1 meter	860 – 8,000 Hz	Galli et al., 2003; Matzner & Jones, 2011; Sebastianutto et al., 2011
Large Ship	176 – 186 dB re: 1 μPa^2sec SEL at 1 meter	20 – 1,000 Hz	McKenna, 2011
Tug docking gravel barge	149 dB re: 1 µPa at 100 meters	200 – 1,000 Hz	Blackwell & Greene, 2002

Key: dB = decibels; Hz = Hertz; µPa = microPascal; re = referenced to; RMS = root mean square; sec = second; SEL = sound exposure level

1.2 Impulsive and Non-Impulsive Sound

Among various underwater sound sources at MPR activities locations, in-water construction using impact and vibratory pile drivers will generally produce the highest sound levels. The sounds produced by pile driving activities fall into two sound types: impulsive and non-impulsive (defined below). Impact pile driving produces impulsive sounds, while vibratory pile driving produces non-impulsive sounds. The distinction between these two general sound types is important because they have differing potential to cause physical effects on receptors such as marine fish, birds, and mammals, particularly with regard to hearing (Ward, 1997; SAIC, 2011; Popper et al., 2014).

Impulsive sounds (e.g., explosions, seismic airgun pulses, and impact pile driving), which are referred to as pulsed sounds in Southall et al. (2007), are brief, broadband, atonal transients (Harris, 1998) and occur either as isolated events or repeated in some succession (Southall et al., 2007). Impulsive sounds are characterized by a relatively rapid rise from ambient pressure to a maximal pressure value followed by a decay period that may include a period of diminishing, oscillating maximal and minimal pressures (Southall et al., 2007). Impulsive sounds generally have a greater capacity to induce physical injury compared with sounds that lack these features (Southall et al., 2007).

Non-impulsive sounds (referred to as non-pulsed in Southall et al., [2007]) can be tonal, broadband, or both. They lack the rapid rise time and can have longer durations than impulsive sounds. Non-impulsive sounds can be either intermittent or continuous. Examples of non-impulsive sounds include vessel and aircraft engines, and machinery operations such as drilling, dredging, and vibratory pile driving (Southall et al., 2007). In some environments, the duration of both impulsive and non-impulsive sounds can be extended due to reverberations.

1.3 Ambient Airborne Sound

Airborne sound at the MPR activities locations is produced by common industrial equipment, including trucks, cranes, compressors, generators, pumps, and other equipment that might typically be employed along industrial waterfronts; and small boat noise. Airborne sound is produced by many natural sources such as wind-driven wave noise, precipitation, and sea lions present at some of the locations. Sound levels are highly variable based on the types and operational states of equipment at the recording location, and sound levels may even vary within a single location, with some piers/wharfs very loud and others relatively quiet.

Airborne sounds are commonly referenced to human hearing using a method that weights sound frequencies according to measures of human perception, de-emphasizing very low and very high frequencies that are not perceived well by humans. This is called A-weighting, and the decibel level measured is called the A-weighted sound level (dBA).

Airborne sound measurements were taken at the waterfront industrial area at NAVBASE Kitsap Bangor (Navy, 2010; Illingworth & Rodkin, 2012) and at NAVBASE Kitsap Bremerton (Navy, 2016a). No on-site airborne sound measurements are available for the NAVBASE Kitsap, Keyport, Manchester, Zelatched Point, NAVMAG Indian Island, or NAVSTA Everett. This analysis uses data from NAVBASE Kitsap Bangor and Bremerton to estimate ambient sound levels at a broad scale for all of the MPR activities locations.

1.4 Construction-Related Airborne Sound

MPR activities will generate elevated airborne sound, with the greatest levels produced during the pile driver operation (Washington State Department of Transportation [WSDOT], 2018). EA Section 3.1.2 discusses A-weighted noise levels of anticipated construction equipment, which are used in the analysis of impacts of human receptors. This analysis of noise impacts on marine mammals, however, uses unweighted airborne noise levels from impact driving because of current threshold criteria (see Section 2.5.1)

2 Analysis of MPR Activities Noise Impacts

MPR activities will result in temporarily elevated underwater and airborne noise levels. Noise will be generated from support vessels, small boat traffic, and barge-mounted equipment, such as generators, and pile extraction and installation. Noise levels from all MPR activities except pile driving will typically not exceed ambient sound levels resulting from routine waterfront operations in the vicinity of any of the structures. The most significant project-related noise source would be impact pile driving of piles, particularly impact driving of steel piles (WSDOT, 2018).

The analysis of MPR activities noise impacts requires consideration of noise levels resulting from pile driving, the duration of pile driving, noise-level thresholds for acoustic effects on fish, marine birds, and marine mammals, and estimation of the extent of elevated noise levels above these thresholds.

2.1 Proxy Source Levels for Pile Driving

2.1.1 Underwater Source Levels

Underwater pile driving noise source levels were chosen from recommendations developed by the Navy for Navy waterfront projects located in Puget Sound (Navy, 2015a, *Proxy Source Sound Levels and Potential Bubble Curtain Attenuation for Acoustic Modeling of Nearshore Marine Pile Driving at Navy Installations in Puget Sound*), and other sources. Values used in the analysis are shown in Table B-3.

Table B-3. Underwater Sound Source Levels for Driving of HDPE Plastic, Timber, Concrete, Steel Pipe, and Steel Sheet Piles

Pile Driving Method	*Pile Type*	*Pile Size (inches)*	*RMS[2] (dB re 1 µPa))*	*PEAK[2] (dB re 1 µPa)*	*SEL[2] (dB re 1 µPa^2•sec)*
Impact Installation[1]	*HDPE plastic*	13	156	N/A	N/A
	Timber	12 and 14	170	N/A	N/A
	Concrete pile	18	170	184	159
		24	178	189	166
	Steel pipe	12 and 13[3]	177	192	167
		14	184	200	174
		24	193	210	181
		30	195	216	186
		36	192 (all other installations) 194 (Bangor only)	211	184 (all other installations) 181 (Bangor only)
Vibratory Installation and Extraction	*Steel pipe*	13 and 14[4]	155	N/A	N/A
		16 and 24	161	N/A	N/A
		30 and 36	166 (Bangor only) 167 (all other locations)	N/A	N/A
	Steel sheet	N/A	163	N/A	N/A
	Timber	12	153[5]	N/A	N/A

Table B-3. Estimated Underwater Sound Source Levels for Driving of HDPE Plastic, Timber, Concrete, Steel Pipe, and Steel Sheet Piles (continued)

Source: Navy, 2015a except HDPE from Illingworth & Rodkin, 2008, and 12-in, 13-in, and 14-in steel impact sound levels from ICF Jones & Stokes and Illingworth & Rodkin, 2012, and 24-in concrete from Navy, 2016a. Timber extraction levels from Navy, 2015a and Navy, 2016a.

Key:dB re 1 µPa = decibels referenced at 1 microPascal; HDPE = high density polyethylene; in = inch; m = meter; N/A = not applicable; RMS = root mean square; SEL = sound exposure level

Notes:

1. Values for impact driving steel piles will be reduced by 8 dB for modeling to account for attenuation from a bubble curtain, except at NAVBASE Kitsap Bremerton where no bubble curtain will be used.
2. SPLs are presented for a distance of 10 m from the pile. RMS and Peak levels are relative to 1 µPa and cumulative SEL levels are relative to 1 $\mu Pa^2 \bullet sec$.
3. No data available for impact driving of 13-in steel pile. Assumes 12-in source level is similar.
4. Insufficient data for vibratory driving of 14-in steel pile. Assumes 13-in source level is similar.
5. Vibratory extraction source level assumed to be the same as vibratory installation source level.

2.1.2 Airborne Source Levels

Unweighted airborne impact and vibratory pile driving source levels are reviewed in Navy (2015a). Recommended unweighted airborne source level values used in this analysis are presented in Table B-4. Available data were limited to concrete and steel pile installation. The level of airborne noise from impact or vibratory pile driving of other pile types is anticipated to be quieter than the levels presented in Table B-4.

Table B-4. Airborne Sound Levels for Concrete and Steel Pipe and Steel Sheet Piles

		Installation Method	
Pile Type	*Size (diameter in inches)*	*Impact RMS L_{max}*	*Vibratory RMS L_{eq}*
Concrete	24	109	N/A
Steel Pipe	18	110[1]	88
	24	110[2]	92[2]
	30	112[1]	95
	36	112	95
Steel Sheet	N/A	N/A	92[3]

Source: Navy, 2015a, 2016a

Key:in = inch; L_{eq} = equivalent sound level; L_{max} = maximum sound level; m = meter; µPa = microPascal;
N/A = not applicable; RMS = root mean square

Notes: All values relative to 20 µPa and at 15 m (50 ft) from pile. All values unweighted.

1. Data not available for this pile size. Source level assumed to be equivalent to next larger size pile.
2. Limited data set.
3. Data not available. Source level assumed to be equivalent to 24-in steel pile.

2.2 Underwater Sound Propagation

Modeling sound propagation is useful in evaluating noise levels to determine distance from the pile driving activity that certain sound levels may travel. The decrease in acoustic intensity as a sound wave propagates outward from a source is known as transmission loss (TL). TL underwater is the decrease in acoustic intensity as an acoustic pressure wave propagates out from a source until the source becomes indistinguishable from ambient sound. Transmission loss parameters vary with frequency, temperature, sea conditions, current, source and receiver depth, water depth, water chemistry, and bottom composition and topography. A standard sound propagation model was used to estimate the range from pile driving activity to various expected sound pressure levels at potential project structures. This model follows a geometric propagation loss based on the distance from the driven pile, resulting in a 4.5 dB reduction in level for each doubling of distance from the source. In this model, the sound pressure level at some distance away from the source (e.g., driven pile) is governed by a measured source level, minus the transmission loss of the energy as it dissipates with distance. The transmission loss equation is:

$$TL = 15 \log_{10}\left(\frac{R_1}{R_2}\right)$$

where

TL is the transmission loss in dB,

R_1 is the distance of the modeled sound pressure level (SPL) from the driven pile, and

R_2 is the distance from the driven pile of the initial measurement.

A bubble curtain[1] will be used to minimize the noise generated by driving steel pipe piles, except at NAVBASE Kitsap Bremerton and NAVBASE Kitsap Keyport. The bubble curtain is expected to attenuate impact pile driving sound levels an average of 8 dB; therefore, 8 dB was subtracted from the peak, SEL, and RMS values in Table B-3 prior to modeling the injury and behavioral thresholds for fish for impact pile driving steel pipe piles, and for injury thresholds for marbled murrelets for impact pile driving. Marine mammal injury thresholds were modeled differently, as discussed in detail in Section 2.7.5. If a new method of sound attenuation is developed that has demonstrated an average of at least 8 dB of attenuation, then this method could be employed instead of a bubble curtain for driving steel pile.

Because impact driving of concrete, plastic high density polyethylene (HDPE), and timber piles has a less impulsive waveform, lower SPLs, and lower sound exposure levels than impact driving steel piles, bubble curtains are not proposed for concrete, HDPE plastic, or timber piles and are not required as an additional measure to reduce noise impacts to Endangered Species Act (ESA)-listed species, including ESA-listed marine mammals. Additionally, vibratory pile driving sound levels can be 20 to 30 or more decibels lower than impact driving sound levels and do not produce high peak amplitudes with fast rise times typical of steel pile driving. Therefore, bubble curtains are not used for vibratory pile driving.

[1] Bubble curtains emit a series of bubbles around a pile to introduce a high-impedance boundary through which pile driving noise is attenuated and can be unconfined or confined. A confined bubble curtain uses a flexible or rigid shroud around the bubble curtain to hold air bubbles near the pile. Confined bubble curtains are only implemented when water velocities are greater than 1.6 ft per sec (NMFS, 2011).

The degree to which underwater noise propagates away from a noise source is dependent on a variety of factors, most notably by the water bathymetry and presence or absence of reflective or absorptive conditions including the sea surface and sediment type. The transmission loss model described above was used to calculate the expected noise propagation from both impact and vibratory pile driving, using representative source levels to estimate the zone of influence (ZOI) or area exceeding the noise criteria. The estimated effects ranges for fish, marine mammals, and marine birds are provided in the following sections and depicted for each MPR location in the location-specific chapters of the EA. The noise-affected areas are assumed to take a circular shape around the notional pile being driven, but land features (e.g., shorelines) may result in some areas being "clipped" as sounds will attenuate as they encounter land or other solid obstacles. As a result, the ranges calculated by the model may not actually be attained.

2.3 Airborne Sound Propagation

Airborne noise behaves as point-source and therefore propagates in a spherical manner with a 6 dB decrease in sound pressure level over water ("hard-site" condition) per doubling of distance (WSDOT, 2018). A spherical spreading loss model, assuming average atmospheric conditions, was used to estimate the distance to the 100 dB and 90 dB RMS re 20 µPa (unweighted) airborne thresholds. The transmission loss equation is:

$$TL = 20\log_{10}\left(\frac{R_1}{R_2}\right)$$

where

TL is the transmission loss in dB,

R_1 is the distance of the modeled SPL from the driven pile, and

R_2 is the distance from the driven pile of the initial measurement.

2.4 Pile Driving Duration

Each project's pile driving duration will vary by the size and complexity of the project, the types of piles installed, and the need to move barges or equipment. For example, a project that requires structural pile repairs beneath an existing structure at multiple locations would be expected to conduct pile driving much slower than a fender pile replacement where all piles are located on the exterior of a structure, are not load bearing, and are lined up in a row. For many projects the design details are not known; thus, it is not possible to state the number of pile driving days that will be required. Table B-5 is a conservative estimate of pile driving days at each location over the 5-year duration of MPR activities based on the assumption that pile driving rates would be relatively slow. Actual daily production rates may be higher, resulting in fewer actual pile driving days. Pile driving days in Table B-5 include both extraction of existing piles and installation of new piles.

Table B-5. Pile Driving Days at MPR Locations Over 5 Years of Activities

Location	*Bangor*	*Zelatched Point*	*Bremerton*	*Keyport*	*Manchester*	*Indian Island*	*Everett*
Total Pile Driving Days	119	20	168	20	50	4 to 8	78

To provide a general estimate of daily steel pile impact driving durations, Navy geotechnical and engineering staff used information from past projects using diesel hammers to estimate pile time and strikes needed to install steel piles. The estimated duration of impact and vibratory pile installation is summarized in Table B-6. Based on data from a large wharf construction project in Hood Canal, vibratory installation was estimated to take a median time of 10 minutes per pile with 45 minutes estimated as a maximum.[2] For steel piles that are "proofed" a median of 14 minutes per pile (approximately 600 strikes) was estimated.[3] However, not all projects will require proofing every pile. Some projects will require only a subset of piles be proofed and some projects, such as those installing fender piles, may not require any proofing because the structure is not load bearing. Other piles may encounter difficult substrate and need to be advanced further with an impact driver. For piles that cannot be advanced with a vibratory driver, less than 30 minutes of impact driving (approximately 1,300 strikes) was conservatively estimated to complete installation.[4] Based on these estimates, no more than 4,000 strikes are estimated to occur on any one day. This estimate would account for (approximately 6 steel piles installed with a median time of 14 minutes per pile [~1.5 hours of drive time] or 3 steel piles needing extended driving. Actual driving duration at any of the project sites will vary due to substrate conditions and the type and energy of impact hammers. For example, at the Explosives Handling Wharf #1 (EHW-1) at NAVBASE Kitsap Bangor, where most of the steel pile work will occur, four piles were installed with a vibratory driver and impact proofing in 61 minutes total (vibratory and impact driving) with an average of 172 strikes / pile.[5] Therefore, we believe the information in Table B-6 is conservative for this location.

Estimates of concrete pile impact driving durations are based on Pier B and Pier 6 data at NAVBASE Kitsap Bremerton for the installation of fender piles. Drive time durations from Pier B were estimated based on pile driving logs from installation of 18-in square, 20-in square, and 24-in octagonal piles. At Pier B, a maximum of 11 piles were installed per day (average 6.3 piles/day) with a maximum drive time per day of 3 hours and 38 minutes (average 89 minutes/day). For this analysis we estimated that the maximum number of piles installed per day would be up to 11 with a drive time of up to 4 hours per day. Strikes per piles were calculated at 544 based on Pier B data where the average impact time per pile was 14.2 minutes and the average strike rate was 38.5 strikes/minute (14.2 minutes/pile × 38.3 strikes/minute = 547 strikes/pile). Only strike numbers were available from 10 concrete piles at Pier 6. Strike numbers were considerably less than at Pier B and only ranged from 10 to 218 per pile with an average of 125 strikes per pile. Therefore, the numbers presented in Table B-6 will likely overestimate strike numbers for some projects. Because substrate conditions vary at each project site and the type and energy of impact hammers will likely vary, the strike number and strike rate estimates will vary between project sites. For purposes of analysis, impact pile driving of concrete piles is estimated to take a maximum of 4 hours or an average of 1.5 hours in a day.

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[2] Based on data from 809 piles installed with a vibratory driver at Explosives Handling Wharf #2 (EHW-2), NAVBASE Kitsap Bangor. The 95th percentile installation time was 44 minutes/pile.

[3] Based on data from 501 piles installed at EHW-2, the median was 14 minutes/pile and the 95th percentile was 26 minutes/pile. Strike number estimates assumed an average estimated strike rate of 44 strikes per minute (or almost a strike every second and a half) rounded up from 3,960.

[4] Based on data from 501 piles installed at EHW-2, the median was 14 minutes/pile and the 95th percentile was 26 minutes/pile. Strike number estimates assumed an average estimated strike rate of 44 strikes per minute (or almost a strike every second and a half) rounded up from 3,960.

[5] Data from NAVBASE Kitsap Bangor, EHW-1 Bent 27 repairs, August 2015.

Table B-6. Pile Driving Duration Summary

Installation Method and Pile Type and Size	Installation Rate for Replacement Piles	Estimated Duration				
		Median/ Pile	Maximum/ Pile	Daily Time	MPR Estimated Average Strikes/Day	MPR Estimated Maximum Strikes/Day
Impact steel 14-in[1]	No data	No data	No data	No data	<<1,000	<<1,000
Impact steel 24–30 in[2]	1 to 6 piles/day	14 minutes	30 minutes	4.5 minutes to 1.5 hours	1,000	4,000
Impact concrete 18-24-in[3]	1 to 11 piles/day	—	4 hours	3 minutes to 4 hours	4,000	6,000
Vibratory steel 12.75 in[4]	2 to 17 piles/day	—	—	0–31 minutes	N/A	N/A
Vibratory steel 24–30 in [5]	1 to 6 piles/day	10 minutes	45 minutes	10 minutes to 4.5 hours	N/A	N/A

Key: in = inch; N/A = not applicable; "—" = not calculated

Notes:

1. All 14-in piles are anticipated to be fully vibratory driven and no impact driving data is available. If impact driving is necessary, it would only be needed due to hard substrate conditions. If needed, very few strikes are anticipated per pile due to the small diameter of the piles.
2. Minimum based on data from 4 piles installed at NAVBASE Kitsap Bangor, EHW-1 Bent 27 repairs, August 2015. Maximum assumes 6 piles each taking ~14 minutes to install or 3 piles advanced through difficult substrate taking ~30 minutes each. Median and maximum based on data from 501 piles installed at EHW-2.
3. Minimum based on 10 piles installed at NAVBASE Kitsap Bremerton Pier 6, September 2015. Average and maximum daily time and estimates based on data from 272 piles installed at NAVBASE Kitsap Bremerton Pier B.
4. Data from NAVBASE Kitsap Bremerton, Piers 5 and 6, fender pile installation, n = 70 piles.
5. Maximum duration assumes 6 piles advanced at rate of 45 minutes/pile, based on data from 809 piles installed with a vibratory driver at EHW-2, NAVBASE Kitsap Bangor.

2.5 Analysis of Hydroacoustic Effects to Fish from Pile Driving

2.5.1 Thresholds for Hydroacoustic Effects to Fish

The National Marine Fisheries Service's (NMFS's) West Coast Region and the U.S. Fish and Wildlife Service (USFWS) established interim thresholds for the onset of physical injury from impact pile driving through participation in the Fisheries Hydroacoustic Working Group in 2008 (Table B-7). Because of limited pile driving data the Fisheries Hydroacoustic Working Group relied on surrogate data primarily from underwater explosives and seismic airguns to derive a dual threshold for injury using both peak SPLs and cumulative SEL (Fisheries Hydroacoustic Working Group, 2008; Stadler and Woodbury, 2009). The underwater noise threshold criterion for fish injury from a single impact hammer pile strike is a SPL of 206 dB PEAK (Fisheries Hydroacoustic Working Group, 2008). Cumulative SEL is a measure of the risk of injury from exposure to multiple pile strikes. The number of pile strikes is estimated per continuous work period which is considered one day. The cumulative SEL criterion for injury to fish is 187 dB SEL for fish greater than or equal to 2 grams in weight, and 183 dB SEL for fish less than 2 grams in weight

(Fisheries Hydroacoustic Working Group, 2008). For reference, juvenile chum salmon weighing 2 grams are approximately 2.7 to 2.8 in (68 to 70 mm) long (Tynan, 2013), and juvenile English sole are 2.4 to 2.8 in (60 to 70 mm) long (Hunt, 2005).

Table B-7. Fisheries Hydroacoustic Working Group Interim Fish Noise Injury Thresholds and Behavioral Guidance

Fish Size	*Impact Pile Driving*	*Vibratory Pile Driving*
Injury		
≥ 2 grams	187 dB cumulative SEL	N/A
< 2 grams	183 dB cumulative SEL	
All sizes	206 dB PEAK	
Behavior		
All sizes	150 dB RMS	150 dB RMS

Key: dB = decibel; N/A = not applicable; RMS = root mean square; SEL = sound exposure level

Note: Peak levels are relative to 1 µPa and cumulative SEL levels are relative to 1 μPa^2•sec.

The method used to calculate distances to the cumulative SEL thresholds involves limiting the maximum affected distance to a point ("effective quiet") at which the acoustic energy from a single strike attenuates to 150 dB SEL re 1 $\mu Pa^2 \cdot sec$ (WSDOT, 2018). No physical injury is expected beyond this distance.

Popper et al. (2014) proposed new dual threshold interim criteria for pile driving based on a review of available data associated with fishes and pile driving. The data used to set the criteria was from controlled experiments that mimicked pile driving on several fish species that varied in body type, swim bladder configuration, and internal morphologies. Guidelines were developed for mortality and the lowest level where injury was found (recoverable injury). No injuries were found in the species without a swim bladder (hogchoker) exposed to cumulative SEL of 216 dB. In addition, Popper et al. (2014) developed guidance for the onset of temporary threshold shift (TTS). Table B-8 lists impact pile driving guidance for the lowest level where injury was found and the onset of TTS.

Table B-8. Popper et al. (2014) Fish Impact Pile Driving Injury Guidance

Fish Size	*Recoverable Injury*	*Temporary Threshold Shift*
No swim bladder	>216 dB cumulative SEL or >213 dB PEAK	>186 dB cumulative SEL
Swim bladder not involved in hearing	203 dB cumulative SEL >207 dB PEAK	>186 dB cumulative SEL
Swim bladder involved in hearing	203 dB cumulative SEL >207 dB PEAK	186 dB cumulative SEL

Key: dB = decibel; SEL = sound exposure level

Note: Peak levels are relative to 1 µPa and cumulative SEL levels are relative to 1 μPa^2•sec.

There is little data on the behavioral response of fish, including salmon, to pile driving sounds (NMFS, 2015b). A sound level of 150 dB RMS has been used as a conservative guideline for evaluating potential behavior effects of noise, including pile driving (NMFS, 2015b). The effect of behavior alterations, whether or not an alteration results in injury, is dependent on project-specific factors such as a behavioral change that results in a migration delay or disturbance to juvenile rearing. This behavioral guideline applies to both impact hammer and vibratory pile driving. During pile driving, the associated underwater noise levels could result in a behavioral response, including project area avoidance. To reduce underwater noise levels and associated impacts on underwater organisms during steel impact pile driving, a bubble curtain will be deployed, where possible.

2.5.2 Estimation of Extent of Elevated Underwater Noise Levels above Fish Thresholds

The Practical Spreading Loss model (NMFS, 2012) was used to calculate the expected noise propagation from both impact and vibratory pile driving using representative sound levels from past acoustic studies in Puget Sound (Navy, 2015a, 2016a). Because a bubble curtain or other attenuation device will be used to minimize the level of underwater noise generated into the water column by impact driving steel pipe piles, an expected attenuation of 8 dB was first subtracted from the modeled source levels for steel impact driven piles shown in Table B-3. To calculate cumulative SEL, the number of pile strikes were estimated from past project information and engineering staff. Approximately 6,017 pile strikes per day for installation of up to 11 piles per day is estimated for concrete pile installation. Approximately 4,000 pile strikes per day for installation of up to 6 piles per day is estimated for steel pile installation.

Calculated distances to the fish noise thresholds using the Practical Spreading Loss Model (Section 2.2) and adjusted maximum areas are provided in Table B-9. The area exceeding the threshold values decreases the closer to shore pile driving occurs and where shallow water and land block noise transmission.

2.5.3 Potential Effects Exceeding the Injury Threshold and Behavioral Guidance

The degree to which an individual fish exposed to underwater sound will be affected depends on a number of variables, including species, size, and physical condition of the fish; presence of a swim bladder; maximum sustained sound pressure and frequency; shape of the sound wave (rise time); depth of the water; depth of the fish in the water column; amount of air in the water; size and number of waves on the water surface; bottom substrate composition and texture; effectiveness of bubble curtain sound/pressure attenuation technology (if used); currents; and presence of predators. Depending on these factors, effects on fish can range from changes in behavior to immediate mortality. Fish injury and mortality from impact pile driving steel piles has been documented (ICF Jones & Stokes and Illingworth & Rodkin, 2009). Therefore, the discussion below on the physiological responses of fish is focused on impact driving of steel piles.

2.5.3.1 Physiological Responses

All fish fall into two hearing categories: “hearing generalists” such as salmon and trout and “hearing specialists” such as herring and eulachon (Hastings & Popper, 2005). The majority of fish on the Pacific coast are hearing generalists and do not have specialized hearing capabilities apart from their swim bladder, inner ear, and lateral line. They sense sound directly through the inner ear, and some use the inner ear coupled with the swim bladder to sense additional energy. Hearing specialists (i.e., eulachon) have particular adaptations that enhance their hearing bandwidth and sensitivity versus hearing generalists (Hastings & Popper, 2005). The hearing category for sturgeon is still undetermined. Popper (2005) found that sturgeon can detect an extremely wide range of sounds, and several studies have found that some sturgeon produce sounds that may be used to facilitate breeding.

Table B-9. Maximum Range to Fish Sound Thresholds from Pile Driving

Method, Pile Type, and Pile Size	Threshold (distance)					
	Fisheries Hydroacoustics Working Group, 2008			Popper et al., 2014		
	206 dB PEAK (injury)	187 dB Cumulative SEL for Fish ≥2 g (injury)	183 dB Cumulative SEL for Fish <2 g (injury)	>207 dB PEAK (onset of injury)	203 dB Cumulative SEL (injury)	150 dB RMS (potential behavioral)
Impact Pile Driving						
18-in concrete pile	< 1 m	40 m	40 m	< 1 m	3 m	0.21 km
24-in concrete pile	1 m	117 m	117 m	< 1 m	11 m	0.74 km
14-in steel pipe	4 m	343 m	398 m	3 m	29 m	1.84 km
24-in steel pipe	5 m	294 m	341 m	5 m	25 m	2.1 km
30-in steel pipe	14 m	633 m	736 m	12 m	54 m	2.9 km
36-in steel pipe	6 m	466 m	541 m	5 m	40 m	1.8 km
36-in steel pipe (Bangor only)	6 m	294 m	341 m	5 m	25 m	2.5 km
Vibratory Pile Driving						
16- to 24-in steel pipe	N/A	N/A	N/A	N/A	N/A	63 m
30- to 36-in steel pipe	N/A	N/A	N/A	N/A	N/A	293 m
30- to 36-in steel (Bangor only)	N/A	N/A	N/A	N/A	N/A	116 m
24-in steel sheet	N/A	N/A	N/A	N/A	N/A	73 m

Key: g = gram; in = inch; km = kilometer; m = meter; N/A = not applicable; RMS = root mean square; SEL = sound exposure level

Notes: Practical spreading loss model (15 log R, or 4.5 dB per doubling of distance) used for calculations. Assumes 8 dB attenuation with use of a bubble curtain for steel piles only, with the exception of Bremerton as identified for 14-in diameter pipe piles. Cumulative SEL calculated as Single Strike SEL + 10 * log (# of pile strikes), assumes up to 6 piles installed/day at 4,000 pile strikes/day for steel piles. Assumes no attenuation on 24-in concrete piles and installing up to 11/day at 6,017 strikes/day.

The effects to fish at different intensities of underwater sound are unclear. Many of the previous studies cited for the physical effects, including injury and mortality, of underwater sound on fish were based on seismic air gun and underwater explosives studies. These physical effects can include swim bladder, otolith, and other organ damage; hearing loss; and mortality (Hastings & Popper, 2005).

Fish with swim bladders, including salmonids and rockfish, are more susceptible to barotraumas from impulsive sounds (sounds of very short duration with a rapid rise in pressure like steel impact pile driving) because of swim bladder resonance (vibration at a frequency determined by the physical parameters of the vibrating object). When a sound pressure wave strikes a gas-filled space, such as the swim bladder, it causes that space to vibrate (expand and contract) at its resonant frequency. When the amplitude of this vibration is sufficiently high, the pulsing swim bladder can press against, and strain, adjacent organs, such as the liver and kidney. This pneumatic compression causes demonstrable injury, in the form of ruptured capillaries, internal bleeding, and maceration of highly vascular organs (ICF Jones & Stokes and Illingworth & Rodkin, 2009).

Hastings and Popper (2005) also noted that sound waves can cause different types of tissue to vibrate at different frequencies, and that this differential vibration can cause tearing of mesenteries and other sensitive connective tissues. Exposure to high noise levels can also lead to injury through "rectified diffusion," the formation and growth of bubbles in tissues. These bubbles can cause inflammation, cellular damage, and blockage or rupture of capillaries, arteries, and veins (Crum & Mao, 1996; Vlahakis & Hubmayr, 2000; Stroetz et al., 2001). These effects can lead to overt injury or even mortality. Death from barotrauma and rectified diffusion injuries can be instantaneous, or delayed for minutes, hours or even days after exposure.

Even in the absence of mortality, elevated noise levels can cause sublethal injuries affecting survival, and fitness. Fish suffering damage to hearing organs may suffer equilibrium problems, and may have a reduced ability to detect predators and prey (Turnpenny et al., 1994; Hastings et al., 1996). Other types of sublethal injuries can place the fish at increased risk of predation and disease.

Adverse effects on survival and fitness can occur even in the absence of overt injury. Exposure to elevated noise levels can cause a temporary shift in hearing sensitivity (referred to as a temporary threshold shift, or TTS), decreasing sensory capability for periods lasting from hours to days (Turnpenny et al., 1994; Hastings et al., 1996). The severity of effects from high noise levels produced by impact driving of steel piles depends on several factors, including the size and species of fish exposed. Regardless of species, smaller fish appear to be more sensitive to injury of non-auditory tissues (Yelverton et al., 1975). Approximately 100 surf perch from three different species (*Cymatogaster aggregata, Brachyistius frenatus,* and *Embiotoca lateralis*) were killed during impact pile driving of 30-in diameter steel pilings at Bainbridge Island, Washington, (Stadler, 2002 personal observation). Dissections revealed complete swim bladder destruction across all species in the smallest fish (80 mm fork length), while swim bladders in the largest fish (170 mm fork length) were nearly intact. However, swim bladder damage was typically more extensive in *C. aggregata* when compared to *B. frenatus* of similar size.

Halvorsen et al. (2012a) noted that caged field studies (Abbott et al., 2005; Ruggerone et al., 2008; California Department of Transportation, 2010) lacked appropriate biological control groups because the experimental fishes may not have been neutrally buoyant resulting in a lower risk of injury because their swim bladder may have been deflated. To better understand the effects of impulsive sounds from impact pile driving, Halvorsen et al. (2011, 2012b) conducted a controlled study with juvenile Chinook (mean standard length 103 mm, mean weight 11.8 grams). Based on the results of the study, the authors concluded that the onset of injury to Chinook salmon occurred at a minimum cumulative SEL of 210 dB. Recent studies conducted on four fish species of different life style and anatomy (Nile tilapia, hybrid striped bass, hogchoker, and lake sturgeon) were exposed to controlled number of steel impact pile strikes at known sound levels to produce a predetermined cumulative SEL. Fish were examined for bleeding, damage to swim bladder, and damage to internal organs. Of the four, no impacts resulted to the hogchoker, which has no swim bladder. Fish that did show major internal damage was to kidney, gonads, and spleen that are closely positioned near the swim bladder. What was found was that the onset of physical effects to the other four species did not occur until the cumulative SEL was above 203 dB and in most species above 207 (Dahl et al., 2015). These results were also supported by other studies conducted on both larval (Bolle et al., 2012) and juvenile fishes (Debusschere et al., 2014) as well as the studies conducted by Halvorsen et al. (2011, 2012b). Interim guidelines for fishes were presented in an analysis of studies by Popper et al. (2014) as discussed in Section 2.5.1 and presented in Table B-8.

Because of their large size, adult salmon can tolerate higher noise levels and are generally less sensitive to injury of non-auditory tissues than juveniles (Hubbs & Rechnitzer, 1952). Dahl et al. (2015) suggested that fish, in general, are likely to move away from the sound source that is too loud before physiological damage is of concern. This behavior response can result in fish leaving breeding or feedings sites or mask the ability of fish to hear biologically important sounds (i.e., soundscape or other species) (Dahl et al., 2015). However, no information is available to determine whether or not the risk of auditory tissue damage decreases with increasing size of the fish.

2.5.3.2 Behavioral Responses

Field investigations of the behavior of Puget Sound juvenile salmon, when present near pile driving projects, found little evidence that normally nearshore migrating juvenile salmonids moved further offshore to avoid the general project area (Feist, 1991; Feist et al., 1992). In fact, some studies indicate that construction site behavioral responses, including site avoidance, may be as strongly tied to visual stimuli as underwater sound (Feist, 1991; Feist et al., 1992; Ruggerone et al., 2008). However, the level of sound to which fish are exposed is not controlled in field studies (ICF Jones & Stokes and Illingworth & Rodkin, 2009).

Fish in the area where the behavioral disturbance guidance is exceeded may display a startle response during initial stages of pile driving and could avoid the immediate project vicinity during construction activities, including pile driving. Similarly, if injury does not occur, noise may modify fish behavior that may make them more susceptible to predation.

To minimize underwater noise impacts during pile driving, a majority of pile driving activity will be conducted using a vibratory pile driver. Although behavioral effects could occur from vibratory pile driving, no injury threshold has been identified for this type of pile driving due to its lower amplitude and non-impulsive waveform (Fisheries Hydroacoustic Working Group, 2008).

2.5.4 General Summary of Underwater Noise Impacts to Fish

As shown in Table B-9, the maximum distance to the 206 dB peak injury threshold is calculated to 14 m or less. At this distance, a fish could be exposed to injurious noise impacts from a single pile strike. The maximum distance to the 187 dB and 183 dB cumulative SEL thresholds is calculated to 633 m and 736 m, respectively. However, using guidance developed from the analysis by Popper et al. (2014), 203 dB cumulative SEL, is calculated to 54 m or less. This last guideline was the lowest level where injury was found (Popper et al. 2014) and results in a significant reduction in the area where fish are anticipated to potentially be exposed to injury. In all cases, because the cumulative SEL formula takes into account all impact pile strikes within a 24-hour period, the size of the injury zones are presented as they have increased to their maximum extent through the course of a pile driving day. As a result, during the early portion of the construction day, the injury zone will be smaller and will only gradually increase out to a maximum extent as calculated in Table B-9 after all strikes have been completed. Further, the formula assumes fish are remaining within the range to effect during the entirety of active impact pile driving. In other words, an individual fish would have to be constantly within the calculated range during all impact pile driving in order to accumulate energy from every impact strike.

Fish exposed to pile driving sounds of 186 dB cumulative SEL or higher, depending on swim bladder presence and its configuration with hearing, could experience a TTS. However, as with the cumulative SEL zones above, the TTS zone would increase to its maximum extent throughout the course of a pile driving day with strikes throughout the day. In addition, TTS is not considered the onset of injury (NMFS, 2015b; Popper et al., 2014). The maximum distance to exposure above the 150 dB RMS behavioral threshold would be 2.9 km. At this distance, fish present within this threshold could modify their behavior as described above. The following summarizes general impacts to ESA-listed fish under the Proposed Action. It is important to note that some impacts may be considered discountable under detailed evaluation by location and these analyses can be found in Chapters 4 through 9 of the EA.

2.5.4.1 Puget Sound Chinook, Puget Sound Steelhead, Hood Canal Summer Run Chum, and Bull Trout

Impacts to Chinook, steelhead, chum, and bull trout present within the peak injury zone will be discountable because of the following:

- Pile driving would occur during the approved in-water work window when juvenile salmonids are least likely to be present;
- The majority of steel pile driving would occur using a vibratory pile driver;
- The majority of concrete pile driving at NAVMAG Indian Island would occur using a water jetting device;
- Larger juvenile and adult salmon and steelhead are not nearshore dependent and not likely to be within the peak injury zone;
- Bull trout are not likely to be present at any location but NAVSTA Everett, where only 0.5 hour of steel impact driving is anticipated;
- At NAVBASE Kitsap Bangor, NAVBASE Kitsap Keyport, and Zelatched Point where steel impact pile driving could occur, it is anticipated to be required primarily for proofing piles, would occur intermittently, and would occur an estimated maximum duration of 1.5 hours throughout a day;
- At NAVMAG Indian Island where concrete impact pile driving would occur, it is it is anticipated to be required primarily for proofing piles, would occur intermittently, and would occur an estimated maximum duration of 1.5 hours throughout a day;
- An attenuation device would be used during impact pile driving of steel piles at NAVBASE Kitsap Bangor, NAVBASE Kitsap Keyport, Zelatched Point, and NAVSTA Everett where a bubble curtain would be operating resulting in turbulent water that would startle fish from the immediate area surrounding a pile;
- No steel piles will be installed at Manchester and Indian Island;
- Steel piles at NAVBASE Kitsap Bremerton would be 14-in diameter or less. Because NAVBASE Kitsap Bremerton plans to fully vibe all 14-in steel piles, an estimated maximum duration of 1.5 hours over the 5 years of MPR activities is expected;
- Only one steel pile would be installed at NAVSTA Everett, resulting in a shorter duration of potential exposure to the injury zone as compared to other installations installing multiple steel piles;
- A maximum of 20 steel piles would be installed at NAVBASE Kitsap Keyport and Zelatched Point; and
- A maximum of 30 steel piles greater than 14-in diameter would be installed in an MPR activity year at NAVBASE Kitsap Bangor.
- A maximum of nine 24-inch concrete piles would be installed at NAVMAG Indian Island.

Impacts to salmonids present within the cumulative SEL onset of injury zones will be insignificant because:

- Larger juvenile and adult salmon and steelhead are not nearshore dependent, would likely be migrating through the area during pile driving, and unlikely to remain long enough to accumulate energy from every pile strike;
- At NAVSTA Everett, where bull trout could occur, steel impact pile driving would be of limited duration, anticipated at 0.5 hour;
- At NAVBASE Kitsap Bangor, NAVBASE Kitsap Keyport, and Zelatched Point where steel impact pile driving could occur, it is anticipated to be required primarily for proofing piles, would occur intermittently, and with a maximum estimated duration of 1.5 hours throughout a day;
- At NAVMAG Indian Island where concrete impact pile driving could occur, it is it is anticipated to be required primarily for proofing piles, would occur intermittently, and would occur an estimated maximum duration of 1.5 hours throughout a day;
- An attenuation device would be used during impact pile driving of steel piles at NAVBASE Kitsap Bangor, NAVBASE Kitsap Keyport, Zelatched Point, and NAVSTA Everett;
- No steel piles would be installed at Manchester and Indian Island;
- Steel piles at NAVBASE Kitsap Bremerton would be 14-in diameter or less. Because NAVBASE Kitsap Bremerton plans to fully vibe all 14-in steel piles, an estimated maximum duration of 1.5 hours over the 5 years of MPR activities is expected;
- Only one steel pile would be installed at NAVSTA Everett, resulting in a shorter duration of potential exposure to the injury zone as compared to other installations installing multiple steel piles;
- A maximum of 20 steel piles would be installed at NAVBASE Kitsap Keyport and Zelatched Point; and
- A maximum of 30 steel piles greater than 14-in diameter would be installed in a program year at NAVBASE Kitsap Bangor.
- A maximum of nine 24-inch concrete piles would be installed at NAVMAG Indian Island.

Impacts to ESA-listed salmonids within the behavioral threshold will be insignificant because:

- Larger juvenile and adult salmonids would be further offshore, typically migrating, and not likely to be significantly affected during pile driving;
- The majority of steel pile driving would occur using a vibratory pile driver;
- The majority of concrete pile driving at NAVMAG Indian Island would occur using a water jetting device;
- Steel impact pile driving is anticipated to be required primarily for proofing piles, would occur intermittently, and with a maximum estimated duration of 1.5 hours throughout a day at NAVBASE Kitsap Bangor, NAVBASE Kitsap Keyport, Zelatched Point, and NAVSTA Everett;
- An attenuation device would be used during impact pile driving of steel piles at NAVBASE Kitsap Bangor, NAVBASE Kitsap Keyport, Zelatched Point, and NAVSTA Everett;
- Because NAVBASE Kitsap Bremerton plans to fully vibe all 14-in steel piles, an estimated maximum duration of 1.5 hours over the 5 years of MPR activities is expected;
- A maximum of 30 steel piles greater than 14-in diameter would be installed in a program year at NAVBASE Kitsap Bangor; and

- Concrete, timber, and/or HDPE plastic piles could be installed of which concrete would generate the highest SPLs of the three pile types installed. Impact pile driving of concrete piles is estimated to last an estimated maximum duration of 4 hours and an average of 1.5 hours in a day.

2.5.4.2 Puget Sound/Georgia Basin Bocaccio, and Yelloweye Rockfish

Impacts to adult life stages of ESA-listed rockfish and juvenile yelloweye rockfish within the 206 dB Peak injury zone would be discountable because of the following:

- All proposed pile driving sites are shallower than adult ESA-listed rockfish and juvenile yelloweye rockfish inhabit and therefore would not be within 14 m of a pile strike;
- Juvenile bocaccio rearing habitat is not present near the structures at NAVBASE Kitsap Bremerton, NAVBASE Kitsap Keyport, and NAVSTA Everett;
- The majority of pile driving would occur using a vibratory pile driver;
- The majority of concrete pile driving at NAVMAG Indian Island would occur using a water jetting device;
- Impact pile driving is anticipated to be required primarily for proofing steel piles, would occur intermittently, and with a maximum estimated duration of 1.5 hours throughout a day at NAVBASE Kitsap Bangor, NAVBASE Kitsap Keyport, and Zelatched Point;
- An attenuation device would be used during impact pile driving of steel piles at NAVBASE Kitsap Bangor, NAVBASE Kitsap Keyport, and Zelatched Point; and
- A maximum of 30 steel piles greater than 14-in diameter would be installed in an MPR activity year at NAVBASE Kitsap Bangor.
- Due to rare historical and no recent sightings of bocaccio in Hood Canal, they are not expected within vicinity of NAVBASE Kitsap Bangor or Zelatched Point.

Impacts to ESA-listed rockfish present within the cumulative SEL injury zones would be insignificant because:

- The majority of steel pile driving would occur using a vibratory pile driver;
- An attenuation device would be used during impact pile driving of steel piles at NAVBASE Kitsap Bangor, NAVBASE Kitsap Keyport, Zelatched Point, and NAVSTA Everett;
- Steel impact pile driving is anticipated to be required primarily for proofing piles, would occur intermittently, and with a maximum estimated duration of 1.5 hours throughout a day at NAVBASE Kitsap Bangor, NAVBASE Kitsap Keyport, and Zelatched Point;
- The limited time required for impact pile driving steel piles in a day would only accumulate enough energy to fully extend out to the maximum distance (736 m) if all strikes were needed in a day. The lack of canopy kelp habitats adjacent to structures and intermittent nature of the work will preclude measureable impacts to juvenile rockfish; and
- Steel impact pile driving would not occur at Manchester and Indian Island, would only occur for 1 pile total at NAVSTA Everett, would be limited to 20 piles total at NAVBASE Kitsap Keyport and Zelatched Point, and would be limited to a maximum of 30 steel piles installed in a program year at NAVBASE Kitsap Bangor.

Impacts to ESA-listed rockfish within the behavioral threshold would be insignificant because:

- The majority of pile driving would occur using a vibratory pile driver;
- If ESA-listed rockfish are present, exposure to noise above the behavioral threshold would be brief, lasting an estimated maximum of 1.5 hours in a day during steel pile installation at NAVBASE Kitsap Bangor, NAVBASE Kitsap Keyport, and Zelatched Point, and likely to result in unmeasurable changes in rockfish behavior;
- An attenuation device would be used during impact pile driving of steel piles at NAVBASE Kitsap Bangor, NAVBASE Kitsap Keyport, Zelatched Point, and NAVSTA Everett;
- Steel impact pile driving is anticipated to be required primarily for proofing piles, would occur intermittently, and with a maximum estimated duration of 1.5 hours throughout a day at NAVBASE Kitsap Bangor, NAVBASE Kitsap Keyport, Zelatched Point; and
- A maximum of 30 steel piles greater than 14-in diameter would be installed in a program year at NAVBASE Kitsap Bangor.
- Concrete, timber, and/or HDPE plastic piles could be installed of which concrete would generate the highest SPLs of the three pile types installed. Impact pile driving of concrete piles is estimated to last a maximum of 4 hours and an average of 1.5 hours in a day.

2.6 Analysis of Acoustic Effects to Marine Birds from Pile Driving

Sources and levels of underwater noise that will be generated during MPR activities are described in Section 2.1 above. As described in that section, impact pile driving of steel piles generates the highest source levels of underwater noise. To minimize impacts on listed fish species, a vibratory pile driver will be used to install new steel piles and extract existing piles of all types. Impact pile drivers will be used to install new piles other than steel, although it is possible that a vibratory driver may be used for other pile types. The following analysis focuses on underwater noise effects of installing steel pile up to 36-in diameter and concrete piles up to 24-in diameter with an impact driver; installation of other pile types generates lower sound pressure levels.

Assessing whether a sound may disturb or injure a marine bird involves understanding the characteristics of the acoustic source and the potential effects that sound may have on the physiology and behavior of that marbled murrelet. Although it is recognized that project-related sound may affect marine birds' communication and predator detection, other factors besides the received level of sound may affect a bird's reaction, such as the its activity state, prior experience with the sound, and proximity to the source of the sound.

2.6.1 Thresholds for Hydroacoustic Effects to Marine Birds from Pile Driving

Like the fish injury thresholds (Section 2.3.1), underwater onset of injury thresholds for marbled murrelets only apply to impact pile driving, and the distance to the injury criterion is dependent upon the number of strikes of the impact hammer that are carried out within a 24-hour period. The USFWS uses thresholds developed by the Marbled Murrelet Hydroacoustic Science Panel (SAIC, 2011), and subsequently revised (USFWS, 2013), for two general forms of injury: (1) auditory injury (generally damage to sensory hair cells of the ear) beginning at 202 dB SEL cumulative, and (2) non-auditory injury (trauma to non-auditory body tissues/organs) beginning at 208 dB SEL cumulative. The onset of auditory injury is defined as the loss of hair cells due to impulsive acoustic overexposure. Injuries associated with non-auditory injury (barotrauma) could include bruising, hemorrhaging, rupture of internal organs, and/or death. Since the underwater criterion for auditory injury was the lower of the two thresholds, this is the criterion used for assessing injurious impacts to the marbled murrelet in this analysis.

2.6.2 Estimation of Extent of Elevated Underwater Noise Levels above Marbled Murrelet Thresholds

To determine how far project noise will exceed impact thresholds, distances to noise levels anticipated from installation of 14- to 36-in diameter steel piles and 18- to 24-in concrete piles were modeled as described in Section 2.5.2. Because the marbled murrelet injury thresholds use SEL values, source levels from Table B-4 and strike numbers from Table B-6 were used in the Practical Spreading Loss model (Section 2.2) to calculate the expected noise propagation to the thresholds for the pile types and sizes proposed in the MPR activities.

Based on the above analysis, the greatest auditory injury threshold distance (cumulative SEL = 202 dB) is estimated to extend 63 meters (m) from impact pile driving of 30-in steel piles (Table B-10). Marbled murrelets could be exposed to injurious noise levels if they were at or within 63 m of a 30-in steel pile during impact pile driving after all strikes were completed. Because the cumulative SEL formula takes into account all impact pile strikes within a 24-hour period, the 63 m area is the size of the injury zone as it has increased to its maximum extent through the course of the pile driving day. As a result, during the early portion of the construction day, the injury zone will be smaller and will only gradually increase out to a distance of 63 m after all strikes have been completed. Moreover, the model assumes marbled murrelets remain underwater within the range to effect during the entirety of active impact pile driving. In other words, an individual bird would have to be under water constantly within the calculated range during all impact pile driving in order to accumulate energy from every impact strike. Because this assumption is physiologically impossible for marbled murrelets, the modeling results represent an extreme worst-case scenario regarding pile driving methods and numbers, and the actual range to effect will be significantly smaller than the distances listed in Table B-10. The table also shows estimated distances to the barotrauma injury threshold, which encompasses much smaller distances around the driven pile than the auditory injury threshold. For these reasons, it is unlikely that any marbled murrelet would be present in the injury zones long enough to accumulate the full energy predicted by the model. Moreover, implementation of monitoring and shutdown procedures (Appendix D) during impact pile driving will avoid injury to marbled murrelets.

2.6.3 Potential Effects of Exceeding the Injury Thresholds

Underwater sound levels from impact pile driving have the potential to harm (as defined by the ESA) marbled murrelets foraging and resting in the vicinity of the MPR activities project sites. Murrelet responses to elevated noise levels are likely to depend on a variety of factors. These may include an individual bird’s motivational state (e.g., current demand for food intake) and previous experience with elevated sound. Birds may initially startle, flush, dive, or leave the area when exposed to elevated sound levels and visual disturbance associated with human activities. Marbled murrelets resting in the waters of the project area initially will be likely to dive underwater if disturbed by airborne noise from pile driving, potentially exposing them to underwater noise impacts.

Behaviors that indicate disturbance of foraging birds may include flushing, aborted feeding attempts, or avoidance of foraging habitats over one or multiple days. Habituation may reduce these avoidance responses over time in the absence of significant negative reinforcement. Observations of marbled murrelets during pile driving for the East Half Replacement and West-Half Retrofit of the Hood Canal

Bridge in 2004, suggest that foraging birds are likely to flush at the onset of pile driving, but eventually will habituate to pile driving noise (Entranco and Hamer Environmental, 2005).

Table B-10. Calculated Radial Distances to Underwater Marbled Murrelet Pile Driving Noise Thresholds for Impact Pile Driving

	Distance to Threshold	
Pile Size and Type	***202 dB Cumulative SEL (Auditory Injury)***	***208 dB Cumulative SEL (Barotrauma)***
18-in concrete pile	4 m	2 m
24-in concrete pile	10 m	5 m
14-in steel pipe	10 m	4 m
14-in steel pipe (Bremerton only)	34 m	14 m
24-in steel pipe	29 m	12 m
30-in steel pipe	63 m	25 m
36-in steel pipe	47 m	19 m
36-in steel pipe (Bangor only)	29 m	12 m

Key:dB = decibels; in = inch; m = meters; SEL = sound exposure level

Notes: Practical spreading loss model (15 log R, or 4.5 dB per doubling of distance) used for calculations. Assumes 8 dB attenuation with use of a bubble curtain for steel piles driven with impact hammer, except at Bremerton where no bubble curtain will be used. Cumulative SEL calculated as Single Strike SEL + 10* log (# of piles strikes), assumes up to 6 piles installed/day at 4,000 strikes/day for steel piles and installation of up to 11 piles/day at 6,017 strikes/day for concrete piles.

A complicating factor is related to the annual molting cycle of marbled murrelets. The late-summer, pre-basic molt condition (July to November), during which murrelets are essentially flightless for up to 2 months, may overlap with the in-water construction season for the MPR activities. During the pre-basic molt period, marbled murrelets will be less able to withdraw quickly from the project area when exposed to sound at disturbance levels and will likely dive underwater to avoid the disturbance.

However, marbled murrelets are unlikely to be present during impact pile driving within the relatively small areas defined by the 202 dB cumulative SEL isopleth for auditory injury because they are expected to avoid areas with high levels of human activity. Moreover, impact pile driving will not occur continuously during construction days; the actual time during which pile driving will occur is expected to be considerably less, based on the Navy's pile driving effort during the 3 years of construction of Explosives Handling Wharf #2 (EHW-2) at NAVBASE Kitsap Bangor (Illingworth & Rodkin, 2013; Table 2-1). The actual duration of pile driving each day (14 minutes to 1.5 hours per day for impact driving of steel piles) is expected to represent a relatively small portion of the available hours during the in-water work window. The Navy will actively avoid injury effects due to pile driving by implementing a marbled murrelet monitoring plan (Appendix D), which will provide for halting impact pile driving while murrelets are present within the injury zones for underwater noise. It is expected that monitors will detect any murrelets present in the affected area during pile driving because the monitored area is small. Therefore, the likelihood of exposure to underwater sound at injury levels is discountable at MPR activities locations.

Representative scenarios of areas encompassed by underwater injury zones for each location are depicted in the location-specific analyses in the Draft EA (Chapters 4 through 10). The largest potential underwater injury zone for each location is depicted in these scenarios, corresponding to the pile type proposed at that location that produces the highest source level (Table B-3). Thus, the injury zone for 30-in steel pile is shown for NAVBASE Kitsap Bangor, Keyport, Zelatched Point, and NAVSTA Everett because this pile type is proposed at these locations and it produces the highest sound pressure level when installed with an impact pile driver (although only one 30-in steel pile is proposed for NAVSTA Everett). The injury zone for 24-in concrete or steel pile is shown for NAVBASE Bremerton, as both pile types have been modeled to produce the same sound pressure levels. The injury zone for 24-in concrete is depicted at Manchester and Indian Island, as no steel piles are proposed at these locations, and also at NAVSTA Everett, where the overwhelming majority of proposed piles are 24-in concrete.

2.6.4 Airborne Noise Impacts on Marine Birds

Based on the finding of the Marbled Murrelet Hydroacoustic Science Panel tasked with evaluating non-injurious thresholds for pile driving noise (SAIC, 2012), the USFWS has determined that airborne acoustic masking due to impact pile driving may affect foraging marbled murrelets. Marbled murrelets typically perform foraging dives in pairs and are highly vocal when they are above the surface (Strachan et al., 1995). On the water's surface, birds typically stay within 100 ft of their partners during foraging bouts. This behavior is thought to play a role in foraging efficiency, and therefore airborne noise that masks their vocalizations has the potential to affect foraging success (Carter & Sealy, 1990; Strachan et al., 1995). Unlike other noise effects criteria and guidelines established for injury and behavioral disturbances, the distance from a pile driving source within which communications will be masked is dependent upon ambient airborne noise levels and therefore is site-specific. Masking effects cease immediately when the masking noise stops.

The Marbled Murrelet Hydroacoustic Science Panel (SAIC, 2012) developed methods to calculate masking distances due to impact pile driving and applied the procedure to sample cases using ambient and pile driving source data from a test pile program (Illingworth & Rodkin, 2012) on the Bangor waterfront. Under typical conditions on the waterfront, the maximum distance within which pile driving noise for steel piles <36 in is expected to compromise communication between pairs of murrelets foraging 30 m apart will be 42 m (USFWS, 2013). Acoustic monitoring during EHW-2 construction (Illingworth & Rodkin, 2013) indicated that average airborne source levels during impact driving of 36-in steel piles were the same as, and in some cases lower than, 24-in steel piles.

Therefore, the masking distance for 24-in steel piles was applied to all steel pile sizes installed under the MPR activities. The masking zone for 24-in concrete pile was calculated using ambient and source data from pile driving at Pier 6 at NAVBASE Kitsap Bremerton (Navy, 2016a). The average masking distance in this location was 36 m. Masking zones for impact installation of 18-in HDPE plastic and timber piles have not been determined, but they are assumed to be smaller than the zones calculated for 24-in steel piles.

The USFWS (2013) has provided guidance on evaluating the significance of airborne masking effects for pile driving projects. "Typical" pile driving projects involve:

- Installation of 24-in or 36-in steel piles,
- Use of vibratory pile drivers,
- Use of impact pile drivers for proofing only, and
- Adherence to a 2-hour timing restriction (i.e., no pile driving within 2 hours after sunrise and within 2 hours before sunset during the breeding season).

Typical pile driving projects do not result in measurable effects on marbled murrelets because the use of impact hammers is intermittent and of short duration, the two-hour timing restriction protects murrelets during their most active foraging periods, and murrelet vocalizations are adapted to overcome the effects of ambient noise (USFWS, 2013).

Steel pile driving during MPR activities would fit into the "typical" category because all piles would be 36-in or less, vibratory drivers would be used to install the piles, with limited proofing, and the timing restrictions will be observed. The USFWS guidance does not cover concrete piles; but since the calculated masking distance is less than the masking distance for steel pile, we conclude that concrete pile driving would also fit into the "typical" category and would not result in measurable effects on marbled murrelets. The potential for masking effects due to pile driving will be minimized by implementing a marbled murrelet monitoring plan (Appendix D), which will halt impact pile driving while murrelets are present within the masking zone for airborne noise or the underwater auditory injury zone specified for the pile type/size, as indicated in Table B-10, whichever is greater. It is expected that monitors will detect any murrelets present in the affected area during pile driving because the monitored area is small. Therefore, the likelihood of exposure to masking effects is discountable at MPR activities locations.

2.7 Analysis of Acoustic Effects to Marine Mammals from Pile Driving

Sources and levels of underwater noise that will be generated during MPR activities are described in Section 2.1.1 above. As described in that section, impact pile driving of steel piles generates the highest source levels of underwater noise. To minimize impacts on listed fish species, a vibratory pile driver will be used to install new steel piles and extract existing piles of all types. Impact pile drivers will be used to install new piles other than steel, although it is possible that a vibratory driver or jetting device may be used for other pile types. The following analysis focuses on underwater noise effects of installing steel pile up to 36-in diameter and concrete piles up to 24-in diameter with both impact and vibratory drivers, and vibratory extraction of existing piles.

Research suggests that increased noise may affect marine mammals in several ways and depends on many factors. This is discussed in more detail below. Assessing whether a sound may disturb or injure a marine mammal involves understanding the characteristics of the acoustic source and the potential effects that sound may have on the physiology and behavior of that marine mammal. Although it is known that sound is important for marine mammal communication, navigation, and foraging (National Research Council, 2003, 2005), there are many unknowns in assessing impacts such as the potential interaction of different effects and the significance of responses by marine mammals to sound exposures (Nowacek et al., 2007; Southall et al., 2007). Furthermore, many other factors besides the received level of sound may affect an animal's reaction, such as the animal's physical condition, prior experience with the sound, and proximity to the source of the sound.

2.7.1 Vocalization and Hearing of Marine Mammals

All marine mammals that have been studied can produce sounds and use sounds to forage, orient, detect and respond to predators, and facilitate social interactions (Richardson et al., 1995). Measurements of marine mammal sound production and hearing capabilities provide some basis for assessing whether exposure to a particular sound source may affect a marine mammal behaviorally or physiologically. Marine mammal hearing abilities are quantified using live animals either via behavioral audiometry or electrophysiology (see Schusterman, 1981; Au, 1993; Wartzok & Ketten, 1999; Nachtigall et al., 2007). Behavioral audiograms, which are plots of animals' exhibited hearing threshold versus frequency, are obtained from captive, trained live animals using standard testing procedures with appropriate controls and are considered to be a more accurate representation of a subject's hearing abilities. Behavioral audiograms of marine mammals are difficult to obtain because many species are too large, too rare, and too difficult to acquire and maintain for measurements in captivity. Consequently, our understanding of a species' hearing ability may be based on the behavioral audiogram of a single individual or small group of animals. In addition, captive animals may be exposed to local ambient sounds and other environmental factors that may impact their hearing abilities and may not accurately reflect the hearing abilities of free-swimming animals.

For animals not available in captive or stranded settings (including large whales and rare species), estimates of hearing capabilities are made based on anatomical and physiological structures, the frequency range of the species' vocalizations, and extrapolations from related species.

Electrophysiological audiometry measures small electrical voltages produced by neural activity when the auditory system is stimulated by sound. The technique is relatively fast, does not require a conscious response, and is routinely used to assess the hearing of newborn humans. It has been adapted for use on non-humans, including marine mammals (Dolphin, 2000). For both methods of evaluating hearing ability, hearing response in relation to frequency is a generalized U-shaped curve or audiogram showing the frequency range of best sensitivity (lowest hearing threshold) and frequencies above and below with higher threshold values.

NMFS reviewed studies of hearing sensitivity of marine mammals and developed draft thresholds for use as guidance when assessing the effects of anthropogenic sound (NMFS, 2016a). NMFS placed marine mammals into functional hearing groups based on their generalized hearing sensitivities. Humpback whales are in the low frequency group and Southern Resident killer whales are in the high frequency group. Table B-11 provides a summary of sound production and hearing capabilities for these groups.

Table B-11. Hearing and Vocalization Ranges for Marine Mammal Functional Hearing Groups and Species Potentially Within the Project Areas

Functional Hearing Group	*Species*	*Functional Hearing Range* [1]
Low-frequency cetaceans	Gray whale, minke whale, humpback whale	7 Hz to 25 kHz
Mid-frequency cetaceans	Killer whale	150 Hz to 160 kHz
High-frequency cetaceans	Harbor porpoise, Dall's porpoise	200 Hz to 180 kHz
Phocidae	Harbor seal	In-water: 75 Hz to 100 kHz In-air: 75 Hz to 30 kHz
Otariidae	California sea lion, Steller sea lion	In-water: 100 Hz to 48 kHz In-air: 50 Hz to 75 kHz

Key: Hz = Hertz; kHz = kilohertz

Note:

1. In-water hearing data from NMFS, 2016a. In-air data from Schusterman, 1981; Hemilä et al., 2006; Southall et al., 2007.

2.7.2 Thresholds for Acoustic Effects to Marine Mammal from Pile Driving

Under the Marine Mammal Protection Act (MMPA), NMFS has defined levels of harassment for marine mammals. Level A harassment is defined as, "Any act of pursuit, torment, or annoyance which has the potential to injure a marine mammal or marine mammal stock in the wild." Level B harassment is defined as, "Any act of pursuit, torment, or annoyance which has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including but not limited to migration, breathing, nursing, breeding, feeding, or sheltering."

To date, no studies have been conducted that examine impacts to marine mammals from pile driving sounds from which empirical noise thresholds have been established. NMFS uses underwater sound exposure thresholds to determine when an activity could result in impacts to a marine mammal defined as Level A (injury) or Level B (disturbance including behavioral and temporary threshold shift) harassment (Table B-12). NMFS (2016a) recently described the acoustic threshold levels for determining the onset of permanent threshold shift (PTS) in marine mammals in response to underwater impulsive and non-impulsive sound sources. The criteria use cumulative SEL metrics (dB SEL_{CUM}) and peak pressure (dB PEAK) rather than the previously used dB RMS metric. NMFS equates the onset of PTS, which is a form of auditory injury, with Level A harassment under the MMPA and "harm" under the ESA. Level B harassment occurs when marine mammals are exposed to impulsive underwater sounds >160 dB RMS re 1 µPa, such as from impact pile driving, and to non-impulsive underwater sounds >120 dB RMS re 1 µPa, such as from vibratory pile driving (NMFS, 2005) The onset of temporary threshold shift (TTS) is a form of Level B harassment under the MMPA and "harassment" under the ESA. All forms of harassment, either auditory or behavioral, constitute "incidental take" under these statutes.

NMFS applies the generic sound exposure thresholds (Table B-12) to determine when an activity in the ocean that produces airborne sound might result in impacts to a marine mammal under the MMPA (70 FR 1871). Construction-period airborne noise would have little impact to cetaceans because noise from airborne sources would not transmit as well underwater (Richardson et al., 1995); thus, airborne noise would primarily be a problem for hauled-out pinnipeds near the project locations. The Level B behavioral harassment threshold criteria for airborne noise generated by pile driving for pinnipeds regulated under the MMPA are: 90 dB RMS re 20 µPa (unweighted) for harbor seals and 100 dB RMS re 20 µPa (unweighted) for all other pinnipeds. Level A injury threshold criteria for airborne noise have not been established.

2.7.3 Limitations of Existing Noise Criteria

The application of the 120 dB RMS re 1 µPa behavioral threshold can sometimes be problematic because this threshold level can be either at or below the ambient noise level of certain locations. The 120 dB RMS re 1 µPa threshold level for non-impulsive noise originated from research conducted by Malme et al. (1984, 1988) for California gray whale response to continuous industrial sounds such as drilling operations. The 120 dB re 1 µPa non-impulsive sound threshold is not the same as the species-specific 120 dB pulsed sound criterion established for migrating bowhead whales in the Arctic based on research in the Beaufort Sea (Richardson et al., 1995; Miller et al., 1999).

Table B-12. Marine Mammal Injury and Disturbance Thresholds for Underwater and Airborne Sounds

Marine Mammals	*Airborne Noise (impact and vibratory pile driving) (re 20 μPa)*[1]	*Underwater Vibratory Pile Driving Noise (non-impulsive sounds)*		*Underwater Impact Pile Driving Noise (impulsive sounds)*	
	Disturbance Guideline (haulout)[2]	*PTS Onset (Level A) Threshold*	*Level B Disturbance Threshold*	*PTS Onset (Level A) Threshold*[3]	*Level B Disturbance Threshold*
Low-Frequency Cetaceans	N/A	199 dB SEL_{CUM}[4]	120 dB RMS	219 dB Peak[5] 183 dB SEL_{CUM}[4]	160 dB RMS
Mid-Frequency Cetaceans	N/A	198 dB SEL_{CUM}[4]	120 dB RMS	230 dB Peak[5] 185 dB SEL_{CUM}[4]	160 dB RMS
High-Frequency Cetaceans	N/A	173 dB SEL_{CUM}[4]	120 dB RMS	202 dB Peak[5] 155 dB SEL_{CUM}[4]	160 dB RMS
Otariidae (sea lions)	100 dB RMS (unweighted)	219 dB SEL_{CUM}[4]	120 dB RMS	232 dB Peak[5] 203 dB SEL_{CUM}[4]	160 dB RMS
Phocidae (elephant seal, harbor seal)	90 dB RMS (unweighted)	201 dB SEL_{CUM}[4]	120 dB RMS	218 dB Peak[5] 185 dB SEL_{CUM}[4]	160 dB RMS

Key: dB = decibel; N/A = not applicable; PTS = permanent threshold shift; RMS = root mean square; SEL = sound exposure level

Notes:

1. Airborne disturbance thresholds not specific to pile driver type.
2. Sound level at which pinniped haulout disturbance has been documented. This is not considered an official threshold, but is used as a guideline.
3. Dual metric acoustic thresholds for impulsive sounds: Whichever results in the largest isopleth for calculating PTS onset is used in the analysis.
4. Cumulative sound exposure level over 24 hours.
5. Flat weighted or unweighted peak sound pressure within the generalized hearing range.

To date, there is no research or data supporting a response by pinnipeds or odontocetes to non-impulsive sounds from vibratory pile driving as low as the 120 dB threshold. Southall et al. (2007) reviewed studies conducted to document behavioral responses of harbor seals and northern elephant seals to non-impulsive sounds under various conditions and concluded that those limited studies suggest that exposures between 90 dB and 140 dB RMS re 1 μPa generally do not appear to induce strong behavioral responses.

2.7.4 Auditory Masking

Natural and artificial sounds can disrupt behavior through auditory masking or interference with a marine mammal's ability to detect and interpret other relevant sounds, such as communication and echolocation signals (Wartzok et al., 2004). Masking occurs when both the signal and masking sound have similar frequencies and either overlap or occur very close to each other in time. A signal is very likely to be masked if the noise is within a certain "critical bandwidth" around the signal's frequency and its energy level is similar or higher (Holt, 2008). Noise within the critical band of a marine mammal signal will show increased interference with detection of the signal as the level of the noise increases (Wartzok et al., 2004). For example, in delphinid subjects relevant signals needed to be 17 to 20 dB louder than masking noise at frequencies below 1 kilohertz (kHz) in order to be detected and 40 dB greater at approximately 100 kHz (Richardson et al., 1995). Noise at frequencies outside of a signal's critical bandwidth will have little to no effect on the detection of that signal (Wartzok et al., 2004).

Additional factors influencing masking are the temporal structure of the noise and the behavioral and environmental context in which the signal is produced. Continuous noise is more likely to mask signals than is intermittent noise of the same amplitude; quiet "gaps" in the intermittent noise allow detection of signals which would not be heard during continuous noise (Brumm & Slabbekoorn, 2005). The behavioral function of a vocalization (e.g., contact call, group cohesion vocalization, echolocation click, etc.) and the acoustic environment at the time of signaling may both influence call source level (Holt et al., 2011), which directly affects the chances that a signal will be masked (Nemeth & Brumm, 2010).

Masking noise from anthropogenic sources could cause behavioral changes if it disrupts communication, echolocation, or other hearing-dependent behaviors. As noted above, noise frequency and amplitude both contribute to the potential for vocalization masking; noise from pile driving typically covers a frequency range of 10 Hz to 1.5 kHz, which is likely to overlap the frequencies of vocalizations produced by cetacean species that may occur in the project area. Amplitude of noise from both impact and vibratory pile driving methods is variable and may exceed that of marine mammal vocalizations within an unknown range of each incident pile. Depending on the animal's location and vocalization source level, this range may vary over time. Possible behavioral reactions to vocalization masking include changes in vocal behavior (e.g., cessation of calling or increased amplitude of calls) (Holt et al., 2009), habitat abandonment (long- or short-term), and modifications to the acoustic structure of vocalizations (which may help signalers compensate for masking) (Brumm & Slabbekoorn, 2005; Brumm & Zollinger, 2011).

Based on the frequency overlap between noise produced by both vibratory and impact pile driving (10 Hz to 1.5 kHz) and recorded vocalizations (Table B-11), animals that remain in a project area during pile driving may be vulnerable to masking during pile driving (typically a maximum of 2.25 hours (Table B-6) intermittently over the course of a day depending on the site and project). However, the likelihood of exposure to masking effects is very low for several reasons. Most cetacean species that may be subject to masking are transitory within the action area, reducing the duration of any potential exposure to masking effects. Minimization and monitoring/shutdown measures described in EA Section 2.5 would further reduce the likelihood of exposure. Given the relatively high source levels for most marine mammal vocalizations, the Navy has estimated that masking events would occur well within the zones of behavioral harassment estimated for vibratory and impact pile driving. Most installation of steel pile would utilize vibratory drivers. Energy levels of vibratory pile driving are less than half than those of impact pile driving; therefore, the potential for masking noise due to vibratory pile driving would be limited to a small radius around a pile. Therefore, the likelihood that vibratory pile driving would mask relevant acoustic signals for marine mammals is negligible. To reduce the likelihood of masking effects, pile driving will cease in the event that a cetacean enters the monitorable portion of the behavioral harassment zone for impact pile driving.

2.7.5 Estimation of Extent of Elevated Underwater Noise Levels above Thresholds

To determine how far project noise will exceed impact thresholds, distances to noise levels anticipated from installation of 14- to 36-in diameter steel piles, 18- to 24-in concrete piles, 13-in HPDE plastic piles, and 12-14-in timber piles were modeled. If a source level for a particular pile size was not available, the next highest source level was used to produce a conservative estimate of areas above threshold values.

For the analyses that follow, the TL model described above was used to calculate the expected noise propagation from pile driving. For vibratory and impact behavioral zones and peak injury zones, a representative source level (Table B-3) was use to estimate the area exceeding the noise criteria. For vibratory pile driving distances to the PTS thresholds, the TL model described above incorporated the auditory weighting functions for each hearing group using a single frequency as described in the NMFS Spreadsheet (NMFS, 2016b). For impact pile driving distances to the PTS thresholds for 24-in and 36-in steel pile and 24-in concrete pile, the TL model described above incorporated frequency weighting adjustments by applying the auditory weighting function over the entire one-second SEL spectral data sets from impact pile driving.

Calculated distances to the underwater marine mammal SEL_{CUM} thresholds during impact pile driving for the various hearing groups are provided in Table B-13 and distances to the Peak PTS onset thresholds are provided in Table B-14. Calculated distances to the underwater marine mammal thresholds during vibratory driving are provided in Table B-15. Adjusted maximum distances are provided where the extent of noise reaches land prior to reaching the calculated radial distance to the threshold. Areas encompassed within the threshold (zone of influence, or ZOI) were calculated using the location of a representative pile that might be driven at one or more structures at each installation. Pile locations were chosen to model the greatest possible affected areas at each installation; typically, these locations would be at the seaward end of a pier that extends the farthest into the marine environment or is close to a known pinniped haulout site.

Table B-13. Calculated Radial Distance(s) to Underwater Marine Mammal Impact Pile Driving Noise Thresholds and Areas Encompassed Within Threshold Distance—SEL_{CUM} Thresholds[1]

Pile Size and Type	*Injury (PTS Onset) Level A Pinnipeds*[2]		*Injury (PTS Onset) Level A Cetaceans*[2]			*Behavioral Disturbance Level B (160 dB RMS)*[3]	
	PW	OW	LF	MF	HF	*Radial Distance to Threshold*	*Area Encompassed by Threshold*[4]
13-in HDPE	[7]	[7]	[7]	[7]	[7]	5 m	79 sq m
12- to 14-in timber	[7]	[7]	[7]	[7]	[7]	46 m	6648 sq m
18-in timber	86 m	5m	159 m	3 m	342 m	398 m	5 sq km (Everett)
18-in concrete	[7]	[7]	[7]	[7]	[7]	46 m	6648 sq m
24-in concrete[5]	34 m	2 m	216 m	3 m	136 m	159 m	0.08 sq km
14-in steel[6]	86 m	5 m	159 m	6 m	342 m	398 m	0.5 sq km (Bremerton)
24-in steel[6]	86 m (No BC) 25 m (BC)	5 m (No BC) 1.4 m (BC)	159 m (No BC) 136 m (BC)	6 m (No BC) 3 m (BC)	342 m (No BC) 185 m (BC)	1,585 (No BC) 464 (BC)	0.54 sq km (Bangor) 2.09 sq km (Keyport) 0.48 sq km (Zelatched Point)
30-in steel[6]	736 m (No BC) 158 m (BC)	46 m (No BC) 9 m (BC)	2,512 m (No BC) 736 m (BC)	63 m (No BC) 10 m (BC)	2,512 m (No BC) 541 m (BC)	2,154 m (no BC) 631 m (BC)	0.91 sq km (Bangor) 1.94 sq km (Keyport) 0.85 sq km (Zelatched Point) 1.2 sq km (Everett)
36-in steel[6]	736 m (No BC) 158 m (BC)	46 m (No BC) 9 m (BC)	2,512 m (No BC) 736 m (BC)	63 m (No BC) 10 m (BC)	2,512 m (No BC) 541 m (BC)	1,359 m (Keyport) (no BC) 541 m (Bangor) (BC) 398 m (other locations) (BC)	0.7 sq km (Bangor) 0.42 sq km (Keyport) 0.36 sq km (Zelatched Point) 0.5 sq km (Everett)

Key: BC = bubble curtain); HF = high frequency cetacean, km = kilometer; LF = low frequency cetacean; m = meter; MF = mid-frequency cetacean, No BC = no bubble curtain; OW= otariid (sea lion); PTS = permanent threshold shift; PW = phocid (harbor seal); sq = square

Notes:

1. Calculations based on SEL_{CUM} threshold criteria shown in Table B-12 and source levels shown in Table B-3. Threshold distances and ensonified areas calculated for representative piles located at seaward ends of wharfs, intended to model a conservative scenario for pile driving at each MPR location.
2. Representative spectra were used to calculate the distances to the injury (PTS onset) thresholds for each functional hearing group for 24-in, and 36-in steel pile, and 24-in concrete pile (see Appendix E). Distances for 18-in concrete piles assumed to be the same as 24-in concrete piles. Distances for 14-in steel pile assumed to be the same as 24-in steel pile, and 30-in steel pile assumed to be the same as for 36-in steel pile.
3. Distances to behavioral disturbance thresholds calculated using practical spreading loss model.
4. Areas were adjusted wherever land masses are encountered prior to reaching the full extent of the radius around the driven pile.
5. Assumes 4,000 strikes/day. No bubble curtain proposed for concrete pile.
6. Assumes 1,000 strikes/day. No bubble curtain will be used at NAVBASE Kitsap Bremerton and NAVBASE Keyport; therefore, unattenuated source levels were used. Bubble curtain will be used for 24-in, 30-in, and 36-in steel piles at NAVBASE Bangor, NAVSTA Everett, and Zelatched Point, but not for 14-in steel pile. Where bubble curtain used, 8 dB attenuation assumed. Steel piles will not be installed at Manchester and Indian Island.
7. Shutdown zones will be 300 m for cetaceans and 15 to 46 m for phocids, depending on the number of strikes anticipated for a project. This would avoid all injury and behavioral takes for these pile types.

Table B-14. Calculated Radial Distance(s) to Underwater Marine Mammal Impact Pile Driving—Peak PTS Thresholds[1]

Pile Size and Type	*Injury (PTS Onset) Level A Pinnipeds[2] (m)*		*Injury (PTS Onset) Level A Cetaceans[2] (m)*		
	PW	***OW***	***LF***	***MF***	***HF***
13-in HDPE	2	2	2	2	2
12- to14-in timber	2	2	2	2	2
18-in concrete	0	0	0	0	1
24-in concrete	0	0	0	0	1
14-in steel[3]	1	0	1	0	7
24-in steel[3]	3 (No BC) 1 (BC)	0 (No BC) 0 (BC)	3 (No BC) 1 (BC)	0 (No BC) 0 (BC)	34 (No BC) 10 (BC)
30-in steel[3]	7 (No BC) 2 (BC)	1 (No BC) 0 (BC)	6 (No BC) 2 (BC)	1 (No BC) 0 (BC)	86 (No BC) 25 (BC)
36-in steel[3]	3 (No BC) 1 (BC)	0 (No BC) 0 (BC)	3 (No BC) 1 (BC)	1 (No BC) 0 (BC)	40 (No BC) 12 (BC)

Key: BC = bubble curtain); HF = high frequency cetacean, LF = low frequency cetacean; m = meter; MF = mid-frequency cetacean, No BC = no bubble curtain; OW= otariid (sea lion); PTS = permanent threshold shift; PW = phocid (harbor seal)

Notes:

1. Calculations based on Peak threshold criteria shown in Table B-12 and source levels in Table B-3. Distances to peak PTS thresholds calculated using practical spreading loss model.
2. Shutdown zones will be 300 m for cetaceans and 15 to 46 m for phocids, depending on the number of strikes anticipated for a project. This would avoid all injury and behavioral takes for these pile types.
3. No bubble curtain will be used at NAVBASE Kitsap Bremerton and NAVBASE Keyport; therefore, unattenuated source levels were used. Bubble curtain will be used for steel piles at NAVBASE Bangor, NAVSTA Everett, and Zelatched Points; therefore, 8 dB attenuation assumed. Steel piles will not be installed at Manchester and Indian Island.

Table B-15. Calculated Radial Distance(s) to Underwater Marine Mammal Vibratory Pile Driving Noise Thresholds and Areas Encompassed Within Threshold Distance[1]

Pile Size and Type	***Injury (PTS Onset) Level A Pinnipeds[2]***		***Injury (PTS Onset) Level A Cetaceans[2]***			***Behavioral Disturbance Level B (120 dB RMS)[3]***	
	PW	OW	LF	MF	HF	***Radial Distance to Threshold***	***Area Encompassed by Threshold[4]***
12-in timber[5]	1 m	<1 m	1 m	<1 m	2 m	1.6 km	3.8 (Manchester Finger Pier)[8] 4.6 (Manchester Fuel Pier)[8]
13 and 14-in timber[5]	1 m	<1 m	2 m	<1 m	3 m	2.2 km	6.8 sq km (Bremerton)
14-in steel	1 m	<1 m	2 m	<1 m	3 m	2.2 km	6.8 sq km (Bremerton)
18-in timber/plastic[8]	1 m	<1 m	2 m	<1 m	3 m	2.2 km	5.9 sq km (Manchester Finger Pier) 7.8 sq km (Manchester Fuel Pier) 9.4 sq km (Everett)
16 and 24-in steel[6]	7 m	1 m	12 m	1 m	17 m	5.4 km	26.8 sq km (Bangor) 4.9 sq km (Keyport) 37.9 sq km (Zelatched Point)
30- and 36-in steel (locations other than Bangor)[6]	18 m	1 m	30 m	3 m	43 m	13.6 km	4.9 sq km (Keyport) 75.24 sq km (Zelatched Point) 117.8 sq km (Everett)
30- and 36-in steel (Bangor)[6]	15 m	11 m	25 m	2 m	37 m	11.7 km	40.9 sq km (Bangor)
Sheet steel[6]	10 m	1 m	16 m	1 m	24 m	7.4 km	15.0 sq km (Bremerton)

Key: HF = high frequency cetacean; km = kilometer; LF = low frequency cetacean; m = meter; MF = mid-frequency cetacean, OW= otariid (sea lion); PTS = permanent threshold shift; PW = phocid (harbor seal); sq = square

Notes:

1. Calculations based on threshold criteria shown in Table B-12. Threshold distances and ensonified areas calculated for representative piles located at seaward ends of wharfs, intended to model a conservative scenario for pile driving at each MPR location.
2. Distances to the injury (PTS onset) thresholds calculated using NMFS calculator with default Weighting Factor Adjustment of 2.5 (NMFS, 2016b). http://www.nmfs.noaa.gov/pr/acoustics/guidelines.htm). WFA = 2.5.
3. Distances to the behavioral disturbance thresholds calculated using practical spreading loss model.
4. Areas were adjusted wherever land masses are encountered prior to reaching the full extent of the radius around the driven pile.
5. Duration for HDPE, timber, and 14-in steel piles assumed to be the same as 13-in steel piles = 0.5 hour duration (see Table B-6).
6. Duration for 16-in steel and sheet piles assumed to be the same as 24- to 36-in steel piles = 2.25 hours (see Table B-6).
7. Values provided for Manchester projects because vibratory extraction of existing timber piles represents the worst case for pile driving noise impacts on marine mammals.
8. Radial distance for the 14-in steel pile was used for the 18-in timber pile due to lack of information for this pile.

2.7.6 Estimation of Extent of Elevated Airborne Noise Levels above Thresholds

The distances to the airborne harassment thresholds were calculated for steel and concrete pile impact and vibratory pile driving with the airborne transmission loss formula and source levels shown in Table B-4. The distances to the pinniped airborne noise thresholds produced by the loudest pile installation method (impact installation of 36-in steel pipe), are shown in Table B-16. Because these areas are smaller than the underwater behavioral threshold zones, a separate analysis of Level B take was not conducted for the airborne zones. Animals in the airborne zones would already have been exposed within a Level B underwater zone; therefore, no additional takes due to exposure to airborne noise are expected.

Table B-16. Calculated and Measured Distances to Pinniped Behavioral Airborne Noise Thresholds

Installation Method	*Pile Size and Type*	*Harbor Seal Threshold = 90 dB RMS*	*Steller Sea Lions and California Sea Lions Threshold = 100 dB RMS*
Impact	24-in concrete	134 m	42 m
	18-in steel	150 m	47 m
	24-in steel	150 m	47 m
	30- and 36-in steel	189 m	60 m
Vibratory	36-in steel	Measured mean[1] = 33 m (51 m max) Calculated[2] = 27 m	Measured mean[1] = 10 m (16 m max) Calculated[2] = 8 m
	Sheet steel	19 m	8 m

Key: dB = decibel; in = inch; m = meter; RMS = root-mean-square
Notes:
1. Measured during EHW-2 construction, Illingworth & Rodkin, 2012
2. Calculated using spherical spreading model

2.7.7 Evaluation of Potential Species Presence

In prior Navy applications, either density data from the Navy's Marine Mammal Species Density Database (NMSDD) (Navy, 2015b) or site-specific survey information was used to quantify exposure to noise above threshold levels. However, using a density based analysis for species that occur intermittently does not adequately account for their unique temporal and spatial distributions.[6] For intermittently occurring species, historical occurrence and numbers as well as group size were reviewed to develop a realistic estimate of potential exposure. Therefore, potential exposure estimates in this application for species without a predictable occurrence are based on a historical likelihood of encounter. The following species were in this category for all installations in Puget Sound (Table B-17): Humpback whale, minke whale, gray whale, transient killer whale, Southern Resident killer whale, Dall's porpoise in Hood Canal, and elephant seal.

[6] Previously a density based exposure analysis was required for these species. The analyses often resulted in zero exposure estimates. Therefore, to obtain Incidental Harassment Authorization for potential exposure to these animals, the Navy would typically augment the requested take by the typical group size of animals. NMFS has subsequently requested that future Navy Incidental Harassment Authorization applications for Puget Sound not use a density estimate for marine mammal species with a low likelihood of occurrence.

Table B-17. Evaluation Method for Potential Marine Mammal Species at Installations

Installation	*Species*	*Analysis Method*
NAVBASE Kitsap Bangor	Humpback whale, minke whale, gray whale, transient killer whale, Southern Resident killer whale, Dall's porpoise, and elephant seal	Historical occurrence
	Harbor porpoise	Density
	California sea lion, Steller sea lion, harbor seal	Installation-specific abundance
NAVBASE Kitsap Bremerton	Humpback whale, minke whale, gray whale, transient killer whale, Southern Resident killer whale, and elephant seal	Historical occurrence
	Harbor porpoise, Dall's porpoise, Steller sea lion,	Density
	California sea lion, harbor seal	Installation-specific abundance
NAVBASE Kitsap Keyport	Humpback whale, minke whale, gray whale, transient killer whale, Southern Resident killer whale, and elephant seal	Historical occurrence
	Steller sea lion, California sea lion, harbor seal, Dall's porpoise, harbor porpoise	Density
Manchester	Humpback whale, minke whale, gray whale, transient killer whale, Southern Resident killer whale, and elephant seal	Historical occurrence
	Dall's porpoise, harbor porpoise, harbor seal	Density
	California sea lion, Steller sea lion	Installation-specific abundance
Zelatched Point	Humpback whale, minke whale, gray whale, transient killer whale, Southern Resident killer whale, Dall's porpoise, and elephant seal	Historical occurrence
	Harbor porpoise, harbor seal, California sea lion, Steller sea lion	Density
NAVMAG Indian Island	Humpback whale, minke whale, gray whale, transient killer whale, Southern Resident killer whale, and elephant seal	Historical occurrence
	California sea lion, harbor seal, harbor porpoise	Installation-specific abundance
NAVSTA Everett	Humpback whale, minke whale, gray whale, transient killer whale, Southern Resident killer whale, and elephant seal	Historical occurrence
	Harbor porpoise, Dall's porpoise, Steller sea lion	Density
	California sea lion, harbor seal	Installation-specific abundance

Notes:
Density data source (Navy, 2015b)
Installation-specific abundance sources (Navy, 2016b)

For species with more frequent occurrence, but no site-specific surveys at MPR installations, density estimates in inland waters (Navy, 2015b) were used for quantification of potential exposure. These species include harbor porpoise, Dall's porpoise, Steller sea lion, California sea lion, and harbor seal, except as noted in the following sentence.

Long-term monitoring data are available for pinniped species (California sea lion, Steller sea lion, and harbor seal) at several installations, resulting in data on installation-specific abundances (Navy, 2016b). These abundances were used to calculate potential exposure at the monitored installation.

2.7.8 Estimating Potential Level B Harassment Exposures

Cetaceans (whales, dolphins, and porpoises) spend their entire lives in the water and spend most of their time (greater than 90 percent for most species) entirely submerged below the surface. When at the surface, cetacean bodies are almost entirely below the water's surface, with only the blowhole exposed to allow breathing. This makes cetaceans difficult to locate visually and also exposes them to underwater noise, both natural and anthropogenic, essentially 100 percent of the time because their ears are nearly always below the water's surface.

Pinnipeds (seals and sea lions) spend significant amounts of time out of the water during breeding, molting, and hauling out periods. In the water, pinnipeds spend varying amounts of time underwater. California sea lions are known to rest at the surface in large groups for long amounts of time. When not actively diving, pinnipeds at the surface often orient their bodies vertically in the water column and hold their heads above the water surface. Consequently, pinnipeds may not be exposed to underwater sounds to the same extent as cetaceans.

For the purpose of assessing impacts from underwater sound, the Navy assumed that all cetacean and pinniped species spend 100 percent of their time underwater. This approach is conservative because pinnipeds spend a portion of their time hauled out and, therefore, are expected to be exposed to less sound than is estimated by this approach.

To quantitatively assess exposure of marine mammals to noise levels from pile driving over the NMFS threshold guidance, one of three calculation methods was used depending on the species spatial and temporal occurrence. For species with rare or infrequent occurrence during the in-water work window, the likelihood of occurrence was reviewed based on the information in EA Section 3 and the potential maximum duration of work days at each location and total work days for all locations. Based on this review, none of the species in this category, most of which are cetaceans, are anticipated to linger for multiple days. Therefore, for species in this category the duration of occurrence was set to 2 days, equivalent to a transit by a project site going one direction and then back. The calculation for species with rare or infrequent occurrence was:

(1) Exposure estimate = Probable abundance during construction × Probable duration

where

Probable abundance = maximum expected group size.

Probable duration = probable duration of animal(s) presence at construction sites during in-water work window.

Assumed to be 2 days for humpback whales, minke whales, gray whale, Southern Resident killer whale, transient killer whales.

For species that regularly occur in Puget Sound, but do not have site-specific abundances, marine mammal density estimates were used to determine the number of animals potentially exposed in a ZOI on any one day of pile driving or extraction (Table B-18). The density estimates used for this analysis come from the Navy's Marine Species Density Database (Navy, 2015b). The maximum density value for each species during the in-water work window at each site was used in the marine mammal take assessment calculation.

Table B-18. Marine Mammal Species Densities Used in Exposure Calculations

Species	***Region Location[1]***	***Density (June–February) Animals/sq km***
Harbor porpoise[1]	Hood Canal (Bangor, Zelatched Point) East Whidbey (Everett) Bainbridge (Bremerton, Keyport) Vashon (Manchester) NAVMAG Indian Island	0.44 0.75 0.53 0.25 0.16
Dall's porpoise	Puget Sound	0.039
Steller sea lion	Puget Sound Dabob Bay	0.0368 0.0251
California sea lion	Puget Sound Dabob Bay NAVMAG Indian Island	0.1266 0.279 0.07
Harbor seal	NAVSTA Everett NAVBASE Keyport, Manchester Dabob Bay NAVMAG Indian Island	2.2062 1.219 9.918 1.219

Source: NMSDD (Navy, 2015b); (Smultea et al., 2017)

Key: sq km = square kilometers

Note:

1. For harbor porpoise density estimates, Smultea et al. (2017) sub-divided Puget Sound into sub-regions. The sub-region that includes each MPR location is indicated in parentheses in this table.

The equation for species likely to occur with only density estimates and no site-specific abundance was:

$$\text{(2) Exposure estimate} = (N \times ZOI) \times \text{maximum days of pile driving}^{7}$$

where

N = density estimate used for each species

ZOI = Zone of Influence; the area where noise exceeds the noise threshold value

For species with site-specific surveys available, exposures were estimated by:

$$\text{(3) Exposure estimate} = \text{Abundance} \times \text{maximum days of pile driving}$$

where:

Abundance = average monthly maximum over the time period when pile driving will occur

Average monthly maximum counts (Navy, 2016b) were averaged over the in-water work window. The maximum number of animals observed during the month(s) with the highest number of animals present on a survey day was used in the analysis.

[7] The product is rounded up to a whole number.

The following assumptions were used to calculate potential exposures to impact and vibratory pile driving noise for each threshold:

- For formulas (2) and (3), each species will be present in the project area each day during construction. The timeframe for takings would be one potential take (Level B harassment exposure) per individual, per 24 hours.
- For projects that do not have a pile type or size specified, the pile type, size, and installation method that produces the largest ZOI were used to estimate exposure of marine mammals to noise impacts. For example, piles to be installed at NAVBASE Kitsap Bangor may be steel or concrete up to 36 in. Since vibratory installation of steel piles creates the largest ZOI, the exposure analysis assumes that all of the piles will be 30- to 36-in steel pipe.
- All pilings installed at each site will have an **underwater** noise disturbance distance equal to the pile that causes the greatest noise disturbance (i.e., the piling farthest from shore) installed with the method that has the largest ZOI. Vibratory pile driving would produce the largest ZOI. In this case, the ZOI for an impact hammer will be encompassed by the larger ZOI from the vibratory driver. Vibratory driving was assumed to occur on all days of pile driving where steel piles could be installed. Where other pile types are installed, an impact hammer would produce the largest ZOI.
- All pilings installed at each site will have an **airborne** noise disturbance distance equal to the pile that causes the greatest noise disturbance (i.e., the piling furthest from shore) installed with the method that has the largest ZOI. The largest airborne ZOI will be produced by impact driving. The ZOI for a vibratory hammer will be encompassed by the larger ZOI from the impact driver. Impact pile driving was assumed to occur on all days of pile driving. However, exposures to airborne noise were considered to be included in the larger underwater ZOIs from vibratory or impact driving and were not calculated in the analysis of exposure of pinnipeds to noise above thresholds.
- Days of pile driving at each location (Table B-5) were conservatively based on a relatively slow daily production rate, allowing for production delays due to equipment failure, etc., but actual daily production rates may be higher, resulting in fewer actual pile driving days.

Of significant note is that successful implementation of mitigation methods (i.e., visual monitoring and the use of shutdown zones) will result in no Level A exposure for most species because the injury zones are small enough to be fully monitored. Harbor seals are the exception at Bangor and Everett (Section 2.7.9.11). The Navy is projecting incidental takes only for Level B exposures to underwater pile driving noise for most species, and takes for Level A and Level B for harbor seal. The exposure assessment estimates the numbers of individuals potentially exposed to the effects of pile driving noise exceeding NMFS established thresholds. Results from acoustic impact exposure assessments should be regarded as conservative overestimates that are strongly influenced by limited marine mammal data, the assumption that marine mammals will be present during pile driving, and the assumptions that the maximum number of piles will be extracted or installed.

2.7.9 Exposure Estimates

Exposure estimates for each species from the 5-year period of this application are discussed in the following sections and presented in Tables B-19 and B-20. Annual reporting requirements will provide details of how many actual and extrapolated animals of each species are exposed to noise levels considered potential Level B harassment at each location. NAVMAG Indian Island would have a Behavioral Disturbance zone out to 158 m and would be monitored to prevent any Level B exposures.

Table B-19. Total Underwater Level B Exposure Estimates by Species

Species	*Bangor*	*Zelatched Point*	*Bremerton*	*Keyport*	*Manchester*	*Everett*	*Indian Island*	*Total*
Humpback whale	Applies to all installations						0	**4**
Minke whale	Applies to all installations						0	**4**
Gray whale	Applies to all installations						0	**4**
Transient killer whale	Applies to all installations						0	**12**
Southern Resident killer whale	Applies to all installations						0	**40**
Harbor porpoise	2,142	662	1,336	52	98	552	0	**4,842**
Dall's porpoise	0	0	98	4	15	29	0	**146**
Steller sea lion	357	38	93	4	500	27	0	**1,019**
California sea lion	5,831	420	11,592	12	2,150	5,148	0	**25,153**
Northern elephant seal	Applies to all installations						0	**2**
Harbor seal	4,680	14,925	1,848	119	477	16,536	0	**38,585**

Table B-20. Total Underwater Level A Exposure Estimates by Species

Species	*Bangor*	*Zelatched Point*	*Bremerton*	*Keyport*	*Manchester*	*Indian Island*	*Everett*	*Total*
Harbor seal	119	0	0	0	0	0	167	**286**

Exposure estimates generally do not differentiate age, sex, or reproductive condition. However, some inferences can be made based on what is known about the life stages of animals that visit or inhabit Puget Sound. When possible and with the available data, this is discussed by species in the sections that follow.

The assumptions described above tend to produce highly conservative exposure estimates. At NAVBASE Kitsap Bremerton, for example, pile driving and extraction at Pier 6 provides a contrast between estimated exposures and actual reported exposure of several marine mammal species that may occur in the vicinity of this location. The Navy projected takes of three species (harbor seal, California sea lion, Steller sea lion) but reported only a fraction of the requested number of harbor seals and California sea lions were actually potentially exposed to elevated noise levels (all due to use of vibratory pile drivers).

2.7.9.1 Humpback Whale

Humpback whales are considered rare in the project areas. Based on the Navy's analysis of humpback whales' intermittent occurrence in Puget Sound, density estimates were not used to determine animals potentially exposed to pile driving. Humpback whales have been observed in the waters of Puget Sound in every month of the year, singly or in pairs. Because known feeding areas are not present at any of the locations included in this application, any exposure to elevated project noise levels is expected to be of short duration as the animal(s) moves through an area. Therefore, based on a low probability of occurrence at any project site, the Navy used formula (1) described in Section 2.7.8 to calculate potential exposures and requested takes for exposure for up to four humpback whales at any of the potential project locations during the 5 years of MPR activities. Animals of any age, sex, or reproductive status could be exposed.

To protect this species, with two ESA-listed distinct population segments potentially present, from noise impacts, the Navy will implement a shutdown if humpback whales are seen by marine mammal monitors in an injury or behavioral harassment zone (see mitigation measures in Chapter 2). A monitor will be stationed at locations from which the injury zone for impact pile driving is visible and will implement shutdown if a whale enters either zone. With the implementation of monitoring, even if a whale enters an injury zone, shutdown would occur before cumulative exposure to noise levels that would result in PTS could occur. Because pile driving will be shut down if whales are in the injury zone, no Level A take is requested. Any exposure of humpback whales to pile driving noise will be minimized to short-term Level B behavioral harassment in areas beyond the visually monitorable portion of the disturbance zone during vibratory pile driving.

2.7.9.2 Minke Whale

Minke whales in Washington inland waters typically feed in the areas around the San Juan Islands and along banks in the Strait of Juan de Fuca. Minke whales are infrequent visitors to Puget Sound, especially east of Admiralty Inlet. When present, minke whales are usually seen singly or in pairs. Therefore, based on a low probability of occurrence at any one project site, the Navy used formula (1) described in Section 2.7.8 to calculate potential Level B exposure and requested takes for exposure for up to four minke whales at any of the potential project locations for the duration of the 5-year MPR LOA. If present, minke whales of the California/Oregon/Washington stock would be exposed to noise levels considered Level B harassment. Animals of any age, sex, or reproductive status could be affected.

To protect minke whales from noise impacts, the Navy will implement a shutdown if minke whales are seen by marine mammal monitors in an injury or behavioral harassment zone (see mitigation measures in Chapter 2). A monitor will be stationed at locations from which the injury zone for impact pile driving is visible and will implement shutdown if a whale enters either zone. With the implementation of monitoring, even if a whale enters an injury zone, shutdown would occur before cumulative exposure to noise levels that would result in PTS could occur. Because pile driving will be shut down if whales are in the injury zone, no Level A take is requested. Any exposure of minke whales to pile driving noise will be minimized to short-term Level B behavioral harassment in areas beyond the visually monitorable portion of the disturbance zone during vibratory pile driving.

2.7.9.3 Gray Whale

Most gray whales in Puget Sound utilize the feeding areas in northern Puget Sound around Whidbey Island and in Port Susan in March through June with a few individual sightings occurring year-round that are not always associated with feeding areas. Gray whales utilizing the feeding areas around Whidbey Island and in Port Susan pass by NAVSTA Everett. However, because known feeding areas are not present at any of the installations included in this application, any exposure to elevated project noise levels are expected to be of short duration as the animal(s) moves through an area. Moreover, the majority of in-water work will occur during the fall and winter when gray whales utilizing these areas are less likely to be present in Puget Sound. Individuals have been observed in the waterways near NAVBASE Kitsap Bremerton, NAVBASE Kitsap Keyport, and NAVBASE Kitsap Manchester. Gray whales have not been reported in Hood Canal since 1999 and, therefore, are not expected to be present in the vicinity of NAVBASE Kitsap Bangor or Zelatched Point. Based on a low probability of occurrence at any project site during the time period of potential pile driving and the small number of pile driving days proposed, the Navy used formula (1) described in Section 2.7.8 to calculate potential exposure and requested Level B takes for up to two gray whales at any of the project locations for 2 days for a total of four exposures for the duration of the 5-year MPR LOA. Animals of any age, sex, or reproductive status could be exposed.

To protect gray whales from noise impacts, the Navy will implement a shutdown if gray whales are seen by marine mammal monitors in an injury or behavioral harassment zone (see mitigation measures in Chapter 2). A monitor will be stationed at locations from which the injury zone for impact pile driving is visible and will implement shutdown if a whale enters either zone. With the implementation of monitoring, even if a whale enters an injury zone, shutdown would occur before cumulative exposure to noise levels that would result in PTS could occur. Because pile driving will be shut down if whales are in the injury zone, no Level A take is requested. Any exposure of gray whales to pile driving noise will be minimized to short-term Level B behavioral harassment in areas beyond the visually monitorable portion of the disturbance zone during vibratory pile driving.

2.7.9.4 Killer Whale, West Coast Transient Stock

Transient killer whales occasionally occur throughout Puget Sound with sightings at all Puget Sound locations. They are typically observed in small groups with an average group size in Puget Sound of six individuals. Based on a low probability of occurrence at any project site during the in-water work window, the Navy used formula (1) described in Section 2.7.8 to calculate exposure to Level B noise levels at any of the project locations for a group of 6 individuals over 2 days. The Navy requested incidental takes of up to 12 individuals from Level B harassment from underwater sound incidental to pile driving during the 5 years of MPR activities. Twelve individuals will account for two groups of average size in Puget Sound passing a project site twice or a single larger than average group passing once. Killer whales of any age, sex or reproductive status would be exposed.

To protect transient killer whales from noise impacts, the Navy will implement a shutdown if killer whales are seen by marine mammal monitors in an injury or behavioral harassment zone (see mitigation measures in Chapter 2). A monitor will be stationed at locations from which the injury zone for impact pile driving is visible and will implement shutdown if a whale enters either zone. With the implementation of monitoring, even if a whale enters an injury zone, shutdown would occur before cumulative exposure to noise levels that would result in PTS could occur. Because pile driving will be shut down if whales are in the injury zone, no Level A take is requested. Any exposure of killer whales to pile driving noise will be minimized to short-term behavioral harassment in areas beyond the visually monitorable portion of the disturbance zone during vibratory pile driving.

2.7.9.5 Killer Whale, Eastern North Pacific Southern Resident Stock/Distinct Population Segment

Eastern north Pacific Southern Resident killer whales occur seasonally in Puget Sound, although they have not been reported in Hood Canal since at least 1995. Animals, when present, are most frequently seen in inland waters north of the MPR activities locations in late spring, summer, and fall. They are occasionally observed in Puget Sound in winter months but less frequently than in summer and fall. Based on a low probability of occurrence at any project site during the in-water work window, the Navy used formula (1) described in Section 2.7.8 to calculate potential exposure and requested incidental take for exposure of up to 40 Southern Resident killer whales at any of the project locations during the 5 years of MPR activities. This number represents the approximate group size of the largest pod, L pod, although J pod with approximately 20 members is historically the pod most likely to enter Puget Sound. Therefore, 40 individuals were considered a reasonable estimate to account for the size of the entire J pod passing a project site over 2 days or a larger group over 1 day. Animals of any age, sex, or reproductive status could be exposed.

To protect Southern resident killer whales from noise impacts, the Navy will implement a shutdown if killer whales are seen by marine mammal monitors in an injury or behavioral harassment zone (see mitigation measures in Chapter 2). A monitor will be stationed at locations from which the injury zone for impact pile driving is visible and will implement shutdown if a whale enters either zone. With the implementation of monitoring, even if a whale enters an injury zone, shutdown would occur before cumulative exposure to noise levels that would result in PTS could occur. Because pile driving will be shut down if whales are in the injury zone, no Level A take is requested. Any exposure of killer whales to pile driving noise will be minimized to short-term behavioral harassment in areas beyond the visually monitorable portion of the disturbance zone during vibratory pile driving.

2.7.9.6 Harbor Porpoise

Harbor porpoises may be present in all major regions of Puget Sound throughout the year. Group sizes ranging from 1 to 150 individuals were reported in aerial surveys conducted from summer 2013 to spring 2016 but mean group size was 1.7 animals (Smultea et al., 2017). The estimated harbor porpoise density in inland waters is provided in Table B-18. Level B exposure estimates utilized formula (2) as described in Section 2.7.8 with these densities and the anticipated number of pile driving days as follows:

NAVBASE Kitsap Bangor

The Navy applied the Hood Canal density, 119 days of pile driving, and the largest ZOI calculated for pile driving at this location (40.9 km sq for vibratory installation of 30- or 36-in steel piles) (Table B-15). The

Navy requested takes for level B exposure of up to 2,142 harbor porpoises for the duration of the MPR LOA at Bangor (Table B-19).

NAVBASE Kitsap Bremerton

The Navy applied the Bainbridge density, 168 days of pile driving, and the largest ZOI calculated for pile driving at this location (15 km sq for vibratory installation of sheet steel) (Table B-15). The Navy requested Level B takes for level B exposure of up to 1,336 harbor porpoises for the duration of the MPR LOA at Bremerton (Table B-19).

NAVBASE Kitsap Keyport

The Navy applied the Bainbridge density, 20 days of pile driving, and the largest ZOI calculated for pile driving at this location (4.9 km sq for vibratory installation of 30- or 36-in steel pile) (Table B-15). The Navy requested takes level B for exposure of up to 52 harbor porpoises for the duration of the MPR LOA at Keyport (Table B-19).

Manchester

The Navy applied the Vashon density, 50 days of pile driving, and the largest ZOI calculated for pile driving at this location (7.8 km sq for vibratory extraction of 18-in timber or plastic piles) (Table B-15). The Navy requested takes for level B exposure of up to 98 harbor porpoises for the duration of the MPR LOA at Manchester (Table B-19).

Zelatched Point

The Navy applied the Hood Canal density, 20 days of pile driving, and the largest ZOI calculated for pile driving at this location (75.24 km sq for vibratory installation of 30- or 36-in steel pile) (Table B-15). The Navy requested takes for Level B exposure of up to 662 harbor porpoises for the duration of the MPR LOA at Zelatched Point (Table B-19).

NAVSTA Everett

Only one 36-in pile is anticipated to be installed with a vibratory driver and the likelihood of exposure of harbor porpoises during the relatively brief installation of this pile is low. The majority of piles will be installed with impact drivers, resulting in relatively smaller areas affected by elevated noise (Table B-13). However, vibratory drivers may be used to extract timber piles at this location, resulting in ZOIs that would be larger than for impact installation. Therefore, the Navy applied the East Whidbey density, 78 days of pile driving, and the largest ZOI calculated for pile driving at this location (9.4 km sq for 18-in timber) (Table B-15). The Navy requested takes for level B exposure of up to 552 harbor porpoises for the duration of the MPR LOA at Everett (Table B-19).

In summary, the Navy requested Level B takes for exposure of up to 4,842 harbor porpoises at all installations for the duration of the 5-year MPR LOA (Table B-19). Animals of any age, sex, or reproductive status could be exposed to underwater sounds.

To protect harbor porpoises from noise impacts, the Navy will implement a shutdown if porpoises are seen by marine mammal monitors in an injury or behavioral harassment zone (see mitigation measures in Chapter 2). A monitor will be stationed at locations from which the injury zones for impact pile driving are visible and will implement shutdown if a porpoise enters either zone. With the implementation of monitoring, even if a harbor porpoise enters an injury zone, shutdown would occur before cumulative exposure to noise levels that would result in PTS could occur. Because pile driving will be shut down if porpoises are in the injury zone, no Level A take is requested. Any exposure of porpoises to pile driving noise will be minimized to short-term behavioral harassment in areas beyond the visually monitorable portion of the disturbance zone during vibratory pile driving.

2.7.9.7 Dall's Porpoise

In Washington inland waters, Dall's porpoises are most abundant in the Strait of Juan de Fuca and Haro Strait in the San Juan Island area, but may be present in Puget Sound year-round. Group size is usually one to three, but up to 25 individuals have been reported. Based on historical records, no Dall's porpoises are anticipated in Hood Canal. At other locations in Puget Sound, where Dall's porpoise are more likely to occur, the Navy has estimated that Dall's porpoise density is 0.039 animals/sq km (Table B-18). Level B exposure estimates utilized formula (2) with this density, the anticipated number of piles driving days at Puget Sound locations, and the largest ZOI calculated for each installation. The Navy requested takes for exposure of up to 146 Dall's porpoises during the 5 years of MPR activities (Table B-19). Animals of any age, sex, or reproductive status could be exposed to underwater sounds.

NAVBASE Kitsap Bremerton

The Navy applied the Dall's porpoise density is 0.039 animals/sq km , 168 days of pile driving, and the largest ZOI calculated for pile driving at this location (15 km sq for vibratory installation of sheet steel) (Table B-15). The Navy requested takes for Level B exposure of up to 98 Dall's porpoises for the duration of the MPR LOA at Bremerton (Table B-19).

NAVBASE Kitsap Keyport

The Navy applied the Dall's porpoise density is 0.039 animals/sq km, 20 days of pile driving, and the largest ZOI calculated for pile driving at this location (4.9 km sq for vibratory installation of 30- or 36-in steel pile) (Table B-15). The Navy requested takes for Level B exposure of up to 4 Dall's porpoises for the duration of the MPR LOA at Keyport (Table B-19).

Manchester

The Navy applied the Dall's porpoise density is 0.039 animals/sq km, 50 days of pile driving, and the largest ZOI calculated for pile driving at this location (7.836 km sq for vibratory extraction of 18-in timber or plastic piles) (Table B-15). The Navy requested takes for Level B exposure of up to 15 Dall's porpoises for the duration of the MPR LOA at Manchester (Table B-19).

NAVSTA Everett

Only one 36-in pile is anticipated to be installed with a vibratory driver and the likelihood of exposure of Dall's porpoises during the relatively brief installation of this pile is low. The majority of piles will be installed with impact drivers, resulting in relatively smaller areas affected by elevated noise (Table B-13). However, vibratory drivers may be used to extract timber piles at this location, resulting in ZOIs that would be larger than for impact installation. Therefore, the Navy applied the Dall's porpoise density is 0.039 animals/sq km, 78 days of pile driving, and the largest ZOI calculated for pile driving at this location (9.434 km sq for 18-in timber) (Table B-15). The Navy requested takes for Level B exposure of up to 29 Dall's porpoises for the duration of the MPR LOA at Everett (Table B-19).

To protect Dall's porpoises from noise impacts, the Navy will implement a shutdown if Dall's porpoises are seen by marine mammal monitors in an injury or behavioral harassment zone (see mitigation measures in Chapter 2. A monitor will be stationed at locations from which the injury zone for impact pile driving are visible and will implement shutdown if a porpoise enters either zone. With the implementation of monitoring, even if a porpoise enters an injury zone, shutdown would occur before cumulative exposure to noise levels that would result in PTS could occur. Because pile driving will be shut down if porpoises are in the injury zone, no Level A take is requested. Any exposure of porpoises to pile driving noise will be minimized to short-term behavioral harassment in areas beyond the visually monitorable portion of the disturbance zone during vibratory pile driving.

2.7.9.8 Steller Sea Lion

Steller sea lions occur seasonally in Puget Sound primarily from September through May. Two installations have haulouts on-site or nearby: NAVBASE Kitsap Bangor and near NAVBASE Kitsap Manchester. Exposure may occur if these animals move through ZOIs during impact or vibratory pile driving. Formula (3) as described in Section 2.7.8 was used with site-specific abundance data to calculate potential exposures of Steller sea lions at NAVBASE Kitsap Bangor and NAVBASE Kitsap Manchester. At all other installations, haulouts are greater than 8.5 mi away; therefore, formula (2) described in Section 2.7.8 using density estimates was used. Estimates of Steller sea lion exposure at each installation are provided below. A total of 1,009 Steller sea lions were estimated to be potentially exposed to sound levels considered Level B behavioral harassment from underwater sound incidental to pile driving. Exposures are expected to be limited to subadult or adult males at all locations. Animals could be exposed when traveling, resting, and foraging. Because a Level A injury zone can be effectively monitored, a shut-down zone will be implemented, and no exposure to Level A noise levels is anticipated at any location.

If project work occurs during months when Steller sea lions are less likely to be present, actual exposures would be less. Additionally, if daily pile driving duration is short, exposure would be expected to be less because some animals would remain hauled out for the duration of pile driving. Any exposure of Steller sea lions to pile driving noise will be minimized to short-term behavioral harassment.

NAVBASE Kitsap Bangor

Steller sea lions are routinely seen hauled out from mid-September through May on submarines at NAVBASE, Bangor, with a maximum haulout count of 13 individuals in November 2014. Because the daily average number of Steller sea lions hauled out at Bangor has increased since 2013 compared to prior years, the Navy relied on monitoring data from 2013 through June 2016 to determine the average of the maximum count of hauled out Steller sea lions for each month in the in-water work window (Navy, 2016b). The Navy conservatively assumes that any Steller sea lion that hauls out at Bangor could swim into the behavioral harassment zone each day during pile driving because this zone extends across Hood Canal and up to 11.7 km from the driven pile. Therefore, the Navy projected takes for the average of the monthly maximum counts during the in-water work window, or three exposures per day for an estimated 119 days of pile driving at Bangor. These values provide a worst case assumption that on all 119 days of pile driving all animals would be in the water each day during pile driving. Applying formula (3) to this abundance and the 119 pile driving days (Table B-5), the Navy requested takes for exposure of up to 357 Steller sea lions at NAVBASE Kitsap Bangor for the duration of the 5-year MPR LOA (Table B-19).

Zelatched Point

The nearest Steller sea lion haulout to Zelatched Point is at NAVBASE Kitsap Bangor, where animals are present from mid-September through May. During this time period, animals from the NAVBASE Kitsap

Bangor haulout could enter Dabob Bay and be present in the behavioral harassment zone during pile driving. Because haulouts are not present on-site, the density formula (2) presented in Section 2.7.7 was used to calculate potential Steller Sea lion exposure to pile driving noise. The Navy has estimated that Steller sea lion density in inland waters is 0.0251 animals/sq km (Table B-18). Applying formula (2) to this density, the largest ZOI for Level B exposure for this installation (Table B-15), and 20 days of pile driving (Table B-5), the Navy requested takes for exposure of up to 38 Steller sea lions at Zelatched Point for the duration of the 5-year MPR LOA (Table B-19).

NAVBASE Kitsap Bremerton

Steller sea lions have been documented only twice at this installation, once in 2012 and once in 2013, hauled out on a float. The nearest Steller sea lion haulout to NAVBASE Kitsap Bremerton is at NAVBASE Kitsap Manchester. Surveys at NAVBASE Kitsap Manchester have not been conducted in all months of the in-water work window; however, animals are documented on floats in Clam Bay off Rich Passage in the November through January timeframe. Therefore, during this time period, animals from the haulout near NAVBASE Kitsap Manchester could be present in the ZOI for Level B exposure at Bremerton during pile driving. Because haulouts are not present on-site, the density formula (2) as described in Section 2.7.7 was used to calculate potential Steller Sea lion exposure to pile driving noise. The Navy has estimated that Steller sea lion density in inland waters is 0.0368 animals/sq km (Table B-18). Applying formula (2) to this density and the largest ZOI for Level B exposure for this installation (Table B-15), the Navy requested takes for exposure of up to 93 Steller sea lions at NAVBASE Kitsap Bremerton for the duration of the 5-year MPR LOA (Table B-19)

NAVBASE Kitsap Keyport

The nearest Steller sea lion haulout to NAVBASE Kitsap Keyport is over 9.5 mi near the NAVBASE Kitsap Manchester in Rich Passage, where animals have been documented from at least November through February and may be present in the in-water work window from September through February. During this time period, animals could enter the Keyport area and be present in the behavioral harassment zone during pile driving. Because no haulout is present on-site, the density formula (2) was used to calculate potential Steller Sea lion exposure to pile driving noise. The Navy has estimated that Steller sea lion density in inland waters is 0.0368 animals/sq km (Table B-18). Applying formula (2) to this density and the largest ZOI for Level B exposure for this installation (Table B-11), the Navy requested Level B take for exposure of 4 Steller sea lions at NAVBASE Kitsap Keyport for the duration of the 5-year MPR LOA (Table B-19).

NAVBASE Kitsap Manchester

California sea lions and Steller sea lions haul out on floats approximately 0.5 mi offshore from the Rich Passage side of the NAVBASE Kitsap Manchester. The Navy has determined abundance of Steller sea lions in the vicinity based on shore-based observations conducted intermittently in 2012–2013 and more frequently in 2014–2016, in addition to aerial surveys conducted by WDFW in selected months in 2013–2014 (Navy, 2016b). Steller sea lions have been present in surveys conducted from October through May, with the largest number counted in a survey in November 2014. The Navy used these monitoring data to determine the average of the maximum count of hauled out Steller sea lions for each month (Navy, 2016b). Since 50 days of pile driving are proposed at NAVBASE Kitsap Manchester (Table B-5), the Navy determined abundance of Steller sea lions based on the average maximum counts during the in-water work window of 10 individuals. Only 24-in concrete and/or 18-in timber or HDPE plastic piles are proposed for pile installation projects at Manchester, and the largest ZOI around pile driving (impact driving of 24-in concrete piles) would be 159 m or less (Table B-13). Since the haulout is 0.5 mi away, the Navy assumes that few Steller sea lions would swim into the behavioral harassment zone during pile installation at NAVBASE Kitsap Manchester. However, existing 18-in timber and plastic piles will be extracted with a vibratory driver, producing a ZOI of 1.6 km (Table B-15). The Navy conservatively assumes that any Steller sea lion that hauls out at the floats near Manchester could be exposed to behavioral harassment each day during pile extraction. Applying formula (3) to the abundance of this species in the vicinity and the 50 pile driving days (Table B-5), the Navy requested takes for Level B exposure of up to 500 Steller sea lions at NAVBASE Kitsap Manchester for the duration of the 5-year MPR LOA (Table B-19). The requested takes are highly conservative because the amount of time required to extract existing piles will likely be less than 50 days and pile extraction noise from the fuel pier would be truncated by the land mass of NAVBASE Kitsap Manchester before it propagates to the vicinity of the haulout floats.

NAVSTA Everett

The nearest Steller sea lion haulout to NAVSTA Everett is in Admiralty Inlet over 14 mi away where an estimated two individuals occur on a navigation buoy. The Navy has estimated that Steller sea lion density in inland waters is 0.0368 animals/sq km (Table B-18). Only one 36-in steel pile is anticipated to be installed with a vibratory driver and the likelihood of exposure of sea lions during the relatively brief installation of this pile is low. The majority of piles will be installed with impact drivers, resulting in relatively smaller areas affected by elevated noise (Table B-13). However, vibratory drivers may be used to extract timber piles at this location, resulting in ZOIs that would be larger than for impact installation. Applying formula (2) to the Puget Sound density, 78 days of pile driving, and the largest ZOI calculated for pile driving at this location (6.8 km sq for 13 or 14-in timber) (Table B-15). The Navy requested takes for level B exposure of up to 20 Steller sea lions for the duration of the MPR LOA at Everett (Table B-19).

In summary, the Navy requested Level B takes for exposure of up to 1,019 Steller sea lions at all installations for the duration of the 5-year MPR LOA (Table B-19).

2.7.9.9 California Sea Lion

California sea lions occur in Puget Sound from August to June. This species hauls out at three of the installations: NAVBASE Kitsap Bangor, NAVBASE Kitsap Bremerton, and NAVSTA Everett. These haulouts are adjacent to, in, or near the Level B ZOIs, so exposure may occur if animals move through ZOIs during impact or vibratory pile driving activities. A fourth haulout is located approximately 0.5 mi from NAVBASE Kitsap Manchester. Formula (3) described in Section 2.7.8 was used with site-specific abundance data to calculate potential exposures of California sea lions at NAVBASE Kitsap Bangor, NAVBASE Kitsap Bremerton, and NAVBASE Kitsap Manchester. Exposures at NAVSTA Everett were evaluated differently, as described below. At NAVBASE Kitsap Keyport and Zelatched Point, haulouts are greater than 8.5 mi away; therefore, formula (2) using density estimates was used. Estimates of California sea lion exposure at each installation are provided below. A total of 25,227 California sea lions were estimated to be potentially exposed to sound levels considered Level B behavioral harassment from underwater sound incidental to pile driving. Since primarily only male California sea lions migrate into the Study Area (Jeffries et al., 2000), all exposures are expected to be sub-adult or adult males. Animals could be exposed when traveling, resting, and foraging. Because a Level A injury zone can be effectively monitored and a shut-down zone will be implemented, no exposure to Level A noise levels is anticipated at any location.

If project work occurs during months when California sea lions are less likely to be present, actual exposures would be less. Additionally, if daily pile driving duration is short, exposure would be expected to be less because some animals would remain hauled out for the duration of pile driving. Any exposure of California sea lions to pile driving noise will be minimized to short-term behavioral harassment.

NAVBASE Kitsap Bangor

California sea lions are routinely seen hauled out from August through June on the PSB floats and submarines at NAVBASE Kitsap Bangor. Because the daily average number of California sea lions hauled out at Bangor has increased since 2013 compared to prior years, the Navy relied on monitoring data from 2013 through June 2016 to determine the average of the maximum count of hauled out California sea lions for each month (Navy, 2016b). Since 119 days of pile driving are proposed at NAVBASE Kitsap Bangor (Table B-5), the Navy determined abundance of California sea lions based on the average monthly maximum counts during the in-water work window (Navy, 2016b), respectively, for an average maximum count of 49 individuals. The Navy conservatively assumes that any California sea lion that hauls out at Bangor could swim into the behavioral harassment zone each day during pile driving because this zone extends across Hood Canal and up to 11.7 km from the driven pile. Therefore, the Navy projected 49 exposures per day for an estimated 119 days of pile driving at Bangor. These values provide a worst case assumption that on all 119 days of pile driving all animals would be in the water each day during pile driving. Applying formula (3) to this abundance and the 119 pile driving days, the Navy requested takes for Level B exposure of up to 5,831 California sea lions at NAVBASE Kitsap Bangor for the duration of the 5-year MPR LOA (Table B-19).

Zelatched Point

The nearest California sea lion haulout to Zelatched Point is at NAVBASE Kitsap Bangor, where animals are present from August through June. During this time period, animals from the haulout could enter Dabob Bay and be present in the behavioral harassment zone during pile driving. Because no haulout is present on-site, the density formula (2) was used to calculate potential California sea lion exposure to pile driving noise. The Navy has estimated that California sea lion density in Hood Canal is 0.279 animals/sq km (Table B-18). The Navy applied formula (2) to this density, 20 days of pile driving, and the largest ZOI calculated for Level B exposure for this installation (75.24 sq km for vibratory installation of 30- or 36-in pile) (Table B-15). The Navy estimates takes for Level B exposure of up to 420 California sea lions at Zelatched Point for the duration of the 5-year MPR LOA (Table B-19).

NAVBASE Kitsap Bremerton

California sea lions are routinely seen hauled out on the PSB floats at NAVBASE Kitsap Bremerton. Survey data from 2012 through June 2016 indicate as many as 144 animals hauled out each day during this time period with the majority of animals observed August through May and the greatest numbers observed in November. Since 168 days of pile driving are proposed at NAVBASE Kitsap Bremerton (Table B-5), the Navy determined abundance of California sea lions based on the average monthly maximum counts during the in-water work window (Navy, 2016b), for an average maximum count of 69 individuals. The Navy conservatively assumes that any California sea lion that hauls out at Bremerton could swim into the behavioral harassment zone each day during pile driving because this zone extends across Sinclair Inlet and up to 2.2 km from the driven pile. Therefore, the Navy projected 69 exposures per day for an estimated 168 days of pile driving at Bremerton. These values provide a worst case assumption that on all 168 days of pile driving all animals would be in the water each day during pile driving. Applying formula (3) to this abundance and 168 pile driving days, the Navy requested takes for

Level B exposure of up to 11,592 California sea lions at NAVBASE Kitsap Bremerton for the duration of the 5-year MPR LOA (Table B-19).

NAVBASE Kitsap Keyport

The nearest California sea lion haulout to NAVBASE Kitsap Keyport is at the NAVBASE Kitsap Bremerton, over 9 mi from Keyport. At NAVBASE Kitsap Bremerton, California sea lions haul out on PSB floats primarily from August through May. During this time period, animals could enter the Keyport area and be present in the behavioral harassment zone during pile driving. Because no haulout is present on-site, density formula (2) was used to calculate potential California sea lion exposure to pile driving noise. The Navy has estimated that California sea lion density in Puget Sound is 0.1266 animals/sq km (Table B-18). The Navy applied formula (2) to this density, 20 days of pile driving, and the largest ZOI calculated for this installation (4.9 sq km for vibratory installation of 30- or 36-in steel pile) (Table B-13). The Navy requested takes for level B exposure of up to 12 California sea lions at NAVBASE Kitsap Keyport for the duration of the 5-year MPR LOA (Table B-19).

NAVBASE Kitsap Manchester

California sea lions and Steller sea lions haul out on floats approximately 0.5 mi offshore from the Rich Passage side of the NAVBASE Kitsap Manchester. The Navy has determined abundance of California sea lions in the vicinity based on shore-based observations conducted intermittently in 2012–2013 and more frequently in 2014–2016, in addition to aerial surveys conducted by WDFW in selected months in 2013–2014 (Navy, 2016b). California sea lions have been present in shore-based surveys conducted from October through June, with the largest number counted in a survey in November 2014. A small number of California sea lions were present in aerial surveys in August 2013, but no shore-based or aerial surveys were conducted in September. The Navy used these monitoring data to determine the average of the maximum count of hauled out California sea lions for each month (Navy, 2016b). The Navy determined abundance of California sea lions based on the highest average maximum counts during the in-water work window, for an average maximum count of 43 individuals. Only 24-in concrete and/or 18-in timber or HDPE plastic piles are proposed for projects at Manchester, and the largest ZOI around pile driving (impact driving of 24-in concrete piles) would be 159 m or less (Table B-13). Since the haulout is 0.5 mi away, the Navy assumes that few California sea lions would swim into the behavioral harassment zone during pile driving at NAVBASE Kitsap Manchester. However, existing 18-in timber and plastic piles will be extracted with a vibratory driver, producing a ZOI of 1.6 km. The Navy conservatively assumes that any California sea lion that hauls out at the floats near Manchester could be exposed to behavioral harassment each day during pile extraction. Applying formula (3) to the abundance of this species in the vicinity and the 50 pile driving days (Table B-5), the Navy requested takes for Level B exposure of up to 2,150 California sea lions at NAVBASE Kitsap Manchester for the duration of the 5-year MPR LOA (Table B-19). The requested takes are highly conservative because the amount of time required to extract existing piles will likely be much less than 50 days and pile extraction noise from the fuel pier would be truncated by the land mass of NAVBASE Kitsap Manchester before it propagates to the vicinity of the haulout floats.

NAVSTA Everett

California sea lions are routinely seen hauled out from August through June on the PSB floats at NAVSTA Everett. A few animals have been observed in July. Surveys from 2012 through June 2016 indicate as many as 130 animals hauled out each day during the in-water work period from July through February with the maximum number observed in November. Since 78 days of pile driving are proposed at NAVSTA

Everett (Table B-5), the Navy determined abundance of California sea lions based on the average monthly maximum counts during the in-water work window (Navy, 2016b), respectively, for an average maximum count of 66 individuals. The Navy assumes that any California sea lion that hauls out at Everett could swim into the behavioral harassment zone each day during pile driving. Only one 36-in steel pile is to be installed at Everett and the remainder will be 24-in concrete piles or timber piles. The largest affected area around 24-in concrete pile driving would be 159 m or less (Table B-13). Vibratory driving and extraction of existing steel or timber piles could produce a ZOI up to 9.4 sq km. Applying formula (3) to the abundance of this species and the 78 pile driving days (Table B-5), the Navy requested takes for Level B exposure of up to 5,148 sea lions at NAVBASE Kitsap Everett for the duration of the 5-year MPR LOA (Table B-19). The requested takes are highly conservative because the amount of time required to extract existing piles will likely be much less than 78 days.

In summary, the Navy requested Level B takes for exposure of up to 25,153 California sea lions at all installations for the duration of the 5-year MPR LOA (Table B-19).

NAVMAG Indian Island

Monthly counts of marine mammals are not made around NAVMAG Indian Island Ammunition Wharf and there are no haulout sites near NAVMAG Indian Island or within Port Townsend Bay (Navy 2016). However, California sea lions do occasionally haulout on navigation aids in the area (Navy 2014). No sea lions were observed during monitoring for impact driving of concrete piles from October 2015 through January 2016 (Navy 2016c). Only 24-in concrete piles would be jetted and then impact driven. The largest affected area around 24-in concrete pile driving would be 159 m or less (Table B-13).

2.7.9.10 Northern Elephant Seal

Northern elephant seals are considered rare visitors to Puget Sound. However, solidary juvenile elephant seals have been known to sporadically haul out to molt in Puget Sound during spring and summer months.

No elephant seal haulouts occur in Puget Sound although individual elephant seals have been detected hauling out for two to four weeks to molt, usually during the spring and summer. Haulout locations are unpredictable (Norberg, 2012), but only one record is known for an MPR activities location. Because there are occasional sightings in Puget Sound, the Navy reasons that over the 5-year span of this requested authorization, exposure of up to one northern elephant seal to Level B harassment levels could occur from underwater or airborne sound incidental to pile driving at any of the project sites for a 2-day duration. Therefore, a total of two elephant seals exposures to Level B harassment are requested (Table B-19). Any exposure or northern elephant seals to pile driving noise will be minimized to short-term behavioral harassment.

2.7.9.11 Harbor Seal

Harbor seals are expected to occur year-round at all installations, with the greatest numbers expected at installations with nearby haulout sites, as discussed below. This species hauls out regularly in large numbers on log rafts adjacent to NAVSTA Everett year-round with a dip in numbers in winter months, and in smaller numbers at NAVBASE Kitsap Bangor. Harbor seals are most likely to be exposed to Level A noise where they regularly haul out in close proximity to MPR project sites (i.e., at NAVBASE Kitsap Bangor and NAVSTA Everett). Pile driving will shut down whenever a seal is detected by monitors within the injury zone, but for some projects structures on the waterfront may restrict the ability of monitors to view the entire injury zone. Harbor seal haulouts are farther away from the other installations, as discussed below; however, since harbor seals are widespread throughout Puget Sound, exposure to Level B noise may occur within the ZOIs at any MPR installation.

For most projects, exposure of harbor seals to pile driving noise will be minimized to short-term behavioral harassment (Level B). Formula (3) described in Section 2.7.8 was used with site-specific abundance data to calculate potential exposures of harbor seals at NAVBASE Kitsap Bangor and NAVSTA Kitsap Everett, and formula (2) was used with density data to calculate potential exposures at other installations. Estimates of harbor seal exposure at each installation are provided below. A total of 37,511 harbor seals were estimated to be potentially exposed to sound levels considered Level B behavioral harassment from underwater sound incidental to pile driving (Table B-19). Animals of any age, sex, or reproductive status could be exposed while traveling, resting, or foraging within the Level B ZOIs at any installation. Additionally, 288 harbor seals of any age, sex, or reproductive status at NAVBASE Kitsap Bangor and NAVSTA Kitsap Everett may be exposed to sound levels considered Level A injury (PTS onset) from underwater sound incidental to pile driving (Table B-20).

NAVBASE Kitsap Bangor

The closest major haulouts to NAVBASE Kitsap Bangor that are regularly used by harbor seals are the mouth of the Dosewallips River located approximately 8.2 mi away. No harbor seal haulout have been seen on the shoreline opposite Bangor (the east-side of the Toandos Peninsula) during 2015 and 2016 beach seine surveys. A small haulout occurs at NAVBASE Kitsap Bangor under Marginal Wharf and small numbers of harbor seals are known to routinely haul out around the Carderock pier. Boat-based surveys and monitoring indicate that harbor seals regularly swim in the waters at NAVBASE Kitsap Bangor (Navy, 2016b). Hauled-out adults, mother/pup pairs, and neonates have been documented occasionally but quantitative data are limited. Incidental surveys in August and September 2016 recorded as many as 28 harbor seals hauled out under Marginal Wharf or swimming in adjacent waters. Assuming a few other individuals may be present elsewhere on the Bangor waterfront, the Navy estimates that 35 harbor seals may be present near the installation during summer and early fall months. Based on haulout survey data from NAVSTA Everett (Navy, 2016b), the number of harbor seals present at Bangor is likely to be lower in late fall and winter months.

The Navy assumes that any harbor seal that hauls out at Bangor could swim into the behavioral harassment zone each day during pile driving. Up to 119 steel and/or concrete piles may be installed at this installation. The largest ZOI for behavioral disturbance (Level B) would be 11.7 km for vibratory driving and extraction of 30- or 36-in steel piles. Applying formula (3) described in Section 2.7.8 to the abundance of this species (35 individuals) and the 119 pile driving days (Table B-5), the Navy requested takes for Level B exposure of up to 3,570 harbor seals at NAVBASE Kitsap Bangor for the duration of the 5-year MPR LOA (Table B-19). The requested takes are highly conservative because the amount of time required to install or extract existing piles will likely be much less than 119 days.

The largest ZOI for Level A injury will be 158 m for impact driving of 30- or 36-in steel piles(with bubble curtain) assuming 1,000 strikes. If impact driving of 30-in or 36-in steel piles occurs with more strikes (up to 4,000), the largest ZOI for Level A injury is estimated at 399 m (with the use of a bubble curtain). Because some of the 119 days of pile driving will involve only vibratory driving and no strikes, and not all days will have the maximum strike count, 158 m was used for estimating potential Level A takes. Because the haulout location under Marginal Wharf is difficult to monitor, and the presence of other structures on the Bangor waterfront may interfere with monitors' ability to visualize the entire injury zone, it is possible that some individuals may enter, and remain in, the injury zone undetected by monitors, resulting in potential PTS. We estimate that one of the 35 individuals present on the Bangor waterfront would enter, and remain in, the injury zone without being detected by marine mammal monitors each day. Therefore, with 119 pile driving days and 1 individual per day being exposed to Level A noise levels, 119 Level A takes of harbor seals are requested (Table B-20). This request overestimates the likely Level A takes at this installation for several reasons: (1) Seals are unlikely to remain in the Level A zone underwater long enough to accumulate sufficient exposure to noise resulting in PTS, (2) the estimate assumes that new seals appear at the Bangor waterfront every day during pile driving, (3) some of the pile driving projects will not be in close proximity to Marginal Wharf, which appears to be the focus of harbor seal activity at this installation, and therefore seals are less likely to enter the injury zones. No Level A takes are requested for vibratory pile driving because the maximum harbor seal injury zone is 18 m and is within a practicable monitoring/shutdown distance.

NAVBASE Kitsap Bremerton

While no haulouts for harbor seals exist on NAVBASE Kitsap Bremerton or within the ZOI, haulouts are present year round in the nearby waters of Sinclair Inlet (Jeffries et al., 2000; Beckley, 2013). These haulouts are outside of, but adjacent to, the Level B ZOIs so exposure is likely if animals move to or from these haulouts during vibratory pile driving activities. However, marine mammal surveys were conducted in the vicinity of NAVBASE Kitsap Bremerton during the construction of the Manette Bridge just north of the ZOI in the Port Washington Narrows (Washington State Department of Transportation 2011, 2012). Marine mammal monitoring for this project occurred over multiple years and aligns with the in-water work windows in Puget Sound. Over the course of this project an average of 11 harbor seals were detected per day. Applying formula (3) to the abundance of this species and the 168 pile driving days (Table B-5), the Navy requested Level B takes for exposure of up to 1,848 harbor seals at NAVBASE Kitsap Bremerton for the duration of the 5-year MPR LOA (Table B-19). No Level A takes are requested for vibratory pile driving because the maximum harbor seal injury zone is 18 m and is within a practicable distance for monitoring and shutdown. The Level A zone for impact driving of 24-in concrete piles is 34 m and for 14-in steel pile is 86 m. These zones will be monitored and shutdown will be implemented before exposure to pile driving noise resulting in PTS would occur. Because harbor seals do not haul out at this location, a Level A injury shut-down zone will be implemented and is expected to effectively eliminate the likelihood of Level A take. Therefore, no exposure to Level A noise levels is anticipated.

NAVBASE Kitsap Keyport

No harbor seal haulouts have been identified at NAVBASE Kitsap Keyport. The closest documented haulouts are approximately 2 mi away. Because no regularly-used haulout is present on-site, the density formula (2) was used to calculate potential harbor seal exposure to pile driving noise. The Navy has estimated that harbor seal density in Puget Sound, excluding Hood Canal, is 1.219 animals/sq km (Table B-18). The largest ZOI for behavioral disturbance (Level B) would be 4.9 sq km for vibratory driving of 30- or 36-in steel piles at Keyport (Table B-15). Applying formula (2) to this density, the largest ZOI for Level B exposure at this installation, 20 days of pile driving at Keyport, the Navy requests Level B takes for exposure of up to 119 harbor seals for the duration of the 5-year MPR LOA at NAVBASE Kitsap Keyport (Table B-19). No Level A takes are requested for vibratory pile driving because the maximum harbor seal injury zone is 18 m and is within a practicable distance for monitoring and shutdown. Impact driving of 30-in steel piles, which could occur at Keyport without the use of a bubble curtain, is 736 m. These injury zones will be monitored during pile driving and shutdown will be implemented before exposure to pile driving noise resulting in PTS would occur. Because harbor seals do not haul out at these installations, a Level A injury shut-down zone will be implemented and is expected to effectively eliminate the likelihood of Level A take. Therefore, no exposure to Level A noise levels is anticipated.

NAVBASE Kitsap Manchester

No harbor seal haulouts have been identified at NAVBASE Kitsap Manchester. The closest documented haulouts are approximately 3.5 mi away. Because no regularly-used haulout is present on-site, the density formula (2) was used to calculate potential harbor seal exposure to pile driving noise. The Navy has estimated that harbor seal density in Puget Sound, excluding Hood Canal, is 1.219 animals/sq km (Table B-18). The largest ZOI for behavioral disturbance (Level B) would be 7.836 sq km for vibratory extraction of timber piles at Manchester (Table B-15). Applying formula (2) to this density, the largest ZOI for Level B exposure at this installation 50 days of pile driving at Manchester, the Navy requests Level B takes for exposure of up to 477 harbor seals for the duration of the 5-year MPR LOA at these installations (Table B-19). No Level A takes are requested for vibratory pile driving because the maximum harbor seal injury zone is 18 m and is within a practicable distance for monitoring and shutdown. The Level A zone for impact driving of 24-in concrete piles, which could be installed at Manchester is 34 m. These injury zones will be monitored during pile driving and shutdown will be implemented before exposure to pile driving noise resulting in PTS would occur. Because harbor seals do not haul out at this installation, a Level A injury shut-down zone will be implemented and is expected to effectively eliminate the likelihood of Level A take. Therefore, no exposure to Level A noise levels is anticipated.

Zelatched Point

The closest major haulouts to Zelatched Point that are regularly used by harbor seals are in Dabob Bay located 2.3 mi away. The Navy has estimated that harbor seal density in Hood Canal is 9.918 animals/sq km (Table B-18). The largest ZOI for behavioral disturbance (Level B) would be 13.6 km for vibratory driving and extraction of 30- or 36-in steel piles. At Zelatched Point, formula (2) was applied using the Hood Canal Harbor seal density and the largest ZOI for Level B exposure (for vibratory installation of 30- or 36-in steel pile (Table B-15), and 20 days of pile driving at Zelatched Point (Table B-5), the Navy requested Level B takes for exposure of up to 14,925 harbor seals for the duration of the 5-year MPR LOA at this installation (Table B-19). No Level A takes are requested for vibratory pile driving because the maximum harbor seal injury zone is 18 m and is within a practicable distance for monitoring and shutdown. The Level A zone for impact driving of 24-in concrete piles, which could be installed at Zelatched Point, is 34 m. Impact driving of 30-in steel piles, which could also occur at Zelatched Point with the use of a bubble curtain, is 158 m. These injury zones will be monitored during pile driving and shutdown will be implemented before exposure to pile driving noise resulting in PTS would occur. Because harbor seals do not haul out at this location, a Level A injury shut-down zone will be implemented and is expected to effectively eliminate the likelihood of Level A take. Therefore, no exposure to Level A noise levels is anticipated.

NAVSTA Everett

Harbor seals haul out year-round on log rafts adjacent to NAVSTA Everett. Surveys from 2012 through June 2016 indicate as many as 491 animals hauled out each day during the in-water work period from July through January with the maximum number observed in September and October. Since 78 days of pile driving are proposed at NAVSTA Everett (Table B-5), the Navy determined abundance of harbor seals based on the average monthly maximum counts during the in-water work window (Navy, 2016b), respectively, for an average maximum count of 212 individuals. The Navy assumes that any harbor seal that hauls out at Everett could swim into the behavioral harassment zone each day during pile driving. Only one 36-in steel pile is to be installed at Everett and the remainder will be 24-in concrete piles or timber piles. The largest ZOI around 24-in concrete pile impact driving would be 159 m or less (Table B-11). Vibratory driving and extraction of existing steel or timber piles could produce a ZOI up to 13.6 km. Applying formula (3) to the abundance of this species and the 78 pile driving days (Table B-5), the Navy requested takes for Level B exposure of up to 16,536 harbor seals at NAVBASE Kitsap Everett for the duration of the 5-year MPR LOA (Table B-19). The requested takes are highly conservative because the amount of time required to extract existing piles will likely be much less than 78 days.

NAVMAG Indian Island

Monthly counts of marine mammals are not made around NAVMAG Indian Island Ammunition Wharf and there only one haulout site near NAVMAG Indian Island Ammunition Wharf at Rat Island (approximately 2 km from the Ammunition Wharf) (Navy 2014, 2016b). At least 113 harbor seals were observed during 12 days of monitoring (9.4 harbor seals per day) for impact driving of concrete piles from October 2015 through January 2016 (Navy 2016c). all but two of those harbor seals were observed beyond 125 m of the pile diving (Navy 2016c). Only 24-in concrete piles would be jetted and then impact driven, and the largest affected area around 24-in concrete pile driving would be 159 m or less (Table B-13).

The largest potential Level A zone will be from the single 30-in steel pile if it requires impact driving. No Level A takes are requested for vibratory pile driving of this pile because the maximum harbor seal injury zone is 18 m and is within a practicable distance for monitoring and shutdown. The Level A zone for impact driving of this pile with a bubble curtain would extend 158 m. Because of the potential difficulty in monitoring the abundant local seal population within an area of this size, there is a potential for Level A take associated with impact driving of the single steel pile. The injury zone will be monitored and a shutdown zone will be implemented, but Level A exposure could occur to some portion of the harbor seal population that may swim into, and remain undetected in, the Level A zone during the approximate 30-minute duration of pile driving. We estimate that 5 percent of the population (based on average monthly maximum of 212 individuals present during the in-water construction period; Navy, 2016b) might enter the Level A zone during impact installation of the steel pile without shutdown occurring, resulting in Level A take of 11 individuals. The Level A zone for impact pile driving of the majority of piles (24-in concrete) at this installation will be 34 m. A shutdown zone will be implemented during impact pile driving of concrete piles over the 78 days of pile driving but it is possible that some seals could be exposed to noise resulting in PTS due to the abundance of seals in the area. Because of the small size of the Level A zone for concrete piles, we estimate that only 1 percent of the 212 individuals, or 2 individuals, would experience Level A exposure each day. Therefore, with 78 pile driving days and 2 individuals per day potentially experiencing Level A exposure, 156 Level A takes of harbor seals are requested for concrete pile driving. The total number of requested Level A takes for steel pile and concrete pile impact installation is 167 individuals (Table B-19). Because the animals are unlikely to remain underwater in the Level A zone during the duration of pile driving each day, the estimated Level A takes likely overestimate actual Level A takes.

In summary, the Navy requested Level B takes of up to 38,585 harbor seals at all installations and Level A takes of up to 286 harbor seals at Bangor and Everett for the duration of the 5-year MPR LOA (Table B-19).

2.7.10 Potential Effects on Marine Mammals of Exceeding the Injury and Behavioral Harassment Thresholds

The following discussion of the effects of exposure to elevated underwater and airborne noise applies generally to marine mammal species in the vicinity of all of the MPR activities locations. Specific conditions and estimates of the likelihood of exposure of each marine mammal species at each location are described in the location-specific sections of the EA.

2.7.10.1 Potential Effects Resulting from Underwater Noise

The effects of pile driving noise on marine mammals depend on several factors, including the species, size of the animal, and proximity to the source; the depth, intensity, and duration of the pile driving sound; the depth of the water column; the substrate of the habitat; the distance between the pile and the animal; and the sound propagation properties of the environment. Effects to marine mammals from pile driving activities are expected to result primarily from acoustic pathways. The degree of effect is intrinsically related to the received level and duration of the sound exposure, which are in turn influenced by the distance between the animal and the source. In general, sound exposure should be less intense farther away from the source. The substrate and depth of the habitat affect the sound propagation properties of the environment. Shallow environments are typically more structurally complex, which leads to rapid sound attenuation. In addition, substrates that are soft (i.e., sand) will absorb or attenuate the sound more readily than hard substrates (rock) which may reflect the acoustic wave. Soft porous substrates will also likely require less time to drive the pile, and possibly less forceful equipment, which would ultimately decrease the intensity of the acoustic source.

Potential impacts to marine species can be caused by physiological responses to both the type and strength of the acoustic signature (Viada et al., 2008). Behavioral impacts may also occur, though the type and severity of these effects are more difficult to define due to limited studies addressing the behavioral effects of impulsive sounds on marine mammals. Potential effects from impulsive sound sources can range from Level B effects such as brief behavioral disturbance, tactile perception, and physical discomfort, to Level A impacts, which may include slight injury of the internal organs and the auditory system, and possible death of the animal (Yelverton et al., 1973; O'Keefe & Young, 1984; Ketten, 1995; Navy, 2001).

Physiological Responses

Direct tissue responses to impact/impulsive sound stimulation may range from mechanical vibration or compression with no resulting injury to tissue trauma (injury). Because the ears are the most sensitive organ to pressure, they are the organs most sensitive to injury (Ketten, 2000). Sound-related trauma can be lethal or sub-lethal. Lethal impacts are those that result in immediate death or serious debilitation in or near an intense source (Ketten, 1995). Sub-lethal damage to the ear from a pressure wave can rupture the tympanum, fracture the ossicles, and damage the cochlea; cause hemorrhage, and cause leakage of cerebrospinal fluid into the middle ear (Ketten, 2004). Sub-lethal impacts also include hearing loss, which is caused by exposure to perceptible sounds. Moderate injury implies partial hearing loss. Permanent hearing loss (also called permanent threshold shift, PTS) can occur when the hair cells of the ear are damaged by a very loud event, as well as by prolonged exposure to noise. Instances of temporary threshold shifts and/or auditory fatigue are well documented in marine mammal literature as being one of the primary avenues of acoustic impact. Temporary loss of hearing sensitivity (called temporary threshold shift, TTS) has been documented in controlled settings using captive marine mammals exposed to strong sound exposure levels at various frequencies (Ridgway et al., 1997; Kastak et al., 1999; Finneran et al., 2005). While injuries to other sensitive organs are possible, they are less likely since pile driving impacts are almost entirely acoustically mediated, versus explosive sounds which also include a shock wave that can result in damage. Based on the mitigation measures outlined in Chapter 2 and the conservative modeling assumptions discussed in this appendix, Level A harassment is not expected to any individuals, except potentially harbor seals during impact pile driving at NAVBASE Kitsap Bangor and NAVSTA Everett. However, based on the continued presence of harbor seals near the Explosives Handling Wharf #2 (EHW-2) at NAVBASE Kitsap Bangor through multiple years of construction, no effect to the harbor seal population at NAVBASE Kitsap Bangor is expected. Therefore, auditory effects could be experienced by individual harbor seals, but will not cause population-level impacts or affect the continued survival of the species.

Behavioral Responses

Behavioral responses to sound can be highly variable. For each potential behavioral change, the magnitude of the change ultimately determines the severity of the response. A number of factors may influence an animal’s response to noise, including its previous experience, its auditory sensitivity, its biological and social status (including age and sex), and its behavioral state and activity at the time of exposure. Habituation occurs when an animal’s response to a stimulus wanes with repeated exposure, usually in the absence of unpleasant associated events (Wartzok et al., 2004). Animals are most likely to habituate to sounds that are predictable and unvarying. The opposite process is sensitization—when an unpleasant experience leads to subsequent responses, often in the form of avoidance, at a lower level of exposure. Behavioral state or differences in individual tolerance levels may affect the type of response as well. For example, animals that are resting may show greater behavioral change in response to disturbing noise levels than animals that are highly motivated to remain in an area for feeding (Richardson et al., 1995; National Research Council, 2003; Wartzok et al., 2004). Indicators of disturbance may include sudden changes in the animal’s behavior or avoidance of the affected area. A marine mammal may show signs that it is startled by the noise and/or it may swim away from the sound source and avoid the area. Increased swimming speed, increased surfacing time, and cessation of foraging in the affected area would indicate disturbance or discomfort. Pinnipeds may increase their haulout time, possibly to avoid in-water disturbance.

Controlled experiments with captive marine mammals showed pronounced behavioral reactions, including avoidance of loud sound sources (Ridgway et al., 1997; Finneran et al., 2003). Observed responses of wild marine mammals to loud pulsed sound sources (typically seismic guns or acoustic harassment devices and including pile driving) have been varied, but often consist of avoidance behavior or other behavioral changes suggesting discomfort (Morton & Symonds, 2002; also see reviews in Gordon et al., 2003/2004; Wartzok et al., 2004; and Nowacek et al., 2007). Some studies of acoustic harassment and acoustic deterrence devices have found habituation in resident populations of seals and harbor porpoises (see review in Southall et al., 2007). Blackwell et al. (2004) found that ringed seals exposed to underwater pile driving sounds in the 153–160 dB RMS range tolerated this noise level and did not seem unwilling to dive. One individual was as close as 63 m from the pile driving. Responses of two pinniped species to impact pile driving at the San Francisco-Oakland Bay Bridge East Span Seismic Safety Project were mixed (California Department of Transportation, 2001; Thorson & Reyff, 2006;

Thorson, 2010). Harbor seals were observed in the water at distances of approximately 400–500 m from the pile driving activity and exhibited no alarm responses, although several showed alert reactions, and none of the seals appeared to remain in the area. One of these harbor seals was even seen to swim to within 150 m of the pile driving barge during pile driving. Several sea lions, however, were observed at distances of 500–1,000 m swimming rapidly and porpoising away from pile driving activities.

Observations of marine mammals on NAVBASE Kitsap Bangor during a test pile project concluded that pinniped (harbor seal and California sea lion) foraging behaviors decreased slightly during construction periods involving impact and vibratory pile driving, and both pinnipeds and harbor porpoise were more likely to change direction while traveling during construction (HDR, 2012). Pinnipeds were more likely to dive and sink when closer to pile driving activity, and a greater variety of other behaviors were observed with increasing distance from pile driving. Relatively few observations of cetacean behaviors were obtained during pile driving, and all were outside the WRA. Most harbor porpoises were observed swimming or traveling through the project area and no obvious behavioral changes were associated with pile driving.

Three years of marine mammal monitoring has been completed during vibratory and impact pile driving for the construction of EHW-2 at NAVBASE Kitsap Bangor (Hart Crowser, 2013, 2014, 2015). Over the 3 years of monitoring, harbor seals, California sea lions, and Steller sea lions were detected within the shut down and behavioral disturbance zones (Primary Surveys) and outside the WRA (Outside Boat Surveys). Results from monitoring have varied slightly year to year, but in general marine mammals were equally observed moving away (or swimming parallel) from the pile or having no motion during vibratory pile driving. During impact driving, animals were most frequently observed moving away (or moving parallel to) or not moving relative to the pile (Hart Crowser, 2013, 2014, 2015). Harbor porpoises were only observed outside the WRA, where the predominant behavior during construction (vibratory pile driving) was swimming or traveling through the project area. During pre-construction monitoring, marine mammal observers also reported harbor porpoise foraging. Marine mammal observers did not detect adverse reactions to the Test Pile Program or EHW-2 construction activities consistent with distress, injury, or high speed withdrawal from the area, nor did they report obvious changes in less acute behaviors.

Marine mammal monitoring at the Port of Anchorage marine terminal redevelopment project found no response by marine mammals (primarily beluga whales and smaller numbers of harbor seals, harbor porpoises, and Steller sea lions) swimming within the threshold distances to noise impacts from construction activities including pile driving (both impact hammer and vibratory driving) (Integrated Concepts and Research Corporation, 2009). Background noise levels at this port are typically at 125 dB.

Cetaceans infrequently transit the waters in the vicinity of MPR activities locations and they do not tend to remain there. If they encounter pile driving noise they would likely avoid affected areas in which they experience noise-related disturbance. Avoidance of the affected area during pile driving operations would potentially reduce access to foraging areas and inhibit transit through the area. The likelihood of exposure to behavioral disturbance due to pile driving noise will be limited by the infrequent occurrence of cetaceans in the vicinity, and monitoring and shutdown of pile driving if monitors detect cetaceans in the monitoring zone, as described in EA Section 2.

2.7.10.2 Potential Effects Resulting from Airborne Noise

Airborne noise resulting from pile driving has the potential to cause behavioral harassment of marine mammals, depending on their distance from pile driving activities. Airborne pile driving noises are expected to have very little impact to cetaceans because noise from atmospheric sources does not transmit well through the air-water interface (Richardson et al., 1995), consequently, cetaceans are not expected to be exposed to airborne sounds that will result in harassment as defined under the MMPA. Airborne noise will primarily be an issue for pinnipeds that are swimming or hauled out within the affected area defined by the acoustic threshold criteria (Table B-13). Most likely, airborne sound will cause behavioral responses similar to those discussed above in relation to underwater noise. For instance, anthropogenic sound could cause hauled-out pinnipeds to exhibit changes in their normal behavior, such as reduction in vocalizations, or cause them to temporarily abandon their usual or preferred locations and move farther from the noise source. Pinnipeds swimming in the vicinity of pile driving may avoid or withdraw from the area, or may show increased alertness or alarm (e.g., heading out of the water, and looking around). However, studies of ringed seals by Blackwell et al. (2004) and Moulton et al. (2005) indicate a tolerance or lack of response to unweighted airborne sounds as high as 112 peak decibels and 96 dB RMS, which suggests that habituation occurred.

California sea lions and harbor seals were present during impact installation and vibratory extraction of piles at NAVBASE Kitsap Bremerton in February 2014 and November 2014 to February 2015 (Northwest Environmental Consulting, 2014, 2015). In February 2014, California sea lions were observed basking on the PSB within the underwater behavioral disturbance zone (117 m from the driven pile) and no behavioral harassment takes were documented because they did not enter the water. California sea lions and harbor seals were observed in the water during vibratory hammer activity. Marine mammal observers detected 160 individuals during vibratory pile extraction within the 1,600-m vibratory disturbance zone, resulting in exposure to noise levels above the Level B threshold. Marine mammal observers detected 125 individuals during impact pile driving within the 117-m impact disturbance zone, resulting in exposure to noise levels above the Level B threshold. There were no shutdowns of pile driving activity because pinnipeds never entered the injury zones. No visible behaviors indicating a reaction to noise disturbance were observed. Behaviors observed included hauling-out (resting), foraging, milling, and traveling.

Based on these observations, pinnipeds in the impact zones may exhibit temporary behavioral reactions to airborne pile driving noise. These exposures may have a temporary effect on individual or groups of animals, but this level of exposure is very unlikely to result in population-level impacts.

3 Literature Cited

Abbott, R., Reyff, J., & Marty, G. (2005). Monitoring the effects of conventional pile driving on three species of fish. *Final report prepared by Strategic Environmental Consulting, Inc. for Manson Construction Company, Richmond, California*.

Acoustical Society of America. (1994). *American National Standard Acoustical Terminology.* (ANSI (American National Standards Institute) S1.1-1994 (ASA 111-1994)). Standards Secretariat, Acoustical Society of America, New York. Approved January 4, 1994.

Au, W. W. L. (1993). *The sonar of dolphins*. New York, NY: Springer-Verlag.

Betke, K. (2006). *Measurement of underwater noise emitted by an offshore wind turbine at Horns Rev.* ITAP – Institut für technische und angewandte Physik GmbH, Oldenburg, Germany. February 13, 2006.

Blackwell, S. B., Lawson, J. W., & Williams, M. T. (2004). Tolerance by ringed seals (*Phoca hispida*) to impact pipe-driving and construction sounds at an oil production island. *The Journal of the Acoustical Society of America, 115*(5), 2346–2357.

Bolle, L. J., de Jong, C. A. F., Bierman, S. M., van Beek, P. J. G., van Keeken, O. A., Wessels, P. W., . . . Dekeling, R. P. A. (2012). Common sole larvae survive high levels of pile-driving sound in controlled exposure experiments. *PLoS One, 7*(3), e33052.

Brumm, H. & Slabbekoorn, H. (2005). Acoustic communication in noise. *Advances in the Study of Behavior, 35*, 151–209.

Brumm, H., & Zollinger, S. A. (2011). The evolution of the Lombard effect: 100 years of psychoacoustic research. *Behaviour, 148*(11-13), 1173−1198.

California Department of Transportation. (2001). *San Francisco – Oakland Bay Bridge East Span seismic safety project. Pile installation demonstration project: marine mammal impact assessment.* California Department of Transportation. August 2001.

Carter, H. R., & Sealy, S. G. (1990). Daily foraging behavior of marbled murrelets. *Studies in Avian Biology, 14*, 93–102.

Crum, L. A., & Mao, Y. (1996). Acoustically enhanced bubble growth at low frequencies and its implications for human diver and marine mammal safety. *The Journal of the Acoustical Society of America, 99*(5), 2898–2907.

Dahl, P. H., de Jong, C. A. F., & Popper, A. N. (2015). The Underwater Sound Field from Impact Pile Driving and Its Potential Effects on Marine Life. *Acoustics Today, 11*(2).

Debusschere, E., De Coensel, B., Bajek, A., Botteldooren, D., Hostens, K., Vanaverbeke, J., . . . Degraer, S. (2014). *In Situ* Mortality Experiments with Juvenile Sea Bass (*Dicentrarchus labrax*) in Relation to Impulsive Sound Levels Caused by Pile Driving of Windmill Foundations. *PLoS One, 9*(10), e109280.

DEFRA (Department for Environment, Food and Rural Affairs). (2003). *Preliminary investigation of the sensitivity of fish to sound generated by aggregate dredging and marine construction.* (Project AE0914 Final Report). London, UK. Undated – project completed in March 2003.

http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&Completed=0&ProjectID=9098

Dolphin, W. F. (2000). Electrophysiological measures of auditory processing in odontocetes. In W. W. L. Au, A. N. Popper, & R. R. Fay (Eds.). *Hearing by Whales and Dolphins*. Springer Handbook of Auditory Research series, New York: Springer-Verlag.

Entranco, & Hamer Environmental. (2005). *SR 104 – Hood Canal Bridge East-Half Replacement and West-Half Retrofit Project.* Prepared by Entranco, Inc., Bellevue, WA, and Hamer Environmental, L.P., Mount Vernon, WA. Prepared for Washington State Department of Transportation, Olympic Region, Olympia, WA. May 2005.

Feist, B. E. (1991). *Potential impacts of pile driving on juvenile pink (Oncorhynchus gorbuscha) and chum (O. keta) salmon behavior and distribution.* (M.S. thesis), University of Washington, Seattle, WA.

Feist, B. E., Anderson, J. J., & Miyamoto, R. (1992). *Potential impacts of pile driving on juvenile pink (Oncorhynchus gorbuscha) and chum (O. keta) salmon behavior and distribution*. Seattle, WA: Fisheries Research Institute, School of Fisheries, and Applied Physics Laboratory, University of Washington.

Finneran, J. J., Dear, R., Carder, D. A., & Ridgway, S. H. (2003). Auditory and behavioral responses of California sea lions (*Zalophus californianus*) to single underwater impulses from an arc-gap transducer. *The Journal of the Acoustical Society of America, 114*(3), 1667–1677.

Fisheries Hydroacoustic Working Group. (2008). *Memorandum of agreement in principle for interim criteria for injury to fish from pile driving.* California Department of Transportation in coordination with the Federal Highway Administration, NOAA Fisheries Northwest and Southwest Regions, the Departments of Transportation of Washington and Oregon, and the California Department of Fish and Game. June 12, 2008. http://www.dot.ca.gov/hq/env/bio/files/fhwgcriteria_agree.pdf.

Galli, L., Hurlbutt, B., Jewett, W., Morton, W., Schuster, S., & Van Hilsen, Z. (2003). *Source-level noise in Haro Strait: relevance to orca whales.* Colorado College, Colorado Springs, CO. http://www2.coloradocollege.edu/dept/ev/Research/Faculty/OVALItems/FinalRptWeb/finalAll.html.

Gordon, J., Gillespie, D., Potter, J., Frantzis, A., Simmonds, M. P., Swift, R., & Thompson, D. (2003/2004). A review of the effects of seismic surveys on marine mammals. *Marine Technology Society Journal, 37*(4), 16–34.

Götz, T., Hastie, G., Hatch, L., Raustein, O., Southall, B. L., Tasker, M., & Thomsen, F. (2009). *Overview of the impacts of anthropogenic underwater sound in the marine environment.* (OSPAR Publication Number 441/2009). OSPAR Commission, London, UK. http://ospar.org/documents/dbase/publications/p00441/p00441_Noise%20background%20document.pdf.

Halvorsen, M., Casper, B., Woodley, C., Carlson, T., & Popper, A. (2011). Predicting and mitigating hydroacoustic impacts on fish from pile installations. *National Cooperative Highway Research Program Research Results Digest, 363*.

Halvorsen, M. B., Casper, B. M., Woodley, C. M., Carlson, T. J., & Popper, A. N. (2012a). Threshold for onset of injury in Chinook salmon from exposure to impulsive pile driving sounds. *PLoS One, 7*(6), e38968.

Halvorsen, M. B., Casper, B. M., Matthews, F., Carlson, T. J., & Popper, A. N. (2012b). Effects of exposure to pile-driving sounds on the lake sturgeon, Nile tilapia and hogchoker. *Proceedings of the Royal Society B: Biological Sciences*, rspb20121544.

Hart Crowser. (2013). *Naval Base Kitsap-Bangor Explosives Handling Wharf 2: Year 1 Marine Mammal Monitoring Report (2012–2013), Bangor, Washington.* Prepared by Hart Crowser. Prepared for NAVFAC, Silverdale, WA. April 2013.

Hart Crowser. (2014). *Naval Base Kitsap-Bangor Explosives Handling Wharf 2: Year 2 Marine Mammal Monitoring Report (2013–2014), Bangor, Washington*. Prepared by Hart Crowser. Prepared for NAVFAC Northwest, Silverdale, WA. June 2014.

Hart Crowser. (2015). *Naval Base Kitsap-Bangor Explosives Handling Wharf 2: Year 3 Marine Mammal Monitoring Report (2014–2015), Bangor, Washington*. Prepared by Hart Crowser. Prepared for NAVFAC Northwest, Silverdale, WA. March 2015.

Hastings, M. C., & Popper, A. N. (2005). *Effects of sound on fish.* Prepared by Jones & Stokes. Prepared for California Department of Transportation, Sacramento, CA. http://www.dot.ca.gov/hq/env/bio/files/Effects_of_Sound_on_Fish23Aug05.pdf

Hastings, M. C., Popper, A. N., Finneran, J. J., & Lanford, P. J. (1996). Effects of low-frequency underwater sound on hair cells of the inner ear and lateral line of the teleost fish *Astronotus ocellatus*. *The Journal of the Acoustical Society of America, 99*(3), 1759–1766.

HDR. (2012). *Naval Base Kitsap at Bangor Test Pile Program Final Marine Mammal Monitoring Report, Bangor, Washington.* Prepared by HDR. Prepared for Naval Facilities Engineering Northwest, Silverdale, WA. April 2012.

Hemilä, S., Nummela, S., Berta, A., & Reuter, T. (2006). High-frequency hearing in phocid and otariid pinnipeds: An interpretation based on inertial and cochlear constraints. *The Journal of the Acoustical Society of America, 120*(6), 3463–3466.

Holt, M. M. (2008). *Sound exposure and southern resident killer whales (Orcinus orca): a review of current knowledge and data gaps.* (NOAA technical memorandum NMFS-NWFSC, 89). National Marine Fisheries Service Northwest Fisheries Science Center, Seattle, Wash.

Holt, M. M., Noren, D. P., & Emmons, C. K. (2011). Effects of noise levels and call types on the source levels of killer whale calls. *The Journal of the Acoustical Society of America, 130*(5), 3100–3106.

Holt, M. M., Noren, D. P., Veirs, V., Emmons, C. K., & Veirs, S. (2009). Speaking up: Killer whales (*Orcinus orca*) increase their call amplitude in response to vessel noise. *The Journal of the Acoustical Society of America, 125*(1), EL27-EL32.

Hubbs, C. L., & Rechnitzer, A. B. (1952). Report on experiments designed to determine effects of underwater explosions on fish life. *California Fish and Game, 38*(3), 333–365.

Hunt, C. (2005). *Unpublished data from beach seines conducted in 2005 at NAVBASE Kitsap Bangor, Silverdale, WA.* (Provided by Chris Hunt). Science Applications International Corporation, Bothell, WA.

ICF Jones & Stokes, & Illingworth & Rodkin. (2009). *Final technical guidance for assessment and mitigation of the hydroacoustic effects of pile driving on fish.* Prepared by ICF Jones & Stokes, Sacramento, CA and Illingworth & Rodkin, Inc., Petaluma, CA. Prepared for California Department of Transportation, Sacramento, CA. February 2009. http://www.dot.ca.gov/hq/env/bio/files/Guidance_Manual_2_09.pdf

Illingworth & Rodkin. (2008). *Solano Route 37 Bridge Fender Repair Plastic Pile Installation – Results of Underwater Sound Measurements.* (Letter report to John Miller, Vortex Marine Construction, Oakland, CA). James A. Reyff, Illingworth & Rodkin, Inc., Petaluma, CA. February 5, 2008.

Illingworth & Rodkin. (2012). *Acoustic monitoring report. Test Pile Program.* Prepared by Illingworth & Rodkin, Petaluma, CA. Prepared for Naval Base Kitsap, Bangor, WA. April 27, 2012.

Illingworth & Rodkin. (2013). *Naval Base Kitsap at Bangor Trident Support Facilities Explosives Handling Wharf (EHW-2) Project. Acoustic Monitoring Report. Bangor, WA.* Prepared for Naval Base Kitsap at Bangor, WA. May 15, 2013.

Integrated Concepts & Research Corporation. (2009). *Marine mammal monitoring final report, 15 July 2008 through 14 July 2009. Construction and Scientific Marine Mammal Monitoring associated with the Port of Anchorage Marine Terminal Redevelopment Project.* Prepared by ICRC, Anchorage, AK. Prepared for U.S. Department of Transportation Maritime Administration and the Port of Anchorage, Anchorage, AK. October 2009. http://www.nmfs.noaa.gov/pr/pdfs/permits/poa_monitoring_report.pdf

Kastak, D., & Schusterman, R. J. (1998). Low-frequency amphibious hearing in pinnipeds: methods, measurements, noise, and ecology. *The Journal of the Acoustical Society of America, 103*(4), 2216–2228.

Ketten, D. R. (1995). Estimates of blast injury and acoustic trauma zones for marine mammals from underwater explosions. In R. A. Kastelein, J. A. Thomas, & P. E. Nachtigall (Eds.), *Sensory systems of aquatic mammals* (pp. 391–407). Woerden, The Netherlands: De Spil Publishers.

MacGillivray, A. O., & Chapman, N. R. (2005). *Results from an acoustic modelling study of seismic airgun survey noise in Queen Charlotte Basin.* School of Earth and Ocean Sciences, University of Victoria, Victoria, BC, Canada. December 7, 2005. http://www.em.gov.bc.ca/Mining/Geoscience/MEM_UVic_Partnership/Documents/QCB_Acoustic_Modelling_Study_Report_2005.pdf.

Malme, C. I., Miles, P. R., Clark, C. W., Tyack, P. L., & Bird, J. E. (1984). *Investigations of the potential effects of underwater noise from petroleum industry activities on migrating gray whale behavior. Phase II, January 1984 migration.* Prepared by Bolt, Beranek, and Newman, Cambridge, MA. Prepared for United States Minerals Management Service, Alaska, OCS Office, Anchorage, AK. August 1984.

Malme, C. I., Wursig, B., Bird, J. E., & Tyack, P. L. (1988). Observations of feeding gray whale responses to controlled industrial noise exposure. In W. M. Sackinger, M. O. Jefferies, J. L. Imm, & S. D. Treacy (Eds.), *Port and Ocean Engineering Under Arctic Conditions* (Vol. II, pp. 55–73). Fairbanks, AK: University of Alaska.

Matzner, S., & Jones, M. E. (2011). Measuring coastal boating noise to assess potential impacts on marine life. *Sea Technology, 52*(7), 41–44.

McKenna, M. F. (2011). Blue whale response to underwater noise from commercial ships. Dissertation. University of California, San Diego. 242 pp.

Miller, G. W., Elliott, R. E., Koski, W. R., Moulton, V. D., & Richardson, W. J. (1999). Whales. In LGL and Greeneridge (Eds.), *Marine Mammal and Acoustical Monitoring of Western Geophysical's Open-Water Seismic Program in the Alaskan Beaufort Sea, 1998.* LGL Report TA 2230-3. King City, Ont., Canada: LGL Ecological Research Associates, Inc.

Morton, A. B., & Symonds, H. K. (2002). Displacement of *Orcinus orca* (L.) by high amplitude sound in British Columbia, Canada. *ICES Journal of Marine Science, 59*, 71–80.

Moulton, V. D., Richardson, W. J., Elliott, R. E., McDonald, T. L., Nations, C., & Williams, M. T. (2005). Effects of an offshore oil development on local abundance and distribution of ringed seals (*Phoca hispida*) of the Alaskan Beaufort Sea. *Marine Mammal Science, 21*(2), 217–242.

Nachtigall, P. E., Mooney, T. A., Taylor, K. A., & Yuen, M. M. (2007). Hearing and auditory evoked potential methods applied to odontocete cetaceans. *Aquatic Mammals, 33*(1), 6–13.

National Research Council (2003). *Ocean noise and marine mammals*. Washington, DC: National Research Council Committee on Potential Impacts of Ambient Noise in the Ocean on Marine Mammals; The National Academies Press.

National Research Council. (2005). *Marine Mammal Populations and Ocean Noise: Determining When Noise Causes Biologically Significant Effects*. Washington, DC: Ocean Studies Board, Division on Earth and Life Sciences, National Academies Press.

Navy (U.S. Department of the Navy). (2001). *Shock trial of the WINSTON S. CHURCHILL (DDG 81): final environmental impact statement.*

Navy. (2010). *Naval Base Kitsap Bangor Airborne noise measurements – October 2010.* Silverdale, WA.

Navy. (2014). Naval Magazine Indian Island Integrated Natural Resources Management Plan. Prepared by Naval Magazine Indian Island and Naval Facilities Engineering Command Northwest. 119 pp.

Navy. (2015a). *Proxy source sound levels and potential bubble curtain attenuation for acoustic modeling of nearshore marine pile driving at Navy installations in Puget Sound.* Navy Facilities Engineering Command Northwest, Silverdale, WA. Revised January 2015.

Navy. (2015b). Pacific Navy Marine Species Density Database, Revised Final Northwest Training and Testing Technical Report. May 4, 2015. Naval Facilities Engineering Command Pacific, Pearl Harbor, HI.

Navy. (2016a). *Puget Sound Naval Shipyard Intermediate Maintenance Facility Pier 6 Fender Pile Replacement Project Acoustic Monitoring Results.* (NSWCCD-73-TR–2016/553). Naval Surface Warfare Center, Carderock Division, Signature Measurement and Systems Division, West Bethesda, MD.

Navy. (2016b). Pinniped surveys at Naval Base Kitsap Bangor, Naval Base Kitsap Bremerton, Manchester Fuel Department, and Naval Station Everett: summary through June 2016. Naval Facilities Engineering Command Northwest, Silverdale, WA.

Navy. (2016c). Monitoring report for the Ammunition Wharf Pile Replacement Project. Prepared by Naval Magazine Indian Island. 7 pp.

Nedwell, J. R., Parvin, S. J., Edwards, B., Workman, R., Brooker, A. G., & Kynoch, J. E. (2007). *Measurement and interpretation of underwater noise during construction and operation of offshore windfarms in UK waters.* (Report No. 544R0738). Prepared by Subacoustech Ltd., Bishops Waltham, Hampshire, UK. Prepared for COWRIE (Collaborative Offshore Wind Research into the Environment), London, UK. December 21, 2007.

Nemeth, E., & Brumm, H. (2010). Birds and anthropogenic noise: are urban songs adaptive? *American Naturalist, 176*(4), 465−475.

NMFS (National Marine Fisheries Service). (2005). Endangered Fish and Wildlife; Notice of intent to prepare an environmental impact statement. 70 FR 1871.

NMFS. (2012). *Guidance Document: Sound Propagation Modeling to Characterize Pile Driving Sounds Relevant to Marine Mammals.* Memorandum from NMFS Northwest Region and Northwest Fisheries Science Center. Seattle, WA. January 31, 2012. Retrieved from http://www.westcoast.fisheries.noaa.gov/publications/protected_species/marine_mammals/killer_whales/esa_status/characterize_sound_propagation_modeling_guidance_memo.pdf

NMFS. (2015). Endangered Species Act Section 7 Biological Opinion and Conference Report on Navy Northwest Training and Testing Activities and NMFS's MMPA Incidental Take Authorization. Prepared by the Endangered Species Act Interagency Cooperation Division, Office of Protected Resources, NMFS. FPR-2015-9110. November 9.

NMFS. (2016a). Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing: Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shifts. U.S. Dept. of Commer., NOAA. NOAA Technical Memorandum NMFS-OPR-55, 178 pp.

NMFS. (2016b). Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing: Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shifts (July 2016). Optional User Spreadsheet. Version 1.1. August 2016. Available at http://www.nmfs.noaa.gov/pr/acoustics/guidelines.htm.

Northwest Environmental Consulting. (2014). *Replace Fendering System, Pier 6, PSNS & IMF Marine Mammal Monitoring.* Prepared by Northwest Environmental Consulting, LLC, Seattle, WA. Prepared for Watts Constructors, LLC, Gig Harbor, WA. March 2014.

Northwest Environmental Consulting. (2015). *Naval Base Bremerton Pier 6 Pile Replacement – Marine Mammal Monitoring.* Prepared by Northwest Environmental Consulting, LLC, Seattle, WA. Prepared for Watts Constructors, LLC, Gig Harbor, WA. March 2015.

Nowacek, D. P., Thorne, L. H., Johnston, D. W., & Tyack, P. L. (2007). Responses of cetaceans to anthropogenic noise. *Mammal Review, 37*(2), 81–115.

O'Keefe, D. J., & Young, G. A. (1984). *Handbook on the environmental effects of underwater explosions.* (NSWC TR 83-240). Naval Surface Weapons Center, Dahlgren, VA and Silver Spring, MD. September 13, 1984.

Popper, A. N. (2005). *A review of hearing by sturgeon and lamprey.* Prepared by A. Popper, Environmental BioAcoustics, LLC, Rockville, MD. Prepared for US Army Corps of Engineers, Portland District, Portland, OR. August 12.

Popper, A. N., Hawkins, A. D., Fay, R. R., Mann, D. A., Bartol, S., Carlson, T. J., . . . Halvorsen, M. B. (2014). *ASA S3/SC1. 4 TR-2014 Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report Prepared by ANSI-Accredited Standards Committee S3/SC1 and Registered with ANSI*: Springer.

Reine, K. J., Clarke, D., & Dickerson, C. (2014). Characterization of underwater sounds produced by hydraulic and mechanical dredging operations. *The Journal of the Acoustical Society of America, 135*(6), 3280–3294.

Richardson, W. J., Greene, C. R., Jr., Malme, C. I., & Thomson, D. H. (1995). *Marine mammals and noise*. San Diego, CA: Academic Press.

Ridgway, S. H., Carter, D. A., Smith, R. R., Kamolnick, T., Schlundt, C. E., & Elsberry, W. R. (1997). *Behavioral responses and temporary shift in masked hearing threshold of bottlenose dolphins, Tursiops truncatus, to 1-second tones of 141 to 201 dB re 1 µPa.* (Technical Report 1751). Naval Command, Control and Ocean Surveillance Center, RDT&E Division, San Diego, CA. http://handle.dtic.mil/100.2/ADA327722.

Ruggerone, G. T., Goodman, S. E., & Miner, R. (2008). *Behavioral response and survival of juvenile coho salmon to pile driving sounds.* Prepared by Natural Resources Consultants, Inc., Seattle, WA, and Robert Miner Dynamic Testing, Inc. Prepared for Port of Seattle, Seattle, WA. July 2008.

SAIC (Science Applications International Corporation). (2011). *Final Summary Report: Environmental Sound Panel for Marbled Murrelet Underwater Noise Injury Threshold. Science Panel convened July 27–29, 2011, attended by representatives of the U.S. Fish and Wildlife Service, National Marine Fisheries Service, U.S. Navy, National Marine Mammal Foundation, and other experts.* Prepared by Science Applications International Corporation, Bothell, WA. Prepared for NAVFAC Northwest, Silverdale, WA. September 7, 2011.

SAIC. (2012). *Final Summary Report: Marbled Murrelet Hydroacoustic Science Panel II. Panel conducted March 28–30, 2012, attended by representatives of the U.S. Fish and Wildlife Service, U.S. Geological Survey, National Marine Fisheries Service, U.S. Navy, and other experts.* Prepared by Bernice Tannenbaum, Science Applications International Corporation, Bothell, WA. Prepared for NAVFAC Northwest, Silverdale, WA. September 4, 2012.

Schusterman, R. J. (1981). Behavioral capabilities of seals and sea lions: a review of their hearing, visual, learning and diving skills. *The psychological record, 31*(2), 125–143.

Sebastianutto, L., Picciulin, M., Costantini, M., & Ferrero, E. A. (2011). How boat noise affects an ecologically crucial behaviour: the case of territoriality in *Gobius cruentatus* (Gobiidae). *Environmental Biology of Fishes, 92*(2), 207–215.

Slater, M. C. (2009). *Naval Base Kitsap, Bangor baseline underwater noise survey report.* Prepared by Science Applications International Corporation, Bremerton, WA. Prepared for BAE Systems Applied Technologies, Inc., Rockville, MD. February 18, 2009.

Smultea, M. A., Jefferson, T. A., Courbis, S., Campbell, G., & Hopkins, J. (2015). *Marine Mammal Aerial Surveys Conducted in the Inland Puget Sound Waters of Washington, Summer 2013–Spring 2015.* (Draft Final Report). Prepared by Smultea Environmental Sciences, LLC, Preston, WA. Prepared for Naval Facilities Engineering Command Pacific, Pearl Harbor, HI. December 31, 2015.

Smultea, M. A., Lomac-MacNair, K., Campbell, G., Courbis, S., & Jefferson, T. A. (2017). *Aerial Surveys of Marine Mammals Conducted in the Inland Puget Sound Waters of Washington, Summer 2013 through Winter 2016. Final Report*. Prepared by Smultea Sciences for Commander, U.S. Pacific Fleet and Naval Sea Systems Command. Submitted to Naval Facilities Engineering Command Northwest (NAVFAC NW), Pearl Harbor, Hawaii under Contract No. N62470-15-D-8006 issued to HDR, Inc., San Diego, CA. June 2017.

Southall, B. L., Bowles, A. E., Ellison, W. T., Finneran, J. J., Gentry, R. L., Green, G. R., Jr., . . . Tyack, P. L. (2007). Marine mammal noise exposure criteria: Initial scientific recommendations. *Aquatic Mammals, 33*(4), 411–521.

Stadler, J. (2002). Personal observation: NMFS biologists observed that approximately 100 surf perch from three different species (*Cymatogaster aggregata*, *Brachyistius frenatus*, and *Embiotoca lateralis*) were killed during impact pile driving of 36-inch (91-centimeter) diameter steel pilings at Bremerton, Washington (Stadler, NMFS, 2002, personal observation). (Cited in the Navy's Test Pile permitting documents).

Strachan, G., McAllister, M., & Ralph, C. J. (1995). Marbled murrelet at-sea and foraging behavior. In C. J. Ralph, G. L. Hunt, M. G. Raphael, & J. F. Piatt (Eds.), *Ecology and conservation of the marbled murrelet* (pp. 247–253). Albany, CA. U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station. PSW-GTR-152.

Stroetz, R. W., Vlahakis, N. E., Walters, B. J., Schroeder, M. A., & Hubmayr, R. D. (2001). Validation of a new live cell strain system: characterization of plasma membrane stress failure. *Journal of Applied Physiology, 90*(6), 2361–2370.

Thorson, P. (2010). *San Francisco-Oakland Bay Bridge east span seismic safety project marine mammal monitoring for the self-anchored suspension temporary towers, June 2008–May 2009*. California Department of Transportation. Retrieved from http://www.nmfs.noaa.gov/pr/pdfs/permits/sfobb_mmreport.pdf

Thorson, P., & Reyff, J. (2006). *San Francisco-Oakland Bay bridge east span seismic safety project marine mammals and acoustic monitoring for the marine foundations at piers E2 and T1*. California Department of Transportation. Retrieved from http://biomitigation.org/reports/files/Marine_Mammal_Piers_E2-T1_Report_0_17b1.pdf

Turnpenny, A. W. H., Thatcher, K. P., & Nedwell, J. R. (1994). *The effects on fish and other marine animals of high-level underwater sound.* (Report FRR 127/94). Fawley Aquatic Research Laboratory, Ltd., United Kingdom. October 1994.

Tynan, T. (2013). [Timothy Tynan, Senior Biologist, National Marine Fisheries Service Northwest Regional Office, Sustainable Fisheries Division, Lacey, Washington]. Personal communication with Sharon Rainsberry, Fisheries Biologist, NAVFAC Northwest, re: outmigrant chum sizes in Puget Sound marine waters and river systems. October 24, 2013.

USFWS (U.S. Fish and Wildlife Service). (2013). *Conducting masking analysis for marbled murrelets & pile driving projects.* (Presentation for WSDOT Biologists and Consultants by Emily Teachout). U.S. Fish and Wildlife Service, Washington Fish and Wildlife Office Transportation Branch, Lacey, WA. November 19, 2013.

Viada, S. T., Hammer, R. M., Racca, R., Hannay, D., Thompson, M. J., Balcom, B. J., & Phillips, N. W. (2008). Review of potential impacts to sea turtles from underwater explosive removal of offshore structures. *Environmental Impact Assessment Review, 28*(4), 267–285.

Vlahakis, N. E., & Hubmayr, R. D. (2000). Invited review: plasma membrane stress failure in alveolar epithelial cells. *Journal of Applied Physiology, 89*(6), 2490–2496.

Ward, W. D. (1997). Effects of high-intensity sound. In M. J. Crocker (Ed.), *Encyclopedia of Acoustics* (Vol. Three, pp. 1497–1507). John Wiley & Sons, Inc.

Wartzok, D., & Ketten, D. R. (1999). Marine mammal sensory systems. In I. J.E. Reynolds & S. A. Rommel (Eds.), *Biology of Marine Mammals* (pp. 117–175). Washington, DC: Smithsonian Institution Press.

Wartzok, D., Popper, A. N., Gordon, J., & Merrill, J. (2004). Factors affecting the responses of marine mammals to acoustic disturbance. *Marine Technology Society Journal, 37*, 6–15.

WSDOT (Washington State Department of Transportation). (2011). *Underwater sound levels associated with driving 72-inch steel piles at the SR 529 Ebey Slough Bridge Replacement Project*. March 2011.

WSDOT. (2018). *Biological Assessment Preparation for Transportation Projects - Advanced Training Manual.* (Version 2015). Olympia, WA. January 2018. Retrieved from http://www.wsdot.wa.gov/Environment/Biology/BA/BAguidance.htm#Manual.

Yelverton, J. T., Richmond, D. R., Fletcher, R. E., & Jones, R. K. (1973). *Safe distance from underwater explosions for mammals and birds.* Lovelace Foundation for Medical Education and Research, Albuquerque, NM.

Yelverton, J. T., Richmond, D. R., Hicks, W., Saunders, K., & Fletcher, R. E. (1975). *The relationship between fish size and their response to underwater blast.* (DNA 3677T). Prepared by Lovelace Foundation for Medical Education and Research, Albuquerque, NM. Prepared for Defense Nuclear Agency, Washington, DC. June 18, 1975.

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APPENDIX C

FISH SPECIES WITH DESIGNATED ESSENTIAL FISH HABITAT WITHIN THE ACTION AREA

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Table C-1. Fish Species with Designated EFH in Action Area

Species	*Applicable Life Stages*	*Habitat*
Pacific Coast Groundfish		
Arrowtooth flounder *(Atheresthes stomias)*	L, E	Unconsolidated bottom, epipelagic zone
Black rockfish *(Sebastes melanops)*	A, J	Vegetated bottom, hard bottom, Unconsolidated sediment
Blue rockfish *(Sebastes mystinus)*	A, L	Vegetated bottom, hard bottom, epipelagic zone
Bocaccio *(Sebastes paucispinis)*	A, J	Steep slopes consisting of sand or rocky substrates
Brown rockfish *(Sebastes auriculatus)*	A, J	Rocky habitat, artificial structures, kelp
Butter sole *(Isopsetta isolepis)*	A	Muddy or silty sediment
Cabezon *(Scorpaenichthys marmoratus)*	A	Hard bottom
California skate *(Raja inornata)*	E	Soft (muddy) bottom sediments
Canary rockfish *(Sebastes pinniger)*	A, J	Rocky, course habitat
China rockfish *(Sebastes nebulosus)*	J	Rocky reef, vegetated bottoms (kelp)
Copper rockfish *(Sebastes caurinus)*	A, J	Rocky reef, artificial structures, kelp
Dover *sole (Solea solea)*	J	Muddy bottom
English sole *(Parophrys vetulus)*	A, J, L	Unconsolidated bottom, epipelagic zone
Flathead sole *(Hippoglossoides elassodon)*	J	Unconsolidated sediments
Greenstriped rockfish *(Sebastes elongates)*	A	Sandy, course sediments
Kelp greenling *(Hexagrammos decagrammus)*	L	Rocky reefs near dense algae or kelp, epipelagic zone
Lingcod *(Ophiodon elongates)*	A, J, E	Unconsolidated sediments, rocky reefs, kelp and eelgrass beds, epipelagic zone
Longnose skate *(Raja rhina)*	A, J, E	Mixed sediments
Pacific cod *(Gadus microcephalus)*	E	Unconsolidated sediments
Pacific Grenadier *(Coryphaenoides acrolepis)*	E, L	Unconsolidated sediments, epipelagic zone
Pacific Hake *(Merluccius productus)*	A	Epipelagic zone
Pacific sanddab *(Citharichthys sordidus)*	A, J, L, E	Mixed bottom, unconsolidated, epipelagic zone
Petrale sole *(Eopsetta jordani)*	J	Soft sediments
Quillback rockfish *(Sebastes maliger)*	A, J	Artificial structure, rocky reef, mixed bottom, vegetated bottom
Rex sole *(Glyptocephalus zachirus)*	J	Unconsolidated sediments
Rock sole *(Lepidopsetta bilineata)*	A	Hard bottom
Sablefish *(Anoplopoma fimbria)*	A, E	Unconsolidated sediments, drifting kelp, epipelagic zone

Table C-1. Fish Species with Designated EFH in Action Area

Species	*Applicable Life Stages*	*Habitat*
Sand sole *(Psettichthys melanostictus)*	A, J, L	Unconsolidated sediments, epipelagic zone
Shortspine thornyhead *(Sebastolobus alascanus)*	A	Deep, high rocky relief habitats
Soupfin shark *(Galeorhinus galeus)*	A, J	Unconsolidated sediments, epipelagic zone
Spiny dogfish *(Squalus acanthias)*	A, J	Unconsolidated sediments, epipelagic zone
Splitnose rockfish *(Sebastes diploproa)*	L	Muddy, vegetated bottoms (specifically eelgrass and kelp), epipelagic zone
Spotted ratfish *(Hydrolagus colliei)*	A, J, E	Unconsolidated sediments, low-rocky relief
Starry flounder *(Platichthys stellatus)*	A, J, E	Unconsolidated sediments, epipelagic zone
Yelloweye rockfish *(Sebastes ruberrimus)*	A, J	Deep, high-relief rocky habitat, steep slopes
Yellowtail rockfish *(Sebastes flavidus)*	J	Deep, high-relief rocky habitat, steep slopes
Vermilion rockfish *(Sebastes miniatus)*	A	Deep, high-relief rocky habitat, steep slopes
Coastal Pelagics		
Anchovy *(Engraulis mordax)*	A, L, E	All estuarine waters above the thermocline and falling between 10 and 20 degrees Celsius
Market squid *(Loligo opalescens)*	A	Same as for anchovy
Pacific mackerel *(Scomber japonicas)*	A, J	Same as for anchovy
Pacific Coast Salmon		
Coho *(Oncorhynchus kisutch*	A, J	Estuarine waters and substrates, including the nearshore and tidal submerged environments, and most freshwater bodies historically accessible to salmon (except above certain impassable natural barriers)
Chinook *(Oncorhynchus tshawytscha)*	A, J	Same as for coho
Pink *(Oncorhynchus gorbuscha)*	A, J	Same as for coho

Sources: PFMC 2005a, 2005b, 2011a, 2014a, 2014b; Palsson et al. 2009

Key: A = adult; E = eggs; J = juvenile; L = larvae.

APPENDIX D

MONITORING PLAN TEMPLATE

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Monitoring Plan

1 Mitigation Requirements

Table D-1 provides a comprehensive list of all mitigation requirements associated with the Proposed Action, as required by the Office of the Chief of Naval Operations M-5090.1, Section 10-3-6. Mitigation requirements are described in detail in the Environmental Assessment (EA), Chapter 2.5, Best Management Practices and Minimization Measures.

The following sections provide templates for monitoring plans that will be developed for specific Marine Structure Maintenance and Pile Replacement (MPR) projects.

2 Marbled Murrelet Monitoring Plan Template

Project

Location

(Monitoring plans will be prepared by Navy biologists based on the current monitoring plan template and the specific project/location. If the U.S. Fish and Wildlife Service [USFWS] Marbled Murrelet Monitoring Plan is revised in the future, the Navy's monitoring plans for specific projects will be revised accordingly.)

2.1 OBJECTIVE

The intent of the monitoring protocol[8] is to:

1. Comply with the requirements of the Endangered Species Act section 7 consultation for the United States Department of the Navy (Navy) ***Project Name*** at ***Location Name***.
2. Detect all marbled murrelets (*Brachyramphus marmoratus*) (murrelets) within 42 meters of impact pile driving.
3. To avoid take of murrelets from both exposure to potentially injurious underwater sound pressure levels, and from the masking effects of in-air sound associated with impact pile driving[9] by communicating immediately with the pile driving operator to shut-down pile driving.

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[8] This protocol is based on USFWS protocol dated October 2013; however, the protocol was modified to avoid hazing of murrelets from monitoring vessels.

[9] The threshold for injury due to elevated underwater sound pressure levels during impact pile driving is 202 dB re 1 µPa cumulative SEL, which is approximately 40 meters from a 30-inch steel pile during impact driving. Based on information from USFWS (http://www.wsdot.wa.gov/environment/biology/ba/baguidance.htm#noise), the criterion for sound potentially resulting in auditory masking of communication calls is 42 meters from impact pile driving.

2.2 ADAPTIVE APPROACH

The individuals that implement this protocol will assess its effectiveness during implementation. They will use their best professional judgment throughout implementation and will seek improvements to these methods when deemed appropriate. Any modifications to this protocol will be coordinated between the Navy and USFWS's Washington Fish and Wildlife Office (WFWO).

2.3 MONITORING

2.3.1 Activities to Be Monitored

Application of this protocol is required as specified through the Endangered Species Act consultation process for the ***Project Name***. It applies to project activities that involve either in-water impact pile driving when injurious sound pressure levels are expected or impact pile driving when in-air sounds are expected to cause masking effects.

2.3.2 Equipment

- Binoculars – quality 8 or 10 power
- Two-way radios with earpieces
- Range finder
- Log books
- Seabird identification guide
- Life vest or other personal flotation device for observer in boats
- Hard hat or other personal protective equipment needed for Lead Biologist
- Monitoring Plan
- Cellular phone to contact the Construction Contractor and the Navy personnel responsible for coordinating monitoring. The Navy will contact WFWO if necessary during the project.

2.3.3 Monitoring Location

The spacing and placement of the monitoring location has been designed to provide adequate coverage of the entire monitoring area. The location is identified on Figure***(s) D-1-x. Add project-specific figure(s)***. If conditions change on-site ***(list construction activities that may change during the course of the project, such as barge movements)***, monitoring locations can be refined in the field. For example, a stationary boat may be used on one side of a wharf to provide full visual coverage. In all cases, the monitoring location will allow for the entire monitoring area to be fully surveyed within 5 minutes.

2.3.4 Monitoring Techniques

One qualified biologist shall be identified as the Lead Biologist. The Lead Biologist has the authority to stop pile driving when murrelets are detected in the monitoring area or when visibility impairs monitoring. The Lead Biologist is responsible for:

- Ensuring monitoring is consistent with the criteria in the consultation
- Communicating with monitoring crew(s), the pile driver operator, and the Navy monitoring points of contact (Section 2.4). The Navy will be responsible for communicating with WFWO should it be necessary during project construction.

- Determining monitoring start and end times

The Lead Biologist will be positioned at a safe location near the pile driving operator. At least one qualified observer will be positioned to provide adequate coverage to ensure no murrelets are in the 42-meter monitoring area during impact pile driving. The murrelet observer will either be positioned within a boat or on the pier (Figure D-1). Monitoring will begin at least 30 minutes prior to commencement of pile driving.

All observers are responsible for:

- Understanding the requirements in the consultation and monitoring plan
- Knowing the lines and method of communicating with the Lead Biologist and pile driving operator
- Evaluating the sea conditions and visibility
- Calibrating their ability to determine a 50-meter distance at the beginning of each day. Calibration should be done using a range finder on a stationary object on the water.
- Determining when conditions for monitoring are not met

Monitoring will only occur when the sea state is at a Beaufort scale of 2 or less. The Beaufort Wind Scale used for marbled murrelet monitoring is presented in Table D-2. Observers should scan without a scope or binoculars; scopes and binoculars should only be used to verify species.

No impact pile driving will occur if marbled murrelet monitoring to protocol cannot be implemented. At least two full sweeps of the monitoring zone shall be conducted prior to pile driving to ensure that no murrelets are in the monitoring zone. The observer is responsible for scanning from 0° (straight ahead) to 90° left or right. The observer should occasionally scan past 90°, looking for murrelets that may have surfaced.

If no murrelets are within the monitoring zone, the observers will notify the Lead Biologist who will communicate to the pile driver operator that pile driving may commence. All observers will have two-way radios with earpieces to allow for effective communication during pile driving. The Lead Biologist will maintain communication with the pile driving operator via two-way radios and may use cell phones as a backup. If murrelets are seen within the monitoring zone during pile driving, the observers will immediately notify the Lead Biologist who will communicate to the pile driver operator that he/she is to cease pile driving. Pile driving will not resume until the murrelets have left the monitoring area and at least two full sweeps of the monitoring area have confirmed murrelets are not present.

When a murrelet is detected within the monitoring area, it will be continuously observed until it leaves the monitoring area. If observers lose sight of the murrelet, searches for the murrelet will continue for at least 5 minutes. If the murrelet is still not found, then at least two full sweeps of the monitoring area to confirm no murrelets are present will be conducted prior to resumption of pile driving.

It is the observer's responsibility to determine if he/she is not able to see murrelets and inform the Lead Biologist that the monitoring needs to be terminated until conditions allow for accurate monitoring.

Murrelets are especially vulnerable to disturbance when they are molting and flightless. Molting occurs after nesting in late summer, typically July through October in Puget Sound populations. Extra precaution should be exercised during this period.

2.3.5 Limitations

No monitoring will be conducted during inclement weather that creates potentially hazardous conditions as determined by the Lead Biologist. Observers must have visibility to at least 50 meters. No monitoring will be conducted when visibility is significantly limited such as during heavy rain, fog, glare, or in a Beaufort Sea State Scale greater than 2.

Glare can significantly limit an observer's ability to detect birds. Boat orientation may be adjusted to reduce glare (e.g., change direction). However, if visibility cannot be adjusted, monitoring and pile driving must cease until effective monitoring can be conducted.

Monitoring will not start until after sunrise and will cease prior to sunset. During the nesting season, April 1 – September 23, pile driving will not begin until 2 hours after sunset and will cease 2 hours prior to sunset.

2.3.6 Documentation

The observers will document the number and general location of all murrelets in the monitoring area. Additional information on other seabirds and behaviors will be collected during documentation to improve general data knowledge on seabird presence and distribution as well as project impacts on various seabirds. Each observer will record information using the *Seabird Monitoring Data Collection Form* and reference completed *Seabird Monitoring Site/Transects Identification* form. These forms are depicted in the Figures D-2 and D-3, respectively.

2.3.7 Data Collection

All murrelets within transects or monitoring sites will be continuously documented. On the *Seabird Monitoring Data Collection Form*, document the time, number of birds, location, and observed behavior. Update the documentation when a murrelet changes behavior, changes location, or leaves the area. Include the time pile driving was ceased and how long project activities were halted.

Observers will also note all seabirds within the area that appear to be acting abnormally during any project activities. For example, if a seabird is listing, paddling in circles, shaking head, or suddenly flushing at the onset of activity, note the information on the *Seabird Monitoring Data Collection Form.* For all birds except murrelets, providing a genus level (grebe, loon, cormorant, scoter, gull, etc.) of identification is sufficient.

General information on other seabird behavior and distribution within the monitoring area will be collected. Every 2 hours at minimum during pile driving activities, the observer will document other seabird presence, behavior, and distribution in the monitoring area. This information can be collected more frequently. Many seabirds may linger in an area for several hours. If this is the case, note the time, species, and in the comments section identify that this is the same group from earlier and document any notable changes in behavior.

Under location, the data form indicates two separate options for documenting location. Land-based observers can fill out the land-based only or both land-based and boat sections. For the boat locations, identify the distance in meters from the boat to the seabird and whether it is landward (toward activity) or seaward (away from activity).

2.3.8 Timing and Duration

Pile driving will not begin until the monitoring pre-sweep has been conducted. The pre-sweep monitoring can commence once there is enough daylight for adequate visibility, and must begin at least 30 minutes before the initiation of pile driving. Monitoring will then continue until pile driving is completed each day. The monitoring set-up (i.e., number and location of observers) allows for the entire monitoring area to be covered within 5 minutes.

2.3.9 Contingency

In the unlikely event that a murrelet is perceived to be injured by pile driving, all pile driving will cease and WFWO will be contacted by Navy personnel as soon as possible.

The Navy will work with WFWO to determine if changes to the monitoring plan as described in Section 2.3 above are necessary. Pile driving will not resume until the necessary amendments have been made.

2.4 USFWS COMMUNICATION

The Navy will keep the WFWO informed of the progress and effectiveness of the monitoring activities and will notify the WFWO of any problems and/or necessary modifications to the monitoring plan. The Navy will coordinate with the WFWO in the development of a modified approach and will obtain WFWO approval for such modifications.

Primary points of contact for the Navy are: ***[Revise points of contact as necessary]***

1. Tyler Yasenak – phone: (360) 315-2452
2. Greg Leicht – phone: (360) (360) 649-1623

The Navy point of contact will contact the WFWO of the USFWS. Primary points of contact at the WFWO are:

1. Lindsy Wright – phone: (360) 753-6055
2. Ryan McReynolds – phone: (360) 753-6047
3. Emily Teachout – phone: (360) 753-9583
4. Deanna Lynch – phone: (360) 753-9545

2.5 PERSONNEL QUALIFICATIONS AND TRAINING

All observers must be certified by the USFWS under the Marbled Murrelet Marine Protocol. Observers will have appropriate qualifications, including education or work experience in biology, ornithology, or a closely related field; at least one season (2–3 months) of work with bird identification being the primary objective (i.e., not incidental to other work). Observers must have experience identifying marine birds in the Pacific Northwest, as well as understanding and documenting bird behavior.

All observers will attend the marbled murrelet marine monitoring protocol training and pass the written and photo examination with 90 percent proficiency. Upon successful completion, observers will be certified. Certification is valid for one year. Recertification is required annually, unless the observer can document that he/she implemented the monitoring protocol for at least 25 monitoring days in the previous year. Recertification can then be delayed for one year; however, recertification can only be delayed for one year.

Certifications will be considered expired after one year, unless the WFWO is notified by the biologist that greater than 25 days of survey were done within 1 year of their certificate date. If an observer does conduct greater than 25 days of survey the certificate will be valid for an additional year from the certificate date. To extend a certification the biologist sends an email to the attention of Emily Teachout (emily_teachout@fws.gov) with the dates of the surveys they conducted and the date of their original certificate. The WFWO will maintain a list a certified observers and it will be available on our website.

All observers will be provided with a copy of the consultation documents for the project. Observers must read and understand the contents of the consultation documents related to identifying, avoiding, and reporting "incidental take" of murrelets.

2.6 REPORTING

At the completion of each in-water work window for which there has been impact pile driving, the Navy will forward a monitoring report to the WFWO within 90 days.

Reports shall be sent to the attention of (WFWO Branch Manager). The report shall include:

- Observation dates, times, and conditions
- Copies of field data sheets or logs

3 Marine Mammal Monitoring Plan Template

(Monitoring plans will be prepared by Navy biologists based on the current* National Marine Fisheries Service *[NMFS] monitoring plan template and the specific project/location.)

3.1 INTRODUCTION

(This section will be location and project-specific.)

The Navy proposes to conduct maintenance and repair activities at marine waterfront structures over a 5-year period at six locations within Navy Region Northwest (Region). These locations, which are in the Puget Sound region of Washington State, include: Naval Base (NAVBASE) Kitsap Bangor, NAVBASE Kitsap Bremerton, NAVBASE Kitsap Keyport, NAVBASE Kitsap Manchester, Zelatched Point, NAVMAG Indian Island, and Naval Station (NAVSTA) Everett. ***State which location/project(s) are covered by this monitoring plan.***

The purpose of this plan is to provide a protocol for marine mammal monitoring that will occur during in-water construction scheduled to occur between ***Insert dates for the project(s) covered by this monitoring plan***. Visual marine mammal monitoring will be conducted before, during, and after pile driving activities where noise levels may behaviorally disturb marine mammals. Noise levels from pile driving were determined to exceed the behavioral and injury thresholds for marine mammals, and a zone surrounding piles being installed will be visually monitored. Two zones will be monitored including the Injury Zone, corresponding to the area encompassed by the estimated injury thresholds for marine mammals, and the Behavioral Disturbance Zone, corresponding to the area encompassed by the estimated behavioral disturbance thresholds. As described in the following protocol, these zones will be used to determine Shutdown Zones for pile driving (i.e., pile driving will be shut-down if marine mammals are in the Shutdown Zones). This monitoring plan was developed to ensure compliance with the Letter of Authorization issued for this project by NMFS.

3.2 METHODS

3.2.1 Observer Qualifications

Monitoring will be conducted by qualified, trained marine mammal observers (hereafter, "observer"). An observer is a biologist with prior training and experience in conducting marine mammal monitoring or surveys, and who has the ability to identify marine mammal species and describe relevant behaviors that may occur in proximity to in-water construction activities. A trained observer will be placed at the best vantage point(s) practicable (e.g., from a small boat, the pile driving barge, on shore, or any other suitable location) to monitor for marine mammals and implement shutdown/delay procedures when applicable by calling for the shutdown to the hammer operator. The observers will have no other construction-related tasks while conducting monitoring.

A dedicated monitoring coordinator will be on-site during all construction days. The monitoring coordinator will oversee marine mammal observers. The monitoring coordinator will serve as the liaison between the marine mammal monitoring staff and the construction contractor to assist in the distribution of information.

3.2.2 Data Collection

Observers will use an NMFS-approved Marine Mammal Observation Record Form (Table D-3), which will be completed by each observer for each survey day.

- Date and time that pile driving begins or ends
- Construction activities occurring during each sighting
- Weather parameters (e.g., percent cover, percent glare, visibility)
- Water conditions (e.g., tidal state [incoming (flood), slack (neither direction), or outgoing (ebb)] and sea state). The Beaufort Sea State Scale shown in Table D-4 will be used to determine sea-state during marine mammal surveys.
- Species, numbers, and if possible, sex and age class of marine mammals
- Marine mammal behavior patterns observed, including bearing from observer and direction of travel. If possible, include the correlation to sound pressure levels for context.
- Distance from pile driving activities to marine mammals and distance from the marine mammal to the observation point
- Locations of all marine mammal observations
- Other human activity in the area. Record the hull numbers of fishing vessels if possible.

The monitoring coordinator will complete a Marine Mammal Observation Record Form (Table D-3) for each day of monitoring. The summary form compiles information collected on the individual sighting forms and provides additional details about construction activities during marine mammal monitoring. The summary form will be provided to the Navy each day following monitoring. A chain of custody form (Table D-5) will be completed in the event that marine mammal remains are found in the vicinity of MPR Program projects during construction.

3.2.3 Equipment

The following equipment will be required to conduct marine mammal monitoring:

- ***If boat-based monitors are used, add the following text.*** A survey boat will include the following minimum equipment: a means to keep electrical equipment dry, a fixed marine radio for the Captain to communicate on marine channels independent of observers communicating on a dedicated channel, depth finder, measuring tape, and GPS units that track the constant movement of the vessel. Vessels will comply with all Coast Guard regulations and be able to pass a Coast Guard safety inspection. ***Other equipment may need to be added to the list depending on the extent and timing of the project need, such as a flying bridge for elevated observation, depth finder, and navigation plotting equipment.***
- Hearing protection for biologists and boat operators working near heavy construction equipment
- At a minimum, portable marine radios with extra batteries and headsets for the observers to communicate with the monitoring coordinator, construction contractor, and other observer(s). Red and green flags can be added as back-up or in addition to the radios.
- Cellular phones that do not have a camera (depending on location restrictions) and the contact information for the other observer(s), monitoring coordinator, and Navy point of contact
- Nautical charts
- Daily tide tables for the project area watch or chronometer
- Binoculars (quality 7 x 50 or better, can have built-in rangefinders or reticles) and/or rangefinders
- Monitoring Plan, Incidental Harassment Authorization (IHA) permit, and/or other relevant permit requirement specifications in sealed clear plastic cover
- Notebook with pre-standardized monitoring Marine Mammal Observation Record Form (Table D-3) on non-bleeding paper (e.g., Rite-in-the-Rain)
- Marine mammal identification guides on waterproof paper
- Clipboard
- Pen/pencil

3.2.4 Pile Driving Visual Monitoring and Shutdown Zones

Visual monitoring and Shutdown Zones will be determined in consultation with NMFS and will be stated in the Letter of Authorization and Endangered Species Act Incidental Take Statement and/or Terms and Conditions sections of the Biological Opinion. Monitoring and shutdown distances may vary depending on the location and project specifications, such as pile size and pile type. In the following sections, state the Shutdown Zone distance that is required for the project(s) covered by this monitoring plan.

During all pile driving, the Navy will visually monitor Injury and Behavioral Disturbance Zones as follows:

- An **xx** meter **Injury Zone** shall be established and monitored to prevent injury to marine mammals from noise due to pile driving and physical interaction with construction equipment. Injury Zones will have a minimum Shutdown Zone of 10 meters to prevent injury to marine mammals from interaction with construction equipment. During pile driving, a **Behavioral Disturbance Zone** shall be established that will encompass as much of the behavioral disturbance zone as possible (i.e., for impact driving, the zone where impact pile driving levels are estimated to be at or above 160 dB re 1 µPa and for vibratory driving, the zone where vibratory pile driving noise levels are estimated to be at or above 120 dB RMS) (Figure D-4).

During all pile driving, the Navy will establish Shutdown Zones as follows:

- A **Shutdown Zone for cetaceans** will include the Injury Zone and the portion of the Behavioral Disturbance Zone that can be practicably monitored from observer positions described in Section 3.2.5. If a cetacean approaches or enters the Shutdown Zone, pile driving will cease. See Figure D-5.
- A **Shutdown Zone for pinnipeds** will include the Injury Zone. If a pinniped enters the Shutdown Zone, pile driving will cease, but if it enters only the Behavioral Disturbance Zone, a take would be recorded and behaviors documented. That pile would be completed without cessation, unless the animal approaches or enters the Shutdown Zone, at which point all pile driving activities will be halted. See Figure D-6.
- If marine mammals are seen outside the Behavioral Disturbance Zone, these animals will also be recorded (not as a take) and their location identified.

Distances for all monitoring zones are provided in Table D-6.

3.2.5 Observer Monitoring Locations

[The number of marine mammal observers will be determined based on the effectiveness of monitoring the Injury and Behavioral Disturbance Zones at each project site.] In order to effectively monitor the Injury and Behavioral Disturbance Zones, marine mammal observer will be positioned at the best practicable vantage point, taking into consideration security, safety, and space limitations at the waterfront. The observer will be stationed on the pier, or on the pile driving barge in a location that will provide adequate visual coverage for the **xx** meter Injury Zones. If required, a second observer will be stationed in a small vessel, on the pier, or on the pile driving barge to maximize observation of the **Behavioral Disturbance Zone**. Each monitoring location will have a minimum of one dedicated marine mammal observer (not including boat operators) (see Figure D-4).

3.2.6 Monitoring Techniques

The Navy will collect sighting data and behaviors of marine mammal species observed pre-, during, and post-driving period. The efficacy of visual detection depends on several factors including the observer's ability to detect the animal, the environmental conditions (visibility and sea state), and monitoring platforms. The following survey methodology will be implemented for all monitoring activities:

- Observers will survey the Injury and Behavioral Disturbance Zones. Monitoring will take place 15 minutes prior to initiation through 30 minutes post-completion of pile driving to ensure there are no marine mammals present.
- In case of reduced visibility due to weather or sea state, the observers must be able to see the Shutdown Zones or pile driving will not be initiated until visibility in these zones improves to acceptable levels.
- The Injury and Behavioral Disturbance Zones will be monitored throughout the time required to install a pile.
- Marine Mammal Observation Record Form (Table D-3) will be used to document observations.

[Obtain most recent version of sighting form prior to use.]

- Any survey boats engaged in marine mammal monitoring will maintain speeds equal to or less than 10 knots.
- Observers will be trained and experienced marine mammal observers in order to accurately verify species sighted.
- Observers will use binoculars and the naked eye to search continuously for marine mammals.

3.2.6.1 Visual Survey Protocol – Pre-Activity Monitoring

The following survey methodology will be implemented prior to commencing pile driving:

- Visual surveys of the Injury and Behavioral Disturbance Zone will occur for at least 15 minutes prior to the start of construction.
- If marine mammal(s) are present within or approaching a Shutdown Zone prior to pile driving, the start of these activities will be delayed until the animal(s) leave the Shutdown Zone voluntarily and have been visually confirmed beyond the Shutdown Zone, or 15 minutes has elapsed without re-detection of the animal.
- If marine mammal(s) are not detected within a Shutdown Zone (i.e., the zone is deemed clear of marine mammals), the observers will inform the monitoring coordinator/construction contractor that pile driving can commence.
- If a marine mammal approaches or enters a Shutdown Zone, pile driving will be delayed until the animal(s) leave the zone. If pinnipeds (s) are present within the Behavioral Disturbance Zone, pile driving would not need to be delayed, but observers would monitor and document, to the extent practical, the behavior of marine mammals that remain in the zone.

3.2.6.2 Visual Survey Protocol – During Activity Monitoring

The Injury and Behavioral disturbance Zones will be monitored throughout pile driving. The following survey methodology will be implemented during pile driving:

- If a cetacean approaches or enters the Shutdown Zone for cetaceans, pile driving will cease until the animal(s) leave the zone. If a pinniped enters the Shutdown Zone for pinnipeds, pile driving will cease until the animal(s) leave the zone. If a pinniped is observed within or entering the Behavioral Disturbance Zone during pile driving, a take would be recorded, behaviors documented, and the Shutdown Zone monitor alerted to the position of the animal. However, that pile segment would be completed without cessation, unless the animal approaches or enters the Shutdown Zone for pinnipeds, at which point all pile driving activities will be halted. The observers shall immediately radio to alert the monitoring coordinator/construction contractor. This action will require an immediate “all-stop” on pile operations.
- Once a shutdown has been initiated, pile driving and other in-water construction activities will be delayed until the animal has voluntarily left the Shutdown Zone and has been visually confirmed beyond the Shutdown Zone, or 15 minutes have passed without re-detection of the animal.
- Once the Shutdown zone is deemed clear of marine mammals, the monitoring coordinator will inform the construction contractor that activities can re-commence.
- If shutdown and clearance procedures would result in an imminent concern for human safety, then the Navy point of contact will be notified prior to re-initiation of pile driving.

3.2.6.3 Visual Survey Protocol – Post-Activity Monitoring

Monitoring of the Shutdown Zones will continue for 30 minutes following completion of pile driving. These surveys will record marine mammal observations, and will focus on observing and reporting unusual or abnormal behavior of marine mammals. During these surveys, if any injured, sick, or dead marine mammals are observed, procedures outlined below in Section 3.3 should be followed.

3.3 INTERAGENCY NOTIFICATION

In the event that the Navy needs to modify terms of this monitoring plan, the NMFS representative will be promptly contacted for discussion of the requested modification. In the unanticipated event that the specified activity clearly causes the take of a marine mammal in a manner prohibited by this IHA, such as an injury (Level A harassment), serious injury, or mortality, Navy shall immediately cease the specified activities and report the incident to the Chief of the Permits and Conservation Division (301-427-8425), Office of Protected Resources, NMFS, and the Northwest Regional Stranding Coordinator (206-526-6550), NMFS. The report must include the following information:

- Time and date of the incident
- Description of the incident
- Environmental conditions (e.g., wind speed and direction, Beaufort sea state, cloud cover, and visibility)
- Description of all marine mammal observations in the 24 hours preceding the incident
- Species identification or description of the animal(s) involved
- Fate of the animal(s) and
- Photographs or video footage of the animal(s)

Activities shall not resume until NMFS is able to review the circumstances of the prohibited take. NMFS will work with Navy to determine what measures are necessary to minimize the likelihood of further prohibited take and ensure Marine Mammal Protection Act compliance. Navy may not resume their activities until notified by NMFS.

In the event that Navy discovers an injured or dead marine mammal, and the lead observer determines that the cause of the injury or death is unknown and the death is relatively recent (e.g., in less than a moderate state of decomposition), Navy shall immediately report the incident to the Chief of the Permits and Conservation Division, Office of Protected Resources, NMFS, and the Northwest Regional Stranding Coordinator, NMFS. The report will include the same information as listed above. Activities may continue while NMFS reviews the circumstances of the incident. The Navy will work with NMFS to determine whether additional mitigation measures or modifications to the activities are appropriate.

In the event that Navy discovers an injured or dead marine mammal, and the lead observer determines that the injury or death is not associated with or related to the activities authorized in the IHA (e.g., previously wounded animal, carcass with moderate to advanced decomposition, or scavenger damage), the Navy shall report the incident to the Chief of Permits and Conservation Division, Office of Protected Resources, NMFS, and the Northwest Regional Stranding Coordinator, NMFS, within 24 hours of the discovery. Navy shall provide photographs or video footage or other documentation of the stranded animal sighting to NMFS.

Care should be taken in handling dead specimens to preserve biological materials in the best possible state for later analysis of cause of death, if that occurs. In preservation of biological materials from a dead animal, the finder (i.e., marine mammal observer) has the responsibility to ensure that evidence associated with the specimen is not unnecessarily disturbed.

Primary points of contact for the Navy are: **[*Update contacts as needed*]**

- Tyler Yasenak – (360) 315-2452
- Greg Leicht – (360) 315-5411

The Navy primary point of contact will contact NMFS. The primary points of contact at NMFS are:

- Modification to protocol – (360) 753-5835
- Chief of the Permits and Conservation Division – (301) 427-8425
- Northwest Regional Stranding Coordinator – (206) 526-6550

3.4 MONITORING REPORTS

A draft report will be submitted to NMFS within 90 work days of the completion of marine mammal monitoring. A final report will be prepared and submitted to the NMFS within 30 days following receipt of comments on the draft report from the NMFS. At a minimum, the report shall include:

- General data:
  - Date and time of activities
  - Water conditions (e.g., sea-state, tidal state)
  - Weather conditions (e.g., percent cover, visibility)
- Specific pile data:
  - Description of the pile driving activities including the size and type of pile
  - Installation methods used for each pile and the duration each method was used per pile
  - Impact or vibratory hammer force used to drive/extract piles
  - Detailed description of the sound attenuation system, including the design specifications
  - Depth of water in which the pile was driven
  - Depth into the substrate that the pile was driven
- Specific pile removal data:
  - Description of the pile removal activities being conducted
    - Size and type of piles
    - The machinery used for removal
    - Duration each pile removal method was used
  - The vibratory driver force
- Pre-activity observational survey-specific data:
  - Dates and time survey is initiated and terminated
  - Description of any observable marine mammal behavior in the immediate area during monitoring

  - If possible, the correlation to underwater sound levels occurring at the time of the observable behavior
  - Actions performed to minimize impacts to marine mammals
- During-activity observational survey-specific data:
  - Description of any observable marine mammal behavior within monitoring zones or in the immediate area surrounding monitoring zones including the following:
    - Distance from animal to source
    - Reason why/why not shutdown implemented
    - If a shutdown was implemented, behavioral reactions noted and if they occurred before or after implementation of the shutdown
    - If a shutdown is implemented, the distance from animal to source at the time of the shutdown
    - Behavioral reactions noted during soft starts[10] and if they occurred before or after implementation of the soft start
    - Distance to the animal from the source during soft start
  - Actions performed to minimize impacts to marine mammals
  - Times when pile driving is stopped due to presence of marine mammals within the Shutdown Zones and time when pile driving resumes
- Post-activity observational survey-specific data:
  - Results, which include the detections of marine mammals, species and numbers observed, sighting rates and distances, behavioral reactions within and outside of monitoring zones
  - A refined take estimate based on the number of marine mammals observed during the course of construction

[10] The objective of a soft-start is to provide a warning and/or give animals in close proximity to pile driving a chance to leave the area prior to a vibratory or impact driver operating at full capacity thereby, exposing fewer animals to loud underwater and airborne sounds.

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APPENDIX D

TABLES

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Table D-1. Summary of Mitigation Requirements

Mitigation Measure	*Origin of Measure*	*Anticipated Benefit*	*Criteria for Evaluating Effectiveness*	*Responsible Party*	*Estimated Completion Date*
In-water work windows: July 16–Jan. 15 (Bangor, Zelatched Point); July 16–Feb. 15 (Bremerton, Manchester, Keyport); July 16–Feb. 15 (Everett) Oct 1–Jan. 15 (Indian Island)	BA CWA permit EA	Avoid impacts to juvenile salmon and bull trout	Observance of approved work windows for protection of juvenile salmon and bull trout	Navy	2023
Impact pile driving starting 2 hrs after sunrise and ending 2 hrs before sunset from July 16 (Bangor, Zelatched Point, Everett) or Aug. 1 (other locations) to Sept. 23	BA EA	Minimize exposure of foraging marbled murrelets to noise during nesting season	Observance of agency timing restrictions for protection of marbled murrelets	Navy	2023
Bubble curtain	BA IHA EA	Reduce sound pressure level of impact driving of steel pile	Observance of design specifications, including testing requirements for air pressure and flow, and placement on the substrate.	Navy	2023
Species monitoring and shutdown	BA IHA EA	Minimize exposure of marbled murrelet and ESA-listed cetaceans to noise impacts	Marbled murrelet and marine mammal monitoring	Navy	2023
Soft start	BA IHA	Allow animals in proximity to pile driving the opportunity to leave prior to operating driver at full capacity	Observance of soft start specifications	Navy	2023

Key: BA = Biological Assessment; CWA = Clean Water Act; EA = Environmental Assessment;
IAH = Incidental Harassment Authorization

Table D-2. Beaufort Wind Scale Developed in 1805 by Sir Francis Beaufort of England (0=calm to 12=hurricane)

Force	Wind (knots)	Classification	Appearance of Wind Effects on the Water	Appearance of Wind Effects on Land	Notes Specific to On-water Seabird Observations
0	<1	Calm	Sea surface smooth and mirror like	Calm, smoke rises vertically	Excellent conditions, no wind, small or very smooth swell. You have the impression you could see anything.
1	1-3	Light air	Scaly ripples, no foam crests	Smoke drift indicates wind direction, still wind vanes	Very good conditions, surface could be glassy (Beaufort 0), but with some lumpy swell or reflection from forests, glare, etc.
2	4-6	Light breeze	Small wavelets, crests glassy, no breaking	Wind felt on face, leaves rustle, vanes begin to move	Good conditions, no whitecaps, texture/lighting contrast of water make murrelets more difficult to see. Surface could also be glassy or have small ripples, but with a short, lumpy swell, thick fog, etc.
3	7-10	Gentle breeze	Large wavelets, crests beginning to break, scattered whitecaps	Leaves and small twigs constantly moving, light flags extended	Surveys cease, scattered whitecaps present, detection of murrelets definitely compromised, a hit-or-miss chance of seeing them owing to water choppiness and high contrast. This could also occur at lesser wind with a very short wavelength, choppy swell.
4	11-16	Moderate breeze	Small waves 0.3 to 1.1 m becoming longer, numerous whitecaps	Dust, leaves, and loose paper lifted, small tree branches move	Whitecaps abundant, sea chop bouncing the boat around, etc.
5	17-21	Fresh breeze	Moderate waves 1.1 to 2.0 m taking longer form, many whitecaps, some spray	Small trees begin to sway	

Table D-3. Marine Mammal Observation Record Form

Project Name: ______________________________

Monitoring Location______________________________
(Pier Location, Vessel based, Land Location, other)

Page ___________ of ____________

Date: ______________________________

Vessel Name: ______________________________

Time Effort Initiated:______________

Time Effort Completed:_____________

Sighting Data

Event Code	Sighting Number (1 or 1.1 if resight)	Time/Duration watching sighting (Start/End time if continuous)	WP # (every time a sighting is made)	Observer	Sighting cue	Species	Dist/ Dir to Animal (from Observer)	Dist to Pile (btwn animal & pile)	# of Animals Group Size (min/max/best)# of Calves	Relative Motion/and Behavior Code (see code sheet)	Const Type During Sighting	Miti gation used during sighting?	Miti gation Type?	Visibility	% Glare	Weath Cond	Sea State and Wave Ht	Swell Dir	Behavior Change/ Response to Activity/Comments
		: : : :					m or km °	m or km	/ / __ calves	opening closing parallel none	PRE POST SSV SSI V I PC DP ST NONE	Y N	DE SD	B P M G E			Light Mod Heavy	N or S W or E	
		: : : :					m or km °	m or km	/ / __ calves	opening closing parallel none	PRE POST SSV SSI V I PC DP ST NONE	Y N	DE SD	B P M G E			Light Mod Heavy	N or S W or E	
		: : : :					m or km °	m or km	/ / __ calves	opening closing parallel none	PRE POST SSV SSI V I PC DP ST NONE	Y N	DE SD	B P M G E			Light Mod Heavy	N or S W or E	
		: : : :					m or km °	m or km	/ / __ calves	opening closing parallel none	PRE POST SSV SSI V I PC DP ST NONE	Y N	DE SD	B P M G E			Light Mod Heavy	N or S W or E	
		: : : :					m or km °	m or km	/ / __ calves	opening closing parallel none	PRE POST SSV SSI V I PC DP ST NONE	Y N	DE SD	B P M G E			Light Mod Heavy	N or S W or E	
		: : : :					m or km °	m or km	/ / __ calves	opening closing parallel none	PRE POST SSV SSI V I PC DP ST NONE	Y N	DE SD	B P M G E			Light Mod Heavy	N or S W or E	
		: : : :					m or km °	m or km	/ / __ calves	opening closing parallel none	PRE POST SSV SSI V I PC DP ST NONE	Y N	DE SD	B P M G E				N or S W or E	

Sighting #=chronological number of sightings, If resight of same animal, then 1.1, 1.2, etc. WP (Waypoint)=GPS recording of lat/long, time/date stamp. Critical for vessel observers.

[Obtain most recent version of sighting form prior to use.]

Table D-3. Marine Mammal Observation Record Form (continued)

Sighting Codes
(Sighting Cue and Behavior Codes)

Behavior Code

Code	***Behavior***	***Definition***
BR	Breaching	Leaps clear of water
CD	Change direction	Suddenly changes direction of travel
CH	Chuff	Makes loud, forceful exhalation of air at surface
DI	Dive	Forward dives below surface
DE	Dead	Shows decomposition or is confirmed as dead by investigation
DS	Disorientation	An individual displaying multiple behaviors that have no clear direction or purpose
FI	Fight	Agonistic interactions between two or more individuals
FO	Foraging	Confirmed by food seen in mouth
MI	Milling	Moving slowly at surface, changing direction often, not moving in any particular direction
PL	Play	Behavior that does not seem to be directed toward a particular goal; may involve one, two, or more individuals
PO	Porpoising	Moving rapidly with body breaking surface of water
SL	Slap	Vigorously slaps surface of water with body, flippers, tail, etc.
SP	Spyhopping	Rises vertically in the water to “look” above the water
SW	Swimming	General progress in a direction; note general direction of travel when last seen (example: “SW [N]” for swimming north)
TR	Traveling	Traveling in an obvious direction; note direction of travel when last seen (example: “TR [N]” for traveling north)
UN	Unknown	Behavior of animal undetermined, does not fit into another behavior
Pinniped only		
EW	Enter water (from haul out)	Enters water from a haul out for no obvious reason
FL	Flush (from haul out)	Enters water in response to disturbance
HO	Haul out (from water)	Hauls out on land
RE	Resting	Resting onshore or on surface of water
LO	Look	Is upright in water “looking” in several directions or at a single focus
SI	Sink	Sinks out of sight below surface without obvious effort (usually from an upright position)
VO	Vocalizing	Animal emits barks, squeals, etc.
Cetacean only		
LG	Logging	Resting on surface of water with no obvious signs of movement

Marine Mammal Species

Code	Marine Mammal Species
CASL	California sea lion
HSEA	Harbor seal
STSL	Steller sea lion
HPOR	Harbor porpoise
DPOR	Dall's porpoise
ORCA	Killer whale
HUMP	Humpback whale
UNLW	Unknown large whale
RIVO	River otter (not a marmam)
OTHR	Other
UNKW	Unknown

Event

Code	Activity Type
E ON	Effort on
E OFF	Effort off
PRE	Pre watch
POST	Post watch
SSV	Soft start vibratory
SSI	Soft start impact
WC	Weather condition/change
S	Sighting
M-DE	Mitigation delay
M-SD	Mitigation shutdown

Construction Type

Code	Activity Type
SSV	Soft start vibratory
SSI	Soft start impact
V	Vibratory pile driving (installation and extraction)
I	Impact pile driving
PC	Pneumatic chipping
DP	Dead pull
ST	Stabbing
NONE	No pile driving

Mitigation Code

Code	Activity Type
DE	Delay onset of pile driving
SD	Shut down pile driving

Visibility

Code	Distance Visible
B	Bad (<0.5 km)
P	Poor (0.5 – 1.5 km)
M	Moderate (1.5 – 10 km)
G	Good (10 – 15 km)
E	Excellent (>15 km)

Glare

Percent glare should be total glare of observer's area of responsibility. Are they covering 90 degrees or 180 degrees? Total glare for that area and write that area down on the datasheet so we know later what percentage of the field of view was poor due to glare.

Weather Condition

Code	Weather Condition
S	Sunny
PC	Partly cloudy
L	Light rain
R	Steady rain
F	Fog
OC	Overcast

Sea State and Wave Height

Use Beaufort Sea State Scale for Sea State Code. This refers to the surface layer and whether it is glassy in appearance or full of white caps. In the open ocean, it also takes into account the wave height; but in inland waters, the wave heights (swells) may never reach the levels that correspond to the correct surface white cap number. Therefore, include wave height for clarity.

Code	Wave Height
Light	0 – 3 feet
Moderate	4 – 6 feet
Heavy	>6 feet

Swell Direction

Swell direction should be where the swell is coming from (S for coming from the south). If possible, record direction relative to fixed location (pier). Choose this location at beginning of monitoring project.

Table D-4. Beaufort Sea State Scale

US Navy and Beaufort Sea State Codes (http://ioc.unesco.org and http://www.wrh.noaa.gov/pqr/info/beaufort.php)

Beaufort Sea State	Wind Speed (knots)	Wind Description	Wave Height (ft) Beaufort	Sea State – Beaufort	Notes Specific to On-water Seabird Observations	Photos Indicating Beaufort Sea State
0	<1	Calm	0	Calm; like a mirror	Excellent conditions, no wind, small or very smooth swell. You have the impression you could see anything.	
1	1-3	Light air	¼ < ½	Ripples with appearance of scales; no foam crests	Very good conditions, surface could be glassy (Beaufort 0), but with some lumpy swell or reflection from forests, glare, etc.	

Table B-4. Beaufort Sea State Scale (continued)

Beaufort Sea State	Wind Speed (knots)	Wind Descriptio n	Wave Height (ft) Beaufort	Sea State – Beaufort	Notes Specific to On-water Seabird Observations	Photos Indicating Beaufort Sea State
2	4-6	Light breeze	½ – 1 (max 1)	Small wavelets; crests with glassy appearance, not breaking	Good conditions, no whitecaps; texture/lighting contrast of water make murrelets hard to see. Surface could also be glassy or have small ripples, but with a short, lumpy swell, thick fog, etc.	
3	7-10	Gentle breeze	2 – 3 (max 3)	Large wavelets; crests begin to break; scattered whitecaps	Fair conditions, scattered whitecaps, detection of murrelets definitely compromised; a hit-or-miss chance of seeing them owing to water choppiness and high contrast. This could also occur at lesser wind with a very short wavelength, choppy swell.	

Table B-4. Beaufort Sea State Scale (continued)

Beaufort Sea State	Wind Speed (knots)	Wind Description	Wave Height (ft)	Sea State – Beaufort	Notes Specific to On-water Seabird Observations	Photos Indicating Beaufort Sea State
4	11-16	Moderate breeze	3 ½ – 5 (max 5)	Small waves becoming longer, numerous whitecaps	Whitecaps abundant, sea chop bouncing the boat around, etc.	
5	17-20	Fresh breeze	6 – 8 (max 8)	Moderate waves, taking longer form; many whitecaps; some spray		

Table D-5. Chain of Custody Record

<table>
<tr><td colspan="6">Chain of Custody Record</td></tr>
<tr><td colspan="2">Date and Time of Collection:</td><td colspan="2">Duty Station:</td><td colspan="2">Collection By:</td></tr>
<tr><td colspan="3">Source of Specimen (Person and/or Location):</td><td colspan="3">Project Name:</td></tr>
<tr><td>Item No:</td><td colspan="5">Description of Specimen (Include Species and Tag Number):</td></tr>
<tr><td rowspan="2">Item No:</td><td>From: (Print Name, Agency)</td><td>Release Signature:</td><td>Release Date:</td><td rowspan="2" colspan="2">Delivered via:
FEDEX
U.S. Mail
In Person
Other:</td></tr>
<tr><td>To: (Print Name, Agency)</td><td>Receipt Signature:</td><td>Receipt Date:</td></tr>
</table>

Table D-5. Chain of Custody Record (continued)

Chain of Custody Record				
Item No:	From: (Print Name, Agency)	Release Signature:	Release Date:	Delivered via: FEDEX U.S. Mail In Person Other:
	To: (Print Name, Agency)	Receipt Signature:	Receipt Date:	
Item No:	From: (Print Name, Agency)	Release Signature:	Release Date:	Delivered via: FEDEX U.S. Mail In Person Other:
	To: (Print Name, Agency)	Receipt Signature:	Receipt Date:	
Item No:	From: (Print Name, Agency)	Release Signature:	Release Date:	Delivered via: FEDEX U.S. Mail In Person Other:
	To: (Print Name, Agency)	Receipt Signature:	Receipt Date:	
Item No:	From: (Print Name, Agency)	Release Signature:	Release Date:	Delivered via: FEDEX U.S. Mail In Person Other:
	To: (Print Name, Agency)	Receipt Signature:	Receipt Date:	

Table D-6. Example of Monitoring Zone Distances

Marine Mammal Group	Monitoring Zones					
	Vibratory			Impact		
	Behavioral Disturbance	Injury	Shutdown	Behavioral Disturbance	Injury	Shutdown
Cetaceans	Approximately **XX** meters	n/a	Approximately **XX** meters	**XX** meters	**XX** meters	**XX** meters
Pinnipeds	Approximately **XX** meters	n/a	10 meters	**XX** meters	**XX** meters	**XX** meters

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APPENDIX D

FIGURES

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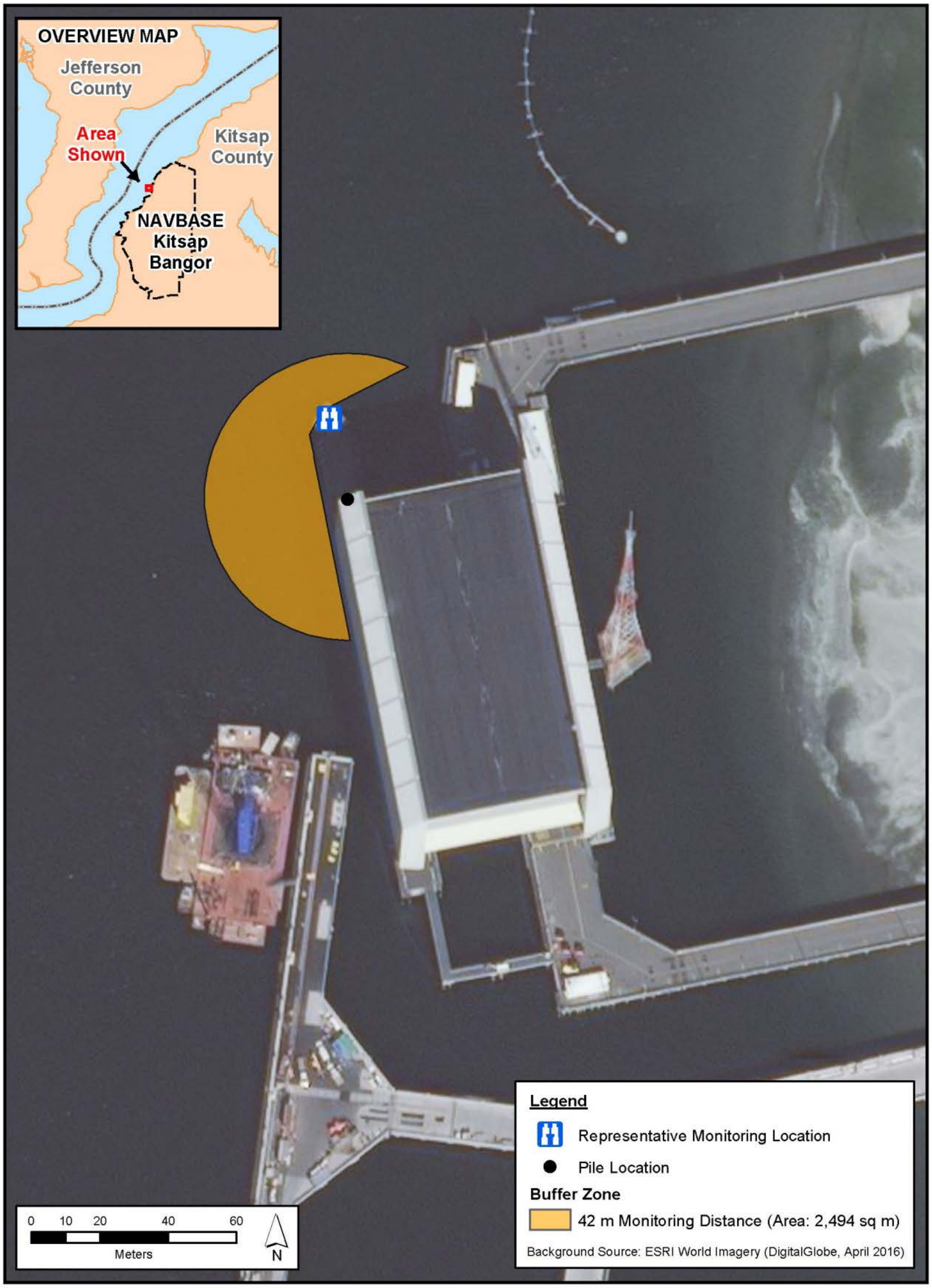

Figure D-1. Example of Marbled Murrelet Monitoring Locations

Replace with project/location specific figure(s).

Seabird Monitoring Data Collection Form

Date____________________

Project Name ______________________________ **Monitoring Site/Transect ID** ____________________________

Observers____

Activity __________________________________ **Time and Duration**__________________________________

Time	**Species**	**# of birds**	**Wind speed** (Beaufort Marine scale)	**Land Observer**	**Boat Observer**		**Observed Behavior***	**Comments**
				Grid Location	Distance	Land/Sea Ward		

* R=resting, F=feeding/diving, P=preening, Y=flying/flushing, T=transient, N=nesting, O=other

Figure D-2. Seabird Monitoring Data Collection Form

Seabird Monitoring Site/Transect Identification Form

Project Name

Monitoring Dates

Number of Monitoring Sites/Transects

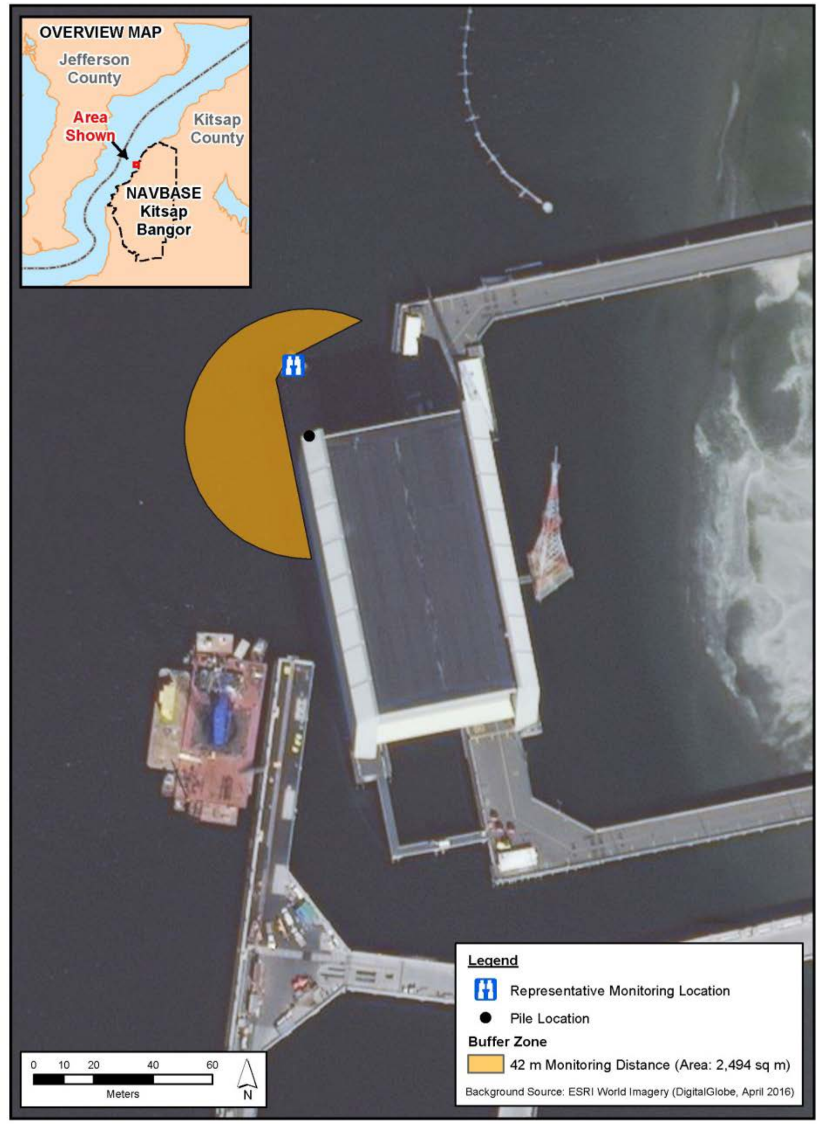

Figure D-3. Seabird Site Monitoring Site/Transect Identification Form

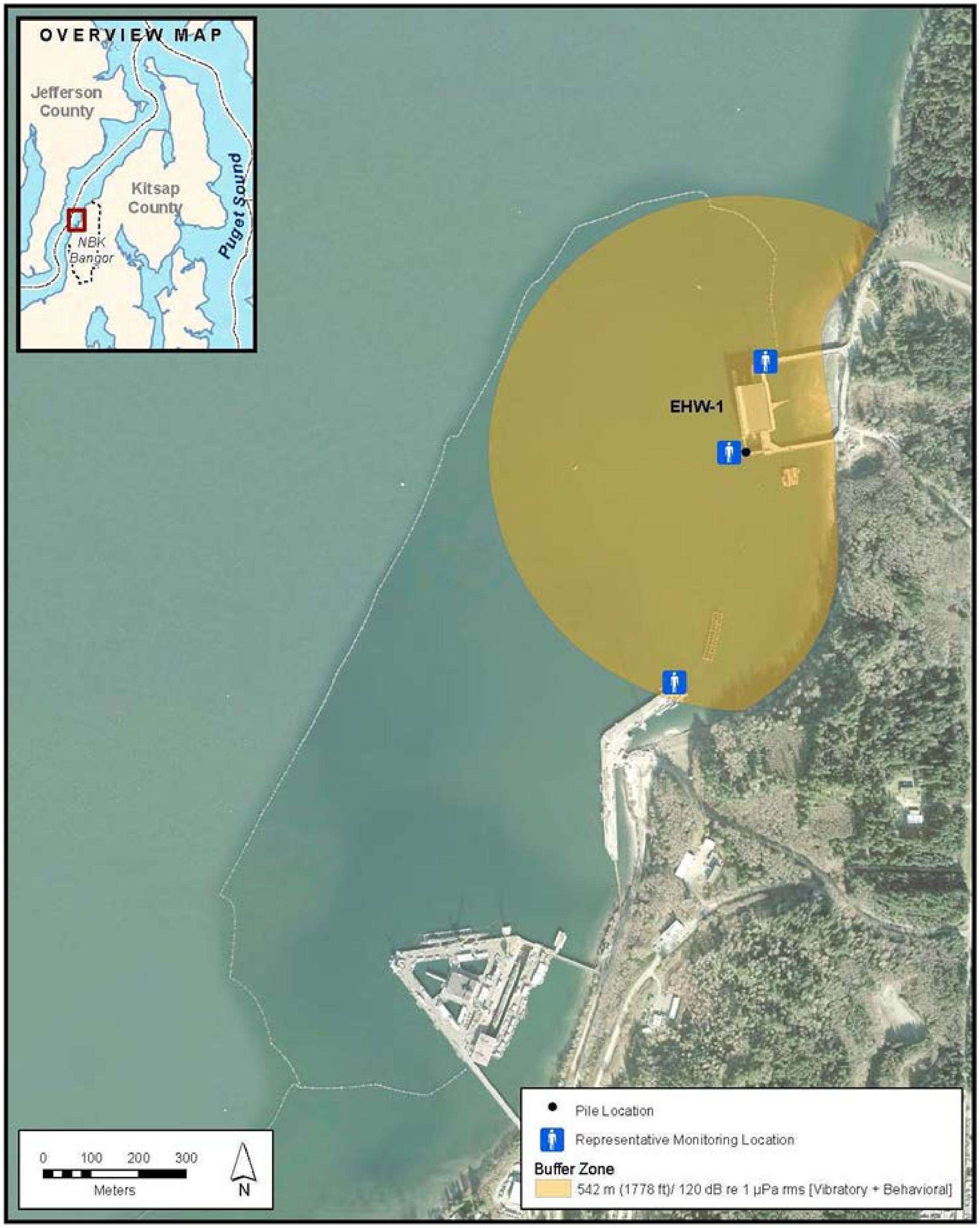

Figure D-4. Example of Marine Mammal Visual Monitoring Zone with Representative Monitoring Locations Indicated

(Replace this figure with figure(s) depicting the project and location covered by this plan.)

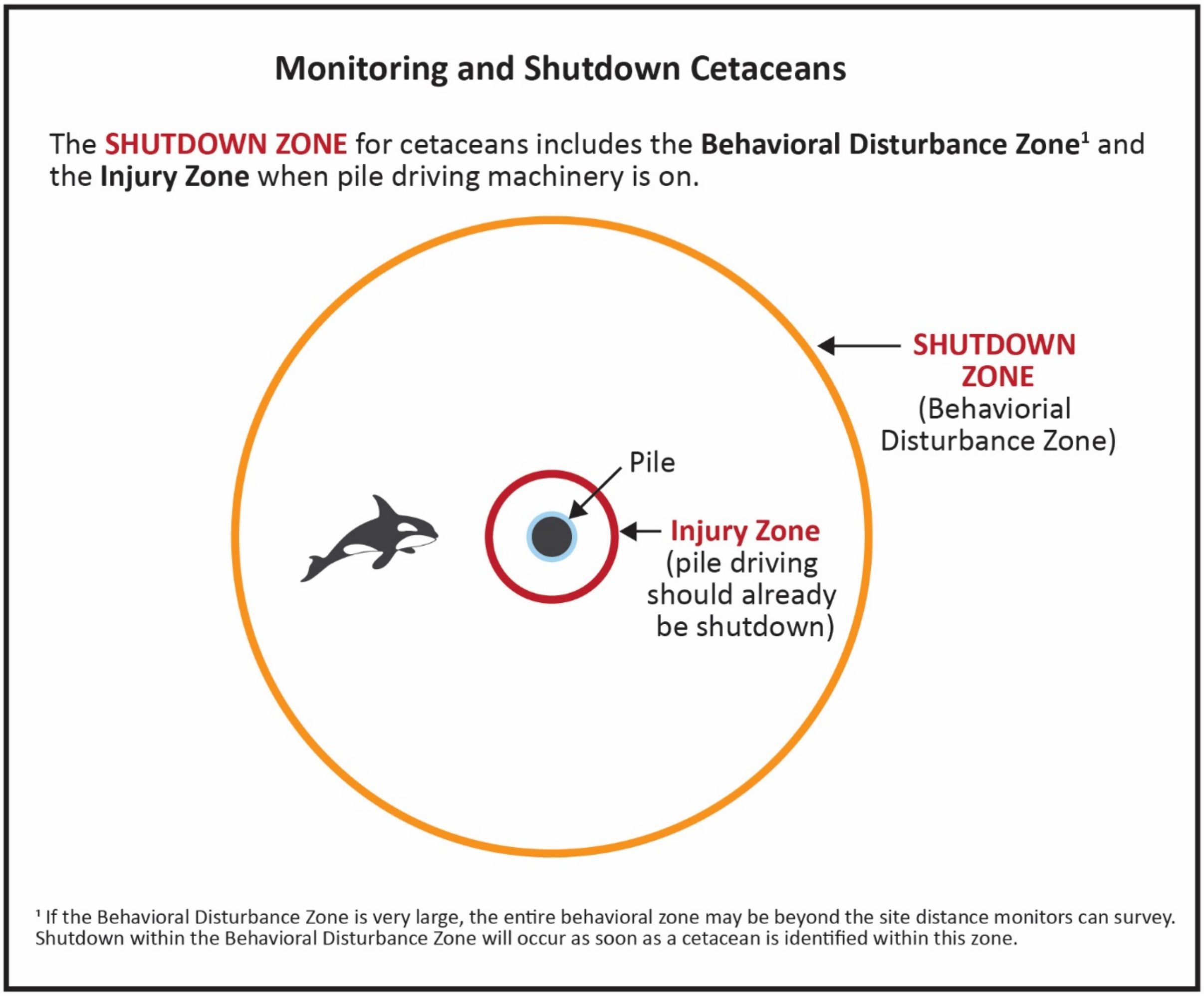

Figure D-5. Monitoring and Shutdown Zones for Cetaceans

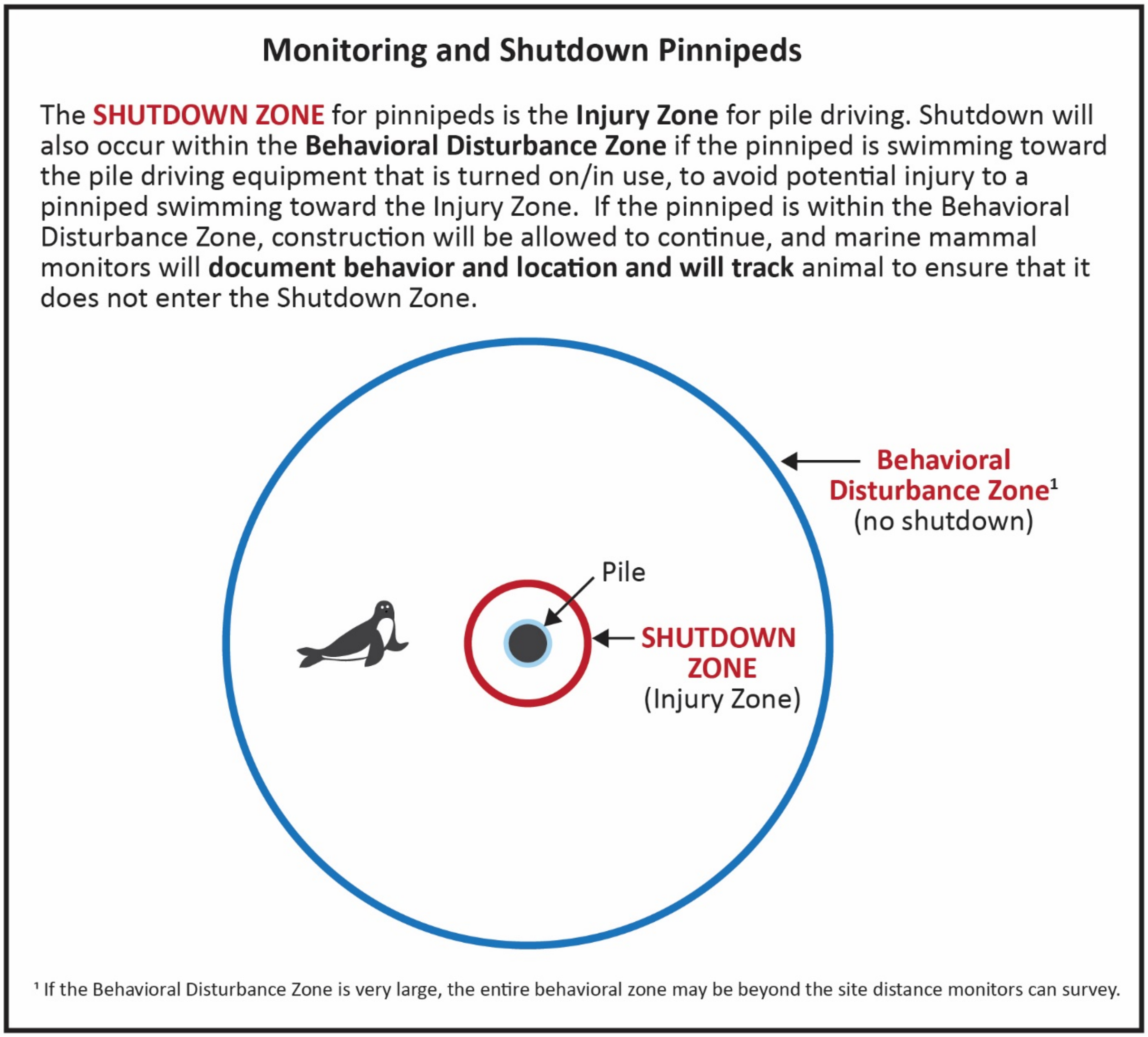

Figure D-6. Monitoring and Shutdown Zones for Pinnipeds

APPENDIX E

NATIONAL HISTORIC PRESERVATION ACT
SECTION 106 DOCUMENTATION

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U.S. Navy to DAHP, May 12, 2016

DEPARTMENT OF THE NAVY
NAVY REGION NORTHWEST
1100 HUNLEY RD.
SILVERDALE, WASHINGTON 98315-1100

5090
N45/0147
MAY 12 2016

Allyson Brooks, PhD
State Historic Preservation Officer
Department of Archaeology and Historic Preservation
P.O. Box 48343
Olympia, WA 98504-8343

Subj: U.S. NAVY INITIATION OF CONSULTATION AND REQUEST FOR CONCURRENCE WITH DEFINITION OF AREA OF POTENTIAL EFFECTS FOR PROPOSED MARINE STRUCTURE MAINTENANCE AND PILE REPLACEMENT PROGRAM, NAVY REGION NORTHWEST

Dear Dr. Brooks:

The U.S. Navy is initiating consultation in accordance with Section 106 of the National Historic Preservation Act (NHPA), as amended and 36 CFR Part 800 for the proposed effort to conduct maintenance and repair activities at marine waterfront structures over a 5-year period at six Navy installations within Navy Region Northwest (Enclosure 1). Installations include: Naval Base (NAVBASE) Kitsap Bangor, NAVBASE Kitsap Bremerton, NAVBASE Kitsap Keyport, NAVBASE Kitsap Manchester, Zelatched Point, and Naval Station (NAVSTA) Everett.

Maintenance and repair activities would occur at various piers, wharves, and other marine pile supported structures and could include replacing broken safety ladders, cable straps, camel and camel connections, and light pole bases on piers. Damaged or deteriorated guide piles systems, brow floats, and pile caps would be repaired or replaced where needed. General maintenance could include deck resurfacing and recoating various corroded metal components. Repair activities would be conducted on wetwell concrete spalling, piers (including repairs to piles), and quay walls. In addition to the maintenance and repair activities, approximately 822 structurally unsound piles would be replaced. The piles are a combination of treated timber, steel, concrete, and high-density polyethylene plastic.

In accordance with 36 CFR § 800.4(a)(1), the Navy has defined the Area of Potential Effects (APE) as the foot print of each wharf and pier that would be affected by this proposed undertaking along with the viewshed from which the individual properties can

Subj: U.S. NAVY INITIATION OF CONSULTATION AND REQUEST FOR CONCURRENCE WITH DEFINITION OF AREA OF POTENTIAL EFFECTS FOR PROPOSED MARINE STRUCTURE MAINTENANCE AND PILE REPLACEMENT PROGRAM, NAVY REGION NORTHWEST

be seen (Enclosures 2-7). This letter is to request your concurrence with our defined APEs. If you require further information or have any questions, please contact Russ Sackett, NAFVAC NW Historical Architect, at (360) 396-0024 or russell.h.sackett1@navy.mil.

Sincerely,

M. T. Geronime
Captain, CEC, U. S. Navy
Regional Director for Facilities and Environmental
By direction of the Commander

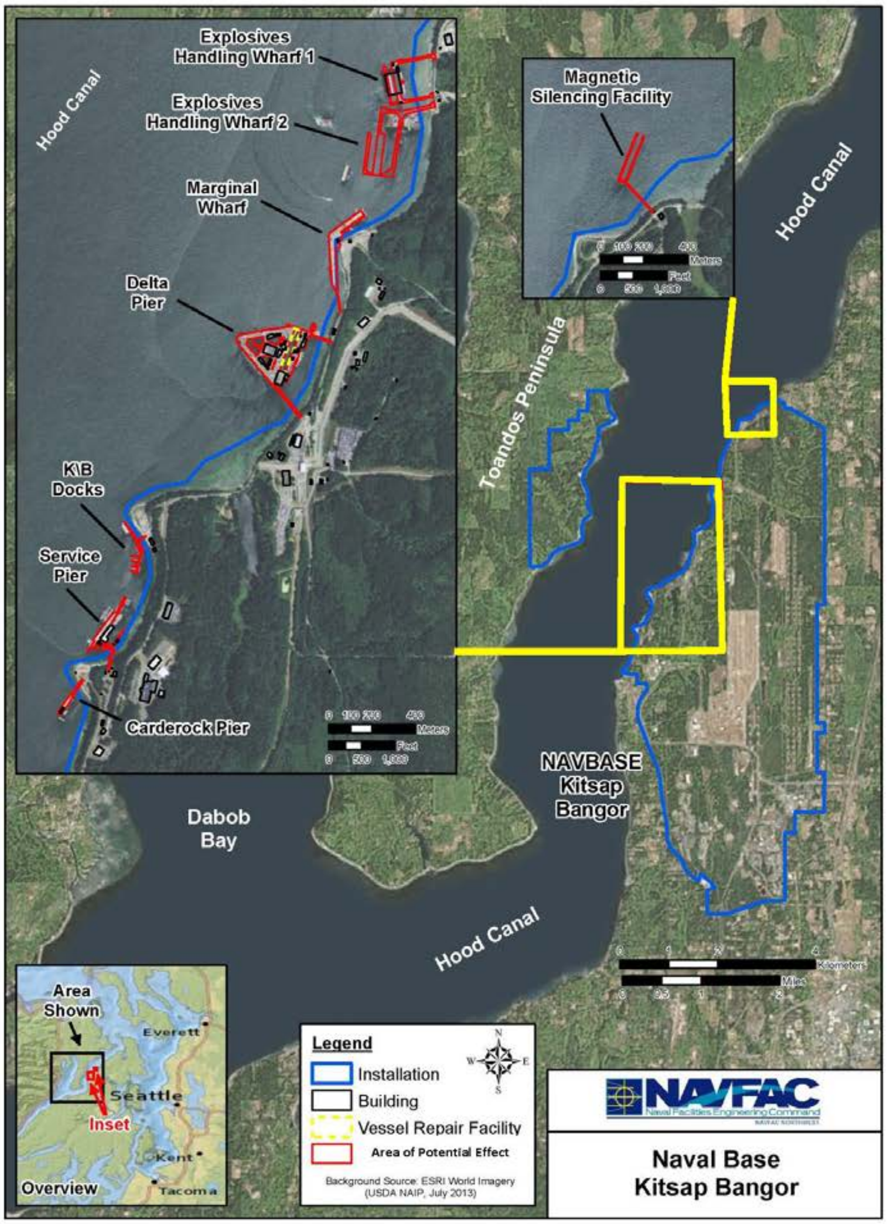
Enclosures:
1. Site Location Map
2. APE Map NAVBASE Kitsap Bangor
3. APE Map NAVBASE Kitsap Bremerton
4. APE Map NAVBASE Kitsap Keyport
5. APE Map NAVBASE Kitsap Manchester
6. APE Map NAVSTA Everett
7. APE Map Zelatched Point

Copy to:
Ms. Kris Miller, Skokomish Tribe
Mr. Dennis Lewarch, Suquamish Tribe
Mr. Josh Wisniewski, THPO, Port Gamble S'Klallam Tribe
Mr. Gideon Cauffman, Cultural Resources, Jamestown S'Klallam Tribe
Mr. Bill White, Archaeologist, Cultural Resources, Lower Elwha S'Klallam Tribe
Ms. Lena Tso, THPO Cultural Resources, Lummi Nation
Ms. Josephine Peters, Cultural Resource Technician, Swinomish Indian Tribal Community
Mr. Richard Young, Cultural Resources, Hibulb Cultural Center and Natural History Preserve, Tulalip Tribes of Washington

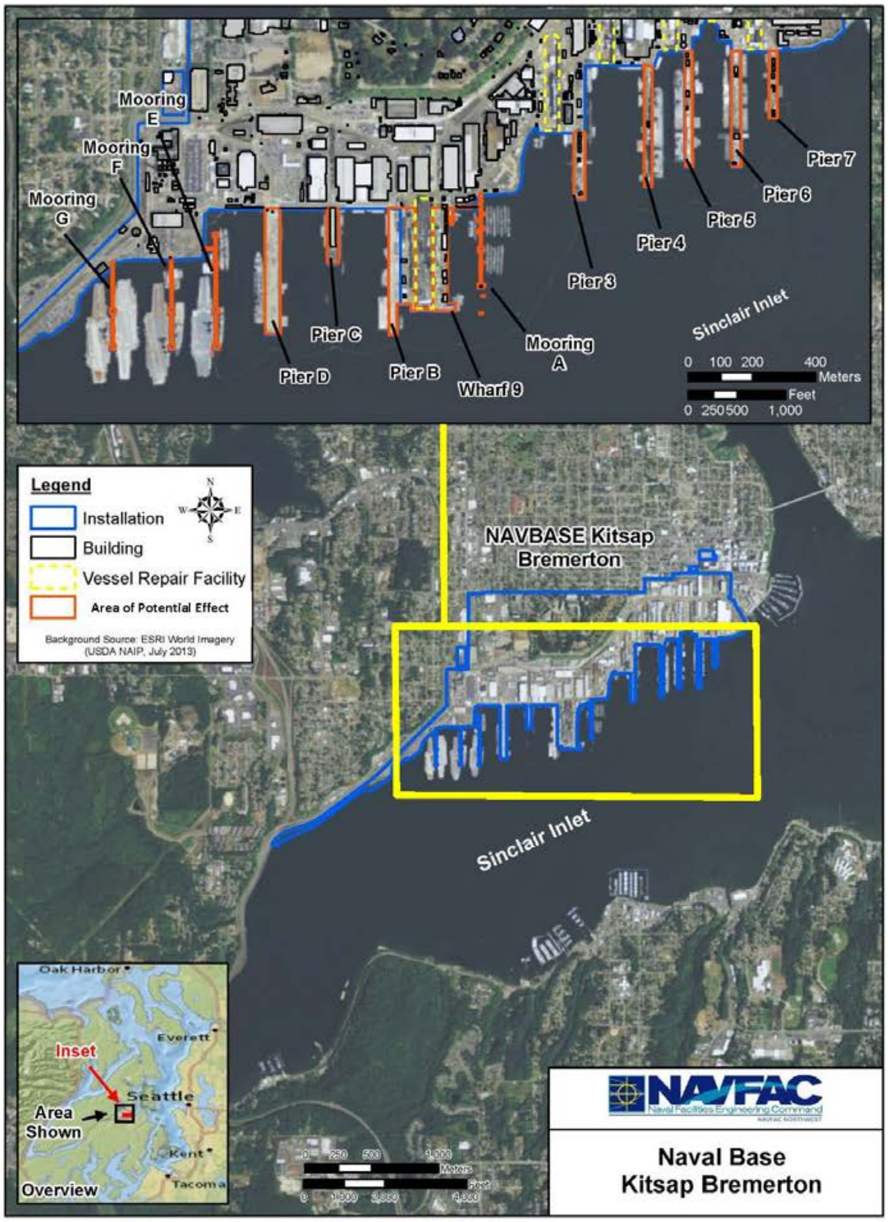
2

Enclosure 1. Site Location Map, Marine Structure Maintenance and Pile Replacement Program, Navy Region Northwest

Enclosure 2. APE for Marine Structure Maintenance and Pile Replacement Program, NAVBASE Kitsap Bangor



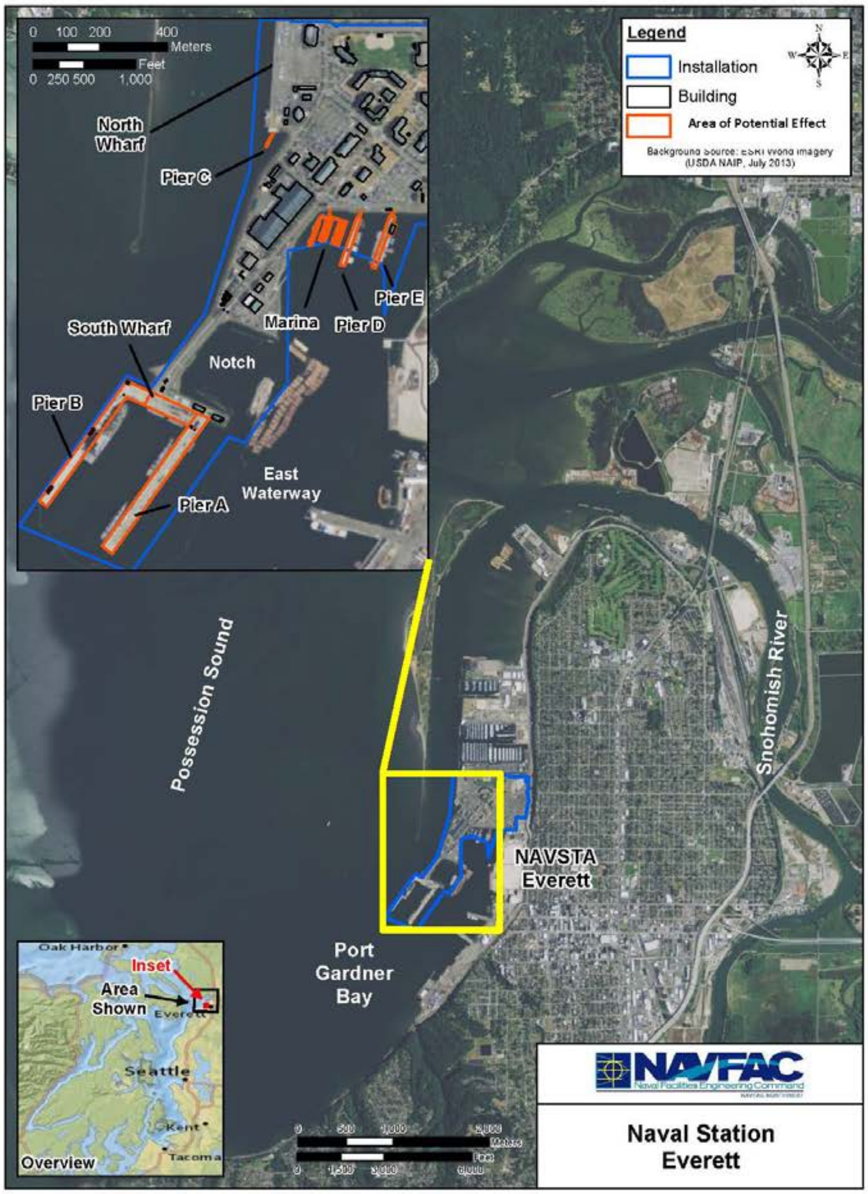
Enclosure 3. APE for Marine Structure Maintenance and Pile Replacement Program, NAVBASE Kitsap Bremerton



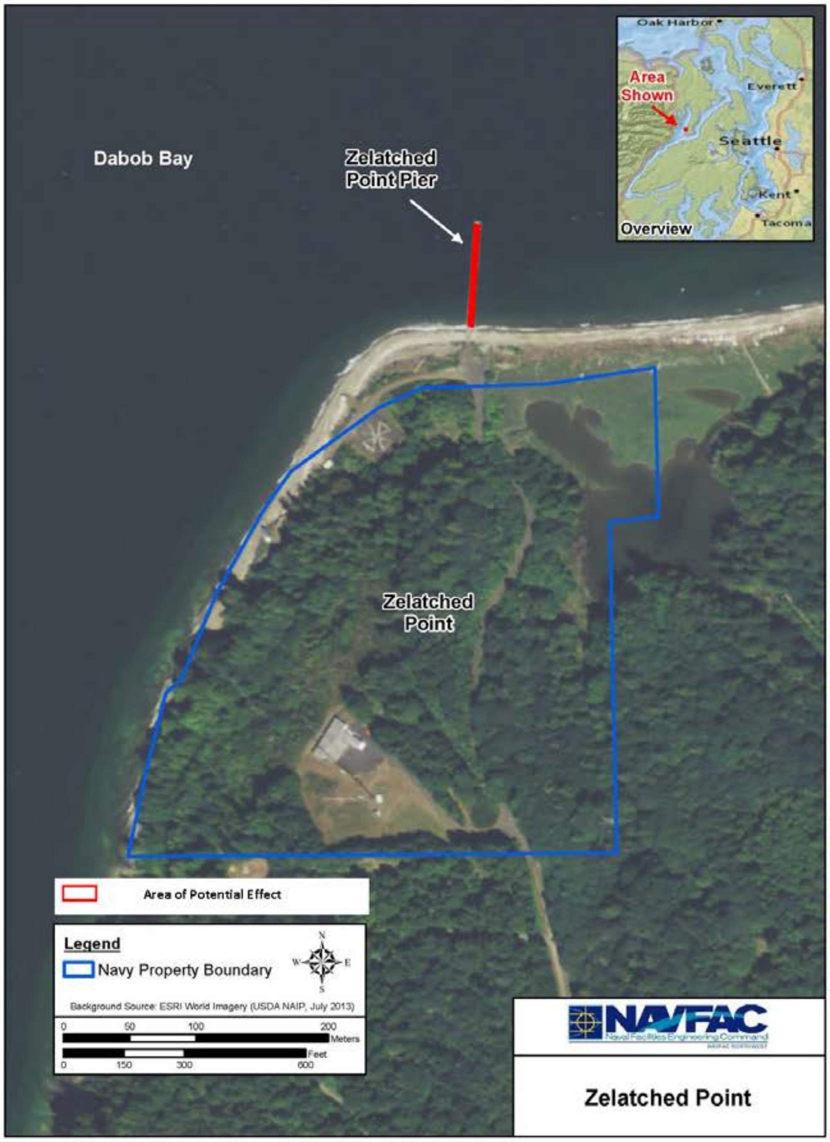
Enclosure 4. APE for Marine Structure Maintenance and Pile Replacement Program, NAVBASE Kitsap Keyport

Enclosure 5. APE for Marine Structure Maintenance and Pile Replacement Program, NAVBASE Kitsap Manchester

Enclosure 6. APE for Marine Structure Maintenance and Pile Replacement Program, NAVSTA Everett



Enclosure 7. APE for Marine Structure Maintenance and Pile Replacement Program, Zelatched Point



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DAHP to U.S. Navy, June 1, 2016

dahp
protect the past, shape the future

Allyson Brooks Ph.D., Director
State Historic Preservation Officer

June 1, 2016

Capt. M. T. Geronime
US Dept. of the Navy
Regional Director of Facilities
NAVFAC NW EV-1
Silverdale, WA 98315

In future correspondence please refer to:
Project Tracking Code: 2016-06-03830
Property: Marine Structure Maintenance
Re: APE Concur

Dear Capt. Geronime:

Thank you for contacting the State Historic Preservation Officer (SHPO) and Department of Archaeology and Historic Preservation (DAHP) regarding the above referenced project to repair and replace various marine structures at Bangor, Bremerton, Everett, Keyport, Manchester, and Zelatched Point. In response, we have reviewed your description and map of the area of potential effect (APE). As a result of our review, we concur with your definition of the APE.

We look forward to the results of your cultural resource survey efforts, your consultation with the concerned tribes, other interested/affected parties, and receiving the survey report when it is available for our review. Also, we appreciate receiving any correspondence or comments from concerned tribes and/or other parties that you receive as you consult under the requirements of 36 CFR 800.4(a)(4). These comments are based on the information available at the time of this review and on behalf of the SHPO in conformance with Section 106 of the National Historic Preservation Act and its implementing regulations 36 CFR 800. Should additional information about the project become available, our assessment may be revised.

Thank you for the opportunity to review and comment. If you have any questions, please feel free to contact me.

Sincerely,

Russell Holter

Russell Holter
Project Compliance Reviewer
(360) 586-3533
russell.holter@dahp.wa.gov

State of Washington • **Department of Archaeology & Historic Preservation**
P.O. Box 48343 • Olympia, Washington 98504-8343 • (360) 586-3065
www.dahp.wa.gov

THE SEAL OF THE STATE OF WASHINGTON 1889

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U.S. Navy to DAHP, April 21, 2017

DEPARTMENT OF THE NAVY
NAVY REGION NORTHWEST
1100 HUNLEY ROAD
SILVERDALE, WA 98315-1100

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N45/0149
APR 21 2017

Allyson Brooks, PhD
State Historic Preservation Officer
Department of Archaeology and Historic Preservation
P.O. Box 48343
Olympia, WA 98504-8343

Dear Dr. Brooks:

SUBJECT: DAHP PROJECT TRACKING CODE 2016-06-03830: U.S. NAVY REQUEST FOR CONCURRENCE ON DETERMINATIONS OF ELIGIBILITY AND FINDINGS OF EFFECT FOR THE PROPOSED MARINE STRUCTURE MAINTENANCE AND PILE REPLACEMENT PROGRAM, NAVY REGION NORTHWEST

Pursuant to Section 106 of the National Historic Preservation Act, the Navy would like to continue consultation regarding the proposed undertaking to conduct maintenance and repair activities at various marine waterfront structures. The area of potential effects for this undertaking was previously defined with Washington State Historic Preservation Officer's (SHPO) concurrence dated June 1, 2016 (DAHP Project Tracking Code 2016-06-03830).

The proposed action, as described in our letter dated May 12, 2016, is to conduct maintenance and repair activities at various piers, wharves, and other marine pile supported structures. In addition to the maintenance and repair activities, approximately 822 structurally unsound piles would be replaced. The Navy requests your concurrence on the following eligibility determinations and finding of effects for the proposed undertaking:

NAVAL BASE KITSAP BANGOR

The Area for Potential Effect (APE) for the Proposed Action at NAVBASE Kitsap Bangor consists of eight facilities (Enclosure 1). All work would occur in- or over-water. No on-shore work is planned, and any staging required would occur in previously disturbed or developed areas.

Of the eight facilities projected for pier repair or pile replacement, either programmed or contingency (Table 1), only three facilities, the Delta Pier, Explosives Handling Wharf 1 (EHW-1), and Magnetic Silencing Facility are considered eligible for listing on the National Register of Historic Places (NRHP). The Service Pier, Keyport-Bangor (K/B) Dock and Marginal Wharf have been previously determined not eligible for the NRHP. The Carderock Pier is too recent to be considered eligible for listing on the NRHP, and has not

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achieved exceptional significance as required by Criteria Consideration G. The Explosives Handling Wharf 2 (EHW-2) is currently under construction and is also too new to be considered eligible for listing on the NRHP. As a result of their age, these two resources have not been surveyed or input into WISAARD.

A Bangor waterfront survey performed in 2010 identified no prehistoric or ethno-historic cultural materials or sites. This survey covered all of the areas above the water line, including the beach (Stell Environmental & Cardno TEC, 2013). There are no recorded submerged historic properties, downed aircraft, or shipwrecks in the APE. The presence of intact prehistoric archaeological deposits or features buried within the substrate of this coastline is very low due to Holocene sea level changes and associated erosion of glacial deposits found along the shoreline of Hood Canal. No historic properties or anomalies have been encountered by diver, remotely operated vehicle, or remote sensing surveys near NAVBASE Kitsap Bangor. National Oceanic and Atmospheric Administration (NOAA) nautical charts show no submerged ships or shipwrecks in the vicinity of NAVBASE Kitsap Bangor (NOAA, 2016).

Table 1. Facilities Projected for Repair in the Proposed Action at NAVBASE Kitsap Bangor

Structure Name	Year Built	NRHP Status	SHPO Concurrence Date	DAHP Log #	Note
Explosives Handling Wharf 2	2015-2017	N/A			Currently Under Construction
Carderock Pier	2008	N/A			Post-dates Cold War
Service Pier	1980	Not Eligible	2/16/2012	030911-62-USN	
Delta Pier	1979	Eligible	2/16/2012 & 4/20/2011	030911-62-USN	
Magnetic Silencing Facility	1978	Eligible	3/13/2013	031313-13-USN	
Explosives Handling Wharf 1(	1975	Eligible	4/20/2011	030911-58-USN	
Keyport - Bangor (K/B) Dock	1965	Not Eligible	2/16/2012	030911-62-USN	
Marginal Wharf	1945	Not Eligible	4/20/2011	030911-58-USN	

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The replacement of existing piles in accordance with the *Secretary of the Interior's Standards for the Rehabilitation of Historic Properties* would maintain and preserve the functionality of three structures that are considered eligible for listing in the NRHP: Delta Pier, EHW-1, and Magnetic Silencing Facility.

Implementation of the proposed activities at Bangor would not adversely affect any known NRHP-eligible archaeological sites. Construction activities would take place in previously disturbed areas at the existing piles. Piles would be installed in the same or similar locations from which they were removed. Because of the extent and nature of modern marine activity, it is unlikely that unrecorded submerged historic resources exist along the shoreline. However, in the event of an inadvertent discovery of potentially significant archaeological resources, the Navy will stop work in the immediate area and consult with the SHPO, affected American Indian tribes, and other interested parties. Similarly, if American Indian human remains, funerary items, sacred objects, or items of cultural patrimony are encountered, the Navy will comply with the North American Graves Protection and Repatriation Act (NAGPRA).

The Navy has determined that the Proposed Action would have no adverse effect on historic properties at NAVBASE Kitsap Bangor.

NAVAL BASE KITSAP BREMERTON

The APE for the Proposed Action at NAVBASE Kitsap Bremerton includes up to 16 facilities (Table 2) that could be repaired (Enclosure 2). All work would occur in- or over-water. No on-shore work is planned, and any staging required would occur in previously disturbed or developed areas.

The largest historical resource at NAVBASE Kitsap Bremerton is the Navy Yard Puget Sound National Historic Landmark (NHL), associated with the ship repair efforts during World War II, near the southeastern corner of the base. Piers 3, 4, 5, 6 and 7, Dry Dock 5 (DD5), and the Hammer Head Crane on Pier 6 are contributing resources to the NHL, listed in 1990. Pier C, Mooring Piers A, E, F, and G, and Quay Wall #730 were determined not eligible for listing in the NRHP in the 1986 survey and evaluation by Grulich Architecture and Planning Services and reaffirmed in the 1995 Puget Sound Naval Shipyard Historical and Archeological Resource Protection Plan, which was reviewed and accepted by the SHPO on April 13, 1995. Piers B and D are too new to be considered eligible for listing on the NRHP and have not been surveyed or input into WISAARD.

Pier 9 has not been evaluated, but is over 50 years old. Per 36 CFR Part 800.4(b)(2,) the Navy chooses to defer final NRHP eligibility

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evaluation of Pier 9 until the in-progress survey and evaluation of resources within the Puget Sound Naval Shipyard has been completed. The survey and evaluation is a mitigation measure stipulated in the Memorandum of Agreement for Improvements to Building 431 at Naval Base Kitsap Bremerton (DAHP Log. No. 010914-20-USN). Recommendations for eligibility for Pier 9 will be included in the survey, which will be provided to your office for review during development and concurrence upon completion. Data will also be inputted into WISAARD for Pier 9 at that time.

Shoreline structures at Bremerton, including the piers proposed for repair or pile replacement, or contingency repair, are constructed on fill, and the current shoreline where these structures are located does not reflect the original coast line. There are no recorded submerged historic properties, downed aircraft, or shipwrecks, in the NAVBASE Kitsap Bremerton APE. New piles would be installed adjacent to where existing piles were removed.

Table 2. Facilities Projected for Repair in the Proposed Action at NAVBASE Kitsap Bremerton

Structure Name	Year Built	NRHP Status	SHPO Concurrence Date	DAHP Log #	Notes
Pier 3 (#713)	1943	Contributing	12/20/1990		NHL
Pier 4 (#714)	1932	Contributing	12/20/1990		NHL
Pier 5 (#715)	1923	Contributing	12/20/1990		NHL
Pier 6 (#716)	1926	Contributing	12/20/1990		NHL
Pier 7 (#717)	1943	Contributing	12/20/1990		NHL
Pier 9 (#823)	1962	Unevaluated			Outside NHL
Pier B (#722A)	2012	Unevaluated			Outside NHL, original pier replaced
Pier C (#723)	1941	Not Eligible	1986 & 1995		Outside NHL
Pier D (#724A)	2004	Unevaluated			Outside NHL, original pier replaced
Mooring Pier A (#721)	1949	Not Eligible	1986 & 1995		Outside NHL

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Structure Name	Year Built	NRHP Status	SHPO Concurrence Date	DAHP Log #	Notes
Mooring Pier E (#726)	1946	Not Eligible	12/1/2010	120110-05-USN	Outside NHL
Mooring Pier F (#727)	1949	Not Eligible	12/1/2010	120110-05-USN	Outside NHL
Mooring Pier G (#728)	1949	Not Eligible	12/1/2010	120110-05-USN	Outside NHL
Hammer Head Crane Foundation (#709)	1933	Contributing	12/20/1990		NHL
Dry Dock 5 (#705)	1941	Contributing	12/20/1990		NHL
Quay Wall (#730)	1942	Not Eligible	1986 & 1995		Outside NHL

The replacement of existing piles in accordance with the *Secretary of the Interior's Standards for the Rehabilitation of Historic Properties* would maintain and preserve the functionality of the structures that are considered eligible for listing in the NRHP. Although Piers 3, 4, 5, 6, and 7, Dry Dock 5 and the Hammerhead Crane are contributing elements of the NHL, their pilings do not embody key elements of the historic properties, and changes to these elements would not adversely affect the NRHP eligibility of the individual contributing resources or of the overall NHL.

Implementation of the proposed activities at Bremerton would not adversely affect any known NRHP-eligible archaeological sites. Construction activities would take place in previously disturbed underwater areas along or near the shoreline, with a substrate consisting of fill. The probability for the presence of intact prehistoric archaeological deposits or features buried within the substrate is very low due to Holocene sea level changes and associated erosion of glacial deposits found along the shoreline. Piles would be installed in the same or similar locations from which they were removed. Because of the extent and nature of modern marine activity, it is unlikely that unrecorded submerged historic resources exist along the shoreline. However, in the event of an inadvertent discovery of potentially significant archaeological resources, the Navy will stop work in the immediate area and consult with the SHPO, affected American Indian tribes, and other interested parties. Similarly, if American Indian human remains, funerary items, sacred objects, or items of cultural patrimony are encountered, the Navy will comply with the NAGPRA.

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The Navy has determined that the Proposed Action would have no adverse effect on historic properties at NAVBASE Kitsap Bremerton.

NAVAL BASE KITSAP KEYPORT

The APE for the Proposed Action at NAVBASE Kitsap Keyport consists of one facility (Enclosure 3). All work would occur in- or over-water. No on-shore work is planned, and any staging required would occur in previously disturbed or developed areas. Keyport Pier (Pier 1), the single structure scheduled for repair, was built in 2002, and is not eligible for listing in the NRHP (Table 3) because of its recent construction date and its lack of extraordinary significance as evaluated under Criteria Consideration G. As a result, the pier has not been surveyed or input into WISAARD.

Two archaeological sites at Keyport are potentially eligible for the NRHP, but neither is within the proposed project APE. No prehistoric archaeological resources have been identified in the offshore areas at Keyport. Multiple shipwrecks are located within or near the Keyport Range site, but there are no recorded submerged historic properties, downed aircraft, or shipwrecks, within the pier repair and replacement APE.

Table 3. Proposed Action at NAVBASE Kitsap Keyport

Structure Name	Year Built	NRHP Status	SHPO Concurrence Date	DAHP Log #	Note
Pier 1	2002	Unevaluated			Post-dates Cold War

Implementation of the proposed activities at NAVBASE Kitsap Keyport would not affect any known NRHP-eligible archaeological sites. Contingent construction activities would take place in a previously disturbed underwater area along or near the shoreline. The probability for the presence of intact prehistoric archaeological deposits or features buried within the substrate is very low due to Holocene sea level changes and associated erosion of glacial deposits found along the shoreline.

However, in the event of an inadvertent discovery of potentially significant archaeological resources, the Navy will stop work in the immediate area and consult with the SHPO, affected American Indian tribes, and other interested parties. Similarly, if American Indian human remains, funerary items, sacred objects, or items of cultural patrimony are encountered, the Navy will comply with the NAGPRA.

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The Navy has determined that the Proposed Action would have no adverse effect on historic properties at NAVBASE Kitsap Keyport.

NAVAL BASE KITSAP MANCHESTER

The APE for the Proposed Action at NAVBASE Kitsap Manchester consists of up to two facilities (Enclosure 4). All work would occur in- or over-water. No on-shore work is planned, and any staging required would occur in previously disturbed or developed areas.

The Manchester Finger Pier, built in 1978, has been determined not eligible for the NRHP (Table 4). The Fuel Pier at Manchester was replaced in 1993 and has not been surveyed for eligibility for the NRHP as it is less than 50 years old, post-dates the Cold War era, and lacks extraordinary significance. As a result of its age, the Fuel Pier has not been surveyed or input into WISAARD.

An archeological survey was conducted in 1995 and three sites were identified. The sites are located outside the APE for the Proposed Action of contingency pier repair and replacement. There are no recorded submerged historic properties, downed aircraft, or shipwrecks in the APE.

Table 4. Proposed Action at NAVBASE Kitsap Manchester

Structure Name	Year Built	NRHP Status	SHPO Concurrence Date	DAHP Log #	Note
Manchester Fuel Pier	1993	Unevaluated			Post-dates Cold War
Manchester Finger Pier	1978	Not Eligible	4/7/2014	040714-12-USN	

Implementation of the proposed activities at NAVBASE Kitsap Manchester would not affect any known NRHP-eligible archaeological sites. Contingent construction activities would take place in a previously disturbed underwater area along or near the shoreline. The probability for the presence of intact prehistoric archaeological deposits or features buried within the substrate is very low due to Holocene sea level changes and associated erosion of glacial deposits found along the shoreline of Puget Sound.

However, in the event of an inadvertent discovery of potentially significant archaeological resources, the Navy will stop work in the immediate area and consult with the SHPO, affected American Indian tribes, and other interested parties. Similarly, if American Indian

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human remains, funerary items, sacred objects, or items of cultural patrimony are encountered, the Navy will comply with the NAGPRA.

The Navy has determined that the Proposed Action would have no adverse effect on historic properties at NAVBASE Kitsap Manchester.

ZELATCHED POINT

The APE for the Proposed Action at Zelatched Point consists of one pier facility (Enclosure 5). All work would occur in- or over-water. No on-shore work is planned, and any staging required would occur in previously disturbed or developed areas.

The Zelatched Point Pier, facility 477, is a contributing resource to the NRHP-eligible Zelatched Point Historic District (Table 5).

No known NRHP-eligible archaeological sites are located at Zelatched Point. Review of previous archaeological studies, ethnographic data, and project area landforms indicates a moderate probability for hunter-fisher-gatherer and historic archaeological resources in undisturbed areas along the shoreline at Zelatched Point. Shell midden sites and historic deposits demonstrate the types of archaeological materials that can occur on the shoreline of Dabob Bay. There are no recorded submerged historic properties, downed aircraft, or shipwrecks in the Zelatched Point APE.

Table 5. Proposed Action at Zelatched Point

Structure Name	Year Built	NRHP Status	SHPO Concurrence Date	DAHP Log #	Note
Zelatched Point Pier (#477)	1965	Eligible	7/11/2012	042412-10-USN	

The replacement of existing piles in accordance with the *Secretary of the Interior's Standards for the Rehabilitation of Historic Properties* would maintain and preserve the functionality of the structure that is considered eligible for listing in the NRHP. Although the pier is a contributing resource to the Zelatched Point Historic District, the pier pilings do not embody key elements of the historic property, and changes to these elements would not adversely affect the NRHP eligibility of the contributing resource or of the overall NHL. Piling replacement projects for this pier have been previously found to have no adverse effect on the historic district or contributing resource (DAHP Log Nos. 111615-06-USN and 042412-10-USN).

Implementation of the proposed activities at Zelatched Point would not affect any known NRHP-eligible archaeological sites. Construction

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activities consisting of contingent repairs would take place in previously disturbed areas along the shoreline. The probability for the presence of intact prehistoric archaeological deposits or features buried within the substrate is very low due to Holocene sea level changes and associated erosion of glacial deposits found along the shoreline.

However, in the event of an inadvertent discovery of potentially significant archaeological resources, the Navy will stop work in the immediate area and consult with the SHPO, affected American Indian tribes, and other interested parties. Similarly, if American Indian human remains, funerary items, sacred objects, or items of cultural patrimony are encountered, the Navy will comply with the NAGPRA.

The Navy has determined that the Proposed Action would have no adverse effect on historic properties at Zelatched Point.

NAVAL STATION EVERETT

The APE for the Proposed Action at NAVSTA Everett consists of nine waterfront structures (Enclosure 6). All work would occur in- or over-water. No on-shore work is planned, and any staging required would occur in previously disturbed or developed areas.

Of the nine waterfront structures at NAVSTA Everett, the majority of the structures were evaluated in 2014 and determined not eligible for the NRHP. SHPO concurred with this determination in a letter dated June 23, 2014 (DAHP Log No. 062314-31-USN). Pier C (2005), the recreational marina (1995), and the small craft boat launch (2012) all post-date the Cold War era (Table 6), and each structure has not achieved the exceptional importance as required under Criteria Consideration G for properties less than 50 years of age. Pier C, the recreational marina, and the small boat launch have not been surveyed or entered into WISAARD.

No known NRHP-eligible archaeological sites are located at NAVSTA Everett. Review of previous archaeological studies, ethnographic data, and project area landforms indicates the installation lies west of the historic shoreline. Therefore, there is low probability that buried pre-contact or ethnographic cultural resources exist within the footprint of NAVSTA Everett. There is high probability that historic cultural resources could be encountered in the historic waterfront fill materials in the upland portion of the installation. There is low probability that cultural materials would be encountered along the west sea wall expansion where Piers A, B, C, the North Wharf and South Wharf are located. There are no recorded submerged properties, downed aircraft, or shipwrecks in the NAVSTA Everett APE.

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Table 6. Proposed Action at NAVSTA Everett

Structure Name	Year Built	NRHP Status	SHPO Concurrence Date	DAHP Log #	Note
Pier A	1992	Not Eligible	6/23/2014	062314-31-USN	
Pier B (Breakwater)	1998	Not Eligible	6/23/2014	062314-31-USN	
Pier C	2005	Unevaluated			Post-dates Cold War
Pier D	1941	Not Eligible	6/23/2014	062314-31-USN	
Pier E	1941	Not Eligible	6/23/2014	062314-31-USN	
North Wharf	1978	Not Eligible	6/23/2014	062314-31-USN	
South Wharf	1992	Not Eligible	6/23/2014	062314-31-USN	
Recreational Marina	1995	Unevaluated			Post-dates Cold War
Small Craft Boat Launch	2012	Unevaluated			Post-dates Cold War

Proposed activities would take place in previously disturbed areas at the existing piles. Piles would be installed in the same or similar locations from which they were removed. Because of the extent and nature of modern marine activity, it is unlikely that unrecorded submerged historic resources exist along the shoreline. However, in the event of an inadvertent discovery of potentially significant archaeological resources, the Navy will stop work in the immediate area and consult with the SHPO, affected American Indian tribes, and other interested parties. Similarly, if American Indian human remains, funerary items, sacred objects, or items of cultural patrimony are encountered, the Navy will comply with the North American Graves Protection and Repatriation Act (NAGPRA).

The Navy has determined that the Proposed Action would have no adverse effect on historic properties at NAVSTA Everett.

If you have any further questions or need additional information, please contact the following staff: For NAVBASE Kitsap Bangor, NAVBASE Kitsap Bremerton, NAVBASE Kitsap Keyport, NAVBASE Kitsap Manchester, and Zelatched Point, my point of contact is Amanda Bennett, Landscape Architect. She can be reached at (360) 476-6613 or amanda.j.bennett@navy.mil. For NAVSTA Everett, my point of contact is

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APR 21 2017

Jennifer Sullivan, Cultural Resources Manager. She can be reached at (425) 304-3464 or jennifer.sullivan@navy.mil.

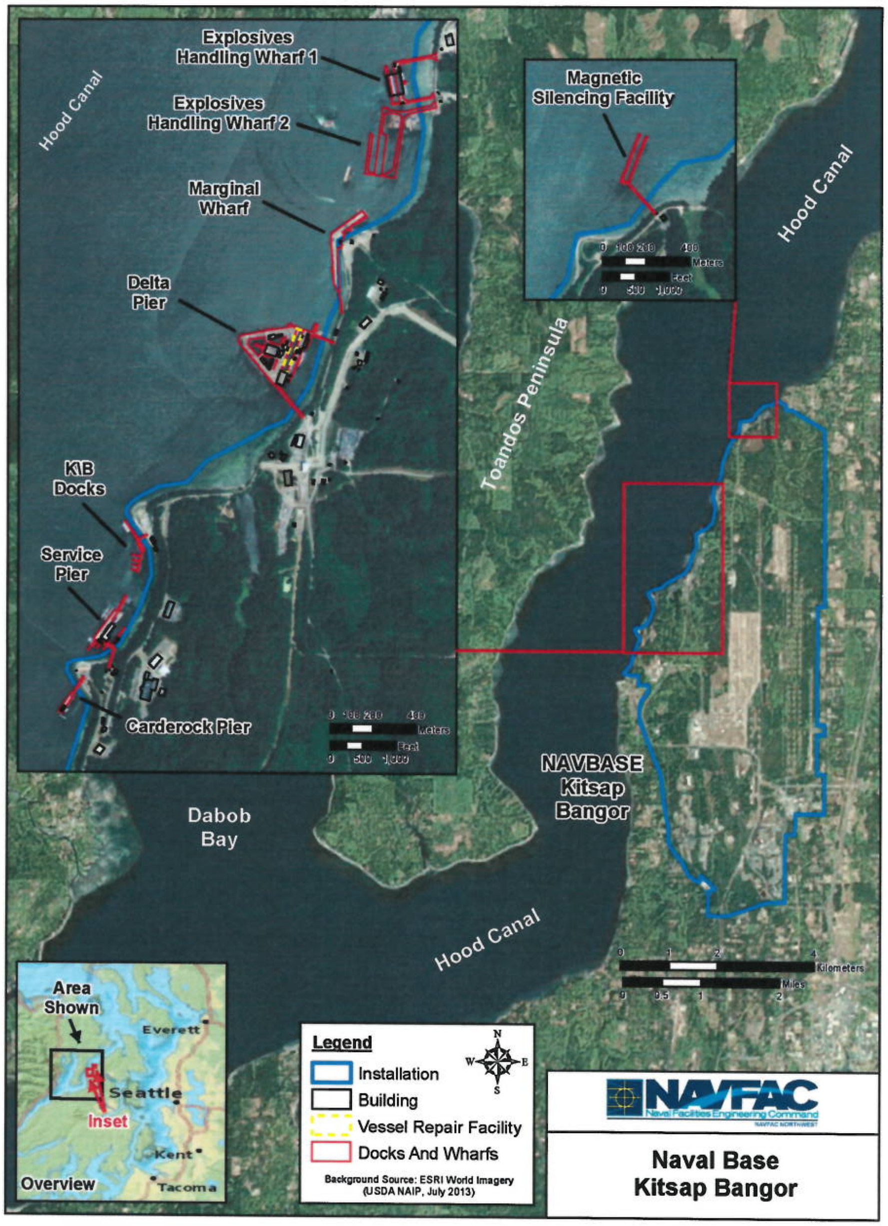
Sincerely,

C. M. KURGAN
Captain, CEC, U.S. Navy
Regional Director for Facilities
and Environmental
By direction of the Commander

Enclosures:
1. Naval Base Kitsap Bangor Aerial Photograph
2. Naval Base Kitsap Bremerton Aerial Photographs
3. Naval Base Kitsap Keyport Aerial Photograph
4. Naval Base Kitsap Manchester Aerial Photograph
5. Zelatched Point Aerial Photograph
6. Naval Station Everett Aerial Photograph

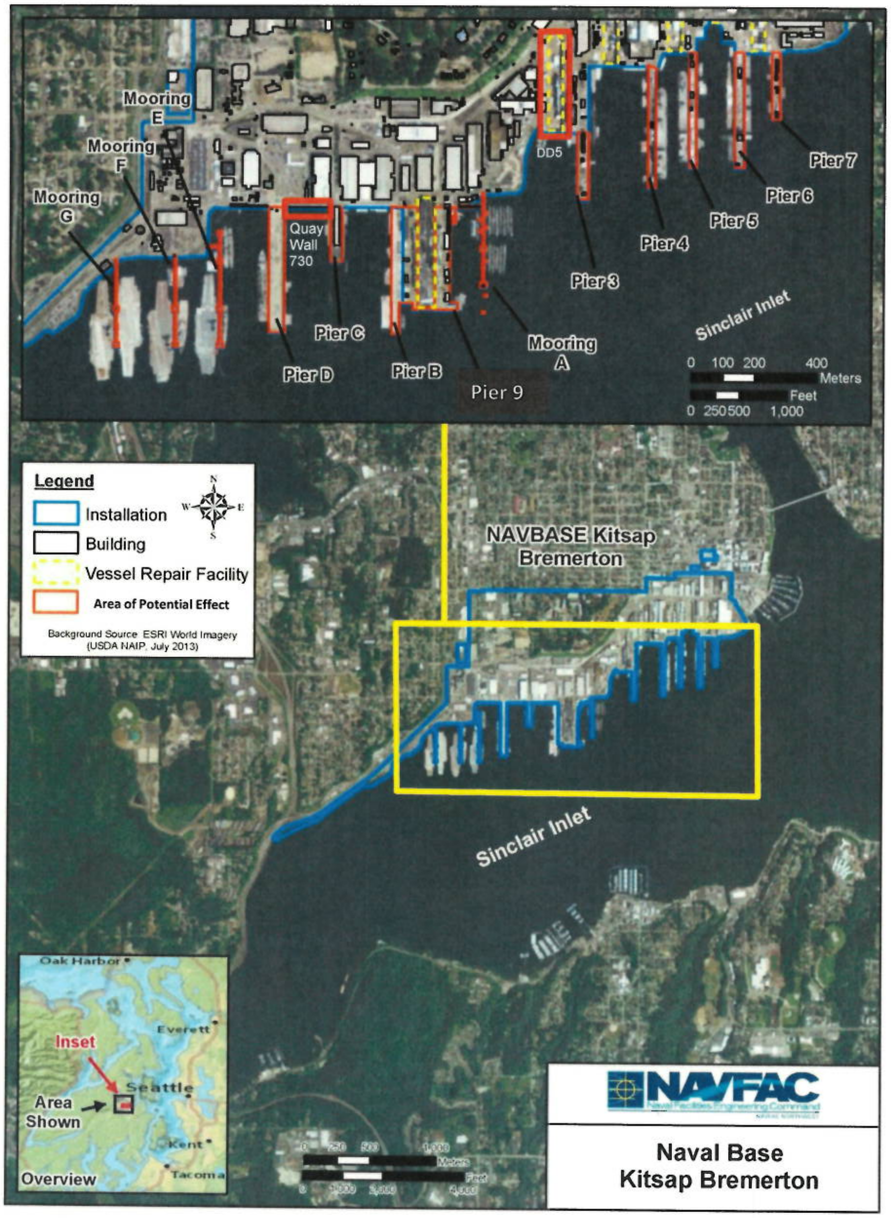
Copy to:
NBK
NSE
Ms. Kris Miller, THPO, Skokomish Indian Tribe
Mr. Dennis Lewarch, THPO, Suquamish Tribe
Ms. Laura Price, THPO, Port Gamble S'Klallam Tribe
Mr. David Brownell, Cultural Resources, Jamestown S'Klallam Tribe
Mr. Bill White, Archaeologist, Lower Elwha Klallam Tribe
Ms. Lena Tso, THPO Cultural Resources, Lummi Nation
Ms. Josephine Jefferson, Cultural Resource Technician, Swinomish Indian Tribal Community
Mr. Richard Young, Cultural Resources, Hibulb Cultural Center and Natural History Preserve, Tulalip Tribes of Washington

11



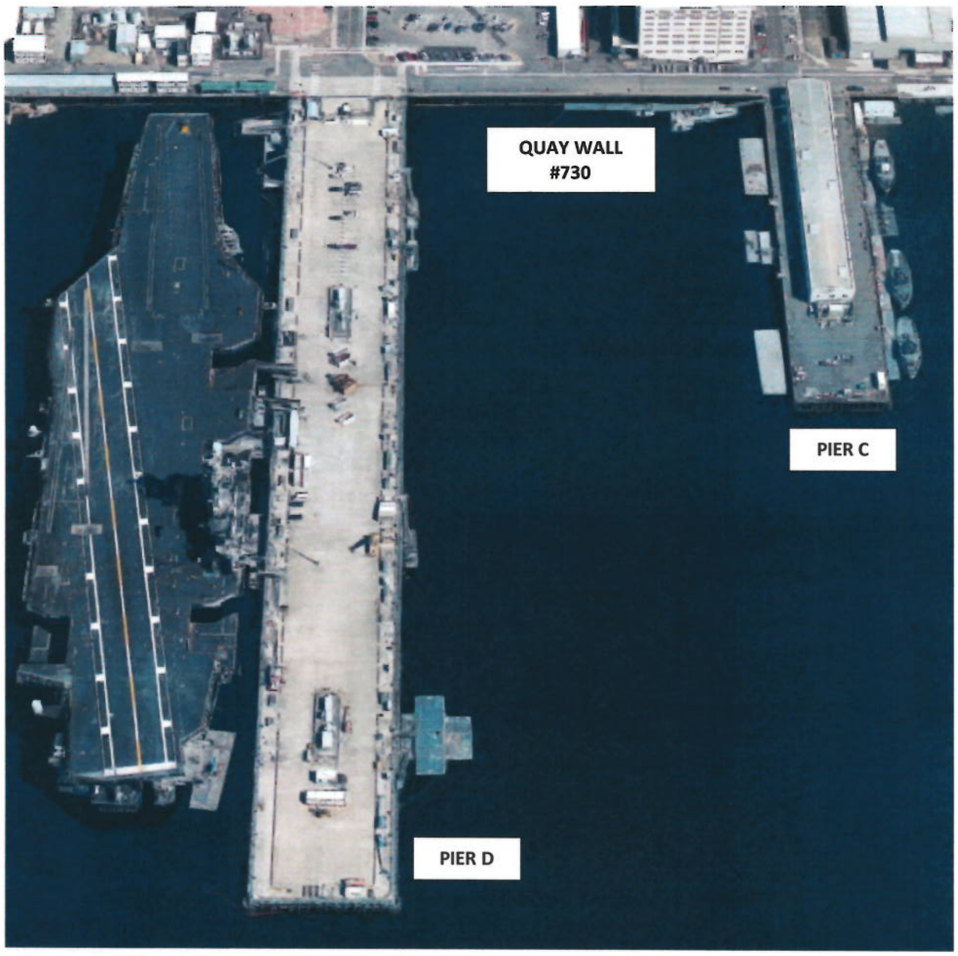
Naval Base Kitsap Bangor

Enclosure 1



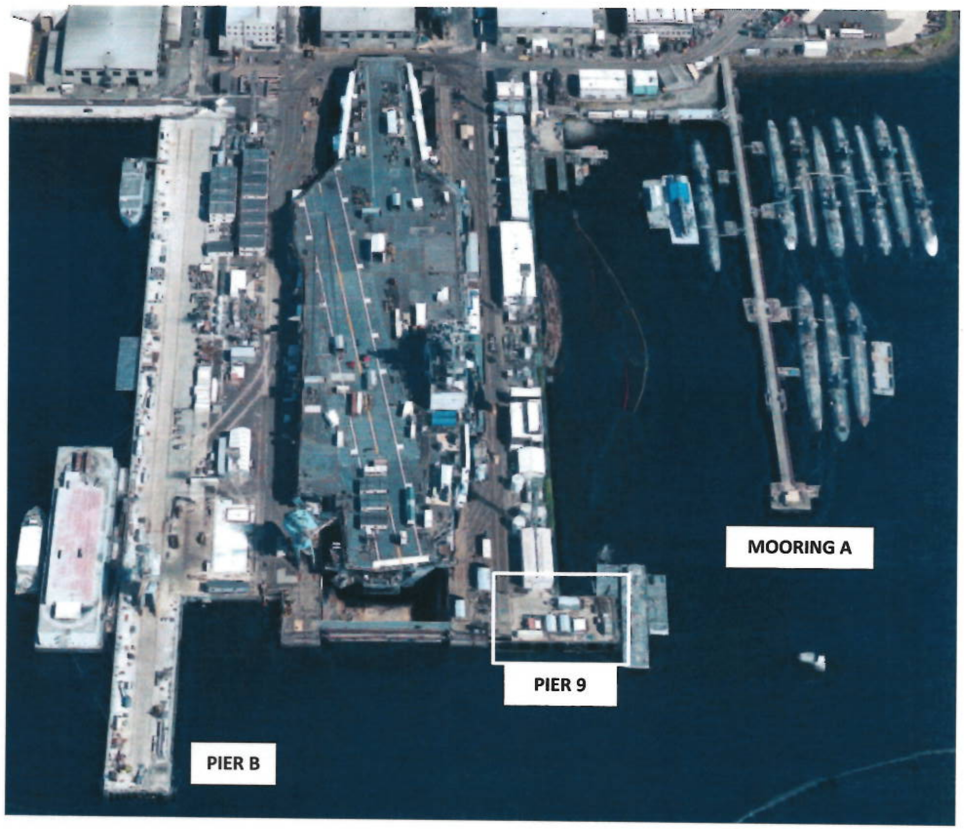
Naval Base Kitsap Bremerton

Enclosure 2
Page 1 of 6



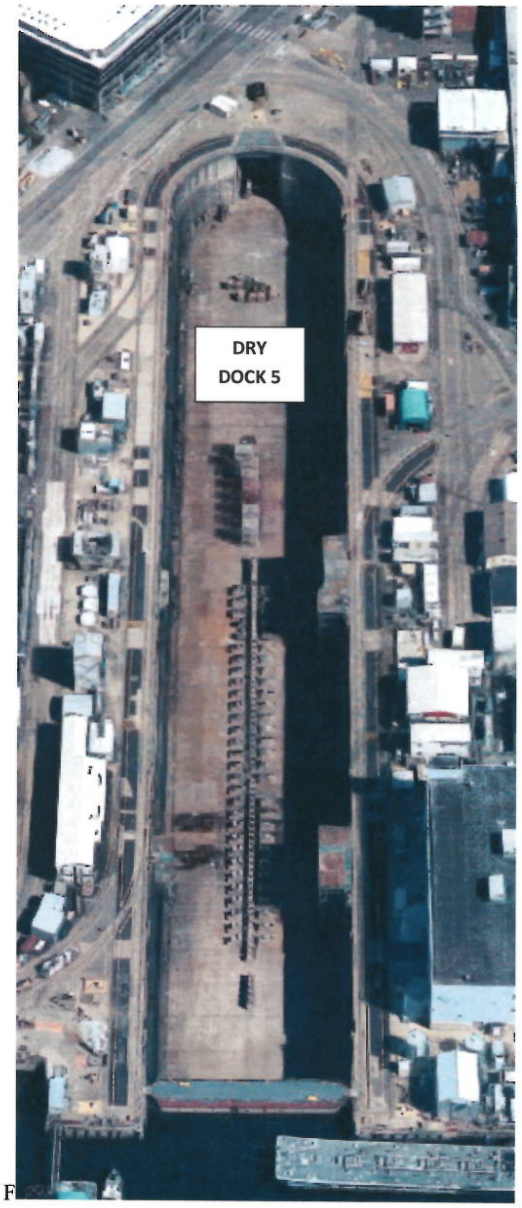
Pier D, Quay Wall #730 & Pier C, Naval Base Kitsap Bremerton

Enclosure 2
Page 2 of 6



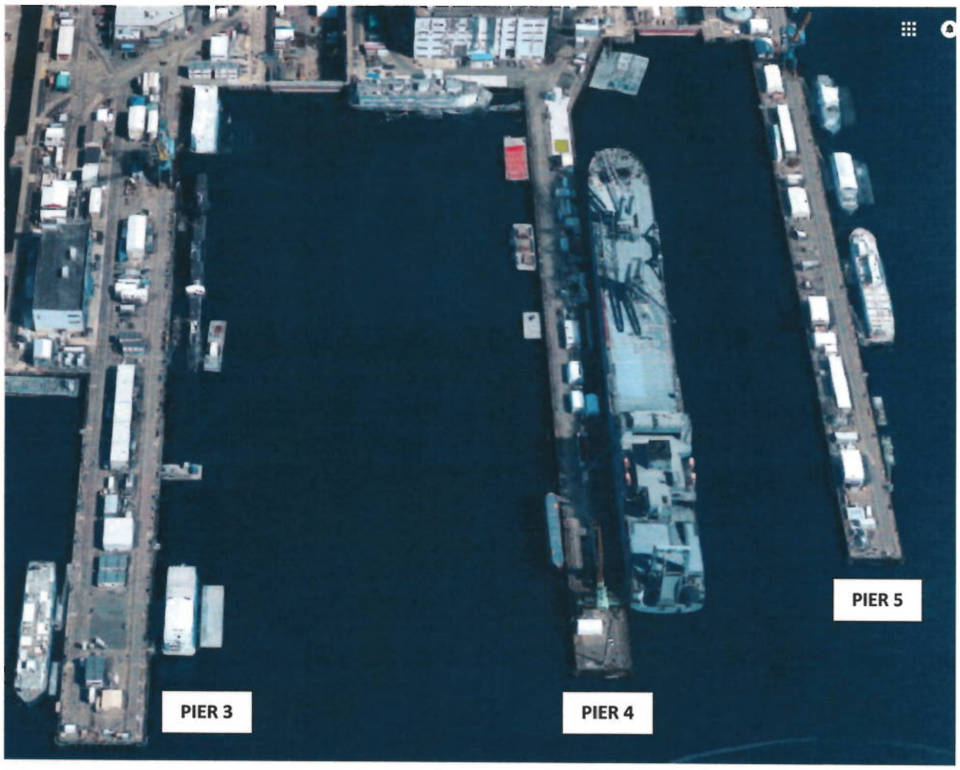
Pier B, Wharf 9 & Mooring A, Naval Base Kitsap Bremerton

Enclosure 2
Page 3 of 6



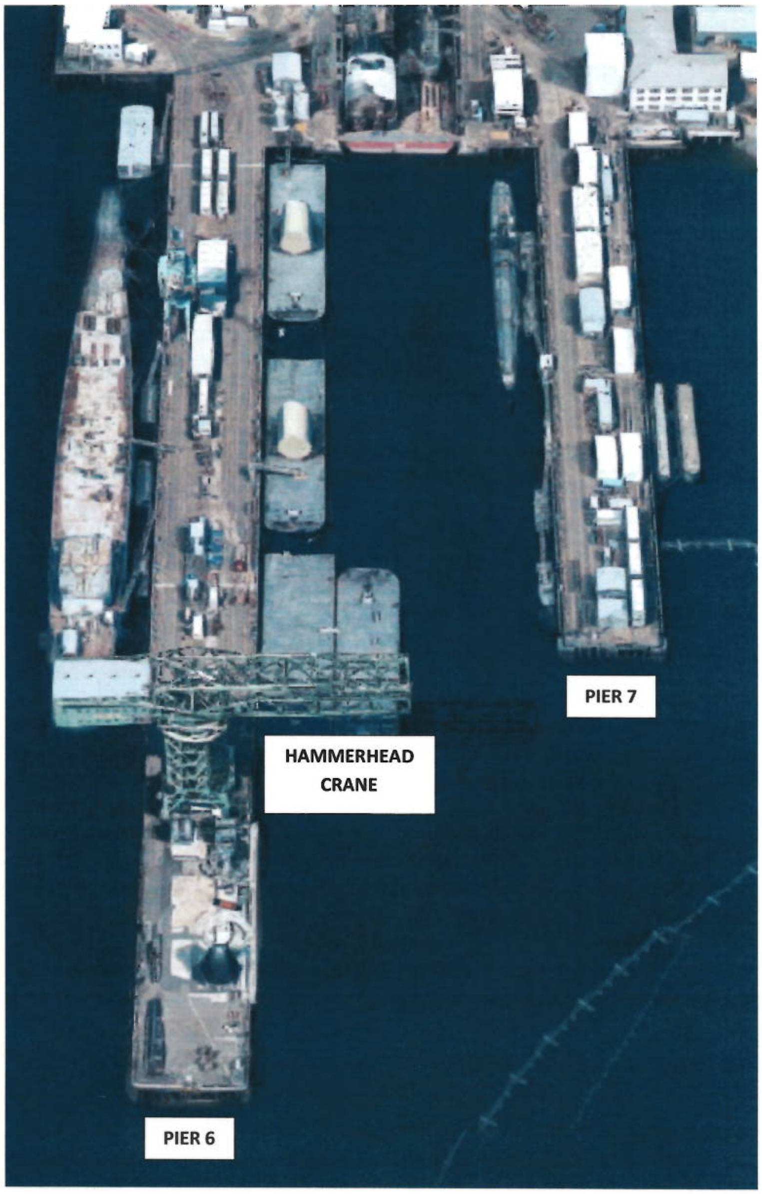
Dry Dock 5, Naval Base Kitsap Bremerton

Enclosure 2
Page 4 of 6



Pier 3, Pier 4 & Pier 5, Naval Base Kitsap Bremerton

Enclosure 2
Page 5 of 6



Pier 6, Hammerhead Crane & Pier 7, Naval Base Kitsap Bremerton

Enclosure 2
Page 6 of 6

Naval Base Kitsap Keyport

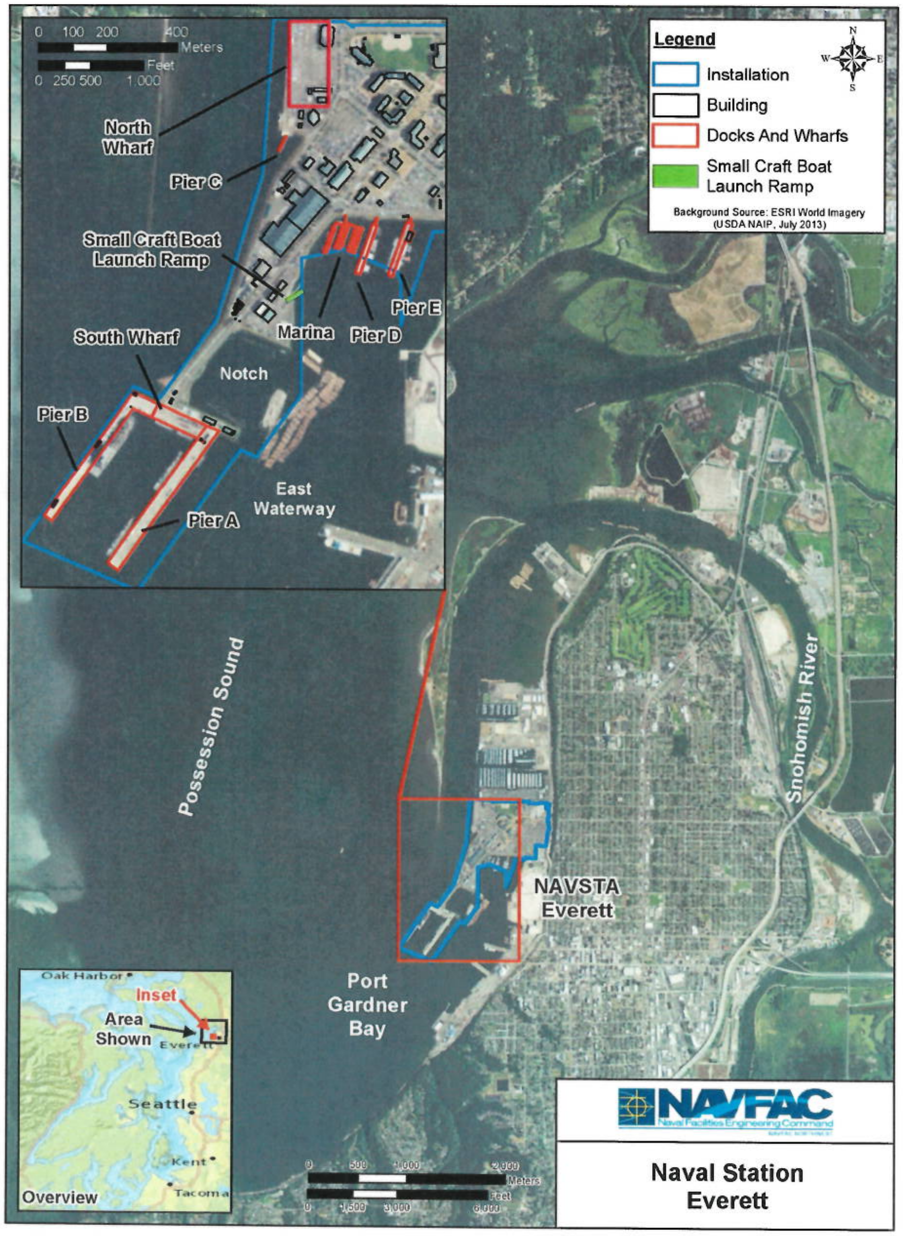
Enclosure 3

Naval Base Kitsap Manchester

Enclosure 4

Zelatched Point

Enclosure 5



Naval Station Everett

Enclosure 6

DAHP to U.S. Navy, May 31, 2017

dahp
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Allyson Brooks Ph.D., Director
State Historic Preservation Officer

May 31, 2017

Captain C. M. Kurgan
US Dept. of the Navy
Naval Station Everett
2000 West Marine View Drive
Everett, WA 98207-5001

In future correspondence please refer to:
Project Tracking Code: 2016-06-03830
Property: Marine Structure Maintenance
Re: More Information Needed

Dear Capt. Kurgan:

Thank you for contacting the Washington State Historic Preservation Officer (SHPO) and Department of Archaeology and Historic Preservation (DAHP) regarding the above referenced proposal. Your communication on this action has been reviewed on behalf of the SHPO by Historic Architect, Nick Vann and myself, under provisions of Section 106 of the National Historic Preservation Act of 1966 (as amended) and 36 CFR Part 800. Our review is based upon documentation provided in your submittal.

We concur that no historic properties will be affected by the current project as proposed at the following locations described in the undertaking's project activity:

- Bangor
  - EHW2
  - Carderock Pier
  - Service Pier
  - Kitsap/Bangor Dock
  - Marginal Wharf, and
- Keyport
  - Pier 1, and
- Manchester
  - Finger Pier
  - Fuel Pier, and
- Naval Station Everett
  - Piers A through E
  - North and South Wharf
  - Recreational Marina
  - Small Craft Launch

We also concur that the result of the undertaking will result in No Adverse Effect to eligible historic properties located at:

- Bangor
  - Delta Pier

State of Washington • **Department of Archaeology & Historic Preservation**
P.O. Box 48343 • Olympia, Washington 98504-8343 • (360) 586-3065
www.dahp.wa.gov

EHW1
Magnetic Silencer, and
Zelatched Point Pier

No further consultation regarding effects to the built environment is warranted at the abovementioned facilities. However, we are requesting further consultation from your office on the project scope and effects to the Bremerton Ship Yard and its National Historic Landmark District. We are requesting a determination of effect to the NHL and Historic Property Inventories (or updated inventory forms), at the reconnaissance level of effort, be completed on the following structures prior to the start of operations at this facility:

Pier 4
Pier 9
Mooring Pier G

If any archaeological resources are uncovered during construction, please halt work immediately in the area of discovery and contact the appropriate Native American Tribes and DAHP for further consultation. Thank you for the opportunity to review and comment. If you have any questions, please don't hesitate to contact me.

Sincerely,

Russell Holter
Project Compliance Reviewer
(360) 586-3533
russell.holter@dahp.wa.gov

DAHP to U.S. Navy, August 2, 2017

dahp
protect the past, shape the future

Allyson Brooks Ph.D., Director
State Historic Preservation Officer

August 2, 2017

Captain C. M. Kurgan
US Dept. of the Navy
Naval Station Everett
2000 West Marine View Drive
Everett, WA 98207-5001

Attn: Amanda Bennett

In future correspondence please refer to:
Project Tracking Code: 2016-06-03830
Property: Naval Base Kitsap, Naval Station Everett, Zelatched Point
Re: Marine Structure Maintenance

Dear Capt. Kurgan:

Thank you for contacting the Washington State Historic Preservation Officer (SHPO) and Department of Archaeology and Historic Preservation (DAHP) regarding the above referenced proposal. Your communication on this action has been reviewed on behalf of the SHPO by Russell Holter and myself, under provisions of Section 106 of the National Historic Preservation Act of 1966 (as amended) and 36 CFR Part 800. Our review is based upon documentation provided in your submittal and the additional information you provided per our request.

We concur that no historic properties will be affected by the current project as proposed at Mooring Pier G, and that the result of the undertaking will result in No Adverse Effect to eligible historic properties located at Pier 4 and Pier 9 in the Navy Yard Puget Sound National Historic Landmark District. Please refer to Russell Holter's letter dated May 31, 2017 for concurrence on all other affected properties.

If any archaeological resources are uncovered during construction, please halt work immediately in the area of discovery and contact the appropriate Native American Tribes and DAHP for further consultation. Thank you for the opportunity to review and comment. If you have any questions, please don't hesitate to contact me.

Sincerely,

Nicholas Vann, AIA
Historical Architect
(360) 586-3079
nicholas.vann@dahp.wa.gov

State of Washington • **Department of Archaeology & Historic Preservation**
P.O. Box 48343 • Olympia, Washington 98504-8343 • (360) 586-3065
www.dahp.wa.gov

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U.S. Navy to National Park Service, Pacific West Region Office, June 6, 2017

DEPARTMENT OF THE NAVY
NAVAL BASE KITSAP
120 SOUTH DEWEY ST
BREMERTON, WA 98314-5020

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PRB4/ 00024
6 JUN 2017

Ms. Elaine Jackson-Retondo
National Park Service – Pacific west Region Office
National Historic Landmarks Program Manager
333 Bush Street, Suite 500
San Francisco, CA 94104

Dear Ms. Jackson-Retondo:

SUBJECT: U.S. NAVY REQUEST FOR CONCURRENCE ON AREA OF POTENTIAL EFFECT AND FINDING OF EFFECT FOR THE PROPOSED MARINE STRUCTURE MAINTENANCE AND PILE REPLACEMENT ACTIVITIES, NAVBASE KITSAP BREMERTON

Pursuant to Section 106 of the National Historic Preservation Act, the Navy is initiating consultation regarding the proposed undertaking to conduct maintenance and repair activities at various marine waterfront structures over a 5-year period at NAVBASE Kitsap Bremerton. A portion of the proposed project would take place within the boundary of the Navy Yard Puget Sound National Historic Landmark (NHL) at NAVBASE Kitsap Bremerton and includes maintenance and pile replacement on resources contributing to the NHL. The activities are part of a larger Navy project that spans several installations (Washington State Historic Preservation Officer Project Tracking Code 2016-06-03830); NAVBASE Kitsap Bremerton is the only installation that has an NHL.

Maintenance and repair activities would occur at various piers, wharves, and other marine pile supported structures and could include replacing broken safety ladders, cable straps, camel and camel connections, and light pole bases on piers. Damaged or deteriorated guide piles systems, brow floats, and pile caps would be repaired or replaced where needed. General maintenance could include deck resurfacing and recoating various corroded metal components. Repair activities would be conducted on wetwell concrete spalling, piers (including repairs to piles), and quay walls. In addition to the maintenance and repair activities, unsound piles would be replaced. The piles are a combination of treated timber, steel, concrete, and high-density polyethylene plastic.

In accordance with 36 CFR § 800.4(a)(1), the Navy has defined the Area of Potential Effects (APE) as the foot print of each wharf and pier that would be affected by this proposed undertaking along with the viewshed from which the individual properties can be seen.

The APE for the Proposed Action at NAVBASE Kitsap Bremerton includes up to 16 facilities (Table 2) that could be repaired (Enclosure 2). All work would occur in- or over-water. No on-shore work is planned, and any staging required would occur in previously disturbed or developed areas.

The largest historical resource at NAVBASE Kitsap Bremerton is the Navy Yard Puget Sound National Historic Landmark (NHL), associated with the ship repair efforts during World War II, near the southeastern corner of the base. Piers 3, 4, 5, 6 and 7, Dry Dock 5 (DD5), and the Hammer Head Crane on Pier 6 are contributing resources to the NHL, listed in 1990.

Other marine structure resources at NAVBASE Kitsap Bremerton, outside the boundary of the NHL, would also be included in the proposed project (Table 2, shaded).

Table 2. Facilities Projected for Repair in the Proposed Action at NAVBASE Kitsap Bremerton

Structure Name	Year Built	NRHP Status	SHPO Concurrence Date	Notes
Pier 3 (#713)	1943	Contributing	12/20/1990	NHL
Pier 4 (#714)	1932	Contributing	12/20/1990	NHL
Pier 5 (#715)	1923	Contributing	12/20/1990	NHL
Pier 6 (#716)	1926	Contributing	12/20/1990	NHL
Pier 7 (#717)	1943	Contributing	12/20/1990	NHL
Hammer Head Crane Foundation (#709)	1933	Contributing	12/20/1990	NHL
Dry Dock 5 (#705)	1941	Contributing	12/20/1990	NHL
Pier C (#723)	1941	Not Eligible	1986 & 1995	Outside NHL
Mooring Pier A (#721)	1949	Not Eligible	1986 & 1995	Outside NHL
Mooring Pier E (#726)	1946	Not Eligible	12/1/2010	Outside NHL
Mooring Pier F (#727)	1949	Not Eligible	12/1/2010	Outside NHL
Mooring Pier G (#728)	1949	Not Eligible	12/1/2010	Outside NHL
Quay Wall (#730)	1942	Not Eligible	1986 & 1995	Outside NHL
Pier 9 (#823)	1962	Unevaluated		Outside NHL
Pier B (#722A)	2012	Unevaluated		Outside NHL
Pier D (#724A)	2004	Unevaluated		Outside NHL

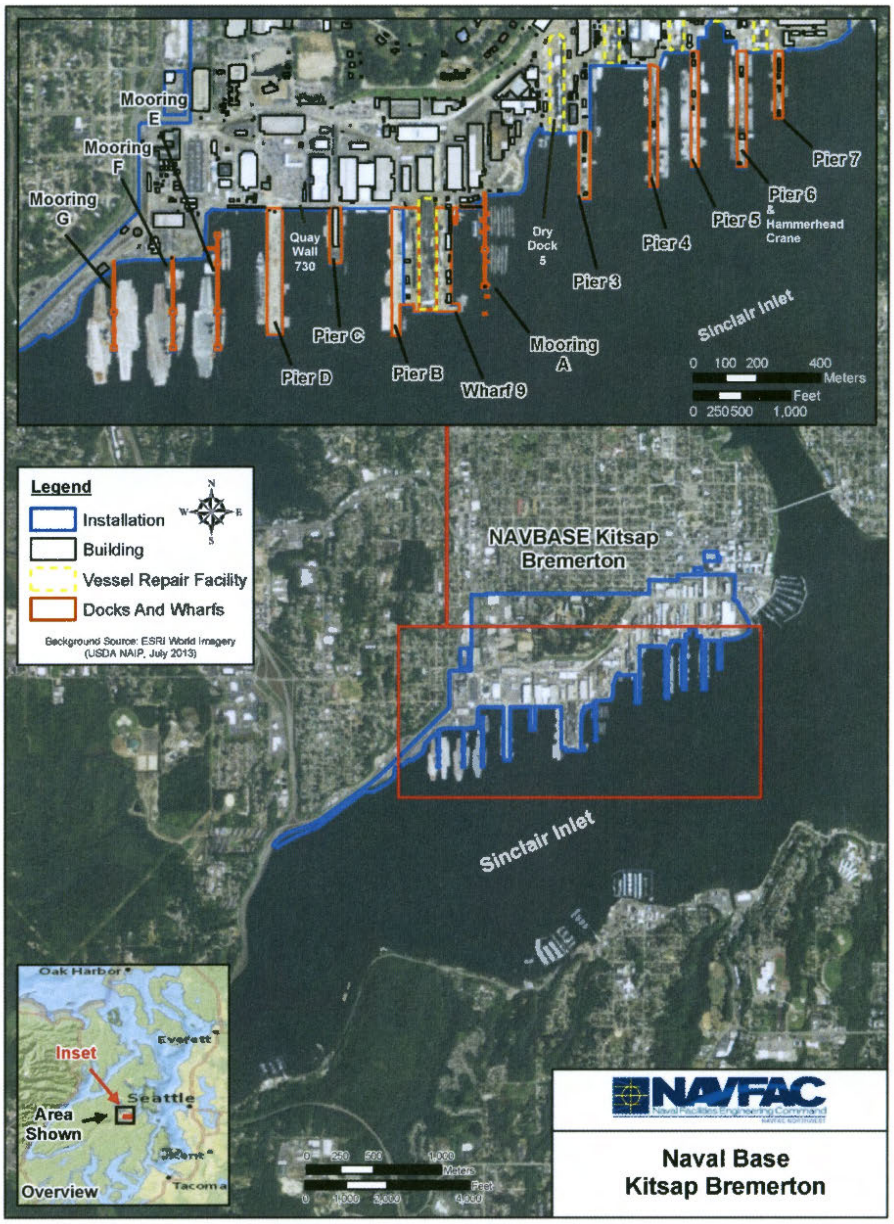
The replacement of existing piles in accordance with the *Secretary of the Interior's Standards for the Rehabilitation of Historic Properties* would maintain and preserve the functionality of the structures that are considered eligible for listing in the NRHP. Although Piers 3, 4, 5, 6, and 7, Dry Dock 5 and the Hammerhead Crane are contributing elements of the NHL, their pilings do not embody key elements of the historic properties, and changes to these elements would not adversely affect the NRHP eligibility of the individual contributing resources or of the overall NHL. As such, the Navy has determined that the proposed action would have no adverse effect on historic properties at NAVBASE Kitsap Bremerton.

The Navy requests your concurrence on the definition of the APE and determination of effect. If you have any further questions or need additional information, please contact Ms. Amanda J. Bennett at (360) 476-6613 or amanda.j.bennett@navy.mil.

Sincerely,

E.A. Schrader

Enclosures: 1. Naval Base Kitsap Bremerton APE
2. NHL Boundary & Contributing Resources



Enclsoure 1. Naval Base Kitsap Bremerton APE

Enclsoure 2. NHL Boundary & Contributing Resources

U.S. Navy to DAHP, April 2, 2019

DEPARTMENT OF THE NAVY
NAVAL MAGAZINE INDIAN ISLAND
100 INDIAN ISLAND ROAD
PORT HADLOCK, WA 98339-9723

5090
Ser N45/088
April 2, 2019

Allyson Brooks, PhD
State Historic Preservation Officer
Department of Archaeology & Historic Preservation
P.O. Box 48343
Olympia, WA 98504-8343

Dear Dr. Brooks:

SUBJECT: DAHP LOG NO. 2019-03-02117 REQUEST FOR CONCURRENCE WITH AREA OF POTENTIAL EFFECT AND FOR VARIOUS IMPROVEMENTS TO THE AMMUNITION WHARF AT NAVAL MAGAZINE INDIAN ISLAND HADLOCK, WA

The Navy is initiating consultation in accordance with Section 106 of the National Historic Preservation Act as amended and 36 CFR Part 800 for the proposed undertaking for various repairs at the Ammunition Wharf (B832) and Waterfront Operations Building (B833) at Naval Magazine Indian Island (NAVMAGII) (Figure 1). The Area of Potential Effect (APE) for this undertaking is an area that encompasses the project footprint, which includes the main wharf, the central pier and a small upland part of the parking lot southeast of the central pier where the laydown area will be located (Figure 2).

The principle purpose of the proposed action is to ensure the pier and attached float can support current and future mission requirements. Repairs and replacements were recommended to address deficiencies identified in a pier condition survey. The proposed project will include the removal and replacement of 9 concrete piles along with other repairs to the wharf and B833 on the wharf (Figures 3-6).

- Removing and installing 9 piles
- Demolition and restoration of concrete wharf deck and building roof section for pile installation
- New pile caps or extensions of existing pile caps for newly installed piles
- Installation and connection of cathodic protection systems
- Recoating steel fender piles and wale above water
- Repairing spalling piles and pile caps
- Replacing corroded or missing utility hangers
- Repairing miscellaneous damaged utilities and lighting

The existing piles will be removed to the mudline and concrete replacement piles will be installed.

Constructed in 1979, the Ammunition Wharf and Waterfront Operations Building have been determined not eligible for the National Register of Historic Places-eligible (DAHP Log No. 2018-03-01683). As such, the Navy has determined that the improvements to the wharf and building will have no effect on historic properties.

An archaeological review has found two archaeological sites on land east of the Wharf, JE00016 and JE0007. JE00016, directly east of the Wharf has been determined eligible for the State Heritage Register, and JE0007, northeast of the wharf is without an eligibility determination (Figure 8). However, the proposed project will not disturb any land along the shoreline within or near the known sites. The proposed laydown area for the project will be atop a paved parking lot southwest of the central pier and will not involve any ground-disturbing activities. Implementation of the proposed activities at NAVMAGII would not adversely affect any known archaeological sites.

Construction activities would take place in previously disturbed areas at the existing piles. Piles would be installed in the same or similar locations from which they were removed. Because of the extent and nature of modern marine activity, it is unlikely that unrecorded submerged historic resources exist along the shoreline. However, in the event of an inadvertent discovery of potentially significant archaeological resources, the Navy will stop work in the immediate area and consult with the State Historic Preservation Officer, affected American Indian tribes, and other interested parties. Similarly, if American Indian human remains, funerary items, sacred objects, or items of cultural patrimony are encountered, the Navy will comply with the North American Graves Protection and Repatriation Act (NAGPRA). As such, the Navy finds the proposed project will have no adverse effect on historic properties.

In 2017 the Navy provided a Biological Evaluation for the pile replacement to the Port Gamble Tribe, at which time the Tribe objected to the project. After further discussion and a site visit, the Tribe withdrew their objection. The Navy is providing this letter to the Port Gamble S'Klallam, Jamestown S'Klallam, Lower Elwha Klallam and Suquamish Tribes for their review and comment.

The Navy requests your concurrence with our definition of the APE and on the determination of no historic properties affected by the proposed undertaking. If you have any further questions, please contact Ms. Amanda Bennett at (360) 476-6613 or amanda.j.bennett@navy.mil.

Sincerely,

ROCKY B. PULLEY
Commander, U. S. Navy
Commanding Officer

Figures:
1. Location of Naval Magazine Indian Island
2. Area of Potential Effect
3. Project Plans North Pier Deck
4. Project Plans South Pier
5. Project Plans North Pier Deck
6. Project Plans North Pier Deck
7. Archaeological Sites

5090
Ser N45/088
April 2, 2019

Figure 1. Location of Naval Magazine Indian Island

5090
Ser N45/088
April 2, 2019

Figure 2. Area of Potential Effect

5090
Ser N45/088
April 2, 2019

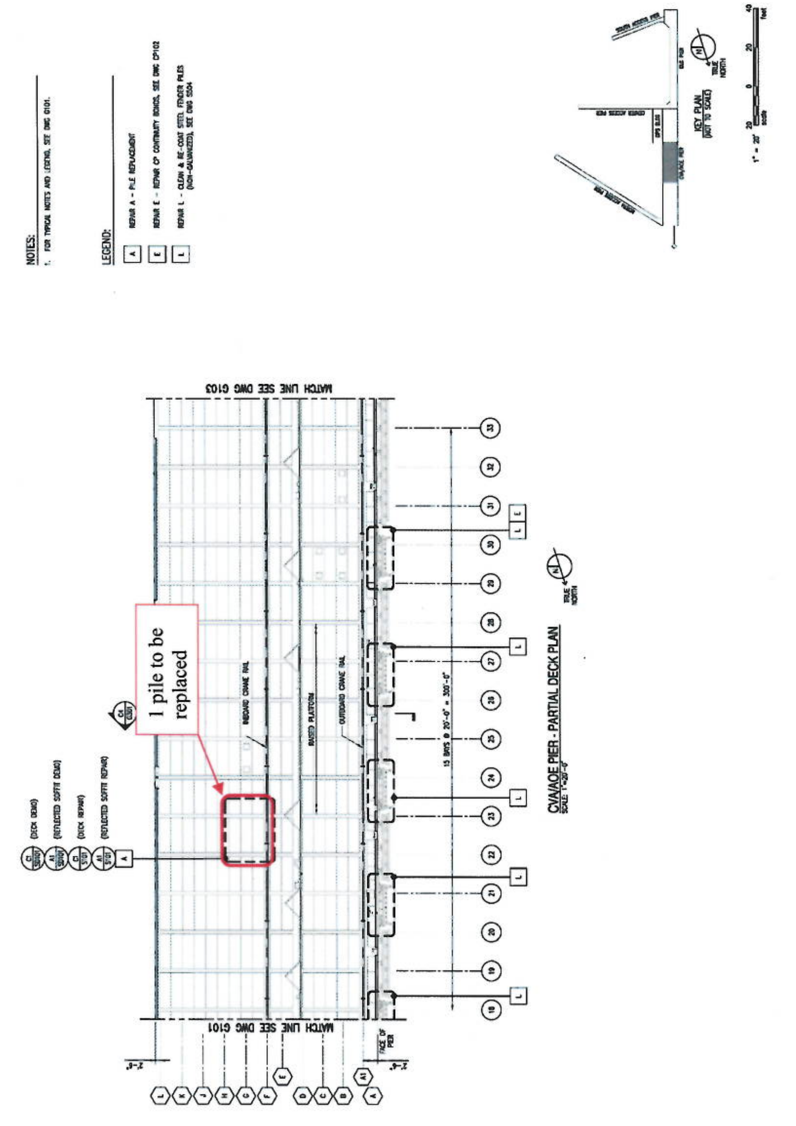


Figure 3. Project Plans North Pier Deck

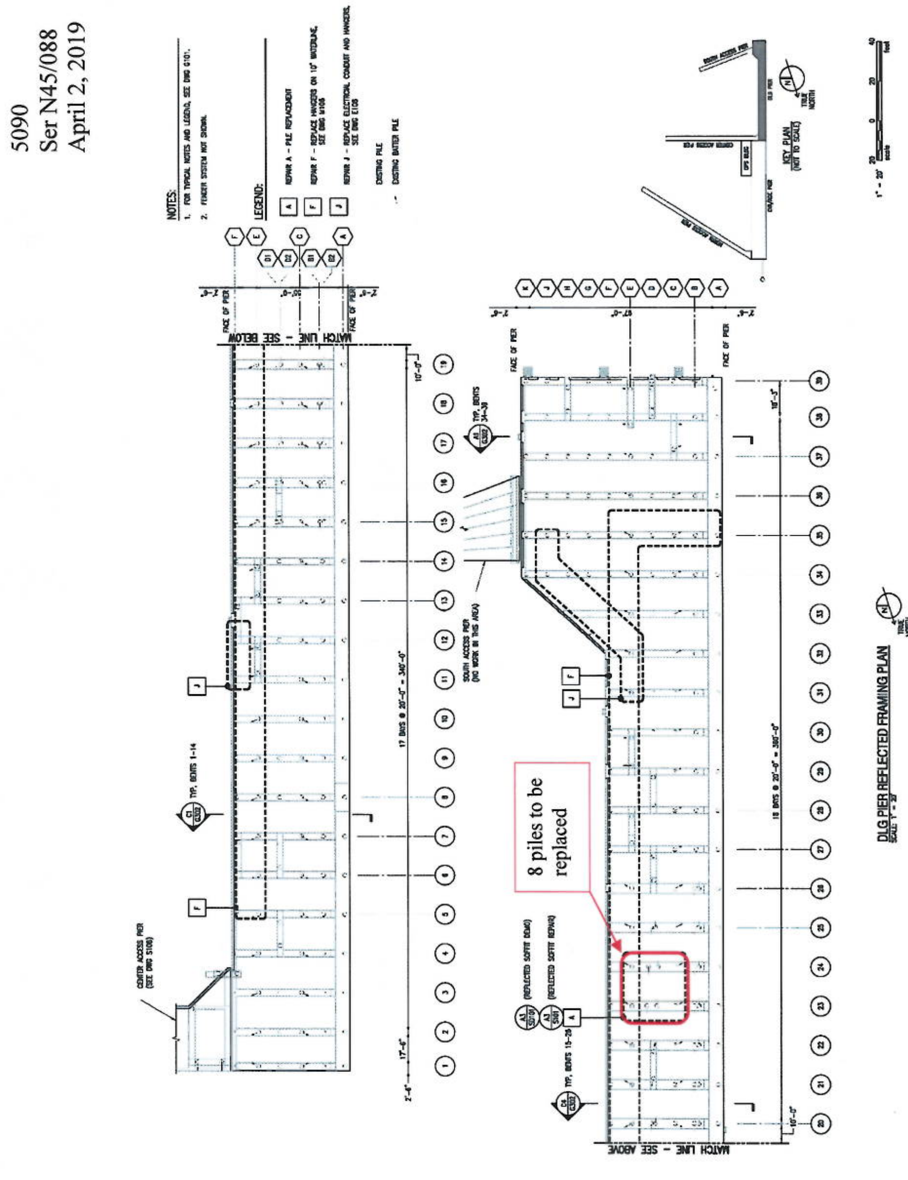


Figure 4. Project Plans South Pier

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Ser N45/088
April 2, 2019

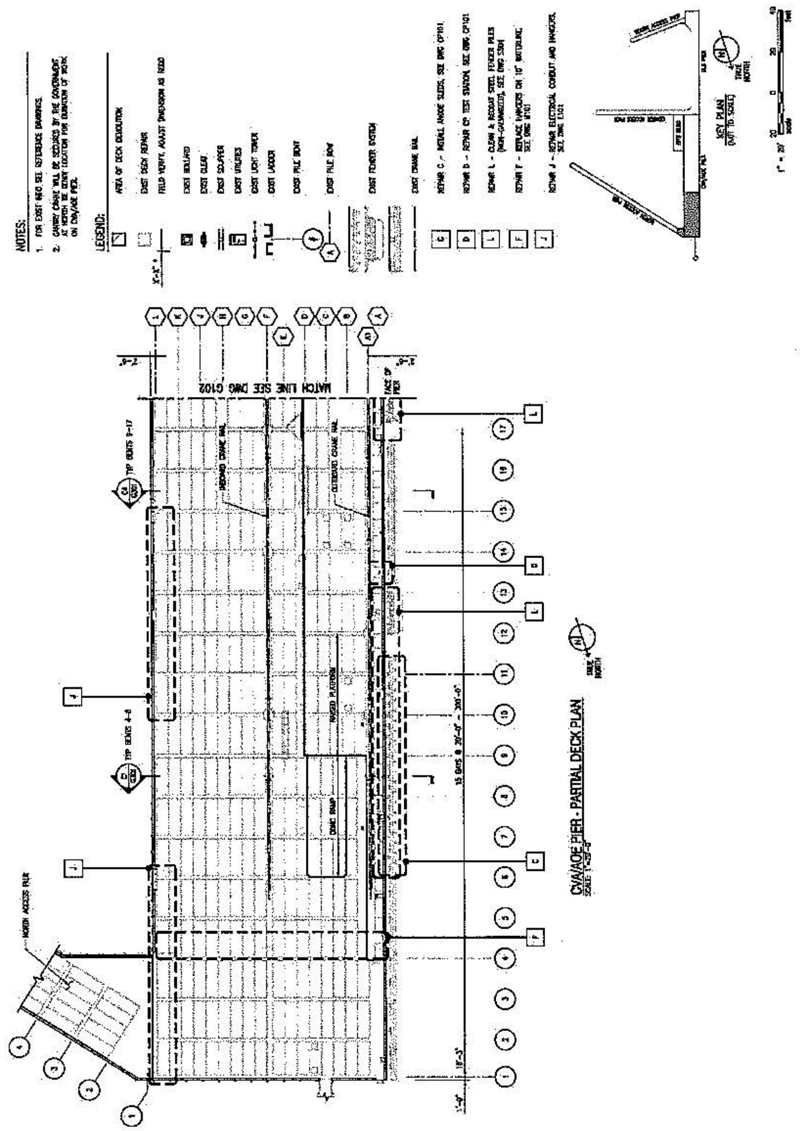

Figure 5. Project Plans North Pier

5090
Ser N45/088
April 2, 2019

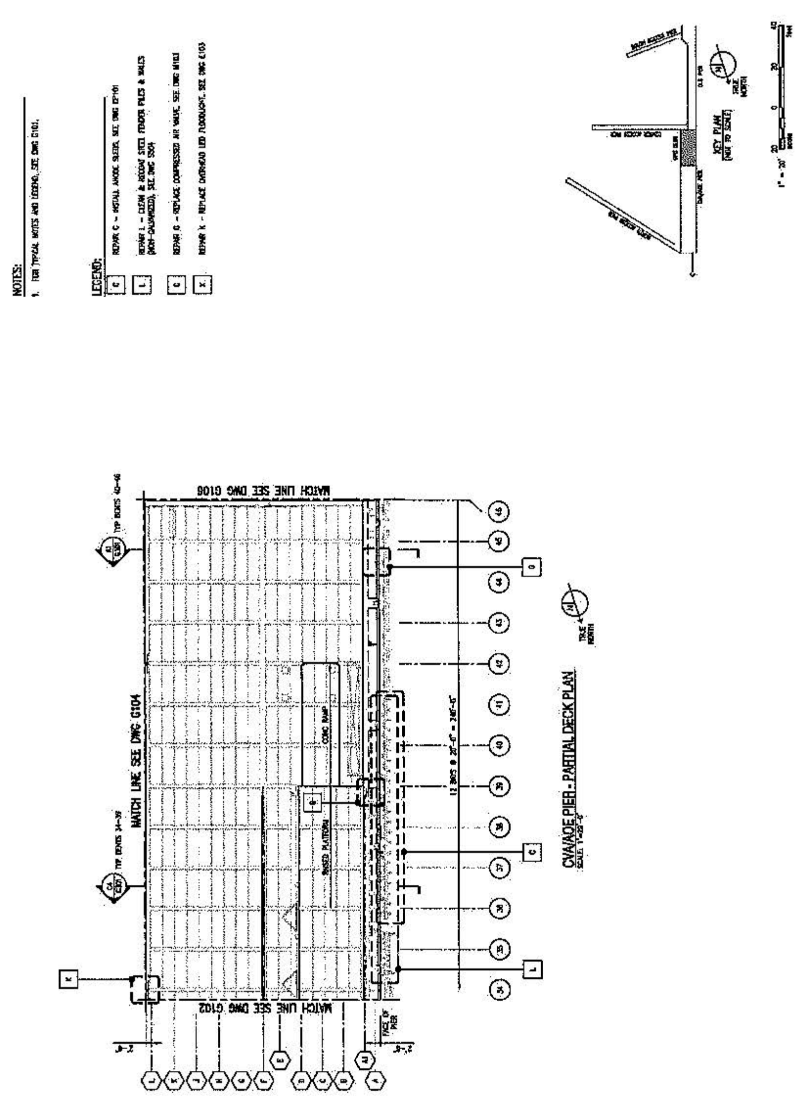

Figure 6. Project Plans North Pier Deck

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Ser N45/088
April 2, 2019

Figure 7. Archaeological Sites

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DAHP to U.S. Navy, April 8, 2019

dahp
protect the past, shape the future

Allyson Brooks Ph.D., Director
State Historic Preservation Officer

April 8, 2019

Commander Rocky B. Pulley
Naval Magazine Indian Island
100 Indian Island Road
Port Hadlock, Washington 98339

Re: Ammunition Wharf Improvements Project
Log No: 2019-03-02117-USN

Dear Commander Pulley:

Thank you for contacting our department. We reviewed the materials you provided for the proposed Ammunition Wharf Improvements Project at Naval Magazine Indian Island, Port Hadlock, Jefferson County, Washington.

We concur with your proposed Area of Potential Effect (APE). We concur with your determination of No Historic Properties Affected with the stipulation for an unanticipated discovery plan.

We would appreciate receiving any correspondence or comments from concerned tribes or other parties that you receive as you consult under the requirements of 36CFR800.4(a)(4).

These comments are based on the information available at the time of this review and on the behalf of the State Historic Preservation Officer in conformance with Section 106 of the National Historic Preservation Act and its implementing regulations 36CFR800. Should additional information become available, our assessment may be revised.

In the event that archaeological or historic materials are discovered during project activities, work in the immediate vicinity must stop, the area secured, and the concerned tribes and this department notified. Thank you for the opportunity to comment and a copy of these comments should be included in subsequent environmental documents..

Sincerely,

Robert G. Whitlam, Ph.D.
State Archaeologist
(360) 586-3080
email: *rob.whitlam@dahp.wa.gov*

State of Washington • **Department of Archaeology & Historic Preservation**
P.O. Box 48343 • Olympia, Washington 98504-8343 • (360) 586-3065
www.dahp.wa.gov

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APPENDIX F

TRIBAL GOVERNMENT-TO-GOVERNMENT DOCUMENTATION

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U.S. Navy to Skokomish Tribe, July 23, 2012

DEPARTMENT OF THE NAVY
NAVAL BASE KITSAP
120 SOUTH DEWEY ST
BREMERTON, WA 98314-5020

5090
Ser PRB4/00575
23 Jul 12

The Skokomish Tribe
The Honorable Charles Miller
North 80 Tribal Center Road
Skokomish WA 98584

Dear Chairman Miller:

SUBJECT: INVITATION TO INITIATE GOVERNMENT-TO-GOVERNMENT CONSULTATION FOR PROJECTS AT NAVAL BASE KITSAP

I am writing to inform you of several facility construction projects and operational activities being planned for Naval Base Kitsap. Some of the anticipated projects may be of interest to your tribe. The proposed actions, which are described in more detail in the attached enclosure, include the following:

- Bangor, Service Pier Barge Moorage
- Bangor, Relocate Floats to Delta Pier
- Bangor, Service Pier Extension
- Bangor, Swimmer Net Test
- Bangor, Pile Repair and Replacement

Pursuant to the Navy's American Indian/Alaska Native policy, I would like to extend the opportunity to review these actions and evaluate whether you believe there would be significant impacts on tribal treaty harvest rights or cultural resources resulting from the implementation of any of the actions. My staff will be coordinated with your staff, and a brief for you will be proposed for the near future. If our discussion leads to a concern that tribal rights or resources may be adversely affected by one or more of the projects, we will arrange for further government-to-government consultation. Your comments and concerns will be considered and will enable the Navy to address potential issues prior to implementation.

In addition to the new projects listed above, the Navy would like to continue our discussions about two projects previously discussed, the Land Water Interface and Electromagnetic Measurement Range projects.

SUBJECT: INVITATION TO INITIATE GOVERNMENT-TO-GOVERNMENT CONSULTATION FOR PROJECTS AT NAVAL BASE KITSAP

I look forward to working with you to address any concerns or provide additional information you may need. Please feel to contact me or my Environmental Director, Mr. Greg Leicht, (360) 315-5411 or gregory.leicht@navy.mil, with any questions or comments.

Sincerely,

P. M. DAWSON
Captain, U.S. Navy
Commanding Officer

Enclosure: 1. Major Upcoming Projects at Naval Base Kitsap, July 2012

Major Upcoming Projects at Naval Base Kitsap
June 2012

- Bangor, Service Pier Barge Moorage

  The proposed project would install 16 steel pipe piles inboard of the Service Pier to moor a new 260'x 85' research barge. The existing 1940's research barge, presently moored outboard of the Service Pier would be removed, and a 50 foot section of a floating pier would be relocated. The mooring piles for the existing barge and pier would be removed. This work is scheduled for fiscal year 2013.

- Bangor, Relocate Floats to Delta Pier

  The proposed project would relocate two 45' x 15' floats from the Marginal Wharf, and moor them next to the Delta Pier. The project would include installation of about 10 concrete or steel piles. This action is scheduled for fiscal year 2013.

- Bangor, Service Pier Extension

  The proposed project would install a 500' x 66' extension on the southern end of the Service Pier. The pier would parallel the Carlson Spit shoreline at the -40 to -60 MLLW water depth. The purpose of the project is to provide berthing for two submarines presently berthed in Bremerton. The project would involve driving an estimated 320 steel pipe piles. This project is proposed for fiscal year 2015.

- Bangor, Swimmer Net Test

  The proposed project would install a net adjacent to the Magnetic Silencing Facility for approximately 1 year. The net would be approximately 100'long x 24'to 36' high, at water depths between -18' and -6'MLLW. It would be secured to the Magnetic Silencing Facility trestle. It would be anchored with steel plate anchors. The net would have 7" x 7" openings. This project is proposed for fiscal year 2013.

- Pile Repair and Replacement

  The proposed project would repair or replace 280 existing deteriorated piles at Bangor and Zelatched Point, and 950 piles at Bremerton, Keyport and Manchester. The project would occur from fiscal year 2013 through 2018.

Enclosure (1)

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U.S. Navy to Port Gamble S'Klallam Tribe, July 23, 2012

DEPARTMENT OF THE NAVY
NAVAL BASE KITSAP
120 SOUTH DEWEY ST
BREMERTON, WA 98314-5020

5090
Ser PRB4/00571
23 Jul 12

The Port Gamble S'Klallam Tribe
The Honorable Jeromy Sullivan
31912 Little Boston Road NE
Kingston WA 98346

Dear Chairman Sullivan:

SUBJECT: INVITATION TO INITIATE GOVERNMENT-TO-GOVERNMENT CONSULTATION FOR PROJECTS AT NAVAL BASE KITSAP

I am writing to inform you of several facility construction projects and operational activities being planned for Naval Base Kitsap. Some of the anticipated projects may be of interest to your tribe. The proposed actions, which are described in more detail in the attached enclosure, include the following:

- Bangor, Service Pier Barge Moorage
- Bangor, Relocate Floats to Delta Pier
- Bangor, Service Pier Extension
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- Bangor, Pile Repair and Replacement

Pursuant to the Navy's American Indian/Alaska Native policy, I would like to extend the opportunity to review these actions and evaluate whether you believe there would be significant impacts on tribal treaty harvest rights or cultural resources resulting from the implementation of any of the actions. My staff will be coordinated with your staff, and a brief for you will be proposed for the near future. If our discussion leads to a concern that tribal rights or resources may be adversely affected by one or more of the projects, we will arrange for further government-to-government consultation. Your comments and concerns will be considered and will enable the Navy to address potential issues prior to implementation.

In addition to the new projects listed above, the Navy would like to continue our discussions about two projects previously discussed, the Land Water Interface and Electromagnetic Measurement Range projects.

SUBJECT: INVITATION TO INITIATE GOVERNMENT-TO-GOVERNMENT CONSULTATION FOR PROJECTS AT NAVAL BASE KITSAP

I look forward to working with you to address any concerns or provide additional information you may need. Please feel to contact me or my Environmental Director, Mr. Greg Leicht, (360) 315-5411 or gregory.leicht@navy.mil, with any questions or comments.

Sincerely,

P. M. DAWSON
Captain, U.S. Navy
Commanding Officer

Enclosure: 1. Major Upcoming Projects at Naval Base Kitsap, July 2012

Major Upcoming Projects at Naval Base Kitsap
June 2012

- Bangor, Service Pier Barge Moorage

  The proposed project would install 16 steel pipe piles inboard of the Service Pier to moor a new 260'x 85' research barge. The existing 1940's research barge, presently moored outboard of the Service Pier would be removed, and a 50 foot section of a floating pier would be relocated. The mooring piles for the existing barge and pier would be removed. This work is scheduled for fiscal year 2013.

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  The proposed project would install a 500' x 66' extension on the southern end of the Service Pier. The pier would parallel the Carlson Spit shoreline at the -40 to -60 MLLW water depth. The purpose of the project is to provide berthing for two submarines presently berthed in Bremerton. The project would involve driving an estimated 320 steel pipe piles. This project is proposed for fiscal year 2015.

- Bangor, Swimmer Net Test

  The proposed project would install a net adjacent to the Magnetic Silencing Facility for approximately 1 year. The net would be approximately 100'long x 24'to 36' high, at water depths between -18' and -6'MLLW. It would be secured to the Magnetic Silencing Facility trestle. It would be anchored with steel plate anchors. The net would have 7" x 7" openings. This project is proposed for fiscal year 2013.

- Pile Repair and Replacement

  The proposed project would repair or replace 280 existing deteriorated piles at Bangor and Zelatched Point from fiscal year 2013 through 2018.

Enclosure (1)

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U.S. Navy to Jamestown S'Klallam Tribe, July 23, 2012

DEPARTMENT OF THE NAVY
NAVAL BASE KITSAP
120 SOUTH DEWEY ST
BREMERTON, WA 98314-5020

5090
Ser PRB4/00574
23 Jul 12

Jamestown S'Klallam Tribe
The Honorable W. Ron Allen
1033 Old Blyn Hwy
Sequim, WA 98382

Dear Chairman Allen:

SUBJECT: INVITATION TO INITIATE GOVERNMENT-TO-GOVERNMENT CONSULTATION FOR PROJECTS AT NAVAL BASE KITSAP

I am writing to inform you of several facility construction projects and operational activities being planned for Naval Base Kitsap. Some of the anticipated projects may be of interest to your tribe. The proposed actions, which are described in more detail in the attached enclosure, include the following:

- Bangor, Service Pier Barge Moorage
- Bangor, Relocate Floats to Delta Pier
- Bangor, Service Pier Extension
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- Bangor, Pile Repair and Replacement

Pursuant to the Navy's American Indian/Alaska Native policy, I would like to extend the opportunity to review these actions and evaluate whether you believe there would be significant impacts on tribal treaty harvest rights or cultural resources resulting from the implementation of any of the actions. My staff will be coordinated with your staff, and a brief for you will be proposed for the near future. If our discussion leads to a concern that tribal rights or resources may be adversely affected by one or more of the projects, we will arrange for further government-to-government consultation. Your comments and concerns will be considered and will enable the Navy to address potential issues prior to implementation.

In addition to the new projects listed above, the Navy would like to continue our discussions about two projects previously discussed, the Land Water Interface and Electromagnetic Measurement Range projects.

SUBJECT: INVITATION TO INITIATE GOVERNMENT-TO-GOVERNMENT CONSULTATION FOR PROJECTS AT NAVAL BASE KITSAP

I look forward to working with you to address any concerns or provide additional information you may need. Please feel to contact me or my Environmental Director, Mr. Greg Leicht, (360) 315-5411 or gregory.leicht@navy.mil, with any questions or comments.

Sincerely,

P. M. DAWSON
Captain, U.S. Navy
Commanding Officer

Enclosure: 1. Major Upcoming Projects at Naval Base Kitsap, July 2012

Major Upcoming Projects at Naval Base Kitsap
June 2012

- Bangor, Service Pier Barge Moorage

  The proposed project would install 16 steel pipe piles inboard of the Service Pier to moor a new 260'x 85' research barge. The existing 1940's research barge, presently moored outboard of the Service Pier would be removed, and a 50 foot section of a floating pier would be relocated. The mooring piles for the existing barge and pier would be removed. This work is scheduled for fiscal year 2013.

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  The proposed project would install a 500' x 66' extension on the southern end of the Service Pier. The pier would parallel the Carlson Spit shoreline at the -40 to -60 MLLW water depth. The purpose of the project is to provide berthing for two submarines presently berthed in Bremerton. The project would involve driving an estimated 320 steel pipe piles. This project is proposed for fiscal year 2015.

- Bangor, Swimmer Net Test

  The proposed project would install a net adjacent to the Magnetic Silencing Facility for approximately 1 year. The net would be approximately 100'long x 24'to 36' high, at water depths between -18' and -6'MLLW. It would be secured to the Magnetic Silencing Facility trestle. It would be anchored with steel plate anchors. The net would have 7" x 7" openings. This project is proposed for fiscal year 2013.

- Bangor, Pile Repair and Replacement

  The proposed project would repair or replace 280 existing deteriorated piles at Bangor and Zelatched Point from fiscal year 2013 through 2018.

Enclosure (1)

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U.S. Navy to Lower Elwha Klallam Tribe, July 23, 2012

DEPARTMENT OF THE NAVY
NAVAL BASE KITSAP
120 SOUTH DEWEY ST
BREMERTON, WA 98314-5020

5090
Ser PRB4/00573
23 Jul 12

The Lower Elwha Klallam Tribe
The Honorable Frances Charles
2851 Lower Elwha Road
Port Angeles WA 98362

Dear Chairwoman Charles:

SUBJECT: INVITATION TO INITIATE GOVERNMENT-TO-GOVERNMENT CONSULTATION FOR PROJECTS AT NAVAL BASE KITSAP

I am writing to inform you of several facility construction projects and operational activities being planned for Naval Base Kitsap. Some of the anticipated projects may be of interest to your tribe. The proposed actions, which are described in more detail in the attached enclosure, include the following:

- Bangor, Service Pier Barge Moorage
- Bangor, Relocate Floats to Delta Pier
- Bangor, Service Pier Extension
- Bangor, Swimmer Net Test
- Bangor, Pile Repair and Replacement

Pursuant to the Navy's American Indian/Alaska Native policy, I would like to extend the opportunity to review these actions and evaluate whether you believe there would be significant impacts on tribal treaty harvest rights or cultural resources resulting from the implementation of any of the actions. My staff will be coordinated with your staff, and a brief for you will be proposed for the near future. If our discussion leads to a concern that tribal rights or resources may be adversely affected by one or more of the projects, we will arrange for further government-to-government consultation. Your comments and concerns will be considered and will enable the Navy to address potential issues prior to implementation.

In addition to the new projects listed above, the Navy would like to continue our discussions about two projects previously discussed, the Land Water Interface and Electromagnetic Measurement Range projects.

SUBJECT: INVITATION TO INITIATE GOVERNMENT-TO-GOVERNMENT CONSULTATION FOR PROJECTS AT NAVAL BASE KITSAP

I look forward to working with you to address any concerns or provide additional information you may need. Please feel to contact me or my Environmental Director, Mr. Greg Leicht, (360) 315-5411 or gregory.leicht@navy.mil, with any questions or comments.

Sincerely,

P. M. DAWSON
Captain, U.S. Navy
Commanding Officer

Enclosure: 1. Major Upcoming Projects at Naval Base Kitsap, July 2012

2

Major Upcoming Projects at Naval Base Kitsap
June 2012

- Bangor, Service Pier Barge Moorage
  The proposed project would install 16 steel pipe piles inboard of the Service Pier to moor a new 260'x 85' research barge. The existing 1940's research barge, presently moored outboard of the Service Pier would be removed, and a 50 foot section of a floating pier would be relocated. The mooring piles for the existing barge and pier would be removed. This work is scheduled for fiscal year 2013.

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- Bangor, Swimmer Net Test
  The proposed project would install a net adjacent to the Magnetic Silencing Facility for approximately 1 year. The net would be approximately 100'long x 24'to 36' high, at water depths between -18' and -6'MLLW. It would be secured to the Magnetic Silencing Facility trestle. It would be anchored with steel plate anchors. The net would have 7" x 7" openings. This project is proposed for fiscal year 2013.

- Pile Repair and Replacement
  The proposed project would repair or replace 280 existing deteriorated piles at Bangor and Zelatched Point from fiscal year 2013 through 2018.

Enclosure (1)

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U.S. Navy to Suquamish Tribe, July 23, 2012

DEPARTMENT OF THE NAVY
NAVAL BASE KITSAP
120 SOUTH DEWEY ST
BREMERTON, WA 98314-5020

5090
Ser PRB4/00572
23 Jul 12

The Suquamish Tribe
The Honorable Leonard Forsman
PO Box 498
Suquamish WA 98392

Dear Chairman Forsman:

SUBJECT: INVITATION TO INITIATE GOVERNMENT-TO-GOVERNMENT CONSULTATION FOR PROJECTS AT NAVAL BASE KITSAP

I am writing to inform you of several facility construction projects and operational activities being planned for Naval Base Kitsap. Some of the anticipated projects may be of interest to your tribe. The proposed actions, which are described in more detail in the attached enclosure, include the following:

- Bangor, Service Pier Barge Moorage
- Bangor, Relocate Floats to Delta Pier
- Bangor, Service Pier Extension
- Bangor, Swimmer Net Test
- Several Facilities, Pile Repair and Replacement
- Bremerton, Chico Creek Trestle

Pursuant to the Navy's American Indian/Alaska Native policy, I would like to extend the opportunity to review these actions and evaluate whether you believe there would be significant impacts on tribal treaty harvest rights or cultural resources resulting from the implementation of any of the actions. My staff will be coordinated with your staff, and a brief for you will be proposed for the near future. If our discussion leads to a concern that tribal rights or resources may be adversely affected by one or more of the projects, we will arrange for further government-to-government consultation. Your comments and concerns will be considered and will enable the Navy to address potential issues prior to implementation.

In addition to the new projects listed above, the Navy would like to continue our discussions about two projects previously discussed, the Land Water Interface and Electromagnetic Measurement Range projects.

SUBJECT: INVITATION TO INITIATE GOVERNMENT-TO-GOVERNMENT CONSULTATION FOR PROJECTS AT NAVAL BASE KITSAP

I look forward to working with you to address any concerns or provide additional information you may need. Please feel to contact me or my Environmental Director, Mr. Greg Leicht, (360) 315-5411 or gregory.leicht@navy.mil, with any questions or comments.

Sincerely,

P. M. DAWSON
Captain, U.S. Navy
Commanding Officer

Enclosure: 1. Major Upcoming Projects at Naval Base Kitsap, July 2012

2

Major Upcoming Projects at Naval Base Kitsap
June 2012

- Bangor, Service Pier Barge Moorage

The proposed project would install 16 steel pipe piles inboard of the Service Pier to moor a new 260'x 85' research barge. The existing 1940's research barge, presently moored outboard of the Service Pier would be removed, and a 50 foot section of a floating pier would be relocated. The mooring piles for the existing barge and pier would be removed. This work is scheduled for fiscal year 2013.

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- Several Facilities, Pile Repair and Replacement

The proposed project would repair or replace 280 existing deteriorated piles at Bangor and Zelatched Point, and 950 piles at Bremerton, Keyport and Manchester. The project would occur from fiscal year 2013 through 2018.

- Bremerton, Chico Creek Trestle

Enclosure (1)

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U.S. Navy to Lummi Nation, December 8, 2016

DEPARTMENT OF THE NAVY
NAVAL STATION EVERETT
2000 WEST MARINE VIEW DRIVE
EVERETT, WA 98207-5001

IN REPLY REFER TO
5090
N4
December 8, 2016

The Honorable Tim Ballew, II
Lummi Nation
2616 Kwina Road
Bellingham, WA 98226

Dear Chairman Ballew,

I am writing to inform you that the U.S. Navy is proposing to conduct maintenance and repair activities at marine waterfront structures over a five-year period at six of the Navy installations in Puget Sound including Naval Station (NAVSTA) Everett in Everett, Washington. I welcome your comments, including whether the proposed action would significantly affect tribal rights and protected tribal resources at NAVSTA Everett.

The proposed activities include maintenance and repairs at existing marine structures including replacement of in-water piles. It is anticipated that these activities would occur from July 2018 through July 2023. In addition to NAVSTA Everett, the proposed action also includes activities at Naval Base Kitsap (NBK) Bangor, NBK Bremerton, NBK Keyport, NBK Manchester and Zelatched Point (Enclosure 1). The proposed maintenance and repairs are necessary to maintain the structural integrity of marine waterfront structures onboard NAVSTA Everett and ensure the U.S. Navy's support facilities continue to meet mission requirements.

While the study area for the proposed action includes other U.S. Navy installations, the portion of work proposed for NAVSTA Everett consists of replacement of up to 77 concrete or timber piles and one steel pile during five years of project activities. There are nine pile-supported structures onboard NAVSTA Everett which include Piers A, B, C, D and E; North Wharf and South Wharf; the recreational marina; the small boat launch and fender piles along the waterfront areas (Enclosure 2). General maintenance and repair activities would include deck resurfacing and recoating various corroded metal components. Damaged or deteriorated components would be repaired or replaced, including guide pile systems, brow floats, pile caps, safety ladders, cable straps, camel and camel connections and lighting.

COPY

5090
N4
December 8, 2016

Pursuant to the U.S. Navy's policies for consultation with federally-recognized American Indian tribes, I ask you to consider whether implementation of the proposed action onboard NAVSTA Everett has the potential to significantly affect tribal rights or protected tribal resources. If you determine there may be a potential for significant affects onboard NAVSTA Everett, please specify which tribal rights and resources will be affected and how they will be significantly affected. If you indicate tribal rights or resources are affected, we invite you to consider initiating government-to-government consultation as a way to discuss issues and concerns before we move forward. Please provide your response to this letter and whether government-to-government consultation is desired within 60 days.

We look forward to working with you to address any concerns you may have regarding this proposed action onboard NAVSTA Everett. If you have questions or concerns, please contact me directly at (425) 304-3325 or mark.lakamp@navy.mil. Please feel free to have your staff contact Ms. Jennifer Sullivan, NAVSTA Everett Cultural Resources Manager, at (425) 304-3464 or jennifer.sullivan@navy.mil.

Sincerely,

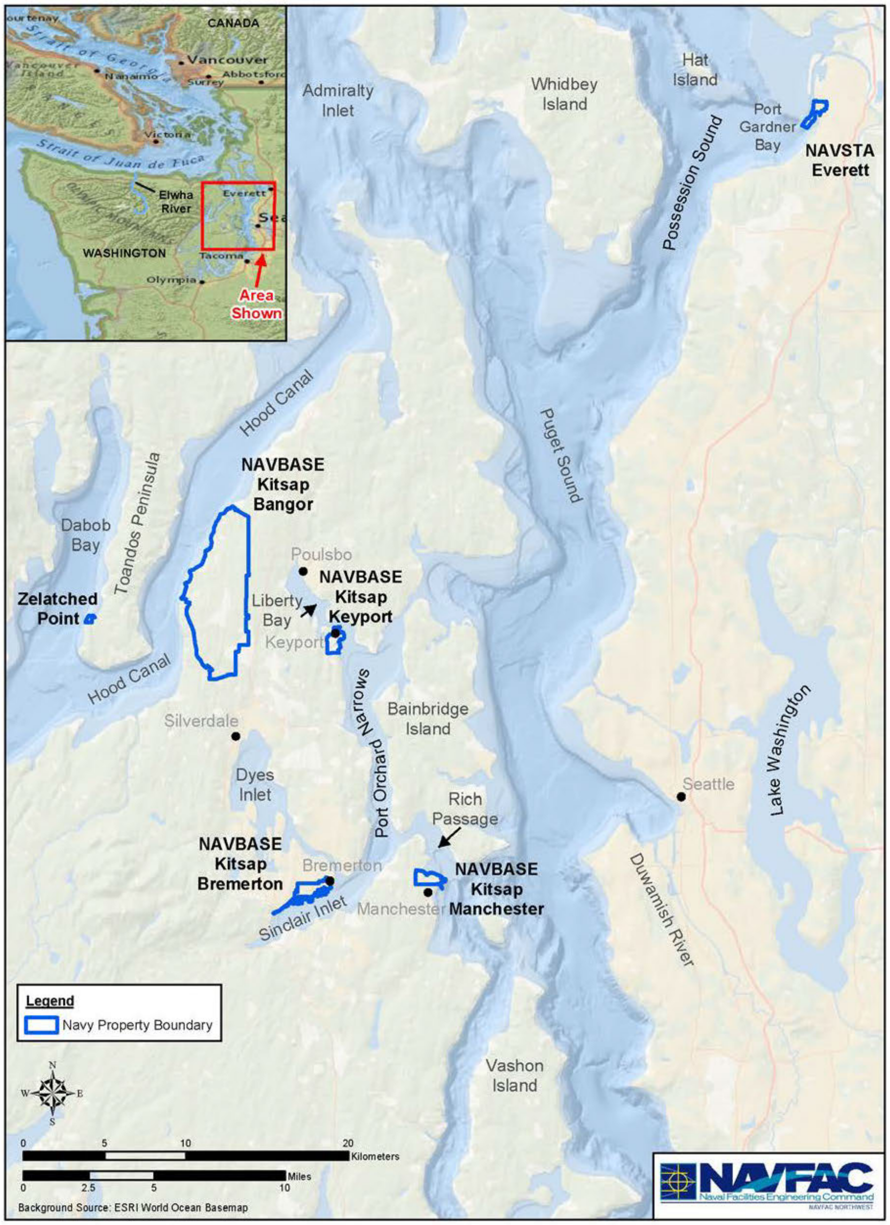
M. A. LAKAMP
Captain, U.S. Navy
Commanding Officer

Enclosures: 1. Navy Locations Included in Marine Structures Maintenance and Pile Replacement Activities
2. Naval Station Everett Map

Copy to: Mr. Jeremy Freimund, Water Resource Manager
Ms. Lena Tso, Tribal Historic Preservation Officer

2

Enclosure 1. Navy Locations Included in Marine Structures Maintenance and Pile Replacement Activities



Enclosure (1)

Enclosure 2: Naval Station Everett Map

Enclosure (2)

U.S. Navy to Suquamish Tribe, December 8, 2016

DEPARTMENT OF THE NAVY
NAVAL STATION EVERETT
2000 WEST MARINE VIEW DRIVE
EVERETT, WA 98207-5001

IN REPLY REFER TO
5090
N4
December 8, 2016

The Honorable Leonard Forsman
Suquamish Tribe
PO Box 498
Suquamish, WA 98392

Dear Chairman Forsman,

I am writing to inform you that the U.S. Navy is proposing to conduct maintenance and repair activities at marine waterfront structures over a five-year period at six of the Navy installations in Puget Sound including Naval Station (NAVSTA) Everett in Everett, Washington. I welcome your comments, including whether the proposed action would significantly affect tribal rights and protected tribal resources at NAVSTA Everett.

The proposed activities include maintenance and repairs at existing marine structures including replacement of in-water piles. It is anticipated that these activities would occur from July 2018 through July 2023. In addition to NAVSTA Everett, the proposed action also includes activities at Naval Base Kitsap (NBK) Bangor, NBK Bremerton, NBK Keyport, NBK Manchester and Zelatched Point (Enclosure 1). The proposed maintenance and repairs are necessary to maintain the structural integrity of marine waterfront structures onboard NAVSTA Everett and ensure the U.S. Navy's support facilities continue to meet mission requirements.

While the study area for the proposed action includes other U.S. Navy installations, the portion of work proposed for NAVSTA Everett consists of replacement of up to 77 concrete or timber piles and one steel pile during five years of project activities. There are nine pile-supported structures onboard NAVSTA Everett which include Piers A, B, C, D and E; North Wharf and South Wharf; the recreational marina; the small boat launch and fender piles along the waterfront areas (Enclosure 2). General maintenance and repair activities would include deck resurfacing and recoating various corroded metal components. Damaged or deteriorated components would be repaired or replaced, including guide pile systems, brow floats, pile caps, safety ladders, cable straps, camel and camel connections and lighting.

5090
N4
December 8, 2016

Pursuant to the U.S. Navy's policies for consultation with federally-recognized American Indian tribes, I ask you to consider whether implementation of the proposed action onboard NAVSTA Everett has the potential to significantly affect tribal rights or protected tribal resources. If you determine there may be a potential for significant affects onboard NAVSTA Everett, please specify which tribal rights and resources will be affected and how they will be significantly affected. If you indicate tribal rights or resources are affected, we invite you to consider initiating government-to-government consultation as a way to discuss issues and concerns before we move forward. Please provide your response to this letter and whether government-to-government consultation is desired within 60 days.

We look forward to working with you to address any concerns you may have regarding this proposed action onboard NAVSTA Everett. If you have questions or concerns, please contact me directly at (425) 304-3325 or mark.lakamp@navy.mil. Please feel free to have your staff contact Ms. Jennifer Sullivan, NAVSTA Everett Cultural Resources Manager, at (425) 304-3464 or jennifer.sullivan@navy.mil.

Sincerely,

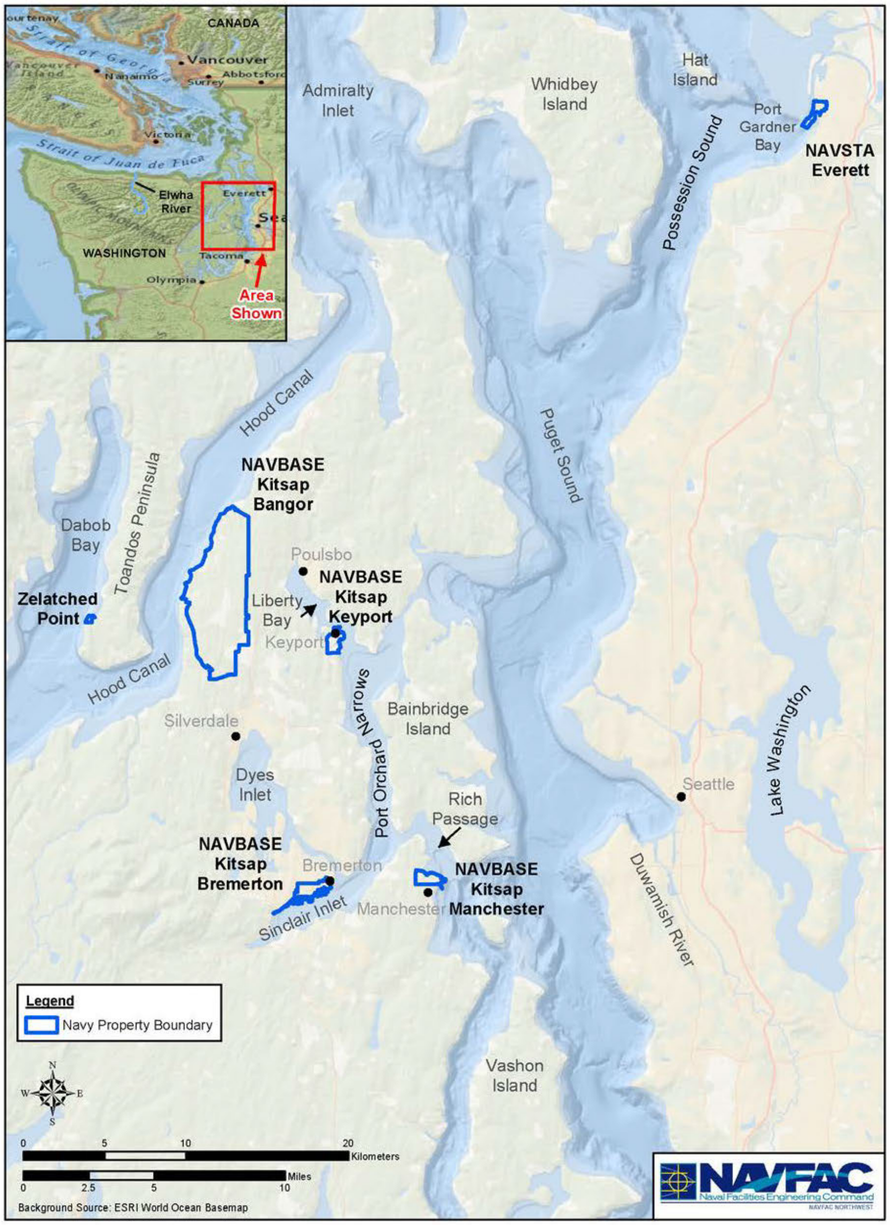
M. A. LAKAMP
Captain, U.S. Navy
Commanding Officer

Enclosures: 1. Navy Locations Included in Marine Structures Maintenance and Pile Replacement Activities
2. Naval Station Everett Map

Copy to: Mr. Steve Todd, Suquamish Fisheries Department
Mr. Dennis Lewarch, Suquamish Tribal Historic Preservation Officer

2

Enclosure 1. Navy Locations Included in Marine Structures Maintenance and Pile Replacement Activities



Enclosure (1)

Enclosure 2: Naval Station Everett Map

Enclosure (2)

U.S. Navy to Swinomish Indian Tribal Community, December 8, 2016

DEPARTMENT OF THE NAVY
NAVAL STATION EVERETT
2000 WEST MARINE VIEW DRIVE
EVERETT, WA 98207-5001

IN REPLY REFER TO
5090
N4
December 8, 2016

The Honorable Brian Cladoosby
Swinomish Indian Tribal Community
11404 Moorage Way
LaConner, WA 98257

Dear Chairman Cladoosby,

I am writing to inform you that the U.S. Navy is proposing to conduct maintenance and repair activities at marine waterfront structures over a five-year period at six of the Navy installations in Puget Sound including Naval Station (NAVSTA) Everett in Everett, Washington. I welcome your comments, including whether the proposed action would significantly affect tribal rights and protected tribal resources at NAVSTA Everett.

The proposed activities include maintenance and repairs at existing marine structures including replacement of in-water piles. It is anticipated that these activities would occur from July 2018 through July 2023. In addition to NAVSTA Everett, the proposed action also includes activities at Naval Base Kitsap (NBK) Bangor, NBK Bremerton, NBK Keyport, NBK Manchester and Zelatched Point (Enclosure 1). The proposed maintenance and repairs are necessary to maintain the structural integrity of marine waterfront structures onboard NAVSTA Everett and ensure the U.S. Navy's support facilities continue to meet mission requirements.

While the study area for the proposed action includes other U.S. Navy installations, the portion of work proposed for NAVSTA Everett consists of replacement of up to 77 concrete or timber piles and one steel pile during five years of project activities. There are nine pile-supported structures onboard NAVSTA Everett which include Piers A, B, C, D and E; North Wharf and South Wharf; the recreational marina; the small boat launch and fender piles along the waterfront areas (Enclosure 2). General maintenance and repair activities would include deck resurfacing and recoating various corroded metal components. Damaged or deteriorated components would be repaired or replaced, including guide pile systems, brow floats, pile caps, safety ladders, cable straps, camel and camel connections and lighting.

5090
N4
December 8, 2016

Pursuant to the U.S. Navy's policies for consultation with federally-recognized American Indian tribes, I ask you to consider whether implementation of the proposed action onboard NAVSTA Everett has the potential to significantly affect tribal rights or protected tribal resources. If you determine there may be a potential for significant affects onboard NAVSTA Everett, please specify which tribal rights and resources will be affected and how they will be significantly affected. If you indicate tribal rights or resources are affected, we invite you to consider initiating government-to-government consultation as a way to discuss issues and concerns before we move forward. Please provide your response to this letter and whether government-to-government consultation is desired within 60 days.

We look forward to working with you to address any concerns you may have regarding this proposed action onboard NAVSTA Everett. If you have questions or concerns, please contact me directly at (425) 304-3325 or mark.lakamp@navy.mil. Please feel free to have your staff contact Ms. Jennifer Sullivan, NAVSTA Everett Cultural Resources Manager, at (425) 304-3464 or jennifer.sullivan@navy.mil.

Sincerely,

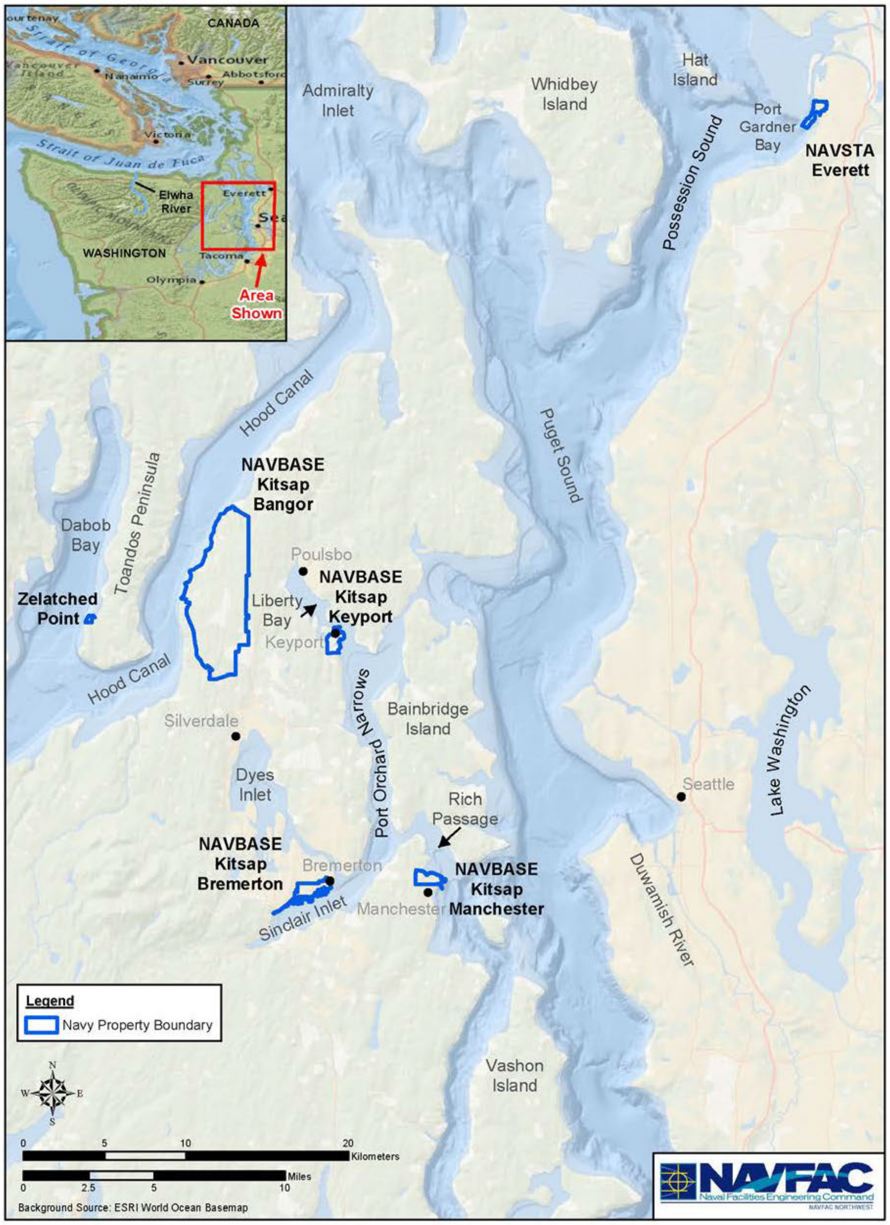
M. A. LAKAMP
Captain, U.S. Navy
Commanding Officer

Enclosures: 1. Navy Locations Included in Marine Structures Maintenance and Pile Replacement Activities
2. Naval Station Everett Map

Copy to: Mr. Todd Mitchell, Environmental Director
Ms. Josephine Jefferson, Cultural Resource Technician

2

Enclosure 1. Navy Locations Included in Marine Structures Maintenance and Pile Replacement Activities



Enclosure (1)

Enclosure 2: Naval Station Everett Map

Enclosure (2)

U.S. Navy to Tulalip Tribes of Washington, December 8, 2016

DEPARTMENT OF THE NAVY
NAVAL STATION EVERETT
2000 WEST MARINE VIEW DRIVE
EVERETT, WA 98207-5001

IN REPLY REFER TO
5090
N4
December 8, 2016

The Honorable Melvin Sheldon, Jr.
The Tulalip Tribes of Washington
6406 Marine Drive
Tulalip, WA 98271

Dear Chairman Sheldon,

I am writing to inform you that the U.S. Navy is proposing to conduct maintenance and repair activities at marine waterfront structures over a five-year period at six of the Navy installations in Puget Sound including Naval Station (NAVSTA) Everett in Everett, Washington. I welcome your comments, including whether the proposed action would significantly affect tribal rights and protected tribal resources at NAVSTA Everett.

The proposed activities include maintenance and repairs at existing marine structures including replacement of in-water piles. It is anticipated that these activities would occur from July 2018 through July 2023. In addition to NAVSTA Everett, the proposed action also includes activities at Naval Base Kitsap (NBK) Bangor, NBK Bremerton, NBK Keyport, NBK Manchester and Zelatched Point (Enclosure 1). The proposed maintenance and repairs are necessary to maintain the structural integrity of marine waterfront structures onboard NAVSTA Everett and ensure the U.S. Navy's support facilities continue to meet mission requirements.

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December 8, 2016

Pursuant to the U.S. Navy's policies for consultation with federally-recognized American Indian tribes, I ask you to consider whether implementation of the proposed action onboard NAVSTA Everett has the potential to significantly affect tribal rights or protected tribal resources. If you determine there may be a potential for significant affects onboard NAVSTA Everett, please specify which tribal rights and resources will be affected and how they will be significantly affected. If you indicate tribal rights or resources are affected, we invite you to consider initiating government-to-government consultation as a way to discuss issues and concerns before we move forward. Please provide your response to this letter and whether government-to-government consultation is desired within 60 days.

We look forward to working with you to address any concerns you may have regarding this proposed action onboard NAVSTA Everett. If you have questions or concerns, please contact me directly at (425) 304-3325 or mark.lakamp@navy.mil. Please feel free to have your staff contact Ms. Jennifer Sullivan, NAVSTA Everett Cultural Resources Manager, at (425) 304-3464 or jennifer.sullivan@navy.mil.

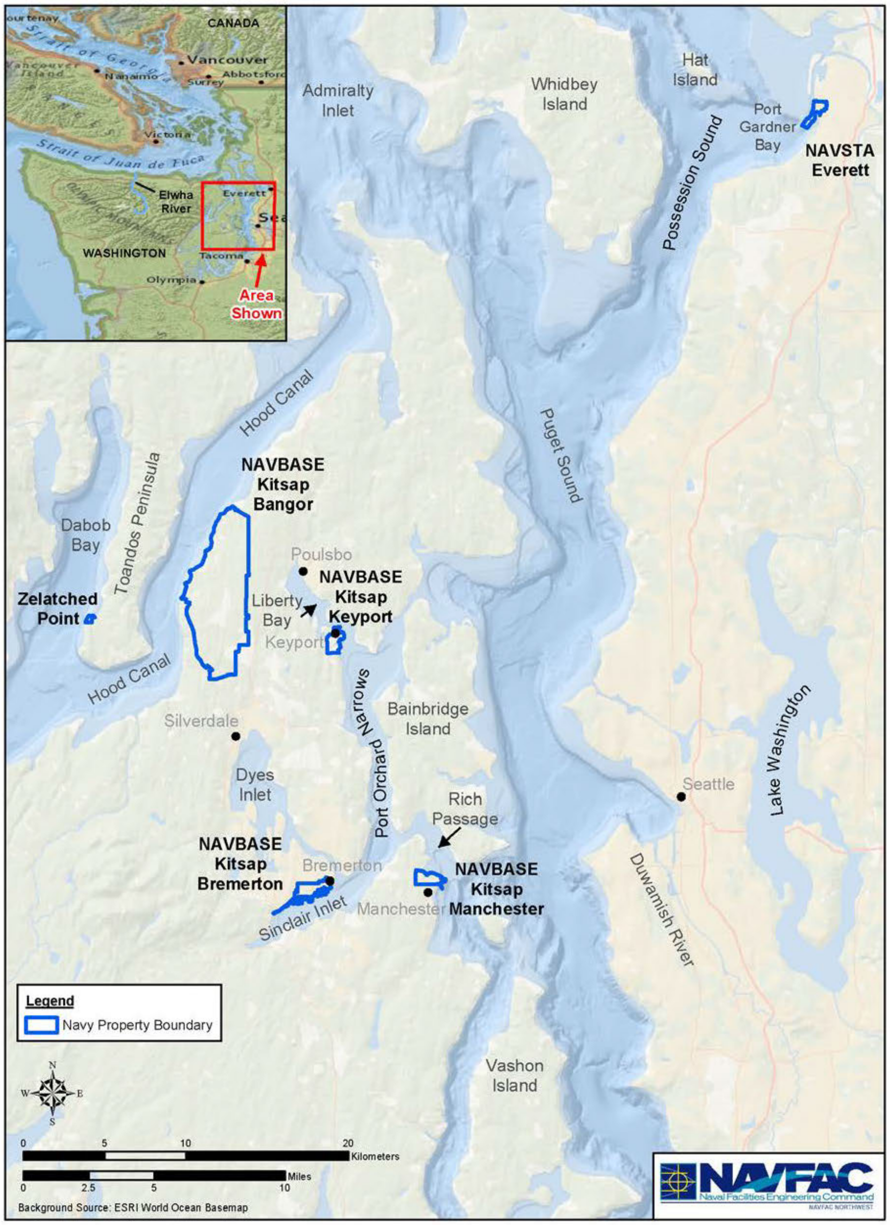
Sincerely,

M. A. LAKAMP
Captain, U.S. Navy
Commanding Officer

Enclosures: 1. Navy Locations Included in Marine Structures Maintenance and Pile Replacement Activities
2. Naval Station Everett Map

Copy to: Mr. Kurt Nelson, Tulalip Natural Resources
Mr. Richard Young, Tulalip Cultural Resources

Enclosure 1. Navy Locations Included in Marine Structures Maintenance and Pile Replacement Activities



Enclosure (1)

Enclosure 2: Naval Station Everett Map

Enclosure (2)

U.S. Navy to Jamestown S'Klallam Tribe, March 13, 2019

DEPARTMENT OF THE NAVY
NAVAL MAGAZINE INDIAN ISLAND
100 INDIAN ISLAND ROAD
PORT HADLOCK, WA 98339-9723

5090
Ser PRB4/065
March 13, 2019

The Honorable W. Ron Allen
Jamestown S'Klallam Tribe
1033 Old Blyn Highway
Sequim, WA 98382

Dear Chairman Allen:

SUBJECT: INVITATION TO INITIATE GOVERNMENT-TO-GOVERNMENT CONSULTATION FOR THE REPLACEMNT OF NINE PILES ON THE AMMUNITION WHARF AT NAVAL MAGAZINE INDIAN ISLAND PORT HADLOCK, WA

I am writing to inform you of a proposed project to replace nine 24" diameter concrete piles on the Ammunition Wharf at Naval Magazine Indian Island. The project would also include the manual surface preparation and recoating the upper portion of 156 steel fender piles.

There would be two mechanisms available for the contractor to install the piles: jetting and impact driving. Installing the piles by jetting process is done by attaching a 2.5" water hose to a pipe installed in the center of the new pile and pumping water into the pipe at approximately 400-500 pounds per square inch. Impact pile driving is done by attaching an impact hammer to the top of the pile being driven and energizing the hammer until the pile is driven to the appropriate depth. Jetting each pile takes approximately 40 minutes. Up to two piles would be installed per day. Pile installation would occur within the approved in-water work window of October 1 to January 15.

Pursuant to the Navy's policy for American Indian/Alaska Native tribal government-to-government consultation, I would like to extend the opportunity for you to review the proposed action and to evaluate whether you believe there would be a potential to significantly affect tribal treaty rights or resources resulting from the implementation of the proposed action. Your comments and concerns will be considered and will enable the Navy to address potential issues.

Please let us know if you would like more information about the project. If you believe that tribal rights or resources may be adversely affected by the project, we will arrange for government-to-government consultation. We would appreciate hearing from you within 30 days.

I can be contacted at (360) 396-5227 (work), (360) 340-6609 (cell), or e-mail rocky.pulley@navy.mil. My Environmental Director, Mr. Greg Leicht can be reached at (360) 315-5411 (work), (360) 649-1623 (cell), or e-mail gregory.leicht@navy.mil.

Sincerely,

ROCKY B. PULLEY
Commander, U.S. Navy
Commanding Officer

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U.S. Navy to The Lower Elwha Klallam Tribe, March 13, 2019

DEPARTMENT OF THE NAVY
NAVAL MAGAZINE INDIAN ISLAND
100 INDIAN ISLAND ROAD
PORT HADLOCK, WA 98339-9723

5090
Ser PRB4/066
March 13, 2019

The Honorable Frances Charles
The Lower Elwha Klallam Tribe
2851 Lower Elwha Road
Port Angeles, WA 98362

Dear Chairwoman Charles:

SUBJECT: INVITATION TO INITIATE GOVERNMENT-TO-GOVERNMENT CONSULTATION FOR THE REPLACEMNT OF NINE PILES ON THE AMMUNITION WHARF AT NAVAL MAGAZINE INDIAN ISLAND PORT HADLOCK, WA

I am writing to inform you of a proposed project to replace nine 24" diameter concrete piles on the Ammunition Wharf at Naval Magazine Indian Island. The project would also include the manual surface preparation and recoating the upper portion of 156 steel fender piles.

There would be two mechanisms available for the contractor to install the piles: jetting and impact driving. Installing the piles by jetting process is done by attaching a 2.5" water hose to a pipe installed in the center of the new pile and pumping water into the pipe at approximately 400-500 pounds per square inch. Impact pile driving is done by attaching an impact hammer to the top of the pile being driven and energizing the hammer until the pile is driven to the appropriate depth. Jetting each pile takes approximately 40 minutes. Up to two piles would be installed per day. Pile installation would occur within the approved in-water work window of October 1 to January 15.

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Sincerely,

ROCKY B. PULLEY
Commander, U.S. Navy
Commanding Officer

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U.S. Navy to The Port Gamble S'Klallam Tribe, March 13, 2019

DEPARTMENT OF THE NAVY
NAVAL MAGAZINE INDIAN ISLAND
100 INDIAN ISLAND ROAD
PORT HADLOCK, WA 98339-9723

5090
Ser PRB4/067
March 13, 2019

The Honorable Jeromy Sullivan
Port Gamble S'Klallam Tribe
31912 Little Boston Road NE
Kingston, WA 98346

Dear Chairman Sullivan:

SUBJECT: INVITATION TO INITIATE GOVERNMENT-TO-GOVERNMENT CONSULTATION FOR THE REPLACEMNT OF NINE PILES ON THE AMMUNITION WHARF AT NAVAL MAGAZINE INDIAN ISLAND PORT HADLOCK, WA

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Sincerely,

ROCKY B. PULLEY
Commander, U.S. Navy
Commanding Officer

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U.S. Navy to The Suquamish Tribe, March 13, 2019

DEPARTMENT OF THE NAVY
NAVAL MAGAZINE INDIAN ISLAND
100 INDIAN ISLAND ROAD
PORT HADLOCK, WA 98339-9723

5090
Ser PRB4/068
March 13, 2019

The Honorable Leonard Forsman
The Suquamish Tribe
PO Box 498
Suquamish, WA 98392

Dear Chairman Forsman:

SUBJECT: INVITATION TO INITIATE GOVERNMENT-TO-GOVERNMENT CONSULTATION FOR THE REPLACEMNT OF NINE PILES ON THE AMMUNITION WHARF AT NAVAL MAGAZINE INDIAN ISLAND PORT HADLOCK, WA

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Please let us know if you would like more information about the project. If you believe that tribal rights or resources may be adversely affected by the project, we will arrange for government-to-government consultation. We would appreciate hearing from you within 30 days.

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Sincerely,

ROCKY B. PULLEY
Commander, U.S. Navy
Commanding Officer

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APPENDIX G

BIOLOGICAL RESOURCE CONSULTATION DOCUMENTATION

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U.S. Fish and Wildlife Service to U.S. Navy, July 27, 2017

United States Department of the Interior

FISH AND WILDLIFE SERVICE

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

In Reply Refer To:
01EWFW00-2017-I-0677

JUN 27 2017

Commander N.A. Vande Griend
Department of the Navy
Naval Base Naval Magazine Indian Island
ATTN: Bill Kalina
100 Indian Island Road
Port Hadlock, Washington 98339-9723

Dear Commander Vande Griend:

Subject: Ammunition Wharf Piling Replacement

This letter is in response to your March 7, 2017, request for our concurrence with your determinations that the proposed action on Port Townsend Bay and Indian Island, Jefferson County, Washington, "may affect, but is not likely to adversely affect" the marbled murrelet (*Brachyramphus marmoratus*) and bull trout (*Salvelinus confluentus*). We received your letter and Biological Evaluation (BE) on March 24, 2017. We requested additional information on April 14, and received the information necessary to complete consultation on May 8, 2017. This informal consultation has been completed in accordance with section 7(a)(2) of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) (ESA).

The U.S. Department of the Navy (Navy) has determined that the action will have "no effect" on additional species and critical habitat that are known to occur in Jefferson County. The U.S. Fish and Wildlife Service (Service) has no regulatory or statutory authority for concurring with "no effect" determinations, and no consultation with the Service is required. We recommend that the federal action agency document their analyses and maintain that documentation as part of their project file.

The Navy proposes to replace approximately nine 24-inch diameter concrete piles at the Naval Magazine Indian Island Ammunition Wharf. The Navy will use a water-jet(s) to install new piles. Jetting will require approximately 40 minutes per pile. The Navy will use adaptive management to control turbidity and will employ best management practices, including a silt or turbidity curtain. Installed piles will be proofed with an impact hammer. Proofing will require approximately 10 minutes per pile, and the Navy will use stacked wood blocks to attenuate sound levels.

Commander N.A. Vande Griend 2

Replacement of the piles will require approximately 6 to 10 work days in total. Additional work will include resurfacing and epoxy coating some of the existing steel fender piles. The Navy will implement best management practices to capture debris and prevent and minimize impacts to water quality.

Based on the information provided in your letter and BE, we have concluded that foreseeable effects to the federally listed marbled murrelet and bull trout are insignificant or discountable. Therefore, we concur with your "may affect, not likely to adversely affect" determinations for the marbled murrelet and bull trout. Our conclusions are based on full and successful implementation of the conservation measures described in the BE and the following rationale.

Marbled Murrelet

Available data indicate moderate to high concentrations of marbled murrelets throughout the surrounding marine waters (Port Townsend Bay, Admiralty Inlet/Oak Harbor, and outer shorelines of Indian and Marrowstone Islands). Based upon location and baseline environmental conditions, we expect that marbled murrelets use the action area regularly and in moderate numbers.

The proposed action consists of maintenance activities and will have no long-term or permanent effects to marbled murrelets, their habitat, or prey resources. Temporary, construction-related exposures and effects (i.e., elevated sound levels, turbidity) will be limited in physical extent, duration, and intensity. We expect that these temporary exposures will not result in measureable effects to normal marbled murrelet behaviors (i.e., the ability to successfully feed, move, and/or shelter), and these potential exposures and effects are therefore considered insignificant:

1. The piles to be installed are concrete. The sound pressure levels that typically result from proofing concrete piles with an impact hammer are have a more gradual rise time than the sound pressure levels that typically result from installation of steel piles. As such, the waveform of the underwater sound generated by impact proofing of concrete piles is not of the type associated with injurious effects.

2. Masking of vocalizations and communications between foraging adults can result in significant disruptions of normal marbled murrelet behaviors. When proofing 24-inch diameter concrete piles with an impact hammer, in-air sound levels sufficient to mask marbled murrelet vocalizations may extend as far as 42 meters (138 ft). Whether the masking that potentially results from pile driving or sand blasting is likely to cause a significant disruption of normal behaviors depends on a number of additional factors, including: the duration of the exposure, the probability that two or more foraging partners will experience masking, and the distance of the marbled murrelets from the sound source. Because the project will produce elevated in-air and underwater sound that is intermittent and limited in duration (i.e., a total of approximately 90 minutes over a 6- to 10-day period), the Service expects that effects to marbled murrelets from masking will be insignificant.

Commander N.A. Vande Griend 3

3. Jetting will cause elevated levels of turbidity. However, temporary impacts to water quality will be controlled by best management practices, including containment by a silt or turbidity curtain. The Service concludes that temporary increases in turbidity will be limited in physical extent and duration, will not measurably affect normal marbled murrelet behaviors, and will have no adverse effects to marbled murrelet habitat or prey resources.

Bull Trout

The action is located on Port Townsend Bay and Indian Island where, at present, bull trout are considered rare and unlikely to be present during the proposed work period. The proposed action consists of maintenance activities and will have no long-term or permanent effects to bull trout, their habitat, or prey resources. It is extremely unlikely that bull trout will be exposed to construction activities or resulting stressors, and effects are therefore considered discountable.

Conclusion

This concludes informal consultation pursuant to the regulations implementing the ESA (50 CFR 402.13). This project should be re-analyzed and re-initiation may be necessary if 1) new information reveals effects of the action that may affect listed species or critical habitat in a manner, or to an extent, not considered in this consultation, 2) if the action is subsequently modified in a manner that causes an effect to a listed species or critical habitat that was not considered in this consultation, and/or 3) a new species is listed or critical habitat is designated that may be affected by this project.

If you have any questions about this letter or our shared responsibilities under the ESA, please contact Terry Frederick at 360-534-4320 or Emily Teachout at 360-753-9583.

Sincerely,

for

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

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Federal Register Notice, August 4, 2017

Federal Register / Vol. 82, No. 149 / Friday, August 4, 2017 / Notices **36359**

SUMMARY: The Advisory Committee on Commercial Remote Sensing ("ACCRES" or "the Committee") will meet August 24, 2017.

DATES: The meeting is scheduled as follows: August 24, 2017, 9:00 a.m.–4:30 p.m. There will be a one hour lunch break from 11:45 a.m.–12:45 p.m.

ADDRESSES: The meeting will be held at the George Washington University, The Elliot School of International Affairs—Lindner Commons, 1957 E Street NW., Washington, DC 20052.

FOR FURTHER INFORMATION CONTACT: Samira Patel, NOAA/NESDIS/CRSRA, 1335 East West Highway, Room 8247, Silver Spring, Maryland 20910; (301) 713–7077 or *samira.patel@noaa.gov.*

SUPPLEMENTARY INFORMATION: As required by Section 10(a)(2) of the Federal Advisory Committee Act, 5 U.S.C. App. 2 (FACA) and its implementing regulations, *see* 41 CFR 102–3.150, notice is hereby given of the meeting of ACCRES. ACCRES was established by the Secretary of Commerce (Secretary) on May 21, 2002, to advise the Secretary of Commerce through the Under Secretary of Commerce for Oceans and Atmosphere on matters relating to the U.S. commercial remote sensing space industry and on the National Oceanic and Atmospheric Administration's activities to carry out the responsibilities of the Department of Commerce set forth in the National and Commercial Space Programs Act of 2010 (51 U.S.C. 60101 *et seq.*).

Purpose of the Meeting and Matters To Be Considered

The meeting will be open to the public pursuant to Section 10(a)(1) of the FACA. During the meeting, the Committee will receive updates on NOAA's Commercial Remote Sensing Regulatory Affairs activities, discuss updates to the new licensing conditions, and report out on committee task groups. The Committee will also discuss the new draft legislation related to commercial remote sensing activities recently introduced in the U.S. House of Representatives. The Committee will be available to receive public comments on its activities.

Special Accommodations

The meeting is physically accessible to people with disabilities. Requests for special accommodations may be directed to Samira Patel, NOAA/NESDIS/CRSRA, 1335 East West Highway, Room 8247, Silver Spring, Maryland 20910; (301) 713–7077 or *samira.patel@noaa.gov.*

Additional Information and Public Comments

Any member of the public who plans to attend the open meeting should RSVP to Samira Patel at (301) 713–7077, or *samira.patel@noaa.gov* by August 18, 2017. Any member of the public wishing further information concerning the meeting or who wishes to submit oral or written comments should contact Tahara Dawkins, Designated Federal Officer for ACCRES, NOAA/NESDIS/CRSRA, 1335 East West Highway, Room 8260, Silver Spring, Maryland 20910; (301) 713–3385 or *tahara.dawkins@noaa.gov.* Copies of the draft meeting agenda can be obtained from Samira Patel at (301) 713–7077, or *samira.patel@noaa.gov.*

ACCRES expects that public statements presented at its meetings will not be repetitive of previously-submitted oral or written statements. In general, each individual or group making an oral presentation may be limited to a total time of five minutes. Written comments sent to NOAA/NESDIS/CRSRA on or before August 18, 2017 will be provided to Committee members in advance of the meeting. Comments received too close to the meeting date will normally be provided to Committee members at the meeting.

Stephen M. Volz,

Assistant Administrator for Satellite and Information Services.

[FR Doc. 2017–16470 Filed 8–3–17; 8:45 am]

BILLING CODE 3510–HR–P

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

RIN 0648–XF590

Taking and Importing Marine Mammals; Taking Marine Mammals Incidental to U.S. Navy Marine Structure Maintenance and Pile Replacement in Washington

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Notice; receipt of application for Letters of Authorization; request for comments and information.

SUMMARY: NMFS has received a request from the U.S. Navy (Navy) for authorization to take small numbers of marine mammals incidental to conducting construction activities related to marine structure maintenance and pile replacement at facilities in Washington, over the course of five years from the date of issuance. Pursuant to regulations implementing the Marine Mammal Protection Act (MMPA), NMFS is announcing receipt of the Navy's request for the development and implementation of regulations governing the incidental taking of marine mammals. NMFS invites the public to provide information, suggestions, and comments on the Navy's application and request.

DATES: Comments and information must be received no later than September 5, 2017.

ADDRESSES: Comments on the applications should be addressed to Jolie Harrison, Chief, Permits and Conservation Division, Office of Protected Resources, National Marine Fisheries Service. Physical comments should be sent to 1315 East-West Highway, Silver Spring, MD 20910 and electronic comments should be sent to *ITP.Laws@noaa.gov.*

Instructions: NMFS is not responsible for comments sent by any other method, to any other address or individual, or received after the end of the comment period. Comments received electronically, including all attachments, must not exceed a 25-megabyte file size. Attachments to electronic comments will be accepted in Microsoft Word or Excel or Adobe PDF file formats only. All comments received are a part of the public record and will generally be posted to the Internet at *www.nmfs.noaa.gov/pr/permits/incidental/research.htm* without change. All personal identifying information (*e.g.*, name, address) voluntarily submitted by the commenter may be publicly accessible. Do not submit confidential business information or otherwise sensitive or protected information.

FOR FURTHER INFORMATION CONTACT: Ben Laws, Office of Protected Resources, NMFS, (301) 427–8401. An electronic copy of the Navy's application may be obtained online at: *www.nmfs.noaa.gov/pr/permits/incidental/construction.htm.* In case of problems accessing these documents, please call the contact listed above.

SUPPLEMENTARY INFORMATION:

Background

Sections 101(a)(5)(A) and (D) of the MMPA (16 U.S.C. 1361 *et seq.*) direct the Secretary of Commerce (as delegated to NMFS) to allow, upon request, the incidental, but not intentional, taking of small numbers of marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing) within a specified geographical region if certain findings are made and either regulations are issued or, if the taking is limited to harassment, a notice of a proposed authorization is provided to the public for review.

An authorization for incidental takings shall be granted if NMFS finds that the taking will have a negligible impact on the species or stock(s), will not have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses (where relevant), and if the permissible methods of taking and requirements pertaining to the mitigation, monitoring and reporting of such takings are set forth.

NMFS has defined "negligible impact" in 50 CFR 216.103 as an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival.

The MMPA states that the term "take" means to harass, hunt, capture, kill or attempt to harass, hunt, capture, or kill any marine mammal.

Except with respect to certain activities not pertinent here, the MMPA defines "harassment" as: Any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild (Level A harassment); or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering (Level B harassment).

Summary of Request

On July 24, 2017, NMFS received an adequate and complete application from the Navy requesting authorization for take of marine mammals incidental to construction activities related to marine structure maintenance and pile replacement at five Naval installations in Washington inland waters. The requested regulations would be valid for five years, from 2018 through 2023. The Navy plans to conduct necessary work, including impact and vibratory pile driving, to repair and maintain existing marine structures at six installations. The proposed action may incidentally expose marine mammals occurring in the vicinity to elevated levels of underwater sound, thereby resulting in incidental take, primarily by Level B harassment but also including some expected potential for Level A harassment. Therefore, the Navy requests authorization to incidentally take marine mammals.

Specified Activities

Washington Naval installations covered by this request include Naval Base Kitsap Bangor, Naval Base Kitsap Bremerton, Naval Base Kitsap Keyport, Naval Base Kitsap Manchester, Zelatched Point, and Naval Station Everett. To ensure continuance of necessary missions at these installations, the Navy must conduct annual maintenance and repair activities at existing marine waterfront structures, including removal and replacement of piles of various types and sizes. Exact timing and amount of necessary in-water work is unknown, but the Navy estimates replacing up to 822 structurally unsound piles over the 5-year period, including individual actions currently planned and estimates for future marine structure repairs. Construction will include use of impact and vibratory pile driving, including removal and installation of steel, concrete, plastic, and timber piles.

Information Solicited

Interested persons may submit information, suggestions, and comments concerning the Navy's request (see **ADDRESSES**). NMFS will consider all information, suggestions, and comments related to the request during the development of proposed regulations governing the incidental taking of marine mammals by the Navy, if appropriate.

Dated: August 1, 2017.

Catherine Marzin,

Acting Deputy Director, Office of Protected Resources, National Marine Fisheries Service.

[FR Doc. 2017–16454 Filed 8–3–17; 8:45 am]

BILLING CODE 3510–22–P

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

RIN 0648–XF541

Takes of Marine Mammals Incidental to Specified Activities; Taking Marine Mammals Incidental to a Pier Replacement Project in San Diego, CA

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Notice; proposed incidental harassment authorization; request for comments.

SUMMARY: NMFS has received a request from the U.S. Navy (Navy) for authorization to take marine mammals incidental to construction and demolition activities as part of a pier replacement project. Pursuant to the Marine Mammal Protection Act (MMPA), NMFS is requesting comments on its proposal to issue an incidental harassment authorization (IHA) to the Navy to incidentally take marine mammals, by Level B Harassment only, during the specified activity. NMFS will consider public comments prior to making any final decision on the issuance of the requested MMPA authorizations and agency responses will be summarized in the final notice of our decision.

DATES: Comments and information must be received no later than September 5, 2017.

ADDRESSES: Comments on the application should be addressed to Jolie Harrison, Chief, Permits and Conservation Division, Office of Protected Resources, National Marine Fisheries Service. Physical comments should be sent to 1315 East-West Highway, Silver Spring, MD 20910 and electronic comments should be sent to *ITP.McCue@noaa.gov.*

Instructions: NMFS is not responsible for comments sent by any other method, to any other address or individual, or received after the end of the comment period. Comments received electronically, including all attachments, must not exceed a 25-megabyte file size. Attachments to electronic comments will be accepted in Microsoft Word or Excel or Adobe PDF file formats only. All comments received are a part of the public record and will generally be posted to the Internet at *www.nmfs.noaa.gov/pr/permits/incidental/construction.htm* without change. All personal identifying information (*e.g.,* name, address) voluntarily submitted by the commenter may be publicly accessible. Do not submit confidential business information or otherwise sensitive or protected information.

FOR FURTHER INFORMATION CONTACT: Laura McCue, Office of Protected Resources, NMFS, (301) 427–8401. Electronic copies of the application and supporting documents, as well as a list of the references cited in this document, may be obtained online at: *www.nmfs.noaa.gov/pr/permits/incidental/construction.htm.* In case of problems accessing these documents, please call the contact listed above.

SUPPLEMENTARY INFORMATION:

Background

Sections 101(a)(5)(A) and (D) of the MMPA (16 U.S.C. 1361 *et seq.*) direct the Secretary of Commerce (as delegated to NMFS) to allow, upon request, the

U.S. Fish and Wildlife Service to U.S. Navy, December 15, 2017

United States Department of the Interior

FISH AND WILDLIFE SERVICE

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

DEC 15 2017

In Reply Refer To:
01EWFW00-2016-I-1229

C.M. Kurgan
Captain, CEC, U. S. Navy
Regional Director for Facilities and Environmental
Navy Region Northwest
1100 Hunley Rd.
Silverdale, Washington 98315-1100

Dear Captain Kurgan:

Subject: Marine Structure Maintenance and Pile Replacement Activities, Navy Region Northwest

This letter is in response to your August 18, 2016, request for informal consultation on the above-named project at Naval Base Kitsap at Bangor, Bremerton, Keyport, and Manchester, as well as at Naval Station Everett and at the Navy facility at Zelatched Point. The U.S. Fish and Wildlife Service (Service) received your letter and biological assessment on August 25, 2016. Your letter requested our concurrence with "may affect, not likely to adversely affect" determinations for the bull trout (*Salvelinus confluentus*), the marbled murrelet (*Brachyramphus marmoratus*), and designated bull trout critical habitat. This informal consultation has been completed in accordance with section 7(a)(2) of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*).

Navy Region Northwest (Navy) proposes to perform maintenance and repair activities at various piers, wharves, and other marine pile-supported structures over the next five years. General maintenance will include deck resurfacing and recoating various corroded metal components. Repair activities will be performed on wetwell concrete spalling, piers (including repairs to piles), and quay walls. Damaged or deteriorated components will be repaired or replaced, including guide piles systems, brow floats, pile caps, safety ladders, cable straps, camel and camel connections, and lighting.

The proposed action includes extraction and replacement of approximately 822 structurally unsound piles. Of the new piles that will be installed, as many as 160 will be steel piles with a maximum diameter of 36 inches and as many as 100 steel piles that will be either sheet piles or pipe piles with a maximum diameter of 14 inches. Steel piles will be installed at each location except for Manchester. The remaining piles will be concrete, timber, or plastic piles. Piles will be installed with a vibratory pile driver to the extent possible, but impact hammers may be used to proof piles with as many as 4,000 total strikes per day.

The Navy will use a bubble curtain or other attenuation device while impact driving steel piles at Bangor, Keyport, and Zelatched Point to decrease the sound pressure level that will be transmitted into the environment, and the Navy will ensure the attenuation device's performance through hydroacoustic monitoring when installing more than three piles at a time. The Navy will also conduct monitoring for marbled murrelets (following Service protocol enclosed) and pile driving will cease if marbled murrelets are observed in the areas of injury or masking. Refer to Table 1 for the radii of those areas.

Table 1. Radii of effects areas for marbled murrelet monitorin in meters

	Effect Type	
Work site	**Injury**	**Masking** (When impact pile-diving more than intermittent proofing)
Bangor	36	168
Bremerton	34	42
Everett	102	168
Keyport	63	168
Zelatched Point	63	168

The Navy will also implement conservation measures to further reduce exposure of bull trout or marbled murrelet to stressors including:

1. In-water work will occur during in-water work windows
2. All in-water construction will occur during daylight hours except during the marbled murrelet nesting season when impact pile driving will not occur close to dawn and dusk
3. Impact pile driving will be preceded by soft start procedures

Impact and vibratory pile driving can cause sound pressure levels (SPLs) that disrupt the typical behavior of bull trout and marbled murrelets. However, the proposed action will generate noise from pile driving for a maximum of four hours per day at any location. We do not expect pile installation over that short time frame to result in any measureable effects on the behavior of bull trout or marbled murrelets. The behavioral effects to bull trout and marbled murrelets from the proposed action are therefore insignificant.

We do not associate installation of wood, concrete, or plastic piles with injurious SPLs because the SPLs from those piles have a slower pressure increase (relative to steel piles) causing less stress on bull trout and marbled murrelet tissues. Therefore the effects of impact pile driving wood, concrete, or plastic piles to bull trout and marbled murrelets will be insignificant.

Impact pile driving steel piles can cause underwater SPLs that injure bull trout and marbled murrelets.

Bull trout occurrence is rare or unlikely around the Kitsap Peninsula including the eastern shore of Hood Canal. Therefore, exposure of bull trout to stressors from construction the construction activities at Bangor, Bremerton, and Keyport (there will be no steel piles installed at Manchester) is discountable. However, the marine waters waters around Everett and Zelatched Point provide foraging, migrating, and overwintering (FMO) habitat for bull trout. FMO habitat is essential to maintaining connectivity between core areas and local populations, and provides important bull trout foraging and overwintering opportunities. The area is presumed to support adult and subadult bull trout at any time of year. The small number of steel piles that will be installed at Everett and Zelatched Point (one and twenty piles, respectively) and the short duration of pile driving per day (around 15 minutes and at most 45 minutes, respectively) make exposure of bull trout to injurious SPLs extremely unlikely to occur. The injurious effects of the proposed action to bull trout are therefore discountable.

Marbled murrelets could be present near any of the construction areas throughout the year. However, based on the areas where SPLs would cause injury to marbled murrelets and the marbled murrelets densities estimated in those areas by Northwest Forest Plan Effectiveness Monitoring at-sea surveys, it is extremely unlikely that marbled murrelets will be exposed to injurious SPLs caused by the proposed action. The injurious effects of the proposed action to marbled murrelets are therefore discountable.

Based on the conlcusions stated above, we concur with the Navy's conclusion that the proposed action may affect, but is unlikely to adversely affect bull trout and marbled murrelets.

The proposed action is located within designated bull trout critical habitat. The final revised rule designating bull trout critical habitat (75 FR 63898 [October 18, 2010]) identifies nine Primary Constituent Elements (PCEs) essential for the conservation of the species. The 2010 designation uses the term PCE. The new critical habitat regulations (81 FR 7214) replace this term with physical or biological features (PBFs). This shift in terminology does not change the approach used in conducting our analysis, whether the original designation identified PCEs, PBFs, or essential features. In this letter, the term PCE is synonymous with PBF or essential features of critical habitat.

We expect the proposed action to have no effect on many PCEs, but may affect the PCEs listed below. Because impacts to the PCEs will be short in duration, limited in extent, and will not alter the function of the PCE, these effects are considered insignificant:

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

The action may temporarily introduce an impediment or barrier within migration habitat; however, it will not preclude bull trout movement through the area, either during or after construction, and any effects will be temporary. The migration habitat will not be permanently altered, destroyed, or degraded.

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

Increased SPLs my decrease the abundance of forage fish in the action area, but that impact will be temporary.

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

The action will maintain the degraded conditions of the habitat by continuing to preclude and/or degrade natural shoreline/riparian processes, but will not increase or result in further declines in shoreline/riparian complexity.

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

The action may impact water quality. ACZA-treated piles are likely to leach trace metals into the water and sediments. However, the effects will be temporary and localized and the benefits of removing of creosote-treated piles are expected to more than compensate for the effects of the ACZA-treated piles.

Based on the conclusions stated above, we concur with the Navy's conclusion that the proposed action may affect, but is not likely to adversely affect designated bull trout critical habitat.

This action should be reanalyzed if new information reveals effects of the action that may affect listed species or critical habitat in a manner, or to an extent, not considered in this consultation. This action should also be reanalyzed if subsequently modified in a manner that causes an effect to a listed species or critical habitat that was not considered in this consultation, and/or a new species is listed or critical habitat is designated that may be affected by the action.

If you have any questions about this letter or our shared responsibilities under the Endangered Species Act, please contact Lee Corum (lee_corum@fws.gov; 360-753-5835), or Emily Teachout (emily_teachout@fws.gov; 360-753-9583).

Sincerely,

Martha L. Jensen

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

Enclosure:
Protocol for Marbled Murrelet Monitoring during Pile Driving

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U.S. Fish and Wildlife Service – Washington Fish and Wildlife Office
Protocol for Marbled Murrelet Monitoring During Pile Driving (Revised 10/30/2013)

1.0 Objective
The intent of the monitoring protocol is to:
1. Comply with the requirements of the Endangered Species Act Section 7 consultation.
2. Detect all marbled murrelets (*Brachyramphus marmoratus*) (murrelets) within the monitoring area.
3. To minimize take of murrelets from both exposure to potentially injurious underwater sound pressure levels, and from the masking effects of in-air sound by communicating immediately with the pile driver operator.
4. Track incidental take exempted through the Incidental Take Statement found in the final Biological Opinion for the project so that the Lead Federal Action Agency will know when take occurs and/or when take exemptions might be exceeded.

2.0 Adaptive Approach
The individuals that implement this protocol will assess its effectiveness during implementation. They will use their best professional judgment throughout implementation and will seek improvements to these methods when deemed appropriate. Any modifications to this protocol will be coordinated between the Lead Federal Action Agency and the Washington Fish and Wildlife Office.

3.0 Monitoring

3.1 Activities to be Monitored
Application of this protocol is required as specified through the Endangered Species Act consultation process for individual projects. It may apply to projects that involve either in-water impact pile driving when injurious sound pressure levels are expected and to projects that involve either vibratory or impact pile driving when in-air sounds are expected to cause masking effects.

3.2 Equipment
- Binoculars - quality 8 or 10 power
- Spotting scopes (optional)
- Two-way radios with earpieces
- Range finder
- Log books

1

- Seabird identification guide
- Life vest or other personal flotation device for observers in boats
- Cellular phone to contact Lead Federal Action Agency, the Construction Contractor, or WFWO.

3.3 Monitoring Locations

The spacing and placement of monitoring locations must be designed to provide adequate coverage of the entire monitoring area. Locations are determined ahead of time and are identified on the Seabird Monitoring Site/Transect Identification Form. The monitoring design should allow for the entire monitoring area to be fully surveyed within five minutes.

Each land-based observer can cover a 180° arc over a 50 meter (m) area. Each boat observer can cover a 50 m transect on one side of the boat. Using the *Seabird Monitoring Site/Transects Identification Form*, insert an aerial photo of the project site and outline each boat transect or land-based monitoring site. Identify on the aerial photo where each of the two types of monitoring (boat transects and land-based sites) will occur (See Example Dolphin Repair). Construction activity and/or other site specific variables (i.e., topography, pier or barge placement, etc.) can limit visibility. These should be identified on the aerial photo when known ahead of time. If conditions change on-site (e.g., a barge moves into the monitoring zone), monitoring locations can be refined in the field. In that case, note final monitoring locations on an aerial photo or plan sheet, and document the changes in the final monitoring report.

For each land-based monitoring site, draw the shoreline on the *Seabird Land-Based Monitoring Site Form*. Include on-site information such as structures that could be used by seabirds, or fishing piers, which may draw in feeding birds (i.e. gulls). The gridwork will allow the observer to quickly fill in location identifiers during monitoring.

3.4 Monitoring Techniques

One qualified biologist shall be identified as the Lead Biologist. The Lead Biologist has the authority to stop pile driving when murrelets are detected in the monitoring area or when visibility impairs monitoring. The Lead Biologist is responsible for:

- Ensuring consistency with the criteria in the consultation;
- Communicating with monitoring crew(s), the pile driver operator, and the WFWO; and
- Determining monitoring start and end times.

An appropriate number of qualified observers will be positioned on shore and in boats to provide adequate coverage of the monitoring area to ensure no murrelets are in the monitoring area. Monitoring will begin at least 30 minutes prior to commencement of pile driving. Each qualified observer will cover an on shore station or boat transect that is no more than 50 m wide. All observers are responsible for:

- Understanding the requirements in the consultation and monitoring plan;
- Knowing the lines and method of communicating with the Lead Biologist and

boat operator (if an observer on the boat);

- Evaluating the sea conditions and visibility;
- Calibrating their ability to determine a 50 m distance at the beginning of each day. Calibration should be done using a range finder on a stationary object on the water; and
- Determining when conditions for monitoring are not met.

Monitoring will only occur when the sea state is at a Beaufort scale of 2 or less. The Beaufort scale is presented in Table 1 below. Observers should scan without a scope or binoculars; scopes and binoculars should only be used to verify species.

Observers will be positioned at land-based vantage points to scan for murrelets within the monitoring zone. The land-based vantage points must have an unobstructed view of the monitoring zone at all times. Each land-based observer can cover a 50 m area with a 180° arc. At least 2 full sweeps of the monitoring zone shall be conducted prior to pile driving to ensure that no murrelets are in the monitoring zone. Each boat observer is responsible for scanning from 0° (straight ahead of bow) to 90° left or right, depending upon which side of the boat they occupy. Observers should occasionally scan past 90°, looking for murrelets that may have surfaced behind the boat. Boat speed should be no less than 5 knots and no greater than 10 knots. Observer coverage should not be compromised; therefore, observer's ability to scan dictates the speed of the boat. Boat operators will not function as murrelet monitors while operating the boat.

If no murrelets are within the monitoring zone, the observers will notify the Lead Biologist who will communicate to the pile driver operator that pile driving may commence. During pile driving the observers on shore will continue scanning the area for murrelets. The observers in the boats will patrol and scan the monitoring area. All observers will have two-way radios with earpieces to allow for effective communication during pile driving. If murrelets are seen within the monitoring zone during pile driving, the observers will immediately notify the Lead Biologist who will communicate to the pile driver operator that he/she is to cease pile driving. Pile driving will not resume until the murrelets have left the monitoring area and at least 2 full sweeps of the monitoring area have confirmed murrelets are not present.

When a murrelet is detected within the monitoring area, it will be continuously observed until it leaves the monitoring area. If observers lose sight of the murrelet, searches for the murrelet will continue for at least 5 minutes. If the murrelet is still not found, then at least 2 full sweeps of the monitoring area to confirm no murrelets are present will be conducted prior to resumption of pile driving.

It is the observer's responsibility to determine if he/she is not able to see murrelets and inform the Lead Biologist that the monitoring needs to be terminated until conditions allow for accurate monitoring.

Murrelets are especially vulnerable to disturbance when they are molting and flightless. Molting occurs after nesting in late summer, typically July through October in Puget Sound populations. Extra precaution should be exercised during this period.

Table 1 – Beaufort Wind Scale develop in 1805 by Sir Francis Beaufort of England (0=calm to 12=hurricane)

Force	Wind (knots)	Classification	Appearance of wind effects on the water	Appearance of wind effects on land	Notes specific to on-water seabird observations
0	<1	Calm	Sea surface smooth and mirror like	Calm, smoke rises vertically	Excellent conditions, no wind, small or very smooth swell. You have the impression you could see anything.
1	1-3	Light air	Scaly ripples, no foam crests	Smoke drift indicates wind direction, still wind vanes	Very good conditions, surface could be glassy (Beaufort 0), but with some lumpy swell or reflection from forests, glare, etc.
2	4-6	Light breeze	Small wavelets, crests glassy, no breaking	Wind felt on face, leaves rustle, vanes begin to move	Good conditions, no whitecaps, texture/lighting contrast of water make murrelets more difficult to see. Surface could also be glassy or have small ripples, but with a short, lumpy swell, thick fog, etc.
3	7-10	Gentle breeze	Large wavelets, crests beginning to break, scattered whitecaps	Leaves and small twigs constantly moving, light flags extended	Surveys cease, scattered whitecaps present, detection of murrelets definitely compromised, a hit-or-miss chance of seeing them owing to water choppiness and high contrast. This could also occur at lesser wind with a very short wavelength, choppy swell.
4	11-16	Moderate breeze	Small waves 0.3 to 1.1m becoming longer, numerous whitecaps	Dust, leaves, and loose paper lifted, small tree branches move	Whitecaps abundant, sea chop bouncing the boat around, etc.
5	17-21	Fresh breeze	Moderate waves 1.1 to 2.0 m taking longer form, many whitecaps, some spray	Small trees begin to sway	

3.5 Limitations

No monitoring will be conducted during inclement weather that creates potentially hazardous conditions as determined by the Lead Biologist. Observers must have visibility to at least 50 m. No monitoring will be conducted when visibility is significantly limited such as during heavy rain, fog, glare or in a Beaufort sea state greater than 2.

Glare can significantly limit an observer's ability to detect birds. Boat orientation may be adjusted to reduce glare (e.g. change direction or reduce width of transects to 50 m with observers on only one side of boat). However, if visibility cannot be adjusted, monitoring and pile driving must cease until effective monitoring can be conducted.

Monitoring will not start until after sunrise and will cease prior to sunset. Specific timing restrictions may be in place per the consultation documents.

3.6 Documentation

The observers will document the number and general location of all murrelets in the monitoring area. Additional information on other seabirds and behaviors will be collected during documentation to improve general data knowledge on seabird presence and distribution as well as project impacts on various seabirds. Each observer will record information using the *Seabird Monitoring Data Collection Form* and reference completed *Seabird Monitoring Site/Transects Identification* and *Seabird Land-Based Monitoring Site Forms*. Forms are included in the Appendix.

Data Collection

All murrelets within transects or monitoring sites will be continuously documented during impacting activities. On the *Seabird Monitoring Data Collection Form*, document the time, number of birds, location, and observed behavior (See Example Dolphin Repair). Update the documentation when a murrelet changes behavior, changes location, or leaves the area. To the extent possible, the observers will also record each murrelet "take" incident observed, as defined in the final Biological Opinion. This may include obvious disturbance responses from pile driving or other construction activities, and injury or mortality that can be attributed to project-related activities.

Observers will also note all seabirds within the area that appear to be acting abnormally during any project activities. For example, if a seabird is listing, paddling in circles, shaking head, or suddenly flushing at the onset of activity, note the information on the *Seabird Monitoring Data Collection Form*. For all birds except murrelets, providing a genus level (grebe, loon, cormorant, scoter, gull, etc) of identification is sufficient.

General information on other seabird behavior and distribution within the monitoring area will be collected. Every two hours at minimum during pile driving activities, the observer will document other seabird presence, behavior, and distribution in the monitoring area. This information can be collected more frequently. Many seabirds may linger in an area for several hours. If this is the case, note the time, species, and in the comments section identify that this is the same group from earlier and document any notable changes in behavior.

Under location, the data form indicates two separate options for documenting location. Land-based observers can fill out the land-based only or both land-based and boat sections. The land-based location will be based on the grid drawn out on the *Seabird Land-Based Monitoring Site Form* (See Example Dolphin Repair). For the boat transect locations, identify the distance in meters from the boat to the seabird and whether it is landward (toward activity) or seaward (away from activity).

Example Dolphin Repair

Seabird Monitoring Site/Transect Identification Form

Project Name

Dolphin repair

Monitoring Dates

November 8, 9, 10, 2012

Number of Monitoring Sites/Transects

4

Insert aerial photo of entire monitoring project area. Identify each monitoring site/station reflecting 50 meter zones for each observer. For example, if there are two observers on a boat transect, the box will be 100 meters wide. Some monitoring stations will overlap and should be indicated here.

7

Seabird Land-Based Monitoring Site Form

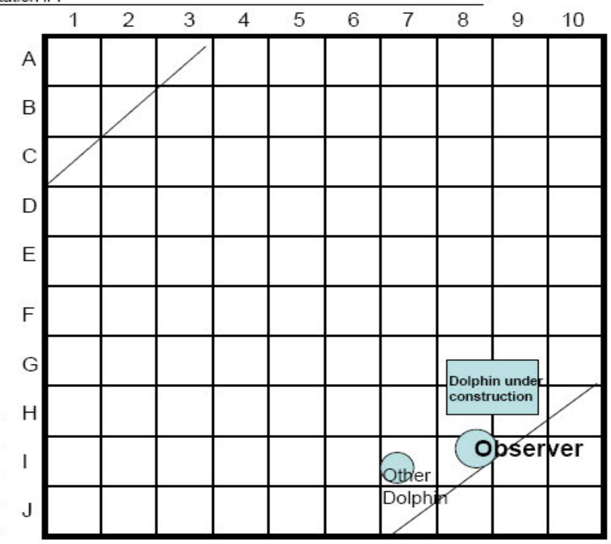
Project Name Dolphin Repair Date 11/10/12

Land Based Monitoring Site ID Station #4

For each monitoring station referenced in the main map grid, sketch the coastline using the 5 meter squares. Indicate the direction to where impacting activities are occurring.

Use space below to describe additional monitoring site details that may be pertinent such as other structures seabirds may use.

Observer located at end of terminal pier adjacent to construction activities. There is another dolphin to the west currently used by cormorants.



Seabird Monitoring Data Collection Form

Date

Project Name Dolphin Repair Monitoring Site/Transect ID Land Based Station #4

Observers Harry Downy

Activity Pile Driving Time and Duration 10:30 am to 4:00 pm

Time	Species	# of birds	Wind speed (Beaufort Marine scale)	Land Observer	Boat Observer		Observed Behavior*	Comments
				Grid Location	Distance	Land/Sea Ward		
10 am	scoters	10	2	C6			R	
10 am	cormorants	20	2	I8			R, P	Hanging out on adjacent dolphin
11:15 am	marbled murrelet	1	1	B4			F	Pile driving ceased, MM left observation area at 11:20
12:00 pm	grebe	2	2	G6			P	
12:00 pm	cormorants	20	2	I8			R, P	Hanging out on adjacent dolphin
2:00	gulls	15	1	H10			F	Group attracted by fisherman dumping guts
2:00	cormorants	20	1	I8			R, P	Hanging out on adjacent dolphin
4:00	gulls	5	2	H10			F	Residuals from earlier
4:00	cormorants	20	2	I8			R, P	Hanging out on adjacent dolphin

* R=resting, F=feeding/diving, P=preening, Y=flying/flushing, T=transient, N=nesting, O=other

8

Seabird Monitoring Data Collection Form Date 11/10/12

Project Name Dolphin Repair Monitoring Site/Transect ID Land Based Station #4

Observers Jimmy Jones

Activity Pile Driving Time and Duration 10:30 am to 4:00 pm

				Land Observer	Boat Observer			
Time	Species	# of birds	Wind speed (Beaufort Marine scale)	Grid Location	Distance	Land/Sea Ward	Observed Behavior*	Comments
10 am	grebe	1	2		25	sea	T	
11:25	marbled murrelet	1	1		45	land	F	Pile driving ceased at 11:15, left monitoring area at 11:45
12:00	scoters, loon	8	1		15	land	R, P	Startled by pile driving re-start, flushed out of area
12:00	common murre	2	1		25	sea	T	Startled by pile driving re-start, flushed out of area
2:00	gulls	1	2		75	sea	T	
4:00	gulls	5	2		50	sea	T	

* R=resting, F=feeding/diving, P=preening, Y=flying/flushing, T=transient, N=nesting, O=other

3.7 Timing and Duration

Pile driving cannot start until the monitoring pre-sweep has been conducted. The pre-sweep monitoring can commence once there is enough daylight for adequate visibility, and must begin at least 30 minutes before the initiation of pile driving. Monitoring will then continue until pile driving is completed each day. The monitoring set-up (i.e., number and location of observers) should allow for the entire monitoring are to be covered within five minutes.

3.8 Contingency

In the unlikely event that a murrelet is perceived to be injured by pile driving, all pile driving will cease and WFWO will be contacted as soon as possible.

The Lead Federal Action Agency will work with WFWO to make necessary changes to the monitoring plan as described in section 2.0 above. Pile driving cannot resume until the plan has been amended, unless the WFWO cannot be reached, then the Lead Biologist determines the course of action and continues to ensure consistency with the consultation.

9

4.0 Beach Surveys

Searches for diving seabird carcasses along nearby beaches will be conducted following pile driving activities. The biologist will walk accessible beaches within 0.5 mile of the pile driving location. Beach surveys will be conducted during low or receding tides, if possible, to maximize the chances of finding beached carcasses. Beach surveys will be conducted each day following in-water impact pile driving (as is practical based on the timing of tide events and pile driving activities.) Beach surveys are of secondary priority and will not be conducted if such activities would interfere with the implementation of murrelet monitoring or if the timing of low/receding tides imposes unreasonable schedule demands on the biologist.

Any dead murrelets or other diving seabirds found during the beach surveys (or during monitoring activities) will be collected by monitoring staff and delivered, as soon as possible, to the WFWO in Lacey, Washington for examination. Collected carcasses will be put in plastic bags, and kept cool (but not frozen) until delivery to the WFWO. Surveyors will follow the chain-of-custody process included in the consultation documents.

5.0 FWS Communication

Prior to the initiation of monitoring the Lead Federal Action Agency and a representative from the WFWO will meet to review the proposed monitoring locations and any logistical concerns that may have developed during monitoring preparation. The Lead Federal Action Agency will keep the WFWO informed of the progress and effectiveness of the monitoring activities and of the number and disposition of murrelet take that is documented throughout the duration of the project.

The Lead Federal Action Agency will notify the WFWO of any problems and/or necessary modification to the monitoring plan. The Lead Federal Action Agency will coordinate with the WFWO in the development of a modified approach and will obtain WFWO approval for such modifications.

Primary points of contact at the WFWO are:

1. Consulting Biologist – phone:
2. Emily Teachout – phone: (360) 753-9583
3. Deanna Lynch – phone: (360) 753-9545

6.0 Personnel Qualifications and Training

All observers must be certified under the Marbled Murrelet Marine Protocol. Observers will have appropriate qualifications, including education or work experience in biology, ornithology, or a closely related field; at least one season (2-3 months) of work with bird identification being the primary objective (i.e. not incidental to other work). Observers must have experience identifying marine birds in the Pacific Northwest, as well as understanding and documenting bird behavior.

All observers will attend the marbled murrelet marine monitoring protocol training and pass the written and photo examination with 90% proficiency. Upon successful completion, observers will be certified. Certification is valid for one year.

Recertification is required annually, unless the observer can document that he/she implemented the monitoring protocol for at least 25 monitoring days in the previous year. Recertification can then be delayed for one year; however, recertification can only be delayed for one year.

Certifications will be considered expired after one year, unless the WFWO is notified by the biologist that greater than 25 days of survey were done within one year of their certificate date. If an observer does conduct greater than 25 days of survey the certificate will be valid for an additional year from the certificate date. To extend a certification the biologist sends an email to the attention of Emily Teachout (emily_teachout@fws.gov) with the dates of the surveys they conducted and the date of their original certificate. The WFWO will maintain a list a certified observers and it will be available on our website.

The Lead Federal Agency is expected to provide all observers with a copy of the consultation documents for the project. Observers must read and understand the contents of the consultation documents related to identifying, minimizing, and reporting "incidental take" of murrelets.

7.0 Reporting

At the completion of each in-water work window for which there has been impact pile driving, the Lead Federal Action Agency will forward a monitoring report to the WFWO within 30 days. Reports shall be sent to the attention of (WFWO Branch Manager). The report shall include:

- Observation dates, times, and conditions
- Description of the any "take" (as described in the final Biological Opinion) identified by the biologist
- Copies of field data sheets or logs

Note: Questions and comments regarding this protocol should be directed to Emily Teachout at the USFWS, Washington Fish and Wildlife Office (360-753-9583); emily_teachout@fws.gov

APPENDIX

Seabird Monitoring Site/Transect Identification Form

Project Name

Monitoring Dates

Number of Monitoring Sites/Transects

Insert aerial photo of entire monitoring project area. Identify each monitoring site/transect. Each monitoring station will reflect the 50 meter zone for each observer. For example, if there are two observers on a boat transect, the box will be 100 meters wide. Some monitoring stations will overlap and should be indicated here.

Seabird Land-Based Monitoring Site Form

Project Name ______________________________ **Date** ______________

Land Based Monitoring Site ID ______________________________

For each monitoring station referenced in the main map grid, sketch the coastline using the 5 meter squares. Indicate the direction to where impacting activities are occurring.

Use space below to describe additional monitoring site details that may be pertinent such as other structures seabirds may use.

	1	2	3	4	5	6	7	8	9	10
A										
B										
C										
D										
E										
F										
G										
H										
I										
J										

Seabird Monitoring Data Collection Form

Date____________________

Project Name ______________________________ **Monitoring Site/Transect ID** ____________________________

Observers____

Activity __________________________________ **Time and Duration**__________________________________

Time	Species	# of birds	Wind speed (Beaufort Marine scale)	Land Observer	Boat Observer		Observed Behavior*	Comments
				Grid Location	Distance	Land/Sea Ward		

* R=resting, F=feeding/diving, P=preening, Y=flying/flushing, T=transient, N=nesting, O=other

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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

Refer to NMFS Consultation Nos.:
WCRO-2016-00018

April 5, 2019

C. M. Brooks
Commanding Officer
NAVFAC Northwest
1101 Tautog Circle
Silverdale, Washington 98315

Jolie Harrison, Chief
Permits and Conservation Division
Office of Protected Resources
1315 East-West Highway
Silver Spring, Maryland 20910

Re: Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Navy's Programmatic Proposed Marine Structure Maintenance and Pile Replacement Activities in the Northwest Region and NOAA's Protected Resources Division issuance of a Letter of Authorization.

Dear Captain Brooks and Ms. Harrison:

Thank you for requesting 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 authorization of a five-year Marine Structure Maintenance and Pile Replacement Activities of the Navy throughout Puget Sound as well as NOAA's Protected Resources Division issuance of a Letter of Authorization to the Navy. Thank you, also, for your request for consultation pursuant to the essential fish habitat (EFH) provisions in Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA)(16 U.S.C. 1855(b)) for this action.

The enclosed document contains a joint biological opinion prepared by the National Marine Fisheries Service (NMFS) pursuant to section 7(a)(2) of the Endangered Species Act (ESA) on the effects of the U.S. Navy's proposed maintenance and repair programmatic and NOAA's Protected Resources Division's (PRD) proposal to issue to the Navy a letter of authorization for the take of marine mammals. This document also includes the results of our analysis of the action's likely effects on essential fish habitat (EFH) pursuant to Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA), and includes 15 conservation recommendations to avoid, minimize, or otherwise offset potential adverse effects on essential fish habitat.

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

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

Please contact Conrad Newell in the Central Puget Sound Branch of the Oregon/Washington Coastal Office at (360) 753-9003, or by electronic mail at Conrad.newell@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: Ben Keasler (Navy)
Benjamin Laws (NOAA)

WCRO-2016-00018

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

Navy's Programmatic Proposed Marine Structure Maintenance and Pile Replacement Activities in the Northwest Region and NOAA's issuance of a Letter of Authorization

NMFS Consultation Number: WCRO-2016-00018

Action Agency: U.S. Department of the Navy, NOAA

Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species?	Is Action Likely To Jeopardize the Species?	Is Action Likely to Adversely Affect Critical Habitat?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
Puget Sound Steelhead *(O. mykiss)*	Threatened	Yes	No	NA	No
Puget Sound fall Chinook *(O. tshawytscha)*	Threatened	Yes	No	Yes	No
Hood Canal Summer-run Chum *(O. keta)*	Threatened	Yes	No	Yes	No
Puget Sound/Georgia Basin Yelloweye Rockfish *(Sebastes ruberrimus)*	Threatened	Yes	No	Yes	No
Puget Sound/Georgia Basin Bocaccio *(S. paucispinis)*	Endangered	Yes	No	Yes	No
Southern Resident Killer whale *(Orcinus area)*	Endangered	Yes	No	Yes	No
Humpback Whale Central American DPS *(Megaptera novaeanRliae)*	Endangered	Yes	No	NA	NA
Humpback Whale Mexico DPS *(Megaptera novaeanRliae)*	Threatened	Yes	No	NA	NA

Affected EFH and NMFS' Determination:

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

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

Issued By:

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

Date: April 5, 2019

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.

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). A complete record of this consultation is on file at Oregon Washington Coastal Office in Lacey, Washington.

1.2 Consultation History

On August 22nd, 2016 NMFS received from the United States Dept. of the Navy (Navy) a request to initiate ESA Section 7 informal consultation for the proposed 5-year programmatic maintenance and replacement program. The initiation package for each of the proposed actions included a Memorandum for the Services (MFS), a Biological Evaluation (BE), and project drawings.

The Navy originally determined that the proposed action may affect but is not likely to adversely affect Puget Sound (PS) Chinook and their critical habitat, PS steelhead, PS/Georgia Basin (GB) bocaccio rockfish and their critical habitat, and PS/GB yelloweye rockfish and their critical habitat. There is no designated critical habitat for PS steelhead in marine waters. Additionally, the Navy determined that their project is likely to adversely affect Southern Resident Killer Whales and their critical habitat as well as Humpback Whales. The Navy also requested consultation for PS/GB canary rockfish and their critical habitat.

NMFS disagreed with the Navy’s request for informal consultation based upon effects of sound in the aquatic habitat. Several meetings followed to discuss the nature of adverse effects. Additional information and an updated sound pressure affects analysis was requested from the Navy on September 29th and November 11th, 2016.

PS/GB canary rockfish was delisted on March 24th, 2017, and therefore does not require consultation, either formal or informal.

The additional information on Navy's proposed pile replacement at each of six facilities was provided in pieces between March 29th and July 27th, 2017.

On July 19th, 2018, NOAA's Office of Protected Resources (OPR) requested consultation for their issuance of a Letter of Authorization (LOA) to the Navy for the incidental take of listed species for the Navy's action. We responded to them that because their authorization under the Marine Mammal Protection Act would authorize take for the same action that NMFS was reviewing, we would review both actions within a single analytical document. We consider the Navy as the Lead Action Agency for this combined consultation.

August 25nd, 2017, we began formal consultation for both actions.

A draft Biological Opinion was shared with the Navy on December 10th 2018.

Consultation was held in abeyance for 38 days due to a lapse in appropriations and resulting partial government shutdown. Consultation resumed on January 28, 2019.

The Navy provided the NMFS two position papers outlining concerns with the analysis and with a detailed list of comments and questions on January 18th, 2019.

The Navy requested a project change and modification to the proposed action for this consultation on March 15th 2019. The project change included the addition of replacing 9 concrete piles at Indian Island ammunition Wharf. The Navy also included a commitment to initiate a programmatic consultation for a broader suite of maintenance/repair actions at the ammunition wharf by the 2022 work window, the details of which will be more apparent after upcoming inspections.

A complete record of this consultation is on file at the Oregon Washington Coastal Office in Lacey, Washington.

1.3 Proposed Federal Action

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

1.3.1 Construction and Operations Action

The United States (U.S.) Department of the Navy (Navy) proposes to conduct maintenance and repair activities at marine waterfront structures over a 5-year period (from time of signature**)** at six Navy locations within Navy Region Northwest. These locations, which are located in the Puget Sound region of Washington State, include: Naval Base (NAVBASE) Kitsap Bangor, NAVBASE Kitsap Bremerton, Naval Magazine Indian Island, NAVBASE Kitsap Keyport, NAVBASE Kitsap Manchester, Zelatched Point, and Naval Station (NAVSTA) Everett. Maintenance and repair activities will occur at various piers, wharves, and other marine pile-supported structures at each facility (Table 1).

The Navy proposes to replace 831 piles at 34 structures over 5 years. Half will be structural piles and half will be fender piles. Structural piles support an overwater structure, such as a wharf or pier and are an integral component of the structure itself. Fender piles are non-structural, freestanding piles intended to guide approaching vessels or protect an overwater structure from impact. All in-water work will occur within the Army Corp of Engineers' prescribed salmon work windows. The Navy has proposed to constrain in-water work to three work windows only:

- At NAVBASE Kitsap Bangor (waterfront) and Zelatched Point the salmonid work window is July 16–January 15
- At NAVBASE Kitsap Bremerton, NAVBASE Kitsap Manchester, and NAVBASE Kitsap Keyport, NAVSTA Everett, the salmonid work window is July 16–February 15
- Naval Magazine Indian Island work window is October 1st - January 15th.

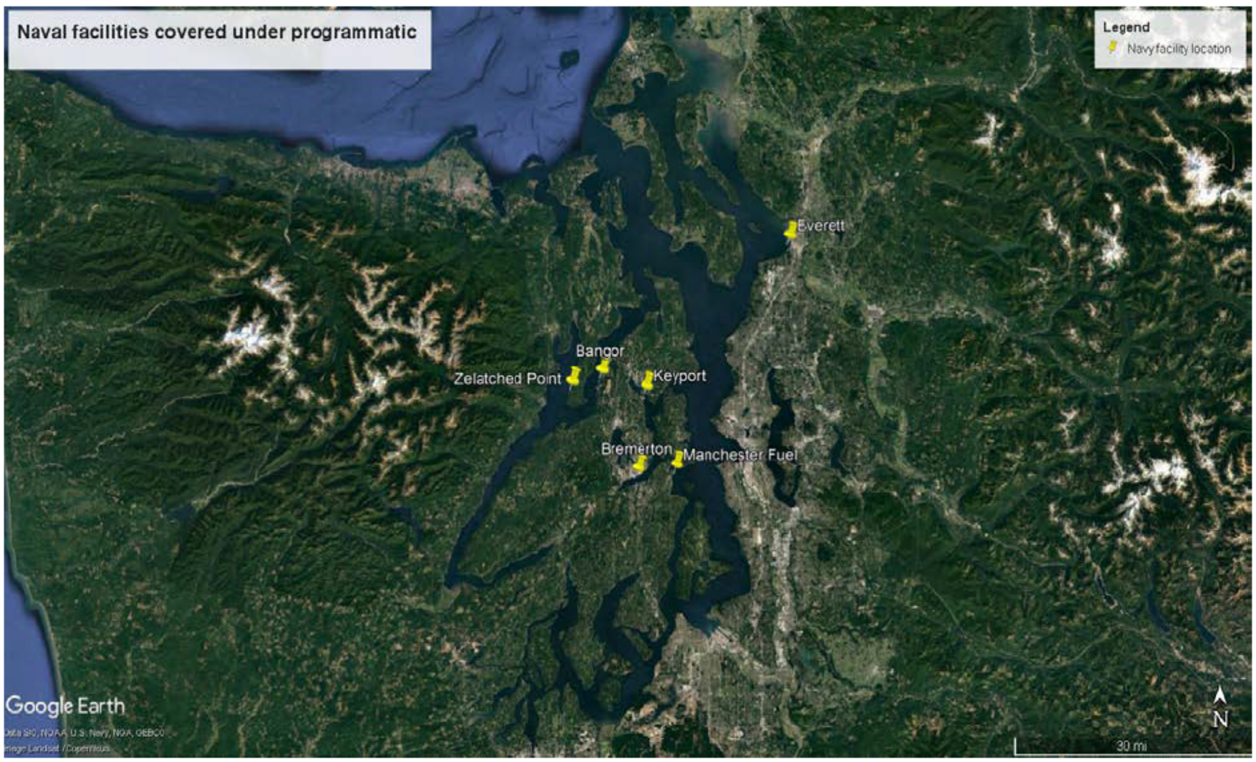

Figure 1. Region Map indicating Six Naval Sites where work will be performed

Table 1. Marine Pile-Supported Structures Included in the MPR Activities

Structure Name	Year Built
NAVBASE Kitsap Bangor	
Carderock Pier	2008
Service Pier	1980
Keyport□Bangor (K/B) Dock	1965
Delta Pier	1979
Marginal Wharf	1945

Structure Name	Year Built
Explosive Handling Wharf #1 (EHW-1)	1975
Magnetic Silencing Facility	1978
NAVBASE Kitsap Bremerton	
Pier 3	1943
Pier 4	1932
Pier 5	1923
Pier 6	1926
Pier 7	1943
Pier (Wharf) 9	1962
Pier B	1946, rebuilt 2012
Pier C	1941
Pier D	Rebuilt 2004
Mooring Pier A	1949
Mooring Pier E	1949
Mooring Pier F	1949
Mooring Pier G	1949
Naval Magazine Indian Island	
Ammunition Wharf	1979
NAVBASE Kitsap Keyport	
Keyport Pier	2002
NAVBASE Kitsap Manchester	
Manchester Fuel Pier	1993
Manchester Finger Pier	1978–1979, approach 2015
Zelatched Point	
Zelatched Point Pier	1965
NAVSTA Everett	
Pier A	1993
Pier B	1998
Pier C	1940s
Pier D	1940s
Pier E	1940s
North Wharf	1986
South Wharf	1992
Small Boat Marina	1995
Small Boat Launch	2011

The Navy has an ongoing waterfront inspection program to identify deficiencies in marine structures. Identified deficiencies are prioritized and then programmed for design and construction to maintain or replace the deficient structures. The Navy anticipates maintenance and replacement activities for up to 831 piles. It is this maintenance and replacement program that we review under ESA Section 7 and the MSA. Future waterfront inspections, as well as damage caused by severe weather events and/or incidents caused by vessels will result in emergent marine structure repairs. Because of the dynamic nature of this planning process no set schedule for repair & replacement activities is being proposed other than the 5 year termination date. A facility may complete its allotted repair and replacement activities within one work window or spread it out over several. There is no proposed order for which facilities will conduct their activities.

The Navy's BA includes the following discussion regarding the proposed action as: "Marine structure maintenance and pile replacement projects at the six locations identified in this document will be able to utilize this programmatic consultation if the following conditions are met:

1. Projects are reviewed prior to use of the MPR programmatic by a Navy biologist for their ability to meet the requirements of activities covered by this biological assessment and the accompanying biological opinion and concurrence letter issued by NMFS and USFWS, respectively.
2. Projects included in the programmatic adhere to the Best Management Practices (BMPs) and minimization measures as described in this BA and any Terms and Conditions provided in the biological opinions issued by NMFS.
3. Projects submit a post-project completion form including any monitoring reports required.

The Navy will also meet with the Services on an annual basis prior to the start of the in-water work window to review upcoming projects, required monitoring plans, and the results of projects that were conducted under the programmatic in the proceeding in-water work window. The intent is to utilize lessons learned to better inform potential effects of future MPR activities and in any follow-up programmatic consultations. For projects seeking ESA coverage for repair/replace/maintenance activities that do not meet these conditions, an individual ESA consultation with the NMFS may be necessary prior to the issuance of permit or verification letter."

Table 2. Pile Types and Maximum Number to Be Replaced at Each Station

Project	Pile Extraction				Pile Installation				Total Piles Remaining
	Pile Type	Size (in)	Qty	Method	Pile Type[2]	Size (in)	Qty[3]	Method	
NBK Bangor									
Contingency	Steel Timber Concrete	Up to 36	75	Vibratory or cut at mudline	Steel Concrete	Up to 36	75	Impact or vibratory	9,079
EHW-1 (*estimated 4* **of 9**)	Steel Timber Concrete	Up to 36	44	Vibratory or cut at mudline	Steel Concrete	Up to 36	44	Impact or vibratory	1,029
Zelatched Point									
Contingency	Timber	12	20	Vibratory or cut at mudline	Steel Timber Concrete	Up to 36	20	Impact or vibratory	73
NBK Bremerton									
Contingency	Steel Timber	Up to 24 Up to 14	75	Vibratory/ choke & pull	Concrete	Up to 24	75	Impact	7,412
RM021-05 Replace Fender Pile Pier 5	Timber	Up to 14	360	Vibratory/ choke & pull	Concrete	Up to 24	360	Impact	160 structural piles
RM1114785 Piers 5, 6, 7, Mooring A & Dry Dock 5	Timber	Various	20	Vibratory/ choke & pull	Sheet steel	Various	20	Vibratory	1,766
Pier 4, Replace Fender Piles	Timber	Up to 14	80	Vibratory/ choke & pull	Steel	Up to 14	80	Vibratory	315 fender piles 291 structural piles
NBK Keyport									
Contingency	Concrete Steel	Up to 18	20	Vibratory	Steel	Up to 36	20	Impact or	90
NBK Manchester									
Contingency	Timber Plastic	Up to 18	50	Vibratory/ choke & pull	Timber Plastic Concrete	Up to 18 Up to 24	50	Impact or vibratory	464
NAVSTA Everett									
Contingency	Steel Timber	Various	1 75	Vibratory/ choke & pull	Steel Concrete Timber	36 Up to 24	1 75	Impact or vibratory	5,099
RM10-7403 North Wharf Repairs	Concrete	□	2	TBD	Concrete	□	2	Impact	627
Indian Island									

Project	Pile Extraction				Pile Installation				Total Piles Remaining
	Pile Type	Size (in)	Qty	Method	Pile Type[2]	Size (in)	Qty[3]	Method	
Ammo Wharf[1]	Concrete	24	8	Cut and extract	Concrete	24	9	Jetting	TBD

Old and/or damaged piles may be removed by several methods: vibratory extraction, cutting/chipping, clamshell removal, or direct pull. The method used will be dependent on site conditions and the conditions of the pile. In some cases the pile may be cut at or below the mudline and the stump left in place.

Marine Structure Maintenance, Repair, and Pile Replacement

This section describes the various maintenance, repair, and pile replacement activities that would occur at the locations under the Proposed Action. The methods in this section are representative of typical Navy in-water/overwater construction methods that may be utilized.

Pile Repair

Several methods of pile repair may be used including stubbing, wrapping, pile encapsulation, and welding. Pile stubbing is a process in which an existing, damaged length of timber pile above the ground line is removed and replaced with a new length of timber pile. Wrapping may be utilized on existing timber piles to protect against marine borers. Typically, flexible polyvinyl chloride is wrapped around the entire pile from the mudline to above the water line. Epoxy-grout-filled fiberglass jackets may also be used. There are different methods of pile encapsulation, but in general, encapsulation refers to the process of encasing piles in concrete. Encapsulation is used when a pile is damaged, but still retains some load-bearing capacity. Welding may be used if a steel pile is damaged above the water line. The damaged section of the steel pile may be cut out/off and a new pile section welded on. These processes do not involve pile driving. All of the above repair activities would occur overwater or involve only minor in-water work, and would be conducted with the appropriate Spill Prevention Control and Countermeasures Plan and other BMPs identified in Section 1.3.2.

Pile Replacement

Most in-water structures are pile-supported; therefore, repair of these structures typically involves removal of existing piles and installation of new piles or repair of existing piles in-place (see previous section for pile repair description). In addition, fender piles (or guide piles) protect in-water structures from direct contact with vessels. In-water piles may be treated timber, steel, pre-stressed concrete, or high-density polyethylene (HDPE) plastic. Existing timber piles are generally treated with creosote or ammoniacal copper zinc arsenate (ACZA) to preserve the wood. New timber piles proposed for installation would not contain creosote. Steel piles may be

[1] In addition to the 9-pile project, correspondence from the Navy regarding the proposed action indicates that there are expected to be a broader suite of future maintenance/repairs at Indian Island Ammo Wharf (the details of which will be informed by some upcoming inspections) and states the Navy's undertaking to consult programmatically on such activities by 2020.

hollow or filled with concrete following installation. Below is a description of the various pile replacement methods that may be used under the Proposed Action.

Pile Removal

Four methods of pile removal (vibratory extraction, cutting/chipping, clamshell removal, and direct pull) may be used depending on site conditions. In some cases, piles may be cut at or below the mudline, with the below-mudline portion of the pile left in place.

All materials and waste will be disposed of in accordance with federal and state requirements. Creosote- treated piles will be cut into smaller segments in a manner that precludes further use and disposed of at an appropriate upland location (USEPA, 2016). With the exception of creosote-treated piles, the Navy will evaluate if it would be possible to reclaim or recycle the materials. The four pile removal methods are described below.

Vibratory Extraction

Vibratory extraction is a common method for removing all pile types. A barge-mounted crane operates from the water adjacent to the pile during removal activities. A vibratory driver is a large mechanical device (5–16 tons) suspended from a crane by a cable and positioned on top of a pile. The pile is then loosened from the sediments by activating the driver and slowly lifting up on the driver with the aid of the crane. Once the pile is released from the sediments, the crane continues to raise the driver and pull the pile from the sediment. The driver is shut off once the end of the pile reaches the mudline and the pile is pulled from the water and placed on a barge. Vibratory extraction is expected to take approximately 1 to 30 minutes per pile depending on the pile size, type, and substrate conditions.

Cutting/Chipping

Concrete piles may be removed with a pneumatic chipping hammer or another similar tool capable of cutting through concrete. Pneumatic hammers are used for drilling and the chipping of brick, concrete, and other masonry. A pneumatic chipping hammer is similar to an electric power tool, but uses the energy of compressed air instead of electricity. The pneumatic chipping hammer consists of a steel piston that is reciprocated (moved backward and forward alternately) in a steel barrel by compressed air. On its forward stroke, the piston strikes the end of the chisel. The reciprocating motion of the piston occurs at such a rate that the chisel edge vibrates against the concrete with enough force to fragment or splinter the pile. Large pieces are removed from the substrate. Some inert concrete pebbles would remain.

Clamshell

In some cases, removal with a vibratory driver is not possible because the pile may break apart from the force of the clamp and the vibration. If piles break or are damaged, a clamshell apparatus may be lowered from the crane to remove pile stubs. A clamshell is a hinged steel apparatus that operates similar to a set of steel jaws. The bucket is lowered from a crane and the jaws grasp the pile stub as the crane pulls upward. The use and size of the clamshell bucket will be minimized to reduce the potential for turbidity during pile removal.

Direct Pull

Based on site conditions, piles may be removed by wrapping the piles with a cable or chain and pulling them directly from the sediment with a crane. In some cases, depending on access and location, piles may be cut at or below the mudline. The removal of broken piles below the mudline is contingent on Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) agreements at each applicable Navy locations.

Pile Installation

The primary methods of pile installation would be vibratory and impact pile driving, depending on site conditions. A third method, water jetting, may also be used. The vibratory pile driver method is a technique that may be used in pile installation where the substrate allows. Use of this technique may be limited in very hard or liquefiable substrates. This process begins by placing a choker cable around a pile and lifting it into vertical position with a crane. The pile is then lowered into position and set in place at the mudline. The pile is held steady while the vibratory driver installs the pile to the required tip elevation. In some substrates, a vibratory driver may be unable to advance a pile until it reaches the required depth. In these cases, an impact hammer may be used to entirely advance the pile to the required depth. For load-bearing structures, an impact hammer is typically required to strike a pile a number of times to ensure it has met the load-bearing specifications; this is referred to as "proofing."

Impact hammers may be used to install steel, concrete, plastic, or timber piles. Impact hammers have guides that hold the hammer in alignment with the pile while a heavy piston moves up and down striking the top of the pile and driving the pile into the substrate from the downward force of the hammer. To drive the pile, a pile is first moved into position and set into the proper location by placing a choker cable around a pile and lifting it into vertical position with the crane. A vibratory driver may be used to set the pile in place at the mudline. Once the pile is properly positioned, pile installation typically takes less than a minute to 60 minutes depending on pile type, pile size, and conditions (i.e., bedrock, loose soils, etc.) to reach the required tip elevation.

Because impact driving of steel piles can produce underwater noise levels that have been known to be harmful to fish and wildlife, piles will be advanced to the extent practicable with a vibratory driver and only impact driven when required for proofing or when a pile cannot be advanced with a vibratory driver due to hard substrate conditions. When impact driving steel piles, a bubble curtain, or other noise attenuation device capable of achieving at least 8 dB of attenuation, will be employed for all pile strikes when water depths are deep enough for propagation (0.67 m) with the possible exception of short periods when the device is turned off to test the effectiveness of the noise attenuation device. A bubble curtain is usually a ring or series of stacked rings that are placed around a pile along the pile's entire length under water. The rings are made of tubing which has small puncture holes through which compressed air is pumped. As the compressed air bubbles flow from the tubing, they create an air barrier that impedes the sound produced during pile driving. The bottom ring of the bubble curtain rests on the substrate around the pile, and it is likely that the bubbling action at the bottom ring would create turbidity in the immediate area while the bubble curtain is active. Therefore, bubble curtains would not be used at Bremerton to avoid disturbing contaminated sediment. Similarly, due to the potential for disturbing contaminated sediments, the Navy will assess the use of bubble curtains at NAVBASE Kitsap Keyport and NAVSTA Everett on a project-by-project basis.

Water jetting may be used to aid the penetration of a pile into a dense sand or sandy gravel stratum. Water jetting utilizes a carefully directed and pressurized flow of water at the pile tip, which disturbs a ring of soils directly beneath it. The jetting technique liquefies the soils at the pile tip during pile placement, reducing the friction and interlocking between adjacent sub-grade soil particles around the water jet. Load-bearing piles installed with water jetting would still need to be proofed with an impact pile driver. Water jetting will not be used at NAVBASE Kitsap Bremerton, NAVBASE Kitsap Keyport, and NAVSTA Everett, to minimize disturbance of contaminated sediments.

Pile Installation by Pile Type
Pile type has been identified for 633 of the 831 piles anticipated to be replaced during the 5 years of MPR activities, as discussed in the following sections and summarized in Appendix A. Pile type has not been determined for 189 of the piles included in the Proposed Action.

Steel Piles
A maximum of 121 of the total 831 piles planned for replacement have been identified as steel piles. These piles will be installed over the duration of the MPR activities at NAVBASE Kitsap Bremerton, NAVBASE Kitsap Keyport, and NAVSTA Everett (Appendix A). In addition, another 139 piles that will be installed at NAVBASE Kitsap Bangor (119) and Zelatched Point (20) do not have a pile type determined yet; these piles could potentially be steel, concrete, timber, or HDPE. For this analysis, it is assumed all 139 of these piles will be installed as steel piles. This is a conservative assumption because steel pile installation has the potential to cause the highest underwater sound pressure levels if they require installation with an impact driver (as discussed in Section 5.1.1.1). Therefore, for analysis of project impacts at these locations, it is assumed that a total of 260 steel piles will be installed. Steel piles will be a maximum of 36-inch (in) diameter except at Bremerton where they will be a maximum of 14-in diameter. To minimize noise levels to marine mammals and other marine life from impact installation of steel piles, steel piles will be driven with a vibratory driver to the extent practicable. The vibratory driver will install the new piles to a point of refusal or, if the load-bearing capacity of the pile needs to be verified, within approximately 5 feet (ft) of the final tip elevation. To further minimize noise levels from impact installation of steel piles, a bubble curtain or other noise attenuating device will be used when impact driving steel piling (except at NAVBASE Kitsap Bremerton and possibly NAVBASE Kitsap Keyport and NAVSTA Everett as noted above). Because steel impact pile driving produces high underwater sound pressure levels that can be harmful to aquatic organisms, a performance measure to limit impact pile driving at any one location to no more than thirty 16-in to 36-in diameter steel piles per year per location will be employed. Smaller 14-in diameter piles are not anticipated to be driven with an impact driver for proofing and, therefore, are not included in this measure. Thirty steel piles per year was considered a reasonable level to allow individual replacement projects to proceed yet provides a limit to the extent of aquatic noise impact at each location each year.

Concrete Piles
A maximum of 521 of the 831 total piles planned for replacement have been identified as concrete piles. These piles will be installed at NAVBASE Kitsap Bremerton (435) and NAVSTA Everett (77), Indian Island (9). An additional 50 piles at NAVBASE Kitsap Manchester have not had a specific type determined yet. These piles could be concrete, timber, or HDPE plastic. For

analysis purposes, we assume that these piles will be concrete. This is a conservative assumption because concrete pile installation has the potential to cause greater underwater sound pressure levels than timber or HDPE plastic (as discussed in Section 5.1.1.1). At all locations, concrete piles will be a maximum of 24-in diameter.

Vibratory driving is less efficient at driving concrete piles than steel piles because concrete piles are solid and do not have a cutting edge. Therefore, all concrete piles are anticipated to be fully impact driven or water jetted (as noted above water jetting will not be utilized at NAVBASE Kitsap Bremerton, NAVBASE Kitsap Keyport, or NAVSTA Everett). Because of the relatively low underwater noise levels associated with these piles when impact driven, or water jetted, bubble curtains are not proposed during impact installation or water jetting of concrete piles.

HDPE Plastic and Timber Piles
A portion of the 189 piles that have an undecided type could be HDPE plastic or timber piles. Timber piles could be installed at NAVBASE Kitsap Bangor, NAVBASE Kitsap Manchester, Zelatched Point, and NAVSTA Everett. Currently, HDPE piles are only anticipated at NAVBASE Kitsap Manchester, but could potentially be installed at any location. Timber piles are typically not used as replacement piles at Navy locations due to the superior longevity of steel or concrete piles, but some structures could require installation of timber piles to comply with the National Historical Preservation Act. Timber/HDPE plastic piles will be a maximum of 18-in diameter. Both HDPE and timber piles are anticipated to be fully impact driven, but could be installed with a vibratory driver. Because of the low underwater noise levels associated with these piles when impact driven (see Appendix B), bubble curtains are not proposed for installation.

Sheet Steel Piles
Sheet piles will be installed using a vibratory pile driver. Impact pile driving will follow if the pile cannot reach the required depth using a vibratory pile driver. Because of their shape and attachment to each other, sheet steel piles transmit energy differently than hollow round steel piles and bubble curtains are not proposed for installation.

Marine Structure Maintenance
In addition to pile repair, removal and replacement, other work may be performed, including repair and replacement of other components. Repairs may include, but not be limited to, replacement of structural elements such as pile caps and cross bracing, replacement or repair of decking, and replacement of wave break panels. Fender system components such as camels may be replaced. Periodic maintenance, repair or application of coatings may be required to prevent corrosion of metal components exposed to the marine environment. All of the associated repair activities either occur over water or involve only minor in-water work. All of the above activities will be conducted in accordance with the appropriate Spill Prevention Control and Countermeasures (SPCC) Plan and other best management practices (BMPs) identified in Section 1.3.2.

Demolition and Repair of Deck Portions
A wire saw or other equipment could be used to cut timber or concrete decks into sections. Sections would be removed with a crane. Debris would be captured using debris

curtains/sheeting and removed from a project area. Deck pieces would be hauled to a barge and on to an upland disposal site. Large concrete deck areas requiring repair would be cast-in-place with formwork and smaller areas would be performed using hand trowels. The concrete debris would be captured using debris curtains/sheeting and removed from the project area.

Wetwell Repair
A wetwell is a reinforced concrete encasement for a sanitary sewer lift station pump. Repairs would occur by removing failed and delaminated concrete. The reinforced steel substructure would then be repaired and new concrete applied. Large areas requiring concrete would be cast-in-place with formwork and smaller areas would be performed using hand trowels. The concrete debris would be captured using debris curtains/sheeting and removed from the project area.

Recoat Piles and Mooring Fittings
Piles and mooring fittings would be cleaned prior to coating. All coatings would be applied to dry surfaces and limited to areas above mean sea level (+6.5 ft mean lower low water). Coatings would be inorganic, non-toxic, and free of volatile organic compounds.

Passive Cathodic Protection System
A passive cathodic protection system is a metallic rod or anode attached to a metal object to protect it from corrosion. The more easily oxidized metal of the anode corrodes first, protecting the primary structure from corrosion damage. These would be banded to newly install steel piles to prevent the metallic surfaces from corroding due to saline conditions.

Repair or Replacement of Pile Caps
Pile caps are situated on the tops of piles located directly beneath a structure and function as a load transfer mechanism between the superstructure and the piles. Replacement concrete pile caps may be cast in place. Concrete framework may be located below mean higher high water. The concrete debris would be captured using curtains/sheeting and removed from the project area.

Concrete Spalling Repairs
Concrete spalling occurs when concrete becomes chipped, scaled or flaked. Repair of spalled concrete involves removal of damaged sections and installation of new concrete. Concrete debris would be captured using curtains/sheeting and removed from the project area.

Foundation Mud-line Repair
The Hammerhead Crane foundation on Pier 6 at NAVBASE Kitsap Bremerton is supported by concrete pilings, which are bell-shaped at the bottom, that are installed on top of timber pilings. The timber pilings are completely embedded into the substrate, and the bottom 4–5 ft of the concrete pilings are covered by additional substrate that forms a "mud-line." At one concrete pile, the mud-line has receded and timber pilings are partially exposed. Additional material (up to 5 cubic yards) would be added to cover both the timber piling and the bottom of the concrete piling. Work would include: importing additional clean substrate and depositing the material via bag or clamshell with the use of crane or davit to lower to the seafloor and re-building the mud-line around the base of the concrete piling. This work is expected to occur at one concrete pile in the foundation no more than one time in 5 years.

Mooring Foundation and Substructure Repairs
Repairs may involve removal and replacement of concrete mooring foundations and concrete substructure on piers, wharfs, and quay walls. Work may include preservation of rebar, and injection of epoxy as required. Sheet pile or cofferdams would be installed as needed to isolate water from concrete surfaces.

Repair or Replacement of Components
Structural and non-structural components of waterfront structures would be repaired or replaced as required. Replacement of components would involve removal of existing components and installation of new components. Components may include, but are not limited to:

- Timber wave breaks
- Cross bracing members
- Fender components, including but not limited to camels, chocks, and whalers
- Hand rails
- Splash guards
- Safety ladders
- Electrical conduit and wiring
- Light poles
- Guide pile systems for floats. These systems are used to secure a floating dock or barge to a pile but allow the floating dock or barge to move up and down with tidal changes.
- Brows or gangways. Brows are small, movable, bridge-like structures used to board or leave a vessel.

Rewrap/Replace Steel Cable Straps on Dolphins
Dolphins are groups of piles used to guide vessels and hold them in place while docked or berthed. Straps are used to hold pile groupings together.

Interrelated and Interdependent Actions
"Interrelated actions" are those that are part of a larger action and depend on the larger action for their justification. "Interdependent actions" are those that have no independent utility apart from the action under consideration (50 CFR 402.02). Effects caused by interrelated and/or interdependent actions are evaluated with the effects of the proposed action. We describe these Interrelated and Interdependent actions here.

The Navy's purpose in maintaining the piles that support the piers is to enable continued use of the piers for the foreseeable future (for the analysis in this biological opinion NMFS assumes this to be 50 years[2]). Fender piles protect such structures, but in and of themselves, do not significantly extend the life of a structure. In cases where a proposed action extends the useful life of a structure, the additional duration of the impacts which the structure has on habitat values and/ or species are appropriately characterized as 'effects of the action' for the purpose of consultation. To determine if an action extends the life of a structure, we consider the portion of the structure being replaced, the current condition of the structure, and what would likely occur if the proposed action did not take place.

[2] 50 year expected structural stability is based on communications with marine construction companies operating in Puget Sound who have experience with concrete and steel pile instillation in marine waters.

In this case, the proposed action will extend the life of only one of the 33 involved structures. At the remaining 32 structures, the Navy proposes to replace a small proportion of piles at each structure. The work proposed at these sites is not significant enough to meaningfully extend the life of these structures.

The pier at Zelatched Point was built in 1965 with an expected structural life of 50 years. While some of the 93 piles have already been replaced over the last 63 years, enough of the original piles remain and so for the purposed of the analysis of this biological opinion NMFS assumes that the structure is considered to be near the end of its structural life.

The Navy conducted an assessment of the Zelatched Point pier 2017. The assessment indicated that while the pier was usable in 2017 there was an anticipation of structural defects within the following 5 years (2017-2022). While the Navy contends that their assessment indicates a low likelihood of a significant reduction in structural capacity of Zelatched Point pier, the NMFS infers from the age of the structure and the standard design life of similar commercial structures (50 years) that replacement of structural piles is intended to extend the structural life of the pier. The Navy's practice of performing these assessments and periodic maintenance activities including pile replacement is to keep their structures in suitable operating capacity (as stated in their BA). The Navy monitors this capacity through the assessments and scoring system of "Condition Index. NMFS reviewed the "Condition Index" and found that the calculations, while important and useful for the Navy planning purposes, allow for incrementally extending the structural life of all naval facilities in Puget Sound, such that there is no beginning or end life to the structure. As such the "Condition Index" does not lend itself to the determining whether the structure is an interrelated or interdependent action.

The pier at Zelatched Point will have a substantial number of structural piles replaced over the 5-year period (20 of 93 piles). The Zelatched Point pier can be exposed to significant wave energy with a North to south fetch of approximately 8.6 miles, which is classified as "High Wave Energy" (MSDG 2014). Wave and physical energy impacting piles puts strain and risk on any piles that exist beyond the original design life. Given the significant number of original piles, absent the proposed action, the condition and usefulness of this pier are expected to deteriorate in the near future due to high wave energy. Unlike the other piers that fall within the Navy's program of pile replacement and maintenance, which anticipate a smaller percentage of replacement demands, the proposed replacement of structural piles at Zelatched Point pier will ensure that the pier at this location will remain operational well into the future. Thus, the future impacts of this structure, and of the use associated with this structure, are attributable to the proposed action and are treated as effects of the action.

The continued operation of this single overwater structure is the interrelated action. This pier supports test and evaluation range activities (torpedo testing) conducted by the NUWC Keyport within Dabob Bay. This includes historic use by floatplanes and range craft. The Navy deploys, tracks and tests these torpedoes from vessels supported by Zelatched Point pier. Vessel traffic and use of the pier by seaplanes and operations vessels were not covered under a previous BiOp as either direct or interrelated and interdependent actions. The previous BiOp on operations at Zelatched Point only pertained to the actual testing of the torpedoes in Dabob Bay and did involve work on the pier. As this is a testing and research range, no standardized schedule or amount of use of the pier is known. Use of the pier occurs when there is funded and approved research that requires the field testing of torpedoes. This testing does not include detonations as Dabob Bay is classified as a non-explosive test range by the Navy and they have not been granted authorization to detonate any munitions in the area. Their continued use of the Zelatched Point pier is expected to continue as long as the support structure exists and there is a need to test munitions. Therefore, vessel traffic, seaplane use, and torpedo testing are considered I&I actions for the purpose of this consultation.

NOAA's MMPA Authorization

Pursuant to MMPA Section 101(a)(5)(A), the Navy has requested from NOAA's Office of Protected Resources (OPR) the issuance of a Letter of Authorization (LOA) for the incidental harassment of marine mammals in connection with the action described above. Regulations governing the issuance of incidental take under certain circumstances are codified at 50 Code of Federal Regulations Part 216, Subpart I (Sections 216.101–216.108). The Navy has requested from OPR authorization of level B Take of two ESA listed species; humpback whales (4) and Southern Resident killer whales (40) that will occur as a consequence of sound generated during pile driving over the five years of pile replacement activity. Level B harassment is defined as, "Any act of pursuit, torment, or annoyance which has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including but not limited to migration, breathing, nursing, breeding, feeding, or sheltering." OPR accordingly requested consultation with NMFS WCR on its action, and because of the Navy's underlying proposal, we are consolidating the consultation requests into a single analysis.

1.3.2 Avoidance and Minimization Measures

The Navy has proposed the following Best Management Practices (BMPs) to avoid and minimize adverse impacts of their activities on species and habitats. While these measures will not completely avoid or offset in any way the adverse impacts, they will diminish the degree to which adverse effects occur.

- Comply with water quality restrictions imposed by WDOE [Chapter 173-201A Washington Administrative Code (WAC)], which specify a mixing zone beyond which water quality standards cannot be exceeded. Compliance with WDOE's standards is intended to ensure protection of fish and aquatic life to the extent feasible and practicable.
- Navy will adhere to performance conditions imposed as part of any required Clean Water Act (CWA) permit. No in-water work will be conducted until the CWA authorization process has been completed.
- An Environmental Protection Plan will be prepared prior to the start of construction activities. The plan will identify construction planning elements and recognize spill sources at the sites. The plan will outline BMPs, responsive actions in the event of a spill or release, and notification and reporting procedures. The plan will also outline contractor management elements such as personnel responsibilities, project site security, site inspections, and training.
- No petroleum products, fresh cement, lime, fresh concrete, chemicals, or other toxic or harmful materials will be allowed to enter surface waters.

- Washwater resulting from wash-down of equipment or work areas will be contained for proper disposal, and will not be discharged unless authorized.
- Equipment that enters surface water will be maintained to prevent any visible sheen from petroleum products.
- There will be no discharge of oil, fuels, or chemicals to surface waters, or onto land where there is a potential for re-entry into surface waters. Fuel hoses, oil drums, oil or fuel transfer valves, fittings, etc. will be checked regularly for leaks. Materials will be maintained and stored properly to prevent spills.
- No cleaning chemicals or solvents will be discharged to ground or surface waters.
- Construction materials will not be stored where high tides, wave action, or upland runoff could cause materials to enter surface waters.
- Barge operations may be restricted to tide elevations adequate to prevent grounding of a barge.
- Where eelgrass has been mapped in the work area, the Navy will provide the contractor with plan sheets showing eelgrass boundaries. The following restrictions will apply to areas designated as having eelgrass:
    - Construction barges would avoid grounding in eelgrass beds during construction activities. This would be conducted through the use of spuds that would elevate barges during low tides.
    - Shallow draft, lower horsepower tugboats would be used in the nearshore area and for extended operations in areas shallower than 40 feet below MLLW, where feasible.
    - No scouring of sediments will occur within eelgrass beds.
    - Construction barges would avoid shading eelgrass beds for extended periods of time.
- Containment boom surrounding the work area will be used during creosote-treated pile removal to contain and collect any floating debris and sheen. In some cases, the boom may be lined with oil-absorbing material to absorb released creosote.
- Oil-absorbent materials will be used in the event of a spill if any oil product is observed in the water.
- All creosote-treated material and associated sediments will be disposed of in a landfill that meets the liner and leachate standards of the WAC.
- Creosote-treated timber piles will be replaced with non-creosote-treated piles.
- Used creosote piles will be cut into 4-ft lengths to prevent reuse.
- Removed piles and associated sediments (if any) will typically be contained on a barge. If a barge is not utilized, piles and sediments may be stored in a containment area near the construction sites.
- Piles that break or are already broken below the waterline may be removed by wrapping the piles with a cable or chain and pulling them directly from the sediment with a crane. If this is not possible, piles will be removed with a clamshell bucket. To minimize disturbance to bottom sediments and splintering of piling, the contractor will use the minimum size bucket required to pull out piles based on pile depth and substrate. The clamshell bucket will be emptied of piling and debris on a contained barge before it is lowered into the water. If the bucket contains only sediment, the bucket will remain closed and be lowered to the mudline and opened to redeposit the sediment. In some cases (depending on access, location, etc.), piles may be cut below the mudline.

- Any floating debris generated during removal or installation will be retrieved. Any debris in a containment boom will be removed by the end of the work day or when the boom is removed, whichever occurs first. Retrieved debris will be disposed of at an upland disposal site.
- If steel piles are filled with concrete, the tube used to fill steel piles with concrete will be placed inside and toward the bottom of the pile to prevent splashing and overflow.
- Whenever activities that generate sawdust, drill tailings, concrete fragments, or wood chips from treated timbers are conducted, tarps or other containment material will be used to prevent debris from entering the water.
- Timber piles will be pre-treated with a water-born preservative (ACZA) as defined in the American Wood Preservers Association usage standard UC5A for wood subject to marine borers.
- To ensure that leaching of the preservative is minimized, the piles will be produced and pre-treated in compliance with the "Best Management Practices for the Use of Treated Wood in Aquatic and Other Sensitive Environments" published by the "Supporting Organizations," (Western Wood Preservers Institute et al.) August 1, 2006 or the most current version, including published amendments.
- The piles used will be certified by an independent third party inspection agency as having been produced in compliance with the BMPs referenced above.
- If excavation around piles to be repaired or replaced is necessary, hand tools or a siphon dredge will be used to excavate around piles, depending on site-specific conditions. If siphon dredges are used, any contaminated sediment must be accounted for as waste and disposed of properly.
- Vibratory installation will be used to the extent possible to drive steel piles to minimize high sound pressure levels associated with impact pile driving.
- A bubble curtain or other noise attenuation device will be employed during impact installation or proofing of steel piles where water depths are greater than 0.67 meter (m). A noise attenuation device is not required during vibratory pile driving. Bubble curtains would not be used at NAVBASE Kitsap Bremerton to minimize disturbance of contaminated sediments. Due to the potential for disturbing contaminated sediments, the Navy will assess the use of bubble curtains at NAVBASE Kitsap Keyport and NAVSTA Everett on a project-by-project basis.
- If a bubble curtain or similar measure is used, it will distribute air bubbles around 100 percent of the piling perimeter for the full depth of the water column. Any other attenuation measure must provide 100 percent coverage in the water column for the full depth of the pile. The lowest bubble ring will be in contact with the mudline for the full circumference of the ring. The weights attached to the bottom ring will ensure 100 percent mudline contact. No parts of the ring or other objects will prevent full mudline contact.
- A performance test of the noise attenuation device will be conducted prior to initial use for impact pile driving. If a bubble curtain or similar measure is utilized, the performance test will confirm the calculated pressures and flow rates at each manifold ring. The contractor will also train personnel in the proper balancing of air flow to the bubblers. The contractor will submit an inspection/performance report to the Navy for approval within 72 hours following the performance test. Corrections to the noise attenuation device to meet the performance standards will occur prior to use for impact driving.

- No more than 30 steel piles per year will be installed by impact pile driving at any one location.
- For impact pile driving, the following soft-start procedures will be conducted:
    - o The contractor will provide an initial set of strikes from the impact hammer at reduced energy, followed by a 30-second waiting period, followed by two subsequent sets of strikes. (The reduced energy of an individual hammer cannot be quantified because they vary by individual drivers. Further, the number of strikes will vary at reduced energy because raising the hammer at less than full power and then releasing it results in the hammer "bouncing" as it strikes the pile resulting in multiple "strikes").

1.3.3 Marine Mammal Monitoring and Shutdown

The Navy has proposed the following BMPs with regard to marine mammals to avoid and minimize adverse impacts of their activities on species and habitats. While these non-discretionary measures will not completely avoid or offset in any way the adverse impacts, they will diminish the degree to which adverse effects occur. The Navy has proposed marine mammal monitoring as part of the action. Although the Navy has not proposed specific monitoring design parameters, they have made commitments to developing project-specific Plans in coordination with NMFS and have committed to certain key features such as location of monitors.

- A Marine Mammal Monitoring Plan will be developed for each project in coordination with NMFS and approved by the NMFS prior to initiation of in-water work. Implementation of these plans will prevent exposure to potentially injurious noise levels.
- In accordance with the Plans, monitoring will occur within pre-determined shutdown zones for purposes of avoiding injurious effects.
- In accordance with the Plans, monitoring will result in cessation of pile driving if cetaceans are seen approaching or entering the injury zone or visually monitorable portion of the disturbance zone during impact or vibratory pile driving, work will be halted and delayed until either the animal has voluntarily left and been visually confirmed beyond the injury zone or visual portion of the disturbance zone or 15 minutes have passed without re-detection of the animal."
- In accordance with the Plans, monitoring will result in cessation of pile driving of steel or concrete piles if marine mammals are seen by monitors within the impact pile driving underwater injury threshold or the airborne masking threshold.
- Trained observers will be placed at the best vantage point(s) practicable to monitor for marine mammals and implement shutdown/delay procedures when applicable. Separate observers will be dedicated for monitoring marine mammals.

1.4 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 greatest extent of physical, chemical or biological effects stemming from the proposed action, either directly or indirectly, determines the action area.

For the proposed action, there are both short-term construction-related effects and long-term permanent effects of one structure's presence in aquatic habitat. The greatest extent of effects stemming from the proposed action in this case is the biological effect of prey reduction, affecting both salmonids (in the form of forage fish reduction) and SRKW (in the form of reduced Chinook salmon abundance). We anticipate the construction related activities (sound caused during pile driving) will directly impact forage fish and salmonids that occupy or traverse through the immediate construction areas and subsequently spread throughout Puget Sound. We also anticipate any effects on these species to carry over as indirect effects on SRKW who rely on Chinook as their primary prey throughout Puget Sound. This effects analysis is fully described below in Section 2.4.

Although most of the direct effects of the action will occur in the vicinity of each structure (Navy piers), pile driving, reductions in forage, and effects from boating activity have the potential to affect listed salmonids and whales throughout PS and Hood Canal. Because the biological effect of the proposed action with the greatest geographic scope is on fishes that are prey to other listed species, the action area for this consultation is defined as all marine waters, shallow as well as deep, of Puget Sound and Hood Canal.

The action area is occupied by PS Chinook salmon, PS steelhead, HCSR chum salmon, and two species of listed rockfish, SRKW and Humpback whales. Portions of the action area are designated as critical habitat for some of these species. The action area is also EFH for Chinook, coho and pink salmon, as well as groundfish. Portions of the action area are exempt from critical habitat listing as they are either DOD lands with right-of-ways, are managed through an INRMP, or designated Security Zones (33 CFR 334).

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 provides 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 list of species and habitats designated under the ESA that are covered in this Biological Opinion, and the designation status, is presented in Table 3, below.

Table 3. List of species and habitats designated under the ESA and those relevant designations that are covered in this Biological Opinion

Species	Status	Listing	Listing Date	Critical Habitat Designation	Designation Date
Puget Sound Chinook	Threatened	64 FR 14308	3/24/1999	50 FR 52630	9/2/2005
Puget Sound Steelhead	Threatened	72 FR 26722	6/11/2007	81 FR 9252	2/24/2016
Puget Sound- Georgia Basin Bocaccio	Endangered	75 FR 22276 (updated with 79 FR 20802)	4/28/2010	79 FR 68042	2/11/2015
Puget Sound-Georgia Basin yelloweye Rockfish	Threatened	77 FR 22276 (updated with 79 FR 20802)	4/28/2010	79 FR 68042	2/11/2015
Southern Resident Killer Whales	Endangered	70 FR 69903 (updated with 79 FR 20802)	11/18/2005	71 FR 69054	11/19/2006
Humpback Whale (Central America and Mexican DPSs)	Endangered and Threatened	35 FR 18319 (update 80 FR 22303)	4/21/2015	Not Applicable	Not Applicable
Hood Canal Summer-run Chum	Threatened	64 FR 14508 (updated with Good et al… 2005)	3/25/1999	70 FR 52630	9/2/2005

2.1 Analytical Approach

This biological opinion includes both a jeopardy analysis and/or an adverse modification analysis. The jeopardy analysis relies upon the regulatory definition of "to jeopardize the continued existence of" a listed species, which is "to engage in an action that 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 for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features" (81 FR 7214).

The designation(s) of critical habitat for (species) use(s) the term primary constituent element (PCE) or essential features. The new critical habitat regulations (81 FR 7414) replace 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.

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

- Identify the rangewide status of the species and critical habitat expected to be adversely affected by the proposed action.

- Describe the environmental baseline in the action area.
- Analyze the effects of the proposed action on both species and their habitat using an "exposure-response-risk" approach.
- Describe any cumulative effects in the action area.
- Integrate and synthesize the above factors by: (1) Reviewing the status of the species and critical habitat; and (2) adding the effects of the action, the environmental baseline, and cumulative effects to assess the risk that the proposed action poses to species and critical habitat.
- Reach a conclusion about whether species are jeopardized or critical habitat is adversely modified.
- If necessary, suggest a RPA to the proposed action.

2.2 Rangewide Status of the Species and Critical Habitat

This opinion examines the status of each species that would be adversely affected by the proposed action. The status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species' likelihood of both survival and recovery. The species status section also helps to inform the description of the species' current "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 current function of the essential PBFs that help to form that conservation value.

One factor affecting the status of ESA-listed species considered in this opinion, and aquatic habitat at large, is climate change. Climate change is likely to play an increasingly important role in determining the abundance and distribution of ESA-listed species, and the conservation value of designated critical habitats, in the Pacific Northwest. These changes will not be spatially homogeneous across the Pacific Northwest. The largest hydrologic responses are expected to occur in basins with significant snow accumulation, where warming decreases snow pack, increases winter flows, and advances the timing of spring melt (Mote et al. 2014, Mote 2016). Rain-dominated watersheds and those with significant contributions from groundwater may be less sensitive to predicted changes in climate (Tague et al. 2013, Mote et al. 2014).

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

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

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 3.5-5.3^{o}C increases in Columbia Basin streams and a peak temperature of 26^{o}C 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 2007). Reduced flows will make it more difficult for migrating fish to pass physical and thermal obstructions, limiting their access to available habitat (Mantua et al. 2010; Isaak et al. 2012). Temperature increases shift timing of key life cycle events for salmonids and species forming the base of their aquatic foodwebs (Crozier et al. 2011; Tillmann and Siemann 2011; Winder and Schindler 2004). Higher stream temperatures will also cause decreases in dissolved oxygen and may also cause earlier onset of stratification and reduced mixing between layers in lakes and reservoirs, which can also result in reduced oxygen (Meyer et al. 1999; Winder and Schindler 2004, Raymondi et al. 2013). Higher temperatures are likely to cause several species to become more susceptible to parasites, disease, and higher predation rates (Crozier et al. 2008; Wainwright & Weitkamp 2013; Raymondi et al. 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 (McMahon and Hartman 1989; Lawson et al. 2004).

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 1.0-3.7^{o}C 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 (Tillmann and Siemann 2011, Reeder et al. 2013).

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

Global sea levels are expected to continue rising throughout this century, reaching likely predicted increases of 10-32 inches by 2081-2100 (IPCC 2014). These changes will likely result in increased erosion and more frequent and severe coastal flooding and shifts in the composition of nearshore habitats (Tillmann and Siemann 2011, Reeder et al. 2013). 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 (Tillmann and Siemann 2011, Reeder et al. 2013).

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

2.2.1 Status of the Species

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

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

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

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

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

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

Additional information is available at NMFS’s West Coast Region website; http://www.westcoast.fisheries.noaa.gov/).

Puget Sound Chinook salmon.

The Puget Sound Chinook salmon evolutionarily significant unit (ESU) was listed as threatened on June 28, 2005 (70 FR 37160). We adopted the recovery plan for this ESU in January 2007. The recovery plan consists of two documents: the Puget Sound salmon recovery plan (Shared Strategy for Puget Sound 2007) and a supplement by NMFS (2006). The recovery plan adopts ESU and population level viability criteria recommended by the Puget Sound Technical Recovery Team (PSTRT) (Ruckelshaus *et al.* 2002). The PSTRT’s biological recovery criteria will be met when all of the following conditions are achieved:

- The viability status of all populations in the ESU is improved from current conditions, and when considered in the aggregate, persistence of the ESU is assured;
- Two to four Chinook salmon populations in each of the five biogeographical regions of the ESU (Table 6) achieve viability, depending on the historical biological characteristics and acceptable risk levels for populations within each region;
- At least one population from each major genetic and life history group historically present within each of the five biogeographical regions is viable;
- Tributaries to Puget Sound not identified as primary freshwater habitat for any of the 22 identified populations are functioning in a manner that is sufficient to support an ESU-wide recovery scenario; Production of Chinook salmon from tributaries to Puget Sound

not identified as primary freshwater habitat for any of the 22 identified populations occurs in a manner consistent with ESU recovery; and

- Populations that do not meet the viability criteria for all VSP parameters are sustained to provide ecological functions and preserve options for ESU recovery.

Spatial Structure and Diversity. The Puget Sound Chinook salmon ESU includes all naturally spawning populations of Chinook salmon from rivers and streams flowing into Puget Sound including the Straits of Juan De Fuca from the Elwha River, eastward, including rivers and streams flowing into Hood Canal, South Sound, North Sound and the Strait of Georgia in Washington. The ESU also includes the progeny of numerous artificial propagation programs (NWFSC 2015). The PSTRT identified 22 extant populations, grouped into five major geographic regions, based on consideration of historical distribution, geographic isolation, dispersal rates, genetic data, life history information, population dynamics, and environmental and ecological diversity. The PSTRT distributed the 22 populations among five major biogeographical regions, or major population groups (MPG), that are based on similarities in hydrographic, biogeographic, and geologic characteristics (Table 4).

Between 1990 and 2014, the proportion of natural-origin spawners has trended downward across the ESU, with the Whidbey Basin the only MPG with consistently high fractions of natural-origin spawner abundance. All other MPG have either variable or declining spawning populations with high proportions of hatchery-origin spawners (NWFSC 2015).Overall, the new information on abundance, productivity, spatial structure and diversity since the 2010 status review supports no change in the biological risk category (NWFSC 2015).

Table 4. Extant PS Chinook salmon populations in each biogeographic region (PSTRT 2002, NWFSC 2015)

Biogeographic Region	Population (Watershed)
Strait of Georgia	North Fork Nooksack River
	South Fork Nooksack River
Strait of Juan de Fuca	Elwha River
	Dungeness River
Hood Canal	Skokomish River
	Mid Hood Canal Rivers
Whidbey Basin	Skykomish River
	Snoqualmie River
	North Fork Stillaguamish River
	South Fork Stillaguamish River
	Upper Skagit River
	Lower Skagit River
	Upper Sauk River
	Lower Sauk River
	Suiattle River
	Upper Cascade River
Central/South Puget Sound Basin	Cedar River
	North Lake Washington/ Sammamish River
	Green/Duwamish River
	Puyallup River
	White River
	Nisqually River

Abundance and Productivity. Available data on total abundance since 1980 indicate that although abundance trends have fluctuated between positive and negative for individual populations, there are widespread negative trends in natural-origin Chinook salmon spawner abundance across the ESU (NWFSC 2015). Productivity remains low in most populations, and hatchery-origin spawners are present in high fractions in most populations outside of the Skagit watershed. Available data now shows that most populations have declined in abundance over the past 7 to 10 years. Further, 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 (NWFSC 2015).

Washington Dept. of Fish and Wildlife maintain annual abundance observances indexing for individual runs of Puget Sound Chinook salmon stock inventory (SaSI). These counts and estimates are made on the bases of fish in system at post-harvest levels. The most recent estimates for abundance 2015-2017 put natural spawner abundance at 26,904 returners and hatchery produced spawners at 26,617 individuals (SaSI 2017).

Limiting Factors. Limiting factors for this species include:

- Degraded floodplain and in-river channel structure
- Degraded estuarine conditions and loss of estuarine habitat
- Riparian area degradation 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
- Altered flow regime

Even though different life history forms have to date been studied most extensively in Skagit River Chinook salmon, Beamer et al. (2005) assume that they naturally occur in other populations, too. Further, Beamer et al. (2005) assume that the distribution within a population will depend upon environmental conditions. For example, the large number of fry migrants in the Skagit can be interpreted as a response to limited delta habitat. In the action area, salmonid fork lengths generally increased for each species' cohort, as a consequence of seasonal growth after outmigration from local watersheds, from January through September. In 2016 outmigrating chinook fork length averaged between 80 and 250 millimeters (Figure 2). Chum average fork length averaged between 35 and 125 millimeters (Frierson et al. 2017).

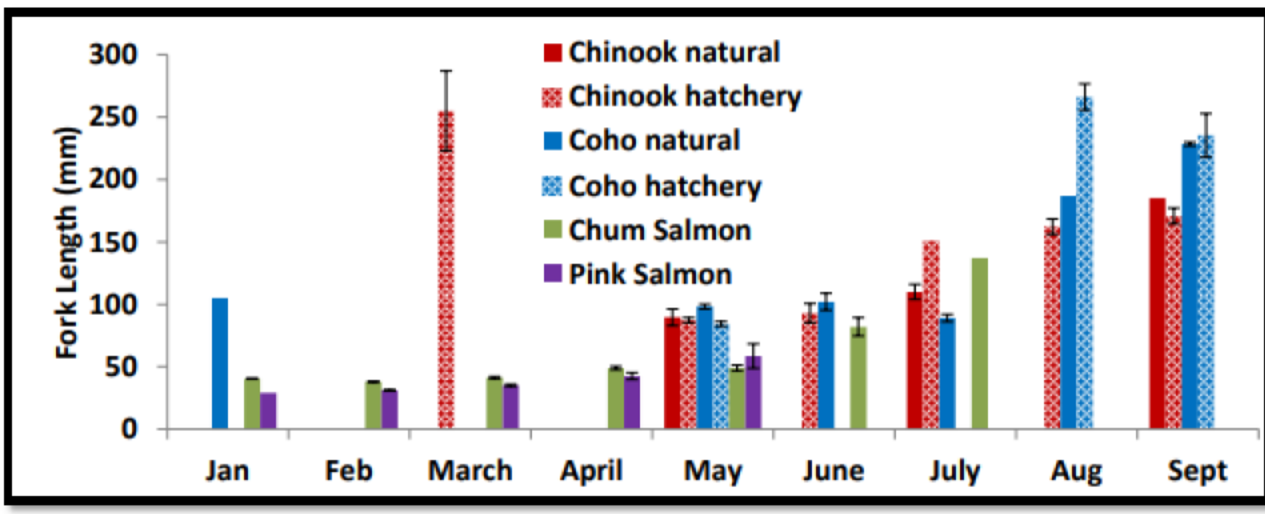

Figure 2. Mean for Length for Juvenile Salmonid Species in the Action Area, 2016

Rockfish.

Abundance. There are no estimates of historic or present-day abundance of yelloweye rockfish, or bocaccio across the full DPSs area. In 2013, the Washington State Department of Fish and Wildlife (WDFW) published abundance estimates from a remotely operated vehicle survey conducted in 2008 in the San Juan Island area (Pacunski et al. 2013). This survey was conducted exclusively within rocky habitats and represents the best available abundance estimates to date for one basin of the DPS. The survey produced estimates of 47,407 (25 percent variance) yelloweye rockfish, and 4,606 (100 percent variance) bocaccio in the San Juan area (Tonnes et al., 2016).

Further, data suggest that total rockfish declined at a rate of 3.1 to 3.8 percent per year from 1977 to 2014 or a 69 to 76 percent total decline over that period. The three listed species declined over-proportional compared to the total rockfish assemblage. Therefore, long-term population growth rate for the listed species was likely even lower (more negative) than that for total rockfish. Finally, there is little to no evidence of recent recovery of total rockfish abundance to recent protective measures.

Productivity. Mature females of each listed species produce from several thousand to over a million eggs annually (Love et al., 2002). In rockfish the number of embryos produced by the female increases with size. For example, female copper rockfish that are 20 cm in length produce 5,000 eggs while a female 50 cm in length may produce 700,000 eggs (Palsson, 2009). These specific observations come from other rockfish, not the two listed species. However, the generality of maternal effects in Sebastes suggests that some level of age or size influence on reproduction is likely for all species.

Puget Sound Steelhead.

The PS Steelhead TRT produced viability criteria, including population viability analyses (PVAs), for 20 of 32 demographically independent populations (DIPs) and three major population groups (MPGs) in the DPS (Hard 2015). It also completed a report identifying historical populations of the DPS (Myers *et al.* 2015). The DIPs are based on genetic, environmental, and life history characteristics. Populations display winter, summer, or summer/winter run timing (Myers *et al.* 2015). The TRT concludes that the DPS is currently at "very low" viability, with most of the 32 DIPs and all three MPGs at "low" viability.

The designation of the DPS as "threatened" is based upon the extinction risk of the component populations. Hard 2015, identify several criteria for the viability of the DPS, including that a minimum of 40 percent of summer-run and 40 percent of winter-run populations historically present within each of the MPGs must be considered viable using the VSP-based criteria. For a DIP to be considered viable, it must have at least an 85 percent probability of meeting the viability criteria, as calculated by Hard (2015).

Spatial Structure and Diversity**.** The PS steelhead DPS is the anadromous form of O. mykiss that occur in rivers, below natural barriers to migration, in northwestern Washington State that drain to Puget Sound, Hood Canal, and the Strait of Juan de Fuca between the U.S./Canada border and the Elwha River, inclusive. The DPS also includes six hatchery stocks that are considered no more than moderately diverged from their associated natural-origin counterparts: Green River natural winter-run; Hamma Hamma winter-run; White River winter-run; Dewatto River winter-run; Duckabush River winter-run; and Elwha River native winter-run (USDC 2014). Steelhead are the anadromous form of *Oncorhynchus mykiss* that occur in rivers, below natural barriers to migration, in northwestern Washington State (Ford 2011). Non-anadromous ''resident'' *O. mykiss* occur within the range of PS steelhead but are not part of the DPS due to marked differences in physical, physiological, ecological, and behavioral characteristics (Hard *et al.* 2007).

DIPs can include summer steelhead only, winter steelhead only, or a combination of summer and winter run timing (*e.g.,* winter run, summer run or summer/winter run). Most DIPs have low viability criteria scores for diversity and spatial structure, largely because of extensive hatchery influence, low breeding population sizes, and freshwater habitat fragmentation or loss (Hard *et* *al.* 2007). In the Central and South Puget Sound and Hood Canal and Strait of Juan de Fuca MPGs, nearly all DIPs are not viable (Hard 2015). More information on PS steelhead spatial structure and diversity can be found in NMFS' technical report (Hard 2015).

Abundance and Productivity. Abundance of adult steelhead returning to nearly all Puget Sound rivers has fallen substantially since estimates began for many populations in the late 1970s and early 1980s. Smoothed trends in abundance indicate modest increases since 2009 for 13 of the 22 DIPs. Between the two most recent five-year periods (2005-2009 and 2010-2014), the geometric mean of estimated abundance increased by an average of 5.4 percent. For seven populations in the Northern Cascades MPG, the increase was 3 percent; for five populations in the Central & South Puget Sound MPG, the increase was 10 percent; and for six populations in the Hood Canal & Strait of Juan de Fuca MPG, the increase was 4.5 percent. However, several of these upward trends are not statistically different from neutral, and most populations remain small. Inspection of geometric means of total spawner abundance from 2010 to 2014 indicates that 9 of 20 populations evaluated had geometric mean abundances fewer than 250 adults and 12 of 20 had fewer than 500 adults. Between the most recent two five-year periods (2005-2009 and 2010-2014), several populations showed increases in abundance between 10 and 100 percent, but about half have remained in decline. Long-term (15-year) trends in natural spawners are predominantly negative (NWFSC 2015).

There are some signs of modest improvement in steelhead productivity since the 2011 review, at least for some populations, especially in the Hood Canal & Strait of Juan de Fuca MPG. However, these modest changes must be sustained for a longer period (at least two generations) to lend sufficient confidence to any conclusion that productivity is improving over larger scales across the DPS. Moreover, several populations are still showing dismal productivity, especially those in the Central & South Puget Sound MPG (NWFSC 2015).

Little or no data is available on summer-run populations to evaluate extinction risk or abundance trends. Because of their small population size and the complexity of monitoring fish in headwater holding areas, summer steelhead have not been broadly monitored.

Limiting factors. In our 2013 proposed rule designating critical habitat for this species (USDC 2013b), we noted that the following factors for decline for PS steelhead persist as limiting factors:

- The continued destruction and modification of steelhead habitat
- Widespread declines in adult abundance (total run size), despite significant reductions in harvest in recent years
- Threats to diversity posed by use of two hatchery steelhead stocks (Chambers Creek and Skamania)
- Declining diversity in the DPS, including the uncertain but weak status of summer run fish
- A reduction in spatial structure
- Reduced habitat quality through changes in river hydrology, temperature profile, downstream gravel recruitment, and reduced movement of large woody debris
- In the lower reaches of many rivers and their tributaries in Puget Sound where urban development has occurred, increased flood frequency and peak flows during storms and

reduced groundwater-driven summer flows, with resultant gravel scour, bank erosion, and sediment deposition
- Dikes, hardening of banks with riprap, and channelization, which have reduced river braiding and sinuosity, increasing the likelihood of gravel scour and dislocation of rearing juveniles

***Hood Canal Summer-Run Chum*.**

We adopted a recovery plan for HC summer-run chum salmon in May of 2007. The recovery plan consists of two documents: the Hood Canal and Eastern Strait of Juan de Fuca Summer Chum Salmon Recovery Plan (Hood Canal Coordinating Council 2005) and a supplemental plan by NMFS (2007). The recovery plan adopts ESU and population level viability criteria recommended by the Puget Sound Technical Recovery Team (PS-TRT) (Sands *et al.* 2007). The PSTRT's biological recovery criteria will be met when the following conditions are achieved:
- Spatial Structure: 1) Spawning aggregations are distributed across the historical range of the population. 2) Most spawning aggregations are within 20 km of adjacent aggregations. 3) Major spawning aggregations are distributed across the historical range of the population and are not more than approximately 40 km apart. Further, a viable population has spawning, rearing, and migratory habitats that function in a manner that is consistent with population persistence.
- Diversity: Depending on the geographic extent and ecological context of the population, a viable population includes one or more persistent spawning aggregations from each of the two to four major ecological diversity groups historically present within the two populations (see also McElhany et al. 2000).
- Abundance and Productivity: Achievement of minimum abundance levels associated with persistence of Hood Canal Summer Chum ESU populations that are based on two assumptions about productivity and environmental response (Table 5).

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 (NWFSC 2015).

Table 5. Hood Canal summer-run chum ESU abundance and productivity recovery goals (Sands et al. 2007)

Population	Low Productivity Planning Target for Abundance (productivity in parentheses)	High Productivity Planning Target for Abundance (productivity in parentheses)
Strait of Juan de Fuca	12,500 (1.0)	4,500 (5.0)
Hood Canal	24,700 (1.0)	18,300 (5.0)

<u>Spatial Structure and Diversity</u>. The ESU includes all naturally spawning populations of summer-run chum salmon in Hood Canal tributaries as well as populations in Olympic Peninsula rivers between Hood Canal and Dungeness Bay, Washington, as well as several artificial propagation programs. The Puget Sound Technical Recovery Team identified two independent populations for the Hood Canal summer chum, one which includes the spawning aggregations from rivers

and creeks draining into the Strait of Juan de Fuca, and one which includes spawning aggregations within Hood Canal proper (Sands et al. 2009).

Spatial structure and diversity measures for the Hood Canal summer chum recovery program have included the reintroduction and sustaining of natural-origin spawning in multiple small streams where summer chum spawning aggregates had been extirpated. Supplementation programs have been very successful in both increasing natural spawning abundance in 6 of 8 extant streams (Salmon, Big Quilcene, Lilliwaup, Hamma Hamma, Jimmycomelately, and Union) and increasing spatial structure due to reintroducing spawning aggregations to three streams (Big Beef, Tahuya, and Chimacum). Spawning aggregations are present and persistent within five of the six major ecological diversity groups identified by the PS TRT (Table 6). As supplementation program goals have been met in most locations, they have been terminated except in Lilliwaup/Tahuya, where supplementation is ongoing (NWFSC 2015). Spatial structure and diversity viability parameters for each population have increased and nearly meet the viability criteria.

Table 6. Seven ecological diversity groups as proposed by the PSTRT for the Hood Canal Summer Chum ESU by geographic region and associated spawning aggregation.

Geographic Region(population)	Proposed Ecological Diversity Groups	Spawning aggregations: Extant* and extinct**
Eastern Strait of Juan de Fuca	Dungeness	Dungeness R (unknown status)
	Sequim-Admiralty	Jimmycomelately Cr* Salmon Cr* Snow Cr* Chimacum Cr**
Hood Canal	Toandos	Unknown
	Quilcene	Big Quilcene R* Little Quilcene R*
	Mid-West Hood Canal	Dosewallips R* Duckabush R*
	West Kitsap	Big Beef Cr** Seabeck Cr** Stavis Cr** Anderson Cr** Dewatto R** Tahuya R** Mission Cr** Union R*
	Lower West Hood Canal	Hamma Hamma R* Lilliwaup Cr* Skokomish R*

<u>Abundance and Productivity</u>. Smoothed trends in estimated total and natural population spawning abundances for both Hood Canal and Strait of Juan de Fuca populations have generally increased over the 1980 to 2014 time period. The Hood Canal population has had a 25 percent increase in abundance of natural-origin spawners in the most recent 5-year time period over the 2005-2009 time period. The Strait of Juan de Fuca has had a 53 percent increase in abundance of natural-origin spawners in the most recent 5-year time period.

Trends in population productivity, estimated as the log of the smoothed natural spawning abundance in year t minus the smoothed natural spawning abundance in year (t-4), have increasing over the past five years, and were above replacement rates in the 2012 and 2013. However, productivity rates have been varied above and below replacement rates over the entire time period up to 2014. PNPTT and WDFW (2014) provide a detailed analysis of productivity for the ESU, each population, and by individual spawning aggregation, and report that 3 of the 11 stocks exceeded the co-manager's interim productivity goal of an average of 1.6 Recruit/Spawner over 8 years. They also report that natural-origin Recruit/Spawner rates have been highly variable in recent brood years, particularly in the Strait of Juan de Fuca population. Only one spawning aggregation (Chimacum) meets the co-manager's interim recovery goal of 1.2 recruits per spawner in 6 of most recent 8 years. Productivity of individual spawning aggregates shows only two of eight aggregates have viable performance. (NWFSC 2015).

Limiting factors. Limiting factors for this species include (Hood Canal Coordinating Council 2005):

- Reduced floodplain connectivity and function
- Poor riparian condition
- Loss of channel complexity (reduced large wood and channel condition, loss of side channels, channel instability)
- Sediment accumulation
- Altered flows and water quality

Southern Resident Killer Whales.

The Southern Resident killer whale Distinct Population Segment (DPS), composed of J, K and L pods, was listed as endangered under the ESA on November 18, 2005 (70 FR 69903). A 5-year review under the ESA completed in 2016 concluded that Southern Residents should remain listed as endangered and includes recent information on the population, threats, and new research results and publications (NMFS 2016).

The limiting factors described in the final recovery plan included reduced prey availability and quality, high levels of contaminants from pollution, and disturbances from vessels and sound (NMFS 2008). This section summarizes the status of Southern Resident killer whales throughout their range. This section summarizes information taken largely from the recovery plan (NMFS 2008), recent 5-year review (NMFS 2016), as well as new data that became available more recently.

Abundance, Productivity, and Trends

Southern Resident killer whales are a long-lived species, with late onset of sexual maturity (review in NMFS 2008). Females produce a low number of surviving calves over the course of their reproductive life span (Bain 1990, Olesiuk et al. 1990). Compared to Northern Resident killer whales (a resident killer whale population with a sympatric geographic distribution ranging from coastal waters of Washington State and British Columbia north to Southeast Alaska) Southern Resident females appear to have reduced fecundity (Ward et al. 2013, Vélez-Espino et al. 2014); the average inter-birth interval for reproductive Southern Resident females is 6.1 years, which is longer than the 4.88 years estimated for Northern Resident killer whales (Olesiuk et al. 2005). Recent evidence has indicated pregnancy hormones (progesterone and testosterone) can be detected in Southern Resident killer whale feces and have indicated several miscarriages, particularly in late pregnancy (Wasser et al. 2017). The authors suggest this reduced fecundity is largely due to nutritional limitation. Mothers and offspring maintain highly stable social bonds throughout their lives, which is the basis for the matrilineal social structure in the Southern Resident population (Baird 2000, Bigg et al. 1990, Ford 2000). Groups of related matrilines form pods. Three pods – J, K, and L – make up the Southern Resident community. Clans are composed of pods with similar vocal dialects and all three pods of the Southern Residents are part of J clan.

At present, the Southern Resident population has declined to historically low levels. Since censuses began in 1974, J and K pods have steadily increased their sizes. However, the population suffered an almost 20 percent decline from 1996-2001 (from 97 whales in 1996 to 81 whales in 2001), largely driven by lower survival rates in L pod. The overall population had increased slightly from 2002 to 2010 (from 83 whales to 86 whales). During the international science panel review of the effects of salmon fisheries (Hilborn et al. 2012), the Panel stated that during 1974 to 2011, the population experienced a realized growth rate of 0.71 percent, from 67 individuals to 87 individuals. Since then, the population has decreased to only 74 whales, a historical low in the last 30 years with a current realized growth rate (from 1974 to 2017) at half of the previous estimate described in the Panel report, 0.29 percent.

There is representation in all three pods, with 22 whales in J pod, 18 whales in K pod and 34 whales in L pod. There are currently 4 reproductively mature males in J pod, 8 in K pod, and 10 mature males in L pod between the ages of 10 and 42 years. Although the age and sex distribution is generally similar to that of Northern Residents that are a stable and increasing population (Olesiuk et al. 2005), there are several demographic factors of the Southern Resident population that are cause for concern, namely reduced fecundity, sub-adult survivorship in L pod, and the total number of individuals in the population (review in NMFS 2008). Based on an updated pedigree from new genetic data, most of the offspring in recent years were sired by two fathers, meaning that less than 30 individuals make up the effective reproducing portion of the population. Because a small number of males were identified as the fathers of many offspring, a smaller number may be sufficient to support population growth than was previously thought (Ford et al. 2011, NWFSC unpublished data). Some offspring were the result of matings within the same pod raising questions and concerns about inbreeding effects. Research into the relationship between genetic diversity, effective breeding population size, and health is currently underway to determine how this metric can inform us about extinction risk and inform recovery (NWFSC unpublished data).The historical abundance of Southern Resident killer whales is estimated from 140 to an unknown upper bound. The minimum estimate (~140) is the number of whales killed or removed for public display in the 1960s and 1970s added to the remaining population at the time the captures ended. Several lines of evidence (i.e., known kills and removals [Olesiuk et al. 1990], salmon declines (Krahn et al. 2002) and genetics (Krahn et al. 2002, Ford et al. 2011) all indicate that the population used to be larger than it is now and likely experienced a recent reduction in size, but there is currently no reliable estimate of the upper bound of the historical population size.

Seasonal mortality rates among Southern and Northern Resident whales may be highest during the winter and early spring, based on the numbers of animals missing from pods returning to inland waters each spring. Olesiuk et al. (2005) identified high neonate mortality that occurred outside of the summer season. At least 12 newborn calves (9 in the southern community and 3 in the northern community) were seen outside the summer field season and disappeared by the next field season. Additionally, stranding rates are higher in winter and spring for all killer whale forms in Washington and Oregon (Norman et al. 2004). Data collected from three Southern Resident killer whale strandings in the last five years have contributed to our knowledge of the health of the population and the impact of the threats to which they are exposed. Transboundary partnerships have supported thorough necropsies of L112 in 2012, J32 in 2014, and L95 in 2016, which included testing for contaminant load, disease and pathogens, organ condition, and diet composition14. A final necropsy report for J34, who was found dead near Sechelt, British Columbia on December 20, 2016 is still pending.

The NWFSC continues to evaluate changes in fecundity and mortality rates, and has updated the work on population viability analyses conducted for the 2004 Status Review for Southern Resident Killer Whales and the science panel review of the effects of salmon fisheries (Krahn et al. 2004; Hilborn et al. 2012; Ward et al. 2013). Following from that work, the data now suggests a downward trend in population growth projected over the next 50 years. As the model projects out over a longer time frame (50 years) there is increased uncertainty around the estimates, however, if all of the parameters in the model remain the same the overall trend shows a decline in later years. This downward trend is in part due to the changing age and sex structure of the population, but also related to the relatively low fecundity rate observed over the period from 2011 to 2016 (NMFS 2016f). To explore potential demographic projections, Lacy et al. (2017) constructed a population viability assessment that considered sub-lethal effects and the cumulative impacts of threats (contaminants, acoustic disturbance, and prey abundance). They found that over the range of scenarios tested, the effects of prey abundance on fecundity and survival had the largest impact on the population growth rate. Furthermore, they suggested in order for the population to reach the recovery target of 2.3 percent growth rate, the acoustic disturbance would need to be reduced in half and the Chinook abundance would need to be increased by 15 percent (Lacy et al. 2017).

Because of this population's small abundance, it is also susceptible to demographic stochasticity – randomness in the pattern of births and deaths among individuals in a population. Several other sources of stochasticity can affect small populations and contribute to variance in a population's growth and extinction risk. Other sources include environmental stochasticity, or fluctuations in the environment that drive fluctuations in birth and death rates, and demographic heterogeneity, or variation in birth or death rates of individuals because of differences in their individual fitness (including sexual determinations). In combination, these and other sources of random variation combine to amplify the probability of extinction, known as the extinction vortex (Gilpin and Soulé 1986, Fagen and Holmes 2006, Melbourne and Hastings 2008). The larger the population size, the greater the buffer against stochastic events and genetic risks. A delisting criterion for the Southern Resident killer whale DPS is an average growth rate of 2.3 percent for 28 years (NMFS 2008e). In light of the current average growth rate of 0.29 percent (from 1974 to present), this recovery criterion reinforces the need to allow the population to grow quickly.

Population growth is also important because of the influence of demographic and individual heterogeneity on a population's long-term viability. Population-wide distribution of lifetime reproductive success can be highly variable, such that some individuals produce more offspring than others to subsequent generations, and male variance in reproductive success can be greater than that of females (i.e., Clutton-Brock 1988, Hochachka 2006). For long-lived vertebrates such as killer whales, some females in the population might contribute less than the number of offspring required to maintain a constant population size (n = 2), while others might produce more offspring. The smaller the population, the more weight an individual's reproductive success has on the population's growth or decline (i.e., Coulson et al. 2006). For example, although there are currently 26 reproductive aged females (ages 11-42) in the Southern Resident killer whale population, only 14 have successfully reproduced in the last 10 years (CWR unpubl. data). This further illustrates the risk of demographic stochasticity for a small population like Southern Resident killer whales – the smaller a population, the greater the chance that random variation will result in too few successful individuals to maintain the population.

Geographic Range and Distribution

Southern Residents occur throughout the coastal waters off Washington, Oregon, and Vancouver Island and are known to travel as far south as central California and as far north as Southeast Alaska (NMFS 2008, Hanson et al. 2013, Carretta et al. 2017) Southern Residents are highly mobile and can travel up to 86 miles (160 km) in a single day (Baird 2000, Erickson 1978), with seasonal movements likely tied to the migration of their primary prey, salmon.

During the spring, summer, and fall months, the whales spend a substantial amount of time in the inland waterways of the Strait of Georgia, Strait of Juan de Fuca, and Puget Sound (Bigg 1982; Ford 2000; Krahn et al. 2002; Hauser et al. 2007). In general, the three pods are increasingly more present in May and June and spend a considerable amount of time in inland waters through September. Late summer and early fall movements of Southern Residents in the Georgia Basin are consistent, with strong site fidelity shown to the region as a whole and high occurrence in the San Juan Island area (Hanson and Emmons 2010, Hauser et al. 2007). All three pods generally remain in the Georgia Basin through October and make frequent trips to the outer coasts of Washington and southern Vancouver Island and are occasionally sighted as far west as Tofino and Barkley Sound (Ford 2000; Hanson and Emmons 2010, Whale Museum unpubl. data). Sightings in late fall decline as the whales shift to the outer coasts of Vancouver Island and Washington.

Although seasonal movements are generally predictable, there can be large inter-annual variability in arrival time and days present in inland waters from spring through fall, with late arrivals and fewer days present in recent years (Hanson and Emmons 2010; The Whale Museum unpubl. data). For example, K pod has had variable occurrence in June ranging from 0 days of occurrence in inland waters to over 25 days. Fewer observed days in inland waters likely indicates changes in their prey availability (i.e., abundance, distribution and accessibility). During fall and early winter, Southern Resident pods, and J pod in particular, expand their routine movements into Puget Sound, likely to take advantage of chum and Chinook salmon runs (Hanson et al. 2010, Osborne 1999).

In recent years, several sightings and acoustic detections of Southern Residents have been obtained off the Washington and Oregon coasts in the winter and spring (Hanson et al. 2010, Hanson et al. 2013, NWFSC unpubl. data). Satellite-linked tag deployments have also provided more data on the Southern Resident killer whale movements in the winter indicating that K and L pods use the coastal waters along Washington, Oregon, and California during non-summer months. Detection rates of K and L pods on the passive acoustic recorders indicate Southern Residents occur with greater frequency off the Columbia River and Westport and are most common in March (Hanson et al. 2013). J pod has also only been detected on one of seven passive acoustic recorders positioned along the outer coast (Hanson et al. 2013). The limited range of the sightings/ acoustic detections of J pod in coastal waters, the lack of coincident occurrence during the K and L pod sightings, and the results from satellite tagging in 2012–2016 (NWFSC unpubl. data) indicate J pod's limited occurrence along the outer coast and extensive occurrence in inland waters, particularly in the northern Georgia Strait.

Limiting Factors and Threats

Several factors identified in the final recovery plan for Southern Residents may be limiting recovery. These are quantity and quality of prey, toxic chemicals that accumulate in top predators, and disturbance from sound and vessels. Oil spills are also a risk factor. It is likely that multiple threats are acting together to impact the whales. Modeling exercises have attempted to identify which threats are most significant to survival and recovery (Lacy et al. 2017) and available data suggests that all of the threats are potential limiting factors (NMFS 2008).

Quantity and Quality of Prey

Southern Resident killer whales consume a variety of fish species (22 species) and one species of squid (Ford et al. 1998; Ford 2000; Ford and Ellis 2006; Hanson et al. 2010; Ford et al. 2016), but salmon are identified as their primary prey. Southern Residents are the subject of ongoing research, including direct observation, scale and tissue sampling of prey remains, and fecal sampling. The diet data indicate that the whales are consuming mostly larger (i.e., older) Chinook salmon. Chinook salmon is their primary prey despite the much lower abundance in some areas and during certain time periods in comparison to other salmonids, for mechanisms that remain unknown but factors of potential importance include the species' large size, high fat and energy content, and year-round occurrence in the whales' geographic range. Chinook salmon have the highest value of total energy content compared to other salmonids because of their larger body size and higher energy density (kcal/kg) (O'Neill et al. 2014). For example, in order for a killer whale to obtain the total energy value of one Chinook salmon, they would need to consume approximately 2.7 coho, 3.1 chum, 3.1 sockeye, or 6.4 pink salmon (O'Neill et al. 2014). Recent research suggests that killer whales are capable of detecting, localizing and recognizing Chinook salmon through their ability to distinguish Chinook echo structure as different from other salmon (Au et al. 2010).

Scale and tissue sampling from May to September in inland waters of WA and B.C. indicate that their diet consists of a high percentage of Chinook salmon (monthly proportions as high as >90 percent) (Hanson et al. 2010; Ford et al. 2016). Genetic analysis of the Hanson et al. (2010) samples indicate that when Southern Residents are in inland waters from May to September, they consume Chinook stocks that originate from regions including the Fraser River (including Upper Fraser, Mid Fraser, Lower Fraser, North Thompson, South Thompson and Lower Thompson), Puget Sound (North and South Puget Sound), the Central British Columbia Coast and West and East Vancouver Island.

DNA quantification methods are used to estimate the proportion of different prey species in the diet from fecal samples (Deagle et al. 2005). Recently, Ford et al. (2016) confirmed the importance of Chinook salmon to the Southern Residents in the summer months using DNA sequencing from whale feces. Salmon and steelhead made up to 98 percent of the inferred diet, of which almost 80 percent were Chinook salmon. Coho salmon and steelhead are also found in the diet in spring and fall months when Chinook salmon are less abundant. Specifically, coho salmon contribute to over 40 percent of the diet in late summer, which is evidence of prey shifting at the end of summer towards coho salmon (Ford et al. 1998; Ford and Ellis 2006; Hanson et al. 2010; Ford et al. 2016). Less than 3 percent each of chum salmon, sockeye salmon, and steelhead were observed in fecal DNA samples collected in the summer months (May through September). Prey remains and fecal samples collected in inland waters during October through December indicate Chinook and chum salmon are primary contributors of the whale's diet (NWFSC unpubl. data).

Observations of whales overlapping with salmon runs (Wiles 2004; Zamon et al. 2007; Krahn et al. 2009) and collection of prey and fecal samples have also occurred in coastal waters in the winter months. Preliminary analysis of prey remains and fecal samples sampled during the winter and spring in coastal waters indicated the majority of prey samples were Chinook salmon, with a smaller number of steelhead, chum salmon, and halibut (NWFSC unpubl. data). The occurrence of K and L pods off the Columbia River in March suggests the importance of Columbia River spring runs of Chinook salmon in their diet (Hanson et al. 2013). Chinook genetic stock identification from samples collected in winter and spring in coastal waters included 12 U.S. west coast stocks, and over half the Chinook salmon consumed originated in the Columbia River (NWFSC unpubl. data). Columbia River, Central Valley, Puget Sound, and Fraser River Chinook salmon comprise over 90 percent of the whales' coastal Chinook salmon diet (NWFSC unpubl. data).

Over the past decade, some Chinook salmon stocks within the range of the whales have had relatively high abundance (e.g. WA/OR coastal stocks, some Columbia River stocks), whereas other stocks originating in the more northern and southern ends of the whales' range (e.g. most Fraser stocks, Northern and Central B.C. stocks, Georgia Strait, Puget Sound, and Central Valley) have declined. Changing ocean conditions driven by climate change may influence ocean survival of Chinook and other Pacific salmon, further affecting the prey available to Southern Residents.

Currently, hatchery production is a significant component of the salmon prey base returning to watersheds within the range of Southern Resident killer whales (Barnett-Johnson et al. 2007; NMFS 2008e). Although hatchery production has contributed some offset of the historical declines in the abundance of natural-origin salmon within the range of the whales, hatcheries also pose risks to natural-origin salmon populations (Nickelson et al. 1986; Ford 2002; Levin and Williams 2002; Naish et al. 2007). Healthy natural-origin salmon populations are important to the long-term maintenance of prey populations available to Southern Residents because it is uncertain whether a hatchery dominated mix of stocks is sustainable indefinitely and because hatchery fish can differ, relative to natural-origin Chinook salmon, for example, in size and hence caloric value and in availability/migration location and timing. However, the release of hatchery fish has not been identified as a threat to the survival or persistence of Southern Residents. It is possible that hatchery produced fish may benefit this endangered population of whales by enhancing prey availability as scarcity of prey is a primary threat to Southern Resident killer whale survival and hatchery fish often contribute to the salmon stocks consumed (Hanson et al. 2010).

Nutritional Limitation and Body Condition

When prey is scarce, Southern Residents likely spend more time foraging than when prey is plentiful. Increased energy expenditure and prey limitation can cause poor body condition and nutritional stress. Nutritional stress is the condition of being unable to acquire adequate energy and nutrients from prey resources and as a chronic condition, can lead to reduced body size of individuals and to lower reproductive and survival rates of a population (Trites and Donnelly 2003). During periods of nutritional stress and poor body condition, cetaceans lose adipose tissue behind the cranium, displaying a condition known as “peanut-head” in extreme cases (Pettis et al. 2004, Bradford et al. 2012, Joblon et al. 2014). Between 1994 and 2008, 13 Southern Resident killer whales were observed from boats to have a pronounced “peanut-head”; and all but two subsequently died (Durban et al. 2009; Center for Whale Research, unpublished data). None of the whales that died were subsequently recovered, and therefore definitive cause of death could not be identified. Both females and males across a range of ages were found in poor body condition.

Since 2008, NOAA’s SWFSC has used aerial photogrammetry to assess the body condition and health of Southern Resident killer whales, initially in collaboration with the Center for Whale Research and, more recently, with the Vancouver Aquarium and SR3. Aerial photogrammetry studies have provided finer resolution for detecting poor condition, even before it manifests in “peanut heads” that are observable from boats. Annual aerial surveys of the population from 2013-2017 (with exception of 2014) have detected declines in condition before the death of seven Southern Residents (L52 and J8 as reported in Fearnbach et al. 2018; J14, J2, J28, J54, and J52 as reported in Durban et al. 2017), including five of the six most recent mortalities (Trites and Rosen 2018). These data have provided evidence of a general decline in Southern Resident killer whale body condition since 2008, and documented members of J pod being in poorer body condition in May compared to September (at least in 2016 and 2017) (Trites and Rosen 2018).

Although body condition in whales can be influenced by a number of factors, including prey availability, disease, physiological or life history status, and may vary by season and across years, prey limitation is the most likely cause of observed changes in body condition in wild mammalian populations (Matkin et al. 2017). It is possible that poor nutrition could contribute to mortality through a variety of mechanisms. To demonstrate how this is possible, we reference studies that have demonstrated the effects of energetic stress (caused by incremental increases in energy expenditures or incremental reductions in available energy) on adult females and juveniles, which have been studied extensively (e.g., adult females: Gamel et al. 2005, Schaefer et al. 1996, Daan et al. 1996, juveniles: Noren et al. 2009a, Trites and Donnelly 2003). Small, incremental increases in energy demands should have the same effect on an animal's energy budget as small, incremental reductions in available energy, such as one would expect from reductions in prey. Ford and Ellis (2006) report that resident killer whales engage in prey sharing about 76 percent of the time. Prey sharing presumably would distribute more evenly the effects of prey limitation across individuals of the population than would otherwise be the case (i.e., if the most successful foragers did not share with other individuals). Therefore, although cause of death for most individuals that disappear from the population is unknown, poor nutrition could occur in multiple individuals as opposed to only unsuccessful foragers, contributing to additional mortality in this population.

Toxic Chemicals

Various adverse health effects in humans, laboratory animals, and wildlife have been associated with exposures to persistent pollutants. These pollutants have the ability to cause endocrine disruption, reproductive disruption or failure, immunotoxicity, neurotoxicity, neurobehavioral disruption, and cancer (Reijnders 1986, de Swart et al. 1996, Subramanian et al. 1987, de Boer et al. 2000; Reddy et al. 2001, Schwacke et al. 2002; Darnerud 2003; Legler and Brouwer 2003; Viberg et al. 2003; Ylitalo et al. 2005; Fonnum et al. 2006; Viberg et al. 2006; Darnerud 2008; Legler 2008; Bonefeld-Jørgensen et al. 2011). Southern Residents are exposed to a mixture of pollutants, some of which may interact synergistically and enhance toxicity, influencing their health. High levels of these pollutants have been measured in blubber biopsy samples from Southern Residents (Ross et al. 2000; Krahn et al. 2007; Krahn et al. 2009), and more recently, these pollutants were measured in fecal samples collected from Southern Residents providing another potential opportunity to evaluate exposure to these pollutants (Lundin et al. 2015; Lundin et al. 2016).

Killer whales are exposed to persistent pollutants primarily through their diet. For example, Chinook salmon contain higher levels of some persistent pollutants than other salmon species, but only limited information is available for pollutant levels in Chinook salmon (Krahn et al. 2007; O'Neill and West 2009; Veldhoen et al. 2010; Mongillo et al. 2016). These harmful pollutants, through consumption of prey species that contain these pollutants, are stored in the killer whale's blubber and can later be released; when the pollutants are released, they are redistributed to other tissues when the whales metabolize the blubber in response to food shortages or reduced acquisition of food energy that could occur for a variety of other reasons. The release of pollutants can also occur during gestation or lactation. Once the pollutants mobilize in to circulation, they have the potential to cause a toxic response. Therefore, nutritional stress from reduced Chinook salmon populations may act synergistically with high pollutant levels in Southern Residents and result in adverse health effects.

In April 2015, NMFS hosted a 2-day Southern Resident killer whale health workshop to assess the causes of decreased survival and reproduction in the killer whales. Following the workshop, a list of potential action items to better understand what is causing decreased reproduction and increased mortality in this population was generated and then reviewed and prioritized to produce the Priorities Report (NMFS 2015c). The report also provides prioritized opportunities to establish important baseline information on Southern Resident and reference populations to better assess negative impacts of future health risks, as well as positive impacts of mitigation strategies on Southern Resident killer whale health.

Disturbance from Vessels and Sound

Vessels have the potential to affect killer whales through the physical presence and activity of the vessel, increased underwater sound levels generated by boat engines, or a combination of these factors. Vessel strikes are rare, but do occur and can result in injury or mortality (Gaydos and Raverty 2007). In addition to vessels, underwater sound can be generated by a variety of other human activities, such as dredging, drilling, construction, seismic testing, and sonar (Richardson et al. 1995; Gordon and Moscrop 1996; National Research Council 2003). Impacts from these sources can range from serious injury and mortality to changes in behavior. In other cetaceans, hormonal changes indicative of stress have been recorded in response to intense sound exposure (Romano et al. 2003). Chronic stress is known to induce harmful physiological conditions including lowered immune function, in terrestrial mammals and likely does so in cetaceans (Gordon and Moscrop 1996).

Killer whales rely on their highly developed acoustic sensory system for navigating, locating prey, and communicating with other individuals. While in inland waters of Washington and British Columbia, Southern Resident killer whales are the principal target species for the commercial whale watch industry (Hoyt 2001; O'Connor et al. 2009) and encounter a variety of other vessels in their urban environment (e.g., recreational, fishing, ferries, military, shipping). Several main threats from vessels include direct vessel strikes, the masking of echolocation and communication signals by anthropogenic sound, and behavioral changes (NMFS 2008). There is a growing body of evidence documenting effects from vessels on small cetaceans and other marine mammals (NMFS 2010c; NMFS 2016f; NMFS in press). Research has shown that the whales spend more time traveling and performing surface active behaviors and less time foraging in the presence of all vessel types, including kayaks, and that noise from motoring vessels up to 400 meters away has the potential to affect the echolocation abilities of foraging whales (Holt 2008; Lusseau et al. 2009; Noren et al. 2009; Williams et al. 2010b). Individual energy balance may be impacted when vessels are present because of the combined increase in energetic costs resulting from changes in whale activity with the decrease in prey consumption resulting from reduced foraging opportunities (Williams et al. 2006; Lusseau et al. 2009; Noren et al. 2009a; Noren et al. 2012).

At the time of the whales' listing under the ESA, NMFS reviewed existing protections for the whales and developed recovery actions, including vessel regulations, to address the threat of vessels to killer whales. NMFS concluded it was necessary and advisable to adopt regulations to protect killer whales from disturbance and sound associated with vessels, to support recovery of Southern Resident killer whales. Federal vessel regulations were established in 2011 to prohibit vessels from approaching killer whales within 200 yards (182.9 m) and from parking in the path of the whales within 400 yards (365.8 m). These regulations apply to all vessels in inland waters of Washington State with exemptions to maintain safe navigation and for government vessels in the course of official duties, ships in the shipping lanes, research vessels under permit, and vessels lawfully engaged in commercial or treaty Indian fishing that are actively setting, retrieving, or closely tending fishing gear (76 FR 20870, April, 14, 2011).

In the final rule, NMFS committed to reviewing the vessel regulations to evaluate effectiveness, and also to study the impact of the regulations on the viability of the local whale watch industry. In March 2013, NMFS held a killer whale protection workshop16 to review the current vessel regulations, guidelines, and associated analyses; review monitoring, boater education, and enforcement efforts; review available industry and economic information and identify data gaps; and provide a forum for stakeholder input to explore next steps for addressing vessel effects on killer whales.

In December 2017, NOAA Fisheries completed a technical memorandum evaluating the effectiveness of regulations adopted in 2011 to help protect endangered Southern Resident killer whales from the impacts of vessel traffic and noise (Ferrara et al. 2017). In the assessment, Ferrara et al. (2017) used five measures: education and outreach efforts, enforcement, vessel compliance, biological effectiveness, and economic impacts. For each measure, the trends and observations in the 5 years leading up to the regulations (2006-2010) were compared to the trends and observations in the 5 years following the regulations (2011-2015). The memo finds that the regulations have benefited the whales by reducing impacts without causing economic harm to the commercial whale-watching industry or local communities. The authors also find room for improvement in terms of increasing awareness and enforcement of the regulations, which would help improve compliance and further reduce biological impacts to the whales.

Oil Spills

In the Northwest, Southern Resident killer whales are the most vulnerable marine mammal population to the risks imposed by an oil spill due to their small population size, strong site fidelity to areas with high oil spill risk, large group size, late reproductive maturity, low reproductive rate, and specialized diet, among other attributes (Jarvela-Rosenberger et al. 2017). Oil spills have occurred in the range of Southern Residents in the past, and there is potential for spills in the future. Oil can be discharged into the marine environment in any number of ways, including shipping accidents, refineries and associated production facilities, and pipelines.

Despite many improvements in spill prevention since the late 1980s, much of the region inhabited by Southern Residents remains at risk from serious spills because of the heavy volume of shipping traffic and proximity to petroleum refining centers in inland waters. Numerous oil tankers transit through the inland waters range of Southern Residents throughout the year. The magnitude of risk posed by oil discharges in the action area is difficult to precisely quantify. The total volume of oil spills declined from 2007 to 2013, but then increased from 2013 to 2017 (WDOE 2017). The percent of potential high-risk vessels that were boarded and inspected between 2009 and 2017 also declined (from 26 percent inspected in 2009 to 12.2 percent by 2017) (WDOE 2017).

Repeated ingestion of petroleum hydrocarbons by killer whales likely causes adverse effects; however, long-term consequences are poorly understood. In marine mammals, acute exposure to petroleum products can cause changes in behavior and reduced activity, inflammation of the mucous membranes, lung congestion and disease, pneumonia, liver disorders, neurological damage, adrenal toxicity, reduced reproductive rates, and changes in immune function (Geraci and St. Aubin 1990; Schwacke et al. 2013; Venn-Watson et al. 2015; de Guise et al. 2017; Kellar et al. 2017), potentially death and long-term effects on population viability (Matkin et al. 2008; Ziccardi et al. 2015). For example, 122 cetaceans stranded or were reported dead within 5 months following the Deepwater Horizon spill in the Gulf of Mexico (Ziccardi et al. 2015). An additional 785 cetaceans were found stranded from November 2010 to June 2013, which was declared an Unusual Mortality Event (Ziccardi et al. 2015). In addition, oil spills have the potential to adversely impact habitat and prey populations, and, therefore, may adversely affect Southern Residents by reducing food availability.

Humpback Whales

We listed humpback whales as endangered under the Endangered Species Conservation Act in June 1970 (35 FR 18319) and subsequently listed as endangered under the ESA in 1973[2]. We issued the final recovery plan for humpback whales in 1991 followed by a status review in 2015 (NMFS 1991, Bettridge 2015). On September 8, 2016, NMFS published a final rule to divide the globally listed endangered humpback whale into 14 distinct population segments ("DPS"), remove the species-level listing, and place four DPSs as endangered and one as threatened (81 FR 62259). NMFS has identified three DPSs of humpback whales that may be found off the coasts of Washington, Oregon and California. These are the Hawaiian DPS (found predominately off Washington and southern British Columbia) which is not listed under the ESA; listed DPS' expected to be affected by the project are members of the Mexico DPS (found all along the West Coast) which is listed as threatened under the ESA; and the Central America DPS (found predominately off the coasts of Oregon and California) which is listed as endangered under the ESA. When a humpback whale is sighted in Washington inland waters (Puget Sound, Strait of Juan de Fuca, San Juan Islands) it has a 43 percent likelihood of being from the unlisted Hawaii DPS, 42 percent likelihood of being from the threatened Mexico DPS, and 15 percent likelihood of being from the endangered Central American DPS (NMFS 2016a).

Spatial Structure/Diversity. Humpback whales are found in all oceans of the world and migrate from high latitude feeding grounds to low latitude calving areas. They are typically found in coastal or shelf waters in summer and close to islands and reef systems in winter (Clapham 2009). Humpbacks primarily occur near the edge of the continental slope and deep submarine canyons, where upwelling concentrates zooplankton near the surface for feeding. They often feed in shipping lanes which makes them susceptible to mortality or injury from large ship strikes (Douglas et al. 2008). Humpback whales feed on euphausiids (shrimp-like crustaceans) and various schooling fishes, including herring, capelin, sand lance, and mackerel (Clapham 2009). The feeding aggregation off Washington occurs primarily in the northwest Washington-British Columbia border area; a small number are periodically seen within Puget Sound (Calambokidis et al. 2004, Calambokidis et al. 2009).

Humpbacks were one of the most commonly sighted large whales in Washington inland waters and Puget Sound in the early 1900s, but are only seen occasionally now (Calambokidis and Steiger 1994). Humpback sightings in the Strait of Georgia and Puget Sound (collectively called the Salish Sea) increased during the early 2000s to include 13 individually identified whales (Falcone et al. 2005). Humpback whales sightings in Elliot Bay are uncommon, but approximately twenty-eight sightings of several individuals have been observed in the vicinity of the Seattle Terminal in the past 13 years. The sightings are from February to June and

September of 2004, July of 2006, June and July of 2008, and February and December of 2010, November 2014, and March 2017 (Orca Network 2017).

Humpback whales also occur along the outer coast of Washington in waters greater than 50 meters depth on the continental shelf (Oleson et al. 2009). The endangered Central America DPS and the threatened Mexico DPS both at times travel and feed off the U.S. west coast.

Central America DPS

Current estimates of abundance for the Central America DPS range from approximately 400 to 600 individuals (Bettridge et al. 2015, Wade et al. 2016). The size of this population is relatively low compared to most other North Pacific breeding populations.

The population trend for the Central America DPS is unknown (Bettridge et al. 2015).

The Central America DPS has a relatively small population size (Calambokidis *et al.* 2008). The estimated number of mature individuals may be less than 250 and there are no data available to determine a population-level growth rate for this DPS, which adds uncertainty to the current status of this DPS. In light of historical records of whaling on the feeding grounds of this population and neighboring feeding grounds, this population likely remains well below pre- exploitation size despite observed positive population trends in other populations over the past decades…. Entanglement scarring rates in this population indicate a significant interaction with fishing gear and vessel collisions may be impacting population growth to a small degree. The Central America DPS is therefore considered to be at moderate risk of extinction over the next three generations."

Mexico DPS

The Mexico DPS, which also occurs in the action area, is estimated to include up to 6,000 to 7,000 individuals, based on the SPLASH3 project (Calambokidis et al. 2008) and in the status review (Bettridge et al. 2015).

"The DP is likely growing at a rate of about 4.9% or more per year (Calambokidis *et al.* 2008). Breeding locations used by this population (and migratory routes to get to aggregation areas) are adjacent to large human population centers. The population may, therefore, be exposed to adverse effects from a number of human activities, including fishing activities (possible competition with fisheries), effluent and runoff from human population centers as coastal development increases, activities associated with oil and gas development, and a great deal of vessel traffic.

For the years 2008 to 2014 and in the August to February timeframe, The Whale Museum (TWM 2015) reported six sightings days4 for humpback whales in the Seattle area, with a high of three whale days in August of those years.

2.2.2 Status of Critical Habitat

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

For salmon NMFS's critical habitat analytical review teams (CHARTs) ranked watersheds within designated critical habitat at the scale of the fifth-field hydrologic unit code (HUC5) in terms of the conservation value they provide to each ESA-listed species that they support (NOAA Fisheries 2005). The conservation rankings were high, medium, or low. To determine the conservation value of each watershed to species viability, the CHARTs evaluated the quantity and quality of habitat features, the relationship of the area compared to other areas within the species' range, and the significance to the species of the population occupying that area. Even if a location had poor habitat quality, it could be ranked with a high conservation value if it were essential due to factors such as limited availability, a unique contribution of the population it served, or serving another important role. No critical habitat in marine areas has been designated for PS steelhead, and so the action area does not include critical habitat for this DPS.

In designating critical habitat (CH) for PS Chinook and HCSR chum salmon in estuarine and nearshore marine areas[5], NMFS determined that the area from extreme high water extending out to the maximum depth of the photic zone (no greater than 30 meters relative to MLLW) contain essential features that require special protection. For nearshore marine areas, NMFS designated the area inundated by extreme high tide because it encompasses habitat areas typically inundated and regularly occupied during the spring and summer when juvenile salmon are migrating in the nearshore zone and relying heavily on forage, cover, and refuge qualities provided by these occupied habitats.

All physical and biological features (or primary constituent elements) of estuarine, and nearshore marine CH for two of the affected salmonid species and Yelloweye rockfish and bocaccio CH have been degraded throughout the PS region. The causes for these losses of CH value include human development, including diking, filling of wetlands and bays, channelization, nearshore and floodplain development. The continued growth contributes to the anthropogenic modification of the PS shorelines and is the major factor in the cumulative degradation and loss of nearshore and estuarine habitat. The development of shorelines includes bank hardening and the introduction of obstructions in the nearshore, each a source of structure and shade which can interfere with juvenile salmonid migration, diminish aquatic food supply, and is a potential source of water pollution from boating uses (Shipman et al., 2010; Morley et al., 2012; Fresh et al., 2011).

The degradation of multiple aspects of PS Chinook, HCSR chum salmon, Yelloweye and bocaccio rockfish and SRKW CH indicates that the conservation potential of the CH is not being reached, even in areas where the conservation value of habitat is ranked high.

During the listing process for SRKW, NMFS requested specific information on critical habitat to assist in gathering and analyzing the best available scientific data to support critical habitat designations, and met with co-managers and other stakeholders to review the information and the overall designation process (NMFS 2006). Since then, significant work has been done to continue to understand the threats to SRKW habitat, including in the Recovery Plan process, status reviews, in a 2014 special report on SRKW and in analyzing and responding to a petition to revise SRKW critical habitat.

Table 7 provides a summary of critical habitat information for the species addressed in this opinion. More information relevant to critical habitat status can be found in the Federal Register notices, recovery plans, status reports and other documents available at NMFS' West Coast Region website (http://www.westcoast.fisheries.noaa.gov/) and is incorporated here by reference.

Table 7. Current Status of Designated Critical Habitat

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.
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.
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 bocaccio rockfish. No nearshore component was included in the CH listing for juvenile yelloweye rockfish as they, different from bocaccio rockfish, typically are not found in intertidal waters (Love et al., 1991). Yelloweye rockfish are most frequently observed in waters deeper than 30 meters (98 ft) 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.
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.
Southern resident killer whale	11/29/06 71 FR 69054	Critical habitat consists of three specific marine areas of inland waters of Washington: 1) the Summer Core Area in Haro Strait and waters around the San Juan Islands; 2) Puget Sound; and 3) the Strait of Juan de Fuca. These areas comprise approximately 2,560 square miles of marine habitat. Based on the natural history of the Southern Residents and their habitat needs, NMFS identified three PCEs, or physical or biological features, essential for the conservation of Southern Residents: 1) Water quality to support growth and development; 2) prey species of sufficient quantity, quality, and availability to support individual growth, reproduction and development, as well as overall population growth; and 3) passage conditions to allow for migration, resting, and foraging. Water quality in Puget Sound, in general, is degraded. Some pollutants in Puget Sound persist and build up in marine organisms including Southern Residents and their prey resources, despite bans in the 1970s of some harmful substances and cleanup efforts. The primary concern for direct effects on whales from water quality is oil spills, although oil spills can also have long-lasting impacts on other habitat features In regards to passage, human activities can interfere with movements of the whales and impact their passage. In particular, vessels may present obstacles to whales' passage, causing the whales to swim further and change direction more often, which can increase energy expenditure for whales and impacts foraging behavior. Reduced prey abundance, particularly Chinook salmon, is also a concern for critical habitat.

2.3 Environmental Baseline

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 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process (50 CFR 402.02).

NMFS has consulted with the Navy 179 times for actions within the greater Salish Sea area. Of this total, 166 were informal consultations and 13 were formal consultations. Formal consultations each identified take that would accrue among PS Chinook salmon, PS steelhead, SRKW, and rockfishes. Most of these consultations used an incidental take surrogate, relying on temporal or spatial measures for take, because quantifying the numbers of these species to be harassed, injured, harmed, or killed, would not be accurate and/or practicable. However, consultation FPR -2015-9110, prepared by the Office of Protected Resources, exempted incidental take from Navy training and testing activities in Puget Sound in the amount of 13,871 PS Chinook, 122 PS steelhead. Additionally, the same consultation provided an incidental take exemption for 0.002 percent of bocaccio and 0.003 percent of Yelloweye rockfish DPSs.

The action area includes all riparian areas, shoreline, and all waters of PS. The shoreline and shallow water habitat in PS has been and continues to be subject to intense development from residential, recreational, municipal, and industrial/commercial construction. The State of the Sound biannual report produced by the Puget Sound Partnership (PSP) (Partnership et al., 2015) summarizes how different indicators of health of the PS ecosystem are changing.

Their assessment can be summarized to a few key points: (1) development pressure continues to impact habitat in the marine and freshwater portion of the range; (2) improvements in human use patterns are slow at best; and (3) few of the 2020 improvement targets identified by the PSP will be reached. In more detail, this most recent report points out the following issues:

- Chinook salmon: ongoing decline. PSP Target: Stop the overall decline and start seeing improvements in wild Chinook salmon abundance in two to four populations in each biogeographic region.
- Herring stocks: declining
- Loss of non-federal forested land cover to developed land cover: continuing. Loss of 1,196 acres of non-federal forested land per year between 2006 and 2011.
- Shoreline armoring: Stable between 2011 and 2014. No recent net increase, restoration actions balance out increase from private shoreline armoring. However, this could be related to poor economic conditions. More years of data are needed to determine trend.
- Accelerated conversion/loss of vegetation cover on ecologically important lands: 1.116 percent loss for 2006-2011. This is even more loss than the cautious 2020 Target: Basin-wide loss of vegetation cover on ecologically important lands under high pressure from development does not exceed 0.15 percent of the total 2011 baseline land area over a 5- year period.
- Marine water quality: Overall, trends have been getting worse with closures of beaches and shellfish harvest in some bays. While there has been some increase

between 2011 and 2014 in the amount of shellfish beds open to harvest, about 19 percent are still closed. PCB levels in fish[7] are still high.

- Native Eelgrass (*Z. marina*) abundance seems stable comparing 2011 to 2013 data to baseline from 2000 to 2008. This does not account for losses that occurred prior to 2000.
- Human Sound Behavior Index: No change in average behavior. Thus, an increase in population is likely to continue to degrade habitat quality. (The Sound Behavior Index tracks 28 human use practices[3] that likely affect habitat and water quality and quantity).
- OWS: not assessed by PSP. Current percent of nearshore coverage is 0.63 percent for all of PS, as detailed below.

The PSP concludes the overall decline in habitat conditions and native species abundance in the PS has been caused by development and climate change pressures. Over the last 150+ years, 4.5 million people have settled in the PS region. With the level of infrastructure development associated with this population growth the PS nearshore has been altered significantly. Major physical changes documented include the simplification of river deltas, the elimination of small coastal bays, the reduction in sediment supplies to the foreshore due to beach armoring, and the loss of tidally influenced wetlands and salt marsh (Fresh et al., 2011).

In addition to beach armoring, other shoreline changes including OWS, marinas, roads, and railroads reduce habitat quality. The amount of these changes varies, and their source varies by region, generally correlating with development, but overall is staggering (Simenstad et al., 2011). The simplification of the largest river deltas has caused a 27 percent decline in shoreline length compared to historical conditions. Of 884 historic small embayments, 308 have been eliminated. About 27 percent of PS's shorelines are armored and only 112 of 828 shoreline segments remain in properly functioning condition. The loss of tidal wetlands in the largest deltas averages 26 percent (Fresh et al., 2011). Each of these habitat changes is related to development and overall reduces the quality and quantity of PS Chinook, HC summer-run, PS steelhead habitat in the PS foreshore and nearshore.

Shoreline armoring often results in increased beach erosion waterward of the armoring, which, in turn, leads to beach lowering, coarsening of substrates, increases in sediment temperature, and reductions in invertebrate density (Fresh et al., 2011;Morley et al., 2012;Dethier et al., 2016). New shoreline armoring continues to reduce the suitable habitat for Pacific sand lance and surf smelt spawning and may reduce their numbers. Fresh et al. (2011) write "We can only surmise how much forage fish spawning habitat we have lost because we lack comprehensive historical data on spawning areas." Considering that these forage fish are an essential food source for salmon, the beach armoring has multiple negative effects on salmon including reductions in prey and reductions in access to shallow water rearing habitat and refuge.

[3] Human use practices include among others: (a) Number of residents with native vegetation on banks of waterways; (b) number of residents using pump stations for boat wastewater; (c) residents using herbicides and pesticides, and (d) pasture practices for residents with livestock.

The distribution and sizes of OWS in the nearshore[4] are detailed further in Schlenger et al. (2011) and (Simenstad et al., 2011). The South Central PS sub-basin has the highest number (2,040), density (4 per km), and area of OWS (6.8 km^2) of all sub-basins (Figure 3). The South PS sub-basin has the second highest number (1,871) and density (3 per km) of OWS, but only the fourth largest area (0.9 km^2). This disparity in area of overwater coverage between the South Central PS and South PS sub-basins, despite the two having almost the same number of OWS, is consistent with the expectation that the structures in the South PS sub-basin would be more commonly associated with residential landowners (and hence typically smaller in size), while the South Central PS sub-basin includes concentrations of large industrial and commercial docks (for example, Commencement Bay). While the South PS sub-basin has a high number of OWS, but a relatively small overwater structure area, the Whidbey sub-basin has approximately one-third as many OWS as the South PS sub-basin (654 versus 1,871), but substantially more area of OWS (0.8 versus 0.5 km^2).

More than one-third (67) of marinas in PS are in the South Central sub-basin, and they cover over 3 square kilometers, which is nearly half of the total PS area covered by marinas (Schlenger et al., 2011). More than 1 percent of the nearshore zone area of the South Central PS sub-basin is covered by marinas. The San Juan Islands – Strait of Georgia sub-basin also has a relatively large number of marinas (40) that cover 2 square kilometers, or 1.11 percent of the sub- basin nearshore area. Moderate numbers of marinas are in the Whidbey (28 total, 1 square kilometers) and South PS (26 total, 1.11 square kilometers) sub-basins. Relatively few marinas were mapped in the Hood Canal (8), North Central PS (6), and Strait of Juan de Fuca (4) sub- basins.

[4] The nearshore area includes the area from the deepest part of the photic zone (approximately 10 meters below Mean Lower Low Water [MLLW]) landward to the top of shoreline bluffs, or in estuaries upstream to the head of tidal influence (Clancy, M., et al., 2009).

Figure 3. Puget Sound Sub-basin Boundaries

Hood Canal is a large fjord that is separated from Puget Sound by the Kitsap Peninsula. Hood Canal averages 3.8-miles wide and 500-feet deep, with a maximum width 10.2 miles and maximum depth of 600 feet (Johnson, et al. 1997). The canal stretches 63 miles from its mouth at Admiralty Inlet to the tip of Lynch Cove at Belfair. At the southern extent of Hood Canal, where the Skokomish River enters the Hood Canal, a 90-degree bend to the east occurs (The Great Bend).

Four WRIAs drain into Hood Canal: Kennedy-Goldbsorough (WRIA 14); Kitsap Basin (WRIA 15); Hood Canal Basin (WRIA 16); and Quilcene Basin (WRIA 17). Hood Canal has several major tributaries including the Skokomish, Big Quilcene, Dosewallips, Duckabush, Dewatto, Hamma Hamma, and Union rivers. WRIAs 15 and 17 encompass the action area.

Within northern Hood Canal, nearshore development is limited with few industrial waterfront sites other than Naval Base Kitsap Bangor. A few residential docks and small piers occur at Seabeck, approximately eight miles south of the Naval Base Bangor waterfront and attract recreational boaters to the action area. The Hood Canal Bridge is located approximately seven miles north of Bangor waterfront.

Naval Base Kitsap Bangor is a large industrial/military complex in northern Hood Canal with more than 3.6 acres of over-water and in-water structures, approximately 4.20 miles of shoreline, a large amount of which is armored, and more than 75 acres of pollution-generating impervious surface landward of HAT (most recent Google Earth imagery). These structures can support multiple nuclear submarines at once and approximately 32 support vessels of different sizes. In addition to the concrete in and overwater structures, a security exclusion net running more than three miles encompasses the facility and extends from HAT down to a depth of more than -50 MLLW.

Recreational boating activities, including fishing are common in the Canal. The local fishery includes sport and tribal fishing. The abundance of boats on the water is seasonal and varies with the length of the sport fishing season set by WDFW. No commercial fishing occurs in Hood Canal although there are abundant aquaculture activities, commercial and non-commercial.

Frequent vessel traffic from the mix of users produces sound energy throughout Hood Canal and the action area. Several studies have shown fish to respond physiologically and biologically to increased noise (Mueller, 1980; Scholik and Yan, 2002; Picciulin et al., 2010). Xie et al. (2008) report on the commonsense knowledge, that adult migrating salmon avoid vessels by swimming away. Graham and Cooke (2008) studied the effects of three boat noise disturbances (canoe paddling, trolling motor, and combustion engine (9.9 horsepower)) on the cardiac physiology of largemouth bass (*Micropterus salmoides*). Exposure to each of the treatments resulted in an increase in cardiac output in all fish, associated with a dramatic increase in heart rate and a slight decrease in stroke volume, with the most extreme response being to that of the combustion engine treatment (Graham and Cooke, 2008). Recovery times were the least with canoe paddling (15 minutes) and the longest with the power engine (40 minutes). They postulate that this demonstrates that fish experienced sublethal physiological disturbances in response to the noise propagated from recreational boating activities.

Circulation patterns within Hood Canal are complex due to the configuration of the basin and the tidal regime. Tides in Hood Canal are mixed semidiurnal with one flood and one ebb tidal event characterized by a small to moderate range (one to six feet) and a second flood and second ebb with a larger range (eight to 16 feet) during a 24.8-hour tide cycle. As a result, higher high, lower high, higher low, and lower low water levels occur within each tide day (URS Consultants, Inc., 1994; Morris et al., 2008). Larger tidal ranges promote higher velocity currents and increased flushing of the basin, whereas small to moderate tidal ranges are associated with weaker currents and comparatively smaller volumes of seawater exchanged between Hood Canal and Puget Sound.

Because the tides are mixed semidiurnal, Hood Canal is subject to one major flushing event per tide day, when approximately three percent of the total canal volume is exchanged over a six-hour period. Due to the wide range of tidal heights, the actual seawater exchange volume for Hood Canal ranges from one percent during a minor tide to four percent during a major tide. Northern Hood Canal has 20 parameters listed on the WDOE’s 303(d) List of Threatened and

Endangered Waters (WDOE 2000) within WRIA 15. Water quality in Hood Canal is characterized by low dissolved oxygen (DO), high fecal coliform, and high levels of heavy metals and chemicals.

Storm waves are the principal mechanism driving longshore sediment transport within Hood Canal shoreline (Golder Associates, 2010). Wave energy and the magnitude of sediment transport in Hood Canal are related to the direction and speed of the regional winds.

The effects of climate change and increased population and development also have impacted the freshwater portion of the salmonid habitat. Habitat in tributary watersheds continues to be disconnected, lost, and degraded by diking, operation of hydropower facilities, flow regulation, timber harvest, land conversions, effects of transportation infrastructure, and growth-related commercial and residential development (Beechie et al., 1994; Hough-Snee 2010). Further, water quality reductions, from multiple pollutant sources—stormwater, municipal and industrial discharges, agricultural and non-point source conveyances—continue to compromise water quality in freshwater and marine portions of PS (Ruckelshaus and McClure 2007).

2.4 Effects of the Action

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

The proposed action will have multiple effects, ranging from temporary to permanent. The temporary effects associated with construction include 1) sound, 2) disturbance of bottom sediments, 3) shade, and 4) reduced predators/marine mammal presence. The permanent effects associated with structures in the aquatic habitat are: 1) migration impediment, 2) shade, 3) increased predator habitat, and 4) nighttime lighting. We analyze these effects on features of habitat first, including designated critical habitat and defense land exempted from the critical habitat designation. Then we identify the listed species that will encounter these effects, and analyze their responses.

Whether or not habitat is designated as critical, the full range of the action area provides accessible habitat to the various listed species considered in this opinion. Given the mixture of critical and non-critical habitat within the action area, in the following section, we will review effects to all habitat features, whether or not the habitat is designated as critical, as this analysis is foundational to our review of the effects of the proposed action on the listed species themselves. However, our conclusion regarding the effects of the proposed action on critical habitat will be based only on effects to those areas included within the designated critical habitat.

2.4.1 Effects of the Action on Critical Habitat and Habitat

As mentioned in Section 2.2, critical habitat for PS chinook, HCSR chum, two rockfish species, and southern resident killer whales is within the action area. However, DoD lands and associated easements and rights-of-way can be exempted from critical habitat designation when there is an approved Integrated Natural Resources Management Plan (INRMP) that outline species protection measurements (33 CFR 334). In areas within Navy security zones identified at 33 CFR 334 that are outside the areas described in Section 1.4, critical habitat is only designated within a narrow nearshore zone from the line of extreme high tide down to the line of mean lower low water (Figure 4).

Figure 4. DoD Critical Habitat Excluded areas within action area (Puget Sound)

The NMFS reviewed the effects on all habitat affected by the proposed action by examining changes of the project to the condition and trends of physical and biological features identified as essential to the conservation of the listed species. The salmonid PBFs present in the action area are:

> Nearshore marine areas free of obstruction and excessive predation with
> (1) water quality and quantity conditions and foraging opportunities, including aquatic invertebrates and fishes, supporting growth and maturation, and
> (2) natural cover including submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels.

Rockfish critical habitat features are distinguished between species and between adults and juveniles, as each species and life history stage has different location and habitat needs. PBFs essential to the conservation of juvenile bocaccio rockfish include:

> Juvenile settlement habitats located in the nearshore with substrates such as sand, rock and/or cobble compositions that also support kelp are essential

> for conservation because these features enable forage opportunities and refuge from predators and enable behavioral and physiological changes needed for juveniles to occupy deeper adult habitats. Several attributes of these sites determine the quality of the area; these attributes include: (1) quantity, quality, and availability of prey species to support individual growth, survival, reproduction, and feeding opportunities; and (2) water quality and sufficient levels of dissolved oxygen to support growth, survival, reproduction, and feeding opportunities.

PBFs essential to the conservation of adult bocaccio rockfish, and adult and juvenile yelloweye rockfish include:

> Benthic habitats or sites deeper than 98 feet that possess or are adjacent to areas of complex bathymetry consisting of rock and or highly rugose habitat. Several attributes of these sites determine the quality of the habitat including (1) quantity, quality, and availability of prey species to support individual growth, survival, reproduction, and feeding opportunities, (2) water quality and sufficient levels of dissolved oxygen to support growth, survival, reproduction, and feeding opportunities, and (3) the type and amount of structure and rugosity that supports feeding opportunities and predator avoidance.

The PBF essential to SRKW conservation and recovery are:

> Marine waters within Puget Sound and the Strait of Juan de Fuca, typically greater than 20 feet in depth, with (1) Water quality to support growth and development; (2) prey species of sufficient quantity, quality, and availability to support individual growth, reproduction and development, as well as overall population growth; and (3) passage conditions to allow for migration, resting, and foraging.

Therefore, habitat features common to each species and life stage are the aquatic habitat generally, and specifically good water quality, abundant prey, and areas with safe passage. We will present our analysis to features of habitat, and then consider the effect with regard to their designation status.

2.4.1.1 Temporary Effects on Habitat

1) Sound Impairment of Habitat Values

Sound will be generated within the action area by two sources, pile driving, and vessels that bring equipment to and from the worksites.

During the 5-year period of the programmatic 831 total piles will be installed (Table 2). Each day a maximum of 1.5 hours of impact pile driving will occur. No more than 30 steel piles will be installed at any given location within a single year. Piles may be installed with either or a combination of vibratory or impact driving methods. When impact driving is used a bubble curtain and wooden block will be used to attenuate the energy.

All pile driving will significantly increase sound waves in the aquatic habitat. The sound pressure levels from pile driving and extraction will occur contemporaneous with the work and radiate outward; the effect attenuates with distance. Cumulative sound exposure level (SEL) is a measure of the sound energy integrated across all of the pile strikes. The Equal Energy Hypothesis, described by NMFS (2007b), is used as a basis for calculating cumulative SEL (cSEL). The number of pile strikes is estimated per continuous work period. This approach defines a work period as all the pile driving between 12-hour breaks. NMFS uses the practical spreading model to calculate transmission loss, and define the area affected. Both vibratory noise and impact noise can create sufficient disturbance to affect the suitability of habitat from a behavioral and physiological sense for listed species.

Of the pile types to be installed only steel piles are generally known to generate enough energy to cause detrimental effects. The material characteristics of concrete do not vibrate properly to generate significant amounts of energy. The energy levels from each pile type and size that are used in this consultation have been taken from previously measured energy levels from historical Navy projects in Puget Sound. Table 8 provides the anticipated energy levels for each pile type and size for both vibratory and impact driving. To accurately assess the greatest potential for harm and exposure to listed species and their habitat we will focus this analysis on the pile type and size that will produce the greatest amount of energy for each installation method (vibratory and impact).

Table 8. Expected unattenuated energy output levels by pile type and size for both impact and vibratory methodologies.

Pile Driving Method	Pile Type	Pile Size (inches)	RMS (dB re 1 μPa)[1]	PEAK (dB re 1 μPa)[1]	SEL (dB re 1 μPa)[1]
Impact Installation[2]	HDPE	13	156	N/A	N/A
	Timber	12 and 14	170	N/A	N/A
	Concrete pile	18	170	184	159
		24	178	189	166
	Steel pipe	12 and 13	177	192	167
		14	184	200	174
		24	193	210	181
		30	195	216	186
		36	192	211	184
	Bangor	36	194	211	181
Vibratory Installation	Timber	12	153	N/A	N/A
	Steel pipe	13 and 14	155	N/A	N/A
		16 and 24	161	N/A	N/A
		30 and 36	166	N/A	N/A
	Steel sheet	24	163	N/A	N/A
Vibratory Extraction	Timber	12	153	N/A	N/A

Based on the data from Table 8, the Cumulative SEL is calculated by Single Strike SEL + 10*log (# of piles strikes). The number of pile strikes is estimated at 6 piles installed per day with 4,000 pile strikes per day for steel piles. The Cumulative SEL is the best measurement for assessing pressure generated from pile driving because it takes into account both the great amount of energy and the duration of that energy production. Attenuation devices will be used at both Bangor, Zelatched point, and Manchester allowing for a 8 dB reduction in Cumulative SEL. No impact driving of any kind will occur at Bremerton, including proofing. There are three Cumulative SELs for the 6 installations;

Manchester: 202 dB $SEL_{cumulative}$
Bangor: 209 dB $SEL_{cumulative}$
Zelatched Point: 212 dB $SEL_{cumulative}$
Keyport, Everett: 220 dB $SEL_{cumulative}$

Barges that are used to stage equipment during construction are also a source of noise in the aquatic environment. These and other boats may increase the amount of noise before and after the construction efforts, but it will be short term. Tugboats will be deployed once to position the barge, and once to remove it once construction is complete. The barge will only serve as a work platform.

The proposed action is likely to affect aquatic habitat via pressure waves at several discrete locations throughout the action area, but will be confined to the area immediately surrounding each impact pile driving location (Figure1). In some locations the area of increased sound pressure will be beyond the DOD critical habit exclusions for salmonids, rockfish and whales, and will thus impact both designated and non-designated critical habitat for multiple species.

Noise from the tugboats and barge are not expected to reach the levels that are generated by pile driving, and will be far shorter in both duration and area affected. Increased background noise has been shown to increase stress in humans (Hattis and Richardson 1980) and other mammals (Owen *et al*. 2004), and several studies support that the same is true for fish (Mueller 1980; Scholik and Yan 2002; Picciulin *et al*. 2010). Recreational boat noise diminished the ability of resident red-mouthed goby (*Gobius cruentatus*) to maintain its territory (Sebastianutto *et al*. 2011).

Depending on speed and proximity to nests, boats caused spawning long-eared sunfish to abandon their nests for varying periods in order to find shelter (Mueller 1980). Xie *et al*. (2008) report that adult migrating salmon avoid vessels by swimming away. Graham and Cooke (2008) studied the effects of three boat noise disturbances (canoe paddling, trolling motor, and combustion engine (9.9 horsepower) on the cardiac physiology of largemouth bass (*Micropterus salmoides*). Exposure to each of the treatments resulted in an increase in cardiac output in all fish, associated with a dramatic increase in heart rate and a slight decrease in stroke volume, with the most extreme response being to that of the combustion engine treatment (Graham and Cooke 2008). Recovery times were the least with canoe paddling (15 minutes) and the longest with the power engine (40 minutes). Graham and Cooke (2008) postulate that the fishes' reactions demonstrate that the fish experienced sublethal physiological disturbances in response to the noise propagated from recreational boating activities. Even though NMFS did not find studies exploring the physiological effects of increased noise from vessel traffic specifically on salmon, it is reasonable to assume that juvenile and adult salmon (as well as other species covered by this Opinion), in addition to avoiding boats (Xie *et al*. 2008), experience sublethal physiological stress. However, we do not expect the response of any species to the exposure of the construction vessels to be detectible above the background levels already experienced within these highly active commercial ports and marinas. Compared to the daily vessel traffic and operations the noise generated by the construction barges will be relatively low sound levels, short duration and small area affected. In addition, vessel traffic will be limited to naval vessels, which have much fewer sailings than traditional commercial operations.

Sound in Rockfish Aquatic Habitat - Noise caused by the proposed action may affect PS/GB bocaccio nearshore critical habitat. Critical habitat may be affected because noise levels detectable to rockfish, beyond background noise levels, and above the cumulative SEL injury threshold will be throughout the action area for an estimated maximum daily duration of less than 1.5 hours for impact pile driving. Additionally, noise caused by the proposed action may affect PS/GB bocaccio and yelloweye rockfish deep-water critical habitat because noise levels detectable to rockfish, beyond background noise levels, and above the cumulative SEL injury threshold will be throughout the action area for an estimated maximum daily duration of less than 1.5 hours for impact pile driving of steel piles and less for impact driving of non-steel piles.

Salmonid Migration Values - Pile driving will produce noise detectible by the protected fish species during impact pile driving of steel and concrete in the portion of the action area that contains designated critical habitat as well as the portions of the action area where critical habitat is exempted. The increased noise levels within the portion of the action area that contains critical habitat will be temporary, lasting less than 1.5 hours per for each location (maximum of 9 hours cumulative across all locations), where impact driving occurs. Because work ceases each day, migration values are re-established during the evening, night, and early morning hours.

Because the impact pile driving of steel and concrete piles will be conducted during the timeframe when juvenile salmon are less likely to be present and will also be conducted utilizing a noise attenuation device (bubble curtain or other device), migration impairment will be minimized. The remainder of the pile driving will be with vibratory driver, which also creates sound throughout the action area, but does not create sound pressure levels that would diminish the area for migration values.

The Salmonid estuarine PBFs will be exposed to noise above the cumulative SEL injury and within detectable limits throughout the action area during construction; however, this exposure will be temporary and intermittent. Therefore, effects to PS Chinook and HCSR chum critical habitat migration values will be indiscernible. Rockfish do not generally migrate large distance like salmonids once they have settled out of their pelagic larval stage. They tend to have a high site fidelity, therefore the impact to rockfish migration is indiscernible.

Marine Mammal Migration Values - SRKW may also detect and interact with the increase sound energy, primarily through vibratory pile driving. SRKW have critical habitat within the discrete areas with increased sound levels. SRKW also require uninhibited pathways of movement within their critical habitat. There is no timing window available to avoid peak presence of this species and the likelihood of SRKW being present within all of the areas impacted by increased sound is ubiquitous, with the exception of Bangor and Zelatched Point, which no SRKW have been sighted near within the last 15 years. Therefore it is likely that the SRKW PBF of "passage conditions to allow for migration, resting, and foraging" will be affected for at least 1.5 hours at each installation where impact pile driving is occurring, every day during the work window for all 5 years.

Salmonid Prey Base - Several species of forage fish spawn within the action area throughout the year. Common fish species identified as forage fish to salmon include, surf smelt, land lance, and Pacific herring. Forage fish occur year-round in the action area but do have slight site-specific variances in presence timing. However, these species become increasingly abundant in the spring months, largely due to the arrival of large schools of herring, before decreasing in abundance again in late summer. The forage fish presence increases the probability of occurrence of salmon during in-water activity, as they are a primary prey base both within Puget Sound and offshore and a key component of all three salmonid species' PBFs (Duffy et al, 2010). Fish were identified as approximately 50% of the gut content by prey items and 90% by content weight of juvenile Puget Sound Chinook salmon captured at sea (Sweeting et al. 2007). Daly et al, 2009, identified that the three forage fish species made up on average 35% of gut content for Chinook salmon over 376 mm and approximately 11% for Puget Sound Chinook with a fork length of 80-100 mm.

Populations of forage fish species such as Pacific Herring and sand lance have seen sharp declines in recent years due to other human based activates with a parallel decline in juvenile salmon survival, suggesting the loss of forage fish may also affect certain life stages of salmonid species (NMFS 2015).

Corollary to salmon following their prey base, SRKW forage on salmon and therefore can be expected to increase in abundance in areas with increased salmon presence. A primary distinction between SRKW and other killer whale species is that they feed almost exclusively on salmon, with a preference for chinook. A reduction in this early food chain link will likely have a corresponding reduction in prey and forage opportunity up the food.

The Navy's proposed construction activity occurs within the salmon work window but not within the forage fish work windows (Army Corp of Engineers 2012). These windows have been designed to avoid time of highest fish presence within the action area. While forage fish do occur throughout Puget Sound year round and for different life stages, the times of year when these fish are actively spawning typically have increased numbers of fish and tighter concentrations. Forage fish spawning times are variable across Puget Sound and are defined based on Tidal Reference Area (TRA). The programmatic's actions will occur in several of these TRAs. The forage fish work windows, designed to avoid times when forage fish are in highest abundance, that most closely overlap with the proposed actions are;

Tidal Reference Area 5: May 1st – August 31st
Tidal Reference Area 7: April 15th – October 14th
Tidal Reference Area 13: April 15th – October 14th

Because of the overlap between pile driving and forage fish spawning adult forage fish 2 grams or larger, and juveniles and larval forage fish smaller than 2 grams, may be exposed to injurious levels of underwater noise. Halvorsen et al. (2012) determined that fish like sand lance that do not have swim bladders, may be less susceptible to injury from simulated impact pile driving but not immune. Pacific Herring, who have sizable swim bladders, are susceptible to barotrauma from exposure to increased single and sustained acoustic pressure. Barotrauma in reference to pile driving refers to the damage or rupture of soft tissue, hair follicles and swim bladders.

A multi-agency work group identified criteria to define sound pressure levels where effects to fish are likely to occur from pile driving activities (Hydroacoustic Working Group, 2008). These thresholds represent the initial onset of injury, and not the levels at which fish will be severely injured or killed. The most harmful level of effects is where a single strike generates peak noise levels greater than 206 dBpeak where direct injury or death of fish can occur. Besides peak levels, sound exposure levels (SEL) (the amount of energy dose the fish receive) can also injure fish. These criteria are either 187 dBSEL for fish larger than 2 grams or 183 dBSEL for fish smaller than 2 grams for cumulative strikes (Hydroacoustic Working Group, 2008). In addition, any salmonid within a certain distance of the source will be exposed to levels that change the fish's behavior or cause physical injury (*i.e.* harm). The result of exposure could be a temporary threshold shift (TTS) in hearing due to fatigue of the auditory system, which can increase the risk of predation and reduce foraging or spawning success (Stadler and Woodbury, 2009). When these effects take place, they are likely to reduce the survival, growth, and reproduction of the affected fish.

Cumulative SEL is intended as a measure of the risk of injury from exposure to multiple pile strikes. A sound exposure formula based on the Equal Energy Hypothesis is used to calculate cumulative SEL exposure:

Cumulative SEL = Single-strike SEL + 10*log (number of pile strikes)

For potential behavioral responses of fishes (i.e. sub-injury) from exposure to anthropogenic sounds, there are no formal criteria yet established. This is largely due to the sheer diversity of fishes, their life histories and behaviors, as well as the inherent difficulties conducting studies related to fish behavior in the wild. NMFS applies a conservative threshold of 150 dB rms (re 1 μPa) to assess potential behavioral responses of fishes from acoustic stimuli, described below.

In a study conducted by Fewtrell (2003), fish were exposed to air guns and observed to exhibit alarm responses from sound levels of 158 to 163 dB (re 1 μPa). In addition, when the 2008 criteria were being developed, one of the technical panel experts, Dr. Mardi Hastings, recommended a "safe limit" of fish exposure, meaning where no injury would be expected to occur to fishes from sound exposure, set at 150 dB rms (re 1 μPa) based upon her research (Hastings 1990a; referenced in Sonalysts 1997). This "safe limit" was also referenced in a document investigating fish effects from underwater sounds generated from construction (Sonalysts 1997) where the authors mention two studies conducted by Dr. Hastings that noted no physical damage to fishes occurred when exposed to sound levels of 150 dB rms at frequencies between 100-2,000 Hz. In that same report, the authors noted they also observed fish behavioral responses during sound exposure of 160 dB rms, albeit at very high frequencies. More recently, Fewtrell and Mccauley (2012) exposed fishes to air gun sound between 147-151 dB SEL, and observed alarm responses in fishes as well as tightly grouped swimming or fast swimming speeds.

None of the current research available on fish behavioral response to sound make recommendations for a non-injury threshold. The studies mentioned here, as with most data available on behavioral responses to anthropogenic sound for fishes, have been obtained through controlled laboratory studies. In other cases, behavioral studies have been conducted in the field with caged fish. Research on fish behaviors has demonstrated that caged fish do not show normal behavioral responses which makes it difficult to extrapolate caged fish behavior to wild, unconfined fishes (Hawkins et al. 2014; Popper and N. 2014). It is also important to mention, that some of the information regarding fish behavior while exposed to anthropogenic sounds has been obtained from unpublished documents such as monitoring reports, grey literature, or other non-peer reviewed documents with varying degrees of quality. Therefore, behavioral effects from anthropogenic sound exposure remains poorly understood for fishes, especially in the wild.

Nonetheless, potential behavioral responses must be considered as an effect of acoustic stressors on ESA-listed fishes and their forage species. For the reasons discussed, and until new data indicate otherwise, NMFS believes a 150 dB rms (re 1 μPa) threshold for behavioral responses of fishes is appropriate. This criterion is used as a guideline to establish a sound level where responses of fishes may occur and could be a concern. For ESA-listed fishes and their forage species, NMFS applies this criterion when considering the life stage affected, and any adverse effects that could occur from behavioral responses such as attentional disruption, which could lead to reduced foraging success, impaired predatory avoidance, leaving protective cover, release of stress hormones affecting growth rates, poor reproductive success rates and disrupted migration.

The above discussed criteria specifically address fish exposure to impulsive sound. No consideration of non-impulsive sounds on fish is given, and the discussion in Stadler and Woodbury (2009) makes it clear that the thresholds likely overestimate the potential for impacts on fish. Further, non-impulsive sounds have less potential to cause adverse effects in fish than impulsive sounds. Impulsive sources cause short bursts of sound with very fast rise times and the majority of the energy in the first fractions of a second. Whereas, non-impulsive sources cause noise with slower rise times and sound energy that is spread across an extended period of time; ranging from several seconds to many minutes in duration. Therefore, any application of these criteria to non-impulsive sound is likely to overestimate the potential for effects in fish.

Each of the seven naval installations covered in this programmatic will have different types, sizes and amounts of piles (Table 9). Therefor each installation will have a different area of increased pressure exposure to forage fish. However, only 6 of the installations will produce sound energy sufficient enough and of the correct type to be possibly affect fish. Those 5 installations are listed in Table 9. Naval Base Bangor will not have impact driving occurring at all for any reason and will only be utilizing vibratory pile driving methodology.

To estimate the greatest amount of exposure to increased pressure for each installation we utilize the pile type and size at each location with the greatest expected energy output (Table 8). The

Navy has proposed to utilize energy attenuation devices (bubble curtain and wood block) at both Bangor and Zelatched Point which are expected to reduce sound energy by 8 dB. Using these individual energy estimates and the $SEL_{Cumulative}$ calculation from above, we calculate the greatest distance out where exposure diminishes below the level or harm to the prey base (Table 9). Additionally, we take into account the physical constraints of the area at each installation to further bound the area of impact (Figure 5).

Table 9. Area of exposure to harmful sound levels for fish at each installation.

Location	Pile size and Type	206 dB PEAK (distance)	187 dB Cumulative SEL for Fish ≥2 g (distance)	183 dB Cumulative SEL for Fish <2 g (distance)	150 dB Cumulative SEL Behavior
Impact Pile Driving -					
Manchester	24-in concrete	1 m	100 m	117 m	7,36 m
NAVBASE Bangor	36-in steel pipe	6 m	294 m	341 m	2512 m
Zelatched Point	36-in steel pipe	6 m	466 m	541 m	1848 m
NAVBASE Kitsap Keyport, NAVSTA Everett	36-in steel pipe	22 m	1,590 m	1,848 m	6,310 m

Figures 5a-e show forage fish spawning areas in relation to zones of injurious sound pressure.

Figures 5a-e show areas where sound decreases forage base. Red is area where physical harm from sound pressure will occur and green is the area where behavioral modification may occur; Gold is herring holding area; Pink is documented herring spawning area; Purple is documented surf smelt spawning; Yellow is sand lance spawning area.

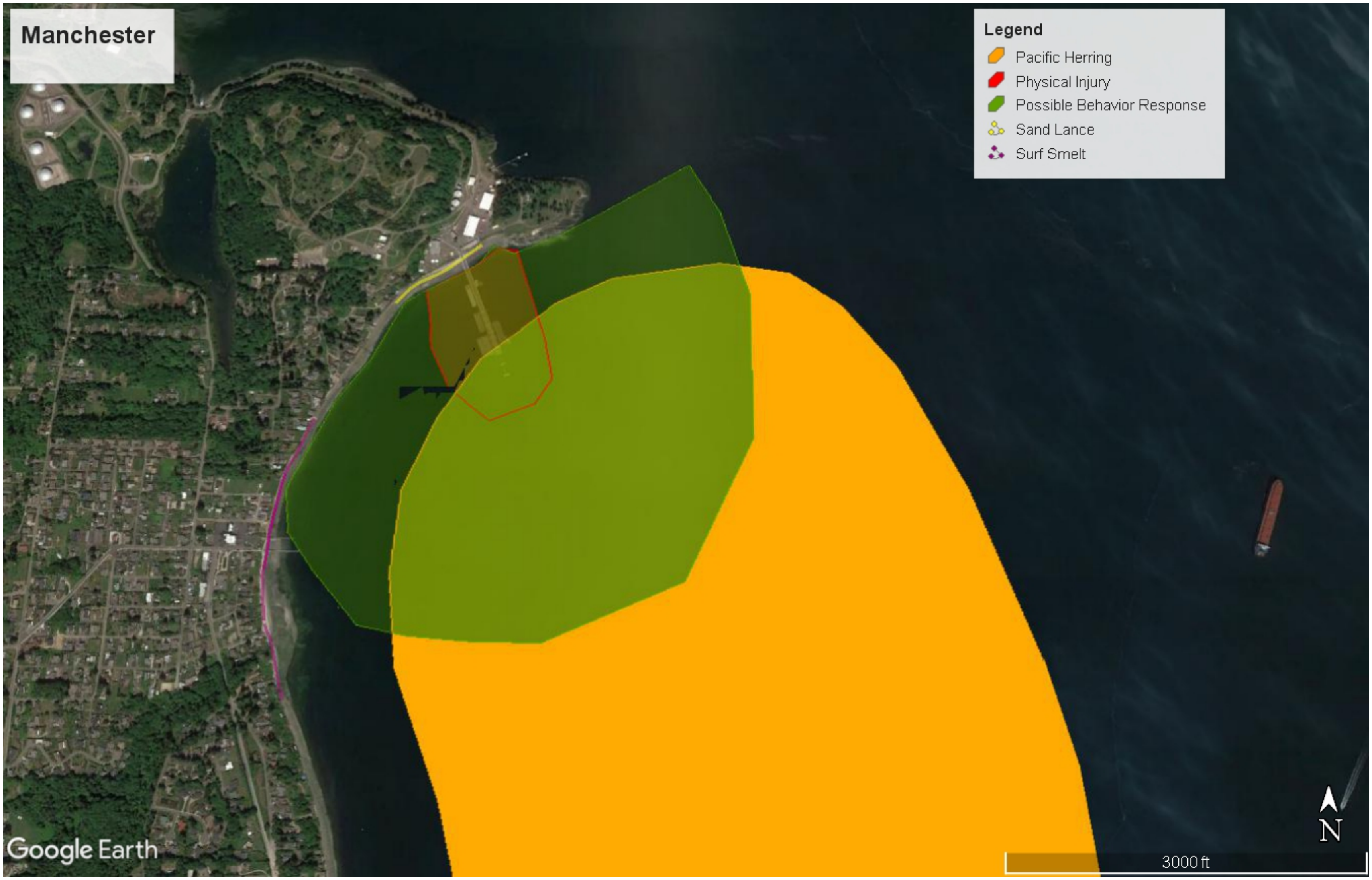

Figure 5a. Manchester fuel depot physical injury zone and potential behavioral response zone.

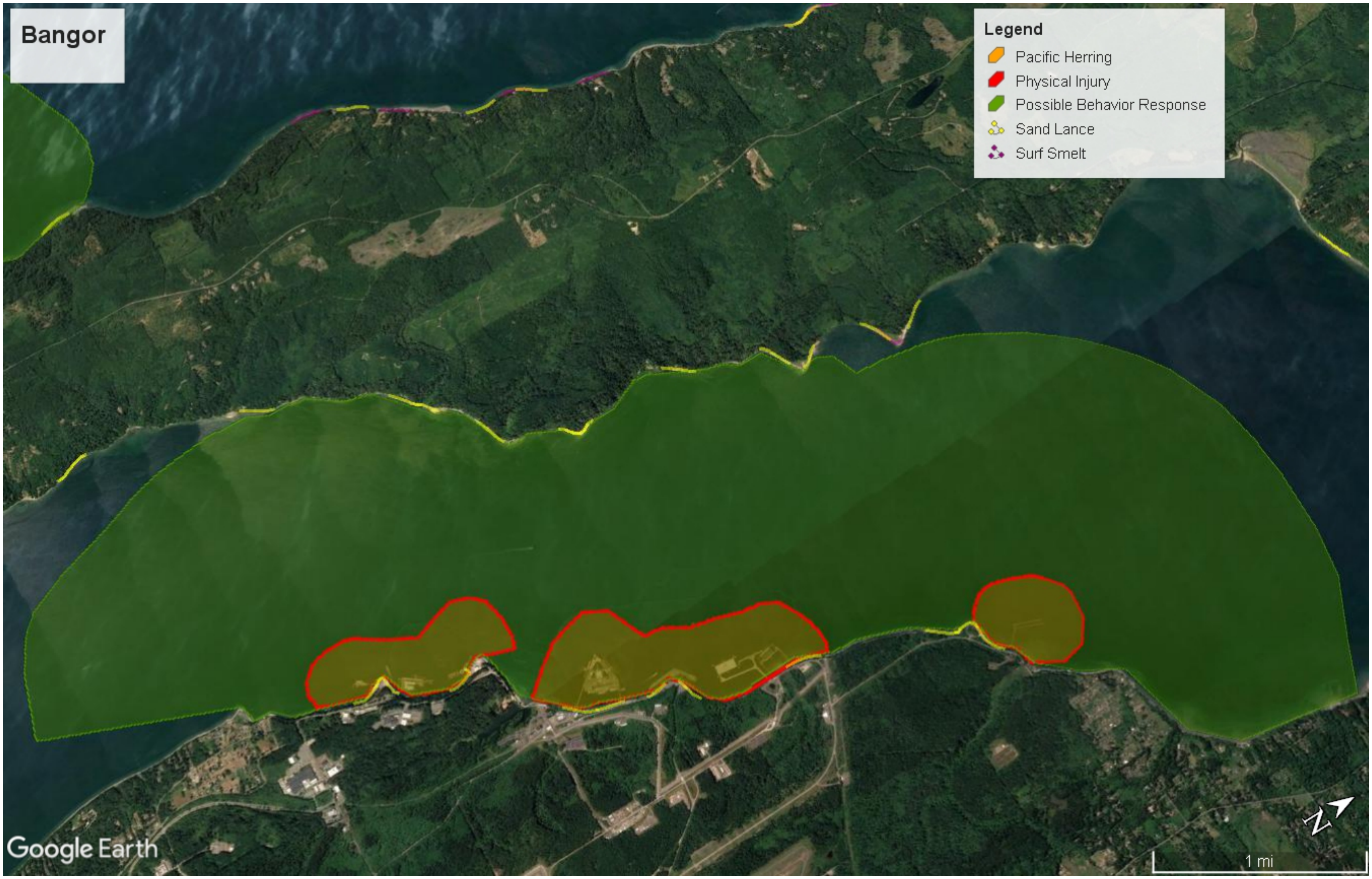

Figure 5b. NAVBASE Bangor physical injury zone and potential behavioral response zone.

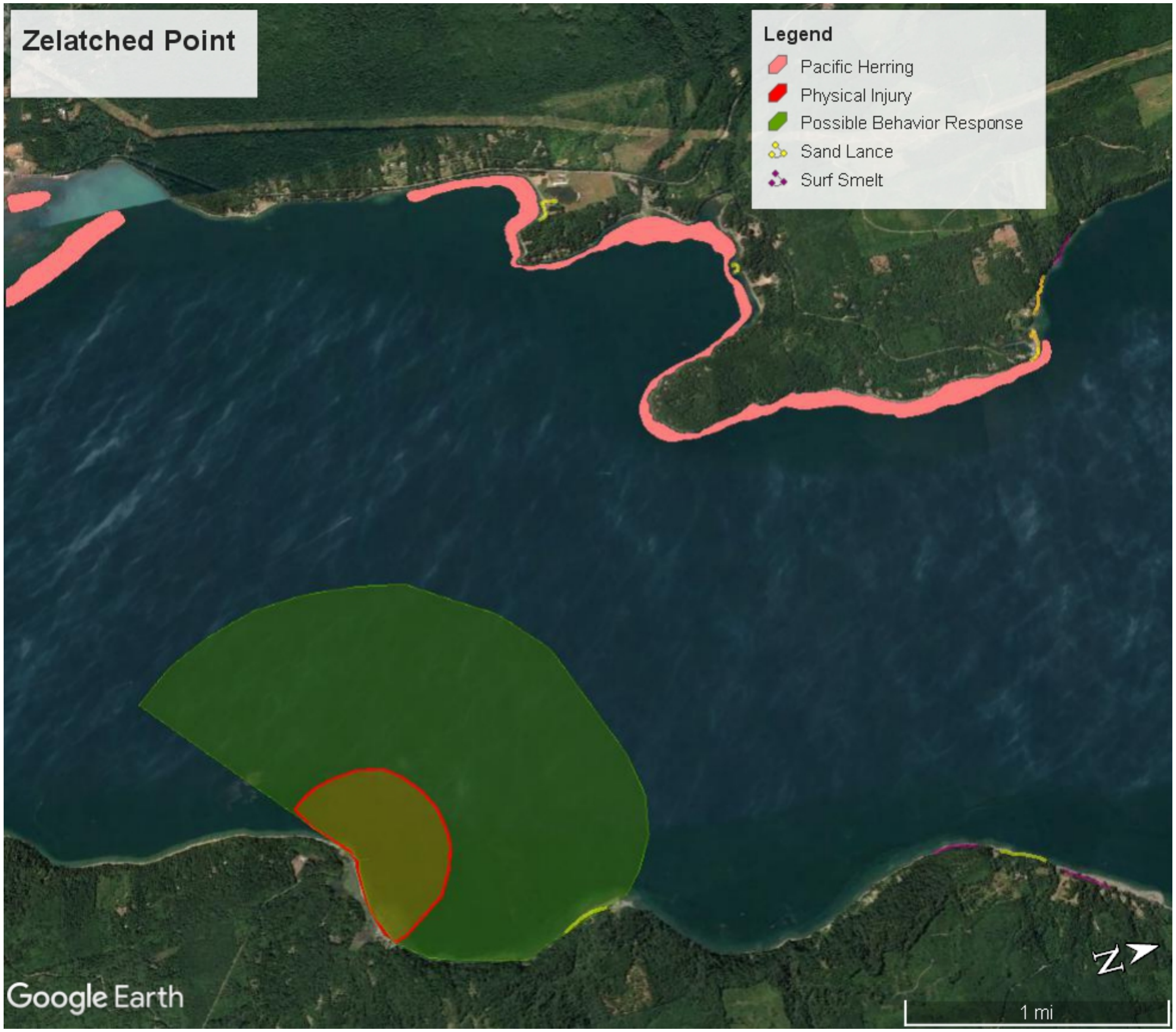

Figure 5c. Zelatched Point physical injury zone and potential behavioral response zone.

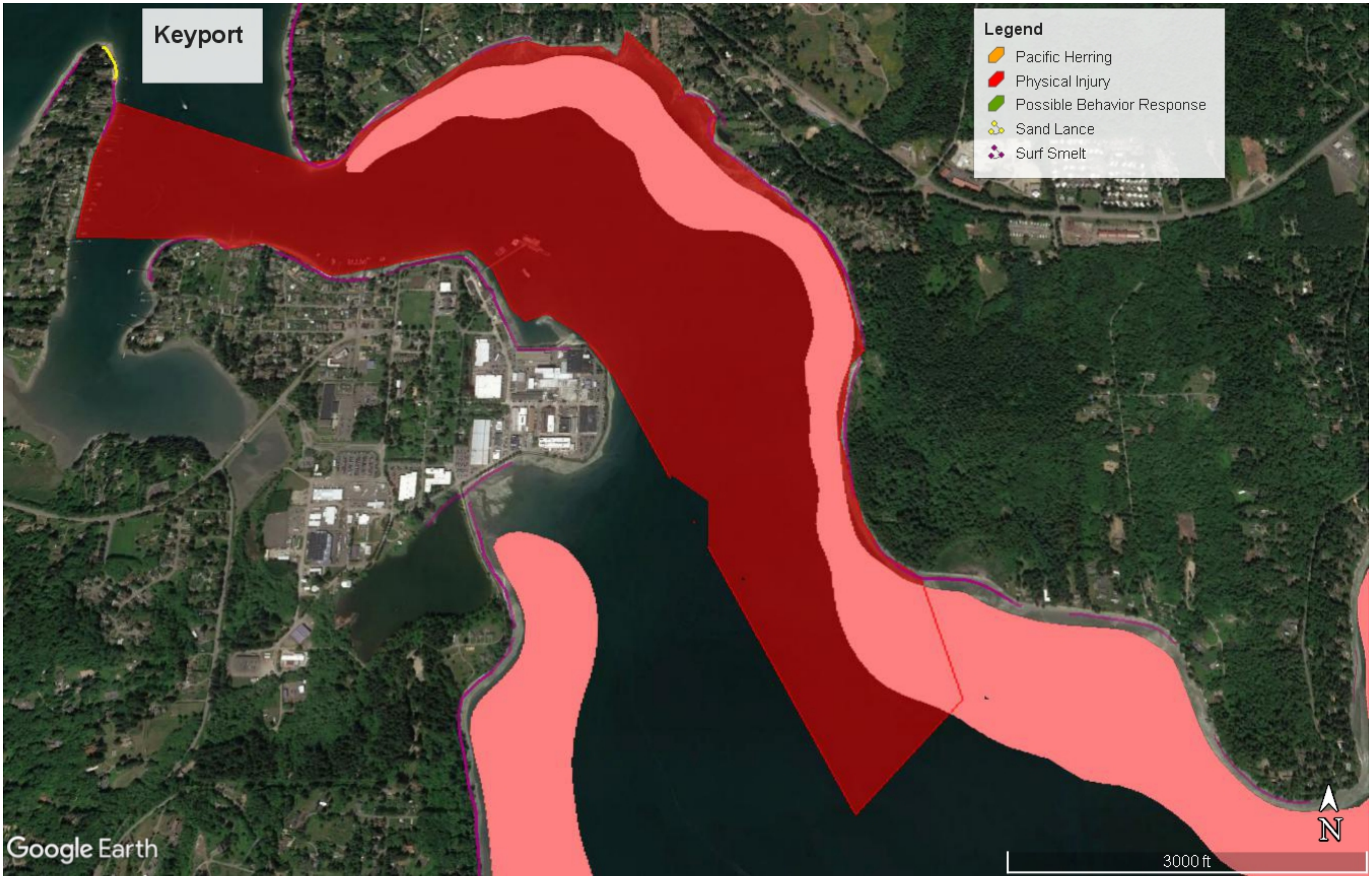

Figure 5d. Keyport physical injury zone and potential behavioral response zone.

Figure 5e. Everett physical injury zone and potential behavioral response zone.

Adverse effects on survival and fitness of fishes can occur even in the absence of overt injury. Exposure to elevated noise levels, which can be caused by both attenuated impact driving (and by vibratory driving) can cause a temporary shift in hearing sensitivity, decreasing sensory capability for periods lasting from hours to days (Turnpenny et al. 1994; Hastings et al. 1996). Popper et al. (2005) found TTS in hearing sensitivity after exposure to cSELs as low as 184 dB. TTSs reduce the survival, growth, and reproduction of the affected fish by increasing the risk of predation and reducing foraging or spawning success. To discern the duration and intensity of species exposure, we consider specific elements of the proposed project.

The impact to the prey base of salmonids does not take into account the expected behavior changes that coincide with fish's detection of increased sound energy. As described in Section 2.4.1.1, NMFS uses 150 dB rms (dB re 1 μPa) for impulsive sound sources to estimate potential zones where fish may exhibit some degree of a behavioral response. Although this is considered an "informal" criterion, it provides a means of qualitatively assessing potential non-injurious (e.g., sub-injury) response of fishes exposed to impulsive sounds. Although injury and mortality is possible for fishes from sound exposure, most of the research to date regarding effects from this sound source indicates that injury or mortality are more likely to occur for small, juvenile or larval fish, and temporary hearing impairment could occur for larger fish if they are exposed for a sufficient duration that would lead to onset of TTS.

As shown in Table 6 the area of potential behavior change for forage fish at each of the naval facilities is even greater than the expected physical harm area. Therefore we expect that in addition to the death of individuals within the salmon prey base caused directly by barotrauma we also expect that additional prey may be harmed (reduced forage, reduced fecundity). This area is represented in Figures 5a-e by the green shaded area around each of the naval instillations. In total the area exposed to sound levels at or above 150 dB encompasses 31.63 square miles.

There are 1,168.0 mi^2 of marine water area in Puget Sound. The total area with elevated pressure levels above the physical damage thresholds for the naval installations is ~ 4.78 mi^2, which represents ~ 0.41 percent of the overall marine water area within the action area that could be occupied by forge fish during the time of pile driving. This represents a conservative proxy for the amount of forage fish expected to be injured with the Puget Sound populations annually. Additionally, 31.63 mi^2 of Puget Sound will have sound levels above 150 dB where a negative behavior response (impairments of feeding, spawning, moving) may occur in some forage fish. This 31.63 mi^2 of potential behavioral response zone represents ~2.71% of the total marine area of Puget Sound.

Because salmon do not depend entirely on feeding on forage fish and only within Puget Sound, it is unlikely that the ~0.41 percent reduction in forage fish from mortality and 2.71% reduction in forage productivity due to potential behavior modifications will equate to an exact match in reduced salmonid percentages each year. Using the Daly 2009 estimate of 35 percent diet composition a maximum ~2.71 percent reduction in the three forage fish species is more likely to result in a 0.95 percent reduction in Puget Sound Chinook marine prey base throughout the action area.

Even in those portions of the action area where forage fish spawning has not been documented the likelihood of forage fish presence within the area cannot be considered discountable. Forage fish and especially Pacific Herring do not have strong specific site fidelity and can travel large distances to spawn in multiple areas (Hay et al, 2001). Additionally, several of the installations (Bangor, Keyport, Manchester, and Zelatched) are located at the mouth of water bodies. This choke point type of location causes an increase in the number of fish effected by the increased pressure and more fish must pass by the installation in order to access forage sites, spawning beaches located on the other side of the installations, and/or avoid predators located before the instillation. Co-occurrence of transient forage fish with pile driving is likely to occur among some of the installations for an unknown amount of time over the 5-year programmatic period.

SRKW Prey Base - Corollary to salmon following their prey base, SRKW forage on salmon will have increased presence in areas where salmon presence is high. A primary distinction between SRKW and other killer whale species is that they feed almost exclusively on salmon, with a preference for chinook. A reduction early in the food chain for salmonids will likely have a corresponding reduction in prey and forage opportunity further up the food chain for SRKW.

In addition to the reduction in salmonids due to a loss of prey base, there may also be a reduction of salmonids due to barotrauma experienced when salmon enter areas of increased sound pressure. The extent of salmon mortality due to barotrauma is expected to be similar to that of the forage fish, especially Pacific Herring who also have gas bladders. Both adult and outmigrating juvenile salmon are likely to be greater than 2 grams and thus the area of physical harm effects resulting from increased sound pressure is expected to be equal to the area mapped in Figure 5 for forage fish. Although the Navy will be conducting pile driving activities during times of year when salmon occurrence is expected to be low, there is still a chance that some early or late traveling individuals may co-occur with some pile driving activities.

The combined reduction in salmon (especially PS Chinook) from reduced prey availability and direct effects of barotrauma will result in a reduction in the SRKW prey base critical habitat PBF. As previously mentioned, SRKW feed almost exclusively on PS salmon (Ford et al, 2010). The National Marine Fisheries Service has identified prey availability as a limiting factor for SRKW recovery (NMFS, 2008).

The reduction in prey base for salmonids and SRKW will be commensurate with the number of years of pile driving (5 years) plus a number of years after pile driving has ceased when the individuals that were killed are replaced by new and maturing fish. Because the exact age and quantity of forage fish cannot be precisely quantified we will use the proportional analysis of area affected to the entire action area.

2) Disturbance of sediments

Pile driving causes short-term, localized increases in turbidity and total suspended solids (TSS) as the bottom materials are displaced during the intrusion of the pile structures, and from the percussive effect of the driving. This affects water quality and benthic prey communities.

Water quality impairment **-** To estimate the magnitude of suspended sediment associated with the proposed pile driving, NMFS reviewed results from a vibratory pile removal project near the mouth of Jimmycomelately Creek in Sequim Bay (Weston Solutions, 2006). Because the character of vibration is the same for both installation and removal, the analysis of sediments for removal provides a reliable review of likely suspended sediments from installation. In that study, TSS concentrations associated with activation of the vibratory hammer to loosen the pile from the substrate ranged from 13 to 42 milligrams per liter (mg/L) and averaged 25 mg/L. During the pile driving, elevated levels of TSS averaging 40 mg/L were recorded near the pile and 26 mg/L at the sensors located 16 to 33 feet from the pile. Concentrations during extraction ranged from 20 to 82.9 mg/L and were sometimes visible in the water column as a 10- to 16-foot diameter plume that extended at least 15 to 20 feet from the actual pulling event. Although concentrations decreased after pile extraction, the time interval was unavailable due to tug movement as soon as the pile cleared the water's surface.

Just as sediment is disturbed during pile installation, sediment will also be disturbed with pile removal. A total of 831 existing piles (maximum of 724 treated timber) will be removed using a mixture of methods including wrapping the piles with a cable or chain and pulling them or using vibratory extraction and may be cut at the mudline if splitting or breakage occurs. A containment boom surrounding the work area will be used during creosote-treated pile removal to contain and collect any floating debris and sheen. In some cases, the boom may be lined with oil-absorbing material to absorb released creosote. Removed creosote piles and associated sediments (if any) will typically be contained on a barge. If a barge is not utilized, piles and sediments may be stored in a containment area near the construction sites. The potential for releases of creosote from treated piles removed during the programmatic will be managed by BMPs and current practices that will minimize the potential for releases of creosote to the water column, which could affect benthic organisms. The area affected by any accidental release of creosote is expected to be no bigger than the 150 ft area of estimated TSS spreading from pile driving.

We anticipate multiple episodes of suspended sediment daily for the 5 years of piling work at each of the facilities, with each pile extraction and installation, creating a small, temporary, turbidity plume at each site. These repeated diminishments in water quality are most likely to affect habitat values for forage fish, rockfish, and Chinook salmon which have a component of their population that does not migrate to the open ocean. Because pile installation and extraction generate sound and suspended sediment at the same time, we anticipate that any marine mammals in the action area will respond to noise in a manner that prevents them from encountering areas of high turbidity. For this reason, the repeated water quality diminishments over 5 years have a larger impact on fish habitat values than on values for marine mammals.

<u>Benthic and Prey Communities/Forage Base -</u>Pile removal and installation activities will diminish the prey communities in the affected area. There will be some minor loss of encrusting species (e.g., mussels) on the piles removed. The benthic communities in the footprints of the piles (0.133 acre) will be eliminated when the piles (temporary and permanent) are installed. Additionally, 0.133 acre of piles will be removed without replacement, for a net conversion of 0.266 acre of benthic habitat. There will be some disturbance to sediments and benthic community from pile removal and vessel anchors, but there will be little potential disturbance from propeller wash and no potential for barge grounding due to the water depths at the site. Intertidal habitats, including clam and oyster beds, will be outside the construction zone and will not be impacted by construction. The potential area that will be disturbed by construction activity

was estimated by adding the area within 150 feet of the proposed structure to the structure footprint (WDOE 2016). For marine waters, the expected point where turbidity is likely to drop below background levels is a radius of one hundred fifty feet from the pile. When combined, the construction activities will result in the temporary disturbance of approximately 23.5 acres of benthic habitat.

Marine macroinvertebrates and other organisms have a demonstrated ability to recolonize disturbed substrates (Dernie et al. 2003); most of the benthic habitat, with the exception of very small areas displaced by piles, will begin to recover within months after construction is completed. Previous studies of dredged, sediment capped, and other disturbed sites show that many benthic and epibenthic invertebrates rapidly recolonize disturbed bottom areas within 2 years of disturbance (Romberg et al., 1995; Parametrix, 1994, 1999; Vivan et al., 2009). Many benthic organisms lost due to turbidity and bottom disturbances caused by barges, tugboats, and anchors recolonize the construction areas quickly, for example, mobile species such as crabs and short-lived species such as polychaetes and become reestablished over a 3-year period after sediment disturbance at the site has ceased. Less mobile, longer-lived benthic species such as clams can take two to three years to reach sexual maturity (Chew and Ma, 1987; Goodwin and Pease, 1989) and may require five years to recover from disturbance such as smothering by sediment. Therefore, shellfish communities impacted by construction are expected to recover within approximately five years after construction. Ecological productivity will be reduced during the five-year recovery period. Any geoduck or other clams lost in the pile footprints during construction will no longer be available to contribute as seed stock for future generations.

Forage fish that occur in the immediate project vicinity during in-water construction will be exposed to increased levels of turbidity. Therefore, forage fish could be present and potentially affected by construction activities. In general, behavioral response including shoreline avoidance from visual stimuli of nearshore-occurring pre-spawn adult sand lance would not be expected from the offshore construction activity. Additionally, increase in vessels activity from construction barges and associated wakes at the naval facilities could have minor effects to distribution and behavior of adult and larvae Pacific sand lance. Both rockfishes and salmonids will experience prey reductions from benthic disturbances over the 5 years of work plus the recovery period for the prey base. As described above, reductions in prey communities which diminish salmonid forage opportunities may also diminish prey base for SRKW in turn. However, the 23.4 acres (0.037 mi^2) of benthic habitat disturbed is minor relative to the amount of such habitat otherwise available in the same general area and is very minor relative to the amount of critical habitat generally. Similarly, the number of salmonids that would be affected is minor relative to the aggregate numbers of fish likely available as prey to SRKW in the same general vicinity.

3) <u>Shade from construction barges</u>

During construction, a number of barges will be on site at any one time, depending on the type of pile removal/instillation taking place, for approximately 5 years. Tug boats will tow the barges to and from the construction site and position the barges for construction activity but will leave the site once these tasks are completed, and so will not be on site for extended periods; smaller skiff type boats (less than 30 feet in length) will be on site performing various functions in support of construction and sensitive species monitoring. Shade disrupts salmonid migration behaviors, and when structures including vessels shade the shallower areas where salmon are assumed to migrate the fish are forced into deeper water. Thus equipment and vessels create overwater cover that may lead to a temporary impediment to fish passage and an increase in cover for predators of juvenile salmon and steelhead that rely on shade to enhance predation success.

Because this is a programmatic for 7 installations, most with several individual structures with replacement piles, an exact number and frequency of barges at each facility is not feasible to predict. However we can make an estimate of total barge area coverage for the entire programmatic using some basic assumptions. It is reasonable to assume that only one barge will be needed to install or extract one pile and that a single barge can only extract or install one pile at a time. Because daily work efficiencies cannot be predicted we will use the conservative assumption that each barge is only able to install six piles per day. It is expected that once a barge has successfully completed its pile driving that it will be removed from the construction site. Therefor the maximum number of days with barges present in the action area will be 137 days. A typical construction barge is approximately 45 feet wide and 100 feet long (4,500 $feet^2$). We can therefore estimate that a cumulative 14.15 acres will be shaded by barges over the course of 5 years. This estimate depicts temporary shading with the acres of shading ebbing and flowing as work progresses. The acres of shade will likely not be concentrated in any given year and are expected to be dispersed between the 7 installations, and commensurate with the number of piles to be installed at each facility.

4) <u>Reduced Predator Presence</u>

The Navy's request for an LOA from PRD includes incidental take of harbor seals, California sea lion, and Steller sea lion. All three species are known predators of Puget Sound salmonids and rockfish (Everitt et al,. 1982). As described below in the sound effects to species section, the increased sound pressure resulting from pile driving can, and is expected to, adversely affect marine mammals by causing Permanent Threshold Shift (PTS)[5] and physical tissue damage among individuals present during pile driving. PRD estimated the following amounts of Take for each species based on area of sound exposure, animal density estimates and duration of pile driving:

Harbor seals (288 Level A; 37,506 Level B)
California sea lion (25,227 Level B)
Steller sea lion (1,009 Level B)

As discussed more completely in section 2.4.2.2, marine mammals can experience shifts in their auditory senses, blinding of their auditory senses and physical tissue damage from increased sound pressure. When, either level B or level A take occurs, it is likely that the marine mammals so affected will be either removed as active predators or that their ability to predate on listed fish species will be diminished. A common primary feature of habitat for Puget Sound salmonids and rockfish species is "habitat free from contaminants and *predators* with sufficient quantity and quality of water for ……." throughout Puget Sound. The proposed action (and the interrelated activity) incidentally increase that habitat value for listed salmonids and rockfish species in the Action Area where predators have historically been located, by diminishing the number of predators or the predators' success.

[5] Permanent Threshold Shift is a permanent change in the hearing sensitivity of a human or animal.

This reduction in predators and increase in habitat quality is expected to be temporary, with decreased predation success lasting minutes to hours each day while pile driving is occur, and lower abundance in predators persisting through one or two breeding cycles. Marine mammals that survive the exposure to increased sound pressure may return to the same areas and reengage in foraging activities when sound ceases.

2.4.1.2 Permanent Effects on Habitat[6]

The repairs at Zelatched Point will extend the life of those structures such that the effects of the structures will occur for much longer into the future (we anticipate 50 years), affecting many additional cohorts of listed fish. These effects result from the structures being repaired and are thus properly construed as effects of the action. Interrelated operations at the structure will similarly occur into the future as a result of the proposed action. Habitat features and function that will be affected by the structures into the future include effects from structure width, shade and light conditions, and presence/lack of macrophytes.

1) Migration Obstruction

The pier at Zelatched Point is 300 feet long and is 10 - 12 feet wide, with a total overwater area of 3,085 feet^2. There is substantial evidence that OWS impede the movements of juvenile salmonids with fish stopping at the edge of the OWS and avoiding swimming into the shadow or underneath the structure (Heiser and Finn 1970; Able et al., 1998; Simenstad 1988; Southard et al., 2006; Toft et al., 2013; Ono 2010), whereas juvenile Chinook salmon appear less hesitant to pass beneath narrower structures. Of further concern, studies have shown that swimming around OWS not only lengthens the salmonid migration route, but is also correlated to increased mortality. For example, migratory travel distance rather than travel time or migration velocity has been shown to have the greatest influence on survival of juvenile spring Chinook salmon migrating through the Snake River (Anderson et al., 2005).

Rockfish migration is unlikely to be affected by the presence of structure, however, because larval rockfish are not volitional swimmers, and juvenile rockfish that do have volitional capacity would be migrating to deeper habitats.

2) Shade

The Zelatched Point pier is located at a depth of 30 feet and greater. Fish that would normally swim closer to shore (12 feet above MLLW to 30 feet below MLLW) will swim into deeper waters to avoid the pier. OWS create a sharp-edged shadow and Ono (2010) reports that juveniles salmonids tended to stay on the bright side of the shadow edge, 2 to 5 meters away from the dock, even when the shadow line moved underneath the dock. These findings suggest that OWS can disrupt juvenile salmonid migration in the PS nearshore, degrading the role of this

[6] As indicated above, in addition to the proposed nine-pile project at Indian Island Ammunition Wharf, there are expected to be further maintenance/repairs at Indian Island. NMFS anticipates that that the useful life of the structure will be extended by all this work. In this Opinion, NMFS is relying on the Navy's undertaking in its March 15, 2019 letter to consult programmatically on the future suite of repairs. We have assumed that additional information that is expected to become available regarding the exact nature of future work, as well as the greater scale of that work, will provide a better basis than we have presently about the nine-pile project for analyzing the permanent effects of the structure itself and any interrelated and interdependent activity. The nine-pile project analyzed in this biological opinion will be in the environmental baseline of the Indian Island programmatic to the extent geographically relevant.

habitat for migration purposes. While operation of the pier will mean the presence of seaplanes and support vessels, we cannot accurately determine the exact size of these vessels/planes. Their presence is expected to be brief, being stationed at the pier only during testing and duties lasting hours during the day. We therefore assume that any additional shade provided by these vessels will be additive to the effects of the pier but in a temporary capacity.

<u>Reductions in aquatic vegetation/cover</u> - Pier and float structures, like Zelatched Point, can adversely affects primary productivity and SAV if present in the shadow zone of the OWS. The NMFS is not aware of studies examining the effect of OWS on SAV other than eelgrass and kelp (Mumford, 2007). However, the physiological pathways that result in the reduction in shoot density and biomass from shading applies to all SAV. Thus, it is reasonable to assume that shading from OWS and the associated vessels adversely affects (by inhibiting and stunting growth) any SAV within the shadow of the 3,085 square foot structure.

In addition to reduced SAV biomass and shoot density, shading also has been shown to be correlated with reduced density of the epibenthic assemblage under ferry terminals compared to a control site (Haas et al., 2002), which is another source of prey reduction.

<u>Diminished benthic communities/forage</u> - Forage fish such as Pacific herring, Pacific sand lance and surf smelt are present in the action area and specifically near the Zelatched Point pier.

There is documented herring spawning grounds roughly 2 miles to the north of Zelatched Point. The Port Gamble and Quilcene Bay herring stocks spawn in waters to the north and south of the Zelatched pier. Pacific sand lance active spawning habitat has been identified ~0.9 miles north of the pier. Surf smelt are believed to spawn throughout Dabob Bay area, with the heaviest spawn occurring from mid-October through December. Herring, a food source for listed PS Chinook, thus has documented spawning in the action area.

Spawning areas for PS herring are largely limited to depth at which SAV will grow with herring using several species of macroalgae as spawning substrate. In shallower areas, *Zostera marina* is of primary importance, and in slightly deeper areas, *Gracilaria* spp. predominates (Penttila, 2007). An essential element of herring spawning habitat appears to be the presence of perennial marine vegetation beds at rather specific locations (Penttila, 2007). While across the PS region native eelgrass (*Zostera marina)* is of primary importance as spawning substrate, other SAV is used locally. In some parts of PS, algal turf, often formed by dozens of species of red, green and brown algae, is used by spawning herring (Millikan and Penttila, 1974). In deeper water and in areas where native eelgrass beds do not predominate, herring spawn on the mid-bottom-dwelling red alga *Gracilariopsis sp.* (referred to as *Gracilaria* in some sources) (Penttila, 2007).

The intertidal shallows and eelgrass beds provide important habitat for a variety of marine invertebrates and fishes, including salmonid species. The area directly under and near Zelatched Point pier is reported to have continuous eelgrass bed presence (Coastal Atlas). The presence of the OWS at Zelatched point into the future is likely to continue to suppress SAV growth and prevent future colonization by SAV for the entire area of the pier (3,085 ft^2). Any additional loss of SAV as well as the future suppression of SAV at Zelatched Point represents impaired, and inhibited potential, forage fish spawning ground and invertebrate colonization, indicating that prey for both salmonids, and as a corollary prey for SRKW will be limited in this portion of the action area.

3) Increased Predation Exposure

A mentioned the action will result in the continued impairment of migration and fish movement through and around the Zelatched Point pier. The 300 ft waterward impairment to fish movement will result in fish being forced into deeper water where predation is more likely to occur than within their traditional nearshore shallow habitat. However, because the area immediately surrounding Zelatched Point pier is DoD exempt from critical habitat this affect is not considered for the purposes of analyzing effects to critical habitat; it is considered only to the extent it translates into effects on the species. The duration of this increased predation exposure is likely to last for the entire duration of time that the pier is located with the shoreline (50 years).

2.4.1.3 Summary of Effects on Habitat and Critical Habitat

Multiple habitat features will be adversely affected by the proposed action, and the effects range across areas that are not designated as critical habitat (because of the DOD exemption), into areas that are designated critical habitat.

Effects on Designated Critical Habitat

The areas of designated critical habitat will be directly adversely affected only by sound in aquatic habitat, which will temporarily diminish the migration and forage value of the habitat while sound is present. The sound impacts will only occur across one salmonid work window at each location, timed when migration use is expected to be quite low, but each location may conduct activities during any (or each) year of the 5 years of this program. While sound will have direct effects within critical habitat, indirect effects are also likely to occur. For instance, because the Navy is not proposing to work within the established forage fish work windows, there will likely be an adverse impact on forage fish which would directly diminish the prey base of salmonids. This impact to forage fish will occur in each year of the 5 years of the proposed action with effects extending for roughly 2 years beyond the end of construction, as the forage fish populations recover. As presented above, we anticipate the reduction in forage will not exceed 1.1 percent per year. We assume for the sake of this analysis that the reduction is arithmetic, causing an assumed 5.5 percent reduction of forage base by the end of the 5-year programmatic.

To the degree that noise and related prey reductions occur within designated critical habitat as a result of the proposed action, the conservation value of the habitat will be diminished for rockfish, salmonids, and SRKW. This effect could be somewhat dampened by the contemporaneous effect of the predatory marine mammal (seals and sea lions) having reduced presence in the action area and/or reduced predation success due to hearing reduction during pile driving.

Effects on DOD Areas Exempt from Critical Habitat

Effects to habitat features that are not included in the critical habitat designations include temporary and permanent diminishment of benthic communities and forage fish (i.e., prey abundance and diversity), migratory obstruction and required energy expenditure, and temporary and permanent increases in predators and predator success upon juvenile salmonids. Timing, duration, and intensity of the effects on DoD exempted areas will be the same as for the critical habitat effects listed above (we assume effects are consistent across designated and non-designated areas). These effects will occur within the Navy's security zones, which is excluded from the critical habitat designation and thus not taken into account in the adverse modification analysis, but we nevertheless consider them as the pathways of exposure creating effects to the species, as discussed below.

We quantified the long term impacts to habitat quality and environmental services at Zelatched Point utilizing a Nearshore Habitat Equivalency Analysis (HEA). This analysis modeled long term environmental service changes through anticipated in changes in all temporary and long term effects listed above including, shading, and turbidity, fill of habitat, migration disruption, and water quality. Over the course of another 50 years (anticipated design life of support piles and structure), the presence and operation of Zelatched Point is likely to adversely affect 0.486 Discounted Service Acre Years (DSAYs).

2.4.2 Effects on Species

As described in Section 1.3, three distinct work windows, which are timed to minimize the presence of juvenile salmonids, govern the timing of work at the 7 installations. However, work conducted within the window will not completely avoid all fish exposure to construction effects, and exposure to long-term effects of the structure in aquatic habitat will remain for the foreseeable future.

2.4.2.1 Species Presence and Exposure

Each of the following species uses the action area, but is present at differing life history stages, and with variable presence. In order to determine effects on species, we must evaluate when species will be present and the nature (duration and intensity) of their exposure to those effects of the action in their habitat, which were described above. It should be noted; an effect exists even if only one individual or habitat segment may be affected (Fish and Wildlife Service and the National Marine Fisheries Service 1998).

Juvenile Salmon. Juvenile Chinook salmon are nearshore oriented (Fresh, 2006) and have been found in PS neritic waters between April and November (Rice et al., 2011). Like juvenile Chinook, juvenile chum salmon are very estuarine and marine nearshore dependent (Salo, 1991) (Simenstad, 2000). Juvenile HC summer-run chum salmon occur in Hood Canal waters between February and May and inhabit shallow nearshore areas for the first weeks of life (Tynan, 1997). Juvenile presence for Chinook species will overlap with construction windows and diminishment of forage base.

Steelhead smolts. Puget Sound steelhead yearlings migrate quickly, within weeks, through PS into the Straits and open Ocean. After entry into the estuary, they quickly move into off-shore waters (Goetz et al., 2015). However, steelhead smolts have been found in low abundances in the marine nearshore, outside of their natal estuary, between May and August (Brennan, 2004)

(Fresh, 2006). Thus, steelhead smolt exposure is mostly limited to construction effects and effects from boat use in deeper water.

Adult Salmon and Steelhead. Adult PS Chinook salmon can reside in PS year-round. Puget Sound Chinook usually inhabit water much deeper than where the proposed structures will be located.

Hood Canal summer-run chum salmon return to Hood Canal in early August through September. Chum can swim close to the shore, especially as they get close to natal streams. They mill in front of their stream of origin for 10 to 12 days before entering the river (WDFW and Tribes, 2000).

Two life history types of steelhead occur in PS - winter-run and summer-run. Adult winter-run steelhead typically return to their natal river November through May; summer-run steelhead return between April and October. Their presence in PS will overlap with the construction windows and adult salmonids are likely to experience noise from pile driving the 12-ich diameter pilings as noise can travel as far from the site of impact as 200 feet.

Like PS Chinook adults, steelhead occupy deep water, generally deeper than the location where the structures are proposed. Thus, we expect the habitat effects from the structures to be of little importance to PS Chinook and steelhead adults as they do not frequent the nearshore. Similarly, chum only utilize the nearshore for a short duration and are sufficiently mobile to avoid or swim around the proposed structures so the influence of these structures in their aquatic habitat is not likely have notable exposure or response.

Puget Sound Rockfish Larvae. Rockfish fertilize their eggs internally and extrude the young as larvae (Love et al. 2002). Inflation of the swim bladder has been shown to generally occur within 48 hours after release (McConnell Chaille, 2006). Larval rockfish appear in the greatest numbers during the spring months (Moser and Boehlert 1991; Palsson et al. 2009). However, PS rockfish have been reported to extrude larvae as late as September (Bec2an 1998). Yelloweye rockfish in PS have been reported to release larvae from April to September with highest abundances in June and July (Palsson et al. 2009). Rockfish larvae are typically found in the pelagic zone, often occupying the upper layers of open waters, under floating algae, detached seagrass, and kelp. Rockfish larvae are thought to be mostly distributed passively by currents (Love et al. 2002). As reported, rockfish larvae presence will overlap with the work window (July through September) so their exposure to construction effects is likely.

Puget Sound Rockfish Juveniles. Juvenile bocaccio rockfish are known to settle onto rocky or cobble substrates in the shallow nearshore at 3 to 6 months of age in areas that support kelp and other aquatic vegetation, and then move to progressively deeper waters as they grow (Love et al. 1991; Love et al. 2002; Palsson et al. 2009). Juvenile bocaccio rockfish also recruit to sandy zones with eelgrass or drift algae (Love et al. 2002). In contrast to juvenile bocaccio rockfish, juvenile yelloweye rockfish are not known to typically occupy intertidal or shallow water habitats (Love et al. 1991). Juvenile yelloweye rockfish between 2.5 centimeters and 10 centimeters (approximately 1 and 10 inches, respectively) have been observed in areas of high relief at depths greater than 15 meters (49.5 feet) (Love et al. 2002). Accordingly, exposure to construction effects other than sound are expected among juvenile bocaccio but not among juvenile yelloweye.

Puget Sound Rockfish Adults. Adult yelloweye rockfish and bocaccio occur year-round in PS, typically occupy waters deeper than 120 feet (about 36 meters) (Love, 2002), and prefer rocky habitats like Dalco Pass near Tacoma. Deepwater habitats favored by adult rockfish also include extreme slopes of unconsolidated substrates, or sand, shell, and cobble fields often located in the periphery of rocky outcroppings (Palsson, 2009). A few of these deep unconsolidated habitats occur off islands and points in South Sound, like Ketron Island, north of the Nisqually River Delta. However, this preferred habitat is significantly scarcer in South PS than in central and North PS. Yelloweye rockfish have been found to be most common in Hood Canal, less frequent in North and Central PS, and least common in South PS (Palsson et al. 2009). Because of their depth preference, it is extremely unlikely that adult rockfish would be exposed to any of the effects of the proposed action.

***Southern Resident Killer Whales*.** SRKW are highly mobile with an average daily travel distance of 75 miles (CWA). While there may be areas within Puget Sound and the Strait of Juan de Fuca that the whales prefer, they are capable of occupying and traveling through any area during any part of the year. Because their primary prey base is salmon their movement patterns often overlap with the occurrence and movement patterns of salmon, especially Chinoook. The SRKW do not enter or occupy Hood Canal beyond the floating bridge that spans the canal. Because of their relatively large size, they do not typically enter waters less than 30 feet deep for fear of entrainment and stranding on the beach.

Humpback Whales. Since 2000, humpback whales have been sighted with increasing frequency in the inside waters of Washington (Falcone et. al. 2005). In 2014 and 2015 sightings sharply increased to around 500 each year (Orca Network). These sightings were distributed throughout Puget Sound, Hood Canal, and the Strait of Juan de Fuca. Most of these sightings were documented by nonscientists or agency personnel and typically coincided with increased numbers of people recreating on or near the water. If humpback whales occur within the action area, they are likely to be from either the Mexico DPS or the Central America DPS.

2.4.2.2 Species Response to Temporary Effects

1) Sound

All of the listed species will be exposed to sound during the 5 years of construction. The responses of species to sound varies based on species-specific attributes such as their hearing acuity, their size, and their body composition. Based on the best scientific information available, we used the following assumptions for estimating the effects of the pile driving component of the proposed action on juvenile and adult PS chinook, steelhead, HCSRC, bocaccio and yelloweye rockfish, SRKW, and Humpbacks:

- PS Chinook salmon juveniles in the vicinity of pile driving activity during the work window will weigh more than 2 grams. This is based on fork length data of juvenile salmonids passing through the PS nearshore (Rice, 2011). After July 2 juvenile Chinook can be expected to be longer than 80 mm fork length (FL). Weight of 80 mm FL Chinook ranges above 4 grams (McFarlane and North, 2002).

- Densities of PS Chinook juveniles in the PS nearshore average 25 fish per hectare in July and 14 fish per hectare in August (Rice 2011).
- The density of steelhead smolts in the vicinity of pile driving is extremely low and all steelhead smolts in PS are larger than 2 grams.
- Larval and juvenile listed bocaccio may be present in the nearshore during impact pile driving
- In-water work windows in PS range between July 2nd and March 2nd, depending on tidal reference area.
- Adults of listed salmonids may be present during piling installation.
- All life stages of SRKW may be present during pile installation.
- Only adult humpback whales are likely be present during pile installation.
- If an impact hammer (e.g., drop, hydraulic, diesel, or sledge hammer) is used to drive or proof steel pilings, the following sound attenuation methods will be employed:
    - Use of a bubble curtain or other noise attenuating devices that distributes air bubbles around 100 percent of the perimeter of the piles over the full depth of the water column and will result in a minimum reduction of 8 dB of pressure.

Sound during impact and vibratory pile driving is likely to have a range of direct effects on fish and whales. Behavioral effects are observed at far lower noise levels than those associated with injury for all species, with whales reacting differently to different frequencies. For fish a conservative estimate of 150 dB RMS is used to estimate the area where potential behavior changes could occur, depending on the life stage exposed. Using the practical spreading loss model for underwater sound we calculated the range at which sound pressure generated by the pile driving would attenuate to levels below the 150 dB RMS level.

RMS sound pressure levels (SPLs) are commonly used in behavioral studies. For analytical purposes, the FHWG (2008) presumes that SPLs in excess of 150 dB RMS (re: 1μPa) may elicit temporary behavioral changes, including a startle response or other behaviors, which may alter their behavior in such a way as to delay migration, increase risk of predation, reduce foraging success, or reduce spawning success, indicative of stress and recommends this value as a threshold for possible behavioral effects. While SPLs of this magnitude are unlikely to lead to permanent injury, depending on a variety of factors (e.g., duration of exposure) they can still indirectly result in potentially lethal effects. NMFS' overall synthesis of the best available science leads us to our findings. Studies in which these effects have been studied for salmonids and rockfish include, Grette 1985 (on Chinook salmon and sockeye), Feist et al. 1996 (on chum), Ruggerone et al. 2008 (on Coho), Popper 2003 (on behavioral responses of fishes), Pearson et al.1992 (on rockfish), and Skalski et al. 1992 (on rockfish).

Numerous studies have attempted to discern behavioral effects on different types of fish species from elevated sound levels that are below harm levels but above ambient levels. Relatively few papers have linked exposure at these lower sound levels to effects on fish (Popper et al. 2014). Under some conditions, with some species, elevated sound may cause an effect but it is not possible to extrapolate to other conditions and other species (Popper and Hastings 2009).

Vessel Noise

The increase in noise related to construction vessel traffic may also affect Chinook salmon, HCSR chum, steelhead, rockfish, Humpback Whales and SRKW. Increased background noise has been shown to increase stress in humans (Hattis and Richardson 1980) and other mammals (Owen *et al*. 2004), and several studies support that the same is true for fish (Mueller 1980; Scholik and Yan 2002; Picciulin *et al*. 2010). Recreational boat noise diminished the ability of resident red-mouthed goby (*Gobius cruentatus*) to maintain its territory (Sebastianutto *et al*. 2011). Depending on speed and proximity to nests, boats caused spawning long-eared sunfish to abandon their nests for varying periods in order to find shelter (Mueller 1980). Xie *et al*. (2008) report that adult migrating salmon avoid vessels by swimming away. Graham and Cooke (2008) studied the effects of three boat noise disturbances (canoe paddling, trolling motor, and combustion engine (9.9 horsepower) on the cardiac physiology of largemouth bass (*Micropterus salmoides*). Exposure to each of the treatments resulted in an increase in cardiac output in all fish, associated with a dramatic increase in heart rate and a slight decrease in stroke volume, with the most extreme response being to that of the combustion engine treatment (Graham and Cooke 2008). Recovery times were the least with canoe paddling (15 minutes) and the longest with the power engine (40 minutes). Graham and Cooke (2008) postulate that the fishes' reactions demonstrate that the fish experienced sublethal physiological disturbances in response to the noise propagated from recreational boating activities.

Even though NMFS did not find studies exploring the physiological effects of increased noise from vessel traffic specifically on salmon, it is reasonable to assume that juvenile and adult salmon, in addition to avoiding boats (Xie *et al*. 2008), experience sublethal physiological stress when exposed to continuous large vessel's noise. SRKW are known to experience adverse effects related to boat noise. Erbe (2002) identified that SRKW will stop feeding and avoid whale watching and other large vessels out to a distance of 450 meters from the boat. Because both species of marine mammals experience TTS and PTS from exposure to increased sound energy it is likely that humpback whales will also avoid large vessels like construction barges and potentially change their behavior. Effects from vessel noise will last minutes to hours each day construction activities occur within the action area and will cease once the vessels and construction materials have left each of the construction sites. However, we do not expect the response of any species to the exposure of the construction vessels to be detectible above the background levels already experienced within these highly active commercial ports and naval bases. Compared to the daily vessel traffic and operations of naval vessels and support craft the noise generated by the construction barges will be relatively low sound levels, short duration and be small in area.

Pile Driving - Fish

Davidson et al. (2009) indicated that studies have shown that salmonids do not have a wide hearing bandwidth or hearing sensitivity to sound pressure levels and are therefore not as likely to experience auditory changes from increased ambient sound. However, each form of pile driving will produce sound characteristics that species do respond to. Fish experience impact driving more acutely, while marine mammals experience vibratory driving more acutely via physical harm and damage.

Fishes with swimbladders (including salmonids, rockfish and forage fish) are sensitive to underwater impulsive sounds (*i.e.*, sounds with a sharp sound pressure peak occurring in a short interval of time) such as those produced by impact pile driving. As a pressure wave passes through a fish, the swimbladder is rapidly compressed due to the high pressure, and then rapidly expanded as the “under pressure” component of the wave passes through the fish. The injuries caused by such pressure waves are known as barotraumas. They include the hemorrhage and rupture of internal organs, damage to the auditory system, and death for individuals that are sufficiently close to the source (Abbott *et al.* 2002; Caltrans 2009). Death can occur instantaneously, within minutes after exposure, or several days later.

A multi-agency work group identified criteria to define sound pressure levels where effects to fish are likely to occur from pile driving activities (Hydroacoustic Working Group, 2008). These thresholds represent the initial onset of injury, and not the levels at which fish will be severely injured or killed. The most harmful level of effects is where a single strike generates peak noise levels greater than 206 dBpeak where direct injury or death of fish can occur. Besides peak levels, sound exposure levels (SEL) (the amount of energy dose the fish receive) can also injure fish. These criteria are either 187 dBSEL for fish larger than 2 grams or 183 dBSEL for fish smaller than 2 grams for cumulative strikes (Hydroacoustic Working Group, 2008). In addition, any salmonid within a certain distance of the source will be exposed to levels that change the fish’s behavior or cause physical injury (*i.e.* harm). The result of exposure could be a temporary threshold shift (TTS) in hearing due to fatigue of the auditory system, which can increase the risk of predation and reduce foraging or spawning success (Stadler and Woodbury, 2009). When these effects take place, they are likely to reduce the survival, growth, and reproduction of the affected fish.

The available information for impact driving steel pipe piles (Table 8) supports the understanding that sound level increases non-linearly with pile size. However, when graphed, there is near-linear rise in sound level for piles up to 20-inches, after which the curve flattens. The Navy’s action includes piles ranging in sizes from 16 to 36 inches. This wide range of pile sizes indicates that the entire spectrum of wave lengths and pressure values will occur during the action at various locations and times covered under this consultation.

The preceding section describes the physical effects of increased sound pressure on listed salmonid species. Rockfish also have gas bladders and are expected to experience similar physical harm as salmonids and forage fish species with gas bladders and similar auditory tissues. Rockfish are present all year. While rockfish species are sensitive to sudden noises, data on the potential impacts to sound below the threshold for injury are limited. Pearson et al. (1992) found that rockfish exposed to air gun sounds showed startle and alarm responses. The threshold for behavioral responses was observed between 161 and 205 dB. Skalski et al. (1992) found that catch per unit effort in hook-and-line fisheries declined by an average of 52 percent when geophysical survey air guns were shot near aggregations of rockfish. No eelgrass and very little marine macrovegetation is present within the waterway to provide habitat for juvenile rockfish and very little natural structure is present for adults so we anticipate few individuals at either lifestage would be exposed, and if present, have no data to indicate that the migration of juvenile rockfish to deeper water areas of habitat as they mature will be affected by sound associated with the proposed action.

Pile Driving – Marine Mammals

As mentioned in the proposed action (Section 1.3) NOAA PRD proposes to issue an LOA for MMPA Level B Take of both species of listed marine mammals. In ESA consultations, NMFS applies its interim guidance on the ESA term “harass.” Under that interim guidance, NMFS interprets harass under the ESA as: “Create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering…”

Sound thresholds applicable to marine mammals

Pile driving can have an array of effects on marine mammals, with physical tissue damage and auditory threshold shifts being the most common and significant effects. Physical tissue damage is most likely to be caused by pressure generated by impact driving, while auditory threshold shifts are most likely to be caused by pressure generated by vibratory pile driving. The area of affect is greater for auditory threshold shifts than physical tissue damage because of the properties and characteristics of the waves generated by the two methods. Humpback whales are members of Low Frequency (LF) group, while the SRKW are members of the Medium Frequency (MF) group.

Exposure to sound with sufficient duration and sound pressure level (SPL) may result in an elevated hearing threshold (i.e., a loss of hearing sensitivity), called a noise-induced threshold shift (NITS). If the hearing threshold eventually returns to normal, the NITS is called a temporary threshold shift (TTS); otherwise, if thresholds remain elevated after some extended period of time, the remaining NITS is called a permanent threshold shift (PTS). TTS and PTS data have been used to guide the development of safe exposure guidelines for people working in noisy environments. Similarly, TTS and PTS criteria and thresholds form the cornerstone of Navy analyses to predict auditory effects in marine mammals incidentally exposed to intense underwater sound during naval activities through the US Navy’s Tactical Training Theater Assessment and Planning (TAP).

Marine mammals are not equally sensitive to noise at all frequencies. To capture the frequency-dependent nature of the effects of noise, auditory weighting functions are used. Auditory weighting functions are mathematical functions used to emphasize frequencies where animals are more susceptible to noise exposure and de-emphasize frequencies where animals are less susceptible. The functions may be thought of as frequency-dependent filters that are applied to a noise exposure before a single, weighted SPL or sound exposure level (SEL) is calculated. The filter shapes are normally “band-pass” in nature; i.e., the function amplitude resembles an inverted “U” when plotted versus frequency. The weighting function amplitude is approximately flat within a limited range of frequencies, called the “pass-band,” and declines at frequencies below and above the pass-band.

Auditory weighting functions for humans were based on *equal loudness contours* — curves that show the combinations of SPL and frequency that result in a sensation of equal loudness in a human listener. Equal loudness contours are in turn created from data collected during loudness comparison tasks. Analogous tasks are difficult to perform with non-verbal animals; as a result, equal loudness contours are available for only a single marine mammal (a dolphin) across a limited range of frequencies (2.5 to 113 kHz) (Finneran and Schlundt, 2011). In lieu of performing loudness comparison tests, reaction times to tones can be measured, under the assumption that reaction time is correlated with subjective loudness (Stebbins, 1966; Pfingst et al., 1975). From the reaction time vs. SPL data, curves of equal response latency can be created and used as proxies for equal loudness contours.

Just as human damage risk criteria use auditory weighting functions to capture the frequency-dependent aspects of noise, US Navy acoustic impact analyses use weighting functions to capture the frequency-dependency of TTS and PTS in marine mammals.

Navy weighting functions for TAP Phase 2 (Finneran and Jenkins, 2012) were based on the "M-weighting" curves defined by Southall et al. (2007), with additional high-frequency emphasis for cetaceans based on equal loudness contours for a bottlenose dolphin (Finneran and Schlundt, 2011). Phase 2 TTS/PTS thresholds also relied heavily on the recommendations of Southall et al. (2007), with modifications based on preliminary data for the effects of exposure frequency on dolphin TTS (Finneran, 2010; Finneran and Schlundt, 2010) and limited TTS data for harbor porpoises (Lucke et al., 2009; Kastelein et al., 2011).

Since the derivation of TAP Phase 2 acoustic criteria and thresholds, new data have been obtained regarding marine mammal hearing (e.g., Dow Piniak et al., 2012; Martin et al., 2012; Ghoul and Reichmuth, 2014; Sills et al., 2014; Sills et al., 2015), marine mammal equal latency contours (e.g., Reichmuth, 2013; Wensveen et al., 2014; Mulsow et al., 2015), and the effects of noise on marine mammal hearing (e.g., Kastelein et al., 2012b; Kastelein et al., 2012a; Finneran and Schlundt, 2013; Kastelein et al., 2013a; Kastelein et al., 2013b; Popov et al., 2013; Kastelein et al., 2014b; Kastelein et al., 2014a; Popov et al., 2014; Finneran et al., 2015; Kastelein et al., 2015c; Kastelein et al., 2015b; Popov et al., 2015). As a result, new weighting functions and TTS/PTS thresholds have been developed for Phase 3. The new criteria and thresholds are based on all relevant data and feature a consistent approach for species of interest.

Marine mammals were divided into six groups with the same weighting function and TTS/PTS thresholds used for all species within a group. Species were grouped by considering their known or suspected audible frequency range, auditory sensitivity, ear anatomy, and acoustic ecology (i.e., how they use sound), as has been done previously (e.g., Ketten, 2000; Southall et al., 2007; Finneran and Jenkins, 2012).

The Low-Frequency (LF) cetacean group contains all of the mysticetes (baleen whales). Although there have been no direct measurements of hearing sensitivity in any mysticete, an audible frequency range of approximately 10 Hz to 30 kHz has been estimated from observed vocalization frequencies, observed reactions to playback of sounds, and anatomical analyses of the auditory system. A natural division may exist within the mysticetes, with some species (e.g., blue, fin) having better low-frequency sensitivity and others (e.g., humpback, minke) having better sensitivity to higher frequencies; however, at present there is insufficient knowledge to justify separating species into multiple groups. Therefore, a single species group is used for all mysticetes. The Mid-Frequency (MF) cetacean group contains most delphinid species (e.g., bottlenose dolphin, common dolphin, killer whale, pilot whale), beaked whales, and sperm whales (but not pygmy and dwarf sperm whales of the genus Kogia, which are treated as high-frequency species). Hearing sensitivity has been directly measured for a number of species within this group using psychophysical (behavioral) or auditory evoked potential (AEP) measurements.

NMFS (2016) has recently developed acoustic threshold levels for determining the onset of PTS (permanent hearing threshold shift) in marine mammals in response to underwater impulsive (impact driving) and non-impulsive (vibratory pile driving) sound sources. The criteria use cumulative SEL metrics (dB SELCUM) and peak pressure (dB PEAK) rather than the previously used dB RMS metric. NMFS equates the onset of PTS, which is a form of auditory injury, with Level A harassment under the MMPA and "harm" under the ESA. The onset of TTS (temporary hearing threshold shift) is a form of harassment under the MMPA and "harassment" under the ESA.

NMFS has identified different thresholds for behavioral disturbance ("harassment" under the ESA) for vibratory pile driving versus impact pile driving. For cetaceans the behavioral harassment threshold for impact pile driving is 160 dB RMS and the threshold for vibratory pile driving (non-impulsive noise) is 120 dB RMS. All forms of harassment, either auditory or behavioral, constitute "incidental take" under these statutes.

Pile driving will produce noise above the underwater behavioral harassment threshold during impact and vibratory pile driving. Since installation of steel piles will utilize a vibratory pile driver to the extent practicable in order to reduce adverse effects to listed fish species we evaluate the potential for exposure to that area. The affected area due to the vibratory pile driver will be much larger than the area affected by impact pile installation (due to the low behavioral harassment threshold for continuous sound (120 dB RMS versus 160 dB RMS for impulsive sound). Impact pile driving noise is not expected to result in behavioral harassment or physical damage of marine mammals because affected areas are so small (Table 10) that they can be fully monitored and any cetacean approaching the affected area would be detected by the Navy's proposal to conduct marine mammal monitoring. Because the area is so small (2,154 meters in the most extreme case) any monitoring of the area is likely to be able to detect marine mammals.

Using the practical spreading model described in Section 2.4.1.1 and the data in Table 8 we calculated out the distance at which the sound levels are expected to attenuate below the thresholds listed above. The distances where physical harm is likely to occur represents that area where immediate physical (tissue) damage resulting in PTS is likely to occur for each species. As noted earlier, the threshold for inducing a behavior change (cessation of breeding, foraging, communicating) is much lower and therefor the area of potential affects is much greater. Any animal that enters the area encompassed by harassment is likely to significantly alter or cease their normal behavior until they have left the area. If any animal becomes confused while in that area there is a chance they may take longer to leave the area or not be able to leave at all if the physical constraints of the shoreline prohibit easy movement (Bremerton, Keyport, Zelatched Point, and Bangor).

Impact pile driving of 30-in and 36-in steel piles will produce the greatest noise levels, exceeding underwater PTS thresholds up to 736 m for humpback whales when a bubble curtain is used. Distances for killer whales are much smaller with the largest distance to the PTS threshold only

10 m when a bubble curtain is used. Projects at four MPR locations may include these pile sizes: NAVBASE Kitsap Bangor, NAVBASE Kitsap Keyport, Zelatched Point, and NAVSTA Everett. However, we do not expect physical injury due to pile driving noise because, under the proposed action, if cetaceans are seen approaching or entering the injury zone or visually monitorable portions of the disturbance zone during impact or vibratory pile driving, work will be halted and delayed until either the animal has voluntarily left and been visually confirmed beyond the injury zone or visual portion of the disturbance zone or 15 minutes have passed without re-detection of the animal. Furthermore, the majority of pile driving will be conducted with a vibratory driver, and potential injury zones will be fully monitored during all pile driving, which has wave characteristics that do not damage tissue by deliver acoustic threshold shifts instead. Further, the area of potential physical tissue damage is extremely small and so we reasonably expect the Navy's proposal to monitor for marine mammals in this small area to be successful.

The greatest risk of exposing cetaceans to significant disruptions during pile driving will be during vibratory installation of steel piles due to the much larger area of potential impacts generated by the specific wave characteristics of non-impulsive generation. Vibratory pile drivers will be used for installation or extraction at every location in the Proposed Action; the greatest affected areas would result from vibratory installation of steel pile, which may extend as much as 13.6 km from the driven pile. Behavioral disturbance due to vibratory installation of steel piles may occur at five locations: NAVBASE Kitsap Bangor, NAVBASE Kitsap Bremerton, NAVBASE Kitsap Keyport, Zelatched Point, and NAVSTA Everett. At NAVBASE Kitsap Bremerton, 14-in steel piles installed with a vibratory driver may affect an area up to 2.2 km from the driven pile, and vibratory extraction of timber piles at any of the MPR locations may affect an area up to 1.6 km from the extracted pile.

Acoustic analyses of vibratory driving steel pipe piles show that most of the acoustic energy resides at relatively low frequencies. Monitoring indicated that the signature consisted of harmonics of a 15 Hz fundamental frequency, with most of the energy for vibratory driving 36-inch steel pipes in Alaska was between 400 and 2,500 Hz, with the peak at about 1,000 Hz and sound energy steadily falling with increased frequency above that, such that the received level is reduced by about 8 decibels (dB) at 3,000 hertz (Hz). The Compendium, reported that the peak sound energy for vibratory driving of 72-inch pipe piles is at about 600 Hz, and that sound energy drops steadily with increasing frequency above that, such that there was a 30 dB reduction in sound energy at about 3,100 Hz. Burgess (*et.al.* 2005) reported that the signature consisted of a fundamental frequency of 12 to 18 Hz (related to the frequency of the driver) with several harmonics. Over 89 percent of the acoustic energy occurred at the fundamental frequency, with the harmonics being at least 30 dB quieter. They also reported that noise intensity increased with proximity to the substrate.

The available information to describe vibratory extraction of piles suggests that the noise levels are similar to, and sometimes slightly lower than those of vibratory driving the same sized pile. NMFS applied the same extrapolation procedure described above for estimating the 10-meter RL for steel piles.

To assess potential exposure of humpback whales and Southern Resident killer whales to above-threshold noise levels during the in-water work window, the likelihood of occurrence was reviewed. The humpback review was based on the information in WCR guidance document "West Coast Region's Endangered Species Act implementation and considerations about "take" given the September 2016 humpback whale DPS status review and species-wide revision of listings" (December 7, 2016). We utilized the information regarding the proportion of Humpback whales by DPS for the various feeding areas within the action area of the referenced guidance document. Because there is only a 5.2% probability that whales encountered in Washington are from the Central America stock, we assume that the exposed whales could be from the Mexico stock. However, it is equally likely that they could be from the non-listed Hawaii stock.

The exposure estimates for SRKW were based on the family groups of the species due to their extreme social behavior (pod dynamics) and constant presence and movement through the action area. Because these groups are constantly traveling it was not possible to determine where each pod may be within the action area at each specific point in time during the programmatic's proposed work windows. Thus we anticipate the maximum exposure level, giving deference to the species, of 40 individuals (L pod).

Table 10. Distances to marine mammal physical harm and behavior harassment thresholds for vibratory pile driving for all pile types and sizes addressed.

Pile Size and Type	Injury (PTS Onset) Cetaceans[1]		Behavioral Harassment Impact Driving (160 dB RMS)[2]		Behavioral Harassment Vibratory Installation (120 dB RMS)[2]	
	LF HW	MF SRKW	Radial Distance to Threshold	Area Encompassed by Threshold	Radial Distance to Threshold	Area Encompassed by Threshold
Impact Installation						
13-in HDPE	**3**	**3**	5 m	79 sq m	N/A	N/A
12- to 14-in timber	**3**	**3**	46 m	6,648 sq m	N/A	N/A
18-in concrete	**3**	**3**	46 m	6,648 sq m	N/A	N/A
24-in concrete	216 m	3 m	158 m	0.08 sq km	N/A	N/A
14-in steel	159 m	6 m	398 m	0.5 sq km	N/A	N/A
24-in steel	159 m	6 m	1,585 (No BC) 464 (BC)	0.54 sq km (Bangor) 2.09 sq km (Keyport) 0.48 sq km (Zelatched Point)		
30-in steel	736 m	10 m	2,154 m (no BC) 631 m (BC)	0.91 sq km (Bangor) 0.93 sq km (Keyport) 0.85 sq km (Zelatched Point) 1.2 sq km (Everett)	N/A	N/A
36-in steel	736 m	10 m	1,359 m (Keyport- no BC) 541 m (Bangor- BC) 398 m (other locations-BC)	0.7 sq km (Bangor) 0.42 sq km (Keyport) 0.36 sq km (Zelatched Point) 0.5 sq km (Everett)	N/A	N/A
Vibratory Installation						
12-in timber	1 m	<1 m	N/A	N/A	1.6 km	3.8 (Manchester Finger Pier) 4.6 (Manchester Fuel Pier)
13 and 14-in timber	2 m	<1 m	N/A	N/A	2.2 km	6.8 sq km (Bremerton)

Pile Size and Type	Injury (PTS Onset) Cetaceans[1]		Behavioral Harassment Impact Driving (160 dB RMS) [2]		Behavioral Harassment Vibratory Installation (120 dB RMS) [2]	
	LF HW	**MF SRKW**	**Radial Distance to Threshold**	**Area Encompassed by Threshold**	**Radial Distance to Threshold**	**Area Encompassed by Threshold**
14-in steel	**4**	**4**	N/A	N/A	2.2 km	6.8 sq km (Bremerton)
16 and 24-inch steel	12 m	1 m	N/A	N/A	5.4 km	6.8 sq km (Bremerton)
30- and 36-in steel (locations other than Bangor)	30 m	3 m	N/A	N/A	13.6 km	4.9 sq km (Keyport) 75.24 sq km (Zelatched Point) 117.8 sq km (Everett)
30- and 36-in steel (Bangor)	25 m	2 m	N/A	N/A	11.7 km	40.9 sq km (Bangor)
Sheet steel	16 m	1 m	N/A	N/A	7.4 km	15.0 sq km (Bremerton)

Key: N/A = not applicable; LF = low frequency; HF = high frequency; HW = humpback whale; SRKW = Southern Resident killer whale; km = kilometer; m = meter; PTS = permanent threshold shift; PW = phocid (harbor seal); sq = square

Exposure
We estimate that there will be 4 instances of humpback whales and 40 instances of SRKW encountering the sound/pressure effects of the proposal. These numbers are generated using the following formula:

> *SRKW exposure estimate = Probable abundance during activity x Probable duration*
> The largest group of SRKW with the greatest likelihood of presence is L pod with 40 individuals.
>
> *Humpback exposure estimate = Probable abundance during activity x Probable duration*
> Humpback whales have been observed in the waters of Puget Sound in every month of the year, singly or in pairs. Because known feeding areas are not present at any of the installations included in this application, any exposure to elevated project noise levels is expected to be of short duration as the animal(s) moves through an area. The greatest probable duration is 2 consecutive days of un-interruption.

These instances of exposure may be dispersed among all individuals of the populations up to 40 SRKW individuals or 4 humpback individuals or may be concentrated with one individual SRKW experiencing all 40 events or one individual humpback experiencing all 4 events.

Response
Exposure to sound above the 160 and 120 dB RMS thresholds can result in significant changes in the typical behavior of SRKW or humpback whales (e.g., increased swimming speed, decreased feeding, and communication disruption) or cause them to avoid the affected area. However, any behavior impacts on SRKW and humpbacks from the proposed action are only expected to occur during the time period when pile driving is actually occurring and thus the impacts are only expected to be short in duration, lasting for minutes to hours, and are expected to cease immediately upon termination of pile driving activities. Furthermore, the temporary exposure to increased sound pressure will be limited and mitigated by the BMPs listed above. In particular under the proposed action, if cetaceans are seen approaching or entering the injury zone or visually monitorable portions of the disturbance zone during impact or vibratory pile driving, work will be halted and delayed until either the animal has voluntarily left and been visually confirmed beyond the injury zone or visual portion of the disturbance zone or 15 minutes have passed without re-detection of the animal. The area of potential physical tissue damage is extremely small and so we reasonably expect the Navy's proposal to monitor for marine mammals in this small area to be successful.

2) Bottom (Substrate) Disturbance
Resuspension of sediments will be occur within a small area around each pile driven or removed, temporarily reducing water quality and disrupting benthic communities.

Water Quality Reduction
The effects of suspended sediment on fish increase in severity with sediment concentration and exposure time and can progressively include behavioral avoidance and/or disorientation, physiological stress (e.g., coughing), gill abrasion, and death—at extremely high concentrations. However, studies show that salmonids have an ability to detect and distinguish turbidity and other water quality gradients (Quinn, 2005; Simenstad, 1988), and that larger juvenile salmonids

are more tolerant to suspended sediment than smaller juveniles (Servizi and Martens, 1991; Newcombe and Jensen, 1996).

While an exposure duration of up to two hours and an increase in TSS over background of up to 240 mg/L, could produce among juvenile salmon, the maximum increase in TSS reported in Weston Solutions (2006) is 83 mg/L. Even if the pile driving that is part of this proposed project would result in double the TSS as reported for vibratory pile driving in Weston Solutions (2006), the likely level of TSS is well below levels and durations that could result in injurious physiological stress. Further, any elevations in turbidity and TSS generated by the pile driving will be localized, short-term and similar to the variations that occur normally within the environmental baseline of the marine nearshore—which is regularly subject to strong winds and currents that generate suspended sediments. Thus, the juvenile salmonids and rockfish likely will have encountered similar turbidity before, and have adaptive avoidance behavior.

In summary, the, generally low level expected increase in TSS, the small affected area of water quality at each location, the brevity of the duration, and the mobility of the listed fish indicates that exposure to diminished water quality is likely to be avoided, and if not fully avoided, exposure will not be of enough duration or intensity to create harmful response among salmonids or rockfishes. SRKW are unlikely to be within close enough proximity to the area with increased TSS due to their inclination to avoid shallow water and physical obstructions, thus there is no likely effect on SRKW CH from water quality reductions.

Forage Reduction

When juvenile salmonids are entering the nearshore or marine environment, they must have abundant prey to allow their growth, development, maturation, and overall fitness. As pile driving (and removal) dislodges bottom sediments, benthic communities are also disrupted, both in the location where the installation (or removal) occurs, and in the locations where sediment falls out of suspension and layers on top of adjacent benthic areas. As was noted above, benthic communities can take up to three years to fully re-establish their former abundance and diversity. Given that the work will occur across five work windows, we can expect up to 8 years in which benthic prey is less available to juveniles, incrementally diminishing the growth and fitness of eight separate cohorts of individual outmigrant salmonids that pass through the action area. Rockfish may be equally effected by the reduction in prey as lower trophic organisms from the benthos directly and indirectly feed into their prey base. Reduce prey availability for salmonids can impair growth, fitness, or even survival among some of the individuals exposed to this condition, in each cohort of chinook, steelhead, or rockfish, for up to 8 years.

As previously mentioned in the effects to the forage PBF section, any reduction in salmonids will result in a reduction in SRKW forage base. The proposed action is not anticipated to affect prey quality; however, the project may affect the quantity of prey available to Southern Residents. However, the salmon the number of Chinook salmon that will be harmed and die as a result of direct and indirect exposure to effects are expected to be relatively low compared to the dietary requirements of even a single SRKW, as discussed further in the affects to species section.

Therefore, NMFS anticipates that the reduction in Chinook salmon would result in an insignificant reduction in prey resources for SR killer whales that may intercept these species within their range.

3) Vessel Shading

As discussed in Section 2.4.1.1, work barges and vessels will be used to carry out the activities covered under the programmatic and the Zelatched Point pier will continue to service float planes and small vessels. It is estimated that no more than 84.9 cumulative acres will be shaded over the course of 5 years. This equipment will occupy space in the water column and temporarily create overwater cover that impede fish passage and simultaneously increase in cover for predators of juvenile salmon, steelhead, and rockfish. While these vessels are present there is an incremental increase in risk to juvenile salmonids based on their likelihood to lose visual acuity, shift migration movements, and succumb to predators. The duration of these effects will be limited to a maximum of one in-water work period which is timed to occur when fewer juvenile salmon and steelhead would be present in the action area.

2.4.2.3 Species Response to Permanent Effects

As discussed in Section 2.4.1.2, the replacement of 20 piles at Zelatched Point meaningfully extends the useful life of the pier and with it the duration of effects stemming from that structure within the aquatic habitat. These adverse effects on habitat conditions in turn affect species. Species responses include altered migration behavior, increased susceptibility to predation, reaction to shading, and reaction to vessel noise.

1) Structure and Migration Behavior

Based on the findings of numerous studies, we are reasonably certain that the Zelatched Point pier will adversely affect juvenile salmonid migration for the extended life of the structure.

Juvenile salmon in the marine nearshore as well as in freshwater have been reported to migrate along the edges of shadows rather than through them (Nightingale and Simenstad, 2001; Southard et al., 2006; Celedonia et al., 2008a; Celedonia et al., 2008b; Ono, 2010; Moore et al., 2013; Munsch et al., 2014). In freshwater, about three-quarters of migrating Columbia River fall Chinook salmon smolts avoided a covered channel and selected an uncovered channel when presented with a choice in an experimental flume setup (Kemp et al., 2005). In Lake Washington, actively migrating juvenile Chinook salmon appeared to change course when they approached a structure, swimming around structures through deeper water rather than remaining in shallow water and swimming underneath a structure (Celedonia et al., 2008b). Finally, juvenile Chinook salmon appeared to move into deeper water to travel beneath or around structures (Celedonia et al. 2008b).

In the PS nearshore, 35 to 45 millimeter juvenile chum and pink salmon were reluctant to pass under docks (Heiser and Finn 1970). Southard et al. (2006) snorkeled underneath ferry terminals and found that juvenile salmon were not underneath the terminals at high tides when the water was closer to the structure, but only moved underneath the terminals at low tides when there was more light penetrating the edges. Increased energy expenditure during migration can impair growth and fitness at a time when juveniles are maturing for their ocean life history phase. Salo et al. (1980) found that juvenile chum salmon moved offshore around the existing wharves as they migrated north out of Hood Canal. The evidence was circumstantial, but they observed both a change in migratory behavior (moving offshore) and a reduction in catch of juvenile chum (presumably due to an increase in predation of juvenile chum) that appeared to be related to the construction and operation of the piers.

The Zelatched Point pier is likely to function as a barrier to migrating juvenile salmon due to physical characteristics such as the large number of piles, their close spacing, the low height-over-water design, and extension of the pier from the deep shore zone to the riparian zone. The amount of impairment to juvenile salmon can be quantified by the length of the pier (302 ft). Because number of fish encountering the barrier cannot be accurately anticipated we assume that all salmon in the area will encounter this 302 ft barrier will experience the same amount of impairment. We are not aware of altered behavior among any lifestage of rockfish in response to overwater structures.

2) <u>Structure and Increased Predator Habitat</u>
There are only a few areas on the West Coast, other than the Ballard Locks, where studies have documented the influence of pinniped predation on local salmonid populations. In the Puntledge River estuary, British Columbia, Bigg et al. (1990) observed Pacific harbor seals surface feeding on salmonids and documented predation rates of up to 46 percent of the returning adult fall chinook. In Netarts Bay, Brown and Mate (1983) found that the number of seals feeding in the area was similar in each year of their study; however, the impact of the predation was greatest when the chum salmon return was low. In 1979, the seals took more than seven percent of about 550 returning chum salmon, while in 1980, the estimated consumption of nearly twice as many fish represented less than two percent of the return of more than 5,000 salmon. In the Rogue River, Roffe and Mate (1984) estimated that in the late 1960s, sea lions and seals removed less than one percent of the spring chinook and about six percent of the summer steelhead returns to the Rogue River, which was equal to about half of the annual sport catch during that time.

One recent study in Canada quantifies harbor seal predation on smolts. In the lower Puntledge River in British Columbia, harbor seals forage on chum salmon fry and Coho salmon smolts at night by using the lights from bridges to silhouette the fish and aid in their capture. During the peak of predation, consumption was estimated at 140,000 chum salmon fry and 13,000 Coho salmon smolt per night (Olesiuk 1996). As is true in most areas where individual pinnipeds can be identified, most predation (53-57 percent) was attributable to a small number (10) of recognizable seals. Total consumption was estimated at 3.1 million chum salmon fry (7-31 percent of the 1995 production) and 138,000 Coho salmon smolt (15 percent of the 1995 production) between April and June (Olesiuk 1996).

Not all pinnipeds at a haul-out near a salmonid run are actively feeding on salmonids. Herder (1983) found that although there were up to 200 harbor seals in the Klamath River area, only nine seals were responsible for depredation on gillnets each day. At the Ballard Locks, only three percent of the 248 sea lions marked in the nearby Shilshole Bay entered the Ballard Locks area in 1995 to feed on steelhead (NMFS 1996). This indicates that removing pinnipeds from nearby areas may not be an effective solution to the problem of pinniped predation in local areas.

Hood Canal pinnipeds, as all pinnipeds, are opportunistic predators feeding on a variety of prey species, primarily schooling fishes, adult salmonids, and cephalopods (WDFW, 2000). Pacific hake, Pacific herring, salmon, shiner surfperch, and two cephalopod species were the five most commonly occurring species for each year and for all years combined. Pinniped predation on small populations of depressed or listed salmonids, whether in river or in the open ocean, is important in assessing the impacts of predation on recovery of salmonid populations (Adams et al, 2016, Chasco et al, 2017).

Pinnipeds have been well documented in large numbers at multiple haulout sites within Quilcene bay, approximately 5.7 miles north of the Zelatched pier. These large numbers of pinnipeds are most likely attracted to the area due to the large numbers of salmonids utilizing the area (London et al. 2012). Based on migration behaviors noted above, Zelatched pier will continue to “push” salmonids out from the shoreline and into deeper water, while concurrently retaining suitable haulout, and therefore likely presence of, predatory mammals such as seals and sea lions. This extension will mean fish spend more time in deeper water and expend more energy navigating this space, which will leave them with less energy to use to evading predators. NMFS assumes that with the continued push out of fish into deeper water there will be an associated increased number of pinniped predation events, primarily on salmonids, though we assume that pinnipeds may also opportunistically prey upon rockfish as well. To the degree that sound impairs auditory function in these marine mammals, however, there could be a contemporaneous reduction in predation efficacy. During construction this effect will be mitigated by the pinnipeds and predatory fish’s avoidance of the increased sound pressure area.

3) <u>Structure and Shade</u>

Shade directly affects salmonids and may also affect rockfish. The reduced light regime under the OWS and associated vessels likely results in temporarily decreased visual ability and decreased feeding success for those juveniles’ salmonids that do swim under the structures. In freshwater laboratory studies, schools of Pacific salmon disbanded and stopped feeding when light dropped below the rod threshold (Ali, 1959). Juvenile chum and pink salmon take 30 to 40 minutes to fully adapt to dark conditions, and 20 to 25 minutes to adapt to increased light conditions. During the adaptation period to the new light regime the visual acuity is diminished, depending upon the magnitude of the light intensity contrast. The adverse effects of temporarily decreased visual ability suggests a resulting decreased feeding success and decreased predator avoidance are reasonably likely consequences among some portion of all future cohorts of salmonids co-extensive with presence and operation of the Zelatched Point pier. While the short-term decreased feeding success will likely result in a minor sub-lethal response of incrementally reduced growth in individuals, the decreased visual ability can lead to increased mortality among juvenile salmonids due to predation, as mentioned above.

4) <u>Suppressed aquatic Vegetation</u>

SAV (eelgrass) has been documented in the area around Zelatched point (WA Ecology Coast Atlas). A SAV survey conducted in February 2015 identified eelgrass bed from 16th to 33 ft depth at Zelatched Point (Frierson et al., 2016). Abundant non-rooted SAV (Ulva sp.) has also be documented in the area. Patchy presence of kelp species (*A. fimbriatum, Saccharina* spp) has been documented sporadically throughout Dabob Bay.

Both eelgrass and kelp need fairly high light levels to grow and reproduce, so they are found only in shallow waters, mostly less than 65 feet for kelp, and 32 feet meters for eelgrass (Mumford 2007). The deeper waters (-30 to – 50 MLLW) could grow kelp. Shade from overwater and in-water structures are likely to reduce SAV. A reduction to the primary production of SAV beds is likely to incrementally reduce the food sources and cover for individual PS Chinook salmon, HCSR chum, and steelhead. The reduction in food source includes epibenthos (Haas et al., 2002) as well as forage fish. The shade from structures at Zelatched Point in the nearshore will likely continue to prevent any disturbed eelgrass and macroalgae from reestablishing in the shaded area for the increased lifetime of the structure. This retained reduction will constrain the abundance of prey, which will primarily affect juvenile salmonids that migrate through the action area at a time when their growth, development, maturation, fitness, and energy expenditure require plentiful prey. (The effects on salmonids as prey to SRKW will be presented below).

SAV presence will continue to fluctuate within the action area immediately surrounding Zelatched Point pier within the life of the structure. SAV is important in providing cover and a food base for juvenile PS Chinook, HCSR chum and steelhead. OWS shade SAV for the life of the structure (Kelty and Bliven, 2003). If any juvenile and sub-adult bocaccio are within the action area, they would be expected to be found near the kelp habitat near the pier and nearshore which may also be seasonally used by juvenile and sub-adult bocaccio. It is unlikely that juvenile yelloweye rockfish will occur within kelp habitats of the action area because they don't use the nearshore for rearing.

Reduced Prey Communities

In addition to the reduction in prey base caused by increased sound pressure from pile driving, there is likely to be a reduction in prey base resulting from the Zelatched Point pier due to its continued existence. Forage fish such as Pacific herring, Pacific sand lance, and surf smelt are present in Hood Canal and the action area, but spawning locations are few. Common fish species identified as forage fish were recorded near Zelatched Point at NBK Bangor during beach seine surveys conducted in 2005 to 2008 (SAIC 2009). WDFW has identified Pacific Herring, sandlance, and surfsmelt spawning beaches within 2.5 miles from Zelatched Point pier.

Piers in areas with forage fish spawning are likely to result in reduced numbers of forage fish due to the direct occupation of spawning area and the increased noise from associated vessel traffic. Fish response to vessel traffic noise is discussed below. All salmon exposed to these diminished conditions are likely to experience a reduction in their individual growth, fitness, survival, and the populations will experience constraint on their total abundance. In general, early marine juvenile growth is dependent on ample food supply and has been shown to be linked to overall salmonid survival and production (Beamish et al., 2004) (Tomaro et al., 2012). Rapid growth of PS Chinook salmon during the early marine period is critical for improved marine survival (Duffy and Beauchamp, 2011).

Eelgrass beds along the Zelatched Point waterfront provide substrate for invertebrates, such as copepods, amphipods, and snails, which might otherwise not be found on soft sediments (Mumford 2007). Copepods and other zooplankton represent the major food base for the food chain in Puget Sound, specifically for small and juvenile fish including Pacific herring, sand lance, surf smelt, and salmonids. The intertidal shallows and eelgrass beds provide important habitat for a variety of marine invertebrates and fishes, including salmonid species.

Herring, a food source for listed PS Chinook, has a documented spawning location in the action area. Spawning areas for PS herring are largely limited to depth at which SAV will grow with herring using several species of macroalgae as spawning substrate. In shallower areas, *Zosteramarina* is of primary importance, and in slightly deeper areas, *Gracilaria* spp. predominates (Penttila, 2007). An essential element of herring spawning habitat appears to be the presence of perennial marine vegetation beds at rather specific locations (Penttila, 2007). While across the PS region native eelgrass (*Zostera marina)* is of primary importance as spawning substrate, other SAV is used locally. In some parts of PS, algal turf, often formed by dozens of species of red, green and brown algae, is used by spawning herring (Millikan and Penttila, 1974). In deeper water and in areas where native eelgrass beds do not predominate, herring spawn on the mid-bottom-dwelling red alga *Gracilariopsis sp.* (referred to as *Gracilaria* in some sources) (Penttila, 2007). In Wollochet Bay WDFW documented spawning mainly on *Ulva sp*.

This continued reduction in forage fish presence and spawning will be an additional loss of prey, both in terms of prey abundance, and in prey diversity, which will primarily affect juvenile salmonids that migrate through the action area at a time when their growth, development, maturation, fitness, and energy expenditure require abundant prey resources. As generalist predators, rockfish eat a diversity of other animals, from crabs, to worms, to fish and the loss of prey will affect them as well. Operation impacts of the pier on the benthic community will be due primarily to the conversion of soft bottom habitat to hard-bottom habitat, prop scour and increased sound.

5) I&I Vessel Noise

Support vessels and seaplanes are expected to operate at existing levels around the Zelatched Point pier into the future as a result of the pier remaining on the landscape for an additional 50 years.[7] Increased background noise has been shown to increase stress in humans (Hattis and Richardson 1980) and other mammals (Owen et al. 2004), and several studies indicate that the same is true for fish (Mueller 1980; Scholik and Yan 2002; Picciulin et al. 2010). Recreational boat noise diminished the ability of resident red-mouthed goby (*Gobius cruentatus*) to maintain its territory (Sebastianutto et al. 2011). Depending on speed and proximity to nests, boats caused spawning long-eared sunfish to abandon their nests for varying periods in order to find shelter (Mueller 1980). Xie et al. (2008) report that adult migrating salmon avoid vessels by swimming away. Graham and Cooke (2008) studied the effects of three boat noise disturbances (canoe paddling, trolling motor, and combustion engine [9.9 horsepower]) on the cardiac physiology of largemouth bass (*Micropterus salmoides*). Exposure to each of the treatments resulted in an increase in cardiac output in all fish, associated with a dramatic increase in heart rate and a slight decrease in stroke volume, with the most extreme response being to that of the combustion engine treatment (Graham and Cooke 2008). Recovery times were the least with canoe paddling (15 minutes) and the longest with the power engine (40 minutes). Graham and Cooke (2008) postulate that the fishes' reactions demonstrate that the fish experienced sublethal physiological disturbances in response to the noise propagated from recreational boating activities.

[7] While torpedo testing is also I&I, these do not involve explosions and we do not expect any effects from these activities on listed species or their critical habitats.

While the effects of vessel noise is unlikely to be significant and distinguishable at the other five naval sites due to the extremely high number of large commercial and naval vessels operating each day, Zelatched Point is much more isolated and rarely used. This lack of intense commercial and naval operations makes any vessel noise more discernable beyond typical background levels and likely detectible by fish.

Even though NMFS did not find studies exploring the physiological effects of noise from vessel traffic specifically on salmon, it is reasonable to assume that juvenile and adult salmon, in addition to avoiding boats (Xie et al. 2008), experience sublethal physiological stress. Future support vessel and seaplane traffic at Zelatched Point will not exceed existing levels for the area; however the proposed action will meaningfully extend the useful life of the Pier, such that the behavioral disturbance associated with vessel traffic at the Pier will continue to affect members of all future cohorts of all populations of salmonids and rockfish that occur within the vicinity of Zelatched Point. Noise will be temporary in nature, lasting minutes to hours during days of operations. Zelatched Point is not a continuous use facility and does not have staff or vessels stationed there permanently.

2.4.2.4 Species Responses at the Population Scale

The range of responses to temporary and permanent effects is presented above at the individual scale but must be considered collectively at the population or species scale over time, in order to determine the effects on the four viability parameters.

As presented in the above section, the most acute effects to species will be response to sound, which has the potential to alter behavior, injure, and kill listed fishes (primarily salmonids but to a lesser degree rockfish) and to affect two listed marine mammals (SRKW and humpback whales). Given the work window timing restriction to avoid outmigration, we expect that in each of the 5 years of expected work, sound will not injure or kill a large number of juveniles from any single population, ESU or DPS of salmonids or PS rockfish. With no work window restrictions existing to avoid presence of marine mammals it is likely that sound will alter behavior of one or more individuals from both marine mammal ESUs each year for the 5 years of work.

More likely to be influential on population dynamics are the combination of temporary and permanent reductions in the abundance and variety of prey for juvenile and adult salmonids and rockfish, and SRKW. The temporary effects have a duration which begins contemporaneously with the permanent effects, and the permanent deleterious conditions attributable to the extended service-life of the structure at Zelatched Point can be evaluated as an overall suppression of habitat values for the foreseeable future at that specific site. Due to the slightly reduced carrying capacity with prey diminishment, and the anticipated direct and indirect harm from increased pressure levels, we can anticipate some injury and death of individuals in all future cohorts of juvenile salmonids that use the action area as a result of this programmatic action. Given that a number of salmonids are expected to perish there will be a correlating decrease in SRKW prey base.

The prey base for PS salmonid species (forage fish) may be reduced through a variety of vectors described above (sound, benthic disturbance, shade). Daly et al 2009 estimated that roughly 35 percent of adult salmonid diet is composed of forage fish and other small teleosts while out at sea. The actions within the programmatic are anticipated to adversely affect up to 2.71 percent of the forage fish population that utilize and originates from Puget Sound. This 2.71 percent decrease would represent a decrease in salmon population wide food supply. Because both the prey and salmon are in constant movement with precise spatial location impossible to predict the likelihood of any individual salmon encountering areas of reduced prey availability is universal. However, the overall experience of reduced prey availability is not likely to exceed 0.95 percent for the entire population as the 2.71 percent reduction in forage fish represents a margin within a margin of overall salmon diet. If the Chinook population experiences a 0.35 percent reduction in forage fish availability, at most the population may experience a 0.35 percent reduction in overall abundance. This extreme case would only occur if all the reduction in available forage fish was experienced by the same individuals so that those fish were completely devoid of the ability to acquire the 35 percent prey base and all other salmon (99.65 percent of population) experienced no change available prey. If these select Chinook did experience a 0.35 percent reduction, at current abundance levels, the loss to the population would be at most a loss of 507 Puget Sound Chinook salmon.

Reduced numbers of Chinook salmon represents a reduction in SRKW prey base. Each individual SRKW consumes approximately 11.4 adult chinook per day (Noren, 2011). If the 507 Puget Sound Chinook salmon were eliminated it is extremely unlikely that all individuals would be a lost within the same SRKW forage area and even less likely that they would represent a loss to only one foraging SRKW individual. Therefore, the extent of take up to the aforementioned maximum extent would result in an insignificant reduction in prey resources for SRKW. The NMFS anticipates direct or indirect effects on SR killer whale prey quantity and quality would be insignificant to the population as a whole.

Abundance:
Construction-related effects will affect only those cohorts of fish and marine mammals present during the work and any cohorts that subsequently depend on them. These effects include episodic disturbances of water quality parameters (TSS), shade from construction barges, and increase sound/noise pressure. The greatest of these effects is expected to be the direct and indirect from increased sound pressure (direct: physical harm, indirect: reduced forage). It is expected that this affect will result in at most a 0.35 percent reduction in abundance for salmonids which is an insignificant amount of reduction for SRKW. These affects will be far reaching affecting any and all cohorts that are present in the area.

The programmatic has long-term effects on the marine nearshore environment that multiple cohorts of fish will experience over the life of the structure at Zelatched Point. The long-term obstruction of fish passage, reduced SAV density and food supply, and episodic disturbance from boating activity and noise all diminish conditions, and the species most likely to be repeatedly/chronically exposed to these conditions are juvenile PS Chinook and HCSR chum, which typically migrate or rear in the nearshore area. Steelhead are less affected by the habitat detriments associated with the action because by the time they reach the nearshore/marine environment, they are larger fish more adapted to deeper water, and so have lower demand for nearshore migration, predator refugia, and prey base. Populations comprising PS Chinook salmon and HCSRC will continue to experience habitat factors that limit their juvenile to adult survival consistent with the current level of diminished habitat carrying capacity. Abundance is not expected to discernibly decrease, but increases of abundance are curtailed by these conditions.

We do not expect that the structure's migration/movement interruption and shading effects, other than the reduction in food supply, and the construction's increased sound pressure, would affect rockfish. These long-term habitat changes at Zelatched Point, which will persist for the life of the structures, result in an incremental increase in stress, reduction in foraging success, alteration of migration patterns (forcing juveniles to leave the nearshore), and impairment of predator avoidance. Effects to individual fish will occur among an undetermined percentage of all future cohorts of all populations that use the action area. We anticipate that a small number of juveniles of each species (salmonids and rockfish) will be injured or killed because of reduced habitat suitability for listed species and juvenile and adult salmonids from the increased predation resulting from the action. We expect these decreases to be proportional to the relatively small amount of habitat adversely affected, but that salmonid populations that rely on this specific location within the action area will incur the greatest level of exposure and detrimental response.

As outlined above, the proposed action does not create any likelihood of injury by significantly disrupting behavior patterns (or otherwise) and thus there is no expected impact to abundance. We therefore do not further evaluate the remaining viability criteria.

In summary, the proposed action results in some future, ongoing suppression of habitat quality due to the continued existence of the Zelatched Point pier which functions as a limit on abundance by impairing carrying capacity in an area that would serve nearshore rearing (Chinook and chum salmon, primarily). Pile driving is expected to reduce habitat quality for and physically harm any juvenile or adult rockfish within the area of increase sound pressure. Additionally the construction effects, especially pile replacement, will diminish abundance of prey fishes and salmonids as prey for SRKW. We expect these annual decreases to be proportional to the relative amount of habitat affected (at most, 2.71 percent per year) and the proportion of dietary composition forage fish make up within the food chain, with prey populations recovering incrementally after each construction period. The 0.95 percent reduction in Chinook will likely represent 44.47 days of lost feeding for one individual SRKW or 0.16 percent of the feeding days each year for the entire population.

<u>Productivity:</u>
The construction activities of replacing piles and the other associated maintenance activities will have short term effects on productivity. With immediate reductions of productivity occurring through the reduction of prey items (forage fish and thus salmonids). Productivity reductions will be instantaneous but brief with productivity returning within a short number of years after construction activities have ceased.

The Zelatched Point pier will perpetuate degraded nearshore habitat conditions for the life of the structure. In response to this habitat condition, we expect individual juvenile salmonids to expend more energy in their migration, reducing growth and fitness; also reduced foraging

opportunity and is expected to diminish individual fitness, growth, and survival. However, on balance, the small annual impacts on individuals in the juvenile cohorts accessing the action area over time is impossible to discern from returning adult cohorts.
We consider the influence of the project on rockfish to be similarly indiscernible in terms of future productivity.

Spatial Structure:
Salmon have complex life histories and changes in the nearshore environment will have a greater effect on specific life history traits that make prolonged use of the nearshore. We do not expect the proposed action to affect the spatial structure of any of the five affected ESUs/DPSs. The affected salmonid populations spread across the nearshore and mix when they enter PS (Fresh et al., 2006), and rockfish spread through nearshore habitats with larval drift. The construction activities of replacing piles and the other associated maintenance activities will have short term minor effects on diversity, only affecting the life history stage that is within the area at any given time during construction. Because the construction activities will vary in timing and geography, the concentration of temporary construction related effects will be indiscernible between life stages The Zelatched pier will likely disproportionately affect Hood Canal populations and thus a small diminishment in spatial structure is expected as a result of the proposed action. However, the presence of multiple runs within Hood Canal will dampen the reduction in spatial structure and spread any loss throughout multiple Hood Canal populations.

Diversity:
Salmon have complex life histories and changes in the nearshore environment will have a greater effect on specific life history traits that make prolonged use of the nearshore. The construction activities of replacing piles and the other associated maintenance activities will have short term minor effects on diversity, only affecting the life history stage that is within the area at any given time during construction. Because the construction activities will vary in timing and geography, the concentration of temporary construction related effects will be indiscernible between life stages. An implication of juvenile salmon avoiding OWS is that some of them will swim around the structure (Nightingale and Simenstad 2001) meaning they will temporarily utilize deeper habitat.

The proposed action will concentrate the effects on HCSR chum and PS Chinook delta fry. After emergence, delta fry quickly migrate downstream through the estuary into the marine nearshore and pocket estuaries such as those near Naval Base Kitsap Bangor (Beamer, 2005). Over time, selective pressure on one component of a life-history strategy tends to eliminate that divergent element from the population, reducing diversity in successive generations and the ability of the population to adapt to new environmental changes (McElhany et al., 2000). The subset of juvenile salmonids that extensively utilize the nearshore, delta fry, are likely to be killed or injured at a higher rate than other life history forms which use the marine nearshore for a shorter amount of time. These delta fry that experience increased mortality from the proposed action will have their life history strategy selected against. This will likely result in a slight, proportional to the limited habitat alteration, decline in HCSR chum and PS Chinook diversity by differentially affecting specific populations that encounter piers in greater frequency during their early marine life history.

We do not expect any effects that would result in a reduction in diversity to PS steelhead, PS/GB bocaccio, and PS/GB yelloweye rockfish.

2.5 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). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

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

The action area, all waters of PS, is influenced by actions in the nearshore, along the shoreline, and also in tributary watersheds of which effects extend into the action area. Future actions in the nearshore and along the shoreline of PS and HC likely include port and ferry terminal expansions, residential and commercial development, shoreline modifications, road and railroad construction and maintenance, and agricultural development. Changes in tributary watersheds that are likely to affect the action area include reductions in water quality, water quantity, and sediment transport. Future actions in the tributary watersheds whose effects are likely to extend into the action area include operation of hydropower facilities, flow regulations, timber harvest, land conversions, disconnection of floodplain by maintaining flood-protection levees, effects of transportation infrastructure, and growth-related commercial and residential development. Some of these developments will occur without a Federal nexus, including commercial and residential construction and even shoreline stabilization if it occurs above the OHWM interpreted by the Seattle District COE as their line of federal jurisdiction under the CWA. However, activities that occur waterward of the OHWM require a Corps permit and future ESA consultation.

All such future non-Federal actions, in the nearshore as well as in tributary watersheds, will cause long-lasting environmental changes and will continue to harm ESA-listed species and their critical habitats. Especially relevant effects include the loss or degradation of nearshore habitats, pocket estuaries, estuarine rearing habitats, wetlands, floodplains, riparian areas, and water quality. We consider human population growth to be the main driver for most of the future negative effects on salmon and steelhead and their habitat.

The human population in the PS region has increased from about 1.29 million people in 1950 to about 3.84 million in 2014, is expected to reach 4.17 million by 2020, and nearly 5 million by 2040 (Puget Sound Regional Council, 2016). Thus, future private and public development actions are very likely to continue in and around PS. As the human population continues to grow, demand for agricultural, commercial, and residential development and supporting public infrastructure is also likely to grow. We believe the majority of environmental effects related to future growth will be linked to these activities, in particular land clearing, associated land-use changes (i.e., from forest to impervious, lawn or pasture), increased impervious surface, and related contributions of contaminants to area waters. Land use changes and development of the built environment that are detrimental to salmonid habitats are likely to continue under existing regulations. Though the existing regulations minimize future potential adverse effects on salmon habitat, as currently constructed and implemented, they still allow systemic, incremental, additive degradation to occur; also see above, Section 2.3 “no change in Human Sound Behavior Index.”

In June 2005, the Shared Strategy presented its recovery plan for PS Chinook salmon and the Hood Canal Coordinating Council presented its recovery plan for Hood Canal summer-run chum salmon to NOAA Fisheries who adopted and expanded the recovery plans to meet its obligations under the ESA. Together, the joint plans comprise the 2007 PS Chinook and Hood Canal summer-run chum Recovery Plan. Several not for profit organizations and state and Federal agencies are implementing recovery actions identified in these recovery plans.

Notwithstanding the beneficial effects of ongoing habitat restoration actions, the cumulative effects associated with continued development are likely to have ongoing adverse effects on salmon and steelhead population abundance and productivity. Only improved low-impact development actions together with increased numbers of restoration actions, watershed planning, and recovery plan implementation would be able to address growth related impacts into the future. To the extent that non-Federal recovery actions are implemented and offset on- going development actions, adverse cumulative effects may be minimized, but will probably not be completely avoided.

2.6 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 2.4) to the environmental baseline (Section 2.3) and the cumulative effects (Section 2.5), 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 diminishes the value of designated or proposed critical habitat for the conservation of the species.

Bocaccio rockfish and SRKW are endangered. Each of the other species considered in this opinion was listed as threatened with extinction because of declines in abundance, poor productivity, and reduced spatial structure and diminished diversity. Systemic anthropogenic detriments in fresh and marine habitats are limiting the productivity for Puget Sound Chinook salmon and Puget Sound steelhead. Hood Canal Summer-run chum, however, has seen notable improvements in freshwater habitat, and with the contribution of conservation hatchery practices, has improving abundance, productivity, and spatial structure in freshwater areas. Bocaccio live only in the marine environment, and the nearshore habitat of juveniles is degraded by bank armoring and impaired sediment processes. Both rockfish are long lived with late sexual maturity, which makes increasing productivity very difficult to enhance by any human endeavor.

The shoreline and shallow water habitat in PS has been and continues to be subject to intense development from residential, recreational, municipal, and industrial/commercial construction. With the level of infrastructure development associated with this population growth the PS nearshore has been altered significantly. Major physical changes documented include the simplification of river deltas, the elimination of small coastal bays, the reduction in sediment supplies to the foreshore due to beach armoring, and the loss of tidally influenced wetlands and salt marsh (Fresh et al., 2011). This wave of commercial and residential development has resulted in significant declines in species and habitat resulting in the current status and number of listed species in Puget Sound.

To this context of species status and baseline conditions, we add the temporary and the permanent effects of the proposed action, together with cumulative effects (which are anticipated to include future nonpoint sources of water quality impairment associated with upland development and stressors associated with climate change), in order to determine the effect of the action on the likelihood of species' survival and recovery. We also evaluate if the project's habitat effects will appreciably diminish the value of designated critical habitat for the conservation of the listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features.

Habitat

Designated Critical Habitat
The only temporary effect of the action on features of designated critical habitat for PS Chinook salmon, HCSR chum salmon, rockfish , and SRKW will be underwater sound levels during construction, in the proposed in water work window. The other temporary effects of the action (shade from vessels, turbidity, temporary forage reduction, temporary increase in predator risk) all occur within the DoD critical habitat exclusion area. The sound effects of the proposed action to install piles will be acute, ceasing after pile driving concludes for the day, for the days within the work window for the duration of the proposed action. The sound effects of the barges and interrelated vessels may be longer in duration but will generate sound at levels below already existing operation levels within DoD excluded Critical Habitat and below the behavioral thresholds outside of the exclusion areas. The interrelated sea plane and vessel traffic at Zelatched Point will continue to produce deleterious sound within the water, but this will be confined to an area excluded from critical habitat designation. Given the limited duration of the pile driving and the location of the effected habitat within the DoD critical habitat exclusion zone, it is not expected to diminish the value of critical habitat for the conservation of the species.

However, the temporary increase in sound will also indirectly affect the available prey primary feature of designated Critical Habitat by directly and indirectly reducing the number of forage fish present in the action area. This effect will last for the duration of the action and will not be confined to only days with active pile driving. Because this reduction in prey is based on increased sound the reduction the effect on individual forage fish will cease upon completion of the work. The forage fish populations are, however, expected to recover fairly quickly. Thus the available and quality forage component of both critical habitat and DoD exempted habitat is not expected to impair long term habitat success.

Sound will also result in a temporary decrease in the number and effectiveness of predators within the action area during pile driving activities. The decrease in predators will increase habitat value for salmonid and rockfish species. Any seals and sea lions that survive the exposure are expected to return to the area and reengage in foraging behavior, thus the improvement in habitat quality will only last as long as their absence or diminishment of their foraging ability lasts. This reduction in seals and sea lions will not impact the habitat values of SRKW.

Likewise, the sound produced by the proposed action will affect attributes of rockfish nearshore critical habitat (juvenile critical habitat) and deep water critical habitat (adult critical habitat). Impact pile driving will produce daily noise in the aquatic habitat detectable by fish, this habitat alteration will be short-term within the work windows, and largely localized to within areas exempt from critical habitat designation. Therefore, the temporary impacts of sound to critical habitat will diminish the features of critical habitat for 5 years in a manner that temporarily impairs conservation values of that habitat for PS Chinook salmon, HCSR chum, SRKW, and rockfish. However, due to the temporary nature of the effect, the conservation value in the action area will not be diminished in a meaningful or permanent way.

When considering the status of the critical habitat, and added to the baseline and considered together with the cumulative impact of numerous and contiguous urban marine structures, the effects of the proposed action (and particularly those related to construction) are likely to temporarily impair the conservation values of critical habitat for PS Chinook salmon, HCSR chum and SRKW. The temporary duration of this impairment is not expected to last more than 5 years during the activities of the programmatic.

Habitat Effects in DOD-Exclusion Areas
We expect some other habitat effects to occur within the DoD exclusion area from critical habitat. These habitat effects are not factored into the adverse modification analysis but inform the jeopardy analysis relative to species. The continued overwater cover and shade expected at Zelatched Point will result in migratory obstruction, continued noise disturbance (from I&I vessels), and increased predation of ESA-listed species. The structure will also impede benthic communities permanently (pile placement) and temporarily (pile driving/removal turbidity). The temporary and permanent impacts that disrupt benthic environments will diminish the rockfish larval/juvenile rearing habitats and food sources in the action area. Reduced diversity or density of epibenthic mesofauna also reduces prey habitat components for juvenile salmon.

Species
Salmonids - Pile removal and driving will temporarily produce sound, turbid conditions, and prey reductions, and shade from the presence of the barges will temporarily modify salmonid visual acuity and migration behavior similar to the continued presence of the Zelatched point pier, and also decrease SAV, impacting cover and forage base for salmonids. Although the sound effects of impact pile driving are expected to be the most acute, these effects are limited to the

work days with pile driving occurring and effects will dissipate immediately after pile driving ceases, and even within that period they are at the most transitory, ceasing each time pile driving has stopped for the day with a break of 12 hours in pile driving. Because the work window is timed when juvenile salmon migration is largely avoided, we expect that the numbers of fish present from each species will be low, and that no particular population among the species of salmonids will be disproportionately affected.

Turbidity will be more confined than sound but persist for minutes to hours at each pile replacement site, and salmonids that are present should be able to avoid the individual pulses of suspended sediment. We expect most fish that are present to avoid the pulses, and for the very small numbers of fish from each population that are exposed, we expect they will suffer only minor impacts.

The diminishment in forage base will persist the longest of the temporary effects, and we expect multiple listed salmonids from each population of each species will need to modify its forage locations to compensate for the reduction. However, we expect the forage base to return within a short time after the pile driving activity has ceased. The timing will depend upon the species spawning behavior. This diminishment will affect all salmonid cohorts, rockfish and SRKW pass through the action area during the 5+ years of the diminishment.

There will be a long-term (for the life of the Zelatched Point pier), decrease in prey base, and increase in predation of juvenile fish from each of the affected salmonid populations, based on modified migration behavior, reduced visual acuity, continued reduction of SAV, and increased predator abundance. The operational effects of the structure (noise) will continue to effect fish behavior and increase predation risk immediately around the structure where vessels and planes operate. This indicates for the 50-year life of the project, there is likely to be a small annual reduction in numbers of salmonids and continued suppression of rockfish within the action area.

NMFS concludes that the numbers of listed salmonids directly affected (barotrauma) by the temporary effects of sound will be very small because the activity occurs when few juvenile PS Chinook salmon, PS steelhead and HCSR chum salmon are present. However, because the indirect effects of increased sound (reduced prey base) are likely to last beyond the period of time when pile driving is occurring these species are likely to be exposed to the lower food levels and thus impacted for the duration of the reduced prey populations. Turbidity and loss of SAV through shade is also likely to further impact the forage reduction though these reductions are expected to be minor being constrained to the area of immediate turbidity and directly under shaded area.

The numbers of fish impaired by the permanent effects of are unlikely to be discerned among adult returns because the loss will be across several cohorts of the three salmonid species and only impact those fish that access the action area, and when the general rate of juvenile to adult survival and ocean survival are considered, the incremental reduction in numbers of juveniles is insufficient to alter the abundance and composition of the adult returning Puget Sound and Hood Canal cohorts.

Rockfish –Pile driving as a temporary effect in the proposed in-water work window (but not turbidity or shade) will kill or injure individual larval fish from of each of the PS/Georgia Basin DPSs of rockfish (yelloweye rockfish and bocaccio). Rockfish losses will include larval, juvenile and adult life stages that are located within the immediate areas of the increased pressure at physical damage levels. No studies have directly quantified the number of rockfish through Puget Sound, however it is generally believed that there are very few bocaccio and Yelloweye left in Puget Sound.

The permanent effects of the continued operation of the Zelatched Point structure (shade, reduced SAV, and reduced forage) are unlikely to discernibly affect abundance of adult rockfish because adult PS/GB yelloweye rockfish, and PS/GB bocaccio do not use nearshore habitat in the action area where the permanent effects will occur/persist). Larval and Juvenile rockfish may be effected within the area of Zelatched Point as the features of the nearshore area allow for their presence.

SRKW – Pile removal and driving will temporarily produce sound, turbid conditions, and prey reductions for SRKW. Although the effects of vibratory pile driving are expected to be the most acute, these effects are limited to the work days with pile driving, and even within that period they are at the most transitory, ceasing each time pile driving has stopped for the day with a break of 12 hours in pile driving. We expect that there will be no more than 40 occurrences of SRKW encountering increased sound levels. Exposure to sound above the 160 and 120 dB RMS threshold can result in changes in the typical behavior of SRKW or humpback whales (e.g., increased swimming speed, decreased feeding, and communication disruption) or cause them to avoid the affected area, with any of the behavioral changes ceasing upon stopping of pile driving.

The temporary reduction in SRKW prey (salmon) resulting from the reduction in forage fish and from direct exposure to harmful levels of increased sound will likely last for the entire duration of the 5-year programmatic plus two years for the salmon levels to recover. The SRKW will need to modify its forage locations to compensate for the reduction. This reduction in forage base will equally affect all life stages of SRKW and all 74 remaining individuals equally throughout the action area.

Humpback Whales – Vibratory pile driving is expected to affect Humpback whales as exposure will lead to significant behavioral changes. No more than 4 occurrences of exposure are expected for the two DPSs of this species. Occurrences can be spread across up to four individuals or may occur to just one individual 4 times. Exposure to sound above the 160 and 120 dB RMS threshold can result in changes in the typical behavior of SRKW or humpback whales (e.g., increased swimming speed, decreased feeding, and communication disruption) or cause them to avoid the affected area, with any of the behavioral changes ceasing upon stopping of pile driving.

Accordingly, NMFS expects the small reduction in abundance of PS Chinook salmon, HCSR chum salmon, PS steelhead, ESA-listed rockfish, SRKW and humpback whales by the temporary and permanent effects, will have small but identifiable effects on productivity, spatial structure, and genetic diversity of any of steelhead or rockfishes. Genetic diversity of PS Chinook, HCSR chum, ESA listed rockfish, SRKW and humpback whales could be slightly diminished over decades.

When considered in the context of the status of the species, and with the environmental baseline in the action area and cumulative effects, the action, as proposed, does not increase risk to the affected populations to a level that would appreciably reduce the likelihood for survival of the PS Chinook salmon ESU, PS steelhead DPS, HCSR chum salmon ESU, PSGB bocaccio rockfish ESU, PSGB Yelloweye rockfish ESU, Humpback whale Mexico or Central America DPSs, or Southern Resident Killer Whale DPS, and is not expected to alter trends relative to recovery.

2.7 Conclusion

After reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the action area, the effects of the proposed action, any effects of interrelated and interdependent activities, and cumulative effects, it is NMFS' biological opinion that while the proposed action is likely to adversely affect the listed species and their critical habitat both temporarily and long term the Navy's proposed action not likely to jeopardize the continued existence of PS Chinook salmon, HCSR chum, PS steelhead, PS/GB bocaccio, PS/GB yelloweye rockfish, SRKW, Humpback whales or destroy or adversely modify PS chinook, HCSR chum, PS/GB bocaccio, and PS/GB yelloweye rockfish, or SRKW designated critical habitats

2.8 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.

2.8.1 Amount or Extent of Take

The PS Chinook salmon, PS steelhead, HCSR chum salmon, PS/Georgia Basin DPSs of yelloweye rockfish and bocaccio, Central America and Mexico DPSs of Humpback whales, and Southern Resident Killer Whale DPS are present in the action area and are likely to be exposed to temporary and permanent effects of the project. Individuals from each of these species are likely experience a range of responses to these effects, some of which constitute a form of incidental take, which we articulate below.

2.8.1.1 Take of ESA-listed Fishes

Because the presence of these fishes at any given time is highly variable due to their mobility, their life history, and because a large range of factors can determine run sizes of cohorts (e.g., stream temperatures, timing of rain events, ocean factors, etc.), as well as the size of the action area (all water of Puget Sound and Hood Canal), we cannot quantify the actual number of fish that could be incidentally taken by the proposed action. Moreover, no monitoring protocols exist that would allow an effective enumeration of all the forms of take. In these circumstances, instead of defining an amount or extent of take, we use a measurable surrogate that is causally related to the expected incidental take. We describe below the take surrogates for listed fish.

Take in the form of harm and death from Pier and Vessels – Shade and Migration Disruption
Juvenile salmon and steelhead will modify their behavior in response to the shade created by Zelatched Point and associated vessels by going around the area and into deeper water where they will expend greater energy, lose migration time and increase their risk of predation. The amount/extent of incidental take is represented here by two surrogates.

Specifically, the surrogate for take associated with Zelatched is the size of the Zelatched Point pier's overwater coverage, which will be 3,085 $ft^{2.}$ This surrogate is causally linked to the expected incidental take because the overwater coverage directly correlates with the area of shade which in turn correlates with the amount of predator habitat created and is a rough proxy for the likelihood that juvenile fish will be forced to swim into deeper water.. The Pier footprint can be measured after construction to ensure that 3,085 ft^2 overwater coverage is not exceeded and because the Navy is the action agency, and has control over the structure, reinitiation would be meaningful even after the structure was completed.

The take surrogate for incidental take caused by construction barges will be, cumulatively, 84.9 acres of in/overwater vessel presence during the 5 years of construction. This is based on the maximum number of days with barges present in the action area, which is calculated as 822 divided by construction rate (6 piles/day) = 137 days. A typical construction barge is approximately 45 feet wide and 100 feet long (4,500 $feet^2$). We can therefore estimate that a cumulative 14.15 acres will be shaded by barges over the course of 5 years, with an average of 2.83 acres per year. This estimate can be monitored by the number of barges at each site, the duration of barges at each site, and the size of barges present. As above, this surrogate is causally linked to the expected incidental take because the area of shade correlates with the amount of predator habitat created and is a rough proxy for the likelihood that juvenile fish will be forced to swim into deeper water. The surrogate functions as meaningful reinitiation trigger because it can be monitored and reported on an annual basis.

Take in the form of harm from diminished prey base from pile driving sound
Incidental take in the form of harm is reasonably certain to occur among all ESA-listed Puget Sound fishes due to the reduction of prey base caused by pile driving and 2 years post construction until forage fish populations recover. Impact pile driving is proposed to occur for up to 1.5 hours a day during any given day with impact pile driving within the salmonid work window and outside the forage fish work windows at any single or combination of the 7 facilities listed in the proposed action.

The take surrogate for incidental take associated with loss of prey base (caused by pile-driving underwater sound) is a maximum of 1.5 hours per day of impact pile driving during any given day within the salmonid work window at any single or combination of the 7 facilities listed in the proposed action. This take surrogate is causally linked to the expected incidental take because there is a proportional relationship between the amount of time the pile driving occurs and the number that will be affected, which in turn correlates to the number of listed fish that will be harmed by a reduced prey base. Although the surrogate might be construed as partially coextensive with the proposed action, it nevertheless functions as a meaningful reinitiation trigger because it can be measured on a daily basis providing multiple opportunities for reinitiation to occur.

Take in the form of injury or death from pile driving sound – harm and death of listed fish
Incidental take in the form of harm, injury, or death among salmonids and rockfishes is reasonably certain to occur from elevated underwater sound from impact pile driving for a period of 5 years but will be constrained to the facility specific salmon work window – and within the day of the pile driving.

The two-part surrogate for this incidental take is:

1) A maximum of 1.5 hours per day of impact pile driving during any given day within the salmonid work window at any single or combination of the 7 facilities listed in the proposed action, and,
2) The following sound pressure levels, measured at 10 meters from source, resulting from impact pile driving at each of the locations is listed below;

Manchester: 202 dB $SEL_{cumulative}$
Bangor: 209 dB $SEL_{cumulative}$
Zelatched Point: 212 dB $SEL_{cumulative}$
Keyport, Everett: 220 dB $SEL_{cumulative}$

This surrogate is causally linked to the take because the amount of time during which pile driving occurs and the sound levels generated is positively correlated to the likelihood of listed fish being exposed to the sound and harmed or killed. Although the surrogate might be construed as partially coextensive with the proposed action, it nevertheless functions as a meaningful reinitiation trigger because it can be measured on a daily basis providing multiple opportunities for reinitiation to occur.

Also, because the Navy is the action agency, and has control over the construction, reinitiation would be meaningful even after the structure was completed.

2.8.1.2 Take of Marine Mammals

NMFS does not expect humpback whales or SRKW to be physically injured or killed by the proposed action but NMFS does expect ESA incidental take of these two species in the form of harassment. This harassment will come from exposure to sound pressure from pile driving. Exposure to sound above the 160 and 120 dB RMS thresholds (for impact and vibratory pile driving respectively) can result in significant changes in the normal behavior of SRKW or humpback whales (e.g., increased swimming speed, decreased feeding, and communication disruption). For the reasons set out the Opinion, we expect that there will up to but no more than 40 occurrences of SRKW encountering these sound levels and up to but no more than 4 occurrences of exposure are expected for the two humpback DPSs. Thus, these are the amounts of incidental take by harassment.

Before incidental take of listed marine mammals may be exempt from the taking prohibition of ESA section 9(a), incidental taking must be authorized under section 101(a)(5) of the MMPA. Therefore, although NMFS is including an incidental take statement for marine mammals at this time, it is not immediately operative because the MMPA Letter of Authorization (LOA) for this action is yet to be issued. However, when NMFS issues an MMPA authorization for the proposed action, this incidental take statement will automatically become operative.

2.8.2 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.

2.8.3 Reasonable and Prudent Measures

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

1. The Navy shall minimize the amount or extent of take by coordinating with NOAA annually to evaluate whether adaptive management strategies are needed based on long term changing population dynamics.
2. The Navy shall minimize the amount or extent of take of listed species from the effects of pile driving by utilizing methods and technology to reduce sound pressure generated.
3. The Navy shall minimize the amount or extent of take by minimizing the amount of shading in habitat.
4. The Navy shall minimize the amount or extent of take by avoiding killing or damaging prey base.
5. The Navy shall minimize the amount or extent of SRKW and humpback whale take by complying with the LOA for this action (to the extent it applies to those species).
6. The Navy shall prepare and provide NMFS with plans and reports describing how impacts of the incidental take on listed species in the action area were monitored and documented.
7. The Navy shall adhere to all proposed action components and best management practices.

2.8.4 Terms and Conditions

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

1. To implement RPM number 1 (long term), the Navy shall:
    a. Coordinate annually with NMFS staff in the region to ensure that, as listed populations increase or decrease, potential measures to avoid corollary changes in risk associated with exposure from that year's anticipated pile driving are implemented to ensure no increased risk of Take.
    b. Provide to NOAA a list of proposed activities and timing for said activities
        i. Develop with NOAA a marine mammal monitoring plan for each project and acquire approval from NOAA in writing of the plan before work is carried out

2. To implement RPM numbers 2 & 4 (pile driving and forage base), the Navy shall:
    a. Adhere to work windows outlined in BiOp "Proposed Action" for all actions except for impact pile driving.
    b. When impact driving steel piles, adhere to the following work windows
        i. NAVBASE Kitsap Bangor and Zelatched Point: July 16–January 15
        ii. NAVBASE Kitsap Keyport, Everett: July 16–October 14
    c. Utilize vibratory pile driving whenever sediment conditions allow.
    d. Only conduct steel impact pile driving for 1.5 hours each day for each facility.
    e. Do not exceed 4,000 steel impact strikes, including proofing, per day at each facility
    f. Utilize sound attenuation measure(s) (double walled piled, wooden block, bubble curtain, etc) for all steel impact pile driving activities to keep source sound levels below the following thresholds at 10 meters distance
        i. Manchester: 204 dB SELcumulative
        ii. Bangor: 209 dB SELcumulative
        iii. Zelatched Point: 212 dB SELcumulative
        iv. Keyport, Everett: 220 dB SELcumulative
    g. The Navy shall use "soft starts" before every impact pile driving session.
    h. Develop and Implement an Acoustic Monitoring Plan each year for a subset of the anticipated projects/piles. The Plan must be approved by NMFS each year. The Acoustic Monitoring Plan will include the submission of a report to NMFS regarding the results of acoustic monitoring. Acoustic monitoring report should include:
        i. "if sound exceeds cumulative SEL threshold at 10 meters, NMFS identified in section 2.4.1.1, then the amount of take authorized by the Incidental Take Statement will have been exceeded
        ii. Dates of construction related activities such as:
            - Removal of the creosote piles and falsework piles.
            - Installation of new steel and concrete piles.
        iii. Description of pile driving activities such as:
            - Number and method of piles removed.
            - Number of piles installed with an impact pile driver.

iv. Number and duration of strikes per pile and throughout the day.
v. Tidal elevation and depth of piles

All reports shall be sent to NMFS Regional Office, Oregon Washington Coastal Office.

3. To implement RPM number 2 (pile driving), the Navy shall:
    a. Develop a marine mammal monitoring plan for each pile driving project within each year that includes the following components;
        i. Includes adequate monitoring of the injury and behavioral zones using boats, shore monitors or other technology.
        ii. Observers must have adequate spacing so that they can maintain the nearest observer at all time without optical assistance.
        iii. Observers must be places so as to completely cover the area of Level B harm.
    b. If a cetacean including SRKW or humpback whale is identified within or approaching the Zone of Influence for Level Ball pile driving activities will immediately cease.
        i. Pile driving activities will not restart until after the animals have left the Zone of Influence for Level B harm or until 15 minutes has passed without re-sight of the animal.
    c. Report to NOAA annually;
        i. Date and time pile driving occurred
        ii. The observer details including, qualifications, placement location, equipment used.
        iii. Environmental conditions including; wave height, cloud cover, precipitation, and vessel traffic.
        iv. Occurrences of marine mammal presence near and within the zones of influence (A & B).
    d. If the number of occurrences of SRKW and Humpback Whales reaches 80% of the assessed Take occurrences reports must be submitted to NOAA monthly.
    e. Contact local agencies and groups monitoring marine mammals each day before pile driving occurs to determine presence of nearby marine mammals.

4. To implement RPM number 3 (shading), the Navy shall:
    a. Utilize grating instead of solid decking wherever feasible on replacement and maintained structures
    b. Do not allow barges to arrive on site early or stay past completion of work
    c. Elevate structures at least 18 feet off of the water whenever possible.
    d. Reduce the size of all overwater and on-water structures if less than 18 ft off the water where structurally feasible.

5. To implement RPM number 5 (marine mammals) the Navy shall comply with all prohibitions as well as mitigation, monitoring and reporting requirements in the MMPA authorization for this proposed action, to the extent they are applicable to SRKW and humpbacks.

6. To implement RPM number 6 (monitoring) the Navy shall:
    a. Ensure that a monitoring report identifying any incidental take associated with project activities. The report shall include a description of construction activities conducted and duration of activities to ensure take was not exceeded. The report shall be submitted to NMFS' offices in Lacey, Washington, within 6 months of completion of construction or immediately upon reaching the extent of Take authorized. The report shall summarize the compliance with the project description and conservation measures and the level of exempted incidental take during the implementation of the project that year.
        i. The report shall include the following:
            - Number and pile type installed
            - Dates of construction activities
            - Number of strikes and duration it took to drive each pile
            - All reports shall be sent to NMFS Regional Office, Oregon Washington Coastal Offices, Attention: (Conrad Newell, 7600 Sand Point Way NE, Seattle, WA 98115), As well as NOAA's reporting system (projectreports.wcr@noaa.gov).
    b. Where a survey of nearshore SAV (eelgrass and kelp) has not been completed within 5 years of any year's anticipated work a SAV survey will be completed. For example; anticipated work in 2021 would be able to use surveys dating back to 2016.
        i. The area to be surveyed includes the Highest Astronomical Tideline out to a depth 30 m.
        ii. A single SAV survey once complete will be valid for the entire duration of the programmatic for that specific location.
        iii. Surveys must be completed in spring and summer months.
        iv. All reports shall be sent annually to NMFS Regional Office, Oregon Washington Coastal Area Offices: (projectreports.wcr@noaa.gov).
        v. The Navy will provide the contractor with plan sheets showing eelgrass boundaries. The following restrictions will apply to areas designated as having eelgrass and/or Kelp:
            - Construction barges will avoid grounding in eelgrass beds during construction activities.
            - Shallow draft, lower horsepower tugboats will be used in the nearshore area and for extended operations in areas shallower than 40 feet below MLLW, where feasible.
            - Construction barges will avoid shading eelgrass and/or kelp beds.

7. To implement RPM #7 the Navy shall adhere to all components of the proposed action including:
    a. Implementing all BMPs.
    b. Utilizing vibratory or jetting pile driving where ever feasible as the primary driving method.
    c. Initiating and completing programmatic consultation for the maintenance and repair activities at Indian Island ammunition wharf by 2022 work window.

2.9 Conservation Recommendations

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

1. Provide for either onsite or through a third party appropriate habitat restoration and enhancement activities to offset the adverse habitat impacts resulting from continued existence and operation of the Zelatched Point pier and the operations associated with it, currently estimated to be 0.486 DSAYs.
2. Plant woody vegetation along the perimeter of all overwater structures, where feasible, to provide cover and food drop.
3. Remove all debris, trash, and vessel related material below and next to structures that service, repair and paint any vessels.
4. Utilize only pile driving technology that do not produce cumulatively harmful sound levels where possible.
5. Monitor salmonid presence and use of under pier areas to identify impediments for fish movement.
6. Mitigate for all habitat impacts resulting from current and maintained structures at all naval facilities in Puget Sound.
7. The Navy should advance development of its INRMP process to ensure that INRMP proposals are advancing recovery needs for Puget Sound listed species through further protection, and restoration of habitat.

2.10 Reinitiation of Consultation

This concludes formal consultation the Navy's Marine Maintenance and Pile Replacement programmatic and NOAA's issuance of an LOA for the Navy's actions.

As 50 CFR 402.16 states, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained or is authorized by law and if: (1) The amount or extent of incidental 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 agency action is subsequently modified in a manner that causes an effect on the listed species or critical habitat that was not considered in this opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action.

If the Navy does not complete a programmatic consultation on Indian Island maintenance and repairs by 2022, we would likely consider that new information revealing effects of the action not considered in this opinion or a subsequent modification of the action that causes effects not considered in this opinion

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

Section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect EFH. The MSA (section 3) defines EFH as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.” Adverse effect means any impact that reduces quality or quantity of EFH, and may include direct or indirect physical, chemical, or biological alteration of the waters or substrate and loss of (or injury to) benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects on EFH may result from actions occurring within EFH or outside of it and may include site-specific or EFH-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Section 305(b) also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH.

This analysis is based, in part, on the EFH assessment provided by the Navy and descriptions of EFH for Pacific Coast groundfish (Pacific Fishery Management Council [PFMC] 2005), coastal pelagic species (CPS) (PFMC 1998), and Pacific Coast salmon (PFMC 2014) contained in the fishery management plans developed by the PFMC and approved by the Secretary of Commerce.

3.1 Essential Fish Habitat Affected by the Project

The proposed action and action area for this consultation are described above in Sections 1.3 (Proposed Federal Action) and 1.4 (Action Area). The action area for the proposed project includes habitat which has been designated as EFH for various life stages of Pacific coast groundfish, coastal pelagic species, and Pacific salmon (Table 11).

Table 11. EFH species and life history stage associated with shallow nearshore water in PS.

Scientific Name	Common Name	Adult	Juvenile	Larvae	Egg
Groundfish Species					
Anoplopoma fimbria	Sablefish	X	X	X	X
Citharichthys sordidus	Pacific sanddab	X			
Eopsetta jordani	Petrale sole	X			
Glyptocephalus zachirus	Rex sole	X			
Hexagrammos decagrammus	Kelp greenling	X		X	
Hippoglossoides elassodon	Flathead sole	X			
Hydrolagus colliei	Spotted ratfish	X	X		
Isopsetta isolepis	Butter sole	X			
Lepidopsetta bilineata	Rock sole	X			
Merluccius productus	Pacific hake	X	X		
Ophiodon elongates	Lingcod			X	
Parophrys vetulus	English sole	X	X		
Platichthys stellatus	Starry flounder	X	X		
Psettichthys melanostictus	Sand sole	X	X		
Raja binoculata	Big skate	X			
Raja rhina	Longnose skate	X	X		X
Scorpaenichthys marmoratus	Cabezon	X	X	X	X
Sebastes auriculatus	Brown rockfish	X			
Sebastes caurinus	Copper rockfish	X	X		
Sebastes diploproa	Splitnose rockfish		X	X	
Sebastes entomelas	Widow rockfish		X		
Sebastes flavidus	Yellowtail rockfish	X			
Sebastes maliger	Quillback rockfish	X	X		
Sebastes melanops	Black rockfish	X	X		
Sebastes mystinus	Blue rockfish	X	X	X	
Sebastes nebulosus	China rockfish	X	X		
Sebastes nigrocinctus	Tiger rockfish	X			
Sebastes paucispinis	Bocaccio		X	X	
Sebastes pinniger	Canary Rockfish		X	X	
Sebastes ruberrimus	Yelloweye rockfish			X	
Squalus acanthias	Spiny dogfish	X			
Coastal Pelagic Species					
Engraulis mordax	Anchovy	X	X	X	X
Scomber japonicas	Pacific mackerel	X			
Loligo opalescens	Market squid	X	X	X	
Pacific Salmon					
Oncorhynchus tshawytscha	Chinook salmon	X	X		
Oncorhynchus kisutch	Coho salmon	X	X		
Oncorhynchus gorbuscha	Pink salmon	X	X		

Habitat areas of particular concern (HAPC) are specific habitat areas, a subset of the much larger area identified as EFH, that play an important ecological role in the fish life cycle or that are especially sensitive, rare, or vulnerable.

The action area also includes habitat which has been designated as habitat areas of particular concern (HAPC) for groundfish. Estuaries, sea grass beds, canopy kelp, rocky reefs, and other "areas of interest" (e.g., seamounts, offshore banks, Puget Sound and canyons) are designated HAPCs for groundfish. In general, there are large amounts of both patchy and established eelgrass and kelp beds throughout the action area. However, Hood Canal is generally described as having a lower abundance of both SAV types. Groundfish HAPCs within the action area include estuaries and sea grass beds.

Three coastal pelagic species are known to occur in the greater Puget Sound: northern anchovy, Pacific mackerel, and market squid and have been documented in Hood Canal and Puget Sound. The definition for coastal pelagic species EFH is based on the geographic range and in-water temperatures where these species are present during a particular life stage (67 Federal Register 2343-2383). EFH for these species includes all estuarine and marine waters above the thermocline where sea surface temperatures range from 50 to 68°F. These boundaries include Puget Sound and Hood Canal. Coastal pelagic species have value to commercial Pacific fisheries, and are also important as food for other fish, marine mammals, and birds (63 Federal Register 13833). Coastal pelagic species do not have designated HAPCs.

In estuarine and marine areas, salmon EFH extends from the extreme high tide line in nearshore and tidal submerged environments within state territorial waters out to the exclusive economic zone (200 nautical miles) offshore of Washington (Pacific Fishery Management Council 2014). Within these areas, EFH consists of four major components: (1) Spawning and incubation; (2) juvenile rearing; (3) juvenile migration corridors; and (4) adult migration corridors and adult holding habitat. The action area also includes habitat which has been designated as HAPC for Pacific salmon and include marine SAV.

3.2 Adverse Effects on Essential Fish Habitat

Migratory Pathway Obstruction

The proposed repair and continued existence of the Zelatched Point pier in aquatic habitat will alter outmigration routes of juvenile salmonids due to physical characteristics of the structure. Juveniles will likely alter their migratory route to navigate around the proposed structures and move into even deeper water. Salo et al. (1980) found that juvenile chum salmon moved offshore around the existing wharves as they migrated north out of Hood Canal. When juveniles leave the shallow nearshore it increases their migration route and will likely increase their risk of predation. The total overwater area of Zelatched Point pier will be 3,085 ft^2. An additional 6,000 square-feet will be partially shaded by the structure and movement of the sun, shade cast by the over-water structure on the water. The area in partial shade is assumed to be that within 10 feet of the footprint of the pier (Ono 2010). Therefore, we expect this project to degrade the quality of the migratory corridor and impair safe passage.

Effects on Forage, Cover, and Predation

Although SAV was not documented in the project footprint during the last survey, six years ago, there is a high likelihood that SAV patches will come and go within the action area within the life of the structure. Eelgrass is present within the nearshore areas of the Zelatched Point pier. SAV is important in providing cover and a food base for fish. OWS shade SAV for the life of the structure and can adversely affects primary productivity and SAV if present in the structures shadow zone.

Coastal pelagics, like Northern anchovy, use estuarine habitats such as the intertidal zone, eelgrass, kelp, and macroalgae and could therefore be affected by the impacts on their designated EFH. If any juvenile and sub-adult groundfish are within the action area, some would be expected to be found near the kelp habitat. The presence of new structures in the water column at the site will alter the suitability for recruitment of some groundfish EFH species, with different species preferring different types of habitat. Juvenile rockfish use habitats that include macroalgae-covered rocks or sandy areas with eelgrass or macroalgae as well as manmade in-water structures. Manmade structures also serve as habitat for sub-adult and adult lingcod, rockfish, and greenling, which are potential predators of juvenile rockfish.

Water Quality

Maintaining the Zelatched Point pier will require installation of up to 20 piles. Pile installation will temporarily disturb bottom sediments within the immediate project construction area, resulting in localized increases in suspended sediment concentrations that, in turn, will cause increases in turbidity during the work window. Also, installation and operation of the sound attenuation measures (e.g., bubble curtain) will result in some local resuspension of bottom sediments into the water column. In general, the predominately coarse-grained sediments that occur in most areas of the project site are more resistant to resuspension and have a higher settling speed than fine-grained sediments.

Nearshore habitat disturbance and localized turbidity increases could affect the water column and substrate that is used as EFH by eggs and larvae of EFH species. Northern anchovy do not spawn on Puget Sound beaches but instead spawn year-round in the water column. Species that deposit eggs on, or in, the substrate have potential to be damaged directly by construction activities or smothered by sediments settling out of the water column. Should nearshore spawning habitats be disturbed during the eggs' presence, these eggs could be dispersed into the water column, increasing their risk of predation. Elevated turbidity could alter normal dispersal patterns within the water column, potentially reducing survival. Larvae for a number of species for which EFH has been designated could also be affected by increased turbidity. Changes in turbidity throughout in-water construction activities will be relatively small scale and localized and may affect EFH differently depending on varying life histories. Based on the analysis of water quality effects, along with the BMPs and minimization measures included, all effects to EFH from changes in water quality will be minor and localized, and short in duration.

Sediment quality within the project area is generally good based on contaminant levels that are below marine sediment quality standards. The potential for accidental spills or releases of hazardous materials will be minimized through implementation of spill prevention and response plan to clean up fuel or fluid spills.

Benthic Communities

Temporary (vessel disturbance) and permanent (piling placement, structure and vessel shading, etc.) impacts will disrupt benthic environments and larval/juvenile rearing habitats and food sources. Reduced diversity or density of epibenthic meiofauna reduces prey resources. Marine benthos will be removed where it is growing attached to existing piles. The cumulative impact of numerous and contiguous urban marine structures may be detrimental to the long-term success of numerous species, particularly recovery efforts for anadromous fish species that migrate along shorelines. There will be some loss of benthic habitat, some slow recovery, but other areas will rebound after the disturbance.

Hydroacoustic Obstruction of Migratory Pathway and Safe Passage

Construction-generated noise has the potential to degrade groundfish, salmon, and coastal pelagic EFH by exposing the EFH to noise above behavioral and possibly injurious thresholds. The proposed action will increase cause sound waves that disrupt the aquatic habitat. The sound pressure levels from pile driving and extraction will occur contemporaneous with the work and radiate outward; the effect attenuates with distance. Both vibratory noise with high frequency and impact noise with high amplitude can create sufficient disturbance that the action area is impaired as a migratory area, but this persists only for the duration of the pile driving or removal. Because work ceases each day, migration values are re-established during the evening, night, and early morning hours.

As stated in Section 1.3, the installation of 20 piles will occur to maintain the Zelatched Point pier. EFH will experience temporary increases in underwater sound levels during construction. Piles will be driven with an impact hammer daily with a maximum duration of 1.5 hours throughout a day. Coastal pelagic, Pacific coast groundfish, and Pacific coast salmon EFH present within this threshold will be exposed to detectable noise in the water column above the 183 dB SEL_{CUM} threshold out to a distance of 541 meters. Pacific coast groundfish and salmon EFH will be exposed to noise above the injurious threshold as these distances would extend over existing eelgrass shoreward of the project area.

Sound could also occur with the interrelated seaplane and vessel use via engine operation. Engine noise from support vessels is a low frequency sound which will extend throughout the action area but is not expected to alter the suitability of the migratory pathway from the baseline condition, and the habitat is expected to continue to function with a comparable level of safe passage.

Mitigation

The proposed project will have temporary and permanent effects on EFH water bottoms and water columns. These effects culminate in short-term (construction-related) and long-term adverse effects on Pacific Coast groundfish, coastal pelagic species, and Pacific Coast salmon EFH. The proposed action incorporates a number of minimization measures to avoid, reduce, and minimize the adverse effects of the action on EFH. The Navy has not proposed to offset any long term impacts of this structure to designated EFH. NMFS ran the Habitat Equivalency Analysis and preliminarily determined the Navy would need 0.486 DSAYs to offset the impacts to EFH.

Summary

Table 12. Programmatic impacts to EFH.

Pacific Coast Groundfish	All waters and substrate in areas less than or equal to 3,500 m to mean higher high water level or the upriver extent of saltwater intrusion Seamounts in depth greater than 3,500 m as mapped in the EFPH assessment geographic information system	HAPC: Estuaries, canopy kelp, seagrass, rocky reefs, and "areas of interest"
Migratory Pathway Obstruction/Shading	May adversely affect	May adversely affect
Forage, Cover, and Predation	May adversely affect	May adversely affect
Water Quality	May adversely affect	May adversely affect
Benthic Communities	May adversely affect	May adversely affect
Hydroacoustics	May adversely affect	May adversely affect

Pacific coast groundfish species are considered sensitive to overfishing, the loss of habitat, and reduction in water and sediment quality.

Pacific Coast Salmon Species	All waters from the ocean extent of the EEZ to the shore, and inland up to all freshwater bodies occupied of historically accessible to salmon in Alaska, Washington, Oregon, Idaho, and California	HAPC: Marine and Estuarine Submerged Aquatic Vegetation
Migratory Pathway Obstruction/Shading	May adversely affect	May adversely affect
Effects on Forage, Cover, and Predation	May adversely affect	May adversely affect
Water Quality	May adversely affect	May adversely affect
Benthic Communities	May adversely affect	May adversely affect
Hydroacoustic	May adversely affect	May adversely affect

Pacific salmon EFH is primarily affected by the loss of suitable spawning habitat, barriers to fish migration (habitat access), reduction in water quality and sediment quality, changes in estuarine hydrology, and decreases in prey food source

Coastal Pelagic Species	All marine and estuarine waters above the thermocline from the shoreline offshore to 200 nm offshore	HAPC: None
Migratory Pathway Obstruction/Shading	No Effect	NA

Coastal Pelagic Species	All marine and estuarine waters above the thermocline from the shoreline offshore to 200 nm offshore	HAPC: None
Effects on Forage, Cover, and Predation	May adversely affect	NA
Water Quality	May adversely affect	NA
Benthic Communities	May adversely affect	NA
Hydroacoustic	May adversely affect	NA

Coastal pelagic species are considered sensitive to overfishing, loss of habitat, reduction in water and sediment quality, and changes in marine hydrology

3.3 Essential Fish Habitat Conservation Recommendations

The NMFS believes that these conservation recommendation will limit the effects of the proposed action on EFH. NMFS recommends the following measures as necessary to avoid, mitigate, or offset the impact of the proposed action on EFH. The conservation recommendations do include subset of the ESA terms and conditions. However, they are an independent value and requirement to the EFH under the MSA.

1. The Navy should provide sufficient mitigation to offset the impacts to EFH from the continued adverse effects resulting from the presence of all 831 piles throughout Puget Sound.
2. The Navy should:
    a. Coordinate annually with NMFS staff in the region to plan activities for the year and ensure no changes in population structure or occurrences will cause an increased exposure managed fish stocks
    b. Provide to NOAA a list of proposed activities and timing for said activities
        i. Develop with NOAA an acoustic monitoring plan for a subset of the year's anticipated projects and acquire approval from NOAA in writing of the plan before work is carried out.
3. The Navy should:
    a. Conduct all pile driving activities (vibratory and impact) during the approved forage fish work window: July 16–October 14
    b. Utilize vibratory pile driving whenever sediment conditions allow.
4. The Navy should:
    a. Utilize grating instead of solid decking wherever feasible on replacement and maintained structures
    b. Do not allow barges to arrive on site early or stay past completion of work.
5. The Navy should:
    a. Ensure that a monitoring report identifying any incidental take associated with project activities. The report shall include a description of construction activities conducted and duration of activities to ensure take was not exceeded. The report shall be submitted to NMFS' offices in Lacey, Washington, within 6 months of completion of construction. The report shall summarize the compliance with the

project description and conservation measures and the level of exempted incidental take during the implementation of the project that year.

    i. The report shall include the following:
        1. Number and pile type installed
        2. Dates of construction activities
        3. Number of strikes and duration it took to drive each pile
        4. All reports shall be sent to NMFS Regional Office, Oregon Washington Coastal Offices, Attention: (Conrad Newell, 510 Desmond Dr. SE, Lacey, WA 98115), As well as NOAA's reporting system (projectreports.wcr@noaa.gov).

b. Where an SAV survey has not been completed within 5 years of any year's anticipated work a SAV survey will be completed. For example; anticipated work in 2021 would be able to use surveys dating back to 2016.
    i. A single SAV survey once complete will be valid for the entire duration of the programmatic for that specific location.
    ii. Surveys must be completed in spring and summer months.
    iii. All reports shall be sent to NMFS Regional Office, Oregon Washington Coastal Area Offices: (projectreports.wcr@noaa.gov).
    iv. The Navy will provide the contractor with plan sheets showing eelgrass boundaries. The following restrictions will apply to areas designated as having eelgrass and/or kelp:
        1. Construction barges will avoid grounding in eelgrass beds during construction activities.
        2. Shallow draft, lower horsepower tugboats will be used in the nearshore area and for extended operations in areas shallower than 40 feet below MLLW, where feasible.
        3. Construction barges will avoid shading eelgrass and/or kelp beds

6. Provide for either onsite or through a third party appropriate habitat restoration and enhancement activities to offset the adverse habitat impacts resulting from continued the Zelatched Point pier and the operations associated with it.
7. Plant woody vegetation along the perimeter of all overwater structures, where feasible, to provide cover and food drop.
8. Remove all debris, trash, and vessel related material below and next to structures that service, repair and paint any vessels that have accumulated from previous historic use.
9. Utilize only pile driving technology that do not produce cumulatively harmful sound levels.
10. Monitor salmonid, coastal pelagic species and ground fish presence and use of under pier areas to identify impediments for fish movement.
11. The Navy should use grating instead of solid decking where feasible.
12. The Navy should reduce, dim, or turn off nighttime lighting on all overwater structure when not necessary for operations.
13. The Navy should continue to work with NMFS and other pertinent natural resource agencies to develop a mitigation plan that will offset impacts to EFH at all of their facilities with Puget Sound.
14. The Navy should offset and mitigate the effects of the continued presence and operation of Zelatched Point pier, currently estimated at 0.486 DSAYs.

15. The Navy should continue to implement and review its INRMP with coordination and approval from NOAA to protect, restore and recover species and habitats occurring among and within DOD lands.

3.4 Statutory Response Requirement

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

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

3.5 Supplemental Consultation

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

4. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

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

4.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users of this opinion are the U.S. Navy and NOAA's Office of Protected Resources. Other interested users could include Army Corps of Engineers, and the Hood Canal Coordinating Council. Individual copies of this opinion were provided to the U.S. Navy and NOAA's Office of Protected Resource. The format and naming adheres to conventional standards for style.

4.2 Integrity

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

4.3 Objectivity

Information Product Category: Natural Resource Plan

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

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

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

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

5. REFERENCES

Abatzoglou, J.T., Rupp, D.E. and Mote, P.W. 2014. Seasonal climate variability and change in the Pacific Northwest of the United States. Journal of Climate 27(5): 2125-2142.

Abbott, R., E. Bing-Sawyer, and R. Blizard. 2002. Assessment of Pile Driving Impacts on the Sacramento Blackfish (*Orthodon Microlepidotus*). Caltrans.

Able, K.W., J.P. Manderson, and A.L. Studholme. 1998. The distribution of shallow water juvenile fishes in an urban estuary: The effects of manmade structures in the lower Hudson River. *Estuaries*. 21:731-744.

Adams, J., Kaplan, I.C., Chasco, B., Marshall, K.N., Acevedo-Gutiérrez, A. and Ward, E.J., 2016. A century of Chinook salmon consumption by marine mammal predators in the Northeast Pacific Ocean. *Ecological informatics*, *34*, pp.44-51.

Ali, M.A. 1959. The Ocular Structure, Retinomotor and Photo-Behavioral Responses of Juvenile Pacific Salmon. *Canadian Journal of Zoology*. 37.

Ames, J., G. Graves, and C. Weller, editors. 2000. Summer chum salmon conservation initiative: an implementation plan to recovery summer chum in the Hood Canal and Strait of Juan de Fuca region. Washington Department of Fish and Wildlife and Point-No-Point Treaty Tribes.

Anchor QEA. (2012). Eelgrass survey data report, Naval Base Kitsap, Bangor, P-834, SSN Pier Extension and Ship Support Building. Prepared by Anchor QEA, LLC, Seattle, WA, on behalf of KPFF Consulting Engineers. Prepared for Naval Base Kitsap Bangor, Bangor, WA. November 2012.

Anderson, J.J., E. Gurarie, and R.W. Zabel. 2005. Mean free-path length theory of predator-prey interactions: Application to juvenile salmon migration. *Ecological Modelling*. 186:196-211.

Army Corp of Engineers, 2012. Approved Work Windows for Fish Protection for All Marine/Estuarine Areas excluding The Mouth of the Columbia River (Baker Bay) By Tidal Reference Area. https://www.nws.usace.army.mil/Portals/27/docs/regulatory/ESA%20forms%20and%20templates/Marine%20Fish%20Work%20Windows%20(8-14-12).pdf

Atchison, D., K. Potter, and L. Severson. 2006. Design Guidelines for Stormwater Bioretention Facilities. University of Wisconsin–Madison Civil & Environmental Engineering.

Atilla, N., M.A. Wetzel, and J.W. Fleeger. (2003). Abundance and colonization potential of artificial hard substrate-associated meiofauna. Journal of Experimental Marine Biology and Ecology. 287:273-287.

Bain, D. 1990. Examining the validity of inferences drawn from photo-identification data, with special reference to studies of the killer whale (*Orcinus orca*) in British Columbia. Report of the International Whaling Commission, Special Issue 12:93- 100.

Baird, R.W. 2000. The killer whale: foraging specializations and group hunting. Pages 127- 153 in J. Mann, R.C. Connor, P.L. Tyack, and H.Whitehead, editors. Cetacean societies: field studies of dolphins and whales. University of Chicago Press, Chicago, Illinois.

Barlow, J., J. Calambokidis, E.A. Falcone, C.S. Baker, A.M. Burdin, P.J. Clapham, J.K.B. Ford, C.M. Gabriele, R. LeDuc, D.K. Mattila, T.J. Quinn, L. Rojas-Bracho, J.M. Straley, B.L. Taylor, J. Urban-R., P. Wade, D. Weller, B. Witteveen, and M. Yamaguchi. 2011. Humpback whale abundance in the North Pacific estimated by photographic capture-recapture with bias correction from simulation studies. . Marine Mammal Science. 27(4):793-818.

Beamer, E.M., A McBride, C. Greene, R. Henderson, G. Hood, K. Wolf, K. Larsen, C. Rice, and K Fresh. 2005. Delta and nearshore restoration for the recovery of wild Skagit Chinook salmon: Linking estuary restoration to wild Chinook salmon populations. Skagit River System Cooperative.

Beamish, R.J., C. Mahnken, and C.M. Neville. 2004. Evidence That Reduced Early Marine Growth Is Associated with Lower Marine Survival of Coho Salmon. Transactions of the American Fisheries Society. 133:26-33.

Beddington, J.R., and W.K. de la Mare. 1985. Marine mammal-fishery interactions: modelling and the Southern Ocean. Pages 94- 105 in R. J. H. B. J.R. Beddington, D.M. Lavigne, editor. Marine Mammals and Fisheries. George Allen & Unwin, London.

Bigg, M.A. and I. Fawcett. 1985. Two biases in diet determination of northern fur seals (Callorhinus ursinus). Pages 284-291 in Beddington, J.R., R.J.H. Beverton, and D.M. Lavigne, eds. Marine mammals and fisheries. George Allen and Unwin, London

Bigg, M., G. Ellis, P. Cottrell, and L. Milette. 1990. Predation by harbour seals and sea lions on adult salmon in Comox Harbour and Cowichan Bay, British Columbia. Can. Tech. Rep. Fish. Aquat. Sci. 1769, 31 p.

Bigg, M.A., P.F. Olesiuk, G.M. Ellis, J.K.B. Ford, and K.C. Balcomb. 1990. Social organization and genealogy of resident killer whales (*Orcinus orca*) in the coastal waters of British Columbia and Washington State. Report of the International Whaling Commission, Special Issue 12:383-398.

Bonefeld-Jørgensen, E. C., H. R. Andersen, T. H. Rasmussen, and A. M. Vinggaard. 2001. Effect of highly bioaccumulated polychlorinated biphenyl congeners on estrogen and androgen receptor activity. Toxicology 158:141–153.

Bradford, A. L, D. W. Weller, A. E. Punt, Y. V. Ivashchenko YV, A. M. Burdin, G. R. VanBlaricom, and R. L. Brownell. 2012. Leaner leviathans: body condition variation in critically endangered whale population. J. Mammal. 93(1):251-266.

Brown, R., and B. Mate. 1983. Abundance, movements and feeding habits of harbor seals, *Phoca vitulina*, at Netarts and Tillamook Bays, Oregon. Fish. Bull., U.S., 81:291301.

Burgess, W.C., S.B. Blackwell, and R. Abbott. 2005. Underwater Acoustic Measurements of Vibratory Pile Driving at the Pipeline 5 crossing in the Snohomish River, Everett, Washington. Emergency Water Transmission Pipeline Repairs Construction Project – City of Everett Project No. UP 3148, URS project No. 33756899. Greeneridge Report 322-2. February 3, 2005. 40 pp.

California Department of Transportation (CalTrans). 2009. Final Technical Guidance for Assessment and Mitigation of the Hydroacoustic Effects of Pile Driving on Fish. Including the Oct 2012 update to the Appendix 1 - Compendium of Pile Driving Sound Data. Prepared for: California Department of Transportation 1120 N Street Sacramento, CA 94274. Prepared by: ICF Jones & Stokes 630 K Street, Suite 400 Sacramento, CA 95818 And: Illingworth and Rodkin, Inc. 505 Petaluma Blvd. South Petaluma, CA 94952. February 2009. 367 pp.

Carretta, J.V., K. A. Forney, E. M. Oleson, D. W. Weller, A. R. Lang, J. Baker, M. M. Muto, B. Hanson, A. J. Orr, H. Huber, M. S. Lowry, J. Barlow, J. E. Moore, D. Lynch, L. Carswell, and R. L. Brownell Jr. 2017. U.S. Pacific Marine Mammal Stock Assessments: 2016. NOAA-TM-NMFS-SWFSC-577. 414 p.

Celedonia, M.T., R.A. Tabor, S. Sanders, S. Damm, D.W. Lantz, T.M. Lee, Z. Li, J.-M. Pratt, B.E. Price, and L. Seyda. 2008a. Movement and Habitat Use of Chinook Salmon Smolts, Northern Pikeminnow, and Smallmouth Bass Near the SR 520 Bridge, 2007 Acoustic Treacking Study. U.F.a.W. Service, editor. 139.

Celedonia, M.T., R.A. Tabor, S. Sanders, D.W. Lantz, and I. Grettenberger. 2008b. Movement and Habitat Use of Chinook Salmon Smolts and Two Predatory Fishes in Lake Washington and the Lake Washington Ship Canal, Western WS Fish and Wildlife Office Lacey, WA.

Center for Whale Research (CWA) Research. https://www.whaleresearch.com/. Accessed on 8/13/2018.

Chasco, B.E., Kaplan, I.C., Thomas, A.C., Acevedo-Gutiérrez, A., Noren, D.P., Ford, M.J., Hanson, M.B., Scordino, J.J., Jeffries, S.J., Marshall, K.N. and Shelton, A.O., 2017. Competing tradeoffs between increasing marine mammal predation and fisheries harvest of Chinook salmon. *Scientific reports*, *7*(1), p.15439.

Chew, K.P., and A.P. Ma. (1987). Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Pacific Northwest): common littleneck clam. USFWS Biological Report 82(11.78), USACE TR EL-82-4. Prepared by University of Washington School of Fisheries Division of Fishery Science and Aquaculture, Seattle, WA. Prepared for U.S. Dept. of the Interior, Fish and Wildlife Service, Research and Development, National Wetlands Research Center, Washington, DC; Coastal Ecology Group, Waterways Experiment Station, U.S. Army Corps of Engineers, Vicksburg, MS. August 1987.

Calambokidis, J., E.A. Falcone, T.J. Quinn, A.M. Burdin, P.J. Clapham, J.K.B. Ford, C.M. Gabriele, R. LeDuc, D.K. Mattila, L. Rojas-Bracho, J.M. Straley, B.L. Taylor, J. Urbán-Ramirez, R.D. Weller, B.H. Witteveen, M. Yamaguchi, A. Bendlin, D. Camacho, K. Flynn, A. Havron, J. Huggins, and N. Maloney. 2008. SPLASH: Structure of Populations, Levels of Abundance and Status of Humpback Whales in the North Pacific. Cascadia Research.

Clutton-Brock, T.H. 1998. Reproductive success. Studies of individual variation in contrasting breeding systems. University of Chicago Press; Chicago, Illinois.

Cohen, A.N., C.E. Mills, H. Berry, M.J. Wonham, B. Bingham, B. Bookheim, J.T. Carlton, J.W. Chapman, J.R. Cordell, L.H. Harris, T. Klinger, A. Kohn, C.C. Lambert, G. Lambert, K. Li, D. Secord, and J. Toft. (1998). Report of the Puget Sound Expedition, September 8□16, 1998; A rapid assessment survey of nonindigenous species in the shallow waters of Puget Sound. Prepared for the Washington State Department of Natural Resources, Olympia WA, and United States Fish and Wildlife Service, Olympia WA.

Cottrell, P.E., A.W. Trites, and E.H. Miller. 1996. Assessing the use of hard parts in feces to identify harbour seal prey: results of captive-feeding trials. Canadian Journal of Zoology 74:875-880.

Crozier, L.G., Hendry, A.P., Lawson, P.W., Quinn, T.P., Mantua, N.J., Battin, J., Shaw, R.G. and Huey, R.B., 2008. Potential responses to climate change in organisms with complex life histories: evolution and plasticity in Pacific salmon. *Evolutionary Applications* 1(2): 252-270.

Crozier, L. G., M. D. Scheuerell, and E. W. Zabel. 2011. Using Time Series Analysis to Characterize Evolutionary and Plastic Responses to Environmental Change: A Case Study of a Shift Toward Earlier Migration Date in Sockeye Salmon. *The American Naturalist* 178 (6): 755-773.

Daan, S., C. Deerenberg and C. Dijkstra. 1996. Increased daily work precipitates natural death in the kestrel. The Journal of Animal Ecology 65(5): 539 - 544.

Daly, E.A., Brodeur, R.D. and Weitkamp, L.A., 2009. Ontogenetic shifts in diets of juvenile and subadult coho and Chinook salmon in coastal marine waters: important for marine survival? *Transactions of the American Fisheries Society*, *138*(6), pp.1420-1438.

Darnerud, P. O. 2003. Toxic effects of brominated flame retardants in man and in wildlife Environment. 29:841–853.

Darnerud, P. O. 2008. Brominated flame retardants as possible endocrine disrupters. Int. J. Androl. 31:152–160.

Da Silva, J. and J.D. Neilson. 1985. Limitations of using otoliths recovered in fecal samples to estimate prey consumption in seals. Can. J. Fish. Aquat. Sci., 42:1439-1442

Davidson, J., J Bebak, and P. Mazik. 2009. The effects of aquaculture production noise on the growth, condition factor, feed conversion, and survival of rainbow trout, Oncorhynchus mykiss. Aquaculture. Volume 288, Issues 3–4, 20 March 2009, Pages 337–343 http://www.sciencedirect.com/science/article/pii/S0044848608008934

Deagle, B.E., D.J. Tollit, S.N. Jarman, M.A. Hindell, A.W. Trites, and N.J. Gales. 2005. Molecular scatology as a tool to study diet: analysis of prey DNA in scats from captive Steller sea lions. Mol. Ecol. 14:1831-1842.

de Boer, J., K. de Boer, and J. P. Boon. 2000. Toxic effects of brominated flame retardants in man and wildlife. Environ. Int. 29:841–853.

de Swart, R. L., P. S. Ross, J. G. Vos, and A.Osterhaus. 1996. Impaired immunity in habour seals (*Phoca vitulina*) exposed to bioaccumulated environmental contaminants: Review of long-term feeding study. Environ. Health Perspect. 104:823–828.

Dernie, K.M., M.J. Kaiser, E.A. Richardson, and R.M. Warwick. 2003. Recovery of soft sediment communities and habitats following physical disturbance. Journal of experimental Marine Biology and Ecology 285-286: 415-434.

Drake J.S., E.A. Berntson, J.M. Cope, R.G. Gustafson, E.E. Holmes, P.S. Levin, N. Tolimieri, R.S. Waples, S.M. Sogard, and G.D. Williams. 2010. NOAA Technical Memorandum NMFS59 NWFSC-108. Status of five species of rockfish in Puget Sound, Washington: Bocaccio (*Sebastes paucispinis*), Canary Rockfish (*Sebastes pinniger*), Yelloweye Rockfish (*Sebastes ruberrimus*), Greenstriped Rockfish (*Sebastes elongatus*) and Redstripe Rockfish (*Sebastes proriger*). U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-108, 234 p.

Dominguez, F., E. Rivera, D. P. Lettenmaier, and C. L. Castro. 2012. Changes in Winter Precipitation Extremes for the Western United States under a Warmer Climate as Simulated by Regional Climate Models. *Geophysical Research Letters* 39(5).

Doney, S. C., M. Ruckelshaus, J. E. Duffy, J. P. Barry, F. Chan, C. A. English, H. M. Galindo, J. M. Grebmeier, A. B. Hollowed, N. Knowlton, J. Polovina, N. N. Rabalais, W. J. Sydeman, and L. D. Talley. 2012. Climate Change Impacts on Marine Ecosystems. *Annual Review of Marine Science* 4: 11-37.

Dorn, P., and P.N. Best. 2005. Integration of Joint City of Bainbridge Island/Suquamish Tribal Beach Seining Results into Shoreline Management and Salmon Recovery Efforts in Kitsap County, Washington. Proceedings of the 2005 Puget Sound Georgia Basin Research Conference.

Duffy, E.J., and D.A. Beauchamp. 2011. Rapid growth in the early marine period improves the marine survival of Chinook salmon (Oncorhynchus tshawytscha) in Puget Sound, Washington. *Canadian journal of fisheries and aquatic sciences/Journal canadien des sciences halieutiques et aquatiques*. 68:232-240.

Duffy, E. J., Beauchamp, D. A., Sweeting, R. M., Beamish, R. J., & Brennan, J. S. (2010). Ontogenetic diet shifts of juvenile Chinook salmon in nearshore and offshore habitats of Puget Sound. *Transactions of the American Fisheries Society*, *139*(3), 803-823.

Durban, J., H. Fearnbach, D. Ellifrit, and K. Balcomb. 2009. Size and Body Condition of Southern Resident Killer Whales. Contract report to National Marine Fisheries Service, Order No. AB133F08SE4742, February 2009.

Erbe, C. (2002). Underwater noise of whale-watching boats and potential effects on killer whales (Orcinus orca), based on an acoustic impact model. *Marine mammal science*, *18*(2), 394-418.

Erickson, A. W. 1978. Population studies of killer whales (*Orcinus orca*) in the Pacific Northwest: a radio-marking and tracking study of killer whales. U.S. Marine Mammal Commission, Washington, D.C.

Everitt, R. D., Gearin, P. J., Skidmore, J. S., & DeLong, R. L. (1981). Prey items of harbor seals and California sea lions in Puget Sound, Washington. *The Murrelet*, *62*(3), 83-86.

Fagen, W.F. and E.E. Holmes. 2006. Quantifying the extinction vortex. Ecology Letters 9:51-60.

Fearnbach, H., J. W. Durban, D. K. Ellifrit and K. C. Balcomb III. 2018. Using aerial photogrammetry to detect changes in body condition in endangered Southern Resident killer whales. Endangered Species Research.

Feist, B.E., J.J. Anderson, and R. Miyamoto. 1996. Potential impacts of pile driving on juvenile pink (Oncorhynchus gorbuscha) and chum (O. keta) salmon behavior and distribution. Fisheries Research Institute Report No. FRI-UW-9603:66 pp.

Feely, R.A., T. Klinger, J.A. Newton, and M. Chadsey (editors). 2012. Scientific summary of ocean acidification in Washington state marine waters. NOAA Office of Oceanic and Atmospheric Research Special Report.

FHWG. 2008. Agreement in Principal for Interim Criteria for Injury to Fish from Pile Driving Activities. Memorandum of Agreement between NOAA Fisheries' Northwest and Southwest Regions; USFWS Regions 1 and 8; California, Washington, and Oregon Departments of Transportation; California Department of Fish and Game; and Federal Highways Administration. Fisheries Habitat Working Group. June 12.

Fisheries and Oceans Canada. 2013. Recovery Strategy for the North Pacific Humpback Whale (Megaptera novaeangliae) in Canada. Species at Risk Act Recovery Strategy Series. Fisheries and Oceans Canada, Ottawa. x + 67 pp.

Fonnum, F., E. Mariussen, and T. Reistad. 2006. Molecular mechanisms involved in the toxic effects of polychlorinated biphenyls (PCBs) and brominated flame retardants (BFRs). J. Toxicol. Environ. Health A 69:21–35.

Ford, J. K. B. 2000. Killer whales: the natural history and genealogy of Orcinus orca in British Columbia and Washington State. Vancouver, British Columbia, UBC Press, 2nd Edition.

Ford, J.K.B. and G.M. Ellis. 2006. Selective foraging by fish-eating killer whales Orcinus orca in British Columbia. Marine Ecology Progress Series 316:185-199.

Ford J.K.B., A.L. Rambeau, R.M. Abernethy, M.D. Boogaards, L.M. Nichol, and L.D. Spaven. 2009. An Assessment of the Potential for Recovery of Humpback Whales off the Pacific Coast of Canada. DFO Can. Sci. Advis. Sec. Res. Doc. 2009/015. iv + 33 p.

Ford, J. K., Ellis, G. M., Olesiuk, P. F., & Balcomb, K. C. (2010). Linking killer whale survival and prey abundance: food limitation in the oceans' apex predator?. *Biology letters*, *6*(1), 139-142.

Ford, M.J.e. 2011. Status review update for Pacific salmon and steelhead listed under the Endangered Species Act: Pacific Northwest. 281 p.

Ford, M. J., M. B. Hanson, J. Hempelmann, K. L. Ayres, C. K. Emmons, G. S. Schorr, R. W. Baird, K. C. Balcomb, S. K. Wasser, K. M. Parsons, K. Balcomb-Bartok. 2011. Inferred Paternity and Male Reproductive Success in a Killer Whale (*Orcinus orca*) Population. Journal of Heredity. Volume 102 (Issue 5), pages 537 to 553.

Ford, M. J. 2013. Status review update of Southern Resident killer whales. U.S. Dept. of Commerce, Northwest Fisheries Science Center.41p. Available at (Acessed July 2015): http://www.westcoast.fisheries.noaa.gov/publications/protected_species/marine_mammals/killer_whales/srkw_status_revew_update_final_july_31_2013.pdf

Fresh, K.L. 2006. Juvenile Pacific Salmon in Puget Sound. *In* Valued Ecosystem Components Report Series.

Frierson, T., W Dezan, D. Lowry, L. LeClair, L. Hillier, R. Pacunski, J. Blaine, A. Hennings, A. Phillips, P. Campbell. Final Assessment of Threatened and Endangered Marine and Anadromous Fish Presence Adjacent to the NAVBASE Kitsap Bangor: 2015-16 Beach Seine Survey Results. The WDFW Marine Fish Science Unit.

Fish and Wildlife Service and the National Marine Fisheries Service. 1998. Endangered Species Act Section 7 Consultation Handbook. Fish and Wildlife Service and the National Marine Fisheries Service. Endangered Species Act Section 7 Consultation Hanbook. 315p.

Gamel, C.M., R.W. Davis, J.H.M. David, M.A. Meyer and E. Brandon. 2005. Reproductive energetics and female attendance patterns of Cape fur seals (*Arctocephalus pusillus pusillus*) during early lactation. American Midland Naturalist 153(1): 152-170

Gaydos, J.K., and S. Raverty. 2007. Killer Whale Stranding Response, August 2007 Final Report. Report under UC Davis Agreement No. C 05-00581 V, August 2007.

Gearin, P. J., S. J. Jeffries, M. E. Gosho, J. R. Thomason, R. DeLong, M. Wilson, and S.R. Melin. 1996. Report on capture and marking of California sea lions in Puget Sound, Washington during 199495: Distribution, abundance and movement patterns. NMFS-NWR Report, 26 p. (Available from Northwest Regional Office, Natl. Mar. Fish. Serv., NOAA, 7600 Sand Point Way NE, Seattle, WA 98115.)

Geraci, J. R., and D. J. St. Aubin. 1990. Sea mammals and oil: Confronting the risks. Academic Press, San Diego, CA.

Gilpin, M. E., and M. E. Soulé. 1986. Minimum viable populations: Processes of species extinction. Conservation biology: the science of scarcity and diversity. 19-34.

Glick, P., J. Clough, and B. Nunley. 2007. Sea-Level Rise and Coastal Habitats in the Pacific Northwest: An analysis for Puget Sound, southwestern Washington, and northwestern Oregon. National Wildlife Federation, Seattle, WA.

Goode, J.R., Buffington, J.M., Tonina, D., Isaak, D.J., Thurow, R.F., Wenger, S., Nagel, D., Luce, C., Tetzlaff, D. and Soulsby, C., 2013. Potential effects of climate change on streambed scour and risks to salmonid survival in snow-dominated mountain basins. *Hydrological Processes* 27(5): 750-765.

Goodwin, C.L., and B. Pease. (1989). Species profiles: life histories and environmental requirements of coastal fish and invertebrates (Pacific Northwest): Pacific geoduck clam. USFWS Biological Report 82(11); USACE TR EL-82-4. U.S. Army Corps of Engineers, Coastal Ecology Group, Waterways Experiment Station, Vicksburg, MS; U.S. Fish and Wildlife Service, Research and Development, National Wetlands Research Center, Washington, DC. December 1989.

Gordon, J., and A. Moscrop. 1996. Underwater noise pollution and its significance for whales and dolphins. Pages 281-319 in M.P. Simmonds and J.D. Hutchinson, editors. The conservation of whales and dolphins: science and practice. John Wiley and Sons, Chichester, United Kingdom.

Graham, A.L., and S.J. Cooke. 2008. The effects of noise disturbance from various recreational boating activities common to inland waters on the cardiac physiology of a freshwater fish, the largemouth bass (Micropterus salmoides). *Aquatic Conservation: Marine and Freshwater Ecosystems*. 18:1315-1324.

Grette, G.B. 1985. Fish monitoring during pile driving at Hiram H. Chittenden Locks, August-September 1985. Seattle District Army Corps of Engineers. Evans-Hamilton, Inc

Gustafson, R. G., L. Weitkamp, YW. Lee, E. Ward, K. Somers. V. Tuttle, and J. Jannot. 2016. Status Review Update of Eulachon (*Thaleichthys pacificus*) Listed under the Endangered Species Act: Southern Distinct Population Segment. US Department of Commerce, NOAA, Online at: http://www.westcoast.fisheries.noaa.gov/publications/status_reviews/other_species/eulachon/eulachon_2016_status_review_update.pdf

Haas, M.E., C.A. Simenstad, J.R. Cordell, D.A. Beauchamp, and B.S. Miller. 2002. Effects of Large Overwater Structures on Epibenthic Juvenile Salmon Prey Assemblages in Puget Sound, WA.

Halvorsen, M. B., Casper, B. M., Woodley, C. M., Carlson, T. J., and Popper, A. N. (2012). Threshold for onset of injury in Chinook salmon from exposure to impulsive pile driving sounds. PLoS One, 7(6), e38968.

Hanson, M. B., and C. K. Emmons. 2010. Annual Residency Patterns of Southern Resident Killer Whales in the Inland Waters of Washington and British Columbia. Revised Draft - 30 October 10. 11p.

Hanson, M. B., C. K. Emmons, and E. J. Ward. 2013. Assessing the coastal occurrence of endangered killer whales using autonomous passive acoustic recorders. The Journal of the Acoustical Society of America. 134(5): 3486–3495.

Harvey, James T. 1989. Assessment of errors associated with harbour-seal (Phoca vitulina) fecal sampling. Journal of Zoology 219:101-111.

Hastings, M.C., A.N. Popper, J.J. Finneran, and P. Lanford. 1996. Effects of low-frequency underwater sound on hair cells of the inner ear and lateral line of the teleost fish *Astronotus ocellatus*. Journal of the Acoustical Society of America, 99(3):1759–1766.

Hastings, M.C., and A.N. Popper. 2005. Effects of Sound on Fish. Prepared by Jones and Stokes for the California Department of Transportation.

Hattis, D., and B. Richardson. 1980. Noise, general stress responses, and cardiovascular disease processes: Review and reassessment of hypothesized relationships. EPA 550/9-80-101, U.S. Environmental Protection Agency, Washington, D.C.

Hauser, D.D.W., M.G. Logsdon, E.E. Holmes, G.R. VanBlaricom, R.W. Osborne. 2007. Summer distribution patterns of southern resident killer whales Orcinus orca: core areas and spatial segregation of social groups. Marine Ecology Progress Series 351:301-310.

Hay, D. E., McCarter, P. B., & Daniel, K. S. (2001). Tagging of Pacific Herring Clupea pallasi from 1936 1992: a review with comments on homing, geographic fidelity, and straying. *Canadian Journal of Fisheries and Aquatic Sciences*, *58*(7), 1356-1370.

Heiser, D.W., and E.L. Finn 1970. Observations of Juvenile Chum and Pink Salmon in Marina and Bulkheaded Areas. State of Washington Department of Fisheries.

Herder, M. J. 1983. Pinniped fishery interactions in the Klamath River system, July 1979 to October 1980. Southwest Fish. Cent., Admin. Rep. LJ8312C, 71 p. (Available from Southwest Fisheries Science Center, Natl. Mar. Fish. Serv., NOAA, P.O. Box 271, La Jolla, CA 92038.)

Hilborn, R., S. P. Cox, F. M. D. Gulland, D. G. Hankin, N. T. Hobbs, D. E. Schindler, A. W. Trites. 2012. The effects of salmon fisheries on Southern Resident killer whales: Final report of the Independent Science Panel. Prepared with the assistance of D. R. Marmorek and A. W. Hall, ESSA Technologies Ltd., Vancouver, BC. National Marine Fisheries Service, Seattle, WA, and Fisheries and Oceans Canada, Vancouver, BC.

Hochachka, W.M. 2006. Unequal lifetime reproductive success, and its implication for small isolated populations. Pages: 155-173. In: Biology of small populations: the song sparrows of Mandarte Island. Edited by J.N.M. Smith, A.B. Marr, L.F. Keller and P. Arcese. Oxford University Press; Oxford, United Kingdom.

Hood Canal Bridge Assessment Team. 2016. Hood Canal Bridge Ecosystem Impact Assessment Plan: Framework and Phase 1 Details. Long Live the Kings, Seattle, WA.

Hood Canal Coordinating Council. 2005. Hood Canal & Eastern Strait of Juan de Fuca summer chum salmon recovery plan. Hood Canal Coordinating Council. Poulsbo, Washington.

Hoyt, E. 2001. Whale watching 2001: worldwide tourism numbers, expenditures, and expanding socioeconomic benefits. International Fund for Animal Welfare, Yarmouth, Massachusetts.

Hydroacoustic Working Group, F. 2008. Agreement in Principle for Interim Criteria for Injury to Fish from Pile Driving Activities.

ISAB (editor). 2007. Climate change impacts on Columbia River Basin fish and wildlife. *In:* Climate Change Report, ISAB 2007-2. Independent Scientific Advisory Board, Northwest Power and Conservation Council. Portland, Oregon.

Intergovernmental Panel on Climate Change (IPCC). 2014. Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp.

Isaak, D.J., Wollrab, S., Horan, D. and Chandler, G., 2012. Climate change effects on stream and river temperatures across the northwest US from 1980–2009 and implications for salmonid fishes. *Climatic Change* 113(2): 499-524.

Jarvela-Rosenberger, A.L., M. MacDuffee, A.G.J. Rosenberger, and P.S. Ross. 2017. Oil spills and marine mammals in British Columbia, Canada: Development and application of a risk-based conceptual framework. Arch. Environ. Contam. Toxicol. 73:131-153.

Joblon, M. J., M. A. Pokra, B. Morse, C. T. Harry, K. S. Rose, S. M. Sharp, M. E. Niemeyer, K. M. Patchett, W. B. Sharp, and M. J. Moore. 2014. Body condition scoring system for delphinids based on short-beaked common dolphins (*Delphinus delphis*). J Mar Anin Ecol 7(2):5-13.

Johnson, D.H., and T.A. O’Neil. (2001). Wildlife-habitat relationships in Washington and Oregon. Corvallis, OR: Oregon State University Press. Karl, T.R., J. Melillo, and T.e. Peterson. 2009. Global Climate Change Impacts in the United States. *Cambridge University Press*.

Krahn, M.M., P.R. Wade, S.T. Kalinowski, M.E. Dahlheim, B.L. Taylor, M.B. Hanson, G.M. Ylitalo, R.B. Angliss, J.E. Stein, and R.S. Waples. 2002. Status review of Southern Resident killer whales (Orcinus orca) under the Endangered Species Act, U.S. Dept. of Commerce, NOAA Tech. Memo., NMFS-NWFSC- 54, 133p.

Krahn, M.M., M.J. Ford, W.F. Perrin, P.R. Wade, R.B. Angliss, M.B. Hanson, B.L. Taylor, G.M. Ylitalo, M.E. Dahlheim, J.E. Stein, and R.S. Waples. 2004. 2004 status review of Southern Resident killer whales (*Orincus orca*) under the Endangered Species Act, U.S. Dept. of Commerce, NOAA Tech. Memo., NMFS-NWFSC-62, 73p.

Krahn, M.M., M.B. Hanson, R.W. Baird, R.H. Boyer, D.G. Burrows, C.K. Emmons, J.K.B. Ford, L.L. Jones, D.P. Noren, P.S. Ross, G.S. Schorr, and T.K. Collier. 2007. Persistent organic pollutants and stable isotopes in biopsy samples (2004/2006) from Southern Resident killer whales. Marine Pollution Bulletin 54:1903-1911.

Krahn, M.M., M.B. Hanson, G.S. Schorr, C.K. Emmons, D.G. Burrows, J.L. Bolton, R.W. Baird, and Gina Ylitalo. 2009. Effects of age, sex and reproductive status on persistent organic pollutant concentrations in “Southern Resident” killer whales. Marine Pollution Bulletin 58:1522-1529.

Kelty, R., and S. Bliven. 2003. Environmental and aesthetic impacts of small docks and piers. *In* Decision Analysis Series No. 22. N.C.O. Program, editor.

Kemp, P.S., M.H. Gessel, and J.G. Williams. 2005. Seaward migrating subyearling Chinook salmon avoid overhead cover. *Journal of Fish Biology*. 67:10.

Kunkel, K. E., L. E. Stevens, S. E. Stevens, L. Sun, E. Janssen, D. Wuebbles, K. T. Redmond, and J. G. Dobson. 2013. Regional Climate Trends and Scenarios for the U.S. National Climate Assessment: Part 6. *Climate of the Northwest U.S. NOAA Technical Report NESDIS 142-6*. 83 pp. National Oceanic and Atmospheric Administration, National Environmental Satellite, Data, and Information Service, Washington, D.C.

Lacy, R. C., R. Williams, E. Ashe, K. C. Balcomb III, L. J. N. Brent, C. W. Clark, D. P. Croft, D. A. Giles, M. MacDuffee, and P. C. Paquet. 2017. Evaluating anthropogenic threats to endangered killer whales to inform effective recovery plans. Scientific Reports. 7:14119. doi:10.1038/s41598-017-0.

Laughlin, J. 2004. Underwater Sound Levels Associated with Construction of the SR 240 Bridge on the Yakima River at Richland. Washington State Department of Transportation Office of Air Quality and Noise 15700 Dayton Avenue North, P.O. Box 330310 Seattle, WA 98133-9710. September 2004. 36 pp.

Lawson, P. W., Logerwell, E. A., Mantua, N. J., Francis, R. C., & Agostini, V. N. 2004. Environmental factors influencing freshwater survival and smolt production in Pacific Northwest coho salmon (*Oncorhynchus kisutch*). *Canadian Journal of Fisheries and Aquatic Sciences* 61(3): 360-373

Legler, J., and A. Brouwer. 2003. Are brominated flame retardants endocrine disruptors? Environ. Int. 29:879–885.

Lehmann, E. February 4, 2014. Research suggests that flooding from sea level rise will prove more costly than building barriers to protect coastlines. ClimateWire and Scientific American.

Levin, P.S. and Williams, J.G. 2002. Interspecific effects of artificially propagated fish: An additional conservation risk for salmon. Conservation Biology 16: 1581-1587.

London, J.M., M.M. Lance, and S.J. Jeffries. 2002. Observations of Harbor Seal Predation on Hood Canal Salmonids from 1998 to 2000. WDFW Publications. https://wdfw.wa.gov/publications/00429/

London, J. M., Ver Hoef, J. M., Jeffries, S. J., Lance, M. M., & Boveng, P. L. (2012). Haul-out behavior of harbor seals (Phoca vitulina) in Hood Canal, Washington. *PloS one*, *7*(6), e38180.

Love, M. S., M. Carr, and L. Haldorson. 1991. The ecology of substrate-associated juveniles of the genus Sebastes. Environmental Biology of Fishes. Volume 30, pages 225 to 243.

Lowry, Lloyd F., and K.J. Frost. 1985. Biological interactions between marine mammals and commercial fisheries in the Bering Sea. Pages 39-61 in R. J. H. B. J.R. Beddington, D.M. Lavigne, editor. Marine Mammals and Fisheries. George Allen & Unwin, London.

Lundin, J. I., R. L. Dills, G. M. Ylitalo, M. B. Hanson, C. K. Emmons, G. S. Schorr, J. Ahmad, J. A. Hempelmann, K. M. Parsons, and S. K. Wasser. 2015. Persistent organic pollutant determination in killer whale scat samples: Optimization of a gas chromatography/mass spectrometry method and application to field samples. Arch Environ Contam Toxicol. DOI 10.1007/s00244-015-0218-8.

Lundin, J. I., G. M. Ylitalo, R. K. Booth, B. Anulacion, J. A. Hempelmann, K. M. Parsons, D. A. Giles, E. A. Seely, M. B. Hanson, C. K. Emmons, and S. K. Wasser. 2016. Modulation in persistent organic pollutant concentration and profile by prey availability and reproductive status in Southern Resident killer whale scat samples. Environ. Sci. Technol. doi: 10.1021/acs.est6b00825.

Lusseau, D., D. E. Bain, R. Williams, and J. C. Smith. 2009. Vessel traffic disrupts the foraging behavior of southern resident killer whales *Orcinus orca.* Endangered Species Research. 6: 211-221.

Mantua, N., I. Tohver, and A. Hamlet. 2009. Impacts of Climate Change on Key Aspects of Freshwater Salmon Habitat in Washington State. In the Washington Climate Change Impacts Assessment: Evaluating Washington’s Future in a Changing Climate, edited by M. M. Elsner, J. Littell, L. Whitely Binder, 217-253. The Climate Impacts Group, University of Washington, Seattle, Washington.

Mantua, N., I. Tohver, and A. Hamlet. 2010. Climate change impacts on streamflow extremes and summertime stream temperature and their possible consequences for freshwater salmon habitat in Washington State. *Climatic Change* 102(1): 187-223.

Marshall, C. May 5, 2014. Massive Seawall May Be Needed to Keep New York City Dry. ClimateWire and Scientific American.

Matkin, C. O., M. J. Moore, and F. M. D. Gulland. 2017. Review of Recent Research on Southern Resident Killer Whales (SRKW) to Detect Evidence of Poor Body Condition in the Population. Report from The Killer Whale Health Assessment Workshop, March 6 and 7, 2017.

Matkin, C.O., E.L. Saulitis, G. M. Ellis, P. Olesiuk, S.D. Rice. 2008. Ongoing population- level impacts on killer whales *Orcinus orca* following the ‘Exxon Valdez’ oil spill in Prince William Sound, Alaska. Marine Ecology Progress Series. 356: 269-281.

McElhany, P. 2000. Estimating minimum viable population sizes for Pacific salmonids.

McFarlane, B.R., and E.C. North. 2002. Physiological ecology of juvenile chinook salmon (Oncorhynchus tshawytscha) at the southern end of their distribution, the San Francisco Estuary and Gulf of the Farallones, California. *Fisheries Bulletin*. 100:13.

McMahon, T.E., and G.F. Hartman. 1989. Influence of cover complexity and current velocity on winter habitat use by juvenile Coho salmon (Oncorhynchus kisutch). Canadian Journal of Fisheries and Aquatic Sciences 46: 1551–1557.

Melbourne, B. A., and A. Hastings. 2008. Extinction risk depends strongly on factors contributing to stochasticity. Nature. 454(7200): 100-103.

Meyer, J.L., M.J. Sale, P.J. Mulholland, and N.L. Poff. 1999. Impacts of climate change on aquatic ecosystem functioning and health. *JAWRA Journal of the American Water Resources Association* 35(6): 1373-1386.

Millikan, A. and D. Penttila. 1974. Puget Sound baitfish study, July 1, 1973-June 30, 1974. Washington Department of Fisheries Progress Report. 32 p

Mongillo, T.M., G.M. Ylitalo, L.D. Rhodes, S.M. O'Neill, D.P. Noren, M.B. Hanson. 2016. Exposure to a mixture of toxic chemicals: Implications to the health of endangered Southern Resident killer whales. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-X

Moore, M.E., B.A. Berejikian, and E.P. Tezak. 2010. Early marine survival and behavior of steelhead smolts through Hood Canal and the Strait of Juan de Fuca. Transactions of the American Fisheries Society 139: 49-61.

Moore, M.E., B.A. Berejikian, and E.P. Tezak. 2013. A Floating Bridge Disrupts Seaward Migration and Increases Mortality of Steelhead Smolts in Hood Canal, Washington State. *PloS one*. 8.

Mote, P.W., J.T. Abatzglou, and K.E. Kunkel. 2013. Climate: Variability and Change in the Past and the Future. In Climate Change in the Northwest: Implications for Our Landscapes, Waters, and Communities, edited by M.M. Dalton, P.W. Mote, and A.K. Snover, 41-58. Island Press, Washington, DC.

Mote, P.W, A. K. Snover, S. Capalbo, S.D. Eigenbrode, P. Glick, J. Littell, R.R. Raymondi, and W.S. Reeder. 2014. Ch. 21: Northwest. In Climate Change Impacts in the United States: The Third National Climate Assessment, J. M. Melillo, T.C. Richmond, and G.W. Yohe, Eds., U.S. Global Change Research Program, 487-513.

Mote, P.W., D.E. Rupp, S. Li, D.J. Sharp, F. Otto, P.F. Uhe, M. Xiao, D.P. Lettenmaier, H. Cullen, and M. R. Allen. 2016. Perspectives on the cause of exceptionally low 2015 snowpack in the western United States, Geophysical Research Letters, 43, doi:10.1002/2016GLO69665

Mueller, G. 1980. Effects of Recreational River Traffic on Nest Defense by Longear Sunfish. *Transactions of the American Fisheries Society*. 109:248-251.

Mumford, T.F. 2007. Kelp and Eelgrass in Puget Sound *in* Valued Ecosystem Component Reports Series. Washington Department of Natural Resources.

Munsch, S.H., J.R. Cordell, J.D. Toft, and E.E. Morgan. 2014. Effects of Seawalls and Piers on Fish Assemblages and Juvenile Salmon Feeding Behavior. *North American Journal of Fisheries Management*. 34:814-827.

Naish, K.A., J.E. Taylor, III, P.S. Levin, T.P. Quinn, J.R. Winton, D. Huppert, and R. Hilborn. 2007. An evaluation of the effects of conservation and fishery enhancement hatcheries on wild populations of salmon. Advances in Marine Biology 53: 61-194.

Newcombe, C.P., and J.O.T. Jensen. 1996. Channel suspended sediment and fisheries: a synthesis for quantitative assessment of risk and impact. *North American Journal of Fisheries Management*. 16:34.

Nickelson, T.E., Solazzi, M.F., and S.L. Johnson. 1986. Use of hatchery coho salmon (*Oncorhynchus kisutch*) presmolts to rebuild wild populations in Oregon coastal streams. Canadian Journal of Fisheries and Aquatic Sciences 43: 2443-2449.

Nightingale, B., and C.A. Simenstad. 2001. Overwater Structures: Marine Issues. University of Washington, Washington State Transportation Center. 133.

NMFS. 1995. Environmental assessment on protecting winter run wild steelhead from predation by California sea lions in the Lake Washington ship canal. NMFS Environ. Assess. Rep., 122 p. (Available from Northwest Regional Office, Natl. Mar. Fish. Serv., NOAA, 7600 Sand Point Way NE, Seattle, WA 98115.)

NMFS. 1996. Environmental assessment on conditions for lethal removal of California sea lions at the Ballard Locks to protect winter steelhead. NMFS Environ. Assess. Rep., 81 p. (Available from Northwest Regional Office, Natl. Mar. Fish. Serv., NOAA, 7600 Sand Point Way NE, Seattle, WA 98115.)

NMFS. 1997. Investigation of Scientific Information on the Impacts of California Sea Lions and Pacific Harbor Seals on Salmonids and on the Coastal Ecosystems of Washington, Oregon, and California. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-NWFSC-28, 172 p.

NMFS. 1999. Report to Congress: Impacts of California Sea Lions and Pacific Harbor Seals on Salmonids and West Coast Ecosystems. U.S. Department of Commerce, NOAA National Marine Fisheries Service. 48 p.

NMFS. 2003. Alaska Fishery Science Center, processed report 2003-10. Marine protected areas and early life-history of fishes.

NMFS. 2005. Assessment of NOAA Fisheries' critical habitat analytical review teams for 12 evolutionarily significant units of West Coast salmon and steelhead. NMFS, Protected Resources Division, Portland, Oregon.

NMFS. 2006. Final supplement to the Shared Strategy's Puget Sound salmon recovery plan. National Marine Fisheries Service, Northwest Region. Seattle

NMFS. 2006. Designation of Critical Habitat for Southern Resident Killer Whales. Biological Report. Northwest Region October 2006.

NMFS. 2007. Final Supplement to the recovery plan for the Hood Canal and eastern Strait of Juan de Fuca summer chum salmon (*Oncorhynchus keta*). National Marine Fisheries Service, Northwest Region. Portland, Oregon

NMFS. 2007b. Rationale for the Use of 187 dB Sound Exposure Level for Pile Driving Impacts Threshold. Unpublished memorandum. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Seattle, Washington.

NMFS. 2008. Recovery plan for Southern Resident killer whales (*Orcinus orca*). National Marine Fisheries Service, Northwest Region, Seattle, Washington.

NMFS. 2015. *Populated Puget Sound sees stark shifts in marine fish species*. Northwest Fisheries Science Center. Contributed by Michael Milstein.

NMFS. 2016. Southern Resident Killer Whales (Orcinus orca) 5-Year Review: Summary and Evaluation. December 2016. NMFS, West Coast Region, Seattle, Washington. 74p

NMFS. 2016a. West Coast Region's Endangered Species Act implementation and considerations about "take" given the September 2016 humpback whale DPS status review and species-wide revision of listings. Memo from Chris Yates, Assistant Regional Administrator for Protected Resources, NMFS West Coast Region. December 7, 2016.

NMFS. 2016b. Technical Guidance of Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing. *Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shifts*. NMFS West Coast Region. July, 2016.

NMFS. 2016e. Draft Rockfish Recovery Plan: Puget Sound / Georgia Basin yelloweye rockfish (Sebastes ruberrimus) and bocaccio (*Sebastes paucispinis*). National Marine Fisheries Service. Seattle, WA.

NMFS. 2016f. Five year status review: summary and evaluation, yelloweye rockfish (*Sebastes ruberrimus*), canary rockfish (*Sebastes pinniger*),and bocaccio (*Sebastes paucispinis*) of the Puget Sound/Georgia Basin. West Coast Region. Seattle, WA. April. 131 p.

NOAA. 1999. Endangered and threatened species: threatened status for two ESUs of chum salmon in Washington and Oregon. Federal Register 64(57):14508-14517.

Noren, D. P. (2011). Estimated field metabolic rates and prey requirements of resident killer whales. *Marine Mammal Science*, *27*(1), 60-77.

Noren, D. P., R. C. Dunkin, T. M. Williams, and M. M. Holt. 2012. Energetic coast of behaviors performed in response to vessel disturbance: one link the in population consequences of acoustic disturbance model. *In*: Anthony Hawkins and Arthur N. Popper, Eds. The Effects of Noise on Aquatic Life, pp. 427–430.

Noren D.P., Rea L., Loughlin T. 2009. A model to predict fasting capacities and utilization of body energy stores in weaned Steller sea lions (*Eumetopias jubatus*) during periods of reduced prey availability. Canadian Journal of Zoology 87:852-864.

Northwest Fisheries Science Center. 2015. Status review update for Pacific salmon and steelhead listed under the Endangered Species Act: Pacific Northwest.

Noren, D. P., A. H.Johnson, D. Rehder, and A. Larson. 2009a. Close approaches by vessels elicit surface active displays by Southern Resident killer whales. Endangered Species Research. 8:179-192.

Norman, S.A., C.E. Bowlby, M.S. Brancato, J. Calambokidis, D. Duffield, P.J. Gearin, T.A. Gornall, M.E. Gosho, B. Hanson, J. Hodder, S.J. Jeffries, B. Lagerquist, D.M. Lanbourn, B. Mate, B. Norberg, R.W. Osborne, J.A. Rash, S. Riemer, and J. Scordino. 2004. Cetacean strandings in Oregon and Washington between 1930 and 2002. Journal of Cetacean Research and Management 6: 87-99.

NRC (National Research Council). 2003. Ocean noise and marine mammals. National Academy Press, Washington, D.C.

O’Connor, S., R. Campbell, H. Cortez, and T. Knowles. 2009. Whale Watching Worldwide: Tourism numbers, expenditures and expanding economic benefits, a special report from the International Fund for Animal Welfare. Economists at Large, Yarmouth, MA.

Olesiuk, P. F., M. A. Bigg, and G. M. Ellis. 1990. Life history and population dynamics of resident killer whales (*Orcinus orca*) in the coastal waters of British Columbia and Washington State. Pages 209-244 in International Whaling Commission, Individual Recognition of Cetaceans: Use of Photo-Identification and Other Techniques to Estimate Population Parameters (Special Issue 12), incorporating the proceedings of the symposium and workshop on individual recognition and the estimation of cetacean population parameters.

Olesiuk P.F. 1996. Canada Department of Fisheries and Oceans, Science Branch, Pacific Biologic Station, Nanaimo, BC V9R 5K6.

Olesiuk, P. F., G. M. Ellis, and J. K. B. Ford. 2005. Life history and population dynamics of northern resident killer whales (*Orcinus orca*) in British Columbia (pages 1-75). Canadian Science Advisory Secretariat.

O'Neill, S.M. and J.E. West. 2009. Marine Distribution, Life History Traits, and the Accumulation of Polychlorinated Biphenyls in Chinook Salmon from Puget Sound, Washington. Transactions of the American Fisheries Society 138: 616-632.

O'Neill, S.M., G. M. Ylitalo, and J. E. West. 2014. Energy content of Pacific salmon as prey of northern and southern resident killer whales. Endanger. Species Res. 25:265–281.

Ono, K. 2010. Assessing and Mitigating Dock Shading Impacts on the Behavior of Juvenile Pacific Salmon (Oncorhynchus spp.): can artificial light mitigate the effects? *In* School of Aquatic and Fishery Sciences. Vol. Master of Science. University of Washington.

Orca Network. 2018. Orca Network Sightings Archives. Orca Network. Accessed April 2, 2018. www.orcanetwork.org/Archives

Osborne, R.W. 1999. A historical ecology of Salish Sea "resident" killer whales (*Orcinus orca*): with implications for management. Doctoral dissertation. University of Victoria, Victoria, British Columbia.

Owen, M.A., R.R. Swaisgood, N.M. Czekala, K. Steinman, and D.G. Lindburg. 2004. Monitoring stress in captive giant pandas: behavioral and hormonal responses to ambient noise. Zoo Biology 23(2): 147-164.

Parametrix. (1994). Metro North Beach epibenthic operational monitoring program, 1994 surveys. Prepared by Parametrix, Inc., Kirkland, WA. Prepared for King County Department of Metropolitan Services, Seattle, WA.

Parametrix. (1999). St. Paul Waterway area remedial action and habitat restoration project. 1998 monitoring report. Prepared by Parametrix, Inc., Kirkland, WA. Prepared for Simpson Tacoma Kraft Co., Tacoma, WA.

Pearson, W.H., J.R. Salaski, and C.I. Malme 1992. Effects of Sound from a Geophysical Survey Devise on Behavior of Captive Rockfish (Sebastes spp.). Canadian Journal of Fisheries and Aquatic Science 49:1343–1356.

Penttila, D. 2007. Marine Forage Fishes in Puget Sound. *In* Valued Ecosystem Components Report Series. Washington Department of Fish and Wildlife. 30.

Pettis H. M., R. M. Rolland, P. K. Hamilton, S. Brault, A. R. Knowlton, S. D. Kraus. 2004. Visual health assessment of North Atlantic right whales (*Eubalaena glacialis*) using photographs. Can J Zool 82:8-19.

PFMC (Pacific Fishery Management Council). 1998. Description and identification of essential fish habitat for the Coastal Pelagic Species Fishery Management Plan. Appendix D to Amendment 8 to the Coastal Pelagic Species Fishery Management Plan. Pacific Fishery Management Council, Portland, Oregon. December.

PFMC. 2005. Amendment 18 (bycatch mitigation program), Amendment 19 (essential fish habitat) to the Pacific Coast Groundfish Fishery Management Plan for the California, Oregon, and Washington groundfish fishery. Pacific Fishery Management Council, Portland, Oregon. November.

PFMC. 2007. U.S. West Coast highly migratory species: Life history accounts and essential fish habitat descriptions. Appendix F to the Fishery Management Plan for the U.S. West Coast Fisheries for Highly Migratory Species. Pacific Fishery Management Council, Portland, Oregon. January.

PFMC. 2008. Management of krill as an essential component of the California Current ecosystem. Amendment 12 to the Coastal Pelagic Species Fishery Management Plan. Environmental assessment, regulatory impact review & regulatory flexibility analysis. Pacific Fishery Management Council, Portland, Oregon. February.]

PFMC. 2014. Appendix A to the Pacific Coast Salmon Fishery Management Plan, as modified by Amendment 18 to the Pacific Coast Salmon Plan: Identification and description of essential fish habitat, adverse impacts, and recommended conservation measures for salmon. Pacific Fishery Management Council, Portland, OR. September 2014. 196 p. + appendices.

Picciulin, M., L. Sebastianutto, A. Codarin, A. Farina, and E.A. Ferrero. 2010. In situ behavioural responses to boat noise exposure of Gobius cruentatus (Gmelin, 1789; fam. Gobiidae) and Chromis (Linnaeus, 1758; fam. Pomacentridae) living in a Marine Protected Area. *Journal of Experimental Marine Biology and Ecology*. 386:125-132.

Pitcher, K.W. 1980. Stomach contents and feces as indicators of harbor seal, Phoca vitulina, foods in the Gulf of Alaska. Fish. Bull. 78: 797-798.

Popper, A.N. 2003. Effects of anthropogenic sounds on fishes. *Fisheries* 28(10): 24-31. doi: 10.1577/1548-8446(2003)28[24:EOASOF]2.0.CO;2

Popper, A. N. and M. C. Hastings. 2009 The effects of anthropogenic sources of sound on fishes. Journal of Fish Biology (2009) 75, 455–489 doi:10.1111/j.1095-8649.2009.02319.

Popper A.N. A. D. Hawkins, R. R. Fay, D. A. Mann, S. Bartol, T. J. Carlson, S. Coombs, W. T. Ellison, R. L. Gentry, M. B. Halvorsen, S. Løkkeborg, P. H. Rogers, B. L. Southall, D. G. Zeddies, and W. N. Tavolga . (2014). Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report prepared by ANSI-Accredited Standards Committee S3/SC1 and registered with ANSI. Springer Briefs in Oceanography. Springer, Cham

Popper, A.N., M.E. Smith, P.A. Cott, B.W. Hanna, A.O. MacGillivray, M.E. Austin, and D.A. Mann. 2005. Effects of exposure to seismic airgun use on hearing of three fish species. Journal of the Acoustical Society of America, 117:3958–3971.

Quinn, T.P. 2005. The Behavior and Ecology of Pacific Salmon and Trout. UW Press.

Raymondi, R.R., J.E. Cuhaciyan, P. Glick, S.M. Capalbo, L.L. Houston, S.L. Shafer, and O. Grah. 2013. Water Resources: Implications of Changes in Temperature and Precipitation. *In* Climate Change in the Northwest: Implications for Our Landscapes, Waters, and Communities, edited by M.M. Dalton, P.W. Mote, and A.K. Snover, 41-58. Island Press, Washington, DC.

Reeder, W.S., P.R. Ruggiero, S.L. Shafer, A.K. Snover, L.L Houston, P. Glick, J.A. Newton, and S.M Capalbo. 2013. Coasts: Complex Changes Affecting the Northwest's Diverse Shorelines. *In Climate Change in the Northwest: Implications for Our Landscapes*, Waters, and Communities, edited by M.M. Dalton, P.W. Mote, and A.K. Snover, 41-58. Island Press, Washington, DC

Reddy, M. L., J. S. Reif, A. Bachand, and S. H. Ridgway. 2001. Opportunities for using Navy marine mammals to explore associations between organochlorine contaminants and unfavorable effects on reproduction. Sci. Total Environ. 274:171–182.

Reijnders, P. J. 1986. Reproductive failure in common seals feeding on fish from polluted coastal waters. Nature 324:456–457.

Rice, C.A., C.M. Greene, P. Moran, D.J. Teel, D.R. Kuligowski, R.R. Reisenbichler, E.M. Beamer, J.R. Karr, and K.L. Fresh. 2011. Abundance, Stock Origin, and Length of Marked and Unmarked Juvenile Chinook Salmon in the Surface Waters of Greater Puget Sound. *Transactions of the American Fisheries Society*. 140:170-189.

Richardson, W.J., C.R. Greene, Jr., C.I. Malme, and D.H. Thomson. 1995. Marine mammals and noise. Academic Press, San Diego, California.

Roffe, T., and B. Mate. 1984. Abundance and feeding habits of pinnipeds in the Rogue River, OR. J. Wildl. Manage. 48(4):12621274.

Romberg, P.G., C. Homan, and D. Wilson. (1995). Monitoring at two sediment caps in Elliott Bay. In: Puget Sound Research Conference 1995. January 12-14, Bellevue, WA. 289-299. Royal Society, T. 2005. Ocean acidification due to increasing atmospheric carbon dioxide contents.

Romano, T.A., M. J. Keogh, C. Kelly, P. Feng, L. Berk, C. E. Schlundt, D. A. Carder, and J. J. Finneran. 2003. Anthropogenic sound and marine mammal health: measures of the nervous and immune systems before and after intense sound exposure. Canadian Journal of Fisheries and Aquatic Sciences 61:1124-1134.

Ross, P.S., G.M. Ellis, M.G. Ikonomou, L.G. Barrett-Lennard, and R.F. Addison. 2000. High PCB concentrations in free-ranging Pacific killer whales, Orcinus orca: effects of age, sex, and dietary preference. Marine Pollution Bulletin 40(6):504-515.

Ruckelshaus, M.H., K.P. Currens, W.H. Graeber, R.R. Fuerstenberg, K. Rawson, N.J. Sands, and J.B. Scott. 2006. Independent populations of Chinook salmon in Puget Sound. U.S. Dept. Commer. NOAA Tech. Memo. NMFS-NWFSC-78, 125p.

Ruggerone, G. T., S. Goodman, and R. Miner. 2008. Behavioral Response and Survival of juvenile Coho Salmon Exposed to Pile Driving Sounds. Prepared for the Port of Seattle, Seattle, Washington.

SAIC (Science Applications International Corporation). 2006. Naval Base Kitsap-Bangor fish presence and habitat use, combined phase I and II field survey report. Prepared by Science Applications International Corporation, Bothell, WA. Prepared for BAE Systems Applied Technologies, Inc., Rockville, MD.

SAIC (Science Applications International Corporation). 2009. Naval Base Kitsap-Bangor fish presence and habitat use, combined phase III field survey report, 2007-2008. Prepared by Science Applications International Corporation, Bothell, WA. Prepared for BAE Systems Applied Technologies, Inc., Rockville, MD.

Salo, E.O., N.J. Bax, T.E. Prinslow, C.J. Whitmus, B.P. Snyder, and C.A. Simenstad. 1980. The effects of construction of naval facilities on the out-migration of juvenile salmonids from Hood Canal, Washington, Final Report. Fisheries Research Institute, FRI-UW-8006, University of Washington.

Schaefer, K.M. 1996. Spawn time, frequency, and batch fecundity of yellowfin tuna (Thunnus albacares) near Clipperton Attoll in the eastern Pacific Ocean. Fisheries Bulletin 94: 98-112.

Scheuerell, M.D., and J.G. Williams. 2005. Forecasting climate-induced changes in the survival of Snake River spring/summer Chinook salmon (Oncorhynchus tshawytscha). Fisheries Oceanography 14:448-457.Shared Strategy for Puget Sound. 2007. Puget Sound salmon recovery plan. Volume 1, recovery plan. Shared Strategy for Puget Sound. Seattle.

Scholik, A.R., and H.Y. Yan. 2002. Effects of boat engine noise on the auditory sensitivity of the fathead minnow, Pimephales promelas. *Environmental Biology of Fishes*. 63:203-209.

Schwacke, L. H., E. O. Voit, L. J. Hansen, R. S. Wells, G. B. Mitchum, A. A. Hohn, and P.A. Fair. 2002. Probabilistic risk assessment of reproductive effects of polychlorinated biphenyls on bottlenose dolphins (*Tursiops truncatus*) from the southeast United States coast. Environ. Toxicol. Chem. 21:2752–2764.

Schwacke, L.H., C.R. Smith, F.I. Townsend, R.S. Wells, L.B. Hart, B.C. Balmer, T.K. Collier, S. De Guise, M.M. Fry, L.J. Guillette, Jr., S.V. Lamb, S.M. Lane, W.E. McFee, N.J. Place, M.C. Tumlin, G.M. Ylitalo, E.S. Zolman, and T.K. Rowles. 2013. Health of common bottlenose dolphins (*Tursiops truncatus*) in Barataria Bay, Louisiana, following the *Deepwater Horizon* Oil spill. Environ. Sci. Technol. 48:93- 103.

Scordino, J., and B. Pfeifer. 1993. Sea lion/steelhead conflict at the Ballard Locks. A history of control efforts to date and a bibliography of technical reports. Washington Department of Fish and Wildlife Report, 10 p. (Available from Northwest Regional Office, Natl. Mar. Fish. Serv., NOAA, 7600 Sand Point Way NE, Seattle, WA 98115.)

Sebastianutto, L., M. Picciulin, M. Costantini, and E.A. Ferrero. 2011. How boat noise affects an ecologically crucial behaviour: the case of territoriality in Gobius cruentatus (Gobiidae). *Environmental Biology of Fishes*. 92:207-215.

Servizi, J.A., and D.W. Martens. 1991. Effect of temperature, season, and fish size on acute lethality of suspended sediments to Coho salmon (Oncorhynchus kisutch). *Canadian Journal of Fisheries and Aquatic Sciences*. 48:493-497.

Simenstad, C.A. 1988. Summary and Conclusions from Workshop and Working Group Discussions. Pages 144-152 in Proceedings, Workshop on the Effects of Dredging on Anadromous Pacific Coast Fishes, Seattle, Washington, September 8-9, 1988. C.A. Simenstad, ed., Washington Sea Grant Program, University of Washington, Seattle, Washington.

Simenstad, C.A. 1999. Estuarine Landscape Impacts on Hood Canal and Strait of Juan de Fuca Summer Chum Salmon and Recommended Actions. *In* Summer Chum Conservation Initiative. Vol. Appendix Report 3.5.

Simenstad, C.A. 2001. Estuarine Landscape Impacts on Hood Canal and Strait of Juan de Fuca Summer Chum Salmon and Recommended Actions. *In* Summer Chum Conservation Initiative. Vol. Appendix Report 3.5.

Skalski, J.R., W.H. Pearson, and C.I. Malme 1992. Effects of Sounds from a Geophysical Survey Device on Catch-Per-Unit-Effort in a Hook-and-Line Fishery for Rockfish (Sebastes spp.). Canadian Journal of Fisheries and Aquatic Science 49:1357–1365.

Southard, S.L., R.M. Thom, G.D. Williams, T.J. D., C.W. May, G.A. McMichael, J.A. Vucelick, J.T. Newell, and J.A. Southard. 2006. Impacts of Ferry Terminals on Juvenile Salmon Movement along Puget Sound Shorelines. Battelle Memorial Institute, Pacific Northwest Division

SSPS. 2007. Puget Sound Salmon Recovery Plan. Shared Strategy for Puget Sound, Shared Strategy Development Committee. Plan adopted by the National Marine Fisheries Service January 19.

Stadler, J.H., and D.P. Woodbury. 2009. Assessing the effects to fishes from pile driving: Application of new hydroacoustic criteria. 8 pp.

Stout, H.A., P.W. Lawson, D.L. Bottom, T.D. Cooney, M.J. Ford, C.E. Jordan, R.J. Kope, L.M. Kruzic, G.R. Pess, G.H. Reeves, M.D. Scheuerell, T.C. Wainwright, R.S. Waples, E. Ward, L.A. Weitkamp, J.G. Williams, and T.H. Williams. 2012. Scientific conclusions of the status review for Oregon Coast coho salmon (*Oncorhynchus kisutch*). U.S. Department of Commerce. NOAA Technical Memorandum NMFS-NWFSC-118. 242 p.

Subramanian, A., S. Tanabe, R. Tatsukawa, S. Saito, and N. Miyazaki. 1987. Reduction in the testosterone levels by PCBs and DDE in Dall's porpoises of Northwestern North Pacific. Mar. Pollut. Bull. 18:643–646.

Sunda, W. G., and W. J. Cai. 2012. Eutrophication induced CO2-acidification of subsurface coastal waters: interactive effects of temperature, salinity, and atmospheric p CO2. *Environmental Science & Technology*, 46(19): 10651-10659

Sweeting, R., R. J. Beamish, and C. A. Cooper. "Comparison of juvenile salmon diets in the Strait of Georgia and Puget Sound 1997–2006." *Proceedings of the 2007 Georgia Basin Puget Sound research conference. Puget Sound Action Team, Olympia, Washington*. 2007.

Tabor, Roger A. 2017. Phototaxic Behavior of Subyearling Salmonids in the Nearshore Area of Two Urban Lakes in Western Washington State. Transactions of the American Fisheries Society. 146.4 (2017): 753-761

Tague, C. L., Choate, J. S., & Grant, G. 2013. Parameterizing sub-surface drainage with geology to improve modeling streamflow responses to climate in data limited environments. Hydrology and Earth System Sciences 17(1): 341-354

Tillmann, P., and D. Siemann. 2011. Climate Change Effects and Adaptation Approaches in Marine and Coastal Ecosystems of the North Pacific Landscape Conservation Cooperative Region. National Wildlife Federation.

Toft, J.D., A.S. Ogston, S.M. Heerhartz, J.R. Cordell, and E.E. Flemer. 2013. Ecological response and physical stability of habitat enhancements along an urban armored shoreline. *Ecological Engineering*. 57:97-108.

Tollit, D.J., M.J. Steward, P.M. Thompson, G.J. Pierce, M.B. Sontos, and S. Hughes. 1997. Species and size differences in the digestion of otoliths and beaks: implication for estimates of pinniped diet composition. Canadian Journal of Fisheries and Aquatic Sciences 54:105-119.

Tomaro, L.M., D.J. Teel, W.T. Peterson, and J.A. Miller. 2012. When is bigger better? Early marine residence of middle and upper Columbia River spring Chinook salmon. *Marine Ecology Progress Series*. 452:237-252.

Trites, A.W. and C.P. Donnelly. 2003. The decline of Steller sea lions *Eumetopias jubatus* in Alaska: a review of the nutritional stress hypothesis. Mammal Rev. 33(1): 3-28.

Trites, AW and Rosen, DAS (eds). 2018. Availability of Prey for Southern Resident Killer Whales. Technical Workshop Proceedings. November 15–17, 2017. Marine Mammal Research Unit, Institute for the Oceans and Fisheries, University of British Columbia, Vancouver, B.C., 64 pages

Turnpenny, A.W.H., K.P. Thatcher, and J.R. Nedwell. 1994. The effects on fish and other marine animals of high-level underwater sound. Fawley Aquatic Research Laboratory, Ltd., Report FRR 127/94, United Kingdom. October.

VanBlaricom, Glenn, Leah R. Gerber, and Robert L. Brownell Jr. 2001. Marine Mammals, Extinctions of. Pages 37-69. Encyclopedia of Biodiversity, Volume 4. Academic Press.

Veldhoen, N., M.G. Ikonomou, C. Dubetz, N. MacPherson, T. Sampson, B.C. Kelly, and C.C. Helbing. 2010. Gene expression profiling and environmental contaminant assessment of migrating Pacific salmon in the Fraser River watershed of British Columbia. Aquatic Toxicology 97(3):212-225.

Venn-Watson S, Colegrove KM, Litz J, Kinsel M, Terio K, Saliki J, et al. 2015. Adrenal Gland and Lung Lesions in Gulf of Mexico Common Bottlenose Dolphins (Tursiops truncatus) Found Dead following the Deepwater Horizon Oil Spill. PLoS ONE 10(5): e0126538. doi:10.1371/journal. pone.0126538

Vélez-Espino, L.A., J.K.B. Ford, H.A. Araujo, G. Ellis, C.K. Parken, and K.C. Balcomb. 2014. Comparative demography and viability of northeastern Pacific resident killer whale populations at risk. Can. Tech. Rep. Fish. Aquat. Sci. 3084: v + 58 p.

Viberg, H., A. Fredriksson, and P. Eriksson. 2003. Neonatal exposure to polybrominated diphenyl ether (PBDE-153) disrupts spontaneous behaviour, impairs learning and memory, and decreases hippocampal cholinergic receptors in adult mice. Toxicol. Appl. Pharmacol. 192:95–106.

Viberg, H., N. Johansson, A. Fredriksson, J. Eriksson, G. Marsh, and P. Eriksson. 2006. Neonatal exposure to higher brominated diphenyl ethers, hepta-, octa-, or nonabromodiphenyl ether, impairs spontaneous behavior and learning and memory functions of adult mice. Toxicol. Sci. 92:211–218.

Vivan, J.M., T.C.M. de Almeida, and M. Di Domenico. (2009). Effects of dredged material disposal on benthic macrofauna near Itajaí Harbour (Santa Catarina, South Brazil). Ecological Engineering. 35(10): 1435-1443.

Ward, E.J., M.J. Ford, R.G. Kope, J.K.B. Ford, L.A. Velez-Espino, C.K. Parken, L.W. LaVoy, M.B. Hanson, and K.C. Balcomb. 2013. Estimating the impacts of Chinook salmon abundance and prey removal by ocean fishing on Southern Resident killer whale population dynamics. U.S. Dept. Commer., NOAA Tech. Memo. NMFS- NWFSC-123.

Wainwright, T. C., and L. A. Weitkamp. 2013. Effects of climate change on Oregon Coast coho salmon: habitat and life-cycle interactions. *Northwest Science* 87(3): 219-242

Wasser, S. K., J. I. Lundin, K. Ayers, E. Seely, D. Giles, K. Balcomb, J. Hempelmann, K. Parsons, R. Booth. 2017. Population growth is limited by nutritional impacts on pregnancy success in endangered Southern Resident killer whales (*Orcinus orca*). PLoS ONE 12(6): e0179824. https://doi.org/10.1371/journal. pone.0179824.

WDFW (Washington Department of Fisheries), and WWTIT (Western Washington Treaty Indian Tribes). 1993. 1992 Washington State salmon and steelhead stock inventory (SASSI). Internal Report to Washington Department of Fisheries and Wildlife, Olympia, Washington Wash. Dep. Fish Wildl., Olympia, WA, 212 p. plus 5 regional volumes.

WDFW SaSI. 2017. Accessed 20/2/2018. https://data.wa.gov/Natural-Resources-Environment/WDFW-Salmonid-Stock-Inventory-Populations/ncqh-ypvf.

WDFW, 2000. Atlas of Seal and Sea Lion Haulout Sites In Washington.

WDFW (Washington Department of Fish and Wildlife) and PNPTT (Point No Point Treaty Tribes). 2000. Summer chum salmon conservation initiative: An implementation plan to recover summer chum in the Hood Canal and Strait of Juan de Fuca Region. Report for WDFW and Point No Point Treaty Tribes. http://wdfw.wa.gov/publications/pub.php?id=00155

WDOE 2014. Stormwater Management Manual for Western Washington, as Amended in December 2014. Publication Number 14-10-055. Washington State Department of Ecology, Water Quality Program, Olympia, WA. December 2014.

WDOE 2016. Water Quality Standards for Surface Waters of the State of Washington Chapter 173-201A WAC Adopted August 1, 2016. Revised October 2017. https://fortress.wa.gov/ecy/publications/documents/0610091.pdf

WDOE (Washington Department of Ecology). 2017. Spill Prevention Preparedness and Response Program 2017-2019. Publication 17-08-018. 29 pp.

Weston_Solutions. 2006. Jimmycomelately piling removal monitoring project, Final Report. Prepared for Jamestown S'Klallam Tribe, Port Townsend, Washington. 109.

Wiles, G. J. 2004. Washington State Status Report for the Killer Whale. March 2004. WDFW, Olympia, Washington. 120p.

Willette, T.M. 2001. Foraging behaviour of juvenile pink salmon (Oncorhynchus gorbuscha) and size-dependent predation risk. *Fisheries Oceanography*. 10:110-131.

Williams, R., E. Ashe, and D. Lusseau. 2010b. Killer whale activity budgets under no-boat, kayak-only and power-boat conditions. Contract via Herrera Consulting, Seattle, Washington. 29 pp.

Williams, R., D. Lusseau and P. S. Hammonda. 2006. Estimating relative energetic costs of human disturbance to killer whales (*Orcinus orca*). Biol. Cons. 133:301–311.

Winder, M. and D. E. Schindler. 2004. Climate change uncouples trophic interactions in an aquatic ecosystem. Ecology 85: 2100–2106

Wissmar, R.C., J.E. Smith, B.A. McIntosh, H.W. Li, G.H. Reeves, and J.R. Sedell. 1994. Ecological Health of River Basins in Forested Regions of Eastern Washington and Oregon. Gen. Tech. Rep. PNW-GTR-326. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. Portland, OR. 65 p.

Xie, Y.B., C.G.J. Michielsens, A.P. Gray, F.J. Martens, and J.L. Boffey. 2008. Observations of avoidance reactions of migrating salmon to a mobile survey vessel in a riverine environment. *Canadian Journal of Fisheries and Aquatic Sciences*. 65:2178-2190.

Yamanaka, K. L., L. C. Lacko, R. Witheler, C. Grandin, J. K. Lochead, J.-C. Martin, N. Olsen, and S. S. Wallace. 2006. A review of yelloweye rockfish Sebastes ruberimus along the Pacific coast of Canada: biology, distribution, and abundance trends. Research Document 2006/076. Fisheries and Oceans Canada. 54 pages.

Ylitalo, G. M., J. E. Stein, T. Horn, L. L. Johnson, K. L. Tilbury, A. J. Hall, T. Rowles, D. Greig, L. J. Lowenstine, and F. M. Gulland. 2005. The role of organochlorines in cancer-associated mortality in California sea lions (*Zalophus californianus*). Mar. Pollut. Bull. 50:30–39.

Zabel, R.W., M.D. Scheuerell, M.M. McClure, and J.G. Williams. 2006. The interplay between climate variability and density dependence in the population viability of Chinook salmon. Conservation Biology 20(1):190-200

Zamon, J.E., T.J. Guy, K. Balcomb, and D. Ellifrit. 2007. Winter observations of Southern Resident killer whales (*Orcinus orca*) near the Columbia River Plume during the 2005 Spring Chinook Salmon (Oncorhynchus tshawytscha) spawning migration. Northwest Naturalist 88:193-198.

Zerbini, A., J. Waite, J. Laake, and P. Wade. 2006a. Abundance, trends and distribution of baleen whales off Western Alaska and the central Aleutian Islands. Deep Sea Research Part I: Oceanographic Research Papers 53(11):1772-1790.

Ziccardi, M.H., S.M.Wilkin, T.K. Rowles, and S. Johnson. 2015. Pinniped and Cetacean Oil Spill Response Guidelines. U.S. Dept. of Commer., NOAA. NOAA Technical Memorandum NMFS-OPR-52, 138p.

(b) *Identification of sources.* The MOA and related Federal plan apply to all affected SSI units for which construction commenced on or before October 14, 2010.

(c) *Effective date of delegation.* The delegation became fully effective on May 17, 2019.

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DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

50 CFR Part 218

[Docket No. 170919913–9271–02]

RIN 0648–BH27

Taking and Importing Marine Mammals; Taking Marine Mammals Incidental to U.S. Navy Marine Structure Maintenance and Pile Replacement in Washington

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Final rule.

SUMMARY: NMFS, upon request of the U.S. Navy (Navy), hereby issues regulations to govern the unintentional taking of marine mammals incidental to conducting construction activities related to marine structure maintenance and pile replacement at facilities in Washington, over the course of five years. These regulations, which allow for the issuance of Letters of Authorization (LOA) for the incidental take of marine mammals during the described activities and specified timeframes, prescribe the permissible methods of taking and other means of effecting the least practicable adverse impact on marine mammal species or stocks and their habitat, as well as requirements pertaining to the monitoring and reporting of such taking.

DATES: Effective from May 17, 2019 through May 17, 2024.

ADDRESSES: A copy of the Navy's application and supporting documents, as well as a list of the references cited in this document, may be obtained online at: *www.fisheries.noaa.gov/action/incidental-take-authorization-us-navy-marine-structure-maintenance-and-pile-replacement-wa.* In case of problems accessing these documents, please call the contact listed below.

FOR FURTHER INFORMATION CONTACT: Ben Laws, Office of Protected Resources, NMFS, (301) 427–8401.

SUPPLEMENTARY INFORMATION:

Purpose and Need for Regulatory Action

These regulations establish a framework under the authority of the MMPA (16 U.S.C. 1361 *et seq.*) to allow for the authorization of take of marine mammals incidental to the Navy's construction activities related to marine structure maintenance and pile replacement at facilities in Washington.

We received an application from the Navy requesting five-year regulations and authorization to take multiple species of marine mammals. Take is expected to occur by Level A and Level B harassment incidental to impact and vibratory pile driving. Please see ''Background'' below for definitions of harassment.

Legal Authority for the Action

Section 101(a)(5)(A) of the MMPA (16 U.S.C. 1371(a)(5)(A)) directs the Secretary of Commerce to allow, upon request, the incidental, but not intentional taking of small numbers of marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing) within a specified geographical region for up to five years if, after notice and public comment, the agency makes certain findings and issues regulations that set forth permissible methods of taking pursuant to that activity and other means of effecting the ''least practicable adverse impact'' on the affected species or stocks and their habitat (see the discussion below in the ''Mitigation'' section), as well as monitoring and reporting requirements. Section 101(a)(5)(A) of the MMPA and the implementing regulations at 50 CFR part 216, subpart I, provide the legal basis for issuing this rule containing five-year regulations, and for any subsequent LOAs. As directed by this legal authority, the regulations contain mitigation, monitoring, and reporting requirements.

Summary of Major Provisions Within the Regulations

Following is a summary of the major provisions of the regulations regarding Navy construction activities. These measures include:

- Required monitoring of the construction areas to detect the presence of marine mammals before beginning construction activities.
- Shutdown of construction activities under certain circumstances to avoid injury of marine mammals.
- Soft start for impact pile driving to allow marine mammals the opportunity to leave the area prior to beginning impact pile driving at full power.

Background

Section 101(a)(5)(A) of the MMPA (16 U.S.C. 1361 *et seq.*) directs the Secretary of Commerce (as delegated to NMFS) to allow, upon request, the incidental, but not intentional, taking of small numbers of marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing) within a specified geographical region if certain findings are made, regulations are issued, and notice is provided to the public.

An authorization for incidental takings shall be granted if NMFS finds that the taking will have a negligible impact on the species or stock(s), will not have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses (where relevant), and if the permissible methods of taking and requirements pertaining to the mitigation, monitoring and reporting of such takings are set forth.

NMFS has defined ''negligible impact'' in 50 CFR 216.103 as an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival.

The MMPA states that the term ''take'' means to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal.

Except with respect to certain activities not pertinent here, the MMPA defines ''harassment'' as: Any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild (Level A harassment); or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering (Level B harassment).

Summary of Request

On July 24, 2017, we received an adequate and complete request from the Navy for authorization to take marine mammals incidental to construction activities related to marine structure maintenance and pile replacement at six Naval installations in Washington inland waters. On August 4, 2017 (82 FR 36359), we published a notice of receipt of the Navy's application in the **Federal Register**, requesting comments and information related to the request for thirty days. We received comments from Whale and Dolphin Conservation

(WDC). The comments received from WDC were considered in development of the proposed rule and are available online at: *www.fisheries.noaa.gov/action/incidental-take-authorization-us-navy-marine-structure-maintenance-and-pile-replacement-wa*. We subsequently published a notice of proposed rulemaking in the **Federal Register** on March 5, 2018 (83 FR 9366). Comments received during the public comment period on the proposed regulations are addressed in ''Comments and Responses.''

The Navy plans to conduct construction necessary for maintenance of existing in-water structures at the following facilities: Naval Base Kitsap (NBK) Bangor, NBK Bremerton, NBK Keyport, NBK Manchester, Zelatched Point, and Naval Station Everett (NS Everett). These repairs include use of impact and vibratory pile driving, including installation and removal of steel, concrete, plastic, and timber piles. Hereafter (unless otherwise specified or detailed) we use the term ''pile driving'' to refer to both pile installation and pile removal. The use of both vibratory and impact pile driving is expected to produce underwater sound at levels that have the potential to result in harassment of marine mammals.

The Navy requests authorization to take individuals of 10 species by Level B harassment. Take by Level A harassment is anticipated only for the harbor seal. These regulations are valid for five years (2019–2024).

Description of the Specified Activity

Overview

Maintaining existing wharfs and piers is vital to sustaining the Navy's mission and ensuring readiness. To ensure continuance of necessary missions at the six installations, the Navy must conduct annual maintenance and repair activities at existing marine waterfront structures, including removal and replacement of piles of various types and sizes. The Navy refers to this program as the Marine Structure Maintenance and Pile Replacement (MPR) program. Exact timing and amount of necessary in-water work is unknown, but the Navy estimates replacing up to 822 structurally unsound piles over the 5-year period, including individual actions currently planned and estimates for future marine structure repairs. Construction will include use of impact and vibratory pile driving, including removal and installation of steel, concrete, plastic, and timber piles. Aspects of construction activities other than pile driving are not anticipated to have the potential to result in incidental take of marine mammals because they are either above water or do not produce levels of underwater sound with likely potential to result in take of marine mammals.

The Navy's waterfront inspection program prioritizes deficiencies in marine structures and plans those maintenance and repairs for design and construction. The Navy's planned activities include individual projects (where an existing need has been identified and funds have been requested) and estimates for emergent or emergency repairs. The latter are also referred to as contingency repairs. Estimates of activity levels for contingency repairs are based on Navy surveys of existing structures, which provide assessments of structure condition and estimates of numbers of particular pile types that may require replacement (at an assumed 1:1 ratio) over the 5-year duration of these regulations. Additional allowance is made for the likelihood that future waterfront inspections will reveal unexpected damage, or that damage caused by severe weather events and/or incidents caused by vessels will result in need for additional contingency repairs.

LOAs could be issued for projects conducted at any of the six facilities if they fit within the structure of the programmatic analysis provided herein and are able to meet the requirements described in the regulations. The Navy will meet with NMFS on an annual basis prior to the start of in-water work windows to review upcoming projects, required monitoring plans, and the results of relevant projects conducted in the preceding in-water work window. The intent is to utilize lessons learned to better inform potential effects of future MPR activities and in any follow-up consultations.

Dates and Duration

These regulations are valid for a period of five years (2019–2024). The specified activities may occur at any time during the five-year period of validity of the regulations, subject to existing timing restrictions. These timing restrictions, or in-water work windows, are typically designed to protect fish species listed under the Endangered Species Act (ESA). For NBK Bangor and Zelatched Point (located in Hood Canal), in-water work may occur from July 16 through January 15. At the remaining four facilities (located in Puget Sound), in-water work may occur from July 16 through February 15. Impact or vibratory driving could occur on any work day within in-water work windows during the period of validity of these regulations.

For many projects the design details are not known; thus, it is not possible to state the number of pile driving days that will be required. Days of pile driving at each site were based on the estimated work days using a slow production rate, *i.e.,* one pile removed per day and one pile installed per day for contingency pile driving and an average production rate of six piles per day for fender pile replacement. These conservative rates give the following estimates of total days at each facility over the 5-year duration: NBK Bangor, 119 days; Zelatched Point, 20 days; NBK Bremerton, 168 days; NBK Keyport, 20 days; NBK Manchester, 50 days; and NS Everett, 78 days. These totals include both extraction and installation of piles, and represent a conservative estimate of pile driving days at each facility. In a real construction situation, pile driving production rates would be maximized when possible and actual daily production rates may be higher, resulting in fewer actual pile driving days.

Specified Geographical Region

The six installations are located within the inland waters of Washington State. Two facilities are located within Hood Canal, while the remainder are located within Puget Sound. Please see Figure 1–1 of the Navy's application for a regional map.

NBK Bangor and Zelatched Point are located in the Hood Canal, a long, narrow, fjord-like basin of western Puget Sound. Please see Figures 1–2 and 1–6 of the Navy's application. NBK Bremerton is located on the north side of Sinclair Inlet in southern Puget Sound. Please see Figure 1–3 of the Navy's application. NBK Keyport is located on the eastern shore of the Kitsap Peninsula. Please see Figure 1–4 of the Navy's application. NBK Manchester is located on Orchard Point, approximately 6.4 km due east of Bremerton. Please see Figure 1–5 of the Navy's application. NS Everett is located in Port Gardner Bay in Puget Sound's Whidbey Basin. Please see Figure 1–7 of the Navy's application.

For additional detail regarding the specified geographical region, please see our notice of proposed rulemaking (83 FR 9366; March 5, 2018) and Section 2 of the Navy's application.

Detailed Description of Activities

As described above, the Navy requested incidental take regulations for its MPR program, which includes maintenance and repair activities at marine waterfront structures at six installations within Washington inland waters. In order to address identified deficiencies in existing marine structures at the six facilities, the Navy plans to replace up to 822 structurally unsound piles over the 5-year period using both impact and vibratory pile driving. Existing marine structures at the six facilities are identified in Table 1–2 of the Navy's application. The MPR program includes pile repair, extraction, and installation, all of which may be accomplished through a variety of methods. However, only pile extraction and installation using vibratory and impact pile drivers is expected to have the potential to result in incidental take of marine mammals. A detailed description of the Navy's planned activities was provided in our notice of proposed rulemaking (83 FR 9366; March 5, 2018) and is not repeated here. No changes have been made to the specified activities described therein.

Steel piles are typically vibratory-driven for their initial embedment depths or to refusal and finished with an impact hammer for proofing or until the pile meets structural requirements, as necessary. Non-steel piles (concrete, timber, or plastic) are typically impact-driven for their entire embedment depth, in part because non-steel piles are often displacement piles (as opposed to pipe piles) and require some impact to allow substrate penetration. Pile installation can typically take a minute or less to 60 minutes depending on pile type, pile size, and conditions (*i.e.,* bedrock, loose soils, etc.) to reach the required tip elevation.

Impact or vibratory pile driving could occur on any day, but would not occur simultaneously. Location-specific pile totals are given in Table 1 and described below. These totals assume a 1:1 replacement ratio; however, the actual number installed may result in a replacement ratio of less than 1:1. Please see Table A–1 of the Navy's application for additional detail regarding expectations for both planned work and possible contingency work.

TABLE 1—PILE TYPES AND MAXIMUM ANTICIPATED NUMBER TO BE REPLACED AT EACH INSTALLATION

Installation	Existing piles to be replaced	Anticipated piles to be installed
NBK Bangor	44 concrete, 75 steel and/or timber	119 steel or concrete.
NBK Bremerton	75 steel and/or timber, 460 timber	100 steel (14-in diameter and sheet piles), 435 concrete.
NBK Keyport	20 steel and/or concrete	20 steel.
NBK Manchester	50 timber and/or plastic	50 concrete, timber, and/or plastic.
Zelatched Point	20 timber	20 steel, concrete, and/or timber.
NS Everett	1 steel, 2 concrete, and 75 timber	1 steel and 77 concrete and/or timber.

Steel piles would be a maximum size of 36-inch (in) diameter except at NBK Bremerton where they would be 14-in diameter. Concrete piles will be a maximum of 24-in diameter and timber/plastic piles will be a maximum of 18-in diameter. For purposes of analysis, it is assumed that any unknown pile type would be steel, since this provides a worst-case scenario in terms of noise levels produced. All concrete, timber, and plastic piles are assumed to be installed entirely by impact pile driver, and all steel piles are assumed to require some use of an impact driver. This is a conservative assumption, as all steel piles would be initially driven with a vibratory driver until they reach a point of refusal (where substrate conditions make use of a vibratory hammer ineffective) or engineering specifications require impact driving to verify load-bearing capacity. Therefore, some steel piles may not in fact require use of the impact driver during installation.

Of 822 piles expected to be installed as replacement piles, 121 have been identified as steel piles. These piles will be installed over the 5-year duration at NBK Bremerton, NBK Keyport, and NS Everett. In addition, another 139 piles that would be installed at NBK Bangor (119) and Zelatched Point (20) have not been identified as to pile type and could be steel, concrete, timber, or plastic. For this analysis, it is assumed all 139 of these would be steel piles. Therefore, 260 piles are assumed to be steel, with 100 of these 14-in and the remainder assumed to be 36-in diameter. A total of 435 replacement piles have been identified as concrete (NBK Bremerton). The remaining 127 replacement piles (NBK Manchester and NS Everett) could ultimately be concrete, timber, or plastic, but are assumed for purposes of analysis to be concrete, which is a more conservative noise scenario.

Comments and Responses

We published a notice of proposed rulemaking in the **Federal Register** on March 5, 2018 (83 FR 9366). During the 30-day comment period, we received letters from the Marine Mammal Commission (Commission) and WDC. The comments and our responses are described below. For full detail of the comments and recommendations, please see the comment letters, which are available online at: *www.fisheries.noaa.gov/action/incidental-take-authorization-us-navy-marine-structure-maintenance-and-pile-replacement-wa.*

Comment: The Commission recommends that NMFS should consult with scientists and acousticians to determine the appropriate accumulation time that action proponents should use to determine the extent of Level A harassment zones based on the associated cumulative sound exposure level (cSEL) thresholds in such situations. The Commission further recommends that NMFS consult with both internal and external scientists and acousticians to determine the appropriate accumulation time that action proponents should use to determine the extent of the Level A harassment zones based on the associated cSEL thresholds for the various types of sound sources, including stationary sound sources, when simple area x density methods are employed.

Response: NMFS appreciates the Commission's interest in these issues, and we agree that these are important issues needing further consideration. Therefore, NMFS will continue to consider and refine our approach to assessing the appropriate calculation of Level A harassment through future actions as more information and experience is available. However, we also note that the Commission itself has a nine-member Committee of Scientific Advisors, including experts on the very topics mentioned, in addition to a professional staff including subject matter experts on marine mammal behavior and acoustics. As such, we would welcome in the future any more substantive recommendations relating to these issues that the Commission wishes to provide.

In addition, as described in NMFS's 2018 *Revision to Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing* (NMFS, 2018), NMFS is committed to re-examining the default 24-hour accumulation period and has convened a working group to investigate alternative means of identifying appropriate accumulation periods.

Comment: The Commission recommends NMFS share its criteria for rounding take estimates with the Commission.

Response: On June 27, 2018, NMFS provided the Commission with its internal guidance on rounding and the consideration of additional factors in take estimation.

Comment: WDC recommends that NMFS and the Navy consult on the status of marine mammal populations on a yearly basis at minimum, and with greater frequency regarding southern resident killer whales (SRKW). In addition, WDC suggests that the Navy must communicate and coordinate with Washington State on the status of localized impacts to SRKW for each project site, during the time of each construction project.

Response: We appreciate WDC's comments and share, generally, their concern regarding the status of the endangered SRKW population. However, as discussed herein and as separately evaluated through NMFS's consultation under section 7 of the ESA, the Navy's construction actions (and NMFS's potential issuance of LOAs for take of marine mammals incidental to those actions) do not present meaningful concern relating to impacts on SRKW. In most locations, SRKW are not expected to be present and, where they could be encountered, the Navy has committed to robust monitoring and mitigation requirements. As such, the requirement to meet annually (as proposed) is sufficient for information exchange regarding ongoing and future actions associated with the Navy's MPR program. With regard to the need to consult with Washington State, it is outside NMFS's jurisdiction to require such consultation of the Navy. The Navy will consult with Washington State in accordance with applicable state law.

Comment: WDC disagrees with statements in our notice of proposed rulemaking regarding the likely presence of SRKW individuals in the vicinity of Navy facilities, and suggests that the estimated taking of SRKW as a result of the specified activities is underestimated. WDC supports this recommendation in part by stating that the occurrence of SRKW in Puget Sound, which is likely determined by the presence and abundance of seasonally-preferred salmon runs, has been highly variable in recent years. WDC recommends reconsideration of the number of SRKW that may be taken by the specified activity.

Response: We first clarify that WDC apparently misunderstands our previous statement relating to expected SRKW occurrence. Rather than stating that SRKW occur ''only rarely and unpredictably'' in the Puget Sound region as a whole, as WDC comments, we noted that SRKW (among other species considered herein) occur only rarely and unpredictably in the vicinity of Navy facilities. Reiterating our discussion in the notice of proposed rulemaking, SRKW have not been reported in Hood Canal (NBK Bangor and Zelatched Point) since 1995. The most recent confirmed sighting of SRKW near NBK Bremerton and Keyport was in Dyes Inlet in 1997. SRKW occur only rarely in far southern Puget Sound, near NBK Manchester. We acknowledged that SRKW are more likely to occur in the vicinity of NS Everett.

Even at these latter two facilities (NBK Manchester and NS Everett), a density-based analysis would lead to an assumption that SRKW takes are unlikely, given the generally small acoustic harassment zones (other than when vibratory driving steel piles) and low number of expected days on which pile driving would occur under the MPR. Further, the robust monitoring requirements that will be required of the Navy—including a commitment to monitor local sightings networks and avoid pile driving when SRKW are known to be in the vicinity of a facility—in conjunction with the Navy's commitment to cease pile driving if SRKW (and cetaceans in general) are detected at any distance strengthen the conclusion that take of SRKW is unlikely. However, in recognition that it is possible that SRKW could briefly enter a harassment zone undetected during vibratory pile driving of steel piles (when harassment zones are largest), we include analysis of a precautionary amount of take (equivalent to two occurrences of J pod or one occurrence of L pod). The best available information supports a conclusion that this amount of take by Level B harassment is sufficient, and WDC provides no specific information to the contrary.

Comment: WDC similarly suggests that the take number provided for transient killer whales is underestimated, citing take estimates produced for previous incidental take authorizations for Navy construction activities in Hood Canal.

Response: As for SRKW, the best available information, including local sightings data—described in our notice of proposed rulemaking—suggest that transient killer whales are unlikely to occur in the vicinity of Navy construction activities. The take estimate considered herein considers available information regarding group size and a reasonable estimate of days on which transient killer whales may be present, given their rarity, small acoustic harassment zones for most pile driving, and few days on which pile driving is expected to occur. The incidental take authorization cited by WDC (83 FR 10689; March 12, 2018) included an extremely precautionary take estimate, as has occurred for other past Navy authorization requests for construction activities specific to the Hood Canal. We note that, although relatively large amounts of take have been authorized for transient killer whales in association with such activities—since 2010, nine IHAs have been issued to the Navy for construction activities at NBK Bangor in Hood Canal—no killer whale observations have ever been reported during construction activities, and no actual takes are believed to have occurred.

Overall, with regard to both SRKW and transient killer whales, we believe that the take estimates analyzed herein reasonably reflect the available information and should be expected to be reasonably reflective of the actual potential for killer whale occurrence in the vicinity of Navy facilities during the specified construction activities. However, these regulations also include an adaptive management component that will allow Navy and NMFS to evaluate on an annual basis whether these assumptions remain accurate.

Comment: With regard to mitigation and monitoring, WDC recommends ensuring that the Navy uses adequate numbers and placement of marine mammal observers to detect killer whales at all project sites, to ensure awareness regarding updated information on killer whale presence, and to utilize citizen sightings networks on a daily basis to monitor for presence and activity of killer whales in the area before construction activities begin. WDC also recommends ensuring that observers have sufficient training to differentiate between resident and transient killer whales.

Response: We agree with WDC regarding these measures, all of which were included in our notice of proposed rulemaking and are carried forward in these final regulations. However, we do caution that identification of transient versus resident killer whales may be difficult, although observers will be required to have sufficient training and experience to make such determinations, within reason.

Comment: WDC encourages ‘‘extensive use of the proposed hydroacoustic system’’ to detect the presence of marine mammals. In addition, WDC states that this unspecified system should be used to measure localized levels of underwater noise at project sites and, in conjunction with a threshold level to be determined, that construction activities not be allowed to proceed if background noise levels are above some predetermined level.

Response: Overall, this proposal is too vague to reasonably be acted upon. It is unclear what ‘‘proposed hydroacoustic system’’ WDC is referring to, and significantly greater detail would need to be provided with regard to the technical specifications of such a system as well as with regard to the data to be collected and its monitoring in order to meaningfully evaluate such a proposal. It is also unclear what WDC suggests as an appropriate threshold for background noise. Moreover, even if we assume that a passive acoustic monitoring system exists in conjunction with the capacity to monitor data in real-time, the proposal to not allow construction activities if background noise is above a specified threshold would likely be considered impracticable, as the level of background noise is outside the Navy's control, such a requirement could significantly constrain Navy's ability to conduct necessary construction activities, and the requirement would be of uncertain benefit to affected marine mammals.

Description of Marine Mammals in the Area of the Specified Activity

We have reviewed the Navy's species descriptions—which summarize available information regarding status and trends, distribution and habitat preferences, behavior and life history, and auditory capabilities of the potentially affected species—for accuracy and completeness and refer the reader to Sections 3 and 4 of the Navy's application, instead of reprinting the information here. Additional information regarding population trends and threats may be found in NMFS's Stock Assessment Reports (SAR; *www.fisheries.noaa.gov/topic/population-assessments#marine-mammals*) and more general information about these species (*e.g.,* physical and behavioral descriptions) may be found on NMFS's website (*www.fisheries.noaa.gov/find-species*).

Table 2 lists all species with expected potential for occurrence in the specified geographical region where the Navy proposes to conduct the specified activities and summarizes information related to the population or stock, including regulatory status under the MMPA and ESA and potential biological removal (PBR), where known. For taxonomy, we follow Committee on Taxonomy (2017). PBR, defined by the MMPA as the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population, is considered in concert with known sources of ongoing anthropogenic mortality (as described in NMFS's SARs).

Marine mammal abundance estimates presented in this document represent the total number of individuals that make up a given stock or the total number estimated within a particular study or survey area. NMFS's stock abundance estimates for most species represent the total estimate of individuals within the geographic area, if known, that comprises that stock. All managed stocks in the specified geographical region are assessed in either NMFS's U.S. Alaska SARs or U.S. Pacific SARs. All values presented in Table 2 are the most recent available at the time of writing, including updated information provided in the draft 2018 SARs (available online at: *www.fisheries.noaa.gov/national/marine-mammal-protection/draft-marine-mammal-stock-assessment-reports*).

Ten species (with 13 managed stocks) are considered to have the potential to co-occur with Navy activities. There are several species or stocks that occur in Washington inland waters, but which are not expected to occur in the vicinity of the six Naval installations. These species may occur in waters of the Strait of Juan de Fuca or in more northerly waters in the vicinity of the San Juan Islands and areas north to the Canadian border, and include the Pacific white-sided dolphin (*Lagenorhynchus obliquidens*) and the northern resident stock of killer whales. In addition, the sea otter is found in coastal waters, with the northern (or eastern) sea otter (*Enhydra lutris kenyoni*) found in Washington. However, sea otters are managed by the U.S. Fish and Wildlife Service and are not considered further in this document.

Two populations of gray whales are recognized, eastern and western North Pacific (ENP and WNP). As discussed in greater detail in our notice of proposed rulemaking (83 FR 9366; March 5, 2018), there is no indication that WNP whales occur in waters of Hood Canal or southern Puget Sound, and it is extremely unlikely that a gray whale in close proximity to Navy construction activity would be one of the few WNP whales that have been documented in the eastern Pacific. The likelihood that a WNP whale would be present in the vicinity of Navy construction activities is insignificant and discountable, and WNP gray whales are omitted from further analysis.

TABLE 2—MARINE MAMMALS POTENTIALLY PRESENT IN THE VICINITY OF NAVY CONSTRUCTION ACTIVITIES

Common name	Scientific name	Stock	ESA/MMPA status; strategic (Y/N) [1]	Stock abundance (CV, N_{min}, most recent abundance survey) [2]	PBR	Annual M/SI [3]
Order Cetartiodactyla—Cetacea—Superfamily Mysticeti (baleen whales)						
Family Eschrichtiidae:.						
Gray whale	*Eschrichtius robustus*	Eastern North Pacific	-; N	26,960 (0.05; 25,849; 2016)	801	138
Family Balaenopteridae (rorquals):						
Humpback whale	*Megaptera novaeangliae kuzira.*	California/Oregon/Washington (CA/OR/WA).	E/D; Y	2,900 (0.03; 2,784; 2014)	16.7 [7]	≥38.6
Minke whale	*Balaenoptera acutorostrata scammoni.*	CA/OR/WA	-; N	636 (0.72; 369; 2014)	3.5	≥1.3

TABLE 2—MARINE MAMMALS POTENTIALLY PRESENT IN THE VICINITY OF NAVY CONSTRUCTION ACTIVITIES—Continued

Common name	Scientific name	Stock	ESA/MMPA status; strategic (Y/N) [1]	Stock abundance (CV, N_{min}, most recent abundance survey) [2]	PBR	Annual M/SI [3]
Superfamily Odontoceti (toothed whales, dolphins, and porpoises)						
Family Delphinidae:						
Killer whale	*Orcinus orca* [4]	West Coast Transient [5]	-; N	243 (n/a; 2009)	2.4	0
		Eastern North Pacific Southern Resident.	E/D; Y	77 (n/a; 2017)	0.13	0
Family Phocoenidae (porpoises):						
Harbor porpoise	*Phocoena phocoena vomerina.*	Washington Inland Waters	-; N	11,233 (0.37; 8,308; 2015)	66	≥7.2
Dall's porpoise	*Phocoenoides dalli dalli*	CA/OR/WA	-; N	25,750 (0.45; 17,954; 2014)	172	0.3
Order Carnivora—Superfamily Pinnipedia						
Family Otariidae (eared seals and sea lions):						
California sea lion	*Zalophus californianus*	United States	-; N	257,606 (n/a; 233,515; 2014)	14,011	≥319
Steller sea lion	*Eumetopias jubatus monteriensis.*	Eastern U.S.	-; N	41,638 (n/a; 2015)	2,498	108
Family Phocidae (earless seals):						
Harbor seal	*Phoca vitulina richardii*	Washington Northern Inland Waters [6].	-; N	11,036 (0.15; 7,213; 1999)	Undet.	9.8
		Southern Puget Sound [6]	-; N	1,568 (0.15; 1,025; 1999)	Undet.	3.4
		Hood Canal [6]	-; N	1,088 (0.15; 711; 1999)	Undet.	0.2
Northern elephant seal	*Mirounga angustirostris*	California Breeding	-; N	179,000 (n/a; 81,368; 2010)	4,882	8.8

[1] Endangered Species Act (ESA) status: Endangered (E), Threatened (T)/MMPA status: Depleted (D). A dash (-) indicates that the species is not listed under the ESA or designated as depleted under the MMPA. Under the MMPA, a strategic stock is one for which the level of direct human-caused mortality exceeds PBR or which is determined to be declining and likely to be listed under the ESA within the foreseeable future. Any species or stock listed under the ESA is automatically designated under the MMPA as depleted and as a strategic stock.

[2] NMFS marine mammal stock assessment reports at: *www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessments.* CV is coefficient of variation; N_{min} is the minimum estimate of stock abundance. In some cases, CV is not applicable. For two stocks of killer whales, the abundance values represent direct counts of individually identifiable animals; therefore there is only a single abundance estimate with no associated CV. For certain stocks of pinnipeds, abundance estimates are based upon observations of animals (often pups) ashore multiplied by some correction factor derived from knowledge of the species' (or similar species') life history to arrive at a best abundance estimate; therefore, there is no associated CV. In these cases, the minimum abundance may represent actual counts of all animals ashore.

[3] These values, found in NMFS' SARs, represent annual levels of human-caused mortality plus serious injury from all sources combined (*e.g.,* commercial fisheries, subsistence hunting, ship strike). Annual M/SI often cannot be determined precisely and is in some cases presented as a minimum value. All M/SI values are as presented in the draft 2018 SARs.

[4] Transient and resident killer whales are considered unnamed subspecies (Committee on Taxonomy, 2017).

[5] The abundance estimate for this stock includes only animals from the "inner coast" population occurring in inside waters of southeastern Alaska, British Columbia, and Washington—excluding animals from the "outer coast" subpopulation, including animals from California—and therefore should be considered a minimum count. For comparison, the previous abundance estimate for this stock, including counts of animals from California that are now considered outdated, was 354.

[6] Abundance estimates for these stocks are not considered current. PBR is therefore considered undetermined for these stocks, as there is no current minimum abundance estimate for use in calculation. We nevertheless present the most recent abundance estimates, as these represent the best available information for use in this document.

[7] This stock is known to spend a portion of time outside the U.S. EEZ. Therefore, the PBR presented here is the allocation for U.S. waters only and is a portion of the total. The total PBR for humpback whales is 33.4 (one half allocation for U.S. waters). Annual M/SI presented is for U.S. waters only.

Additional detail regarding the affected species and stocks, including local occurrence data for each of the six Navy facilities, was provided in our notice of proposed rulemaking (83 FR 9366; March 5, 2018) and is not repeated here.

Marine Mammal Hearing

Hearing is the most important sensory modality for marine mammals underwater, and exposure to anthropogenic sound can have deleterious effects. To appropriately assess the potential effects of exposure to sound, it is necessary to understand the frequency ranges marine mammals are able to hear. Current data indicate that not all marine mammal species have equal hearing capabilities (*e.g.,* Richardson *et al.,* 1995; Wartzok and Ketten, 1999; Au and Hastings, 2008). To reflect this, Southall *et al.* (2007) recommended that marine mammals be divided into functional hearing groups based on directly measured or estimated hearing ranges on the basis of available behavioral response data, audiograms derived using auditory evoked potential techniques, anatomical modeling, and other data. Note that no direct measurements of hearing ability have been successfully completed for mysticetes (*i.e.,* low-frequency cetaceans). Subsequently, NMFS (2018) described generalized hearing ranges for these marine mammal hearing groups. Generalized hearing ranges were chosen based on the approximately 65 dB threshold from the normalized composite audiograms, with an exception for lower limits for low-frequency cetaceans where the result was deemed to be biologically implausible and the lower bound from Southall *et al.* (2007) retained. The functional groups and the associated frequencies are indicated below (note that these frequency ranges correspond to the range for the composite group, with the entire range not necessarily reflecting the capabilities of every species within that group):

• Low-frequency cetaceans (mysticetes): Generalized hearing is estimated to occur between approximately 7 Hz and 35 kHz;

• Mid-frequency cetaceans (larger toothed whales, beaked whales, and most delphinids): Generalized hearing is estimated to occur between approximately 150 Hz and 160 kHz;

• High-frequency cetaceans (porpoises, river dolphins, and members of the genera *Kogia* and *Cephalorhynchus*; including two members of the genus *Lagenorhynchus,* on the basis of recent echolocation data and genetic data): Generalized hearing is estimated to occur between approximately 275 Hz and 160 kHz;

- Pinnipeds in water; Phocidae (true seals): Functional hearing is estimated to occur between approximately 50 Hz to 86 kHz;
- Pinnipeds in water; Otariidae (eared seals): Functional hearing is estimated to occur between 60 Hz and 39 kHz for Otariidae.

For more detail concerning these groups and associated frequency ranges, please see NMFS (2018) for a review of available information. Ten marine mammal species (six cetacean and four pinniped (two otariid and two phocid) species) have the potential to co-occur with Navy construction activities. Please refer to Table 2. Of the six cetacean species that may be present, three are classified as low-frequency cetaceans (*i.e.,* all mysticete species), one is classified as a mid-frequency cetacean (*i.e.,* killer whales), and two are classified as high-frequency cetaceans (*i.e.,* porpoises).

Potential Effects of the Specified Activity on Marine Mammals and Their Habitat

We provided discussion of the potential effects of the specified activity on marine mammals and their habitat in our **Federal Register** notice of proposed rulemaking (83 FR 9366; March 5, 2018). Therefore, we do not reprint the information here but refer the reader to that document. That document included a summary and discussion of the ways that components of the specified activity may impact marine mammals and their habitat, as well as general background information on sound. The ''Estimated Take'' section later in this document includes a quantitative analysis of the number of individuals that are expected to be taken by this activity. The ''Negligible Impact Analysis and Determination'' section considers the content of this section and the material it references, the ''Estimated Take'' section, and the ''Mitigation'' section, to draw conclusions regarding the likely impacts of these activities on the reproductive success or survivorship of individuals and how those impacts on individuals are likely to impact marine mammal species or stocks.

Estimated Take

This section provides an estimate of the number of incidental takes for authorization, which will inform both NMFS's consideration of whether the number of takes is ''small'' and the negligible impact determination.

Except with respect to certain activities not pertinent here, section 3(18) of the MMPA defines ''harassment'' as: Any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild (Level A harassment); or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering (Level B harassment).

Take of marine mammals incidental to Navy construction activities could occur as a result of Level A or Level B harassment. Below we describe how the potential take is estimated.

Acoustic Thresholds

We provided discussion of relevant sound thresholds in our **Federal Register** notice of proposed rulemaking (83 FR 9366; March 5, 2018) and do not repeat the information here. Generalized acoustic thresholds based on received level are used to estimate the onset of Level B harassment. These thresholds are 160 dB rms (intermittent sources) and 120 dB rms (continuous sources). Please see Table 3 for Level A harassment (auditory injury) criteria.

TABLE 3—EXPOSURE CRITERIA FOR AUDITORY INJURY

Hearing group	Peak pressure [1] (dB)	Cumulative sound exposure level [2]	
		Impulsive (dB)	Non-impulsive (dB)
Low-frequency cetaceans	219	183	199
Mid-frequency cetaceans	230	185	198
High-frequency cetaceans	202	155	173
Phocid pinnipeds	218	185	201
Otariid pinnipeds	232	203	219

[1] Referenced to 1 μPa; unweighted within generalized hearing range.
[2] Referenced to 1 μPa^2-s; weighted according to appropriate auditory weighting function.

Zones of Ensonification

Sound Propagation—We provided discussion of relevant propagation considerations in our **Federal Register** notice of proposed rulemaking (83 FR 9366; March 5, 2018) and do not repeat the information here. As is common practice in coastal waters, here we assume practical spreading loss (4.5 dB reduction in sound level for each doubling of distance). Practical spreading is a compromise that is often used under conditions where water depth increases as the receiver moves away from the shoreline, resulting in an expected propagation environment that would lie between spherical and cylindrical spreading loss conditions.

Sound Source Levels—We provided discussion of source level considerations in our **Federal Register** notice of proposed rulemaking (83 FR 9366; March 5, 2018) and do not repeat the information here. No changes have been made to the source level selections described in that notice and shown in Table 4.

TABLE 4—ASSUMED SOURCE LEVELS

Method	Type	Size (in)	SPL (rms) [1]	SPL (peak) [1 2]	SEL [1 3]
Impact	Plastic	13	156	Not available	Not available.
	Timber	12/14	170	Not available	Not available.
	Concrete	18	170	184	159.
		24	178	189	166.

TABLE 4—ASSUMED SOURCE LEVELS—Continued

Method	Type	Size (in)	SPL (rms) [1]	SPL (peak) [1 2]	SEL [1 3]
	Steel pipe	12/13	177	192	167.
		14	184	200	174.
		24	193	210	181.
		30	195	216	186.
		36	194 (Bangor); 192 (others).	211	181 (Bangor); 184 (others).
Vibratory	Timber	12	153	n/a	n/a.
		13/14	155	n/a	n/a.
	Steel pipe	13/14	155	n/a	n/a.
		16/24	161	n/a	n/a.
		30/36	166 (Bangor); 167 (others).	n/a	n/a.
	Steel sheet	n/a	163	n/a	n/a.

[1] Source levels presented at standard distance of 10 m from the driven pile. Peak source levels are not typically evaluated for vibratory pile driving, as they are lower than the relevant thresholds for auditory injury. SEL source levels for vibratory driving are equivalent to SPL (rms) source levels.

The Navy will use bubble curtains when impact driving steel piles of 24-in diameter and greater, except at NBK Bremerton and NBK Keyport (see Mitigation for further discussion). For the reasons described in our **Federal Register** notice of proposed rulemaking (83 FR 9366; March 5, 2018), we assume here that use of the bubble curtain would result in a reduction of 8 dB from the assumed SPL (rms) and SPL (peak) source levels for these pile sizes, and reduce the applied source levels accordingly. For determining distances to the cumulative SEL injury thresholds, auditory weighting functions were applied to the attenuated one-second SEL spectra for steel pipe piles (see Appendix E of the Navy's application).

Level A Harassment—In order to assess the potential for injury on the basis of the cumulative SEL metric, one must estimate the total strikes per day (impact driving) or the total driving duration per day (vibratory driving). Estimates of total strikes per day and total driving duration per day, shown in Table 5, were described in detail in our notice of proposed rulemaking, and are unchanged (83 FR 9366; March 5, 2018). Table 5 presents an estimate of average strikes per day; average strikes per day and average daily duration values are used in the exposure analyses. For vibratory driving of piles less than 16-in, a daily duration of 0.5 hours was assumed; for vibratory driving of larger piles a daily duration of 2.25 hours was assumed.

TABLE 5—ESTIMATED DAILY STRIKES AND DRIVING DURATION

Pile type and method	Installation rate per day	Estimated duration	
		Average strikes/day	Average daily duration
14-in steel; impact	No data	[1] <<1,000	No data.
24- to 30-in steel; impact	1–6	1,000	4.5 minutes to 1.5 hours.
18- to 24-in concrete; impact	1–11	[2] 4,000	3 minutes to 4 hours.
13-in steel; vibratory	2–17	n/a	0–31 minutes.[3]
24- to 30-in steel; vibratory	1–6	n/a	10 minutes to 4.5 hours.[4]

[1] All 14-in piles are expected to be vibratory driven for full embedment depth. In the event that conditions requiring impact driving are encountered, very few strikes are expected to be necessary.
[2] Estimate based on data from 272 piles installed at NBK Bremerton.
[3] Estimate based on data from 70 piles installed at NBK Bremerton.
[4] Estimate based on data from 809 piles installed at NBK Bangor. Maximum assumes six piles advanced at a rate of 45 minutes per pile.

Delineation of potential injury zones on the basis of the peak pressure metric was performed using the SPL(peak) values provided in Table 4 above. Source levels for peak pressure are unweighted within the generalized hearing range, while SEL source levels are weighted according to the appropriate auditory weighting function. As discussed in detail in the notice of proposed rulemaking (83 FR 9366; March 5, 2018), delineation of potential injury zones on the basis of the cumulative SEL metric for vibratory driving was performed using the NMFS User Spreadsheet. This relatively simple approach will typically result in higher predicted exposures for broadband sounds, since only one frequency is being considered, compared to exposures associated with the ability to fully incorporate the Technical Guidance's weighting functions.

Because use of the WFA typically results in an overestimate of zone size, the Navy took an alternative approach to delineating potential injury zones for impact driving of 24- and 36-in steel piles and 24-in concrete piles. Note that, because data is not available for all pile sizes and types, we conservatively assume the following in using the available data for 24- and 36-in steel piles and 24-in concrete piles: (1) Injury zones for impact driving 14- and 24-in piles are equivalent to the zones for 24-in piles with no bubble curtain; (2) injury zones for impact driving plastic and timber piles and for 18-in concrete piles are equivalent to the zones for 24-in concrete piles; and (3) injury zones for impact driving 30-in steel piles are equivalent to the zones calculated for 36-in piles (both with and without bubble curtain).

This approach, described in detail in Appendix E of the Navy's application, incorporated frequency weighting adjustments by applying the auditory weighting function over the entire one-second SEL spectral data sets from impact pile driving. If this information for a particular pile size was not available, the next highest source level was used to produce a conservative estimate of areas above threshold values. Sound level measurements from construction activities during the 2011 Test Pile Program at NBK Bangor were used for evaluation of impact-driven steel piles, and sound level measurements from construction activities during the 2015 Intermediate Maintenance Facility Pier 6 Fender Pile Replacement Project at NBK Bremerton were used for evaluation of impact-driven concrete piles.

In consideration of the assumptions relating to propagation, sound source levels, and the methodology applied by the Navy towards incorporating frequency weighting adjustments for delineation of cumulative SEL injury zones for impact driving of steel and concrete piles, notional radial distances to relevant thresholds were calculated (Table 6). However, these distances are sometimes constrained by topography. Actual notional ensonified zones at each facility are shown in Tables 6–1 to 6–6b of the Navy's application. These zones are modeled on the basis of a notional pile located at the seaward end of a given structure in order to provide a conservative estimate of ensonified area.

TABLE 6—CALCULATED DISTANCES TO LEVEL A HARASSMENT ZONES

Pile	Driver	PW		OW		LF		MF		HF	
		pk	cSEL	pk	cSEL	pk	cSEL	pk	cSEL	pk	cSEL
24-in concrete [1]	Impact	0	34	0	2	0	216	0	3	1	136
24-in steel [2]	Impact; BC	1	25	0	1.4	1	136	0	3	10	185
24-in steel [2]	Impact; no BC	3	86	0	5	3	159	0	6	34	342
36-in steel [2]	Impact; BC	1	158	0	9	1	736	0	10	12	541
36-in steel [2]	Impact; no BC	3	736	0	46	3	2,512	1	63	40	2,512
12- to 14-in timber [3]	Vibratory	n/a	1	n/a	<1	n/a	2	n/a	<1	n/a	3
16- and 24-in steel [4]	Vibratory	n/a	7	n/a	1	n/a	12	n/a	1	n/a	17
30- and 36-in steel (Bangor) [4].	Vibratory	n/a	15	n/a	11	n/a	25	n/a	2	n/a	37
30- and 36-in steel (others) [4].	Vibratory	n/a	18	n/a	1	n/a	30	n/a	3	n/a	43
Sheet steel [4]	Vibratory	n/a	10	n/a	1	n/a	16	n/a	1	n/a	24

PW = Phocid; OW = Otariid; LF = low frequency; MF = mid frequency; HF = high frequency; pk = peak pressure; cSEL = cumulative SEL; BC = bubble curtain

[1] Assumes 4,000 strikes per day.

[2] Assumes 1,000 strikes per day. Bubble curtain will be used for 24-, 30-, and 36-in steel piles except at NBK Bremerton and NBK Keyport. Steel piles will not be installed at NBK Manchester.

[3] Assumes 30 minute daily driving duration.

[4] Assumes 2.25 hour daily driving duration.

Summary—Here, we summarize facility-specific information about piles to be removed and installed. In general, it is likely that pile removals may be accomplished via a combination of methods (*e.g.,* vibratory driver, cut at mudline, direct pull). However, for purposes of analysis we assume that all removals would be via vibratory driver. In addition, we assume that installation of all steel piles larger than 14-in would require use of both impact and vibratory drivers, although it is likely that some of these piles would be installed solely via use of the vibratory driver. All concrete, timber, and plastic piles would be installed solely via impact driver. Steel sheet piles and steel pipe piles of 14-in diameter and smaller would be installed solely via vibratory driver. All piles removed are assumed to be replaced at a 1:1 ratio, although it is likely that a lesser number of replacement piles would be required. For full details, please see Appendix A of the Navy's application.

• NBK Bangor: The Navy anticipates ongoing maintenance work at the older Explosives Handling Wharf (EHW–1), including removal and replacement of up to 44 piles. Replacement of up to 75 piles is anticipated for contingency repairs at any existing structure. Piles to be removed would be steel, timber, and/or concrete, and replacement piles would be steel and/or concrete. As a conservative scenario, all piles are assumed to be 36-in steel for purposes of analysis.

• Zelatched Point: Replacement of up to 20 piles is anticipated for contingency repairs. Piles to be removed would be 12-in timber piles, while replacement piles could be steel, timber, and/or concrete. As a conservative scenario, all replacement piles are assumed to be 36-in steel for purposes of analysis.

• NBK Bremerton: The Navy anticipates ongoing maintenance work at multiple existing structures. At Pier 5, 360 timber fender piles would be removed and replaced with concrete piles. Timber piles are assumed to be 14-in diameter, and concrete piles are assumed to be 24-in. At Pier 4, 80 timber fender piles would be replaced with steel piles—timber and steel piles are assumed to be 14-in diameter. Anticipated repairs to other piers would require removal of up to 20 timber piles, followed by installation of steel sheet piles. Replacement of up to 75 piles is anticipated for contingency repairs at any existing structure. Piles to be removed would be steel and/or timber, and replacement piles would be 24-in concrete. The largest estimated Level B harassment zone of influence (ZOI) results from vibratory driving of sheet piles, which is expected to occur for only twenty of the estimated total of 168 activity days. The Navy has elected to assume this largest estimated ZOI for all 168 activity days as a conservative scenario.

• NBK Keyport: Replacement of up to 20 piles is anticipated for contingency repairs. Piles to be removed would be steel and/or concrete (up to 18-in), while replacement piles would be steel. As a conservative scenario, all replacement piles are assumed to be 36-in steel for purposes of analysis.

• NBK Manchester: Replacement of up to 50 piles is anticipated for contingency repairs. Piles to be removed would be timber and/or plastic (up to 18-in), while replacement piles could be timber, plastic, and/or concrete. As a conservative scenario, all replacement piles are assumed to be 24-in concrete for purposes of analysis.

• NS Everett: The Navy anticipates minor repairs at the North Wharf, requiring replacement of two concrete piles (assumed to be 24-in). Replacement of up to 76 piles is anticipated for contingency repairs. Piles to be removed would include one steel pile and 75 timber piles. The one steel pile would be replaced by a 36-in steel pile, while the timber piles could be replaced by concrete and/or timber piles. As a conservative scenario, these replacement piles are assumed to be 24-in concrete for purposes of analysis.

Level B harassment zones and associated areas of ensonification are identified in Table 7 below. Although not all zones are applied to the exposure analysis, these may be effected as part of the required monitoring. Ensonified areas vary based on topography in the vicinity of the facility and are provided for each relevant facility.

TABLE 7—RADIAL DISTANCES TO RELEVANT BEHAVIORAL ISOPLETHS AND ASSOCIATED ENSONIFIED AREAS

Pile size and type	Impact (160-dB rms) [1]	Ensonified Area [2]	Vibratory 120-dB) [3]	Ensonified area [2]
Plastic (13-in)	5	0.001	n/a	n/a.
Timber (12-in)	46	0.01	1.6	3.8 (Manchester Finger Pier); 4.6 (Manchester Fuel Pier).
Timber (13⁄14-in) [4]	46	0.01	2.2	6.8 (Bremerton); 5.9 (Manchester Finger Pier); 7.8 (Manchester Fuel Pier);[6] 9.4 (Everett).
Concrete (24-in) [4]	159	0.08	n/a	n/a.
Steel (14-in)	398	0.5 (Bremerton)	2.2	6.8 (Bremerton)
Steel (24-in; BC)	464	0.54 (Bangor); 0.48 (Zelatched Point).	n/a	n/a.
Steel (24-in; no BC) [5]	1,585	2.09 (Keyport)	5.4	26.8 (Bangor); 4.9 (Keyport); 37.9 (Zelatched Point).
Steel (30-in; BC)	631	0.91 (Bangor); 0.85 (Zelatched Point); 1.2 (Everett).	n/a	n/a.
Steel (30-in; no BC)	2,154	1.94 (Keyport)	Same as 36-in	Same as 36-in.
Steel (36-in; BC)	541 (Bangor); 398 (others)	0.7 (Bangor); 0.36 (Zelatched Point); 0.5 (Everett).	n/a	n/a.
Steel (36-in; no BC)	1,359	0.42 (Keyport)	11.7 (Bangor); 13.6 (others).	4.9 (Keyport); 75.24 (Zelatched Point); 117.8 (Everett); 40.9 (Bangor).
Sheet steel	n/a	n/a	7.4	15.0 (Bremerton).

BC = bubble curtain.
[1] Radial distance to threshold in meters.
[2] Ensonified area in square kilometers.
[3] Radial distance to threshold in kilometers.
[4] Zones for impact driving of 18-in concrete piles are equivalent to those for impact driving of timber piles. Zones for vibratory removal of up to 18-in diameter plastic/timber piles are assumed to be equivalent to those for 13⁄14-in timber piles.
[5] Zones for vibratory driving of 16-in steel piles assumed equivalent to those for 24-in steel piles.
[6] Worst-case values for vibratory extraction of timber/plastic piles at NBK Manchester, where piles to be removed are a maximum 18-in diameter.

Marine Mammal Occurrence

Available information regarding marine mammal occurrence in the vicinity of the six installations includes density information aggregated in the Navy's Marine Mammal Species Density Database (NMSDD; Navy, 2015) or site-specific survey information from particular installations (*e.g.,* local pinniped counts). More recent density estimates for harbor porpoise are available in Smultea *et al.* (2017). First, for each installation we describe anticipated frequency of occurrence and the information deemed most appropriate for the exposure estimates. For all facilities, large whales (humpback whale, minke whale, and gray whale), killer whales (transient and resident), and the elephant seal are considered as occurring only rarely and unpredictably, on the basis of past sighting records. For these species, average group size is considered in concert with expected frequency of occurrence to develop the most realistic exposure estimate. Although certain species are not expected to occur at all at some facilities—for example, resident killer whales are not expected to occur in Hood Canal—the Navy has developed an overall take estimate and request for these species that would apply to activities occurring over the 5-year duration at all six installations.

• NBK Bangor: In addition to the species described above, the Dall's porpoise is considered as a rare, unpredictably occurring species. A density-based analysis is used for the harbor porpoise, while data from site-specific abundance surveys is used for the California sea lion, Steller sea lion, and harbor seal.

• Zelatched Point: In addition to the species described above, the Dall's porpoise is considered as a rare, unpredictably occurring species. A density-based analysis is used for the harbor porpoise, California sea lion, Steller sea lion, and harbor seal.

• NBK Bremerton: A density-based analysis is used for the harbor porpoise, Dall's porpoise, and Steller sea lion, while data from site-specific abundance surveys is used for the California sea lion and harbor seal.

• NBK Keyport: A density-based analysis is used for the harbor porpoise, Dall's porpoise, California sea lion, Steller sea lion, and harbor seal.

• NBK Manchester: A density-based analysis is used for the harbor porpoise, Dall's porpoise, and harbor seal, while data from site-specific abundance surveys is used for the California sea lion and Steller sea lion.

• NS Everett: A density-based analysis is used for the harbor porpoise, Dall's porpoise, and Steller sea lion, while data from site-specific abundance surveys is used for the California sea lion and harbor seal.

TABLE 8—MARINE MAMMAL DENSITIES

Species	Region	Density (June–February)
Harbor porpoise	Hood Canal (Bangor, Zelatched Point)	0.44
	East Whidbey (Everett)	0.75
	Bainbridge (Bremerton, Keyport)	0.53
	Vashon (Manchester)	0.25
Dall's porpoise	Puget Sound	0.039
Steller sea lion	Puget Sound	0.0368
	Dabob Bay	0.0251
California sea lion	Puget Sound	0.1266
	Dabob Bay	0.279
Harbor seal	Everett	2.2062
	Keyport/Manchester	1.219
	Dabob Bay	9.918

Sources: Navy, 2015; Smultea *et al.,* 2017 (harbor porpoise).

Exposure Estimates

To quantitatively assess exposure of marine mammals to noise from pile driving activities, we use three methods, determined by the species' spatial and temporal occurrence. For species with rare or infrequent occurrence at a given installation during the in-water work window, the likelihood of interaction was reviewed on the basis of past records of occurrence (described in detail in our **Federal Register** notice of proposed rulemaking (83 FR 9366; March 5, 2018)) and the potential maximum duration of work days at each installation, as well as total work days for all installations. Occurrence of the species in this category (*i.e.,* large whales, killer whales, elephant seal (all installations), and Dall's porpoise (Hood Canal)) would not be anticipated to extend for multiple days. For the large whales and killer whales, the duration of occurrence was set to two days, expected to be roughly equivalent to one transit in the vicinity of a project site. The calculation for species with rare or infrequent occurrence is:

Exposure estimate = expected group size × probable duration

For species that occur regularly but for which site-specific abundance information is not available, density estimates (Table 8) were used to determine the number of animals potentially exposed on any one day of pile driving or extraction. The calculation for density-based analysis of species with regular occurrence is:

Exposure estimate = N (density) × ZOI (area) × maximum days of pile driving

For remaining species, site-specific abundance information (*i.e.,* average monthly maximum over the time period when pile driving will occur) was used:

Exposure estimate = Abundance × maximum days of pile driving

Large Whales—For each species of large whale (*i.e.,* humpback whale, minke whale, and gray whale), we assume rare and infrequent occurrence at all installations. For all three species, if observed, they typically occur singly or in pairs. Therefore, for all three species, we assume that a pair of whales may occur in the vicinity of an installation for a total of two days. We do not expect that this would happen multiple times, and cannot predict where such an occurrence may happen, so would authorize a total of four takes by Level B harassment of each species in total for the 5-year duration (across all installations).

It is important to note that the Navy will implement a shutdown of pile driving activity if any large whale is observed within any defined harassment zone (see Mitigation section below). Therefore, the take number is intended to provide insurance against the event that whales occur within Level B harassment zones that cannot be fully observed by monitors. As a result of this mitigation, we do not believe that Level A harassment is a likely outcome upon occurrence of any large whale. While the calculated Level A harassment zone is as large as 2.5 km for impact driving of 36-in steel piles without a bubble curtain (ranging from 136–736 m for other impact driving scenarios), this requires that a whale be present at that range for the full assumed duration of 1,000 pile strikes (expected to require 1.5 hours). Given the Navy's commitment to shut down upon observation of a large whale, and the likelihood that the presence of a large whale in the vicinity of any Navy installation would be known due to reporting via Orca Network (see Monitoring and Reporting), we do not expect that any whale would be present within a Level A harassment zone for sufficient duration to actually experience permanent threshold shift (PTS).

Killer Whales—For killer whales, the take number is derived via the same process described above for large whales. For transient killer whales, we assume an average group size of six whales occurring for a period of two days. The resulting total take number of 12 would also account for the low probability that a larger group occurred once. For resident killer whales, we assume an average group size of 20 whales occurring for two days. This is equivalent to the expected pod size for J pod, which is most likely to occur in the vicinity of Navy installations, but would also account for the unlikely occurrence of L pod (with a size of approximately 40 whales) once in the vicinity of any Navy installation.

As with large whales, the Navy will implement shutdown of pile driving activity at any time that any killer whale is observed within any calculated harassment zone. We expect this to minimize the extent and duration of any Level B harassment. Given the small size of calculated Level A harassment zones—maximum of 63 m for the worst-case scenario of impact-driven 36-in steel piles with no bubble curtain, other scenarios range from 1–10 m—we do not anticipate any potential for Level A harassment of killer whales.

Dall's Porpoise—Using the density given in Table 8, the largest appropriate

ZOI for each of the four installations in Puget Sound, and the number of days associated with each of these installations (as indicated in harbor porpoise section below), the total estimated exposure of Dall's porpoises above Level B harassment thresholds is 146. Dall's porpoises are not expected to occur in Hood Canal. Dall's porpoises are not expected to occur frequently in the vicinity of Navy installations and have not been reported in recent years. This total take authorization number (146) is applied to all installations over the 5-year duration.

The Navy will implement shutdown of pile driving activity at any time if a Dall's porpoise is observed in any harassment zone. Therefore, the take estimate is precautionary in accounting for potential occurrence in areas that cannot be visually observed or in the event that porpoises appear within Level B harassment zones before shutdown can be implemented. As was described for large whales, as a result of this mitigation, we do not believe that Level A harassment is a likely outcome. While the calculated Level A harassment zone is as large as 2.5 km for impact driving of 36-in steel piles without a bubble curtain (ranging from 136–541 m for other impact driving scenarios), this requires that a porpoise be present at that range for the full assumed duration of 1,000 pile strikes (expected to require 1.5 hours). Given the Navy's commitment to shut down upon observation of a porpoise, and the likelihood that a porpoise would engage in aversive behavior prior to experiencing PTS, we do not expect that any porpoise would be present within a Level A harassment zone for sufficient duration to actually experience PTS.

Harbor Porpoise—Level B harassment estimates for harbor porpoise were calculated for each installation using the appropriate density given in Table 8, the largest appropriate ZOI for each installation, and the appropriate number of days.

- NBK Bangor: Using the Hood Canal sub-region density, 119 days of pile driving, and the largest ZOI calculated for pile driving at this location (40.9 km² for vibratory installation of 30- or 36-in steel piles) produces an estimate of 2,142 incidents of Level B harassment exposure for harbor porpoise.
- Zelatched Point: Using the Hood Canal sub-region density, 20 days of pile driving, and the largest ZOI calculated for pile driving at this location (75.24 km² for vibratory installation of 30- or 36-in steel piles) produces an estimate of 662 incidents of Level B harassment exposure for harbor porpoise.
- NBK Bremerton: Using the Bainbridge sub-region density, 168 days of pile driving, and the largest ZOI calculated for pile driving at this location (15 km² for vibratory installation of sheet steel piles) produces an estimate of 1,336 incidents of Level B harassment exposure for harbor porpoise.
- NBK Keyport: Using the Bainbridge sub-region density, 20 days of pile driving, and the largest ZOI calculated for pile driving at this location (4.9 km² for vibratory installation of 30- or 36-in steel piles) produces an estimate of 52 incidents of Level B harassment exposure for harbor porpoise.
- NBK Manchester: Using the Vashon sub-region density, 50 days of pile driving, and the largest ZOI calculated for vibratory removal of timber piles (7.8 km² for vibratory extraction of timber piles) produces an estimate of 98 incidents of Level B harassment exposure for harbor porpoise.
- NS Everett: Using the East Whidbey sub-region density, 78 days of pile driving, and the largest ZOI calculated for vibratory extraction of timber piles (9.4 km²) produces an estimate of 552 incidents of Level B harassment exposure for harbor porpoise. Although some vibratory installation is anticipated for a single steel pile, we anticipate this would occur for only a brief period. Therefore, use of the assumed zone for vibratory extraction of timber piles is appropriate in accounting for reasonably expected marine mammal exposure at this location.

The Navy will implement shutdown of pile driving activity at any time if a harbor porpoise is observed in any harassment zone. Therefore, the take estimate is precautionary in accounting for potential occurrence in areas that cannot be visually observed or in the event that porpoises appear within Level B harassment zones before shutdown can be implemented. As was described for large whales, as a result of this mitigation, we do not believe that Level A harassment is a likely outcome. While the calculated Level A harassment zone is as large as 2.5 km for impact driving of 36-in steel piles without a bubble curtain (ranging from 136–541 m for other impact driving scenarios), this requires that a porpoise be present at that range for the full assumed duration of 1,000 pile strikes (expected to require 1.5 hours). Given the Navy's commitment to shut down upon observation of a porpoise, and the likelihood that a porpoise would engage in aversive behavior prior to experiencing PTS, we do not expect that any porpoise would be present within a Level A harassment zone for sufficient duration to actually experience PTS.

Steller Sea Lion—Level B harassment exposure estimates for Steller sea lions were calculated for each installation using the appropriate density given in Table 8 or site-specific abundance, the largest appropriate ZOI for each installation, and the appropriate number of days. Additional detail regarding site-specific abundance information was provided in our **Federal Register** notice of proposed rulemaking (83 FR 9366; March 5, 2018).

- NBK Bangor: The average of the monthly maximum counts during the in-water work window provides an estimate of three Steller sea lions present per day. Using this value for 119 days results in an estimate of 357 incidents of Level B harassment exposure.
- Zelatched Point: Using the Dabob Bay density value (Table 8), 20 days of pile driving, and the largest ZOI calculated for pile driving at this location (75.24 km² for vibratory installation of 30- or 36-in steel piles) produces an estimate of 38 incidents of Level B harassment exposure for Steller sea lions.
- NBK Bremerton: Using the Puget Sound density value (Table 8), 168 days of pile driving, and the largest ZOI calculated for pile driving at this location (15 km² for vibratory installation of sheet steel piles) produces an estimate of 93 incidents of Level B harassment exposure for Steller sea lions.
- NBK Keyport: Using the Puget Sound density value (Table 8), 20 days of pile driving, and the largest ZOI calculated for pile driving at this location (4.9 km² for vibratory installation of 30- or 36-in steel piles) produces an estimate of four incidents of Level B harassment exposure for Steller sea lions.
- NBK Manchester: Site-specific occurrence data indicate that 10 Steller sea lions may be present on any given day. Using this average value for 50 days results in an estimate of 500 incidents of Level B harassment exposure.
- NS Everett: Using the Puget Sound density value (Table 8), 78 days of pile driving, and the largest ZOI calculated for this location (9.4 km²) produces an estimate of 27 incidents of Level B exposure for Steller sea lion.

Given the small size of calculated Level A harassment zones—maximum of 43 m for the worst-case scenario of impact-driven 36-in steel piles with no bubble curtain, other scenarios range from 1–11 m—we do not anticipate any potential for Level A harassment of Steller sea lions.

California Sea Lions—Level B harassment exposure estimates for California sea lions were calculated for each installation using the appropriate density given in Table 8 or site-specific abundance, the largest appropriate ZOI for each installation, and the appropriate number of days. Additional detail regarding site-specific abundance information was provided in our **Federal Register** notice of proposed rulemaking (83 FR 9366; March 5, 2018).

- NBK Bangor: The average of the monthly maximum counts during the in-water work window provides an estimate of 49 California sea lions per day. Using this value for 119 days results in an estimate of 5,831 incidents of Level B harassment exposure.
- Zelatched Point: Using the Dabob Bay density value (Table 8), 20 days of pile driving, and the largest ZOI calculated for pile driving at this location (75.24 km^2 for vibratory installation of 30- or 36-in steel piles) produces an estimate of 420 incidents of Level B harassment exposure for California sea lions.
- NBK Bremerton: The average of the monthly maximum counts during the in-water work window provides an estimate of 69 California sea lions per day. Using this value for 168 days results in an estimate of 11,592 incidents of Level B harassment exposure.
- NBK Keyport: Using the Puget Sound density value (Table 8), 20 days of pile driving, and the largest ZOI calculated for pile driving at this location (4.9 km^2 for vibratory installation of 30- or 36-in steel piles) produces an estimate of 12 incidents of Level B harassment exposure for California sea lions.
- NBK Manchester: Site-specific occurrence data indicate that 43 California sea lions may be present on any given day. Using this average value for 50 days results in an estimate of 2,150 incidents of Level B harassment exposure.
- NS Everett: The average of the monthly maximum counts during the in-water work window provides an estimate of 66 California sea lions per day. Using this value for 78 days results in an estimate of 5,148 incidents of Level B harassment exposure.

Given the small size of calculated Level A harassment zones—maximum of 43 m for the worst-case scenario of impact-driven 36-in steel piles with no bubble curtain, other scenarios range from 1–11 m—we do not anticipate any potential for Level A harassment of California sea lions.

Harbor Seal—Harbor seals are expected to occur year-round at all installations, with the greatest numbers expected at installations with nearby haul-out sites. Level B harassment exposure estimates for harbor seals were calculated for each installation using the appropriate density given in Table 8 or site-specific abundance, the largest appropriate ZOI for each installation, and the appropriate number of days. Additional detail regarding site-specific abundance information was provided in our **Federal Register** notice of proposed rulemaking (83 FR 9366; March 5, 2018).

Harbor seals are expected to be the most abundant marine mammal at all installations, often occurring in and around existing in-water structures in a way that may restrict observers' ability to adequately observe seals and subsequently implement shutdowns. In addition, the calculated Level A harassment zones are significantly larger than those for sea lions, which may also be abundant at various installations at certain times of year. For harbor seals, the largest calculated Level A harassment zone is 736 m (compared with a maximum zone of 43 m for sea lions), calculated for the worst-case scenario of impact-driven 36-in steel piles without use of the bubble curtain. Other scenarios range from 25–158 m. Therefore, we assume that some Level A harassment is likely to occur for harbor seals and provide installation-specific estimates below.

- NBK Bangor: Site-specific occurrence data indicate that as many as 28 harbor seals hauled out per day under Marginal Wharf (or were observed swimming in adjacent waters). Assuming a few other individuals may be present elsewhere on the Bangor waterfront, we estimate that 35 harbor seals may be present per day near the installation during summer and early fall, which are expected to be months with greatest abundance of seals. Using this value for 119 days results in an estimate of 4,165 incidents of Level B harassment exposure.

Considering the largest Level A harassment zone expected to typically occur at NBK Bangor (158 m), and assuming as a precaution that one seal per day could remain within the calculated zone for a sufficient period to accumulate enough energy to result in PTS, we estimate 119 incidents of take by Level A harassment. It is important to note that the estimate of potential Level A harassment for NBK Bangor is expected to be an overestimate, as planned projects are not expected to occur near Marginal Wharf—the location where most harbor seal activity occurs.

- Zelatched Point: Using the Dabob Bay density value (Table 8), 20 days of pile driving, and the largest ZOI calculated for pile driving at this location (75.24 km^2 for vibratory installation of 30- or 36-in steel piles) produces an estimate of 14,925 incidents of Level B harassment exposure for harbor seals. The largest calculated Level A harassment zone at Zelatched Point would be 158 m. However, because harbor seals are not known to haul out or congregate in the vicinity of in-water structures, as is the case at NBK Bangor, we do not anticipate that Level A harassment will occur at Zelatched Point and will not authorize such take.
- NBK Bremerton: Site-specific occurrence data indicate that approximately 11 harbor seals may be present per day. Using this value for 168 days results in an estimate of 1,848 incidents of Level B harassment exposure. The largest Level A harassment zone at NBK Bremerton would be 86 m and, given the lack of regular presence of harbor seals in close proximity to existing in-water structures, we do not anticipate that Level A harassment will occur at NBK Bremerton and will not authorize such take.
- NBK Keyport: No harbor seal haul-outs have been identified at this installation. Using the Puget Sound density value (Table 8), 20 days of pile driving, and the largest ZOI calculated for pile driving at this location (4.9 km^2 for vibratory installation of 30- or 36-in steel piles) produces an estimate of 119 incidents of Level B harassment exposure for harbor seals. Given the lack of haul-outs and of regular harbor seal presence at this installation, we do not anticipate that Level A harassment will occur at NBK Keyport and will not authorize such take.
- NBK Manchester: No harbor seal haul-outs have been identified at this installation. Using the appropriate density value (Table 8), 50 days of pile driving, and the largest ZOI calculated for vibratory extraction of timber piles (7.8 km^2) produces an estimate of 477 incidents of Level B harassment exposure for harbor seals. Given the lack of haul-outs and of regular harbor seal presence at this installation, we do not anticipate that Level A harassment will occur at NBK Manchester and will not authorize such take.
- NS Everett: The average of the monthly maximum counts during the in-water work window provides an estimate of 212 seals per day. Using this

value for 78 days results in an estimate of 16,536 incidents of Level B harassment exposure.

The largest Level A harassment zone calculated for NS Everett (158 m) would occur for only one day during impact driving of the single 36-in steel pile. During the remainder of pile driving at this installation, the largest Level A harassment zone would be 34 m (impact driving of 24-in concrete piles). Given the abundant seal population at this site, we assume that some portion of the seal population may be present and unobserved within these zones for a sufficient period to accumulate enough energy to result in PTS. For the larger zone, we assume that 11 seals (five percent of animals present) may occur within the Level A harassment zone for such a duration, while for the smaller zone associated with concrete piles, we assume that two seals (one percent of animals present) of the population may occur within the zone for such a duration. Therefore, we estimate a total number of 165 incidents of take by Level A harassment (*i.e.,* two seals on each of the 77 concrete pile driving days in addition to 11 seals on the one day on which a steel pile would be installed).

Northern Elephant Seal—Northern elephant seals are considered rare visitors to Puget Sound. However, solitary juvenile elephant seals have been known to sporadically haul out to molt in Puget Sound during spring and summer months. Because there are occasional sightings in Puget Sound, we reason that exposure of up to one seal to noise above Level B harassment thresholds could occur for a two-day duration. This event could occur at any installation over the 5-year duration of these regulations.

The total amount of take by Level B harassment that may be authorized for all species and installations is summarized in Table 9 below. Take by Level A harassment may be authorized only for harbor seals occurring at NBK Bangor and NS Everett (a total of 284 such incidents, as detailed above).

TABLE 9—ESTIMATED TAKE BY LEVEL B HARASSMENT

Species	Bangor	Zelatched Point	Bremerton	Keyport	Manchester	Everett	Total	Percent [1]
Humpback whale	Applies across all installations						4	0.2
Minke whale	Applies across all installations						4	0.02
Gray whale	Applies across all installations						4	0.6
Killer whale (transient)	Applies across all installations						12	4.9
Killer whale (resident)	Applies across all installations						40	48.2
Dall's porpoise	Applies across all installations						146	0.6
Harbor porpoise	2,142	662	1,336	52	98	552	4,842	43.1
Steller sea lion	357	38	93	4	500	27	1,019	2.4
California sea lion	5,831	420	11,592	12	2,150	5,148	25,153	8.5
Harbor seal	4,680	14,925	1,848	119	477	16,536	38,585	n/a
Elephant seal	Applies across all installations						2	0.001

[1] Please see Small Numbers Analysis for more details about these percentages.

Mitigation

Under Section 101(a)(5)(A) of the MMPA, NMFS must set forth the permissible methods of taking pursuant to such activity, and other means of effecting the least practicable adverse impact on such species or stock and its habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance, and on the availability of such species or stock for taking for certain subsistence uses (''least practicable adverse impact''). NMFS does not have a regulatory definition for ''least practicable adverse impact.'' However, NMFS's implementing regulations require applicants for incidental take authorizations to include information about the availability and feasibility (economic and technological) of equipment, methods, and manner of conducting such activity or other means of effecting the least practicable adverse impact upon the affected species or stocks and their habitat (50 CFR 216.104(a)(11)).

In evaluating how mitigation may or may not be appropriate to ensure the least practicable adverse impact on species or stocks and their habitat, we carefully consider two primary factors:

(1) The manner in which, and the degree to which, implementation of the measure(s) is expected to reduce impacts to marine mammal species or stocks, their habitat, and their availability for subsistence uses. This analysis will consider such things as the nature of the potential adverse impact (such as likelihood, scope, and range), the likelihood that the measure will be effective if implemented, and the likelihood of successful implementation.

(2) The practicability of the measure for applicant implementation. Practicability of implementation may consider such things as cost, impact on operations, personnel safety, and practicality of implementation.

The mitigation strategies described below largely follow those required and successfully implemented under previous incidental take authorizations issued in association with similar construction activities. Measurements from similar pile driving events were coupled with practical spreading loss and other relevant information to estimate ZOIs (see ''Estimated Take''); these ZOI values were used to develop mitigation measures for pile driving activities at the six installations. Background discussion related to underwater sound concepts and terminology was provided in our **Federal Register** notice of proposed rulemaking (83 FR 9366; March 5, 2018). The ZOIs were used to inform the mitigation zones that would be established to prevent Level A harassment and to minimize Level B harassment for all cetacean species, while providing estimates of the areas within which Level B harassment might occur.

During installation of steel piles, the Navy will use vibratory driving to the maximum extent practicable. In addition to the specific measures described later in this section, the Navy will conduct briefings for construction supervisors and crews, the marine mammal monitoring team, and Navy staff prior to the start of all pile driving activity, and when new personnel join the work, in order to explain responsibilities, communication procedures, the marine mammal monitoring protocol, and operational procedures. Other mitigation requirements committed to by the Navy but not relating to marine mammals (*e.g.,* construction best management practices) are described in section 11 of the Navy's application.

Timing

As described previously, the Navy will adhere to in-water work windows designed for the protection of fish. These timing windows would also benefit marine mammals by limiting the annual duration of construction activities. At NBK Bangor and Zelatched Point, the Navy will adhere to a July 16 through January 15 window, while at the remaining facilities this window is extended to February 15.

On a daily basis, in-water construction activities will occur only during daylight hours (sunrise to sunset) except from July 16 to September 15 when impact pile driving will only occur starting two hours after sunrise and ending two hours before sunset in order to protect marbled murrelets (*Brachyramphus marmoratus*) during the nesting season.

Monitoring and Shutdown for Pile Driving

The following measures apply to the Navy's mitigation through shutdown and disturbance zones:

Shutdown Zone—The purpose of a shutdown zone is to define an area within which shutdown of activity would occur upon sighting of a marine mammal (or in anticipation of a marine mammal entering the defined area), thus preventing some undesirable outcome, such as auditory injury or behavioral disturbance of sensitive species (serious injury or death are unlikely outcomes even in the absence of mitigation measures). For all pile driving activities, the Navy will establish a minimum shutdown zone with a radial distance of 10 m. This minimum zone is intended to prevent the already unlikely possibility of physical interaction with construction equipment and to establish a precautionary minimum zone with regard to acoustic effects.

Relevant information regarding Level A harassment zones was provided in Tables 3–5 and calculated isopleth distances were provided in Table 6. In many cases, especially for vibratory driving, the minimum shutdown zone of 10 m is expected to contain the area in which auditory injury could occur. In all circumstances where the predicted Level A harassment zone exceeds the minimum zone, the Navy shall implement a shutdown zone equal to the predicted Level A harassment zone (see Table 6). In addition, the Navy will implement shutdown upon observation of any cetacean within a calculated Level B harassment zone (see Table 7).

Disturbance Zone—Disturbance zones are the areas in which sound pressure levels equal or exceed 160 and 120 dB rms (for impact and vibratory pile driving, respectively). Disturbance zones provide utility for monitoring conducted for mitigation purposes (*i.e.,* shutdown zone monitoring) by establishing monitoring protocols for areas adjacent to the shutdown zones and, as noted above, the disturbance zones act as de facto shutdown zones for cetaceans. Monitoring of disturbance zones enables observers to be aware of and communicate the presence of marine mammals in the project area but outside the shutdown zone, and thus prepare for potential shutdowns of activity. For cetaceans, the Navy will implement shutdowns upon observation of any cetacean within a disturbance zone (while acknowledging that some disturbance zones are too large to practicably monitor)—these will also be recorded as incidents of harassment. For pinnipeds, the primary purpose of disturbance zone monitoring is for documenting incidents of Level B harassment; disturbance zone monitoring is discussed in greater detail later (see ''Monitoring and Reporting''). Nominal radial distances for disturbance zones are shown in Table 7.

In order to document observed incidents of harassment, monitors record all marine mammal observations, regardless of location. The observer's location and the location of the pile being driven will be known, and the location of the animal may be estimated as a distance from the observer and then compared to the location from the pile. It may then be estimated whether the animal was exposed to sound levels constituting incidental harassment on the basis of predicted distances to relevant thresholds in post-processing of observational data, and a precise accounting of observed incidents of harassment created. This information may then be used to extrapolate observed takes to reach an approximate understanding of actual total takes, in cases where the entire zone was not monitored.

Monitoring Protocols—Monitoring will be conducted before, during, and after pile driving activities. In addition, observers will record all incidents of marine mammal occurrence, regardless of distance from activity, and monitors will document any behavioral reactions in concert with distance from piles being driven. Observations made outside the shutdown zone will not result in shutdown; that pile segment will be completed without cessation, unless the animal approaches or enters the shutdown zone, at which point all pile driving activities would be halted. Monitoring will take place from 15 minutes prior to initiation through 30 minutes post-completion of pile driving activities. Pile driving activities include the time to install or remove a single pile or series of piles, as long as the time elapsed between uses of the pile driving equipment is no more than 30 minutes.

Prior to the start of pile driving on any day, the Navy will contact and/or review the latest sightings data from the Orca Network and/or Center for Whale Research to determine the location of the nearest marine mammal sightings. The Orca Sightings Network consists of a list of over 600 residents, scientists, and government agency personnel in the United States and Canada, and includes passive acoustic detections. The presence of a killer whale in the vicinity of any of the six installations would likely be a notable event, drawing public attention and media scrutiny. With this level of coordination in the region of activity, the Navy should be able to effectively receive real-time information on the presence or absence of whales, sufficient to inform the day's activities. Pile driving will not occur if there is a risk of incidental harassment of a southern resident killer whale.

The following additional measures apply to visual monitoring:

(1) Monitoring will be conducted by qualified, trained protected species observers, who will be placed at the best vantage point(s) practicable (*i.e.,* from a small boat, construction barges, on shore, or any other suitable location) to monitor for marine mammals and implement shutdown/delay procedures when applicable by calling for the shutdown to the hammer operator. Observers shall have no other construction-related tasks while conducting monitoring. Observers should have the following minimum qualifications:

• Visual acuity in both eyes (correction is permissible) sufficient for discernment of moving targets at the water's surface with ability to estimate target size and distance; use of binoculars may be necessary to correctly identify the target;

• Ability to conduct field observations and collect data according to assigned protocols;
• Experience or training in the field identification of marine mammals, including the identification of behaviors;
• Sufficient training, orientation, or experience with the construction operation to provide for personal safety during observations;
• Writing skills sufficient to document observations including, but not limited to: the number and species of marine mammals observed; dates and times when in-water construction activities were conducted; dates and times when in-water construction activities were suspended to avoid potential incidental injury of marine mammals from construction noise within a defined shutdown zone; and marine mammal behavior; and
• Ability to communicate orally, by radio or in person, with project personnel to provide real-time information on marine mammals observed in the area as necessary.

Observer teams employed by the Navy in satisfaction of the mitigation and monitoring requirements described herein must meet the following additional requirements:
• Independent observers (*i.e.,* not construction personnel) are required.
• At least one observer must have prior experience working as an observer.
• Other observers may substitute education (degree in biological science or related field) or training for experience.
• Where a team of three or more observers are required, one observer should be designated as lead observer or monitoring coordinator. The lead observer must have prior experience working as an observer.

(2) Prior to the start of pile driving activity, the shutdown zone will be monitored for 15 minutes to ensure that it is clear of marine mammals. Pile driving will only commence once observers have declared the shutdown zone clear of marine mammals; marine mammals will be allowed to remain in the shutdown zone (*i.e.,* must leave of their own volition), and their behavior will be monitored and documented. The shutdown zone may only be declared clear, and pile driving started, when the entire shutdown zone is visible (*i.e.,* when not obscured by dark, rain, fog, etc.). In addition, if such conditions should arise during impact pile driving that is already underway, the activity will halt.

(3) If a marine mammal approaches or enters the shutdown zone during the course of pile driving operations, activity will be halted and delayed until either the animal has voluntarily left and been visually confirmed beyond the shutdown zone or fifteen minutes have passed without re-detection of the animal. Monitoring will be conducted throughout the time required to drive a pile and for thirty minutes following the conclusion of pile driving.

Soft Start

The use of a soft start procedure is believed to provide additional protection to marine mammals by warning marine mammals or providing them with a chance to leave the area prior to the hammer operating at full capacity, and typically involves a requirement to initiate sound from the hammer at reduced energy followed by a waiting period. This procedure is repeated two additional times. It is difficult to specify the reduction in energy for any given hammer because of variation across drivers and, for impact hammers, the actual number of strikes at reduced energy will vary because operating the hammer at less than full power results in ''bouncing'' of the hammer as it strikes the pile, resulting in multiple ''strikes.'' The Navy will utilize soft start techniques for impact pile driving. We require an initial set of three strikes from the impact hammer at reduced energy, followed by a 30-second waiting period, then 2 subsequent 3-strike sets. Soft start will be required at the beginning of each day's impact pile driving work and at any time following a cessation of impact pile driving of thirty minutes or longer; the requirement to implement soft start for impact driving is independent of whether vibratory driving has occurred within the prior 30 minutes.

Bubble Curtain

Sound levels can be greatly reduced during impact pile driving using sound attenuation devices, including bubble curtains, which create a column of air bubbles rising around a pile from the substrate to the water surface. The air bubbles absorb and scatter sound waves emanating from the pile, thereby reducing the sound energy. Bubble curtains may be confined or unconfined. Cushion blocks are also commonly used by construction contractors in order to protect equipment and the driven pile; use of cushion blocks typically reduces emitted sound pressure levels to some extent.

The literature presents a wide array of observed attenuation results for bubble curtains (see Appendix B of the Navy's application). The variability in attenuation levels is due to variation in design, as well as differences in site conditions and difficulty in properly installing and operating in-water attenuation devices. As a general rule, reductions of greater than 10 dB cannot be reliably predicted. Prior monitoring by the Navy during a project at NBK Bangor reported a range of measured values for realized attenuation mostly within 6 to 12 dB, but with an overall average of 9 dB in effective attenuation (Illingworth and Rodkin, 2012).

The Navy will use a bubble curtain during impact driving of all steel piles greater than 14-in diameter in water depths greater than 2 ft (0.67 m), except at NBK Bremerton and Keyport. Bubble curtains will not be used during impact driving of smaller steel piles or other pile types due to the relatively low source levels, as the requirement to deploy the curtain system at each driven pile results in a significantly lower production rate. Where a bubble curtain is used, the contractor will be required to turn it on prior to the soft start in order to flush fish from the area closest to the driven pile.

Bubble curtains cannot be used at NBK Bremerton and Keyport due to the risk of disturbing contaminated sediments at these sites. Sediment contamination within Sinclair Inlet, including the project areas at NBK Bremerton, includes a variety of metals and organic chemicals originating from human sources. The marine sediments have been affected by past shipyard operations, leaching from creosote-treated piles, and other activities in Sinclair Inlet. Sediments at the project sites and adjacent to the piers at Bremerton have a pollution control plan for various metals, polycyclic aromatic hydrocarbons, polychlorinated biphenyls, and other semivolatile organic compounds (SVOC), and active cleanup is occurring pursuant to the terms of an agreement developed under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) in cooperation with the U.S. Environmental Protection Agency and the Washington Department of Ecology. The sediment at and near Keyport in Liberty Bay also has a pollution control plan, for multiple heavy metals, polychlorinated aromatic hydrocarbons, phthalates, and various other SVOCs. The Navy will assess the use of bubble curtains at NBK Keyport on a project-by-project basis.

To avoid loss of attenuation from design and implementation errors, the Navy will require specific bubble curtain design specifications, including testing requirements for air pressure and flow at each manifold ring prior to initial impact hammer use, and a requirement for placement on the substrate. The bubble curtain must distribute air bubbles around 100 percent of the piling perimeter for the full depth of the water column. The lowest bubble ring shall be in contact with the mudline for the full circumference of the ring, and the weights attached to the bottom ring shall ensure 100 percent mudline contact. No parts of the ring or other objects shall prevent full mudline contact. The contractor shall also train personnel in the proper balancing of air flow to the bubblers, and must submit an inspection/performance report to the Navy for approval within 72 hours following the performance test. Corrections to the noise attenuation device to meet the performance standards shall occur prior to use for impact driving.

We have carefully evaluated the Navy's planned mitigation measures and considered a range of other measures in the context of ensuring that we prescribe the means of effecting the least practicable adverse impact on the affected marine mammal species and stocks and their habitat. Based on our evaluation of these measures, we have determined that the planned mitigation measures provide the means of effecting the least practicable adverse impact on marine mammal species or stocks and their habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance, and on the availability of such species or stock for subsistence uses.

Monitoring and Reporting

In order to issue an LOA for an activity, Section 101(a)(5)(A) of the MMPA states that NMFS must set forth requirements pertaining to the monitoring and reporting of the authorized taking. NMFS's MMPA implementing regulations further describe the information that an applicant should provide when requesting an authorization (50 CFR 216.104(a)(13)), including the means of accomplishing the necessary monitoring and reporting that will result in increased knowledge of the species and the level of taking or impacts on populations of marine mammals.

Monitoring and reporting requirements prescribed by NMFS should contribute to improved understanding of one or more of the following:

- Occurrence of significant interactions with marine mammal species in action area (*e.g.,* animals that came close to the vessel, contacted the gear, or are otherwise rare or displaying unusual behavior).
- Nature, scope, or context of likely marine mammal exposure to potential stressors/impacts (individual or cumulative, acute or chronic), through better understanding of: (1) Action or environment (*e.g.,* source characterization, propagation, ambient noise); (2) affected species (*e.g.,* life history, dive patterns); (3) co-occurrence of marine mammal species with the action; or (4) biological or behavioral context of exposure (*e.g.,* age, calving or feeding areas).
- Individual marine mammal responses (behavioral or physiological) to acoustic stressors (acute, chronic, or cumulative), other stressors, or cumulative impacts from multiple stressors.
- How anticipated responses to stressors impact either: (1) Long-term fitness and survival of individual marine mammals; or (2) populations, species, or stocks.
- Effects on marine mammal habitat (*e.g.,* marine mammal prey species, acoustic habitat, or important physical components of marine mammal habitat).
- Mitigation and monitoring effectiveness.

Coordination and Plan Development

An installation-specific marine mammal monitoring plan for each year's anticipated work will be developed by the Navy and presented each year for approval by NMFS prior to the start of construction. Final monitoring plans will be prepared and submitted to NMFS within 30 days following receipt of comments on the draft plans from NMFS. Please see Appendix D of the Navy's application for a marine mammal monitoring plan template. During each in-water work period covered by an LOA, the Navy will periodically update NMFS on the progress of ongoing projects, as needed.

Visual Marine Mammal Observations

The Navy will collect sighting data and behavioral responses to pile driving activity for marine mammal species observed in the region of activity during the period of activity. The number and location of required observers will be determined specific to each installation on an annual basis, depending on the nature of work anticipated (including the size of zones to be monitored). All observers will be trained in marine mammal identification and behaviors and are required to have no other construction-related tasks while conducting monitoring. The Navy will monitor all shutdown zones at all times, and will monitor disturbance zones to the extent practicable (some zones are too large to fully observe (Table 7)). The Navy will conduct monitoring before, during, and after pile driving, with observers located at the best practicable vantage points.

As noted above, the Navy plans to monitor the full shutdown zone with appropriate marine mammal monitors. By developing monitoring plans based on specific project details, an adequate number of observers will be assigned to provide full coverage of the shutdown zones. Survey boats will be utilized for all projects that have monitoring zones extending beyond the visual survey range of shoreline monitors.

As described in ''Mitigation'' and based on our requirements, the Navy will implement the following procedures for pile driving:

- Marine mammal observers will be located at the best vantage point(s) in order to properly see the entire shutdown zone and as much of the disturbance zone as possible.
- During all observation periods, observers will use binoculars and the naked eye to search continuously for marine mammals.
- If the shutdown zones are obscured by fog or poor lighting conditions, pile driving at that location will not be initiated until that zone is visible. Should such conditions arise while impact driving is underway, the activity will halt.
- The shutdown zone around the pile will be monitored for the presence of marine mammals before, during, and after all pile driving activity, while disturbance zone monitoring will be implemented according to the schedule described here.

Individuals implementing the monitoring protocol will assess its effectiveness using an adaptive approach. Monitoring biologists will use their best professional judgment throughout implementation and seek improvements to these methods when deemed appropriate. Any modifications to the protocol will be coordinated between NMFS and the Navy.

Data Collection

We require that observers use standardized data forms. Among other pieces of information, the Navy will record detailed information about any implementation of shutdowns, including the distance of animals to the pile and a description of specific actions that ensued and resulting behavior of the animal, if any. We require that, at a minimum, the following information be collected on the sighting forms:

- Date and time that monitored activity begins or ends;
- Construction activities occurring during each observation period;

- Weather parameters (*e.g.,* wind speed, percent cloud cover, visibility);
- Water conditions (*e.g.,* sea state, tide state);
- Species, numbers, and, if possible, sex and age class of marine mammals;
- Description of any observable marine mammal behavior patterns, including bearing and direction of travel and distance from pile driving activity;
- Distance from pile driving activities to marine mammals and distance from the marine mammals to the observation point;
- Description of implementation of mitigation measures (*e.g.,* shutdown or delay).
- Locations of all marine mammal observations; and
- Other human activity in the area.

The Navy will note in behavioral observations, to the extent practicable, if an animal has remained in the area during construction activities. Therefore, it may be possible to identify if the same animal or different individuals are being exposed.

Acoustic Monitoring

The Navy will conduct hydroacoustic monitoring for a subset of impact-driven steel piles for projects including more than three piles where a bubble curtain is used. The USFWS has imposed requirements relating to impact driving of steel piles, including restrictions on unattenuated driving of such piles, as a result of concern regarding impacts to the ESA-listed marbled murrelet. If USFWS allows the Navy to conduct minimal driving of steel piles without the use of the bubble curtain, baseline sound measurements of steel pile driving will occur prior to the implementation of noise attenuation to evaluate the performance of the device. Impact pile driving without noise attenuation will be limited to the number of piles necessary to obtain an adequate sample size for each project.

Marine Mammal Surveys

Subject to funding availability, the Navy will continue pinniped haul-out survey counts at specific installations. Biologists conduct counts of seals and sea lions at NBK Bremerton, Bangor, Manchester, and NS Everett. Counts are conducted several times per month, depending on the installation. All animals are identified to species where possible. This information aids in determination of seasonal use of each site and trends in the number of animals.

Reporting

The Navy will submit a draft annual report to NMFS within 90 days of the completion of each year's monitoring effort. The report will include marine mammal observations pre-activity, during-activity, and post-activity during pile driving days, and will also provide descriptions of any behavioral responses to construction activities by marine mammals and a complete description of all mitigation shutdowns and the results of those actions and an extrapolated total take estimate based on the number of marine mammals observed during the course of construction. A final report must be submitted within 30 days following resolution of comments on the draft report. The Navy will also submit a comprehensive summary report covering all activities conducted under the incidental take regulations.

Negligible Impact Analysis and Determination

NMFS has defined negligible impact as an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival (50 CFR 216.103). A negligible impact finding is based on the lack of likely adverse effects on annual rates of recruitment or survival (*i.e.,* population-level effects). An estimate of the number of takes alone is not enough information on which to base an impact determination. In addition to considering estimates of the number of marine mammals that might be ''taken'' by mortality, serious injury, and Level A or Level B harassment, we consider other factors, such as the likely nature of any behavioral responses (*e.g.,* intensity, duration), the context of any such responses (*e.g.,* critical reproductive time or location, migration), as well as effects on habitat, and the likely effectiveness of mitigation. We also assess the number, intensity, and context of estimated takes by evaluating this information relative to population status. Consistent with the 1989 preamble for NMFS's implementing regulations (54 FR 40338; September 29, 1989), the impacts from other past and ongoing anthropogenic activities are incorporated into this analysis via their impacts on the environmental baseline (*e.g.,* as reflected in the regulatory status of the species, population size and growth rate where known, ongoing sources of human-caused mortality).

Pile driving activities associated with the maintenance projects have the potential to disturb or displace marine mammals. Specifically, the specified activities may result in take, in the form of Level B harassment (behavioral disturbance) only (for all species other than the harbor seal) from underwater sounds generated from pile driving. Potential takes could occur if individual marine mammals are present in the ensonified zone when pile driving is happening.

No serious injury or mortality would be expected even in the absence of the planned mitigation measures. For all species other than the harbor seal, no Level A harassment is anticipated given the nature of the activities, *i.e.,* much of the anticipated activity would involve vibratory driving and/or installation of small-diameter, non-steel piles, and measures designed to minimize the possibility of injury. The potential for injury is small for cetaceans and sea lions, and is expected to be essentially eliminated through implementation of the planned mitigation measures—use of the bubble curtain for larger steel piles at most installations, soft start (for impact driving), and shutdown zones. Impact driving, as compared with vibratory driving, has source characteristics (short, sharp pulses with higher peak levels and much sharper rise time to reach those peaks) that are potentially injurious or more likely to produce severe behavioral reactions. Given sufficient notice through use of soft start, marine mammals are expected to move away from a sound source that is annoying prior to its becoming potentially injurious or resulting in more severe behavioral reactions. Environmental conditions in inland waters are expected to generally be good, with calm sea states, and we expect conditions would allow a high marine mammal detection capability, enabling a high rate of success in implementation of shutdowns to avoid injury.

As described previously, there are multiple species that should be considered rare in the project areas and for which we would authorize only nominal and precautionary take of a single group for a minimal period of time (two days). Therefore, we do not expect meaningful impacts to these species (*i.e.,* humpback whale, gray whale, minke whale, transient and resident killer whales, and northern elephant seal) and find that the total marine mammal take from each of the specified activities will have a negligible impact on these marine mammal species.

For remaining species, we discuss the likely effects of the specified activities in greater detail. Effects on individuals that are taken by Level B harassment, on the basis of reports in the literature as well as monitoring from other similar activities, will likely be limited to reactions such as increased swimming speeds, increased surfacing time, or decreased foraging (if such activity were occurring) (*e.g.,* Thorson and Reyff, 2006; HDR, Inc., 2012; Lerma, 2014). Most likely, individuals will simply move away from the sound source and be temporarily displaced from the areas of pile driving, although even this reaction has been observed primarily only in association with impact pile driving. The pile driving activities analyzed here are similar to, or less impactful than, numerous other construction activities conducted in San Diego Bay, San Francisco Bay, and in the Puget Sound region, which have taken place with no known long-term adverse consequences from Level B harassment.

The Navy has conducted multi-year activities potentially affecting marine mammals, and typically involving greater levels of activity than is contemplated here in various locations such as San Diego Bay and some of the installations considered herein (NBK Bangor and NBK Bremerton). Reporting from these activities has similarly shown no apparently consequential behavioral reactions or long-term effects on marine mammal populations (Lerma, 2014; Navy, 2016). Repeated exposures of individuals to relatively low levels of sound outside of preferred habitat areas are unlikely to significantly disrupt critical behaviors. Thus, even repeated Level B harassment of some small subset of the overall stock is unlikely to result in any significant realized decrease in viability for the affected individuals, and thus would not result in any adverse impact to the stock as a whole. Level B harassment will be reduced to the level of least practicable adverse impact through use of mitigation measures described herein and, if sound produced by project activities is sufficiently disturbing, animals are likely to simply avoid the area while the activity is occurring. While vibratory driving associated with some project components may produce sound at distances of many kilometers from the pile driving site, thus intruding on higher-quality habitat, the project sites themselves and the majority of sound fields produced by the specified activities are within industrialized areas. Therefore, we expect that animals annoyed by project sound would simply avoid the area and use more-preferred habitats.

In addition to the expected effects resulting from authorized Level B harassment, we anticipate that harbor seals may sustain some limited Level A harassment in the form of auditory injury at two locations (NBK Bangor and NS Everett), assuming they remain within a given distance of the pile driving activity for the full number of pile strikes. However, seals in these locations that experience PTS would likely only receive slight PTS, *i.e.,* minor degradation of hearing capabilities within regions of hearing that align most completely with the energy produced by pile driving (the low-frequency region below 2 kHz), not severe hearing impairment or impairment in the regions of greatest hearing sensitivity. If hearing impairment occurs, it is most likely that the affected animal would lose a few decibels in its hearing sensitivity, which in most cases is not likely to meaningfully affect its ability to forage and communicate with conspecifics. As described above, we expect that marine mammals would be likely to move away from a sound source that represents an aversive stimulus, especially at levels that would be expected to result in PTS, given sufficient notice through use of soft start.

In summary, this negligible impact analysis is founded on the following factors: (1) The possibility of serious injury or mortality may reasonably be considered discountable; (2) as a result of the nature of the activity in concert with the planned mitigation requirements, injury is not anticipated for any species other than the harbor seal; (3) the anticipated incidents of Level B harassment consist of, at worst, temporary modifications in behavior; (4) the additional impact of PTS of a slight degree to few individual harbor seals at two locations is not anticipated to increase individual impacts to a point where any population-level impacts might be expected; (5) the absence of any significant habitat within the industrialized project areas, including known areas or features of special significance for foraging or reproduction; and (6) the presumed efficacy of the planned mitigation measures in reducing the effects of the specified activity to the level of least practicable adverse impact.

In addition, although affected humpback whales may be from DPSs that are listed under the ESA, and southern resident killer whales are depleted under the MMPA as well as listed as endangered under the ESA, it is unlikely that minor noise effects in a small, localized area of sub-optimal habitat would have any effect on the stocks' ability to recover. In combination, we believe that these factors, as well as the available body of evidence from other similar activities, demonstrate that the potential effects of the specified activities will have only minor, short-term effects on individuals. The specified activities are not expected to impact rates of recruitment or survival and will therefore not result in population-level impacts.

Based on the analysis contained herein of the likely effects of the specified activity on marine mammals and their habitat, and taking into consideration the implementation of the planned monitoring and mitigation measures, we find that the total marine mammal take from the Navy's maintenance construction activities will have a negligible impact on the affected marine mammal species or stocks.

Small Numbers

As noted above, only small numbers of incidental take may be authorized under Section 101(a)(5)(A) of the MMPA for specified activities. The MMPA does not define small numbers and so, in practice, where estimated numbers are available, NMFS compares the number of individuals taken to the most appropriate estimation of abundance of the relevant species or stock in our determination of whether an authorization is limited to small numbers of marine mammals. Additionally, other qualitative factors may be considered in the analysis, such as the temporal or spatial scale of the activities.

Please see Table 9 for information relating to this small numbers analysis. We would authorize incidental take of 12 marine mammal stocks. The total amount of taking that could be authorized under these regulations is less than one percent for five of these, less than five percent for an additional two stocks, and less than ten percent for another stock, all of which we consider relatively small percentages and we find are small numbers of marine mammals relative to the estimated overall population abundances for those stocks.

For the southern resident killer whale (in addition to the humpback whale, gray whale, minke whale, transient killer whale, and northern elephant seal), we would authorize take resulting from a brief exposure of one group of the stock. We believe that a single incident of take of one group of any of these species represents take of small numbers for that species.

For the two affected stocks of harbor seal (Hood Canal and Northern Inland Waters), no recent abundance estimate is available. The most recent abundance estimates for harbor seals in Washington inland waters are from 1999, and it is generally believed that harbor seal populations have increased significantly during the intervening years (*e.g.,* Mapes, 2013). However, we anticipate that takes estimated to occur for harbor seals are likely to occur only within some portion of the relevant populations, rather than to animals from the stock as a whole. For example, takes anticipated to occur at NBK Bangor or at NS Everett would be expected to accrue to the same individual seals that routinely occur on haul-outs at these locations, rather than occurring to new seals on each construction day. Similarly, at Zelatched Point in Hood Canal many known haul-outs are at locations elsewhere in Hood Canal and, although a density estimate rather than haul-out count is used to inform the exposure estimate for Zelatched Point, we expect that exposed individuals would comprise some limited portion of the overall stock abundance. In summary, harbor seals taken as a result of the specified activities at each of the six installations are expected to comprise only a limited portion of individuals comprising the overall relevant stock abundance. Therefore, we find that small numbers of marine mammals will be taken relative to the population size of both the Hood Canal and Northern Inland Waters stocks of harbor seal.

The estimated taking for harbor porpoise comprises greater than one-third of the best available stock abundance. However, due to the nature of the specified activity—construction activities occurring at six specific locations, rather than a mobile activity occurring throughout the stock range—the available information shows that only a portion of the stock would likely be impacted. Recent aerial surveys that inform the current abundance estimate for harbor porpoise involved effort broken down by region and subregion. According to the data available as a result of these surveys, the vast majority of harbor porpoise abundance occurs in the ''northern waters'' region, including the San Juan Islands and Strait of Juan de Fuca, where no Navy construction activity is planned to occur. The six installations considered here occur within the Hood Canal, North Puget Sound, and South Puget Sound regions, which contain approximately 24 percent of stock-wide harbor porpoise abundance (Jefferson *et al.,* 2016). Therefore, we assume that affected individuals would most likely be from the 24 percent of the stock expected to occur in these regions. This figure itself may be an overestimate, as Navy facilities are located within only three of seven subregions within the North and South Puget Sound regions (*i.e.,* East Whidbey, Bainbridge, and Vashon). However, at this finer scale, it is possible that harbor porpoise individuals transit across subregions. In consideration of this conservative scenario, *i.e.,* that 24 percent of the stock abundance is taken, we find that small numbers of marine mammals will be taken relative to the population size of the Washington inland waters stock of harbor porpoise.

Based on the analysis contained herein of the activity (including the planned mitigation and monitoring measures) and the anticipated take of marine mammals, NMFS finds that small numbers of marine mammals will be taken relative to the population sizes of the affected species or stocks.

Impact on Availability of Affected Species for Taking for Subsistence Uses

There are no relevant subsistence uses of marine mammals implicated by these actions. Therefore, we have determined that the total taking of affected species or stocks will not have an unmitigable adverse impact on the availability of such species or stocks for taking for subsistence purposes.

Adaptive Management

The regulations governing the take of marine mammals incidental to Navy maintenance construction activities contain an adaptive management component.

The reporting requirements associated with this rule are designed to provide NMFS with monitoring data from the previous year to allow consideration of whether any changes are appropriate. The use of adaptive management allows NMFS to consider new information from different sources to determine (with input from the Navy regarding practicability) on an annual or biennial basis if mitigation or monitoring measures should be modified (including additions or deletions). Mitigation measures could be modified if new data suggests that such modifications would have a reasonable likelihood of reducing adverse effects to marine mammals and if the measures are practicable.

The following are some of the possible sources of applicable data to be considered through the adaptive management process: (1) Results from monitoring reports, as required by MMPA authorizations; (2) results from general marine mammal and sound research; and (3) any information which reveals that marine mammals may have been taken in a manner, extent, or number not authorized by these regulations or subsequent LOAs.

Endangered Species Act (ESA)

The southern resident killer whale, as well as multiple DPSs of humpback whale, are listed under the ESA (see Table 3). The authorization of incidental take pursuant to the Navy's specified activity would not affect any designated critical habitat. OPR initiated consultation with NMFS's West Coast Regional Office (WCRO) under section 7 of the ESA on the promulgation of five-year regulations and the subsequent issuance of LOAs to the Navy under section 101(a)(5)(A) of the MMPA. On April 5, 2019, WCRO issued a final Biological Opinion concluding that OPR's action will not jeopardize the continued existence of any ESA-listed species.

National Environmental Policy Act

To comply with the National Environmental Policy Act of 1969 (NEPA; 42 U.S.C. 4321 *et seq.*) and NOAA Administrative Order (NAO) 216–6A, NMFS must evaluate our proposed action (*i.e.,* the promulgation of regulations and subsequent issuance of incidental take authorization) and alternatives with respect to potential impacts on the human environment.

This action is consistent with categories of activities identified in Categorical Exclusion B4 of the Companion Manual for NAO 216–6A, which do not individually or cumulatively have the potential for significant impacts on the quality of the human environment and for which we have not identified any extraordinary circumstances that would preclude this categorical exclusion. Accordingly, NMFS has determined that the action qualifies to be categorically excluded from further NEPA review.

Classification

Pursuant to the procedures established to implement Executive Order 12866, the Office of Management and Budget has determined that this rule is not significant.

Pursuant to section 605(b) of the Regulatory Flexibility Act (RFA), the Chief Counsel for Regulation of the Department of Commerce certified to the Chief Counsel for Advocacy of the Small Business Administration at the proposed rule stage that this action will not have a significant economic impact on a substantial number of small entities. Navy is the sole entity that would be subject to the requirements of these regulations, and the U.S. Navy is not a small governmental jurisdiction, small organization, or small business, as defined by the RFA. No comments were received regarding this certification. As a result, a regulatory flexibility analysis is not required and none has been prepared.

Notwithstanding any other provision of law, no person is required to respond to nor shall a person be subject to a penalty for failure to comply with a collection of information subject to the requirements of the Paperwork Reduction Act (PRA) unless that collection of information displays a currently valid OMB control number. However, this rule does not contain a collection-of-information requirement subject to the provisions of the PRA because the applicant is a Federal agency.

List of Subjects in 50 CFR Part 218

Exports, Fish, Imports, Indians, Labeling, Marine mammals, Penalties, Reporting and recordkeeping requirements, Seafood, Transportation.

Dated: April 10, 2019.

Samuel D. Rauch III,

Deputy Assistant Administrator for Regulatory Programs, National Marine Fisheries Service.

For reasons set forth in the preamble, 50 CFR part 218 is amended as follows:

PART 218—REGULATIONS GOVERNING THE TAKING AND IMPORTING OF MARINE MAMMALS

■ 1. The authority citation for part 218 continues to read as follows:

Authority: 16 U.S.C. 1361 *et seq.*, unless otherwise noted.

■ 2. Add subpart C to read as follows:

Subpart C—Taking Marine Mammals Incidental to U.S. Navy Marine Structure Maintenance and Pile Replacement in Washington

Sec.

Subpart C—Taking Marine Mammals Incidental to U.S. Navy Marine Structure Maintenance and Pile Replacement in Washington

§ 218.20 Specified activity and specified geographical region.

(a) Regulations in this subpart apply only to the U.S. Navy (Navy) and those persons it authorizes or funds to conduct activities on its behalf for the taking of marine mammals that occurs in the areas outlined in paragraph (b) of this section and that occurs incidental to maintenance construction activities, as defined in a Letter of Authorization (LOA).

(b) The taking of marine mammals by the Navy may be authorized in a LOA only if it occurs within Washington inland waters in the vicinity of one of the following six naval installations: Naval Base Kitsap Bangor, Zelatched Point, Naval Base Kitsap Bremerton, Naval Base Kitsap Keyport, Naval Base Kitsap Manchester, and Naval Station Everett.

§ 218.21 Effective dates.

Regulations in this subpart are effective from May 17, 2019 through May 17, 2024.

§ 218.22 Permissible methods of taking.

Under LOAs issued pursuant to §§ 216.106 of this chapter and 218.26, the Holder of the LOA (hereinafter "Navy") may incidentally, but not intentionally, take marine mammals within the area described in § 218.20(b) by Level A or Level B harassment associated with maintenance construction activities, provided the activity is in compliance with all terms, conditions, and requirements of the regulations in this subpart and the appropriate LOA.

§ 218.23 Prohibitions.

Notwithstanding takings contemplated in § 218.22 and authorized by a LOA issued under §§ 216.106 of this chapter and 218.26, no person in connection with the activities described in § 218.20 may:

(a) Violate, or fail to comply with, the terms, conditions, and requirements of this subpart or a LOA issued under §§ 216.106 of this chapter and 218.26;

(b) Take any marine mammal not specified in such LOAs;

(c) Take any marine mammal specified in such LOAs in any manner other than as specified;

(d) Take a marine mammal specified in such LOAs if NMFS determines such taking results in more than a negligible impact on the species or stocks of such marine mammal; or

(e) Take a marine mammal specified in such LOAs if NMFS determines such taking results in an unmitigable adverse impact on the species or stock of such marine mammal for taking for subsistence uses.

§ 218.24 Mitigation requirements.

When conducting the activities identified in § 218.20(a), the mitigation measures contained in any LOA issued under §§ 216.106 of this chapter and 218.26 must be implemented. These mitigation measures shall include but are not limited to:

(a) *General conditions.* (1) A copy of any issued LOA must be in the possession of the Navy, its designees, and work crew personnel operating under the authority of the issued LOA; and

(2) The Navy shall conduct briefings for construction supervisors and crews, the monitoring team, and Navy staff prior to the start of all pile driving activity, and when new personnel join the work, in order to explain responsibilities, communication procedures, the marine mammal monitoring protocol, and operational procedures.

(b) *Shutdown zones.* (1) For all pile driving activity, the Navy shall implement a minimum shutdown zone of a 10 m radius around the pile. If a marine mammal comes within or approaches the shutdown zone, such operations shall cease;

(2) For all pile driving activity, the Navy shall implement shutdown zones with radial distances as identified in any LOA issued under §§ 216.106 of this chapter and 218.26. If a marine mammal comes within or approaches the shutdown zone, such operations shall cease;

(3) For all pile driving activity, the Navy shall designate monitoring zones with radial distances as identified in any LOA issued under §§ 216.106 of this chapter and 218.26. Anticipated observable zones within the designated monitoring zones shall be identified in annual Marine Mammal Monitoring Plans, subject to approval by NMFS. If any cetacean is observed outside the shutdown zone identified pursuant to paragraphs (b)(1) and (2) of this section, but within the designated monitoring zone, such operations shall cease.

(c) *Shutdown protocols.* (1) The Navy shall deploy marine mammal observers as indicated in annual Marine Mammal Monitoring Plans, which shall be subject to approval by NMFS, and as described in § 218.25.

(2) For all pile driving activities, a minimum of one observer shall be stationed at the active pile driving rig or in reasonable proximity in order to monitor the shutdown zone.

(3) Prior to the start of pile driving on any day, the Navy shall take measures to ensure that southern resident killer whales are not located within the vicinity of the project area, including, but not limited to, contacting and/or reviewing the latest sightings data from the Orca Network and/or Center for Whale Research, including passive acoustic detections, to determine the location of the nearest marine mammal sightings.

(4) Monitoring shall take place from fifteen minutes prior to initiation of pile driving activity through thirty minutes post-completion of pile driving activity. Pre-activity monitoring shall be conducted for fifteen minutes to ensure that the shutdown zone is clear of marine mammals, and pile driving may commence only if observers have declared the shutdown zone clear of marine mammals during this period. In the event of a delay or shutdown of activity resulting from marine mammals in the shutdown zone, the marine mammals shall be allowed to remain in the shutdown zone (*i.e.,* must leave of their own volition) and their behavior shall be monitored and documented. Monitoring shall occur throughout the time required to drive a pile. A determination that the shutdown zone is clear cannot be made unless the observer(s) have good visibility of the shutdown zone during the entire fifteen-minute observation period (*i.e.,* the entire shutdown zone must be visible to the naked eye and unobscured by dark, rain, fog, poor lighting conditions, etc.).

(5) If a marine mammal approaches or enters the shutdown zone, the Navy shall halt all pile driving activities at that location. If pile driving is halted or delayed due to the presence of a marine mammal, the activity may not commence or resume until either the animal has voluntarily left and been visually confirmed beyond the shutdown zone or fifteen minutes have passed without re-detection of the animal.

(6) If a species for which authorization has not been granted, or a species for which authorization has been granted but the authorized takes are met, is observed approaching or within the monitoring zone, the Navy must halt pile driving activities immediately using delay and shutdown procedures. Activities must not resume until the animal has been confirmed to have left the area or the fifteen-minute observation period has elapsed.

(7) Monitoring shall be conducted by trained observers, who shall have no other assigned tasks during monitoring periods. Trained observers shall be placed at the best vantage point(s) practicable to monitor for marine mammals and implement shutdown or delay procedures when applicable through communication with the equipment operator. The Navy shall adhere to the following additional observer qualifications:

(i) Independent observers (*i.e.,* not construction personnel) are required.

(ii) At least one observer must have prior experience working as an observer.

(iii) Other observers may substitute education (degree in biological science or related field) or training for experience.

(iv) Where a team of three or more observers are required, one observer shall be designated as lead observer or monitoring coordinator. The lead observer must have prior experience working as an observer.

(d) *Soft start.* The Navy shall use soft start techniques for impact pile driving. Soft start for impact drivers requires contractors to provide an initial set of three strikes at reduced energy, followed by a thirty-second waiting period, then two subsequent reduced energy three-strike sets. Soft start shall be implemented at the start of each day's impact pile driving and at any time following cessation of impact pile driving for a period of thirty minutes or longer.

(e) *Sound attenuation.* The Navy shall employ a bubble curtain (or other sound attenuation device with proven typical performance of at least 8 decibels effective attenuation) during impact pile driving of steel piles greater than 14 inches diameter in water depths greater than 2 feet, except at Naval Base Kitsap Bremerton and Naval Base Kitsap Keyport. The Navy shall assess the potential for the use of bubble curtains at Keyport on a project-by-project basis. In addition, the Navy shall implement the following performance standards:

(1) The bubble curtain must distribute air bubbles around 100 percent of the piling perimeter for the full depth of the water column.

(2) The lowest bubble ring shall be in contact with the mudline for the full circumference of the ring, and the weights attached to the bottom ring shall ensure 100 percent mudline contact. No parts of the ring or other objects shall prevent full mudline contact.

(3) The Navy shall require that construction contractors train personnel in the proper balancing of air flow to the bubblers, and shall require that construction contractors submit an inspection/performance report for approval by the Navy within 72 hours following the performance test. Corrections to the attenuation device to meet the performance standards shall occur prior to impact driving.

§ 218.25 Requirements for monitoring and reporting.

(a) Not later than March 1 of each year, the Navy shall develop and submit for NMFS's approval an installation-specific Marine Mammal Monitoring Plan for each year's anticipated work. Final monitoring plans shall be prepared and submitted to NMFS within 30 days following receipt of comments on the draft plans from NMFS.

(b) During each in-water work period, the Navy shall update NMFS every two months on the progress of ongoing projects.

(c) Trained observers shall receive a general environmental awareness briefing conducted by Navy staff. At a minimum, training shall include identification of the marine mammals that may occur in the project vicinity and relevant mitigation and monitoring requirements. All observers shall have no other construction-related tasks while conducting monitoring.

(d) For shutdown zone monitoring, the Navy shall report on implementation of shutdown or delay procedures, including whether the procedures were not implemented and why (when relevant).

(e) The Navy shall deploy additional observers to monitor disturbance zones according to the minimum requirements defined in annual Marine Mammal Monitoring Plans, subject to approval by NMFS. These observers shall collect sighting data and behavioral responses to pile driving for marine mammal species observed in the region of activity during the period of activity, and shall communicate with the shutdown zone observer as appropriate with regard to the presence of marine mammals. All observers shall be trained in identification and reporting of marine mammal behaviors.

(f) The Navy must conduct hydroacoustic monitoring for a subset of impact-driven steel piles for projects that include more than three such piles. When this requirement for monitoring of impact-driven steel piles is triggered, the Navy must also conduct hydroacoustic monitoring of a subset of impact-driven plastic piles (if applicable).

(g) The Navy must submit annual summary, final, and comprehensive summary reports as described in this paragraph (g):

(1) Navy shall submit an annual summary report to NMFS not later than 90 days following the end of construction for that year. Navy shall provide a final report within 30 days following resolution of comments on the draft report. These reports shall contain, at minimum, the following:

(i) Date and time that monitored activity begins or ends;

(ii) Construction activities occurring during each observation period;

(iii) Weather parameters (*e.g.,* wind speed, percent cloud cover, visibility);

(iv) Water conditions (*e.g.,* sea state, tide state);

(v) Species, numbers, and, if possible, sex and age class of marine mammals;

(vi) Description of any observable marine mammal behavior patterns, including bearing and direction of travel and distance from pile driving activity;

(vii) Distance from pile driving activities to marine mammals and distance from the marine mammals to the observation point;

(viii) Description of implementation of mitigation measures (*e.g.,* shutdown or delay);

(ix) Locations of all marine mammal observations; and

(x) Other human activity in the area.

(2) Navy shall submit a comprehensive summary report to NMFS not later than ninety days following the conclusion of marine mammal monitoring efforts described in this subpart.

(h) The Navy must submit reports of stranded, injured, or dead marine mammals as described in this paragraph (h):

(1) In the event that a live marine mammal is found stranded, whether on shore or in or on any structure or vessel, the following steps shall be taken:

(i) Project personnel who discover the marine mammal shall immediately notify the most appropriate onsite personnel with relevant expertise (*e.g.,* marine mammal observers) as well as the Navy (if non-Navy project personnel initially discover the animal).

(ii) The Navy shall then immediately notify the West Coast Regional Stranding Coordinator, NMFS, and, in consultation with the Stranding Coordinator, shall immediately notify the most appropriate qualified individual (*i.e.,* biologist or veterinarian) to respond to the event.

(iii) In the interim, or in the event that no qualified individual other than onsite marine mammal observers is available to respond to the event, the Navy shall manage the event response and shall take action to prevent any further deterioration of the animal's condition, to the extent possible. Appropriate action may be specific to the event. At minimum, the Navy should provide shade for the animal (if possible), shall not move the animal or cause the animal to move, and shall suspend project activity until the situation is resolved.

(iv) The Navy shall report the incident to the Office of Protected Resources (OPR), NMFS, within 48 hours after discovery.

(2) In the unanticipated event that the activity defined in § 218.20 clearly causes the take of at least one marine mammal in a prohibited manner, the Navy shall immediately cease such activity and report the incident to OPR and the West Coast Regional Stranding Coordinator, NMFS. Activities shall not resume until NMFS is able to review the circumstances of the prohibited take. NMFS will work with the Navy to determine what measures are necessary to minimize the likelihood of further prohibited take and ensure MMPA compliance. The Navy may not resume their activities until notified by NMFS. The report must include the following information:

(i) Time, date, and location (latitude/longitude) of the incident;

(ii) Description of the incident;

(iii) Environmental conditions (*e.g.,* wind speed and direction, Beaufort sea state, cloud cover, visibility);

(iv) Description of all marine mammal observations in the 24 hours preceding the incident;

(v) Species identification or description of the animal(s) involved;

(vi) Fate of the animal(s); and

(vii) Photographs or video footage of the animal(s). Photographs may be taken once the animal(s) have been moved from the waterfront area.

(3) In the event that the Navy discovers an injured or dead marine mammal and determines that the cause of the injury or death is unknown and the death is relatively recent (*e.g.,* in less than a moderate state of decomposition), the Navy shall immediately report the incident to OPR and the West Coast Regional Stranding Coordinator, NMFS. The report must include the information identified in paragraph (h)(2) of this section. Activities may continue while NMFS reviews the circumstances of the incident. NMFS will work with the Navy to determine whether additional mitigation measures or modifications to the activities are appropriate.

(4) In the event that the Navy discovers an injured or dead marine mammal and determines that the injury or death is not associated with or related to the activities defined in § 218.20 (*e.g.,* previously wounded animal, carcass with moderate to advanced decomposition, scavenger damage), Navy shall report the incident to OPR and the West Coast Regional Stranding Coordinator, NMFS, within 24 hours of the discovery. The Navy shall provide photographs or video footage or other documentation of the stranded animal sighting to NMFS. Photographs may be taken once the animal has been moved from the waterfront area.

§ 218.26 Letters of Authorization.

(a) To incidentally take marine mammals pursuant to the regulations in this subpart, the Navy must apply for and obtain an LOA.

(b) An LOA, unless suspended or revoked, may be effective for a period of time not to exceed the expiration date of the regulations in this subpart.

(c) If an LOA expires prior to the expiration date of the regulations in this subpart, the Navy may apply for and obtain a renewal of the LOA.

(d) In the event of projected changes to the activity or to mitigation and monitoring measures required by an LOA, the Navy must apply for and obtain a modification of the LOA as described in § 218.27.

(e) The LOA shall set forth:

(1) Permissible methods of incidental taking;

(2) Means of effecting the least practicable adverse impact (*i.e.,* mitigation) on the species, its habitat, and on the availability of the species for subsistence uses; and

(3) Requirements for monitoring and reporting.

(f) Issuance of the LOA shall be based on a determination that the level of taking will be consistent with the findings made for the total taking allowable under the regulations in this subpart.

(g) Notice of issuance or denial of an LOA shall be published in the **Federal Register** within thirty days of a determination.

§ 218.27 Renewals and modifications of Letters of Authorization.

(a) An LOA issued under §§ 216.106 of this chapter and 218.26 for the activity identified in § 218.20(a) shall be renewed or modified upon request by the applicant, provided that:

(1) The proposed specified activity and mitigation, monitoring, and reporting measures, as well as the anticipated impacts, are the same as those described and analyzed for the regulations in this subpart (excluding changes made pursuant to the adaptive management provision in paragraph (c)(1) of this section); and

(2) NMFS determines that the mitigation, monitoring, and reporting measures required by the previous LOA under the regulations in this subpart were implemented.

(b) For LOA modification or renewal requests by the applicant that include changes to the activity or the mitigation, monitoring, or reporting (excluding changes made pursuant to the adaptive management provision in paragraph (c)(1) of this section) that do not change the findings made for the regulations in this subpart or result in no more than a minor change in the total estimated number of takes (or distribution by species or years), NMFS may publish a notice of proposed LOA in the **Federal Register**, including the associated analysis of the change, and solicit public comment before issuing the LOA.

(c) An LOA issued under §§ 216.106 of this chapter and 218.26 for the activity identified in § 218.20(a) may be modified by NMFS under the following circumstances:

(1) *Adaptive management.* NMFS may modify (including augment) the existing mitigation, monitoring, or reporting measures (after consulting with the Navy regarding the practicability of the modifications) if doing so creates a reasonable likelihood of more effectively accomplishing the goals of the mitigation and monitoring set forth in the regulations in this subpart.

(i) Possible sources of data that could contribute to the decision to modify the mitigation, monitoring, or reporting measures in an LOA:

(A) Results from the Navy's monitoring from the previous year(s).

(B) Results from other marine mammal and/or sound research or studies.

(C) Any information that reveals marine mammals may have been taken in a manner, extent or number not authorized by the regulations in this subpart or subsequent LOAs.

(ii) If, through adaptive management, the modifications to the mitigation, monitoring, or reporting measures are substantial, NMFS will publish a notice of proposed LOA in the **Federal Register** and solicit public comment.

(2) *Emergencies.* If NMFS determines that an emergency exists that poses a significant risk to the well-being of the species or stocks of marine mammals specified in LOAs issued pursuant to §§ 216.106 of this chapter and 218.26, an LOA may be modified without prior notice or opportunity for public comment. Notice would be published in the **Federal Register** within thirty days of the action.

§§ 218.28–218.29 [Reserved]

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DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

50 CFR Part 622

[Docket No. 141107936–5399–02]

RIN 0648–XG960

Fisheries of the Caribbean, Gulf of Mexico, and South Atlantic; 2019 Commercial Accountability Measure and Closure for South Atlantic Gray Triggerfish; January Through June Season

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Temporary rule; closure.

SUMMARY: NMFS implements accountability measures for commercial gray triggerfish in the exclusive economic zone (EEZ) of the South Atlantic. NMFS projects commercial landings for gray triggerfish will reach the commercial annual catch limit (ACL)(commercial quota) for the January through June season by April 17, 2019. Therefore, NMFS is closing the commercial sector for gray triggerfish in the South Atlantic EEZ on April 17, 2019. This closure is necessary to protect the gray triggerfish resource.

DATES: This rule is effective 12:01 a.m., local time, April 17, 2019, until July 1, 2019.

FOR FURTHER INFORMATION CONTACT: Mary Vara, NMFS Southeast Regional Office, telephone: 727–824–5305, email: *mary.vara@noaa.gov.*

SUPPLEMENTARY INFORMATION: The snapper-grouper fishery of the South Atlantic includes gray triggerfish and is managed under the Fishery Management Plan for the Snapper-Grouper Fishery of the South Atlantic Region (FMP). The FMP was prepared by the South Atlantic Fishery Management Council and is implemented by NMFS under the authority of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) by regulations at 50 CFR part 622.

The commercial ACL (commercial quota) for gray triggerfish in the South Atlantic is divided into two 6-month fishing seasons. The total commercial ACL of 312,324 lb (141,668 kg), round weight, is allocated 50 percent to each commercial fishing season, or 156,162 lb (70,834 kg), round weight, each for January through June, and July through December, as specified in 50 CFR 622.190(a)(8)(i) and (ii).

Under 50 CFR 622.193(q)(1)(i), NMFS is required to close the commercial sector for gray triggerfish when either commercial quota specified in 50 CFR 622.190(a)(8)(i) or (ii) is reached, or is projected to be reached, by filing a notification to that effect with the Office of the Federal Register. NMFS has determined that the commercial quota for South Atlantic gray triggerfish for the January through June fishing season will be reached by April 17, 2019. Accordingly, the commercial sector for South Atlantic gray triggerfish is closed effective at 12:01 a.m., local time, April 17, 2019, until the start of the July through December fishing season on July 1, 2019. Additionally, NMFS notes that as specified at 50 CFR 622.190(a)(8)(iii), if there is any unused portion of the January through June seasonal quota, it will be added to the July through December seasonal quota. Any unused portion of the July through December seasonal quota, including, if applicable, any addition of quota from the January through June season, will become void and will not be added to any subsequent quota in the following fishing year.

The operator of a vessel with a valid Federal commercial vessel permit for South Atlantic snapper-grouper having gray triggerfish on board must have landed and bartered, traded, or sold such gray triggerfish prior to 12:01 a.m., local time, April 17, 2019. During the closure, the recreational bag limit specified in 50 CFR 622.187(b)(8), and the possession limits specified in 50 CFR 622.187(c), apply to all harvest or possession of gray triggerfish in or from the South Atlantic EEZ. Also, during the closure, the sale or purchase of gray triggerfish taken from the South Atlantic EEZ is prohibited. The prohibition on the sale or purchase does not apply to gray triggerfish that were harvested, landed ashore, and sold prior to 12:01 a.m., local time, April 17, 2019, and were held in cold storage by a dealer or processor.

For a person on board a vessel for which a valid Federal commercial or charter vessel/headboat permit for the South Atlantic snapper-grouper fishery has been issued, the bag and possession limits and sale and purchase provisions of the commercial closure for gray triggerfish apply regardless of whether the fish are harvested in state or Federal waters, as specified in 50 CFR 622.190(c)(1)(ii).

Classification

The Regional Administrator, NMFS Southeast Region, has determined this temporary rule is necessary for the conservation and management of gray