Final Environmental Assessment

EHW-1 Pile Replacement and Maintenance
Naval Base Kitsap Bangor
Silverdale, Washington

March 2015

Naval Facilities Engineering Command Northwest
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Silverdale, WA 98315

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LEAD AGENCY:	United States Department of the Navy
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ABSTRACT:

This environmental assessment (EA) evaluates the potential environmental impacts associated with the United States (U.S.) Department of the Navy's (Navy's) Proposed Action to perform maintenance and restore the structural integrity of the Explosives Handling Wharf 1 (EHW-1) facility located at Naval Base (NAVBASE) Kitsap Bangor, WA. The Proposed Action includes demolishing four 24-inch hollow prestressed octagonal concrete piles and installing four 30-inch concrete filled steel piles adjacent to the demolished piles at Bent 27 of the outboard support of the EHW-1. Additionally, the project includes replacement of structural elements such as decking and pile caps, installation of cathodic protection, repair of a concrete wetwell, and recoating of the tops of fender piles and steel mooring fittings. As part of the Navy's mission, maintaining facilities and readiness is a priority. Since the action is to replace existing piles and conduct other maintenance, the only alternative would be to not perform maintenance and replace piles; therefore, no practical or feasible action alternatives were identified. This EA will analyze the Proposed Action and the No-Action alternative. The analysis addresses potential direct and indirect impacts on sediments, water quality, airborne noise, biological resources, cultural resources, American Indian traditional resources and cumulative impacts. There is no cooperating agency for this document.

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FINAL ENVIRONMENTAL ASSESSMENT
EHW-1 PILE REPLACEMENT AND MAINTENANCE PROJECT
NAVAL BASE KITSAP BANGOR, SILVERDALE, WA
EXECUTIVE SUMMARY

Proposed Action

The Navy is proposing to perform maintenance and restore the structural integrity of the Explosives Handling Wharf 1 (EHW-1) facility located at Naval Base (NAVBASE) Kitsap Bangor, WA. The Proposed Action includes demolishing four 24-inch hollow prestressed octagonal concrete piles and installing four 30-inch concrete filled steel piles adjacent to the demolished piles at Bent 27 of the outboard support of the EHW-1. Additionally, the project includes replacement of structural elements such as decking and pile caps, installation of cathodic protection, repair of a concrete wetwell, and recoating of the tops of fender piles and steel mooring fittings.

Purpose of and Need for the Proposed Action

The purpose of the Proposed Action is to maintain the existing EHW-1 in-water structure in working condition and to restore its structural integrity. The need for the Proposed Action is to ensure that this in-water structure continues to meet mission requirements.

Alternatives Considered

Alternatives to the Proposed Action must be considered in accordance with National Environmental Policy Act (NEPA), Council of Environmental Quality (CEQ) regulations for implementing NEPA, and OPNAVINST 5090.1D. However, only those alternatives determined to be reasonable relative to their ability to fulfill the purpose and need for the Proposed Action require detailed analysis. Since purpose of the Proposed Action is to maintain the existing EHW-1 in-water structure in working condition and to restore its structural integrity, the only alternative would be to not perform maintenance and pile replacement; therefore, no practical or feasible action alternatives were identified. This EA will analyze the Proposed Action and the No-Action alternative.

Under the No-Action Alternative, maintenance and pile replacement would not occur at EHW-1 to restore structural integrity and mission readiness. The No-Action Alternative does not meet the purpose of and need for the Proposed Action, but represents the baseline condition against which potential consequences of the Proposed Action can be compared. As required by CEQ guidelines, the No-Action Alternative is carried forward for analysis in this EA.

Summary of Environmental Resources Evaluated in the EA

Council on Environmental Quality (CEQ) regulations, National Environmental Policy Act (NEPA), and Navy instructions for implementing NEPA, specify that an Environmental Assessment (EA) should address those resource areas potentially subject to impacts. In addition, the level of analysis should be commensurate with the anticipated level of environmental impact.

The following resource areas have been addressed in this EA: sediments, water quality, 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: land use, air quality, visual resources, recreational and commercial fishing, socioeconomics and environmental justice, traffic and transportation, bathymetry, and health and safety.

Summary of Environmental Effects

The following is a summary of the potential environmental consequences of the Proposed Action:

Sediments. Sediment would be disturbed and re-suspended in the water column during pile removal and pile driving activities. Such suspension would be localized to the immediate area of the pile being driven. Concrete sediment (anticipated to be sand-sized) resulting from cuts made with the chipping hammer is inert and would settle within hours. These inert and dense particles would be incorporated into the sediments in the immediate area. Construction activities would not result in the discharge of wastes containing metals or otherwise alter the concentrations of trace metals in bottom sediments. Nor would construction activities result in the discharge of contaminants or otherwise alter the concentrations of organic contaminants in bottom sediments. Implementation of the Proposed Action would result in temporary, minor and localized impacts from resuspension of sediments but would not result in a violation of Washington Sediment Quality Standards (WAC 172-204-320). Therefore, no significant impacts to sediments would occur with implementation of the Proposed Action.

Water Quality. Construction-related impacts to water quality with implementation of the Proposed Action would be short-term, temporary, and localized changes associated with re-suspension of bottom sediments from pile installation and tug operations, such as anchoring. Accidental losses or spills of construction materials or fuel into Hood Canal are not anticipated. Direct discharges of waste would not occur. Construction-related impacts would not increase pollution levels or violate applicable state or federal water quality standards, nor would they reduce the ability of Hood Canal to support its designated uses. The Navy would implement Best Management Practices (BMPs) as described in Section 2.4 to prevent accidental losses or spills of construction debris. Therefore, no significant impacts to water quality would occur with implementation of the Proposed Action.

Airborne Noise. The State of Washington and Kitsap County exempt temporary construction noise occurring between 7:00 a.m. and 10:00 p.m. from maximum permissible daytime noise levels. As the noise from the Proposed Action is temporary and will occur between the hours of 7:00 a.m. and 10:00 p.m. noise from implementation of the Proposed Action is exempt and would not result in significant impacts.

Biological Resources

Terrestrial Wildlife. There are approximately 14 non Endangered Species Act (ESA) listed bird species comprising shorebirds, wading birds, waterfowl, seabirds/marine birds and raptors that have been observed within or adjacent to the project area. Temporary and short-term noise disturbance to birds would likely occur during impact pile driving but would not be significant as these species are likely acclimated to the elevated noise levels typically produced along the industrial waterfront on a daily basis. No significant impacts to terrestrial species would occur with implementation of the Proposed Action.

Aquatic Species. Marine vegetation and benthic invertebrates could potentially be affected by the Proposed Action due to deterioration of water quality and by direct mortality during pile replacement. As indicated in *Water Quality*, impacts to water quality with implementation of the Proposed Action would be short-term, temporary, and localized changes associated with re-suspension of bottom sediments from pile installation and tug operations. Marine surveys at NAVBASE Kitsap Bangor have shown that eelgrass does not occur at depths where pile replacement would occur. Red and green algae are present nearby the pile locations, but in low densities due to the inherent light limitation at the deepwater depths at the project area, limiting potential impacts. Brown algae, including understory kelp, are distributed outside of the project area. Therefore, effects to macroalgae and eelgrass from changes in water quality during construction would be minimal and would not affect the overall health or distribution of marine vegetation near the project area. There would be some direct mortality of less motile benthic organisms from substrate disturbance and removal of piles colonized by invertebrates. Minimal impacts to habitat and benthic organisms are likely to result from turbidity caused by driving and removing barge anchors, spuds, and removal and installation of the 4 piles. Impacts would be minor in scale and temporary in nature. Overall, the removal and the installation of piles would result in a negligible change to the existing marine vegetation benthic invertebrate habitat beneath the existing EHW-1 wharf and superstructure. No significant impacts to marine vegetation and benthic invertebrates would occur with the implementation of the Proposed Action.

Special-Status Species. Special-status species in the action area include ESA listed species and designated critical habitats, bald eagle, and marine mammals.

ESA listed fish, including Puget Sound Chinook salmon, Puget Sound steelhead, Hood Canal summer-run chum salmon, bull trout, bocaccio rockfish, canary rockfish, and yelloweye rockfish may be exposed to impacts from pile replacement including sound pressure levels which may result in behavioral disturbance, but would be unlikely to result in injury because each session of pile driving would be relatively short and measures to minimize sound pressures would be implemented. While critical habitat has been designated for Puget Sound Chinook salmon, Hood Canal summer-run chum salmon, bocaccio rockfish, canary rockfish, and yelloweye rockfish in the northern Hood Canal, where NAVBASE Kitsap Bangor is located, the entire Bangor waterfront is excluded from critical habitat designation. As such, there is no designated critical habitat in the vicinity of the project area. The following measures would be implemented to protect ESA-listed fish species and their critical habitats: vibratory pile driving will be the primary method used to install new steel piles, an impact hammer may be used if substrate conditions prevent the advancement of piles to the required depth or to verify the load bearing capacity, and an air bubble curtain or other noise-attenuating device would be used to reduce noise levels during impact driving. Exposure of ESA-listed fish to temporary, sporadic and spatially limited increases in sediment and turbidity for brief periods of time during the Proposed Action would be unlikely to affect ESA-listed fish that could be present. With the implementation of these minimization and mitigation measures the Navy determined that the Proposed Action “may affect, but is not likely to adversely affect” Puget Sound Chinook Salmon, Puget Sound steelhead, Hood Canal summer-run chum salmon, bull trout, and listed rockfish, and therefore would not result in significant impacts to ESA-listed fish species or their habitats.

The marbled murrelet is a bird listed under the ESA and is known to occur within the action area. Airborne noise generated by pile driving could potentially disturb marbled murrelets or affect foraging behavior and efficiency through masking of vocalizations between foraging pairs.

Impact pile driving could expose diving marbled murrelets to injurious underwater sound pressure levels. Additionally, to ensure marbled murrelets would not be exposed to injurious sound pressure levels, the Navy developed and will implement a Marbled Murrelet Monitoring Plan, which would include visual monitoring a 50-meter radius around impact driven piles and cessation of impact pile driving if a marbled murrelet enters the injury zone. To further protect marbled murrelets, all pile driving during the nesting season (July 16 to September 23) would begin two hours after sunrise and end two hours before sunset to minimize effects to foraging marbled murrelets. All impact pile driving would occur with the use of a noise attenuation device. The Navy determined that with implementation of minimization measures listed, the Proposed Action "may affect, but is not likely to adversely affect" marbled murrelets and therefore would not result in significant impacts to marbled murrelets.

The humpback whale is an ESA listed marine mammal that has been documented in Hood Canal twice, but in mid-winter; therefore, exposure during the time when pile driving would occur is considered extremely unlikely. Based on the absence of any regular occurrence of humpbacks adjacent to or within the vicinity of the project site, the limited extent and duration of pile driving, and implementation of minimization measures, the Navy determined that the Proposed Action "may affect, but is not likely to adversely affect" humpback whales and therefore would not result in significant impacts to humpback whales.

The Navy has completed informal consultations under the ESA with the USFWS (January 7, 2015) and NMFS (January 8, 2015). With one exception, USFWS and NMFS concurred with the Navy's findings of "may effect, not likely to adversely affect" for the species and designated critical habitats discussed above. For the affects to the humpback whale, while the Navy concluded with a finding of "may affect, not likely to adversely affect", NMFS determined the Proposed Action would have "no effect" on this species.

There are no bald eagle nests, forage concentration areas, or communal roosts near the action area. Therefore, implementation of the Proposed Action would not result in significant impacts to bald eagles.

Non ESA listed marine mammals with a potential to be affected by the Proposed Action include the California sea lion, Steller sea lion, harbor seal, harbor porpoise, and transient killer whale. Individual marine mammals may be exposed to sound pressure levels during pile driving operations, which may result in Level B behavioral harassment (defined by the Marine Mammal Protection Act (MMPA) as potential behavioral disruption). Any marine mammals that are exposed (harassed) may change their normal behavior patterns (i.e., swimming speed, foraging habits, etc.) or be temporarily displaced from the area of construction. To minimize underwater noise impacts on marine mammals, vibratory pile driving will be the primary method used to install new steel piles. An impact hammer may be used if substrate conditions prevent the advancement of piles to the required depth or to verify the load bearing capacity. An air bubble curtain or other noise-attenuating device would be used to reduce noise levels during impact driving. Marine mammal monitoring would be conducted during all pile driving, and work will shut down if marine mammals come within distances where injury could potentially occur. The Navy has applied for an Incidental Harassment Authorization (IHA) under the MMPA. Issuance of an IHA is required from NMFS prior to the commencement of in-water pile driving. The

Navy will comply with all IHA conditions. Therefore, there would be no significant impact to marine mammal populations.

Essential Fish Habitat (EFH). The action area includes habitats for various life stages of groundfish, coastal pelagic species, and species of Pacific salmon. The action would result in a short-term increase in underwater sound-pressure levels from vibratory and impact pile driving. Pile replacement and barge anchoring would also have a localized impact 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 decreasing water quality and suitability through increased sound energy levels during pile driving. However, with implementation of protection measures the Proposed Action would not result in significant impacts to EFH. The Navy completed consultation under the Magnuson-Stevens Fisheries Conservation and Management Act with NMFS in January 2015. NMFS concurred that the Navy's protective measures were sufficient to minimize temporary adverse effects to EFH.

Cultural Resources. Within the area of potential effects for the Proposed Action, there are no known archaeological resources or traditional cultural properties that would be eligible for inclusion in the National Register of Historic Places (NRHP). The Navy determined that EHW-1 is an architectural resource eligible for inclusion in the NRHP based on its Cold War context, with State Historic Preservation Office (SHPO) concurrence on March 25, 2011. The Navy determined that replacement of 4 piles and maintenance activities associated with the Proposed Action would not adversely affect the overall characteristics that make the property eligible for inclusion in the NRHP. The Navy initiated consultation with the SHPO on August 22, 2014 and on September 10, 2014, the SHPO concurred with the Navy's determination that the project, as proposed, would not adversely affect properties eligible for inclusion on the NRHP (Appendix A). Therefore, no significant impacts to cultural resources would occur with implementation of the Proposed Action.

American Indian Traditional Resources. The Proposed Action is located within the usual and accustomed (U&A) fishing grounds and stations of the Skokomish, Port Gamble S'Klallam, Jamestown S'Klallam, Lower Elwha Klallam, and Suquamish Tribes. Under the Proposed Action, access to the waterfront area would remain unchanged. Access to Bangor Beach (a tribal fishing beach), commercial geoduck tracts located outside of the Naval Restricted Areas, and Dungeness crab fishing and finfishing located outside of the Naval Restricted Areas would not be impeded. The quantity of geoduck, finfish, and shellfish inventories would not be significantly impacted by project construction or indirect impacts of increased turbidity and sediment transport. In July 2012, the Navy initiated government-to-government consultation with the Tribes that have U&A that includes the location of the Proposed Action. Government-to-government consultation with the Tribes concluded in February 2015. The Tribes expressed no objections to the Proposed Action. Accordingly, no significant impacts to American Indian traditional resources would occur with implementation of the Proposed Action.

Under the No-Action Alternative, no piles would be removed or driven, thus there would be no change to the natural and physical environment or the relationship of people with that environment.

Public Involvement

The Navy has made the Draft EA available for public review and comment from December 16, 2014 to January 15, 2015 with a notice of availability (NOA) published in the local newspaper (Kitsap Sun). The Draft EA was also posted on the Naval Facilities Engineering Command Northwest website for review and comment. No comments were received from the public.

Conclusion

Based on the analyses in this EA, the Navy has concluded that implementation of the Proposed Action would not result in significant impacts to any resource area when considered individually or cumulatively in the context of NEPA, including both direct and indirect impacts. Implementation of the Proposed Action would not constitute a "major Federal action significantly affecting the quality of the human environment." Therefore, this EA supports a Finding of No Significant Impact (FONSI) for the Proposed Action and the preparation of an Environmental Impact Statement (EIS) is not warranted or required.

Table of Contents

Appendices

List of Figures

List of Tables

Table **Page**

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ACRONYMS AND ABBREVIATIONS

APE	Area of Potential Effects
BA	Biological Assessment
BACT	Best Available Control Technology
BMP	Best Management Practices
BOD	Biochemical Oxygen Demand
CAA	Clean Air Act
CAO	Critical Areas Ordinance
CCD	Coastal Consistency Determination
CDC	Child Development Center
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CISS	Cast-In-Steel-Shell
cm	Centimeter
CNRNW	Commander, Navy Region Northwest
CO_2	Carbon Dioxide
CSL	Cleanup Screening Levels
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
CZMP	Coastal Zone Management Program
DAHP	Department of Archaeological and Historic Preservation
dB	Decibel
dBA	Decibels Adjusted
DNL	Day-Night Average Sound Level
DO	Dissolved Oxygen
DoD	Department of Defense
DPS	Distinct Population Segment
EA	Environmental Assessment
EFH	Essential Fish Habitat
EHW	Explosives Handling Wharf
EIS	Environmental Impact Statement
EO	Executive Order
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FMP	Fisheries Management Plan
FONSI	Finding of No Significant Impact
FR	Federal Register
ft	Feet
FY	Fiscal Year
GHG	Greenhouse Gases
HAP	Hazard Air Pollutants
HCCC	Hood Canal Coordinating Council
HDPE	High-Density Polyethylene

Hp	Horsepower
HUD	Habitat Use Relational Database
Hz	Hertz
IHA	Incidental Harassment Authorization
JARPA	Joint Aquatic Resources Permit Application
K/B	Keyport/Bangor
kHz	Kilohertz
km	Kilometer
lbs	Pounds
LOA	Letter of Authorization
m	Meter
MBTA	Migratory Bird Treaty Act
MILCON	Military Construction
MLLW	Mean Lower Low Water
MMPA	Marine Mammal Protection Act
MOA	Military Operating Area
MSA	Magnuson-Stevens Fisheries Conservation and Management Act
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Grave Protection and Repatriation Act
NAS	Naval Air Station
NAVBASE	Naval Base
NAVMAG	Naval Magazine
NAVSTA	Naval Station
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NO_2	Nitrogen Dioxide
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
NSC	Naval Supply Center
NUWC	Naval Undersea Warfare Center
NWCAA	Northwest Clean Air Agency
OPNAVINST	Office of the Chief of Naval Operations Instruction
ORCAA	Olympic Region Clean Air Agency
OU	Operable Unit
Pa	Pascal
PCB	Polychlorinated Biphenyls
$PM_{2.5}$	Particulate Matter Less Than 2.5 Microns In Diameter
PM_{10}	Particulate Matter Less Than 10 Microns In Diameter
PSAMP	Puget Sound Ambient Monitoring Program
PSCAA	Puget Sound Clean Air Agency
PTRCI	Properties of Traditional Religious and Cultural Importance
RCRA	Resource Conservation and Recovery Act
RCW	Revised Code of Washington
RMS	Root Mean Square

ROD	Record of Decision
SAV	Submerged Aquatic Vegetation
SECNAVINST	Secretary of the Navy Instruction
SED	Shoreline Environment Designations
SEL	Sound Exposure Level
SEPA	State Environmental Policy Act
SHPO	State Historic Preservation Officer
SMA	Shoreline Management Act
SMS	Sediment Management Standards
SO_2	Sulfur Dioxide
SPL	Sound Pressure Level
SQS	Sediment Quality Standards
SRKW	Southern Resident killer whale
STA	Sediment Trend Analysis
TMDL	total maximum daily load
TTS	Temporary Threshold Shift
U&A	Usual and Accustomed
USACE	United States Army Corps of Engineers
U.S.	United States
U.S.C.	United States Code
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	United States Geological Survey
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WDNR	Washington State Department of Natural Resources
WDOE	Washington Department of Ecology
WQA	Water Quality Assessment
WQC	Water Quality Certification
WSDOT	Washington State Department of Transportation
μPa	MicroPascal

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1 PROPOSED ACTION, PURPOSE AND NEED

1.1 INTRODUCTION

The United States (U.S.) Department of the Navy (Navy) has prepared this Environmental Assessment (EA) in accordance with the National Environmental Policy Act (NEPA) of 1969 (42 U.S. Code [USC] §4321-4370h), as implemented by the Council on Environmental Quality (CEQ) Regulations (40 Code of Federal Regulations [CFR] Parts 1500-1508); Navy regulations for implementing NEPA (32 CFR Part 775); and Chief of Naval Operations Instruction (OPNAVINST) 5090.1D, Environmental Readiness Program.

The Navy proposes to perform maintenance and restore the structural integrity of the Explosives Handling Wharf 1 (EHW-1) facility located at Naval Base (NAVBASE) Kitsap Bangor, WA (Figure 1-1). EHW-1 is a U-shaped concrete structure built in 1978 for ordnance handling operations in support of the Trident Submarine squadron home ported at NAVBASE Kitsap Bangor. EHW-1 consists of two 100-foot (ft) (30 meters [m]) access trestles and a main pier deck which measures approximately 700 ft (213 m) in length and is approximately 500 ft (183 m) wide. The wharf is supported by both 16-inch and 24-inch hollow octagonal pre-cast concrete piles (approximately 130 ft [40 m] in length). Additionally, there are steel and timber fender piles on the outboard and inboard edges of the wharf.

The Proposed Action includes demolishing four 24-inch hollow prestressed octagonal concrete piles and installing four 30-inch concrete filled steel piles adjacent to the demolished piles at Bent 27 of the outboard support of the EHW-1. Additionally, the project includes replacement of structural elements such as decking and pile caps, installation of cathodic protection, repair of a concrete wetwell, and recoating of the tops of fender piles and steel mooring fittings.

Construction associated with the Proposed Action is expected to begin in July 2015 and to be completed in January 2016, to minimize impacts to endangered fish (discussed under Section 2.4.3). In-water work would be expected to take approximately 3 weeks to complete, while all repairs would be expected to be completed over a three-month period. No in-water work would begin on the Proposed Action until the Navy has received all required permits and approvals. Construction would occur when the wharf is not in operational use.

This EA will be reviewed by the Navy, who will make a determination regarding the Proposed Action and whether a finding of no significant impacts (FONSI) or an EIS is appropriate. There are no cooperating agencies for the Proposed Action.

1.2 LOCATION

NAVBASE Kitsap Bangor is located north of the community of Silverdale in Kitsap County on the eastern shoreline of northern Hood Canal (Figure 1-2). Hood Canal is a long, narrow fjord-like basin of western Puget Sound. Throughout its 67-mile length, the width of the canal varies from 1 to 2 miles and exhibits strong depth/elevation gradients and irregular seafloor topography in many areas. The width of the canal is approximately 1.5 miles at the project site, 2.2 miles at the northern end of NAVBASE Kitsap Bangor, and constricts to approximately 1.1 miles near the southern end near Hazel Point. Although no official boundaries exist along the waterway, the northeastern section of the canal extending from the mouth of the canal at Admiralty Inlet to the southern tip of Toandos Peninsula is referred to as northern Hood Canal.

Within northern Hood Canal, nearshore development is limited with NAVBASE Kitsap Bangor representing the largest industrial waterfront. There are many nearshore structures in the southern portion of Hood Canal, primarily smaller docks. A few docks and a small pier occur at Seabeck, more than 8 miles (13 kilometers) south, and the Hood Canal Bridge, approximately 7 miles (11 kilometers) north of installation. The remainder of the northern Hood Canal shoreline is generally undeveloped.

The NAVBASE Kitsap Bangor waterfront occupies approximately 4.3 miles (7 kilometers) of the approximately 67-mile (108-kilometer) long eastern shoreline of Hood Canal. The entirety of NAVBASE Kitsap Bangor waterfront is restricted from general public access (Naval Restricted Areas 1 and 2 [33 CFR 334.1220]). The project is located in the Washington Department of Ecology (WDOE) Water Resource Inventory Area 15 and U.S. Geological Service Hydrologic Unit Code 17110018, Hood Canal.

EHW-1 is located along the northern waterfront of NAVBASE Kitsap Bangor and is one of eight pile supported structures at the installation.

1.3 PURPOSE AND NEED

The purpose of the Proposed Action is to maintain the existing EHW-1 in-water structure in working condition and to restore its structural integrity. The need for the Proposed Action is to ensure that this in-water structure continues to meet mission requirements.

1.4 SCOPE OF ENVIRONMENTAL ANALYSIS

This EA includes an analysis of potential environmental impacts associated with the Proposed Action. The environmental resources areas analyzed in this EA include: sediments, water quality, 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:

Land Use – Implementation of the Proposed Action would not alter existing land use on- or off-base. 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.

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 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 is designated an attainment area for all criteria pollutants, the General Conformity Rule does not apply. 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.

Visual Resources – Visual resources are the natural and man-made features that give a particular environment its aesthetic qualities. In developed areas, the natural landscape is more likely to provide a background for more obvious man-made features. The size, forms, materials, and functions of buildings, structures, roadways, and infrastructure would generally define the visual character of the built environment. These features form the overall impression that an observer receives of an area or its landscape character. Attributes used to describe the visual resource value of an area include landscape character, perceived aesthetic value, and uniqueness. The Proposed Action includes replacement of piles and maintenance of the wharf. The Proposed Action would not change the appearance of EHW-1; 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 construction areas as a result of the Proposed Action, but would be expected to return to the area after the pile driving activities were concluded. However, recreational and commercial fishing does not occur near the EHW-1 project site as this area is restricted from access by the general public per 33 CFR 334.1220. Therefore, the activities described under the Proposed Action would have no impact on recreational and commercial fishing or shellfish harvesting.

Socioeconomics and Environmental Justice – 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 installations or surrounding areas. Construction activities would be conducted by contractors. The socioeconomic impacts related to temporary construction employment, if needed, would occur over a six-month period. The Proposed Action may create a small number of temporary jobs and contribute minimally to local earnings 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 construction associated with the Proposed Action.

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 environmental, human health, and socioeconomic affects upon minority and low-income populations, or 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 government vehicles or contractors arriving and leaving for other activities that are concurrently going on at the facility. Pile delivery and disposal would generally be conducted via barge.

Bathymetry – Changes to bathymetry (seafloor topography) would not occur as the Proposed Action is replacing existing piles in highly localized and disturbed areas. The project site has been substantially modified by construction and operation of the existing wharf. 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 activity would return the seafloor to near its original profile over time without intervention.

Health and Safety – The waterfront area of NAVBASE Kitsap Bangor is restricted from public access. Construction contractors and Navy employees would adhere to all applicable regulations with respect to environmental and safety regulations. Children are restricted from access to the Waterfront Restricted Area. The replacement of piles and other maintenance activities at EHW-1 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. Therefore, the activities described under the Proposed Action would have a negligible impact on health and safety of the public, children, construction contractors, or Navy employees with adherence to construction safety standards.

1.5 RELEVANT LAWS AND REGULATIONS

In addition to NEPA, CEQ, and Navy regulations, the Navy has prepared this EA integrating federal laws, statutes, regulations, and policies that are pertinent to the implementation of the Proposed Action including, but not limited to:

- Clean Air Act (CAA) (42 USC 7401 *et seq*.);
- Endangered Species Act (ESA) (16 USC 1531 *et seq*.);
- Marine Mammal Protection Act (MMPA) (16 USC 1361 *et seq*.);
- Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 USC 1361-1421h, as amended);
- Migratory Bird Treaty Act (MBTA) (16 USC 703-712);
- Bald and Golden Eagle Protection Act (16 USC 668-668d);
- Clean Water Act (CWA) (33 USC 1251 *et seq*.);
- Rivers and Harbors Act (RHA) (33 U.S.C. 401 *et seq*.);
- Coastal Zone Management Act (CZMA) (16 USC 1451 *et seq*.);
- National Historic Preservation Act (NHPA) Section 106 (54 USC 306108 *et seq*.);
- Executive Order (EO) 13175, *Consultation and Coordination with Indian Tribal Governments;*
- EO 12088, *Federal Compliance with Pollution Control Standards*;
- EO 12898, *Federal Actions to Address Environmental Justice in Minority and Low-income Populations*; and
- EO 13045, *Protection of Children from Environmental Health Risks and Safety Risks.*

A description of the Proposed Action's consistency with these policies and regulations, as well as regulatory agencies responsible for their implementation is presented in Chapter 5.0 (Table 5-1).

1.6 Public Involvement

Public Review of the Draft EA The Navy has made the Draft EA available for public review and comment from December 16, 2014 to January 15, 2015 with a notice of availability (NOA) published in the local newspaper (Kitsap Sun). The Draft EA was also posted on the Naval Facilities Engineering Command Northwest website for review and comment. No comments were received from the public.

Release of the Final EA and Decision Document. 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 Naval Facilities Engineering Command Northwest website.

Figure 1-1. NAVBASE Kitsap Bangor Vicinity Map

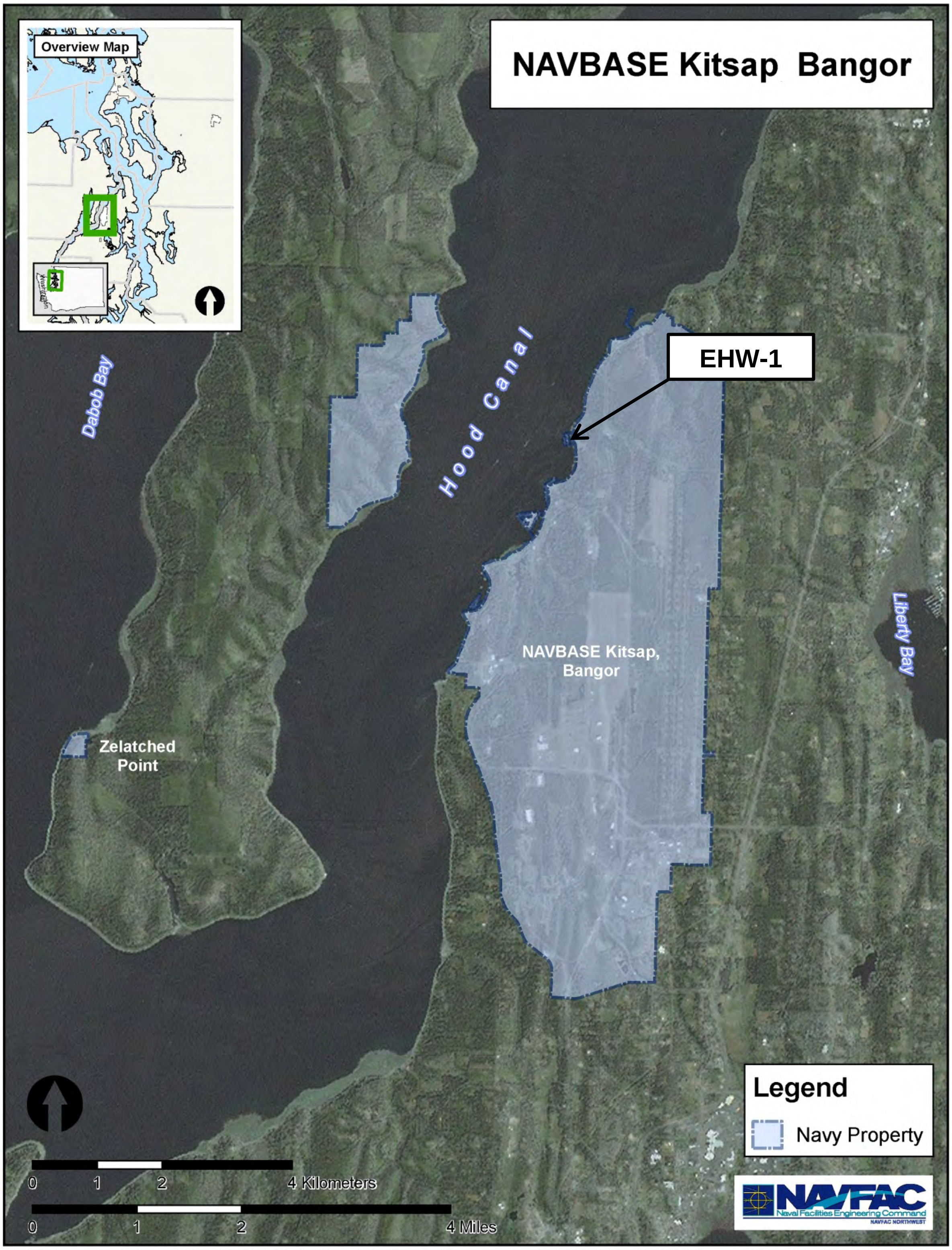

Figure 1-2. NAVBASE Kitsap Bangor

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2 PROPOSED ACTION AND ALTERNATIVES

2.1 PROPOSED ACTION

The Navy proposes to perform maintenance and restore the structural integrity of the EHW-1 facility, including replacement of 4 structurally unsound piles. EHW-1 is a U-shaped concrete structure built in 1978 for ordnance handling operations in support of the Trident Submarine squadron home ported at NAVBASE Kitsap Bangor. EHW-1 consists of two 100-foot (ft) (30 meters [m]) access trestles and a main pier deck which measures approximately 700 ft (213 m) in length and is approximately 500 ft (183 m) wide. The wharf is supported by both 16-inch and 24-inch hollow octagonal pre-cast concrete piles (approximately 130 ft [40 m] in length). Additionally, there are steel and timber fender piles on the outboard and inboard edges of the wharf.

The project will include demolishing and replacing existing piles at Bent 27 of the outboard support of the EHW-1. Additionally, the project includes replacement of structural elements such as decking and pile caps, installation of cathodic protection, repair of a concrete wetwell (concrete encasement for a sanitary sewer lift station pump), and recoating of the tops of fender piles and steel mooring fittings (Figures 2-1 through 2-3). Table 2-1 provides a summary of the proposed maintenance and repair activities.

The Proposed Action includes best management practices (BMPs), and minimization measures that would be implemented to avoid or minimize potential environmental impacts as described in Section 2.4.

Table 2-1. EHW-1 Proposed Pile Replacement and Maintenance Activities

Demolish four existing 24-inch hollow prestressed octagonal concrete piles to the mudline.
Install four new 30-inch concrete filled steel pipe piles adjacent to the demolished piles.
Demolish and replace four 6'-0" by 4'-3" sections of deck in order to install new piles.
Install new concrete pile caps for the newly installed piles.
Install cathodic protection system for newly installed piles.
Repair deteriorated concrete of the wetwell on Wharf Apron.
Recoat top portion of 183 steel pipe fender piles.
Recoat 27 steel mooring fittings on the deck of the Wharf.

2.2 ALTERNATIVES

A reasonable range of alternatives to the Proposed Action must be considered in accordance with NEPA, CEQ regulations for implementing NEPA, and OPNAVINST 5090.1D (January, 2014). However, only those alternatives determined to be reasonable relative to their ability to fulfill the purpose and need for the Proposed Action require detailed analysis. Since the action is to perform maintenance and replace piles at EHW-1, the only alternative would be to not perform maintenance and pile replacement; therefore, no practical or feasible action alternatives were identified. Consequently, this EA will analyze the Proposed Action and the No-Action alternative.

Under the No-Action Alternative, maintenance and pile replacement would not occur at EHW-1 to restore structural integrity and mission readiness. The No-Action Alternative does not meet the purpose of and need for the Proposed Action, but represents the baseline condition against which potential consequences of the Proposed Action can be compared. As required by CEQ guidelines, the No-Action Alternative is carried forward for analysis in this EA.

2.3 PILE REPLACEMENT AND MAINTENANCE CONSTRUCTION METHODS

Sections 2.3.1 and 2.3.2 describe the planned methods that would be used to accomplish the pile removal and installation included as part of this Proposed Action. Other proposed maintenance and repairs at EHW-1 are described in Section 2.3.3.

2.3.1 Pile Removal

Four existing 24-inch hollow prestressed octagonal concrete piles located at Bent-27 would be removed with a pneumatic chipping hammer or another tool capable of cutting through concrete. If possible, piles would be first scored by a diver using a small pneumatic hammer. Each pile would be moved slightly back and forth to break at the score. Remaining pile parts would be chipped away with a pneumatic hammer. If there is not room to move a pile, the entire base of the pile would be chipped away with a pneumatic hammer for removal. A pneumatic chipping hammer is similar to an electric power tool and performs much like a smaller version of a jackhammer, 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. Rebar strands in the piles would be torched to remove. Concrete debris would be captured as practicable using a debris curtains/sheeting and removed from the project area. Removed piles and/or pile pieces would be placed on a barge for upland disposal in accordance with federal and state requirements. The Navy would evaluate if it would be possible to reclaim or recycle the materials.

2.3.2 Pile Installation

To minimize potential impacts to fish and marine mammals due to underwater noise from impact pile driving, the Navy plans to utilize vibratory pile driving, to the maximum extent practicable, to install four 30-inch concrete filled steel piles adjacent to the demolished piles. The vibratory hammer would install the new piles to a point of refusal or within approximately 5 ft of the final tip elevation (approximately -110 ft MLLW). The vibratory hammer process for pile installation 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 would be used to entirely advance the pile to the required depth. Based on the Navy's experience replacing piles during previous repair cycles at the EHW-1 facility, the Navy estimates that use of a vibratory hammer would be sufficient; the impact hammer has yet to be required to accomplish installation. Impact pile driving is anticipated to verify the load bearing capacity (proofing[1]) of the new piles. An impact hammer is typically required to strike a pile a number of times the last few feet to ensure it has met load-bearing specifications. To minimize noise levels, a bubble curtain or other noise attenuation device would be employed for all steel impact pile strikes, as described in section 2.4.4.

To provide a general estimate of daily steel pile impact driving durations, information from past projects using diesel hammers was used to estimate pile strikes and average strike rates needed to install 24- to 36-inch steel piles. For steel piles that are "proofed" an average of 400 strikes per pile were estimated. For piles that cannot be advanced with a vibratory driver and, therefore would be fully impact driven, 2,000 strikes per pile were estimated to fully drive a pile. This estimate assumes an average estimated strike rate of 44 strikes per minute (or almost a strike every second and a half) resulting in an estimate of approximately 9 minutes of impact driving for each pile proofed or approximately 45 minutes for each pile fully impact driven. Actual strike numbers and average strike rates would vary due to substrate conditions and the type and energy of impact hammers would likely vary. Past projects at EHW-1 have not required full impact driving. Therefore, steel impact pile driving is estimated to occur from approximately 36 minutes to a maximum of 3 hours to drive four piles.

2.3.3 Associated Marine Structure Repairs and Maintenance

Other marine structure repairs and maintenance include replacement of structural elements such as decking and pile caps, installation of cathodic protection, repair of a wetwell, and recoating of the tops of fender piles and steel mooring fittings. Each of these is described below.

- Demolish and replace four 6'-0" by 4'-3" sections of deck in order to install new piles. These deck structures would likely be removed by cutting the concrete into sections using a wire saw, or other equipment, and removed using a crane. The concrete debris would be captured using debris curtains/sheeting and removed from the project area. Concrete pieces would be hauled to a barge for upland disposal. New decking would likely be cast-in-place concrete. Concrete formwork would be located above Mean Higher High Water (MHHW). The visual character of the new decking would be similar to that of the old decking.
- Construction of cast-in-place concrete pile caps. The pile caps would be situated on the tops of the steel piles located directly beneath the structure and function as a load transfer mechanism between the superstructure and the piles. Concrete formwork may be located below MHHW. The concrete debris would be captured using debris curtains/sheeting and removed from the project area. The visual character of the new pile caps would be similar to that of the existing pile caps.
- Installation of four sled mounted passive cathodic protection systems. A passive cathodic protection system is a metallic rod or anode attached to a metal object to protect it from corrosion. A more active metal, which easily oxidizes, corrodes the anode first and protects the primary structure from corrosion damage. At the EHW-1 facility, the passive cathodic protection systems would be banded to the steel piles to prevent the metallic surfaces of the wharf from corroding due to the saline conditions in Hood Canal.
- Repair deteriorated concrete of the wetwell on Wharf Apron. A wetwell is a reinforced concrete encasement for a sanitary sewer lift station pump. Repairs would occur by

1 "Proofing" is driving the pile the last few feet into the substrate to determine the capacity of the pile. The capacity is established by measuring the resistance of the pile to a hammer that has a piston with a known weight and stroke (distance the hammer rises and falls) so that the energy on top of the pile can be calculated. The blow count in "blows per inch" is measured to verify resistance, and pile compression capacities are calculated.

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 top portions of 183 steel pipe fender piles and 27 steel mooring fittings on the deck of the Wharf. Fender piles and mooring fittings would be cleaned prior to recoating. All coatings would be applied to dry surfaces and limited to areas above mean sea level (+6.5 ft MLLW). Coatings would be inorganic, non-toxic, and free of volatile organic compounds.

2.3.4 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 the work site. Barges would be moored with spuds or anchors and not allowed to ground. 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 or disturbed areas.

2.3.5 Project Duration and Sequencing

No in-water work would begin on the Proposed Action until the Navy has received all required permits and approvals. Construction would occur when the wharf is not in operational use. Construction associated with the Proposed Action is expected to begin on July 16, 2015 and to be completed no later than January 15, 2016, to minimize impacts to endangered fish (discussed below under Section 2.4.3). In-water work would be expected to take approximately 3 weeks to complete, while all repairs would be expected to be completed over a three-month period.

While sequencing of all proposed repair work has not been scheduled, work would likely proceed with removal of deck segments occurring first, followed by installation of the new concrete filled steel piles and pile caps. Only after the new piles have been installed and the pile caps have fully cured and reached design compressive strength, would removal of the existing concrete piles begin.

2.4 BEST MANAGEMENT PRACTICES (BMPs) AND MINIMIZATION MEASURES

General BMPs, and minimization measures that would be implemented for all in-water repair and replacement activities are presented below. These BMPs are routinely used by the Navy during pile repair, replacement, and maintenance 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 species and designated critical habitats. Specific avoidance measures, such as species monitoring, would be applied as described in Section 3.4 of the EA, and as required by the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS).

2.4.1 General

An Environmental Protection Plan (EPP) would be developed and implemented for the Proposed Action. The EPP would be completed prior to the commencement of any repair or replacement activities. The EPP would identify planning elements and recognize spill sources at the site. The EPP would outline BMPs, responsive actions in the event of a spill or release, and notification and reporting procedures. The EPP would also outline contractor management elements such as personnel responsibilities, project site security, site inspections, and training.

2.4.2 BMPs

Other general BMPs incorporated in the EPP and implemented during project activities would include:

- No petroleum products, fresh cement, lime, fresh concrete, chemicals, or other toxic or harmful materials shall be allowed to enter surface waters.
- Washwater resulting from washdown of equipment or work areas shall be contained for proper disposal, and shall not be discharged unless authorized.
- Equipment that enters surface water shall be maintained to prevent any visible sheen from petroleum products.
- No oil, fuels, or chemicals shall be discharged to surface waters, or onto land. Fuel hoses, oil drums, oil or fuel transfer valves, fittings, etc. would be checked regularly for leaks and materials shall be maintained and stored properly to prevent spills.
- No cleaning solvents or chemicals used for tools or equipment cleaning shall be discharged to ground or surface waters.
- Oil-absorbent materials would be used in the event of a spill if any oil product is observed in the water.
- Waste materials would be disposed of in a state-approved landfill or recycled.
- Removed piles and associated sediments (if any) shall be contained on a barge or stored in a containment area on the pier.
- Construction materials would not be stored where high tides, wave action, or upland runoff could cause materials to enter surface waters.
- Hand tools would be used to excavate around piles to be replaced, if needed.
- The concrete debris would be captured using debris curtains/sheeting and removed from the project area.
- Any floating debris generated during installation would be retrieved. Any debris in the containment boom would be removed by the end of the workday or when the boom is removed, whichever occurs first.
- Barge operations would be restricted to tidal elevations adequate to prevent grounding of a barge.
- 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.

2.4.3 Timing Restrictions

In-water work is planned to begin on July 16, 2015 and be completed by January 15, 2016. As such, in-water work would comply with the timing restrictions (or “fish windows”) developed through consultation with NMFS and USFWS to avoid conducting activities when bull trout and juvenile salmon and steelhead are most likely to be present. The allowable time frame for in-water work at NAVBASE Kitsap Bangor is July 16 to February 15.

All in-water work would occur during daylight hours except from July 16 to September 23, when impact pile driving would only occur starting two hours after sunrise and ending two hours before sunset to protect foraging marbled murrelets during the nesting season (April 15 to September 23). Sunrise and sunset are based on the National Oceanic and Atmospheric Administration (NOAA) data.

To minimize noise impacts to surrounding residents, noise-generating activities would not occur between the hours of 10:00 p.m. and 7:00 a.m.

2.4.4 Sound Attenuation

The Navy would use a bubble curtain or other noise attenuation device to minimize in-water sound during installation of steel piles with an impact driver. Confined and unconfined bubble curtains utilize air as a means of creating a barrier to sound propagation. Air is an effective means of attenuating sound due to the difference in density between air and water. 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 holes through which compressed air is pumped. As compressed air is pumped through the tubing, bubbles are produced creating an air barrier which impedes the sound and pressure produced during pile driving from radiating away from the pile. In a confined system, the bubbles are confined to the area around the piles with a flexible material (plastic or cloth) or a rigid pipe.

2.4.5 Species Monitoring and Shutdown

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

- Developed in coordination with the National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS) and approved by these agencies prior to initiation of in-water work, a Marine Mammal Monitoring Plan and Marbled Murrelet Monitoring Plan would be finalized. Implementation of these plans would prevent exposure to potentially injurious noise levels.
- 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 15 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.

2.4.6 Soft Start

The Navy would utilize a "soft-start" procedure to provide a warning and/or give animals in close proximity to pile driving a chance 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 at the beginning of each day's in-water impact pile driving or any time impact pile driving has ceased for more than 30 minutes.

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

- The contractor would provide an initial set of strikes from the impact hammer at reduced energy, followed by a 30-second waiting period, then two subsequent sets. (The reduced energy of an individual hammer cannot be quantified because they vary by individual drivers. Also, 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").

For vibratory pile driving, the following soft-start procedures would be conducted: [2]

- If a variable moment driver can be used, the contractor will initiate noise from vibratory drivers for 15 seconds at reduced energy followed by a 30-second waiting period. The procedure shall be repeated two additional times. If unsafe working conditions during soft starts are reported by the contractor and verified by an independent safety inspection, the Navy may elect to discontinue vibratory driver soft starts. The Navy will inform NFMS HQ if the soft start procedure is discontinued.
- If use of a variable moment driver is infeasible and the model of vibratory driver was not specifically designed for soft start procedures then the Navy will not employ vibratory soft start procedure due to historical personnel safety concerns.

[2] In 2013, vibratory pile driving during construction of a deep wharf, the Explosives Handling Wharf 2 (EHW-2) located at NAVBASE Kitsap Bangor, resulted in discontinuation of the soft-start procedure due to crane failure from excess wear due to the soft-start procedure. The Marine Mammal Commission has stated that the soft-start is a viable, effective component of a mitigation plan designed to effect the least practicable impact on marine mammals. In response to this concern, NMFS formed a working group with the Navy in April 2014 to address the soft-start procedures. At this time the EHW-2 project is the only project where the procedure has been waived.

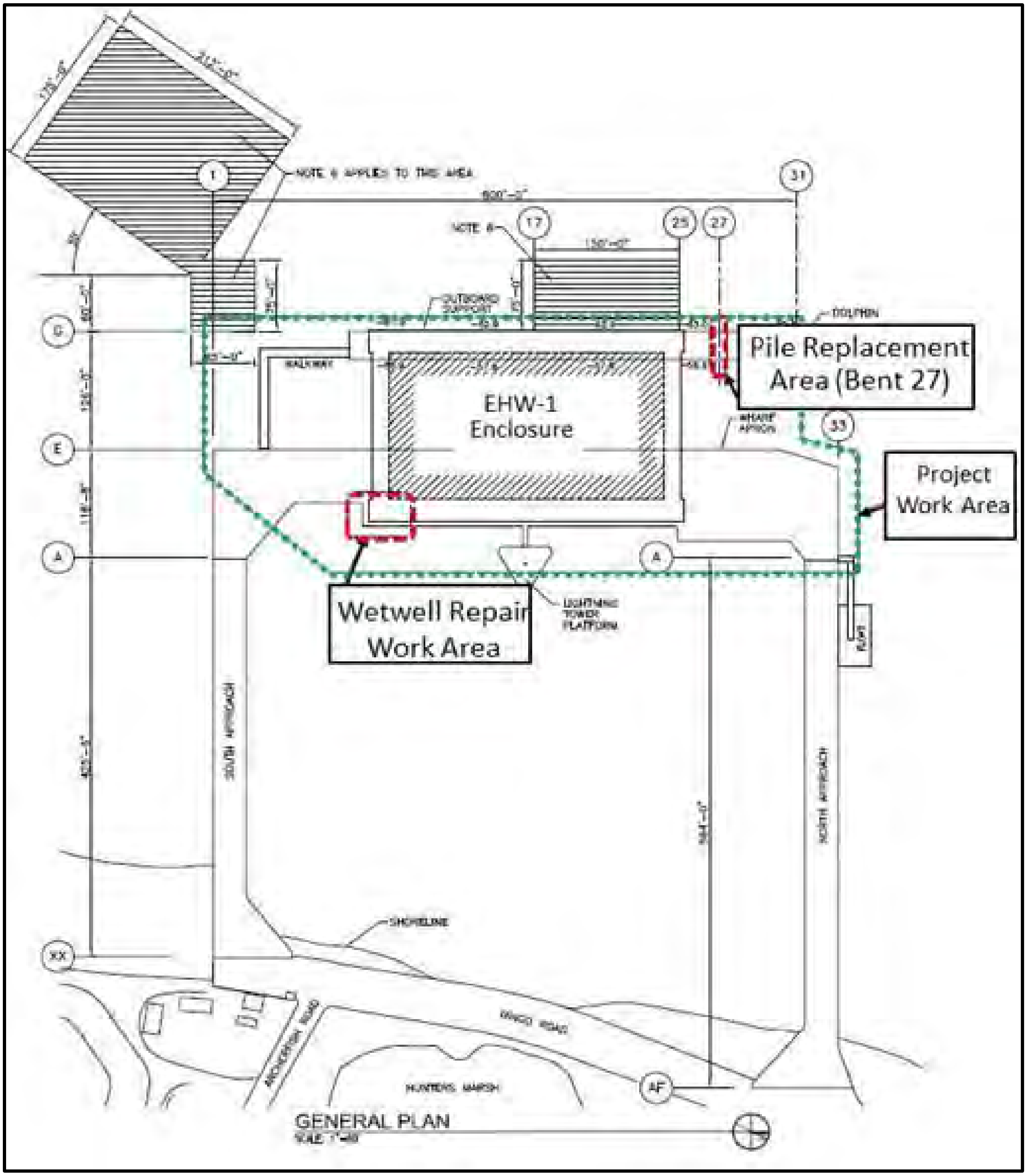

Figure 2-1. EHW-1 Project Work Area

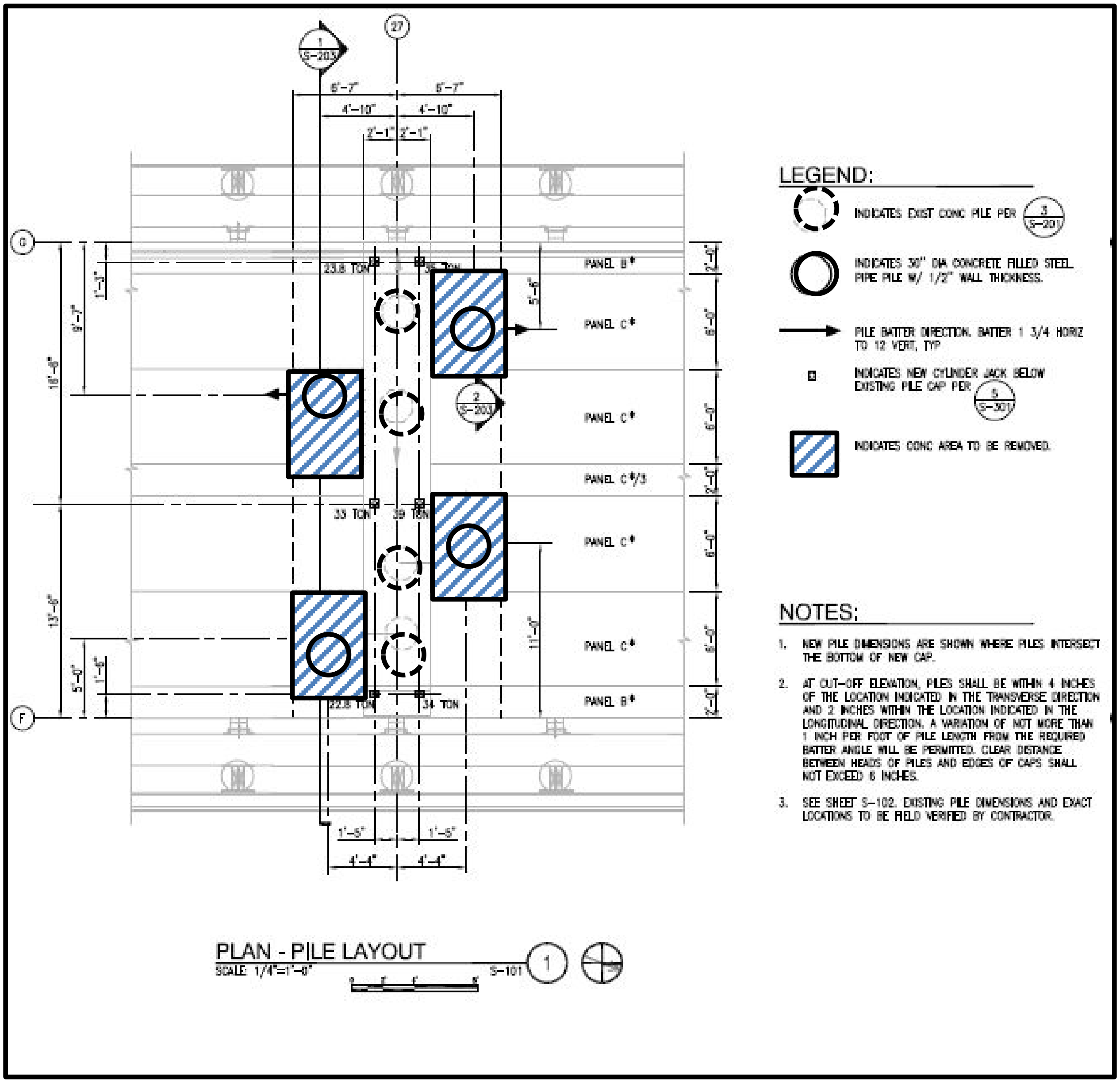

Figure 2-2. EHW-1 Pile Replacement Layout

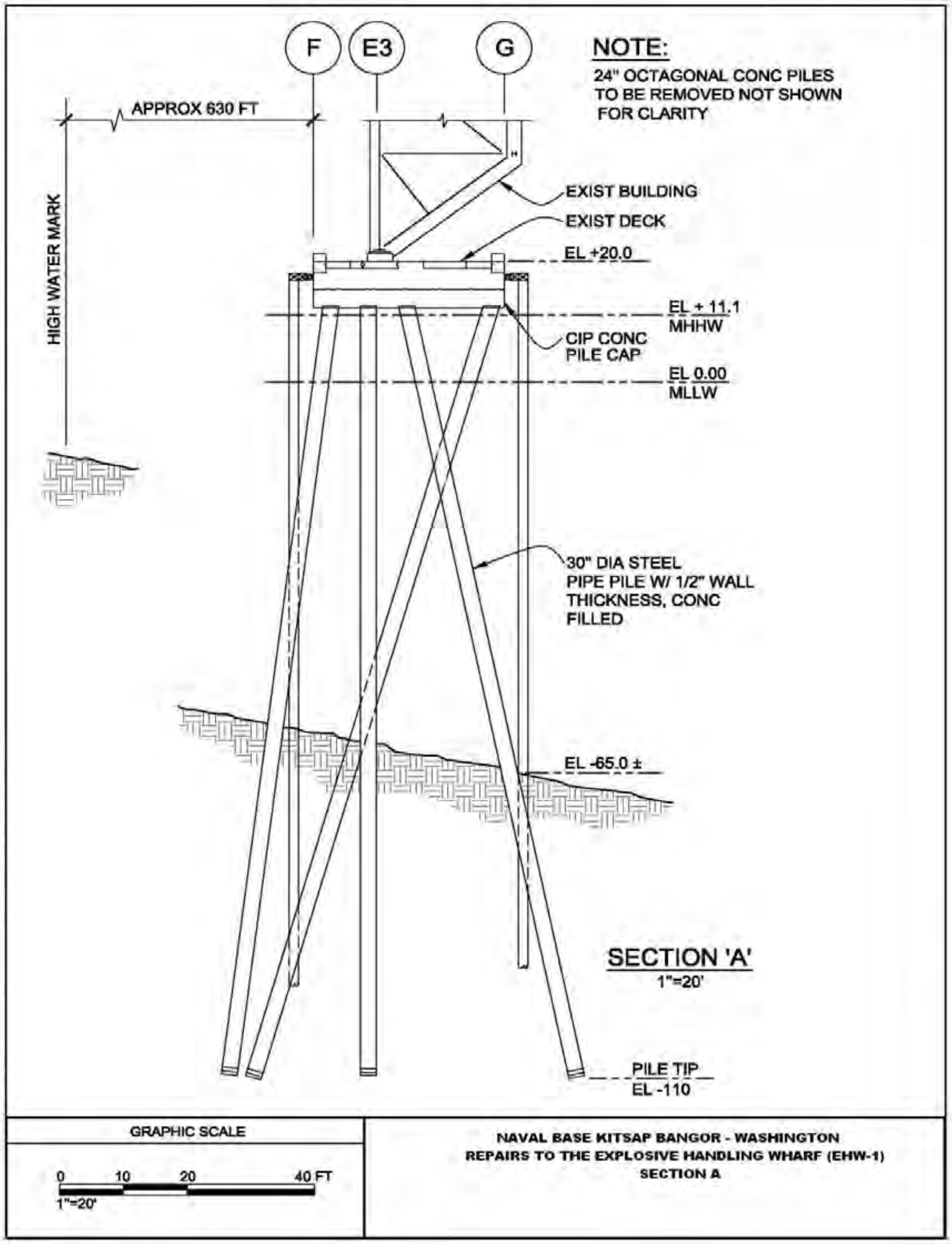

Figure 2-3. EHW-1 Pile Replacement Configuration

3 AFFECTED ENVIRONMENT & ENVIRONMENTAL CONSEQUENCES

This chapter presents baseline data for the affected environment and an assessment of the potential impacts, or environmental consequences that could result from implementation of the Proposed Action. The following resources are evaluated in this chapter: sediments, water quality, airborne noise, biological resources, cultural resources, and American Indian traditional resources.

3.1 SEDIMENTS

3.1.1 Regulatory Overview

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.

3.1.2 Affected Environment

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 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 and Hafner, 2009). The presence of glacial till approximately six feet (two meters) below mud line in the intertidal zone, increasing to over 10 feet (3 m) in the subtidal zone was found in subsurface coring studies performed in 1994 (URS, 1994). The composition of sediment samples from the EHW-1 project site ranged from 65 to 100 percent for sand, less than 1 to 7 percent for gravel, two to 32 percent silt, and 2 to 11 percent clay.

The Navy conducted sediment quality testing at the EHW-1 site in 2009. Testing included an analysis of Total Organic Carbon (TOC), metals and organic compounds. Analyses of samples collected determined that concentrations of contaminants were comparable to background levels for Puget Sound and below all applicable SQS and CSL values (Hammermeister and Hafner, 2009).

3.1.3 Environmental Consequences

The evaluation of impacts to marine sediments considers whether project-related activities would create conditions, such as sediment contamination or physical changes that violate state standards. Impacts would be considered significant if they violated state standards (Sediment Quality Standards, WAC 172-204-320).

3.1.3.1 Proposed Action

Under the Proposed Action, sediment would be disturbed and re-suspended in the water column during pile removal and pile driving activities. Such suspension would be localized to the immediate area of the pile being driven. Concrete sediment (anticipated to be sand-sized) resulting from cuts made with the chipping hammer is inert and would settle within hours onto the canal floor. These inert and dense particles would be incorporated into the sediments in the immediate area. The use of the vibratory hammer and impact hammer for pile driving would 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 are expected to settle within hours to the bottom of the project area. The underlying glacial materials, although a coarse and cohesion-less granular material, would tend to collapse in on itself when drilled and removed (Hart Crowser, 2010). This action would have no effect on the subsurface slope stability within the project area. Setting spuds and anchors for the barges used for pile removal and installation could also cause disturbance of bottom sediments, but would not differ from day-to-day activities occurring in this waterfront area.

Construction activities would not result in the discharge of wastes containing metals or otherwise alter the concentrations of trace metals in bottom sediments. Nor would construction activities result in the discharge of contaminants or otherwise alter the concentrations of organic contaminants in bottom sediments. However, because the magnitude of metal and organic compound concentrations in sediment can vary as a function of grain size (higher concentrations typically are associated with fine-grained sediments due to higher interior surface areas), small changes to grain size associated with construction-related disturbances to bottom sediments could result in minor changes in metal and organic compound concentrations. This would mainly occur in the removal of the piles. These changes are expected to be minimal and not cause chemical constituents to violate SQS due to the limited extent of pile removal (4 piles) and general lack of sediment contaminants in the project area.

Implementation of the Proposed Action would result in minor and localized impacts from resuspension of sediments but would not result in violation of Washington Sediment Quality Standards (WAC 172-204-320). Therefore, no significant impacts to sediments would occur with implementation of the Proposed Action.

3.1.3.2 No-Action Alternative

Under the No-Action Alternative, the proposed pile replacement and maintenance activities at EHW-1 would not occur and there would be no change to baseline sediment conditions due to the Proposed Action. Therefore, no significant impacts due to sediments would occur with implementation of the No-Action Alternative.

3.2 WATER QUALITY

3.2.1 Regulatory Overview

Water quality describes the chemical and physical composition of water as affected by natural conditions and human activities. 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 Clean Water Act (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.

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 two 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.

Waters whose beneficial uses –such as for drinking, recreation, aquatic habitat, and industrial use – that are impaired by pollutants are placed in the "polluted water" category (Category 5) on the 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 two 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.

The CWA contains the requirements to set water quality standards for all contaminants in surface waters. The U.S. Environmental Protection Agency (USEPA) is the designated regulatory authority to implement pollution control programs and other requirements of the CWA. However, USEPA has delegated regulatory authority for the CWA to WDOE for the implementation of pollution control programs, as well as other CWA requirements.

3.2.2 Affected Environment

NAVBASE Kitsap Bangor is located within an area of Hood Canal. Water quality classifications and applicable water quality criteria for the Hood Canal are listed in Table 3-1 (WAC 173-201A). Water quality in Hood Canal offshore of NAVBASE Kitsap Bangor is good and generally meets applicable water quality standards (Hafner and Dolan, 2009). However, dissolved oxygen (DO) levels within the Hood Canal are known to reach very low levels in the summer months and early fall months (a.k.a. hypoxia). This is especially true in the southern Hood Canal where natural and man-made environments combine to create conditions that can be potentially lethal to some underwater species. Water segments located south of the Service Pier, adjacent to Marginal Wharf, and just north of NAVBASE Kitsap Bangor are designated Category 5 water, impaired waters, for exceedances of dissolved oxygen (WDOE, 2014). 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.

Table 3-1. Hood Canal Water Quality Classification and Criteria

Water Quality Classification	***Water Quality Criteria***			
Aquatic Life	*Temperature*[1]	*Dissolved Oxygen*[2]	*Turbidity*[3]	*pH*[4]
Extraordinary Quality	13°C (55°F)	7.0 mg/L	+5 NTU or +10%	7.0 – 8.5
	Fecal Coliform			
Shellfish Harvesting	Geometric mean not to exceed 14 MPN/100 mL fecal coliforms[5]			
Recreation: Primary Contact	Geometric mean not to exceed 14 MPN/100 mL fecal coliforms[5]			

Notes:

°C - degrees Celsius, °F - degrees Fahrenheit, mg/L - milligrams per liter, mL – milliliters, NTU - nephelometric turbidity units

1. 1-day maximum (°C). 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. 1-day minimum (mg/L). When dissolved oxygen (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 exceedances. NTU over background when the background is 50 NTU or less; or 10% increase in turbidity when background turbidity is more than 50 NTU.
4. Human-caused variations within range must be less than 0.2 units.
5. No more than 10% of all samples used to calculate geometric mean may exceed 43 most probable number (MPN)/100 milliliters (mL); when averaging data, it is preferable to average by season and include five or more data collection events per period.

Source: WAC 173-201A as amended in November 2006.

The Navy has sampled the waters surrounding EHW-1 numerous times for water quality parameters (temperature, salinity, dissolved oxygen [DO], and turbidity) (Phillips et al., 2009 and Hafner and Dolan, 2009). This sampling has shown that the waters in the immediate vicinity of EHW-1 are consistently within the Washington State standards for extraordinary water quality for each of these parameters (Phillips et al., 2009 and Hafner and Dolan, 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 the project site and further offshore showed similar results with the exception of DO, which typically ranged from excellent to extraordinary.

3.2.3 Environmental Consequences

Construction-related impacts to water quality with implementation of the Proposed Action would be short-term, temporary, and localized changes associated with re-suspension of bottom sediments from pile installation and tug operations, such as anchoring. These changes would be spatially limited to the construction area, including areas potentially impacted by anchor drag and areas immediately adjacent to the Wharf. Accidental losses or spills of construction materials or fuel into Hood Canal are not anticipated.

During the vibratory and impact pile driving activities, BMPs (See Section 2.4) would be used to avoid and minimize deleterious materials from entering the water. Accidental spills or discharges of deleterious materials would not be expected to significantly impact marine water.

Minor and localized sediment disturbance would occur and subsequently result in suspended sediments in the water column. The use of a vibratory hammer and impact hammer could cause the very fine, soft, sandy silt layers located above the hard glacial deposits to be susceptible to disturbance and suspension. The cutting of the existing piles at the mud line with pneumatic hammer would generate only limited localized sedimentation and turbidity. Overall, the sediments generated from removing four 24-inch concrete piles and installing four 30-inch steel piles would be minimal and localized in the area of pile driving. Resuspended sediments would be expected settle back quickly to the bottom of the project area or be carried out with low-energy tidal flow and currents following conclusion of pile driving operations.

The Proposed Action would not discharge any waste containing materials with an oxygen demand into Hood Canal. Coatings applied to fender piles and mooring fittings would be inorganic, non-toxic, free of volatile organic compounds, and would not affect water quality. Pile installation would re-suspend bottom sediments, 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). The impacts of sediment re-suspension from pile installation and removal on DO concentrations would be minimal and temporary.

Construction-related impacts would not increase pollution levels or violate applicable state or federal water quality standards, nor would they reduce the ability of Hood Canal to support its designated uses. BMPs would be implemented to prevent accidental losses or spills of construction debris and to minimize the impact of suspended sediments. Therefore, no significant impacts to water quality would occur with implementation of the Proposed Action.

3.2.3.1 No-Action Alternative

Under the No-Action Alternative, the proposed pile replacement and maintenance activities at EHW-1 would not occur and there would be no change to baseline water quality due to the Proposed Action. Therefore, no significant impacts to water quality would occur with implementation of the No-Action Alternative.

3.3 AIRBORNE NOISE

Noise is defined as unwanted sound, or more specifically, as any sound that: 1) is undesirable because it interferes with communication; 2) is intense enough to damage hearing; or 3) is otherwise annoying. Human response to sound varies according to the type and characteristics of the noise source, distance between the noise source and the person, sensitivity of the person, and time of day.

A sensitive noise receptor is defined as a location or facility where people involved in indoor or outdoor activities may be subject to stress or considerable interference from noise. Such locations or facilities often include residential dwellings, hospitals, nursing homes, educational facilities, and libraries.

Generally, noise is measured in units called decibels (dB); however, a number of factors affect how the human ear perceives sound: the actual level of noise, frequency, period of exposure, and fluctuations in noise levels during exposure. The dB system of measuring sound provides a simplified relationship between the physical intensity of sound and its perceived loudness to the human ear. The dB scale is logarithmic; therefore, sound intensity increases or decreases exponentially with each dB of change. For example, 10 dB yields a sound level 10 times more intense than 1 dB, while 20 dB is 100 times more intense, and 30 dB is 1,000 times more intense. Human speech is normally around the 60 dB level. Sound levels are typically used to assess impacts to humans and thus are weighted (A-weighting) and expressed as dBA to correspond to the same frequency range that humans hear (approximately 20 hertz (Hz) to 20 kilohertz (kHz). A-weighting is typically applied to measuring noise for activities such as construction engine equipment and industrial ship yard activities. The perceived sound level changes as the subject's distance from the source increases. Therefore, the metrics are given in varying sound levels based on distance. Airborne noise levels are expressed in decibels relative to 20 micropascals and the units are listed as: (dB re 20 μPa).

3.3.1 Regulatory Overview

Section 4(b) of the Noise Control Act of 1972 (42 USC 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 the requirements for Maximum Environmental Noise Levels. WAC 173-60 sets maximum permissible noise levels based on the type environmental 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 3-2. 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.

Kitsap County also has codes related to noise. Kitsap County Code Chapter 10.28, Noise, includes the codes related to noise control. Kitsap County follows a designation of EDNAs very similar to WAC 173-60 and has identical Maximum Permissible Environmental Noise Levels (see Table 3-2). Kitsap County Code also exempts sounds originating from temporary construction sites as a result of construction activity from complying with the Maximum Permissible Environmental Noise Levels between the hours of 7:00 a.m. and 10:00 p.m.

Table 3-2. WAC 173-60 Maximum Permissible Daytime[1] Environmental Noise Levels

EDNA of Noise Source	*EDNA of Receiving Property*		
	Class A	**Class B**	**Class C**
Class A	55 dBA	57 dBA	60 dBA
Class B	57 dBA	60 dBA	65 dBA
Class C	60 dBA	65 dBA	70 dBA

1. WAC 173-60-040 defines daytime as the hours between 7:00 a.m. and 10:00 p.m.

Sound Environment

Ambient noise levels are made up of natural and man-made sounds. Natural sound sources include the wind, rain, thunder, water movement such as surf, and wildlife. The sound levels from these sources are typically low but can be pronounced during violent weather events. Ambient background noise in urbanized areas typically varies from 60 to 70 dBA. Cavanaugh and Tocci (1998) measured typical residential noise at 65 dBA. Depending on average daily traffic levels, traffic on roads could be expected to produce levels between 60 and 80 dBA during daytime hours.

Waterfront construction activities generate noise, with the greatest levels produced during pile driving operations. Airborne noise levels from impact pile driving are estimated at 110 dBA re 20 µPa at a distance of 50 feet (ft) from the pile, and 95 dBA re 20 µPa at 50 ft when using a vibratory driver (WSDOT, 2014, Illingworth and Rodkin, 2012). Table 3-3 outlines typical noise profiles of common construction equipment. Maximum noise levels produced by common construction equipment, including trucks, cranes, generators, pumps, and other equipment that might typically be employed are 90 dBA (WSDOT, 2014). 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 (WSDOT, 2014). These maximum noise levels are intermittent in nature, and not present at all times.

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

Equipment Type	Maximum Noise Level
Impact Pile Driver	110
Vibratory Pile Driver	95
Scraper	90
Backhoe	90
Crane	81
Pumps	81
Generator	81
Front Loader	79
Air Compressor	78

Sources: WSDOT, 2014, Illingworth and Rodkin, 2012
Maximum Sound Pressure Levels in dBA re 20µPa (A-weighted)

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) (WSDOT, 2014). Two additional factors from natural conditions can further contribute to noise reduction between the source and the receptor. The first factor is a 1.5 dB reduction per doubling of distance in "soft-site" conditions, wherein normal, unpacked earth is the predominant soil condition. The second factor is a reduction of 10 dB for interposing dense vegetation (e.g., trees and brush) between the noise source and potential receptors (WSDOT, 2014).

3.3.2 Affected Environment

NAVBASE Kitsap Bangor is an active military base located adjacent to Hood Canal. The sound environment is influenced by the natural environment such as wind, surf, and marine traffic.

However, the primary source of sound in the environment is military activities such as waterfront operations, movement of people and military vehicles at the base, and the various industrial activities that occur at the shoreline facilities. The baseline airborne noise levels that occur at NAVBASE Kitsap Bangor on the waterfront range from 60 to 104 dBA, with an average of approximately 64 dBA (Navy, 2010). The majority of the daily ambient sound at the base that is considered noise is generated by human activities and is typical of an industrial area. The industrial area, including EHW-1, is considered an EDNA Class C. Activities include movement of marine vessels and heavy trucks, operation of equipment (such as cranes, forklifts, and other mechanized equipment), various industrial activities occurring at the shoreline and upland facilities, and general traffic. Evening and nighttime levels ranged from 64 to 96 dBA, with an average level of approximately 64 dBA (Navy, 2010). Measured levels were comparable to estimated noise levels from literature. Per published literature, presuming multiple sources of noise may be present at one time; maximum combined levels may be as high as 99 dBA. These maximum noise levels are intermittent in nature and not present at all times. Existing maximum baseline noise conditions at the waterfront during a typical work week are expected to be approximately 99 dBA due to typical truck, forklift, crane, and other industrial activities. Average baseline noise levels are expected to be in the 70-90 dBA range, consistent with urbanized or industrial environments where equipment is operating.

The closest EDNA Class A receptors (residences) are located just north of the northern property boundary, approximately 1.5 miles northeast of the project area. This residential area is buffered by dense vegetation, which extends from the residences to the shoreline adjacent to EHW-1. The project area is about 2.5 miles southwest of the nearest school and 13 miles north of the nearest hospital. Tribal shellfish harvesting is permitted approximately one mile south of the project area. The closest community west of the base (across Hood Canal) is approximately 4 miles away, and the closest on-base residence is 3.75 miles away. The portion of Hood Canal adjacent to the project area averages 1.5 miles in width and is bordered on the west by a 768-acre Navy-owned buffer strip on the Toandos Peninsula. This military buffer zone is restricted to the public and there is no recreational access. Areas surrounding the buffer area have rural and commercial forest land use designations by Jefferson County.

3.3.3 Environmental Consequences

The threshold of significance for noise impacts would be exceedances of an applicable noise threshold at a sensitive receptor (e.g., residential land uses, nursing homes, hospitals, etc.). Noise impacts to ESA-listed species, EFH, and marine mammals are discussed in Section 3.4.

3.3.3.1 Proposed Action

Noise generated from construction activities associated with the Proposed Action would include impact pile driving, vibratory pile driving, and a pneumatic chipping hammer to remove piles. Noise generated from impact pile driving would be expected to reach peaks of 110 dBA re 20µPa at a distance of 50 ft, while vibratory pile driving of piles would be expected to reach peaks of 95 dBA re 20µPa at a distance of 50 ft. A pneumatic chipping hammer utilized to remove 24 inch concrete piles would be estimated to produce peak noise levels of 90 dBA re 20µPa at 50 ft (WSDOT, 2014). Driving and extraction devices would not be used concurrently; rather, new steel piles would be installed one at a time, primarily by vibratory pile driving, followed by impact driving of the pile if required. Only after the four new piles have been installed would the pneumatic chipping hammer be used to cut the existing concrete piles for removal. Other construction activities or equipment such as cranes, generators, and any other necessary equipment would also generate noise; however, this noise would be much lower in level compared to noise produced by the impact hammer (Table 3-3). In the absence of pile driving noise, the maximum construction noise from barges, tugboats, and equipment involved in deck and pile cap replacement, cathodic protection systems installation, and other maintenance work would be less than that of the vibratory hammer (WSDOT, 2014). All noise generating activities would be limited to the time between 7:00 a.m. and 10:00 p.m.

Sensitive receptors in residences located along the northern border of the Base would be expected to receive peak noise levels below 60 dBA during impact pile driving, which is within the regulatory limits for EDNA Class A receptors and below typical residential noise levels of 65 dBA as measured by Cavanaugh and Tocci (1998). This estimate is based on typical noise attenuation by distance (6 dBA for every doubling of distance over a distance of 1.5 miles) and 10dBA reduction attributed to the dense vegetation between the residential area and the location of the Proposed Action. Noise generated from vibratory pile driving and the pneumatic chipping hammer would also be below 60 dBA at these residences.

Sensitive receptors in the school located 2.5 miles northeast of the project site would be expected to receive to receive peak noise levels below 52 dBA. This estimate is based on typical noise attenuation of 6 dBA for every doubling of distance and a 10dBA reduction attributed to the dense vegetation between the school and the location of the Proposed Action.

Scuba divers diving in Hood Canal could experience underwater noise levels that could cause a behavioral response including increased breathing and elevated heart rate (154 dB re 1μPa) (Naval Submarine Medical Research Laboratory, 2002) within 40,000 feet of the construction site during pile driving activity but would not receive levels sufficient to cause injury (SPL of 200 dB re 1μPa). Other recreational users (i.e., boating, kayaking, fishing, etc.) in the vicinity could be exposed to noise levels. The sound levels would not be injurious but could result in a behavioral response such as avoiding the area around the installation. However, the waters adjacent to the Proposed Action are restricted for public access and the floating security barrier would prevent recreational users from getting close enough to the pile driver to receive injurious noise levels.

All noise resulting from the Proposed Action would be temporary construction-related noise occurring between the hours of 7:00 a.m. and 10:00 p.m. and therefore exempt from Washington State and Kitsap County noise codes. Based on the distance of the Proposed Action to sensitive receptors, and the vegetation and structures between the noise source and the receptors, noise generated during pile driving would attenuate to levels typically experienced in residential neighborhoods. Therefore, no significant impacts to the existing sound environment would result from implementation of the Proposed Action at NAVBASE Kitsap Bangor.

3.3.3.2 No-Action Alternative

Under the No-Action Alternative, the proposed pile replacement and maintenance activities would not occur and there would be no change to baseline noise levels due to the Proposed Action. Therefore, no significant impacts due to noise would occur with implementation of the No-Action Alternative.

3.4 Biological Resources

The study area for biological resources is specific to the nearshore marine environment of Hood Canal along NAVBASE Kitsap Bangor's waterfront. For aquatic mobile species, the study area extends further based on the extent of underwater noise generated under the Proposed Action. In this case, the area extends to Toandos Peninsula, encompassing approximately 32.4 square kilometers (km^2) of Hood Canal.

3.4.1 Regulatory Overview

The analysis of biological resources focuses on the potential impacts to fish and wildlife under the following regulatory laws:

- Migratory Bird Treaty Act (MBTA) (16 USC 703-712);
- Bald and Golden Eagle Protection Act (16 USC 668-668d)
- Endangered Species Act (ESA) (16 USC 1531 et seq.);
- Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 USC 1801-1882); and
- Marine Mammal Protection Act (MMPA) (16 USC 668-668c).

3.4.1.1 Migratory Bird Treaty Act

Migratory birds are any species or family of birds that live, reproduce or migrate within or across international borders at some point during their annual lifecycle. The MBTA was enacted in the United States in 1918 in order to establish federal protection for migratory birds. The MBTA prohibits the taking, killing, or possessing of migratory birds unless permitted. The list of bird species protected by the MBTA appears in 50 CFR 10.13. NAVBASE Kitsap Bangor is located in western Washington State which generally falls within the potential pathway of the Pacific Migratory flyway. Birds use this flyway primarily in fall and spring during their southward and northward migrations, respectively.

3.4.1.2 Bald and Golden Eagle Protection Act

The bald eagle is afforded continued federal protection by the Bald and Golden Eagle Protection Act even though it has been delisted from the ESA. This law prohibits anyone from taking, possessing, or transporting a bald eagle or golden eagle, or the parts, nests, or eggs of such birds without prior authorization. This includes inactive nests as well as active nests. "Take" means to pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, destroy, or disturb. "Disturb" is further defined as to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, (1) injury to an eagle, (2) a decrease in its productivity, by substantially interfering with the normal breeding, feeding, or sheltering behavior, or (3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior. Bald eagles regularly occur in Hood Canal.

3.4.1.3 Endangered Species Act

Federally threatened and endangered species are those listed for protection under the federal ESA. The U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) jointly administer the ESA and are also responsible for the listing of species (i.e., the listing of a species as either threatened or endangered). The USFWS has the primary management responsibility for management of terrestrial and freshwater species, while NMFS has primary responsibility for marine species and anadromous fish species.

The ESA also allows the designation of geographic areas as critical habitat for threatened and endangered species. The final rule designating critical habitat for 12 evolutionarily significant units (ESUs)/distinct populations segments (DPS) of salmonids in Washington, Oregon, and Idaho was published on September 2, 2005 (70 Federal Register [FR] 52630). Under this rule, NMFS identified six primary constituent elements (PCEs) to be essential for the conservation of these listed salmonids (including Puget Sound Chinook and Hood Canal summer-run chum). All lands identified as essential and designated as critical habitat contain one or more of the PCEs (see Appendix B, Section 7.4 for complete list). Critical habitat was designated for ESA-listed rockfish in November 2014 (79 FR 68042). Although critical habitat occurs in Hood Canal waters adjacent to the base, NAVBASE Kitsap Bangor is excluded from critical habitat designation for these species by federal law (70 FR 52630, 79 FR 68042). However, if federal activities could potentially affect ESA-listed species and/or their designated critical habitat, agencies are required to consult with USFWS and/or NMFS.

3.4.1.4 Magnuson-Stevens Fishery Conservation and Management Act

The MSA, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), requires that the regional Fishery Management Councils (FMCs), through federal fishery management plans (FMPs), describe and identify Essential Fish Habitat (EFH) for each federally managed species; minimize, to the extent practicable, adverse effects on such habitat caused by fishing; and identify other actions to encourage the conservation and enhancement of such habitats. Congress defines EFH as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity” (16 USC 1802[10]). The term “fish” is defined in the MSA as “finfish, mollusks, crustaceans, and all other forms of marine animals and plant life other than marine mammals and birds.” The regulations for implementing EFH clarify that “waters” include all aquatic areas and their biological, chemical, and physical properties, while “substrate” includes the associated biological communities that make these areas suitable fish habitats (50 CFR 600.10).

Authority to implement the MSA is given to the Secretary of Commerce through the NMFS. The MSA requires that EFH be identified and described for each federally managed species. The MSA also requires federal agencies to consult with the NMFS on activities that may adversely affect EFH or when the NMFS independently learns of a federal activity that may adversely affect EFH. The MSA defines an adverse effect as “any impact that reduces quality and/or quantity of EFH. Adverse effects may include direct or indirect physical, chemical, or biological alterations 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 and/or quantity of EFH. Adverse effects to EFH may result from actions occurring within EFH or outside of EFH and may include site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions” (50 CFR 600.810).

Pursuant to the MSA, the Pacific Fishery Management Council (PFMC) has designated EFH for federally managed species within the waters of Washington, Oregon, and California. The waters of the greater Puget Sound are designated EFH for coastal pelagic, Pacific salmon, and groundfish species (PFMC, 2011a, 2012, 2014).

3.4.1.5 Marine Mammal Protection Act

The MMPA of 1972 established, with limited exceptions, a moratorium on the "taking" of marine mammals in waters or on lands under United States jurisdiction. The term "take", as defined in Section 3 (16 USC 1362) of the MMPA, means "to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal. "Harassment" was further defined in the 1994 amendments to the MMPA, which provided two levels of "harassment," Level A (potential injury) and Level B (potential disturbance).

Section 101(a) (5) of the MMPA directs the Secretary of the Department of Commerce (the Secretary) to allow, upon request, the incidental (but not intentional) taking of marine mammals by United States citizens who engage in a specified activity (exclusive of commercial fishing), if certain findings are made and regulations are issued. Permission will be granted by the Secretary for the incidental take of marine mammals if the taking will have a negligible impact on the species stock and will not have an immitigable adverse impact on the availability of such species or stock for taking for substance uses.

The Navy is applying for an incidental harassment authorization for potential behavioral harassment of marine mammals that could be exposed to project noise with the potential to result in Level B disturbance. Table 3-4 lists the species and stocks potentially present within Hood Canal during project construction.

Table 3-4. Marine Mammals Potentially Present within Hood Canal

Species and Stock	Endangered Species Act Status
Killer Whale (*Orcinus orca*) West Coast Transient	None
Harbor Porpoise *(Phocoena phocoena)* Washington Inland Waters	None
Steller Sea Lion (*Eumetopias jubatus*) Eastern United States/DPS	None
California Sea Lion (*Zalophus californianus*) United States	None
Harbor Seal (*Phoca vitulina*) Washington Inland Waters	None

3.4.2 Affected Environment

This section describes the terrestrial and aquatic species that occur within the location of the Proposed Action and in the study area where potential direct or indirect impacts to biological resources may occur. For the purposes of this EA, biological resources are divided into four major categories: terrestrial wildlife, aquatic species, special-status species, and EFH. Because the Proposed Action occurs in water, the discussion of terrestrial wildlife species is restricted to birds (shorebirds, seabirds, and raptors). Aquatic species discussed include marine vegetation, benthic invertebrates, and marine fish. Special-status species include species listed as threatened or endangered by USFWS or NMFS under the ESA as well as species not listed but afforded federal protection under the MBTA, Bald and Golden Eagle Protection Act, or the MMPA. Lastly, EFH is summarized and analyzed as required under NEPA; however, a more detailed analysis, as required under the MSA, is included in Appendix B, *Biological Assessment and Essential Fish Habitat Assessment.*

3.4.2.1 Terrestrial Wildlife

A diverse population of birds composed of approximately 100 different species occurs at NAVBASE Kitsap Bangor. Resident and migratory birds are common within the EHW-1 waterfront and the adjacent upland forested areas (Navy, 2001). There are approximately 16 bird species comprising shorebirds, wading birds, waterfowl, seabirds/marine birds and raptors that were observed within or adjacent to the project area (Table 3-5). These are all protected under the MBTA. The bald eagle is afforded federal protection under the MBTA and Bald and Golden Eagle Protection Act and marbled murrelet is listed under the ESA. A more detailed discussion for these two species can be found in *Section 3.4.2.3, Special-Status Species*.

Surveys were conducted between March and September at NAVBASE Kitsap Bangor and therefore outside the wintering period of late fall and winter when species abundance is expected to be higher (Agnes and Tannenbaum, 2009a). The closest documented nests to the project area were three great blue heron nests, which were observed on a lighting tower at EHW-1 in 2008. At least two of these nests had chicks observed during summer 2008 marine wildlife surveys (Tannenbaum et al., 2009b). Subsequent surveys in the winter of 2009/2010 (non-nesting season) did not show the presence of any nesting materials at the tower, though these surveys occurred outside of the nesting season (Tannenbaum et al., 2011). It is expected, however, that future nesting in this location is unlikely since EHW-1 is a poor quality nesting location. While osprey have been observed flying, perching, and foraging at NAVBASE Kitsap Bangor (Agness and Tannenbaum, 2009b; Tannenbaum et al., 2009b), the nearest nest to the Proposed Action is located south of Cattail Lake (> 1 mile from EHW-1).

Table 3-5. Marine Birds within Vicinity of Project Area (Mar-Sept)

Species	*Months Sighted*
Great Blue Heron	April, May
Surf scoter	March, April
Common merganser	March, April
Common goldeneye	March, June
Barrow's goldeneye	March, April
Eared grebe	March, April, May
Canada goose	June
Common loon	March
Pelagic cormorant	March
Glaucous-winged gull	March, April, May, August
Caspian tern	August
Pigeon guillemot	March, April, May, August
Marbled murrelet	April, May

Species	***Months Sighted***
Bald eagle	June, August
Belted kingfisher	August
Killdeer	March, April

Source: Agnes and Tannenbaum, 2009a.

3.4.2.2 Aquatic Species

Marine Vegetation

The primary marine vegetation that occurs along the approximate 4.5 to 5 miles of NAVBASE Kitsap Bangor nearshore habitat includes eelgrass and macroalgae.

Eelgrass

Eelgrass (*Zostera marina*) is prevalent in low-energy areas, occurring in lower intertidal and nearshore marine subtidal zones that are abundant in organic matter and nutrients (Johnson and O'Neil, 2001). Eelgrass beds are habitat for fish and shellfish species by providing vital three-dimensional protective structures (Nightingale and Simenstad, 2001a). They are important in maintaining migratory corridors, and are used as foraging areas by juvenile salmonids, as well as other fish and invertebrates (Simenstad and Cordell, 2000). 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 (0.6 m) below to 20 ft (6 m) below MLLW (Garono and Robinson, 2002; SAIC, 2009). A non-native eelgrass species, *Zostera japonica*, occurs in small patches between 2 ft (0.6m) above and below MLLW, which is also outside of the project area.

Macroalgae

Three types of macroalgae occur within the NAVBASE Kitsap Bangor nearshore marine environment. These include brown algae, red algae, and green algae with dominant growth occurring from April through August. Macroalgae provides food and shelter for many species of sea birds, fish, mollusks and crustaceans. The most dominant macroalgae species that occur within the project area include green (*Ulva*) and brown (*Laminaria* and *Gracilaria*). Dense coverage occurs within depths less than 15 ft below MLLW particularly within the vicinity of the pier structures (SAIC, 2009). These species play an important role in marine trophic systems, linking primary production to higher trophic levels (Mumford 20, 2007).

Red Algae. Red algae of the genera *Ceramium, Endocladia, Gracilaria, Mastocarpus, Mazzaella, Porphyra*, and other unidentified red algae are present along the NAVBASE Kitsap Bangor waterfront (Pentec, 2003). Red algae, particularly *Gracilaria*, are most abundant at water depths between 10 ft (3 m) and 25 ft (8 m) below MLLW. Red algae are typically found within the upper and lower intertidal zones, and are less abundant in the nearshore marine subtidal zone.

Green Algae. Among green algae, sea lettuce (*Ulva* spp.) is the predominant species along the NAVBASE Kitsap Bangor waterfront. Sea lettuce is found in sheltered or partially exposed lower-intertidal and nearshore marine subtidal zones from 2 ft (0.6 m) above MLLW to 20 ft (6 m) below MLLW (SAIC, 2009). Boulders in the nearshore zone off NAVBASE Kitsap Bangor are often encrusted with sea lettuce (Pentec, 2003). It has a high nutrient value and provides an important source of marine nitrogen after it dies and decomposes, supporting eelgrass growth (Kirby, 2001).

Brown Algae. 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 intertidal upper intertidal zone.

Several species of kelp, including flattened acid kelp (*Desmarestia ligulata*), witches hair (*D. aculeata*), and understory kelp (*Laminaria* spp.) are present near the project area. *Desmarestia* spp. are found in the nearshore marine subtidal and lower intertidal zones. Understory kelp provide a major source of decomposed nutrients to the seafloor, and are important vertical habitat for species in the subtidal zone (Mumford, 2007). A narrow band of understory kelp occurs approximately 394 ft (120 m) southeast of the project area. The band is approximately 1,600 ft (488 m) long and covers 2.3 acres (Morris et al., 2009). Canopy-forming kelp beds (e.g., bull kelp) do not occur near the project area (SAIC, 2009).

Benthic Invertebrates

Benthic invertebrates are comprised of bottom dwelling animals that live burrowing or buried in the soft sediments (infauna) and those that live attached to hard bottom substrates (epifauna). Four major groups (Phylum) are found in Hood Canal and in the project area: 1) marine worms (Annelids); 2) snails and bivalves (Molluscs); 3) crabs and other crustaceans (Arthropods); and, 4) 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 (TOC). The organic carbon content is itself strongly correlated with sediment grain size being higher in more fine-grained sediments than coarser ones.

Hood Canal has been divided into nine biotic subregions based on soft-bottom benthic community structure, dominant taxa, percent fines (i.e., the percent of silt or clay material), percent TOC, and depth (WDOE, 2007). NAVBASE Kitsap Bangor and the project area specifically, are within the north Hood Canal biotic subregion.

Sediments at the northern end of Hood Canal are primarily composed of relatively coarse sands near the entrance, on the sill, and in the shallows along the shorelines of both the main axis of the canal and the adjoining bays. Sediments south of the sill, down the central axis of the canal, at the greatest depths, and in portions of the terminal inlets are primarily finer-grained silts and clays. The composition of sediment samples from the project area ranged from 65 to 100 percent for sand, less than one to seven percent for gravel, two to 32 percent for silt, and two to 11 percent for clay (Hammermeister and Hafner, 2009).

Surveys of four different areas along the Bangor waterfront at NAVBASE Kitsap found consistently greater benthic community development in the subtidal zone compared to the intertidal zone and variable community development within and among survey areas (Weston, 2006). A mean total of two to 12 species with a mean total abundance of three to 67 individuals per square foot (0.10 m2) was observed in the intertidal zone. Subtidal values varied from a mean total of 36 to 77 species and a mean total abundance of 301 to 736 individuals per square foot (0.10 m2). Table 3-6 provides a list of some of the benthic invertebrates and shellfish occurring at NAVBASE Kitsap Bangor. The soft-bottom benthic community within the project area is dominated by marine worms, crustaceans, and molluscs across the tide zone, although in the intertidal zone other organisms also may be numerically abundant (Weston, 2006; WDOE, 2007).

<u>Molluscs</u>

Molluscs occurring within the project area include two major classes: gastropods (slugs and snails) and bivalves (having two-part shells, such as clams, oysters, and mussels). In contrast to mussels and oysters, which attach to hard substrate, clams live partially buried in the substrate and gastropods live on the substrate surface.

The gastropod snail *Alvania compacta* was a numerical dominant of shallow subtidal waters within the project area (Weston, 2006); it is commonly found in mixed sediments including fine gravels (Kozloff, 1983). Other snails are associated with eelgrass beds, and limpets occur intertidally on hard substrates such as docks, cobble, and rocks.

A variety of bivalves occur within the project area, ranging from intertidal to subtidal depths. Common intertidal species include Macoma clams, rough-sided littleneck clams, and robust mysella. The most abundant species in subtidal waters include silky axinopsid, various dwarf venus clams, fine-lined lucine, and robust mysella (Weston, 2006). Robust mysella live in semi-permanent burrows and can be an indicator of a more stable habitat (Ockelmann and Muus, 1978). Common species on hard substrates include multiple blue mussel species, jingle shell, rock scallop, Olympia oyster, and Pacific oyster (Navy, 2001; WDFW, 2007). An oyster bed is located parallel to the shore running near and under EHW-1. Bivalve siphons were detected throughout the project area during a 2007 survey in a wide range of depths. Siphon characteristics indicated these were geoducks. These organisms tended to be more concentrated in the silty sand substrate present below 25 ft (8 m) water depth.

Arthropods

Arthropods (crustaceans) are associated with all soft-bottom and hard substrate habitats and also occur in the water column. The most abundant species in the 2005 benthic sediment sampling along the Bangor waterfront at NAVBASE Kitsap was the seed-shrimp (Weston, 2006). Seed-shrimp are minute crustaceans that are protected by a bivalve-like shell and typically feed on detritus in the subtidal nearshore marine habitats. Seed-shrimp comprised almost 30 percent of the individual organisms in the sandy deltaic subtidal zones along the waterfront (Weston, 2006). Larger crabs and shrimps, which are mobile and evasive during sampling, are not well quantified near the project area. Several species have been commonly observed (Weston, 2006).

Dungeness crabs range from intertidal to subtidal depths in sandy habitats and may use eelgrass beds as nursery areas (LFR, 2004). Hermit crabs, cancer crabs, kelp crabs, and shore crabs occur in rocky and/or vegetated habitats. European green crab and helmet crab also have been reported (Navy, 2001).

Annelids

Polychaetes, a type of marine worm, 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 on manmade structures. Suspension-deposit spionids, herbivorous nereids, predatory syllids, and scale worms were found during rapid assessment of several marinas in Puget Sound (Cohen et al., 1998).

Echinoderms

Echinoderms contributed up to six percent to the abundance of benthic organisms occurring in soft-substrate benthic sediment sampling conducted in 2005 along the waterfront but only two percent, at most, to the abundance of benthic organisms within the project area (Weston, 2006). These species included brittle stars and green sea urchins (Navy, 1988; Weston, 2006). However, sea stars have also been observed at many locations along the waterfront (Navy, 1988). Purple stars are found primarily in the lower-intertidal zone on pilings where they feed on mussels. Pink sea stars are often found in subtidal eelgrass beds (Pentec, 2003).

The red sea urchin has not been documented near the project area but typically lives in rocky areas, which have not been extensively surveyed at the waterfront. Red urchin habitat ranges from protected shallow subtidal to inland marine deeper water nearshore marine habitats.

Table 3-6. Benthic Invertebrates at NAVBASE Kitsap Bangor Waterfront

PHYLUM	MAJOR TAXA OF PHYLA	GENERA OR SPECIES	TYPICAL LOCATION	COMMON NAME OR DESCRIPTION
Mollusca	***Gastropod***	*Alvania compacta*	Sand, silt, clay or mixed substrate, vegetated shallow subtidal	Snail
		Lirularia acuticostata	Mixed substrate, intertidal-subtidal	Sharp-keeled lirularia, a snail,
	Bivalves	*Macoma* sp.	Mixed substrate, intertidal-subtidal	Clam
		Nutricola spp.	Sandy subtidal	Clam
		Saxidomus giganteus	Sandy subtidal	Butter Clam
		Panopea abrupta	Sandy intertidal-subtidal	Geoduck clam
		Rochefortia tumida	Sandy intertidal-subtidal	Robust mysella
		Axinopsida serricata	Sandy or mixed substrate with organic enrichment subtidal	Silky axinopsid
		Protothaca staminea	Sandy intertidal-subtidal	Native littleneck clam
		Tellina carpenteri	Sandy or mixed sand/silt intertidal-subtidal	Clam
		Parvilucina tenuisculpta	Sandy, silty, clay or mixed substrate in shallow subtidal	Fine-lined lucine
		Protothaca staminea	Sandy intertidal-subtidal	Rough-sided littleneck clam
		Mytilus spp.	Intertidal-subtidal, hard substrates	Blue mussel
		Pododesmus macroschisma	Hard substrates	Jingle shell
		Hinnites giganteus	Rocky substrates subtidal, rarely intertidal under boulders	Giant rock scallop
		Crassostrea gigas	Rocky substrates	Pacific oyster
		Ostrea lurida	Rocky substrates	Olympia oyster
Crustaceans	***Ostracod***	*Euphilomedes carcharodonta*	All soft substrates	Seed-shrimp
	Tanaid	*Leptochelia dubia*	Mixed substrate, vegetated habitat, manmade structures	Tanaid
	Barnacles	*Balanus* sp.	Rocky, manmade structures	Barnacle
	Amphipods	*Protomedeia* sp.	All soft substrates	Gammarid
		Aoroides spp.	Detritus, sand, vegetated habitats	Corophiid

Table 3-6. Benthic Invertebrates at NAVBASE Kitsap Bangor Waterfront (Continued)

PHYLUM	MAJOR TAXA OF PHYLA	GENERA OR SPECIES	TYPICAL LOCATION	COMMON NAME OR DESCRIPTION
		Rhepoxynius boreovariatus	Sandy subtidal	Gammarid
		Corophium and *Monocorophium* spp.	Sandy subtidal, manmade structures	Corophiid
	Crabs	*Pinnixa occidentalis*	Sand/silt/clay subtidal	Pea crab
		Hemigrapsus oregonsis	Quiet water, rocky habitats, gravel	Green Shore crab
		Pagurus granosimanus	Mixed substrate, eelgrass, subtidal	Hermit crab
		Pugettia spp.	Sand/silt/clay subtidal, eelgrass	Kelp crab
		Cancer gracilis	Intertidal and subtidal, eelgrass	Graceful crab
		Cancer magister	Intertidal and subtidal, eelgrass	Dungeness crab
		Cancer oregonensis	Rocky and manmade structures, intertidal-subtidal	Oregon Cancer crab
		Cancer productus	Sandy, protected rocky areas, eelgrass, intertidal-subtidal	Red Rock crab
		Carcinus maenas	Intertidal, mixed substrates	European green crab
		Telmessus cheiragonus	Eelgrass, kelp, sargassum	Helmet crab
		Pagurus granosimanus	Mixed substrate, eelgrass, subtidal	Hermit crab
	Shrimps	*Crangon* sp.	Shallow waters, sandy substrates	True shrimps
		Pandalus sp.	Mixed sand substrate intertidal and shallow subtidal	Spot shrimp
		Neotrypaea sp.	Mixed sand substrate intertidal and shallow subtidal	Ghost shrimp
Annelida	***Polychaetes***	*Platynereis bicanaliculata*	Mixed substrates, manmade structures, eelgrass	Nereidae
		Podarkeopsis glabra	Soft substrates	Hesionidae
		Pectinaria californiensis	Sandy, low intertidal and subtidal	Cone worm
		Owenia collaris	Sandy, intertidal-subtidal	Oweniidae
		Euclymeninae	Mixed substrates, subtidal	Maldanidae
Echinoderma	***Echinoderms***	*Pisaster brevispinus*	Subtidal eelgrass	Pink sea star
		Pisaster ochraceus	Lower intertidal, hard structures	Purple star

Table 3-6. Benthic Invertebrates at NAVBASE Kitsap Bangor Waterfront (Continued)

PHYLUM	MAJOR TAXA OF PHYLA	GENERA OR SPECIES	TYPICAL LOCATION	COMMON NAME OR DESCRIPTION
		Amphiodia urtica/periercta	Subtidal silty mud	Burrowing brittle star
		Pycnopedia helianthoides	Lower intertidal to subtidal soft substrates	Sunflower star
		Dendraster excentricus	Flat, sandy subtidal	Sand dollar
		Strongylocentrotus droebachiensis	Intertidal to subtidal soft substrates	Green sea urchin
Chordata	***Tunicates***	*Corella willmeriana*	Subtidal to deepwater	Transparent tunicate
		Distaplia occidentalis	Intertidal to subtidal	Mushroom compound tunicate

Sources: Abbott and Reish, 1980; Barnard et al., 1980; Lee and Miller, 1980; Kozloff, 1983; URS, 1994; WDOE, 1998; Pentec, 2003; Weston, 2006.

Non-ESA Listed Marine Fish

Pacific Herring, Surf Smelt, and Pacific Sand Lance

Pacific herring (*Clupea pallasii*), surf smelt (*Hypomesus pretiosus*), and Pacific sand lance (*Ammodytes hexapterus*) are small schooling fish that are an important food resource for other species in Puget Sound waters. Herring deposit their transparent eggs on intertidal and shallow subtidal eelgrass and marine algae. Although large spawning areas are found elsewhere in Hood Canal (Stick and Lindquist, 2009), there are no documented herring spawning grounds at NAVBASE Kitsap Bangor. At NAVBASE Kitsap Bangor, surveys have detected Pacific herring in small numbers during late winter months and larger numbers in early summer months (SAIC, 2006; Bhuthimethee et al., 2009a).

Surf smelt were also detected in NAVBASE Kitsap Bangor surveys and found they were most abundant at in late spring through summer (SAIC, 2006; Bhuthimethee et al., 2009a). Juvenile surf smelt rear in nearshore waters (Bargmann, 1998) and were detected along the shoreline near the EHW-1 from January through the mid-summer months (SAIC, 2006; Bhuthimethee et al., 2009). Surf smelt are expected to be present in the project area year round. Similar to juvenile surf smelt, juvenile sand lance have been detected near the project area from January through the mid-summer months (SAIC, 2006; Bhuthimethee et al., 2009a). Most of these juveniles were captured in sheltered cove-like areas of the nearshore and were in schools mixed with surf smelt and larval sand lance. Adult, juvenile, and larval sand lance are expected to be present in the project area throughout the year.

3.4.2.3 Special-Status Species

ESA-Listed Species and Critical Habitat

Nine ESA-listed species either occur or have the potential to occur in Hood Canal, within the vicinity of the NAVBASE Kitsap Bangor waterfront: seven fish species, one marine mammal species, and one marine bird species. Designated critical habitat occurs in Hood Canal waters, adjacent to the base, for ESA-listed Puget Sound Chinook salmon, Hood Canal summer-run chum salmon, and listed rockfish species. However, NAVBASE Kitsap Bangor is excluded from critical habitat designation by federal law (70 FR 52630, 79 FR 68042). The status of the species and presence of critical habitat (if designated) within the vicinity of the Proposed Action is provided in Table 3-7.

Table 3-7. ESA Species and Critical Habitat Potentially Present within Vicinity of Proposed Action

Common Name/ *Scientific Name*	***ESA Status (Source)***	***Presence in Hood Canal***	***Critical Habitat in Hood Canal***
Fish			
Puget Sound Chinook Salmon ESU/*Oncorhynchus tshawytscha*	T (NMFS, 2005a) CH (NMFS, 2005b)	Present	Designated along the shoreline to depth of -30 meters MLLW (-98 feet) except not along the NAVBASE Kitsap Bangor waterfront.
Puget Sound Steelhead DPS/ *O. mykiss*	T (NMFS, 2007)	Present	Proposed, but not in marine waters (NMFS, 2013).
Hood Canal Summer-run Chum Salmon ESU/*O. keta*	T (NMFS, 1999) CH (NMFS, 2005b)	Present	Designated along the shoreline to depth of -30 meters MLLW (-98 feet) except not along the NAVBASE Kitsap Bangor waterfront.
Bull Trout DPS/*Salvelinus confluentus*	T (USFWS, 1999) CH (USFWS, 2010)	Present in Hood Canal in the Skokomish River; Currently this population is not expected within marine waters.	Designated along the shoreline to depth of -10 meters MLLW (-33 feet). The closest critical habitat occurs along the western and northern shores of Dabob Bay beyond Hazel Point, at the southern tip of Toandos Peninsula, outside of the area affected by the Proposed Action.
Puget Sound/Georgia Basin Bocaccio Rockfish DPS/ *Sebastes paucispinis*	E (NMFS, 2010) CH (NMFS, 2014)	Possible, but uncertain.	Designated outside NAVBASE Kitsap Bangor boundaries in nearshore and deepwater habitats.
Puget Sound/Georgia Basin Canary Rockfish DPS/ *S. pinniger*	T (NMFS, 2010) CH (NMFS, 2014)	Present	
Puget Sound/Georgia Basin Yelloweye Rockfish DPS/ *S. ruberrimus*	T (NMFS, 2010) CH (NMFS, 2014)	Present	
Marine Mammals			
Humpback Whale/*Megaptera novaeangliae*	E (NMFS, 1970)	Rare.	Not designated
Birds			
Marbled Murrelet/ *Brachyrhamphus marmoratus*	T (USFWS, 1992) CH (USFWS, 1996)	Present	Not present

Notes:
CH = critical habitat, DPS = Distinct Population Segment, E = endangered, ESU = Evolutionary Significant Unit, T = threatened.

Additional information regarding all species distribution and likely presence within the vicinity of the Proposed Action is discussed in the following sections.

Puget Sound Chinook Salmon ESU

Puget Sound Chinook were federally listed as threatened under the ESA on March 24, 1999, with the threatened listing reaffirmed in 2005 (NMFS, 2005a). The ESU is composed of both naturally spawning populations and a number of hatchery stocks. There are currently 22 independent populations of Puget Sound DPS Chinook salmon which is drastically reduced from a believed historical number of 30 to 37 independent populations prior to federal protection (Fresh, 2006; NOAA, 2007). The two populations likely occurring near NAVBASE Kitsap Bangor are the Skokomish and the Mid-Hood Canal populations. These populations spawn in the Skokomish, Hamma Hamma, Dosewallips, and Duckabush River systems from September to October and typically return to Hood Canal in July.

A final designation of Puget Sound Chinook salmon critical habitat was published on September 2, 2005, with an effective date of January 2, 2006 (NMFS, 2005b). Nearshore marine waters within Hood Canal were included as part of this designation; however, NAVBASE Kitsap Bangor is excluded from critical habitat designation for ESA-listed Puget Sound Chinook salmon by federal law (70 FR 52630). As a result, no Puget Sound Chinook salmon critical habitat occurs in the immediate vicinity of the project area. The closest critical habitat occurs immediately beyond the northern and southern base boundaries.

Surveys have found that Chinook salmon out-migrating from streams and hatcheries occur most frequently along the Bangor waterfront at NAVBASE Kitsap from late May to early July (Schreiner et al., 1977; Prinslow et al., 1980; Bax, 1983; Salo, 1991; SAIC, 2006; Bhuthimethee et al., 2009). Emergent Chinook fry, like fry of other Pacific salmonids, depend on shaded, nearshore habitat, with slow-moving currents, where they forage on drift organisms, including insects and zooplankton (Healey, 1991).

Puget Sound Steelhead DPS

Puget Sound steelhead DPS was federally listed as threatened under the ESA on May 11, 2007 (NMFS, 2007). The Puget Sound DPS steelhead was listed in May 2007 under the ESA as a threatened DPS (72 FR 26722). The DPS includes all naturally spawned anadromous winter-run and summer-run O. mykiss (steelhead) populations in streams in the river basins of the Strait of Juan de Fuca, Puget Sound, and Hood Canal, Washington, bounded to the west by the Elwha River (inclusive) and to the north by the Nooksack River and Dakota Creek (inclusive), as well as the Green River natural and Hamma Hamma winter-run steelhead hatchery stocks (NMFS, 2011). The Hamma Hamma River hatchery program and four other hatchery programs are not considered part of the DPS, with a number of hatchery supplementation programs terminated in the last 10 years. As a result, steelhead supplementation in the Hamma Hamma was discontinued, with the last returning adult steelhead arriving in 2010 (NMFS, 2011). Five new steelhead programs propagating native-origin fish for the purposes of preserving and recovering the populations also have been initiated. These programs support recovery of native winter-run steelhead in the White, Dewatto, Duckabush, North Fork Skokomish, and Elwha River watersheds. The new programs warrant consideration for inclusion in the DPS (NMFS, 2011).

Adult steelhead enter freshwater December through April with spawning taking place March through June (Hard et al., 2007). Steelhead leave freshwater usually as 2-year old smolts, typically from April to mid-May.

Critical habitat for Puget Sound steelhead DPS is proposed, but marine waters are not included in the proposal (NMFS, 2013a). In addition, streams on DoD lands have been excluded from proposed designation (NMFS, 2013a).

Steelhead do not occur in large numbers along the NAVBASE Kitsap Bangor waterfront. Very few steelhead were collected during fish surveys that took place along the waterfront from 2005 – 2008 and of the small numbers collected, peak catch was in late spring and summer months (SAIC, 2006; Bhuthimethee et al., 2009a).

Hood Canal Summer-run Chum Salmon ESU

Hood Canal summer-run chum salmon were listed as threatened on March 25, 1999 (NMFS, 1999) and the threatened listing was reaffirmed on June 28, 2005 (NMFS, 2005b). Historically, there were 16 stocks within the Hood Canal summer-run chum ESU, eight of which are extant (6 in Hood Canal and 2 in the eastern Strait of Juan de Fuca) with the remaining 8 extinct (71 FR 47180). The Hood Canal summer-run chum salmon ESU 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: Quilcene NFH, Hamma Hamma Fish Hatchery, Lilliwaup Creek Fish Hatchery, Union River/Tahuya, Big Beef Creek Fish Hatchery, Salmon Creek Fish Hatchery, Chimacum Creek Fish Hatchery, and the Jimmycomelately Creek Fish Hatchery summer-run chum hatchery programs (NMFS, 2011). However, five Hood Canal summer-run chum hatchery programs were terminated since the last status review, including Quilcene National Fish Hatchery, Union River/Tahuya River, Big Beef Creek, Salmon Creek, and Chimacum Creek programs. The last adult fish produced through these terminated programs returned in 2008 (NMFS, 2011). Summer-run chum salmon enter rivers from mid-August through mid-October (Johnson et al., 1997). Spawning peaks from mid-September to mid-October with fry emergence beginning in January. Fish immediately migrate to marine waters.

Critical habitat was designated for Hood Canal summer-run chum ESU on September 2, 2005 by the NMFS (70 FR 52630). Critical Habitat extends from extreme high tide to a depth of 30 m relative to MLLW. Although critical habitat occurs in northern Hood Canal waters adjacent to the base, NAVBASE Kitsap Bangor is excluded from critical habitat designation for ESA-listed Hood Canal summer-run chum salmon by federal law (70 FR 52630). As a result, no Hood Canal summer-run chum salmon critical habitat occurs in the immediate vicinity of the project.

Fish surveys conducted along the NAVBASE Kitsap Bangor waterfront collected high numbers of juvenile chum. Peak numbers were in March and April (SAIC, 2006; Bhuthimethee et al., 2009a). Because summer-run chum are not distinguishable from the large releases of hatchery fall-run chum, the peak timing is not representative of summer-run chum salmon.

Bull Trout DPS

Currently, all populations of bull trout in the lower 48 states are listed as threatened under the ESA. Bull trout are in the char subgroup of salmonids and have both resident and migratory life histories. Populations of bull trout that originate from Olympic Peninsula and Puget Sound drainages are part of the Coastal-Puget Sound bull trout population. This population reportedly contains the only occurrence of anadromous bull trout in the contiguous United States (USFWS, 1999).

Critical habitat was designated for bull trout on September 26, 2005 (70 FR 56212) with a final revision to this habitat published in 2010 (USFWS, 2010). However, although both the original and revised final bull trout critical habitats occur in Hood Canal, neither designates waters north of Hazel Point, at the southeastern tip of Toandos Peninsula. Therefore, no bull trout critical habitat occurs at NAVBASE Kitsap Bangor.

The only drainage to Hood Canal with bull trout is the Skokomish River (WDFW, 2004). Bull trout require snow-fed glacial streams, and, since there are none on the Kitsap Peninsula, they would not be expected in any streams at NAVBASE Kitsap Bangor or in any other streams on the Kitsap Peninsula. Further, no bull trout were collected during nearshore fish surveys conducted along the NAVBASE Kitsap Bangor waterfront in 2005 through 2008 (SAIC, 2006; Bhuthimethee et al., 2009a).

Rockfish Species DPS

Three Puget Sound/Georgia Basin DPS populations of rockfish are listed under the ESA. These include Bocaccio (endangered status), canary rockfish (threatened status), and yelloweye rockfish (threatened status) (NMFS, 2010). The designation area for these populations encompasses inland marine waters east of the central Strait of Juan de Fuca and south of the northern Strait of Georgia. A summary of life history and occurrence of each DPS within the vicinity of the project area is described below. A more comprehensive review for each species can be found in Appendix B. Critical habitat is designated for these species, but not within DOD boundaries.

Puget Sound/Georgia Basin Bocaccio DPS. Adult bocaccio inhabit waters at depths ranging from approximately 40 to 1,570 ft, but are most common at depths of 160 to 820 ft (i.e., greater than the project depth). Although bocaccio are typically associated with hard substrate, they may wander into mud flats presumably because they can be located as much as 98 ft off the bottom. Bocaccio release larvae in January, continuing through April off the coast of Washington. Larval and pelagic juvenile bocaccio drift into the nearshore, near the water surface, and are associated with drifting kelp mats (Love et al., 2002). The young bocaccio settle the nearshore environment at 3 to 4 months of age, where the species prefer shallow waters over algae-covered rocks, or in sandy areas where eelgrass beds or drift algae are present (Love et al., 2002). As juveniles, bocaccio rockfish inhabit relatively shallow water, compared to adults (NMFS, 2013b). Bocaccio have never been observed during WDFW bottom trawl, video, or dive surveys in Puget Sound (Palsson et al., 2009). However, Palsson et al. (2009) investigated historic fish catch records and reported 2 known instances of bocaccio captures in Hood Canal. It is important to note that recreational fishing records reflect observed frequencies, not observed densities. Although there had been no confirmed observations of bocaccio in Puget Sound for over a decade (74 FR 18516), Drake et al. (2008) concluded that it is likely that bocaccio occur in low densities.

No more than four juvenile rockfish were captured per year over a 4-year fish survey study along NAVBASE Kitsap Bangor Waterfront (SAIC, 2006; Bhuthimethee et al., 2009a). It is not known if they were juvenile bocaccio as those collected by seine were not identified to species.

Puget Sound/Georgia Basin Canary Rockfish DPS. Larvae and pelagic juveniles are found in the upper 330 ft of the water column from January until about March when they start to move into intertidal areas (tide pools, rocky reefs, kelp beds, cobble areas), although some juveniles remain pelagic in much deeper water until July (Love et al., 2002). Juveniles may occupy rock-sand interfaces near 50-65 ft during the day, and then move to sandy areas at night.

An approximate estimate of canary rockfish abundance in Puget Sound Proper was only 300 individuals during the 1980s (NMFS, 2010). Drake et al. (2008) concluded that canary rockfish occur in low and decreasing abundances in Puget Sound.

As noted in the prior section, no more than 4 juvenile rockfish were captured per year over a 4-year fish survey study along NAVBASE Kitsap Bangor waterfront (SAIC, 2006; Bhuthimethee et al., 2009a). It is not known if they were juvenile canary or bocaccio as those collected by seine were not identified to species.

Puget Sound/Georgia Basin Yelloweye Rockfish DPS. Yelloweye rockfish are more common in northern Puget Sound compared with southern Puget Sound presumably because rockier habitat is available in northern Puget Sound. An approximate estimate of yelloweye rockfish abundance in Puget Sound Proper was only 1,200 individuals during the 1980s (NMFS, 2010).

Yelloweye rockfish is a deep-water species that is relatively sedentary living in association with high relief rocky habitats and often near steep slopes (Palsson et al., 2009; Love et al., 2002, Wang, 2005, as cited in NMFS, 2013b). Yelloweye move into deeper water as they grow into adults, continuing to associate with caves and crevices and spending large amounts of time lying on the substratum, sometimes at the base of rocky pinnacles and boulder fields (Love et al., 2002). Adult yelloweye rockfish inhabit waters from 80-1,560 ft, but they are most common at depths of 300 to 590 ft (i.e., greater than the project depth). They are typically solitary, but sometimes form aggregations near rocky substrate.

Hood Canal has the greatest frequency of yelloweye rockfish observed in both trawl and scuba surveys conducted by WDFW (Palsson et al., 2009). Juvenile rockfish were captured during fish surveys conducted along NAVBASE Kitsap Bangor waterfront in 2005 through 2008. No more than 4 fish total per-year were collected (SAIC, 2006; Bhuthimethee et al., 2009a). However, juvenile yelloweye rockfish are associated with deeper water, so these were unlikely to be yelloweye rockfish.

Humpback Whale

Humpback whales were listed as endangered under the Endangered Species Preservation Act of 1966 (35 FR 1222) due to commercial whaling and this protection threshold was transferred to the ESA in 1973. The recovery plan for humpback whales was finalized in November 1991 (NMFS, 1991). The California/ Oregon/Washington Stock is defined to include humpback whales that feed off the west coast of the continental United States and individuals potentially occurring within the vicinity of the project area would belong to this stock. Critical habitat is not designated for this species.

Humpback whales were one of the most common large cetaceans in the inland waters of Washington in the early 1900s (Scheffer and Slipp, 1948). Humpback whale sightings were infrequent in Puget Sound and the Georgia Basin through the late 1990s, and prior to 2003 the presence of only three individual humpback whales was confirmed (Falcone et al., 2005). However, in 2003 and 2004, 13 individuals were sighted in the inland waters of Washington, mainly during the fall (Falcone et al., 2005). Records available for April 2001 to February 2012 include observations in the Strait of Juan de Fuca, the Gulf Islands and the vicinity of Victoria, British Columbia, Admiralty Inlet, the San Juan Islands, Hood Canal, and Puget Sound (Orca Network, 2012). For the areas listed above, Orca Network records shows humpback whale presence in the areas listed above in all months from May through November in 2009; in all months but January, March, April, May, and August in 2010; and from March through November in 2011.

In Hood Canal, humpback whale sightings occurred several times in January and February 2012 and in February 2015 (Orca Network, 2012 and 2015). Review of the 2012 sightings information indicated they were of one individual (Calambokidis pers. comm., 2012). Prior to these sightings, there were no confirmed reports of humpback whales entering Hood Canal (Calambokidis pers. comm., 2012). No other reports of humpback whales in the Hood Canal were found in the Orca Network database, the scientific literature, or agency reports. Construction of the Hood Canal Bridge occurred in 1961 and could have contributed to the lack of historical sightings (Calambokidis pers. comm., 2010). Only a few records of humpback whales near Hood Canal (but north of the Hood Canal Bridge) are in the Orca Network database. Two were from the northern tip of Kitsap Peninsula (Foulwater Bluff/Point No Point) and a few others from Port Madison Bay in Puget Sound. Therefore, it is unlikely that humpback whales would occur within the vicinity of the project area during relatively short duration of the project activities.

<u>Marbled Murrelet</u>

The Washington, Oregon, and California population of the marbled murrelet was federally listed as threatened on October 1, 1992 (USFWS, 1992). Marbled murrelets are seabirds that spend most of their life in the marine environment and nest in mature and old-growth forests (USFWS, 1997). They use the marine environment in Hood Canal for courtship, loafing, and foraging. Murrelets can occur year-round in Puget Sound and Hood Canal, although their flock size, density, and distribution vary by season (Nysewander et al., 2005; Falxa et al., 2008).

Critical habitat for nesting marbled murrelets was designated in 1996 (USFWS, 1996) and was proposed for revision in 2008 (USFWS, 2008). Only critical habitat in Oregon and California was revised in the final rule (USFWS, 2011). Designated critical habitat in Washington remains unchanged from the 1996 ruling and hence, the project area is not within designated critical habitat (USFWS, 1996, 2011). The closest designated critical habitat to Hood Canal includes forest lands west and south of Dabob Bay.

During the breeding season, murrelets tend to forage in well-defined areas along the shoreline in relatively shallow marine waters. Murrelets forage at all times of the day and in some cases at night (Strachan et al., 1995). During the pre-basic molt phase, flightless murrelets must select foraging sites that provide adequate prey resources within swimming distance (Carter and Stein, 1995). During the non-breeding season, murrelets typically disperse and are found farther from shore (Strachan et al., 1995).

Murrelet presence in Hood Canal has been documented through a number of sources and survey efforts. The most comprehensive information comes from the consistent sampling used to estimate population size and trends under the Northwest Forest Plan Murrelet Effectiveness Monitoring Program (Raphael et al., 2007). Other survey data were generated through the Puget

Sound Ambient Monitoring Program (PSAMP), conducted by WDFW (Nysewander et al., 2005).

WDFW conducted at-sea surveys for two years beginning in 2012 to obtain fall/winter density estimates for areas of Puget Sound near Navy Installations (Pearson and Lance, 2013 and 2014). Marbled murrelets have been documented in the nearshore and deeper waters adjacent to NAVBASE Kitsap Bangor since 2001. The Kitsap Audubon Society reported marbled murrelets in three annual Christmas Bird Count surveys from the shoreline south of the Bangor waterfront between 2001 and 2007 (Kitsap Audubon Society, 2008). Marbled murrelets were observed opportunistically during the course of shoreline fish and sediment surveys conducted from March to September 2007 for a total of 22 days of observations (Agness and Tannenbaum, 2009b). Survey locations and sampling frequency were determined by the sampling design for the fish and sediment surveys, and not all survey locations were scanned in each sampling day. During these observations, eight marbled murrelet pairs were recorded during April and May 2007. No single birds were observed. In all instances, marbled murrelets sighted were in breeding plumage. The breeding season (nesting to fledging) generally extends from April 1 to September 23, but is asynchronous, i.e., pairs do not start nesting at the same time. Marbled murrelets were observed actively diving and foraging off of Carlson Spit on four occasions. Murrelets were observed eating a fish at the water surface (May 1, 2007) and holding a fish cross-wise in the bill, a behavior called fish-holding that is indicative of the chick-rearing stage of breeding (May 25, 2007). During the 2007 surveys, marbled murrelets were not sighted near pier structures but were detected in all nearshore scan areas with the exception of one area.

From July to November 2008, 12 boat-based systematic surveys for marine birds were conducted along transects in the nearshore and deeper waters of the Bangor waterfront (Tannenbaum et al., 2009b) The surveys covered the entire 4.3-mile (6.9-kilometer) waterfront from the shoreline to approximately 1,800 feet (550 meters) from shore (approximately 3.4 sq km [2.1 miles]). Twelve additional transect-based surveys were conducted in the same area from November 2009 to May 2010 (Tannenbaum et al., 2011). These surveys were used to document the presence, location, and habitat use of marine birds in nearshore and deeper water habitats that might be potentially affected by proposed construction projects on the Bangor waterfront. Murrelets were observed in nearshore and deeper waters, including one individual in immature plumage that was observed swimming under EHW-1 in September 2008, and other pairs and individuals observed in deeper water habitats in November 2009 and April 2010.

In January 2009, the Navy conducted marbled murrelet monitoring during the installation of five steel piles for the Carderock Research Facility Wave Deflection System adjacent to Carlson Spit on the Bangor waterfront. During each of the five pile driving days, one to eight marbled murrelets were frequently observed within the 3,280-foot (1,000-meter) zone known as the "area of potential behavioral effect," with intermittent sightings of 12 to 31 murrelets recorded. No marbled murrelet sightings occurred within the 1,000-foot (305-meter) zone known as the "area of potential injury" for this project (Navy, 2009).

Marbled murrelet surveys conducted during the Test Pile Program (late September to late October 2011) did not detect any murrelets within or in close proximity to the Port Security Barrier, although murrelets were detected elsewhere in Hood Canal (HDR, 2012). Marbled murrelet monitoring during the first in-water work season of the EHW-2 construction project detected one individual on three consecutive days in January within the Port Security Barrier between EHW-1 and Marginal Wharf outside the project's 168-meter shut-down zone (Hart

Crowser, 2013). These were the only marbled murrelet sightings in the construction area during the 19-week monitoring period (September 28, 2012, to February 14, 2013). No marbled murrelets were detected within the Port Security area during the second year of construction monitoring of the EHW-2 project (July 16, 2013 to February 15, 2014) (Hart Crowser, 2014).

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 and Nelson, 1995). WDFW Priority Habitat Species maps do not indicate the presence of marbled murrelet nests in the upland areas including and adjacent to NAVBASE Kitsap Bangor (WDFW, 2010). 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 has been located at the northern portion of the base (International Forestry Consultants, 2001; Jones, 2010, personal communication). The Navy and USFWS have 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, personal communication).

Bald Eagle

Bald eagles are regularly observed at NAVBASE Kitsap Bangor. They are likely to be present flying over the project area either to forage or to nesting sites. Bald eagle nesting period is from January 1 through August 31. The closest documented bald eagle nesting site was located approximately 1.5 miles south of the project area, near Devils Hole, however this nest blew down in November 2013 (Yasenak, 2014). A new nest appears to be developing near K/B spit, which is also located approximately 1.5 miles south of the project area (Leicht, 2014).

Marine Mammals

Five species of marine mammals have a reasonable potential to occur within the waters surrounding Naval Base Kitsap Bangor: the Steller sea lion (*Eumetopias jubatus*), the California sea lion (*Zalophus californianus*), the harbor seal (*Phoca vitulina*), the transient killer whale (*Orcinus orca*), and the harbor porpoise (*Phocoena phocoena*). None of these species are listed under the federal Endangered Species Act. These species are included in the analysis of this application based on the potential for exposure to behavioral harassment from noise associated with vibratory and impact pile driving during project construction. Four additional species previously documented in Hood Canal are not carried forward in the analysis because they are unlikely to be present during project construction; the humpback whale (*Megaptera novaeangliae*), the gray whale (*Eschrichtius robustus*), Southern Resident killer whale, and the Dall's porpoise (*Phocoenoides dalli)* (Navy, 2014a). Distribution and occurrence of California sea lions, Steller sea lions and harbor seals, and harbor porpoise as well as rare occurrences of transient killer whales are discussed below.

California Sea Lion

California sea lions breed on islands located in southern California, western Baja California, and the Gulf of California during the summertime. Large numbers of adult and sub adult male and juvenile sea lions migrate north post-breeding and winter from central California to Washington

State (Jeffries et al., 2000). California sea lions feed on a variety of fish and shellfish, including salmon, steelhead, herring, mackerel, and squid.

Jeffries et al. (2000) and Jeffries (pers. comm., 2012) identified dedicated, regular haulouts used by adult and subadult California sea lions in Washington inland waters. Main haulouts occur at NAVBASE Kitsap Bangor, NAVBASE Kitsap Bremerton, and NAVSTA Everett, as well as in Rich Passage near Manchester, 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 pers. comm., 2012). Additionally, Race Rocks, British Columbia, Canada (Canadian side of the Strait of Juan de Fuca) has been identified as a major winter haulout for California sea lions (Edgell and Demarchi, 2012).

The Navy conducts surveys at its installations with sea lions in Puget Sound (see Appendix B for additional information). Haulouts are located at NAVBASE Kitsap Bangor where up to 122 California sea lions, respectively, have been observed hauled out on the Port Security Barrier floats and on docked submarines (Navy, 2014b). Numbers of animals typically peak in October or November.

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, 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 (Navy, 2014b).

<u>Eastern Steller Sea Lion DPS</u>

The Eastern Steller sea lion was removed from protection under the ESA in October 2013, but is still protected under the MMPA.

The eastern stock of Steller sea lions are found along the coasts of southeast Alaska to northern California where they occur at rookeries and haulout locations along the coastline (Jeffries et al., 2000; Scordino, 2006). 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). Based on mark recapture sighting studies, males migrate back into these Oregon and California locations from winter feeding areas in Washington, British Columbia, and Alaska (Scordino, 2006).

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 and 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 the Puget Sound, Jeffries (pers. comm., 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. Numbers of animals observed at these sites ranged from a few to less than 100. In addition, Steller sea lions opportunistically haul out on various navigational buoys in Admiralty Inlet south through southern Puget Sound near Olympia (Jeffries pers. comm., 2012). One or two animals occur on these buoys.

Steller sea lions have been seasonally documented at NAVBASE Kitsap Bangor in Hood Canal since 2008 with up to 11 individuals observed hauled out on submarines at Delta Pier south of the project site (Navy, 2014b). Surveys at NAVBASE Kitsap Bangor indicate Steller sea lions typically arrive in October and depart by the end of May, although two Steller sea lions were seen in September in two different survey years (Navy, 2014b).

Harbor Seal

Harbor seals inhabit coastal and estuarine waters off Baja California, north along the western coasts of the continental United States, British Columbia, and Southeast Alaska west through the Gulf of Alaska and Aleutian Islands (Carretta et al., 2011). They are generally non-migratory and remain local with changes in the tides, weather, season, reproduction, and food availability as the primary factors for movement. Harbor seals generally haul-out on rocks, reefs, and beaches during the day and forage in marine and estuarine waters during the morning and evenings. They haul out at low and high tide (in Hood Canal) to digest food, rest, give birth, or nurse young. Harbor seals eat crustaceans, squid, mollusks, and a variety of fish (Carretta et al., 2011).

Harbor seals occur year-round throughout the nearshore waters of Puget Sound. Haulouts occur throughout Hood Canal primarily on the west side. The nearest haulout identified by Jeffries is at the mouth of the Dosewallips River 10 miles southwest of the NAVBASE Kitsap Bangor waterfront. Surveys conducted from 2007 to 2010 at NAVBASE Kitsap Bangor, observed harbor seals in the water every month of surveys (Agness and Tannenbaum, 2009a; Tannenbaum et al., 2009a, 2011). Harbor seals were routinely seen during marine mammal monitoring for construction projects, at or near EHW-1 (Test Pile Project, EHW-2 construction, and prior EHW-1 repairs (HDR, 2012: Hart Crowser, 2013). Small numbers of harbor seals have been documented hauling out on the PSB floats, the wavescreen at Carderock Pier, buoys, barges, marine vessels, and logs (Agness and Tanenbaum, 2009a; Tannenbaum et al., 2009a, 2011). Most documented occurrences of harbor seals hauling out along the Bangor waterfront were on the Port Security Barrier floats and on manmade floating structures near KB Dock and Delta Pier. On two occasions, four to six individuals were observed hauled out near Delta Pier.

Harbor seals are known to reproduce at Bangor. Known harbor seal births include one on the Carderock wave screen in August 2011 and at least one on a small 10 ft x10 ft floating dock at EHW-2 in fall 2013, as reported by the EHW-2 construction crew, and afterbirth on a float at Magnetic Silencing Facility with an unknown date. Harbor seal pupping has occurred on a section of the Service Pier for the past 13 years according to the Port Operations vessel crews.

Harbor Porpoise

NMFS conservatively recognizes two stocks of harbor porpoise 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.

Sightings of harbor porpoises in Hood Canal north of the Hood Canal Bridge have increased in recent years (Calambokidis pers. comm., 2010). During line transect surveys conducted in the Hood Canal in 2011 for the Test Pile Program near NAVBASE Kitsap Bangor and Dabob Bay (HDR, 2012), an average of six harbor porpoises were sighted per day in the deeper waters.

West Coast Transient Killer Whale

The geographical range of the West Coast Transient stock of killer whales includes waters from California through southeastern Alaska with a preference for coastal waters of southern Alaska and British Columbia (Krahn et al., 2002). 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, 2012), but several studies have shown peaks in occurrences: Morton (1990) found bimodal peaks in spring (March) and fall (September to November) for transients on the northeastern coast of British Columbia, and Baird and Dill (1995) found some transient groups frequenting the vicinity of harbor seal haulouts around southern Vancouver Island during August and September, which is the peak period for pupping through post-weaning of harbor seal pups. However, not all transient groups were seasonal in these studies and their movements appear to be unpredictable.

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). Transient killer whales were observed in Hood Canal in 2003 and 2005, but have not been observed since. In 2003, 11 transients spent almost two months in Hood Canal feeding on harbor seals primarily in the area between the Skokomish River and Quilcene Bay (London, 2006). In 2005, six transient killer whales were in Hood Canal for 172 days between January and June. 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), and also anecdotal accounts of historical use.

3.4.2.4 Essential Fish Habitat

The PFMC has designated EFH for each of the four primary fisheries that they manage within their FMPs: Pacific Coast groundfish, Pacific Coast salmon, coastal pelagic species, and West Coast highly migratory species (PFMC, 2007, 2011, 2012, 2014). Of these fisheries, only three (Pacific Coast groundfish, coastal pelagic species, and Pacific Coast Salmon) contain species for which EFH has been designated within Hood Canal or in the vicinity of NAVBASE Kitsap Bangor. A summary of the designated EFH within the vicinity of NAVBASE Kitsap Bangor and the conclusions regarding potential impacts to EFH are described below. A detailed discussion is located in Appendix B.

Pacific Coast Groundfish

Pacific coast groundfish species are considered sensitive to over-fishing, the loss of habitat, and water and sediment quality (PFMC, 2014). 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, 2014). The PFMC (2014) 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 mean higher high water level (MHHW) or the upriver extent of saltwater intrusion, defined as upstream and landward to where ocean-derived salts measure less than 0.5 ppt during the period of average annual low flow". Furthermore, the PMFC (2014) has also designated EFH for each individual groundfish species by life stage. These designations are contained within Appendix B of the Pacific Groundfish FMP (PFMC, 2014). Using the Pacific Habitat Use Relational Database (HUD) developed by the PFMC, it was determined which groundfish species and life stages have EFH designated within the vicinity of the EHW-1 Pile Replacement Project area. The management unit in the Pacific Coast Groundfish FMP includes 83 groundfish species (PFMC, 2014). Of these, 32 were identified through the analysis of the HUD as having EFH designated in the vicinity of NAVBASE Kitsap Bangor. Based on the analysis, the primary habitats designated as EFH for these species include:

- The entire water column, including macrophyte canopies and drift algae;
- Unconsolidated sediments consisting of mud, sand, or mixed mud/sand;
- Hard bottom habitats composed of boulders, 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 Salmon

The salmon EFH extends from the nearshore and tidal submerged environments within state territorial waters of Washington, Oregon, and California north of Point Conception out to the exclusive economic zone (200 miles) offshore (PFMC, 2012). In addition to the 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, 2012), including the waters of NAVBASE Kitsap Bangor. For the Pacific salmon fishery, EFH (which includes Hood Canal), is identified using U.S. Geological Survey (USGS) hydrologic units, as well as habitat association tables and life history descriptions of each life stage (PFMC, 2012). Pacific salmon species 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, 2012).

Coastal Pelagic Species

The EFH designations for coastal pelagic species are based on the geographic range and in-water temperatures where these species are present during a particular life stage (PFMC, 2011). Specific EFH boundaries (i.e., the habitat necessary to provide sufficient fishery production) are based on best available scientific information and described in the Coastal Pelagics Fishery Management Plan (PFMC, 2011). These boundaries include the waters of NAVBASE Kitsap Bangor. Two species identified as coastal pelagic species are known to occur in Hood Canal waters: northern anchovy and market squid (SAIC, 2006; Bhuthimethee et al., 2009). Aside from their value to commercial Pacific fisheries, coastal pelagic species are also recognized for their importance as food for other fish, marine mammals, and birds (63 FR 13833). Coastal pelagic species are considered sensitive to overfishing, the loss of habitat, reduction in water and sediment quality, and changes in marine hydrology, including entrainment through water intakes (PFMC, 2011).

Habitat Areas of Particular Concern Designations

In addition to designating EFH, the PMFC is also responsible for identifying Habitat Areas of Particular Concern (HAPC) for federally managed species. Out of the four fisheries managed by the PFMC, HAPC have only been identified for groundfish. The four HAPC designated for these species include seagrass, canopy kelp, rocky reef, and estuarine habitats along the Pacific coast, including Puget Sound. Two of these HAPC, estuarine habitats and seagrass, are located within the vicinity of the EHW-1 proposed project area.

3.4.3 Environmental Consequences

Impacts to biological resources would be considered significant if there was a loss of high value habitat for fish and wildlife and/or injury to special-status species would result from the Proposed Action. The threshold of significance is defined as impacts to biological resources causing the loss of high value habitat for fish and wildlife and population of species, including injury impacts as the result of the Proposed Action.

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. A primary construction element of the Proposed Action would be installing four 30-inch steel piles using both a vibratory and impact pile driver. Before all environmental consequences of this alternative are discussed for biological resources, a summary of underwater noise and evaluation criteria for marine birds, fish, and marine mammals is introduced below.

Noise level Criteria for Evaluation of Impacts

In addition to human noise-sensitive receptors (discussed in Section 3.3), habitat for certain wildlife or aquatic species is also considered. It's important to understand the criteria currently in place for terrestrial and aquatic species before evaluating impacts from the Proposed Action.

Both airborne and underwater noise would be generated from pile driving activities. As described in Section 3.3 Airborne Noise, levels measured in the air are typically used to assess impacts on humans and are A-weighted to reduce the contribution of low and high frequencies and correspond to how humans hear. While noise pressures in air are weighted and measured in dB re 20 μPa (approximate threshold of human audibility), the reference pressure for water is 1 μPa. Noise levels underwater are not weighted and therefore measure unaltered frequency ranges that may extend above and below the audible range of many organisms (WSDOT, 2014).

Fish

The degree to which an individual fish exposed to underwater sound would be affected depends on a number of variables, including:

- species of fish;
- size of fish;
- presence of a swim bladder;
- physical condition of the fish;
- 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; and
- tidal currents.

Depending on these factors, effects on fish can range from changes in behavior to immediate mortality. There has been no documented injury or mortality resulting from the use of vibratory pile drivers; however, fish injury from impact hammers has been documented.

Three metrics are commonly used to evaluate noise impacts to fish (WSDOT, 2014):

- *Peak Sound Pressure level (Lpeak)* – Peak sound pressure level based on the largest absolute value of the instantaneous sound pressure over the frequency range from 20 to 20,000 Hz; pressure is unweighted and measured as dB re 1µPa;
- *Root Mean Square (rms)* – rms level is the square root of the energy divided by a defined time period; and
- *Sound Exposure Level (SEL)* – Constant level over 1 second that has the same amount of acoustic energy, as indicated by the square of the sound pressure, as the original sound.

NMFS and USFWS currently use a dual threshold for evaluating injury using both peak SPLs and cumulative SEL. The underwater noise threshold criterion for fish injury from a single impact hammer pile strike is at an SPL of 206 dB peak (Fisheries Hydroacoustic Working Group (FHWG), 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 (FHWG, 2008). As reference points of total fish length at 2 grams weight in Puget Sound, juvenile chum salmon are approximately 2.7 to 2.8 inches (68 to 70 millimeters) (Tynan, 2013, personal communication).

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 µPa2•sec (WSDOT, 2014). No physical injury is expected beyond this distance.

In addition to the injury thresholds, Hastings (2002) recommended an underwater noise guideline for behavioral impacts on fish, including startle response, at a level of 150 dB RMS.

Marine Mammals

The NMFS has used generic sound exposure thresholds to determine when an activity in the ocean that produces sound might result in impacts to a marine mammal such that a take by harassment might occur (70 FR 1871). These thresholds are used to determine compliance with the MMPA (16 USC § 1362 Sec. 3 (13)) and the ESA (7 USC § 36 and 16 USC § 1531 et seq.), but the effects determinations and language used to report exposure to harmful noise levels are different for the two statutes. As described previously, the MMPA imposes a moratorium on the taking of marine mammals, where "take" means to harass, among other actions. The MMPA defines two levels of harassment, each of which has been assigned a noise exposure threshold:

- Cetaceans and pinnipeds exposed to impulsive sounds of 180 and 190 dB rms or above, respectively (i.e., injury threshold levels, and higher than impact or vibratory pile driving sounds), are considered to have been taken by injury (Level A harassment). Injury thresholds are applied to a situation where the noise has the potential to injure a marine mammal or marine mammal stock in the wild (16 USC §1362 Sec. 3 (18) (A) (i)).

- Marine mammals exposed to sounds at or above 160 dB rms for impulse sounds (e.g., impact pile driving) and 120 dB rms for continuous noise (e.g., vibratory pile driving), but below injurious thresholds are considered to have been taken by behavioral/disturbance (Level B harassment).
- Behavioral disturbance thresholds are applied to situations where the noise "has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of natural behavior patterns, including, but not limited to, migration, breathing, nursing, breeding, or sheltering (16 USC §1362 Sec. 3 (18)(A)(ii)). The application of the 120 dB rms threshold can sometimes be problematic because this threshold level can be either at or below the ambient noise level of certain locations. As a result, these levels are considered precautionary (74 FR 41684). NMFS has proposed new science-based thresholds to improve and replace the current exposure level thresholds, but the criteria have not been finalized (NOAA, 2013).

Marine Birds

Little is known about the general airborne hearing or underwater hearing capabilities of birds but research is ongoing. What has been determined is that there are three classes of potential effects identified for birds from noise (i.e., traffic or construction). These are:

- physiological and behavioral effects;
- damage to hearing from acoustic over-exposure; and
- masking of important bioacoustics and communication signals (Dooling and Popper, 2007).

Based on a Science Panel recommendation (SAIC, 2011), guidance currently used by USFWS for evaluation of auditory injury to marbled murrelets is 202 dB SEL re 1µPa-sec cumulative of all strikes over a 24-hour period. The threshold for the extent of where pile driving noise could mask airborne communication between birds is 42 meters for 30-inch diameter piles or less (USFWS, 2014). There is currently no underwater threshold for vibratory installation of piles.

Airborne and underwater noise injury and disturbance thresholds for fish, marine mammals, and marbled murrelet are presented in Table 3-8.

Table 3-8. Airborne and Underwater Noise Injury and Disturbance Thresholds for Marine Mammals, Fish, and Marbled Murrelets

Airborne Noise Thresholds (Impact and Vibratory Pile Driving) (dB re 20 µPa unweighted)		***Underwater Noise Thresholds for Vibratory Pile Driving (dB re 1 µPa)***		***Underwater Noise Thresholds for Impact Pile Driving (dB re 1 µPa)***	
Hearing Group	***Airborne Sound Pressure Level***	***Injury Threshold***	***Behavioral Harassment Threshold***	***Injury Threshold***	***Behavioral Harassment Threshold***
Cetaceans (whales, dolphins, porpoises)	NA	180 dB rms	120 dB rms	180 dB rms	160 dB rms
Pinnipeds (sea lions)	100 dB rms	190 dB rms	120 dB rms	190 dB rms	160 dB rms
Harbor seal	90 dB rms				
Fish ≥ 2 grams	NA	150 dB rms	150 dB rms	187 dB Cumulative SEL	150 dB rms

Airborne Noise Thresholds (Impact and Vibratory Pile Driving) (dB re 20 µPa unweighted)		***Underwater Noise Thresholds for Vibratory Pile Driving (dB re 1 µPa)***		***Underwater Noise Thresholds for Impact Pile Driving (dB re 1 µPa)***	
Hearing Group	***Airborne Sound Pressure Level***	***Injury Threshold***	***Behavioral Harassment Threshold***	***Injury Threshold***	***Behavioral Harassment Threshold***
Fish < 2 grams				183 dB Cumulative SEL	
Fish all sizes				Peak 206 dB	
Foraging Marbled Murrelets	Masking: variable depending on spectrum level ambient levels.	NA	NA	202 dB SEL	150 dB rms (guideline)

Notes: NA = not applicable, no established threshold;
Source: FHWG, 2008; WSDOT 2014.

Estimated Extent of Underwater Noise Levels

The extent of noise produced from pile driving over each underwater threshold was modeled using a propagation loss formula and estimated pile driving noise levels from review of pile driving studies (vibratory and impact) including past projects at NAVBASE Kitsap Bangor (Appendix B). A bubble curtain or other attenuation device would be used to minimize the noise generated by impact pile driving. Bubble curtains emit a series of bubbles around a pile through which pile driving noise is attenuated. Because a bubble curtain would be used to minimize the noise generated by driving steel pipe piles, the expected attenuation from a bubble curtain was first subtracted from the source levels prior to modeling the extent of noise from pile driving. Bubble curtain performance is discussed in Appendix B.

The results of the modeled and estimated extent of underwater noise above the marine mammal, fish and marbled murrelet thresholds and guidance is discussed in the sections for those species.

3.4.3.1 Proposed Action

Terrestrial Wildlife

As discussed in Section 3.3, the highest airborne noise levels at the base are produced along the waterfront and at the ordnance handling areas with an estimated noise level range from 70 to 90 dBA and potentially peaking intermittently at 99 dBA. Proposed pile driving would result in increased airborne noise in the vicinity of the construction site. Maximum peak levels would be generated during impact pile driving using an impact hammer, estimated to be 110 dBA re 20 µPa at a distance of 50 feet (15 meters) from an impact driven pile (WSDOT, 2014) and vibratory pile driving could create noise level of approximately 95 dBA re 20 µPa at 50 feet (15 meters) (WSDOT, 2014). Other construction activities or equipment, such as cranes, heavy trucks, and generators would also cause noise; however, this noise level would be much lower compared to noise produced by the impact hammer (WSDOT, 2014). In the absence of pile driving noise, maximum construction noise would be 94 dBA re 20 µPa at a distance of 50 feet (15 meters) from the activity, computed as the summation of noise of all equipment operating simultaneously (WSDOT, 2014). Terrestrial wildlife along Hood Canal adjacent to the project site could be affected by construction noise. Airborne noise due to impact pile driving would be the most noticeable to terrestrial wildlife. Noise impacts due to other construction activities would be minimal.

Birds are observed within the nearshore marine area. Since noise levels decrease by approximately 6 dBA with each doubling of distance (WSDOT, 2014), the average sound levels at a distance of 500 ft would be estimated at 95 dBA re 20 μPa for impact pile driving. Wildlife species occurring within the industrial areas of NAVBASE Kitsap Bangor waterfront have likely acclimated to the ambient noise levels that occur on a daily basis and are not expected to be impacted during pile driving operations, particularly marine birds occurring within the Port Security Barrier where ongoing Navy vessel noise and general operational activity occurs.

Construction noise can possibly deter birds from nesting. Following the 6 dBA per doubled distance decrease, noise would be expected to attenuate to approximately 85 dBA which is within the range of baseline noise levels generated on a day-to-day basis. Therefore, no significant impacts to nesting sites or nesting activity would result.

Construction could occur 6 days per week, with additional restrictions to minimize disturbance to foraging marbled murrelets during their breeding season. From July 16 to September 23, no in-water work would occur 2 hours before sunrise and/or 2 hours after sunset. The in-water work window restriction would be adjusted from September 24th to January 15th to allow construction from sunrise to sunset. Non-pile driving construction activities could last until 10:00 p.m. in accordance with the WAC noise guidelines. Impact pile driving activities would not exceed 4 days. Temporary and short-term noise disturbance to birds would likely occur but would not be significant as these species are likely acclimated to the elevated noise levels typically produced along the industrial waterfront on a daily basis. No significant impacts to terrestrial species would occur with implementation of the Proposed Action.

Aquatic Species

Marine Vegetation

Implementation of the Proposed Action would include installation of four 30-inch diameter concrete filled steel pipe piles. In addition, four existing, 24-inch diameter concrete piles would be removed at the mudline by a pneumatic chipping hammer. Additionally, the construction of pile caps, installation of sled mounted passive cathodic protection systems, repair of the concrete wetwell, and recoating of the tops piles and mooring fittings would occur.

Marine vegetation could potentially be affected by the Proposed Action due to deterioration of water quality and by direct removal during construction. As indicated in Section 3.2, Water Quality, pile driving-related impacts to water quality from the Proposed Action would be limited to temporary and localized changes associated with resuspension of bottom sediments during construction. The Proposed Action would result in no measurable change to existing DO levels at the NAVBASE Kitsap Bangor waterfront or in Hood Canal in general. The Proposed Action would not result in violations of water quality standards for DO and would, therefore, maintain water quality in the vicinity of the project area. Similarly, pile driving activities would not discharge contaminants or otherwise appreciably alter the concentrations of trace metal or organic contaminants in bottom sediments. NAVBASE Kitsap Bangor has an approved Spill Management Plan and a regional Integrated Spill Contingency Plan is in place. These plans outline procedures designed to reduce the likelihood of fuel spills, and increase the response time and efficiency of clean up. As a result, accidental spills or discharges of deleterious materials would not be expected to adversely impact marine water quality at the project area. Increases in turbidity and suspended solids during pile driving, placement of anchors, and mobilization of tugs, barges, and monitoring vessels would be minimal, temporary, and localized.

Marine surveys at NAVBASE Kitsap Bangor have shown that eelgrass is only present in water down to 20 ft (6 m) MLLW, which is shallower than the project area. The pile replacement activity would occur in water depths of 50 to 60 ft (15.2 to 18.3 m) relative to MLLW. Red and green algae are present nearby the pile locations, but in low densities due to the inherent light limitation at the deepwater depths at the project area, limiting potential impacts. Brown algae, including understory kelp, are also distributed outside of the project area. Therefore, effects to macroalgae and eelgrass from changes in water quality during construction would be minimal and would not affect the overall health or distribution of marine vegetation near the project area.

Direct impacts to marine vegetation during the Proposed Action include direct removal through anchor drag, spuds, and removal of deteriorating wharf components. Any vegetative growth found on existing piles would be removed when those piles are extracted from the water. However, because marine vegetation is distributed outside of the project area, the overall health and abundance of macroalgae and eelgrass would not be compromised. The Navy concludes no significant impacts to marine vegetation would occur with the implementation of the Proposed Action.

Benthic Invertebrates

Implementation of the Proposed Action would include installation of four 30-inch diameter concrete filled steel pipe piles. In addition, four existing, 24-inch diameter concrete piles would be removed at the mudline by a pneumatic chipping hammer. Additionally, the construction of pile caps, installation of sled mounted passive cathodic protection systems, repair of the concrete wetwell, and recoating of the tops piles and mooring fittings would occur.

There would be some direct mortality of less motile benthic organisms from substrate disturbance and removal of piles colonized by invertebrates. Minimal impacts to habitat and benthic organisms are likely to result from turbidity caused by driving and removing barge anchors, spuds, and removal and installation of the 4 piles. Impacts would be minor in scale and temporary in nature. Benthic organisms, particularly annelids, are very resilient to habitat disturbance and are likely to recover to pre-disturbance levels within two years or less (CH2M Hill, 1995; Parametrix, 1994 & 1999; Anchor Environmental, 2002; Romberg, 2005).

Along with the pile removal and installation, work above water would be conducted on the wharf. This work would require the use of heavy machinery such as concrete saws. All materials removed from the existing wharf would be collected with a debris curtain/shield and disposed of. As a result, the bottom sediment and the benthic invertebrates living within that sediment would not be adversely impacted from these activities.

Overall, the removal and the installation of piles would result in a negligible change to the existing benthic invertebrate habitat beneath the existing EHW-1 wharf and superstructure. The Navy concludes no significant impacts to benthic invertebrates would occur with the implementation of the Proposed Action.

Non-ESA Listed Marine Fish

Construction activity associated with the project 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 in the vicinity of EHW-1. The most significant underwater noise potentially affecting listed species would be from impact pile driving of the 4 steel piles. To reduce potential impacts to ESA-listed species, the piles would first be driven using a vibratory pile driver until either the pile hits refusal, necessitating an impact hammer to reach required depth, or depth is achieved with only impact proofing necessary to verify the structural capacity of the piles. Since vibratory pile drivers typically generate noise levels from 10 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 vibratory pile driving (WSDOT, 2012). With the use of vibratory driver as the primary means of installation, estimates of impact driving durations would range from several minutes to proof piles to up to approximately 45 minutes to fully drive a pile. Steel impact pile driving is estimated to occur from approximately 36 minutes to a maximum of 3 hours over the entire project duration. Because piles have been installed with vibratory installation during prior repair projects at the EHW-1 structure, fully driving piles with an impact hammer is not anticipated. Thus, 3-hours of impact driving are unlikely. Impact driving could be conducted all in one day or over a four day period (one pile proofed per day) with no more than 8 days of pile installation (vibratory and impact driving) anticipated.

To determine how far project noise would exceed the thresholds for fish, noise levels anticipated from installation of 30-inch steel piles were estimated and the Practical Spreading Loss model was used to calculate the expected noise propagation from both impact and vibratory pile driving (See Biological Assessment in Appendix B for detailed analysis). Table 3-9 lists calculated distances where pile driving noise is expected to exceed the thresholds or guidance values for fish from pile driving. Figures 3-1 and 3-2 illustrate representative views of the calculated extent and area of underwater noise propagation that exceeds the 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 likely to have minimal exposure to elevated noise levels. Other fish are resident to the area may not move away and thus would be exposed to the noise levels for the duration of the pile driving activity (Hastings and Popper, 2005).

During impact pile driving, a bubble curtain would be used to attenuate noise. In addition, the bubble curtain would be turned on prior to initiation of pile strikes in an effort to flush fish away from the injury zone near the pile where sound pressure levels are loudest. All pile driving activities would be conducted from July 16 through January 15 to reduce potential impacts to juvenile salmon and steelhead. NAVBASE Kitsap Bangor fish surveys in the 1970s and 2005 to 2008 indicate that greater than 95 percent of the juvenile salmonids along the NAVBASE Bangor shoreline occur from February 16 through July (Schreiner et al., 1977; Salo et al., 1980; Bax, 1983; SAIC, 2006; Bhuthimethee et al., 2009a/2009b).

Sediment and turbidity in the water column would occur during pile driving and anchoring of barges creating temporary and localized disturbance to water quality from resuspension of sediments. Suspended sediments are anticipated to settle back down to the seafloor shortly after pile driving commences. Water quality impacts would be short-term and localized and would not result in significant long-term impacts to fish that may be present in the area at the time of construction.

With implementation of BMPs and minimization measures described in Section 2.4, no significant impacts to marine fish are anticipated with implementation of the Proposed Action.

Table 3-9. Distances From Piles Where Noise Exceeds Fish Thresholds and Guidance

Type of Pile Driving	Distance to Injury Threshold (meters) Area Encompassed (square km)			Distance to Behavioral Disturbance Threshold (meters)
	206 dB peak re 1 μPa	187 dB Cumulative SEL re 1 μPa^2 sec[1] for a fish ≥ 2 g	183 dB Cumulative SEL re 1 μPa^2 sec for fish < 2 g	150 dB re 1 μPa rms
Impact	14	399	736	2,929
Vibratory	n/a	n/a	n/a	117

[1]Cumulative Sound Exposure Level (SEL) assumes 2,000 impact pile strikes per day

Notes: Practical spreading loss model (15 log R) used for calculations and 8 dB of attenuation assumed from bubble curtain. Effective quiet range for SEL impact with noise attenuator is 736 meters. Underwater noise thresholds are taken from Fisheries Hydroacoustic Working Group (2008); The underwater noise guideline for behavior is taken from Hastings (2002)

dB = decibel; g = gram; RMS = root-mean-square; SEL = Sound Exposure Level; n/a = not applicable

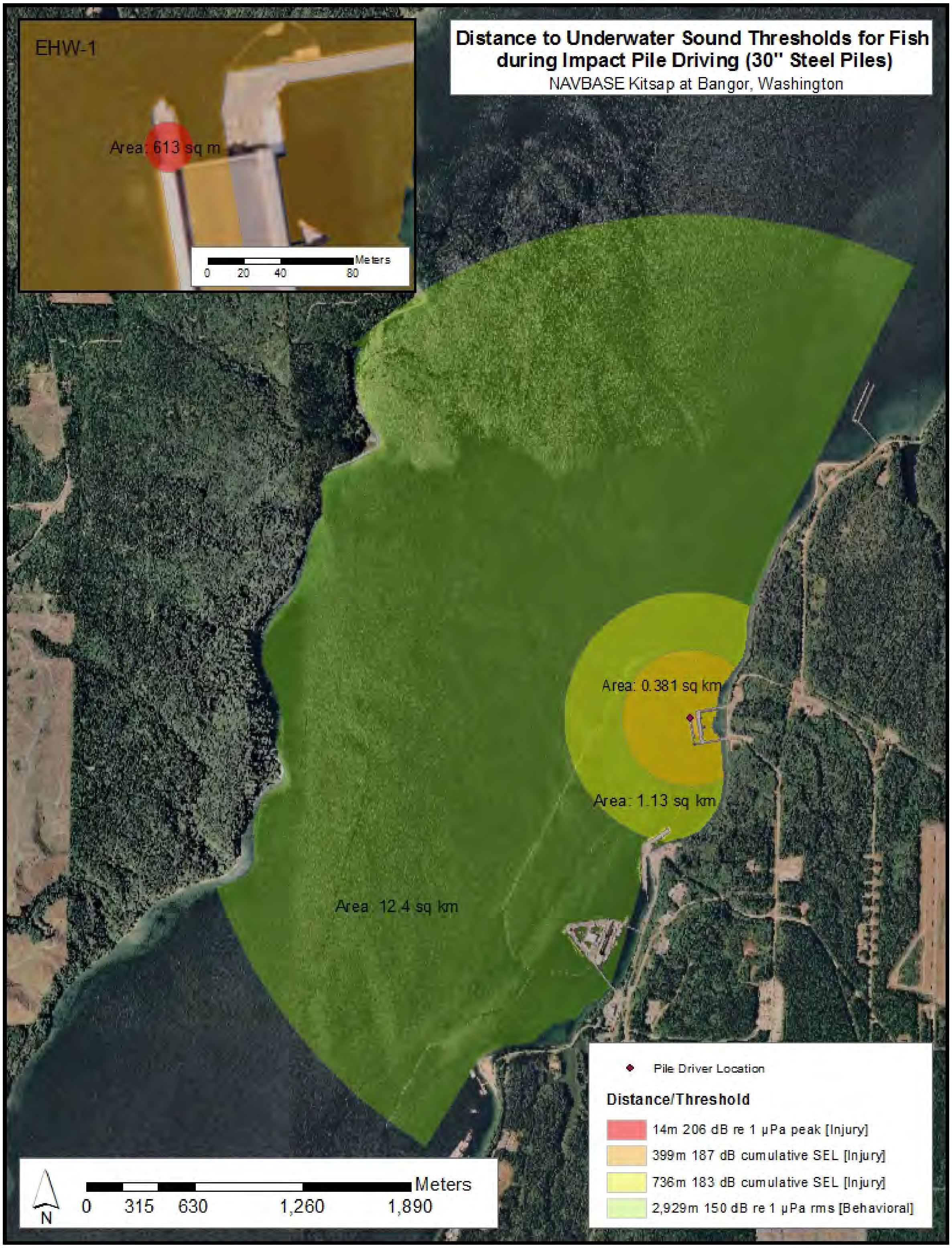

Figure 3-1. Distance to Underwater Sound Thresholds for Fish during Impact Pile Driving (30-inch steel piles)

Figure 3-2. Distance to Underwater Sound Threshold for Fish during Vibratory Pile Driving (30-inch steel piles)

Special-Status Species

ESA-Listed Species and Critical Habitat

Puget Sound Chinook Salmon ESU, Puget Sound Steelhead DPS, and Hood Canal Summer-run Chum Salmon ESU

Pile installation would be conducted during the in-water work window when juvenile salmon are least likely to be present; so exposure of juvenile salmon and steelhead to all in-water work would be minimized. Some juvenile salmon, resident Chinook salmon and returning adult ESA-listed salmon could potentially be present when pile driving would occur. Because larger juvenile salmon, adult salmon, and steelhead are not obligated to the nearshore and the fish are migratory, effects would be unlikely to result in injury levels from sound energy accumulation. Exposure of salmon or steelhead to temporary, sporadic and spatially limited increases in sediment and turbidity for brief periods of time during project repairs would be unlikely to affect salmon or steelhead that could be present. Therefore, the Navy concludes that the appropriate ESA effects determination for ESA-listed salmon and steelhead is "may affect, not likely to adversely affect". The Navy concludes no significant impacts to ESA-listed salmon or steelhead would occur with the implementation of the Proposed Action.

Only Puget Sound Chinook and Hood Canal Summer-run chum salmon have critical habitat designated within northern Hood Canal where NAVBASE Kitsap Bangor is located. However, NAVBASE Kitsap Bangor is excluded from critical habitat designation for these two species by federal law (70 FR 52630). As a result, no Puget Sound Chinook salmon or Hood Canal summer-run chum salmon critical habitat occurs in the immediate vicinity of the project area. However, the closest critical habitat occurs on the west side of Hood Canal, to the north of the base boundary, and to the south of the base boundary (approximately 1,100 m) where noise generated from impact pile driving (most noise-producing activity) may cause temporary behavioral disturbance to these species using those critical habitat areas. Because the in-water work would be conducted when these ESA-listed species are least likely to be present, and the noise that would reach critical habitat would be at a level to only result in behavioral disturbance, the Navy concludes that an effects determination of "may affect, not likely to adversely affect" Puget Sound Chinook salmon and Hood Canal summer-run chum salmon critical habitat is appropriate. The Navy concludes no significant impacts to designated critical habitat would occur with the implementation of the Proposed Action.

Bull Trout

Bull trout from the Skokomish River have not been documented migrating into marine waters. Multiple surveys along the NAVBASE Bangor waterfront have not documented bull trout. If bull trout were to occur in Hood Canal (from other river systems outside Hood Canal), project in-water work would occur during the July 16 through January 15 period when bull trout are least likely to be present. Therefore, exposure of bull trout to temporary, sporadic and spatially limited increases in sediment and turbidity for brief periods of time or temporary increases in noise levels during project repairs would be unlikely. Therefore, the Navy concludes that the appropriate ESA effects determination for bull trout is "may affect, not likely to adversely affect". The Navy concludes no significant impacts to bull trout would occur with the implementation of the Proposed Action.

Puget Sound Boccacio Rockfish DPS, Puget Sound Canary Rockfish DPS, and Puget Sound Yelloweye Rockfish DPS

Juvenile rockfish could potentially be present in the project area because there is eelgrass and some kelp present in the project vicinity. Deepwater habitats with structural complexity used by adult rockfish do not occur near the injury zone calculated for impact pile driving. Based on the intermittent nature of impact pile driving and short-duration (3hours or less), the Navy concludes that the appropriate ESA effects determination for ESA-listed rockfish is "may affect, not likely to adversely affect". The Navy concludes no significant impacts to ESA-listed rockfish would occur with the implementation of the Proposed Action.

All three ESA-listed rockfish species have critical habitat designated within northern Hood Canal where NAVBASE Kitsap Bangor is located. However, NAVBASE Kitsap Bangor is excluded from critical habitat designation for these three species by federal law (79 FR 68042).

Humpback Whale

Humpback whales only occasionally occur in Puget Sound and have only been documented in Hood Canal twice; therefore, exposure during the time when pile driving would occur is considered extremely unlikely. Therefore, based on their lack of presence and the limited amount of pile driving, exposure of humpback whales to project activities is highly unlikely to occur. Additionally, if humpback whales were present they would be unlikely to be within the range of water quality changes or construction disturbance, which would occur within the Port Security Barrier, where cetaceans have never been documented. Based on the absence of any regular occurrence of humpbacks adjacent to or within the vicinity of the project site, no more than 8 days estimated for pile driving, and implementation of marine mammal monitoring, no impacts to humpback whales are anticipated with implementation of the Proposed Action. The Navy concludes that the appropriate ESA effects determination for humpback whale is "may affect, not likely to adversely affect."

Marbled Murrelet

Like the fish injury thresholds, 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 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) 208 dB SEL cumulative. The onset of auditory injury is defined as the loss of hair cells due to impulsive acoustic overexposure. 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.

The distances to the auditory threshold were calculated using the same methods previously described for fish (for a detailed analysis also see Appendix B). To be conservative, the Navy carried out the noise exposure analysis assuming that pile driving would occur over 4 days and each day would require the maximum number of pile driving strikes (e.g., 2,000). Based on the analysis, it is estimated that marbled murrelets could be exposed to injurious sound pressure levels if they were within 40 meters of a 30-inch pile during impact pile driving. Since the cumulative SEL formula takes into account all impact pile strikes within a 24-hour period, this areas 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 would be smaller and would only gradually increase out to a distance of 40 meters after all strikes have been completed. In order to ensure marbled murrelets would not be exposed to injurious sound pressure levels, the Navy intends to visually monitor a 50-meter radius from impact driven piles (see Appendix B for the monitoring plan). Should marbled murrelets approach or enter the injury zone, all impact pile driving would cease until they have left the area. Additionally, the wharf is located within the Port Security Barrier, which experiences frequent routine vessel traffic. To further protect marbled murrelets, all pile driving would begin two hours after sunrise and end two hours before sunset to minimize effects to foraging marbled murrelets during the nesting season. All impact pile driving would occur with the use of a noise attenuation device.

Airborne noise generated by pile driving could potentially disturb marbled murrelets or affect foraging behavior and efficiency through masking of vocalizations between birds because murrelets forage in pairs (SAIC, 2012). The USFWS has issued guidance for marbled murrelet communication masking as a result of impact pile driving. The distance to the marbled murrelet airborne masking threshold is set at 42 meters for impact driving of piles 30-inches (Figure 3-3). All other construction noise associated with the project is anticipated to be at the level of existing waterfront operations and not expected to result in masking. As noted above, the U-shaped configuration of the covered structure limits the area where marbled murrelets would be expected to occur, so the area is effectively smaller than 42 meters.

Because visual monitoring of marbled murrelets would occur out to 50 meters during impact pile driving and impact pile driving would cease if marbled murrelets are observed at or within this distance, measureable effects to foraging due to potential masking effects are not anticipated. The Navy concludes that the appropriate ESA effects determination for marbled murrelets is "may affect, not likely to adversely affect." With the implementation of minimization measures listed, no significant impacts to marbled murrelets would occur with the implementation of the Proposed Action.

The Navy has completed informal consultations under the ESA with the USFWS (January 7, 2015) and NMFS (January 8, 2015). With one exception, USFWS and NMFS concurred with the Navy's findings of "may effect, not likely to adversely affect' for the species and critical habitats discussed above. For the affects to the humpback whale, while the Navy concluded with a finding of "may affect, not likely to adversely affect", NMFS determined the Proposed Action would have "no effect" on this species. Detailed analysis can be found in the BA (See Appendix B).

<u>Bald Eagle</u>

The only project activity identified that would affect bald eagles was noise produced from impact pile driving. Noise levels from pile driving would be above background levels that occur along the waterfront on a daily basis, which could disturb foraging birds. However, because there are no bald eagle nests near the project, forage concentration areas, or communal roosts, the Proposed Action would not have a significant impact on bald eagles. Noise generated during impact pile driving would be expected to attenuate down to approximately 60 dBA near K/B spit and would not effect nesting activity in that area. If an active nest is discovered prior to project construction that would be impacted from project construction, the Navy will consult with the USFWS to ensure compliance with the Bald and Golden Eagle Protection Act. With the lack of the nests, communal roosts, or forage concentration areas near the project site and the only 8 day

Figure 3-3. Distance Masking Thresholds for Marbled Murrelet during Impact Pile Driving (30-inch steel piles)

duration of pile driving, no significant impacts to bald eagles would occur with the implementation of the Proposed Action.

Marine Mammals (Non-ESA Listed Marine Mammals)

The effects of pile driving noise on marine mammals are dependent 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. Impacts to marine mammals from pile driving activities are expected to result primarily from acoustic pathways. As such, 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.

In order to minimize underwater noise impacts on marine species, vibratory pile driving will be the primary method used to install new steel piles. An impact hammer may be used if substrate conditions prevent the advancement of piles to the required depth or to verify the load bearing capacity. An air bubble curtain or other noise-attenuating device will be used to reduce noise levels during impact driving. Marine mammal monitoring will be conducted during all pile driving, and work will shut down if marine mammals come within distances (10 meters for pinnipeds and 29 meters for cetaceans) where injury could potentially occur. A maximum of 8 days of pile driving during one in-water work season (July 16, 2015 through January 15, 2016) will be required for pile installation. Table 3-10 presents the calculated distance to and areas encompassed by the underwater marine mammal thresholds during pile driving 30-inch piles under the Proposed Action. The predicted area exceeding the threshold assumes a field free of obstruction, which is unrealistic, however, because Hood Canal does not represent open water conditions (free field) and therefore, sounds would attenuate as they encountered land masses or bends in the canal. The actual distance to the behavioral disturbance thresholds for pile driving may be shorter than the calculated distance due to the irregular contour of the waterfront, the narrowness of the canal, and the maximum fetch (furthest distance sound waves travel without obstruction [i.e., line of site]) at the project area. These distances are presented in Table 3-10. Figure 3-4 graphically depicts the representative areas of each underwater sound threshold for marine mammals (seals and sea lions [pinnipeds], porpoises and whales [cetaceans]) in the vicinity of the project area.

Table 3-10. Calculated Radial Distance(s) to Underwater Marine Mammal Pile Driving Noise Thresholds and Area Encompassed within Threshold Distance

Pile Size	***Type of Pile Driving***	***Injury Sea Lions and Seals***	***Injury Porpoises and Whales***	***Behavioral Disturbance from Impulse Noise***	***Behavioral Disturbance from Continuous Noise***
		190 dB rms	***180 dB rms***	***160 dB rms***	***120 dB rms***
30-inch	Impact	6 m 113 sq m	29 m 2,630 sq m	631 m 0.9 sq km	N/A
	Vibratory	N/A	N/A	N/A	6.3 km adjusted max* 32.4 sq km

Notes:
dB = decibel; All sound levels expressed in dB re 1 μPa rms.
Practical spreading loss (15 log, or 4.5 dB per doubling of distanced) used for calculations. Sound pressure levels used for calculations were: 195 dB rms re 1 μPa @ 10m for impact and 166 dB rms re1 μPa @ 10 meters for vibratory.
8 db of attenuation was applied to source sound pressure levels.

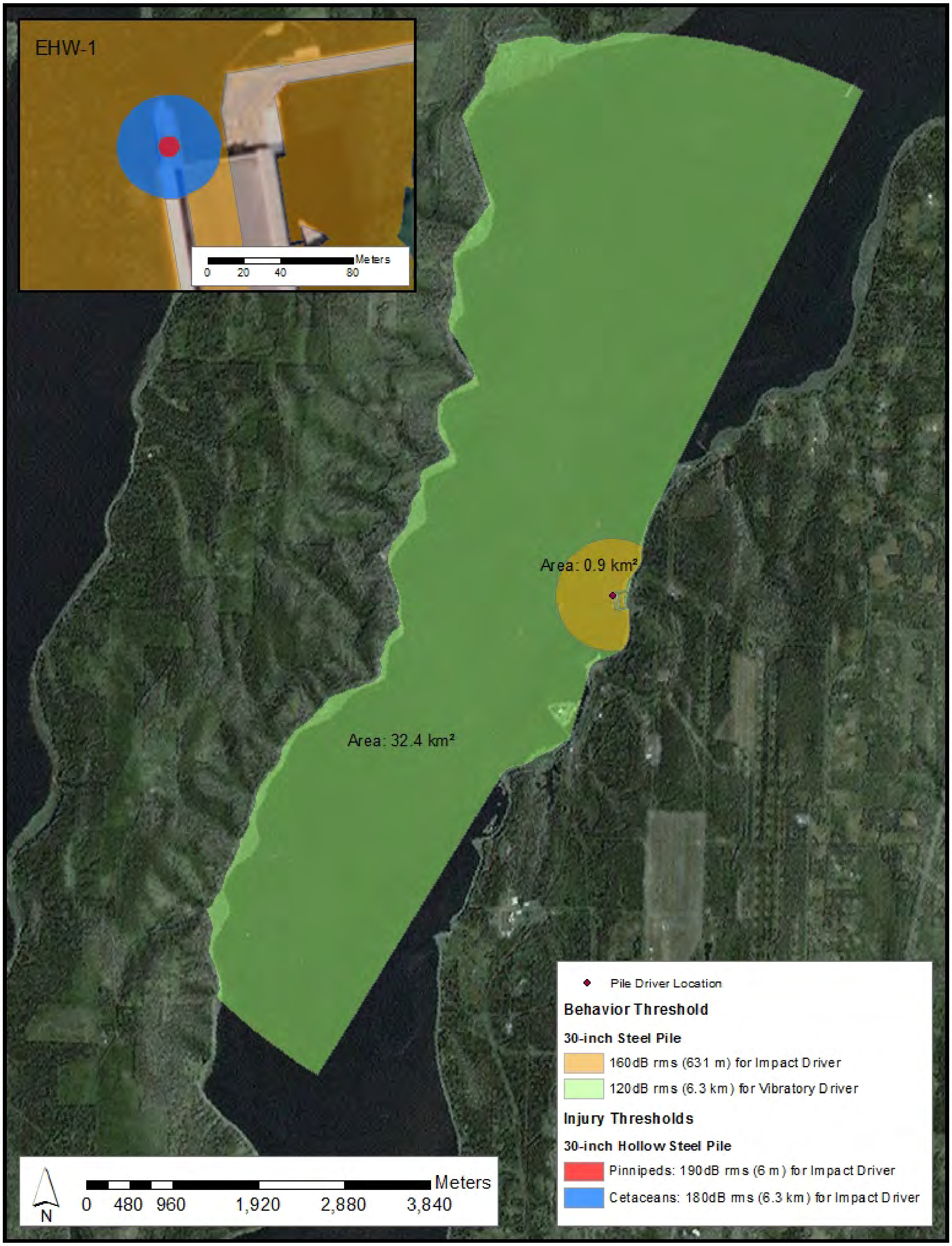

Figure 3-4. Representative View of Affected Areas for Marine Mammals due to Underwater Pile Driving Noise

The Navy is applying for an Incidental Harassment Authorization under the MMPA (Navy 2014). A required element of the application is prediction of the number of potential exposures of marine mammals to noise levels above the thresholds presented in Section 3.4.3. Predicted exposures are summarized in Table 3-11 (Navy 2014). A final Incidental Harassment Authorization is anticipated from NMFS prior to the commencement of in-water pile driving. The authorization is anticipated to span the July 16, 2015 through January 15, 2016 in water work period for pile driving.

Table 3–11. Number of Potential Exposures of Marine Mammals to Behavioral Harassment Thresholds

Species	Total
Transient killer whale	12
Harbor porpoise	20
Steller sea lion	48
California sea lion	568
Harbor seal	2,056
Total	2,704

Potential impacts to marine species can be caused by physiological responses to both the type and strength of the acoustic signature (Southall et al., 2007). 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 impact pile driving can range from brief behavioral disturbance, tactile perception, and physical discomfort, to slight injury of the internal organs and the auditory system, and possible death of the animal (Yelverton et al., 1973; O'Keefe and Young, 1984; Ketten, 1995; U.S. Department of the Navy, 2001).

To avoid any injurious effects, the Navy would visually monitor zones where injurious effects have been modeled and would shut-down impact pile driving if marine mammals are swimming toward or within the zones. A discussion of the anticipated project effects to each species follows.

California Sea Lion, Steller Sea Lion, and Harbor Seal

The Navy analyzed the potential for seals and sea lions hauled out or swimming at the surface to be exposed to airborne sound pressure levels that could result in behavioral harassment. The appropriate airborne noise thresholds for behavioral harassment for all pinnipeds, except harbor seals, is 100 dB rms re 20 µPa (unweighted) and for harbor seals is 90 dB rms re 20 µPa (unweighted) (see Table 3-10). Construction noise behaves as point-source and, thus, propagates in a spherical manner with a 6 dB decrease in sound pressure level over water ("hard-site" condition) per doubling of distance (WSDOT, 2014). A spherical spreading loss model was used to estimate the distance to the 100 dB and 90 dB rms re 20 µPa (unweighted) airborne thresholds. The calculated and measured distances to the pinniped airborne noise thresholds are shown in Table 3-12. Measured distances to the pinniped thresholds were also available for 30-inch piles from monitoring during the Test Pile Program (Illingworth & Rodkin, 2012). These distances are also presented in Table 3-10. The extent of airborne noise from impact pile driving extends the farthest. Because these distances are smaller than those to the behavioral threshold, a separate analysis of Level B take was not conducted for animals in the airborne zone. Animals in the airborne zone would already have been exposed within behavioral disturbance underwater zone.

If present in the affected area during installation of the 4 piles, California sea lions, Steller sea lions, and harbor seals may be exposed to noise from pile driving that could result in disturbance. Because marine mammal monitoring would occur, they would not be exposed to injurious levels of noise from impact pile driving. Additionally, impact installation is only anticipated to occur for the final few feet of driving for the 4 replacement piles. No effects to sea lions, harbor seals, or their prey base are anticipated from the short duration, temporary changes to water quality. Therefore, the Proposed Action would not have a significant impact on sea lions or harbor seals.

Table 3-12. Calculated and Measured Distances to Pinniped Behavioral Airborne Noise Thresholds

Installation Method	Harbor Seal Threshold Distance Threshold = 90 dB rms	Steller Sea lions and California Sea Lions Threshold Distance Thresholds = 100 dB RMS
Impact	189 m	60 m
Vibratory	Calculated= 27 m Measured mean = 33 m (51 m max)	Calculated = 8 m Measured mean = 10 m (16 m max)

Notes: Calculated values from Appendix B. Measured values reported in HDR, 2012 from Bangor Test Pile Program.

Harbor Porpoise

In Washington inland waters, harbor porpoises are most abundant in the Strait of Juan de Fuca, San Juan Island area, and Admiralty Inlet. However, harbor porpoises may be present in Puget Sound year-round typically in groups of 1 to 5 individuals. Harbor porpoises are not likely to be within the Port Security Barrier where most of the 631 m zone above the behavioral threshold for impact pile driving would occur. If harbor porpoises are present during pile driving, only very limited exposure of harbor porpoises to behavioral disturbance from pile driving noise is anticipated as animals transit the area. Harbor porpoise are not expected within injurious exposure distances to pile driving because this area is primarily within the Port Security Barrier and marine mammal monitoring would occur. With implementation of a noise attenuation device, marine mammal monitoring and shut down zones, and the short duration of in-water work (8 days of pile driving), no significant impacts to harbor porpoise would result with implementation of the Proposed Action.

Transient Killer Whale

Transient killer whales have occurred twice in Hood Canal since 2003 with the last occurrence 9 years ago in 2005. Because the extent of noise from impact pile driving is calculated to only extend 631 m from pile driving, most of which is within the Waterfront Restricted Area, and impact pile driving is likely to occur for less than 3 hours, it is unlikely killer whales would be exposed to impact pile driving noise. If transient killer whales were present, they could encounter noise levels above the behavioral disturbance threshold. No impacts to killer whales or their prey based are anticipated from the short duration, temporary changes to water quality. The Navy has applied for an incidental harassment authorization for potential behavioral harassment of this species. Therefore, no significant impacts to West Coast transient killer whales would result with implementation of the Proposed Action.

Essential Fish Habitat

As was discussed for marine fish in general and ESA-listed fish, the primary impact during the proposed EHW-1 pile replacement and maintenance project would be the level of increased sound energy in marine fish habitat. This increased sound would affect the water column, which has been designated as EFH for numerous species (see Appendix B for EFH assessment for in depth species list and noise analysis). This impact to the water column EFH in turn may result in disturbance, avoidance depending on fish species, size, orientation, received noise level and type of noise. As was discussed above for marine fish and ESA-listed species, impact pile driving has resulted in injurious effects and fish kills. To avoid injurious effects and fish kills from impact pile driving, the Navy has adopted minimization measures to reduce the level of noise in the water column. The primary minimization measure is to install piles with a vibratory drive and only use an impact hammer the last few feet to verify the load bearing capacity of the structure. To dampen the amplitude of the sound pressure produced by impact pile driving, a sound attenuation device, such as a bubble curtain would be utilized during all impact hammering. Prior to initiation of the impact hammer, the bubble curtain would be turned on to help flush fish from the immediate area surrounding the pile where sound pressure levels are highest. Furthermore, the use of impact hammers is anticipated to be used for a few minutes to less than 45 minutes per pile. The longer duration of pile installation time would only be necessary if a hard substrate is encountered during vibratory driving. Based on past projects at EHW-1, impact driving to advance piles through difficult substrate has not been necessary. In addition to these measures, all work would be limited to the period from July 16 through January 15 when juvenile salmon are not typically present within the vicinity of the proposed project area. These measures should greatly reduce the impact of the noise levels as a result of the pile driving.

The removal and installation of the piles and anchoring would have a localized impact on marine vegetation and the benthic epifauna/infauna within the immediate vicinity of each pile or anchoring site. While some disruption to marine vegetation and benthic communities is unavoidable as a result of the replacement of the piles, these impacts would be temporary in duration, with a minimal and localized zone of influence. Areas of disruption are expected to recover to pre-disruption levels within a few growing seasons.

Because of the relatively high water quality and low levels of contaminants contained within the sediments at NAVBASE Kitsap Bangor near the project site, no impact to water quality or sediment quality is expected beyond minor, temporary disturbance during ground disturbing activities.

However, because sound levels from pile driving would ensonify the water column at levels high enough to injure or kill fish, the Navy has determined the project may adversely affect designated EFH. Adverse effects would be temporary and would be expected only during impact pile installation of the four replacement piles in the area where noise is above the onset of injury threshold. The Navy completed consultation under the MSA with NMFS on 8 January 2015. NMFS concurred that the Navy's protective measures were sufficient to offset adverse effects to EFH.

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 Action.

3.4.3.2 No-Action Alternative

Under the No-Action Alternative, the proposed pile replacement and maintenance activities would not occur and there would be no change to baseline biological resources. Therefore, there would be no significant impacts to biological resources from implementation of the No-Action Alternative.

3.5 CULTURAL RESOURCES

Cultural resources consist of prehistoric and historic districts, sites, buildings, landscapes, structures, artifacts, or any other physical evidence of human activity considered important to a culture, subculture, or community for scientific, traditional, religious, or other reasons. Cultural resources can be divided into three major categories: archaeological resources, architectural resources, and traditional cultural properties.

Archaeological Resources (prehistoric and historic), are locations where human activity measurably altered the earth or left deposits of physical remains (e.g. stone flakes, arrowheads, or bottles). Archaeological resources can include campsites, trails, dumps, habitation sites, logging camps, cooking hearths, tool fragments, trash piles, and a variety of other features.

Architectural Resources include standing buildings, dams, canals, bridges, cemeteries, landscapes, and other built-environment resources of historic or aesthetic significance.

Traditional Cultural Properties can include archaeological resources, buildings, neighborhoods, prominent topographic features, and natural resources that Native Americans and other ethnic groups consider essential for the continuance of traditional cultures.

Regulatory Overview

Per Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended, federal agencies must consider what affects its undertakings may have on historic properties that fall within their undertaking's area of potential effects. Guidance to assist federal agencies in meeting its Section 106 obligations is set forth in 36 CFR Part 800, *Procedures for Protection of Historic Properties,* and OPNAVINST 5090.1D. To be considered a historic property, archaeological or architectural resources must meet one or more criteria as defined in 36 CFR 60.4 for inclusion on the National Register of Historic Places (NRHP). These criteria include association with an important event, association with a famous person, properties that embody the distinctive characteristics of a type, period, or method of construction, or that have yielded, or may be likely to yield, information important in prehistory or history. Resources must also possess integrity (i.e., their important historic features must still be present and recognizable). Cultural resources generally must be more than 50 years old to be considered for eligibility for listing in the NRHP. However, more recent structures, such as Cold War-era military buildings, may warrant protection if they have achieved "exceptionally important" within the past 50 years.

3.5.1 Affected Environment

The Area of Potential Effects (APE) for cultural resources is the geographic area or areas within which an undertaking (project, activity, program or practice) may cause changes in the character or use of any historic properties present. The APE is influenced by the scale and nature of the undertaking and may be different for different kinds of effects caused by the undertaking. The APE for Proposed Action is the project work area, as shown in Figure 2-1.

Archaeological Resources

An archaeological survey conducted in 2010 of the portion of the NAVBASE Kitsap Bangor waterfront in the area of EHW-1 and EHW-2 identified no prehistoric or ethno historic cultural materials or sites (Grant et al, 2010). Because of the nature and extent of modern marine activity within the APE, it is unlikely that unrecorded submerged resources exist along the shoreline. No submerged properties or anomalies have been encountered by diver, remotely operated vehicle, or remote sensing surveys near NAVBASE Kitsap Bangor. NOAA nautical charts show no submerged ships or shipwrecks in the vicinity of NAVBASE Kitsap Bangor (NOAA, 2007).

Architectural Resources

The Navy conducted an architectural survey in 2010 of the portion of NAVBASE Kitsap Bangor waterfront within the APE of the proposed EHW-2. Based on that survey, the Navy determined that EHW-1, built in 1978, is eligible for listing on the NRHP based on its Cold War context. This determination was based on the facility meeting Criteria A, properties that are associated with events that have made a significant contribution to the broad patterns of our history; and, Criteria C, properties that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction (Sackett, 2010). No other architectural resources determined eligible for inclusion in the NRHP were identified in the APE.

Traditional Cultural Properties

Cultural resources may also include TCPs (National Park Service, 1998) and Properties of Traditional Religious and Cultural Importance to an Indian Tribe (PTRCI) (NHPA Section 101(d)(6)(A) and 36 CFR 800.4). TCPs are eligible for listing in the NRHP owing to their "association with cultural practices or beliefs of a living community that (a) are rooted in that community's history and (b) are important in maintaining and continuing cultural identity of the community." TCPs may be identified by American Indians or other living communities. PTRCIs may be eligible for the NRHP if they meet NRHP criteria (36 CFR 800.16(l)); even if not eligible for the NRHP, this resource type may be afforded protection by other laws, regulations, or executive orders. For any cultural resource to be NRHP eligible, it must be a property (i.e., a physical place) in addition to meeting other eligibility criteria. To date no TCPs or PTRCIs have been identified in or adjacent to the APE for the Proposed Action.

3.5.2 Environmental Consequences

In accordance with 36 CFR 800.5 an action results in an adverse effect to a NRHP-eligible resource when it alters the resource characteristics that qualify it for inclusion in the NRHP. An adverse effect occurs when the undertaking directly or indirectly alters any of these characteristics in a manner that would diminish the property's integrity. Examples of direct impacts can include physical destruction, damage, or alteration of a resource; alteration of the character of the surrounding environment that contributes to the resource's eligibility; introduction of visual, audible, or atmospheric intrusions out of character with the resource or its setting; and neglect of the resource resulting in its deterioration or destruction; or sale of the property.

Impacts to cultural resources would be considered significant if the Proposed Action resulted in adverse effects to NRHP eligible resources that could not be addressed through stipulations contained in a memorandum of agreement with the State Historic Preservation Office (SHPO). Potential impacts to cultural resources as a result of the Proposed Action or alternatives are described below.

3.5.2.1 Proposed Action

Implementation of the Proposed Action would not adversely affect any known NRHP-eligible archaeological sites. Construction activities would take place in previously disturbed underwater areas. Although there are no known or expected underwater cultural resources, if there were a discovery of archaeological resources during construction, the Navy would stop work in the area of discovery and evaluate the eligibility and effects to the discovered resources through consultation with the SHPO, the Tribes, and other interested parties in accordance with 36 CFR Part 800. Similarly, if American Indian human remains, funerary items, sacred objects, or items of cultural patrimony are encountered, the Navy would stop work in the immediate area of discovery and comply with the Native American Graves and Repatriation Act.

EHW-1, which is an architectural resource eligible for inclusion in the NRHP, is an imposing structure located along the NAVBASE Kitsap Bangor waterfront. Its public view is from Hood Canal and the main defining features of the structure are its wharf and super-structure. Pilings that form its foundation for the most part are below waterline and not visible to the public, with the exception when small portions exposed at low-tide. Implementation of the Proposed Action would replace four deteriorated 24-inch concrete piles with four 30-inch concrete filled steel piles and conduct necessary maintenance including deck repair, wetwell repair, and pilings and mooring fittings recoating. Although the pattern of the proposed pile replacements change from the original footprint of the extant piles, it does not adversely affect the overall characteristics that makes the property eligible for inclusion in the NRHP.

The Navy has determined that implementation of the Proposed Action would not adversely affect properties eligible for inclusion on the NRHP. The Navy initiated consultation with the Skokomish Tribe, Port Gamble S'Klallam Tribe, Jamestown S'Klallam Tribe, Lower Elwha Klallam Tribe, and Suquamish Tribe on August 22, 2014, requesting concurrence with the APE and determination of effects under Section 106 of the NHPA (Appendix A).

The Navy initiated consultation with the SHPO on August 22, 2014 (Appendix A). On September 10, 2014, the SHPO concurred with the Navy's determination that the project, as proposed, would not adversely affect properties eligible for inclusion on the NRHP (Appendix A).

There are no known NRHP-eligible archaeological resources or TCPs within the APE, and the Proposed Action would not adversely affect the NRHP-eligible EHW-1. Therefore, no significant impacts to cultural resources would occur with implementation of the Proposed Action.

3.5.2.2 No-Action Alternative

Under the No-Action Alternative, the proposed pile replacement and maintenance activities would not occur and there would be no change to cultural resources. Therefore, no significant impacts to cultural resources would occur with implementation of the No-Action Alternative.

3.6 AMERICAN INDIAN TRADITIONAL RESOURCES

3.6.1 Regulatory Overview

As required by EO 13175, *Consultation and Coordination with Indian Tribal Governments,* the Navy has implemented a policy for consultation with federally recognized Indian Tribes, on actions with the potential to significantly impact protected tribal resources, tribal rights, or Indian lands. This policy, included in Secretary of the Navy Instruction 11010.14A and Commander, Navy Region Northwest Instruction 11010.14, describes the Navy's process and responsibilities during consultation. Federally recognized American Indian Tribes that have adjudicated tribal treaty rights in Hood Canal that include the project area are: Skokomish, Port Gamble S'Klallam, Jamestown S'Klallam, Lower Elwha Klallam, and Suquamish Tribes.

The Skokomish, Port Gamble S'Klallam Tribe, Jamestown S'Klallam Tribe, Lower Elwha Klallam, and Suquamish Tribes are signatories to treaties with the United States. Treaties between American Indians and the United States are part of the supreme law of the land that the states and their officials are bound to observe. The Skokomish and S'Klallam Tribes are signatories to the Treaty of Point No Point signed on January 26, 1855. The Suquamish Tribe is a signatory to the Treaty of Point Elliot, signed on January 22, 1855. Both treaties provide:

> The right of taking fish at usual and accustomed grounds and stations is further secured to said Indians in common with all citizens of the Territory, and of erecting temporary houses for the purposes of curing, together with the privilege of hunting and gathering roots and berries on open and unclaimed lands. Provided, however, that they shall not take shell-fish from any beds staked or cultivated by citizens.

A federal court ruling in United States v. Washington (aka the Boldt Decision) established that Western Washington tribes who were parties to various treaties with the United States have a right of access to their "usual and accustomed fishing grounds and stations" and up to 50 percent of the fin and shellfish in the treaty area. The Skokomish have primary U&A rights in the project area. Under the Hood Canal Agreement between the Skokomish and S'Klallam Tribes, the S'Klallam Tribes also have fishing rights in the Hood Canal that include the project area. The Suquamish Tribe has secondary U&A in the project area. Secondary U&A means that the tribe cannot exercise their tribal treaty rights south of the Hood Canal Bridge (that includes the project area) without the express permission of the Skokomish Tribe. To date, that permission has not been granted.

3.6.2 Affected Environment

The Tribes have identified shellfish as resources located at NAVBASE Kitsap Bangor that are of particular traditional importance. In a cooperative agreement of 1997, signed between the Navy and the Skokomish, Port Gamble S'Klallam, Jamestown S'Klallam, and Lower Elwha Klallam Tribes, the parties agreed the signatory Tribes would have exclusive access to one Bangor beach for the purposes of shellfishing and the Navy would have the other beaches. This tribal beach (also known as Bangor Beach) is located approximately one mile south of the project area, and is separated from the project area by Marginal Wharf and Delta Pier. There are two commercial geoduck tracts located outside of the Naval Restricted Area in Hood Canal to the west of the Service Pier and north to K/B Dock, located at depths of 250 to 300 feet. The geoduck tracts along the portions of the waterfront and west of Bangor Beach are currently listed as inactive by the Department of Fish and Wildlife. Inactive is only an indication that the tracts are not being harvested in the current management year. Known fishing and shellfish harvest seasons within Hood Canal, as of March 2014, include:

- Dungeness Crab – Late July and March
- Commercial Geoduck – Mid-July through March
- Ling Cod – May through September

No tribal finfishing is permitted within the Naval Restricted Area.

3.6.3 Environmental Consequences

Impacts to Native American resources would be considered significant if there was a loss of access to exercise tribal treaty rights secured under treaties or a substantial reduction or degradation of harvestable marine resources.

3.6.3.1 Proposed Action

In accordance with Executive Order 13175 and DOD and Navy instructions, the Navy initiated government-to-government consultation regarding the Proposed Action and potential impacts to tribal treaty rights with the Skokomish, Port Gamble S'Klallam, Jamestown S'Klallam, Lower Elwha Klallam, and Suquamish Tribes in July 2012. Government-to-government consultation with the Tribes was concluded in February 2015. The Tribes expressed no objections to the Proposed Action.

Under the Proposed Action, access to the waterfront area would remain unchanged. Access to Bangor Beach (tribal fishing beach), commercial geoduck tracts located outside of the Naval Restricted Areas, and Dungeness crab fishing and finfishing located outside of the Naval Restricted Areas would not be impeded. The quantity of geoduck, finfish, and shellfish inventories would not be significantly impacted by project construction or indirect impacts of increased turbidity and sediment transport. Accordingly, impacts to American Indian traditional resources and tribal treaty rights would not be significant.

3.6.3.2 No-Action Alternative

Under the No-Action Alternative, the proposed pile replacement and maintenance activities would not occur and there would be no change to tribal resources, tribal rights, or Indian lands as a result of the Proposed Action. Therefore, no significant impacts to American Indian traditional resources would occur with implementation of the No-Action Alternative.

4 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 will 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 Proposed Action 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.

4.1 Past, Present, and Reasonably Foreseeable Projects

For purposes of this cumulative effects analysis, the ROI is NAVBASE Kitsap Bangor for all resources, except cultural resources and American Indian traditional resources (which use the NAVBASE Kitsap Bangor waterfront as the ROI). NAVBASE Kitsap Bangor is restricted from public access. The impacts associated with the Proposed Action are localized and would generally only contribute to cumulative impacts in the immediate vicinity of the project.

The Proposed Action consists of in-water work. Although nearby actions with only terrestrial impacts are noted in the past, present, future projects, they are included to establish the general baseline and are not discussed in the resource sections, as there is no cumulative effect related to the Proposed Action.

This cumulative impacts analysis depends on the availability of data and the relevance of effects of past, present, and future actions. Although certain data may be available for extensive periods in the past, 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 4-1 lists the past, present, and reasonably foreseeable future actions within the ROI that have had, continue to have, or would be expected to have some impact to the natural and human environment. The projects in this table are limited to those implemented in the last 5 years or those with ongoing contributions to environmental effects. Projects with measureable contributions to impacts within the ROI for a resource area were included in the cumulative analysis.

Table 4-1. Past, Present, and Reasonably Foreseeable Future Projects at NAVBASE Kitsap Bangor and the ROI

Project	***Project Description***	***Project Timeframe***		
		Past	***Present***	***Future***
Waterfront Operations	Waterfront operations include the overall integration of all port operations at the Bangor waterfront. Activities include vessel traffic movement and management, personnel clearance and tracking, and ingress/egress within the restricted areas. This is an ongoing action.	X	X	X
Waterfront Facilities Maintenance	Common maintenance activities include pressure washing of waterfront piers to remove bird fecal material, marine debris (i.e., clam and mussel shells) and foreign materials (i.e., dirt and algae). Maintenance area includes walkways and approaches to the piers. Other maintenance activities may involve repair of structures or facilities, as needed.	X	X	X
Navy Surface Warfare Center Carderock Division Detachment Bremerton Command Consolidation	Construction of in-water facilities included a new access pier (8,800 ft^2), pontoon (21,600 ft^2), associated pier mooring components and 102 new steel piles. Project components also included road improvements to Carlson Spit Access Road, a 23,000 ft^2 building, and the addition of 100 workers. The Pier provides location support to the Carderock Division for its missions.	X		
CSDS-5 Support Facilities	The Navy maintains and operates waterfront and shore-based support facilities for its Submarine Development Squadron Five Detachment on NAVBASE Kitsap Bangor. 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 16 new piles over a 3-week period.	X	X	X
Explosive Handling Wharf 1 (EHW-1) Maintenance	Maintenance over multiple years to replace deteriorated piles; the most recent phase installed 29 30-inch steel piles and was completed in 2012. Phased repair of this structure is expected to continue until 2024.	X		
Waterfront Restricted Area and Security Barriers	This project includes construction of enclave fencing for the entire NAVBASE Kitsap Bangor Waterfront Restricted Area and an associated parking lot. Project entails the removal of 55 acres of forest stands, 9 acres of non-forest vegetation, fill 1.8 acres of wetlands, and create 23 acres of impervious surfaces. Mitigation action would restore tidal influence to Cattail Lake, thereby increasing intertidal habitat and providing a benefit to the natural environment.		X	X
K/B Docks Pile Replacement	Replacement of 5 deteriorated timber piles with new timber piles at the K/B Docks is planned for 2015.			X
Relocate Floats to Delta Pier	Project would relocate existing floats from the Marginal Wharf to the Delta Pier at NAVBASE Kitsap Bangor. Project would replace an existing float at Delta Pier with two existing floats from Marginal Wharf. Additionally, eight new 30-inch concrete piles would be installed at Delta Pier, while six creosote piles would be removed and one 30-inch concrete pile would be installed at Marginal Wharf. Project is planned for 2015.			X

Table 4-1. Past, Present, and Reasonably Foreseeable Future Projects at NAVBASE Kitsap Bangor and the ROI

Project	***Project Description***	***Project Timeframe***		
		Past	***Present***	***Future***
Electromagnetic Measurement Range (EMMR)	The proposed project includes installation of sensor equipment, including an underwater instrument array, data/power cables, a pile-supported platform, an on shore navigation aid, and an upland monitoring system at the north end of NAVBASE Kitsap Bangor.			X
Service Pier Extension	Homeporting of two additional Seawolf-class Submarines at Bangor. Construction of an extension to the Service Pier at (33,000 ft^2), a new Pier Services and Compressor Building (2,100 ft^2) on the existing pier, upland Maintenance Support Facility (50,000 ft), and a 421-car parking lot with associated outdoor storage (4,000 ft^2). The project will be addressed in an EIS.			X
Waterfront Restricted Area Land-Water Interface	Objective is to provide security upgrades for the Waterfront Restricted Area by constructing two Waterfront Restricted Area Land-Water Interface barriers, which would connect both ends of the onshore Waterfront 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. This project will be addressed in an EIS.			X
Pile Repair and Replacement Program	Under the Pile Repair and Replacement Program, the Navy plans to repair or replace structurally unsound piles at various Navy installations in the Puget Sound areas over a five year period beginning July 2017. Pile repair and maintenance at NAVBASE Kitsap Bangor would include Service Pier, K/B Dock, Delta Pier, Marginal Wharf, EHW-1, EHW-2, and Magnetic Silencing Facility.			X

Table 4-1. Past, Present, and Reasonably Foreseeable Future Projects at NAVBASE Kitsap Bangor and the ROI

Project	*Project Description*	*Project Timeframe*		
		Past	*Present*	*Future*
Explosives Handling Wharf (EHW-2)	Construction and operation of a second EHW adjacent to the existing EHW. The main wharf will lie 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 will also be constructed. The first of three years of in-water construction began in the fall of 2012. The Navy has received the third IHA from NMFS and the final year of in-water construction will begin in July 2014. EHW-2 Mitigation To compensate for unavoidable impacts to aquatic resources and ensure no net loss of these resources, the Navy purchased credits from the Hood Canal In-Lieu Fee Program. To restore construction areas, the Navy will implement a re-vegetation 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 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, 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 4-1. Past, Present, and Reasonably Foreseeable Future Projects at NAVBASE Kitsap Bangor and the ROI

Project	***Project Description***	***Project Timeframe***		
		Past	***Present***	***Future***
Hood Canal Bedlands Restrictive Easement	The Navy has completed the purchase of a Restrictive Easement over State-owned aquatic bedlands from the Washington State Department of Natural Resources to ensure mission protection and viability of operations on Ranges and Military Operating Areas (MOAs) in Hood Canal associated with commands at Naval Base Kitsap. The restrictive easement extends along the west shore of Hood Canal from the Hood Canal Bridge south to the Hamma Hamma Delta and encompasses depths from -18 feet Mean Low Low Water (MLLW) to -70 feet MLLW for a total of 4804 acres. In addition to protecting the Navy's mission on MOAs, the easement provides new protections for sensitive marine ecosystems. Many high-value habitat areas occur in the area including eelgrass communities and geoduck tracts. All of the 4,804 acres of the easement area are designated critical habitat for ESA listed Salmonid species.		X	X
Modification of Magnetic Silencing Facility Pier	Construction of a berth for U.S. Coast Guard Blocking Vessels (BVs) at the existing Magnetic Silencing Facility Pier. The project includes: a. Installation of steel support structure in two locations, The support structure will be for two 10' x 40' open deck mooring camels, b. Installation of four double-bitts (mooring fittings) on the pier deck, c. Repair of approximately 25 piles: the tops of the piles would be replaced. No new piles would be installed, and no structure would be installed on the sea bottom.			X
Northwest Training Range Complex	A wide variety of military training activities are conducted in the W-237 operating area west of Washington, including training exercises in anti-air, anti-surface, and anti-submarine warfare; electronic combat exercises; mine countermeasures training; naval special warfare training; and various support operations. The Navy has developed policies and procedures to avoid harm and to minimize the effects of Navy training on terrestrial and marine species and habitats. This action involves activities at Floral Point, which is within the ROI for this cumulative analysis. The Navy prepared an EIS for this action; the Record of Decision was signed in October 2011.	X	X	X

Table 4-1. Past, Present, and Reasonably Foreseeable Future Projects at NAVBASE Kitsap Bangor and the ROI

Project	***Project Description***	***Project Timeframe***		
		Past	***Present***	***Future***
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 conducted as part of overhaul, modernization, maintenance and repair activities at Puget Sound Naval Shipyard in Bremerton, NAVBASE Kitsap Bangor and Naval Station Everett. Action will also reassess the environmental analyses of Navy at-sea training and testing activities contained in two previous EISs/OEISs and various environmental planning documents, and consolidate these analyses into a single environmental planning document. This reassessment will support reauthorization of permits under the Marine Mammal Protection Act and the Endangered Species Act. The two EIS/OEIS documents being consolidated are: • Northwest Training Range Complex EIS/OEIS, completed with community input in 2010. • Naval Sea Systems Command Naval Undersea Warfare Center Keyport Range Complex Extension EIS/OEIS, completed with community input in 2010.			X

Non-Navy Shoreline Development Projects

The shoreline of Hood Canal has been, and continues to be, subject to development by property owners. Over the past 5 years, an average of 15 shoreline development permit applications (i.e., Joint Aquatic Resources Permit Applications [JARPAs]) per year have been submitted by property owners along the shoreline of Hood Canal. The permitted actions, such as pier/dock construction, shoreline stabilization, stairways/beach access, shoreline construction, and submarine cable installation, are likely to continue within this region at the same pace (i.e., approximately 15 per year) over the next several years. Future general development in the Hood Canal watershed would increase impervious surface and affect vegetation and soils, with potential impacts to water quality of streams and Hood Canal. Non-Navy projects including Olympic View Marina, Kitsap Memorial State Park, Pleasant Harbor Marina and Golf Resort, and Misery Point Boat Launch were considered but eliminated from the cumulative impacts analysis because they are outside of the ROI.

Agency Plans for Improving Environmental Conditions in Hood Canal

Several governmental entities and community groups have joined together to plan and develop programs to improve environmental conditions in Hood Canal because of water quality problems, concern for salmon, and the overall environmental health of Hood Canal. Hood Canal Coordinating Council (HCCC) is a consortium of county governments, tribes, and other groups that was formed to help recover summer-run chum salmon populations in Hood Canal and the eastern Strait of Juan de Fuca and restore native plant communities along adjacent shorelines.

A primary action plan for Hood Canal was developed by the HCCC to assist in counteracting the adverse effects of past actions and improve environmental conditions in Hood Canal in the future. This is accomplished by the governments and groups of the HCCC working together to educate and help landowners restore the nearshore area, control septic runoff into Hood Canal, remove invasive plants and weeds, and identify properties for conservation acquisition.

The HCCC, under its Marine Riparian Initiative, is working with several entities and programs to develop a coordinated approach to re-vegetating marine shorelines (HCCC, undated). Under this initiative, Master Gardeners, Water Watchers, and other volunteer groups are trained to provide site-specific planting plans for landowners that address soil and slope stability, sediment control, wildlife, microclimate, shade, nutrient input for detrital food webs, fish prey production, habitat/large woody debris structure, water quality, human health and safety, and aesthetics.

The HCCC's primary action plan includes updating Kitsap County's Shoreline Master Plan and critical areas ordinances, conducting a nearshore assessment, adopting the Kitsap County draft shoreline environmental designations, and continued monitoring of the Big Beef Creek summer-run chum salmon reintroduction project as recommended key actions (HCCC, 2005; Kitsap County, 2013).

A portion of the Upper Hood Canal has been identified by the Kitsap County Health District as a restoration area (Kitsap County 2005; Banagan, 2008). The goals of the Upper Hood Canal Restoration Project are to protect public health and the environment by identifying and correcting sources of fecal coliform contamination from failing onsite sewage systems and inadequate animal waste management, obtaining water quality data, and educating Upper Hood Canal residents about the low DO problem and actions they can take to reduce bacteria and nutrient concentrations in Hood Canal.

The restoration area extends approximately 20 miles (32 km) along the eastern shore of Hood Canal from Olympic View Road in the north to the Kitsap County/Mason County line in the south. Most of this area lies directly south of NAVBASE Kitsap Bangor, but a portion lies along the western edge of the southern part of the base. Low DO levels are of particular concern, resulting from algal blooms, which are triggered by increases in nutrients from failing onsite sewage systems, inadequate animal waste management (i.e., hobby farms), and stormwater flowing into Hood Canal. The area of concern for low DO levels is south of the Bangor waterfront at NAVBASE Kitsap.

Commercial and Recreational Fishing

Tribal, recreational and commercial fishing occurs throughout Hood Canal. These fisheries are co-managed by Washington Department of Fish and Wildlife and tribes to minimize impacts to ESA-listed species through Fishery Management and Evaluation Plans submitted for approval to NMFS under Section 4(d) of the ESA. These fisheries will likely affect the listed fish species addressed by this evaluation; however, it is impossible to quantify the number of individual fish that will be affected, exact extent of the area of effect, or the timing and duration of the effect. Additionally, derelict fishing gear is a concern for fish, marine mammals, and marine birds.

4.2 Assessment of Cumulative Impacts by Resource

4.2.1 Sediments

Past and present actions involving in-water construction (i.e., pile driving and dredging) 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.

Projects with future in-water construction elements include the Waterfront Restricted Area and Security Barriers, Electromagnetic Measurement Range, Service Pier Extension, K/B Docks, EHW-2, Transit Protection System, Land-Water Interface, and the Pile Repair and Replacement Program. All of these projects would have impacts to marine sediments similar to those discussed for the Proposed Action, and all would implement sediment controlling BMPs. With implementation of BMPs, any disturbance to marine sediments would be local and temporary. Therefore, implementation of the Proposed Action combined with the past, present, and reasonably foreseeable future projects, would not result in significant cumulative impacts to marine sediments.

4.2.2 Water Quality

Water quality in Hood Canal and its tributaries has been and is being impacted by past and present upland actions. Upland development has caused localized deterioration in the water quality, 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, temperature, pH, and other water quality parameters in localized areas. Past, present, and reasonably future events have impacted and will impact water quality in the ROI, as described above. However, due to the temporary and localized extent of the Proposed Action, including implementation of BMPs to avoid or minimize any potential water quality impacts, it would not make an appreciable contribution to cumulative adverse impacts to water quality.

4.2.3 Airborne Noise

For the Proposed Action to make a cumulative contribution to the airborne noise environment with other projects, these projects must occur concurrently or overlap temporally with the Proposed Action. As discussed in Chapter 2, the Proposed Action is planned to begin in July 2015 and be completed in January 2016. Past and present projects on Table 4-1 would be completed prior to the planned implementation of the Proposed Action. Pile driving construction at EHW-2 would also be completed by July 2015. Additionally, future projects such as EMMR, Service Pier Extension, Transit Protection System, Land Water Interface, and the Pile Repair and Replacement Program are all planned to begin after construction of the Proposed Action is planned to be completed.

Future projects, including, K/B Docks Pile Replacement, Relocation of Floats to Delta Pier and Modification of Magnetic Silencing Facility could overlap with the Proposed Action and contribute to the cumulative airborne noise environment. The highest noise levels would be generated by pile driving during construction at K/B Docks and Delta Pier (no pile driving is proposed for the Modification of Magnetic Silencing Facility). As discussed in Section 3.3, Airborne Noise, impact hammer pile-driving of steel piles would generate average (i.e., root mean square [RMS]) noise levels of 110 A-weighted decibel (dBA) re 20 µPa at a distance of 50 feet (15 meters), while vibratory pile driving would generate RMS noise levels of 95 dBA re 20 µPa at 50 feet (15 meters). These levels attenuate by 6 dB per doubling of distance from the noise source (WSDOT, 2014). However, it is possible that airborne noise from these other proposed project sites could add a cumulative 3 to 4 dB to the sound environment when combined with noise from the Proposed Action (WSDOT, 2014). As such, while noise levels from the Proposed Action would not exceed 60 dBA levels at the nearest residences north of NAVBASE Kitsap Bangor (Section 3.3); when combined with other planned, future pile driving projects, these levels noise levels would not be expected to exceed typical residential noise levels of 65 dBA (Cavanaugh and Tocci,1998). Therefore, implementation of the Proposed Action combined with the past, present, and reasonably foreseeable future projects, would not result in significant cumulative adverse airborne noise impacts.

4.2.4 Biological Resources

4.2.4.1 Marine Vegetation and Benthic Invertebrates

Marine vegetation and benthic invertebrates in Hood Canal 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 to marine vegetation include temporary and/or permanent loss of marine vegetation, reduced productivity, and changes in the type or abundance. Shading can impact the abundance of some benthic organisms and lighting can increase predation rates on benthic invertebrates and likely increase foraging rates of others. Shading and loss/alteration of soft-bottom habitat has impacted the type and abundance of marine vegetation that occurs 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. Areas of erosion could result in adverse impacts to sediment-dwelling species if severe enough. These changes would adversely affect foraging by juvenile salmon, which forage in eelgrass beds and rearing areas for juvenile fish, as well as food for marine mammals, fish, birds and humans. Important marine habitat, such as eelgrass, has decreased over time in Hood Canal as indicated by trend data. Hard surfaces create sites for colonization by species adapted to these surfaces such as some marine vegetation, 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 changed species composition on and nearby these structures.

Past and present Navy and non-Navy actions, including marinas, residential docks, boat ramps, and piers involving placement of pilings and anchors have resulted in the direct loss of the natural benthic soft-bottom habitat. As described above, this habitat is replaced by the hard surfaces of pilings and anchors, and as a result, the types of marine vegetation and benthic organisms have changed and are changing in these localized areas. Future in-water structures would similarly result in the same changes to marine vegetation and benthic organisms.

The Proposed Action is temporary and would not contribute to any permanent cumulative losses to marine vegetation or benthic communities.

4.2.4.2 Fish

Past actions have adversely impacted populations of 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 addition of nutrients that contribute to algal blooms, which can deplete DO in part of the water column. Other factors that have resulted in adverse impacts to native salmon and steelhead abundance are overharvest by fisheries and the influence of hatchery stock on native stocks. Existing Navy structures have affected fish habitat, and have probably impeded and continue to impede juvenile salmon migration to some degree. Current and future waterfront projects at NAVBASE Kitsap Bangor would incorporate best management practices to minimize impacts to juvenile salmon 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. 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 fish 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 (PSAT, 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, MSA, MMPA, and NEPA, was enacted have been considering and are required to consider environmental impacts to special-status species and essential fish habitat, 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 fish.

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. Efforts to reduce construction impacts to 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.

Future actions, including Navy actions, would be designed and implemented to minimize impacts to fish and their 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, is expected to reduce impacts to fish populations. 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 fish in Hood Canal (described above), the impacts of the Proposed Action 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, and BMPs and minimization measures would be in place, cumulative impacts would not significantly affect fish populations in the proposed project area.

4.2.4.3 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 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. Population trend data 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 (Carretta et al., 2013; Allen and Angliss, 2013). For instance, the U.S. stock of California sea lions is nearly at its carrying capacity, harbor seals within the inland waters of WA are at their optimum sustainable population level, and the Eastern stock of Steller sea lions was removed from listing under the federal ESA based on an increase in population size of ~3.0% per year since 1970 (NMFS, 2008). 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. However, some projects such as the construction of a second EHW facility at NAVBASE Kitsap Bangor may result in more moderate impacts due to longer construction timelines (3-5 years). Impacts to marine mammals from the second EHW facility are still expected to primarily result 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 the wharf. Potential impacts to their prey base could include habitat disturbance during construction and overwater shading from the completed structure during its 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 be minimal. Overwater shading may result in a reduction in the amount or quality of submerged aquatic vegetation (SAV) which may in turn affect forage fish due to a reduction in quality habitat. To compensate for unavoidable impacts on aquatic resources, including SAV, from construction and operation of EHW-2, the Navy purchased aquatic habitat credits from the Hood Canal in-Lieu Fee Program. Other future non-Navy actions involving the placement of piles and anchors and resultant shading would also reduce the amount of eelgrass and macroalgae. Future actions impacting eelgrass would require mitigation (in compliance with the USACE rule on compensatory mitigation for losses of aquatic resources) such that there would be no net loss of these resources. 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 adversely affect the ESA-listed humpback whale. The Proposed Action 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 Action could combine 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 Action on marine mammals in general would be temporary and short in duration, cumulative impacts to marine mammals associated with pile driving noise are considered unlikely. 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 would protect marine mammals (i.e., sound attenuation devices, visual surveillance, the use of shutdown zones (see Sections 2.4 and 3.4)) and further decrease the likelihood of potential cumulative impacts to these species.

4.2.4.4 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 Hood Canal indicate that marine bird species have been on the decline. Of the 30 most common marine birds, 19 have experienced declining populations of 20 percent or more over the past 20 years. It is unknown what is causing this decline, but possible reasons include increased predation, habitat loss, changing migration patterns, decreases in forage fish populations, hunting, and disturbance to breeding grounds in the Arctic (PSAT, 2007). The marbled murrelet, listed as threatened under the ESA, declined more than 20 percent in population in the Puget Sound region from the 1970s through the 1990s (PSAT, 2007). The principal reason for the earlier decline was loss of nesting habitat (old-growth forest).

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. However, some projects such as the construction of a second EHW facility at NAVBASE Kitsap Bangor may result in more moderate impacts due to longer construction timelines (3-5 years). 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 the second wharf. Potential impacts to their prey base could include habitat disturbance during construction and overwater shading from the completed structure during its operational life. Impacts during construction are expected to be temporary. Overwater shading would be a long-term impact to the forage base. Additionally, proposed projects along the Bangor waterfront, such as the EHW-1 Pile Replacement and Maintenance Project, would occur in an area that already has industrial uses with higher than normal activity and noise levels. Thus, marine birds in the area could be habituated to these higher levels of activity and less impacted by ongoing waterfront development.

As described in Section 3.4 (Biological Resources), implementation of pile driving and pile removal at the project area would have no significant effect on migratory bird populations and, with sound attenuation devices, visual surveillance, the use of shutdown zones, significant impacts to marbled murrelets will be avoided. The Proposed Action 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 Action could combine 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 Action on marine birds in general would be temporary, cumulative impacts to marine birds associated with pile driving noise from the Proposed Action are considered unlikely.

Continued adherence to the requirements of EO 13186 and the Bald and Golden Eagle Protection Act (16 U.S.C. 668a-d dated 8 June, 1940 as twice amended) by NAVBASE Kitsap Bangor would limit disturbance to the bald eagle and other migratory birds. Furthermore, existing regulatory mechanisms and minimization measures would protect the ESA-listed marbled murrelet (see Section 3.4, Biological Resources) and further decrease the likelihood of potential cumulative impacts to these species.

4.2.5 Cultural Resources

Cultural resources are unique as well as finite in nature, so an adverse effect to a single historic property may affect the context of adjacent historic properties within NAVBASE Kitsap Bangor. Past, present, and future construction projects and modifications to facilities have the potential to adversely affect cultural resources such as prehistoric and historic archaeological sites and historic districts, buildings, or structures meeting NRHP-eligibility criteria.

The mitigation associated with Waterfront Restricted Area and Security Barriers affected historic properties. As a result, an MOA was executed between the Navy and the SHPO to address an unanticipated archaeological discovery and appropriate data collection. The Proposed Action will have no cumulative adverse effects to the archaeological resources addressed in the Cattail Lake MOA.

EHW-1 is a pile supported structure comprised of 961 piles, which has been determined eligible for inclusion in the NRHP. Previous repairs conducted in 2011 and 2012 removed 138 piles (including steel and concrete piles) and the fragmentation barrier. As part of this work, 29 new steel piles were installed. The Navy determined that the repair work conducted in 2011 and 2012, as well as construction of EHW-2, did not have an adverse effect on the eligibility of this historic structure. As discussed in Section 3.5, the Navy has determined that the Proposed Action would not have an adverse effect on properties eligible for inclusion in the NRHP. The SHPO concurred with this determination on September 10, 2014. As such, implementation of the Proposed Action, when combined with past and present actions would not result in cumulative adverse effects to EHW-1.

Though no future pile replacement requirements have been identified at EHW-1, future waterfront inspections could identify degraded piles that must be replaced. The regional Pile Repair and Replacement Program addresses these contingency requirements and estimates a maximum of 15 replacement piles per year for all structures along the NAVBASE Kitsap Bangor waterfront, beginning in 2017. The Navy would comply with Section 106 of the NHPA for all pile replacements planned under the Pile Repair and Replacement Program, as well as all other reasonably foreseeable future actions included in Table 4-1. This by includes identifying the presence of historic properties, evaluating their NRHP eligibility, assessing impacts, and consulting with the SHPO on the mitigation of any adverse impacts could not be avoided or minimized, thereby addressing the cumulative impact of those undertakings. With these procedures in place, the Proposed Action would not contribute to cumulative impacts to cultural resources.

4.2.6 American Indian Traditional Resources

The ROI for evaluating cumulative impacts on American Indian traditional resources consists of the NAVBASE Kitsap Bangor waterfront. The Navy has an active consultation process in place to insure tribal input on resources found on and off the installation, as well as potential access issues. Because of this ongoing process, traditional resources on NAVBASE Kitsap Bangor will continue to be protected and accessible.

Regionally, tribes have expressed a concern over the loss of access to traditional fishing and foraging areas in Puget Sound, especially as a result of incremental habitat loss through construction of piers, bulkheads and docks. Tribes have also expressed concern over lost fishing opportunity, including time and gear lost due to increased vessel traffic in their usual and accustomed areas. The Navy consults with tribes on all Navy proposed actions that may have the potential to significantly affect protected tribal resources and/or tribal access to those resources, as well as any potential cumulative effects. With respect to these issues, the Navy conducted government-to-government consultation with the Skokomish, Port Gamble S'Klallam, Jamestown S'Klallam, Lower Elwha Klallam, and Suquamish Tribes on the EHW-1 Pile Replacement and Maintenance Project and will continue to consult with the Tribes on future Navy projects that may have effects to American Indian traditional resources.

Past, present, and future Navy activities have the potential to significantly affect protected tribal treaty rights and traditional resources. The Proposed Action would not contribute impacts on the designated tribal shellfish harvest beach (Bangor Beach) to the south of the project area, nor would it affect current or future access to Usual and Accustomed fishing grounds and stations. Therefore, the Proposed Action would not contribute to significant cumulative impacts on tribal treaty rights and traditional resources.

4.2.7 Greenhouse Gas (GHG) Cumulative Effects

The potential effects of proposed GHG emissions are by nature global and cumulative impacts, as individual sources of GHG emissions are not large enough to have an appreciable effect on climate change. Therefore, an appreciable impact on global climate change would only occur when proposed GHG emissions combine with GHG emissions from other man-made activities on a global scale.

Currently, there are no formally adopted or published NEPA thresholds of significance for GHG emissions. Formulating such thresholds is problematic, as it is difficult to determine what level of proposed emissions would substantially contribute to global climate change. In the absence of an adopted or science-based NEPA significance threshold for GHGs, this analysis compares GHG emissions that would occur due to implementation of the Proposed Action to the permitting threshold identified in the Greenhouse Gas Mandatory Reporting Rule (40 CFR Part 98).

An appreciable impact on global climate change would, if currently accepted predictions are accurate, only occur when proposed GHG emissions combine with other GHG emissions from other man-made activities on a global scale. However, individual sources of GHG emissions related to the Proposed Action or nearby projects are not large enough to have an appreciable effect on climate change.

Emissions of GHGs from the Proposed Action alone would not cause appreciable global warming that would lead to climate changes. However, these emissions would increase the atmosphere's concentration of GHGs, and, in combination with past and future emissions from all other sources, contribute incrementally to the global warming that produces the adverse effects of climate change. At present, no methodology exists that would enable estimating the specific impacts (if any) that this increment of warming would produce locally or globally.

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5 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 5-1 identifies the principal federal laws and regulations that are applicable to the Proposed Action, and describes briefly how compliance with these laws and regulations would be accomplished.

Table 5-1. Principal Federal Laws Applicable to the Proposed Action

Federal, State, Local, and Regional Land Use Plans, Policies, and Controls	Status of Compliance
National Environmental Policy Act (NEPA); CEQ NEPA implementing regulations; Navy procedures for Implementing NEPA; 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	The USEPA has established NAAQS for seven pollutants. NAVBASE Kitsap Bangor is located in Kitsap County which is an attainment area. A formal conformity determination is not required. Emissions for the Proposed Action would come from temporary, mobile sources and would be well below applicable thresholds. As a result, the project would comply with the requirements of the Clean Air Act, as amended.
Endangered Species Act(ESA)	In accordance with ESA Section 7 requirements, the Navy prepared a Biological Assessment (BA) that concludes the Proposed Action may affect, but is not likely to adversely affect listed species potentially present or designated critical habitats. The Navy informally consulted with USFWS and NMFS regarding these potential effects and received Letters of Concurrence from these agencies on January 7, and January 8, 2015 (respectively), concluding informal consultation (Appendix A).
Marine Mammal Protection Act (MMPA)	Based on potential impacts to marine mammals, the Navy prepared an Incidental Harassment Authorization (IHA) application to request take for level "B" harassment. The IHA application was submitted to NMFS on October 31, 2014 (Appendix A). NMFS will issue the IHA after public review of the Draft IHA. In compliance with the MMPA, the Navy will comply with all IHA conditions.
Magnuson-Stevens Fishery Conservation and Management Act (MSA)	The Navy prepared an EFH Assessment that concluded the Proposed Action may adversely affect designated EFH, but the affect would be minor and temporary. The Navy consulted with NMFS regarding these potential effects and received a Letter of Concurrence on January 8, 2015, concluding consultation (Appendix A).
Migratory Bird Treaty Act (MBTA)	The Proposed Action is not likely to adversely affect migratory bird populations and would be in compliance with the MBTA.
Bald and Golden Eagle Protection Act	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.
Clean Water Act (CWA) (Sections 401 and 404)	A permit under Section 404 of the CWA is required for the discharge of fill into Waters of the U.S. The USACE has determined that pouring concrete into steel piles constitutes a discharge of fill material. The Proposed Action meets the requirements of a Nationwide Permit (NWP) 3 for Maintenance in accordance with the User's Guide for Nationwide

Table 5-1. Principal Federal Laws Applicable to the Proposed Action

Federal, State, Local, and Regional Land Use Plans, Policies, and Controls	Status of Compliance
	Permits in Washington State (USACE, 2012). 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 submitted a Joint Aquatic Resource Permit Application (JARPA) to the USACE, which serves as the pre-construction notification required under NWP 3. The Navy would obtain authorization to work under NWP 3 from the USACE prior to construction and would comply with all NWP 3 conditions.
Rivers and Harbors Act (RHA)	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 the Hood Canal, meets the requirements of a NWP 3 for Maintenance (USACE, 2012). The Navy submitted a JARPA to the USACE, which serves as the pre-construction notification required under NWP 3. The Navy would obtain authorization to work under NWP 3 from the USACE prior to construction and would comply with all NWP 3 conditions.
Coastal Zone Management Act (CZMA)	The Proposed Action is not expected to result in any impacts related to coastal zone management. The Proposed Action would be consistent with Shoreline Management Act and Kitsap County Shoreline Management Master Program. The Proposed Action would have no direct impact to recreational uses or access in the surrounding community nor would it impact the residences on the west side of Hood Canal, on – base residences or the nearest residences to the north. Pile replacement activities occurring at EHW-1 would not represent a change from the existing developed military character and would not be discernable from public vantage points and/or affect views of scenic vistas. 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 (USACE, 2012).
National Historic Preservation Act (NHPA) Section 106	The NHPA requires federal agencies to identify, evaluate, inventory, and protect NRHP resources (or resources that are potentially eligible for listing in the NRHP on properties that they control (54 USC 306108 *et seq*). The Navy determined that the Proposed Action would not adversely affect properties eligible for inclusion in the NRHP. In accordance with Section 106 of the NHPA, the Navy initiated consultation with the Washington SHPO on August 22, 2014, requesting concurrence on the Area of Potential Effect (APE) and the determination of no adverse effects to properties eligible for inclusion in the NRHP. On September 10, 2014 the SHPO concurred with the APE and the Navy's determination of no adverse effects to properties eligible for inclusion in the NRHP (Appendix A).

Table 5-1. Principal Federal Laws Applicable to the Proposed Action

Federal, State, Local, and Regional Land Use Plans, Policies, and Controls	Status of Compliance
Consultation and Coordination with Indian Tribal Governments (EO 13175) and Department of the Navy Policy for Consultation with Federally Recognized Indian Tribes (SECNAV Instruction 11010.14A)	As required under Secretary of the Navy Instruction 11010.14A, *Department of the Navy Policy for Consultation with Federally Recognized Tribes*; DoD Instruction 4710.02, *DoD Interactions with Federally Recognized Tribes*; and DoD Policy, *American Indian and Alaska Native Policy Alaska Implementation Guidance,* the Navy initiated consultation with the Skokomish, Port Gamble S'Klallam, Jamestown S'Klallam, Lower Elwha Klallam, and Suquamish Tribes regarding potential impacts to Tribal U&A fishing grounds and stations in July 2012. Consultations with the Tribes were concluded in February 2015. The Tribes expressed no objections to the Proposed Action.
EO 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. Moreover, only minimal amounts of solid waste requiring disposal would be generated during construction and would be disposed of in an environmentally safe manner.
EO 12898, Federal Actions to Address Environmental Justice in Minority and Low-income Populations	No disproportionately high or adverse impacts to minority and low-income populations would be expected from the Proposed Action.
EO 13045, Protection of Children from Environmental Health Risks and Safety Risks	The Proposed Action is located entirely within the NAVBASE Kitsap Bangor. Access to the site is restricted. The nearest school is 2.5 miles away, which is out of range of harmful noises from the project site. Implementation of the Proposed Action 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.

5.1 IRREVERSIBLE AND 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.

5.2 RELATIONSHIP BETWEEN SHORT-TERM USES OF THE HUMAN ENVIRONMENT AND THE ENHANCEMENT OF LONG-TERM 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. Air quality, water quality and marine sediment, and airborne noise would all expect to be impacted in the short-term. In the long-term, productivity of the area would remain the same, as replacement of piles and other maintenance activities at EHW-1would not change the overall productivity of the area. 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.

5.3 Means to Mitigate and/or Monitor Adverse Environmental Impacts (40 CFR Section 1502.16(h))

The Proposed Action would not result in any significant adverse environmental impacts with implementation of best management practices and minimization measures identified in Section 2.4.

5.4 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.

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7 LIST OF PREPARERS

In accordance with OPNAVINST 5090.1D, this section lists the names and qualifications (expertise/experience, professional disciplines) of the persons who were primarily responsible for preparing the EA.

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APPENDICES

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APPENDIX A

AGENCY CORRESPONDENCE

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UNITED STATES DEPARTMENT OF COMMERCE
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NATIONAL MARINE FISHERIES SERVICE
West Coast Region
7600 Sand Point Way N.E., Bldg. 1
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Refer to NMFS No:
WCR-2014-1767

January 8, 2015

Captain T.A. Zwolfer
Commanding Officer
Department of the Navy
Naval Base Kitsap
120 South Dewey Street
Bremerton, WA 98314-5020

Attn: Sharon Rainsberry

Re: Endangered Species Act Section 7 Informal Consultation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for Naval EHW-1 Pile Replacement and Maintenance Project on Naval Base Kitsap Bangor, Silverdale, Kitsap County, Washington (Lat: 47.75433, Long: -122.72391, 6^{th} Field HUC 171100180108).

Dear Captain Zwolfer:

On November 24, 2014, the National Marine Fisheries Service (NMFS) received your request for a written concurrence that the US Navy (Navy) proposed action to replace four large concrete piles at the Explosives Handling Wharf #1 (EHW-1) is not likely to adversely affect (NLAA) species listed as threatened or endangered, or critical habitats designated under the Endangered Species Act (ESA). This response to your request was prepared by NMFS pursuant to section 7(a)(2) of the ESA, implementing regulations at 50 CFR 402, and agency guidance for preparation of letters of concurrence.[1]

NMFS also reviewed the proposed action for potential effects on essential fish habitat (EFH) designated under the Magnuson-Stevens Fishery Conservation and Management Act (MSA), including conservation measures and any determination that you made regarding the potential effects of the action. This review was pursuant to section 305(b) of the MSA, implementing regulations at 50 CFR 600.920, and agency guidance for use of the ESA consultation process to complete EFH consultation.[2]

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[1] Memorandum from D. Robert Lohn, Regional Administrator, to ESA consultation biologists (guidance on informal consultation and preparation of letters of concurrence) (January 30, 2006).
[2] Memorandum from William T. Hogarth, Acting Administrator for Fisheries, to Regional Administrators (national finding for use of Endangered Species Act section 7 consultation process to complete essential fish habitat consultations) (February 28, 2001).

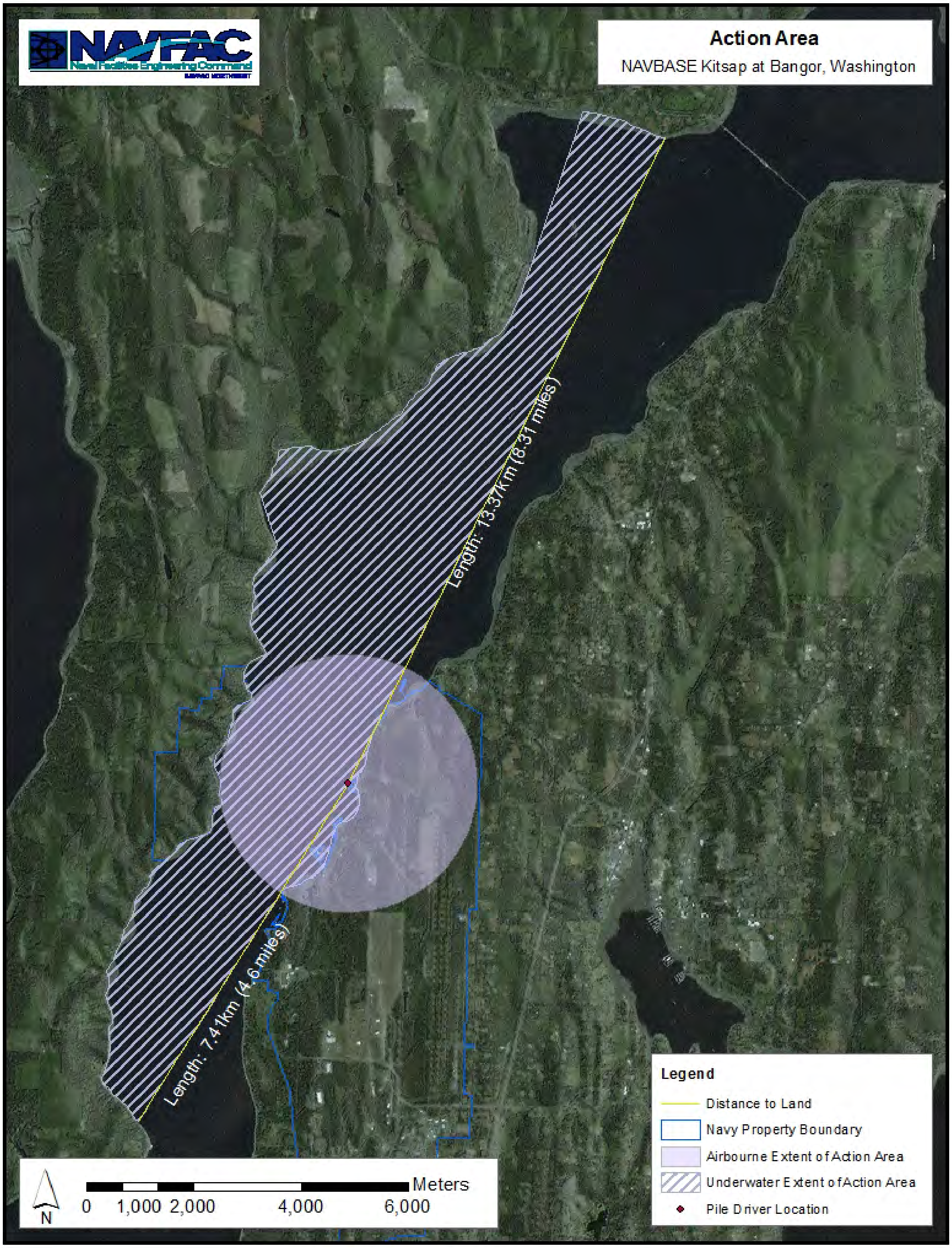
This letter underwent pre-dissemination review using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (section 515 of the Treasury and General Government Appropriations Act for Fiscal year 2001, Public Law 106-554). A complete record of this consultation is on file at Oregon-Washington Coastal Area Office in Lacey, Washington.

Proposed Action and the Action Area

The Navy is proposing to remove four existing 24-inch hollow pre-stressed concrete piles and install four new 30-inch concrete filled steel piles adjacent to the demolished piles. Existing piles will be removed after being cut at the mudline. Pile-driving and removal work will be done from shore-based equipment. Installation of new piles will occur with a vibratory driver. Use of an impact driver is only anticipated to verify structural load requirements. All piles to be replaced occur at depths between -30 and -60 feet. The replacement piles come with a pre-plumbed core that can be jetted into place using pressurized water. Using this system, replacement piles will be jetted to within 5 feet of the final installation depth while using a sediment curtain to contain suspended sediments. Piles will then be proofed to their final elevation using impact pile driving. The Navy estimates that three piles will be installed per day. Additionally, the project includes the replacement of structural elements such as decking and pile caps, installation of cathodic protection, repair of a concrete wetwell, and recoating of the tops of fender piles and steel mooring fittings.

The project is scheduled to begin in July 2015. In-water work would occur from July 16, 2015, through January 15, 2016. Pile driving is estimated to occur over a maximum of 8 days with no more than 4 days of impact pile driving anticipated. No interrelated or interdependent activities associated with this project exist.

The project location is at Bangor on Naval Base Kitsap in Kitsap County, Washington (Lat: 47.75433, Long: - 122.72391, 6^{th} Field HUC 171100180108). The action area is determined by the greatest extent of effects stemming from the project, in this case increased noise from pile installation. Areas not in direct line of sight are considered to be in the "acoustic shadow" where sound waves fail to propagate due to topographical or bathymetric obstructions, such as intervening headlands and other landmasses. Increased noise from pile driving is expected to extend to the nearest shoreline for an area of approximately 16.3 square miles or 10,426 acres of estuarine and marine nearshore waters (see figure below). The action area includes submerged aquatic vegetation and documented forage fish spawning that will not be affected by increased sound pressure from the project.



Explosive Handling Wharf 1 (EHW-1) Action Area

The NMFS listed PS Chinook salmon as threatened under the ESA on March 24, 1999 (64 FR 14308) and designated critical habitat for PS Chinook salmon on September 2, 2005 (70 FR 52630). On June 11, 2007, NMFS listed the PS steelhead Distinct Population Segment (DPS) as threatened under the ESA (72 FR 26722). Critical Habitat for PS steelhead was proposed on January 14, 2013 (78 FR 2725), that does not include the action area. The NMFS listed Hood Canal (HC) summer-run chum salmon as threatened under the ESA on June 28, 2005 (70 FR 37160) and updating this listing on April 14, 2014 (79 FR 20802) and designated critical habitat on Sept. 2, 2005 ((70 FR 52630). Puget Sound/Georgia Basin (PS/GB) canary rockfish and yelloweye rockfish DPSs were listed as threatened and bocaccio DPS was listed as endangered under the ESA on April 28, 2010 (75 FR 22276, updated 79 20802, April 14, 2014). Critical habitat was designated for yelloweye rockfish, canary rockfish, and bocaccio in the Puget Sound/ Georgia Basin effective February 11, 2015 (79 FR 68042).

Potential construction effects from the project include elevated inwater noise from pile driving and extraction and altered water quality from temporary increases in suspended sediment and turbidity levels from pile installation and removal. The Department of the Navy determined that effects could result from pile removal (cutting, chipping), pile installation (vibratory and steel piling impacts), anchoring/spudding, barge/vessel use, replacement of chocks/whalers/bumpers, cathodic protection, and overwater work.

For pile removal and vibratory pile installation, the Navy determined that effects from underwater noise may affect, and are not likely to affect ESA-listed fishes.While the immediate vicinity of the pile work is within the military lands excluded from critical habitat designations, some sound effects extend beyond the excluded lands into Hood Canal (see map of action area). A few areas of deepwater rockfish critical habitat exist in the action area.

While the Navy preliminarily determined that project may affect humpback whales because of one sighting in Dabob Bay several years ago, we have concluded there is no effect on this species.

Consultation History

NMFS received a Biological Assessment (BA) from the Navy, Naval Base Kitsap, on November 24, 2014. The Navy requested informal consultation and concurrence with the determinations of "may affect, is not likely to adversely affect" for Puget Sound (PS) Chinook salmon, PS steelhead, HC summer-run chum salmon, PS/GB bocaccio, PS/GB canary rockfish, and PS/GB yelloweye rockfish.

Additional information was received on December 12, 2014, when informal consultation was initiated. A complete record of this consultation is on file at the NMFS office in Lacey, Washington.

ENDANGERED SPECIES ACT

Effects of the Action

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

The project will likely cause altered water quality from increased suspended sediments and turbidity from pile extraction and installation and elevated inwater noise levels from vibratory and impact hammer pile extraction and installation of replacement piles. These will be slight, temporary and localized disturbances.

Hood Canal summer-run chum salmon
Puget Sound Chinook salmon
Puget Sound steelhead

Several of the small streams on the western Toandos Peninsula are documented as spawning habitat for steelhead. Migration to and from those streams would be outside the in-water work window. The nearest natal streams for Chinook and summer-run chum salmon are more than 5 miles from the action area.

While salmon migration through the Hood Canal during later summer and autumn will overlap with pile driving, the underwater sound threshold during vibratory pile driving will be limited to 150 dB re 1 µPa rms 130 yards radius from the pile driving. For impact pile driving at the project site a threshold of 187 dB cumulative SEL will occur within a 440 yards radius. Minimizing the effects of the vibratory and impact pile driving will result from limiting the time that pile driving will occur (a maximum of 8 days with no more than 4 days of impact pile driving with a total time for impact driving of four piles to occur from approximately 36 minutes to a maximum of 3 hours over the entire project duration). To further lessen the effects from impact pile driving and proofing, a bubble curtain or other noise attenuation device will be employed where water depths are greater than 0.67 meters (2 feet).

This minimal disturbance to the aquatic environment could disrupt salmonid behavior if individuals are present during these activities and exposed to the disturbance. However, effects to salmonids from pile installation are expected to be discountable because these activities will occur within the in-water work window of July 16th to January 15th, when vulnerable, nearshore-dependent juvenile salmonids are unlikely to be in the area and thus will not be exposed to the disturbance. Adult or larger juvenile listed salmonids that occur in the action area during construction will be farther offshore and may enter the action area. If individuals of listed species were present, construction effects would be insignificant because the noise, which would be within maximum threshold limits, and turbidity will be localized, short-term, and of low intensity. All noise disturbance from activities associated with the project will cease at the end of construction. Any suspended sediment impacts will be localized and temporary in duration, limiting the area of potential effects of suspended sediment increases to immediate the area surrounding the pile being removed or installed.

Critical habitat in the action area outside the military lands includes a Primary Constituent Elements (PCE) for the PS Chinook salmon and HC summer-run chum.

> Nearshore marine areas free of obstruction and excessive predation with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation, and natural cover such as submerged and overhanging large wood, aquatic vegetation, etc.

We analyzed the potential impacts on salmon critical habitat and determined that the effects will be insignificant. Construction-related effects will be short term and localized and not change the value of critical habitat for salmon, and the water quality will return to the pre-construction condition following the cessation of activity. Since all potential effects are insignificant, the conservation value of the PCE will be maintained.

PS/GB canary rockfish
PS/GB yelloweye rockfish
PS/GB bocaccio

We analyzed potential effects on Puget Sound/Georgia Basin (PS/GB) canary rockfish, PS/GB yelloweye rockfish and PS/GB bocaccio. Listed rockfishes are not expected within the action area due to the lack of acceptable habitat in the action area and distance from sources of larvae in the eastern Juan De Fuca Straits.

Nearshore critical habitat for juvenile PS/GB canary rockfish, PS/GB yelloweye rockfish and PS/GB bocaccio consists of specific features:

> 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.

The NMFS analyzed the potential effects on critical habitat outside military lands and determined that the effects on essential features will be insignificant. Juvenile PS/GB bocaccio and PS/GB canary rockfish often recruit to, and associate with, submerged aquatic vegetation and rocky reefs as they transition from larvae to juveniles. Pile removal and placement effects will be localized and temporary in duration, limiting the area of potential effects of suspended sediment increases to the area surrounding the pile being removed or installed and not exceeding water quality standards.

Due to the absence of the listed rockfish species at all life stages and habitat in the action area, potential effects from this project will not extend into deeper and rockier habitat types, making it extremely unlikely that juvenile rockfish will be encounter harmful effects. Construction-related effects on the water quality and prey species will be short term and localized, and will return to pre-construction condition following the cessation of activity. Since all potential effects are insignificant, the conservation value of the attributes will be maintained.

Conclusion

Based on this analysis, NMFS concurs with the Navy that the proposed action is not likely to adversely affect the subject ESA listed species of salmon, steelhead, and rockfish and their designated critical habitats.

Reinitiation of Consultation

Reinitiation of consultation is required and shall be requested by the Federal agency**,** or by NMFS, where discretionary Federal involvement or control over the action has been retained or is authorized by law and (1) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (2) the identified action is subsequently modified in a manner that causes an effect on the listed species or critical habitat that was not considered in this concurrence letter; or if (3) a new species is listed or critical habitat designated that may be affected by the identified action (50 CFR 402.16). This concludes the ESA portion of this consultation.

MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

Federal and other consulting agencies operating under Federal authority are required, under section 305(b)(2) of the MSA and its implementing regulations (50 CFR 600 Subpart K), to consult with NMFS regarding actions that are authorized, funded, or undertaken by that agency that may adversely affect essential fish habitat (EFH). For purposes of the MSA, EFH means "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity", and includes the associated physical, chemical, and biological properties that are used by fish (50 CFR 600.10), and "adverse effect" means any impact which reduces either the quality or quantity of EFH (50 CFR 600.910(a). Adverse effects may include direct, indirect, site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions. If an action would adversely affect EFH, NMFS is required to provide the Federal action agency with EFH conservation recommendations (section 305(b)(4)(A)). This consultation is based, in part, on information provided by the Federal agency and descriptions of EFH for Pacific salmon contained in the Fishery Management Plans developed by the Pacific Fishery Management Council and approved by the Secretary of Commerce.

The action area for the proposed project includes habitat that has been designated as EFH for various life stages of Pacific coast groundfish, coastal pelagic species, and Pacific salmon. The action area also includes habitat that has been designated as habitat areas of particular concern (HAPC) for groundfish. HAPCs 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. 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. The BA provides descriptions of sea grass (eelgrass) beds and kelp known to occur within the action area. Kelp species occurring at the Bangor shoreline are not canopy-forming kelp species. Eelgrass constitutes high quality habitat and is most abundant in low-energy areas in the lower intertidal and shallow subtidal photic zone where organic matter and nutrients are abundant. Results of a 2007 survey showed that an eelgrass bed of just over 12 acres occurs in a continuous, narrow band along the shoreline north of EHW-1, ending at the Magnetic Silencing Facility. The upper limits of this eelgrass bed corresponded to the mean lower low water (MLLW) line and extended out to water depths of about 14 feet below MLLW. Groundfish HAPCs within the action area include sea grass beds.

NMFS determined that the proposed action would adversely affect EFH by creating short term, localized increases in suspended sediments and increased sound energy, and creating short term impacts to water quality. The project area includes habitat that has been designated as EFH for various life stages of coastal pelagic species, Pacific coast groundfish, and Pacific salmon. The effects will be offset by limiting the time that pile driving will occur (a maximum of 8 days with no more than 4 days of impact pile driving and total time for impact driving of four piles being no more than 3 hours), and by ensuring that the impact avoidance and minimization measures (Best Management Practices) are adhered to by the contractor(s). The proposed action will not affect the function of existing habitat in support of EFH.

The conservation measures that the project BA included for the proposed action to address ESA/EFH concerns are adequate to avoid, minimize, or otherwise offset potential adverse effects to EFH. Therefore, conservation recommendations pursuant to the MSA (section 305(b)(4)(A)) are not necessary. Since the NMFS is not providing conservation recommendations at this time, no 30 day response from the Department of the Navy is required (MSA section 305(b)(4(B)).

The Department of the Navy must reinitiate EFH consultation with us 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 our EFH conservation recommendations (50 CFR 600.920(l)). This concludes the MSA portion of this consultation.

This concludes consultation under the ESA and MSA. If you have questions concerning these consultations, please contact Valerie Elliott of the Oregon Washington Coastal Area Office at 360-753-5834, or by e-mail at Valerie. Elliott@noaa.gov.

Sincerely,

William W. Stelle, Jr.
Regional Administrator

cc: Sharon Rainsberry, DON

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Washington Fish and Wildlife Office
510 Desmond Dr. SE, Suite 102
Lacey, Washington 98503

JAN - 7 2015

In Reply Refer To:
01EWFW00-2015-I-0134

Captain T.A. Zwolfer
Department of the Navy
Naval Base Kitsap
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Bremerton, Washington 98314-5020

Dear Captain Zwolfer:

Subject: EHW-1 Pile Replacement and Maintenance

This letter is in response to your November 17, 2014, request for our concurrence with your determination that the proposed action at U.S. Naval Base Kitsap Bangor (Navy), Kitsap County, Washington, "may affect, but is not likely to adversely affect" federally listed species. We received your letter and biological assessment, providing information in support of "may affect, not likely to adversely affect" determinations, on November 21, 2014. A copy of your transmittal document describing the proposed action and Marbled Murrelet Monitoring Plan are enclosed. We requested additional information on December 22, 2014, requesting clarification on the type of piles being installed; hollow steel piles or piles filled with concrete and on December 31, 2014, on the accuracy of the attenuated sound pressure level analysis conducted in the biological assessment. We received the requested additional information on the types of piles being installed on December 22, 2014, and clarification on the sound pressure level analysis on January 5, 2015. Specifically, you requested informal consultation pursuant to section 7(a)(2) of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) for the federally listed species and critical habitat identified below.

- Bull trout (*Salvelinus confluentus*)

- Marbled murrelet (*Brachyramphus marmoratus*)

We believe that sufficient information has been provided to determine the effects of the proposed action and to conclude whether it would adversely affect federally listed species and/or designated critical habitat. Our concurrence is based on information provided by the action agency, best available science, and complete and successful implementation of agreed-upon conservation measures.

EFFECTS TO BULL TROUT

Effects and Disturbance

Temporary and/or long-term effects from the action are not expected to measurably disrupt normal bull trout behaviors (i.e., the ability to successfully feed, move, and/or shelter), and are therefore considered insignificant and/or discountable:

- The action is located in Kitsap Peninsula, including Vashon Island, Bainbridge Island, and the eastern shore of Hood Canal where, at present, bull trout occurrence is rare or unlikely.
- The action will occur during the recommended in-water work window (July 16 to January 15), when bull trout are least likely to be present in the project area.
- The action will result in temporary impacts to water quality, including potential temporary increases in elevated levels of turbidity, suspended sediments, and contaminants (uncured concrete). These effects will be intermittent and limited in physical extent and duration.
- The action includes pile driving or activities that will result in elevated sound pressure levels. However, because of the construction methods (vibratory installation, proofing with impact pile driver, and use of a bubble curtain for sound attenuation) that will be used, project-related effects are unlikely to result in injury to bull trout or to disrupt normal bull trout behaviors.
- The action includes vibratory and impact pile installation for proofing or other activities that will result in elevated sound pressure levels. However, because work will be done when bull trout are least likely to be present, project-related effects are unlikely to result in injury to bull trout or to disrupt normal bull trout behaviors.
- The Navy has previously conducted a Test Pile Program at Navy Base Kitsap, Bangor to measure unconfined bubble curtain attenuation when impact pile driving 24-inch, 36-inch, and 48-inch diameter steel piles. Based on this testing the Navy has calculated pressure and flow rates for each mini-fold ring of a bubble curtain. A performance test will be conducted on the bubble curtain prior to initial use o fthe impact pile driver. Based on the Test Pile Program, a bubble curtain is expected to provide 8 to 10 dB_{peak} attenuation (8 dB reduction was used for the sound analysis).

Effects to Bull Trout Habitat and Prey Sources

With successful implementation of the agreed-upon conservation measures, we expect that temporary impacts from the action will not measurably degrade or diminish habitat functions or prey resources in the action area, and effects are therefore considered insignificant and/or discountable:

- Construction methods and proposed permanent features may impact habitat that supports bull trout and/or their prey sources. These impacts will be limited in physical extent and/or duration, and will not measurably degrade habitat functions, including prey resources, that are important to bull trout within the action area:
  - The action will result in limited temporary and/or permanent impacts to native substrates, aquatic vegetation, the benthic invertebrate community, and complexity of instream or marine nearshore habitat. The project involves the removal of four 24-inch diameter piles and installation of four 30-inch diameter piles adjacent to the removed piles. The project results in a slight reduction in benthic invertebrate habitat.
  - Removal and installation of the piles may result in periodic and/or temporary impacts to water quality through elevated levels of turbidity, suspended sediments, contaminants (uncured concrete) and underwater sound; however, these effects will be intermittent and of short duration.
  - The action replaces four piles under an existing wharf and will not result in increased shading, destruction, or long-term impacts to submerged aquatic vegetation, and there will be minimal loss of prey resource abundance.
  - Actions in marine waters will occur only during the recommended in-water work window, from July 16 to January 15, when prey fish presence, spawning, and/or holding is least likely to occur.
  - The action may impact prey resources for bull trout, including effects to potential or documented forage fish or salmonid spawning habitat; however, the action will not result in the permanent net loss of forage fish or salmonid spawning habitat.

EFFECTS TO MARBLED MURRELET

Effects - Terrestrial Environment

Temporary exposures and effects from the action are not expected to measurably disrupt normal marbled murrelet behaviors while in the terrestrial environment (i.e., the ability to successfully feed, move, and/or shelter) and are therefore considered insignificant and/or discountable:

- The project will not result in sound that will extend into nesting habitat or impact nesting marbled murrelets or their young. Thus, nesting marbled murrelets are extremely unlikely to be exposed to project stressors, including sound and visual disturbance.

Effects - Marine Environment

Temporary exposures and effects from the action are not expected to measurably disrupt normal marbled murrelet behaviors (i.e., the ability to successfully feed, move, and/or shelter) and are therefore considered insignificant and/or discountable:

- The action will result in temporary impacts to water quality, including potential temporary increases in elevated levels of turbidity, suspended solids, contaminants (uncured concrete), and underwater sound. These effects would be intermittent and limited in physical extent and duration.
- The action includes pile driving or activities that will result in elevated sound pressure levels. However, because of the construction methods (vibratory installation, proofing with impact pile driver, and use of a bubble curtain for sound attenuation) that will be used, project-related effects are unlikely to result in injury or measurable disturbance to marbled murrelets.
- Monitoring for marbled murrelets will occur to 42 meters according to an approved monitoring protocol (attached). This monitoring is anticipated to prevent injury of marbled murrelets from underwater sound pressure levels.
- From July 16 to September 23 impact pile driving will only occur starting 2 hours after sunrise and ending 2 hours before sunset to protect foraging marbled murrelets during the nesting season.
- The Navy has previously conducted a Test Pile Program at Navy Base Kitsap, Bangor to measure unconfined bubble curtain attenuation when impact pile driving 24-inch, 36-inch, and 48-inch diameter steel piles. Based on this testing the Navy has calculated pressure and flow rates for each mini-fold ring of a bubble curtain. A performance test will be conducted on the bubble curtain prior to initial use o fthe impact pile driver. Based on the Test Pile Program, a bubble curtain is expected to provide 8 to 10 dBpeak attenuation (8 dB reduction was used for the sound analysis).

- The Navy has conducted other similar type of projects where vibraatory and impact pile driving has occurred and have monitored for sound pressure levels and marbled murrelet presence. The Navy's sound pressure analysis and monitoring for marbled murrelets are based on results from these previous projects. Therefore, the project is not expected to result in injury to marbled murrelets or disrupt their normal behaviors (i.e., the ability to successfully fead, loaf, move, and/or shelter).

Effects to Marbled Murrelet Foraging Habitat and Prey Sources

With successful implementation of the included conservation measures, we expect that temporary impacts from the action will not measurably degrade or diminish habitat functions or prey resources in the action area, and effects are therefore considered insignificant and/or discountable:

- Construction methods and proposed permanent features may impact habitat that supports marbled murrelets and/or their prey sources. These impacts will be limited in physical extent and/or duration and will not measurably degrade habitat functions, including prey resources that are important to marbled murrelets within the action area:
    - The action will result in limited temporary and/or permanent impacts to native substrates, aquatic vegetation, the benthic invertebrate community, and instream or marine nearshore habitat. The project removes four 24-inch diameter piles and installs four 30-inch diameter piles adjacent to the removed piles. The project results in a slight reduction in benthic inveretebrate habitat.
    - Removal and installation of the piles may result in periodic impacts to water quality through elevated levels of turbidity, suspended sediments, contaminants (uncured concrete), and sound pressure levels; however, these effects will be intermittent and short duration.
    - The action replaces four piles under an existing wharf and will not result in increased shading, destruction, or long-term impacts to submerged aquatic vegetation, and there would be minimal loss of prey resource abundance.
    - Actions in marine waters would occur during the recommended in-water work window, from July 16 to Janury 15, when prey fish presence, spawning, and/or holding is least likely to occur.
    - The action may impact prey resources for marbled murrelets, including effects to potential or documented forage fish or salmonid spawning habitat; however, the action will not result in the permanent loss of forage fish or salmonid spawning habitat.

Conclusion

This concludes consultation pursuant to the regulations implementing the Endangered Species Act (50 CFR 402.13). Our review and concurrence with your effect determination is based on the implementation of the project as described. It is the responsibility of the Federal action agency to ensure that projects that they authorize or carry out are in compliance with the regulatory permit and/or the Endangered Species Act, respectively. If a permittee or the Federal action agency deviates from the measures outlined in a permit or project description, the Federal action agency has the obligation to reinitiate consultation and comply with section 7(d).

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.

This letter and its enclosures constitute a complete response by the U.S. Fish and Wildlife Service to your request for informal consultation. A complete record of this consultation is on file at the Washington Fish and Wildlife Office, in Lacey, Washington. If you have any questions about this letter or our joint responsibilities under the Endangered Species Act, please contact the consulting biologist identified below.

U.S. Fish and Wildlife Service Consultation Biologist(s):
Jim Muck (206-526-4740)

Sincerely,

Martha L. Jensen

for Thomas L. McDowell, Acting Manager
Washington Fish and Wildlife Office

Enclosure(s)

2 Project Description

2.1 Project Overview

The Navy is proposing to perform maintenance and restore the structural integrity of the EHW-1 facility, including replacement of 4 structurally unsound piles. EHW-1 is a U-shaped concrete structure built in 1977 for ordnance handling operations in support of the Trident Submarine squadron home ported at NAVBASE Kitsap Bangor. EHW-1 consists of two 100-foot (ft) (30 meters [m]) access trestles and a main pier deck which measures approximately 700 ft (213 m) in length and is approximately 500 ft (183 m) wide. The wharf is supported by both 16-inch and 24-inch hollow octagonal pre-cast concrete piles (approximately 130 ft [40 m] in length). Additionally, there are steel and timber fender piles on the outboard and inboard edges of the wharf.

The project will include demolishing and replacing existing piles at Bent 27 of the outboard support of the EHW-1. Additionally, the project includes replacement of structural elements such as decking and pile caps, installation of cathodic protection, repair of a concrete wetwell, and recoating of the tops of fender piles and steel mooring fittings. Table 2-1 provides a summary of the proposed maintenance and repair activities. Figures 2-1 shows the location of Bent 27 and the other repairs.

Table 2-1. EHW-1 Proposed Maintenance and Repair Activities
Demolish four existing 24-inch hollow prestressed octagonal concrete piles to the mudline.
Install four new 30-inch concrete filled steel pipe piles adjacent to the demolished piles.
Demolish and replace four 6'-0" by 4'-3" sections of deck in order to install new piles
Install new concrete pile caps for the newly installed piles
Install cathodic protection system for newly installed piles.
Repair deteriorated concrete of the wetwell on Wharf Apron.
Recoat top portion of 183 steel pipe fender piles.
Recoat 27 steel mooring fittings on the deck of the Wharf.

The Proposed Action includes best management practices (BMPs), and minimization measures that will be implemented to avoid or minimize potential environmental impacts as described in Section 2.4.

2.2 Construction

2.2.1 Upland

No Upland work is associated with the EHW-1 Repair project.

2.2.1 Pile Replacement Construction Methods

This section describes the planned methods of pile removal and installation that would be used to accomplish the work included as part of this Proposed Action. Other repairs at EHW-1 that are planned are described in Section 2.2.3.

2.2.1.1 Pile Removal

Four existing 24-inch hollow prestressed octagonal concrete piles located at Bent-27 will be removed with a pneumatic chipping hammer or another tool capable of cutting through concrete. If possible, piles will be first scored by a diver using a small pneumatic hammer. Each pile will be moved slightly back and forth to break at the score. Remaining pile parts will be chipped away with a pneumatic hammer. If there is not room to move a pile, the entire base of the pile will be chipped away with a pneumatic hammer for removal. A pneumatic chipping hammer is similar to an electric power tool and performs much like a smaller version of a jackhammer, 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. Rebar strands in the piles will be torched to remove. Concrete debris will be captured as practicable using a debris curtains/sheeting and removed from the project area. Removed piles and/or pile pieces will be placed on a barge for upland disposal in accordance with federal and state requirements. The Navy will evaluate if it would be possible to reclaim or recycle the materials.

2.2.1.1 Pile Installation

Because impact driving of steel piles can produce underwater noise levels that have been known to cause fish kills, vibratory hammers will be used to install four 30-inch concrete filed steel piles adjacent to the demolished piles (Figure2-2). The vibratory hammer will install the new piles to a point of refusal or within approximately 5 ft of the final tip elevation (approximately -110 ft MLLW). The vibratory hammer process for pile installation 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 will be used to entirely advance the pile to the required depth. Based on the Navy's experience replacing piles during previous repair cycles at the EHW-1 facility, the Navy feels that use of a vibratory hammer will be sufficient; the impact hammer has yet to be required to accomplish installation. Impact pile driving is anticipated to verify the load bearing capacity (proofing[1]) of the new piles. An impact hammer is typically required to strike a pile a number of times the last few feet to

1 "Proofing" is driving the pile the last few feet into the substrate to determine the capacity of the pile. The capacity is established by measuring the resistance of the pile to a hammer that has a piston with a known weight and stroke (distance the hammer rises and falls) so that the energy on top of the pile can be calculated. The blow count in "blows per inch" is measured to verify resistance, and pile compression capacities are calculated.

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 which impedes the sound produced during pile driving.

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 strikes and average strike rates needed to install 24- to 36-inch steel piles. For steel piles that are "proofed" an average of 400 strikes per pile were estimated. For piles that cannot be advanced with a vibratory driver and will be fully impact driven, 2,000 strikes per pile were estimated to fully drive a pile. This estimate assumes an average estimated strike rate of 44 strikes per minute (or almost a strike every second and a half) resulting in an estimate of approximately 9 minutes of impact driving for each pile proofed or approximately 45 minutes for each pile fully impact driven. Actual strike numbers and average strike rates will vary due to substrate conditions and the type and energy of impact hammers will likely vary. Past projects at EHW-1 have not required full impact driving. Therefore, steel impact pile driving is estimated to occur from approximately 36 minutes to a maximum of 3 hours over the entire project duration.

2.3 Associated Marine Structure Repairs and Maintenance

Other marine structure repairs and maintenance include replacement of structural elements such as decking and pile caps, installation of cathodic protection, repair of a wetwell, and recoating of the tops of fender piles and steel mooring fittings. Each of these is described below.

- Demolish and replace four 6'-0" by 4'-3" sections of deck in order to install new piles for the concrete fragmentation barrier and walkway (Figure 1-2 and 1-3). The walkway is used to get from the Wharf Apron to the Outboard Support. These deck structures will likely be removed by cutting the concrete into sections using a wire saw, or other equipment, and removed using a crane. Concrete pieces will be hauled to a barge for upland disposal. New decking would likely be cast-in-place concrete. Concrete formwork would be located above Mean Higher High Water (MHHW).
- Construction of cast-in-place concrete pile caps. The pile caps will be situated on the tops of the steel piles located directly beneath the structure and function as a load transfer mechanism between the superstructure and the piles. Concrete formwork may be located below MHHW.
- Installation of four sled mounted passive cathodic protection systems. A passive cathodic protection system is a metallic rod or anode attached to a metal object to protect it from corrosion. A more active metal, which easily oxidizes, corrodes the anode first and protects the primary structure from corrosion damage. At the EHW-1 facility, the passive cathodic protection systems will be banded to the steel piles to prevent the metallic surfaces of the wharf from corroding due to the saline conditions in Hood Canal.

- Repair deteriorated concrete of the wetwell on Wharf Apron. Repairs would occur by removing failed and delaminated concrete (delamination occurs in reinforced concrete structures subject to reinforcement corrosion, in which the oxidized metal of the reinforcement is greater in volume than the original metal). 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.
- Recoat top portion of 183 steel pipe fender piles and 27 steel mooring fittings on the deck of the Wharf. Fender piles and mooring fittings would be cleaned prior to recoating. All coatings will be applied to dry surfaces and limited to areas above mean sea level (+6.5 ft MLLW).

2.3.1 Construction Access and Project Staging

Barges will be used as platforms for conducting in-water work activities and to haul materials and equipment to and from the work site. Barges will be moored with spuds or anchors and not allowed to ground. No staging sites have been identified. If staging areas for equipment and materials are identified at a future date, they will occur in currently developed lots or managed fields, unless otherwise approved by the project biologist.

2.3.2 Project Sequencing and Timeline

In-water work will occur from July 16 through January 15 to avoid conducting activities when bull trout and juvenile salmon and steelhead are most likely to be present.

All in-water impact pile driving will occur during daylight hours except from July 16 to September 23, when impact pile driving will only occur starting 2 hours after sunrise and ending 2 hours before sunset to protect foraging marbled murrelets during the nesting season. Pile driving is estimated to occur a maximum of 8 days with no more than 4 days of impact pile driving.

While sequencing of all proposed repair work has not been planned or scheduled, work would likely proceed with removal of deck segments occurring first, followed by installation of the new concrete filled steel piles and pile caps. Only after the new piles have been installed and the pile caps have fully cured and reached design compressive strength, would removal of the existing concrete piles begin.

2.4 Operations and Maintenance

The proposed repair projects are not associated with changes in operations at EHW-1. Future maintenance of EHW-1 will not change as a result of repairs associated with the Proposed Action.

2.5 Impact Avoidance and Minimization Measures

The Navy will employ the Best Management Practices (BMPs) and minimization measures listed in this section to avoid and minimize potential impacts from this action.

Marbled Murrelet Monitoring Plan[1] for the Explosives Handling Wharf #1 Pier Repair Project Naval Base Kitsap Bangor

1.0 Objective

The intent of the monitoring protocol is to:

1. Comply with the requirements of the Endangered Species Act Section 7 consultation for the United States Department of the Navy (Navy) Explosives Handling Wharf #1 (EHW-1) pier repairs at Naval Base Kitsap Bangor.
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[2] by communicating immediately with the pile driving operator.

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 Navy and the Washington Fish and Wildlife Office (WFWO).

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 the Explosives Handling Wharf #1 (EHW-1) Pier Repair Project. 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.

3.2 Equipment

- Binoculars - quality 8 or 10 power
- Two-way radios with earpieces
- Red and green flags

[1] This protocol is based on USFWS protocol dated August 2012; however, the protocol was modified to avoid hazing of murrelets from monitoring vessels.
[2] The threshold for injury due to elevated underwater sound pressure levels during impact pile driving is 202 dB re 1μPa cumulative SEL, which is approximately 40 meters from a 30" 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.

- Range finder
- Log books
- Seabird identification guide
- Life vest or other personal flotation device for observer in boats
- Hard hat or other PPE needed for Lead Biologist
- 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.

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 Figures 1. However, depending on the placement of the barge, monitoring location may need to be adjusted to ensure coverage of 42-meter area. If conditions change on- site (e.g., a barge moves into the monitoring zone), monitoring locations can be refined in the field. For example, a stationary boat may be used on the west side of the wharf to provide full visual coverage. In all cases, the monitoring location will allow for the entire monitoring area to be fully surveyed within five minutes.

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 5.0). 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 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 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.

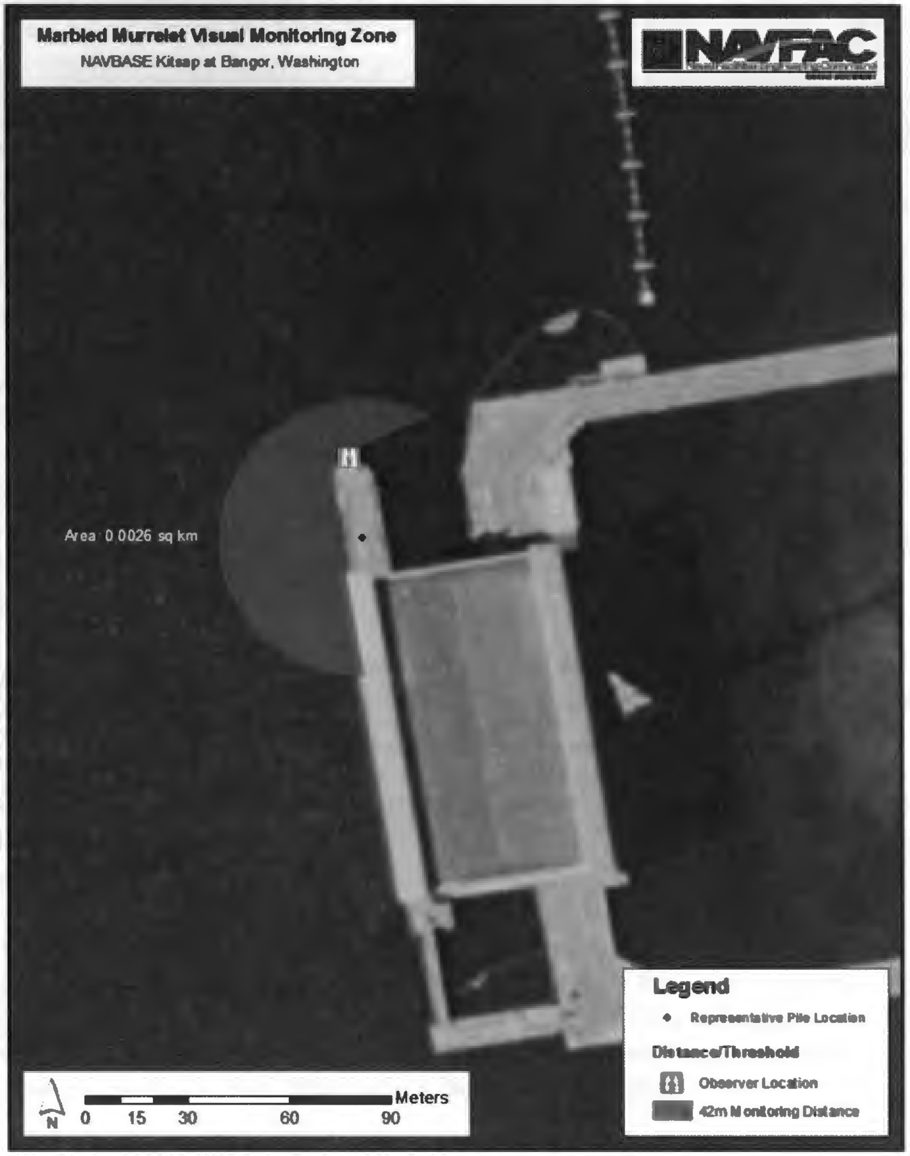

Figure 1: Marbled Murrelet Monitoring Locations

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. 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 2 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.

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	

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. Monitors will also have red and green flags for visual signals in the event there are issues with the audio/radio communications. 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. The lead biologist will also have red and green flags to visually communicate with the pile driving operator if audio communication fails. 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.

3.0 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). 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.

3.5 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. Both forms are included in the Appendix.

3.6 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 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 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. 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).

3.7 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 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 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 2.0 above are necessary. Pile driving will not resume until the necessary amendments have been made.

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.

If dead murrelets or other diving seabirds are found during the beach surveys (or during monitoring activities), Navy personnel will be notified immediately. Dead birds 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

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:

1. Tylor Yasenak – phone: (360) 315-2452
2. Greg Leicht – phone: (360) (360) 649-1623

Primary points of contact at the WFWO are:

1. Ryan McReynolds – phone: (360) 753-6047
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 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% 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. 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.

7.1 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

DEPARTMENT OF THE NAVY
NAVAL BASE KITSAP
120 SOUTH DEWEY ST
BREMERTON, WA 98314-5020

5090
Ser PRB4/02015
17 Nov 14

Ken S. Berg
Manager, Washington Fish and Wildlife Office
U.S. Fish and Wildlife Service
510 Desmond Drive SE, Suite 103
Lacey, WA 98503

Dear Mr. Berg:

SUBJECT: SECTION 7 INFORMAL CONSULTATION FOR EHW-1 PILE REPLACEMENT AND MAINTENANCE, NAVAL BASE KITSAP BANGOR, WASHINGTON

The Department of the Navy (Navy) proposes to demolish four deteriorated 24-inch hollow prestressed octagonal concrete piles and install four 30-inch concrete filled steel piles adjacent to the demolished piles at Bent 27 of the outboard support of the Explosives Handling Wharf #1 (EHW-1). Additionally, the project includes replacement of structural elements such as decking and pile caps, installation of cathodic protection, repair of a concrete wetwell, and recoating of the tops of fender piles and steel mooring fittings.

This letter is to request initiation of informal consultation under the Endangered Species Act. The enclosed biological assessment (BA) contains the Navy's determination of effect for listed species that may be present in the action area. The BA also contains analysis of effects to Essential Fish Habitat as required by the Magnuson-Stevens Fishery Conservation Management Act. The Navy requests your concurrence with the attached BA. If you have any questions, please contact Ms. Sharon Rainsberry. She can be reached at (360) 315-2812 or Sharon.rainsberry@navy.mil.

Sincerely,

T. A. ZWOLFER
Captain, U.S. Navy
Commanding Officer

Enclosure: 1. Biological Assessment

DEPARTMENT OF THE NAVY
NAVAL BASE KITSAP
120 SOUTH DEWEY ST
BREMERTON, WA 98314-5020

5090
Ser PRB4/ 02018
17 Nov 14

Steven Landino
Director, Washington State Habitat Office
National Marine Fisheries Service
510 Desmond Drive SE, Suite 102
Lacey, WA 98503

Dear Mr. Landino:

SUBJECT: SECTION 7 INFORMAL CONSULTATION FOR EHW-1 PILE REPLACEMENT AND MAINTENANCE, NAVAL BASE KITSAP BANGOR, WASHINGTON

The Department of the Navy (Navy) proposes to demolish four deteriorated 24-inch hollow prestressed octagonal concrete piles and install four 30-inch concrete filled steel piles adjacent to the demolished piles at Bent 27 of the outboard support of the Explosives Handling Wharf #1 (EHW-1). Additionally, the project includes replacement of structural elements such as decking and pile caps, installation of cathodic protection, repair of a concrete wetwell, and recoating of the tops of fender piles and steel mooring fittings.

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Sincerely,

T. A. ZWOLFER
Captain, U.S. Navy
Commanding Officer

Enclosure: 1. Biological Assessment

DEPARTMENT OF THE NAVY
NAVAL BASE KITSAP
120 SOUTH DEWEY ST
BREMERTON, WA 98314-5020

5090
Ser PRB4/01953
31 Oct 14

Ms. Helen M. Golde
Acting Director, Office of Protected Resources
National Marine Fisheries Service
National Oceanic and Atmospheric Administration
1315 East-West Highway
SSMC3, Room 13821
Silver Spring, MD 20910-3282

Dear Ms. Golde:

SUBJECT: INCIDENTAL HARASSMENT AUTHORIZATION REQUEST FOR THE EHW-1 PILE REPAIR AND MAINTENANCE PROJECT AT NAVAL BASE KITSAP BANGOR, SILVERDALE, WASHINGTON

In accordance with the Marine Mammal Protection Act, as amended and 50 Code of Federal Regulations Part 216.106, the United States Navy requests an Incidental Harassment Authorization for the take of marine mammals associated with the repair by replacement of piles at the Navy's Explosive Handling Wharf-1 at Naval Base Kitsap Bangor from July 16, 2015 through January 15, 2016.

The proposed action would expose marine mammals in Hood Canal to sound from pile driving. Enclosures (1) through (3) contain information required by the National Marine Fisheries Service for consideration of an incidental take request.

We appreciate your continued support in helping the Navy to meet its environmental responsibilities. For additional comments or questions the Navy's point of contact is Ms. Sharon Rainsberry, Naval Facilities Engineering Command Northwest Biologist. She can be reached at (360) 315-2812, or at sharon.rainsberry@navy.mil.

Sincerely,

T. A. ZWOLFER
Captain, U. S. Navy
Commanding Officer

SUBJECT: INCIDENTAL HARASSMENT AUTHORIZATION REQUEST FOR THE EHW-1 PILE REPAIR AND MAINTENANCE PROJECT AT NAVAL BASE KITSAP BANGOR, SILVERDALE, WASHINGTON

Enclosures:
1. Incidental Harassment Authorization (IHA) application, with Marine Mammal Monitoring Plan (App C)
2. EHW-1 Pile Repair and Maintenance Project at Naval Base Kitsap, Bangor Draft Environmental Assessment (2 copies)
3. CD-ROM of IHA application, Draft Environmental Assessment and transmittal letter (2 copies)

Copy to:
Mr. Ben Laws (NMFS)
Chief of Naval Operations (N45)
Navy Region Northwest (N45)

DEPARTMENT OF
ARCHAEOLOGY &
HISTORIC PRESERVATION
Protect the Past, Shape the Future

Allyson Brooks Ph.D., Director
State Historic Preservation Officer

September 10, 2014

Capt. T.A. Zwolfer
Commanding Officer
U.S. Navy, Naval Base Kitsap Bremerton
120 South Dewey St
Bremerton, WA 98134-5020

In future correspondence please refer to:
Log: 091014-15-USN
Property: EHW-1 Piling Replacement and Wharf Maintenance
Re: NO Adverse Effect

Dear Capt. Zwolfer:

Thank you for contacting the Washington State Department of Archaeology and Historic Preservation (DAHP). The above referenced project has been reviewed on behalf of the State Historic Preservation Officer under provisions of Section 106 of the National Historic Preservation Act of 1966 (as amended) and 36 CFR Part 800. My review is based upon documentation contained in your communication.

First, I agree with the Area of Potential Effect (APE) as mapped in the consultant's report. I also concur that the current project as proposed will have "NO ADVERSE EFFECT" on National Register eligible or listed historic and cultural resources. If additional information on the project becomes available, or if any archaeological resources are uncovered during construction, please halt work 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 contact me.

Sincerely,

Russell Holter
Project Compliance Reviewer
(360) 586-3533
russell.holter@dahp.wa.gov

DEPARTMENT OF THE NAVY
NAVAL BASE KITSAP
120 SOUTH DEWEY STREET
BREMERTON, WA 98314-5020

5090
Ser PRB4/01430
22 Aug 14

Allyson Brooks, PhD
State Historic Preservation Officer
Department of Archaeology & Historic Preservation
P.O. Box 48343
Olympia, WA 98504-8343

Dear Dr. Brooks:

SUBJECT: EXPLOSIVE HANDLING WHARF-1 PILING REPLACEMENT AND WHARF MAINTENANCE PROJECT

In accordance with Section 106 of the National Historic Preservation Act, the Navy would like to initiate consultation regarding the proposed undertaking to replace deteriorating piling beneath the Explosive Handling Wharf #1 (EHW-1) - Facility 7501 at Naval Base (NAVBASE) Kitsap Bangor (Enclosure 1). The Navy has determined the EHW-1 structure is eligible for inclusion in the National Register of Historic Places (NRHP) under Criteria A and C with SHPO concurrence, March 25, 2011.

The site of the proposed undertaking is along the eastern shore of Hood Canal towards NAVBASE Kitsap Bangor's northern border. The proposed project would demolish four 24-inch hollow prestressed octagonal concrete piles and install four 30-inch concrete filled steel piles adjacent to the demolished piles at Bent 27 of the outboard support of the EHW-1 (Enclosure 2). Additionally the project would: demolish and replace four 6'-0" by 4'-3" sections of deck in order to install new piles; construct four cast-in-place concrete pile caps to function as load transfer mechanisms between the superstructure and the new piles; install four sled mounted passive cathodic protection systems; repair deteriorated concrete of the wetwell (encasement for a sanitary sewer lift station pump) on the Wharf Apron; and, recoat top portions of 183 steel pipe fender piles and 27 steel mooring fittings on the deck of the Wharf.

The Area of Potential Effect (APE) is defined as the footprint of the proposed project work area at the existing Wharf. Please refer to Enclosure 3.

SUBJECT: EXPLOSIVE HANDLING WHARF-1 PILING REPLACEMENT AND WHARF MAINTENANCE PROJECT

EHW-1 is an imposing structure on the east shore of Hood Canal. Its public view is from Hood Canal. The main defining features of the structure are its wharf and super-structure. Pilings that form its foundation for the most part are below waterline and not visible to the public except small portions are visible at low-tide. The proposed work would replace four piles, which are largely below water and not part of the public view. The maintenance of the wetwell and recoating of pilings and mooring fittings will sustain the integrity of the facility and retain the overall appearance of the present structure. The Navy has determined that the proposed work does not adversely affect the characteristics that make the property eligible for listing in the NRHP.

The Navy requests your concurrence with our defining of the APE and finding of No Historic Properties Adversely Affected. Please direct additional inquiries to Ms. Amanda Bennett. She can be reached by telephone at (360) 476-6613, or by e-mail at amanda.j.bennett@navy.mil.

Sincerely,

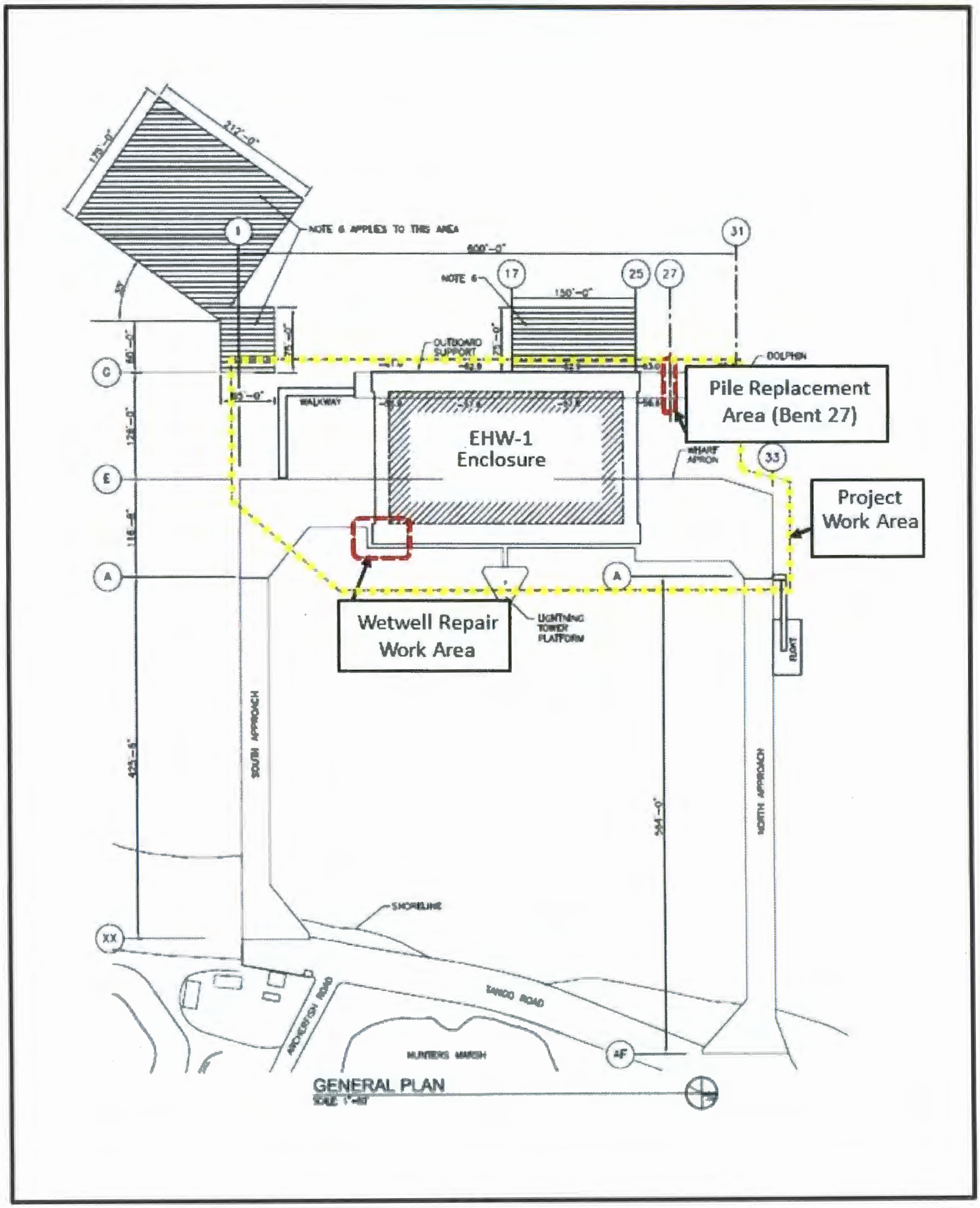
T. A. ZWOLFER
Captain, U. S. Navy
Commanding Officer

Enclosures:
1. Explosive Handling Wharf-1
2. EHW-1 Project Work Area
3. EHW-1 Area of Potential Effects

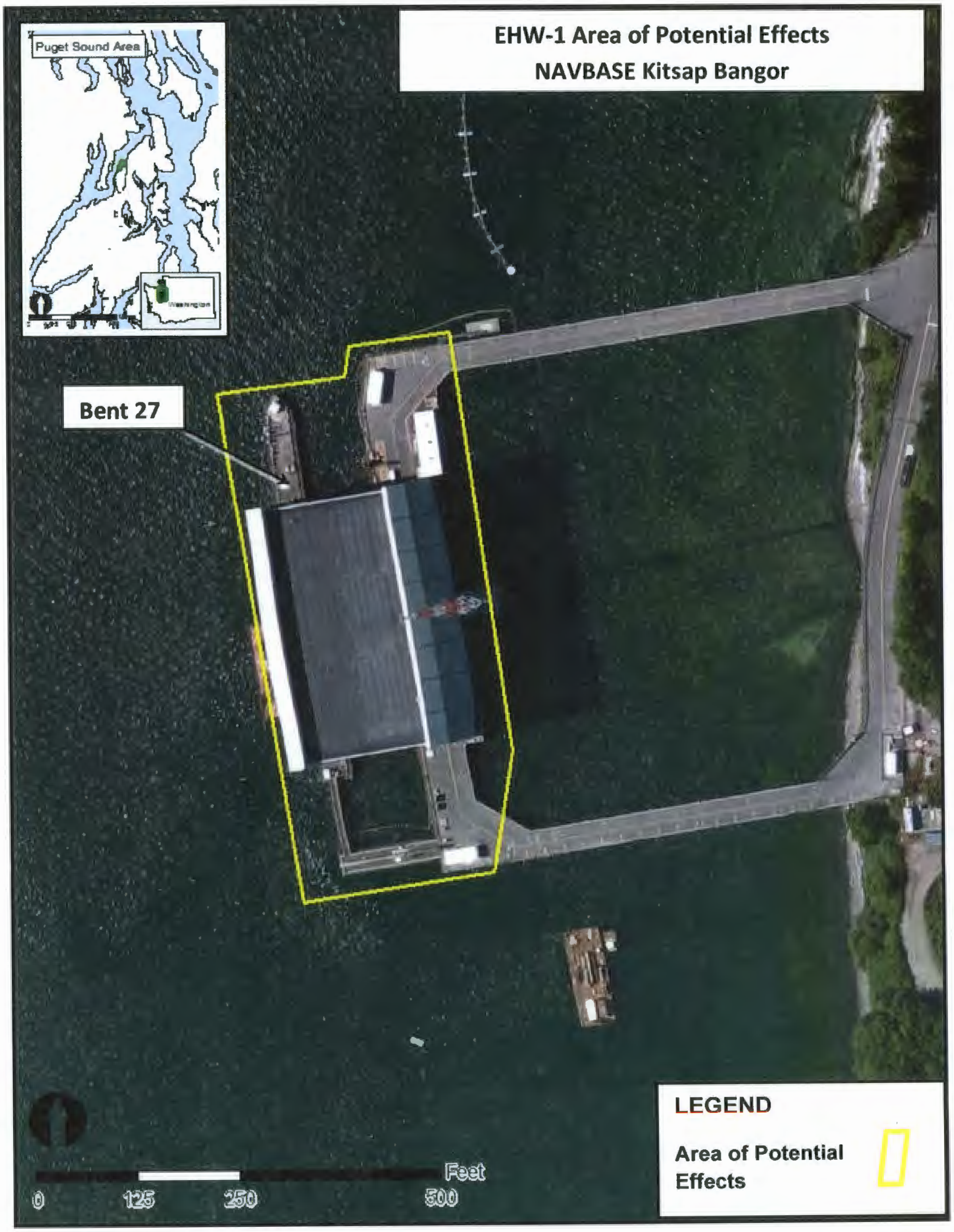
SUBJECT: REQUEST FOR CONCURRENCE WITH THE AREA OF POTENTIAL EFFECT AND FINDING OF NO HISTORIC PROPERTIES ADVERSELY AFFECTED FOR THE EXPLOSIVE HANDLING WHARF-1 PILING REPLACEMENT AND WHARF MAINTENANCE PROJECT

Explosive Handling Wharf-1

SUBJECT: REQUEST FOR CONCURRENCE WITH THE AREA OF POTENTIAL EFFECT AND FINDING OF NO HISTORIC PROPERTIES ADVERSELY AFFECTED FOR THE EXPLOSIVE HANDLING WHARF-1 PILING REPLACEMENT AND WHARF MAINTENANCE PROJECT



EHW-1 Project Work Area



EHW-1 Area of Potential Effects

DEPARTMENT OF THE NAVY
NAVAL BASE KITSAP
120 SOUTH DEWEY STREET
BREMERTON, WA 98314-5020

5090
Ser PRB4/01433
22 Aug 14

Jamestown S'Klallam Tribe
The Honorable W. Ron Allen
1033 Old Blyn Hwy
Sequim, WA 98382

Dear Chairman Allen:

SUBJECT: REQUEST FOR CONCURRENCE WITH THE AREA OF POTENTIAL EFFECT AND FINDING OF NO HISTORIC PROPERTIES ADVERSELY AFFECTED FOR THE EXPLOSIVE HANDLING WHARF-1 PILING REPLACEMENT AND WHARF MAINTENANCE PROJECT

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Sincerely,

T. A. ZWOLFER
Captain, U. S. Navy
Commanding Officer

Enclosures:
1. Explosive Handling Wharf-1
2. EHW-1 Project Work Area
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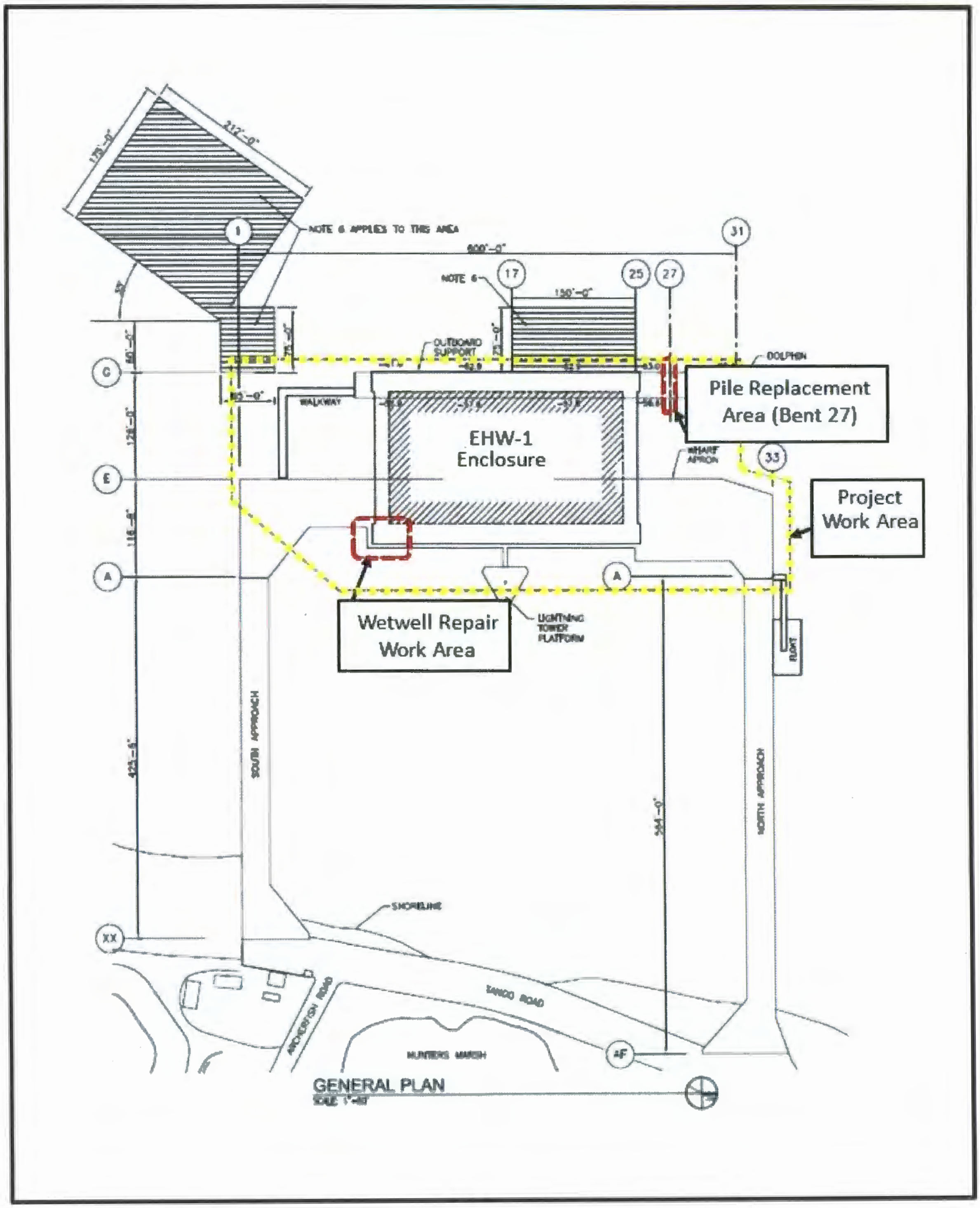
SUBJECT: REQUEST FOR CONCURRENCE WITH THE AREA OF POTENTIAL EFFECT AND FINDING OF NO HISTORIC PROPERTIES ADVERSELY AFFECTED FOR THE EXPLOSIVE HANDLING WHARF-1 PILING REPLACEMENT AND WHARF MAINTENANCE PROJECT

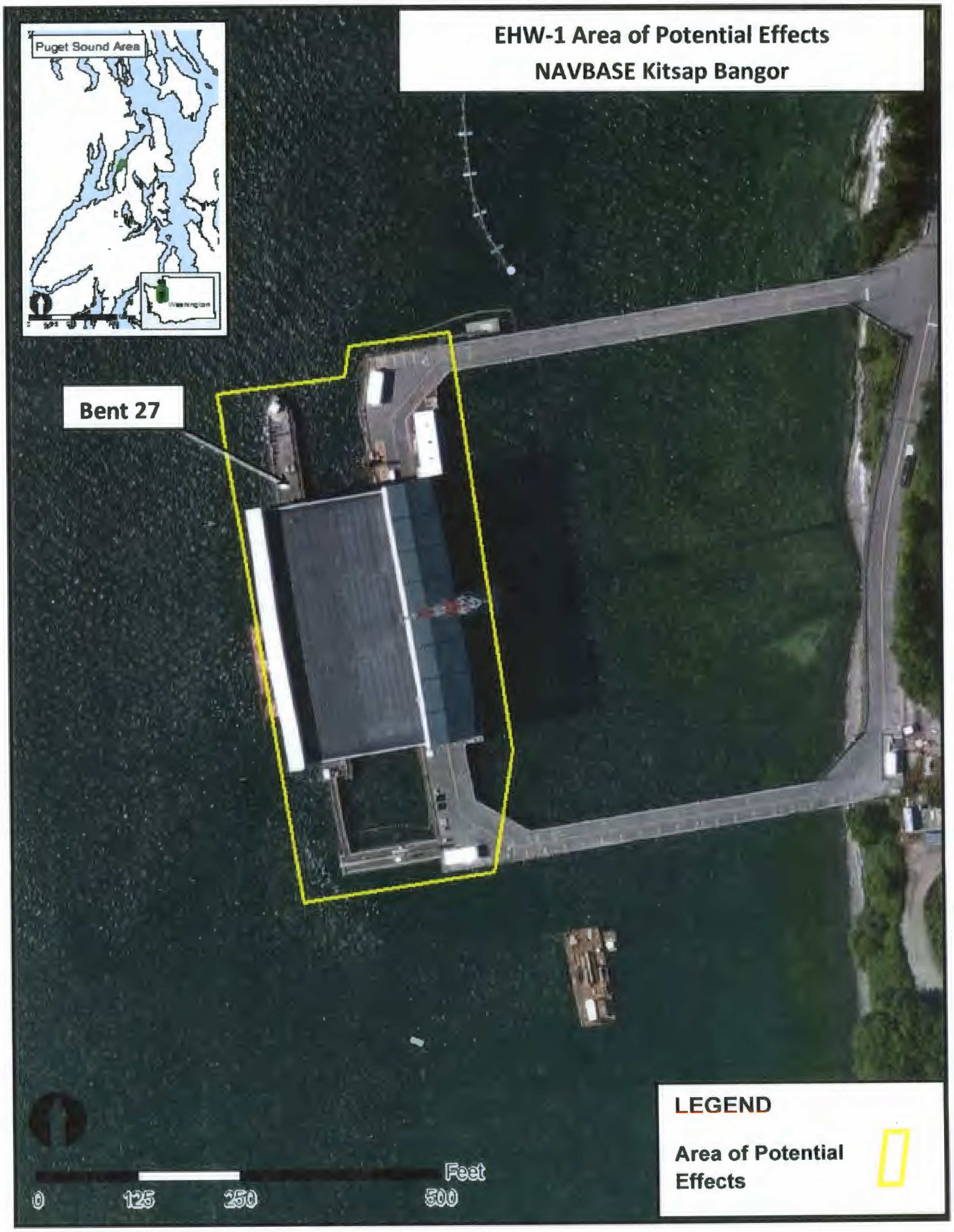
Explosive Handling Wharf-1

SUBJECT: REQUEST FOR CONCURRENCE WITH THE AREA OF POTENTIAL EFFECT AND FINDING OF NO HISTORIC PROPERTIES ADVERSELY AFFECTED FOR THE EXPLOSIVE HANDLING WHARF-1 PILING REPLACEMENT AND WHARF MAINTENANCE PROJECT



EHW-1 Project Work Area

SUBJECT: REQUEST FOR CONCURRENCE WITH THE AREA OF POTENTIAL EFFECT AND FINDING OF NO HISTORIC PROPERTIES ADVERSELY AFFECTED FOR THE EXPLOSIVE HANDLING WHARF-1 PILING REPLACEMENT AND WHARF MAINTENANCE PROJECT



EHW-1 Area of Potential Effects

DEPARTMENT OF THE NAVY
NAVAL BASE KITSAP
120 SOUTH DEWEY STREET
BREMERTON, WA 98314-5020

5090
Ser PRB4/01432
22 Aug 14

The Lower Elwha Klallam Tribe
The Honorable Frances Charles
2851 Lower Elwha Road
Port Angeles WA 98362

Dear Chairwoman Charles:

SUBJECT: REQUEST FOR CONCURRENCE WITH THE AREA OF POTENTIAL EFFECT AND FINDING OF NO HISTORIC PROPERTIES ADVERSELY AFFECTED FOR THE EXPLOSIVE HANDLING WHARF-1 PILING REPLACEMENT AND WHARF MAINTENANCE PROJECT

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The site of the proposed undertaking is along the eastern shore of Hood Canal towards NAVBASE Kitsap Bangor's northern border. The proposed project would demolish four 24-inch hollow prestressed octagonal concrete piles and install four 30-inch concrete filled steel piles adjacent to the demolished piles at Bent 27 of the outboard support of the EHW-1 (Enclosure 2). Additionally the project would: demolish and replace four 6'-0" by 4'-3" sections of deck in order to install new piles; construct four cast-in-place concrete pile caps to function as load transfer mechanisms between the superstructure and the new piles; install four sled mounted passive cathodic protection systems; repair deteriorated concrete of the wetwell (encasement for a sanitary sewer lift station pump) on the Wharf Apron; and, recoat top portions of 183 steel pipe fender piles and 27 steel mooring fittings on the deck of the Wharf.

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SUBJECT: REQUEST FOR CONCURRENCE WITH THE AREA OF POTENTIAL EFFECT AND FINDING OF NO HISTORIC PROPERTIES ADVERSELY AFFECTED FOR THE EXPLOSIVE HANDLING WHARF-1 PILING REPLACEMENT AND WHARF MAINTENANCE PROJECT

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The Navy requests your concurrence with our defining of the APE and finding of No Historic Properties Adversely Affected. Please direct additional inquiries to Ms. Amanda Bennett. She can be reached by telephone at (360) 476-6613, or by e-mail at amanda.j.bennett@navy.mil.

Sincerely,

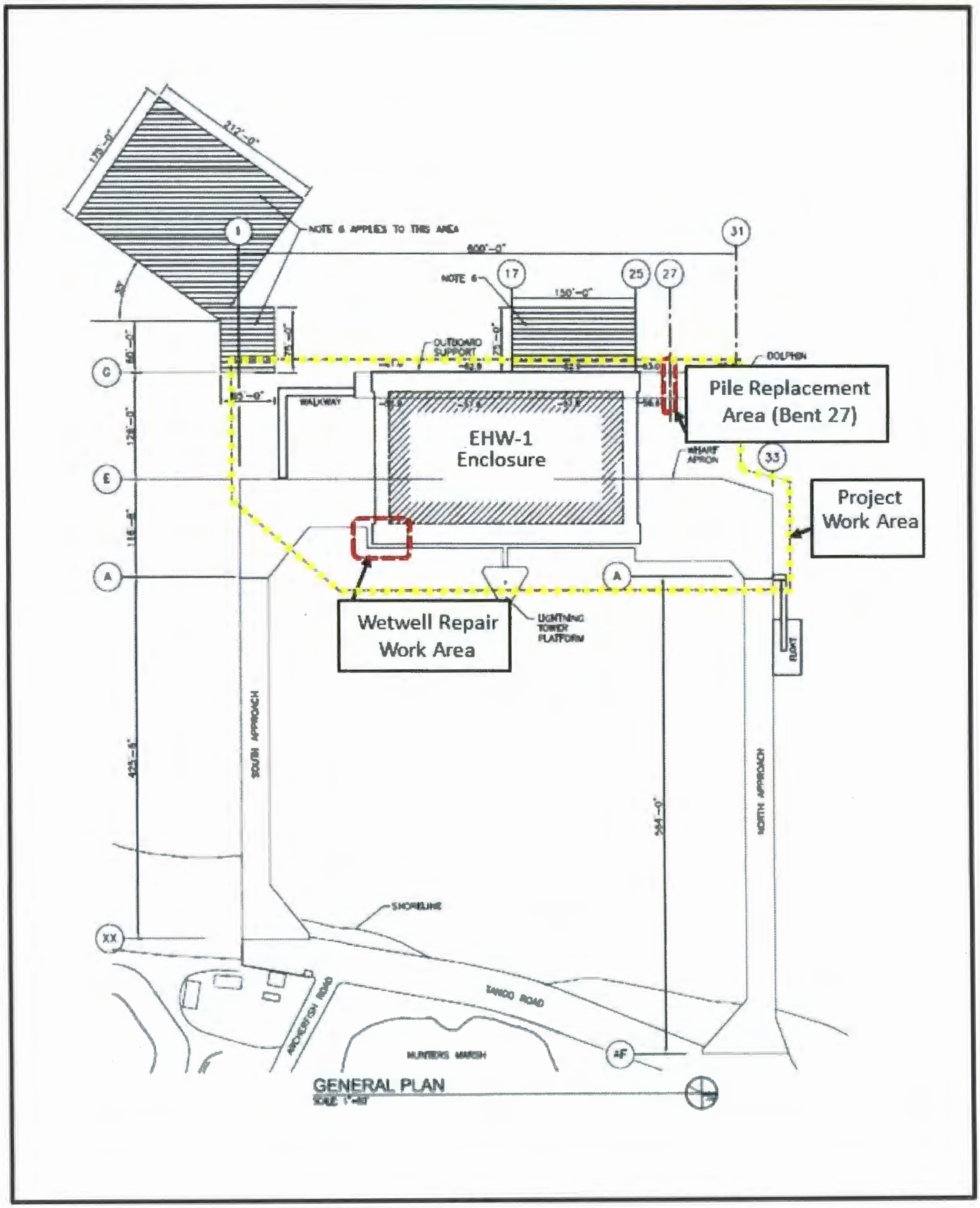
T. A. ZWOLFER
Captain, U. S. Navy
Commanding Officer

Enclosures:
1. Explosive Handling Wharf-1
2. EHW-1 Project Work Area
3. EHW-1 Area of Potential Effects

SUBJECT: REQUEST FOR CONCURRENCE WITH THE AREA OF POTENTIAL EFFECT AND FINDING OF NO HISTORIC PROPERTIES ADVERSELY AFFECTED FOR THE EXPLOSIVE HANDLING WHARF-1 PILING REPLACEMENT AND WHARF MAINTENANCE PROJECT

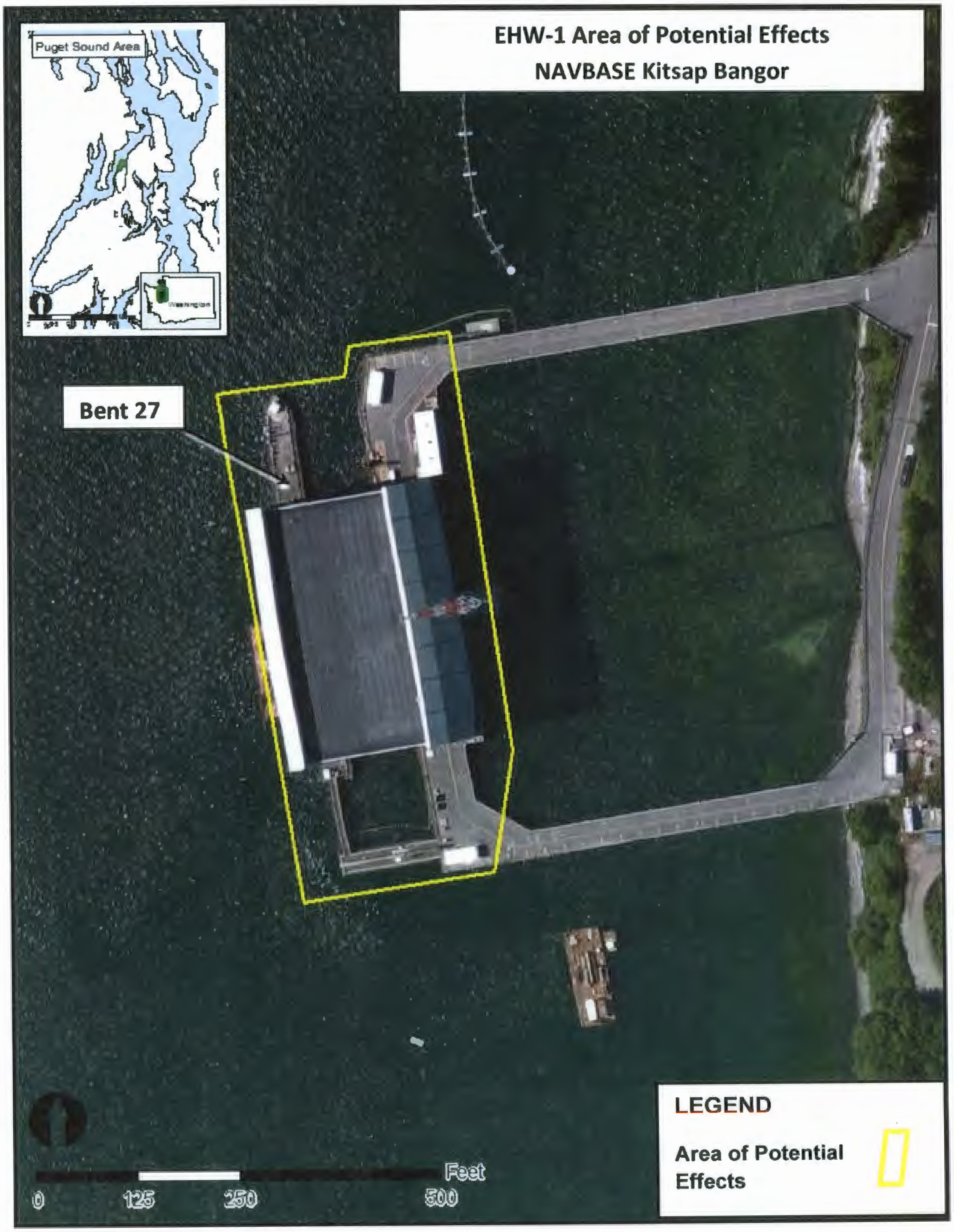
Explosive Handling Wharf-1

SUBJECT: REQUEST FOR CONCURRENCE WITH THE AREA OF POTENTIAL EFFECT AND FINDING OF NO HISTORIC PROPERTIES ADVERSELY AFFECTED FOR THE EXPLOSIVE HANDLING WHARF-1 PILING REPLACEMENT AND WHARF MAINTENANCE PROJECT



EHW-1 Project Work Area

SUBJECT: REQUEST FOR CONCURRENCE WITH THE AREA OF POTENTIAL EFFECT AND FINDING OF NO HISTORIC PROPERTIES ADVERSELY AFFECTED FOR THE EXPLOSIVE HANDLING WHARF-1 PILING REPLACEMENT AND WHARF MAINTENANCE PROJECT



EHW-1 Area of Potential Effects

DEPARTMENT OF THE NAVY
NAVAL BASE KITSAP
120 SOUTH DEWEY STREET
BREMERTON, WA 98314-5020

5090
Ser PRB4/01431
22 Aug 14

The Honorable Jeromy Sullivan
Chairman, Port Gamble S'Klallam Tribe
31912 Little Boston Road NE
Kingston, WA 98346

Dear Chairman Sullivan:

SUBJECT: REQUEST FOR CONCURRENCE WITH THE AREA OF POTENTIAL EFFECT AND FINDING OF NO HISTORIC PROPERTIES ADVERSELY AFFECTED FOR THE EXPLOSIVE HANDLING WHARF-1 PILING REPLACEMENT AND WHARF MAINTENANCE PROJECT

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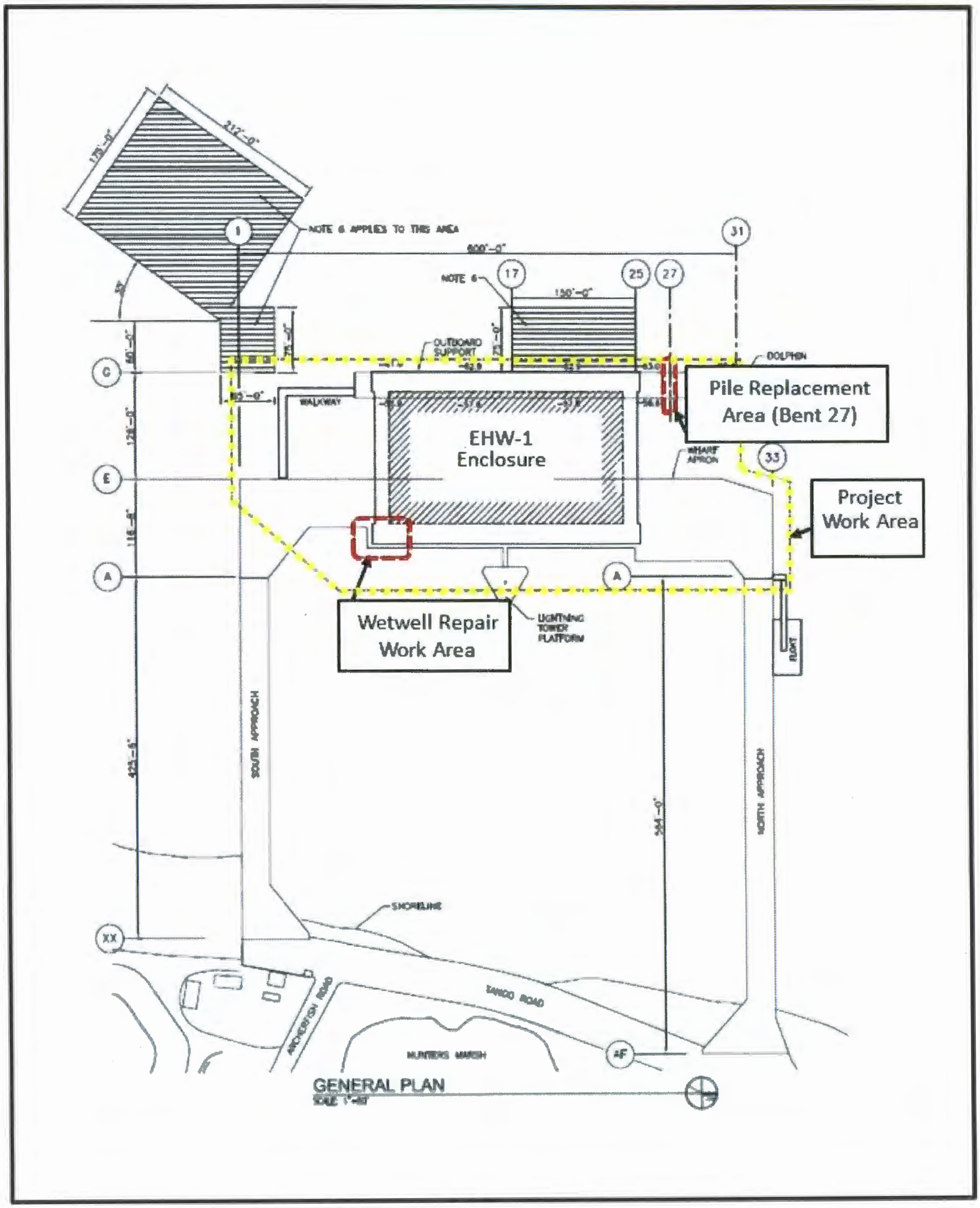
Sincerely,

T. A. ZWOLFER
Captain, U. S. Navy
Commanding Officer

Enclosures:
1. Explosive Handling Wharf-1
2. EHW-1 Project Work Area
3. EHW-1 Area of Potential Effects

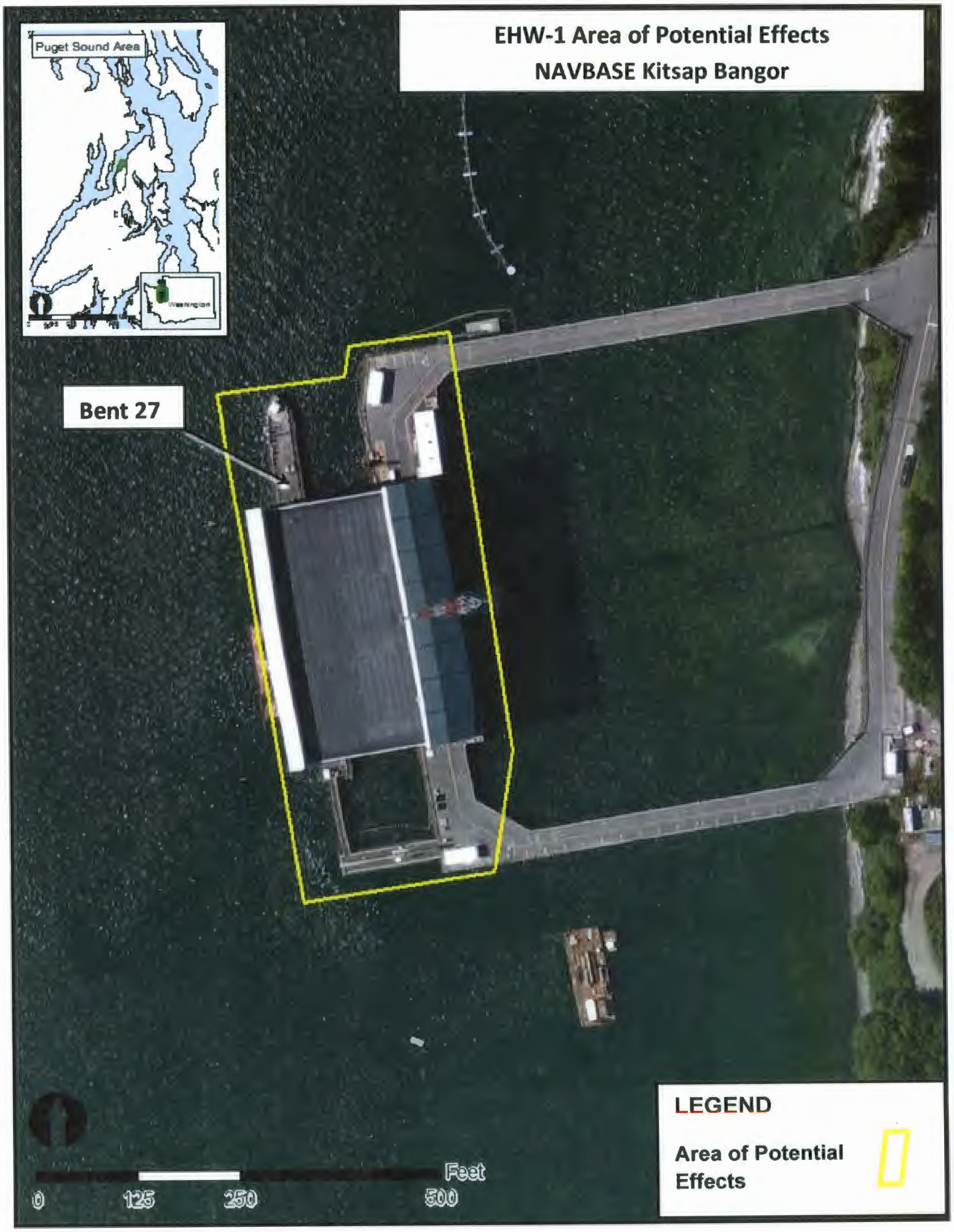
SUBJECT: REQUEST FOR CONCURRENCE WITH THE AREA OF POTENTIAL EFFECT AND FINDING OF NO HISTORIC PROPERTIES ADVERSELY AFFECTED FOR THE EXPLOSIVE HANDLING WHARF-1 PILING REPLACEMENT AND WHARF MAINTENANCE PROJECT

Explosive Handling Wharf-1



EHW-1 Project Work Area

SUBJECT: REQUEST FOR CONCURRENCE WITH THE AREA OF POTENTIAL EFFECT AND FINDING OF NO HISTORIC PROPERTIES ADVERSELY AFFECTED FOR THE EXPLOSIVE HANDLING WHARF-1 PILING REPLACEMENT AND WHARF MAINTENANCE PROJECT



EHW-1 Area of Potential Effects

DEPARTMENT OF THE NAVY
NAVAL BASE KITSAP
120 SOUTH DEWEY STREET
BREMERTON, WA 98314-5020

5090
Ser PRB4/01434
22 Aug 14

The Skokomish Tribe
The Honorable Guy Miller
North 80 Tribal Center Road
Skokomish WA 98584

Dear Chairman Miller:

SUBJECT: REQUEST FOR CONCURRENCE WITH THE AREA OF POTENTIAL EFFECT AND FINDING OF NO HISTORIC PROPERTIES ADVERSELY AFFECTED FOR THE EXPLOSIVE HANDLING WHARF-1 PILING REPLACEMENT AND WHARF MAINTENANCE PROJECT

In accordance with Section 106 of the National Historic Preservation Act, the Navy would like to initiate consultation regarding the proposed undertaking to replace deteriorating piling beneath the Explosive Handling Wharf #1 (EHW-1) - Facility 7501 at Naval Base (NAVBASE) Kitsap Bangor (Enclosure 1). The Navy has determined the EHW-1 structure is eligible for inclusion in the National Register of Historic Places (NRHP) under Criteria A and C.

The site of the proposed undertaking is along the eastern shore of Hood Canal towards NAVBASE Kitsap Bangor's northern border. The proposed project would demolish four 24-inch hollow prestressed octagonal concrete piles and install four 30-inch concrete filled steel piles adjacent to the demolished piles at Bent 27 of the outboard support of the EHW-1 (Enclosure 2). Additionally the project would: demolish and replace four 6'-0" by 4'-3" sections of deck in order to install new piles; construct four cast-in-place concrete pile caps to function as load transfer mechanisms between the superstructure and the new piles; install four sled mounted passive cathodic protection systems; repair deteriorated concrete of the wetwell (encasement for a sanitary sewer lift station pump) on the Wharf Apron; and, recoat top portions of 183 steel pipe fender piles and 27 steel mooring fittings on the deck of the Wharf.

The Area of Potential Effect (APE) is defined as the footprint of the proposed project work area at the existing Wharf. Please refer to Enclosure 3.

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EHW-1 is an imposing structure on the east shore of Hood Canal. Its public view is from Hood Canal. The main defining features of the structure are its wharf and super-structure. Pilings that form its foundation for the most part are below waterline and not visible to the public except small portions are visible at low-tide. The proposed work would replace four piles, which are largely below water and not part of the public view. The maintenance of the wetwell and recoating of pilings and mooring fittings will sustain the integrity of the facility and retain the overall appearance of the present structure. The Navy has determined that the proposed work does not adversely affect the characteristics that make the property eligible for listing in the NRHP.

The Navy requests your concurrence with our defining of the APE and finding of No Historic Properties Adversely Affected. Please direct additional inquiries to Ms. Amanda Bennett. She can be reached by telephone at (360) 476-6613, or by e-mail at amanda.j.bennett@navy.mil.

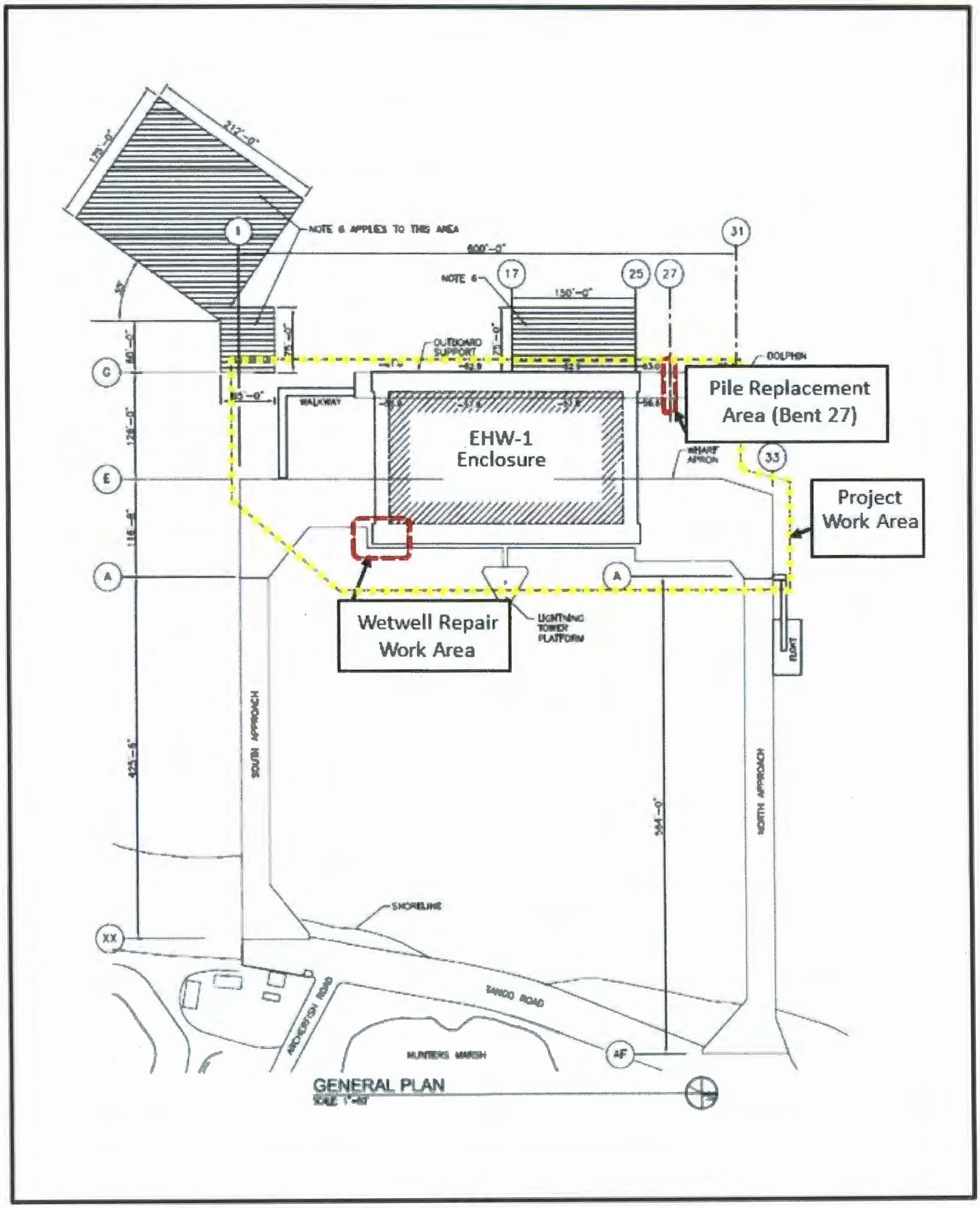
Sincerely,

T. A. ZWOLFER
Captain, U. S. Navy
Commanding Officer

Enclosures:
1. Explosive Handling Wharf-1
2. EHW-1 Project Work Area
3. EHW-1 Area of Potential Effects

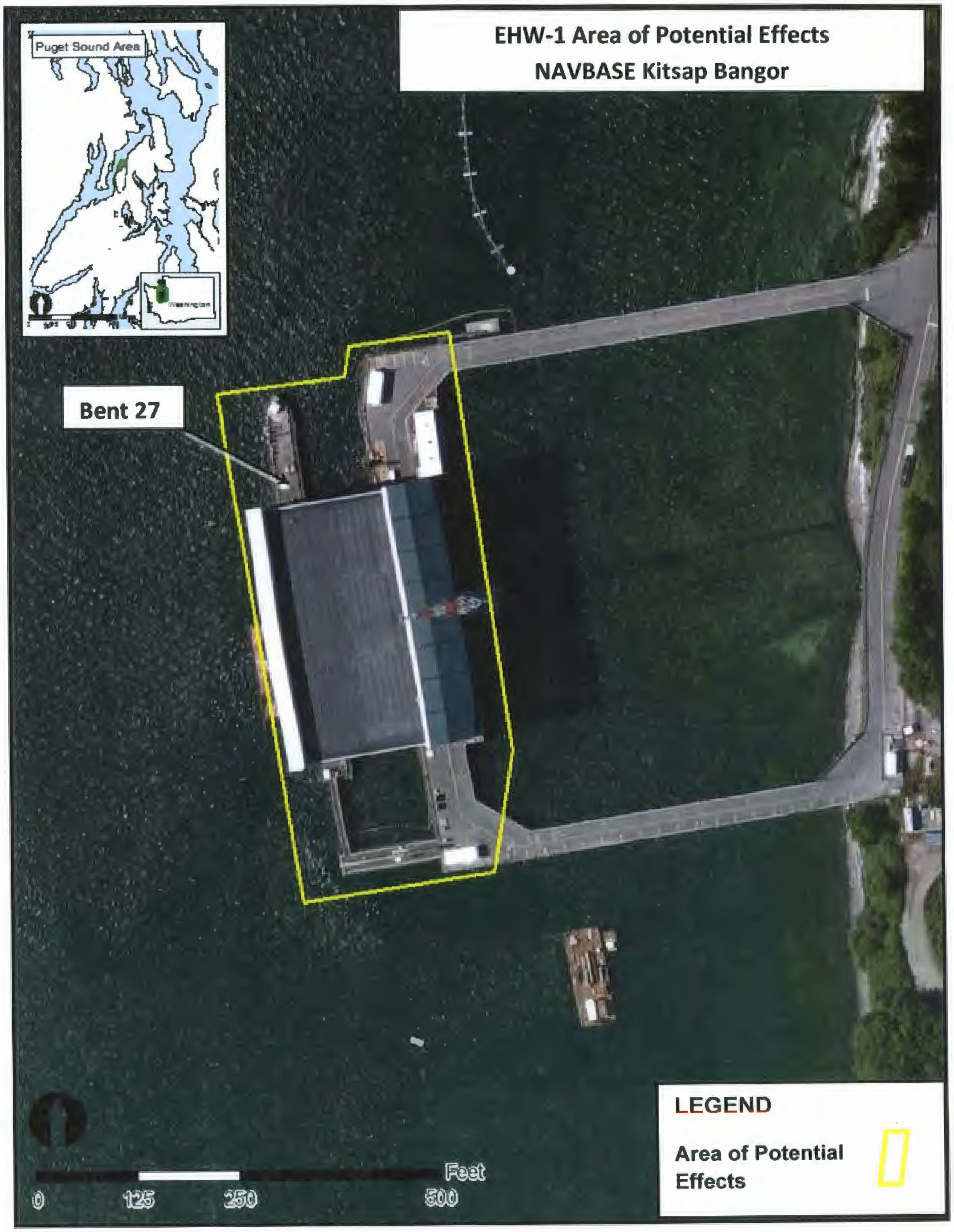
Explosive Handling Wharf-1

SUBJECT: REQUEST FOR CONCURRENCE WITH THE AREA OF POTENTIAL EFFECT AND FINDING OF NO HISTORIC PROPERTIES ADVERSELY AFFECTED FOR THE EXPLOSIVE HANDLING WHARF-1 PILING REPLACEMENT AND WHARF MAINTENANCE PROJECT



EHW-1 Project Work Area

SUBJECT: REQUEST FOR CONCURRENCE WITH THE AREA OF POTENTIAL EFFECT AND FINDING OF NO HISTORIC PROPERTIES ADVERSELY AFFECTED FOR THE EXPLOSIVE HANDLING WHARF-1 PILING REPLACEMENT AND WHARF MAINTENANCE PROJECT



EHW-1 Area of Potential Effects

DEPARTMENT OF THE NAVY
NAVAL BASE KITSAP
120 SOUTH DEWEY STREET
BREMERTON, WA 98314-5020

5090
Ser PRB4/01435
22 Aug 14

The Honorable Leonard Forsman
The Suquamish Tribe
PO Box 498
Suquamish, WA 98392

Dear Chairman Forsman:

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T. A. ZWOLFER
Captain, U. S. Navy
Commanding Officer

Enclosures: 1. Explosive Handling Wharf-1
2. EHW-1 Project Work Area
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Explosive Handling Wharf-1

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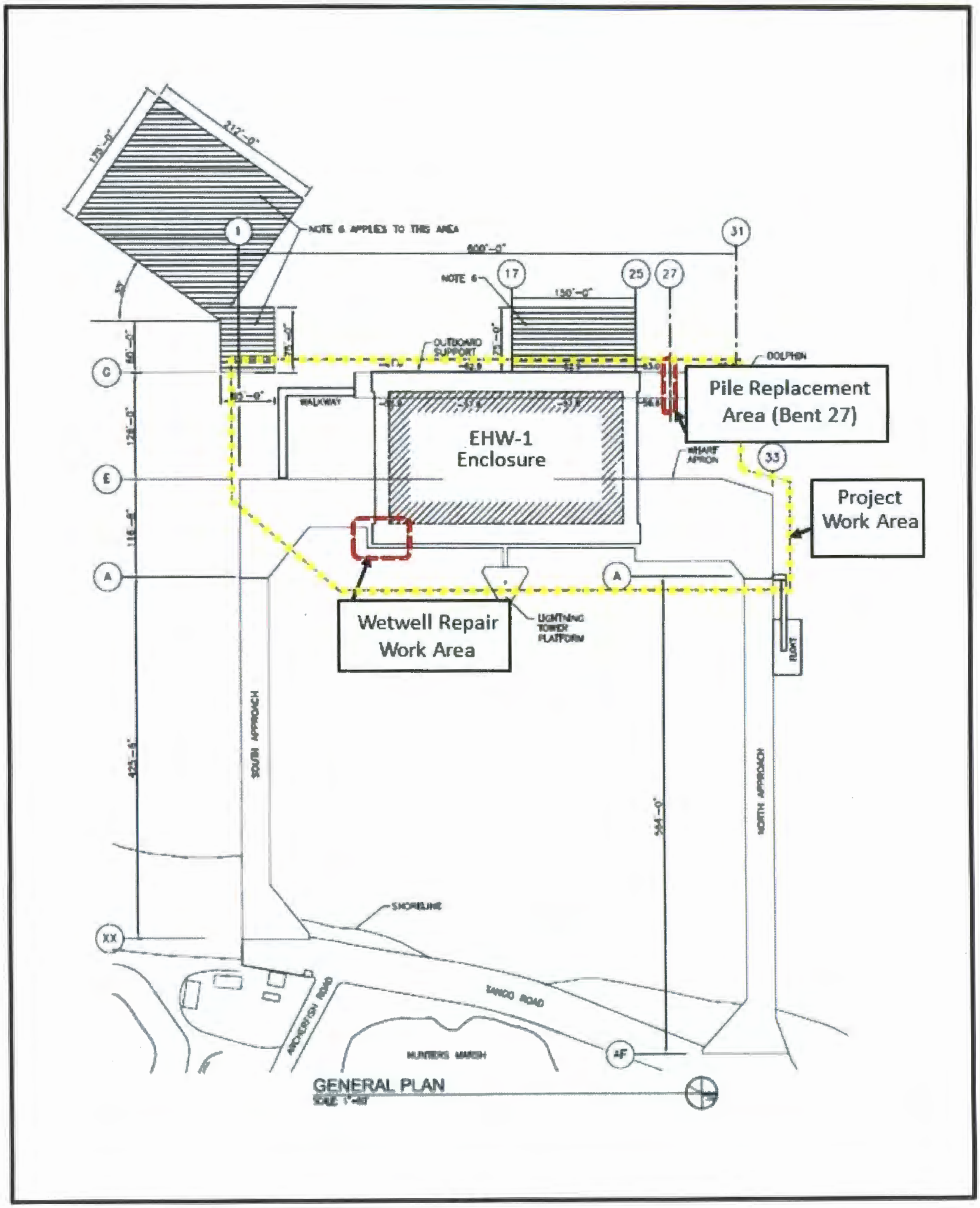

EHW-1 Project Work Area

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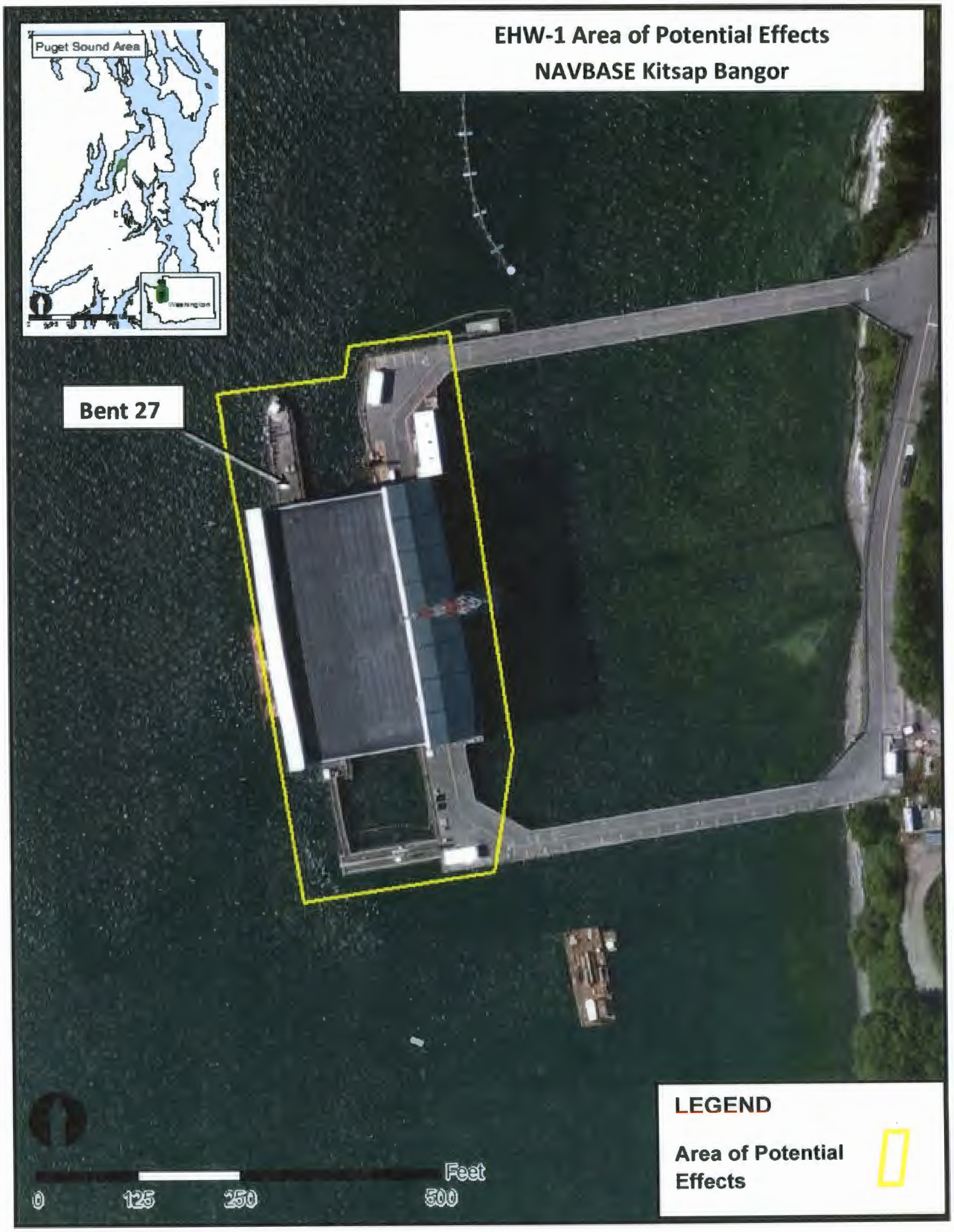

EHW-1 Area of Potential Effects

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APPENDIX B

BIOLOGICAL ASSESSMENT AND ESSENTIAL FISH HABITAT EVALUATION

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Biological Assessment

EHW-1 Pile Replacement and Maintenance
Naval Base Kitsap Bangor
Silverdale, Washington

October 2014

Naval Facilities Engineering Command Northwest
1101 Tautog Circle
Silverdale, WA 98315

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Table of Contents

List of Figures

List of Tables

List of Appendices

Executive Summary

Naval Base Kitsap proposes to perform maintenance and conduct repairs of the existing Explosives Handling Wharf (EHW-1) at the Naval Base Kitsap Bangor, Kitsap County, Washington. The Navy has determined that the EHW-1 structural integrity is compromised due to deterioration of the wharf's piling sub-structure. The purpose of the project is to maintain the structural integrity of the wharf and ensure its continued functionality to support Navy operational requirements.

The project will include removal of 4 deteriorated concrete piles with 4 new concrete filled steel piles. Installation of new piles will occur with a vibratory driver. An impact driver is only anticipated to verify structural load requirements. Additionally, the project includes replacement of structural elements such as decking and pile caps, installation of cathodic protection, repair of a concrete wetwell, and recoating of the tops of fender piles and steel mooring fittings.

Measures have been incorporated into the project to minimize effects to the aquatic environment and protected species and habitats. These include: use of a timing restriction to avoid exposure to outmigrating salmon, use of a timing restriction to avoid exposure of foraging marbled murrelets to impact pile driving noise during the nesting season, use of a noise attenuation device when impact pile driving, and visual monitoring for marbled murrelets during impact driving.

The project is scheduled to begin in July 2015. In-water work would occur from July 16, 2015 through January 15, 2016. No more than 4 days of impact pile driving are anticipated.

This Biological Assessment assesses whether the project would affect species and designated critical habitats listed under the Endangered Species Act. During construction, the project will create noise with the potential to harassment or injury listed-species and their prey and the project will disturb sediments, benthos, and aquatic vegetation. After a review of listed-species potentially present and critical habitats designated in the Action Area, and analysis of potential project effects to species and designated critical habitats, the Navy determined the project is ***not likely to adversely affect*** any listed species potentially present or critical habitat designated within the Action Area. Table ES-1 provides a list of species and critical habitat analyzed for effects and each species effect determination.

The Navy also review of Essential Fish Habitat designated within the Action Area and determined that the project ***may adversely affect*** Pacific Groundfish, Pacific Coast Salmon, and Coastal Pelagics Essential Fish Habitats (Table ES-2). However due to the limited duration of activities and with implementation of conservation and minimization measures, the effects are anticipated to be temporary and minimal.

Table ES-1. Endangered Species Act Effects Determination

<u>Species</u> Common name *Scientific name*	ESA Status	Critical Habitat Status	Effect Determination for Species	Effect Determination for Critical Habitat
Puget Sound Chinook Salmon *Oncorhynchus tshawytscha*	T	Designated within Action Area	*May affect, not likely to adversely affect*	*May affect, not likely to adversely affect*
Puget Sound Steelhead *O. mykiss*	T	Proposed outside Action Area	*May affect, not likely to adversely affect*	*No effect* if designated
Hood Canal Summer-run Chum *O. keta*	T	Designated within Action Area	*May affect, not likely to adversely affect*	*May affect, not likely to adversely affect*
Bull Trout *Salvelinus confluentus*	T	Designated outside Action Area	*May affect, not likely to adversely affect*	*No effect*
Bocaccio Rockfish *Sebastes paucispinis*	E	Proposed within Action Area	*May affect, not likely to adversely affect*	*May affect, not likely to adversely affect if designated*
Canary Rockfish *S. pinniger*	T	Proposed within Action Area	*May affect, not likely to adversely affect*	*May affect, not likely to adversely affect if designated*
Yelloweye Rockfish *S. ruberrimus*	T	Proposed within Action Area	*May affect, not likely to adversely affect*	*May affect, not likely to adversely affect if designated*
Humpback whale *Megaptera novaeangliae*	E	Not designated	*May affect, not likely to adversely affect*	n/a
Marbled Murrelet *Brachyramphus marmoratus*	T	Designated outside Action Area	*May affect, not likely to adversely affect*	*No effect*

Notes:
E = endangered; T = threatened;

Table ES-2. Essential Fish Habitat Effects Determination

Essential Fish Habitat	Effect Determination
Groundfish EFH	*May adversely effect*
Salmon EFH	*May adversely effect*
Coastal Pelagics EFH	*May adversely effect*

1 Introduction

Naval Base (NAVBASE) Kitsap Bangor, Washington provides berthing and support services to U.S. Navy submarines and other fleet assets including the TRIDENT Fleet Ballistic Missile (TRIDENT) program. The Explosive Handling Wharf #1 (EHW-1) facility is a U-shaped concrete structure built in 1977 for ordnance handling operations in support of the Trident Submarine squadron home ported at NAVBASE Kitsap Bangor. The Navy has determined that the EHW-1 structural integrity is compromised due to deterioration of the wharf's piling sub-structure. The purpose of the project is to maintain the structural integrity of the wharf and ensure its continued functionality to support the operational requirements of the TRIDENT program.

Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended (16 United States Code [USC] § 1531 et seq.), requires federal agencies to consult with United States Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) to ensure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of such species. This Biological Assessment (BA) evaluates the potential effects repairs the EHW-1 facility at NAVBASE Kitsap Bangor, beginning in July 2015.

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996 (16 USC 1801, et seq.), requires federal agencies to consult with the NMFS on activities that may adversely affect Essential Fish Habitat (EFH) designated by the Pacific Fisheries Management Council. EFH is designated at the project site for the following federally managed fisheries: Pacific salmon, Pacific groundfish, and coastal pelagic species. Section 7 of this assessment addresses potential project impacts to EFH for these fisheries.

1.1 Project Location

NAVBASE Kitsap Bangor is located north of the city of Silverdale in Kitsap County. The NAVBASE Kitsap Bangor waterfront occupies approximately 4.3 miles (7 kilometers) of the approximately 67-mile (108-kilometer) long eastern shoreline of Hood Canal. The entirety of NAVBASE Kitsap Bangor waterfront is restricted from general public access (Naval Restricted Areas 1 and 2 per 33 CFR 334.1220) (Figure 1-1). The project is located in the Washington Department of Ecology Water Resource Inventory Area 15 and U.S. Geological Service Hydrologic Unit Code 17110018, Hood Canal.

EHW-1 is located along the northern waterfront of NAVBASE Kitsap Bangor and is one of eight pile supported structures at the installation.

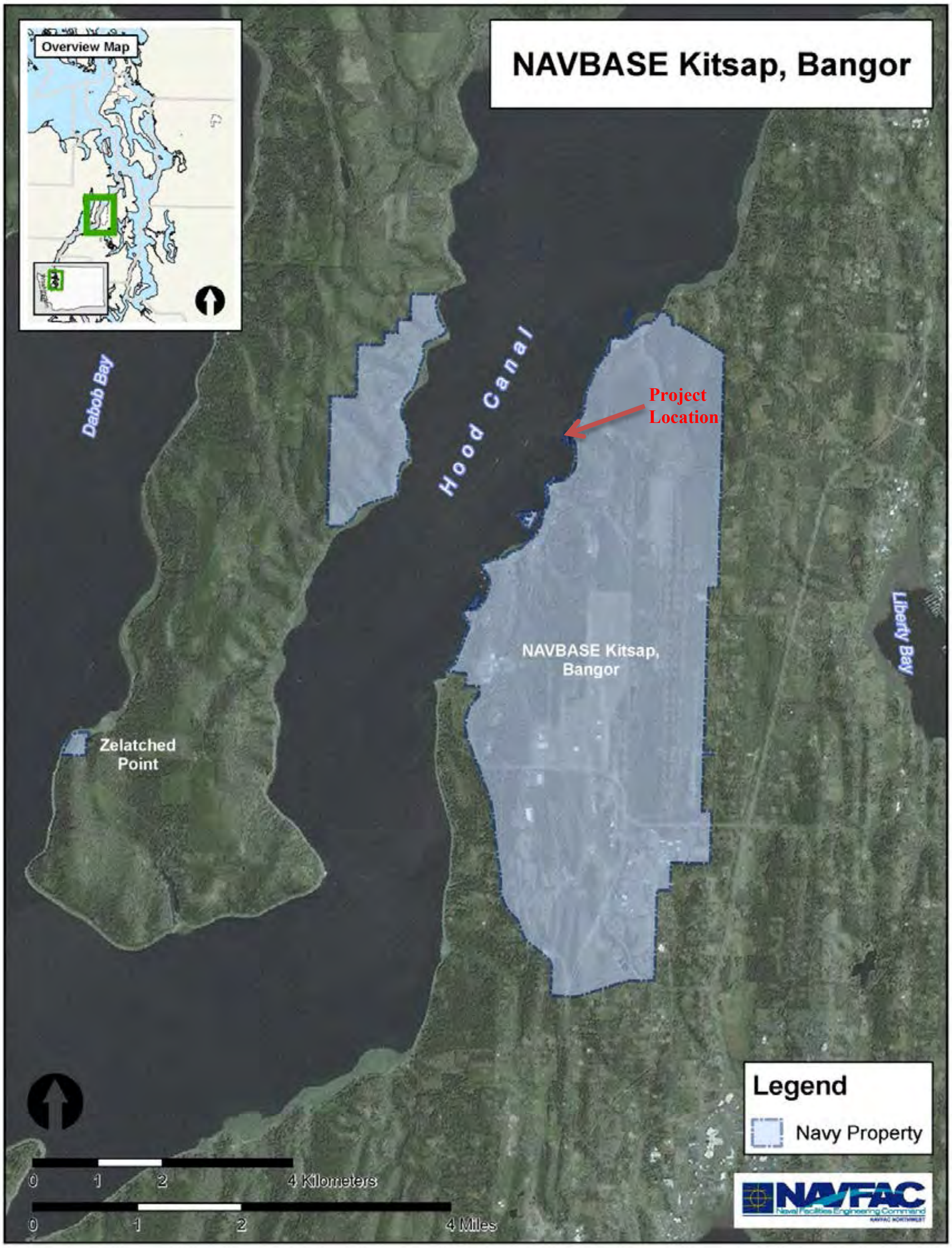

Figure 1-1 Project Location and Vicinity

2 Project Description

2.1 Project Overview

The Navy is proposing to perform maintenance and restore the structural integrity of the EHW-1 facility, including replacement of 4 structurally unsound piles. EHW-1 is a U-shaped concrete structure built in 1977 for ordnance handling operations in support of the Trident Submarine squadron home ported at NAVBASE Kitsap Bangor. EHW-1 consists of two 100-foot (ft) (30 meters [m]) access trestles and a main pier deck which measures approximately 700 ft (213 m) in length and is approximately 500 ft (183 m) wide. The wharf is supported by both 16-inch and 24-inch hollow octagonal pre-cast concrete piles (approximately 130 ft [40 m] in length). Additionally, there are steel and timber fender piles on the outboard and inboard edges of the wharf.

The project will include demolishing and replacing existing piles at Bent 27 of the outboard support of the EHW-1. Additionally, the project includes replacement of structural elements such as decking and pile caps, installation of cathodic protection, repair of a concrete wetwell, and recoating of the tops of fender piles and steel mooring fittings. Table 2-1 provides a summary of the proposed maintenance and repair activities. Figures 2-1 shows the location of Bent 27 and the other repairs.

Table 2-1. EHW-1 Proposed Maintenance and Repair Activities
Demolish four existing 24-inch hollow prestressed octagonal concrete piles to the mudline.
Install four new 30-inch concrete filled steel pipe piles adjacent to the demolished piles.
Demolish and replace four 6'-0" by 4'-3" sections of deck in order to install new piles
Install new concrete pile caps for the newly installed piles
Install cathodic protection system for newly installed piles.
Repair deteriorated concrete of the wetwell on Wharf Apron.
Recoat top portion of 183 steel pipe fender piles.
Recoat 27 steel mooring fittings on the deck of the Wharf.

The Proposed Action includes best management practices (BMPs), and minimization measures that will be implemented to avoid or minimize potential environmental impacts as described in Section 2.4.

2.2 Construction

2.2.1 Upland

No Upland work is associated with the EHW-1 Repair project.

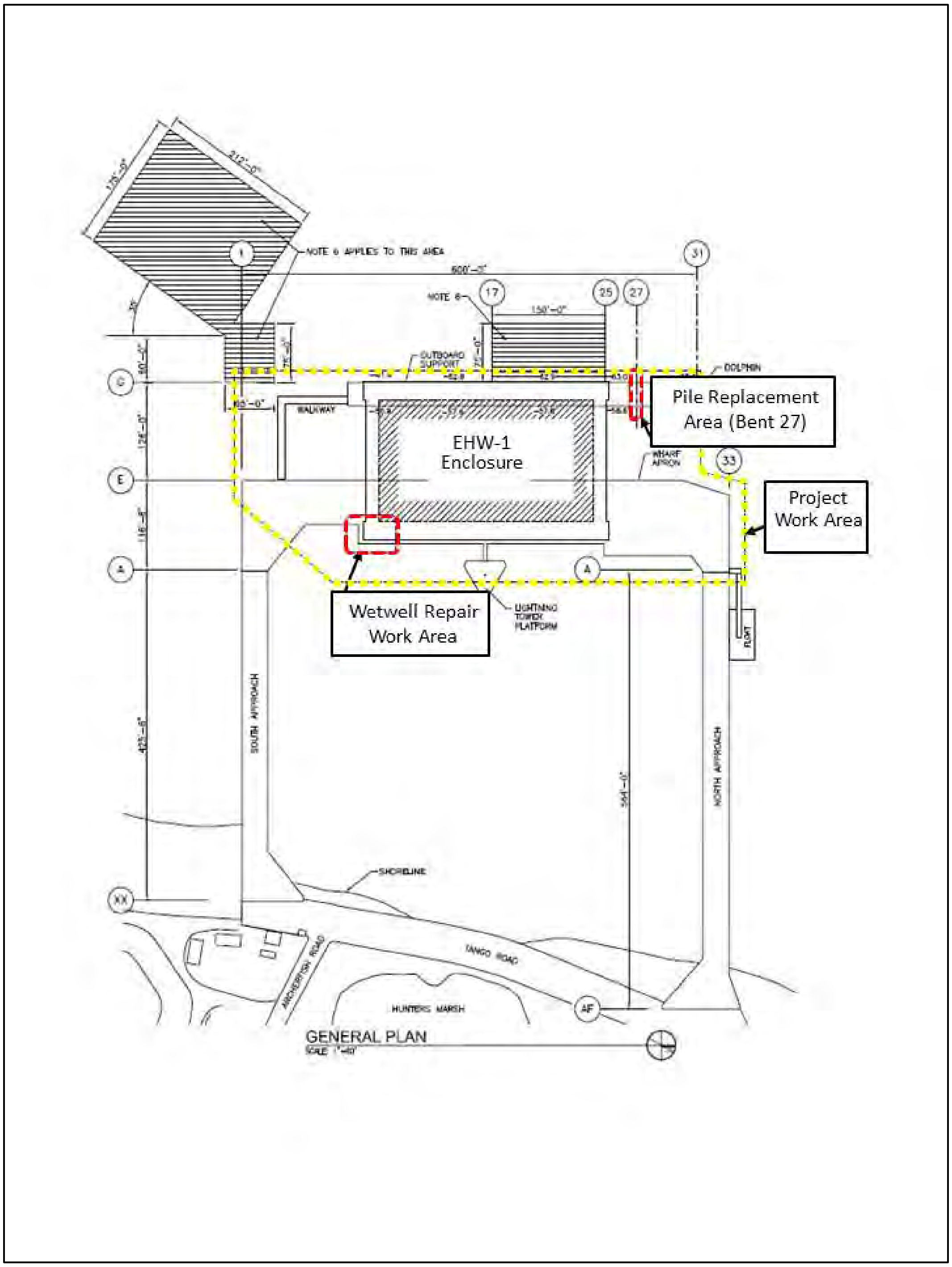

Figure 2-1. EHW-1 Project Work Area

2.2.1 Pile Replacement Construction Methods

This section describes the planned methods of pile removal and installation that would be used to accomplish the work included as part of this Proposed Action. Other repairs at EHW-1 that are planned are described in Section 2.2.3.

2.2.1.1 Pile Removal

Four existing 24-inch hollow prestressed octagonal concrete piles located at Bent-27 will be removed with a pneumatic chipping hammer or another tool capable of cutting through concrete. If possible, piles will be first scored by a diver using a small pneumatic hammer. Each pile will be moved slightly back and forth to break at the score. Remaining pile parts will be chipped away with a pneumatic hammer. If there is not room to move a pile, the entire base of the pile will be chipped away with a pneumatic hammer for removal. A pneumatic chipping hammer is similar to an electric power tool and performs much like a smaller version of a jackhammer, 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. Rebar strands in the piles will be torched to remove. Concrete debris will be captured as practicable using a debris curtains/sheeting and removed from the project area. Removed piles and/or pile pieces will be placed on a barge for upland disposal in accordance with federal and state requirements. The Navy will evaluate if it would be possible to reclaim or recycle the materials.

2.2.1.1 Pile Installation

Because impact driving of steel piles can produce underwater noise levels that have been known to cause fish kills, vibratory hammers will be used to install four 30-inch concrete filed steel piles adjacent to the demolished piles (Figure2-2). The vibratory hammer will install the new piles to a point of refusal or within approximately 5 ft of the final tip elevation (approximately -110 ft MLLW). The vibratory hammer process for pile installation 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 will be used to entirely advance the pile to the required depth. Based on the Navy's experience replacing piles during previous repair cycles at the EHW-1 facility, the Navy feels that use of a vibratory hammer will be sufficient; the impact hammer has yet to be required to accomplish installation. Impact pile driving is anticipated to verify the load bearing capacity (proofing[1]) of the new piles. An impact hammer is typically required to strike a pile a number of times the last few feet to

1 "Proofing" is driving the pile the last few feet into the substrate to determine the capacity of the pile. The capacity is established by measuring the resistance of the pile to a hammer that has a piston with a known weight and stroke (distance the hammer rises and falls) so that the energy on top of the pile can be calculated. The blow count in "blows per inch" is measured to verify resistance, and pile compression capacities are calculated.

ensure it has met load bearing specifications. To minimize noise levels, a bubble curtain or other noise attenuation device will be employed for all steel impact pile strikes. A

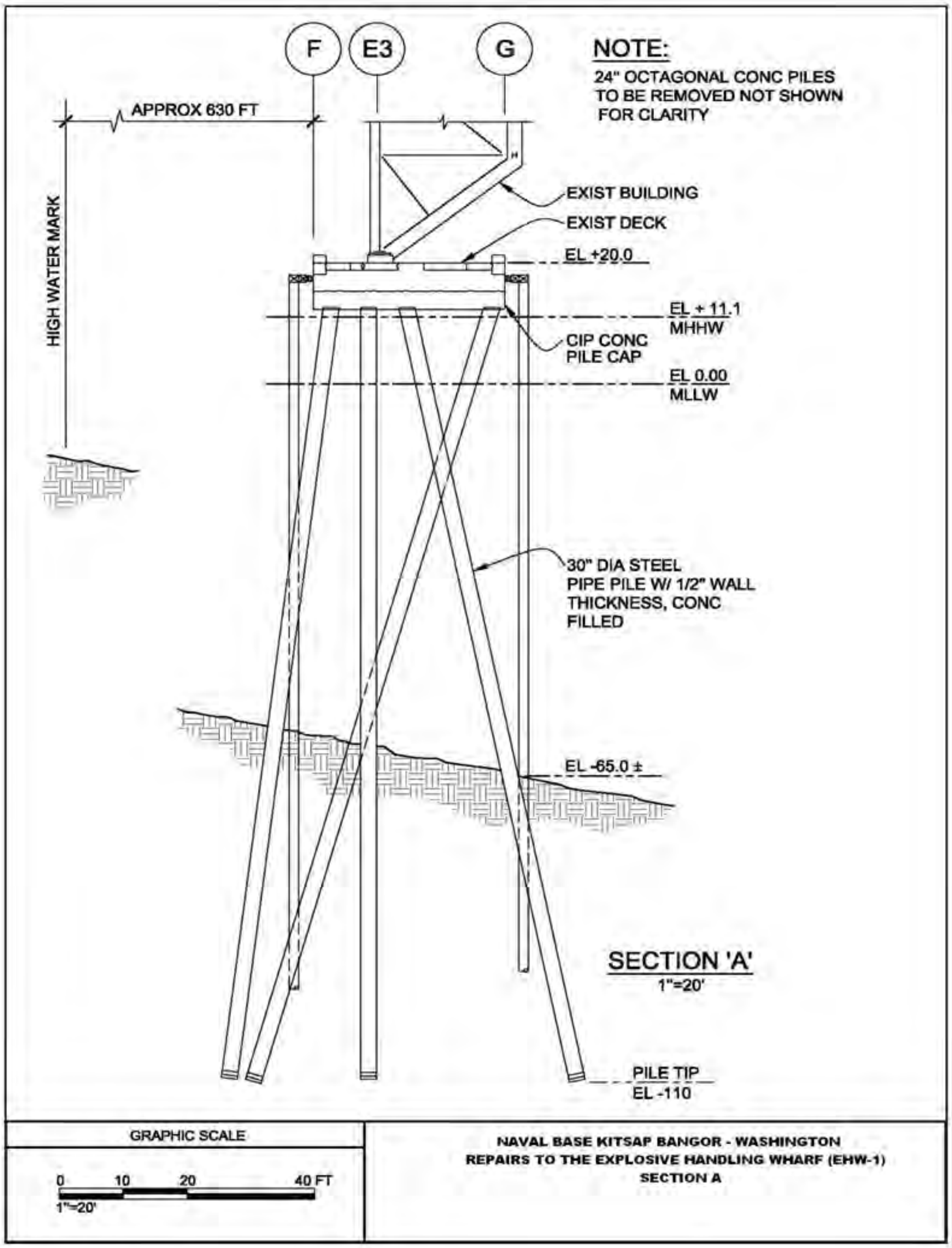

Figure 2-2. EHW-1 Pile Replacement Configuration

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 which impedes the sound produced during pile driving.

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 strikes and average strike rates needed to install 24- to 36-inch steel piles. For steel piles that are "proofed" an average of 400 strikes per pile were estimated. For piles that cannot be advanced with a vibratory driver and will be fully impact driven, 2,000 strikes per pile were estimated to fully drive a pile. This estimate assumes an average estimated strike rate of 44 strikes per minute (or almost a strike every second and a half) resulting in an estimate of approximately 9 minutes of impact driving for each pile proofed or approximately 45 minutes for each pile fully impact driven. Actual strike numbers and average strike rates will vary due to substrate conditions and the type and energy of impact hammers will likely vary. Past projects at EHW-1 have not required full impact driving. Therefore, steel impact pile driving is estimated to occur from approximately 36 minutes to a maximum of 3 hours over the entire project duration.

2.3 Associated Marine Structure Repairs and Maintenance

Other marine structure repairs and maintenance include replacement of structural elements such as decking and pile caps, installation of cathodic protection, repair of a wetwell, and recoating of the tops of fender piles and steel mooring fittings. Each of these is described below.

- Demolish and replace four 6'-0" by 4'-3" sections of deck in order to install new piles for the concrete fragmentation barrier and walkway (Figure 1-2 and 1-3). The walkway is used to get from the Wharf Apron to the Outboard Support. These deck structures will likely be removed by cutting the concrete into sections using a wire saw, or other equipment, and removed using a crane. Concrete pieces will be hauled to a barge for upland disposal. New decking would likely be cast-in-place concrete. Concrete formwork would be located above Mean Higher High Water (MHHW).
- Construction of cast-in-place concrete pile caps. The pile caps will be situated on the tops of the steel piles located directly beneath the structure and function as a load transfer mechanism between the superstructure and the piles. Concrete formwork may be located below MHHW.
- Installation of four sled mounted passive cathodic protection systems. A passive cathodic protection system is a metallic rod or anode attached to a metal object to protect it from corrosion. A more active metal, which easily oxidizes, corrodes the anode first and protects the primary structure from corrosion damage. At the EHW-1 facility, the passive cathodic protection systems will be banded to the steel piles to prevent the metallic surfaces of the wharf from corroding due to the saline conditions in Hood Canal.

- Repair deteriorated concrete of the wetwell on Wharf Apron. Repairs would occur by removing failed and delaminated concrete (delamination occurs in reinforced concrete structures subject to reinforcement corrosion, in which the oxidized metal of the reinforcement is greater in volume than the original metal). 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.
- Recoat top portion of 183 steel pipe fender piles and 27 steel mooring fittings on the deck of the Wharf. Fender piles and mooring fittings would be cleaned prior to recoating. All coatings will be applied to dry surfaces and limited to areas above mean sea level (+6.5 ft MLLW).

2.3.1 Construction Access and Project Staging

Barges will be used as platforms for conducting in-water work activities and to haul materials and equipment to and from the work site. Barges will be moored with spuds or anchors and not allowed to ground. No staging sites have been identified. If staging areas for equipment and materials are identified at a future date, they will occur in currently developed lots or managed fields, unless otherwise approved by the project biologist.

2.3.2 Project Sequencing and Timeline

In-water work will occur from July 16 through January 15 to avoid conducting activities when bull trout and juvenile salmon and steelhead are most likely to be present.

All in-water impact pile driving will occur during daylight hours except from July 16 to September 23, when impact pile driving will only occur starting 2 hours after sunrise and ending 2 hours before sunset to protect foraging marbled murrelets during the nesting season. Pile driving is estimated to occur a maximum of 8 days with no more than 4 days of impact pile driving.

While sequencing of all proposed repair work has not been planned or scheduled, work would likely proceed with removal of deck segments occurring first, followed by installation of the new concrete filled steel piles and pile caps. Only after the new piles have been installed and the pile caps have fully cured and reached design compressive strength, would removal of the existing concrete piles begin.

2.4 Operations and Maintenance

The proposed repair projects are not associated with changes in operations at EHW-1. Future maintenance of EHW-1 will not change as a result of repairs associated with the Proposed Action.

2.5 Impact Avoidance and Minimization Measures

The Navy will employ the Best Management Practices (BMPs) and minimization measures listed in this section to avoid and minimize potential impacts from this action.

Best management practices, mitigation and minimization measures are included in construction contract plans and specifications and must be agreed upon by the contractor prior to any construction activities. A signed contract represents a legal agreement between the contractor and the Navy. Failure to follow the prescribed BMPs and minimization measures constitutes a contract violation.

2.5.1 General Construction Best Management Practices

- All work will adhere to performance requirements of the Clean Water Act Section 404 and Rivers and Harbor Act Section 10 permit. No in-water work will begin until after issuance of regulatory authorizations.
- The construction contractor is responsible for preparation of an environmental protection plan. The plan will be submitted and implemented prior to the commencement of any construction activities and is a binding component of the overall contract. The plan shall identify construction elements and recognize spill sources at the site. The plan shall outline BMPs, responsive actions in the event of a spill or release, and notification and reporting procedures. The plan shall 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 shall be allowed to enter surface waters.
- Wet concrete will not come in contact with marine waters. Forms for any concrete structure will be constructed to prevent leaching of wet concrete. Forms will remain in place until concrete is cured.
- Water displaced by concrete will meet State water quality standards prior to release or be pumped away from the site and disposed of as waste water.
- Washwater resulting from washdown of equipment or work areas shall be contained for proper disposal and shall not be discharged unless authorized.
- Equipment that enters surface waters shall be maintained to prevent any visible sheen from petroleum products.
- No oil, fuels, or chemicals shall be discharged to surface waters, or onto land where there is a potential for re-entry into surface waters to occur. Fuel hoses, oil drums, oil or fuel transfer valves, fittings, etc. shall be checked regularly for leaks and will be maintained and stored properly to prevent spills.
- No cleaning solvents or chemicals used for tools or equipment cleaning shall 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 will be restricted to tidal elevations adequate to prevent grounding of a barge.

- Where eelgrass is present in the work area, the Navy shall provide the contractor with plan sheets showing eelgrass boundaries. The following restrictions shall apply to areas designated as having eelgrass:
  - No derrick spudding or anchoring will occur.
  - No scouring of sediments or significant sediment contamination will occur within eelgrass beds.

2.5.2 Pile Repair, Removal, and Installation Best Management Practices

2.5.2.1 General

- Removed piles and associated sediments (if any) shall be contained on a barge. If a barge is not utilized, piles and sediments may be stored in a containment area near the construction site.
- Pilings 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, pilings 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 piling 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 and the resulting hole backfilled with clean sediment.
- Any floating debris generated during 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 toward the bottom of the pile to prevent splashing and overflow.
- Whenever activities that generate sawdust, drill tailings, or wood chips from treated timbers are conducted, tarps or other containment material will be used to prevent debris from entering the water.
- Ammoniacal copper zinc arsenate-treated wood will be treated using established standards.
- All piles, lumber, and other materials treated with preservatives shall be sufficiently cured to minimize leaching into the water or sediment.
- If excavation around piles to be repaired or replaced is necessary, hand tools or a siphon dredge will be used to excavate around piles to be replaced.

2.5.3 Minimization Measures for Listed Species

2.5.3.1 Timing Restrictions

- To minimize the number of fish exposed to underwater noise and other construction disturbance, in-water work will occur from July 16 through January 15 when juvenile ESA-listed salmonids are least likely to be present.
- All in-water construction activities will occur during daylight hours (sunrise to sunset) except from July 16 to September 23 when impact pile driving will only occur starting 2 hours after sunrise and ending 2 hours before sunset, to protect foraging marbled murrelets during the nesting season (April 15-September 23). Sunrise and sunset are to be determined based on the National Oceanic and Atmospheric Administration (NOAA) data which can be found at http://www.srrb.noaa.gov/highlights/sunrise/sunrise.html.
- Non in-water construction activities could occur between 7:00 AM and 10:00 PM during any time of the year.

2.5.3.2 Coordination

- The Navy shall conduct briefings between 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, monitoring protocol, and operational procedures.

2.5.3.3 Acoustic Minimization Measures

- 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 meters (2 feet) (see Section 2.2.2.2). A noise attenuation device is not required during vibratory pile driving.
  - 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 shall be in contact with the mudline for the full circumference of the ring. 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.
  - A performance test of the noise attenuation device shall be conducted prior to initial use for impact pile driving. If a bubble curtain or similar measure is utilized, the performance test shall confirm the calculated pressures and flow rates at each manifold ring. The contractor shall also train personnel in the proper balancing of air flow to the bubblers. The contractor shall 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.
- A soft start procedure will be used at the beginning of each day's in-water pile driving or any time pile driving has ceased for more than 30 minutes. 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.

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

- o If a bubble curtain is used for impact pile driving, the contractor will start the bubble curtain prior to the initiation of impact pile driving.
- o The contractor will provide an initial set of strikes from the impact hammer at reduced energy, followed by a 30-second waiting period, then two subsequent sets. (The reduced energy of an individual hammer cannot be quantified because they vary by individual drivers. Also, 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").

For vibratory pile driving, the contractor will initiate noise from vibratory hammers for 15 seconds at reduced energy followed by a 30-second waiting period. The procedure shall be repeated two additional times.

2.5.3.4 Marbled Murrelet Visual Monitoring and Shutdown Procedure

- A marble murrelet monitoring plan (Appendix A) will be implemented during impact pile driving. The plan is consistent with the most current USFWS protocol.

2.6 Interrelated and Interdependent Actions

Interrelated actions are those that are part of a larger action and depend on the larger action for their justification (50 CFR §402-02). Interrelated actions are typically "associated with" the proposed action.

Interdependent actions are those that have no independent utility apart from the action under consideration (50 CFR §402-02). Interdependent actions are typically "because of" the proposed action.

No changes in the type or level of operations at EHW-1 will occur as part of the proposed maintenance and repair project. No actions that are interrelated or interdependent to the proposed project were identified.

2.7 Action Area

The Action Area is defined as: "*all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action*" (50 Code of Federal Regulations (CFR) § 402.2). The Action Area addresses the three dimensional extent of all physical, biological, and chemical effects of the action on the environment.

The furthest reaching impact of all project activities was determined to be the temporary extent of airborne and underwater noise from pile driving. The Action Area for the project is then defined as the combination of the extent of noise from pile driving in air and underwater.

Airborne noise levels will extend the farthest from impact pile driving. Using the airborne background sound level of 55 A–weighted decibels (dBA) at 50 feet (see Section 4.2.7.2) and the spherical spreading model for point source sound[2], noise from impact pile driving was calculated to attenuate to background levels by 8.5 kilometers (5.3 miles) over water and by 2.4 kilometers (1.5 miles) over land. Sound levels will attenuate faster over land because vegetation and buildings are present that attenuate noise transmission faster than a hard surface such as water. The actual extent of airborne project noise will depend on site specific factors such as topography, vegetation, presence of industrial areas, wind, and climatic conditions. For this project airborne noise is not expected to extend over land on the Toandos Peninsula because of dense vegetation.

Underwater noise levels will extend the farthest from vibratory pile driving. Average underwater ambient sound levels measured at NAVBASE Kitsap Bangor were 114 dB Root Mean Square (RMS) and noise levels from vibratory pile driving were estimated at 166 dB (see Section 4.2.7.1 and 5.1.1, respectively). Using the Practical Spreading Loss model, vibratory pile driving noise was estimated to extend a maximum underwater distance of 24 kilometers (15 miles) from the project site. Underwater noise levels at this distance are intersected by land. Therefore, the distance noise attenuates until it reaches land represents the maximum distance of project underwater effects.

All other effects of the action, including temporarily increases in turbidity levels from pile installation and removal and temporary effects to forage species are encompassed within the extent of this area. No other direct or indirect project effects from were identified that would increase the size of the Action Area.

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[2] $D = D_o * 10^{((\text{Construction Noise - Ambient Sound Level in dBA})/\alpha)}$, where D = the distance from noise source, Do = reference measurement (50 feet), α = 20 for hard site conditions (water), 25 for soft site conditions (forested/vegetated areas), impact pile driving noise = 110 Lmax dBA, and background levels = 55 dBA. $D = 50 * 10^{((110-55)/20)}$ = 28,117 feet (5.3 miles) for hard site areas (over water extent) and $D = 50 * 10^{((110-55)/25)}$ = 7,924 feet (1.5 miles) for soft site areas (overland extent).

3 Status/Presence of Federally Listed Species and Designated Critical Habitats

The lists of endangered and threatened species that may be affected by the proposed project were obtained from the NMFS and USFWS endangered species web sites. Additional information was gathered from species experts, a review of available literature, and a site visit conducted on June 10, 2014 by Navy biologists. Nine ESA-listed species have the potential to occur in the action area. Table 3-1 lists the species that have the potential to occur in the action area, their listing status, the status of their critical habitat designation, and occurrence of designated critical habitat in the action area. Additional information regarding species distribution and presence in the Action Area is discussed in the following sections.

Table 3-1. Species Potentially Present within the Action Area, Status, and Designated Critical Habitats

Species	Status	Critical Habitat Designation	CH Presence in Action Area
Bull trout *Salvelinus confluentus*	T	Yes	No.
Puget Sound ESU Chinook salmon *Oncorhynchus tshawytscha*	T	Yes	Waters within installation Navy installation boundaries exempt, but designation includes shoreline outside the boundaries to a depth of 30 meters MLLW (70 FR 52630).
Hood Canal summer-run ESU chum salmon *O. keta*	T	Yes	Waters within Navy installation boundaries exempt, but designation includes shoreline outside the boundaries to a depth of 30 meters MLLW (70 FR 52630).
Puget Sound DPS steelhead *O. mykiss*	T	Proposed	None proposed within the action area.
Puget Sound/Georgia Basin DPS bocaccio *Sebastes paucispinis*	E	Proposed	Waters within Navy installation boundaries would be exempt, but designation proposed outside the boundaries in nearshore areas for bocaccio and canary rockfish and in some waters deeper than 30 m for bocaccio, canary, and yelloweye rockfish (78 FR 47635).
Puget Sound/Georgia Basin DPS canary rockfish *S. pinniger*	T	Proposed	
Puget Sound/Georgia Basin DPS yelloweye rockfish *S. ruberrimus*	T	Proposed	
Humpback whale *Megaptera novaeangliae*	E	None Designated	No
Marbled murrelet *Brachyramphus marmoratus*	T	Yes	No

DPS = distinct population segment, ESU = evolutionarily significant unit,T=Threatened, E=Endangered, MLLW = mean lower low water

3.1 Federally Listed Species within the Project Action Area

3.1.1 Bull Trout

3.1.1.1 Status

Bull trout in the coterminous United States were listed as threatened under the ESA in 1999 (64 FR 58909). The Coastal Puget Sound Distinct Population Segment (DPS) of this listing occurs within Washington Inland and Coastal waters. The Coastal-Puget Sound bull trout DPS reportedly contains the only occurrence of anadromous bull trout in the contiguous United States (64 FR 58912); Hood Canal is one of five geographically distinct regions within this DPS. The Skokomish River contains the only population of bull trout among the Hood Canal drainages (WDFW [Washington Department of Fish and Wildlife] 2004).

Threats and Trends

The USFWS identified the following risks to federally listed bull trout: (1) habitat degradation; (2) blockage of migratory corridors; (3) poor water quality; and (4) climate change and (5) past fisheries management practices, including the introduction of non-native species such as brown, lake, and brook trout. A five-year review of bull trout status concluded with a recommendation that the species remain listed as threatened (USFWS 2008).

3.1.1.2 Occurrence in the Action Area

Summaries of recent tagging studies (USFWS 2011) and historical otolith analysis (Correa 2003) indicate 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. Neither historic nor more recent juvenile fish surveys at the NAVBASE Kitsap Bangor waterfront (using beach and lampara seines and tow nets) have captured bull trout (Schreiner et al. 1977; Salo et al. 1980; Bax 1983; Science Applications International Corporation [SAIC] 2006; Bhuthimethee et al. 2009). And no records exist of bull trout in the Hood Canal marine environment or freshwater systems on the Kitsap Peninsula (USFWS 2011). Based on this information, bull trout are unlikely to migrate through the Bangor waterfront from the Skokomish River (USFWS 2010).

3.1.1.3 Designated Critical Habitat within the Action Area

USFWS has designated critical habitat for bull trout in certain freshwater and marine waters within Washington State (75 FR 63898). No designated critical habitat is present within the action area.

3.1.2 Puget Sound Evolutionarily Significant Unit Chinook Salmon

3.1.2.1 Status

The Puget Sound evolutionarily significant unit (ESU) 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, as well as 26 artificial propagation programs. Within Hood Canal, the hatchery program at Big Beef Creek was terminated from this program, with the last of the adults returning to spawn in 2008 (NMFS 2011).

The Puget Sound Technical Recovery Team identified 22 independent populations within the ESU (Shared Strategy for Puget Sound 2007). Hood Canal contains two of the independent populations, the Mid-Hood Canal population and the Skokomish River population. Both of these populations are considered essential to the recovery of the ESU.

Threats and Trends

The NMFS Biological Review Team (BRT) identified the following risks to the PS Chinook salmon ESU: (1) the concentration of the majority of natural production in just two basins; (2) high levels of hatchery production in many areas of the ESU; and (3) widespread loss of estuary and lower floodplain habitat diversity (Good et al. 2005). Threats to the two populations in Hood Canal, the Mid-Hood Canal and Skokomish River populations, are reduced viability attributed to habitat loss and degradation, hatcheries, and harvest management issues. Additionally, dissolved oxygen (DO) levels in portions of Hood Canal are at a historic low, which is a concern and future threat to recovery of the Hood Canal populations within the ESU (70 FR 76445).

All Puget Sound Chinook salmon populations are considered well below escapement abundance levels identified for recovery in the recovery plan (NMFS 2011). After a five-year review in 2011, NMFS concluded the updated information on abundance, productivity, spatial structure and diversity since the last review did not indicate a change in the ESU's biological risk category (76 FR 50448). Although these criteria are in decline for the ESU overall (NMFS 2011), a review of 1999-2008 returning spawning abundance data indicated neither of the Hood Canal populations displayed an increasing or decreasing trend in population abundance (NWFSC 2013). Average adult Chinook escapement (number of fish surviving to reach spawning grounds or hatcheries) in 2002 was relatively low, particularly for the mid-Hood Canal stock, for which average escapements were typically below the low escapement threshold of 400 fish (WDFW 2002). In the most recent 5-Year Review, NMFS reported natural origin recruit escapements have remained fairly constant from1985–2009, but total natural origin recruit abundance and productivity continued to decline (NMFS 2011).

3.1.2.2 Occurrence in the Action Area

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. Tagging investigations have shown that juvenile Chinook distribution and movement patterns are not well known (Chamberlin et al. 2011). Juvenile Chinook salmon may have extended intrabasin residence times and utilize these habitats for extended rearing periods. Smaller outmigrants tend to migrate in schools along nearshore areas (Nightingale and 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 out-migration generally takes place from April through July, though Chinook have been documented in Dabob Bay as early as February in very small numbers (Bahls 2004). A joint investigation by state and federal resource agencies and non-governmental entities of Hood Canal tributaries indicated slightly earlier arrivals to the lower portions of these drainages (Weinheimer 2013). Screw traps were deployed from January to July 2012 to capture juvenile salmonids within the lowest 0.5 mile of the Duckabush and Hamma Hamma Rivers. Findings showed the first Chinook fry arrived in these screw traps February 2. Within the Duckabush, the migration reached a median point in April and was 95 percent complete by the first week of June. In comparison, within the Hamma Hamma, Chinook fry were caught the first night of trapping (January 31), the migration reached a median point in March and was 95 percent complete by April 10.

Along the Bangor waterfront, offshore tow-netting and beach seine surveys during the 1970s (Schreiner et al. 1977; Prinslow et al. 1980; Bax 1983; Salo 1991), and nearshore beach seine surveys from 2005–2008 (SAIC 2006; Bhuthimethee et al. 2009), determined that Chinook salmon occur most frequently from late May to early July (Table 3–2). These studies indicate that peak occurrence in these waters generally occurs from May to early July (Table 3–2).

Table 3–2. Timing of Puget Sound Chinook Juvenile Presence and Out-migration on NAVBASE Kitsap Bangor

Reference	Time period detected in Hood Canal	Peak out-migration timing
Bax et al. 1978; Bax et al. 1980	February to July	May to early June
Schreiner 1977	May to July	Late June to early July
SAIC 2006	April to September	Mid-June to late June

The in-migration and spawn timing of adult Puget Sound Chinook stocks in Hood Canal is listed in Table 3-3. In general, adult Chinook salmon enter Hood Canal waters from August to October and begin spawning in their natal streams in September, with peak spawning occurring in October.

Table 3–3. Spawn Period Timing and Peak of Adult Hood Canal Stocks of Puget Sound Chinook

Stock	Time period detected in Hood Canal	Spawn time period	Spawn peak
Skokomish stock	Late-August to October	Mid-September to October	Mid-October
Mid-Hood Canal stock	Mid-August to late October	Early September to late October	October

Source: Healey 1991

3.1.2.3 Designated Critical Habitat within the Action Area

Critical habitat was designated for the Puget Sound ESU Chinook salmon February 2000 and re-designated September 2005 (70 FR 52630). In marine waters, designated critical habitat extends to -30 MLLW. Department of Defense (DOD) lands were excluded from designation because of implementation of Integrated Natural Resources Management Plan (INRMP) that outlines species protection measurements. Designated critical habitat for Puget Sound ESU Chinook salmon occurs within the action area, but outside DOD lands.

NMFS designated six Primary Constituent Elements (PCEs), three of which occur in marine water and are present in the action area where critical habitat occurs outside DOD boundaries. These are:

- Estuarine areas free of obstruction with water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh-and saltwater; natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels; and juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation.
- Nearshore marine areas free of obstruction with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels.
- Offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation.

3.1.3 Hood Canal Summer-run Distinct Population Segment Chum Salmon

3.1.3.1 Status

The Hood Canal summer-run chum salmon ESU was federally listed as threatened under the ESA in 1999, and the threatened listing was reaffirmed in 2005 (70 FR 37160). The NMFS recovery plan for this species was adopted on May 24, 2007 (72 FR 29121).

Historically, there were sixteen stocks within the Hood Canal summer-run chum ESU, eight of which are extant (six in Hood Canal and two in the eastern Strait of Juan de Fuca) with the remaining eight extinct (71 FR 47180). Six current summer-run chum stocks have been identified in Hood Canal: Quilcene, Dosewallips, Duckabush, Hamma Hamma, Lilliwaup, and Union (NMFS 2011). Six additional stocks were identified as recent extinctions: Skokomish, Finch, Tahuya, Dewatto, Anderson, and Big Beef.

The Hood Canal summer-run chum salmon ESU 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: Quilcene NFH, Hamma Hamma Fish Hatchery, Lilliwaup Creek Fish Hatchery, Union River/Tahuya, Big Beef Creek Fish Hatchery, Salmon Creek Fish Hatchery, Chimacum Creek Fish Hatchery, and the Jimmycomelately Creek Fish Hatchery summer-run chum hatchery programs (NMFS 2011). However, five Hood Canal summer chum hatchery programs were terminated since the last status review, including Quilcene National Fish Hatchery, Union River/Tahuya River, Big Beef Creek, Salmon Creek, and Chimacum Creek programs. The last adult fish produced through these terminated programs returned in 2008 (NMFS 2011).

Threats and Trends

Reduced viability, lower survival, and listing of extant stocks of summer-run chum and recent stock extinctions in Hood Canal are attributed to the combined impacts of three primary factors: (1) habitat loss and degradation, (2) climate change, and (3) increased fishery harvest rates (HCCC 2005). Additional factors cited in WDFW and Point No Point Treaty Tribes (WDFW& PNPTT) (2000) and HCCC (2005) were impacts associated with the releases of hatchery salmonids, which compete with naturally spawning stocks for food and other resources.

Based on the most recent 5-Year Review, NMFS (2011) found that the overall trend in spawning abundance is generally stable for the Hood Canal population (all natural spawners and natural-origin only spawners) and for the Strait of Juan de Fuca population (all natural spawners). Only the Strait of Juan de Fuca population's natural-origin only spawners show a significant positive trend. Productivity from 2005 to 2009 was very low, especially compared to the relatively high productivity observed from 1994 to 2004.

3.1.3.2 Occurrence in the Action Area

Beach seine surveys were conducted along the Bangor Bangor waterfront from 2005 to 2008 (SAIC 2006; Bhuthimethee et al. 2009). During that time, 55,554 out of 58,667 total salmonids captured (approximately 94.7 percent) were juvenile chum salmon (Figure B–1). Chum salmon peak abundance along the NAVBASE Kitsap Bangor shoreline generally peaks in late April to early May (Bhuthimethee et al. 2009). However, this peak abundance is strongly influenced by hatchery releases. In 2007, Hood Canal hatcheries released approximately 26 million juvenile chum salmon (Bhuthimethee et al. 2009). Release dates varied from February to May, although at least 23 million of these fish were released from April 1 to April 20. Because fall chum hatchery releases are visually indistinguishable from summer-run chum, no distinction in the field could be made between the two.

To observe juvenile salmon out-migration timing, Weinheimer (2013) deployed screw traps from January to July 2012 within the lowest 0.5 mile of the Duckabush and Hamma Hamma Rivers. Weinheimer (2013) reported that chum salmon were present in both screw traps in January. Similar to comparing hatchery-produced fish to naturally produced fish, they are visually indistinguishable at smaller sizes, so no distinction in the field could be made between fall-run chum and summer-run chum salmon. Within the Duckabush, findings indicated the migration reached a median point in mid-March, and was 95 percent complete by the first week of April. Within the Hamma Hamma, findings indicated the migration reached a median point in mid-March, and was 95 percent complete by April 9. Genetic studies differentiating fall-run and summer-run chum salmon found that summer-run fish comprised over 90 percent of all chum captured in the Duckabush from January through the first week of April. Within the Hamma Hamma trap, summer-run chum comprised over 90 percent of all chum captured from January through mid-March (Weinheimer 2013).

During out-migration, fry move within the nearshore corridor and into and out of sub-estuaries with the tides, most likely in search of food resources (Hirschi et al. 2003). At a migration rate of 4.4 miles per day, the majority of chum emigrants from southern Hood Canal exit the canal to the north 14 days after their initial emergence in seawater (WDFW and PNPTT 2000). Table 3-4 provides a summary of the presence and out-migration timing of juvenile summer-run chum from Hood Canal. Juvenile summer-run chum are expected to occur near the proposed project area from late January through early June.

Table 3–4. Timing of Hood Canal Summer-run Chum Juvenile Presence and Out-migration in Hood Canal and along the Bangor Shoreline

Reference	Sampling Location(s)	Time Period Detected in Hood Canal	Peak Out-migration Timing on NAVBASE Kitsap Bangor
Prinslow et al. 1980; Salo et al. 1980; Bax 1983	NAVBASE Kitsap Bangor	February to March	March
WDFW and PNPTT 2000	Estimated emergence from Hood Canal	February to late May	Late March
SAIC 2006	NAVBASE Kitsap Bangor	Late January through early June	Late March

Summer-run chum 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, Dosewalips, and Union systems (Table 3–5). Approximately one month separates peak spawn timing of the early (summer) and later (fall) runs of chum salmon in Hood Canal (Johnson et al. 1997).

Table 3–5. Spawning Period, Peak, and 90-Percent Spawn Timing of Adult Stocks of Hood Canal Summer-run Chum

Stock	Time Period Detected in Hood Canal [1]	Spawn Time Period and Peak	Date at which 90 Percent of Spawning is Complete
Big/Little Quilcene	Early September to Mid-October	Mid-September to Mid-October	10/1 to 10/5
Lilliwaup Creek	Early September to Mid-October	Mid-September to Mid-October	10/10
Hamma Hamma	Early September to Mid-October	Mid-September to Mid-October	10/8 to 10/10
Duckabush	Early September to Mid-October	Mid-September to Mid-October	10/11
Dosewalips	Early September to Mid-October	Mid-September to Mid-October	10/9
Union	Mid-August to Early October	Early September to Early October	9/29 to 9/30

Sources: WDFW 2002; WDFW and PNPTT 2000.

1. Range of timing estimates from WDFW and PNPTT 2000, in Appendix Report 1.2 (WDFW and PNPTT 2000).

3.1.3.3 Designated Critical Habitat within the Action Area

Hood Canal summer-run chum salmon critical habitat was designated in 2006 (70 FR 52685). Nearshore marine waters within Hood Canal were included as part of this designation. Although critical habitat occurs in northern Hood Canal waters adjacent to the base, NAVBASE Kitsap Bangor is excluded by federal law (70 FR 52630). Critical habitat is designated within the action area, but outside NAVBASE Kitsap Bangor boundaries. Primary constituent elements are the same as those listed for Puget Sound Chinook in Section 3.1.2.

3.1.4 Puget Sound Distinct Population Segment Steelhead

3.1.4.1 Status

The Puget Sound DPS steelhead was listed in May 2007 under the ESA as a threatened DPS (72 FR 26722). The DPS includes all naturally spawned anadromous winter-run and summer-run *O. mykiss* (steelhead) populations in streams in the river basins of the Strait of Juan de Fuca, Puget Sound, and Hood Canal, Washington, bounded to the west by the Elwha River (inclusive) and to the north by the Nooksack River and Dakota Creek (inclusive), as well as the Green River natural and Hamma Hamma winter-run steelhead hatchery stocks (NMFS 2011). The Hamma Hamma River hatchery program and four other hatchery programs are not considered part of the DPS, with a number of hatchery supplementation programs terminated in the last 10 years. As a result, steelhead supplementation in the Hamma Hamma was discontinued, with the last returning adult steelhead arriving in 2010 (NMFS 2011). Five new steelhead programs propagating native-origin fish for the purposes of preserving and recovering the populations also have been initiated. These programs support recovery of native winter-run steelhead in the White, Dewatto, Duckabush, North Fork Skokomish, and Elwha River watersheds. The new programs warrant consideration for inclusion in the DPS (NMFS 2011). The definition of individual populations of steelhead within the DPS is being developed by the PS Steelhead Technical Recovery Team (NMFS 2011).

Threats and Trends

The Puget Sound steelhead Biological Review Team concluded that the viability of Puget Sound steelhead is at moderate risk of extinction due to reduced life history diversity of stocks and the potential threats posed by artificial propagation and harvest in the Puget Sound (Hard et al. 2007). NMFS (2011) indicated the principal factor for decline for Puget Sound steelhead is the present or threatened destruction, modification, or curtailment of its habitat or range. Within Puget Sound these threats may include barriers to fish passage, adverse effects on water quality, loss of wetland and riparian habitats, and other urban development activities contributing to the loss and degradation of steelhead habitats (NMFS 2011).

The winter-run steelhead is the predominant run in Puget Sound, in part because there are relatively few basins in the Puget Sound DPS with the flow and watershed characteristics necessary to establish the summer-run life history (NMFS 2011). All summer-run stocks are depressed and concentrated in northern and central Puget Sound and Hood Canal. Production of hatchery stocks that are either out-of-DPS-derived stocks (Skamania River summer-run) or within-DPS stocks that are substantially diverged from local populations (Chambers Creek winter-run) largely outnumber naturally-produced steelhead in many basins throughout Puget Sound (NMFS 2011).

3.1.4.2 Occurrence in the Action Area

Limited information is available regarding the timing of juvenile out-migration for winter-run steelhead in Hood Canal. WDFW suggests that juvenile out-migration of steelhead stocks in Hood Canal occurs from March through June, with peak out-migration during April and May (Johnson 2006, personal communication). Beach seine surveys were conducted in the summer of 2005, winter/spring of 2006, late January through late November 2007, and from early January through early June 2008. These surveys did not catch large numbers of steelhead along the Bangor shoreline. Steelhead captured during these shoreline surveys occurred most frequently in the late spring and early summer months. Fifty-eight (approximately 0.1 percent) of the total of 58,667 salmonids captured in beach seine surveys were juvenile steelhead (SAIC 2006, Bhuthimethee et al. 2009). The absence of juvenile steelhead from nearshore surveys is largely due to these juveniles occurring as smolts, much larger than the chum and pink salmon fry that occur along the shoreline. Steelhead smolts enter marine waters at a size and developmental stage that enables them to move further offshore to forage on larger prey items. In the 2013 proposed critical habitat notification, 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" (78 FR 2725).

The majority of adult winter-run steelhead in Hood Canal (Skokomish, Hamma Hamma, Duckabush, Quilcene/Dabob Bay, and Dosewallips) spawn from mid-February to mid-June (WDFW 2002). Spawn timing of summer-run steelhead in Hood Canal is not fully understood; however, spawning is believed to occur from February through April (WDFW 2002).

3.1.4.3 Designated Critical Habitat within the Action Area

Critical habitat for Puget Sound steelhead was proposed in January 2013 (78 FR 2725). Within the Hood Canal Subbasin, currently occupied riverine habitat is proposed as Puget Sound steelhead critical habitat. DoD installations with current Integrated Natural Resources Management Plans (INRMPs) may receive an exemption from critical habitat designation. Conservation measures that provide protection to the species have been identified in the INRMP and reviewed by NMFS. No critical habitat is anticipated to be designated at NAVBASE Kitsap Bangor.

3.1.5 Puget Sound Distinct Population Segment Bocaccio Rockfish

3.1.5.1 Status

Puget Sound bocaccio (*Sebastes paucispinis*), a species of rockfish, was federally listed as endangered under the ESA in 2010 (75 FR 22276) (Table 3–1).

Threats and Trends

Threats to bocaccio rockfish in Puget Sound include areas of low DO concentrations, commercial and sport fisheries (notably, mortality associated with fishery bycatch), reduction of kelp habitat necessary for juvenile recruitment (74 FR 18516), habitat disruption (including exotic species), derelict gear (e.g., lost or abandoned fishing nets), climate change, species interactions (including predation and competition), diseases, and genetic changes (Drake et al. 2009; Palsson et al. 2009).

The species is believed to have commonly occurred along steep walls in most of Puget Sound prior to fishery exploitations, although they are currently very rare in these habitats (Love et al. 2002). Although rockfish are typically long-lived, recruitment is generally poor as larval survival and settlement are dependent on a variety of factors including marine currents, adult abundance, habitat availability, and predator abundance (Drake et al. 2009; Palsson et al. 2009). The combination of these factors, and the threats described above, has contributed to declines in the species within Georgia Basin and Puget Sound in the last few decades (74 FR 18516). A conservation plan to aid in recovery of Puget Sound rockfish was developed by WDFW and approved by NMFS in 2011(WDFW 2011).

3.1.5.2 Occurrence in the Action Area

Bocaccio range from Punta Blanca, Baja California, to the Gulf of Alaska, Alaska (Love et al. 2002). Information on habitat requirements for most rockfishes is limited despite years of research, and even less is known about bocaccio in Puget Sound (Drake et al. 2009; Palsson et al. 2009). Much of the information presented below on bocaccio life history and habitat use is derived from other areas where bocaccio occurs. In general, most adult rockfish are associated with high relief, rocky habitats, which are limited in Hood Canal, while larval and juvenile stages of some rockfishes utilize open water and nearshore habitats as they grow. Larval ESA-listed rockfish are pelagic and occur in surface waters primarily from early spring with no occurrence by November (Greene and Godersky 2012). 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; Bargmann et al. 2010). 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.

Palsson et al. (2009) provides the most comprehensive review of 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). Only two records occurred for Hood Canal, both in the 1960s. Currently both sport and commercial fishing for rockfish in Hood Canal is prohibited. WDFW is conducting rockfish surveys along the Bangor waterfront, but results were not available at the time of this writing. Although in 2009, there had been no confirmed observations of bocaccio in Puget Sound for approximately 7 years (74 FR 18516), Drake et al. (2009) concluded that it is likely that bocaccio occur in low abundances. Therefore, bocaccio rockfish have the potential to occur within the Action Area.

3.1.5.3 Designated Critical Habitat within the Action Area

Critical habitat for yelloweye rockfish, canary rockfish, and bocaccio of the Puget Sound Georgia Basin was proposed August 2013 (78 FR 47635). DoD installations with current INRMPs are exempted from critical habitat designation. The NAVBASE Kitsap Bangor INRMP has been reviewed by NOAA Fisheries. Therefore, no existing or proposed rockfish critical habitat presently occurs along the Bangor shoreline. Conservation measures that provide protection to fish species have been identified in the INRMP.

3.1.6 Puget Sound Distinct Population Segment Canary Rockfish

3.1.6.1 Status

Puget Sound canary rockfish were federally listed as threatened under the ESA in 2010 (75 FR 22276) (Table 3–1). WDFW's April 2010 *Puget Sound Rockfish Conservation Plan* would be applicable to all rockfish in Puget Sound, including canary rockfish.

Threats and Trends

The same stressors contributing to the decline of bocaccio, described above, also affect canary rockfish (74 FR 18516; Drake et al. 2009; Palsson et al. 2009).

3.1.6.2 Occurrence in the Action Area

Canary rockfish range from Punta Blanca, Baja California, to the Shelikof Strait of Alaska, and are abundant from British Columbia to central California. Canary rockfish were once considered fairly common in the greater Puget Sound area (Kincaid 1919; Holmberg et al. 1962), although little is known about their habitat requirements in these waters (Drake et al. 2009; Palsson et al. 2009). Recent reviews of Puget Sound rockfish and their habitats (Drake et al. 2009; Palsson et al. 2009; Bargmann et al. 2010) discuss habitat use by listed rockfish in general terms with little or no distinction between the species. Therefore, as discussed above for bocaccio, adult canary rockfish are considered associated with high-relief, rocky habitats, and larval and juvenile stages likely utilize open water and nearshore habitats with larval stages primarily from early spring with no occurrence by November (Greene and Godersky 2012). Much of the information presented below on canary rockfish life history and habitat use is derived from research from other areas where canary rockfish are more abundant. After review of historical rockfish records in Puget Sound, Palsson et al. (2009) noted 114 records of canary rockfish prior to the mid-1970s, with most records attributed to sport catch from the 1960s to 1970s in Tacoma Narrows, Hood Canal, San Juan Islands, Bellingham, and Appletree Cove. Within Hood Canal, 14 records occurred: 1 in the 1930s and at least 13 in the 1960s (Miller and Borton 1980).

With the absence of associated catch records, and limited scientific surveys of these waters, the prevalence of rockfish in waters adjacent to NAVBASE Kitsap Bangor remains unknown. Drake et al. (2009) concluded that canary rockfish occur in low and decreasing abundances in Puget Sound. Therefore, canary rockfish have the potential to occur in waters within the proposed Action Areas.

3.1.6.3 Designated Critical Habitat within the Action Area

Critical habitat has been proposed for the three ESA-listed rockfish species. Additional information is provided in Section 3.1.5.3.

3.1.7 Puget Sound Distinct Population Segment Yelloweye Rockfish

3.1.7.1 Status

Puget Sound yelloweye rockfish (*Sebastes ruberrimus*) were federally listed as threatened under the ESA in 2010 (75 FR 22276).

Threats and Trends

The same stressors contributing to the decline of bocaccio also affect yelloweye rockfish (74 FR 18516; Drake et al. 2009; Palsson et al. 2009). Recent reviews of Puget Sound rockfish species and their habitats (Drake et al. 2009; Palsson et al. 2009; Bargmann et al. 2010) suggest little distinction between these rockfish species in terms of habitat use in Puget Sound. Therefore, consistent with the discussion for bocaccio, adult yelloweye rockfish are considered associated with deeper, high-relief, rocky habitats, and larval and juvenile stages may use open water and nearshore habitats.

3.1.7.2 Occurrence in the Action Area

Palsson et al. (2009) noted 113 documented Puget Sound yelloweye rockfish historical records associated with sport catch. Of these records, 14 occurred in Hood Canal waters: 1 in the 1930s and 13 in the 1960s (Miller and Borton 1980). Due to the moratorium on both sport and commercial fishing for rockfish in Hood Canal, the absence of associated recent catch records, and no recent scientific surveys of these waters, the prevalence of yelloweye rockfish in these waters remains unknown (Drake et al. 2009; Palsson et al. 2009). However, yelloweye rockfish have been documented in Hood Canal (NMFS 2013) and yelloweye have been caught in Hood Canal in relatively low numbers (WDFW 2011).

3.1.7.3 Designated Critical Habitat within the Action Area

Critical habitat has been proposed for the three ESA-listed rockfish species. Additional information is provided in Section 3.1.5.3.

3.1.8 Humpback Whale

3.1.8.1 Status

Humpback whales are listed as endangered under the ESA and depleted under the MMPA. The stock structure of humpback whales is defined by the NMFS based on feeding areas because of the species' fidelity to feeding grounds (Carretta et al. 2013). The California, Oregon, and Washington stock occurs within Puget Sound.

Threats and Trends

Although humpback whales were common in inland Washington waters prior to the whaling period, few sightings had been reported in this area until the last 10 years (Scheffer and Slipp 1948; Calambokidis and Steiger, 1990; Pinnell and Sandilands, 2004). A number of take reduction and recovery plans, as well as, research and monitoring efforts are currently in place for the humpback whale. The current best abundance estimate for the California, Oregon, and Washington stock is 2,043 (coefficient of variation [CV]=0.10) based on mark-recapture estimates (Calambokidis et al. 2009a and Carretta et al. 2010 Stock Assessment Report (SAR) as presented in Carretta et al. 2013). However, this estimate excludes some whales in Washington. Population trends from mark-recapture estimates have shown an overall long-term increase of approximately 7.5% per year for the California, Oregon, Washington stock (Calambokidis et al. 2009).

3.1.8.2 Occurrence in the Action Area

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).

In Washington inland waters, most humpback whale sightings occur in the Strait of Juan de Fuca and in the San Juan Island area. However, from January 2003 through July 2012 there were over 60 Puget Sound sightings reported to OrcaNetwork, some of which could be the same individuals (OrcaNetwork 2012). Therefore, humpback whales are considered to be regular but not frequent visitors to Puget Sound, especially in areas outside of Admiralty Inlet. Of the 60 sightings reported to OrcaNetwork noted above, almost all were in the main basin of Puget Sound. In Hood Canal, one humpback whale was observed for several weeks in January and February 2012 (Calambokidis pers. comm. 2012). Prior to this sighting, there were no confirmed reports of humpback whales entering Hood Canal (Calambokidis pers. comm. 2012). Construction of the Hood Canal Bridge occurred in 1961 and could have contributed to the lack of historical sightings (Calambokidis pers. comm. 2010). Only a few records of humpback whale sightings near Hood Canal (but north of the Hood Canal Bridge) are in the Orca Network database.

Puget Sound opportunistic sightings primarily occur April through July, but sightings are reported in every month of the year. A review of reported sightings in Puget Sound indicates humpback whales usually occur as individuals or in pairs (OrcaNetwork 2012).

Based on the information presented, the number of humpback whales potentially present in Puget Sound is expected to be very low in any month and even lower from August through March. In-water work will occur from mid-July through mid-January. Therefore, the majority of project work will occur when humpback whales are least likely to be present in Puget Sound. Because humpback whale presence is even less likely in the Hood Canal Basin of Puget Sound, presence is highly unlikely within the project's Action Area.

3.1.8.3 Designated Critical Habitat within the Action Area

There is no designated critical habitat for this species in the North Pacific.

3.1.9 Marbled Murrelet

3.1.9.1 Status

The Washington, Oregon, and California DPS of the marbled murrelet was federally listed as threatened in 1992 by the USFWS (57 FR 45328).

Threats and Trends

Primary causes for the decline of this species include direct mortality from oil spills, by-catch in gillnet fisheries, and loss of nesting habitat (61 FR 26256). A 2009 5-year status review by the Service concluded that the marbled murrelet population had declined significantly since 2002 within its federally-listed range (USFWS 2009). In 2011, the U.S. Fish and Wildlife Service (Service) convened the Marbled Murrelet Recovery Implementation Team (RIT) and held a week-long Stakeholder Workshop to evaluate the specific causes of decline. The RIT identified sustained low recruitment as the most likely cause of the continued population decline with five major mechanisms that appear to be affecting the marbled murrelet population. The five major mechanisms identified were:

1. Ongoing and historic loss of terrestrial (forest) habitat.
2. Nest predation, on murrelet eggs and chicks.
3. Changes in marine forage conditions, affecting the abundance, distribution and quality of murrelet prey.
4. Post-fledging mortality of murrelets.
5. Cumulative and interactive effects of factors on individuals, populations, and the species.

To determine the marbled murrelet's population and trends, at-sea line transect surveys have been conducted in 5-Conservation Zones in Washington, Oregon, and northern California since 2000. Miller et al. (2012) reviewed survey data from 2000 and 2010 and concluded the marbled murrelet population in all Conservation Zones declined about 29% over the survey period. Falxa et al. (2014) found a weaker downward trend of 1.2% per year (p=0.16) when reviewing the 2001-2013 period for the 5 Conservation Zones. They attributed the change in the trend was due to higher population estimates in 2011 and 2012, especially within Conservation Zone 1 of Washington inland waters (Conservation Zone 1; Strait of Juan de Fuca, San Juan Islands, and Puget Sound). Reviewing the population trend for Puget Sound and the Strait of Juan de Fuca, Falxa et al. (2014) reported a of 3.9% per year. Pearson et al. (2014) estimated an average annual rate of decline for the same population of 3.88% (standard error = 1.73%) for the 2001-2013 period (p = 0.0499).

3.1.9.2 Occurrence in the Action Area

Marbled murrelets are seabirds that spend most of their life in the marine environment and nest in mature and old-growth forests (USFWS 1997). Murrelets can occur year round in Puget Sound and Hood Canal, although their flock size, density, and distribution vary by season (Nysewander et al. 2005; Falxa et al. 2008). Murrelets use the marine environment in Hood Canal for courtship, loafing, and foraging (USFWS 2010b). In this area, their 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 and Stein 1995). During the non-breeding season, murrelets typically disperse and are found farther from shore (Strachan et al. 1995).

Murrelet presence in Hood Canal has been documented through a number of sources and survey efforts. The most comprehensive information comes from the consistent sampling used to estimate population size and trends under the Northwest Forest Plan Murrelet Effectiveness Monitoring Program (Raphael et al. 2007). Other survey data were generated through the Puget Sound Ambient Monitoring Program (PSAMP), conducted by WDFW (Nysewander et al. 2005).

In past consultations, the USFWS (2010) estimated the murrelet summer density for Floral Point at the northern end of the Bangor waterfront using the survey results for stratum 2 (conducted in July and August 2009) in Conservation Zone 1[3] (Falxa 2011). The resulting summer density was 4.1 per square mile (sq mi) (1.61 per square kilometer [sq km]). To approximate murrelet winter density at Floral Point, USFWS (2010) developed an index using the results of winter surveys reported by Nysewander et al. (2005) for the PSAMP (1992–1999). This resulted in a multiplication of the summer density by a factor of 1.84, with a resulting winter density of 2.96 per sq km.[4] These estimated densities are assumed to be representative of the entire Bangor waterfront.

In order to obtain better fall/winter density estimates for strata adjacent to Navy installations in Puget Sound, the Navy funded WDFW to conduct at-sea surveys during the fall/winter of 2012–2013 and 2013-2014 (Pearson and Lance 2013; Pearson and Lance 2014). A stratified sampling approach described by Pearson and Lance (2012; 2012, updated 31 October 2013) was used to derive density estimates within each stratum. The survey effort included the Bangor shoreline, among other Hood Canal primary sampling units nested within Stratum 3. WDFW could not derive densities specific to primary sampling units because relatively few birds were encountered within a unit, some units had limited survey effort, and some were very small. Therefore, fall/winter densities were computed for the Stratum 3 (North Hood Canal) and "encounter rates" within the Bangor primary sampling unit (PSU 39) were available. The overall densities for Hood Canal from the 2012-2013(n=4) and 2013-2014 (n=3) survey efforts were 1.78 (CV = 37.2%) and 1.15 (CV = 21.8%) birds per square kilometer, respectively. During the 2012-2013 sampling season, PSU 39 was surveyed once per month during November 2012 through February 2013 (N = 4) with the following results expressed as the number of birds detected per kilometer transect length sampled:

[3] Conservation Zone 1 Stratum 2 includes the San Juan Islands, selected portions of Puget Sound, and northern Hood Canal.

[4] Additional survey data collected subsequently (Falxa 2011) reported the marbled murrelet summer density for stratum 2 for the 2010 summer survey as 1.8 birds per sq km (4.7 per sq mi). For the purpose of exposure analysis in their Biological Opinion of the EHW-2 project, USFWS (2011) adjusted densities to account for historical variability over 10 survey years, including data from 2010 summer surveys. The winter density index (multiplier of 1.84) was retained in this analysis. The adjusted densities were lower than the densities reported in USFWS (2010), so the latter were used as a more conservative basis for estimating potential exposures of murrelets to pile driving noise for the LWI and SPE projects.

November (0.0); December (0.06); January (0.22), February (0.0); average (0.07). During the 2013-2014 sampling season, the same unit was surveyed once in October, November, and February with the following results also expressed as the number of birds detected per kilometer transect length sampled: October (0.53); November (0.53); February (0.06); average (0.37). The highest encounter rates in Hood Canal during both the 2012-2013 and 2013-2014 surveys, occurred in the primary sampling unit at the southern tip of the Toandos Peninsula (PSU 35, Stratum 3) where an average 0.99 bird and 0.48 detected/km transect length sampled, respectively. The highest overall encounter rates occurred outside of Hood Canal on the western side of Admiralty Inlet (PSU 30, Stratum 2) where an average 2.92 and 3.00 birds were detected/km transect length sampled in the 2012-2013 and 2013-2014 sampling efforts, respectively.

Marbled murrelets have been documented in the nearshore and deeper waters adjacent to NAVBASE Kitsap Bangor since 2001. The Kitsap Audubon Society reported marbled murrelets in three annual Christmas Bird Count surveys from the shoreline south of the Bangor waterfront between 2001 and 2007 (Kitsap Audubon Society 2008). Marbled murrelets were observed opportunistically during the course of shoreline fish and sediment surveys conducted from March to September 2007 for a total of 22 days of observations (Agness and Tannenbaum 2009). Survey locations and sampling frequency were determined by the sampling design for the fish and sediment surveys, and not all survey locations were scanned in each sampling day. During these observations, eight marbled murrelet pairs were recorded during April and May 2007. No single birds were observed. In all instances, marbled murrelets sighted were in breeding plumage. The breeding season (nesting to fledging) generally extends from April 1 to September 23, but is asynchronous, i.e., pairs do not start nesting at the same time. Marbled murrelets were observed actively diving and foraging off of Carlson Spit in on four occasions. Murrelets were observed eating a fish at the water surface (May 1, 2007) and holding a fish cross-wise in the bill, a behavior called fish-holding that is indicative of the chick-rearing stage of breeding (May 25, 2007). During the 2007 surveys, marbled murrelets were not sighted near pier structures but were detected in all nearshore scan areas with the exception of one area.

From July to November 2008, 12 boat-based systematic surveys for marine birds were conducted along transects in the nearshore and deeper waters of the Bangor waterfront (Tannenbaum et al. 2009) The surveys covered the entire 4.3-mile (6.9-kilometer) waterfront from the shoreline to approximately 1,800 feet (550 meters) from shore (approximately 3.4 sq km [2.1 miles]). Twelve additional transect-based surveys were conducted in the same area from November 2009 to May 2010 (Tannenbaum et al. 2011). These surveys were used to document the presence, location, and habitat use of marine birds in nearshore and deeper water habitats that might be potentially affected by proposed construction projects on the Bangor waterfront. Murrelets were observed in nearshore and deeper waters, including one individual in immature plumage that was observed swimming under EHW-1 in September 2008, and other pairs and individuals observed in deeper water habitats in November 2009 and April 2010.

In January 2009, the Navy conducted marbled murrelet monitoring during the installation of five steel piles for the Carderock Research Facility Wave Deflection System adjacent to Carlson Spit on the Bangor waterfront. During each of the five pile driving days, one to eight marbled murrelets were frequently observed within the 3,280-foot (1,000-meter) zone known as the "area of potential behavioral effect," with intermittent sightings of 12 to 31 murrelets recorded. No marbled murrelet sightings occurred within the 1,000-foot (305-meter) zone known as the "area of potential injury" for this project (Navy 2009).

Marbled murrelet surveys conducted during the Test Pile Program (late September to late October 2011) did not detect any murrelets within or in close proximity to the WRA (including the project areas), although murrelets were detected elsewhere in Hood Canal (HDR 2012). Marbled murrelet monitoring during the first in-water work season of the EHW-2 construction project detected one individual on three consecutive days in January within the WRA between EHW-1 and Marginal Wharf outside the project's 168-meter shut-down zone (Hart Crowser 2013). These were the only marbled murrelet sightings in the construction area during the 19-week monitoring period (September 28, 2012, to February 14, 2013). No marbled murrelets were detected within the Port Security area during the second year of construction monitoring for the EHW-2 project (July 16, 2013 to February 15, 2014) (Hart Crowser 2014).

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 and Nelson 1995). WDFW Priority Habitat Species maps do not indicate the presence of marbled murrelet nests in the upland areas including and adjacent to NAVBASE Kitsap Bangor (WDFW 2010). 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 has been located at the northern portion of the base (International Forestry Consultants 2001; Jones 2010, personal communication). The Navy and USFWS have identified potential marbled murrelet nesting habitat, defined by the presence of suitable nest platforms, in the conifer forest stand upland from Caderock Pier. Eight trees with a total of 10 platforms appear to be marginally suitable for nesting within this stand (Harke 2013, personal communication).

3.1.9.3 Designated Critical Habitat within the Action Area

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 within the action area.

4 Environmental Setting

4.1 Hood Canal

NAVBASE Kitsap Bangor is located on the eastern shoreline of northern Hood Canal (Figure 1-1). Hood Canal is a long, narrow fjord-like basin of western Puget Sound. Throughout its 67-mile length, the width of the canal varies from 1 to 2 miles and exhibits strong depth/elevation gradients and irregular seafloor topography in many areas. Although no official boundaries exist along the waterway, the northeastern section of the canal extending from the mouth of the canal at Admiralty Inlet to the southern tip of Toandos Peninsula is referred to as northern Hood Canal.

Within northern Hood Canal, nearshore development is limited with few industrial waterfront sites other than NAVBASE Kitsap Bangor. There are many nearshore structures in the southern portion of Hood Canal, primarily smaller docks. A few docks and small piers occur at Seabeck, more than 8 miles (13 kilometers) south, and the Hood Canal Bridge is located approximately 7 miles (11 kilometers) north of installation. The remainder of the northern Hood Canal shoreline is generally undeveloped.

4.2 Marine Habitat Conditions

Marine habitat conditions for northern Hood Canal are described below for water circulation and bathymetry, water quality conditions, aquatic vegetation, benthic community, forage fish, and ambient sound. Where data is available, marine habitat conditions are described at the project scale.

4.2.1 Water Circulation and Bathymetry

In northern Hood Canal, water depths in the center of the waterway near Admiralty Inlet vary between 300 and 420 feet (ft). As the canal extends southwestward toward the Olympic Mountain Range and Thorndyke Bay, water depths shoal to approximately 160 ft over a moraine deposit. This deposit forms a sill across the short axis of the canal in the vicinity of Thorndyke Bay, which limits seawater exchange with the rest of Puget Sound. The Bangor waterfront on NAVBASE Kitsap occupies approximately 5 miles of the shoreline (1.7% of the entire Hood Canal coastline) and lies just south of the sill feature. Water depths along the Bangor waterfront are provided in Figure 2–2. The width of the canal ranges from 2.2 miles at the northern end of NAVBASE Kitsap Bangor to approximately 1.1 miles near the southern end near Hazel Point.

Existing nearshore current patterns along the shoreline are primarily driven by tidal exchange. Two marshes provide freshwater input along the Bangor shoreline: Hunter's Marsh and Devil's Hole. The former Cattail Lake drainage also supplies freshwater. The Hunter's Marsh system is located immediately behind EHW-1.The strong tides and currents, combined with a small outflow from the marsh, result in well-mixed waters at the EHW-1 project site.

4.2.2 Water Quality

NAVBASE Kitsap Bangor is located within an area of Hood Canal classified as "Class AA," defined as "water quality that markedly and uniformly exceeds the requirements for all or substantially all uses" (WDOE 2009). Concentrations of dissolved oxygen (DO) in extraordinary quality marine surface waters, should exceed 7.0 milligrams per liter (mg/L) of DO, allowing for only 0.2 mg/L reductions in the natural condition by human-caused activities (WAC 173-201A). DO levels in northern Hood Canal meet the extraordinary standard for surface waters (3 to 20 feet [1 to 6 meters] in depth) year round and for deep water (66 to 197 feet [20 to 60 meters] in depth) most of the year, although deeper waters can drop to a fair standard in late summer. In 2007, DO concentrations along the NAVBASE Kitsap Bangor waterfront were above 8 mg/L during all but one survey when a minimum concentration of 3.9 mg/L occurred at one location (Hafner and Dolan 2009). However, at offshore stations, the ratings ranged from fair to extraordinary quality standards during 2005–2006, whereas all DO concentrations measured at deep-water locations in 2007 were above 8 mg/L (Hafner and Dolan 2009).

Turbidity, measured in Nephelometric Turbidity Units (NTUs), is a measure of the amount of light scatter related to total suspended solids (TSS) in the water column. Sources of turbidity in Hood Canal waters may include plankton, organic detritus from streams and other storm or wastewater sources, fine suspended sediments (silts and clays), and resuspended bottom sediments and organic particles. Suspended particles in the water have the ability to absorb heat in the sunlight, which then raises water temperature and reduces light available for photosynthesis. Washington State-designated extraordinary quality marine surface waters have an average turbidity reading of less than 5 NTUs (WAC 173-201A). Turbidity measurements were conducted along the Bangor waterfront during the 2005 through 2008 water quality surveys (Hafner and Dolan 2009; Phillips et al. 2009). The mean monthly turbidity measurements for nearshore waters ranged from 0.0 to 9.9 NTU and, for all but one survey (March 1–2, 2007), were within the Washington State standards for extraordinary water quality. The 2005 to 2008 surveys of nearshore water quality off the Bangor waterfront did not detect any consistent spatial patterns in turbidity levels along the waterfront.

Temperature, pH, and other water quality parameters along the Bangor waterfront meet water quality standards and there is no known water contamination in the Action Area (Hafner and Dolan 2009; Phillips et al. 2009).

4.2.3 Sediment Quality

Washington State has established Sediment Management Standards (SMS) for marine, low salinity, and freshwater surface sediments. The goal of these standards is to eliminate adverse effects on biological resources and significant health threats to humans from surface sediment contamination. The process involves establishing standards for the quality of surface sediments, applying these standards as the basis for management pollutant discharges, and providing a management and decision process for cleaning up contaminated sediments.

Existing sediment information is based on results from sampling at the new Explosives Handling Wharf site adjacent to the project area during 2007 (Hammermeister and Hafner 2009); sampling locations are shown in Figure 2-5. Sediment quality at the project site is generally good; levels of contaminants meet applicable state standards. Marine sediments are composed of gravelly sands with some cobbles in the intertidal zone, transitioning to silty sands in the subtidal zone (Hammermeister and Hafner 2009).

4.2.4 Marine Vegetation

The marine vegetation community along the Bangor waterfront is considered healthy and diverse. However, more aquatic vegetation habitat would likely have been present prior to the construction of the existing nearshore piers or wharves. Marine vegetation includes green, red, brown algae (including kelp), and eelgrass. Green algae grow mainly in the lower intertidal and subtidal zones and include common species such as sea lettuce (*Ulva* spp.). Red algae are located in the cobble and gravel upper intertidal zone but also occur subtidally. Brown algae, which include understory kelps (*Saccharina* spp.) and the non-native Sargasso weed, or wireweed (*Sargassum muticum*), are found in nearshore environments of the Bangor shoreline from lower intertidal to subtidal zones (SAIC 2009; Leidos and Grette Associates 2013a). However, no attached, canopy-forming kelp beds (e.g., bull kelp) occur at the Bangor shoreline (SAIC 2009; Leidos and Grette Associates 2013a).

Eelgrass is high quality habitat and is most abundant in low-energy areas in the lower intertidal and shallow subtidal photic zone where organic matter and nutrients are abundant (Johnson and O'Neil 2001). Eelgrass beds build up in the spring and summer and decay in the fall and winter (Puget Sound Water Quality Action Team 2001). Shellfish, such as crabs and bivalves, use eelgrass beds for habitat and nursery areas. Eelgrass is an important habitat for juvenile salmon, which use eelgrass beds as migratory corridors, protection from predators, and foraging (review in Mumford 2007). Eelgrass depth distributions are related to water clarity, and in Hood Canal eelgrass can be found at maximum depths of about 24 feet (7 meters) (review in Mumford 2007).

Based on the results of a 2007 survey, an eelgrass bed of just over 12 acres (4.9 hectares) occurs in a continuous, narrow band along the shoreline north of the EHW-1, ending at the Magnetic Silencing Facility (SAIC 2009). The upper limits of this eelgrass bed corresponded to the MLLW line and extended out to water depths of about 14 feet (4 meters) below MLLW. Macroalgae documented north of the project site include *Ulva*, *Saccharina*, and *Gracilaria* (SAIC 2009; Leidos and Grette Associates 2013a). Rockweed was attached to rocks and cobble in the area north of EHW-1 during the 2008 shellfish survey (Delwiche et al. 2008). The full extent of macroalgae coverage may not have been surveyed during 2007 since many transects did not extend to the MLLW line due to insufficient water depth for the survey vessel. In a 2013 macroalgae survey north of EHW-1, but only out to -15 MLLW, *Ulva* spp. and *Saccharina latissima* were the dominant macroalgae species where eelgrass was absent (Leidos and Grette Associates 2013a).

4.2.5 Benthic Community

The soft-bottom benthic community along the Bangor shoreline is dominated by polychaetes, crustaceans, and molluscs across tide zones, although in the intertidal zone other minor taxa (e.g., nemerteans, nematodes, oligochaetes) also may be numerically abundant (Weston 2006; WDOE 2007). The epibenthic community at NAVBASE Kitsap Bangor includes harpacticoid copepods and gammarid amphipods, preferred juvenile salmon prey sources (Healey 1991; Salo 1991; Webb 1991a,b; Fujiwara and Highsmith 1997; HCCC 2005). Species composition and abundance are variable along the waterfront. A survey of four different areas along the Bangor waterfront found consistently greater benthic community development in the subtidal zone compared to the intertidal zone and variable community development within and among survey areas (Weston 2006).

4.2.6 Forage Fish

Forage fish are an important and abundant group of species that occur in the marine waters of Washington. As the name implies, forage fish are the prey species of a large variety of other marine organisms, including birds, fish, and marine mammals and form a critical link between the marine zooplankton community and larger predatory fish, seabirds, and marine mammals in the marine food web (Penttila 2007; PSAT 2007). They feed mainly on zooplankton and reside in the upper levels of the water column and nearshore areas (PSAT 2007).

The most common forage fish within Puget Sound are Pacific herring (*Clupea harengus pallasi*), surf smelt (*Hypomesus pretiosus*), and Pacific sand lance (*Ammodytes hexapterus*). All three of these species occur within the Action Area.

4.2.6.1 Pacific Herring

The majority of herring spawning in Washington State waters occurs annually from late January through early April (Bargmann 1998). Some months before the onset of spawning activity, fish begin to assemble adjacent to spawning sites in pre-spawning holding areas (Penttila 2007). Herring deposit their transparent eggs on intertidal and shallow subtidal eelgrass and marine algae. Eggs incubate for 10 to 14 days before hatching. Following hatching, the larvae drift in ocean currents (Bargmann 1998).

Although large spawning areas are found elsewhere in Hood Canal (Stick and Lindquist 2009), there are no documented herring spawning grounds at NAVBASE Kitsap Bangor. Herring stocks are known to hold in the Port Gamble area and Quilcene Bay prior to spawning. Port Gamble herring stock pre-spawning holding areas and spawning beaches occur north of the Action Area and the Quilcene Bay herring stockholding area is located west of NAVBASE Bangor on the west side of Dabob Bay and in Quilcene Bay. Additional spawning locations are located south of the installation near Seabeck. For both stocks, spawning occurs between mid-January and mid-April. Abundance has been fairly stable since a low point in the 1990s, with a mean annual spawning biomass of over 2,100 metric tons in since 1999 (Stick and Lindquist 2009). Documented spawning grounds have expanded significantly since 1998. According to Stick and Lindquist (2009), the observed inverse relationship with the Port Gamble stock may indicate that these two stocks are linked and may stray between spawning grounds. They further suggest that the Quilcene stock may be migratory and move to summer feeding grounds offshore.

Pacific herring have been detected in small numbers during late winter months and in larger numbers during early summer months at NAVBASE Kitsap Bangor (SAIC 2006; Bhuthimethee et al. 2009). Based on the location of herring holding areas, NAVBASE Kitsap Bangor survey results, and herring spawn timing (between mid-January and mid-April), project work is unlikely to overlap with spawning activity or larval life stages.

4.2.6.2 Surf Smelt

Approximately 10 percent of Puget Sound shoreline is documented surf smelt spawning habitat, with wide variations in spawning times. Some spawning regions are occupied year-round with a possible seasonal peak, some occupied during the summer (May-August), and others during the fall-winter (September-March) (Penttila 2007).

Surf smelt spawning habitat typically encompasses the uppermost one-third of the tidal range (from +7 feet MLLW [2 meters] to +12 feet [4 meters] MLLW) on beaches where substrate grain size is a sand-gravel mix with the majority of material in the diameter range of 1-7 mm. Incubation times vary from two weeks during summer months to four to eight weeks during the winter months. Surf smelt spawning beaches are often located at the heads of bays or inlets shaded by trees and bluffs.

The life history of surf smelt away from their spawning grounds is vague. No evidence exists to support an annual migration from spawning site to open ocean or forming large open-water pelagic schools. Populations may inhabit the shoreline in the vicinity of their spawning sites throughout their life-cycle (Penttila 2007). Surf smelt are believed to spawn throughout the year in Hood Canal, with the heaviest spawn occurring from mid-October through December. It is expected that more fish will congregate in Hood Canal during the peak spawning time, with adult, juvenile, and larval surf smelt likely to be present year round.

Surf smelt spawning habitat has not been documented along the Bangor shoreline. The nearest documented surf smelt spawning beach is located approximately 2.5 miles south of Carderock Pier as shown in Figure 4-1 (Long et al. 2005, WDFW 2014). However, larval, juvenile, and adult surf smelt may be present in the Action Area year round. Surf smelt are believed to be most abundant at NAVBASE Kitsap Bangor in late spring through summer (SAIC 2006; Bhuthimethee et al. 2009). During the 2005 through 2006 beach seine surveys, surf smelt were second in abundance for all forage fish captured (20 percent of the forage fish catch) (SAIC 2006). In surveys conducted from May 1996 through June 1997, Penttila (1997) found no surf smelt spawning grounds at NAVBASE Kitsap Bangor; however, juvenile surf smelt have been found to rear in nearshore waters

(Bargmann 1998) and were detected along the Bangor shoreline from January through the mid-summer months (SAIC 2006; Bhuthimethee et al. 2009).

4.2.6.3 Pacific Sand Lance

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. Bargmann (1998) indicates that 35 percent of all juvenile salmon diets and 60 percent of the juvenile

Figure 4-1. WDFW Documented Forage Fish Spawning at or near NAVBASE Kitsap Bangor

Chinook diet, in particular, is sand lance. Other regionally important fish species (such as Pacific cod, Pacific hake, and dogfish) feed heavily on juvenile and adult sand lance, as do seabird species such as the ESA listed marbled murrelet.

Sand lance spawning activity occurs annually from early November through mid-February. Sand lance deposit eggs on a range of nearshore substrates, from soft, pure, fine sand beaches to beaches armored with gravel up to 1.2 inches (3 centimeters) in diameter; however, most spawning appears to occur on the finer-grained substrates (Bargmann 1998). Spawning occurs at tidal elevations ranging from +5 feet (1.5 meters) MLLW to about the MHHW line (+12 feet [4 meters] MLLW). Their incubation time is approximately one month and repeated episodes of spawning activity may occur during the spawning season on any particular beach (Penttila 2007).

After hatching, planktonic larval sand lance are subject to local currents and tides and are common in many bays and inlets in Puget Sound during the late winter and spring. Juvenile sand lances rear in nearshore waters along Puget Sound during the summer and form dense surface schools which attract predators. Adult sand lance exhibit a generalized diurnal behavior pattern, feeding in the open water during the day and burrowing into the sand at night to avoid predation.

Similar to juvenile surf smelt, juvenile sand lance have been detected near the project site from January through the mid-summer months (SAIC 2006; Bhuthimethee et al. 2009). Most of these juveniles were captured in sheltered cove-like areas of the nearshore and were in schools mixed with surf smelt and larval sand lance. Field surveys conducted along the shorelines of NAVBASE Kitsap Bangor from 2005 to 2008 indicated that their between-year occurrence at Carlson Spit, south of KB Dock, was somewhat more consistent than along other portions of the shoreline (SAIC 2006; Bhuthimethee et al. 2009). Although sand lance occurred more consistently between years at this location, they did not appear to be more abundant than in other survey areas. One reason for their consistency at the site may be that Pacific sand lance spawning habitat has been documented in scattered locations along the shoreline including beaches adjacent to Carderock Pier, Service Pier, KB Pier, Delta Pier, Marginal Wharf, EHW-1 and the Magnetic Silencing Facility (Figure 4-1) (WDFW 2014). Whether the January to mid-summer month occurrence of Pacific sand lance is the result of adult fish accessing spawning habitats is currently unknown.

4.2.7 Ambient Sound

4.2.7.1 Ambient Underwater Sound

Underwater ambient sound in Puget Sound is comprised of sounds produced by a number of natural and anthropogenic sources and varies both geographically and temporally. Natural sound sources include wind, waves, precipitation, and biological sources such as shrimp, fish, and cetaceans. These sources produce sound in a wide variety of frequency ranges (Urick 1983; Richardson et al. 1995) and can vary over both long (days to years) and short (seconds to hours) time scales. In shallow waters, precipitation may contribute up to 35 dB to the existing sound level, and increases in wind speed of 5 to 10 knots can cause a 5 dB increase in ambient ocean sound between 20 Hz and 100 kHz (Urick 1983).

Human-generated sound is a significant contributor to the ambient acoustic environment at NAVBASE KITSAP Bangor. Normal port activities include vessel traffic from large ships, support vessels and security boats, and loading and maintenance operations, which all generate underwater sound (Urick 1983). Other sources of human-generated underwater sound not specific to the naval installations include sounds from echo sounders on commercial and recreational vessels, industrial ship noise, and noise from recreational boat engines. Ship and small boat noise comes from propellers and other on-board rotating equipment.

Underwater ambient sound has been recorded and measured at NAVBASE Kitsap, Bangor during previous Navy activities. In 2009, the average broadband (100 Hz–20 kHz) sound level near Carderock Pier on NAVBASE Kitsap, Bangor was 114 dB re 1µPa rms (Slater 2009). Below 300 Hz, noise from industrial activity dominated the spectrum, with a maximum level of 110 dB rms in the 125 Hz band. From 300 Hz to 5 kHz, average received levels ranged between 83 and 99 dB rms. Wind-driven wave sound dominated the background sound between 5 and 10 kHz; above 10 kHz, the sound levels were relatively even at all frequencies.

Similar sound levels were recorded near EHW-1 during the Test Pile Program at NAVBASE Kitsap, Bangor in 2011. Average sound levels ranged from 112.4 dB rms at mid depth to 114.3 dB rms at deep depth (Illingworth & Rodkin 2012). These measurements were made during normal port activities, but did not include noise from construction or pile driving.

Ambient sound measurements from NAVBASE Kitsap, Bangor are well within the range of levels reported for a number of sites within the greater Puget Sound region (95 – 135 dB rms; Veirs and Veirs 2005; Carlson et al. 2005). Nearshore broadband measurements near ferry terminals in Puget Sound resulted in median sound levels (50% cumulative distribution function) between 104 and 130 dB rms (WSDOT 2014).Small-scale geographic variations in ambient sound are to be expected based on land shadowing and other environmental factors, but for analysis purposes, the average sound level at this installation was assumed to be 114 dB rms.

4.2.7.2 Ambient Airborne Sound

Airborne sound at NAVBASE Kitsap Bangor 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. Sound levels are highly variable based on the types and operational states of equipment at the recording location, and sound levels may vary within the installation, with some piers/wharfs very loud and others relatively quiet.

Airborne sound measurements were taken at Delta Pier within the waterfront industrial area at NAVBASE Kitsap, Bangor during a two-day period in October 2010. During this period, daytime sound levels ranged from 60 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 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 will vary by time and location, but average background sound levels along the industrial portion of the Bangor waterfront are expected to be 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 (Illingworth & Rodkin 2012; SAIC 2012).

Because EHW-1 is adjacent to the Test Pile Program measurements, 55 dBA is used as the background level for this consultation.

5 Effects of the Action

This section analyzes direct and indirect effects of the action on listed species, their habitats, and critical habitats. The analysis includes activities that are interrelated or interdependent with the action and considers the environmental baseline (50 CFR 402.2). To conduct the analysis, the Navy first identified individual project activities that may result in environmental stressors that have the potential to directly or indirectly affect ESA-listed species, their habitats, and designated critical habitats. For each listed species, the potential for an individual to be exposed to a stressor was evaluated in conjunction with the severity of the stressor and the status of existing baseline conditions. For designated and proposed critical habitats, the effect of the stressor to each PCE present in the Action Area was evaluated. Table 5-1 lists potential environmental stressors identified from project activities; temporarily elevated sound levels, temporarily impaired water quality from temporary increases in suspended sediment and turbidity levels, contaminants, and impacts to marine vegetation and benthos. Each of these stressors was evaluated for each listed species and designated critical habitat, as well as for potential effects to forage species from the same stressors.

Because much of the discussion of each stressor is the same for each species or species group, a general discussion of effects to the environment for each stressor is presented below and then more detailed discussion follows for each species, species group, or designated critical habitat as appropriate.

Because the project occurs within the Port Security Barrier, humpback whales would be potentially only exposed to the elevated underwater noise level from pile driving, which extends past the Port Security Barrier. Because humpback whales only occasionally occur in Puget Sound and have only been documented in Hood Canal once, exposure during the time when pile driving will occur (up to approximately 3 hours over approximately 4 days during the mid-July through mid-January in-water work period), is considered extremely unlikely. Therefore, based on their lack of presence in the Action Area and the limited amount of pile driving, exposure of humpback whales to project activities is discountable and they are not discussed further in this section.

Table 5-1. Potential Environmental Stressors Associated with Project Activities

Project Activity	Noise		Suspended Sediment/Turbidity	Contaminants	Benthos/Marine Vegetation
	Underwater	Airborne (marbled murrelets only)			
Pile removal ***- cutting*** ***- chipping*** ***Pile installation*** ***-vibratory***	Sound levels increase above background and will be above behavioral guidance for fish and marbled murrelets during vibratory installation, but not for the other activities listed because Bangor waterfront has existing vessel and operational use.	Sound levels are not anticipated to be above masking threshold.	Temporary and localized. Increase not expected to affect availability of forage base for listed fish or marbled murrelets.	Spill/debris; however, SPCC plan to prevent spills and a debris control plan will be implemented.	Direct removal of benthos on piles and disturbance, but repair projects, so overall effect is temporary due to replacement of piles. Minor effect expected to marine vegetation attached to substrate because repairs occurring beneath existing structure.
Pile installation ***- impact for steel piling***	Sound levels will increase above behavioral and injury thresholds for fish and marbled murrelets.	Sound levels increase above masking threshold for marbled murrelets.	Same as above.	Same as above.	Same as above.
Anchoring/ spudding	Sound levels anticipated to remain within current background levels because Bangor waterfront has existing vessel and operational use.	N/A	Minor amounts, localized and temporary during activity only.	Same as above.	Temporary, localized disturbance to benthos and marine vegetation. No anchoring in eelgrass, so no effect to eelgrass.
Barge/vessel use for project work	Same as above.	Sound levels anticipated to be within current background levels because Bangor waterfront has existing vessel and operational use.	Propeller wash at project depth not anticipated.	Same as above.	Temporary and spatially limited shading during presence potentially resulting in minor disturbance to benthos or decreased primary productivity. No measurable result to forage base.
Replacement of chocks/whalers/ bumpers, cathodic protection	N/A	Same as above.	No effect	Same as above.	No effect
Overwater work	N/A	Same as above.	N/A	Same as above.	N/A

5.1 Noise

5.1.1 Underwater Noise

Construction activity associated with the project will result in increased underwater 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 activities except pile driving will typically not exceed underwater sound levels resulting from existing routine waterfront operations in the vicinity of EHW-1. The most significant underwater noise potentially affecting listed species will be from impact pile driving of the 4 steel piles. To reduce potential impacts to ESA-listed species, the piles will first be driven using a vibratory pile driver until either the pile hits refusal, necessitating an impact hammer to reach required depth, or depth is achieved with only impact proofing necessary to verify the structural capacity of the piles. Since vibratory pile drivers typically generate noise levels from 10 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 vibratory pile driving (WSDOT 2014). With the use of vibratory driver as the primary means of installation, estimates of impact driving durations will range from several minutes to proof piles to up to approximately 45 minutes to fully drive a pile. We estimated the total installation time would not be more than 4 hours for all piles with only a portion of that being impact driving. Steel impact pile driving is estimated to occur from approximately 36 minutes to a maximum of 3 hours over the entire project duration. Because piles have been installed with vibratory installation during prior repair projects at the EHW-1 structure, fully driving piles with an impact hammer is not anticipated. Thus, 3-hours of impact driving are highly unlikely. Impact driving could be conducted all in one day or over a four day period (one pile proofed per day) with no more than 8 days of pile installation (vibratory and impact driving) anticipated.

Table 5-2. Estimated Maximum Steel Impact Driving Duration

Number of Steel Piles	Total Time for Impact Pile Installation of all Piles	Maximum # of Days of Impact Installation
4	<1 – 3 hours	4

The intensity of pile driving sounds is greatly influenced by factors such as the type of piles, drivers, and the physical environment in which the activity takes place. The intensity of the sound (acoustic pressure wave) decreases as it propagates out from a source. This loss in acoustic intensity as the sound propagates is known as transmission loss. Transmission loss parameters vary with frequency, temperature, sea conditions, current, source and receiver depth, water depth, water chemistry, and bottom composition and topography.

Three metrics are commonly used to evaluate underwater sound (Caltrans 2009):

- *Peak Sound Pressure level (SPL_{peak})* – Peak sound pressure level based on the largest absolute value of the instantaneous sound pressure over the frequency range from 20 to 20,000 Hz. [5]
- *Root Mean Square (RMS)* – RMS level is the square root of the energy divided by a defined time period.
- *Sound Exposure Level (SEL)* – Constant level over 1 second that has the same amount of acoustic energy, as indicated by the square of the sound pressure, as the original sound.

5.1.1.1 Potential Effects of Pile Driving Noise Exposure to Fish

Thresholds for Analysis of Hydroacoustic Effects to Fish from Pile Driving

The USFWS and NMFS have adopted thresholds or guidance for evaluating the effects of sound exposure on fish exposed to sound levels. Table 5-3 lists the current injury thresholds and behavioral guidance currently used by NMFS and USFWS for fish.[6] The criteria use a duel threshold for injury using both peak SPLs and cumulative SEL. The underwater noise threshold criterion for fish injury from a single impact hammer pile strike is at an SPL of 206 dB peak (FHWG 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 (FHWG 2008). As reference points of total fish length at 2 grams weight in Puget Sound, including some variability due to fish health and food availability, juvenile chum salmon are approximately 2.7 to 2.8 inches (68 to 70 millimeters) (Tynan 2013, personal communication) and juvenile English sole are 2.4 to 2.8 inches (60 to 70 millimeters) (Hunt 2005).

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 (WSDOT 2014). No physical injury is expected beyond this distance.

[5] Peak and RMS values are referenced to 1µPa throughout this document. SEL is referenced to 1 $\mu Pa^2 \cdot sec$.

[6] The Fisheries Hydroacoustic Working Group (FHWG) is a multi-agency group that includes members from Caltrans, Oregon Department of Transportation, Washington State Department of Transportation (WSDOT), Federal Highway Administration, NMFS, USFWS, California Department of Fish and Game, and U.S. Army Corps of Engineers. This technical working group is responsible for generating underwater noise effects criteria for fish exposed to pile driving activities. The FHWG developed the Agreement in Principal for *Interim Criteria for Injury to Fish from Pile Driving Activities* that establishes a 206 dB peak and 187 dB cumulative SEL for all fish except those that are less than 2 g. In that case, the criterion for the cumulative SEL is 183 dB (FHWG 2008).

In addition to the injury thresholds, Hastings (2002) recommended an underwater noise guideline for behavioral impacts on fish, including startle response, at a level of 150 dB RMS. The effect of behavior alterations, whether or not an alteration results in injury, is dependent on project specific factors. Project specific factors could be 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.

Table 5-3. Fish Noise Injury Thresholds and Behavioral Guidance

Fish Size	Impact Pile Driving		Vibratory Pile Driving	
	Injury Threshold	**Behavioral Guidance**	**Injury Threshold**	**Behavioral Guidance**
≥ 2 grams	187 dB cumulative SEL	150 dB RMS	n/a	150 dB RMS
< 2 grams	183 dB cumulative SEL			
all sizes	206 dB peak			

Note: dB = decibel; RMS = root-mean-square; SEL = Sound Exposure Level; RMS levels are relative to 1μPa and cumulative SEL levels are relative to 1μPa^2*sec.

Estimation of Extent of Elevated Underwater Noise Levels Above Thresholds

To determine how far project noise will exceed these thresholds, noise levels anticipated from installation of 30-inch steel piles were estimated. The Practical Spreading Loss model was used to calculate the expected noise propagation from both impact and vibratory pile driving using representative sound levels for installing 30-inch steel piles estimated from past acoustic studies (Appendix A). Table 5-4 lists the estimated peak, RMS, SEL levels used to model the injury and disturbance thresholds for fish and marbled murrelets from pile driving. Because a bubble curtain or other attenuation device will be used to minimize the noise generated by driving steel pipe piles, an expected attenuation of 8 dB was first subtracted from the source levels. Bubble curtain performance is discussed in Appendix A. To calculate cumulative SEL, the number of pile strikes were estimated from past project information and engineering staff. Approximately 400 strikes for each pile proofed and up to 2,000 strikes for a pile fully impact driven were estimated. Because piles are not anticipated to be impact driven other than the last few feet, the number of strikes per day used in the analysis was 2,000 for a day, which would account for all piles proofed or one pile fully impact driven.

Calculated distances using the Practical Spreading Loss Model to fish noise thresholds are provided in Table 5-5. Adjusted maximum areas are provided in Table 5-6. The areas only include the area encompassed to the extent of the shoreline. The area above the threshold values decreases the closer to shore pile driving occurs and where shallow water and land block noise transmission. Figures 5- 1 and 5-2 illustrate the calculated extent and area of noise propagation that exceeds the thresholds or behavioral guidance.

Table 5-4. Representative Underwater Source Levels for 30-inch Steel Pipe Piles

Installation Method	Sound Pressure Level at 10meters (dB)		
	Peak	RMS	SEL
Impact	216	195	186
Vibratory	---	166	---

Source: See Appendix A
Notes: dB = decibel; Peak and RMS values referenced to 1µPa2; SEL values referenced to 1µPa2 *sec

Table 5-5. Distances From Piles Where Noise Exceeds Fish Thresholds

Type of Pile Driving	Injury (meters)			Potential Behavioral Disturbance (meters)
	206 dB peak re 1 µPa	187 dB Cumulative SEL re 1 μPa^2 sec[1] for a fish ≥ 2 g	183 dB Cumulative SEL re 1 μPa^2 sec for fish < 2 g	150 dB re 1 µPa rms
Impact	14	399	736	2,929
Vibratory	n/a	n/a	n/a	117

[1]Cumulative Sound Exposure Level (SEL) assumes 2,000 impact pile strikes per day

Notes: Practical spreading loss model (15 log R) used for calculations and 8 dB of attenuation assumed from bubble curtain. Effective quiet range for SEL impact with noise attenuator is 736 meters. Underwater noise thresholds are taken from Fisheries Hydroacoustic Working Group (2008); The underwater noise guideline for behavior is taken from Hastings 2002.

dB = decibel; g = gram; RMS = root-mean-square; SEL = Sound Exposure Level; n/a = not applicable

Table 5-6. Worst Case Area Where Noise Exceeds Fish Thresholds or Behavioral Guidance During Pile Driving

Steel Impact Driving		Vibratory Driving	
Injury	Behavior	Injury	Behavior
1.13 km^2	12.4 km^2	n/a	0.04 km^2

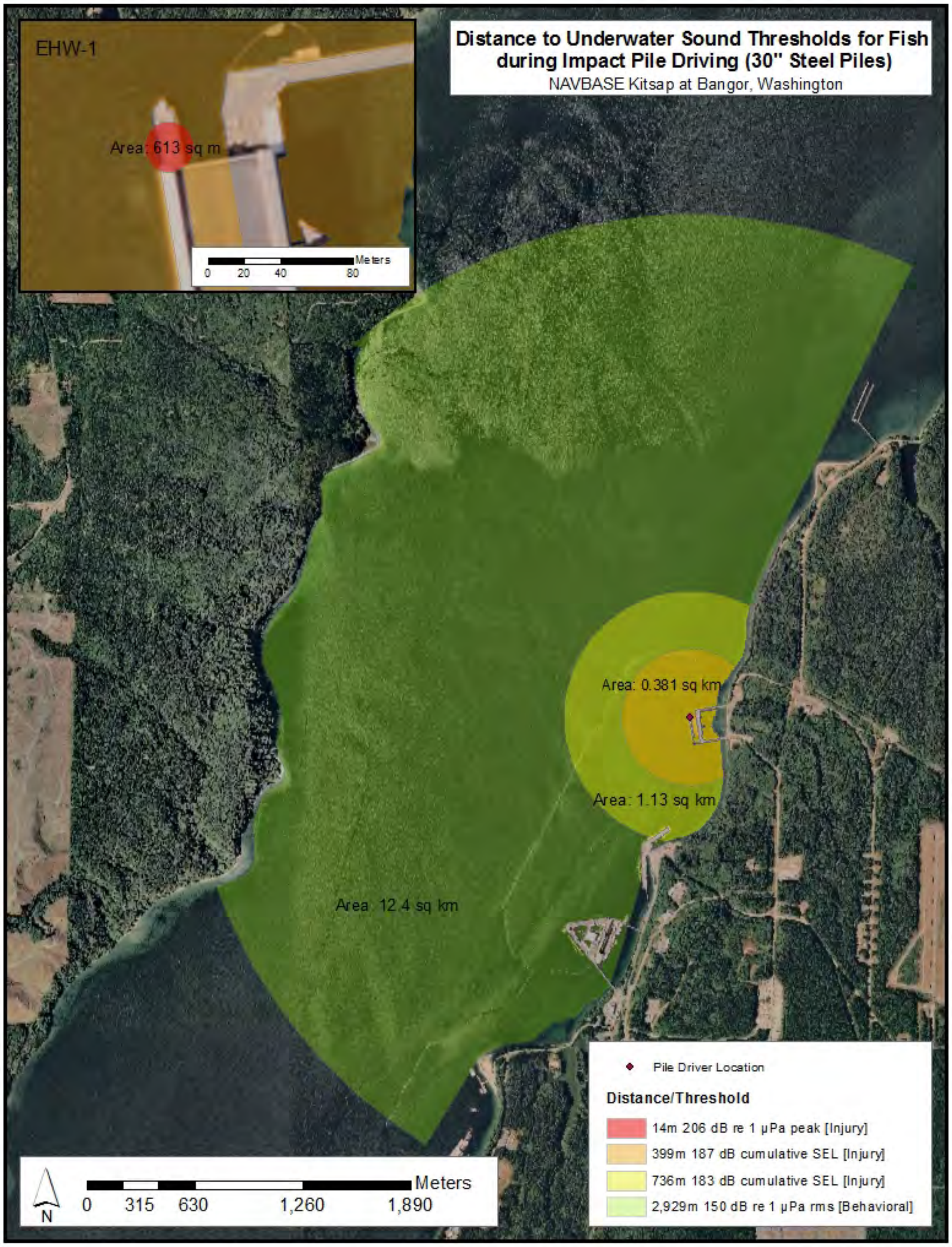

Figure 5-1. Area Exceeding Fish Thresholds and Behavioral Guidance Depicted for a Representative Impact Driven Pile.

Figure 5-2. Area Exceeding Fish Behavioral Guidance Depicted for a Representative Vibratory Driven Pile.

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 (see reviews PFMC 2014). Depending on these factors, effects on fish can range from changes in behavior to immediate mortality. Because less impulsive peaks SPLs and lower overall SPLs are produced when piles are vibratory driven or concrete, timber, or plastic piles are installed with an impact hammer, these activities do not have the same level of concern when analyzing their effects to fish. Injury or mortality has not been documented with the use of vibratory drivers for any pile type or impact drivers when installing concrete, timber, or plastic piling. However fish injury and mortality is documented with impact hammers installing steel piling from 24 to 96 inches in diameter (see review in PFMC 2014). Therefore, much of the discussion below on the physiological responses of fish is focused on impact driving of steel piles.

Physiological Responses

The effects to fish at different intensities of underwater sound are unclear (Hastings and Popper 2005). 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 (Hastings and Popper 2005). These physical effects can include swim bladder, otolith, and other organ damage; hearing loss; and mortality (Hastings and Popper 2005).

Fish with swimbladders, including salmonids and larval 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 swimbladder 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 swimbladder, it causes that space to vibrate (expand and contract) at its resonant frequency. When the amplitude of this vibration is sufficiently high, the pulsing swimbladder 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 (see review in PFMC 2014). Larval rockfish generally develop a swim bladder from two to three weeks after their birth (Tagal et al. 2002), but may be vulnerable to harm from noise before it develops.

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 and Mao 1996; Stroetz et al. 2001;

Vlahakis and Hubmayr 2000). 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-inch diameter steel pilings at Bremerton, Washington, (Stadler, NMFS, pers. obs. 2002). Dissections revealed complete swimbladder destruction across all species in the smallest fish (80 mm fork length), while swimbladders in the largest fish (170 mm fork length) were nearly intact. However, swimbladder damage was typically more extensive in *C. aggregata* when compared to *B. frenatus* of similar size. 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 and Rechnitzer 1952). However, no information is available to determine whether or not the risk of auditory tissue damage decreases with increasing size of the fish.

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 (PFMC 2014), and Halvorsen et al. (2012) noted that caged field studies (Abbot et al. 2005, Ruggerone et al. 2008, Caltrans 2010a, 2010b) lacked appropriate biological control groups because the experimental fishes may not have been neutrally buoyant resulting in a lower risk of injury because there swim bladder may have been deflated.

To better understand the effects of impulsive sounds from impact pile driving, Halvorsen et al. (2011, 2012) conducted a controlled study with juvenile Chinook (mean standard length 103 mm, mean weight 11.8 g) using a special apparatus. Based on the results of the study, the authors conclude that the onset of injury to Chinook salmon occurred at a minimum cumulative SEL of 210 dB. However, due to a number of concerns with the study and to be protective of ESA-listed fish species, the FHWG has not adopted the higher threshold (PFMC 2014).

Behavioral Responses

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. Although pile driving will adhere to the July16 through January 15 period for in-water work to minimize underwater noise impacts on juvenile salmon, adult Hood Canal summer-run chum, Puget Sound Chinook, and Puget Sound steelhead, and some juvenile salmon and ESA-listed rockfish will be expected to occur in the area above the behavioral thresholds during periods of pile driving activity

To minimize underwater noise impacts during pile driving, replacement piles will be vibrated in with only impact proofing anticipated. Although behavioral effects could occur from vibratory pile driving, no injury threshold has been identified for this type of driving due to its lower amplitude and nonimpulsive waveform (FHWG 2008). All pile driving will require no more than 8 days to complete during a single in-water work season, with an estimated duration of impact pile driving ranging from several minutes to 45 minutes per day for up to 4 days. In addition, a nightly reprisal from pile driving is expected to give fish an opportunity to pass through the action area without being subject to noise. Because of the limited duration and the intermittent nature of replacement pile work, noise above the behavioral guidance is not anticipated to result in reduced predatory avoidance or susceptibility to predation for any ESA-listed fish.

Summary of Effects by Species or Species Group

All Fish Species

All impact driven steel piles will be driven with a vibratory hammer initially, if possible, and impact driving of steel piles will be preempted with start-up of a bubble curtain. Therefore, fish are likely to leave the area next to the pile where injurious levels of sound will occur before steel impact pile driving commences and exposure to injurious levels above the 206 dB peak threshold (estimated to extend up to 14 m) are likely avoided. All in-water construction activities will be conducted during the in-water work window for Hood Canal when the majority of juvenile salmon are least likely to be present (July 16 through January 15). The Navy will use mitigation measures to reduce underwater sound during steel impact pile driving to minimize the number of fish potentially exposed to injurious sound levels. A few juvenile salmon, resident and returning Chinook, returning summer-run chum, and steelhead that remain in Hood Canal could be expected to occur during the period of in-water construction and will be exposed to elevated underwater sound levels during pile driving. These fish will not be protected by the work windows, but will be larger, will not be nearshore dependent, and are not anticipated to remain in the work area for any extended period of time. Therefore, they are not expected to be exposed to injurious levels of underwater sound from impact pile driving. As noted above, upon encountering non-injurious levels of elevated underwater sound, these fish could display either a startle response or behavioral disturbance.

Forage fish could occur within the behavioral or injury zones during pile driving. Effects from in-water noise will most likely to occur to sand lance for which the peak spawning periods (November to mid-February) will coincide with the in-water construction period. Minimization measures listed in Section 2.5 will limit exposure of forage fish species to temporary construction impacts. Exposure to noise levels above the injury threshold will be limited to impact proofing 4 pile with a maximum 3 hours anticipated in a scenario where additional impact driving as a contingency if some piles will not advance with a vibratory driver. Because of the limited scale of effects, the project will not significantly impact the overall forage base.

Bull Trout

Pile installation will be conducted during the in-water work window when bull trout are least likely to be present. Additionally, bull trout are not anticipated to be in the action area; therefore exposure is discountable.

Puget Sound Chinook, Hood Canal Summer-run Chum, and Puget Sound Steelhead

Pile installation will be conducted during the in-water work window when juvenile salmon are least likely to be present; so exposure of juvenile Puget Sound Chinook, Hood Canal summer-run chum, and Puget Sound steelhead to all in-water work is minimized. Some larger juveniles, adult Puget Sound Chinook, Hood Canal summer-run chum, and Puget Sound steelhead could potentially be present when pile driving will occur. Because larger juvenile salmon, adult salmon, and steelhead are not obligated to the nearshore and the fish are migratory, effects would be unlikely to result in injury levels from sound energy accumulation from proofing of the 4 piles.

Boccacio Rockfish, Canary Rockfish, and Yelloweye Rockfish

Currently, underwater noise impact thresholds do not differentiate between fish species (Fisheries Hydroacoustic Working Group 2008). Although salmonids and rockfish have very different appearances and life histories, both groups have internal air bladders to maintain buoyancy. This is important since the bladder is susceptible to rapid expansion/decompression when a peak pressure wave from an underwater noise source is encountered. At a high enough level this exposure is fatal for both species groups. Therefore, it is likely that noise effects on rockfish will be similar to noise effects on salmon. Two studies of the effects of air guns on rockfish were reviewed. In a caged fish study investigating the effects of a seismic air gun on five species of rockfish (*Sebastes* spp.), Pearson et al. (1992) found that behaviors varied between species. In general, however, fish formed tighter schools and remained somewhat motionless, thereby indicating behavioral effects. Skalski et al. (1992) found that average rockfish catches for hook and line surveys decreased by 52 percent when occurring after the noise produced by a seismic air gun at the base of rockfish aggregations. Fathometer observations showed that the rockfish schools did not disperse but remained aggregated in schooling patterns similar to those prior to exposure to this noise. However, these aggregations elevated themselves in the water column, away from the underwater noise source. Hastings and Popper (2005) indicate there are no reliable hearing data on rockfish, and is it currently not possible to predict their hearing capabilities based on morphology.

Rockfish occurring within 2,929 meters of a steel pile when struck by an impact hammer will be exposed to underwater noise levels above the behavioral disturbance guidance. Adult and subadult ESA-listed rockfish and juvenile yelloweye are not expected to occur in the project area where SPLs will exceed the threshold for the onset of injury. Therefore, no exposure to elevated noise levels is expected. Juvenile bocaccio and canary rockfish have the potential to be rearing within the action area because eelgrass and some kelp occur in the action area and larval rockfish may occur in the action area. However, only proofing of 4 piles is anticipated and a bubble curtain will be used during impact pile driving.

5.1.1.2 Potential Hydroacoustic Effects of Pile Driving Noise Exposure to Marbled Murrelets

Like the fish injury thresholds, 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 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) 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.

The distances to the auditory threshold were calculated using the Practical Spreading Loss model described in Section 5.1.1 based on an assumption of 2,000 pile strikes per day (equivalent to 45 minutes of pile driving). However this number is the worst-case scenario and it is unlikely this number of strikes would occur each day of pile driving. In order to be conservative, the Navy carried out the noise exposure analysis assuming that impact pile driving would occur over 4 days and each day would require the maximum number of pile driving strikes (e.g., 2,000).

Based on the above analysis, the auditory injury threshold (cumulative SEL = 202 dB) is estimated to extend 40 meters. Therefore, marbled murrelets could be exposed to injurious noise levels if they were at or within 40 meters of a 30-inch 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 40 meter 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 would be smaller and would only gradually increase out to a distance of 40 meters after all strikes have been completed.

The Navy intends to visually monitor for marbled murrelets during impact pile driving in order to ensure no exposures to injurious sound pressure levels occur (see Appendix B for the monitoring plan). Should marbled murrelets approach or enter the monitoring zone, all impact pile driving would cease until they have left the area. Additionally, the wharf is located within the Port Security Barrier, which experiences frequent routine vessel traffic, and the center of the wharf is unlikely to attract marbled murrelets due to the structure's U-shaped configuration. To further protect marbled murrelets, all pile driving will begin two hours after sunrise and cease two hours before sunset to minimize effects to foraging marbled murrelets during the nesting season. All impact pile driving will occur with the use of a noise attenuation device.

5.1.2 Airborne Noise

Pile driving can generate airborne noise that could potentially result in disturbance to marbled murrelets. In addition, airborne pile driving noise has the potential to affect foraging behavior and efficiency through masking effects because murrelets forage in pairs (SAIC 2012). The USFWS has guidance for marbled murrelet communication masking as a result of impact pile driving (USFWS 2014). The distance to the marbled murrelet airborne masking threshold is set at a radius of 42 meters from an impact driven pile 30-inches or smaller in diameter. All other construction noise associated with the project is anticipated to be at the level of existing waterfront operations and not expected to result in masking. Figure 5-3 shows the distance graphically depicted on the landscape. As noted in the prior section, the U-shaped configuration of the covered structure limits the area where marbled murrelets would be expected to occur, so the area is effectively smaller than the 42-meter masking radius.

Because visual monitoring of marbled murrelets will occur out to 42 meters during impact pile driving and impact pile driving will cease if marbled murrelets are observed at or within this distance, measureable effects to foraging due to potential masking effects are not anticipated. Note that the distance encompasses the larger than the underwater injury cumulative SEL distance (40 meters) calculated in the prior section.

Several non-pile construction activities will also occur at the project area as part of the proposed action. Among them are the removal of the fragmentation barrier and walkway and the installation of cast-in-place concrete pile caps, passive cathodic protection systems, and the new pre-stressed wharf superstructure and related appurtenances. All of these construction activities will occur out of the water/above the water's surface and will be installed on the tops of the piles or attached to the wharf's superstructure. Each of these activities could involve the generation of low levels of noise from the operation of associated installation machinery (i.e., concrete cutting saw, bolt gun, welder, etc.). These construction activities are expected to be significantly lower than those estimated for pile installation. The EHW-1 project occurs at a working Navy wharf within the Port Security Barrier where a significant amount of vessel activity occurs routinely. Therefore, the baseline level of activity would not change significantly and no significant effect to marbled murrelets from general construction disturbance is anticipated.

Figure 5-3. Area Exceeding Marbled Murrelet Masking Threshold Depicted for a Representative Impact Driven Pile.

5.2 Water Quality

Construction-related impacts would not violate applicable state or federal water quality standards. BMPs and minimization measures, discussed in Section 2.5, will be employed to prevent accidental losses or spills of construction debris or hazardous materials. Therefore, the project is expected to result in only localized, temporary degradation of the existing water quality as described below. All impacts to water quality will be limited to short-term and localized changes associated with re-suspension of bottom sediments from pile removal and installation and barge and tug anchoring. These changes will be spatially limited and occur intermittently during the construction period.

5.2.1 Dissolved Oxygen

Pile removal, repairs or replacements will not affect DO concentrations in site waters, other than minor, brief, and localized effects associated with resuspension of bottom sediments during installation and removal of 4 piles and barge anchoring. Resuspension of existing bottom sediments will not result in substantial oxygen depletion or reductions in DO levels that will violate water quality standards, or exacerbate low DO concentrations that occur seasonally within portions of Hood Canal. Any changes in DO will be localized at a project site during pile removal or installation and are not expected to result in a significant direct effects to fish including ESA-listed fish species or diving marbled murrelets. Because effects are not anticipated to be significant for fish, effects to the forage prey base for ESA-listed species will not occur.

5.2.2 Suspended Sediment and Turbidity

Temporary increases in turbidity and suspended sediments could impact fish by creating cloudy or murky conditions that interfere with predator avoidance, covering food sources or vegetation with sediments, and interfering with oxygen exchange via impacts to the gills. However, elevated levels of turbidity and suspended sediments from project activities will be limited to short-term and localized changes associated with suspension of bottom sediments from removal and installation of four piles and anchoring. Propeller wash impacts impacts are not anticipated because the project does not occur in shallow waters. Temporary construction-related impacts would not violate applicable state or federal water quality standards and therefore effects are not not anticipated to be significant for fish or the forage prey base for ESA-listed fish or marbled murrelets.

An approximate, conservative calculation of sediment dispersion during pile driving, based on sand-sized grains, ambient current velocities (maximum of 1 foot [0.3 meter]/second), and entrainment up into the water column to 40 feet (12 meters) above the sediment-water interface, yields a horizontal displacement of 130 feet (40 meters) for particle transport prior to resettling. Finer-grained particles will be transported further but will be subject to rapid dilution by currents and eventual flushing during subsequent tidal exchanges (Morris et al. 2008). Consequently, construction activities will not result in persistent increases in turbidity levels or cause changes that will violate water quality standards because processes that generate suspended sediments and increase turbidity levels will be short-term and localized and suspended sediments will disperse and dilute and/or settle rapidly after construction activities cease.

Studies investigating impacts on steelhead and coho salmon from larger scale sediment dredging operations have shown that increased turbidity levels from these activities did not cause salmonid gill damage, although other adverse effects were evident (Redding et al. 1987; Servizi and Martens 1991). Redding et al. (1987) found that coho and steelhead were more susceptible to bacterial infection and displayed reduced feeding rates when exposed to elevated turbidity levels. Servizi and Martens (1991) found that coho were more susceptible to viral infections when exposed to elevated turbidity, and postulated that other impacts include reduced tolerance to environmental changes. Because these findings originated from larger scale sediment operations, and the construction scale of impacts covered in this programmatic is much smaller, salmonids in the immediate project vicinity will not be expected to experience gill tissue damage due to increased turbidity associated with in-water construction activities, and will be unlikely to experience a reduction in fitness including increased susceptibility to bacterial and viral infection.

A bubble curtain could be used as mitigation for in-water noise during steel pile driving at EHW-1. When the bubble curtain is operating increased levels of turbidity and suspended sediment are anticipated. For project-related construction activities, such as barge anchoring, fine-grained particles resuspended from the bottom will be confined to the near-bottom depth layers by natural density stratification of the water column. The subsurface suspended sediment plume will disperse rapidly as a result of particle settling and current mixing. In most cases, suspended sediment/turbidity plumes will not be visible at the surface, with the possible exception of the shallow portions (water depths less than 20 feet) of the construction area (Hitchcock et al. 1999).

Based on the above analysis, in-water work could produce measurable, temporary increases in turbidity and sedimentation, and could cause fish to temporarily avoid areas near construction. However, construction activities will 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, will be short-term and localized and suspended sediments will disperse and/or settle rapidly (within a period of minutes to hours after construction activities cease). Therefore effects to water quality are unlikely to result in large enough increases to result in changes to predator avoidance, significantly affect the availability of prey or habitat, or impact fish gill function. In addition, in-water work will occur during the July 15-January 15 work period when juvenile salmonids are least likely to occur and exposure would be discountable. Additionally, adult Puget Sound Chinook and adult Puget Sound steelhead, and adult Hood Canal summer-run chum, and adult rockfish are unlikely to be in the nearshore work area where the wharf is located especially during pile work. Therefore, exposureof fish at these lifestages to elevated levels is likely to be discountable near the work sites and insignificant further from the sites.

As described for fish above, elevated turbidity levels would not be expected to measurably decrease the availability of prey for foraging marbled murrelets or reduce their ability to detect and capture prey species because turbidity and sedimentation effects from pile driving and anchor placement will be very localized and temporary during the construction period. Therefore, direct effect to marbled murrelets from increases in turbidity or sediment levels or indirect effects from a reduced forage base will be insignificant.

5.3 Contaminants

As sediments at the site are below SQS levels, increases in chemical contaminant concentrations in marine waters as a result of sediment resuspension during construction activities will be negligible. Direct discharges of waste to the marine environment will not occur. The potential for accidental spills or releases of hazardous materials (e.g., from barges, construction platforms, fueling activities on land or in water) will be minimized through implementation of spill prevention and response plans. Contractors will be required to prepare and implement a spill response plan (e.g., Spill Prevention, Control, and Countermeasure) to clean up fuel or fluid spills. The Navy will also require the construction contractors to prepare and implement debris management procedures for preventing discharge of debris to marine water and retrieving and cleaning up all construction debris.

5.4 Benthos and Marine Vegetation

Direct construction effects on aquatic vegetation will be minimal because piles will be repaired or replaced in the same general structural footprint. The most significant effect will be direct removal of marine vegetation attached to repaired or removed piles. Anchoring will not be allowed in eelgrass beds. Some physical disruption from anchors/spuds scouring could occur, but will be minimized through anchoring plans that minimize impacts to eelgrass. Effects from turbidity, sedimentation, and shading, could occur to nearby vegetation, but will be primarily limited to the project's immediate footprint. Turbidity and sedimentation will be temporary and localized at the site of each of the 4 piles as described in Section 4.2.2. Shading will be unlikely to result in measureable disturbance to marine vegetation, because construction and support vessels will not be stationary for the entire construction period and will not be positioned over eelgrass beds. Overall, construction activities will only result in short-term impacts to marine vegetation either on existing piling or in the nearby vicinity. Direct impacts to eelgrass or kelp beds will be avoided. Temporary impacts to marine vegetation are not likely to significantly reduce the quality of eelgrass or kelp habitats used by juvenile salmon or rockfish, or impact the forage base that is associated with those habitats. Therefore, the effect of project activities on marine vegetation is expected to be insignificant to listed-fish species, marbled murrelets, and their forage base.

Benthic organisms are prey for juvenile salmon and rockfish, as well as forage fish which are part of the marine forage base for ESA-listed fish and marbled murrelets. Construction will result in several impacts on the benthos, including potential disturbance to soft-bottom habitat increased turbidity and suspended solids, temporary shading from construction barges and tugs, and increased noise and vibration during pile placement.

Temporary increases of suspended sediment will likely occur from pile removal and driving, and anchor placement/removal. The extent of suspended sediment will be increased above baseline primarily in the immediate construction area with duration of suspension dependent on the on substrate at the site being disturbed with coarser substrates with relatively quick settling times and finer substrates with longer suspension times.

Impacts on benthic organisms potentially include physical damage, burial, and foraging impacts for filter feeders, but these effects would be spatially limited to the area surrounding pile work. Previous studies of dredged and other disturbed sites show that benthic and epibenthic invertebrates recolonize disturbed bottom areas well within 2 years of disturbance (CH2M Hill 1995; Parametrix 1994, 1999; Anchor Environmental 2002; Romberg 2005). Because construction that will affect benthic organisms (bottom disturbances by pile placement and driving and anchor placement/removal) will be spatially limited and prey resources in adjacent area will not be affected, this loss is not expected to significantly affect the available benthic prey base. In addition, because the projects will occur during the in-water work windows at each installation, construction activity will avoid smaller nearshore dependent juvenile chum and Chinook salmon that could forage on intertidal and shallow subtidal benthic invertebrates as a prey source during their out-migration. Larger salmonids and rockfish that occur further offshore in the neritic zone are generally less dependent on benthic invertebrates.

Therefore, the effect of project activities on the marine vegetation and benthic forage base is expected to be insignificant to fish and marbled murrelets.

5.5 Indirect Effects

Indirect effects are those effects caused by or resulting from the proposed action that are later in time, but are still reasonably certain to occur (50 CFR 402.2).

The project is a repair project and will not result in a new facility or structure that will change the pattern of use at EHW-1 or access to the wharf. Indirect effects to the prey base or habitat are discussed for each stressor in the previous section. No indirect effects resulting from changes to ecological systems resulting from alterations in predator/prey relationships or habitats will occur.

6 Conclusions and Effect Determinations

A "may affect, not likely to adversely affect" determination means that effects are insignificant and discountable. Insignificant effects are generally very small in scale, do not reach the level of take as defined by the ESA, and cannot be meaningfully measured, detected, or evaluated. Discountable effects are those that are extremely unlikely to occur. A "may affect, likely to adversely affect" determination means that the effects could rise to the level of take for one or more individuals of the species.

6.1 Bull Trout

The project ***may affect*** bull trout because:

- The Skokomish River drains into Hood Canal and contains a population of bull trout.
- Pile extraction and driving and barge anchoring will increase levels of suspended sediment and turbidity in the water column resulting in potential effects to ESA-listed fish species and their forage base.
- Aquatic vegetation and benthic invertebrates may be exposed to physical removal or changes in water quality from pile extraction and driving and barge anchoring.
- Piles driving will produce noise above the fish behavioral threshold during vibratory pile driving and above the behavior and injury thresholds during impact driving.

However, the project is ***not likely to adversely affect*** bull trout because:

- Anadromous bull trout have not been documented in or from the Skokomish River. Multiple surveys along the NAVBASE Bangor waterfront have not documented bull trout. If bull trout were to occur in Hood Canal (from other river systems), project work will occur from July 16 to January 15, which is inclusive of the in-water work window from July 16 through February 15 when bull trout are least likely to be present. Therefore, exposure to temporary, sporadic and spatially limited increases in sediment and turbidity for brief periods of time or temporary increases in noise levels during project repairs will be discountable.
- Exposure of aquatic vegetation and benthic invertebrates to project activities will be temporary and limited to discrete areas within the project's footprint at or near anchor and pile replacement. Therefore, effects will be short-term and small in scale and insignificant to the forage base of bull trout.
- Impact pile driving of steel piles will be conducted during the in-water work window when juvenile salmonid forage is least likely to be present, will use vibratory installation to the extent practicable and will utilize a noise attenuation device for impact steel driving resulting in a spatially limited fish injury zone for the minimum duration of impact driving (estimated at 3 hours maximum). Therefore, adverse effects to the bull trout forage base from steel impact pile driving noise are considered discountable. Behavioral effects from pile driving will be limited to the installation

of 4 piles and primarily occur from vibratory pile driving. Therefore, these effects are considered insignificant to the bull trout forage base.

6.2 Puget Sound ESU Chinook

The project ***may affect*** Puget Sound ESU Chinook because:

- Pile extraction and driving and barge anchoring will increase levels of suspended sediment and turbidity in the water column resulting in potential effects to ESA-listed fish species and their forage base.
- Aquatic vegetation and benthic invertebrates may be exposed to physical removal or changes in water quality from pile extraction and driving and barge anchoring.
- Piles driving will produce noise above the fish behavioral threshold during vibratory pile driving and above the behavior and injury thresholds during impact driving.

However, the project is ***not likely to adversely affect*** Puget Sound ESU Chinook because:

- Project work will occur in the July 16 through January 15 time period when Puget Sound Chinook juveniles are least likely to be present. Within the in-water work time frame, any juveniles remaining would be larger and not nearshore oriented and resident Chinook or migrating adults would not be expected to be in the nearshore where project work will occur. Therefore, exposure of larger juvenile, resident or returning Puget Sound Chinook salmon to general construction disturbance or localized effects (changes in water quality) are very unlikely to occur.
- Increases in levels of suspended sediment and turbidity will be temporary, sporadic during construction (only expected during pile extraction and driving, and barge anchoring), and localized and not result in a violation of water quality standards. Therefore, exposure of Puget Sound Chinook salmon or their forage base to changes in water quality that are significant enough to decrease prey detection or avoidance or result in gill damage are considered unlikely.
- Exposure of aquatic vegetation and benthic invertebrates to project activities will be temporary and limited to discrete areas within each projects' footprint at or near anchor or pile replacement. Therefore, effects will be short-term and small in scale and insignificant to the forage base of Puget Sound Chinook.
- Impact pile driving of steel piles will be conducted during the timeframe when juvenile salmon are least likely to be present, will use vibratory installation to the extent practicable and will utilize a noise attenuation device for impact steel driving, will turn on the bubble curtain prior to driving, resulting in a spatially limited injury zone with an estimated duration at less than 3 hours. Puget Sound Chinook present during the period of construction will be larger life stages that are migratory and not nearshore dependent. Therefore, Chinook salmon are not likely to remain within the onset of injury zone if present, nor are they likely to be within the peak injury zone (estimated at 14 meters). Behavioral effects from pile driving will be limited to the installation of 4 piles and primarily occur from vibratory pile driving. Forage species for salmon and steelhead could be exposed to injurious noise levels, but the duration will be limited over a 4 day period for impact driving; therefore, the effect to the

forage base for fish will be insignificant. Therefore, injurious effects are considered discountable to Puget Sound Chinook and insignificant to its forage base.

6.3 Hood Canal ESU Summer-run Chum

The project ***may affect*** Hood Canal summer-run chum because:

- Pile extraction and driving, and barge anchoring, will increase levels of suspended sediment and turbidity in the water column resulting in potential effects to ESA-listed fish species and their forage base.
- Aquatic vegetation and benthic invertebrates may be exposed to physical removal or changes in water quality from pile extraction and driving, and barge anchoring.
- Piles driving will produce noise above the fish behavioral threshold during vibratory pile driving and above the behavior and injury thresholds during impact driving.

However, the project is ***not likely to adversely affect*** Hood Canal summer-run chum because:

- Project work will occur during the July 15 to January 15 time period when Hood Canal summer-run chum fry are least likely to be present.
- Increases in levels of suspended sediment and turbidity will be temporary, sporadic during construction (only expected during pile extraction and driving, and barge anchoring), and localized and not result in a violation of water quality standards. Therefore, exposure of Hood Canal summer-run chum and their forage base to changes in water quality that are significant enough to decrease prey detection or avoidance or result in gill damage are considered unlikely.
- Exposure of aquatic vegetation and benthic invertebrates to project activities will be temporary and limited to discrete areas near anchor and pile replacement. Therefore, effects will be short-term and small in scale and insignificant to the forage base of Hood Canal summer-run chum.
- Impact pile driving of steel piles will be conducted during a time period when chum salmon fry are least likely to be present, will use vibratory installation to the extent practicable and will utilize a noise attenuation device for impact steel driving, will turn on the bubble curtain prior to driving, resulting in a spatially limited injury zone for the duration of impact driving (estimated at less than 3 hrs.). Adult summer-run chum could be present in Hood Canal and overlap with pile driving from July 16 through the end of October. However, adult chum are not expected along the nearshore waterfront. Therefore, with a discountable presence of Hood Canal summer-run chum fry and adults in the injury zone, adverse effects from pile driving noise are considered discountable for Hood Canal summer-run chum. Behavioral effects from pile driving will be limited to the installation of 4 piles and primarily occur from vibratory pile driving. Forage species for salmon and steelhead could be exposed to injurious noise levels, but the duration will be limited over a 4 day period for impact driving; therefore, the effect to the forage base for fish will be

insignificant. Therefore, these effects are considered discountable to Hood Canal summer-run chum and insignificant to its forage base.

6.4 Puget Sound DPS Steelhead

The project ***may affect*** Puget Sound steelhead because:

- Pile extraction and driving, and barge anchoring, will increase levels of suspended sediment and turbidity in the water column resulting in potential effects to ESA-listed fish species and their forage base.
- Aquatic vegetation and benthic invertebrates may be exposed to physical removal or changes in water quality from pile extraction and driving, and barge anchoring.
- Piles driving will produce noise above the fish behavioral threshold during vibratory pile driving and above the behavior and injury thresholds during impact driving.

However, the project is ***not likely to adversely affect*** Puget Sound steelhead because:

- Project work will occur during the July 15 to January 15 time period when juveniles salmonids are least likely to be present.
- Within the in-water work period, steelhead present in Hood Canal are not be expected to be in the nearshore where exposure to changes to water quality from project work will occur. Therefore, exposure of steelhead to changes in water quality that are significant enough to decrease prey detection or avoidance or result in gill damage are considered unlikely.
- Increases in levels of suspended sediment and turbidity will be temporary, sporadic during construction (only expected during pile extraction and driving, and barge anchoring, and localized and will not result in a violation of water quality standards. Therefore, effects to the salmonid prey base from changes in water quality are small in scale and considered insignificant.
- Exposure of aquatic vegetation and benthic invertebrates to project activities will be temporary and limited to discrete areas within each projects' footprint at or near anchor and pile replacement. Therefore, effects will be short-term and small in scale and insignificant to the forage base of Puget Sound steelhead.
- Behavioral disturbance from in-water project activity will be limited in duration because only 4 piles will be extracted and only 4 piles will be installed. Therefore, behavioral effects to steelhead from in-water construction noise and disturbance are expected to be insignificant.
- Impact pile driving of steel piles will be conducted during the in-water time period when juvenile steelhead are least likely to be present, will use vibratory installation to the extent practicable and will utilize a noise attenuation device for impact steel

driving, will turn on the bubble curtain prior to driving, resulting in a spatially limited injury zone for duration of impact driving (estimated to extend to 480 m for less than 3 hrs.). Behavioral effects from pile driving will be limited to the installation of 4 piles and primarily occur from vibratory pile driving. Forage species for salmon and steelhead could be exposed to injurious noise levels, but the duration will be limited over a 4 day period for impact driving; therefore, the effect to the forage base for fish will be insignificant. Therefore, these effects are considered discountable to Puget Sound steelhead and insignificant to its forage base.

6.5 Puget Sound DPS Bocaccio, Puget Sound DPS Canary Rockfish, and Puget Sound DPS Yelloweye Rockfish

The project ***may affect*** Puget Sound Bocaccio, Puget Sound Canary rockfish, and Puget Sound yelloweye rockfish because:

- Adult boccacio, canary, and yelloweye and juvenile yelloweye rockfish habitat composed of deep areas with complex bathymetry, slopes, and high rugosity features occur along the rim of nearly all Hood Canal. Bocaccio, canary, and yelloweye rockfish have been documented in Hood Canal and canary and yelloweye have been caught in relatively low numbers in Hood Canal.
- Kelp is located within the action area and may support juvenile settlement habitats for juvenile boccacio and canary rockfish. Larval ESA-listed rockfish are pelagic and occur in surface waters primarily from early spring with no occurrence by November (Greene and Godersky 2012). Therefore, juvenile and larval ESA-listed rockfish could be within the action area.
- Pile extraction and driving and barge anchoring will increase levels of suspended sediment and turbidity in the water column at the project site resulting in potential effects to ESA-listed rockfish species and their forage base.
- Aquatic vegetation and benthic invertebrates may be exposed to physical removal or changes in water quality from pile extraction and driving and barge anchoring.
- Piles driving will produce noise above the fish behavioral threshold during vibratory pile driving and above the behavior and injury thresholds during impact driving.

However, the project is ***not likely to adversely affect*** Puget Sound Bocaccio, Puget Sound Canary rockfish, and Puget Sound yelloweye rockfish because:

- Adult ESA-listed rockfish are found in deeper depths than the project site which is less than 18 m; therefore, exposure of adult rockfish to increases in levels of suspended sediment and turbidity is discountable.
- Increases will be temporary, sporadic during construction (only expected during pile extraction and driving and barge anchoring), localized, and will not result in a

violation of water quality standards. Therefore, exposure of ESA-listed rockfish juveniles, larvae, and their forage base to changes in water quality that are significant in scale and duration to result in gill damage or decrease prey detection or avoidance are considered insignificant.

- Exposure of aquatic vegetation and benthic invertebrates to project activities will be temporary and limited to discrete areas within each projects' footprint at or near anchor, pile replacement, or vessels. Therefore, effects will be short-term and small in scale and insignificant to the forage base or habitats of ESA-listed rockfish.
- Within the action areas all life stages of rockfish could be exposed to behavioral disturbance from pile driving noise. However, behavioral disturbance from pile driving noise will be limited in duration because only 4 piles will be installed with an estimated total duration of impact pile driving of less than 3 hours. Therefore, effects from exposure are unlikely to be significant.
- Impact pile driving of steel piles will use vibratory installation to the extent practicable and will utilize a noise attenuation device for impact steel driving, will turn on the bubble curtain prior to driving, resulting in a spatially limited injury zone for duration of impact driving (estimated to occur for less than 3 hrs.). Behavioral effects from pile driving will be limited to the installation of 4 piles and primarily occur from vibratory pile driving. Forage species for rockfish could be exposed to injurious noise levels, but the duration will be limited over a 4 day period for impact driving; therefore, the effect to the forage base for fish will be insignificant. Therefore, these effects are considered insignificant to Puget Sound Bocaccio, Puget Sound Canary rockfish, and Puget Sound yelloweye rockfish and insignificant to their forage base.

6.6 Marbled Murrelet

The project ***may affect*** marbled murrelets because:

- The project will create noise and visual disturbance that could disturb foraging and loafing marbled murrelets.
- Impact pile driving for placement of four 30-inch steel piles will produce noise levels above the masking and injury thresholds for marbled murrelets out to a distance estimated at 42-meters.
- Forage fish may be affected by noise levels above the behavioral and injury thresholds established for fish. These changes could result in potential effects to the marbled murrelets forage fish base.
- Pile extraction, pile driving, and barge anchoring will increase levels of suspended sediment and turbidity in the water column near in-water work resulting in potential effects to foraging marbled murrelets and their forage base.

- Aquatic vegetation, benthic invertebrates, and forage fish may be exposed to physical removal.

However, the project is ***not likely to adversely affect*** marbled murrelets because:

- Behavioral disturbance from in-water pile installation noise and general construction disturbance, other than impact pile driving, will be limited in duration because construction disturbance will not be above baseline noise and activity levels at EHW-1 and within the Port Security barrier. Therefore behavioral effects to marbled murrelets from general construction disturbance other than impact pile driving noise are considered insignificant.
- Vibratory pile driving will be the primary method to drive piles and impact driving will only be used to proof piles. During impact pile driving, visual monitoring for marbled murrelets will occur and pile driving will be shut-down if marbled murrelets are seen approaching or within a 42-m monitoring zone. Monitoring will be conducted by qualified monitors as required by the USFWS. Within the 50-meter monitoring area, marbled murrelet detections are estimated to be near 100%. Therefore, marbled murrelets will not have vocalizations masked or be exposed to injurious noise levels. Additionally, marbled murrelets are not expected to land, loaf, or forage within the existing wharf structure as depicted in Figure 5-3. Therefore, exposure of marbled murrelets to noise levels resulting in masking or injury is considered discountable.
- Project produced increases in levels of suspended sediment and turbidity will be temporary, sporadic during construction (only expected during pile extraction and driving and barge anchoring), localized, and will not result in a violation of water quality standards. Therefore, exposure of marbled murrelets to changes in water quality that are significant enough to decrease prey detection are considered insignificant because sediment is anticipated to drop out of the water column close to construction or dissipate further from construction.
- Impact pile driving of steel piles will be conducted during the time period when juvenile salmonid forage is least likely to be present, will use vibratory installation to the extent practicable and will utilize a noise attenuation device for impact steel pile driving resulting in a spatially limited fish injury zone for the minimum duration of impact driving (estimated at 3 hours maximum). Therefore, adverse effects to the marbled murrelets forage base from steel impact pile driving noise are considered insignificant. Behavioral effects to fish from pile driving will be limited to the installation of 4 piles and primarily occur from vibratory pile driving. Therefore, these effects are considered insignificant to the marbled murrelet forage base.
- Exposure of aquatic vegetation and benthic invertebrates to project activities will be temporary and limited to discrete areas within each projects' footprint at or near anchor placement and pile extraction and installation work. Therefore, effects will be short-term and small in scale resulting in effects that are insignificant to the forage base of marbled murrelets.

6.7 Humpback Whale

The project ***may affect*** humpback whales because:

- Humpback whales occur in Puget Sound and a humpback whale was documented in Hood Canal

However, the project is ***unlikely to adversely affect*** humpback whales because:

- Although humpback whales were sighted in Hood Canal in 2012, humpback whale presence is extremely rare in Hood Canal and exposure would only potentially occur from increased noise levels during vibratory pile installation, which is only estimated to occur less than 3 hours over the project duration. Therefore, exposure of humpback whales to project noise is discountable.

6.8 Puget Sound ESU Chinook and Hood Canal Summer-run ESU Chum Critical Habitat

The project ***may affect*** Puget Sound ESU Chinook and Hood Canal Summer-run ESU chum critical habitat because:

- The project will affect three critical habitat PCEs: Estuarine Areas, Nearshore Marine Areas, and Offshore Marine Areas because:
    - Noise from pile installation will be above the behavioral threshold for fish in the portion of the action area that contains critical habitat

However, the project is ***unlikely to adversely affect*** Puget Sound ESU Chinook and Hood Canal Summer-run ESU chum critical habitat because:

- Increased noise levels within the portion of the action area that contains critical habitat will be temporary and intermittent for a period of a few hours over a maximum of 8 days, and will not reach levels that will be over the injury thresholds for fish. Therefore, effects to the Estuarine, Nearshore Marine Areas, and Offshore Marine Area PCEs will be insignificant.

7 Magnuson Stevens Fishery Conservation and Management Act

The Magnuson Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), through the Essential Fish Habitat (EFH) provision, protects the waters and substrate necessary for the spawning, breeding, feeding, or growth to maturity of certain commercially managed fisheries species (16 United States Code [USC] 1802(10)). Federal agencies are required to consult with NMFS on proposed actions authorized, funded, or undertaken by the agency that may adversely affect EFH (Section 305(b)(2)). NMFS is required to provide conservation recommendations for any federal activity that would adversely affect EFH (Section 305(b)(4)(A)). Adverse effect means any impact that reduces the quality and/or quantity of EFH, and may include direct, indirect, site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 Code of Federal Regulations [CFR] 600.810).

Pursuant to the MSA, the Pacific Fisheries Management Council (PFMC) has designated EFH for federally managed species within the waters of Washington, Oregon, and California. The waters of the Hood Canal are designated EFH for coastal pelagic, Pacific salmon, and Pacific Coast groundfish species (PFMC 1998, 2003, 2008, respectively).

In addition to EFH designations, areas called Habitat Areas of Particular Concern (HAPC) are also designated by the regional Fishery Management Councils (FMCs). Designated HAPC are discrete subsets of EFH that provide extremely important ecological functions or are especially vulnerable to degradation (50 CFR 600.805-600.815). Regional FMCs may designate a specific habitat area as an HAPC based on one or more of the following reasons: (1) importance of the ecological function provided by the habitat; (2) the extent to which the habitat is sensitive to human-induced environmental degradation; (3) whether, and to what extent, development activities are, or will be, stressing the habitat type; and (4) rarity of the habitat type (67 FR 2343-2383). Categorization as HAPC does not confer additional protection or restriction to the designated area.

The objective of this assessment is to determine whether the Proposed Action "may adversely affect" designated EFH for relevant federally managed commercial species.

7.1 Project Description

As described in Chapter 2, the Proposed Action will repair the bent at the existing EHW-1 structure by replacing 4 concrete piles with concrete-filled steel piles and conducting associated overwater repairs. Pile driving will occur from July 16, 2015 through January 15, 2015 to avoid juvenile salmonid presence (See Chapter 3.1.1-3.1.4). A detailed description of the project's elements, including construction, schedule, and impact avoidance and minimization measures is located in Chapter 2.

7.2 Essential Fish Habitat Designations

7.2.1 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, Pacific mackerel, and jack mackerel. 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). No krill harvest will occur in conjunction with the proposed project. 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 (chub) mackerel, jack mackerel, and market squid. Though extremely rare over the past 30 years in nearshore surveys at NAVBASE Kitsap Bangor (Schreiner et al. 1977; Prinslow et al. 1980; Bax 1983; SAIC 2006; Bhuthimethee et al. 2009), two of these coastal pelagic species are known to occur in Hood Canal waters: northern anchovy and market squid. 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 degrees Fahrenheit (°F) (10 to 20 degrees Celsius [°C]). These boundaries include the waters of NAVBASE Kitsap Bangor.

Coastal pelagic species have value to commercial Pacific fisheries, and are also important as food for other fish, marine mammals, and birds (63 FR 13833). Coastal pelagic species are considered sensitive to overfishing, loss of habitat, reduction in water and sediment quality, and changes in marine hydrology, including entrainment through water intakes.

The general descriptions of northern anchovy and market squid provided in the FMP (PFMC 1998) were reviewed for information on designated EFH pertinent to consideration of effects from construction and operation of the project.

Northern anchovy are small, short-lived fish that are typically found in schools near the surface. They eat phytoplankton and zooplankton and spawn year round with peaks from February to April. All life stages are preyed on by a variety of predators, including salmon and numerous fishes. Northern anchovy were collected along the NAVBASE Kitsap Bangor shoreline in low numbers in the 2007 surveys (19 individuals), confirming occurrence of this species in the nearshore zone in Hood Canal.

Market squid are harvested near the surface, but they also can occur at great depths. They prefer the salinity of the ocean and are rarely found in estuaries, bays, or river mouths. This species feeds on copepods as juveniles and on euphausiids, other small crustaceans, small fish, and other squid as they grow. Habitat requirements for spawning are not well understood, although documented spawning areas along the coast consist of shallow, semi-protected nearshore areas with sandy or mud bottoms adjacent to submarine canyons. Spawning occurs during most of the year, typically beginning in late summer off Washington. Squid are important as forage foods for many fish such as Chinook salmon, coho salmon, lingcod, and rockfish. Market squid are commonly seen by sport divers in Hood Canal. In addition, market squid egg masses trawled from Hood Canal waters have been utilized as a source for laboratory rearing (Mackie 2008). However, only one market squid was captured in the nearshore beach seine surveys along the NAVBASE Kitsap Bangor shoreline from 2005 to 2009, suggesting their presence may be limited in the nearshore waters in the vicinity of the EHW-1.

7.2.2 Salmon

The Pacific salmon management unit includes Chinook (*Oncorhynchus tshawytscha*), coho (*Oncorhynchus kisutch*), and pink (*Oncorhynchus gorbuscha*) 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 miles [322 kilometers]) offshore (PFMC 2003). 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 2003).

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 2003). The most abundant Hood Canal forage fish species for salmonids include Pacific herring, surf smelt, and Pacific sand lance.

The current salmon FMP was adopted in 1999 and includes 17 subsequent amendments; amendment 14 addresses EFH and non-fishing impacts for salmon (PFMC 2003). 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.

Juvenile salmon were well represented in the site-specific surveys, confirming substantial yearly use of the NAVBASE Kitsap Bangor shallow nearshore zone by juvenile Chinook, coho salmon, and pink salmon (SAIC 2006; Bhuthimethee et al. 2009).

7.2.3 Groundfish

Pacific coast groundfish species are considered sensitive to over-fishing, the loss of habitat, and water and sediment quality (PFMC 2008). 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 2008). The PFMC (2008) 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 feet] to mean higher high water level (MHHW) or the upriver extent of saltwater intrusion, defined as upstream and landward to where ocean-derived salts measure less than 0.5 ppt [parts per thousand] during the period of average annual low flow." Furthermore, the PFMC (2008) has also designated EFH for each individual groundfish species by lifestage. These designations are contained within Appendix B of the FMP. Using the Pacific Habitat Use Relational Database (HUD) developed by the PFMC, it was determined which groundfish species and lifestages have EFH designated within the vicinity of the project sites (Appendix A of this EFH assessment). The management unit in the Pacific Coast Groundfish FMP includes over 90 groundfish species (PFMC 2008). Of these, 32 were identified through the analysis of the HUD as having EFH designated in the vicinity of NAVBASE Kitsap Bangor.

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.

Site-specific nearshore surveys at NAVBASE Kitsap Bangor confirmed occurrence of eight groundfish species (Dover sole, English sole, kelp greenling, lingcod, Pacific sanddab, rex sole, sand sole, and starry flounder) as well as unidentified flatfishes/sole species, and unidentified juvenile rockfish (*Sebastes* spp.) (SAIC 2006; Bhuthimethee et al. 2009). The surveys confirmed the nearshore occurrence of these species but this information is not intended to indicate the lack of occurrence of the other groundfish species, particularly based on the shallow-water limits of the surveys.

7.3 Habitat Areas of Particular Concern

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.

7.3.1 Coastal Pelagic Species

No HAPCs have been formally designated for coastal pelagic species.

7.3.2 Salmon

Marine and freshwater EFH for salmon have been determined in the northwest, including landward limits of migration and spawning in freshwater streams. However, there is not sufficient quantity or resolution of data for formal HAPC designations for Chinook, coho, and pink salmon. According to the FMP, the focus of data compilation and habitat assessment efforts will generally be on identification, protection, and/or restoration of suitable spawning conditions in riffle and pool complexes in freshwater streams. However, off-channel rearing habitats in freshwater spawning streams, estuarine, and nearshore marine areas are considered vulnerable habitats in need of protection and restoration for each of the three salmonids protected by the EFH provisions of the MSA. Though no off-channel rearing habitats in freshwater spawning streams, or true estuarine habitats occur within the project areas, the project area is in a nearshore marine area.

7.3.3 Groundfish

Designated HAPCs for Pacific groundfish include seagrass, canopy kelp, rocky reef, and estuarine habitats along the Pacific coast. The estuarine habitats HAPC extends landward to MHHW or the upriver extent of saltwater intrusion. The seagrasses HAPC includes eelgrass beds in estuaries, which occur at EHW-1, but not at the project site.

7.4 Description of Habitats

The project will occur in the nearshore marine waters along the Bangor waterfront in Hood Canal within Puget Sound. Chapter 4 provides a detailed description of the existing environmental conditions along the Bangor waterfront.

7.5 Assessment of Impacts

Potential effects of project construction are addressed in Chapter 5.

The area where EFH may be affected beyond the immediate project area takes into account potential for direct and indirect physical, biological, and chemical effects of the project on motile marine fish species. Based on evaluation of all impact areas (including direct and indirect effects), it was determined that underwater noise, particularly pile driving noise during construction, was the project effect with the largest geographic extent for marine fish. As discussed in Section 5.1 the most conservative area for evaluating the potential effects of noise on fish is where underwater noise exceeds levels that disturb marine fish, 150 dB RMS re 1 μPa. The maximum distance at which this guidance level will be exceeded during pile driving is 2,929 meters.

7.5.1 Construction Impacts

In-water construction will impact marine habitats used by fish through increases in underwater noise and water quality effects and physical disruption caused by pile-driving and anchoring.

7.5.1.1 Underwater Noise

Pile installation at EHW-1 will result in increased underwater noise levels in portions of Hood Canal. Some noise will also be generated from support vessels, small boat traffic, and barge-mounted equipment, such as generators. However, the most significant in-water noise potentially affecting marine fish will be from pile driving using an impact hammer.

The effects of elevated noise levels to fish with designated EFH in the project area are anticipated to be similar to those described for ESA-listed salmon and rockfish (see Section 5.1.1). Pile driving will exceed the underwater noise threshold for fish injury and guideline for fish behavior, resulting in the greatest potential for adverse impacts on EFH. Pile driving will require no more than a few hours per day over approximately 8 days to complete for impact and vibratory installation of 4 piles. Past pile installation work indicates, the vast majority of pile driving will be completed using the much quieter vibratory driver, as opposed to the impact driver. Vibratory drivers have noise levels more than 30 dB RMS less than impact drivers, and do not exceed the injurious noise level threshold for fish. Underwater noise impacts on fish from pile driving will be minimized by adhering to an in-water work period from July 16 through January 15, when less than 5 percent of all juvenile salmonids that occur in NAVBASE Kitsap Bangor nearshore waters are expected to be present (SAIC 2006; Bhuthimethee et al. 2009). This work period will provide protection for sensitive life stages of many of the relevant groundfish and coastal pelagic species as well. With respect to underwater noise impacts on fish, the presence of an internal air (swim) bladder to maintain buoyancy likely makes species with an air bladder more susceptible to injury from underwater noise. This bladder is susceptible to rapid expansion/decompression when a peak pressure wave from an underwater noise source, such as impact pile driving, is encountered. At a sufficient level, this exposure is fatal for fish. However, underwater noise threshold criteria for fish injury, established by a multi-agency working group, currently do not differentiate between species with air bladders and those without them (FHWG 2008).

7.5.1.2 Water Quality

Water quality impacts are discussed in Section 5.2 and Sediment in Section 5.3. The expected changes in water quality from repairs and maintenance of the EHW-1 will only impact water sediment and turbidity levels while ground disturbing activities are in progress. All ground disturbing activities are relatively minor, short in duration, and will only occur intermittently over approximately 8 days (assuming a slow repair rate of 1 pile installed or extracted per day).

Nearshore habitat disturbance and localized turbidity increases could also affect the eggs and larvae of EFH species. Some species (e.g., market squid) deposit their eggs on, or in, the substrate. These eggs have the potential to be damaged directly by construction activities or smothered by sediments settling out of the water column. In addition, should nearshore spawning habitats be disturbed during the eggs' presence, these eggs could be dispersed into the water column, increasing their risk of predation. Other EFH species (e.g., English sole) have eggs that are positively buoyant. Elevated turbidity could alter normal dispersal patterns within the water column, potentially reducing their survival.

Larvae for a number of species for which EFH has been designated could also be affected by increased turbidity. While larvae of Pacific herring may benefit from increased feeding at moderately elevated levels of turbidity (Boehlert and Morgan 1985), other species may experience a decreased feeding rate under similar conditions (De Robertis et al. 2003). Although turbidity can improve the avoidance of predation by some species (e.g., English sole), it can be a limiting factor for other EFH species (De Robertis et al. 2003, Lemke and Ryer 2006). Therefore, although project-related changes in turbidity will be small scale and localized, species for which EFH has been designated will be expected to experience different effects due to varying life histories. However, 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 characterization studies along the waterfront demonstrated that sediments are within state sediment standards (Section 5.3). Therefore, increases in chemical contaminant concentrations in marine waters as a result of sediment resuspension during construction activities will be negligible. Construction activities will not include any discharges. The potential for accidental spills or releases of hazardous materials (e.g., from barges, construction platforms, fueling activities on land or in water) will be minimized through implementation of spill prevention and response plans. The contractor will be required to prepare and implement a spill response plan (e.g., Spill Prevention, Control, and Countermeasure) to clean up fuel or fluid spills. The Navy will also require the construction contractor to prepare and implement debris management procedures for preventing discharge of debris to marine waters.

7.5.1.3 Benthos and Marine Vegetation Disturbance

General construction disturbance will occur from vessels and anchoring but will be temporary during construction and limited to the immediate area surrounding the project footprint. Marine benthos and vegetation will be disturbed where it is growing on the 4 concrete piles and during anchor placement (discussed in Section 5.4). No effects from construction or to benthos or marine vegetation are anticipated to adversely affect EFH for any fishery.

7.5.2 Potential Adverse Effects on Pacific Salmon EFH

The EFH designation for the Pacific salmon includes nearshore and tidal submerged environments and locations of freshwater discharges in the nearshore zone (PFMC 2003). 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 2003). Repairs of EHW-1 will not affect spawning habitats for Pacific salmon. Primary construction effects on water column conditions affecting salmon EFH include impacts to water quality and underwater noise. Additionally, construction from positioning and anchoring the construction barges and pile driving will locally increase turbidity, disturb benthic habitats and forage fish, and shade marine vegetation in the immediate project vicinity.

During construction, implementation of in-water and upland construction BMPs and current practices will prevent anticipated violations of state water or sediment quality standards that will otherwise degrade water column EFH in terms of turbidity, DO, salinity, temperature, contaminants, and corresponding water column prey community abundance. However, increased turbidity during pile driving activities and anchoring/spudding of vessels will not violate State water quality standards and any impacts will be localized, temporary, and not likely to occur coincident with outmigrant Chinook, coho, or pink salmon at the wharf.

Pile driving during construction will result in substantial water column noise in Hood Canal where the threshold for injury and guideline for behavioral response will be exceeded, leading to potential injury, mortality, or behavioral effects (Figures 5-1 and-2). Use of vibratory pile driving and a noise attenuating device during impact driving will reduce construction noise levels, effectively reducing the range over which underwater noise exceeds established thresholds and guidelines and the use of an in-water timing window will avoid most affect to migrating juveniles. However, ensonification of the water column as a result of pile driving activities will have an adverse effect on habitats designated as EFH for salmon.

7.5.3 Potential Adverse Effects on Coastal Pelagic EFH

EFH for coastal pelagic species includes all estuarine and marine waters above the thermocline where sea surface temperatures range from 50 to 68°F (10 to 20°C). These boundaries include the waters of NAVBASE Kitsap Bangor. Coastal pelagic species are considered sensitive to overfishing, loss of habitat, reduction in water and sediment quality, and changes in marine hydrology, including entrainment through water intakes. These species are considered rare in the environments at NAVBASE Kitsap Bangor, although presence in the nearshore zone has been documented based on Bangor site-specific surveys. Northern anchovy use estuarine habitats such as the intertidal zone, eelgrass, kelp, and macroalgae, and could therefore be affected by the impacts on designated EFH described in Section 7.5.2. However, northern anchovy spawn year round and do not spawn on Puget Sound beaches (Penttila 2007), instead spawning in the water column. Market squid are associated with pelagic habitats.

Underwater noise, water column turbidity, and physical disruption from pile driving activities, work barges, and spud/anchoring systems during construction will create short-term disturbances in habitats used by coastal pelagic species. No permanent impacts on coastal pelagic EFH from the project are anticipated.

7.5.4 Potential Adverse Effects on Pacific Groundfish EFH

Designated groundfish EFH includes all estuarine and marine waters from the MHHW line seaward, and the upriver extent of saltwater intrusion in rivers, and specific inland sea and estuarine designated EFH includes the epipelagic zone of the water column. This EFH includes macrophyte canopies and drift algae, soft-bottom habitats, hard-bottom habitats, mixed sediments (sand and rocks), and vegetated bottoms consisting of algal beds, macrophytes, or rooted vascular plants. Pacific coast groundfish species are considered sensitive to overfishing, the loss of habitat, and reduction in water and sediment quality. In addition to use of these habitat types, larval and juvenile groundfish (notably rockfish) are dependent on a variety of habitat factors, including current patterns for larval transport to suitable recruitment habitat (e.g., kelp and eelgrass), good water quality, and abundant food resources.

Impacts on Pacific groundfish EFH from repairs at EHW-1 will be similar to those described above for Pacific salmon EFH. In addition to the effects described above, the project construction activities may affect groundfish spawning and consequently may adversely affect Pacific groundfish EFH.

Limited changes in water quality are anticipated from construction and avoidance of eelgrass and kelp beds will limit impacts to high quality habitats. Construction-generated noise has the potential to cause behavioral effects and injury or mortality to groundfish. However, use of vibratory pile driving and noise attenuation methods during pile driving should reduce the potential for adverse effects. Additionally, noise will be intermittent and short in duration (a few hours over 8 days). No permanent impacts on groundfish EFH from the project are anticipated.

7.6 EFH Conservation Measures

Section 2 lists measures that will be incorporated into the project to avoid, reduce, and minimize the effects on marine habitats and fish including ESA-listed species. Measures to reduce project effects include BMPs and minimization measures to avoid and minimize impacts on water quality and the seafloor during construction, including measures to avoid eelgrass beds and attenuate underwater noise.

7.7 Conclusions

Based on a review of the EFH in Hood Canal, findings pertaining to EFH habitats and federally managed species occurrence in waters at NAVBASE Kitsap Bangor based on site-specific fish surveys, review of the life histories, habitat requirements, and potential conservation measures from the FMPs, and review of the conservation measures developed to minimize adverse effects on EFH, the Navy concludes that repairs of the EHW-1 ***may adversely affect Pacific salmon, coastal pelagic, and Pacific groundfish EFH***. However, the BMPs and minimization measures that will be implemented will minimize adverse effects to the extent practicable and all effects will cease upon completion of the in-water wharf repairs.

8 References

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APPENDIX A

PROXY SOURCE LEVELS FOR NEARSHORE MARINE PILE DRIVING MODELING AT NAVY INSTALLATIONS IN PUGET SOUND/SOUND ATTENUATION WITH BUBBLE CURTAINS

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Proxy Source Sound Levels and Potential Bubble Curtain Attenuation for Acoustic Modeling of Nearshore Marine Pile Driving at Navy Installations in Puget Sound

Final
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Table of Contents

1 Background

The National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS) issue incidental take for Endangered Species Act (ESA)-listed species potentially adversely affected by the Navy's activities. This includes sound pressure levels (SPLs) produced from pile driving. Incidental take statements (ITS) are an outcome of Section 7 consultations and addressed in the Biological Opinions. The NMFS also issues authorizations for noninjurious take (Level B) for marine mammals for noise produced by pile driving. Such take provisions are authorized by the Marine Mammal Protection Act.[1]

ITS often authorize incidental take by the area encompassed within zones above noise thresholds for ESA-listed fish. ITS for other animals such as marbled murrelets and marine mammals are based upon the number of animals anticipated to occur in the zones above the noise thresholds. For example, the peak SPL for the onset of injury threshold for fish is 206 dB referenced to 1 micropascal (μPa)[2]. If actual project noise exceeds the extent of the modeled authorized area, the project would exceed authorized incidental take allotted in the ITS. Consequently, the project would be required to reinitiate consultation under Section 7 of the ESA and a shut-down of impact pile driving would occur until a new ITS is issued. For marbled murrelets and marine mammals, injurious incidental take is avoided by monitoring areas exceeding the injury thresholds. If an animal enters this area, pile driving is shut down until it leaves. In addition, there can be provisions in an ITS or MMPA authorization allocating incidental take for potential behavioral disturbance. In this case, monitoring is required within the behavioral disturbance zones. Therefore, accurate establishment of the extent of the area exceeding established thresholds is essential to complying with the terms of an ITS or MMPA authorization.

When possible data obtained for a given site are used to predict expected source levels. However, for most project sites, prior measurements of the extent of pile driving noise have not been made. For these sites the extents of the areas where noise exceeds threshold values are modeled with an equation for sound propagation using proxy values for the source pile driving levels. Proxy source values are therefore either from prior measurements obtained on-site by installing the same type and size of piles or, when site specific information is lacking, obtained from the same or most similar type and size pile at locations with a similar sound environment. Other important factors include the type of equipment used to install the pile, substrate type, and water depth, all of which result in variations in pile driving noise levels. Detailed analyses of these factors are beyond the scope of this source document. The following section considers the rationale we used when reviewing proxy impact and vibratory pile driving source values for noise threshold metrics. We first discuss the available data included in the review. Second, we discuss the values for each threshold metric (peak SPL, root-mean-square [RMS], and sound

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[1] New NMFS criteria using frequency weighted (filtered) responses are in development, with new standards anticipated. The current revision of this document does not include frequency weighted results; such results will be promulgated in a revised edition.
[2] All peak and root-mean-square (RMS) sound pressure levels in this document are referenced to 1 μPa. All sound exposure levels (SEL) in this document are referenced to 1 μPa^2-second. All peak SPLs in this document refer to absolute peak overpressures or under pressures.

exposure level [SEL]) that will result in a high likelihood of encompassing the extent of actual project noise levels. Last, we review relevant data available for various types and sizes of piles typically used for pile driving and recommend proxy source values for Navy installations in Puget Sound.

Section 2 of this document is a review of attenuation levels reported for various impact pile driving projects.

2 Proxy Source Sound Levels for Acoustic Modeling of Nearshore Marine Pile Driving at Navy Installations in Puget Sound

2.1 Underwater Pile Driving Source Levels

2.1.1 Data Sources

Differences in underwater source levels for a given pile size and type will vary because of differences in geologic conditions, water depths where piles are installed, and pile driver type. In other words, the same size pile and type may generate different noise characteristics when installed in dissimilar environments. To obtain source values and model distances to the USFWS and NMFS thresholds for nearshore marine environments at Navy installations in Puget Sound, we reviewed available values from multiple nearshore marine projects obtained from the California Department of Transportation (CALTRANS), Washington State Department of Transportation (WSDOT), and Navy pile driving acoustic reports. Projects were located in California, Oregon, and Washington. Non-marine projects were excluded because of differences in substrate and/or acoustic conditions, and are not relevant herein due to the dissimilar nature from typical work performed at Navy marine facilities in Puget Sound. For example, a project located in Lake Washington and a freshwater bay (SR 520 Test Pile Project) was excluded due to very different substrate conditions present at those sites. Projects located in rivers were excluded because substrate characteristics, such as presence of bedrock, were not typical of Puget Sound. River projects also had different bathymetric profiles as well as increased current velocities. Of the projects reviewed, only measurements from unattenuated piles (e.g. a noise attenuation device was not operating[3]) were evaluated. Attachments 1 through 5 in Appendix A list the projects considered in this review.

All projects considered in the review had similar nearshore project depths from less than 5 m to approximately 15 m with the exception of Test Pile Program at Naval Base (NAVBASE) Kitsap Bangor where depths ranged from approximately 13 to 27 m. Impact pile driver type is listed in the attachments. Impact pile drivers can be drop, pneumatic, hydraulic, or diesel powered. With some exceptions at the Friday Harbor Ferry Terminal, all impact driven piles were installed with diesel powered drivers. Vibratory drivers vary only by size (energy) and type (variable moment/non-variable moment), but because of the limited data set, no attempt was made to distinguish between driver energies when reviewing noise levels produced from different impact or vibratory drivers.

Proxy values in similar marine sound environments can be challenging to obtain for pile driving because of variations in geologic conditions between projects and variability within project sites. Substrate types were not reported for most projects included in the review. Substrate types typical of Puget Sounds are sand/silt to sand/silt/cobbles overlying glacial till or hard clay layers. Therefore, projects located in the marine waters of Puget Sound, including the San Juan Islands, were considered more heavily because they would be more likely to share the

[3] Pile caps are routinely placed on top of piles prior to driving to cushion equipment. While they are recognized as providing some sound attenuation, they are not considered in this analysis because they are part of baseline sound measurement presented in many reports.

same substrate characteristics than projects located in the San Francisco Bay area, the mouth of the Columbia River, or coastal bays. However, it should be noted that within Puget Sound a considerable variability in substrate conditions can exist between projects and within projects due to harder glacial layers and unforeseen encounters with glacial erratics (e.g. erratic rocks). Depending on the substrate type, piles may easily be advanced or, because of glacial till or submarine boulders, piles may require much more energy to drive. Piles driven to different tip elevations could also experience different driving conditions. For example, fender piles generally are not driven to the same depth as structural piles and may not encounter the same resistance during driving. Therefore, considerable variation in values is expected when looking from project to project or pile to pile within a project. To ensure proxy values are protective of species, conservative values were chosen to encompass regional and pile to pile variation. The following section considers the rationale we used when reviewing values for various sound metrics.

2.1.2 Other Considerations in Evaluation of Pile Driving Source Values

Proxy values need to be conservative. This ensures the area modeled above the injury thresholds is correctly assessed and remains within an ITS for fish. This approach will also preclude incidental take considered injurious based on the established injury criteria of marbled murrelets and marine mammals. In addition, proxy values are used to model the areas above the marbled murrelet and marine mammal behavioral thresholds or guidance values. Sound levels from pile driving are reported on either a per pile basis within a project, or per project summary basis. Summary data reported in acoustic reports varies, but can include one or more of the following:

- Per pile averages
- Ranges
- Minimum and maximum values
- Per project average
- Typical values
- Average range
- Minimum, maximum, average minimum
- Average maximum value
- Standard deviation.

Thus, interpretation of the reported levels may depend on the analytical methodology selected, which in turn can affect the proxy source level selected for modeling analysis. For example, one approach to choosing a source value is to pick the mean value from a number of projects reviewed. The results from the model utilizing this mean value will adequately characterize the estimated average extent of noise from pile driving. However, depending on the pile to pile variability it would only characterize the area for individual piles if the pile to pile variability in the source data were low. If the data were highly variable, the extent of the area above the threshold would be smaller or larger than described by the model on a per pile basis. Therefore, on-site monitoring of pile driving noise could exceed the modeled values on a significant portion of the piles. Another, but more conservative approach is to select the proxy source value from the highest value of all values reported. This method would ensure that most, if not all, measured values on a pile by pile basis would be below the selected value, but could significantly overestimate the area or extent of biological impact.

In the section below we outline the rationale we used for selecting proxy values from the available data for each threshold metric. Values were chosen to ensure that a reasonable worst case scenario is modeled to estimate the extent of noise from pile driving.

2.1.2.1 Root Mean Square

The root-mean-square (RMS) value is the metric used to define the behavioral zones for fish, marbled murrelets, and marine mammals. For piles that are impact driven, RMS values are generally reported for individual piles over the duration of the driving of a given pile; often the number of strikes is also reported on a per-pile basis. Thus, in order to best characterize a broad-base proxy SPL, average RMS pressures were computed from the reported SPL (dB) values, and then weighted by the number of pile strikes for a given pile. This weighting methodology estimates proxy values across multiple projects with differing numbers of piles or strike counts, and the effect of using weighting values ensures that a single project or pile does not overtly bias the result high or low. This proxy value represents the most likely value expected for individual pile strikes for a typical project.

For piles that are vibratory driven, RMS values are typically computed over 10-second or 30-second averaging periods, and represent the most probable typical value over a long event. Thus, recommended proxy RMS values for vibratory and impact pile driving are computed using different techniques. For vibratory piles, reported values were selected on a pile-by-pile basis for a given pile type and size. An average value was computed by converting selected SPL values (dB) into pressure values, summing them together in linear space, dividing by the total number, n, of selected piles, and converting the result back to SPL (dB). In following this approach, the proxy value represents the arithmetic average value for each pile type and size from applicable projects. Thus, for vibratory driven piles averaged RMS values were used from all applicable projects as a representative average level of long-term pile driving events.

The following equations and calculations are used within this report and appendices to compute average values.

$$Sound\ Pressure\ Level\ (SPL, dB) = 10 \cdot \log_{10}(\ Pressure, \mu Pa)$$

$$Pressure\ (\mu Pa), P = 10^{\left(\frac{SPL, dB}{10}\right)}$$

Weighted pressures are simply the linear product of the number of events, *n*, (such as pile strikes), multiplied by the average pressure for the pile, *P*:

$$Weighted\ Pressure\ = n \cdot P$$

Weighted SPL averages are computed by first converting all SPL values to linear pressure, weighting pressure (*P*) values by the number of events (for example, by number of strikes, *n*), normalizing by dividing by the number of events, and then converting back to SPL. Using k as an index counter for all piles, 1 = pile #1, 2 = pile #2, etc:

$$Weighted\ SPL = 10\log_{10}[\frac{1}{n_{total}}\sum_{k=1}^{n_{total}}(n_k P_k)]$$

where

$$n_{total} = n_1 + n_2 + n_3 \ldots$$

Charts depicting the behavior of the measured data used to prepare proxy values within this document are presented in Appendix B. Two types of charts are provided. First, for all data types, a sorted chart showing amplitude for all piles included, recommended proxy value, and when available, minimum and maximum levels observed. Next, the cumulative probability distribution function charts are provided for all pile sizes, with the recommended proxy value annotated on each chart.

2.1.2.2 Peak Sound Pressure Level

The peak sound pressure level (SPL) metric is used to evaluate the potential for injurious effects to fish. The barotrauma injury to fish due to peak over or under pressurization could result in instantaneous injury with a single strike. Average peak impact SPL values were selected from applicable projects, from which a weighted probability distribution function (PDF) was computed based on the number of pile strikes for each pile. To ensure a conservative proxy value, a value representing the ninetieth percentile of the PDF was selected, meaning that for a typical impact pile driving project, 90% of all pile strikes would typically occur below this proxy value. Use of this value ensures potentially injurious effects to fish would have a high likelihood of being within the area exempted for incidental take.

2.1.2.3 Sound Exposure Level

The sound exposure level (SEL) metric for impact driving is used to calculate the area of cumulative exposure potentially resulting in injury to fish or marbled murrelets over a daylong pile driving event (the accumulation of energy received from all pile strikes). To compute the cumulative SEL all single strike SEL energy in a workday is summed to calculate the overall SEL. However, modeling for the SEL "dosage" generally involves estimation of a typical single pile value logarithmically added to sum the expected energy over the day. While some strikes may be lower and some higher than the mean SEL value, use of the mean value would result in the best overall estimate of expected cumulative energy over the work day. In practice, the SEL value will vary on any given workday due to variability in the levels measured for each individual strike. The acoustic reports reviewed typically provided the mean single strike SEL per pile. Therefore, the most representative estimate of the single strike SEL for a proxy value is to use a mean SEL value from data from all piles in applicable projects. Furthermore, to avoid biasing the data high or low from a single pile or project, a weighted average was computed using the number of pile strikes, *n*, in the same manner as was followed for computation of impact RMS values. This approach ensures that a single project or pile does not bias the result high or low. This proxy value represents the most likely value expected for individual pile strikes for a typical project.

2.1.3 Impact Driving Source Values

Table 2-1 summarizes projects from Attachment 1 in Appendix A that were considered in the final analysis and highlights proxy values. Theses highlighted proxy source values are reasonably conservative for modeling future Navy pile driving projects in Puget Sound. Detailed discussions of the projects considered and the values obtained for each pile type and size are provided below.

Table 2-1. Summary of Unattenuated Impact Pile Driving Levels Considered. Recommended Proxy Source SPLs at 10 m Bolded.

Pile Size	Number of Projects Considered[1]	Range of Average RMS (n-weighted pile average) dB re 1µPa	Range of Average Peak (90% PDF value) dB re 1µPa	Range of Average SEL (n-weighted pile average) dB re 1µPa
Steel				
24-inch	2	181-198 (**193**)	196-213 (**210**)	176-185 (**181**)
30-inch	3	192-196 (**195**)	203-217 (**216**)	182-187 (**186**)
36-inch (all projects)	3	185-196 (**192**)	202-211 (**211**)	173-186 (**184**)
36-inch (Bangor only)	1	185-196 (**194**)	Not reported[3]	173-183 (**181**)
All 24/30/36-inch	7	181-198 (**193**)	196-217 (**211**)	173-193 (**184**)
Concrete				
≤18-inch	3	158-173 (**170**)[2]	172-188 (**184**)[2]	147-163 (**159**)[2]
24-inch	7	167-179 (**174**)[2]	180-191 (**188**)[2]	158-167 (**164**)[2]

[1]See Appendix A, Attachment 1 and 2 for projects reviewed.
[2]Number of pile strikes, *n*, was not available for any concrete projects; all piles were equally weighted.
[3]Although absolute peak values were collected for TPP testing, average peak values were not reported; unattenuated data from EHW-2 was not collected.

2.1.3.1 24-Inch Steel Pile Impact Driving Source Values

Attachment 1 in Appendix A lists six marine nearshore projects reviewed for possible inclusion in the analysis. Data for one 24-inch pile installed with an impact hammer in the Test Pile Project at NBK Bangor are listed in Attachment 1. However, only 7 pile strikes were reported and measurements from this pile are lower than all of the other five projects reviewed. Therefore, these data were not considered in the selection of the most conservative value. Of the remaining five projects reviewed, the Bainbridge Island Ferry Terminal Preservation Project and the Friday Harbor Restoration Ferry Terminal project were considered as the most representative of typical glacial till and erratics encountered in Puget Sound and were carried forward in the analysis. We based this on the assumption that substrate conditions are more similar than those found in San Francisco Bay or the mouth of the Columbia River.

For the two ferry terminal sites, five piles were driven at Bainbridge Island in substrate that consisted of a mix of sand and fist-sized rocks with occasional rocks one-foot in diameter. At Friday Harbor six piles were driven into a silty sand substrate approximately 9 meters thick and underlain by a hard clay lens. Three of the piles at this site encountered a large rock ledge approximately 10.7 meters below the mudline. One of the six piles in the project had the high end of the data clipped[4] and therefore invalid, so this pile was excluded from the analysis. This project used different hammer types, but because the report noted little variation in the data, all five remaining piles were included in our review. Data from the two ferry projects only included values without a bubble curtain attenuator operating, i.e. no attenuation.

Source levels for each metric reviewed are discussed below. Table 2-1 summarizes unattenuated impact pile driving source data from Attachment 1 for the two ferry terminal projects.

RMS SPL

Weighted average proxy RMS source values for the two Puget Sound ferry terminal projects were 189 dB (range 181 dB to 193 dB) and 195 dB (range 193 dB to 198 dB) (Attachment 1), representing 1007 pile strikes. Therefore, actual RMS values would be expected to fall between 181 dB and 198 dB. The weighted average RMS value of 193 dB was chosen as a conservative value that likely encompasses the average extent of the area exceeding the injury thresholds for marine mammals and the behavioral thresholds for marine mammals, fish and marbled murrelets.

Peak SPL

Average peak SPLs reported for individual piles at the Bainbridge Island and Friday Harbor projects were 202 dB to 209 dB and 196 dB to 213 dB, with an average weighted value of 207 dB. Of the applicable projects, the 90% probability from the weighted cumulative distribution density function value of 210 dB was chosen as a conservative proxy value that likely encompasses the modeled extent of the area over the onset of injury threshold for fish. Table 2-1 summarizes the values from the two projects considered likely to be most representative.

SEL

Mean weighted SEL values for the two Puget Sound projects reviewed are each 181 dB for all piles. The mean SEL per any one pile for both projects ranged from 176 and 185 dB. These values are higher than the values reported for the other three projects reviewed (project SEL means that ranged from 168 to 177 dB). Therefore, the Washington projects were considered the most conservative and a mean weighted SEL of 181 dB was chosen as a reasonable proxy value of the overall SEL for 24-inch piles.

[4] Clipping occurs when a signal exceeds the linear limits of an electronics system in essence the extreme levels of the signal are truncated or "clipped" off. For pile driving measurements, clipped data can produce results that are lower than the actual signal of interest, thus producing invalid results.

2.1.3.2 30-inch Steel Pile Impact Driving Source Values

Data for 30-inch steel pipe piles were available from three marine pile driving projects in Puget Sound, Washington and one project from San Francisco Bay, California. No projects from Bangor were available for analysis, and data from the California project provided only typical data, and did not provide per-pile SPL or number of strikes for each pile (see Attachment 1 in Appendix A). All available data in Attachment 1 were reviewed. However, as with the 24-inch pile source values, values from the Puget Sound projects were considered the most representative of source values because of similar substrate characteristics and are the only values considered in the Table 2-1 summary. Note that data from the Vashon Island project were acquired from 7m to 16m from the pile, and were normalized using a $15 \cdot \log_{10}(\text{range}/10\text{m})$ relationship.

RMS SPL

Average RMS source values for three Puget Sound projects ranged from 192 dB to 196 dB. The minimum average value reported for any one pile is 192 dB (Eagle Harbor Ferry Terminal) and a maximum average reported of 196 dB (Vashon Island Ferry Terminal, two piles). The RMS values from three Puget Sound projects were moderately higher than values measured from the California project considered, which reported a typical RMS value 190 dB. A conservative proxy RMS value is the weighted average value of 195 dB from the three projects in Puget Sound representing 263 pile strikes. This value would be a reasonable worst case ensuring that noise levels modeled would have a high likelihood of not exceeding this value.

Peak SPL

Average peak SPLs reported from the Puget Sound projects with available data ranged from 203 dB to 217 dB (n=3 projects) on a per-pile basis, with a computed weighted average of 214 dB. Levels from three piles at Eagle Harbor Ferry Terminal range from 7 to 11 dB quieter than those measured at two other Puget Sound sites, indicating a significant variability between sites. The typical peak SPL reported for the single California project was 205 dB, which was noted to be on the lower end of the range of data reported from Puget Sound, although the number of pile strikes was not reported, thus this data were not included in the weighted average for 30" peak values. The 90% weighted cumulative probability value of 216 dB was chosen as a reasonable and conservative proxy value.

SEL

Average per-pile SEL values were reported for the two Puget Sound Projects representing 214 pile strikes; the Eagle Harbor project did not report single strike SEL levels, and a California project did not report any SEL levels. SEL values from the two applicable projects ranged from 182 dB to 187 dB with an overall weighted average of 186 dB. Thus, a reasonable conservative SEL source value for future projects in Puget Sound is 186 dB derived from the weighted value of reported Puget Sound levels.

2.1.3.3 36-inch Steel Pile Impact Driving Source Values

Data for 36-inch steel pipe piles were available from three marine pile driving projects in Puget Sound, Washington and one project from Humboldt Bay along the California coast (Attachment 1 in Appendix A). All projects installed piles with a diesel hammer. The Humboldt Bay project did not report number of pile-strikes, and furthermore, this pile was only measured by re-striking a pile that had already been driven. Therefore, this project was excluded from the 36-inch average value computations. Data from two piles measured during the NBK Bangor Test Pile Program were at 11m and 20m from the pile, and were normalized using a $15 \cdot \log_{10}(\text{range}/10\text{m})$ relationship.

RMS SPL

Average RMS source values for the three Puget Sound projects ranged from 185 dB to 196 dB, representing 662 pile strikes, the full range of which were observed during the Test Pile Program at NBK Bangor project. The weighted average value for these projects was 192 dB, and represents a reasonable proxy RMS value for impact driven 36-inch piles. The average RMS value of 193 dB reported for the 36-inch pile from the Humboldt Bay Bridge project in California fell within the range of values for the three Washington 36-inch pile projects reviewed, although as previously discussed, this value was not included in the averaging calculations. Considering just the Test Pile Program at Bangor, 121 pile strikes produced a set of measurements ranging from 185 to 196 dB, with a weighted average value of 194 dB.

Peak SPL

Average peak SPLs reported from two Puget Sound projects ranged from 202 dB to 211 dB on a per-pile basis, representing 541 pile strikes. Average peak values were not reported for the NBK Bangor project. A proxy peak value of 211 dB was chosen representing the 90% cumulative probability SPL.

SEL

Average SEL values were reported for three Puget Sound projects, with 662 pile strikes measured. SEL values ranged from 173 dB to 186 dB with an overall weighted average of 184 dB, the recommended proxy value for piles driven in Puget Sound. Only one value was reported for the Humboldt Bay project, 183 dB, which was within the range of values reported in Puget Sound. A reasonable conservative SEL source value for future projects in Puget Sound is 184 dB derived from the weighted average of three Puget Sound projects. Analyzing data from just the NBK Bangor project resulted in a weighted average value of 181 dB, with a data range of 173 to 183 dB.

2.1.3.4 Combined Steel Pipe Impact Driving Source Values

Review of RMS, average peak, and SEL values for steel pipe piles of 24, 30, and 36-inches shows that often only slight differences are noted across the three sizes (see Table 2-1). In some cases, weighted average values for smaller piles are higher than for larger piles, even if by only one or two decibels. For this reason a combined analysis was done for each of the metrics to investigate the potential value of preparing overall average values over multiple sizes of steel pipe piles. Each of the metrics is discussed in the following paragraphs.

RMS SPL

Average RMS values over 24, 30, and 36-inch piles ranged from 181 dB to 198 dB, although weighted averages were very close, 193, 195, and 192 dB, respectively, with an overall weighted average value of 193 dB. 30-inch piles (three projects located in Puget Sound, not including any NBK Bangor projects) produced average RMS levels of 195 dB, higher than both 24-inch and 36-inch average values. Even though few piles and a lower number of pile strikes were measured with 30-inch piles, the scatter in the points measured only ranged from 192 to 196 dB, without a large deviation. 24-inch and 36-inch piles have larger data sets, but nonetheless, the recommended proxy value for each of these sizes is only a few decibels different. Figure B-4 in Appendix B graphically shows how the scatter for each pile size compares with other pile sizes. While it is reasonable to assert that RMS impact values for steel pipe piles can be represented by a single, composite value of 193 dB, additional data is recommended to be collected to increase the size of the analysis sample set.

Peak SPL

Peak SPL values varied over a broader range than RMS values, although 24- and 36-inch 90% cumulative probability results were within 1 dB, representing 1,669 pile strikes. 30-inch results were measurably higher than either 24- or 36-inch data, represented by fewer piles, and fewer strikes (263 strikes). Furthermore, 30-inch pile data is somewhat bi-modal in behavior, with three values near 203 to 204 dB, and four in the 211 to 217 dB range, and nothing in between. Figure B-11 in Appendix B graphically shows the distribution of levels by pile size. Three piles represented in the 211 to 217 dB range were measured from distances other than the standard 10 meter de facto measurement range, which were corrected using the traditional practical spreading model. Although not necessarily incorrect, this serves to increase the uncertainty of those measurements. Since none of the 30-inch (nor 24-inch measurements) represent data acquired directly from NBK projects, it makes sense to prepare a broader analysis to consider different pile sizes for the purpose of increasing confidence in the estimated peak values. The 90% cumulative distribution value for all 24-, 30-, and 36-inch applicable projects is 211 dB, represented by 1,932 pile strikes, and is the recommended proxy value for NBK Bangor projects, especially those using 24-inch and 30-inch steel pipe piles, until such time that Bangor-specific data can be acquired using these pile sizes.

SEL

Weighted average SEL values for 24-, 30-, and 36-inch piles also resulted in somewhat anomalous data with 30-inch steel pipe piles, with both 24-inch and 36-inch data producing lower values. As described above, the 30-inch data set includes range corrected values, and furthermore, only represented 4 piles, since single strike SEL values were not reported for one of the Puget Sound projects (Eagle Harbor Ferry Terminal). Figure B-16 in Appendix B shows the data grouping by pile size. This gives rise to increased uncertainty in the 30-inch average vales.

There is some evidence that SEL values for 36-inch piles at NBK Bangor (182 dB, weighted average) is lower than a proxy value including Puget Sound projects (184 dB). This conclusion is drawn from a modest sample size (4 piles, 121 strikes) of NBK Bangor measurements. Similar analyses could not be done with 24- and 30-inch piles, since these data did not exist for NBK Bangor projects.

Taken in summary, there is motivation to compute a single proxy value for all 24-, 30-, and 36-inch steel pipe piles, but this approach is not recommended at this time due to the uncertainty in the data scatter, and different results among RMS, SEL, and peak metrics. Additional data should be collected before using combined analyses.

2.1.3.5 18-Inch Concrete Pile Impact Driving Source Values

Attachment 2 in Appendix A lists three marine nearshore projects that monitored sound levels during installation of 18-inch or similar (16-inch) concrete piles, none of which were conducted in Puget Sound. Two projects were conducted at the Berkeley Marina in San Francisco Bay, California, one in 2007 and one in 2009 using 18-inch concrete piles. Acoustic measurements were only collected for four piles total for both projects. Water depth was fairly shallow ranging from 3 to 4 meters. Source levels for each metric reviewed are discussed below. Another project located near Concord, CA at the Naval Weapons Station (NWS) drove five 16-inch concrete piles, with water depth of 10 meters. Source values for this project were similar to those for the Berkeley Marina projects, and thus data from the Concord NWS were included in the analysis. Table 2-1 summarizes unattenuated impact pile driving source data from Attachment 2 and highlights recommended proxy source values. Since the number of pile strikes for all concrete projects were not reported, pile averages were computed.

RMS SPLs

Average RMS values for three projects using 16 or 18-inch concrete piles ranged from of 158-173 dB (Table 2-1), with an average RMS value of 170 dB over 9 piles, selected as a conservative value likely to encompass the maximum extent of the area exceeding the behavioral thresholds and guidance for marine mammals, fish and marbled murrelets. No concrete pile levels exceed the RMS injury thresholds established for marine mammals (180 dB RMS for cetaceans and 190 dB RMS for pinnipeds).

Peak SPLs

Average peak SPLs reported for all piles at the Berkeley Marina projects ranged from 172 dB to 188 dB. Because only three projects with relatively small samples sizes were available for review, a per-pile average value of 184 dB was chosen as the recommended SPL proxy value for all piles. This value is below the threshold for the onset of injury in fish (206 dB). Table 2-1 summarizes the values from these projects.

SEL

Two average SEL values of 155 and 159 dB were reported for the two Berkeley marina projects, both with very small sample sets ranging from 147 dB to 163 dB. SEL data were not acquired for the Concord NWS project. The per-pile average value of 159 dB SEL was selected as the most conservative proxy value available for 18-inch concrete piles until additional data are obtained.

2.1.3.6 24-Inch Concrete Pile Impact Driving Source Values

Only one value from a single 24-inch concrete pile was available for the Mukilteo Ferry Terminal in Puget Sound. Therefore, we reviewed seven additional marine projects: six in San Francisco Bay, California, and one in Humboldt Bay, California (Attachment 2 in Appendix A). Note that some of the San Francisco Bay projects included data from the same site in two different time periods. Two projects (Humboldt State Floating Dock and Pier 40 Marina) included piles that were driven using a jetting technique, often in combination with a reduced level of fuel to minimize driving energy. Piles driven under these circumstances were not included in the calculation of piles averages. Table 2-1 summarizes unattenuated impact pile driving source data from Attachment 2 and highlights recommended proxy source values.

RMS SPLs

The one pile in Puget Sound reported a maximum RMS value of 170 dB, with average values reported for the California projects ranging from 167 dB RMS to 179 dB RMS. The recommended proxy source value was chosen from the highest average pile value over all projects, 174 dB RMS (Table 2-1). No concrete pile noise levels exceed the RMS injury threshold established for pinnipeds (190 dB RMS), nor the RMS injury threshold for cetaceans (180 dB RMS).

Peak SPLs

Average Peak SPLs reported for projects ranged from approximately 180 dB to 191 dB. The per-pile 90% cumulative probability value of 188 dB was chosen as the recommended proxy peak SPL value. This value is below the peak threshold for the onset of injury in fish (206 dB). Table 2-1 summarizes the values from the two projects.

SEL

Sound exposure levels were only reported for six of the eight projects reviewed, with per-pile values ranging from 158 dB to 167 dB (Table 2-1). The pile SEL average over all projects of 164 dB was considered representative of a conservative average SEL source value for 24-inch piles.

2.1.4 Vibratory Pile Driving Source Values

NMFS has established non-impulsive injury thresholds (180 dB RMS for cetaceans, 190 dB RMS for pinnipeds) and a disturbance threshold (120 dB RMS) for marine mammals. Vibratory driving is considered a non-impulsive sound source. Attachment 3 in Appendix A contains a list of vibratory projects and derived proxy source values we reviewed in order to calculate how far sound from vibratory driving exceeds the thresholds discussed in Section 1.2.1. Table 2-2 presents the summary of vibratory pile driving data from the projects reviewed. Due to the similarity in levels across multiple projects, 16-inch and 24-inch piles were considered together, and 30-inch and 36-inch piles were considered together.

Table 2-2. Vibratory Pile Driving SPLs.*
Recommended Proxy Source SPLs at 10 m Bolded.

Pile Size and Type	Number of Projects Considered[1]	Range of Average RMS dB re 1µPa @ 10 meters	Reasonable Source Level dB re 1µPa dB @ 10 meters
Timber			
12-inch	1	152-155[2]	**153[2]**
Steel Pipe			
16-inch and 24-inch	4	Bangor 153-162 All projects 159-162	**161**
30-inch and 36-inch	7	Bangor 166 All projects 159-172	**NBK Bangor 166 Other Puget Sound Locations 167**
Steel Sheet			
24-inch	3	160-163**	**163**

[1]See Attachment 3 for projects reviewed.
[2]Data reported at 16m, converted to equivalent range of 10m using $15\text{Log}_{10}[16/10]$ range correction factor
*Recommended values for 10 meters unless otherwise indicated.
**Highest value for pile; value includes some averages from only top or bottom depth measurements and one from top and bottom averaged.

2.1.4.1 Timber Pile Vibratory Driving Source Values

Only one timber pile study is available and only for noise measurements taken during extraction of one 12-inch diameter pile (see Attachment 3 in Appendix A). The highest RMS value was 152 dB measured at 16 meters (Table 2-2), with an average value of 150 dB reported at 16 meters.

2.1.4.2 24-Inch Diameter Steel Pipe Pile Vibratory Driving Source Values

Two projects in Washington and one in California were reviewed for 24-inch diameter steel pipe piles. The Washington marine projects at the Friday Harbor Terminal and NBK, Bangor waterfront, only measured one pile each, but reported similar sound levels of 162 dB RMS and 159 dB RMS (range 157 dB to 160 dB), respectively (see Attachment 3 in Appendix A). Because only two piles were measured in Washington, the California project was also included in the analysis. The California project was located in a coastal bay and reported a “typical” value of 160 dB RMS with a range 158 to 178 dB RMS for two piles where vibratory levels were measured. Caltrans summarized the project's RMS level as 170 dB RMS (Table I.2-3 in Caltrans 2012), although most levels observed were nominally 160 dB. A fourth project at NBK, Bangor drove 16-inch hollow steel piles, and measured levels similar to those for the 24-inch piles; therefore these data were included in the 24-inch analyses. Although the data set is limited to these four projects, close agreement of the levels (average project values from 159 to 162 dB at 10 meters) indicate similar vibratory conditions at NBK, Bangor. The highest project average of 162 dB was selected as the most reasonable proxy for 24-inch steel pipe piles. This number is higher than the data from the Bangor Test Pile Program and is therefore conservative.

2.1.4.3 30-inch and 36-inch Diameter Steel Pipe Pile Vibratory Driving Source Values

Five projects were reviewed for 30-inch diameter piles and four projects were reviewed for 36-inch diameter piles, with a total sample set of seven projects since some projects used both 30-inch and 36-inch piles. All projects were located in Puget Sound. Because the 30-inch diameter pile average RMS measurements overlap (164 dB, 168 dB, 170 dB, and 171 dB) the measurements reported for 36-inch diameter piles at the Bangor waterfront, the Edmonds and Anacortes ferry terminals range (159 dB, 162.5 dB, 169 dB, respectively), the 30-inch and 36-inch pile data were combined for the review.

We reviewed data from Bangor waterfront projects for 30 and 36-inch piles, which were based on a large sample size relative to other projects (n~68 piles, Attachment 3). RMS vibratory average levels were consistently lower at Bangor than other Puget Sound locations. We recommend using the site-specific data average RMS level for modeling vibratory pile driving at NBK, Bangor, that is, the recommended RMS vibratory installation proxy source value 30-inch to 36-inch diameter piles is 166 dB. Because site specific data is unavailable for all other Navy installations in Puget Sound, we recommend the more conservative proxy value of 167 dB for other Puget Sound Navy sites, which represents the average level for all Puget Sound locations excluding NBK, Bangor for both 30-inch and 36-inch piles.

Table 2-2 summarizes the ranges for the combined size category. Table 2-2 presents reasonable proxy values expected from reviewing values taken from the highest average project SPL for all projects reviewed.

2.1.4.4 24-Inch Steel Sheet Pile Vibratory Driving Source Values

Sound levels for vibratory sheet pile driving were reported for three Caltrans projects at the Port of Oakland in San Francisco Bay (see Attachment 3in Appendix A). No data were found for sheet pile driving in Puget Sound. RMS values were only available for one pile at one project and this had an average RMS value of 163 dB. The second project reported 1 sec SEL levels at 10 m for 5 vibratory driven sheet piles. The average per pile SEL ranged from 157 to 160 dB based on the average top and bottom depth measurements. Caltrans also reported 162 dB RMS as the highest average for a single depth for the same project. The third project reported 163 dB RMS (Table I.2-3 in Caltrans 2012). Caltrans reported 160 dB RMS as the typical sheet pile value for all three projects (Table I.2-2 in Caltrans 2012). Based on the levels from the three projects, 163 dB RMS value was used as a conservative proxy value.

2.2 Airborne Pile Driving Source Values

NMFS has established an in-air noise disturbance threshold of 90 dB RMS re 20µPa (unweighted) for harbor seals, and 100 dB RMS re 20µPa (unweighted) for all other pinnipeds. Attachment 4 and Attachment 5 in Appendix A list the impact and vibratory pile driving projects, respectively, that were reviewed. Most projects report A-weighted levels. For this review, however, only unweighted data were considered. Two airborne noise values are presented for most projects: L_{max} and L_{eq}, The L_{max} is the instantaneous highest sound level measured during a specified period, or maximum noise level. It typically represents a short duration average, usually 35 milliseconds. Because impact pile driving is an impulsive sound with short durations, the signal is most appropriately characterized by the L_{max} value. Proxy values for impact driving are found in Attachment 4.

The L_{eq} is the equivalent steady-state noise level in a stated period of time. It contains the same acoustic energy as the time-varying noise level during the same period. L_{eq} is primarily used for a steadier, non-impulsive noise. The L_{eq}, which averages the source over a period of time, is a better descriptor for non-impulsive sound like vibratory pile driving. These values are listed in Attachment 5 for vibratory pile driving and Table 2-3 summarizes L_{max} and L_{eq} data.

Review of the available literature provided two unweighted L_{max} levels, both from the NBK Bangor Test Pile Program. A maximum level of 112 dB re 20 µPa was measured for 36-inch piles (n=9 piles), at the de facto measurement distance of 50 feet, and was therefore chosen as a conservative proxy value for piles 30 and 36-inches. A maximum level of 110 dB was measured for a single 24-inch pile, and was selected as the most representative value for modeling analysis.

Unweighted RMS L_{eq} values of 88 dB were obtained from vibratory pile driving 18-inch steel pipe piles. A single 30-second measurement was made for 24-inch piles during the Test Pile Program at NBK, Bangor. These data fit the overall trend of smaller and larger pile sizes. The limited data set for 24-inch steel pipe, supports a reasonable representative proxy value of 92 dB.

Limited data were available for 30 and 36-inch piles. One 30-inch pile measured at the Keystone ferry terminal fell within the range of 36-inch piles measured at Bangor., although the average value for this was 2 dB above the average value measured at Bangor. Levels measured at Vashon Island ferry terminal were made using A-weighted filters, and adjusted for range and filter type. Even after corrections were made observed levels were significantly lower than other sites, thus these data were not considered for further analysis. We therefore selected 95 dB (unweighted) as the representative L_{eq} average proxy value for 30-inch and 36-inch piles. Based on the limited data available, the RMS L_{eq} value for 18-inch steel pipe piles was chosen as the proxy source value for vibratory installation or removal of piles less than 24-inch regardless of pile type. The RMS L_{eq} value for 24-inch steel pipe piles was chosen as the best estimate for 24-inch sheet piles.

Table 2-3. Summary of Airborne Source Levels with Recommended Proxy Source Values Bolded[1]

Pile Type	Size (diameter in inches)	Installation Method	
		Impact RMS L_{max} (Unweighted) Impact	Vibratory RMS L_{eq} (Unweighted) Vibratory
Timber	12-inch	---	---
Steel Pipe	18-inch	---	**88**
	24-inch	**110**[2]	**92**[2]
	30-inch	---	**95**
	36-inch	**112**	**95**
Steel Sheet	24-inch	---	---

Notes: All values relative to 20µPa and at 15 m (50 ft) from pile.
[1]See Attachments 4 and 5 in Appendix A for projects reviewed. [2] Limited data set

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3 Evaluation of Potential Bubble Curtain Sound Attenuation

To reduce noise produced from impact pile driving, bubble curtains are used around the pile as it is driven and can be confined or unconfined. Confined bubble curtains place a fabric shroud or rigid sleeve around the pile to hold air bubbles near the pile, ensuring they are not washed away by currents or tidal action. They are recommended when water velocities are 0.6 meters (1.6 feet per second) or greater (NMFS 2008).

None of the project locations at Naval Base Kitsap, Naval Magazine Indian Island, Naval Station Everett, Naval Air Station Whidbey Island Seaplane Base, Manchester Fuel Depot are in high current areas; therefore, this discussion focuses on unconfined bubble curtains. Unconfined bubble curtains involve use of pressurized air injected from an air compressor on the pile driving barge through small holes in aluminum or PVC pipe around the driven pile. Noise reduction results from unconfined bubble curtains were reported from several projects. There was a wide range of effectiveness from very little measurable attenuation in some cases to high attenuation in others (Illingworth and Rodkin 2001; WSDOT 2013). Caltrans (2009) summarized the application of unconfined bubble curtain systems in various California projects and reported from 1 to 5 dB of attenuation in high current situations and 5 to 15 dB of attenuation in low current situations. Application of a multiple-ring system in a deep water, strong current setting (Benicia-Martinez Bridge) achieved 15 to more than 30 dB attenuation when driving 8-foot diameter piles. Because some sound pressure waves also propagate from the pile through the substrate and reenter the water column, not all sound pressure waves will be attenuated by a bubble curtain (Reinhall and Dahl 2011). Variability in bubble curtain performance when measured at various distances out from the pile is likely explained by the sound propagation properties of various substrates, the localized bathymetry, as well as variances in embedment depths of piles.

3.1 Noise Attenuation Assumptions for Acoustic Modeling

The Navy conducted a Test Pile Program at Naval Base Kitsap, Bangor where attenuation of an unconfined bubble curtain was measured when driving 24-inch, 36-inch, and 48-inch steel pipe piles.[5] It should be noted that attenuation measurements were not conducted at EHW-2, and are therefore excluded from calculations herein.[6] Calculations for attenuation were made by calculating the amplitude ratio reduction of the pressure metric with the bubble curtain on compared to the bubble curtain off measurements, and then converting the ratio into a decibel value. Weighted values are computed for each metric based on the number of strikes measured. All measurements were taken from the nominal 10 meter de facto distance from the pile.

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[5] Illingworth and Rodkin, 2012

[6] Attenuated measurements from pile installation at EHW-2 in 2012 were similar to nonattenuated measurements from test piles installed in 2011 at the project site, indicating a nonfunctional bubble curtain. Most commonly observed problems reported for non-functional bubble curtains reflect inadequate air-flow or poor seating of the bottom of the curtain at the water-sediment boundary resulting in a non-attenuated sound path.

The sole 24-inch pile in this project was struck a total of 3 times with the bubble curtain turned on. Therefore, the results are unlikely to be indicative of values that would be obtained on this site with more extensive measurements and are not considered further in this review. Piles for which fewer than 10 strikes were measured were also excluded. It is recommended to acquire a larger 24-inch data set to obtain a better synopsis for these results.

For 36-inch piles the weighted average peak, RMS, and SEL reduction with use of the bubble curtain was 10 dB, where the averages of all bubble-on and bubble-off data were compared (see Table 3-1 below). This data set represents 2 piles, for a total of 165 strikes. For 48-inch piles, the weighted average pressure reduction for RMS, peak, and SEL with use of a bubble curtain was 8 dB, representing 138 strikes. Across all piles (36" and 48") and all metrics (RMS, peak, SEL), the weighted average attenuation was 9 dB.

Table 3-1. Reduction (dB) in Weighted Average Noise Values for Impact Pile Driving of Steel Piles with a Bubble Curtain, Measured at 10 meters averaging mid-depth and deep-depth data. Measurements obtained during Bangor Naval Base Test Pile Program

Pile Size	**Attenuation Level (RMS)**		**Attenuation Level (Peak)**		**Attenuation Level (SEL)**		**Weighted Average (all metrics)**
	Weighted	Unweighted	Weighted	Unweighted	Weighted	Unweighted	
36-inch	9	9	11	11	10	10	10
48-inch	7	7	9	9	7	7	8
					Overall weighted average		9
Source: Illingworth & Rodkin 2012							

We also reviewed unconfined bubble curtain attenuation rates from available reports from projects in Washington, California, and Oregon that impact drove steel pipe piles up to 48-inches in diameter. Table 3-2 contains a summary of the attenuation levels reported. Several studies were reviewed, but not included in the summary because they were not considered representative. Excluded studies were:

- Willamette River Bridge Project (Caltrans 2012). Bubble curtain was poorly designed and deployed in a river with a high current. No RMS SPLs reported.

- South Umpqua River (Caltrans 2012). Current conditions resulted in little coverage of piles by bubble curtain. No RMS SPLs reported.

- Ten Mile River Bridge Project (Caltrans 2012). 30-inch piles driven with bubble curtain, but inside of cofferdam.

Of the remaining studies reviewed, significant variability in attenuation occurred; however, an average of at least 8 dB of peak SPL attenuation was achieved on ten of the twelve projects (Table 3-2). Some of the lower attenuation levels reported were attributed to the bottom ring not seated on the substrate, poor airflow, or currents that resulted in an uneven distribution of bubbles (WSDOT 2005a, WSDOT 2005b, Caltrans 2012).

Table 3-2. Summary of Attenuation Levels Reported with Unconfined Bubble Curtains During Impact Driving of Steel Pipe Piles up to 40-inches Diameter

Project/Location	Steel Pipe Pile Diameter	Range (dB)	Mean Peak dB re 1µPa @ 10 m	Standard Deviation (dB)
Friday Harbor Ferry Terminal Restoration/ San Juan Island marine waters, WA[1]	24-inch 30-inch	0-5	2	2.2
Bainbridge Island Ferry Terminal Preservation/ Puget Sound marine waters, WA[1]	24-inch	3-14	7	4.7
Cape Disappointment Boat Launch Facility, Wave Barrier Project/ Columbia River, Illwaco, WA[1]	12-inch (n=5*)	6-17	11	4.9
Mukilteo Ferry Terminal Test Pile/Puget Sound marine waters, WA[1]	36-inch (n=2)	7-22	15	10.6
Anacortes Ferry Terminal Dolphin Replacement/Puget Sound marine waters, WA[1]	36-inch (n=7)	3-11	8	3.1
SR 520 Test Pile Project/Lake Washington/Portage Bay (freshwater), WA[1, 2]	24-inch (n=4) 30-inch (n=2)	3-32	20	11.1
Columbia River Crossing Test Pile Program/Columbia River, WA/OR[3]	24-inch (n=1)	---	10	---
Tesoro's Amorco Wharf/San Francisco Bay, Martinez, CA[2]	24-inch (n =18 battered and n =18 vertical)	---	~10 dB (not well seated, stated capable of up to 15 dB and strong currents present at times and poor positioning on some piles)*	---
Deep Water-tongue Point Facility Pier Repairs/Columbia River, Astoria, OR[2]	24-inch (n = 10)	5-22	14	---
Portland-Milwaukie Light Rail Project/Willamette River, Portland, OR[2]	24-inch (n=5)	8-27	---	---
Bay Ship and Yacht Dock/San Francisco Bay, Almeda, CA[2]	40-inch (n = 2)	---	~10-15 (Not installed at the substrate at start of drive. Performance from part of drive when bubble curtain properly situated).*	---
Richmond-San Rafael Bridge Project/San Francisco Bay, CA[2]	30-inch (n=2)	---	9	---

Sources: [1]WSDOT 2013, Also, see individual report references for WSDOT; [2]Caltrans 2012; [3]CRC 2011.
*As reported by Illingworth and Rodkin in Caltrans 2012.

In summary, bubble curtain performance is highly variable. Effectiveness depends on the system design and on-site conditions such as water depth, water current velocity, substrate and underlying geology. Installation and how well the curtain is seated on the substrate at the bottom are also important factors. To avoid loss of attenuation from design and implementation errors, our project has specific bubble curtain design specifications, including testing requirements for air pressure and flow prior to initial impact hammer use, and a requirement for placement on the substrate.

While bubble curtain performance is variable, we believe that, based on information from the Bangor Naval Base Test Pile Program, an average peak SPL[7] reduction of 8 dB to 10 dB at 10 meters would be an achievable level of attenuation for steel pipe piles of 36- and 48-inches in diameter. However, to be more conservative for 48 inch piles, use of 7 dB for both RMS and SEL metrics is justified.

[7] For most of the studies reviewed, Peak SPLs were the only metric reported.

4 References

1) Caltrans (California Department of Transportation). 2009. 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. February 2009.

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12) WSDOT. 2005b. Underwater sound levels associated with pile driving at the Bainbridge Island ferry terminal preservation project. November 2005. Available at http://www.wsdot.wa.gov/environment/air/piledrivingreports.htm.

13) WSDOT. 2006. Underwater sound levels associated with pile driving at the Cape Disappointment boat launch facility, wave barrier project. March 2006. Available at http://www.wsdot.wa.gov/environment/air/piledrivingreports.htm.

14) WSDOT. 2007. Underwater sound levels associated with pile driving during the Anacortes ferry terminal dolphin replacement project. April 2007. Available at http://www.wsdot.wa.gov/environment/air/piledrivingreports.htm.

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Appendix A: Studies Reviewed for Evaluation of Underwater Pile Driving Sound

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Appendix A: Studies Reviewed for Evaluation of Underwater Pile Driving Sound

Attachment 1. Impact Pile Driving SPLs from Studies Utilizing Steel Pipe/CISS Piles. Bolded values were considered for proxy source levels.

Project	Location	Number of Piles Measured	Hammer Type	Water Depth (m)	Distance (m)	RMS (dB re 1 μPa)	Peak (dB re 1 μPa)	SEL (dB re 1 μPa^2s)
24-inch Steel Pipe								
Bainbridge Island Ferry Terminal[1]	**Bainbridge Island, WA**	**n=5**	**Diesel**	**2.1-3.4**	**10**	**Weighted Ave 195 Ave range 193-198**	**Weighted Ave 206 Ave range 202-209**	**Weighted Ave 181 Ave range 177-184**
Friday Harbor Ferry Terminal[2]	**Friday Harbor, WA**	**n=5**	**Diesel, pneumatic, hydraulic**	**10-14.3*, ****	**10**	**Weighted Ave 189 Ave range 181-193**	**Weighted Ave 207 Ave range 196-213**	**Weighted Ave 181 Ave range 176-185**
Bangor Test Pile Program[3]	Bangor Naval Base, WA	† n=1	Impact	4.6	10	Max 180	Max 193	Ave 167
Conoco/Phillips Dock [4]	Rodeo, San Francisco Bay, CA	n=2	Diesel	>5	10	Range 188-189	203 (unclear if this is average or ave max)	Typical 177 Range 177-178
Tesoro's Amorco Wharf- all values were attenuated- values reported are mostly unattenuated – strong currents present[4]	San Francisco Bay; Martinez, CA	(1st pile with poor attenuation)	Diesel	10-15	10	189	Max 209	174
Deep Water-Tongue Point Facility Pier Repairs[4]	Mouth of Columbia River; Astoria, OR	n=10	Diesel	unknown	10	Ave 182 Ave range 178-189	Ave max 198 Range 193-206 Max 207	Ave 168 Ave range 160-175
30-inch Steel Pipe								
Richmond-San Rafael Bridge, CALTRANS[4]	San Rafael, CA	n=4	Diesel	4-5	10	Typical 190 (max=192)	210 max (typical 205)	---
Eagle Harbor Maintenance Facility[5]	**Bainbridge Island, WA**	**n=3**	**Diesel**	**10**	**10 (n=2) 16 (n=1)**	**Weighted Ave 192 Ave range 192-193**	**Weighted Ave 204 Ave range 203-204**	**---*****
Friday Harbor Ferry Terminal #8[2]	**Friday Harbor, WA**	**n=1**	**Diesel**	**10.4***	**10**	**196**	**211**	**187**

Project	Location	Number of Piles Measured	Hammer Type	Water Depth (m)	Distance (m)	RMS (dB re 1 µPa)	Peak (dB re 1 µPa)	SEL (dB re 1 $\mu Pa^2 s$)
Vashon Ferry Terminal[6,#]	**Vashon Island, WA**	**n=3**	**Diesel**	**11-12**	**10**	**Weighted Ave 195 Ave range 192-196**	**Weighted Ave 215 Ave range 212-217**	**Weighted Ave 186 Ave range 182-187**
36-inch Steel Pipe****								
Humboldt Bay Bridge[4]	Humboldt Bay – Eureka, CA	CISS n=1, restrikes	Diesel	10	10-	193 (max)	210 (max)	183 (max)
Mukilteo Test Piles[7]	**Mukilteo, WA**	**n=2**	**Diesel**	**7.3**	**10**	**Weighted Ave 190 Ave range 187-191**	**Weighted Ave 205 Ave range 202-207**	**Weighted Ave 183 Ave range 180-184**
Anacortes Ferry[8]	**Anacortes, WA**	**n=7**	**Impact**	**12.8**	**10**	**Weighted Ave 192 Ave range 189-193**	**Weighted Ave 209 Ave range 205-211**	**Weighted Ave 185 Ave range 183-186**
Bangor Test Pile Program[3,#]	**Bangor Naval Base, WA**	**n=4**	**Diesel**	**13.7-26.8**	**10**	**Weighted Ave 194 Ave range 185-196**	**---^**	**Weighted Ave 181 Ave range 173-183**

Notes: Ave = Average

*   Substrate was sandy silt/clay

** Substrate was sandy silt/rock

*** Single strike SEL not reported.

****EHW-2 project at Bangor waterfront measured 24- and 36-inch piles; however, all piles were attenuated so they are not included in the table. 24-inch (n=41) averages were: average peak = 199 (s.d. 9.58), average RMS = 179 (s.d.=24.10), SEL = 170 dB (s.d.=7.48). 36-inch pile (n=26): average peak=205 (s.d.= 4.33), average RMS = 188 (s.d.=5.01), average SEL=175 (s.d= 5.11) (Navy 2013).

† 24-inch piles were not hit very hard, so these are not representative of the levels that may occur in the future or elsewhere.

\# distance to pile ranged above and below 10m. Data normalized to 10m using $15\log_{10}$(range/10m) relationship.

^ Average peak values not reported.

Sources:

[1] WSDOT 2005a

[2] WSDOT 2005b

[3] Navy 2012.

[4] Caltrans 2012

[5] JASCO Research. 2005, WSDOT 2008

[6] WSDOT 2010b

[7] WSDOT 2007a

[8] WSDOT 2007b

Attachment 2. Impact Pile Driving SPLs from Studies Utilizing Concrete Piles. Bolded values were considered for proxy source levels.

Project	Location	Number of Piles Measured	Hammer Type	Water Depth (m)	Distance (m)	RMS (dB re 1 µPa)	Peak (dB re 1 µPa)	SEL (dB re 1 µPa²s)
16-inch and 18-inch Piles								
Pier 2 Concord NWS[1] (16-inch square)	**Concord, CA**	**n=5**	**Drop Steam Powered**	**7**	**10**	**Ave 171 Ave range 167-173**	**Ave max 183 Ave max range 182-184 Max 184**	**N/A**
Berkeley Marina (2007) [1] (18-inch octagonal)	**Berkeley, CA**	**n=1**	**Diesel**	**2-3**	**10**	**Ave 159 Ave range 155-167**	**Ave max 172 Ave range 172-181 Max 181**	**Ave 155**
Berkeley Marina (2009) [1] (18-inch octagonal)	**Berkeley, CA**	**n=3**	**Diesel**	**2-3**	**10**	**Ave 169 Ave range 165-178**	**Ave max 189 Ave max range 184-192 Max 192**	**Ave 159**
24-inch Piles								
Mukilteo Ferry Terminal[2] (octagonal)	**Mukilteo, WA**	**n=1**	**Diesel**	**7-8**	**10**	**Ave 170 (single pile)**	**Ave max 184 Single pile**	**Ave 159 dB Range 159-170**
Amports Pier 95[1] (octagonal)	**Benicia, CA**	**Not provided**	**Diesel**	**3-7**	**10**	**Ave 170 Range 168-172**	**Ave max 184 Range 180-192 Max 192**	**N/A**
Pier 40 Marina[1] (square)	**San Francisco, CA**	**n=7**	**Diesel**	**3-4**	**10**	**Ave 171 Ave range 167-174**	**Ave max 184 Ave range 180-186 Max 186**	**N/A**
Berth 22 Port of Oakland (December 2004)[1] (octagonal)	**Oakland, CA**	**Several**	**Diesel**	**0-15 (dependent on row)**	**10 (mostly)**	**Ave 176*** Ave range*** 171-179 Max 181**	**Ave max 188*** Ave max range*** 183-191 Max 193**	**Ave 165*** Ave range** 162-167**
Berth 22 Port of Oakland (August 2004)[1] (octagonal)	**Oakland, CA**	**n=4**	**Diesel**	**10-13**	**10**	**Ave 175 Ave range during loudest part of drive 174-176 Max 178**	**Ave max 187 Ave max range during loudest part of drive 186-188 Max 190**	**Ave 165 Ave range during loudest part of drive 164-166 Max 168**
Berth 32 Port of Oakland (2005)[1] (octagonal)	**Oakland, CA**	**n=2**	**Diesel**	**3-7**	**10**	**Ave 174 Ave range 172-176**	**Ave max 186 Ave max range 185-187 Max 187**	**Ave 163 Ave range 158-165**

Project	Location	Number of Piles Measured	Hammer Type	Water Depth (m)	Distance (m)	RMS (dB re 1 μPa)	Peak (dB re 1 μPa)	SEL (dB re 1 μPa^{2}s)
Berth 32 Port of Oakland (2004)[1] (octagonal)	**Oakland, CA**	**n=5**	**Diesel**	**>10**	**10**	**Ave 173 Ave range 173-174**	**Ave max 185 Ave max range 184-185 Max 185**	**Ave 162 Ave range 161-163**
Humboldt State University Floating Dock****[1] **(octagonal)**	Humboldt Bay, Eureka, CA	n=3	Diesel	3-4	10	Ave 157 Ave range 156-158	Ave max 179 Ave max range 176-179 Max 179	Ave 148 Ave range 142-151

Notes: Ave = Average
* For piles with fuel setting on high, no jettng.
**Pile with fuel setting on low, no jetting.
*** Average for row, not pile. Sound levels varied by depth. Only in-water sound levels reported in table (unattenuated values from Row A-D in Table 1.5-4 in Caltrans 2013).
****Piles jetted, so project data is not included in analysis.

Sources:

[1] Caltrans 2012
[2] WSDOT 2007a

Attachment 3. Vibratory Pile Driving SPLs from Marine Projects.
Bolded values were considered for proxy source levels.

Project	Location	Number of Piles Measured	Water Depth (meters)	Distance (meters)	Mean RMS* dB re 1 µPa
12-inch Timber					
Port Townsend Dolphin Timber Pile Removal[1]	**Port Townsend, WA**	**n=1**	**---**	**16**	**Average 150 Range 149-152**
13-inch Steel Pipe					
Mad River Slough Pipeline Construction[2]	Mad River Slough, Arcata, CA	n=3	4.5-5.5	10	155
16-inch Steel Pipe					
EHW-1[3]	**Bangor, WA**	**n=8**	**9-12**	**10**	**162 Ave range 153-168**
24-inch Steel Pipe					
Friday Harbor[4]	**Friday Harbor, WA**	**n=1**	**2.6**	**10**	**162**
Trinidad Pier Reconstruction[2]	**Trinidad Bay, Humbolt County, CA**	**n=2**	**15.2**	**10**	**Typical 160 range 158-178**
Bangor Test Pile Program[5]	**Bangor Naval Base, WA**	**n=2 (1 pile vibed in and out)**	**4.6**	**10**	**160 Ave range 157-160****
30-inch Steel Pipe					
Edmonds[6]	**Edmonds, WA**	**n=2**	**6.4**	**10**	**165-166**
Keystone Ferry Terminal[7]	**Coupeville, WA**	**n=4**	**~9.4**	**10 11 6 11**	**Per pile values due to different distances (165 176 176 165) Ave 173 Ave range 165-176**
Vashon Ferry Terminal[8]	**Vashon Island, WA**	**n=4**	**<6**	**11-16**	**167 Ave range 160 - 169**
Port Townsend Test Pile Project[9, 10]	**Port Townsend, WA**	**n=1**	**8.8**	**10**	**170 Ave range 164-174**
EHW-1[3]	**Bangor, WA**	**n=35**	**9-12**	**10**	**168 Ave range 155-174**
36-inch Steel Pipe					
Edmonds Ferry Terminal[6]	**Edmonds, WA**	**n=2**	**5.8**	**11**	**Ave range 162-163**
Anacortes Ferry Terminal[11]	**Anacortes, WA**	**n=2**	**12.7**	**11**	**Ave range 168-170**
Port Townsend Test Pile Project[9, 10]	**Port Townsend, WA**	**n=1**	**9.5**	**10**	**172 159-177**
Bangor Test Pile Program[5]	**Bangor Naval Base, WA**	**n=~33 ~33**	**13.7-26.8**	**10**	**164 ** Ave range 154-169**
24-inch AZ25 Steel Sheet					
Berth 23, Port of Oakland[2]	**Oakland, CA**	**n=1**	**~12-14**	**10**	**163*****
Berth 30, Port of Oakland[2]	**Oakland, CA**	**n = 5**	**~12**	**10**	1-sec SEL**** **= 159 Ave range 157-160 (162 highest ave from bottom depth)**
Berth 35/37, Port of Oakland[2]	**Oakland, CA**	**---**	**15**	**10**	**163**

Notes: Ave = Average.

*WSDOT typically reports average of 30-second RMS values calculated over the duration of a drive.
** Average of all pile driving events.
***Involved only stabbing. Average reported by Caltrans Table I-1.2-3
****RMS SPLs were not reported, but would be similar to SEL for 1 second. Average top and bottom depths.

Sources:
[1] WSDOT 2011a
[2]Caltrans 2012
[3]Miner 2012
[4]WSDOT 2010a
[5] Navy 2012
[6] WSDOT 2011b.
[7]WSDOT 2010c
[8]WSDOT 2010d
[9] WSDOT 2010e
[10] Laughlin 2010
[11] WSDOT 2012
* Sound attenuation used - water jetting and cushion blocks.
** Water jetting data were excluded from analysis data set
[1] Caltrans 2012

Attachment 4. Impact Pile Driving L_{max} Airborne SPL Studies. Bolded projects were considered for proxy source levels.

Project	Location	Number of Piles Measured	Distance (meters/feet)	L_{max} dB re 20 µPa
12-inch Steel Pipe				
Cape Disappointment Boat Launch Facility, Wave Barrier Project[1]	Columbia River, Astoria, OR	1 at 50 m	50 m/164 ft	89 A-weighted
24-inch Steel Pipe				
Bangor Test Pile Program	**Bangor Naval Base, WA**	**1**	**15.2 m/50 ft** **121.9 m/400 ft**	**110 dB (109dBA)** **95 dB (93 dBA)**
SR 520 Bridge Replacement Test Pile[2]	Portage Bay, Seattle, WA	2	11-15 m/ 36-49 ft	95-100 dBA
30-inch Steel Pipe				
Friday Harbor Ferry Terminal Restoration[3]	San Juan Island Area, Friday Harbor, WA	1	49 m / 160 ft	---
SR 520 Bridge Replacement Test Pile[2]	Union Bay, Lake Washington, Seattle, WA	4	11-15 m/ 36-49 ft	103-106 dBA
36-inch Steel Pipe				
Bangor Test Pile Program[4]	**Bangor Naval Base, WA**	**---**	**15 m/ 50 ft**	**109 dB (sd=2.58)** **Range 106-112 dB**

Notes: All values unweighted unless indicated. Only unweighted values were considered for proxy values.
Sources:
[1] WSDOT 2006
[2]WSDOT 2010f
[3]WSDOT 2005b
[4] Navy 2012

Attachment 5. Vibratory Pile Driving L_{eq} Airborne SPL Studies.
Bolded projects were considered for proxy source levels.

Project	Location	Number of Piles Measured	Distance (meters/feet)	Average RMS L_{eq} dB re 20 µPa*	Average RMS L_{eq} dBA re 20 µPa*
18-inch Steel Pipe					
Wahkiakum Ferry Terminal [1]	**Columbia River, WA**	**1**	**15.2 m/50 ft***	**87.5**	
24-inch Steel Pipe					
Bangor Test Pile Program	Bangor Naval Base, WA	1	15.2 m/50 ft 121.9 m/400 ft	92 78 dB	85 72
SR 520 Bridge Replacement Test Pile[2]	Portage Bay, Seattle, WA	1	11 m/36 ft	88 dBA	---
30-inch Steel Pipe					
Keystone Ferry Terminal[1]	**Puget Sound, WA**	**1**	**15.2 m/50 ft***	**95 Range 93-96**	
Vashon Ferry Terminal Test Pile Project[1,3]	Puget Sound, Vashon Island, WA	2	15.2 m/50 ft*	~83-85**	~77-80 dBA*
36-inch Steel Pipe					
Bangor Test Pile Program[4]	**Bangor Naval Base, WA**	**---**	**15 m/50 ft**	**93 (sd =3.08) Range 89-102**	

Notes; All values unweighted unless indicated.
* Sound pressure levels standardized to 50 ft range. Measurements made at 11 meters
**Converted to C-weighted from A-weighted measurements to approximate unweighted sound level, reported at a distance of 26 to 36 feet.

Sources:
[1] WSDOT 2010g
[2] WSDOT 2010f
[3] WSDOT 2010d
[4] Navy 2012

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10) WSDOT. 2007a. Underwater sound levels associated with driving steel and concrete piles near the Mukilteo Ferry Terminal. March 2007. Available at http://www.wsdot.wa.gov/NR/rdonlyres/64500C4E-3472-4D03-84DF-9F2C787A28EC/0/MukilteoFerryTermTestPileRptWSDOT.pdf

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Appendix B: Data Charts for Measured Data and Cumulative Probability Distribution Functions

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Appendix B: Data Charts for Measured Data and Cumulative Probability Distribution Functions

Impact RMS

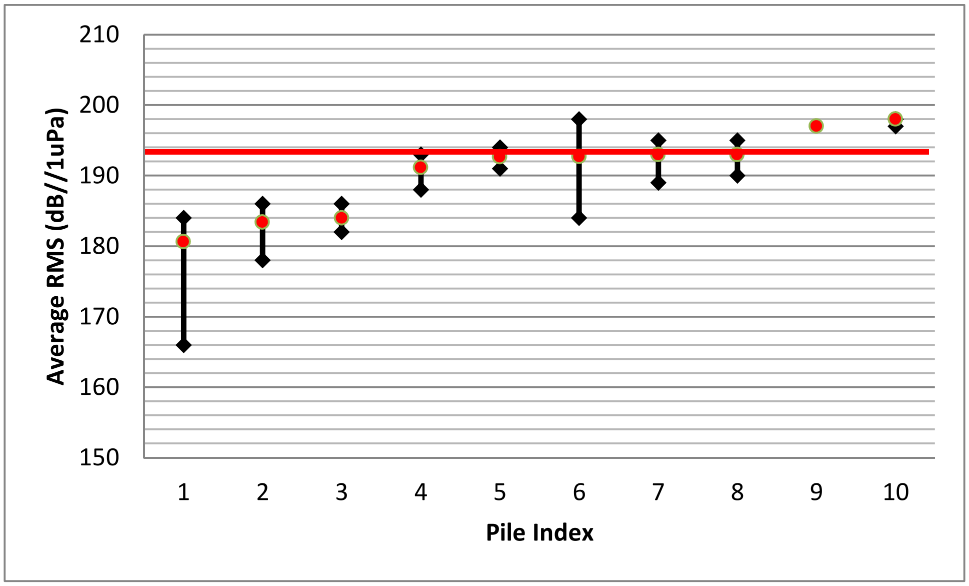

Figure B-1 – 24-inch RMS Measurements

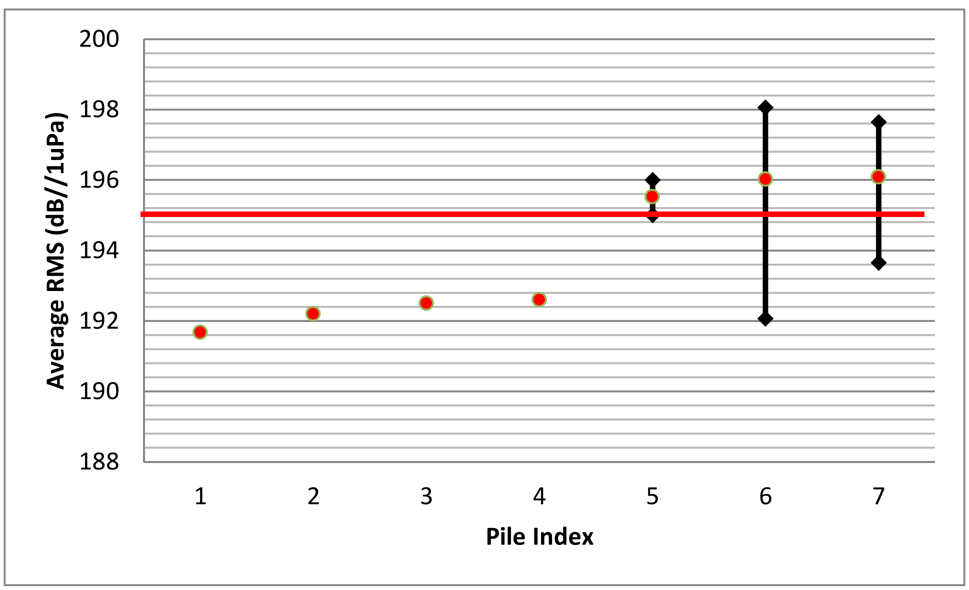

Figure B-2 - 30-inch RMS Measurements

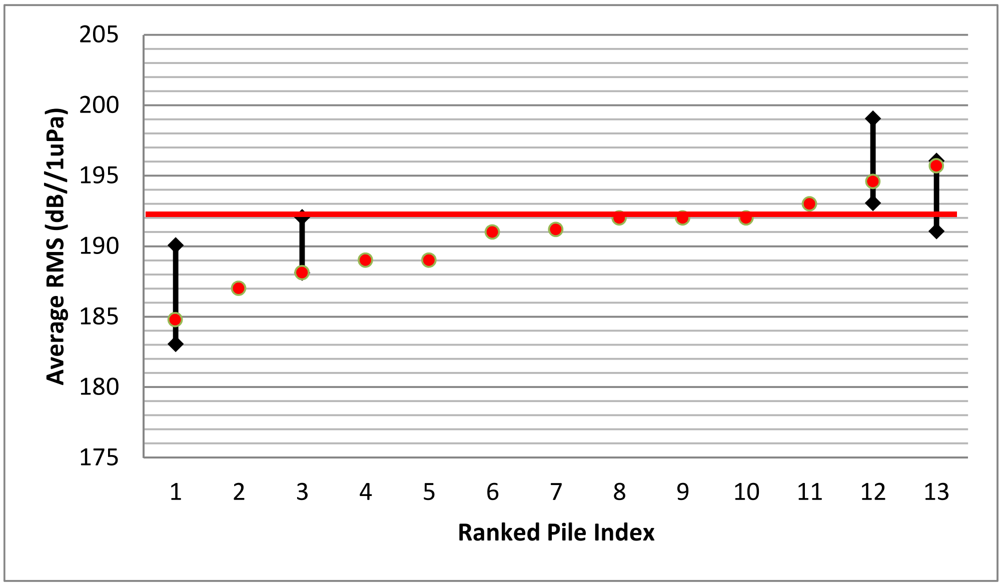

Figure B-3 – 36-inch RMS Measurements

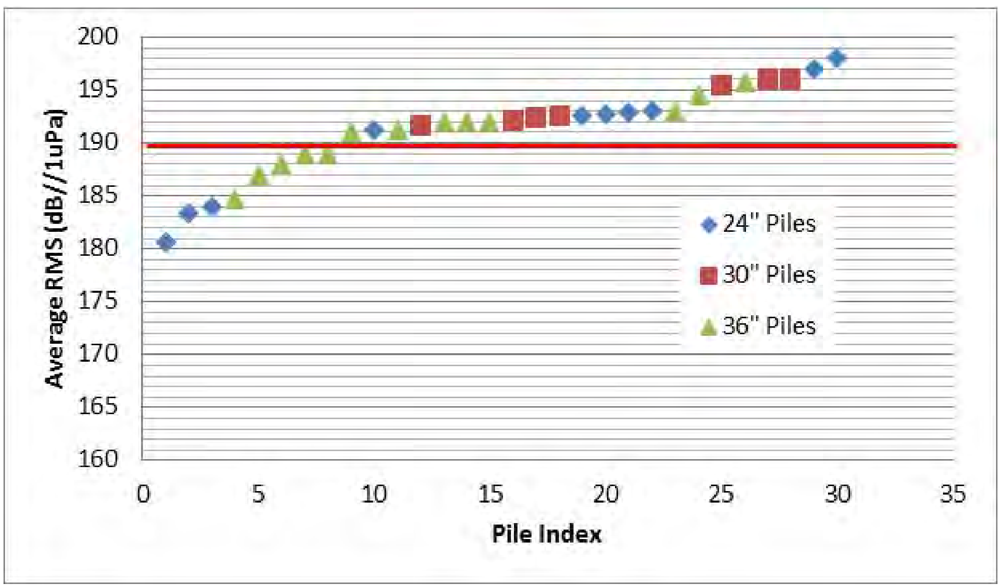

Figure B-4 – Combined Analysis: 24, 30, 36-inch RMS Measurements

Impact Average Peak

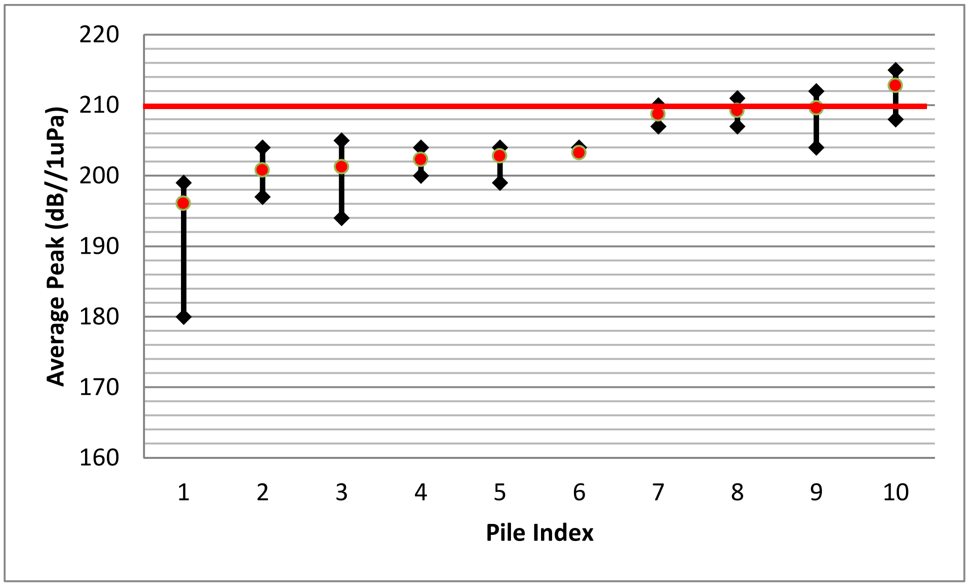

Figure B-5 – 24-inch Average Peak Measurements

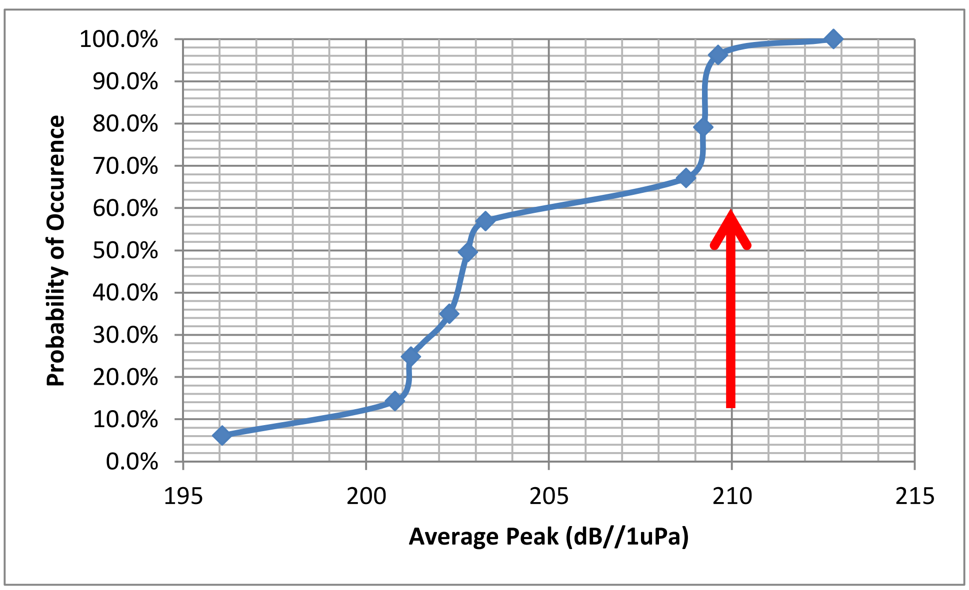

Figure B-6 – 24-inch Average Peak Cumulative Distribution Function

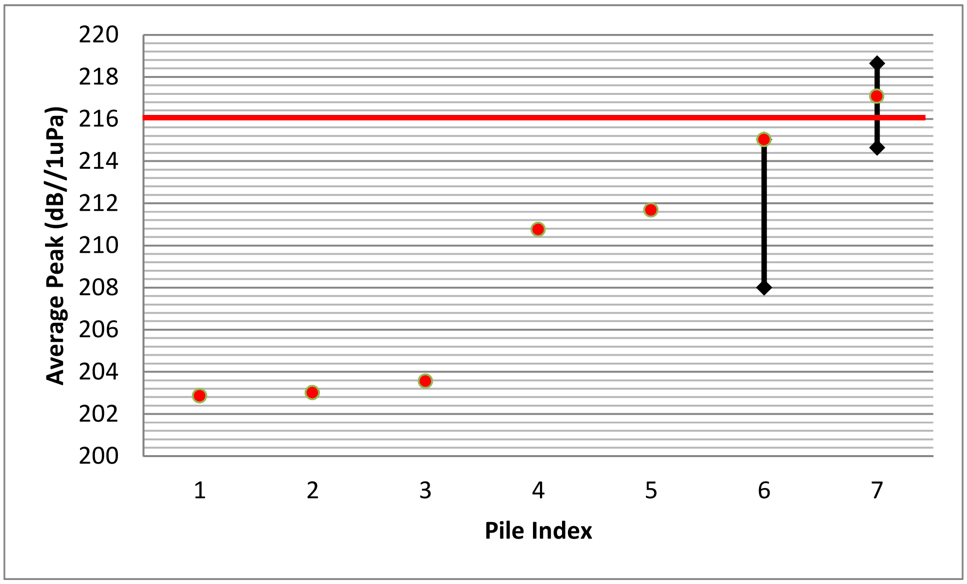

Figure B-7 – 30-inch Average Peak Measurements

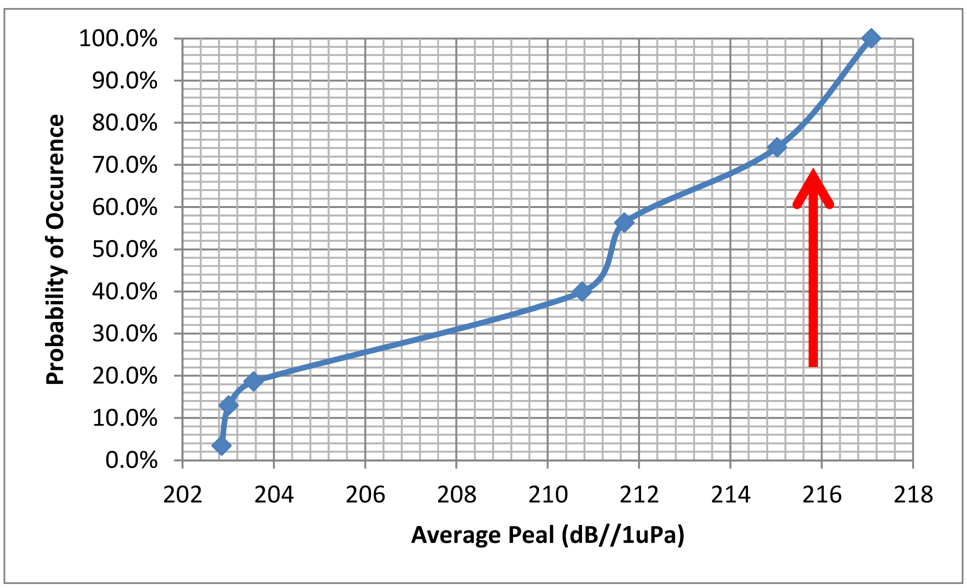

Figure B-8 – 30-inch Average Peak Cumulative Distribution Function

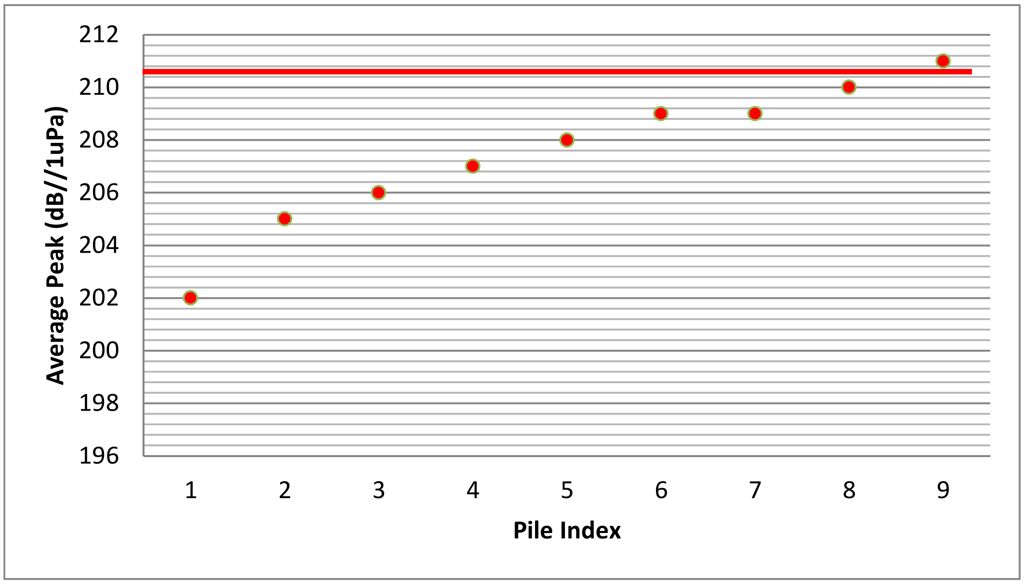

Figure B-9 – 36-inch Average Peak Measurements

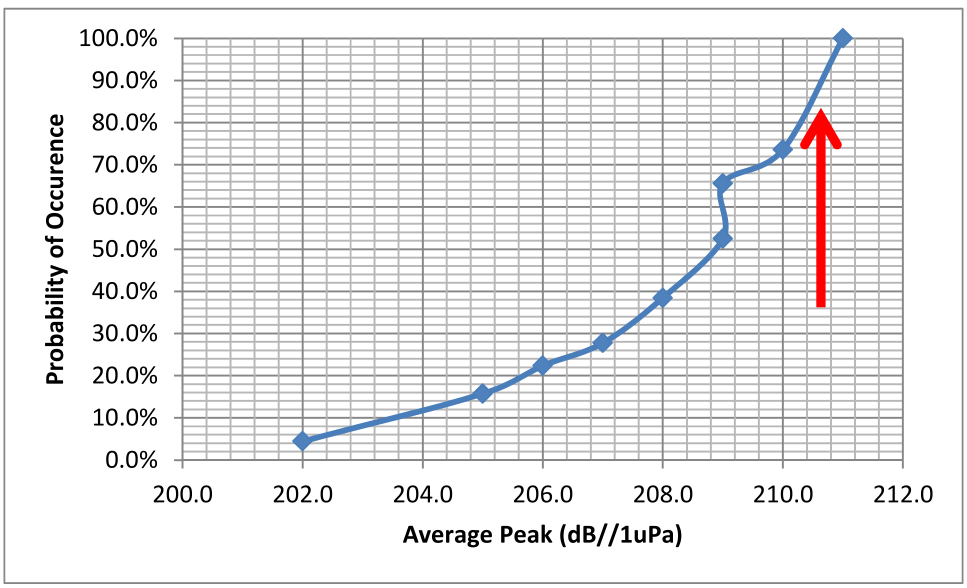

Figure B-10 – 36-inch Average Peak Cumulative Distribution Function

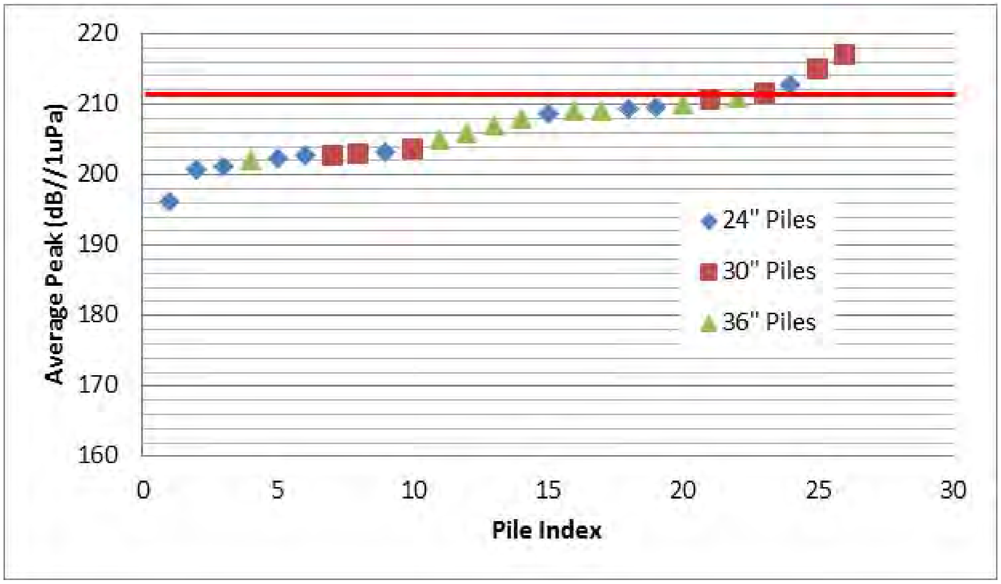

Figure B-11 – Combined Analysis: 24, 30, 36-inch Average Peak Measurements

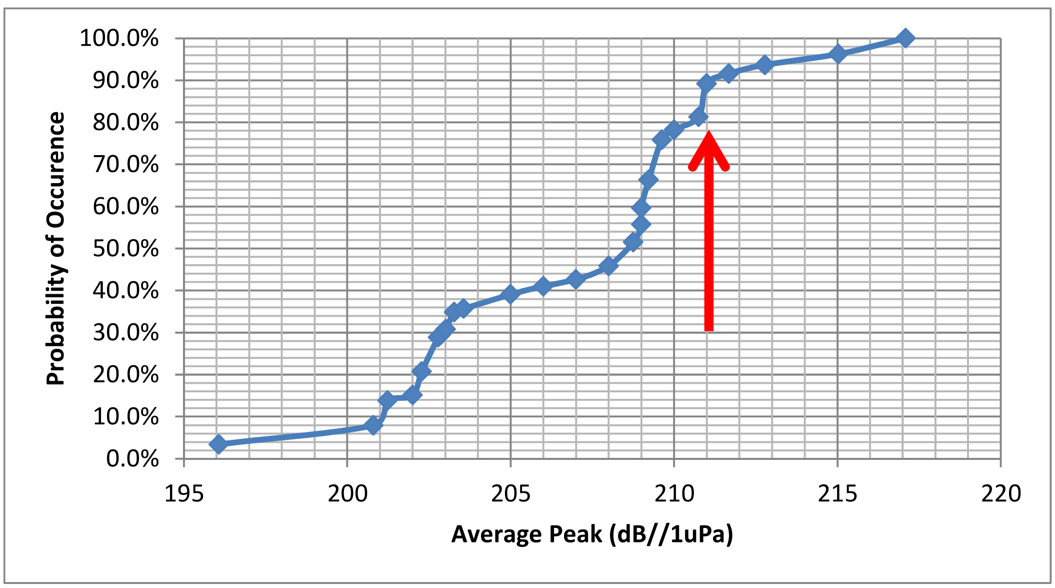

Figure B-12 –Combined Analysis: 24, 30, 36-inch Average Peak Cumulative Distribution Function

Impact SEL

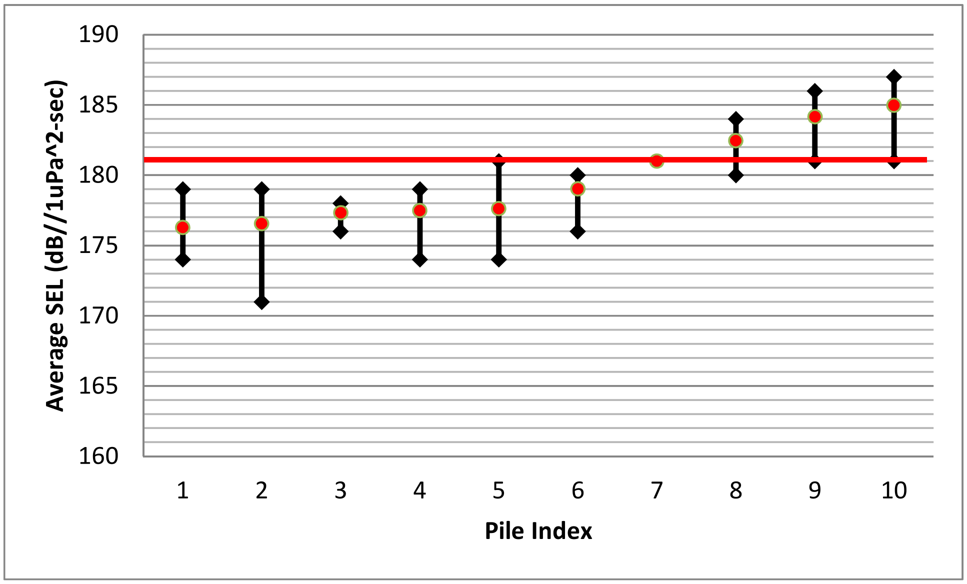

Figure B-13 – 24-inch SEL Measurements

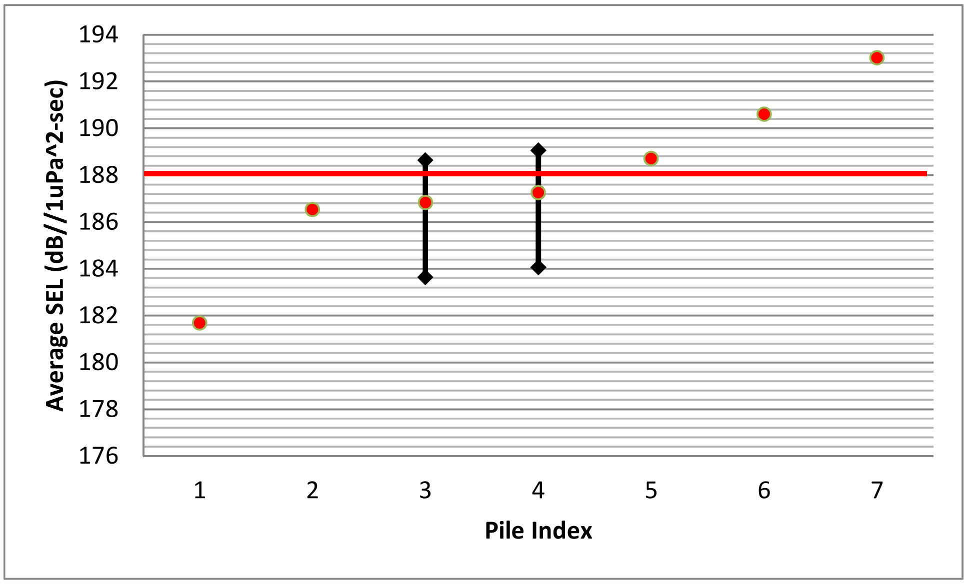

Figure B-14 - 30-inch SEL Measurements

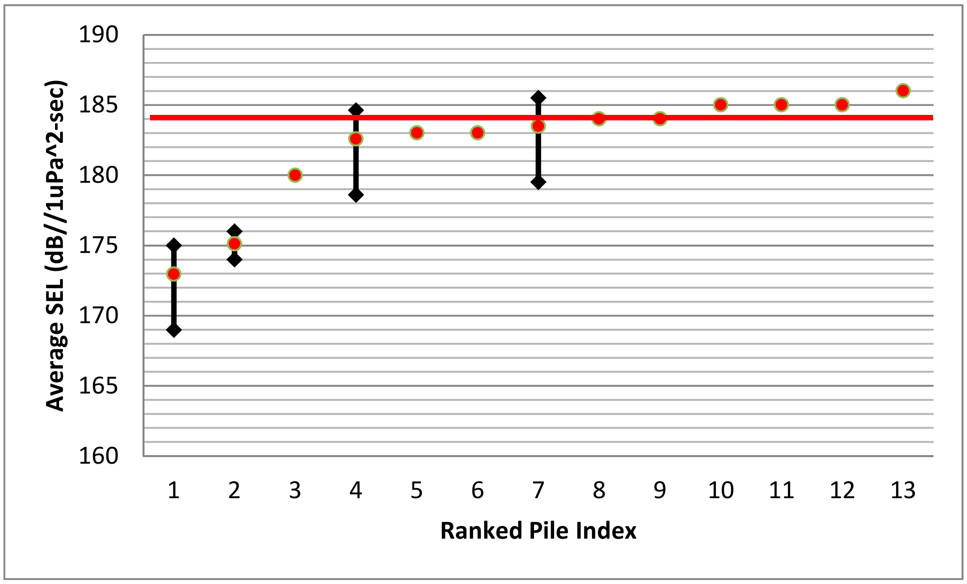

Figure B-15 – 36-inch SEL Measurements

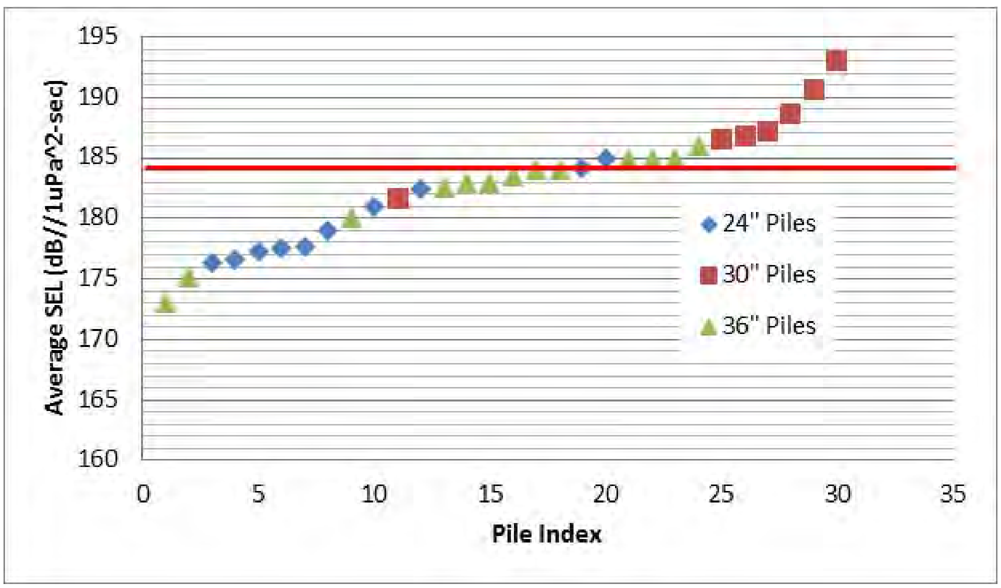

Figure B-16 - Combined Analysis: 24, 30, 36-inch SEL Measurements

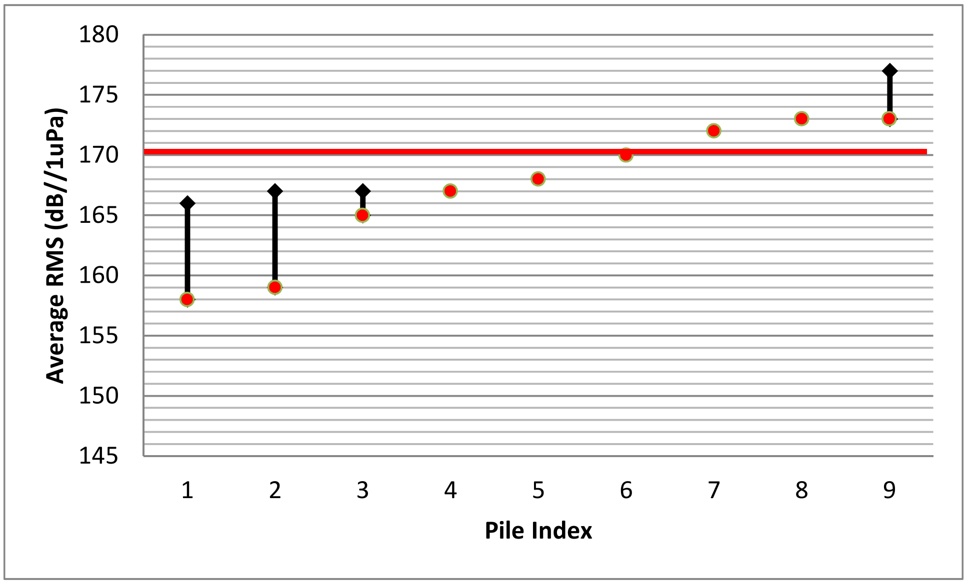

Figure B-17 – Concrete 16, 18-inch RMS Measurements

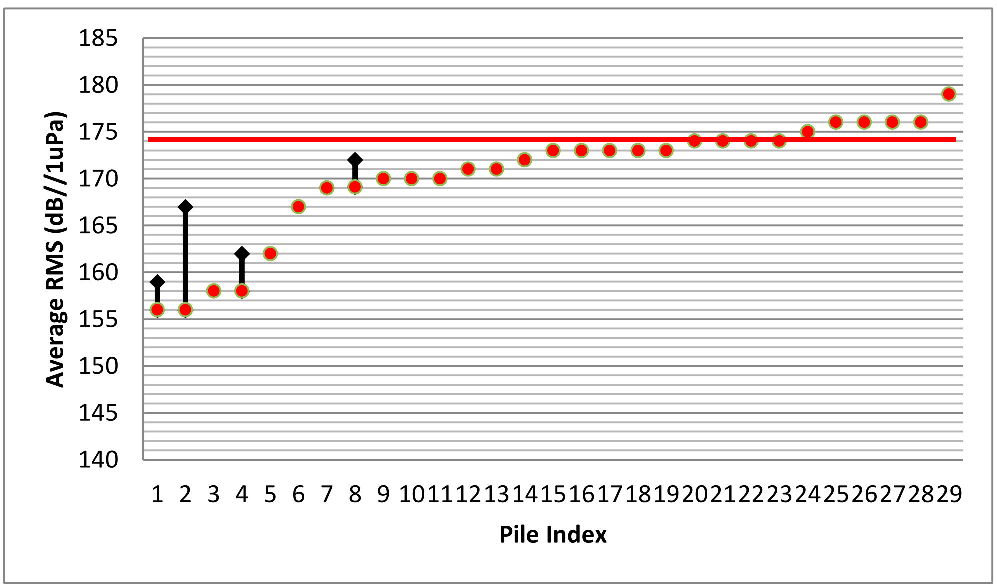

Figure B-18 – Concrete 24-inch RMS Measurements

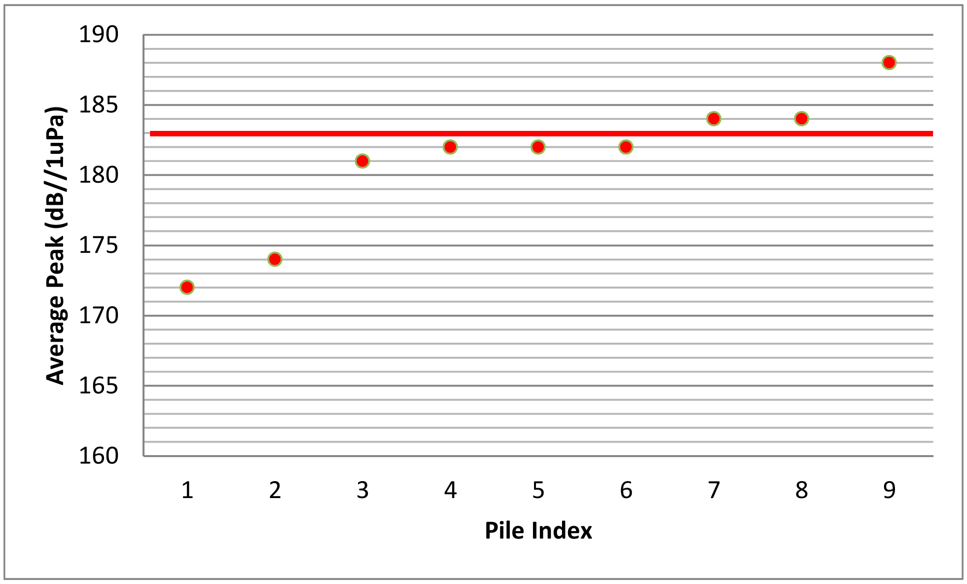

Figure B-19 – Concrete 16, 18-inch Average Peak Measurements

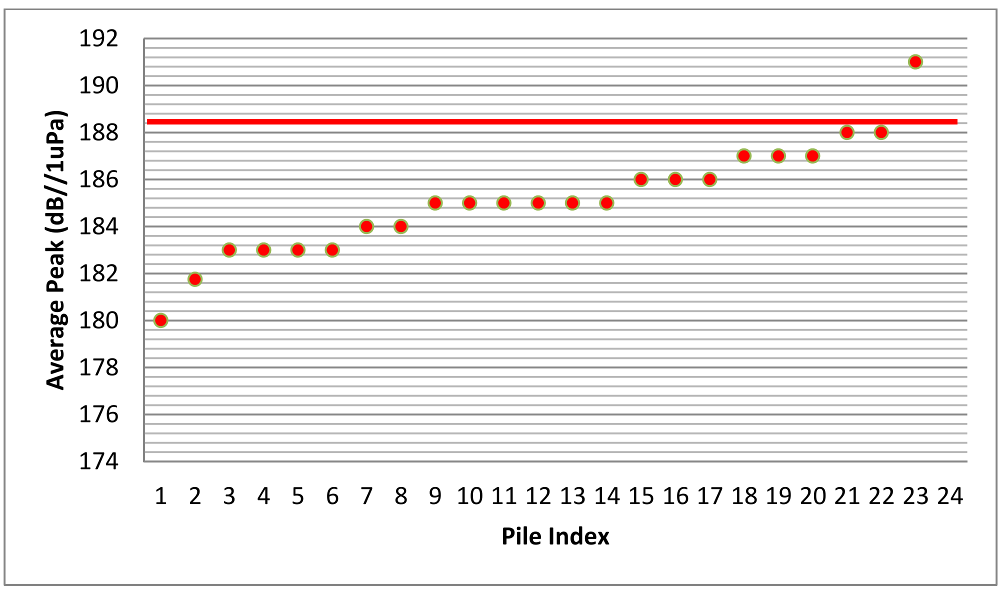

Figure B-20 – Concrete 24-inch Average Peak Measurements

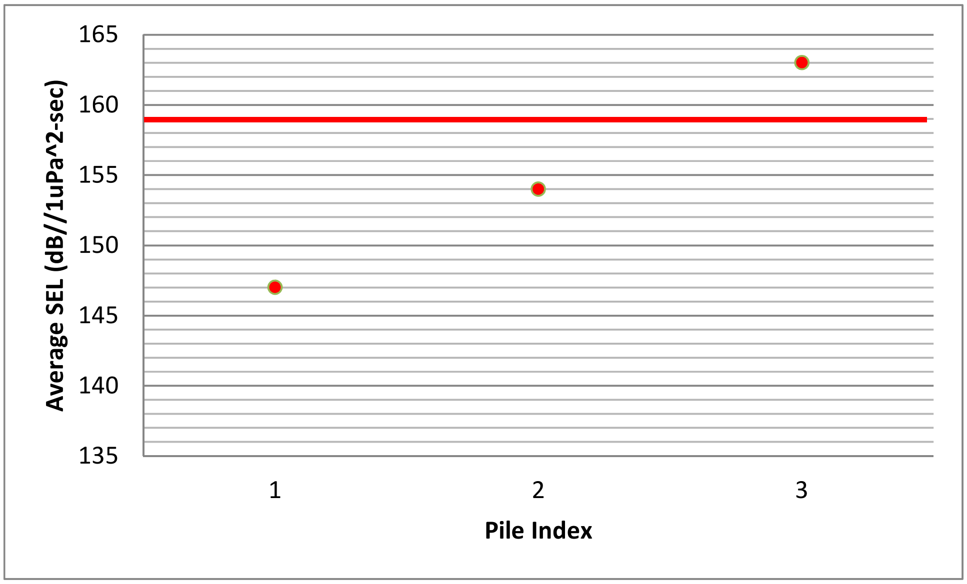

Figure B-21 – Concrete 16, 18-inch SEL Measurements

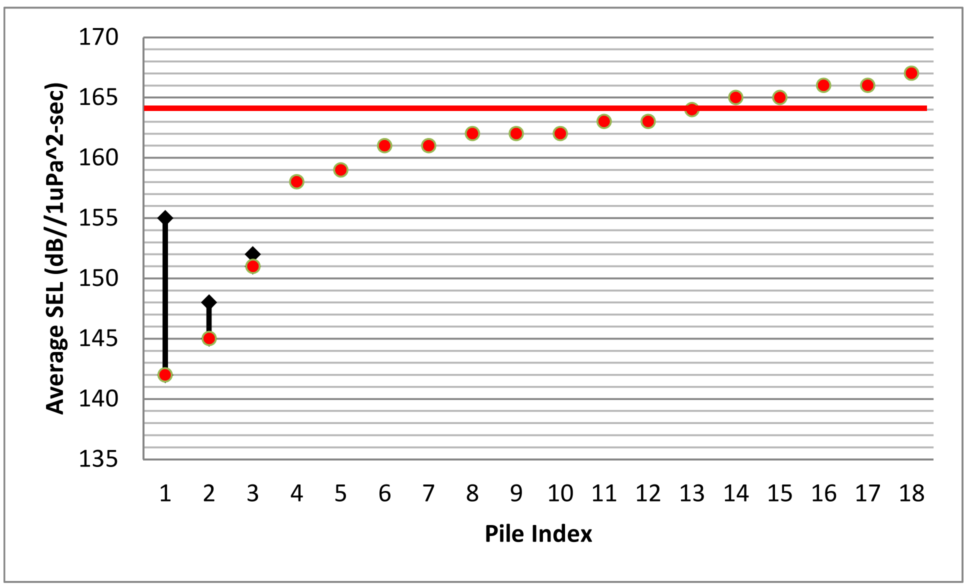

Figure B-22 – Concrete 24-inch SEL Measurements

Vibratory RMS

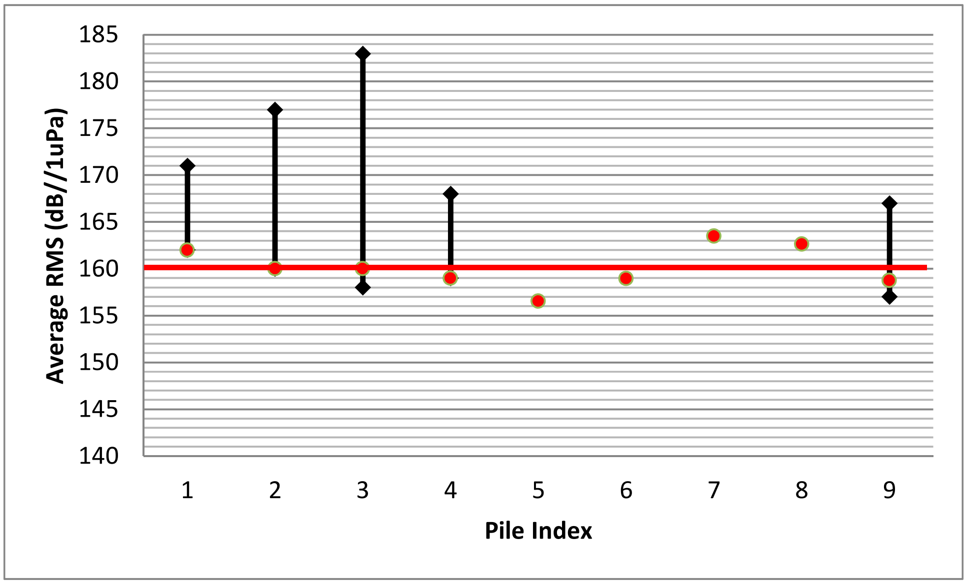

Figure B-23 –24-inch RMS Vibratory Measurements

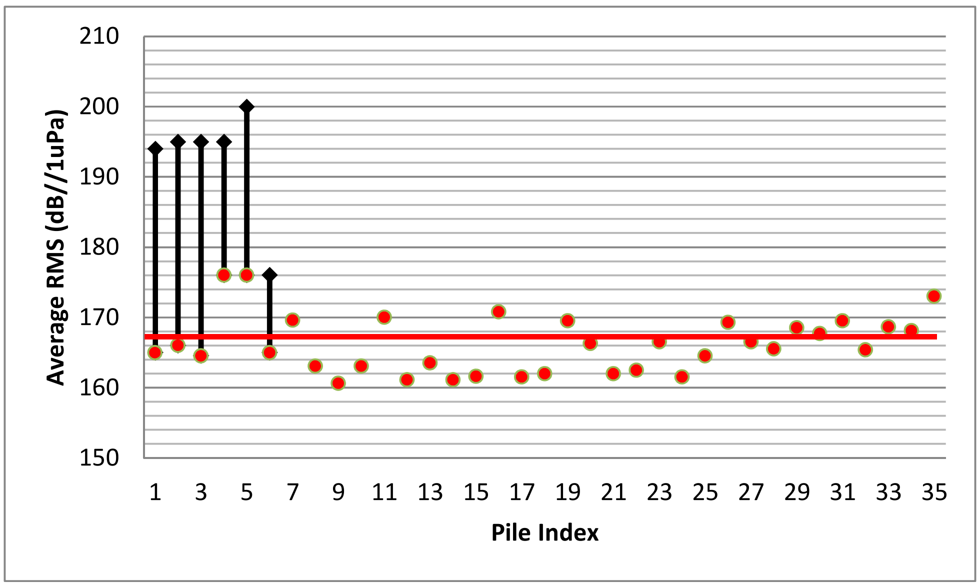

Figure B-24 –30-inch RMS Vibratory Measurements

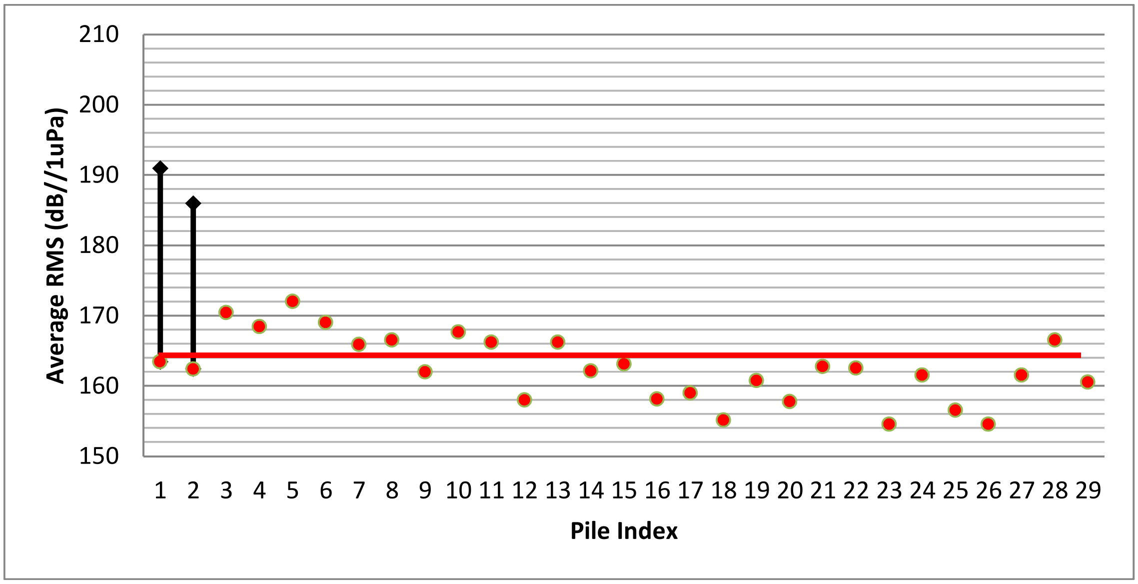

Figure B-25 –36-inch RMS Vibratory Measurement

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APPENDIX B
MARBLED MURRELET MONITORING PLAN

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Marbled Murrelet Monitoring Plan[1] for the Explosives Handling Wharf #1 Pier Repair Project Naval Base Kitsap Bangor

1.0 Objective

The intent of the monitoring protocol is to:

1. Comply with the requirements of the Endangered Species Act Section 7 consultation for the United States Department of the Navy (Navy) Explosives Handling Wharf #1 (EHW-1) pier repairs at Naval Base Kitsap Bangor.
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[2] by communicating immediately with the pile driving operator.

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 Navy and the Washington Fish and Wildlife Office (WFWO).

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 the Explosives Handling Wharf #1 (EHW-1) Pier Repair Project. 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.

3.2 Equipment

- Binoculars - quality 8 or 10 power
- Two-way radios with earpieces
- Red and green flags

[1] This protocol is based on USFWS protocol dated August 2012; however, the protocol was modified to avoid hazing of murrelets from monitoring vessels.

[2] The threshold for injury due to elevated underwater sound pressure levels during impact pile driving is 202 dB re 1µPa cumulative SEL, which is approximately 40 meters from a 30” 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.

- Range finder

- Log books
- Seabird identification guide
- Life vest or other personal flotation device for observer in boats
- Hard hat or other PPE needed for Lead Biologist
- 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.

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 Figures 1. However, depending on the placement of the barge, monitoring location may need to be adjusted to ensure coverage of 42-meter area. If conditions change on- site (e.g., a barge moves into the monitoring zone), monitoring locations can be refined in the field. For example, a stationary boat may be used on the west side of the wharf to provide full visual coverage. In all cases, the monitoring location will allow for the entire monitoring area to be fully surveyed within five minutes.

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 5.0). 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 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 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.

Figure 1: Marbled Murrelet Monitoring Locations

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. 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 2 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.

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	

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. Monitors will also have red and green flags for visual signals in the event there are issues with the audio/radio communications. 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. The lead biologist will also have red and green flags to visually communicate with the pile driving operator if audio communication fails. 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.

3.0 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). 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.

3.5 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. Both forms are included in the Appendix.

3.6 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 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 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. 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).

3.7 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 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 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 2.0 above are necessary. Pile driving will not resume until the necessary amendments have been made.

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.

If dead murrelets or other diving seabirds are found during the beach surveys (or during monitoring activities), Navy personnel will be notified immediately. Dead birds 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

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:

1. Tyler Yasenak – phone: (360) 315-2452
2. Greg Leicht – phone: (360) (360) 649-1623

Primary points of contact at the WFWO are:

1. Ryan McReynolds – phone: (360) 753-6047
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 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% 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. 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.

7.1 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

APPENDIX

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Seabird Monitoring Site/Transect Identification Form

Project Name

Monitoring Dates

Number of Monitoring Sites/Transects

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