Incidental Harassment Authorization Application

Pier and Support Facilities for Transit Protection System
U.S. Coast Guard Air Station/Sector Field Office Port Angeles, Washington

Submitted to:
Office of Protected Resources, National Marine Fisheries Service,
National Oceanographic and Atmospheric Administration

Prepared by:
Naval Facilities Engineering Command Northwest

For:
Naval Base Kitsap at Bangor and Naval Strategic Systems Program

February 2016

Executive Summary

The U.S. Department of the Navy (Navy) is applying for an Incidental Harassment Authorization (IHA) from the National Marine Fisheries Service (NMFS) to construct a pier and support facilities at the U.S. Coast Guard (USCG) Air Station/Sector Field Office Port Angeles (AIRSTA/SFO Port Angeles), located in Port Angeles Harbor on the Ediz Hook peninsula, Port Angeles. The Navy has increased security for in-transit Fleet Ballistic Missile Submarines (SSBNs) in inland marine waters of northern Washington by establishing a Transit Protection System (TPS) that relies on the use of multiple escort vessels. The purpose of the Pier and Support Facilities for TPS project (the project) is to provide a staging location for TPS vessels and crews that escort incoming and outgoing SSBNs between dive/surface points in the Strait of Juan de Fuca and Naval Base (NAVBASE) Kitsap Bangor.

The project's timing and duration and types of activities (specifically pile driving/removal) may result in the incidental taking by acoustical harassment (Level B take) of marine mammals protected under the Marine Mammal Protection Act of 1972 (MMPA). Section 101 (a)(5)(D) of the MMPA allows for the issuance of an IHA, provided an activity results in negligible impacts on marine mammals and would not adversely affect subsistence use of these animals. The Navy is requesting an IHA for the following five marine mammal species that may occur in the vicinity of the project: harbor porpoise (*Phocoena phocoena*), Steller sea lion (*Eumetopias jubatus*), California sea lion (*Zalophus californianus*), northern elephant seal (*Mirounga angustirostris*), and harbor seal (*Phoca vitulina*).

Specific activities that can be expected to result in the incidental taking of marine mammals include the installation and removal of 80 temporary indicator piles and installation of 144 permanent steel piles necessary for the construction of a fixed pier and associated facilities. Total construction is expected to take 18 months. In-water construction would observe the in-water work window for Tidal Reference Area 10 (July 16 through February 15), as designated by the Washington Department of Fish and Wildlife (WDFW), to minimize impacts on salmon (*Oncorhynchus* spp.) and bull trout (*Salvelinus confluentus*). Total duration of the project for both upland and in-water construction would be about 18 months. In-water construction is anticipated to begin in 2016 and require two in-water work window seasons. For in-water construction, a maximum of 75 days/18 weeks of pile driving/removal is anticipated within the two in-water work window periods.

Exposure estimates for each species requested in this IHA Application are summarized in Table E-1, based on the full analysis as presented in this IHA.

Table E-1: Total Underwater Level B Exposure Estimates by Species

Species	Total
Harbor porpoise	225
Steller sea lion	2,097
California sea lion	1,516
Northern elephant seal	75
Harbor seal	12,000
Total	**15,913**

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Acronyms and Abbreviations

AFF	Alert Forces Facility
AIRSTA/SFO	Air Station/Sector Field Office
BMP	Best Management Practice
BV	Blocking Vessel
CFR	Code of Federal Regulations
cm	centimeter
CPO	Chief Petty Officer
CV	coefficient of variation
dB	decibel
DPS	Distinct Population Segment
EHW	Explosives Handling Wharf
ESA	Endangered Species Act
FR	Federal Register
ft	foot/feet
HDPE	high density polyethylene
Hz	Hertz
IHA	Incidental Harassment Authorization
kg	kilogram
kHz	kilohertz
km	kilometer
LAN	Local Area Network
Lmax	maximum sound level
m	meter/meters
MHHW	mean higher high water
MLLW	mean lower low water
MMPA	Marine Mammal Protection Act
NAVBASE	Naval Base
NAVFAC	Naval Facilities Engineering Command
Navy	United States Navy
NMFS	National Marine Fisheries Service
NMSDD	Navy Marine Species Density Database
NOAA	National Oceanic and Atmospheric Administration
Pa	Pascal
psf	pound per square foot
psi	pounds per square inch
PSO	Protected Species Observer

PTS	Permanent Threshold Shift
PZC	Z-shaped interlocking steel sheet pile
RMS	root mean square
RSA	Ready Service Armory
RV	Reaction Vessel
SAR	Stock Assessment Report
SEL	Sound Exposure Level
SPL	Sound Pressure Level
SRKW	Southern Resident Killer Whale
SSBN	Fleet Ballistic Missile Submarine
SV	Screening Vessel
TL	transmission loss
TPP	Test Pile Program
TPS	Transit Protection System
TTS	Temporary Threshold Shift
U.S.	United States
USACE	U.S. Army Corps of Engineers
USCG	United States Coast Guard
USFWS	United States Fish and Wildlife Service
W	West
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WRA	Waterfront Restricted Area
WSDOT	Washington State Department of Transportation
ZOI	Zone of Influence
µPa	Micropascal

1 Description of Activities

A detailed description of the specific activities that can be expected to result in incidental taking of marine mammals

The Navy proposes to construct a pier and support facilities at the U.S. Coast Guard (USCG) Air Station/Sector Field Office Port Angeles (AIRSTA/SFO Port Angeles) located in Port Angeles Harbor at the eastern end of the Ediz Hook peninsula, Port Angeles, Washington (Figure 1-1, *Vicinity Map*). The Navy has increased security for in-transit Fleet Ballistic Missile Submarines (SSBNs) in inland marine waters of northern Washington by establishing a Transit Protection System (TPS) that relies on the use of multiple escort vessels. The purpose of the Pier and Support Facilities for TPS project (the project) is to provide a staging location for TPS vessels and crews that escort incoming and outgoing SSBNs between dive/surface points in the Strait of Juan de Fuca and Naval Base (NAVBASE) Kitsap Bangor.

This project is the subject of this Incidental Harassment Authorization (IHA) Application, for consideration by the National Marine Fisheries Service (NMFS) Office of Protected Resources. The Marine Mammal Protection Act of 1972 (MMPA) prohibits the taking of marine mammals, which is defined as to "harass, hunt, capture or kill, or attempt to harass, hunt, capture or kill," except under certain situations. Section 101 (a)(5)(D) allows for the issuance of an IHA, provided that an activity results in negligible impacts on marine mammals and would not adversely affect subsistence use of these animals. To facilitate review by NMFS, this IHA Application includes 14 specific sections organized to present information as required by regulations (50 Code of Federal Regulations [CFR] § 216.104(a)), as summarized on the NMFS website *Apply for an Incidental Take Authorization*, *What do I include in my application?* (NMFS 2015a).

The project's timing and duration and types of activities (specifically pile driving/removal) may result in the incidental taking by acoustical harassment (Level B take) of marine mammals protected under the MMPA. The Navy is requesting an IHA for the following five marine mammal species that may occur in the vicinity of the project during pile driving/removal: harbor porpoise (*Phocoena phocoena*), Steller sea lion (*Eumetopias jubatus*), California sea lion (*Zalophus californianus*), northern elephant seal (*Mirounga angustirostris*), and harbor seal (*Phoca vitulina*).

The project would be located between the existing medical/dental clinic and Chief Petty Officer (CPO) mess (Figure 1-2, *USCG AIRSTA/SFO Port Angeles Existing Conditions Site Map*; Figure 1-3, *Project Site and Proposed Features*).

Construction of the pier and support facilities is grouped into three broad categories:

- Site Work Activities.
- Construction of Upland Facilities (Alert Forces Facility [AFF] and Ready Service Armory [RSA]).
- Construction of Trestle/Fixed Pier/Floating Docks.

Site work activities and construction of the upland facilities would be performed on land in dry areas above mean higher high water (MHHW) (referred hereafter as "upland") and are not expected to result in the incidental taking of marine mammals.

Specific activities that can be expected to result in the incidental taking of marine mammals are limited to the driving and removal of steel piles used for installation of the trestle/fixed pier/floating docks (Figure 1-4, *Trestle and Fixed Pier Section*). The trestle, fixed pier, and floating docks would result in a permanent increase in overwater coverage of 25,465 square-feet (ft^2) (2,366 square meters [m^2]). An estimated 745 ft^2 (69 m^2) of benthic seafloor would be displaced from the installation of the 144 permanent steel piles. Loss of habitat is addressed in Section 9, *Impacts on the Marine Mammal Habitat and the Likelihood of Restoration*.

1.1 Mobilization

The piles would be fabricated off site and loaded on a supply barge along with other equipment including pile-drivers and hammers needed for the in-water construction. A crane barge along with the supply barge would be towed to the project site. All other materials and equipment including concrete for the pile plugs, pile caps, and trestle topping slab, and pre-cast beams would likely be mobilized by truck on land to the project site.

1.2 Approach Roadway

There would be a short approach road to the trestle from the main installation road. Approximately 375 ft (114 m) of sheet pile (60 steel PZC13-type [Z-shaped interlocking steel sheet piles]) would be required to stabilize and protect the slope of the new approach road and pre-cast concrete abutment for the trestle. The sheet piles would be installed in upland areas using vibratory pile driving methods.

Figure 1-1: Vicinity Map

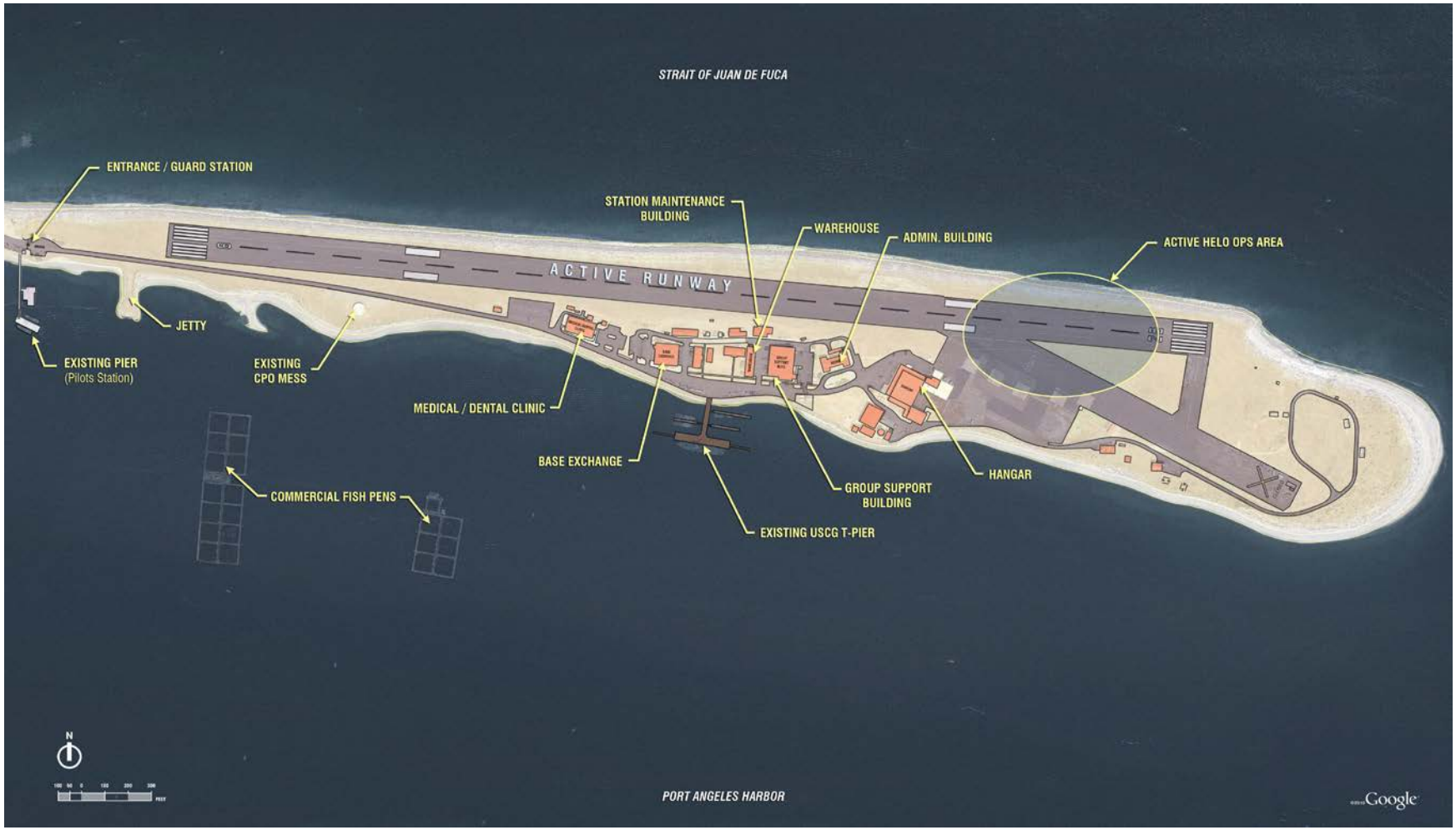

Figure 1-2: USCG AIRSTA/SFO Port Angeles Existing Conditions Site Map

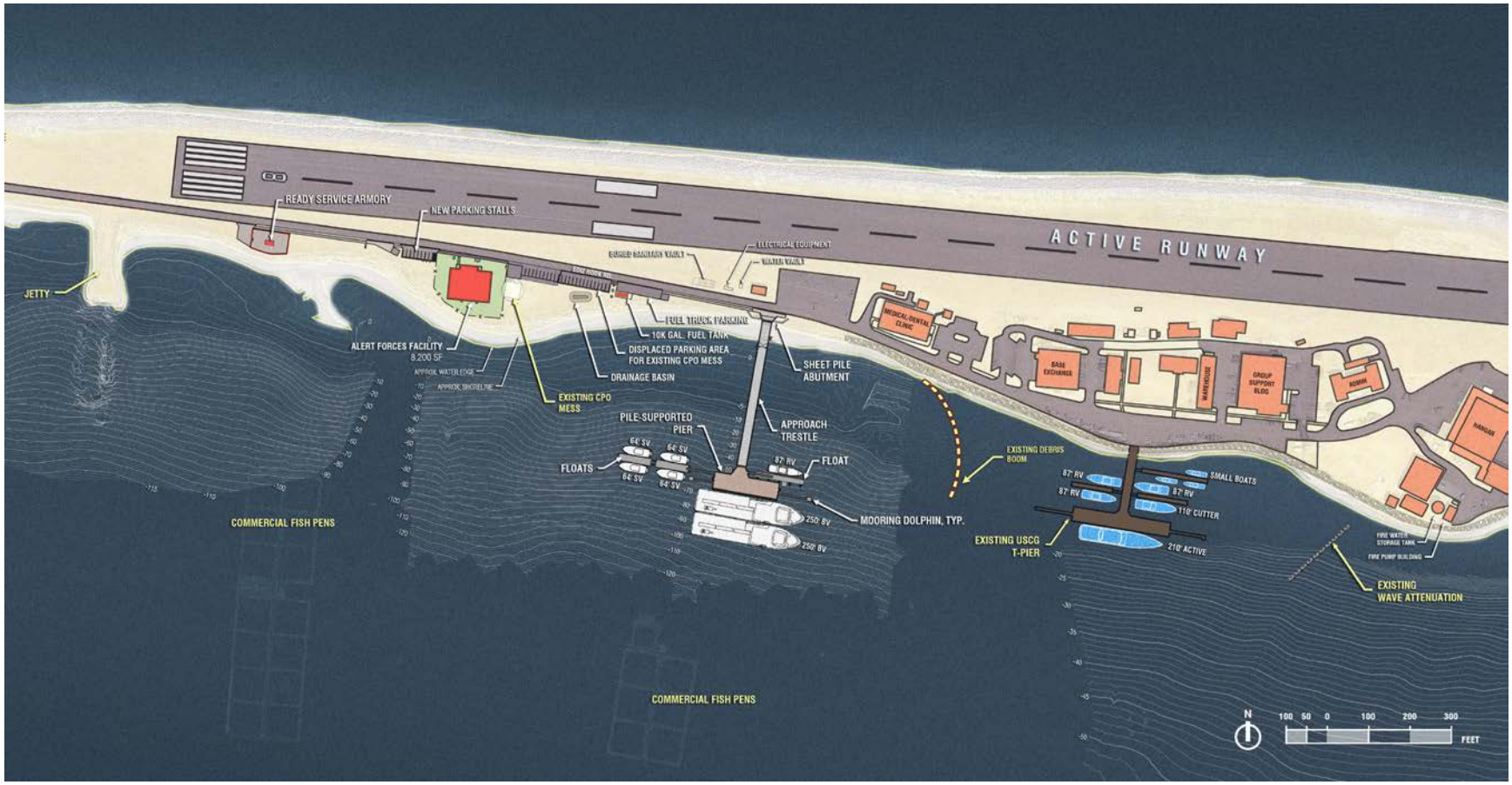

Figure 1-3: Project Site and Proposed Project Features

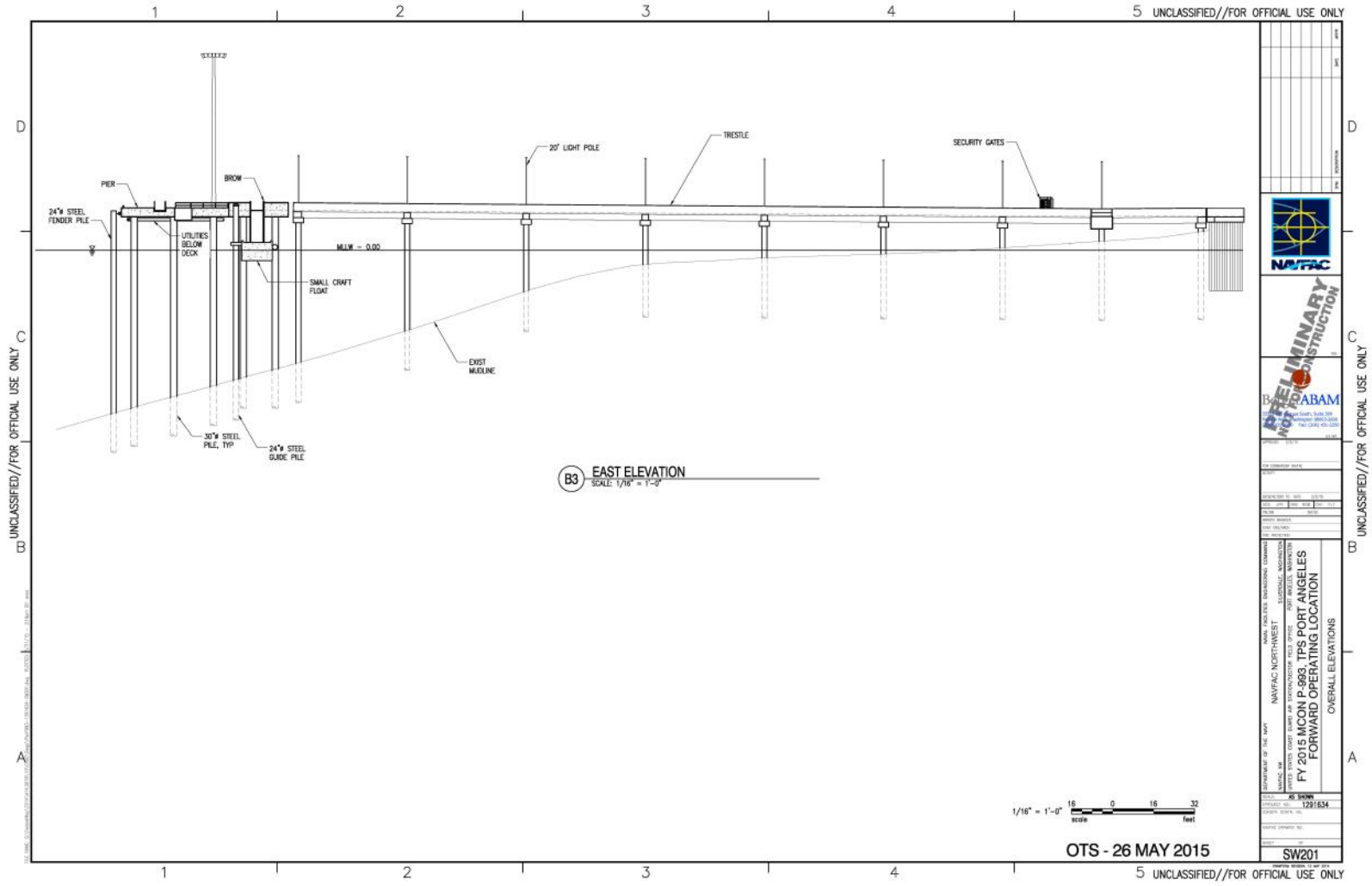

Figure 1-4: Trestle and Fixed Pier Section

1.3 Trestle Installation

The trestle would be installed at the end of the approach roadway. The trestle would provide vehicle and pedestrian access to the pier and convey utilities to the pier. The trestle would be approximately 355 feet long (108 m) long and 24 feet (7 m) wide and constructed of precast concrete. The trestle would be designed to support a 50 pound per square foot (psf) (244 kilograms [kg] per square m) live load or a utility trailer with a total load of 3,000 pounds (1,360 kg). The trestle would be supported by 36 steel piles and result in 10,060 ft^2 (935 m^2) of permanent overwater coverage.

1.4 Fixed Pier and Floating Docks

The fixed pier would have full hotel services at each of the six berths including power, potable water, fire protection, sewage connections, ship overboard drainage collection, fueling connections, and telephone and Local Area Network (LAN) service. The fixed pier and floating docks (also called floats) would also be equipped with lighting, mooring, fendering, brows (gangways), corrosion protection systems, access control, and stormwater protection systems. Anticipated vessel mooring would accommodate up to seven TPS vessels: two 250-ft (76-m) Blocking Vessels (BV), one 87-ft (26-m) Reaction Vessel (RV), and up to four 64-ft (19-m) Screening Vessels (SV-64)(see Figure 1-3). The fixed pier would be constructed of precast concrete and be approximately 160 feet long and 42 feet wide (49 m by 13 m). The fixed pier would have two mooring dolphins that connect to the fixed pier via a catwalk. The fixed pier (including dolphins and walkways) would be supported by 87 steel piles and result in 10,025 ft^2 (931 m^2) of permanent overwater coverage. The floating docks including brows would be supported by 21 steel piles and result in 5,380 ft^2 (500 m^2) of permanent overwater coverage.

1.5 Pile Installation and Removal

Pile driving would be necessary for the installation of production piles to support the trestle, fixed pier, and floating docks. Vibratory pile driving is the preferred method for production piles and would be the initial starting point for each installation; however, impact pile driving methods may be necessary based on substrate conditions. Vibratory methods would be implemented during the removal of piles. Vibratory pile driving/removal involves hydraulic-powered weights to vibrate a pile until the surrounding sediment liquefies, enabling the weight of the pile plus the pile driver to push the pile into the ground. Once a pile hits “refusal,” which is where hard solid or dense substrate (e.g., gravel, boulders) prevents further pile movement by vibratory methods, impact pile driving is used to drive the pile to depth. Impact hammer pile driving uses a rising and falling piston to repeatedly strike a pile and drive it into the ground. The number of strikes would vary, depending on the substrate at each pile location and the pile size. Pile installation would include the installation and removal of 80 temporary indicator piles,

installation of 60 permanent sheet piles, and installation of 144 permanent steel piles (Table 1-1). The duration of pile installation is described in Section 2, *Dates, Duration, and Region of Activities*.

Table 1-1: Summary of Pile Installation

Structure	Pile Number (#) and Size
Indicator Temporary	• (80) 24-inch Steel Piles
Sheet Pile Wall	• (60) PZC13 Steel Sheet Piles
Trestle	• (16) 18-inch Steel Piles • (12) 24-inch Steel Piles • (8) 36-inch Steel Piles
Fixed Pier Piles	• (28) 24-inch Steel Piles • (49) 30-inch Steel Piles • (10) 36-inch Steel Piles
Floating Docks	• (3) 24-inch Steel Piles • (6) 30-inch Steel Piles • (12) 36-inch Steel Piles

Temporary Indicator Piles

The indicator piles are required to determine if required bearing capacities will be achieved with the production piles, and to assess whether the correct vibratory and impact hammers are being used. The process will be to vibrate the piles to within 5 ft (1.5 m) of the target embedment depth required for the project, let the piles rest in place for a day, and then impact drive the piles the final 5 ft (1.5 m). If the indicator piles cannot be successfully vibrated in, then a larger hammer will be used for the production piles. The impact driving will also provide an indication of bearing capacity via proofing. Each indicator pile would then be vibratory extracted (removed) using a vibratory hammer.

Sheet Pile Wall

The approach roadway and trestle abutment require a sheet pile wall. All sheet piles would be driven starting with a vibratory hammer to set the sheets but may require an impact hammer to complete driving. The installation of the sheet pile wall would occur in uplands and is not described further in this IHA.

Trestle, Fixed Pier, and Floating Dock Piles

Because each project structure would use a combination of different-sized piles (Table 1-1), the loudest pile was used in this IHA Application to estimate disturbance to and behavioral

harassment of marine mammals. Overall, the number of piles installed per day could range from one to eight. The number of proofing strikes per day could be as many as 1,600, and impact strikes per day could be up to 7,000. Each pile could take between 60 and 90 minutes to install.

1.6 Best Management Practices and Mitigation and Minimization Measures

The project includes best management practices (BMPs) for construction and other measures that will be implemented to minimize or avoid potential environmental impacts. Section 11, *Means of Effecting the Least Practicable Adverse Impacts*, presents the measures to be implemented to reduce or avoid environmental impacts from the project implementation. Additional measures have been added specifically to protect marine mammals and species listed under the Endangered Species Act (ESA). These measures include the use of vibratory installation for piles where possible, implementation of noise attenuation devices, and marine mammal monitoring as described in Section 11 of this application.

BMPs and mitigation measures are included in the construction contract plans and specifications for individual projects 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 or mitigation and minimization measures constitutes a contract violation.

2 Dates, Duration, and Region of Activities

The dates and duration of such activity and the specific geographical region where it will occur.

2.1 Dates of Activities

In-water construction would observe the in-water work window (July 16 through February 15) for Tidal Reference Area 10 (Washington Administrative Code [WAC] 220-110-240), which includes waters of the Strait of Juan de Fuca and associated bays and inlets, including Port Angeles Harbor, as designated by the Washington Department of Fish and Wildlife (WDFW), to minimize impacts on salmon (*Oncorhynchus* spp.) and bull trout (*Salvelinus confluentus*). In-water construction is anticipated to begin in 2016 and require two in-water work window seasons. Because of the in-water work window constraint and the fact that an IHA only covers a 1-year period, pile driving and removal activities could occur from November 1, 2016 to February 15, 2017, and then begin again on July 16, 2017 and end by October 31, 2017. Overall, a maximum of 75 days of pile driving and removal are anticipated within these two in-water work windows. The 75 days are needed to install piles for the trestle, fixed pier, and floating dock, as well as the installation and removal of the indicator piles described in Section 1.5, *Pile Installation and Removal*. All in-water construction would occur during daylight hours, but a construction equipment barge would likely be lit with industrial lighting during non-daylight hours for safety.

2.2 Duration of Activities

Project construction (both upland and in-water construction) is expected to take about 18 months, and the estimated duration of in-water work and pile driving and removal is expected to be 75 days over the course of 18 weeks (Table 2-1).

Table 2-1: Summary of Duration of Activities

Activity	Duration
Total Construction Period	18 Months
Over-Water Construction	60 Weeks
In-Water Construction	18 Weeks
Number of In-Water Work Windows	2 In-Water Work Windows
Pile Installation	75 Days, 18 Weeks
Piles Installed Per Day	1–8 Piles Per Day
Maximum Proofing Strikes Per Day	1,600 Strikes
Maximum Impact Strikes Per Day	7,000 Strikes

2.3 Region of Activity

The project activity area (region of activity) is located in Port Angeles Harbor, a deep water harbor that is used by vessels travelling between the Strait of Juan de Fuca and the Port of Port Angeles, Ediz Hook peninsula, and the USCG AIRSTA/SFO Port Angeles (Figures 1-1 and 1-2).

Numerous vessel types (e.g., including tankers, dry bulk cargo vessels, barges, leisure vessels, ferries, passenger-carrying vessels, fishing boats, Puget Sound Pilots vessels, USCG vessels, and Navy vessels) call on or reside in the port, on Ediz Hook peninsula, or at the USCG AIRSTA/SFO Port Angeles.

The water current patterns within Port Angeles Harbor are driven by the tidal flow in the Strait of Juan de Fuca (Ebbesmeyer et al. 1979; DOI 1967; NewFields 2012). During flood-tide, a large eddy is established between Dungeness Spit and Ediz Hook that extends a short way into the harbor and circulates water in a clockwise direction (Ebbesmeyer et al. 1979; Yang et al. 2003). The direction of the eddy is driven by water moving along the northern edge of the harbor during flood tides and along the southern edge of the harbor during ebb tides (DOI 1967). The eddy circulates at a slower rate than the flows outside the harbor and is constrained by the size of the harbor itself. Surface currents within the harbor are generally slow (less than 0.885 ft/second [27 cm/second]) with long periods of slack water, especially in the northern and western portions of the harbor (DOI 1967). The trestle would be installed between +7 ft (2 m) mean lower low water (MLLW) and -45 ft (-14 m) MLLW. The fixed pier would be placed between -40 ft (-12 m) and -63 ft (19 m) MLLW.

3 Marine Mammal Species and Numbers

The species and numbers of marine mammals likely to be found within the activity area.

Eleven marine mammal species managed by NMFS have a reasonable potential to occur within the Strait of Juan de Fuca in the vicinity of the project site. A "reasonable potential" is defined as species with any regular occurrence in the Strait of Juan de Fuca since 1995.

Although the humpback whale (*Megaptera novaeangliae*), minke whale (*Balaenoptera acutorostrata*), gray whale (*Eschrichtius robustus*), southern resident killer whale (*Orcinus orca*), transient killer whale (*Orcinus orca*), Dall's porpoise (*Phocoenoides dalli*), and Pacific white-sided dolphin (*Lagenorhynchus obliquidens*) occur in the Strait of Juan de Fuca, these marine mammals species are an extremely rare occurrence in Port Angeles Harbor. Characteristics of Port Angeles Harbor that inhibit or deter use by these marine mammals include the semi-enclosed embayment with no through access and high volume of vessel traffic that include tankers, dry bulk cargo carriers, barges, tugs, fishing boats, leisure craft, Puget Sound Pilots craft, and ferry service, as well as USCG and Navy vessels. The larger sized whales are highly visible and more likely to be detected outside of the behavioral harassment zones (see Section 6.3.1 *Underwater Sound Propagation*) by marine mammal observers (protected species observers [PSOs]); therefore, exposure would be avoided and behavioral harassment would not occur.

The Pacific white-sided dolphin prefers deepwater areas and typically avoids nearshore embayments such as Port Angeles Harbor. In addition, these dolphins exhibit fidelity to foraging areas, and there are no known foraging areas within the behavioral harassment zones. The Navy funded marine mammal aerial surveys in the inland Puget Sound Waters of Washington (Smultea et al. 2015a), and in the Strait of Juan de Fuca and San Juan Islands of Washington (Smultea et al. 2015b). Although these surveys did not focus on the activity area, flights over the Strait of Juan de Fuca in July 2014 and September 2014 resulted in no observations of Pacific white-sided dolphin (Smultea et al. 2015a, 2015b). The Navy Marine Species Density Database (NMSDD) estimate of Pacific white-sided dolphins occurring within the Strait of Juan de Fuca and the San Juan Islands is 0.00248 animals/km^2 (U.S. Department of the Navy 2015a) and would be the best estimate for the activity area for this project. However, because of the lack of preferred habitat in the activity area, no known foraging in the activity area, aerial surveys that resulted in no observations, and the NMSDD estimate for Pacific white-sided dolphins being extremely low, the Pacific white-sided dolphin is not expected to occur in the activity area.

Dall's porpoise prefers deepwater areas and typically avoids nearshore embayments such as Port Angeles Harbor. Dall's porpoise also exhibits fidelity to foraging areas, and there are no known foraging areas within the behavioral harassment zones. The Navy funded marine mammals aerial survey in the inland Puget Sound Waters of Washington (Smultea et al. 2015a), and in the Strait of Juan de Fuca and San Juan Islands of Washington (Smultea et al. 2015b). Although these surveys did not focus on the activity area, there were opportunistic flights over the Strait of Juan de Fuca in July 2014 and September 2014, which resulted in no observations of Dall's porpoise (Smultea et al. 2015a, 2015b). The NMSDD information (U.S. Department of the Navy 2015a) is based on a rough estimate of abundance for other cetacean species sighted during the surveys; data from the 2002–2003 surveys were prorated relative to harbor porpoise (ManTech-SRS 2007 as cited in U.S. Department of the Navy 2015a). The number of Dall's porpoise sightings from these surveys was sufficient to derive separate density estimates for the eastern portion of the Strait of Juan de Fuca and San Juan Islands region (0.39 animals/km^2), as well as for the western portion of the Strait of Juan de Fuca (0.55 animals/km^2) (U.S. Department of the Navy 2015a). Because of the lack of preferred habitat in the activity area, there is no known foraging area, and aerial surveys that resulted in no observations, the Dall's porpoise is not expected to occur in the activity area.

The following marine mammal species have a reasonable potential to occur in the Port Angeles Harbor and the activity area: harbor porpoise, Steller sea lion, California sea lion, northern elephant seal, and harbor seal. Stock abundance, ESA status, MMPA status, and occurrence in Port Angeles Harbor of these species are listed in Table 3–1. Section 3.1 provides a description of each of the species and its population abundance. Section 4, *Status and Distribution of Marine Mammal Species or Stocks Potentially Affected*, contains life history information for each species.

Table 3-1: Marine Mammals with a Reasonable Potential to be Present

Species and Stock	Stock Abundance[1]	ESA Status	MMPA Status	Occurrence in Port Angeles Harbor
Harbor Porpoise (*Phocoena phocoena*) Washington Inland Waters	10,682[2] (CV=0.38)	None	Non-depleted	Rare
Steller Sea Lion (*Eumetopias jubatus*) Eastern DPS	63,160–78,198[2] (No CV values)	None	Strategic/Depleted	Seasonal fall and winter
California Sea Lion (*Zalophus californianus*) United States	296,750[3] (No CV values)	None	Non-depleted	Likely
Northern Elephant Seal (*Mirounga angustirostris*) California Breeding	179,000[3] (No CV values)	None	Non-depleted	Rare
Harbor Seal (*Phoca vitulina*) Washington Northern Inland Waters	11,036[4] (CV=0.15)	None	Non-depleted	Likely

Sources:
[1] NMFS marine mammal stock assessment reports at: http://www.nmfs.noaa.gov/pr/sars/species.htm, accessed Jan. 30, 2015 (NMFS 2015b).
[2] Carretta et al. SAR 2011 as presented in Carretta et al. SAR 2014 Draft.
[3] Carretta et al. SAR 2014 Draft.
[4] Jeffries et al. 2003 as presented in Carretta et al. SAR 2014 Draft.
ESA = Endangered Species Act; MMPA = Marine Mammal Protection Act; CV = coefficient of variation; DPS = Distinct Population Segment.
Non-depleted = species or population stock is at or above its optimum sustainable population.
Depleted = species or population stock is below its optimum sustainable population.
Strategic = is declining and is likely to be listed as a threatened species under ESA in the foreseeable future or designated as depleted under the MMPA.
Rare: The distribution of the species is near enough to the area that the species could occur there, or there are a few confirmed sightings.
Seasonal: Confirmed and regular sightings of the species in the area on a seasonal basis.
Likely: Confirmed and regular sightings of the species in the area year-round.

3.1 Estimates of On-Site Abundance

Prior Navy marine mammal IHA applications in inland marine waters of northern Washington relied on density estimates for some or all species exposure estimates. Analyses based on species density assume that marine mammals are uniformly distributed within a given area at any given point in time. This assumption is not true for Port Angeles Harbor, where marine mammal occurrence is not distributed as it would be in the Strait of Juan de Fuca because many of the species are not resident, but occasionally or seasonally transit through portions of the Strait of Juan de Fuca. Additionally, most species are not distributed evenly but occur clumped in groups. Distribution of individuals or groups does not occur uniformly in space but is biased by areas of greater importance, such as areas of high prey abundance, haul-out sites, or areas with lower predation risk. For example, density estimates near haul-outs or foraging locations

would be expected to be a function of the distance from the attracting haul-out and the number of animals utilizing the haul-out or foraging location.

To characterize potential species occurrence for this IHA Application, the Navy utilized available density information; recent research; and survey information conducted on site, in the Strait of Juan de Fuca, and in inland marine waters of northern Washington in the activity area. The Navy also discussed species occurrence with local species experts and reviewed incidental sighting reports from the Orca Network for verified or reasonably verified species presence, as well as information on seasonal, intermittent, or unusual species occurrences. For Port Angeles Harbor, only harbor seal survey data from WDFW were available and limited to one-time counts in 2010 and 2013.

Based on a review of this information, the Navy separated species into three groups to predict numbers potentially present at the project site during the in-water work period:

1. Species with rare occurrence in all or part of the Strait of Juan de Fuca.
2. Species with likely or seasonal occurrence but no site-specific occurrence data.
3. Species with likely occurrence and site-specific occurrence data.

In the case of species with rare occurrence (i.e., the distribution of the species is near enough to the area that the species could occur, or there are a few confirmed sightings in all or part of the Strait of Juan de Fuca), the Navy reviewed historical temporal and spatial distribution data to predict the potential numbers of animals present during the in-water work period

Therefore, a methodology that assumes at any point in time animals are present or uniformly distributed, either in time or space, would have little chance of predicting actual occurrence. Therefore, for these types of species, a historical temporal and spatial distribution was used to estimate potential occurrence during the in-water work window.

Where species have likely or seasonal occurrence with confirmed and regular sightings of the species in the area on a seasonal basis or year-round, but no site-specific species occurrence data, this application assumes that individuals are relatively uniformly distributed and uses NMSDD densities within the in-water work period to estimate the number of individuals potentially present. The methods and assumptions used to derive these estimates are described in the Draft 3rd and 7th Fleet NMSDD, Naval Facilities Engineering Command (NAVFAC) Pacific Technical Report (U.S. Department of the Navy 2015a).

A reasonable assessment of marine mammal abundance based on site-specific data was used for one species, the harbor seal. These data were used as a predictor of abundance during the in-water work period.

3.2 Species Stock Abundance

3.2.1 Harbor Porpoise

Aerial surveys of inland waters of Washington and southern British Columbia were conducted during August of 2002 and 2003 (J. Laake, unpublished data as cited in Carretta et al. 2013). These aerial surveys included the Strait of Juan de Fuca, the San Juan Islands, the Gulf Islands, and the Strait of Georgia. These areas include waters inhabited by the Washington Inland Waters stock of harbor porpoise, as well as harbor porpoises from British Columbia. An average of the 2002 and 2003 estimates of abundance in U.S. waters resulted in an uncorrected abundance of 3,123 (CV=0.10) harbor porpoises in Washington inland waters (J. Laake, unpublished data as cited in Carretta et al. 2013). When corrected for availability and perception bias, using a correction factor of 3.42 (1/g(0); g(0)=0.292, CV=0.366) (Laake et al. 1997, as cited in Carretta et al. 2013), the estimated abundance for the Washington Inland Waters stock of harbor porpoise in 2002/2003 is 10,682 (CV=0.38) animals (J. Laake, unpublished data as cited in Carretta et al. 2013). However, the most recent abundance estimate is greater than 8 years old, and no more recent current estimate of abundance is available (Carretta et al. 2013).

3.2.2 Steller Sea Lion

Steller sea lions comprise two recognized management stocks (eastern and western). The eastern stock is potentially present near the project site, and the western stock occurs outside of the geographic area considered in this application. The eastern stock of the Steller sea lion was estimated by NMFS in the 2008 Recovery Plan for the Steller Sea Lion to number between 45,000 and 51,000 animals (NMFS 2008). Calkins and Pitcher (1982) and Pitcher et al. (2007) concluded that the total Steller sea lion population abundance could be estimated by multiplying pup counts by a factor based on the birth rate, sex and age structure, and growth rate of the population. Using pup multipliers of either 4.2 or 5.2 (Pitcher et al. 2007), the current population estimated in the 2013 Stock Assessment Report (SAR) (Carretta et al. 2014) is within the range of 63,160 (15,038 × 4.2) to 78,198 (15,038 × 5.2) (Allen and Angliss 2013). The best available information indicates that the eastern stock of Steller sea lion increased at a rate of 4.18 percent per year (90 percent confidence bounds of 3.71–4.62 percent per year) between 1979 and 2010 based on an analysis of pup counts in California, Oregon, British Columbia, and Southeast Alaska (NMFS 2012).

3.2.3 California Sea Lion

The current population estimate for the U.S. stock of California sea lions is 296,750 (Carretta et al. 2011 SAR as presented in Carretta et al. 2014). The entire population cannot be counted

because all age and sex classes are not ashore at the same time when field surveys are conducted. In lieu of counting all sea lions, pups are counted during the breeding season (because this is the only age class that is ashore in its entirety), and the number of births is estimated from the pup count. The size of the population is then estimated from the number of births and the proportion of pups in the population (Carretta et al. 2011 SAR as presented in Carretta et al. 2013). The population trend between 1979 and 2008 has been increasing (Carretta et al. 2011 SAR as presented in Carretta et al. 2013).

3.2.4 Northern Elephant Seal

Northern elephant seals present in the activity area are considered part of the California breeding stock. A complete population count of elephant seals is not possible because all age classes are not ashore at the same time. Instead, pups are counted during the breeding season (because this is the only age class that is ashore in its entirety), and the number of births is estimated from the pup count. The size of the population is then estimated from the number of births and the proportion of pups in the population. Based on counts of elephant seals at U.S. rookeries in 2010, Lowry et al. (2014) reported that 40,684 pups were born. Lowry et al. (2014) applied a multiplier of 4.4 to extrapolate from total pup counts to a population estimate of approximately 179,000 elephant seals in the California breeding stock. The population is reported to have grown at 3.8 percent annually since 1988 (Lowry et al. 2014).

3.2.5 Harbor Seal

Harbor seals are the most numerous pinniped in the inland marine waters of northern Washington. Aerial surveys of harbor seals in Washington inland waters were conducted during the pupping season in 1999, during which time the total numbers of hauled-out seals (including pups) were counted. In 1999, the mean count of harbor seals in Washington's inland waters was 7,213 (CV=0.14) animals. Data from coastal and inland sites were not significantly different and were thus pooled, resulting in a correction factor of 1.53 (CV=0.065) to account for animals in the water, which are missed during the aerial surveys (Huber et al. 2001). Using this correction factor results in a population estimate of 11,036 (7,213 x 1.53; CV=0.15) for the Washington Northern Inland Waters stock (Carretta et al. 2014).

Between 1983 and 1996, the annual rate of increase for this stock was 6 percent (Jeffries et al. 1997). The peak count occurred in 1996 and, based on population modeling a fitted generalized logistic model, the population is thought to be stable (Jeffries et al. 2003). In the absence of recent abundance estimates, the current population trend is unknown.

4 Status and Distribution of Marine Mammal Species or Stocks Potentially Affected

A description of the status, distribution, and seasonal distribution (when applicable) of the affected species or stocks of marine mammals likely to be affected by such activities.

Marine mammal species under NMFS' jurisdiction that potentially occur in the activity area and may be affected by the project belong to two taxonomic groups: cetaceans (odontocetes [toothed whales, porpoises and dolphins]) and pinnipeds (seals and sea lions). Harbor seals are the most common marine mammal in the activity area. This section includes information on each species' stock status and management, distribution (including seasonal information if available), and site-specific occurrence. Some of these sections contain direct excerpts from the most current stock assessment reports developed by NMFS.

4.1 Harbor Porpoise

4.1.1 Status and Management

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

4.1.2 Distribution

In Washington inland waters, harbor porpoise are known to occur in the Strait of Juan de Fuca and the San Juan Island area year round (Calambokidis and Baird 1994; Osmek et al. 1998; Carretta et al. 2012). In the Strait of Juan de Fuca, harbor porpoise are seasonally localized in relatively small areas during the reproductive season (April–October). More densely localized aggregations and increased seasonal densities have been reported in the Strait of Juan de Fuca, near Victoria (Hall et al. 2002). A photo-identification study in the San Juan Islands also provides evidence for local, discrete subpopulations (Flaherty and Stark 1982) with a high degree of site fidelity (Hall 2009). Harbor porpoise tend to occupy an ecological niche consisting of relatively shallow water, generally less than 650 ft (200 m) deep (Hall 1996; Lockyer et al. 2001; Hall 2004).

4.1.3 Site-Specific Occurrence

No site-specific information is available for Port Angeles Harbor. As shallow water predators, they feed upon a variety of cephalopods and fish, such as market squid (*Loligo opalescens*),

Pacific herring (*Clupea pallasi*), sand lance (*Ammodytes hexapterus*), and Pacific hake (*Merluccius productus*) (Walker et al. 1998; Hall 2004). Harbor porpoise could forage within Port Angeles Harbor, following local prey availability, but because of the strong site fidelity and lack of sightings in the harbor, use of the activity area would be rare.

4.2 Steller Sea Lion

4.2.1 Status and Management

In the North Pacific, NMFS has designated two Steller sea lion stocks: (1) the western stock, consisting of populations at and west of Cape Suckling, Alaska (144°W degrees W longitude); and (2) the eastern stock, consisting of populations east of Cape Suckling, Alaska. The western stock is listed as depleted under the MMPA and endangered under the ESA. Although there is evidence of mixing between the two stocks (Jemison et al. 2013), animals from the western stock are not present in inland waters of Washington. Individuals that occur in inland waters of Washington are of the eastern stock (Allen and Angliss 2013). The eastern stock was recently (April 2012) removed from listing under the ESA because it was stable or increasing throughout the northern portion of its range (Southeast Alaska and British Columbia) and stable or increasing slowly in the central portion of its range (Oregon through northern California) (77 Federal Register [FR] 23209; NMFS 2012).

4.2.2 Distribution

The eastern Steller sea lion stock is found along the coasts of southeast Alaska to northern California where they occur at rookeries and numerous haul-out locations along the coastline (Jeffries et al. 2000; Scordino 2006; NMFS 2012). Along the northern Washington coast, up to 25 pups are born annually (Jeffries 2013). 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 haul-out sites primarily along the outer coast from the Columbia River to Cape Flattery (Jeffries et al. 2000). Smaller numbers use the Strait of Juan de Fuca (Wiles 2015). The numbers of sea lions vary seasonally in Washington, with peak numbers present during the fall and winter months and lower counts in the summer months that corresponds to the breeding season at coastal rookeries (approximately late May to early June) (Jeffries et al. 2000).

4.2.3 Site-Specific Occurrence

There are no known Steller sea lions haul-outs in Port Angeles Harbor (WDFW 2015). The nearest haul-out to the project site is approximately 12.5 miles (20 kilometers [km]) across the Strait of Juan de Fuca at Race Rocks and identified to have an annual maximum number of greater than 100 animals (Wiles 2015). Animal censuses at the Race Rocks Ecological Reserve between January 2014 and January 2016 indicated a peak abundance in September to December, with numbers that ranged from 200 to 500 individuals (Race Rocks Ecological Reserve website 2016). The Steller sea lions at Race Rocks are mainly bachelor bulls or juvenile yearlings. This is not a breeding colony, and mature females are not usually present (Race Rocks Ecological Reserve website 2016). In contrast, a haul-out about 30 miles (48 km) east of the project at Point Wilson was surveyed in November 2013 with one Steller sea lion (WDFW 2015). Steller sea lions could forage within Port Angeles Harbor, following local prey availability, but because haul-outs are far away, use of the area is likely limited.

4.3 California Sea Lion

4.3.1 Status and Management

California sea lions are protected under the MMPA and are not listed under the ESA. NMFS has defined one stock for California sea lions (U.S. stock), with five genetically distinct geographic populations: (1) Pacific Temperate, (2) Pacific Subtropical, (3) Southern Gulf of California, (4) Central Gulf of California, and (5) Northern Gulf of California. The Pacific Temperate population includes rookeries within U.S. waters and the Coronados Islands just south of the U.S./Mexico border. Animals from the Pacific Temperate population range north into Canadian waters, and movement of animals between U.S. waters and Baja California waters has been documented (Carretta et al. 2013).

4.3.2 Distribution

During the summer, California sea lions breed on islands from the Gulf of California to the Channel Islands and seldom travel more than about 31 miles (50 km) from the islands. The primary rookeries are located on the California Channel Islands of San Miguel, San Nicolas, Santa Barbara, and San Clemente, probably in response to changes in prey availability. In the nonbreeding season, adult and subadult males migrate north along the coast to central and northern California, Oregon, Washington, and Vancouver Island, and return south in the spring.

Their distribution shifts to the northwest in fall and to the southeast during winter and spring. California sea lions are occasionally sighted hundreds of miles offshore. The animals found in northwest waters are typically males; most adult females with pups remain in waters near their breeding rookeries off the coasts of California and Mexico. Females and juveniles tend to stay

closer to the rookeries. California sea lions also enter bays, harbors, and river mouths and often haul out on man-made structures such as piers, jetties, offshore buoys, and oil platforms.

4.3.3 Site-Specific Occurrence

Dedicated, regular haul-outs used by adult and subadult California sea lions in Washington inland waters have been identified (Jeffries et al. 2000). There are no known California sea lion haul-outs in Port Angeles Harbor (WDFW 2015). The nearest haul-out is about 40 miles (64 km) east of the project site near Admiralty Inlet (Jeffries et al. 2000). California sea lions are typically present between August and June in Washington inland waters, with peak abundance numbers occurring between October and May (NMFS 1997; Jeffries et al. 2000). California sea lions could forage within Port Angeles Harbor, following local prey availability, but because haul-outs are far away, use of the activity area is likely limited. During the summer months and associated breeding periods, the inland waters would not be considered a high-use area by California sea lions, because they would be returning to rookeries in California waters. However, surveys at Navy facilities, primarily located in Hood Canal, indicate that a few individuals are present through mid-June to July, with some arrivals in August and in some cases individuals present year round (U.S. Department of the Navy 2015a). The limited number of California sea lions observed during these surveys suggests that a few individual animals could be moving through the Strait Juan de Fuca and may use the activity area before heading to established haul-out sites to the east within the inland waters of Puget Sound.

4.4 Northern Elephant Seal

4.4.1 Status and Management

Northern elephant seals are protected under the MMPA and are not listed under the ESA. Northern elephant seals are the largest pinniped found in Northwest waters (Jeffries et al. 2000). Individuals that may occur in the activity area belong to the California Breeding stock.

4.4.2 Distribution

The northern elephant seal occurs almost exclusively in the eastern and central North Pacific. Rookeries are located from central Baja California, Mexico, to northern California (Stewart and Huber 1993). Adult elephant seals engage in two long migrations per year, one following the breeding season, and another following the annual molt (Stewart and DeLong 1995; Robinson et al. 2012). Between the two foraging periods, they return to land to molt, with females returning earlier than males (March through April versus July through August). After the molt, adults return to their northern feeding areas until the next winter breeding season. Breeding occurs from December to March (Stewart and Huber 1993). Juvenile elephant seals typically leave the rookeries in April or May and head north, traveling an average of 559 to 621 miles

(900 to 1,000 km). Most elephant seals return to their natal rookeries when they start breeding (Huber et al. 1991). Their foraging range extends thousands of miles offshore into the central North Pacific. Adults tend to stay offshore, but juveniles and subadults are often seen along the coasts of Oregon, Washington, and British Columbia (Condit and Le Boeuf 1984; Stewart and Huber 1993).

4.4.3 Site-Specific Occurrence

Small numbers of juvenile elephant seals haul out and go through their molting process in Washington State. Molting is a natural condition that takes 4 to 5 weeks to complete. In Washington inland waters, there are regular haul-out sites at Smith and Minor Islands, Dungeness Spit, and Protection Island in the Strait of Juan de Fuca that are thought to be used year round (Jeffries et al. 2000). Juvenile elephant seals haul out along the shoreline for several weeks, occasionally entering the water and returning to the same area again. Hauling out allows the skin to warm up and help speed up the molting process. WDFW surveys in 2013 reported two haul-out sites with two individuals present (WDFW 2015). The closest documented haul-out is at Dungeness Spit, 11 miles (18 km) east of the project where one elephant seal was reported last reported in 2006 (WDFW 2015). Northern elephant seals are not expected to occur within Port Angeles Harbor because there are no known haul-outs and they typically use the same sites repeatedly; however, it is possible a juvenile could haul out near the project site and once on shore would likely stay for the duration of the project. In addition, elephant seals could forage within Port Angeles Harbor, following local prey availability.

4.5 Harbor Seal

4.5.1 Status and Management

Harbor seals are not listed as depleted under the MMPA, nor are they listed under the ESA. Three stocks occur in Washington's inland waters: Hood Canal, Northern Inland Waters, and Southern Puget Sound stocks. Harbor seals occurring in the activity area belong to the Washington Northern Inland Waters stock. Radiotelemetry studies indicate that interchange between inland and coastal stocks is unlikely (Jeffries et al. 2003).

4.5.2 Distribution

Harbor seals are the most common, widely distributed marine mammal in Washington marine waters and are frequently observed in the nearshore marine environment. They occur year-round and breed in Washington. Harbor seals are a coastal species, rarely found more than 12 miles (19 km) from shore, and frequently occupy bays, estuaries, and inlets (Baird 2001). Individual seals have been observed several miles upstream in coastal rivers (Baird 2001).

Ideal harbor seal habitat includes haul-out sites, shelter during the breeding periods, and sufficient food (Bjørge 2002). Haul-out areas can include intertidal and subtidal rock outcrops, sandbars, sandy beaches, peat banks in salt marshes, and man-made structures such as log booms, docks, and recreational floats (Wilson 1978; Prescott 1982; Schneider and Payne 1983; Gilbert and Guldager 1998; Jeffries et al. 2000; Lambourn et al. 2010). Numerous harbor seal haul-outs occur in Washington inland waters (Jeffries et al. 2000). Numbers of individuals at haul-outs range from a few to between 100 and 500 individuals (Jeffries et al. 2000). Harbor seals do not make extensive pelagic migrations, although some long distance movements of tagged animals in Alaska (108 miles [174 km]) and along the U.S. west coast (up to 342 miles [550 km]) have been recorded (Brown and Mate 1983; Womble and Gende 2013). Harbor seals have also displayed strong fidelity to haul-out sites.

4.5.3 Site-Specific Occurrence

Harbor seals occur year round throughout the nearshore inland waters of Washington. Harbor seals are expected to occur year round in Port Angeles Harbor, with a nearby haul-out site on a log boom located approximately 1.7 miles (2.7 km) west of the project site that was last surveyed in March 2013 and had a total count of 73 harbor seals (WDFW 2015). Another haul-out site is 1.3 miles (2.1 km) south of the project but is across the harbor that was last surveyed in July 2010 and had a total count of 87 harbor seals (WDFW 2015). The level of use of these haul-outs during the fall and winter is unknown, but is expected to be much less as air temperatures become colder than water temperatures, resulting in seals in general hauling out less (Pauli and Terhune 1987). Harbor seals may also use other undocumented haul-out sites near the project site.

5 Harassment Authorization Requested

The type of incidental taking authorization that is being requested (i.e., takes by harassment only, takes by harassment, injury, and/or death), and the method of incidental taking.

5.1 Take Authorization Request

Under Section 101 (a)(5)(D) of the MMPA, the Navy requests an IHA for Level B incidental take (behavioral harassment) of marine mammals during construction of the Pier and Support Facilities for TPS project at USCG AIRSTA/SFO located in Port Angeles, Washington, as described in this application. All work would occur within the Port Angeles Harbor as described previously. The Navy requests an IHA for a period of 1 year: November 1, 2016 to October 31, 2017.

Except with respect to certain activities not pertinent here, the MMPA defines ‘‘harassment’’ as: any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild [Level A harassment]; or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering but that does not have the potential to injure a marine mammal [Level B harassment] (50 CFR, Part 216, Subpart A, Section 216.3-Definitions).

5.2 Method of Incidental Taking

This IHA Application considers noise from pile installation and removal activities as outlined in Section 1, *Description of Activities*, that has the potential to disturb or displace marine mammals or produce a temporary shift in their hearing ability (temporary threshold shift [TTS] described in Section 6, *Numbers and Species Exposed*) resulting in Level B harassment as defined above. The project is not anticipated to affect the prey base or significantly affect other habitat features of marine mammals that would meet the definition of take.

The analysis in Section 6 estimates the number of marine mammals that would be potentially exposed to levels of sound that may result in Level B harassment. This was accomplished by mathematically estimating the number of marine mammals that may be exposed to levels of sound from vibratory pile removal (only for temporary indicator piles) and vibratory and impact pile driving that could result in behavioral disruption or a temporary shift in hearing by Level B harassment under the MMPA. The Navy’s modeling approach likely results in an overestimation of Level B exposures because assumptions made throughout the species quantification and sound attenuation modeling process, in most cases, give deference to the species (e.g., the highest density or number of animals seen within the in-water work window for each marine mammal species is applied over the entire in-water work window regardless of the seasonal

distribution of species, the maximum number of pile removal and driving days is assumed, and the highest pile removal or driving sound source levels are conservatively chosen).

Level A harassment is not anticipated to occur given the methods of installation or removal; and measures designed to minimize the possibility of injury to marine mammals.

Vibratory pile drivers would be the primary method of steel pile installation and removal. Vibratory pile drivers also have relatively low sound levels (<180 decibels [dB] referenced to 1 micropascal [µPa] at 33 ft [10 m]) and are not expected to cause injury to marine mammals. Impact driving of steel piles would not occur without noise attenuation measures (such as a bubble curtain or other attenuating device) in place, and all pile driving and removal would either not start or be halted if marine mammals approach the Level A injury zone ("shutdown zone")(see Section 6).

To further minimize, to the extent practicable, Level B harassment, the Navy would implement monitoring and shut-down measures if marine mammals are seen entering the Level B behavioral harassment zone ("monitoring zone"). This measure is intended to preclude Level B exposure to sound pressures levels (SPLs) that would result in a temporary shift in marine mammals' hearing thresholds. See Section 11, *Means of Effecting the Least Practicable Adverse Impacts*, for more details on the impact reduction and mitigation measures proposed.

The Level B harassment exposure estimates for all marine mammal species combined are 16,213 Level B exposures to sound above the behavioral thresholds from pile removal and installation. No additional exposures are anticipated from airborne sounds because the area of airborne exposure is similar to existing levels of in-air noise from boat, road, and other noise sources. Section 6 contains detailed results of modeled potential exposures for each marine mammal species.

6 Numbers and Species Exposed

By age, sex, and reproductive condition (if possible), the number of marine mammals (by species) that may be taken by each type of taking, and the number of times such takings by each type of taking are likely to occur.

6.1 Introduction

In-water pile driving and removal would temporarily increase the local underwater and airborne noise environment in the vicinity of the project site. Research suggests that increased noise may impact marine mammals in several ways and depends on many factors. This is described in more detail in Section 7, *Impacts on Marine Mammal Species or Stocks*. Assessing whether a sound may disturb or injure a marine mammal involves an understanding of the characteristics of the acoustic source and the potential effects that sound may have on the physiology and behavior of that marine mammal. Although sound is important for marine mammal communication, navigation, and foraging (National Research Council 2003, 2005), there are many unknowns in assessing impacts such as the potential interaction of different effects and the significance of responses by marine mammals to sound exposures (Nowacek et al. 2007; Southall et al. 2007). Furthermore, many other factors besides the received level of sound may affect an animal's reaction, such as the animal's physical condition, prior experience with the sound, and proximity to the source of the sound.

Of the project activities outlined in Section 1 of this application, only vibratory and impact pile driving and removal are expected to result in Level B exposure of marine mammals as defined under the MMPA. Effects of other activities are described in Section 7. Level A harassment of marine mammals is not expected to occur; therefore, the noise-related impacts described in this IHA Application are entirely Level B harassment. The methods for estimating the number and types of exposure are described in the sections below.

Exposure of each species was determined by:

- Estimating the area of impact where noise levels exceed acoustic thresholds for marine mammals (Sections 6.2 and 6.3).
- Evaluating the potential presence of each species at the project site (based on historical occurrence, density, or by site-specific survey as outlined in Section 6.5).
- Estimating potential Level B harassment exposures by multiplying the density or number, as applicable, of each marine mammal species calculated in the area exposed by their probable duration during construction (Section 6.6).

Each of the three items above is described in the sections that follow. The following section provides information on noise sources as they relate to the project.

6.2 Area of Impact Estimation

6.2.1 Description of Noise Sources

Ambient sound is a composite of sounds from multiple sources, including environmental events, biological sources, and anthropogenic activities. Physical noise sources include waves at the surface, precipitation, earthquakes, ice, and atmospheric noise, among other events. Biological sources include marine mammals, fish, and invertebrates. Anthropogenic sounds include noise produced by vessels (small and large), dredging, aircraft overflights, construction activities, geophysical explorations, commercial and military sonars, and other activities.

In-water construction activities associated with the project include impact and vibratory pile driving and removal. The sounds produced by these activities fall into two sound types: impulsive and non-impulsive (defined below). Impact pile driving produces impulsive sounds, while vibratory pile driving and removal produces non-impulsive sounds. The distinction between these two general sound types is important because they have differing potential to cause physical effects, particularly with regard to hearing (Ward 1997 as cited in Southall et al. 2007).

Impulsive sounds (e.g., explosions, seismic airgun pulses, and impact pile driving), which are referred to as pulsed sounds in Southall et al. (2007), are brief, broadband, atonal transients (Harris 1998) and occur either as isolated events or repeated in some succession (Southall et al. 2007). Impulsive sounds are characterized by a relatively rapid rise from ambient pressure to a maximal pressure value, followed by a decay period that may include a period of diminishing, oscillating maximal and minimal pressures (Southall et al. 2007). Impulsive sounds generally have a greater capacity to induce physical injury compared to non-impulsive with sounds that lack these features (Southall et al. 2007).

Non-impulsive sounds (referred to as non-pulsed in Southall et al. 2007) can be tonal, broadband, or both. They lack the rapid rise time and can have longer durations than impulsive sounds. Non-impulsive sounds can be either intermittent or continuous. Examples of non-impulsive sounds include vessels, aircraft, and machinery operations such as drilling, dredging, and vibratory pile driving or removal (Southall et al. 2007).

In some environments, the duration of both impulsive and non-impulsive sounds can be extended due to by reverberations. Appendix A of this IHA provides additional information on the fundamentals of underwater sound and a review of pile driving sound pressure levels from similar projects as the one proposed in this application.

6.2.2 Vocalization and Hearing of Marine Mammals

Marine mammals that have been studied can produce sound and use sounds to forage, orient, detect and respond to predators, and facilitate social interactions (Richardson et al. 1995). Measurements of marine mammal sound production and hearing capabilities provide some basis for assessing whether exposure to a particular sound source may affect a marine mammal behaviorally or physiologically. Marine mammal hearing abilities are quantified using live animals either via behavioral audiometry or electrophysiology (Schusterman 1981; Au 1993; Wartzok and Ketten 1999; Nachtigall et al. 2007).

NMFS reviewed studies of hearing sensitivity of marine mammals and developed thresholds for use as guidance when assessing the effects of anthropogenic sound on marine mammals based on measured or estimated hearing ranges (NMFS 2013). The guidance places marine mammals into the following functional hearing groups based on their generalized hearing sensitivities: high-frequency cetaceans, mid-frequency cetaceans, low-frequency cetaceans (mysticetes), phocid pinnipeds (true seals), and otariid pinnipeds (sea lions and fur seals). Table 6-1 provides a summary of sound production and hearing capabilities for marine mammal species assessed in this application.

6.2.3 Sound Exposure Criteria and Thresholds

As stated in Section 5.1, NMFS has defined levels of harassment for marine mammals. NMFS is developing acoustic guidance for assessing the effects of anthropogenic sound on marine mammal species under its jurisdiction (2013 guidance)(78 FR 78822; NMFS 2013). Airborne and underwater injury and behavioral harassment thresholds for marine mammals are provided in Table 6-2. Specifically, the guidance provides acoustic threshold levels for the onset of permanent threshold shifts (PTS) and TTS for all sound sources. Thresholds for PTS (Level A) and TTS (Level B) are provided, both incorporating auditory weighting and without auditory weighting).

Prior to the 2013 guidance, NMFS practice was to consider the exposure of cetaceans and pinnipeds to sounds greater than 180 (for cetaceans) and 190 (for pinnipeds) dB root-mean-square (RMS) referenced to (re) 1 µPa, a Level A harassment (NMFS 2005). Behavioral harassment (Level B) thresholds are unchanged by the 2013 guidance, and behavioral harassment occurs when marine mammals are exposed to impulsive underwater sounds above the 160 dB RMS re 1 µPa threshold from impact pile driving and removal, and to non-impulsive underwater sounds above the 120 dB RMS re 1 µPa threshold (NMFS 2005).

Table 6-1: Hearing and Vocalization Ranges for Marine Mammal Functional Hearing and Groups and Species Potentially Within Inland Marine Waters of Northern Washington

Functional Hearing Group	Species	Sound Production[1]		General Hearing Ability Frequency Range[2]
		Frequency Range	Source Level (dB re 1 µPa @ 1 m)	
Low-Frequency Cetaceans	Gray whale, Humpback whale, Minke whale	20 Hz to 20 kHz	142 to 165[3]	7 Hz to 30 kHz
Mid-Frequency Cetaceans	Killer whale	500 Hz to 80kHz[4]	137 to 224[5]	150 Hz to 160 kHz
High-Frequency Cetaceans	Harbor porpoise, Dall's porpoise	100 Hz to 200 kHz	120 to 205[6]	200 Hz to 180 kHz
Phocidae	Northern elephant seal, Harbor seal	100 Hz to 12 kHz[7]	103 to 180[8]	In-water: 75 Hz to 100 kHz In-air: 75 Hz to 30 kHz
Otarridae	California sea lion, Steller sea lion	30 Hz to 6 kHz[9]	120[10]	In-water: 100 Hz to 40 kHz In-air: 200 Hz to 75 kHz

decibels (dB) referenced to (re) 1 micro (µ) Pascal (Pa) at 1 meter; Hz: Hertz; kHz: kilohertz.
Notes:
[1] Sound production data include echolocation clicks for mid- and high-frequency cetaceans. Pinniped data refer only to underwater vocalizations, not in-air sounds. When not otherwise referenced, sound production data are adapted and derived from Richardson et al. (1995).
[2] Hearing data presented from NMFS (2013).
[3] Cummings et al. 1968; Gedamke et al. 2001 (Note that Gedamke et al. reported source levels for dwarf minke whales; there are no published source levels for Minke whale vocalizations).
[4] Richardson et al. 1995; Au et al. 2004.
[5] Veirs 2004; Simon et al. 2006, 2007; Au et al. 2004.
[6] Bain 1992; Evans and Awbrey 1984; Verboom and Kastelein 2003; Villadsgaard et al. 2007.
[7] Hanggi and Schusterman 1994; Richardson et al. 1995.
[8] There are no available underwater source levels for harbor seals. The source levels given are for Harp seals (Rossong and Terhune 2009).
[9] Schusterman et al. 1970; Richardson et al. 1995.
[10] This source level is for walrus sounds (Verboom and Kastelein 1995); there are currently no source level data for underwater vocalizations from otariiads.

NMFS uses generic sound exposure thresholds to determine when an activity in the ocean that produces airborne sound might result in impacts on a marine mammal (70 FR 1871). Construction-period airborne noise would have little impact on cetaceans because noise from airborne sources would not transmit as well underwater (Richardson et al. 1995); thus, noise would primarily be a problem for hauled-out pinnipeds near the project site. NMFS has identified behavioral harassment threshold criteria for airborne noise generated by pile driving for pinnipeds regulated under the MMPA. Level A injury threshold criteria for airborne noise have not been established. The Level B behavioral harassment threshold for harbor seals is 90 dB RMS re 20 µPa (unweighted), and for all other pinnipeds is 100 dB RMS re 20 µPa (unweighted).

Table 6-2: Airborne and Underwater Injury and Behavioral Harassment Thresholds for Marine Mammals

Airborne Noise Thresholds (dB re 20 µPa 2sec un-weighted)		Underwater Noise Thresholds (dB re 1 µPa)		
Functional Hearing Group	**In Air Sound Pressure Level**	**Vibratory Pile Driving Behavioral Harassment Threshold (Level B)**	**Impact Pile Driving Behavioral Harassment Threshold (Level B)**	**Injury Threshold (Level A)**
Cetaceans (whales, dolphins, porpoises)	NA	120 dB RMS	160 dB RMS	180 dB RMS
Pinnipeds (sea lions)	100 dB RMS	120 dB RMS	160 dB RMS	190 dB RMS
Harbor seal	90 dB RMS			

Notes:
NA = not applicable, no established threshold.
Source: Fisheries Hydroacoustic Working Group 2008; WSDOT 2015; NMFS 2013; 70 FR 1871; 71 FR 3260; and 73 FR 41318.

6.2.4 Limitations of Existing Noise Criteria

The application of the 120 dB RMS re 1 µPa behavioral threshold can sometimes be problematic because this threshold level can be either at or below the ambient noise level at certain locations and distances. The 120 dB RMS re 1 µPa threshold level for non-impulsive noise originated from research conducted by Malme et al. (1984, 1988) for California gray whale response to continuous industrial sounds such as drilling operations. (The 120 dB referenced to 1 µPa non-impulsive sound threshold should not be confused with the species-specific 120 dB pulsed sound criterion established for migrating bowhead whales [*Balaena mysticetus*] in the Arctic as a result of research in the Beaufort Sea [Richardson et al. 1995; Miller et al. 1999].)

To date, there is no research or data supporting a response by pinnipeds or odontocetes to non-impulsive sounds from vibratory pile driving and removal as low as the 120 dB threshold. Southall et al. (2007) reviewed studies conducted to document behavioral responses of harbor seals and northern elephant seals to non-impulsive sounds under various conditions and concluded that those limited studies suggest that exposures between 90 dB and 140 dB RMS re 1µPa generally do not appear to induce strong behavioral responses.

6.2.5 Auditory Masking

Natural and artificial sounds can disrupt behavior through auditory masking or interference with a marine mammal's ability to detect and interpret other relevant sounds, such as communication and echolocation signals (Wartzok et al. 2003). Masking occurs when both the signal and masking sound have similar frequencies and either overlap or occur very close to each other in time. A signal is very likely to be masked if the noise is within a certain "critical

bandwidth" around the signal's frequency and its energy level is similar or higher (Holt 2008). Noise within the critical band of a marine mammal signal would show increased interference with detection of the signal as the level of the noise increases (Wartzok et al. 2003). For example, in oceanic dolphin subjects, relevant signals needed to be 17 to 20 dB louder than masking noise at frequencies below 1 kilohertz (kHz) in order to be detected, and 40 dB greater at approximately 100 kHz (Richardson et al. 1995). Noise at frequencies outside of a signal's critical bandwidth would have little to no effect on the detection of that signal (Wartzok et al. 2003).

Additional factors influencing masking are the temporal structure of the noise and the behavioral and environmental context in which the signal is produced. Continuous noise is more likely to mask signals than is intermittent noise of the same amplitude; quiet "gaps" in the intermittent noise allow detection of signals that would not be heard during continuous noise (Brumm and Slabbekoorn 2005). The behavioral function of a vocalization (e.g., contact call, group cohesion vocalization, echolocation click, etc.) and the acoustic environment at the time of signaling may both influence the call source level (Holt et al. 2011), which directly affects the chances that a signal would be masked (Nemeth and Brumm 2010).

Masking noise from anthropogenic sources could cause behavioral changes if it disrupts communication, echolocation, or other hearing-dependent behaviors. As noted above, noise frequency and amplitude both contribute to the potential for vocalization masking; noise from pile driving typically covers a frequency range of 10 Hertz (Hz) to 1.5 kHz, which is likely to overlap the frequencies of vocalizations produced by species that may occur in the project site. Depending on the animal's location and vocalization source level, this range may vary over time.

Based on the frequency overlap between noise produced by both vibratory and impact pile driving/removal (10 Hz–1.5 kHz) and recorded vocalizations, animals that remain near the project site during pile driving may be vulnerable to sound masking for the duration of pile driving/removal (a maximum of 2.5 hours intermittently over the course of a day). Energy levels of vibratory pile driving/removal are less than half that of impact pile driving; therefore, the potential for masking noise would be limited to a smaller radius around a pile during this vibratory method. Most marine mammal species that may be subject to masking are transitory near the project site. The animals most likely to be at risk for vocalization masking are resident pinnipeds (harbor seals and sea lions around local haul-out areas). Possible behavioral reactions to vocalization masking include changes to vocal behavior (including cessation of calling), habitat abandonment (long- or short-term), and modifications to the acoustic structure of vocalizations (which may help signalers compensate for masking) (Brumm and Slabbekoorn 2005). Given the relatively high source levels for most marine mammal vocalizations, the Navy

has estimated that masking events would occur concurrently within the zones of behavioral harassment (Level B) estimated for vibratory and impact pile driving and removal (see Section 6.3.2, *Underwater Noise from Pile Driving and Removal*) and are therefore taken into account in the following exposure analysis.

6.3 Modeling Noise Impact from Pile Driving and Removal

6.3.1 Underwater Sound Propagation

Pile driving and removal would generate underwater noise that potentially could result in disturbance to marine mammals swimming by or near the project site. Transmission loss (TL) underwater is the decrease in acoustic intensity as an acoustic pressure wave propagates out from a source until the source becomes indistinguishable from ambient sound. Transmission loss parameters vary with frequency, temperature, sea conditions, current, source and receiver depth, water depth, water chemistry, and bottom composition and topography. A standard sound propagation model was used to estimate the range from pile driving/removal activity to various expected sound pressure levels at potential project structures. This model follows a geometric propagation loss based on the distance from the driven or removed pile, resulting in a 4.5 dB reduction in level for each doubling of distance from the source. In this model, the sound pressure level at some distance away from the source (e.g., driven or removed pile) is governed by a measured source level, minus the transmission loss of the energy as it dissipates with distance. The transmission loss equation is:

$$TL = 15 \log_{10} \left(\frac{R_1}{R_2} \right)$$

where *TL* is the transmission loss in dB, R_1 is the distance of the modeled SPL from the pile, and R_2 is the distance from the pile of the initial measurement.

The degree to which underwater noise propagates away from a noise source is dependent on a variety of factors, most notably by the water bathymetry and presence or absence of reflective or absorptive conditions including the sea surface and sediment type. The TL model described above was used to calculate the expected noise propagation from both impact and vibratory pile driving/removal, using representative source levels to estimate the zone of influence (ZOI) or area exceeding the noise criteria (Level B behavioral harassment zone). One point representing a pile farthest from the shore was chosen to illustrate the maximum ZOI that would be produced from all pile driving/removal methods.

6.3.2 Underwater Noise from Pile Driving/Removal

The intensity of pile driving or removal sounds is greatly influenced by factors such as the type of pile, hammers used, and the physical environment in which the activity takes place. To determine reasonable sound pressure levels from pile driving or removal at the project site, studies with similar properties to the project were evaluated (Appendix A of this IHA). Studies that met the following parameters were considered:

- **Pile materials:** steel pipe piles.
- **Pile driver type:** vibratory and impact.

Table 6-3 presents the representative SPLs for impact and vibratory driving/removal used for the noise analysis.

Table 6-3: Representative Sound Pressure Levels from Pile Driving/Removal[1]

Method	Pile Size	Average RMS dB re 1µPa	Absolute Peak dB re 1µPa	Average SEL dB re 1µPa
Steel				
Impact	24-inch	193	210	181
	30-inch	195	216	186
	36-inch	192	211	184
Vibratory	24-inch	162	NA	NA
	30-inch	167	NA	NA
	36-inch	167	NA	NA

[1]See Appendix A of this IHA for studies reviewed. Decibels (dB) referenced to (re) 1 micro (µ) Pascal (Pa).
Sound pressure levels do not include a reduction of 8 dB for 24-, 30-, and 36-inch piles. SPL were measured 10 meters from source.
Vibratory SPLs for 30-inch and 36-inch piles were considered together due to similarities in levels over multiple projects (U.S. Department of the Navy 2014).

Underwater noise levels are measured with a hydrophone, or underwater microphone, which converts noise pressure to voltage, which is then converted back to pressure, expressed in Pascals (Pa), pounds per square inch (psi), or decibels (dB). The current standard distance for measuring source noise levels is 10 m (i.e., 33 ft) from the source, where the source and receiver are within line of sight of each other. Several descriptors are used to describe underwater noise. Two common descriptors are the instantaneous peak sound pressure level (dB peak) and the Root Mean Square (dB RMS) pressure level during the impulse, sometimes referred to as the peak and RMS level, respectively. The peak pressure is the instantaneous maximum overpressure or underpressure observed during each pulse and can be presented in Pa or SPL in dB referenced to a pressure of1 micropascal (dB re: 1 µPa). Sound Exposure Level (SEL) is also a metric for acoustic events and is often used as an indication of the energy dose.

A bubble curtain would be used to minimize the noise generated by impact driving steel pipe piles. Bubble curtains emit a series of bubbles around a pile to introduce a high-impedance boundary through which pile driving noise is attenuated. Based on review of similar pile driving projects, it is anticipated that the use of a bubble curtain during this project would result in an 8 dB reduction of the underwater sound pressure levels during impact pile driving (Appendix A of this IHA). If a new method of sound attenuation is developed that has demonstrated an average of at least 8 dB of attenuation, then this method could be employed instead of a bubble curtain for driving steel pile.

Calculated distances to the underwater marine mammal behavioral noise thresholds are provided in Table 6-4. Additional calculations to the proposed TTS and PTS thresholds are provided in Appendix A of this IHA. Adjusted maximum distances are provided where the extent of noise reaches land prior to reaching the calculated radial distance to the threshold. The ZOI areas only include the area encompassed to the extent of the shoreline. The extent and area of each ZOI for a pile representing the worst-case extent of noise propagation (farthest from the shore) are presented in Figures 6-1 and 6-2.

Table 6-4: Calculated Radial Distance(s) to Underwater Marine Mammal Pile Driving/Removal Noise Thresholds and Area Encompassed within Threshold Distance

Underwater Pile Driving/Removal Noise Source	Marine Mammals			
	Injury Pinnipeds	Injury Cetaceans	Behavioral Harassment from Impulse Noise	Behavioral Harassment from Continuous Noise
	190 dB_{RMS} (distance/area)	180 dB_{RMS} (distance/area)	160 dB_{RMS} (distance/area)	120 dB_{RMS} (distance/area)
Impact 24-inch steel pile	5 m/ 0.000078 km^2	22 m/ 0.0015 km^2	464 m/0.43 km^2	NA
Vibratory 24-inch steel pile	NA	NA	NA	6,310 m/ 20.4 km^2
Impact 30-inch steel pile	6 m/ 0.00011 km^2	29 m/ 0.0026 km^2	631 m/0.75 km^2	NA
Vibratory 30-inch steel pile	NA	NA	NA	13,594 m/29.90 km^2
Impact 36-inch steel pile	4 m/ 0.00005 km^2	18 m/0.001 km^2	398 m/0.33 km^2	NA
Vibratory 36-inch steel pile	NA	NA	NA	13,594 m/29.9 km^2

km^2 = square kilometer.
All source levels referenced to 1 µPa. Practical spreading loss model (15 log R, or 4.5 dB per doubling of distance) used for calculations. Values include an 8 dB attenuation. Square kilometer area for the 120 dB RMS threshold is the same for 30-inch and 36-inch due to noise intersecting landmasses rather than extending out to the full distance.
Source SPL from Caltrans 2012.

Figure 6-1: Behavioral Harassment Zone for Marine Mammals Due to Underwater Noise from Vibratory Pile Driving/Removal

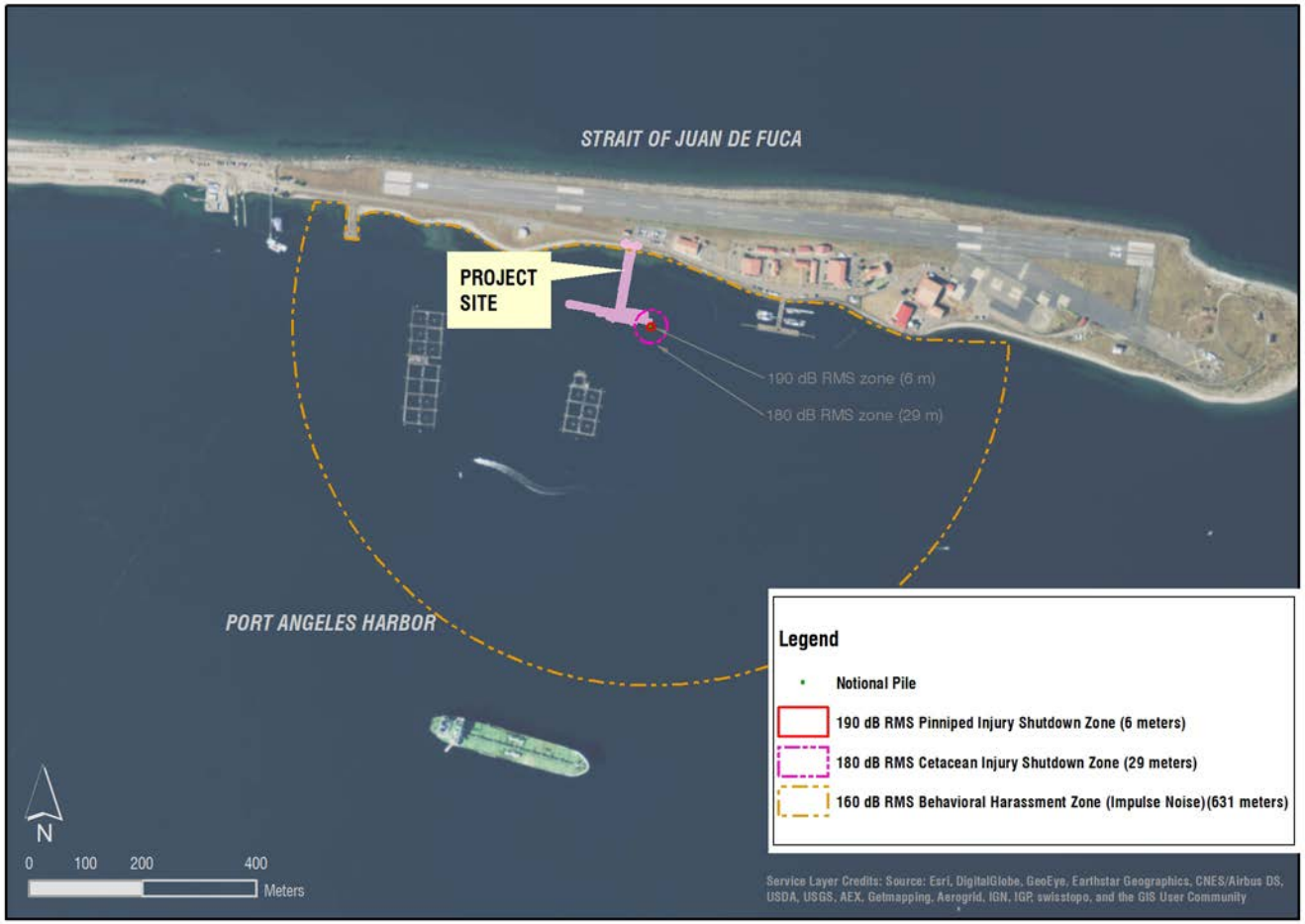

Figure 6-2: Injury and Behavioral Harassment Zones for Marine Mammals Due to Underwater Noise from Impact Pile Driving

6.3.3 Airborne Sound Propagation

Pile driving/removal can generate airborne noise that could potentially result in disturbance to marine mammals (pinnipeds) that are hauled out or at the water's surface. As a result, the Navy analyzed the potential for pinnipeds hauled out or swimming at the surface to be exposed to airborne sound pressure levels that could result in Level B 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 6-2). 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 2015). Construction point source noise is commonly measured by maximum decibel level (Lmax), or the highest value of a sound pressure over a stated time interval. A spherical spreading loss model, assuming average atmospheric conditions, was used to estimate the distance to the 100 dB and 90 dB RMS re 20 µPa (unweighted) airborne thresholds. The transmission loss equation is given by:

$$TL = 20 \log_{10} \left(\frac{R_1}{R_2} \right)$$

where TL is the transmission loss in dB, R1 is the distance of the modeled SPL from the pile, and R2 is the distance from the pile of the initial measurement. In practice, this equation can be rearranged to solve for the distance at which sound attenuates to an acoustical threshold (NMFS 2013).

$$R_2 = R_1 * 10^{((dB_{at\ R1} - dB_{acoustic\ threshold})/20)}$$

The intensity of pile driving/removal sounds is greatly influenced by factors such as the type of piles, hammers, and the physical environment in which the activity takes place. To determine reasonable airborne source sound pressure levels, source levels were chosen based on a review of pile driving in-situ recordings (Table 6-5; see analysis in Appendix A of this IHA).

The distances to the airborne harassment thresholds were calculated for steel impact and vibratory driving/removal with the airborne transmission loss formula. The calculated distances to the pinniped airborne noise thresholds, as well as the areas encompassed by these threshold distances (also referred to as the ZOIs), are shown in Table 6-6 and Figure 6-3. Because these areas are smaller than the TTS and behavioral harassment threshold zones, a separate analysis of Level B take was not conducted for the airborne zones. Animals in the airborne zones would already have been exposed within a Level B underwater behavioral harassment zone.

Table 6-5: Airborne Sound Pressure Levels from Similar In-situ Monitored Construction Activities

Pile Type	Size (diameter in inches)	Installation Method	
		Impact RMS Lmax (unweighted) Impact	Vibratory RMS Leq (unweighted) Vibratory
Steel Pipe	24-inch	110	92
	30-inch	112	95
	36-inch	112	95

Notes: All values relative to 20µPa and at 50 ft (15 m) from pile.

Table 6-6: Calculated and Measured Distances to Pinniped Behavioral Harassment Airborne Noise Thresholds

Pile Type	Description	Harbor Seal (90 dB_{RMS})	Pinnipeds (Seals, Sea Lions, Except Harbor Seals) (100 dB_{RMS})
24-inch steel	Distance to Threshold	Impact: 500 feet/152 meters Vibratory: 63 feet/19 meters	Impact: 158 feet/48 meters Vibratory: 20 feet/6 meters
	Area Encompassed by Threshold	0.073 km^2	0.012 km^2
30-inch steel	Distance to Threshold	Impact: 629 feet/192 meters Vibratory: 89 feet/27 meters	Impact: 199 feet/61 meters Vibratory: 28 feet/9 meters
	Area Encompassed by Threshold	0.11 km^2	0.01 km^2
36-inch steel	Distance to Threshold	Impact: 629 feet/192 meters Vibratory: 89 feet/27 meters	Impact: 199 feet/61 meters Vibratory: 28 feet/9 meters
	Area Encompassed by Threshold	0.11 km^2	0.01 km^2

Notes:
km^2 = square kilometer.
Source SPL from Caltrans 2012.

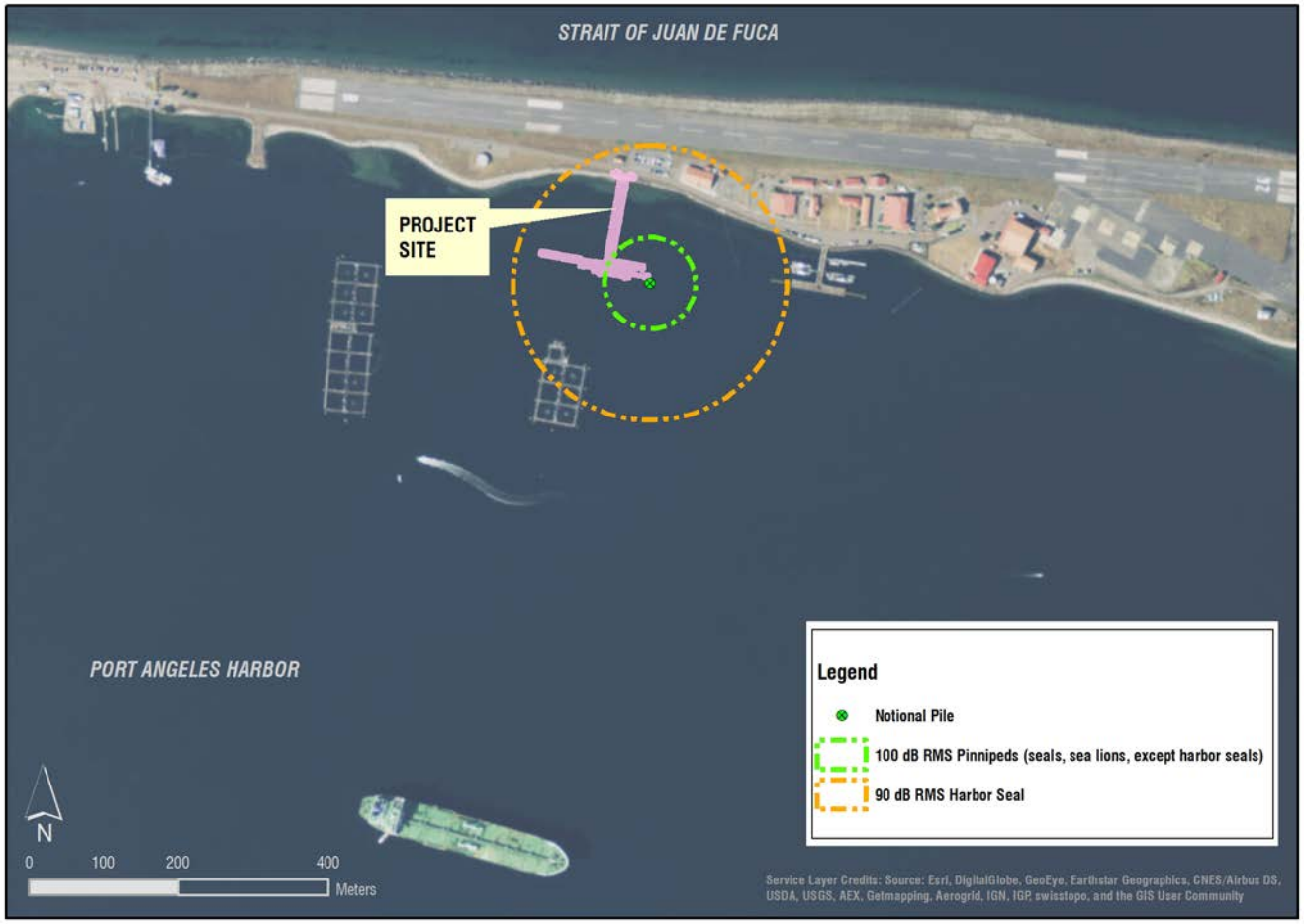

Figure 6-3: Airborne Behavioral Harassment Zones for Harbor Seals and Sea Lions from Impact Pile Driving

During vibratory pile driving/removal, temporary in-air disturbance will be limited to harbor seals swimming on the surface through the immediate area, or hauled-out on beaches or boat ramps within 89 ft (27 m), and within 28 ft (9 m) for all other pinnipeds.

During impact pile driving, temporary in-air disturbance will be limited to harbor seals swimming on the surface through the immediate area, or hauled-out on beaches or boat ramps within 629 ft (192 m), and within 199 ft (61 m) for all other pinnipeds.

6.4 Estimated Duration of Pile Driving and Removal

The estimated duration of pile driving and removal is 75 days over the course of 18 weeks and two in-water work windows. This conservative duration estimate allows the contractor enough flexibility with changing pile sizes and, although vibratory methods are most likely, the ability to use impact pile driving method if necessary.

6.5 Evaluation of Potential Species Presence

In prior Navy applications, either density data from the Navy's marine mammal database (U.S. Department of the Navy 2015a) or site-specific survey information has been used to quantify take. However, as described in Section 3.1, using a density-based analysis for species that occur intermittently does not adequately account for their unique temporal and spatial distributions[1].

For intermittently occurring species, historical occurrence and numbers, as well as group size were reviewed to develop a realistic estimate of potential exposure. Therefore, estimates in this application for species without a predictable occurrence are based on the historical likelihood of encounter. The following species were in this category:

- Harbor Porpoise
- Northern Elephant Seal

For species with potentially more frequent occurrence, but no site-specific surveys, density estimates were used for quantification of potential exposure. The following species were in this category:

- Steller Sea Lion
- California Sea Lion

1 Previously, a density-based exposure analysis was required for these species. The analyses often resulted in zero exposure estimates. Therefore, to obtain IHA coverage for potential exposure to these animals, the Navy would typically augment the requested take by the typical group size of animals. NMFS has subsequently requested that future Navy IHA applications for Washington state not use a density estimate for marine mammal species with a low likelihood of occurrence.

For species with likely occurrence and site-specific occurrence data, those data were used to quantify potential exposure. The following species was in this category:

- Harbor Seal

6.6 Estimating Potential Level B Harassment Exposures

To quantitatively assess the exposure of marine mammals to noise levels from pile driving/removal over the NMFS threshold guidance, one of three methods was used, depending on the species' spatial and temporal occurrence.

Species with rare occurrence in all or part of the Strait of Juan de Fuca
For species with rare occurrence during the in-water work window, the likelihood of occurrence was reviewed based on the information in Section 3 and total number of work days for the project. The calculation for species with rare occurrence was:

Equation #1: Exposure estimate = Probable abundance during construction × Probable duration during construction

where; Probable abundance = maximum expected group size.
Probable duration = maximum days of pile driving/removal.

Species with likely or seasonally occurrence but no site-specific occurrence data
For species that likely or seasonally occur in the Strait of Juan de Fuca but do not have site-specific abundances, marine mammal density estimates were used to determine the number of animals potentially exposed in a ZOI on any one day of pile driving or removal. The density estimates used for this analysis come from the Draft 3rd and 7th Fleet Navy Marine Species Density Database, NAVFAC Pacific Technical Report (U.S. Department of the Navy 2015a). The maximum density value for each species during the in-water work window at each site was used in the marine mammal take assessment calculation. The equation for species likely to occur with only density estimates and no site-specific abundance was:

Equation #2: Exposure estimate = (N × ZOI) × maximum days of pile driving/removal

where; N = density estimate used for each species.
ZOI = behavioral harassment threshold zone of influence impact area.
If exposure is greater or equal 0.5 animals, the product is rounded up to a whole number.

Species with likely or seasonally occurrence and site-specific occurrence data
For species with site-specific surveys available, exposures were estimated by:

Equation #3: Exposure estimate = Abundance × maximum days of pile driving/removal

where: Abundance = average monthly maximum over the time period when pile driving/removal would occur.

The methods for calculating potential exposures to impact and vibratory pile driving/removal noise for each threshold include the following assumptions:

- For Equations #2 and #3, each species would be present in the ZOI each day during construction. The timeframe for takings would be one potential take (Level B harassment exposure) per individual, per 24 hours.
- All piles installed at each site would have an underwater noise disturbance distance equal to the pile that causes the greatest noise disturbance (i.e., the pile farthest from shore) installed with the method that has the largest ZOI. If vibratory pile driving/removal would occur, the largest ZOI would be produced by vibratory driving/removal. The ZOI for an impact hammer would be encompassed by the larger ZOI from the vibratory driver. Vibratory driving/removal were assumed to occur on all days of pile driving.
- All piles installed/removed at each site would have an airborne noise disturbance distance equal to the pile that causes the greatest noise disturbance (i.e., the pile farthest from shore) installed with the method that has the largest ZOI. The largest ZOI would be produced by impact driving. The ZOI for a vibratory hammer would be encompassed by the larger ZOI from the impact driver. Impact pile driving was assumed to occur on all days of pile driving. Exposures to airborne noise were considered as included in the larger underwater ZOIs from vibratory or impact driving/removal and were not calculated for pinnipeds.
- Days of in-water pile driving and removal at each site were based on the estimated work days using a slow production rate (e.g., providing the maximum number of potential exposures): 80 temporary indicator piles, and 144 permanent piles for 75 days at an average production rate of 1 to 8 pile per day. Note that this is not meant to indicate these rates are planned production rates. The rates listed in this bullet are used solely to assess the number of days pile driving/removal could occur if production were delayed due to equipment failure, safety, etc. In a real construction situation, pile driving/removal production rates would be maximized when possible.
- The practical spreading loss model was used to determine the ZOI.

The ZOIs for each threshold are not circular and would be truncated by land masses, such as points of land along the Ediz Hook and the opposite shoreline of Port Angeles.

The exposure assessment methodology estimates the numbers of individuals potentially exposed to the effects of pile driving/removal noise exceeding NMFS established Level B thresholds. Of significant note is that successful implementation of mitigation methods (i.e., visual monitoring and the use of shutdown zones) results in no Level A exposure. Therefore, Level A exposures were not calculated. Results from acoustic impact exposure assessments should be regarded as conservative overestimates that are strongly influenced by limited marine mammal data, the assumption that marine mammals will be present during pile driving/removal, and the assumption that the maximum number of piles will be removed or installed.

6.7 Exposure Estimates

Exposure estimates for each species from the 1-year period of this application are described in the following sections and summarized in Table 6-7. To reduce impacts on marine mammals to the lowest extent practicable, a Marine Mammal Monitoring and Mitigation Plan will be developed and implemented. A proposed Monitoring and Mitigation Plan is included in Appendix B of this IHA. The report will detail the monitoring protocol, summarize the data recorded during monitoring, estimate the number of marine mammals that may have been harassed, and provide details of how many actual and extrapolated animals of each species are exposed to noise levels considered potential Level B harassment at each location.

Table 6-7: Total Underwater Level B Exposure Estimates by Species

Species	Total
Harbor porpoise	225
Steller sea lion	2,097
California sea lion	1,516
Northern elephant seal	75
Harbor seal	12,000
Total	**15,913**

Exposure estimates do not differentiate age, sex, or reproductive condition. However, some inferences can be made based on what is known about the life stages of the animals that visit or inhabit the Strait of Juan de Fuca and Port Angeles Harbor. When possible and with the available data, this is described by species in the sections that follow.

6.7.1 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. Although harbor porpoise occur year round in the

Strait of Juan de Fuca, harbor porpoises are a rare occurrence in Port Angeles Harbor, and density-based analysis does not adequately account for their unique temporal and spatial distributions; therefore, Equation #1 was used (see Section 6.6).

Based on the assumption that an average group of 3 harbor porpoise may be present intermittently in the ZOI (Hall 2004), the following number of harbor porpoises may be intermittently present in the ZOIs:

- ZOI exposure estimate: 3 animals × 75 days of pile activity = 225.

The 450 exposures would be a temporary behavioral harassment and would not impact the long-term health of individuals; the viability of the population, species, or stocks would remain stable.

6.7.2 Steller Sea Lion

Steller sea lions occur seasonally in the Strait of Juan de Fuca from September through May. Steller sea lion haul-outs are 13 miles (21 km) away; therefore, Equation #2 using density estimates was used. Based on the assumption that 0.935 Steller sea lion per km^2 may be present intermittently in the ZOI, the following number of Steller sea lions may be intermittently present in the ZOIs:

- ZOI exposure estimate: (0.935 animals/km^2 x 29.9 km^2) × 75 days of pile activity = 2,097.

The 2,097 exposures would be a temporary behavioral harassment and would have a negligible impact on Steller sea lion stock recruitment or survival. It is assumed that this number would include multiple behavioral harassments of the same individual(s).

6.7.3 California Sea Lion

The California sea lion is most common from fall to late spring. California sea lion haul-outs are greater than 30 miles (48 km) away; therefore, Equation #2 using density estimates was used. Animals could be exposed when traveling, resting, or foraging. Primarily only male California sea lions migrate through the Strait of Juan de Fuca (Jeffries et al. 2000). Based on the assumption that 0.676 California sea lions per km^2 may be present intermittently in the ZOI, the following number of California sea lions may be intermittently present in the ZOIs:

- ZOI exposure estimate: (0.676 animal/km^2 x 29.9 km^2) × 75 days of pile activity = 1,516.

The 1,516 exposures would be a temporary behavioral harassment and would have a negligible impact on California sea lion stock recruitment or survival. It is assumed that this number would include multiple behavioral harassments of the same individual(s).

6.7.4 Northern Elephant Seal

Northern elephant seals are rare visitors to the Strait of Juan de Fuca. However, individuals, primarily juveniles, have been known to sporadically haul out to molt on Dungeness Spit about 12 miles (19 km) from Port Angeles. One elephant seal was observed hauled-out at Dungeness Spit in each of the following years: 2000, 2002, 2004, 2005, and 2006 (WDFW 2015). Elephant seals are primarily present during spring and summer months. If a northern elephant seal was in the ZOI, it would likely be a solitary juvenile. Northern elephant seals are a rare occurrence in Port Angeles Harbor, and density-based analysis does not adequately account for their unique temporal and spatial distributions; therefore, Equation #1 was used (see Section 6.6). Based on the assumption that one elephant seal may be present intermittently in the ZOI, the following number of elephant seals may be intermittently present in the ZOIs:

- ZOI exposure estimate: 1 animal × 75 days of pile activity = 75.

The 75 exposures would be a temporary behavioral harassment and would have a negligible impact on northern elephant seal stock recruitment or survival.

6.7.5 Harbor Seal

Harbor seals are present year round with haul-outs in Port Angeles Harbor. Prior Navy IHAs have successfully used density-based estimates (Equation #3); therefore, this application also uses density to estimate exposure. However, in this case, density estimates were not appropriate because there is a haul-out nearby on a log boom approximately 1.7 miles (2.7 km) west of the project site that was last surveyed in March 2013 and had a total count of 73 harbor seals (WDFW 2015). Another haul-out site is 1.3 miles (2.1 km) south of the project but is across the harbor that was last surveyed in July 2010 and had a total count of 87 harbor seals (WDFW 2015). Based on the assumption that there could be 160 harbors seals hauled out in proximity to the ZOI, the following number of harbors seals may be intermittently present in the ZOIs:

- ZOI exposure estimate: 160 animals × 75 days of pile activity = 12,000.

The exposure estimate assumes that the same 160 harbor seals would likely be subject to temporary behavioral harassment on multiple days. The estimated 160 harbor seals is the maximum number of animals at haul-outs outside of the airborne Level B behavioral harassment zone; the number of exposures to individual harbor seals foraging in the underwater behavioral harassment zone would likely be much lower. The estimated 160 harbor seals represent 2 percent of the 11,036 stock estimate (Jeffries et al. 2003 as presented in Carretta et al. SAR 2014 Draft). In addition, any disturbance would be temporary and not impact the long-term health of individuals; the viability of the population, species, or stocks would remain stable.

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7 Impacts on Marine Mammal Species or Stocks

The anticipated impact of the activity upon the species or stock of marine mammals

7.1 Potential Effects of Pile Driving/Removal on Marine Mammals

7.1.1 Potential Effects Resulting from Underwater Noise

The effects of pile driving/removal 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/removal 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 on marine mammals from pile driving/removal activities are expected to result primarily from acoustic pathways. Therefore, the degree of effect is intrinsically related to the received level and duration of the sound exposure, which are in turn influenced by the distance between the animal and the source. In general, sound exposure should be less intense farther away from the source. The substrate and depth of the habitat affect the sound propagation properties of the environment. Shallow environments are typically more structurally complex, which leads to rapid sound attenuation. In addition, substrates that are soft (e.g., sand) will absorb or attenuate the sound more readily than hard substrates (rock), which may reflect the acoustic wave. Soft porous substrates will also likely require less time to drive the pile, and possibly less forceful equipment, which would ultimately decrease the intensity of the acoustic source.

Potential impacts on marine species can be caused by physiological responses to both the type and strength of the acoustic signature (Viada et al. 2008). Behavioral impacts may also occur, although the type and severity of these effects are more difficult to define because there are limited studies addressing the behavioral effects of impulsive sounds on marine mammals. Potential effects from impulsive sound sources can range from Level B effects such as brief behavioral harassment, tactile perception, and physical discomfort, to Level A impacts, which may include slight injury of the internal organs and the auditory system, and possible death of the animal (Yelverton et al. 1973; O'Keefe and Young 1984; Ketten 1995; U.S. Department of the Navy 2001).

Physiological Responses

Direct tissue responses to impact/impulsive sound stimulation may range from mechanical vibration or compression with no resulting injury to tissue trauma (injury). Because the ears are the most sensitive organ to pressure, they are the organs most sensitive to injury (Ketten 2000).

Sound-related trauma can be lethal or sub-lethal. Lethal impacts are those that result in immediate death or serious debilitation in or near an intense source (Ketten 1995). Sub-lethal damage to the ear from a pressure wave can rupture the tympanum, fracture the ossicles, and damage the cochlea; cause hemorrhage; and cause leakage of cerebrospinal fluid into the middle ear (Ketten 2004). Sub-lethal impacts also include hearing loss, which is caused by exposure to perceptible sounds. Moderate injury implies partial hearing loss. Permanent hearing loss (also called PTS) can occur when the hair cells of the ear are damaged by a very loud event, as well as by prolonged exposure to noise. Instances of temporary threshold shifts and/or auditory fatigue are well documented in marine mammal literature as being one of the primary avenues of acoustic impact. Temporary loss of hearing sensitivity has been documented in controlled settings using captive marine mammals exposed to strong sound exposure levels at various frequencies (Ridgway et al. 1997; Kastak et al. 1999; Finneran et al. 2005). While injuries to other sensitive organs are possible, they are less likely since pile driving/removal impacts are almost entirely acoustically mediated, versus explosive sounds, which also include a shock wave that can result in damage. Based on the analysis in Section 6, no Level A harassment is expected to result from project activities because mitigation measures outlined in Section 11 will be implemented.

Behavioral Responses

Behavioral responses to sound can be highly variable. For each potential behavioral change, the magnitude of the change ultimately determines the severity of the response. A number of factors may influence an animal's response to noise, including its previous experience, its auditory sensitivity, its biological and social status (including age and sex), and its behavioral state and activity at the time of exposure. Habituation occurs when an animal's response to a stimulus wanes with repeated exposure, usually in the absence of unpleasant associated events (Wartzok et al. 2003). Animals are most likely to habituate to sounds that are predictable and unvarying. The opposite process is sensitization— which occurs when an unpleasant experience leads to subsequent responses, often in the form of avoidance, at a lower level of exposure. Behavioral state or differences in individual tolerance levels may affect the type of response as well. For example, animals that are resting may show greater behavioral change in response to disturbing noise levels than animals that are highly motivated to remain in an area for feeding (Richardson et al. 1995; National Research Council 2003; Wartzok et al. 2003). Indicators of disturbance may include sudden changes in the animal's behavior or avoidance of the affected area. A marine mammal may show signs that it is startled by the noise and/or it may swim away from the sound source and avoid the area. Increased swimming speed, increased surfacing time, and cessation of foraging in the affected area would indicate disturbance or discomfort. Pinnipeds may increase their haul-out time, possibly to avoid in-water disturbance.

Controlled experiments with captive marine mammals showed pronounced behavioral reactions, including avoidance of loud sound sources (Ridgway et al. 1997; Finneran et al. 2003). Observed responses of wild marine mammals to loud pulsed sound sources (typically seismic guns or acoustic harassment devices and including pile driving) have been varied, but often consist of avoidance behavior or other behavioral changes suggesting discomfort (Morton and Symonds 2002; also see reviews in Gordon et al. 2004; Wartzok et al. 2003; and Nowacek et al. 2007). Some studies of acoustic harassment and acoustic deterrence devices have found habituation in resident populations of seals and harbor porpoises (see review in Southall et al. 2007). Blackwell et al. (2004) found that ringed seals (*Phoca hispida*) exposed to underwater pile driving sounds in the 153–160 dB RMS range tolerated this noise level and did not seem unwilling to dive; one individual was as close as 207 ft (63 m) to the pile driving. Responses of two pinniped species to impact pile driving at the San Francisco-Oakland Bay Bridge East Span Seismic Safety Project were mixed (Caltrans 2001; Thorson and Reyff 2006; Thorson 2010). Harbor seals were observed in the water at distances of approximately 1,312–1,640 ft (400–500 m) from the pile driving activity and exhibited no alarm responses, although several showed alert reactions, and none of the seals appeared to remain in the area. One of these harbor seals was even seen to swim to within 492 ft (150 m) of the pile driving barge during pile driving. Several sea lions, however, were observed at distances of 1,640–3,280 ft (500–1,000 m) swimming rapidly and porpoising away from pile driving activities. The reasons for these differences are not known, although Kastak and Schusterman (1998) reported that sea lions are more sensitive than harbor seals to underwater noise at low frequencies.

Observations of marine mammals on NAVBASE Kitsap Bangor during the Test Pile Project concluded that pinniped (harbor seal and California sea lion) foraging behaviors decreased slightly during construction periods involving impact and vibratory pile driving, and both pinnipeds and harbor porpoise were more likely to change direction while traveling during construction (HDR Inc. 2012). Pinnipeds were more likely to dive and sink when closer to pile driving activity, and a greater variety of other behaviors (including fighting, foraging, hauling out, milling, playing, and vocalizing) were observed with increasing distance from pile driving. Relatively few observations of cetacean behaviors were obtained during pile driving, and all were outside the Waterfront Restricted Area (WRA). Most harbor porpoises were observed swimming or traveling through the ZOI, and no obvious behavioral changes were associated with pile driving.

During the first year of construction monitoring for the Explosives Handling Wharf-2 (EHW-2) (the July 16, 2012 through February 15, 2013 in-water work window), only California sea lions and harbor seals were detected within the shutdown and behavioral harassment zones (Primary Surveys) and outside the WRA (Outside Boat Surveys). The sample size for California sea lions was too small during pile driving to identify any trends in responses to construction

(Hart Crowser 2013). Harbor seals engaged in a variety of behaviors during pile driving, including swimming, diving, sinking, and looking. They were equally likely to swim, dive, or sink as their ultimate behavior if they were inside the 1,522-ft (464-m) behavioral harassment zone and most likely to dive if they were outside the WRA. However, observation effort within the WRA was more intense than effort outside the WRA. Harbor porpoises were only observed outside the WRA, where the predominant behavior during construction (vibratory pile driving) was swimming or traveling through the ZOI. During pre-construction monitoring, marine mammal observers also reported harbor porpoise foraging. Marine mammal observers did not detect adverse reactions to Test Pile Program (TPP) or EHW-2 construction activities consistent with distress, injury, or high-speed withdrawal from the area, nor did they report obvious changes in less acute behaviors (HDR Inc. 2012; U.S. Department of the Navy 2014).

Marine mammal monitoring at the Port of Anchorage marine terminal redevelopment project found no response by marine mammals swimming within the threshold distances to noise impacts from construction activities including pile driving (both impact hammer and vibratory driving) (Integrated Concepts and Research Corporation 2009). Most marine mammals observed during the two lengthy construction seasons were beluga whales (*Delphinapterus leucas*). Harbor seals, harbor porpoises, and Steller sea lions were observed in smaller numbers. Background noise levels at this port were reported to typically be 125 dB.

A comprehensive review of acoustics and behavioral responses to noise exposure by Nowacek et al. (2007) concluded that one of the most common behavioral responses is displacement. To assess the significance of displacement, it is necessary to know the areas where the animals relocate to, the quality of that habitat, and the duration of the displacement in the event that they return to the pre-disturbance area. Short-term displacement may not be of great concern unless the disturbance happens repeatedly. Similarly, long-term displacement may not be of concern if adequate replacement habitat is available.

Marine mammals encountering pile driving/removal operations over the project construction timeframe would likely avoid affected areas where they experience noise-related discomfort, limiting their ability to forage or rest there. As described above, individual responses to pile driving noise are variable. Some individuals may occupy the ZOI during pile driving/removal without apparent discomfort, but others may be displaced with undetermined effects. Avoidance of the affected area during pile driving/removal operations would reduce the likelihood of injury impacts, but could also reduce access to foraging areas if the ZOI is used for foraging (which seems unlikely for this site). Noise-related disturbance may also inhibit some marine mammals from transiting the area, and there is a potential for displacement of marine mammals from the affected area due to behavioral harassments during the in-water construction season. However, habituation may occur, resulting in a decrease in the severity of

response. Since pile driving/removal would only occur during daylight hours, marine mammals transiting the ZOI or foraging or resting in the ZOI at night would not be affected. Effects of pile driving/removal activities would be experienced by individual marine mammals, but would not cause population-level impacts or affect the continued survival of the species.

7.1.2 Potential Effects Resulting from Airborne Noise

Marine mammals that occur near the project site could be exposed to airborne sounds associated with pile driving/removal that have the potential to cause behavioral harassment, depending on their distance from pile driving/removal activities. Airborne pile driving/removal noises are expected to have very little impact on cetaceans because noise from atmospheric sources does not transmit well through the air-water interface (Richardson et al. 1995); consequently, cetaceans are not expected to be exposed to airborne sounds that would result in harassment as defined under the MMPA.

Airborne noise will primarily be an issue for pinnipeds that are swimming or hauled out near the project site within the range of noise levels elevated above the acoustic criteria as described in Section 6. Most likely, airborne sound will cause behavioral responses similar to those described above in relation to underwater noise. For instance, anthropogenic sound could cause hauled-out pinnipeds to exhibit changes in their normal behavior, such as reduction in vocalizations, or cause them to temporarily abandon their usual or preferred locations and move farther from the noise source. Pinnipeds swimming in the vicinity of pile driving/removal may avoid or withdraw from the area, or may show increased alertness or alarm (e.g., heading out of the water, and looking around). However, studies of ringed seals by Blackwell et al. (2004) and Moulton et al. (2005) indicate a tolerance or lack of response to unweighted airborne sounds as high as 112 peak dB and 96 dB RMS, which suggests that habituation occurred.

Based on these observations, marine mammals in the impact zones may exhibit temporary behavioral reactions to airborne pile driving/removal noise. These exposures may have a temporary effect on individuals or groups of animals, but this level of exposure is very unlikely to result in population-level impacts.

7.2 Conclusions Regarding Impacts on Species or Stocks

Individual marine mammals may be exposed to sound pressure levels during pile driving/removal, which may result in Level B behavioral harassment. The sound generated from vibratory pile driving/removal is non-impulsive, which is not known to cause injury to marine mammals. Marine mammals that are exposed (harassed) may change their normal behavior patterns (e.g., swimming speed, foraging habits) or be temporarily displaced from the area of

construction. As described in Section 6, project activities would have the greatest effect on harbor seals. However, harbor seals in the area are accustomed to disturbance by activity in the harbor including large and small vessel traffic. In addition, the population of harbor seals is considered stable, and exposures to an estimated 2 percent of the stock would likely have only a minor effect on individuals and a negligible effect on the population. Any incidental take would likely be multiple takes of the same individuals, rather than single takes of unique individuals. The stock take calculations, as described in Section 6, assume takes of individual animals, instead of repeated takes of a smaller number.

In addition, if incidental takes occur, it is expected to only result in short-term changes in behavior and potential temporary hearing threshold shift. These takes would be unlikely to have any impact on stock recruitment or survival and, therefore, would have a negligible impact on the stocks of these species.

Mitigation, including implementation of the Marine Mammal Monitoring and Mitigation Plan, is expected to avoid most potential adverse underwater impacts on marine mammals from impact pile driving. In addition, the duration of impact pile driving could be 21 hours over a 12-day period. The maximum level of exposure (defined as acoustic harassment) is presented in Section 6. This level of effect is not anticipated to have any adverse impact on population recruitment or survival.

8 Impact on Subsistence Use

The anticipated impact of the activity on the availability of the species or stock of marine mammals for subsistence uses.

This issue is only applicable in Alaska. Because the proposed activities do not have the potential to impact the ability of Alaska Natives to conduct subsistence hunts, there are no relevant subsistence uses of marine mammals associated with this action.

9 Impacts on the Marine Mammal Habitat and the Likelihood of Restoration

The anticipated impact of the activity upon the habitat of the marine mammal populations, and the likelihood of restoration of the affected habitat.

Impacts on habitat from the project are expected to be temporary and include increased human activity and noise levels, impacts on water quality, and changes in prey availability near the project site. The proposed project would not result in permanent impacts on habitats such as rookeries, haul-outs, or foraging hotspots that may be used by marine mammals.

9.1 Effects from Human Activity and Noise

Existing human activity and underwater noise levels, primarily due to industrial activity and small vessel traffic, could temporarily increase above the baseline levels during pile driving/removal activities and project construction. The increase in underwater noise levels would vary depending on the type of pile and method of pile driving used during pile installation or removal but is expected to be above baseline underwater noise for 75 days over the course of 18 weeks.

Marine mammals in Port Angeles Harbor and surrounding areas encounter vessel traffic associated with both Navy and non-Navy activities. Several studies have linked vessel traffic with behavioral changes in killer whales in Pacific Northwest inland waters (Kruse 1991; Kriete 2002; Williams et al. 2002; Bain et al. 2006), although it is not well understood whether the presence and activity of the vessels, the vessel noise produced, or a combination of these factors produces the changes. The probability and significance of vessel and marine mammal interactions are dependent on several factors including the numbers, types, and speeds of vessels; the regularity, duration, and spatial extent of activities; and the presence/absence and density of marine mammals.

Behavioral changes in response to vessel presence include avoidance reactions, alarm/startle responses, temporary abandonment of haul-outs by pinnipeds, and other behavioral and stress-related changes (such as altered swimming speed, direction of travel, resting behavior, vocalizations, diving activity, and respiration rate) (Watkins 1986; Würsig et al. 1998; Terhune and Verboom 1999; Ng and Leung 2003; Foote et al. 2004; Mocklin 2005; Bejder et al. 2006; Nowacek et al. 2007). Some dolphin species approach vessels and are observed bow riding or jumping in the wake of vessels (Norris and Prescott 1961; Shane et al. 1986; Würsig et al. 1998; Ritter 2002). In other cases, neutral behavior (i.e., no obvious avoidance or attraction) has been

reported (review in Nowacek et al. 2007). Little is known about the biological importance of changes in marine mammal behavior under prolonged or repeated exposure to high levels of vessel traffic, such as increased energetic expenditure or chronic stress, which can produce adverse hormonal or nervous system effects (Reeder and Kramer 2005).

During construction, additional vessels may operate in the ZOI, but would operate at low speeds within the relatively limited construction zone and access routes during the in-water construction period. The presence of vessels would be temporary and occur in a harbor with a high level of existing vessel traffic. Therefore, effects on individual animals are expected to be limited to short-term behavioral changes and are not expected to rise to the level of take or harassment as defined under the MMPA.

Additional noise could be generated by barge-mounted equipment, such as cranes, compressors, and generators, but this noise would typically not exceed existing underwater noise levels resulting from existing routine waterfront operations. While the increase may change the quality of the habitat, noise from barge-mounted equipment is not expected to exceed the Level A or B harassment thresholds, and impacts on marine mammals from these noise sources are expected to be negligible.

9.2 Effects on Water Quality

Temporary and localized reduction in water quality would occur as a result of in-water construction activities. Most of this effect would occur during the installation and removal of piles when bottom sediments are disturbed. Effects on turbidity and sedimentation are expected to be short-term and not result in any measurable effects on marine mammals. Suspension of anoxic sediment could result in temporary, minor, and localized reduced dissolved oxygen in the water column. However, if decreases occur, they would be minimal and localized; in addition, because marine mammals breathe air from the surface, they would not be affected by low levels of dissolved oxygen.

9.3 Impacts on Prey Base (Fish)

Pile driving/removal would impact marine habitats used by fish. Marine habitats used by fish species that occur in the ZOI include nearshore intertidal and subtidal habitats, including piles used for structure and cover. The greatest impact on prey species during pile installation would result from behavioral harassment resulting from pile driving noise. Secondary impacts include benthic habitat displacement, re-suspension of sediments, and injury from underwater noise. The prey base for pinniped species in the ZOI includes a variety of fish such as Pacific hake, Pacific herring, and rockfish (*Sebastes* spp.). Harbor porpoise likely feed on schooling forage fish, such as Pacific herring, smelts (Osmeridae), and squid.

9.3.1 Underwater Noise Effects on Fish

The greatest impact on marine fish during construction would occur during impact pile driving because pile driving would exceed the established underwater noise behavior guidance and injury thresholds for fish (U.S. Department of the Navy 2015b). However, most piles would be installed or removed with vibratory drivers, which have lower amplitude sound levels and have not been associated with fish kills.

During steel impact pile driving, the associated underwater noise levels would have the potential to cause injury and could result in behavioral responses, including ZOI avoidance. To reduce potential effects on salmonids, including juvenile ESA-listed salmonids, the project would adhere to the in-water work window. A bubble curtain, or other noise-attenuating device, would be deployed to reduce the underwater noise levels and associated impacts on underwater organisms during impact pile driving of steel piles. To further minimize the underwater noise impacts, vibratory pile drivers would be used to the maximum extent practicable to drive or remove steel piles. An impact hammer would be primarily used to verify load bearing capacity or where piles cannot be advanced further with a vibratory driver due to hard substrate conditions. Additionally, impact driving of steel piles would occur intermittently throughout any one day and would cease at night, further limiting the potential for adverse effects from cumulative exposure.

Fish within the areas where noise exceeds the behavioral guidance (150 dB RMS re 1µPa) may display a startle response during initial stages of pile driving/removal and would potentially avoid the immediate project vicinity during pile driving/removal and other construction activities. However, field observation investigations of juvenile salmonid behavior near pile driving projects (Feist 1991; Feist et al. 1996) found little evidence that normally nearshore out-migrating salmonids move farther offshore to avoid the general ZOI. In fact, some studies indicate that construction site behavioral responses, including site avoidance, may be as strongly tied to visual stimuli as to underwater sound (Feist 1991; Feist et al. 1996; Ruggerone et al. 2008). Therefore, it is possible that salmonids, and likely other fish species, may alter their normal behaviors including startle response and avoidance of the immediate project site.

Thus, prey availability for marine mammal predators within an undetermined portion of the area near the project site could be reduced temporarily in localized areas during pile driving/removal. However, with the mitigation measures that would be implemented, the effect on the overall marine mammal fish forage base would be minimal and would not rise to the level of MMPA take.

9.3.2 Effects on Fish Habitats/Abundance

The project pile driving/removal activities would adversely affect some habitat conditions for marine fish, including forage fish, in the ZOI. Positioning and anchoring the construction barges and removing/driving piles would locally increase turbidity, disturb benthic habitats, and disturb forage fish in the immediate vicinity of the piles. Additionally, marine vegetation and attached biota would be removed. During pile driving/removal activities, displacement of sediment could bury benthic organisms with limited mobility. Increased turbidity could make it difficult for predators to locate prey. All of these actions would be temporary, with sediments settling back soon after the cessation of activities, and would be localized to the immediate area around piles. Foraging and refuge habitat quality for prey species would be permanently degraded over localized areas. The effect on the forage prey base for marine mammals is expected to be minor. New overwater structures are being built that would permanently degrade or alter habitat.

Impacts on salmonid and forage fish populations, including ESA-listed species, would be minimized by adhering to the in-water work period designated. The work period is designated when out-migrating juvenile salmonids are least likely to occur. The project would result in the loss and modification of fish habitats, but because the impact area is small relative to the harbor, it is not likely to affect the overall prey base for marine mammals.

9.4 Likelihood of Habitat Restoration

The project would result in permanent impacts on foraging habitats that may be used by marine mammals and would not be restored. However, fish species are abundant in the harbor and the Strait of Juan de Fuca. The increase in overwater coverage would displace fish but not affect overall fish abundance and marine mammal prey species.

10 Impacts on Marine Mammals from Loss or Modification of Habitat

The anticipated impact of the loss or modification of the habitat on the marine mammal populations involved.

Construction of the trestle, fixed pier, and floating docks would result in a permanent increase in overwater coverage of 25,465 ft^2 (2,366 m^2). An estimated 745 ft^2 (69 m^2) of benthic seafloor would be displaced from the installation of 144 permanent piles. This loss and modification of habitat is not expected to result in substantial impacts on marine mammals or their food resources. As described in Section 9, temporary impacts may occur, but those impacts would be limited to the immediate area surrounding the structure being installed. These temporary impacts would cease upon the completion of the project.

11 Means of Effecting the Least Practicable Adverse Impacts

The availability and feasibility (economic and technological) of equipment, methods, and manner of conducting such activity or other means of effecting the least practicable adverse impact upon the affected species or stocks, their habitat, and on their availability for subsistence uses, paying particular attention to rookeries, mating grounds, and areas of similar significance.

The Navy would employ the BMPs and mitigation measures listed in this section, and has developed a Marine Mammal Monitoring and Mitigation Plan (provided in Appendix B of this IHA) to avoid and minimize impacts on marine mammals, their habitats, and forage species. BMPs, mitigation measures, and the Marine Mammal Monitoring and Mitigation Plan 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, mitigation measures, and the Marine Mammal Monitoring and Mitigation Plan constitutes a contract violation.

11.1 General Construction Best Management Practices

- All work will adhere to performance requirements of the Clean Water Act, Section 404 permit, and Section 401 Water Quality Certification. No in-water work will begin until regulatory authorizations have been issued.
- The construction contractor is responsible for the preparation of an Environmental Protection Plan. The plan will be submitted to the Navy and implemented before 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.
- Washwater from the washdown of equipment or work areas shall be contained for proper disposal and shall not be discharged into surface waters unless authorized.
- Equipment that enters surface waters shall be inspected and maintained to prevent any leaks that result in 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 the grounding of a barge.
- Where eelgrass (*Zostera* spp.) 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.

11.2 Indicator Pile Removal and Installation Best Management Practices

- 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.
- Any floating debris generated during pile 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.

11.3 Timing Restrictions

- To minimize the number of fish exposed to underwater noise and other construction disturbance, in-water work will occur during the July 16 through February 15 in-water work window, 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 February 15 when impact pile driving/removal will only occur starting 2 hours after sunrise and ending 2 hours before sunset, to protect foraging marbled murrelets during the nesting season (April 1–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.

- Upland construction activities could occur between 7:00 a.m. and 10:00 p.m. during any time of the year.

11.4 Mitigation Measures for Marine Mammals

The following mitigation measures will be implemented during pile driving or removal to avoid marine mammal exposure to Level A injurious noise levels generated from impact pile driving, and to reduce to the lowest extent practicable exposure to Level B behavioral harassment. The Navy will shut down pile driving or removal if any marine mammal not requested for take enters the behavioral harassment zones.

11.4.1 Coordination

The Navy shall conduct briefings between construction supervisors and crews, the marine mammal monitoring team, and Navy staff prior to the start of all pile driving/removal activity and when new personnel join the work. These briefings will include an explanation of project safety, responsibilities, communication procedures, marine mammal monitoring protocol, and operational procedures.

Prior to the start of pile driving or removal, the Navy will ensure that the Orca Network and/or Center for Whale Research are contacted to determine the location of the nearest marine mammal sightings. Daily sightings information are reported on the Orca Network Twitter site (https://twitter.com/orcanetwork), which will be checked several times a day. In addition, there is the SeaSound Remote Sensing Network, which is a system of interconnected hydrophones installed in the marine environment of Haro Strait (the west side of San Juan Island) to study orca communication, in-water noise, bottomfish ecology, and local climatic conditions. Monitoring of these networks will provide real-time information on the presence or absence of whales before starting any pile driving or removal.

11.4.2 Acoustic Minimization Measures

- Vibratory installation and removal 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 2 ft (0.6 m) (see Section 6.3.2). A noise attenuation device is not required during vibratory pile driving/removal.
- 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 its 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 stands shall occur prior to use for impact driving.

11.4.3 Soft-Start

The objective of a soft-start is to provide a warning and/or give animals in close proximity to pile driving/removal 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.

- A soft-start procedure will be used at the beginning of each day's in-water pile driving/removal or any time impact pile driving/removal has been ceased for more than 30 minutes. A soft start would be required regardless of how recently vibratory driving or removal has been conducted.
    - For impact pile driving, the following soft-start procedures will be conducted:
        - 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/removal, the following soft-start procedures would be conducted:
        - 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 NMFS Headquarters if the soft-start procedure is discontinued. [2]

- 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 personnel safety concerns.

11.4.4 Visual Monitoring and Shutdown Procedures

A Marine Mammal Monitoring and Mitigation Plan is included as Appendix B of this IHA and will be approved by NMFS prior to commencement of in-water project work. The plan includes the following:

- For all impact and vibratory pile driving/removal, both shutdown (Level A) and behavioral harassment (Level B) zones will be monitored (see Figures 2-1 and 2-2 in the Marine Mammal Monitoring and Mitigation Plan, included as Appendix B of this IHA).
- Monitoring will take place from 15 minutes prior to initiation through 30 minutes post-completion of pile driving/removal.
- For pile driving, the shutdown zone shall include all areas where the underwater sound pressure levels are anticipated to equal or exceed the Level A (injury) criteria for marine mammals. The shutdown zone will always be a minimum of 33 ft (10 m) from the pile being removed or installed to prevent injury from physical interaction of marine mammals with construction equipment.
- The behavioral harassment zone shall include all areas where the underwater or airborne sound pressure levels are anticipated to equal or exceed the Level B (behavioral harassment) criteria for marine mammals during impact or vibratory pile driving/removal. However, due to the large area of the vibratory underwater behavioral harassment zone, this zone may be reduced to a practicable monitoring area in final approved Marine Mammal Monitoring and Mitigation Plan.
- Visual monitoring will be conducted by qualified, trained marine mammal observers (hereafter “observer”). An observer is a biologist with prior training and experience conducting marine mammal monitoring or surveys, and who has the ability to identify

[2] In 2013, vibratory pile driving during construction of a deep wharf, the 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.

marine mammal species and describe relevant behaviors that may occur in proximity to in-water construction activities.

- Trained observers will be placed at the best vantage point(s) practicable (e.g., from a small boat, construction barge, on shore, or any other suitable location) to monitor for marine mammals and implement shutdown/delay procedures when applicable by calling for the shutdown to the pile driver operator.
- If the shutdown zone is obscured by fog or poor lighting conditions, impact pile driving will not be initiated, and will cease if already in progress, until the entire shutdown zone is visible (i.e., the entire shutdown zone must be visible to the naked eye).
- Prior to the start of impact pile driving, the shutdown zone will be monitored for 15 minutes to ensure that the shutdown zone is clear of marine mammals. Pile driving will only commence once observers have declared the shutdown zone clear of marine mammals.
- If a marine mammal is observed in the behavioral harassment zone, but not approaching or entering the shutdown zone, a "take" will be recorded and the work will be allowed to proceed without cessation. Marine mammal behavior will be monitored and documented.
- If a marine mammal approaches or enters a shutdown zone during pile impact or vibratory driving/removal, work will be halted and delayed until either the animal has voluntarily left and been visually confirmed beyond the shutdown zone or 15 minutes have passed without re-detection of the animal.

11.4.5 Data Collection

NMFS requires that at a minimum, the following information be collected on the marine mammal sighting forms:

- Date and time that pile removal or installation begins and ends.
- Construction activities occurring during each observation period.
- Weather parameters as specified in the Marine Mammal Monitoring and Mitigation Plan (e.g., percent coverage, visibility).
- Water conditions (e.g., sea state, tidal state [incoming, outgoing, slack, low, and high]).
- Species, numbers, and, if possible, sex and age class of marine mammals.
- Marine mammal behavior patterns observed, including bearing and direction of travel, and, if possible, the correlation to sound pressure levels being generated by the project when these observations were made.
- Distance from pile removal and installation activities to marine mammals, and distance from the marine mammal to the observation point.
- Locations of all marine mammal observations.

- Other human activity in the area.

The Navy will note in behavioral pattern observations, to the extent practicable, if an animal remained in the area during construction activities. If possible, the Navy will identify if the same animal or different individuals are being affected.

11.4.6 Mitigation Effectiveness

All observers utilized for mitigation activities will be experienced biologists with training in marine mammal detection and behavior. Due to their specialized training, the Navy expects that visual mitigation will be highly effective. The observers will be positioned in locations that provide the best vantage point(s) for monitoring. This will probably be an elevated position(s) to provide a better range of viewing angles. In addition, the small radius of the shutdown zone makes the likelihood of detecting a marine mammal in this zone extremely high.

12 Effects on Arctic Subsistence Hunting and Plan of Cooperation

Where the proposed activity would take place in or near a traditional Arctic subsistence hunting area and/or may affect the availability of a species or stock of marine mammal for Arctic subsistence uses, the applicant must submit either a plan of cooperation or information that identifies what measures have been taken and/or will be taken to minimize any adverse effects on the availability of marine mammals for subsistence uses. A plan must include the following:

(i) A statement that the applicant has notified and provided the affected subsistence community with a draft plan of cooperation

(ii) A schedule for meeting with the affected subsistence communities to discuss proposed activities and to resolve potential conflicts regarding any aspects of either the operation or the plan of cooperation

(iii) A description of what measures the applicant has taken and/or will take to ensure that proposed activities will not interfere with subsistence whaling or sealing

(iv) What plans the applicant has to continue to meet with the affected communities, both prior to and while conducting activity, to resolve conflicts and to notify the communities of any changes in the operation.

Subsistence use is the traditional exploitation of marine mammals by native peoples for their own consumption. This project does not occur in traditional Arctic subsistence hunting areas. Therefore, there are no relevant subsistence uses of marine mammals associated with this action.

13 Monitoring and Reporting Efforts

The suggested means of accomplishing the necessary monitoring and reporting that will result in increased knowledge of the species, the level of taking, or impacts on populations of marine mammals that are expected to be present while conducting activities and the suggested means of minimizing burdens by coordinating such reporting requirements with other schemes already applicable to persons conducting such activity. Monitoring plans should include a description of the survey techniques that will be used to determine the movement and activity of marine mammals near the activity site(s) including migration and other habitat uses, such as feeding.

13.1 Coordination

During the in-water work period covered by the IHA, the Navy will update NMFS on the progress of the project every other month, beginning at the start of construction.

13.2 Monitoring Plans

To reduce impacts on marine mammals to the lowest extent practicable, a Marine Mammal Monitoring and Mitigation Plan will be implemented. A proposed Monitoring and Mitigation Plan is included in Appendix B of this IHA.

13.3 Reporting

A draft project monitoring report will be submitted to NMFS within 90 work business days of the completion of required monitoring. The report will detail the monitoring protocol, summarize the data recorded during monitoring, and estimate the number of marine mammals that may have been harassed. Final reports will be prepared and submitted to NMFS within 30 days following receipt of comments on the draft reports from NMFS.

14 Research Efforts

Suggested means of learning of, encouraging, and coordinating research opportunities, plans, and activities relating to reducing such incidental taking and evaluating its effects.

To minimize the likelihood that impacts will occur on marine mammals, all construction activities will be conducted in accordance with federal, state, and local regulations, and mitigation measures specified in Section 11 will be implemented to protect marine mammals. The Navy will coordinate all activities with the relevant federal and state agencies, including but not limited to NMFS, U.S. Fish and Wildlife Service (USFWS), USCG, U.S. Army Corps of Engineers (USACE), and WDFW.

The Navy is one of the world's leading organizations in assessing the effects of human activities on the marine environment, including marine mammals. Navy scientists work cooperatively with other government researchers and scientists, universities, industry, and non-governmental conservation organizations in collecting, evaluating, and modeling information on marine resources. They also develop approaches to ensure that these resources are minimally impacted by existing and future Navy activities.

The Navy will share field data and behavioral observations on all marine mammals that occur in near the project site with NMFS and other agencies upon request. Results of the monitoring effort will be provided to NMFS in summary reports (Section 13.3). The Navy strives to be a world leader in marine species research and has provided more than $100 million over the past 5 years to universities, research institutions, federal laboratories, private companies, and independent researchers around the world to increase the understanding of marine species physiology and behavior, with several projects ongoing in Washington state.

The Navy sponsors 70 percent of all U.S. research concerning the effects of human-generated sound on marine mammals and 50 percent of such research conducted worldwide. Major topics of Navy-supported research include the following:

- Gaining a better understanding of marine species distribution and important habitat areas.
- Developing methods to detect and monitor marine species before and during training.
- Understanding the effects of sound on marine mammals.
- Developing tools to model and estimate potential effects of sound.

The Navy has sponsored several workshops and ongoing surveys to evaluate the current state of knowledge and potential for future acoustic monitoring of marine mammals. The workshops

brought together acoustic experts and marine biologists from the Navy and outside research organizations to present data and information on current acoustic monitoring research efforts and to evaluate the potential for incorporating similar technology and methods into Navy activities.

The following marine mammal monitoring activities and contracted studies are being conducted by the Navy outside of and in addition to the Navy's commitments to NMFS under existing permits. To better understand marine mammal presence and habitat use in the inland marine waters of northern Washington, the Navy has funded and coordinated four major efforts:

- **Puget Sound Pinniped Haul-out Surveys at Specific Naval Installations:** Biologists at NAVBASE Kitsap Bremerton, Bangor, and Naval Station Everett conduct counts of seals and sea lions hauled out on Navy assets (e.g., submarines) and on floating security fences. In the case of NAVBASE Kitsap Bangor and Naval Station Everett, counts are conducted daily (excluding weekends). For NAVBASE Kitsap Bremerton, counts are collected during a monthly water quality sampling program. All animals are identified to species where possible. This information aids in the determination of seasonal use of each site and trends in the number of animals. Currently, efforts are underway to increase the frequency of the surveys at NAVBASE Kitsap Bremerton and expand to additional Navy areas such as Manchester, Whidbey Island, and Indian Island.
- **Opportunistic Marine Mammal Vessel Surveys in Hood Canal and Dabob Bay:** The Navy conducted an opportunistic marine mammal density survey in Hood Canal and Dabob Bay during September and October 2011 and again in October 2012. In Hood Canal, the surveys followed a double saw-tooth pattern to achieve uniform coverage of the entire Bangor waterfront. Transects generally covered the area from Hazel Point on the south end of the Toandos Peninsula to Thorndyke Bay. Surveys in adjacent Dabob Bay represented a different pattern and generally followed more closely to the shoreline while completing a circular route through the bay. A large exclusion zone surrounding a Navy ship moored temporarily in Dabob Bay made it difficult to perform zigzag transects across the bay; therefore, early attempts at surveys in Dabob Bay did not follow a zigzag pattern, and switching to this survey pattern later in the project would have made density information collected during early "loop pattern" surveys incompatible with later data. Therefore, the loop pattern was followed during all subsequent baseline surveys in the bay. These surveys had a dual purpose of collecting marine mammal and marbled murrelet (bird species) data, and shoreline surveys tended to yield more marbled murrelet sightings.

- **Aerial Pinniped Haul-out Surveys:** The Navy funded and contracted WDFW to conduct aerial surveys of pinniped haul-outs in all of Puget Sound and the Strait of Juan de Fuca out to Cape Flattery. NMFS funded aerial surveys of the San Juan Islands region. The surveys began in 2013 and continued until spring 2014. Collectively, this information will be used to revise and update the *2000 Atlas of Seal and Seal Lion Haul-outs in Washington State* (Jeffries et al. 2000). The survey area does not cover the outer coast of Washington, only the inland waters.
- **Aerial Cetacean Surveys in Puget Sound (Admiralty Inlet and South):** The Navy has contracted aerial surveys of cetaceans in Puget Sound to better understand seasonality and distribution, with the goal of improved density values. These surveys began in late 2013, with the survey frequency still being established.

Overall, the Navy will continue to research and contribute to university/external research to improve the state of the science regarding marine species biology and acoustic effects. These efforts include monitoring programs, data sharing with NMFS from research and development efforts, and current research as previously described.

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Appendix A Proxy Source Levels for Pile Driving Modeling

Appendix B Marine Mammal Monitoring and Mitigation Plan

Marine Mammal Monitoring and Mitigation Plan

Pier and Support Facilities for Transit Protection System
U.S. Coast Guard Air Station/Sector Field Office Port Angeles, Washington

Submitted to:
Office of Protected Resources, National Marine Fisheries Service,
National Oceanographic and Atmospheric Administration

Prepared by:
Naval Facilities Engineering Command Northwest

For:
Naval Base Kitsap at Bangor and Naval Strategic Systems Program

February 2016

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Acronyms and Abbreviations

AIRSTA/SFO	Air Station/Sector Field Office
CFR	Code of Federal Regulations
dB	decibel
ft	foot/feet
GPS	global positioning system
IHA	Incidental Harassment Authorization
km	kilometer
m	meter/meters
MMMP	Marine Mammal Monitoring and Mitigation Plan
MMPA	Marine Mammal Protection Act
Navy	United States Department of the Navy
NMFS	National Marine Fisheries Service
PSO	Protected Species Observer
RMS	root mean square
TPS	Transit Protection System
U.S.	United States
USCG	United States Coast Guard
WAC	Washington Administrative Code
µPa	microPascal

1 Introduction

As required by the Marine Mammal Protection Act (MMPA), the United States (U.S.) Department of the Navy (Navy) has requested an Incidental Harassment Authorization (IHA) from the National Marine Fisheries Service (NMFS) for Level B incidental take (behavioral harassment) of marine mammals during the construction of a pier and support facilities at the U.S. Coast Guard (USCG) Air Station/Sector Field Office Port Angeles (AIRSTA/SFO Port Angeles), located in Port Angeles Harbor on the Ediz Hook peninsula, Port Angeles (Department of the Navy 2016).

This Marine Mammal Monitoring and Mitigation Plan (MMMP, the Plan) was developed using guidance from NMFS (2015) and is in accordance with the IHA Application submitted for the Transit Protection System (TPS) Pier and Support Facilities project (the project). The Plan would be implemented during pile driving/removal for the requested IHA period of 1 year from November 1, 2016 to October 31, 2017. Because of the in-water work window (July 16 through February 15 for Tidal Reference Area 10 [Washington Administrative Code (WAC) 220-110-240]) and the fact that an IHA covers a 1-year period, pile driving/removal activities and subsequent marine mammal monitoring could occur from November 1, 2016 to February 15, 2017 and then begin again on July 16, 2017 and end by October 31, 2017.

2 Methods

2.1 Observer Qualifications

Monitoring will be conducted by trained marine mammal observers identified as qualified Protected Species Observers (PSOs, observers). PSOs will be present on site at all times during pile removal and driving. Each PSO must meet a list of qualifications for marine mammal observers to be considered qualified, or undergo training to meet the qualifications before the start of pile driving/removal (NMFS 2015).

The minimum qualifications for PSOs (NMFS 2015) include:

- Visual acuity in both eyes (correction is permissible) sufficient for the discernment of moving targets at the water's surface with the ability to estimate target size and distance. Use of binoculars may be necessary to correctly identify the target.
- Experience or training in the field identification of marine mammals (cetaceans and pinnipeds).
- Sufficient training, orientation, or experience with construction operations to provide for personal safety during observations.

- Experience and ability to conduct field observations and collect data according to assigned protocols (this may include academic experience).
- Ability to communicate orally, by radio or in person, with project personnel to provide real time information on marine mammals observed in the area as necessary.
- Writing skills sufficient to prepare a report of observations that would include such information as the number and type of marine mammals observed; the behavior of marine mammals in the activity area during construction; dates and times when observations were conducted; dates and times when in-water construction activities were conducted; dates and times when marine mammals were present at or within the Level B behavioral harassment zone; and dates and times when pile removal or driving activities were paused due to the presence of marine mammals.

A PSO will be placed at the best vantage point(s) practicable (e.g., from a small boat, the pile driving barge, on shore, or any other suitable location) to monitor for marine mammals and implement shutdown/delay procedures when applicable by calling for the shutdown to the hammer operator. The PSOs will have no other construction-related tasks while conducting monitoring. A dedicated monitoring coordinator (also referred to as the PSO lead) will be on-site during all construction days. The monitoring coordinator will oversee PSOs. The monitoring coordinator will serve as the liaison between the PSOs and the construction contractor to assist in the distribution of information.

2.2 Data Collection

PSOs will use the most current NMFS-approved Marine Mammal Observation Record Forms and sighting codes supplied by the Navy (Attachment A of this MMMP), which will be completed by each PSO for each survey day. Recorded data will include the following:

- Date and time that pile driving/removal begins or ends.
- Construction activities occurring during each sighting.
- Weather parameters (e.g., percent cover, percent glare, visibility).
- Water conditions (e.g., tidal state [incoming (flood), slack (neither direction), or outgoing (ebb)], and sea state). The Beaufort Wind Scale and Sea State (Attachment B of this MMMP) will be used to determine sea-state.
- Species, numbers, and if possible, sex and age class of marine mammals.
- Marine mammal behavior patterns observed, including bearing from PSO and direction of travel. If possible, include the correlation to sound pressure levels for context.
- Distance from pile driving/removal activities to marine mammals and distance from the marine mammal to the observation point.
- Locations of all marine mammal observations.

- Marine mammal behavior, overall numbers of individuals observed, frequency of observation, and the time corresponding to the daily tidal cycle will be recorded.
- Other human activity in the area. Record the hull numbers of fishing vessels if possible.

In addition, the PSO shall respond in a timely manner to reports of dead, stranded marine mammals and cooperate with federal, state, and local government officials and employees and other stranding network participants when responding to these strandings and, if needed, complete a chain of custody form (Attachment C of this MMMP). If the PSO receives a report of a dead, stranded marine mammal and does not have the capability to respond to the report, the PSO shall notify the Regional Stranding Coordinator, NMFS. Also, if the Regional Stranding Coordinator receives a report of a dead, stranded marine mammal, the Regional Stranding Coordinator may contact the PSO to determine whether the PSO has the capability to respond to the stranding.

The monitoring coordinator will complete a Marine Mammal Monitoring Summary Form for each day of monitoring. The summary form compiles information collected on the individual sighting forms and provides additional details about construction activities during marine mammal monitoring. The summary form will be provided to the Navy each day following monitoring.

2.3 Equipment

The following equipment will be required to conduct marine mammal monitoring:

- If boat-based monitors are used, a survey boat (with flying bridge for elevated observations) will include: covered cabin areas to keep electrical equipment dry, a fixed marine radio for the Captain to communicate on Ch. 16 and other marine channels independent of PSOs communicating on a dedicated channel, depth finder, measuring tape, navigational plotting equipment, and both fixed and hand-held global positioning system (GPS) units. Vessels will comply with all USCG regulations and be able to pass a USCG safety inspection.
- Hearing protection for biologists and boat operators working near heavy construction equipment.
- Portable marine radios and headsets for the PSOs to communicate with the monitoring coordinator, construction contractor, and other PSO(s).
- Cellular phones and the contact information for the other PSO(s), monitoring coordinator, and NMFS point of contact.
- Green flags (one per boat/observing location) as back-up for radio communication.
- Red flags (one per boat/observing location) as back-up for radio communication.

- Nautical charts.
- Daily tide tables for the activity area within the Hood Canal.
- Watch or chronometer.
- Binoculars with built-in rangefinder or reticles – (quality 7 x 50 or better).
- Marine Mammal Monitoring and Mitigation Plan, IHA permit, and/or other relevant permit requirement specifications in sealed clear plastic cover.
- Notebook with pre-standardized monitoring Marine Mammal Observation Record Forms on non-bleeding paper (e.g., Rite-in-the Rain ™).
- Marine mammal identification guides on waterproof paper.
- Clipboard, pen / pencil.

2.4 Injury Shutdown and Behavioral Harassment Monitoring Zones

The MMPA defines ‘‘harassment’’ as: “*any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild [Level A harassment]; or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering but that does not have the potential to injure a marine mammal*” [Level B harassment] (50 Code of Federal Regulations [CFR], Part 216, Subpart A, Section 216.3-Definitions). Pile driving/removal could generate underwater noise that potentially could result in Level A (injury) or Level B (behavioral harassment) to marine mammals swimming by or near the project site. Distances to injury thresholds and shutdown zones (Level A), as well as behavioral harassment thresholds and monitoring zones (Level B) are provided in Table 2-1 and depicted on Figures 2-1 and 2-2.

During the project, in-water acoustic measurements of vibratory and impact pile driving/removal will be taken. Project monitoring zones may be adjusted based on these measurements.

2.4.1 Injury Shutdown Zones

For the purposes of providing PSOs with clear guidance, injury shutdown zones were rounded up. To preclude injury to pinnipeds, a 10-meter (m) radius shutdown zone from a pile will be implemented during impact pile driving (Figure 2-1). The 10-m shutdown zone is based on encompassing the distance to the 190 decibels (dB) root-mean-square (RMS) referenced to (re) 1 micropascal (µPa) impact pile driving injury zone (calculated at 6 m for pinnipeds). To preclude injury to cetaceans, a 30-m radius shutdown zone will be implemented during impact pile driving (calculated at 29 m for cetaceans). Vibratory pile drivers have relatively low sound levels (<180 dB re 1µPa) and are not expected to cause injury to marine mammals (NMFS

2013). If the Navy determines that another activity may physically harm marine mammals, then a 10-m radius shutdown zone from the activity will be also be monitored.

Table 2-1. Distances/Areas to Injury and Harassment Thresholds and Monitoring Zones for Marine Mammals

Underwater Pile Driving/Removal Noise Source	NMFS Thresholds for Marine Mammals			
	Injury (Level A) Pinnipeds (190 dB_{RMS}) Shutdown Zone (distance)	Injury (Level A) Cetaceans (180 dB_{RMS}) Shutdown Zone (distance)	Behavioral Harassment (Level B) from Impulse Noise (160 dB_{RMS}) (distance)	Behavioral Harassment from Continuous Noise (120 dB_{RMS}) (distance)
Impact Pile Driving	10 m	30 m	631 m	NA
Vibratory Pile Driving/Removal	NA	NA	NA	13,594 m

Note: Thresholds used for loudest pile type, for the TPS project it is 30-inch steel. Injury zone distances were rounded up from calculated distances.
dB = decibel; NA = not applicable; RMS = root mean square.
Source: NMFS 2013.

2.4.2 Behavioral Harassment Zones

The 631-m behavioral harassment zone for impact pile driving is the distance that noise levels are estimated to be at or above the 160 dB re 1µPa Level B behavioral threshold (Table 2-1 and Figure 2-1). A larger behavioral harassment zone is estimated to extend 13.6 kilometer (km) during vibratory pile driving/removal (Table 2-1 and Figure 2-2).

2.5 PSO Monitoring Locations

To effectively monitor the shutdown zones, marine mammal PSOs would be positioned at the best practicable vantage points, taking into consideration security, safety, and space limitations at USCG AIRSTA/SFO Port Angeles. A minimum of three PSOs would be present during both impact and vibratory pile driving/removal. Both the injury and behavioral harassment zones would be monitored in order to remain in compliance with the MMPA. PSOs may be positioned on vessels, on the existing T-Pier, on shore, on the pile driving barge, or at other locations to ensure adequate visual coverage of each zone. The exact locations of PSOs during the monitoring will depend on site conditions during pile driving/removal and locations of the pile being driven or removed. Final placement will be at the professional discretion of the qualified monitoring coordinator.

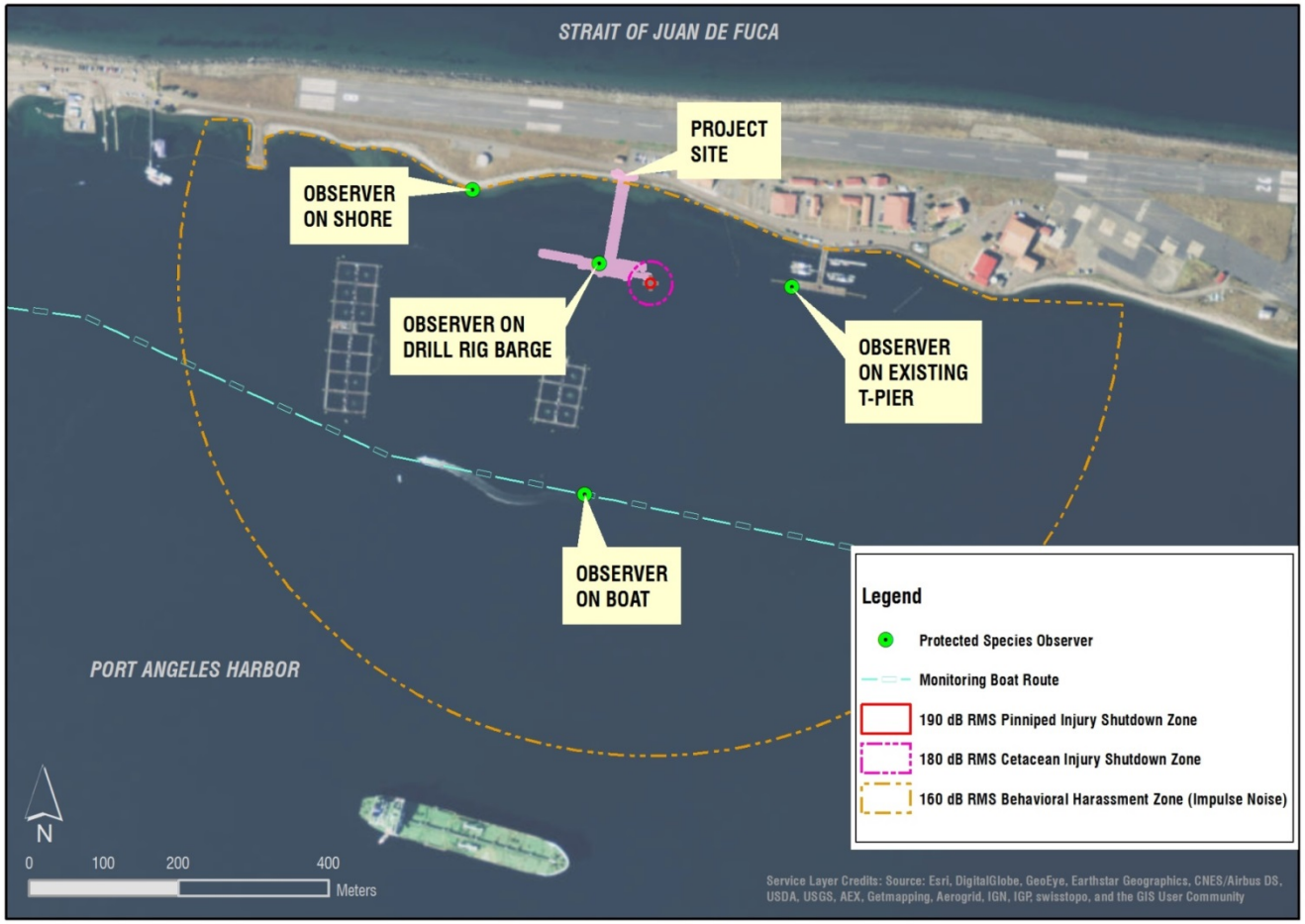


Figure 2-1. Steel Pile Impact Driving Monitoring

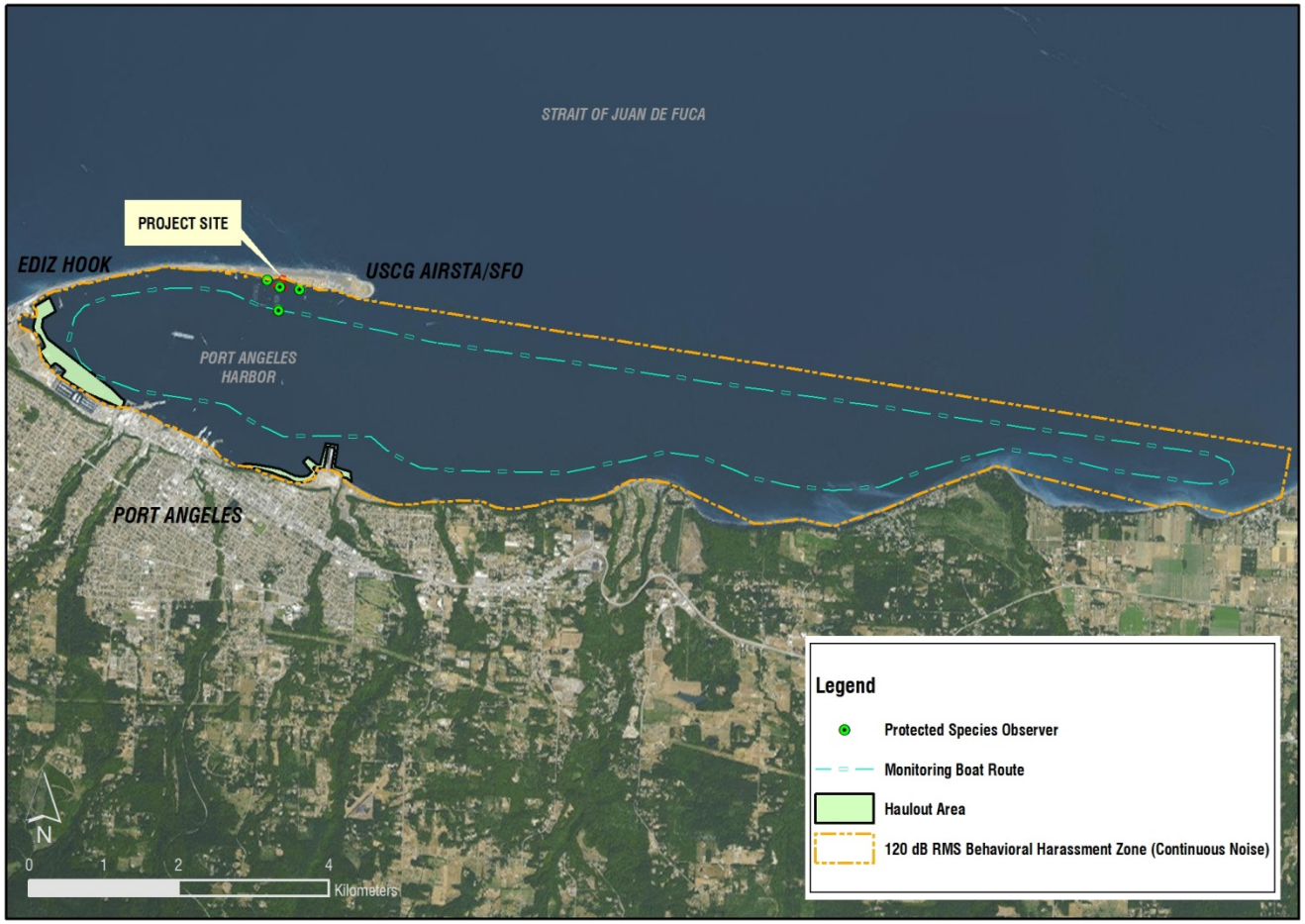


Figure 2-2. Steel Pile Vibratory Driving/Removal Monitoring

2.6 Monitoring Techniques

The Navy would collect sighting data and behaviors of marine mammal species observed before, during, and after pile removal and driving activities. The efficacy of visual detection depends on several factors including the PSO's ability to detect the animal, the environmental conditions (visibility and sea state), and monitoring platforms. The following survey methodology will be implemented for all monitoring activities:

- PSOs will survey the shutdown and behavioral harassment zones. A minimum of three PSOs will be present during all impact and vibratory pile driving/removal. Monitoring of the shutdown zone will take place from 15 minutes prior to initiation through 30 minutes post-completion of pile driving/removal to ensure no marine mammals are present.
- Marine Mammal Observation Record Forms (Attachment A of this MMMP) will be used to document observations.
- Any survey boats engaged in marine mammal monitoring will maintain speeds equal to or less than 10 knots.
- PSOs will be trained and experienced marine mammal experts with the ability to accurately verify species sighted.
- Observers will use binoculars and the naked eye to search continuously for marine mammals.

2.6.1 Monitoring to Estimate Level B Take of Pinnipeds and Harbor Porpoise and Prevent Level A Take

The Navy proposes the following in order to prevent Level A injury take of all marine mammals in the shutdown zones, and to estimate Level B take of pinnipeds and harbor porpoise in the behavioral harassment zone:

- During impact driving, at least two land-based PSO monitors will monitor the injury (shutdown zones) and behavioral harassment zones (Figure 2-1). Pile driving will be shut down if any marine mammal approaches injury zone.
- During vibratory pile removal and installation, at least one land-based PSO and one monitoring boat with a PSO and boat operator will monitor the 120 dB RMS Level B behavioral harassment zone (Figure 2-2).
- To verify the required monitoring distance, the injury (190 [pinnipeds] and 180 [cetaceans] dB RMS) (shutdown zones) and behavioral harassment (160 dB RMS) zones will be determined by using a range finder or hand-held GPS device.

- The behavioral harassment zone will be monitored for the presence of marine mammals 15 minutes before, during, and 30 minutes after any pile removal activity.
- Monitoring will be continuous unless the contractor takes a significant break, in which case monitoring will be required 15 minutes prior to restarting pile removal or driving activities.
- If marine mammals are observed, their location within the behavioral harassment and shutdown zones, and their reaction (if any) to pile removal or driving activities will be documented.

2.6.2 Monitoring to Prevent Take of Humpback Whale, Minke Whale, Gray Whale, Killer Whale, Dall's Porpoise, and Pacific White-Sided Dolphin

The Navy proposes the following measures to prevent Level B behavioral harassment take of humpback whale (*Megaptera novaeangliae*), minke whale (*Balaenoptera acutorostrata*), gray whale (*Eschrichtius robustus*), killer whale (*Orcinus orca*), Dall's porpoise (*Phocoenoides dalli*), and Pacific white-sided dolphin (*Lagenorhynchus obliquidens*):

- If humpback whale, minke whale, gray whale, killer whale, Dall's porpoise, or Pacific white-sided dolphin approach the behavioral harassment zone (120 dB RMS) during pile driving/removal, work will be paused until the marine mammal exits the behavioral harassment zone to avoid Level B harassment take.

2.6.3 Visual Survey Protocol | Pre-Activity Monitoring

The following survey methodology will be implemented prior to commencing pile driving/removal:

- If marine mammal(s) are present within or approaching the shutdown zones prior to pile driving, the start of these activities will be delayed until the animal(s) leave the shutdown zones voluntarily and have been visually confirmed beyond the shutdown zones, or 15 minutes has elapsed without re-detection of the animal.
- If marine mammal(s) are not detected within the shutdown zones (i.e., the zone is deemed clear of marine mammals), the PSOs will raise a green flag and radio the monitoring coordinator/construction contractor that pile driving can commence.
- If harbor porpoise, Steller sea lion, California sea lion, northern elephant seal, or harbor seal are present within the behavioral harassment zone, pile driving/removal would not need to be delayed. PSOs would monitor and document, to the extent practical, the behavior of marine mammals that remain in the zone.
- If humpback whale, minke whale, gray whale, killer whale, Dall's porpoise, Pacific white-sided dolphin, or other marine mammals the Navy does not have incidental harassment authorization for take are present within the behavioral harassment zone, pile

driving/removal would be delayed. PSOs would monitor and document, to the extent practical, the behavior of marine mammals that remain in the zone.

- In case of fog or reduced visibility, the PSOs must be able to see the shutdown zones or impact pile driving would not be initiated, and will cease if already in progress, until visibility in these zones improves to acceptable levels.

2.6.4 Visual Survey Protocol | During Activity Monitoring

The shutdown and behavioral harassment zones would be monitored throughout pile driving/removal. The following survey methodology will be implemented during pile driving/removal:

- If a harbor porpoise, Steller sea lion, California sea lion, northern elephant seal, or harbor seal is observed within or entering the behavioral harassment zones (Level B) during pile driving/removal, an exposure will be recorded, behaviors documented, and the shutdown zones monitor alerted to the position of the animal. However, that pile segment would be completed without cessation, unless the animal approaches or enters the shutdown zones (Level A), at which point all pile driving/removal activities will be halted. The PSOs shall immediately radio to alert the monitoring coordinator/construction contractor and raise a red flag. This action will require an immediate "all-stop" on pile operations.
- If humpback whale, minke whale, gray whale, killer whale, Dall's porpoise, Pacific white-sided dolphin, or other marine mammals the Navy does not have incidental harassment authorization for take is observed within or entering the behavioral harassment zones (Level B) during pile driving/removal, all pile driving/removal activities will be halted. The PSOs shall immediately radio to alert the monitoring coordinator/construction contractor and raise a red flag. This action will require an immediate "all-stop" on pile operations. Under certain construction circumstances where initiating the shutdown and clearance procedures (which could include a delay of 15 minutes or more) would result in an imminent concern for human safety, the shutdown provision may be waived.
- Once a shutdown has been initiated, pile driving/removal and other in-water construction activities will be delayed until the animal has voluntarily left the shutdown zones and has been visually confirmed beyond the shutdown zones, or 15 minutes have passed without re-detection of the animal.
- Once marine mammals are no longer detected within the shutdown zones (i.e., the zone is deemed clear of marine mammals), the PSO will raise a green flag and radio the monitoring coordinator/construction contractor that activities can re-commence.

- If marine mammals are detected outside the shutdown zones, the PSOs will continue to monitor these individuals and record their behavior, but pile driving and other in-water construction may proceed. Any marine mammals detected outside the shutdown zones after pile driving is initiated shall likewise continue to be monitored and their behaviors recorded.

2.6.5 Visual Survey Protocol | Post-Activity Monitoring

Monitoring of the shutdown zones will continue for 30 minutes following the completion of pile driving/removal. These surveys will record marine mammal observations, and will focus on observing and reporting unusual or abnormal behavior of marine mammals. During these surveys, if any injured, sick, or dead marine mammals are observed, procedures outlined below in Section 3.0 should be followed.

3 Interagency Notification

In the event that the Navy needs to modify the terms of this MMMP, the NMFS representative will be promptly contacted for discussion of the requested modification. In the unanticipated event that the specified activity clearly causes the take of a marine mammal in a manner prohibited by this IHA, such as an injury (Level A harassment), serious injury, or mortality, the Navy shall immediately cease the specified activities and report the incident to the Chief of the

Permits and Conservation Division, Office of Protected Resources, NMFS, and the Northwest Regional Stranding Coordinator, NMFS. The report must include the following information:

- Time and date of the incident.
- Description of the incident.
- Environmental conditions (e.g., wind speed and direction, Beaufort sea state, cloud cover, and visibility).
- Description of all marine mammal observations in the 24 hours preceding the incident.
- Species identification or description of the animal(s) involved.
- Fate of the animal(s).
- Photographs or video footage of the animal(s).

Activities shall not resume until NMFS is able to review the circumstances of the prohibited take. NMFS will work with the Navy to determine what measures are necessary to minimize the likelihood of further prohibited take and ensure MMPA compliance. Navy may not resume their activities until notified by NMFS.

In the event that the Navy discovers an injured or dead marine mammal, and the lead PSO determines that the cause of the injury or death is unknown and the death is relatively recent

(e.g., in less than a moderate state of decomposition), the Navy shall immediately report the incident to the Chief of the Permits and Conservation Division, Office of Protected Resources, NMFS, and the Northwest Regional Stranding Coordinator, NMFS. The report will include the same information as listed above. Construction activities may continue while NMFS reviews the circumstances of the incident. The Navy will work with NMFS to determine whether additional mitigation measures or modifications to the activities are appropriate.

In the event that the Navy discovers an injured or dead marine mammal, and the lead PSO determines that the injury or death is not associated with or related to the activities authorized in the IHA (e.g., previously wounded animal, carcass with moderate to advanced decomposition, or scavenger damage), the Navy shall report the incident to the Chief of Permits and Conservation Division, Office of Protected Resources, NMFS, and the Northwest Regional Stranding Coordinator, NMFS, within 24 hours of the discovery. The Navy shall provide photographs, video footage, or other documentation of the stranded animal sighting to NMFS.

Care should be taken in handling dead specimens to preserve biological materials in the best possible state for later analysis of cause of death, if that occurs. In preservation of biological materials from a dead animal, the finder (i.e., PSO) has the responsibility to ensure that evidence associated with the specimen is not unnecessarily disturbed.

Primary points of contact for the Navy are:

1. Tyler Yasenak - (360) 315-2452
2. Greg Leicht - (360) 315-5411

Primary points of contact at NMFS are:

1. Modification to protocol - (360) 753-5835
2. Chief of the Permits and Conservation Division (301) 427-8425
3. Northwest Regional Stranding Coordinator (206) 526-6550

4 Monitoring Reports

A draft report will be submitted to NMFS within 90 work days of the completion of marine mammal monitoring. A final report will be prepared and submitted to the NMFS within 30 work days following receipt of comments on the draft report from NMFS. At a minimum, the report shall include:

- General data:
  - Date and time of activities.
  - Water conditions (e.g., sea-state, tidal state).
  - Weather conditions (e.g., percent cover, visibility).
- Specific pile data:

  - Description of the pile driving/removal activities including the size and type of pile, the installation methods used for each pile, and the duration each method was used per pile.
  - Impact or vibratory hammer force used to drive/extract piles.
  - Detailed description of the sound attenuation system for impact driving, including the design specifications.
  - Depth of water where the pile was driven/removed.
  - Depth into the substrate that the pile was driven/removed.
- Pre-activity observational survey-specific data:
  - Date and time survey is initiated and terminated.
  - Description of any observable marine mammal behavior in the immediate area during monitoring.
  - If possible, the correlation to underwater sound levels occurring at the time of the observable behavior.
  - Actions performed to minimize impacts on marine mammals.
- During-activity observational survey-specific data:
  - Description of any observable marine mammal behavior within the behavioral harassment zones or in the immediate area surrounding behavioral harassment zones including the following:
    - Distance from animal to source.
    - Reason why/why not shutdown implemented.
    - If a shutdown was implemented, behavioral reactions noted and if they occurred before or after implementation of the shutdown.
    - If a shutdown is implemented, the distance from animal to source at the time of the shutdown.
    - Behavioral reactions noted during soft-starts[3] and if they occurred before or after implementation of the soft-start.

3 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.

- 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.
- For impact pile driving, the following soft-start procedures will be conducted:
  - 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.
  - 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.") (*continued on next page*)

        - Distance to the animal from the source during soft-start.
    - If possible, the correlation to underwater or airborne sound levels occurring at the time of this observable behavior.
    - Actions performed to minimize impacts on marine mammals.
    - Time when pile driving is stopped due to the presence of marine mammals within the shutdown zones and time when pile driving resumes.
- Post-activity observational survey-specific data:
    - Results, which include the detections of marine mammals, species and numbers observed, sighting rates and distances, and behavioral reactions within and outside of behavioral harassment zones.
    - A refined take estimate based on the number of marine mammals observed during the course of construction. The refined take estimate will use the most current guidelines. If a contractor is used for visual monitoring, the Navy will include these guidelines along with this MMMP as provision in the contract and will ensure contractor compliance.

(*continued from previous page*)

- 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. If additional marine mammal monitoring data indicate that there is no change in behavior of pinnipeds during vibratory pile driving or soft-start procedures and NMFS concurs, then the soft-start procedure would no longer be required. Additionally, 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 soft-starts. The Navy will inform NMFS HQ if the soft-start procedure is discontinued.

5 References

National Marine Fisheries Service (NMFS). 2013. Draft guidance for assessing the effects of anthropogenic sound on marine mammals: Acoustic threshold levels for onset of permanent and temporary threshold shift in marine mammals. Draft, December. Available at: http://www.nmfs.noaa.gov/pr/acoustics/draft_acoustic_guidance_2013.pdf.

National Marine Fisheries Service (NMFS). 2015. *Guidance for Developing a Marine Mammal Monitoring Plan. website*. Available at: http://www.westcoast.fisheries.noaa.gov/protected_species/marine_mammals/monitoring_plan_guidance.html.

U.S. Department of the Navy. 2016. Incidental Harassment Authorization Application for the U.S. Navy Pier and Support Facilities for TPS Project at the U.S. Coast Guard (USCG) Air Station/Sector Field Office Port Angeles. Naval Facilities Engineering Command Northwest, Environmental. Naval Base Kitsap Bangor, Silverdale, WA.

Attachment A: Marine Mammal Observation Record Forms and Sighting Codes

MARINE MAMMAL OBSERVATION RECORD FORM

Project Name:_______________________________

Monitoring Location_____________________________
(Pier Location, Vessel based, Land Location, other)

Page____________of __________

Date:__________________________________

Vessel Name:________________________________

Time Effort Initiated:____________

Time Effort Completed:__________

Sighting Data

Event Code	Sighting Number (1 or 1.1 if resight)	Time/Duration watching sighting (Start/End time if continuous)	WP # (every time a sighting is made)	Observer	Sighting cue	Species	Dist/ Dir to Animal (from Observer)	Dist to Pile (btwn animal & pile)	# of Animals Group Size (min/max/best) # of Calves	Relative Motion/and Behavior Code (see code sheet)	Const Type During Sighting	Miti-gation used during sighting ?	Miti-gation Type?	Visibility	% Glare	Weath Cond	Sea State and Wave Ht	Swell Dir	Behavior Change/ Response to Activity/Comments
		: : : :					m or km °	m or km	/ / ___calves	opening closing parallel none Behavior Code:	PRE POST SSV SSI V I PC DP ST NONE	Y N	DE SD	B P M G E			Light Mod Heavy	N or S W or E	
		: : : :					m or km °	m or km	/ / ___calves	opening closing parallel none Behavior Code:	PRE POST SSV SSI V I PC DP ST NONE	Y N	DE SD	B P M G E			Light Mod Heavy	N or S W or E	
		: : : :					m or km °	m or km	/ / ___calves	opening closing parallel none Behavior Code:	PRE POST SSV SSI V I PC DP ST NONE	Y N	DE SD	B P M G E			Light Mod Heavy	N or S W or E	
		: : : :					m or km °	m or km	/ / ___calves	opening closing parallel none Behavior Code:	PRE POST SSV SSI V I PC DP ST NONE	Y N	DE SD	B P M G E			Light Mod Heavy	N or S W or E	
		: : : :					m or km °	m or km	/ / ___calves	opening closing parallel none Behavior Code:	PRE POST SSV SSI V I PC DP ST NONE	Y N	DE SD	B P M G E			Light Mod Heavy	N or S W or E	
		: : : :					m or km °	m or km	/ / ___calves	opening closing parallel none Behavior Code:	PRE POST SSV SSI V I PC DP ST NONE	Y N	DE SD	B P M G E			Light Mod Heavy	N or S W or E	
		: : : :					m or km °	m or km	/ / ___calves	opening closing parallel none Behavior Code:	PRE POST SSV SSI V I PC DP ST NONE	Y N	DE SD	B P M G E			Light Mod Heavy	N or S W or E	

Sighting #=chronological number of sightings, If resight of same animal, then 1.1, 1.2, etc. WP (Waypoint)=GPS recording of lat/long, time/date stamp. Critical for vessel observers.

Sighting Codes
(Sighting Cue & Behavior Codes)

Behavior codes

Code	Behavior	Definition
BR	Breaching	Leaps clear of water
CD	Change Direction	Suddenly changes direction of travel
CH	Chuff	Makes loud, forceful exhalation of air at surface
DI	Dive	Forward dives below surface
DE	Dead	Shows decomposition or is confirmed as dead by investigation
DS	Disorientation	An individual displaying multiple behaviors that have no clear direction or purpose
FI	Fight	Agonistic interactions between two or more individuals
FO	Foraging	Confirmed by food seen in mouth
MI	Milling	Moving slowly at surface, changing direction often, not moving in any particular direction
PL	Play	Behavior that does not seem to be directed towards a particular goal; may involve one, two or more individuals
PO	Porpoising	Moving rapidly with body breaking surface of water
SL	Slap	Vigorously slaps surface of water with body, flippers, tail etc.
SP	Spyhopping	Rises vertically in the water to "look" above the water
SW	Swimming	General progress in a direction. Note general direction of travel when last seen [Example: “SW (N)” for swimming north]
TR	Traveling	Traveling in an obvious direction. Note direction of travel when last seen [Example: “TR (N)” for traveling north]
UN	Unknown	Behavior of animal undetermined, does not fit into another behavior
Pinniped only		
EW	Enter Water (from haul out)	Enters water from a haul-out for no obvious reason
FL	Flush (from haul out)	Enters water in response to disturbance
HO	Haul out (from water)	Hauls out on land
RE	Resting	Resting onshore or on surface of water
LO	Look	Is upright in water "looking" in several directions or at a single focus
SI	Sink	Sinks out of sight below surface without obvious effort (usually from an upright position)
VO	Vocalizing	Animal emits barks, squeals, etc.
Cetacean only		
LG	Logging	Resting on surface of water with no obvious signs of movement

Marine Mammal Species

Code	Marine Mammal Species
CASL	California Sea Lion
HSEA	Harbor Seal
STSL	Steller Sea Lion
HPOR	Harbor Porpoise
DPOR	Dall's Porpoise
ORCA	Killer Whale
HUMP	Humpback Whale
UNLW	Unknown Large Whale
OTHR	Other
UNKW	Unknown

Event

Code	Activity Type
E ON	Effort On
E OFF	Effort Off
PRE	Pre Watch
POST	Post Watch
SSV	Soft-start-vibratory
SSI	Soft-start-impact
WC	Weather Condition/Change
S	Sighting
M-DE	Mitigation Delay
M-SD	Mitigation Shutdown

Construction Type

Code	Activity Type
SSV	Soft-Start (Vibratory)
SSI	Soft-Start (Impact)
V	Vibratory Pile Driving (installation and extraction)
I	Impact Pile Driving
PC	Pneumatic Chipping
DP	Dead pull
ST	Stabbing
NONE	No Pile Driving
OTH	Other

Mitigation Codes

Code	Activity Type
DE	Delay onset of Pile Driving/Removal
SD	Shut down Pile Driving/Removal

Visibility

Code	Distance Visible
B	Bad (<0.5 km)
P	Poor (0.5 – 1.5 km)
M	Moderate (1.5 – 10 km)
G	Good (10 – 15 km)
E	Excellent (>15 km)

Glare

Percent glare should be the total glare of observers' area of responsibility. Determine if observer coverage is covering 90 degrees or 180 degrees and document daily. Then assess total glare for that area. This will provide needed information on what percentage of the field of view was poor due to glare.

Weather Conditions

Code	Weather Condition
S	Sunny
PC	Partly Cloudy
L	Light Rain
R	Steady Rain
F	Fog
OC	Overcast

Sea State and Wave Height

Use Beaufort Sea State Scale for Sea State Code. This refers to the surface layer and whether it is glassy in appearance or full of white caps. In the open ocean, it also takes into account the wave height or swell, but in inland waters the wave height (swells) may never reach the levels that correspond to the correct surface white cap number. Therefore, include wave height for clarity.

Code	Wave Height
Light	0 – 3 ft
Moderate	4 – 6 ft
Heavy	>6 ft

Swell Direction

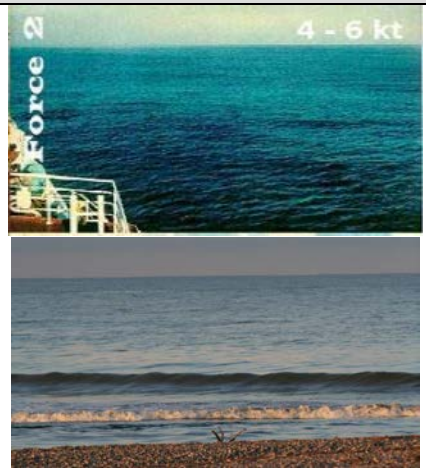
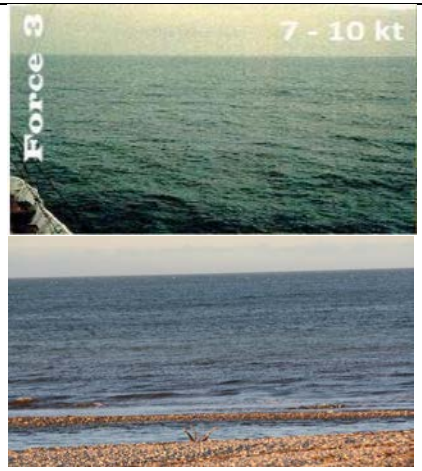
Swell direction should be where the swell is coming from (S for coming from the south). If possible, record direction relative to fixed location (pier). Choose this location at beginning of monitoring project.

Attachment B Beaufort Wind Scale and Sea State

U.S. Navy and Beaufort Wind Scale with Corresponding Sea State Codes

(http://ioc.unesco.org and http://www.wrh.noaa.gov/pqr/info/beaufort.php)

Beaufort SS (Force)	Wind (knots)	Wind Classification	Wave Height (ft)	Wind Effects on Water	Notes Specific to On-Water Protected Species Observations	Photos Indicating Beaufort Sea State from a boat and on shore
0	<1	Calm	0	Calm; like a mirror	Excellent conditions, no wind, small or very smooth swell. You have the impression you could see anything.	
1	1-3	Light air	¼ < ½	Ripples with appearance of scales; no foam crests	Very good conditions, surface could be glassy (Beaufort 0), but with some lumpy swell or reflection from forests, glare, etc.	 

Beaufort SS (Force)	Wind (knots)	Wind Classification	Wave Height (ft)	Wind Effects on Water	Notes Specific to On-Water Protected Species Observations	Photos Indicating Beaufort Sea State
2	4-6	Light breeze	½ – 1 (max 1)	Small wavelets; crests with glassy appearance, not breaking	Good conditions, no whitecaps; texture/lighting contrast of water make protected species hard to see. Surface could also be glassy or have small ripples, but with a short, lumpy swell, thick fog, etc.	
3	7-10	Gentle breeze	2 – 3 (max 3)	Large wavelets; crests begin to break; scattered whitecaps	Fair conditions, scattered whitecaps, detection of protected species 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.	

Beaufort SS (Force)	Wind (knots)	Wind Classification	Wave Height (ft)	Wind Effects on Water	Notes Specific to On-Water Protected Species Observations	Photos Indicating Beaufort Sea State
4	11-16	Moderate breeze	3 ½ – 5 (max 5)	Small waves becoming longer, numerous whitecaps	Whitecaps abundant, sea chop bouncing the boat around, etc.	
5	17-20	Fresh breeze	6 – 8 (max 8)	Moderate waves, taking longer form; many whitecaps; some spray	Land condition: Branches of a moderate size move. Small trees in leaf begin to sway.	

Attachment C Chain of Custody Form

Chain of Custody Record

Date and Time of Collection:	Duty Station:	Collection By:
Source of Specimen (Person and/or Location) Found At:		Project Name:
Item No:	Description of Specimen (include Species and Tag Number):	

Item No:	From: (Print Name, Agency)	Release Signature:	Release Date:	Delivered via: FEDEX U.S. Mail In Person Other:
	To: (Print Name, Agency)	Receipt Signature:	Receipt Date:	

Item No:	From: (Print Name, Agency)	Release Signature:	Release Date:	Delivered via: FEDEX U.S. Mail In Person Other:
	To: (Print Name, Agency)	Receipt Signature:	Receipt Date:	
Item No:	From: (Print Name, Agency)	Release Signature:	Release Date:	Delivered via: FEDEX U.S. Mail In Person Other:
	To: (Print Name, Agency)	Receipt Signature:	Receipt Date:	
Item No:	From: (Print Name, Agency)	Release Signature:	Release Date:	Delivered via: FEDEX U.S. Mail In Person Other:
	To: (Print Name, Agency)	Receipt Signature:	Receipt Date:	
Item No:	From: (Print Name, Agency)	Release Signature:	Release Date:	Delivered via: FEDEX U.S. Mail In Person Other:
	To: (Print Name, Agency)	Receipt Signature:	Receipt Date:	
Item No:	From: (Print Name, Agency)	Release Signature:	Release Date:	Delivered via: FEDEX U.S. Mail In Person Other:
	To: (Print Name, Agency)	Receipt Signature:	Receipt Date:	