



LETTER OF AUTHORIZATION

The U.S. Army Corps of Engineers (Corps) is hereby authorized under section 101(a)(5)(A) of the Marine Mammal Protection Act (MMPA; 16 U.S.C. 1371(a)(5)(A)) to take marine mammals incidental to pile driving activities associated with rehabilitation of the Jetty System at the Mouth of the Columbia River (MCR) in Washington and Oregon, subject to the provisions of the MMPA, the Regulations Governing Taking of Marine Mammals Incidental to Rehabilitation of the Jetty System at the MCR (50 CFR Part 217, Subpart X) (Regulations), and the following conditions:

1. This Letter of Authorization (LOA) is valid from May 1, 2017 through April 30, 2022.
2. This LOA is valid only for take incidental to pile installation and removal activities associated with the rehabilitation of the Jetty System at the MCR in Oregon and Washington and described in the preamble to the Regulations.
3. General Conditions
 - (a) Pile driving installation and removal shall only occur between May 1 and September 30 each year.
 - (b) The Corps shall conduct briefings as necessary between vessel crews, the marine mammal monitoring team, and other relevant personnel prior to the start of all pile driving and removal activity, and when new personnel join the work, in order to explain responsibilities, communication procedures, marine mammal monitoring protocol, and operational procedures;
 - (c) Each Marine Mammal Observer (MMO) shall maintain a copy of the LOA at their respective monitoring location, as well as a copy in the main construction office;
 - (d) The species authorized for taking are the harbor seal (*Phoca vitulina richardii*), California sea lion (*Zalophus californianus*), Steller sea lion (*Eumetopias jubatus*), harbor porpoise (*Phocoena phocoena*), killer whale (*Orcinus orca*),



humpback whale (*Megaptera novaeangliae*), and gray whale (*Eschrichtius robustus*). Authorized take numbers are shown in Table 1.

- (e) Pile activities are limited to the use of a vibratory hammer. Impact hammers are prohibited;
- (f) The Corps must notify NMFS West Coast Regional Office (562-980-3232), at least 24-hours prior to start of activities impacting marine mammals.

4. Mitigation Measures

- (a) Establishment of Level B harassment zone:
 - (i) The Corps shall establish a Level B harassment Zone of Influence (ZOI) delineated by a 7.35-km radius from the point of pile installation or removal.
- (b) Establishment of shutdown zone:
 - (i) The Corps shall establish shutdown zones as shown in Table 2.
 - (ii) For in-water heavy machinery work other than pile driving (using, *e.g.*, standard barges, tug boats, barge-mounted excavators, or clamshell equipment used to place or remove material), operations shall cease if a marine mammal comes within 20 m and vessels shall reduce speed to the minimum level required to maintain steerage and safe working conditions;
 - (iii) If a marine mammal approaches or enters the shutdown zone during the course of vibratory pile driving operations, the activity shall be halted and delayed until the animal has voluntarily left and been visually confirmed beyond the shutdown zone or 15 minutes have passed without the animal being resighted;
 - (iv) If a marine mammal is seen above water within or approaching a shutdown zone and then dives below, the contractor shall wait 15 minutes. If no marine mammals are seen by the observer in that time it may be assumed that the animal has moved beyond the exclusion zone;
 - (v) If the shutdown zone is obscured by fog or poor lighting conditions, pile driving shall not be initiated until the entire shutdown zone is visible;

- (vi) Disturbance zones shall be monitored to maximum line-of-sight distance from established vessel- and shore-based monitoring locations. If marine mammals other than those listed in 3(d) are observed within the disturbance zone, the observation shall be recorded and communicated as necessary to other MMOs responsible for implementing shutdown requirements and any behaviors documented;
 - (vii) Between May 1 and July 1 of each year, observation of any killer whales within the ZOI shall result in immediate shutdown of all pile installation, removal, or maintenance activities. Pile driving shall not resume until all killer whales have moved outside of the ZOI; and
 - (viii) After July 1, no shutdown is required for killer whales occurring within the ZOI, but animals must be recorded as Level B takes in the monitoring forms described below.
- (c) If the allowable number of takes for any marine mammal species in 3(d) is exceeded, or if any marine mammal species not listed in 3(d) is observed within the defined Level B ZOI, the Corps shall immediately shutdown, record the observation, and notify NMFS Office of Protected Resources.

5. Monitoring

- (a) Qualified MMOs shall be used for both shore- and vessel-based monitoring.

Qualified MMOs are third-party trained biologists with the following minimum qualifications:

- (i) Visual acuity in both eyes (correction is permissible) sufficient to discern moving targets at the water's surface with ability to estimate target size and distance. Use of binoculars or spotting scope may be necessary to correctly identify the target;
- (ii) Advanced education in biological science, wildlife management, mammalogy or related fields (Bachelor's degree or higher is preferred);
- (iii) Experience and ability to conduct field observations and collect data according to assigned protocols (this may include academic experience);

- (iv) Experience or training in the field identification of marine mammals (cetaceans and pinnipeds);
 - (v) Sufficient training, orientation or experience with vessel operation and pile driving operations to provide for personal safety during observations;
 - (vi) Writing skills sufficient to prepare a report of observations;
 - (vii) 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 needed; and
 - (viii) All MMOs must be approved by NMFS.
- (b) MMOs must be equipped with the following:
- (i) Binoculars (10x42 or similar), laser rangefinder, GPS, big eye binoculars and/or spotting scope 20-60 zoom or equivalent; and
 - (ii) Camera and video capable of recording any necessary take information, including data required in the event of an unauthorized take.
- (c) MMOs shall conduct monitoring as follows;
- (i) During all pile driving and removal activities;
 - (ii) Only during daylight hours from sunrise to sunset;
 - (iii) Scan the waters for 30 minutes before and during all pile driving. If any species for which take is not authorized are observed within the ZOI or shutdown zones during or 30 minutes before pile driving, the MMO(s) shall immediately notify the on-site supervisor or inspector, and require that pile driving either not initiate or temporarily cease until the animals have moved outside of the zones;
 - (iv) If weather or sea conditions restrict the observer's ability to observe, or become unsafe for the monitoring vessel(s) to operate, pile installation shall not begin or shall cease until conditions allow for monitoring to resume;

- (v) Trained land-based observers shall be placed at the best vantage points practicable. The observers' position(s) shall either be from the top of the jetty or adjacent barge at the location of the pile activities and from Cape Disappointment Visitors Center during work at North and South Jetty, and Clatsop Spit for work at Jetty A;
 - (vi) Vessel-based monitoring for marine mammals must be conducted for all pile-driving activities at the North Jetty and two South Jetty offloading facilities. Two vessels shall be utilized to adequately monitor the offshore ensonified zone;
 - (vii) Any marine mammal listed in 3(d) entering into the Level B ZOI shall be recorded as a take by the MMO and listed on the appropriate monitoring forms described below; and
 - (viii) During pedestrian surveys, personnel shall avoid as much as possible direct approach towards pinnipeds that are hauled out. If it is absolutely necessary to make movements towards pinnipeds, personnel shall approach in a slow and steady manner to reduce harassment of the animals as much as possible.
- (d) Hydroacoustic monitoring shall be performed using methodology described in the November 2016 Addendum containing the NMFS-approved Hydroacoustic Monitoring Plan (attached).

6. Reporting

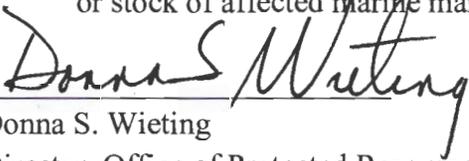
- (a) MMOs must use NMFS-approved monitoring forms and shall record the following information when a marine mammal is observed:
 - (i) Date and time that pile removal and/or installation begins and ends;
 - (ii) Construction activities occurring during each observation period;
 - (iii) Weather parameters (*e.g.*, percent cover, visibility);
 - (iv) Water conditions [*e.g.*, sea state, tidal state (incoming, outgoing, slack, low, and high)];
 - (v) Species, numbers, and, if possible, sex and age class of marine mammals;

- (vi) Marine mammal behavior patterns observed, including bearing and direction of travel, and, if possible, the correlation to received sound pressure levels;
 - (vii) Distance from pile removal and/or installation activities to marine mammals and distance from the marine mammal to the observation point;
 - (viii) Locations of all marine mammal observations; and
 - (ix) Other human activity in the area.
- (b) The Corps shall submit a draft annual report to NMFS Office of Protected Resources covering a given calendar year within 90 days of the last day of pile driving operations. The annual report shall include summaries of the information described in paragraph (a) of this section.
- (c) The Corps shall submit a final annual report to the NMFS Office of Protected Resources, within 30 days after receiving comments from NMFS on the draft report.
- (d) Notification of dead or injured marine mammals.
- (i) In the unanticipated event that the specified activity clearly causes the take of a marine mammal in a manner prohibited by this Authorization, such as an injury, serious injury, or mortality, the Corps shall immediately cease the specified activities and report the incident to the Office of Protected Resources, NMFS (301-427-8408), and the West Coast Regional Stranding Coordinator, NMFS (206-526-4747).
 - a. The report must include the following information:
 1. Time, date, and location (latitude/longitude) of the incident;
 2. Description of the incident;
 3. Environmental conditions (*e.g.*, wind speed and direction, Beaufort sea state, cloud cover, and visibility);

4. Description of marine mammal observations in the 24 hours preceding the incident;
 5. Species identification or description of the animal(s) involved;
 6. Status of all sound source use in the 24 hours preceding the incident;
 7. Fate of the animal(s); and
 8. Photographs or video footage of the animal(s).
- b. Activities shall not resume until NMFS is able to review the circumstances of the prohibited take. NMFS shall work with the Corps to determine what measures are necessary to minimize the likelihood of further prohibited take and ensure MMIPA compliance. The Corps may not resume their activities until notified by NMFS.
- (ii) In the event that the Corps discovers an injured or dead marine mammal, and the lead MMO 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 Corps shall immediately report the incident to the Office of Protected Resources, NMFS, and the West Coast Regional Stranding Coordinator, NMFS. The report must include the same information identified in paragraph (d)(i)a of this section. If the observed marine mammal is dead, activities may continue while NMFS reviews the circumstances of the incident. If the observed marine mammal is injured, measures described in paragraph (d)(i)b of this section must be implemented. NMFS will work with the Corps to determine whether additional mitigation measures or modifications to the activities are appropriate.
- (iii) In the event that the Corps discovers an injured or dead marine mammal, and the lead MMO determines that the injury or death is not associated with or related to the activities authorized in the LOA (*e.g.*, previously wounded animal, carcass with moderate to advanced decomposition, scavenger damage), the Corps shall report the incident to the Office of Protected Resources, NMFS, and the West Coast Regional Stranding

Coordinator, NMFS, within 24 hours of the discovery. The Corps shall provide photographs or video footage or other documentation of the stranded animal sighting to NMFS. If the observed marine mammal is dead, activities may continue while NMFS reviews the circumstances of the incident. If the observed marine mammal is injured, measures described in paragraph (d)(i)b of this section must be implemented. In this case, NMFS will notify the Corps when activities may resume.

7. The holder of this Authorization is required to comply with the Terms and Conditions of the Incidental Take Statement corresponding to NMFS' Biological Opinion as they pertain to listed marine mammals.
8. This Authorization may be modified, suspended or withdrawn if the holder fails to abide by the conditions prescribed herein or contained in the Regulations, or if NMFS determines the authorized taking is having more than a negligible impact on the species or stock of affected marine mammals.



Donna S. Wieting
Director, Office of Protected Resources
National Marine Fisheries Service

 MAR 4 7 2017
Date

Table 1. Authorized Annual Take Numbers.

Species	Authorized Take
Killer whale (<i>Orcinus orca</i> ; Western transient stock)	4
Humpback whale (<i>Megaptera novaeangliae</i>)	3
Gray whale (<i>Eschrichtius robustus</i>)	16
Harbor porpoise (<i>Phocoena phocoena</i>)	328
Steller sea lion (<i>Eumetopias jubatus</i>)	4,694
California sea lion (<i>Zalophus californianus</i>)	1,355
Harbor seal (<i>Phoca vitulina</i>)	167

Table 2. Shutdown Zone Radii at MCR Jetties for Authorized Species.

Species (Hearing Group)	Shutdown Radius (m)
Western transient killer whale	20
Humpback whale	30
Gray whale	30
Harbor porpoise	40
Steller sea lion	20
California sea lion	20
Harbor seal	20

Hydroacoustic Monitoring Plan

For

**Pile Installation, Removal, and Maintenance Work
Associated with the Major Rehabilitation of the Jetty
System at the Mouth of the Columbia River**

In

**Pacific County, Washington, and Clatsop County,
Oregon**

Proposed and Conducted by the U.S. Army Corps of Engineers,
Portland District and Authorized Contractors in Conjunction
with the Requested Letter of Authorization for Marine Mammal

Level B Take

Revised Draft November 2016

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Acronyms and Abbreviations

BA	Biological Assessment
BO	Biological Opinion
Corps	USACE (US Army Corps of Engineers)
EA	Environmental Assessment
ESA	Endangered Species Act
CDF	Cumulative Distribution Function
dB	decibel
GPS	Geographic Positioning System
Hz	Hertz
IHA	Incidental Harassment Authorization
ITS	Incidental Take Statement
kHz	kilohertz
LOA	Letter of Authorization
MMPA	Marine Mammal Protection Act
MCR	Mouth of the Columbia River
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
Pa	Pascals
QA/QC	Quality Control and Quality Assurance
RMS	root mean square
SEL	Sound Exposure Levels
SPL	Sound Pressure Levels
SSL	Sound Source Levels
TL	Threshold Level
μPa	micropascal
TPP	Test Pile Program
ZOI	Zone of Influence

1. Introduction

The U.S. Army Corps of Engineers, Portland District (hereafter referred to as Corps or USACE) is conducting major rehabilitation and repair work on a system of three jetties (North Jetty, Jetty A, and South Jetty) at the Mouth of the Columbia River (MCR). Rehabilitation work may require pile installation, removal, or pile maintenance during installation of barge offloading facilities to transport and place large jetty armor stone. The duration of work at all three jetties could extend to year 2023 and is dependent on Congressional funding. Note that the activity of pile installation and removal will be on order of 17 days duration, for each jetty rehabilitation activity, with exception of Jetty A Removal having a duration of 10 days and additional repair for South Jetty equaling 8 days. The Corps estimates total 49 installation days for all three Jetty sites. During this time, pile driving will not be continuous, and vibratory activity will not exceed 5 hours per day. Relevant pile installation details are provided within this document.

Pile installation via vibratory hammer was determined to potentially have an acoustic effect on several species of marine mammals located within the project action area. Consequently, in a joint Letter of Authorization (LOA)/ Incidental Harassment Authorization (IHA) application, the Corps requested from National Marine Fisheries Service/ National Oceanic and Atmospheric Administration (NMFS/NOAA) non-lethal, Level B take under the Marine Mammal Protection Act (MMPA) and an Incidental Take Statement (ITS) under the Endangered Species Act (ESA). This document, titled: *Addendum to Request for Incidental Harassment Authorization and A Letter of Authorization under the Marine Mammal Protection Act for Rehabilitation of the Jetty System at the Mouth of the Columbia River: North Jetty, South Jetty, and Jetty A; Pacific County, Washington, and Clatsop County, Oregon; Construction October 2015 Through October 2021 (IHA coverage for Jetty A from 1 May 2016 to 30 April 2017, Requested LOA Coverage for North and South Jetties: 1 May 2016 to 30 April 2021) : Revised and Updated Marine Mammal Monitoring Plan* submitted June 2015 and revised with the Addendum January and February 2016, provided a take analysis and request, along with a marine mammal monitoring plan. This document, proposal, and analysis are incorporated by reference herein.

Pile-related work at Jetty A in WA was covered under an Incidental Harassment Authorization issued August 31, 2015 and does not require hydroacoustic monitoring. However, NMFS/NOAA requested that the Corps conduct hydroacoustic monitoring during pile installation activities and develop an associated plan for the LOA covering actions at North Jetty (WA) and South Jetty (OR). This document entails the Corps' proposed monitoring methods and outputs.

a. Abbreviated Project Description and Proposed Pile Driving Action

This project was fully described and evaluated in the associated Environmental Assessment (EA) and Biological Assessment (BA), with reiteration in the Biological Opinion, and LOA request. These documents and their analyses are incorporated herein by reference. The Corps is repairing the jetty system at the MCR in order to rehabilitate the structures, which secure the federal navigation channel. To rehabilitate the structure, large quantities of large armor stone will be placed at the terminal head, along the middle trunk, and at the landward root of each jetty. Because of the large tonnage of stone, it may be more cost-effective for stone to be delivered via barge rather than trucked overland. To accommodate the barge option, in the EA and BA the Corps analyzed delivery methods which included the construction of offloading facilities adjacent to the jetties. The Corps received a Biological Opinion (BO) which included these proposed project elements (NMFS No 2010/06104, 2011).

Since the development of the EA, BA and LOA, the Jetty A barge offloading facility has been constructed and the North Jetty barge offloading facility site has been assessed in more detail which has brought a more concise understanding of the extent of required activities associated with the construction of these facilities. The Jetty A barge offloading facility was constructed in June 2016. The dolphins for the facility were designed to secure a double barge with an approximate size of 180 feet by 280 feet with a capacity to hold up to 14,000 tons of jetty stone, an equivalent of over 500 semi loads. See Figures 1 and 2.

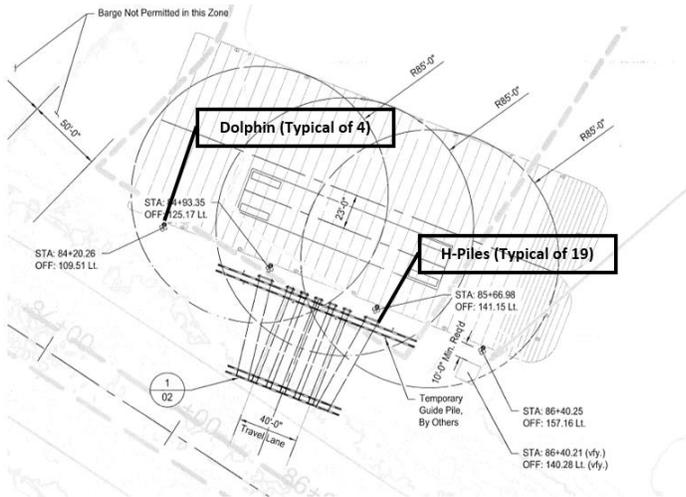


Figure 1. Jetty A Barge Offloading Facility Plan View



Figure 2. View to the West – Jetty A Barge Offloading Facility

The barge offloading facility for Jetty A consists of:

1. Four (4) Dolphins consisting of four 24 inch diameter by 100 ft long steel piles: Total 16 piles
2. Nineteen (19) Steel H-Piles (Soldier Piles). A combination of W24x104 (roughly 24" wide 13" deep) and W18x119 (roughly 19" wide and 11" deep). Both H-Piles were 60 ft in length.

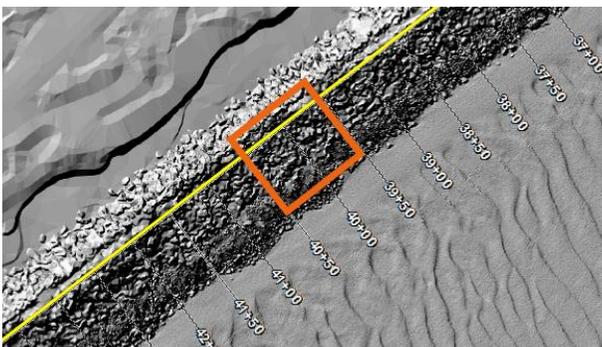
Both the 24 inch and H-Piles were driven to 25 ft of embedment utilizing an APE 200-S vibratory hammer mounted on a 4100 Manitowoc crane. The installation of all of the piles occurred over a three day period. The H-piles took less than 10 minutes each to drive while on average the 24 inch piles took 12.5 minutes. This equates to estimated total driving action of 190 minutes for H-Piles and 200 minutes for 24 inch piles.

The Corps anticipates the speed and duration of removal to be less than installation and will record the time taken to remove the piles.

Z-Piles or sheet piles were not utilized for the Jetty A barge offloading facility. The reason for using H-piles as opposed to the Z-piles is because of the potential for existing relict jetty zone in the location of the barge offloading facility in relation to Jetty A. Furthermore, the site did not require dredging activities to accommodate the required draft or depth of water for the barge and therefore, the Contractor was not able to verify whether relict stone existed or not. Z-pile installation could have been rejected by the relict stone.

Z-piles are typically the best choice in the construction of a facility such as the Jetty A barge offloading facility as they tend to hold the fill material in place and provide more stability than the combination of H-piles and subsequent stop-logs and other bracing. It should be mentioned, however, that it would have taken approximately 80 Z-piles as opposed to 19 H-piles that were used to build the facility.

For the potential North Jetty barge offloading facility, the Corps anticipates that this facility design may not include Z-piles since no dredging will be required for the facility and pile installation would occur at or near the toe of the jetty. Furthermore, due to the site conditions at the North Jetty and adjacent bathymetry, the Corps has limited the facility to a 100 foot by 100 foot square location (at approximate Station 40+00). See Figure 3 Below.



This location and configuration allows for the barge offloading facility to be constructed primarily on top of the existing jetty stone. The existing bathymetry at this location will accommodate a draft of up to 30 feet. It is anticipated that to hold the vertical on the southern side of the facility that H-piles would be utilized due the existing relict stone at the base of the jetty.

Figure 3. North Jetty Barge Offloading Facility Location (North is up)

Therefore, the Corps anticipates that a similar pile-driving action as occurred at the Jetty A barge offloading facility is possible. However, due to the increased wave energy at the North Jetty site and with no foresight on the size of barge that will be used, the number of 24” piles and subsequent number of dolphins cannot be precisely surmised.

For the South Jetty barge offloading sites as shown in the following section, it is anticipated that a similar to Jetty A scale barge offloading facility will be constructed at one of two locations (27+00 or the Clatsop Spit) if the Contractor proposes to deliver by barge and place by crane from atop the jetty. Due to the existing bathymetry at these sites, it is anticipated that dredging will be required and the offloading site would be extended out away from the jetty. Therefore it is very possible that the Contractor would consider utilizing the Z-piles to construct the facility and similarly, a combination of up to 24” diameter piles to build dolphins to secure the barge itself. Furthermore, it is also possible that the Contractor will propose to utilize Jack-up barges to place the jetty stone on the South Jetty and therefore, stone delivery could come via barge directly to the jack-up barge without the need for pile driving activities.

The table below is intended to convey, for the purpose of this draft hydroacoustic plan development, the estimated or anticipated vibratory pile installation and removal/extraction action timeframe, duration and assumed pile numbers and types that could be used to construct and operate the barge offloading facilities at the North Jetty and South Jetty.

Jetty	Timeframe (Install)	Timeframe (Removal)	Pile Type & Number	Duration (Install)	Duration (Removal)	Total Days
North	May 2018	Sep 2019	24 – 24” dia Piles + 20 H-piles	10 days	7 days	17 days
South	May 2020	Sep 2023	24 – 24” dia Piles + 100 Z/Sheet piles	10 days	7 days	17 days
Totals				20 days	14 days	34 days

b. Location and Physical Environment

Project activities associated with this monitoring plan are located at the MCR Jetties (Jetty A, North, and South) in Pacific County, Washington, and Clatsop County, Oregon. They are at the entrance where the Columbia River meets the Pacific Ocean. The coastal margin at MCR is subjected to vigorous environmental loading associated with seasonal variation of winds and waves, tidal action, estuarine circulation, and ever-changing inlet morphology. The primary environmental loading factors that affect coastal navigation infrastructure and shoreline stability are incident wave action and variation of water level. Given the high wave and wind energy, the shifting sand morphology, and the location proximate to the mouth of the federal navigation channel, the project area is expected to have a high level of ambient sound levels.

The Table and figures below indicate the Zones of Influence (ZOIs) that were determined for vibratory pile installation one location at the North Jetty and two locations at the South Jetty. Only one of the two locations will be utilized for barge offloading at the South Jetty. The ZOIs represent locations for which hydroacoustic monitoring may occur and take will be recorded. It should be noted that barging of armor stone is optional and dependent upon the successful contractor on whether they will deliver overland or via water. The ZOI geospatial data used to develop this plan will be provided to the Contractor and the Contractor will reassess the zone location based on their actual proposed action and location.

Species	Permanent Threshold Shift (PTS) Underwater Isopleth ZOI (m)	Revised Shutdown ZOI Radius (m)
Western Transient Killer Whale	2.4	20
Humpback Whale	27.1	30
Gray Whale	27.1	30
Harbor Porpoise	40.1	40
Steller Sea Lion	1.2	20
California Sea Lion	1.2	20
Harbor Seal	16.5	20

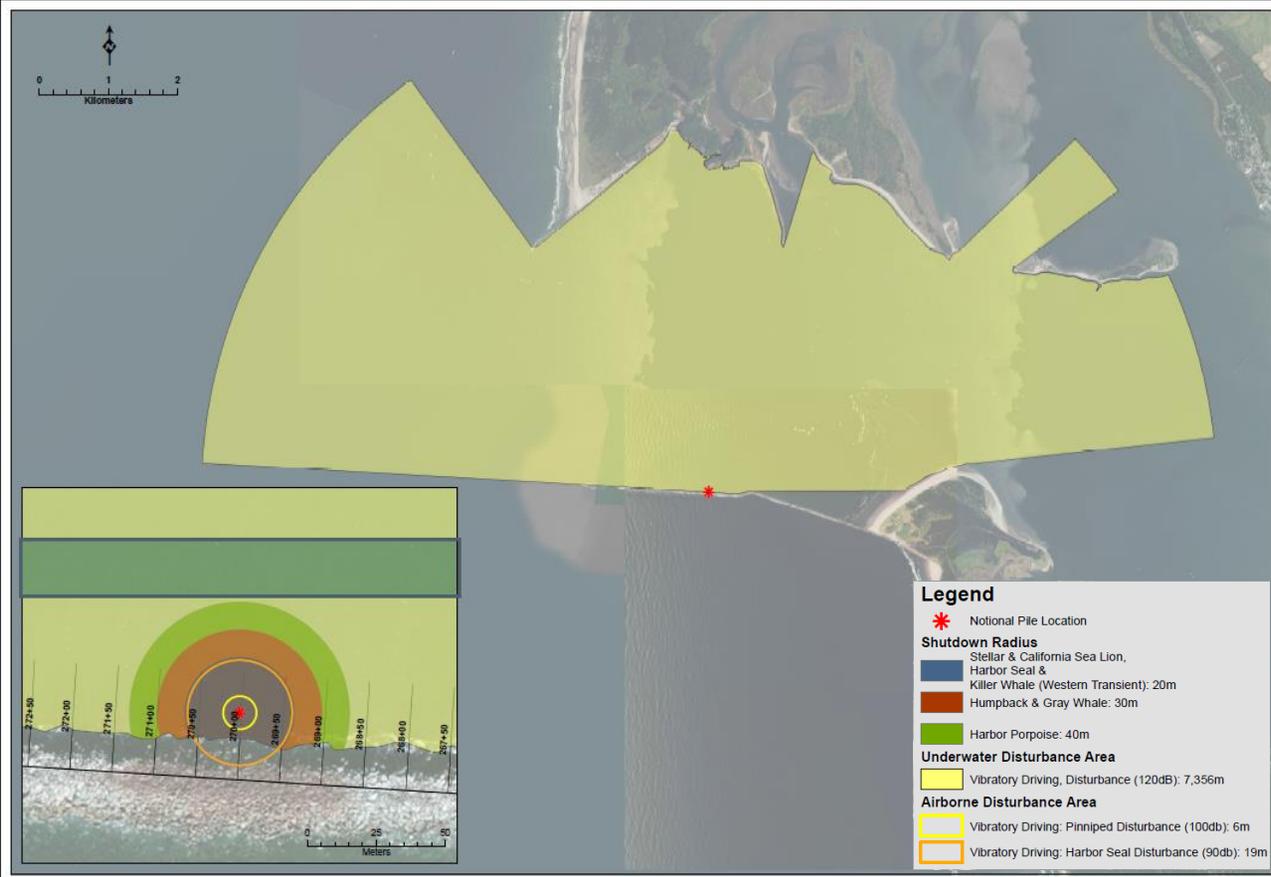


US Army Corps of Engineers
Portland District

PROJECT	DATE	BY	APP'D
US ARMY CORPS OF ENGINEERS PORTLAND DISTRICT	11/15/2011	J. J. [Name]	[Signature]

**Marine Mammal Sound Thresholds
For Pile Driving
North Jetty**

Sheet Identification
Sheet of

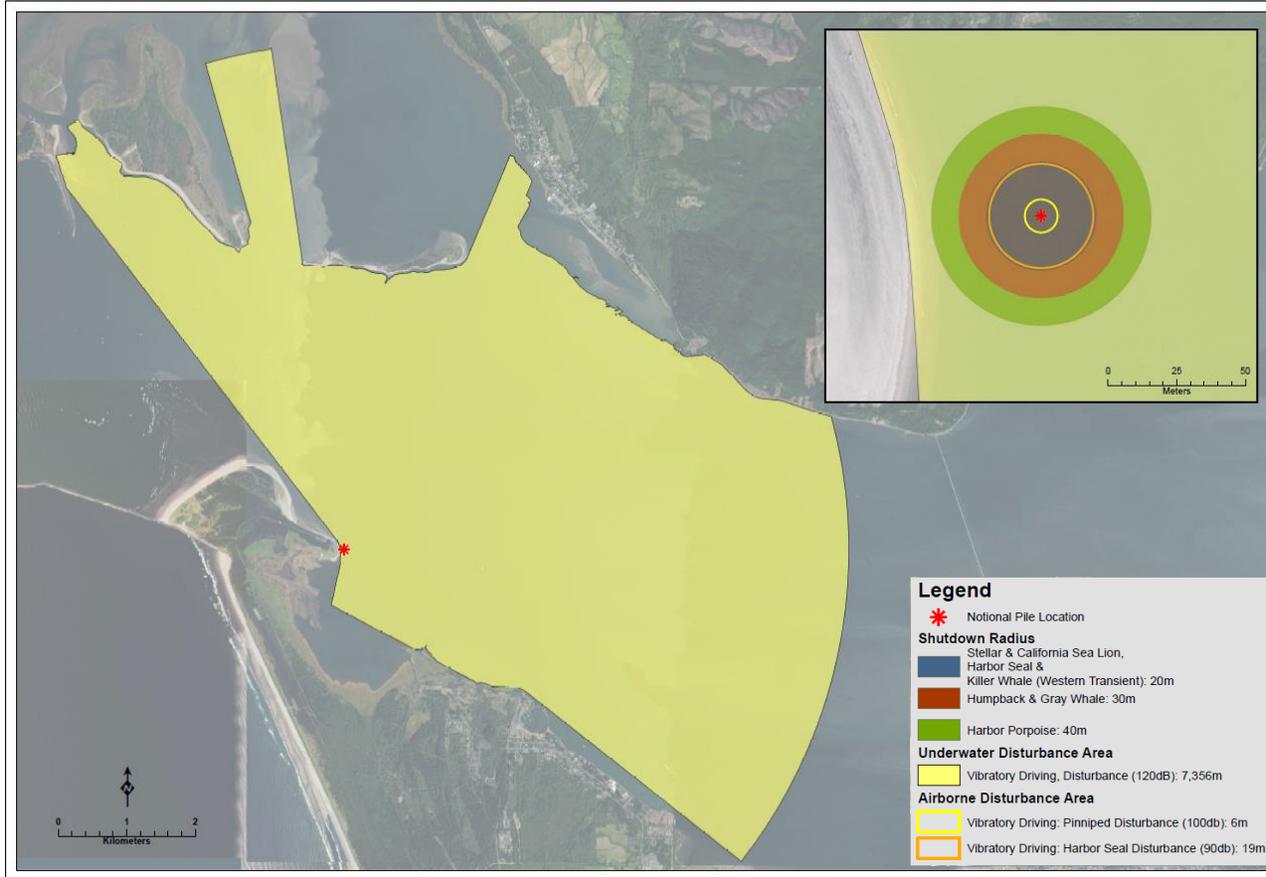


US Army Corps of Engineers
 Portland District

PROJECT NO.	14-00000000
PROJECT NAME	South Jetty
PROJECT LOCATION	Portland, OR
PROJECT NUMBER	14-00000000
PROJECT DATE	10/2014
PROJECT STATUS	Final

**Marine Mammal Sound Thresholds
 For Pile Driving
 South Jetty**

SHEET IDENTIFICATION
 SHEET OF



- Legend**
- * Notional Pile Location
 - Shutdown Radius**
 - Stellar & California Sea Lion, Harbor Seal & Killer Whale (Western Transient): 20m
 - Humpback & Gray Whale: 30m
 - Harbor Porpoise: 40m
 - Underwater Disturbance Area**
 - Vibratory Driving, Disturbance (120dB): 7,356m
 - Airborne Disturbance Area**
 - Vibratory Driving: Pinniped Disturbance (100db): 6m
 - Vibratory Driving: Harbor Seal Disturbance (90db): 19m

US Army Corps of Engineers
Portland District

PROJECT:	DATE:	DRAWN BY:	CHECKED BY:
U.S. ARMY ENGINEER DISTRICT CORPS PORTLAND, OR			
PROJECT:	DATE:	DRAWN BY:	CHECKED BY:
PROJECT:	DATE:	DRAWN BY:	CHECKED BY:

**Marine Mammal Sound Thresholds
For Pile Driving
Clatsop Spit**

SHEET IDENTIFICATION	SHEET OF

2. Hydroacoustic Monitoring Goals and Objectives

In an email dated 5/17/2016 (Pauline), NMFS/NOAA described the preferred goals and objectives for developing a hydroacoustic monitoring plan as part of the LOA rule development. First, because there is no hydroacoustic data available for the MCR, it would be very helpful to have a better understanding of ambient sound and propagation loss at a river mouth opening into the ocean. Also, if the monitoring program shows that the disturbance isopleths are smaller than those predicted for the IHA and proposed for the LOA, then current estimates in the Corps' analyses and request could be amended based on the data. However, the disturbance zones are unlikely to increase because the 120 dB standard is highly conservative.

In order to conduct a comprehensive, meaningful and effective monitoring plan, NMFS suggested measurement of several parameters. These are: 1) ambient (background) noise in the absence of construction activities; 2) sound source levels (at 10 m) associated with different pile types and sizes; and 3) received sound pressure levels (SPLs) at several distances from the pile (Pauline 2016). These parameters would provide important information to establish realistic disturbance zones. Therefore, the Corps is proposing the following metrics:

- 1) While in the absence of any construction activities, at each jetty collect underwater ambient (background) noise for two (2) days. Ambient noise collection period will be completed no longer than within five (5) days before the proposed pile driving activity. Contractor will repeat ambient noise collection period during pile removal if vibratory methods are used and if more than two weeks before or after the dates of installation period ;
- 2) Collect measurements of Sound Pressure Level (SPL) for the appropriate number of piles at each jetty required to estimate SSLs;
- 3) Determine the transmission loss for the appropriate number of piles at each jetty;
- 4) Empirically verify the location of the 120, 180, and 190 dB re 1 μ Pa harassment isopleths for vibratory pile installation for each of the determined number of piles at each jetty.

These parameters would provide agencies important information to establish realistic disturbance zones. NMFS/NOAA also provided three guidance documents which describe the standards and protocols that should be utilized in data collection along with two acceptable plan examples (Pauline, 2016).

NMFS further indicated that they do not expect monitoring during the entire construction period, as data collection at one facility should adequately represent the other facilities. Therefore, earlier monitoring and data collection during the construction process would provide applicable results beneficial to ensuing work. Also, monitoring likely will not be necessary during the entire pile driving process at the off-loading facility being tested, rather data will only need to be collected on a small number of piles.

Finally, NMFS recommended the Corps utilize an established firm with demonstrated experience doing hydroacoustic monitoring. The Corps will include such requirements in its contract specifications. Prior to finalization, the Corps will submit a draft Hydroacoustic Monitoring Plan to the indicated NMFS/NOAA contact (hydro-acoustician, Shane Guan, per Pauline, 2016).

Commented [T1]: Of what size and material?

They plan to use wood or steel pipe piles up to 24-in in diameter and Z-, H-, and sheet piles. That is five different types of piles with essentially only 2 data points per pile type, let alone the three different jetty areas they could be driven for the sound prop portion under #3 and 4. How is 10 piles sufficient for these 5 different variants at 3 different jetty locations within the MCR?

Commented [JLO2R1]: We will incorporate the requirement to develop a final monitoring plan based upon proposed actions by the contractor. For example, for Jetty A sixteen 24" and 19 H-piles were used. Since the installation duration was short, we may have monitored throughout the activity. We will need to adjust per what is actually being proposed in a final plan developed by the Contractor.

3. Methodology

a. Compliance with NMFS Guidance

In order for the data collected and the conclusions drawn from it to be accepted by NMFS, data collection and analysis methods for the monitoring will be compliant with NMFS' guidance on hydroacoustic monitoring (NMFS 2012a, 2012b, 2012c). The NMFS guidance can be found in full in Appendices A, B, and C.

Compliance includes the availability and use of equipment, such as moorings, recording systems, hydrophones, a vessel, and other hardware and software as required to meet the specifications outlined in this Hydroacoustic Monitoring Framework and the NMFS guidance documents.

b. Hammer Types, Hydrophones, Accessories, Methods, Etc.

For each jetty project, one or more types of vibratory hammer may need to be used for each of the different pile types; Z-piles, H-piles or 24" diameter piles or other type of pile being proposed. The Corps' contractor will record the specification of each of the hammers used and for which type of pile and provide them in the final report and analyses. If driving shoes or bearing plates are used, this will be noted by the contractor. Number of impacts, duration of operation per pile, problems, substrate, locations, salinity, temperature, tidal state and Sound Source Levels will be recorded in the monitoring report.

c. Monitoring Placement

Underwater acoustic monitoring will include placing hydrophones within a clear acoustic line-of-sight to the piles.

There will be three locations for monitoring each pile site: two stationary positions, one at approximately 10 meters (33 feet) from the source (NMFS 2012a) and one located between 500 and 1,000 meters (1,640 - 3,280 feet) from the source (NMFS 2012b, c); and one vessel-based position with vessel in 'quiet mode' (no engines). Note: If the vessel is anchored then flow noise around the hydrophone could be an issue unless data is collected during low flow conditions or slack tide. In addition, if the hydrophone is not adequately weighted then the flow could cause the hydrophone to "sail" to a depth much shallower than the actual intended deployment depth. The contractor will propose a method to ensure these disturbance factors are minimized or eliminated.

d. Equipment

The equipment to be used will be able to meet the NOAA/NMFS specification requirements. This includes but is not limited the performance listed below, and is further specified for each monitoring objective:

- Amplitude range (broadband): 90 - 210 dB re 1 μ Pa
- Frequency range: 75 Hz – 20kHz
- Sensitivity: -198 dB re 1 V/ μ Pa
- Amplitude resolution: within 1 dB
- For acoustic analysis: sampling rate at least 48 kHz

Commented [T3]: What does this mean? If they are using two hammers concurrently, #3 and 4 above will be affected.

Commented [JLO4R3]: We will require the contractor to perform one pile driving activity to accommodate appropriate data collection for each type of pile.

Commented [T5]: What about SSPs?

Commented [JLO6R5]: Added additional language.

Commented [S7]: The one near the source (10m) may not need such high sensitivity because there could be signal overload (clipping).

Commented [JLO8R7]: Reduced sensitivity to -198 dB re 1 V/microPA

Commented [JLO9]: Increased sampling rate to 48 kHz from 20 kHz

4. Data Collection

a. Ambient Noise

The methodology described below is consistent with a 31 January 2012 guidance memorandum issued by NMFS, entitled “Data Collection Methods to Characterize Underwater Background Sound Relevant to Marine Mammals in Coastal Nearshore Waters and Rivers of Washington and Oregon” (NMFS 2012c; Appendix C).

i. Location of Hydrophones

Near-Field: A near-field hydrophone will be located at or along the Jetty A, North or South Jetty. This hydrophone may be mounted to a stone or moored off shore, but in a location where it will not be damaged by vessels or interfere with other activity.

This hydrophone will be located at or below the mid-water column, but greater than 4 meters (13 feet) above the bottom.

Far-Range: A far-range hydrophone will be located outside of the active project area, as far away from the navigation channel activity as possible, but within the mouth, and at a distance of between 500 and 1,000 meters (1,640 feet – 3,280 feet) from the indicator test piles and in waters greater than 10 meters (33 feet) deep.

This hydrophone will be located as close to the bottom of the water channel as possible, but at least 4 meters (13 feet) off the bottom. Placement at this level is intended to reduce the influence of flow noise on background noise measurements. Mooring of this hydrophone will need to be sufficient to avoid dislodgement from strong tidal currents or riverine debris.

ii. Equipment

A Reson Model TC4013 or TC4033 or equivalent hydrophone will be used.

The hydrophone will be appropriate for the frequency range of measurements (i.e., 75 Hz to 20 kHz), and it will be calibrated having a known and flat frequency response curve across the bandwidth of measurements.

It will be capable of measuring sound pressure of amplitudes ranging from 90 to 210 dB. The particular hydrophone sensitivity (with gain stage included) will be noted. The recording system will have the capability to continuously record sound levels at a minimum of three consecutive 24-hour periods. The self-noise floor of the recording system will be compared with the lowest spectral level measured in the field to illustrate that the reported levels are not limited by equipment performance (Appendix C).

In order to reduce flow noise, a flow shield made of latex or spandex that does not trap air should be applied to the far-range hydrophone, as described in Appendix C. The contractor will consider other methods to reduce flow noise, such as, but not limited to, the use of bottom-mounted hydrophone systems that minimize cable lengths. Hydrophone placement will be uninhibited by any objects that would block sound waves from reaching the hydrophone, and there will not be any objects directly behind the hydrophone that could amplify the sound waves. The hydrophone will be stabilized to keep it plumb and prevent it from drifting with the current. The recording locations will be outboard of the piles to capture the sound that is traveling towards the open water from where mammals would approach the piles and Zone of Influence.

Commented [S10]: Above it stated that the frequency range would be 20 – 10,000 Hz. Since a large portion of pile driving noise is low-frequency, I think it is important that the hydrophone respond to lower frequency than 150 Hz.

Commented [JLO11R10]: Corrected throughout

Commented [T12]: agree

Commented [S13]: Above it stated that the amplitude range would be 90-210 dB.

Commented [T14]: agree

Commented [T15]: Ambient should be measured in the various seasons (May to Sept), which likely will differ based on seasonal dredging (summer) and varying levels of year-round vessel traffic.

See the 2012 NMFS guidance on ambient, bottom of page 3: “Data should be collected during the season when pile driving will occur. There may be seasonal differences in background sound levels depending on site-specific characteristics, such as increased recreational boat traffic during summer months (e.g., summer background sound is typically 3 dB higher than winter background sound in Haro Strait; Veirs and Veirs 2006). If pile driving is anticipated to occur in more than one season then data should be collected to capture seasonal variability.”

Commented [JLO16R15]: The Contractor will be required to measure ambient prior to construction no later than within five days before activities begin to ensure an accurate ambient is recorded. The Contractor would repeat this method during removal if during a different season. See revised section 2.1

iii. Sampling Schedule

Background underwater sound levels will be measured for a minimum of three full 24-hour cycles (i.e., 6 am to 6 am) immediately prior to the beginning of the inwater project construction. Monitoring will take place in the absence of inwater construction activities to determine normal background sound levels (Appendix C). Data will be downloaded from the hydrophones on a daily basis.

iv. Data Analysis

Analysis will be conducted using both data from the full range of frequencies recorded and using high pass filters at 50 Hz, 60 Hz, 150 Hz, and 275 Hz, thus eliminating the frequencies below these levels (Appendix C) which follows the marine mammal functional hearing groups of Southall et al. (2007). Data will be used to calculate 30-second RMS values for each 30-second interval of the three 24-hour cycles measured. These data will be used to calculate and plot a Cumulative Distribution Function (CDF; Appendix C). Overall background sound levels will be reported as the 50% CDF and include a spectral analysis of the frequencies (Appendix C) for a minimum of one hourly cycle. Ambient sound levels will be presented separately for the near-field and far-range hydrophones. Data analysis will include notations of known shipping traffic reported for ships transiting the Columbia River Bar and Mouth.

b. Source Sound Levels (SSL)

The methodology described below is consistent with a 31 January 2012 guidance memorandum issued by NMFS entitled "Data Collection Methods to Characterize Impact and Vibratory Pile Driving Source Levels Relevant to Marine Mammals" (NMFS 2012a; Appendix A).

i. Location of Hydrophones

A single near-field hydrophone will be used to determine SSLs and located approximately 10 meters (33 feet) from the pile driving activity. This hydrophone can be suspended from the pile driving barge, moored, or attached to a nearby dock or pier. This hydrophone should be located at approximately 70 to 85 percent of the water depth at that location (e.g., if water depth is 10 meters, the hydrophone would be located from 7.0 to 8.5 meters [23.0 to 27.8 feet] from the bottom; Appendix A).

ii. Equipment

The hydrophones used for SSL data collection should be appropriate for the frequency range of measurements (i.e., 75 Hz to 20 kHz; Section 3.d). A minimum sampling rate of 48,000 Hz will be used when monitoring. Receiving sensitivities should be sufficient to measure very high acoustic pressures, and these hydrophones will therefore be different from the one used for ambient sound monitoring (see NMFS 2012a; Appendix A). The near-field hydrophones and associated electronic recording networks should be capable of measuring peak pressures as high as 210 dB re: 1 μ Pa without distortion.

iii. Sampling Schedule

Measurements will be collected during all pile driving activity associated with installation of the first 10 piles. The contractor will keep detailed and accurate notes of start and stop times, ramp up and ramp down times, as well as the types and periods of attenuation (see Section 4 for additional contractor requirements).

iv. Data Analysis

Sound measurements will be reported in overall SPL across the entire frequency band for each of the functional hearing groups found in the project area (i.e., 75 Hz to 20 kHz). Vibratory pile driving will be

Commented [T17]: This isn't in section 1.3, that section doesn't exist, and the frequency range here doesn't match either of the other two ranges listed previously.

Commented [JLO18R17]: All have been corrected/updated (75Hz to 20kHz) & Section 3.d

Commented [T19]: Stated as 215 in one spot and 210 in another, now 220 dB is noted. Which is correct? Amend accordingly throughout.

Commented [JLO20R19]: Corrected throughout

Commented [T21]: If this is the intent, then the range noted throughout the doc should be this range rather than 150 Hz to 20 kHz or 20 Hz to 10 kHz.

I support 75 Hz to 20 kHz as the frequency range.

characterized by taking 10-second averages across the entire vibratory pile driving event. Each pile driven will be considered a single event (NMFS 2012a; Appendix A). The average of these 10-second periods will capture the variability in sound levels and represent the SSL for the entire pile driving event.

c. Transmission Loss (TL)

The methodology described below is consistent with a 31 January 2012 guidance memorandum from NMFS entitled “Sound Propagation Modeling to Characterize Pile Driving Sounds Relevant to Marine Mammals” (NMFS 2012b; Appendix B).

i. Location of Hydrophones

Three independent hydrophones will be used to collect data on sound propagation/transmission loss during installation of the piles: near-field, far-range, and vessel-based. The vessel-based hydrophone will record non-continuous monitoring, or “spot-recordings,” as the vessel will need to reposition periodically during pile driving. Continuous recordings will be obtained from the near-field and far-range static hydrophones.

Near-Field: One near-field hydrophone will be located approximately 10 meters (33 feet) from the pile driving activity as described in Section 4.b.i. As described above, this hydrophone can be extended from the pile driving barge, moored, or attached to a nearby pile, tower, stone, or pier. This hydrophone will be located at between 70 and 85 percent of the water depth at that location (e.g., if water depth is 10 meters, the hydrophone would be located from 7.0 to 8.5 meters from the bottom).

Far-Range: The far-range hydrophone will be located at a distance no less than 20 times the source water depth from the pile driving activity outside of the active shipping lanes/dredge area. If possible, this hydrophone will be moored using the same anchoring equipment and in the same location as was used for the background noise monitoring (see Section 4.a.i). In this situation, the hydrophone would be located between 500 and 1,000 meters (1,640 – 3,280 feet) from the indicator test piles, which is sufficiently greater than 20 times the source water depth as prescribed in Appendix B; Figure 3-2. This hydrophone will also be located in waters greater than 10 meters (33 feet) deep and avoid areas of irregular bathymetry. The hydrophone will be placed within a few meters of the bottom in order to reduce flow noise (Appendix B). Mooring of this hydrophone will need to be sufficient to avoid dislodgement due to strong tidal currents or tidal debris, but will also need to be available for retrieval on a daily basis. The contractor will characterize the general bathymetric conditions of the area between the far-range hydrophone and the sound source in order to inform the effort of changes in seafloor bathymetry that might influence the transmission of sound.

Vessel-based: The vessel-based hydrophone will be mounted to a mobile acoustic vessel located in the between and beyond the Mouth of the Columbia River. During vessel-based recordings, the engine and any depth or fish finders must be turned off. The vessel will be silent and drift temporarily during recordings. The intention is to begin drifting inside the estimated marine mammal harassment zones and drift outside of the zone, or to drift from outside in to this zone as appropriate considering tides and other vessel activity. The primary intention of this vessel-based hydrophone is to empirically identify the location of marine mammal level B harassment isopleths for vibratory pile driving; that is, the location and distance from the noise source where noise levels drop below 160 dB and 120 dB, respectively. A depth sounder will record water depth at the beginning and end of each recording, and the contractor will accurately characterize the bathymetric conditions of the monitoring area using

Commented [BGC22]: Should this instead be at the currently-presumed edge of the Zone of Influence?

Commented [JLO23R22]: The ZOI at 120 dB is 7356 meters. The source water depth may run between 10 and 15 meters which would drive a 200 to 300 meter distance. I believe this is fine as long as NMFS is okay with going out that far.

Commented [BGC24]: Is this feasible given conditions at the Bar? Is there a way to account for the acoustics of the engines in the background and keep underway?

Commented [T25]: Engine noise will be an issue with corrupting the data from vibratory pile driving.

Commented [JLO26R25]: Agreed. The pile driving activities are sporadic... lasting 10 minutes roughly per pile. We will need to start recording a few minutes before and after each driving operation to establish background at that specific time. I've added some language to help clarify that.

existing information. A geographic positioning system (GPS) onboard the vessel will log accurate location data and time during the recordings. Coordination between the vibratory driving activity and vessel-based recording will need to be synchronized such that the vessel can start recording a few minutes prior to vibratory actions and continue a few minutes afterward. The intent would be to establish the current background noise prior to and after operation in order to distinguish the effects from the vibratory operations from the ambient noise and establish the location where noise levels from the vibratory operations drop below 160 db and 120 dB. This operation will need to be repeated for each of the different types of piles proposed to be driven to establish results for each type.

ii. Equipment

The hydrophone recording system must be capable of recording the minimum bandwidth required per above frequency considerations. The far-range and vessel-based hydrophones (and near-field hydrophone if needed) will use a flow shield made of latex or spandex that does not trap air in order to reduce the influence of flow noise (NMFS 2012b). The contractor should consider other methods to reduce flow noise, such as, but not limited to, the use of bottom-mounted hydrophone systems that minimize cable lengths.

iii. Sampling Schedule

Measurements will be collected during active pile driving from all three hydrophones. Measurements will be continuous at the two static hydrophones and intermittent at the vessel-based hydrophone.

iv. Data Analysis

During data collection, the contractor will accurately record the start and stop times of pile driving, ramp-up and ramp-down times, and the time period of maximum hammer energy. Additional contractor requirements are discussed in Section 5. Data analysis will only characterize the periods of maximum hammer energy. Transmission loss will be estimated separately for each pile installation. For each functional hearing group (Table 1-1), the far-range measurements need to be reported in overall SPL across the entire frequency band.

During vibratory pile driving, the overall dB rms levels will be characterized by taking 10-second averages across the whole event and averaging all the 10 second periods.

Table 1-1. Functional Marine Mammal Hearing Groups Under Water

Functional Hearing Group	Functional Hearing Range	Marine Mammals found in Project Area
Low-frequency cetaceans	7 Hz to 35 kHz	Humpback, Gray Whale
Mid-frequency cetaceans	150 Hz to 160 kHz	Killer Whale
High-frequency cetaceans	275 Hz to 160 kHz	Harbor Porpoise
Phocidae (true seals)	50 Hz to 86 kHz	Harbor Seal
Otariidae (eared seals)	60 Hz to 39 kHz	Steller Sea Lion

Source: Southall et al. 2007; modified by NMFS July 2016

d. Other Sources of Noise

During collection of data for SSL verification and TL estimation, the start time; end time; and type of unavoidable extraneous noise sources such as vessel traffic, air traffic, etc., if any, will be recorded by

- Commented [BGC27]: Do we need to do this?
- Commented [T28]: Assume they do need to do this, right?
- Commented [JLO29R28]: We are going to do this.

the contractor. Measurements collected during time periods with significant levels of additional noise should be removed from the data set before analysis. One area of particular concern is dredging operations or large ocean-going transport ships at the MCR. Coordination of schedules may be required to prevent interference from dredging. Ship passage occurs year-round, while dredging occurs throughout the summer months and noise from these activity would therefore be a reasonable contribution to measurements of background noise.

5. Record-keeping, Quality, Communication & Reporting Requirements

a. Data Recording, Collection, & Management

The contractor will collect all required data on a data form. All data forms to be used during the monitoring program will be submitted to and reviewed by the Corps at least two weeks prior to the start of project construction. Data forms will be scanned, backed up, and submitted to the Corps within 24-hours of each collection time period. At a minimum, the contractor will collect the following data on the data form:

- Date
- Contractor name
- Pile number
- Pile location
- Activity (vibratory installation, removal, etc.)
- Hammer type and characteristics (weight, model, make)
- Hammer power by percentage, number of strikes per minute, and strike height
- Time when any changes in hammer type or hammer power occur
- Time pile installation starts and stops and time periods of ramp up/down
- Water depth at the work site (i.e. at the pile being installed) every 30 minutes during pile installation (indicate tidal datum used)
- Depth to which each pile was driven
- Characteristics of the substrate in which each pile was driven
- Time and duration of any activity and/or significant extraneous noise sources that may influence noise levels produced or noise levels recorded (e.g., vessel movements, changes in protocol, changes in construction methods)
- Use of pile cushion or pile cap; make and model
- Use of driving shoe; make and model
- Use of bearing plate; make, model, and specifics
- Weather
- Water temperature
- Water and tidal states

In addition, data will also be collected by hydroacoustic recording equipment. Upon conclusion of the day's pile installation, each system's data will be downloaded, reviewed, and archived on the contractor's server (i.e., a computer that is not used in the field or on the vessel) and submitted to the Corps.

b. Quality Control and Assurance

All hydroacoustic equipment shall be tested within 48 hours prior to sound monitoring to ensure all equipment is fully functional. The contractor shall perform and document a calibration of all applicable equipment prior to initiation of sound monitoring. The contractor will resolve any equipment issues that arise prior to the start of project activities. A Quality Control and Quality Assurance (QA/QC) Plan shall be developed as an integral part of the monitoring plan. The QA/QC Plan will establish standardized procedures for documenting and controlling the quality of all data as it is collected and ensure that data collection and recording methods meet the requirements and standards needed for all subsequent analyses. The QA/QC Plan shall be provided to the Corps for review and comment at least two weeks prior to the start of the TPP. The plan shall include the following:

- Identification of the person accountable for the QA/QC Plan and their responsibilities;
- A detailed description of the methods for routine and consistent checks to ensure data integrity, correctness, and completeness;
- A detailed description of how any errors, omissions, and corrective actions will be addressed and reported;
- A detailed description of standardized procedures for inventorying all data collected;
- Methods for providing documentation that QA/QC procedures were followed during data collection activities.

c. Communication and Reporting

Daily: Communication is a key element to a successful execution of pile monitoring. The contractor and Corps will communicate on a daily basis. The contractor will provide a daily report to the Corps providing information on activities completed, problems encountered, and anticipated activities for the next day. The daily report form will be provided to the Corps for review at a minimum two weeks prior to the commencement of work.

Weekly: The pile installation for the offloading facilities is a short duration project; therefore, it is important that issues are resolved quickly and smoothly. The contractor and Corps will meet on a weekly basis to review preliminary data, discuss overall operations status, problems encountered, suggested resolutions and schedule.

d. Data Processing and Final Report

The contractor is responsible for post-processing of data. The final report will demonstrate the achievement of the hydroacoustic monitoring objectives for the piles observed. The report at a minimum will include:

- Methodology: field data collection, post-processing, data analysis methods, and QA/QC documentation
- All underwater sound pressure levels (peak and RMS) will be reported in dB (re: 1 μ Pa)
- Sound exposure levels (SEL) will be reported in dB (re:1 μ Pa² * sec)
- SSLs for each of the piles recorded
- Transmission loss coefficient for each pile
- Ambient noise level
- Far field measurements intended to assist in the determination of the marine mammal level B harassment isopleths
- Additionally, all of the raw data and GIS files collected will be provided to the Corps.

Commented [T30]: Think you intend SSLs not SPLs.

6. References

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- (Corps USACE). June 2012. Revised Final Environmental Assessment, Rehabilitation of the Jetty System at the Mouth of the Columbia River. Portland District, Portland OR.
- . Revised June 2015, Addendums Prepared January 2016 and Updated February 2016 and Prepared November 2016. Revised and Updated Marine Mammal Monitoring Plan Request for Incidental Harassment Authorization and A Letter of Authorization under the Marine Mammal Protection Act for Rehabilitation of the Jetty System at the Mouth of the Columbia River: North Jetty, South Jetty, and Jetty A; Pacific County, Washington, and Clatsop County, Oregon; Construction October 2015 Through October 2021. Submitted to: Office of Protected Resources National Marine Fisheries Service/National Oceanographic and Atmospheric Administration. Prepared by: Portland District, Portland OR.