Request for Authorization for the Incidental Harassment of Marine Mammals Resulting from Pile Driving Training Exercises at Naval Base Ventura County, Port Hueneme

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Acronyms and Abbreviations

Acronym	**Definition**
dB re 1 µPa	decibels referenced to 1 microPascal
ESA	Endangered Species Act
ft	foot/feet
HSTT EIS/OEIS	Hawaii-Southern California Training and Testing Environmental Impact Statement/Overseas Environmental Impact Statement
Hz	Hertz
ICMP	Integrated Comprehensive Monitoring Program
IHA	Incidental Harassment Authorization
kHz	Kilohertz
m	meter(s)
MMPA	Marine Mammal Protection Act
NBVC	Naval Base Ventura County, Port Hueneme
NCG-1	Naval Construction Group –ONE
NDAA	National Defense Authorization Act
NMFS	National Marine Fisheries Service
PBR	Potential Biological Removal
PL	public law
PTS	permanent threshold shift
RMS	root mean square
SEL	sound exposure level
SPL	sound pressure level
TTS	temporary threshold shift
U.S.	United States
U.S.C.	United States Code
ZOI	Zone(s) of Influence

1 Description of Activities

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

1.1 Introduction

The United States (U.S.) Department of the Navy (Navy) requests an Incidental Harassment Authorization (IHA) from the National Marine Fisheries Service (NMFS) for the incidental taking (as defined in Chapter 5 of this document) of marine mammals during up to three proposed pile driving training activities at Naval Base Ventura County, Port Hueneme (NBVC). In-water pile driving training is essential to construction battalion personnel prior to deployment. These are military readiness activities, as defined under the National Defense Authorization Act (NDAA) of Fiscal Year 2004 (PL 108-136). Naval Construction Group ONE (NCG-1) is proposing to execute training events that would include vibratory and impact pile driving, temporary pier construction, and subsequent removal of all installed materials. Training would occur at either Wharf 4 or Wharf D at NBVC Port Hueneme. A maximum of four exercises would occur during the IHA period. Each exercise may last up to one month, but pile driving would not last for more than two weeks. The primary mission of NBVC Port Hueneme is to provide a home port and furnish training, administrative, and logistical support for the Naval Construction Battalions.

Port Hueneme is located approximately 55 nautical miles northeast of Los Angeles. The port is adjacent to the Santa Barbara Channel, between the California coast and the offshore Channel Islands (Figure 1-1). Port Hueneme does not fall within the Study Area for any other Navy at-sea Environmental Impact Statements/Overseas Environmental Impact Statements in the region, as it is also north of the Navy’s Hawaii-Southern California Training and Testing (HSTT) Study Area, and east of the Navy’s Point Mugu Sea Range Study Area.

Code of Federal Regulations (CFR) 50 216.104 sets out 14 specific items that must be included in requests for take pursuant to Section 101(a)(5)(A) of the Marine Mammal Protection Act (MMPA). Those 14 items are addressed in Chapters 1 through 14 of this IHA. The Navy will seek a renewal of this IHA for an additional year if continuing activities require an IHA. Navy will submit a request for renewal to NOAA Fisheries no later than 60 days prior to expiration of this IHA. The renewal request will include an explanation that the activities to be conducted under the requested renewal are identical to the activities analyzed under the initial IHA, are a subset of the activities, or include changes so minor that the changes do not affect the previous analyses, mitigation and monitoring requirements, or take estimates (with the exception of reducing the type or amount of take because only a subset of the initially analyzed activities remain to be completed under the Renewal). The Renewal request will also include a preliminary monitoring report showing the results of the required monitoring completed to date and an explanation showing that the monitoring results do not indicate impacts of a scale or nature not previously analyzed or authorized.

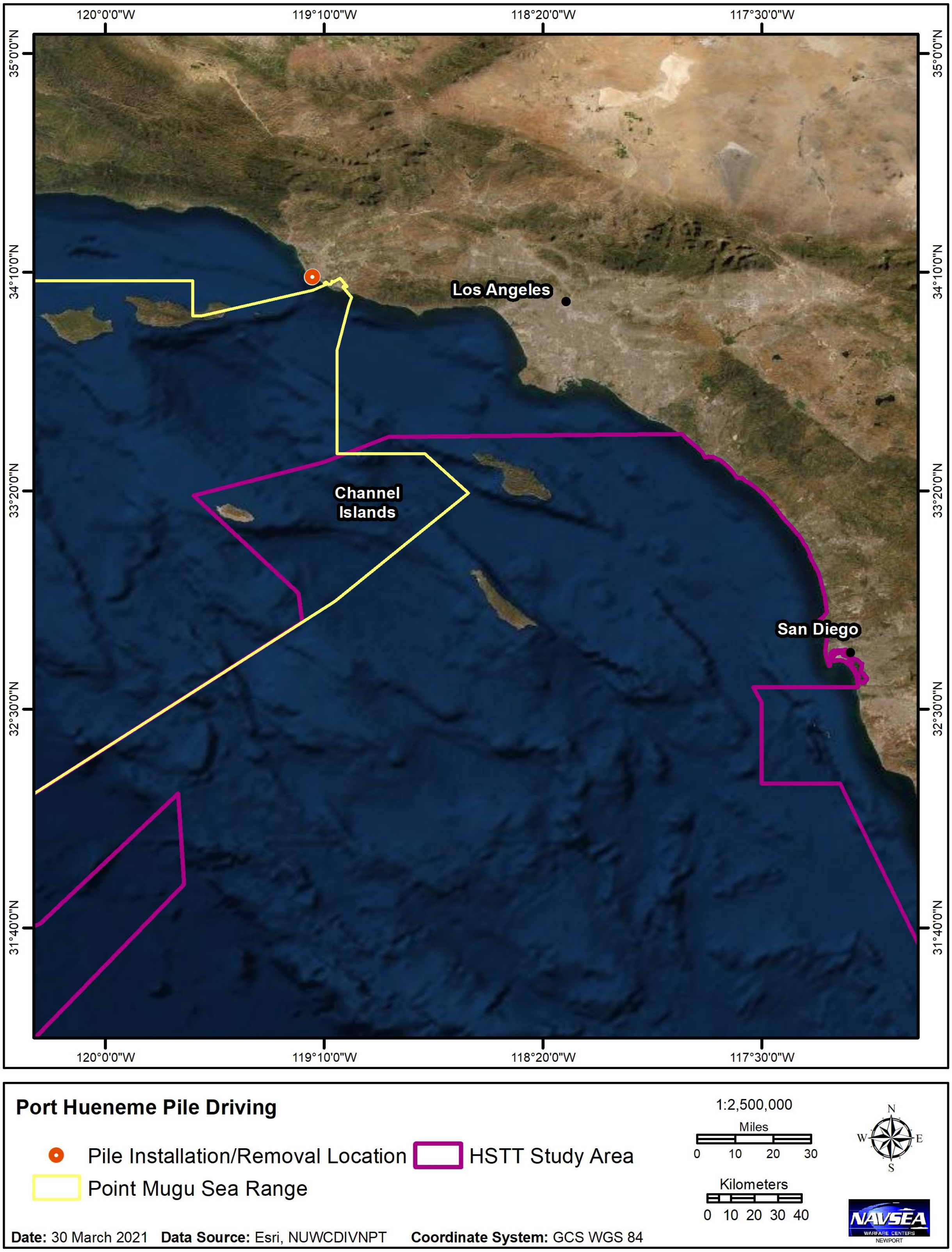

Figure 1-1. Regional Location of Port Hueneme

This document has been prepared in accordance with the applicable regulations of the MMPA, as amended by the National Defense Authorization Act (NDAA) for Fiscal Year 2004 (Public Law [PL] 108-136) and its implementing regulations. The request for an IHA is based on: (1) the analysis of spatial and temporal distribution of marine mammals in the proposed action area, (2) the review of the training activities to determine which aspects would have the potential to incidentally harass marine mammals; and, (3) a risk assessment to determine the likelihood of effects. This chapter describes the aspects of the training activities that are likely to result in Level B harassment under the MMPA; no Level A takes (injury or mortality) are anticipated as a result of the Proposed Action. For military readiness activities, harassment is defined as "(i) any act that injures or has the significant potential to injure a marine mammal or marine mammal stock in the wild [Level A harassment] or (ii) any act that disturbs or is likely to disturb a marine mammal or marine mammal stock in the wild by causing disruption of natural behavioral patterns, including, but not limited to, migration, surfacing, nursing, breeding, feeding, or sheltering, to a point where such behavioral patterns are abandoned or significantly altered [Level B harassment]." Of the stressors associated with Navy pile driving training activities, the Navy has determined that only underwater noise associated with pile driving has the potential to impact marine mammals that may be present within the proposed action area, and rise to the level of harassment as defined under the MMPA.

1.2 Proposed Action

The specific components of each exercise may vary based on the specific training requirements for each battalion. Therefore, the Proposed Action laid out herein is based on the components that would result in the most piles being driven through the duration of the exercise. For all pile driving efforts, a 50-ton crane would be placed on either the southernmost or easternmost end of Wharf 4, or along the western wall of Wharf D, and would be used for both installation and removal of the piles (Figure 1-2). Impact pile driving would use a DELMAG D12-32 (or similar) diesel hammer, while vibratory pile driving would use a vibratory hammer. Regardless of pile type, full-power impact pile driving would incorporate a soft start procedure to reduce the immediate noise exposure to marine mammals. Soft start requires personnel to provide an initial set of strikes at reduced energy, followed by a thirty-second waiting period, then two subsequent reduced energy strike sets. A soft start must be implemented at the start of each day's impact pile driving and at any time following cessation of impact pile driving for a period of thirty minutes or longer. Various moveable floats, or potentially a small boat, would be used to provide in- or near-water support for the pile installation and/or removal. Only one hammer would be used at any given point in time; there would not be any instances where multiple piles would be driven simultaneously. All piles would be removed using the vibratory hammer, which would take up to 11 days.

Four 14-inch steel H beam piles would be driven per exercise in order to support templates for placing steel sheet and timber round piles. These H-piles would typically be driven using a vibratory hammer, but there is potential that they could be driven via impact hammer.

Figure 1-2. Pile Driving Exercise at Wharf 4

1.2.1 Steel Sheet Driving

The sheet pile wall could be constructed in one of two ways: either as a continuous wall or as a set of up to six sheet piles repeatedly driven in the same location to reach a certain number of piles in a smaller space. In this case, up to six piles would be driven, then all but one removed before the process would begin again.

Steel sheet piles are ¾-inch thick and made of corrugated steel. Each pile is a 24-inch wide “Z” shape with a height of 16.14 inches, which means the total footprint of disturbed area due to each sheet pile would be approximately 2.7 square feet. Once the first sheet pile is driven, each subsequent sheet pile would be interlocked with the pile next to it. The crane would slide a pile into the locking channel of the adjacent pile, then into the water. Once the undriven pile is stable, the crane would release the pile, swing the vibratory hammer over and attach it to the pile. Vibratory pile driving is the primary means of driving sheet piles. Each pile would then be driven to a depth of approximately 30 ft (9 m) into the seafloor. Installation of each sheet pile would take approximately 1.5 hours to complete, with around five to ten minutes of actual driving during that timeframe; each sheet pile would take approximately 20 minutes to remove.

Three sheet piles would typically be driven into place during each operating day. Each workday is anticipated to last approximately eight hours, which would include pile driving and supporting pierside activities. Up to five days of steel sheet pile driving would occur per training exercise. This exercise is summarized in Table 1-1.

Table 1-1. Maximum Number of Pile Types That May Be Used Per Training Exercise

Pile Type	***Steel Sheet***	***Timber (round)***	***Steel H Beam***
Size	24”	16”	14”
Number per training exercise	Up to 15	Up to 10	4
Number driven per day	3	2	2
Number removed per day	3	2	2
Pile driving type	Vibratory	Vibratory or Impact	Vibratory or Impact
Number of days of pile driving	5	5	<2
Number of days of removal	5	5	<2
Time to drive one pile (vibratory driving)	5-10 min	20 min	20 min
Number of strikes per pile (impact driving)	n/a	1800	1800
Time to remove one pile (vibratory driving only)	20 min	30 min	30 min

Note: Analysis in this request for IHA considers the maximum number of piles and pile driving days, even if individual training exercises may not reach those numbers.

1.2.2 Round Pile Driving

Aside from the sheet piles, round piles would also be driven using either vibratory or impact pile driving. These round piles would be timber. Five days of driving for round piles is anticipated, and additional details are shown in Table 1-1. An example of the type of training activity using with the round piles is construction of a round pile pier.

The constructed round pile pier would consist of up to ten, but typically six, 16-inch round pier piles spaced approximately 13 ft (4 m) apart and a pre-fabricated pier affixed to the piles above the waterline (Figure 1-3). No other materials would be used. After completion of site feasibility and a survey to ensure no obstructions at the seafloor, a guide system would be put in place (approximately 10 to 15 ft [3 to 4.5 m] into the seafloor) in order to ensure piles are driven in the correct location and straight into the seafloor. The guide system would minimize the movement of a pile once the driving has commenced, and would utilize the two steel H-piles to hold a template in place. The piles would be lifted into place using the crane and the pile driver would be used to embed each pile to a depth of 30 to 35 ft (9 to 11 m) into the seafloor. It is expected that each timber pile would take approximately four hours to be installed into the seafloor, and that two piles per day would be installed (Table 1-1); therefore, each day of pile installation would last for eight hours.

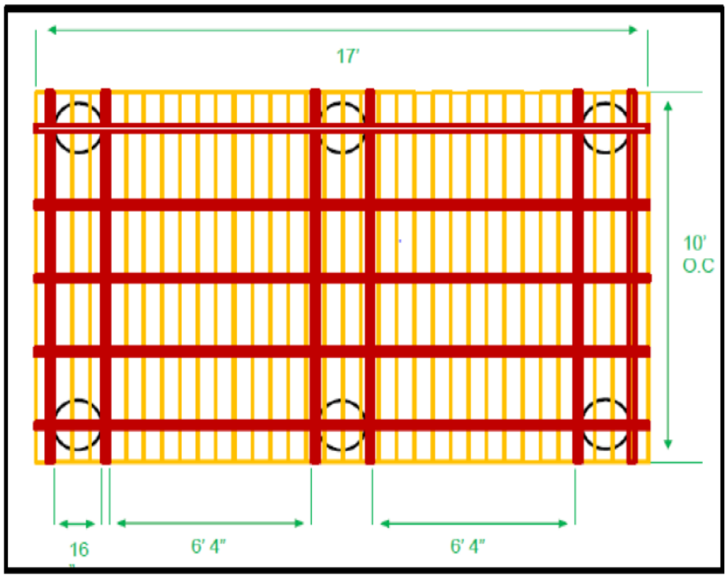

Figure 1-3. Aerial Footprint of Round Pile Pier

Once the pile driving is complete, the guide system would be removed and the Seabees would then build the decking system pierside, on Wharf 4 or Wharf D. The decking system would then be lifted by the crane onto the six piles, and the Seabees would secure the deck to the piles. At this point, the pier installation would be complete, and the decking would be detached from the piles and lifted back to land by the crane. The piles would be removed from the sediment one-by-one with the vibratory hammer and placed onto the wharf.

All piles driven used for this exercise would be washed thoroughly at the NBVC Wash Rack area, which is a self-contained system that ensures the runoff from pile washing would have no environmental impact. The piles would be staged at the NCG-1 staging yard.

2 Dates, Duration, and Geographic Region

The date(s) and duration of such activity and the specific geographical region where it will occur.

The proposed action area for Navy pile driving training activities is NBVC. In-water pile driving could occur for up to 48 days, spread over four annual training exercises. An additional 12 days per exercise, or 48 total days, would be factored in for pile removal at the end of each exercise; the maximum annual number of days of active pile driving or removal would be 96. Navy requests that this IHA include the option to renew the authorization for additional time at the conclusion of this one-year authorization.

Each workday would occur during daylight hours, and would last approximately eight hours, but pile driving/removal would not occur for the entire eight hours. Due to the availability of resources, requirements by NBVC for port use, and battalion training needs, it is not possible to predict the precise dates of training activities. No more than four separate training events would occur over the duration of the IHA. Each individual training event would involve some or all of the components as described in Section 1.2.

Each training event would occur at either Wharf 4 or Wharf D. Wharf 4 contains two potential pile driving training sites. Wharf 4 South is located directly in front of the Naval Facilities Engineering and Expeditionary Warfare Center Dive Locker, and the Wharf 4 East site is located along the side of the Naval Facilities Engineering and Expeditionary Warfare Center Dive Locker (Figure 2-1). The Wharf D site is located near the mouth of the harbor (Figure 2-2). The Wharf 4 locations are open to the majority of the harbor, whereas the Wharf D location is almost entirely self-contained, with only one access point from the channel leading to the harbor itself. No part of the Proposed Action would occur outside of Port Hueneme Harbor in the Pacific Ocean.

Port Hueneme Harbor encompasses NBVC Port Hueneme and a commercial port. The entrance channel is 2,300 ft (701 m) long with the narrowest width of the channel entrance at 330 ft (101 m). The average depth of the harbor is 34.5 ft (10.5 m) at Mean Lower Low Water. Port operations comprise approximately 200 acres at the southern end of NBVC Port Hueneme. The substrate is primarily mud, with occasional rock debris at the base of the inlet jetties. Marine subtidal habitat at NBVC Port Hueneme consists of communities associated with sand, mud, and rock substrates. Shoreline features in the harbor around Wharf 4 and Wharf D include riprap, quay walls, and wharf pilings.

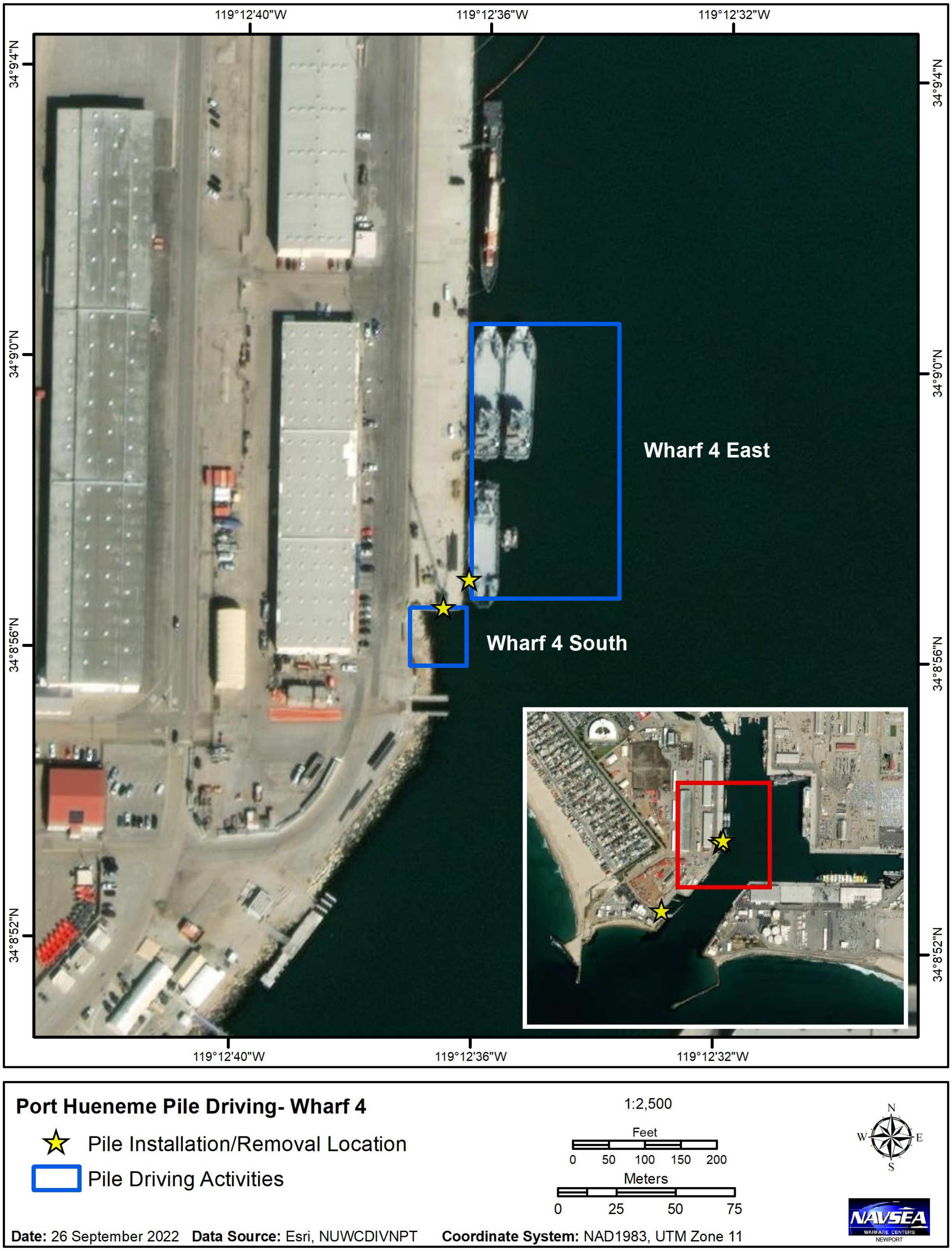

Figure 2-1. Proposed Action Area for Pile Driving Exercises at Wharf 4

Figure 2-2. Proposed Action Area for Pile Driving Exercises at Wharf D

3 Species and Numbers of Marine Mammals

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

Effects to all marine mammal species with potential to be present within the proposed action area were considered; marine mammals considered include California sea lions (*Zalophus californianus*) and harbor seals (*Phoca vitulina richardii*). These are the only two marine mammal species expected to be present in the proposed action area. These two species may be exposed to acoustic sources during pile driving that would reach levels defined as harassment under the MMPA. Table 3-1 and Chapter 4 provide relevant information on their status, life history, and distribution.

Table 3-1. Marine Mammals Potentially Taken by Harassment[1] During Navy Pile Driving Training Activities

Species	***Stock***	***Stock Abundance Estimate and (PBR)[2,3]***	***Occurrence, Seasonality, and Duration in Proposed Action Area***
Harbor seal (*Phoca vitulina richardii*)	California	30,968 (1,641)	Haul out on rocks, beaches, and Navy piers, and feed in Port Hueneme Harbor and the marine waters just outside of the Harbor. Generally non-migratory with local movements in response to prey distribution. Exhibit strong natal site fidelity. Found year-round and numbers near proposed action area are variable.
California sea lion (*Zalophus californianus*)	United States	257,606 (14,011)	Haul out on man-made structures such as docks, buoys, and tidal rip-rap. Typically congregate near rookery islands and specific open-water areas; the nearest rookery islands to the proposed action area are the California Channel Islands. Found year-round, and numbers near proposed action area are variable.

[1]Harassment as defined under the MMPA and as it applies to military readiness.
[2]Potential Biological Removal (PBR): defined by the MMPA as the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population. The PBR level is the product of the following factors: the minimum population estimate of the stock; one-half the maximum theoretical net productivity rate; and a recovery factor of between 0.1 and 1.0.
[3] Stock Abundance and PBR is from the most recent Final U.S. Marine Mammal Stock Assessment Report (Carretta et al. 2022).

4 Affected Species Status and Distribution

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.

4.1 Harbor Seal (*Phoca vitulina richardii*)

The only stock of harbor seals expected in the proposed action areas during Navy pile driving training activities is the California stock. Harbor seals are considered for possible take by harassment in the proposed action area.

4.1.1 Regional and Seasonal Distribution

Two subspecies of harbor seals exist in the Pacific: *P. v. stejnegeri* in the western North Pacific, near Japan, and *P. v. richardii* in the eastern North Pacific (Burns 2002; Jefferson et al. 2008). Of the two subspecies, only the eastern North Pacific subspecies would be found in the proposed action area. This subspecies inhabits near-shore coastal and estuarine areas from Baja California, Mexico, to the Pribilof Islands in Alaska. Harbor seals are rarely found more than 11 nautical miles from shore (Baird 2001) and are generally non-migratory (Burns 2002; Jefferson et al. 2008) and solitary at sea. LaMont et al. (1996) identified four discrete subpopulations based on genetic differences between harbor seals from Washington (two locations), Oregon, and California, with the California stock being the only one present in the proposed action area. However, the Society of Marine Mammalogy's Committee on Taxonomy has determined that all harbor seals in the North Pacific should be recognized as a single subspecies (*P. v. richardii*) until the subspecies limits of various populations are better known (Committee on Taxonomy 2017).

While primarily aquatic, harbor seals also use the coastal terrestrial environment, where they haul out of the water periodically on to rocks, reefs, beaches, and anthropogenic structures to regulate their body temperature, molt, interact with other seals, give birth, and raise their pups. They haul out in groups to avoid predators, and spend less time being watchful for predators than those that haul out alone. Harbor seals feed in marine, estuarine, and occasionally fresh water environments. Harbor seals generally are non-migratory, with local movements associated with such factors as tides, weather, season, food availability, and reproduction (Bigg 1969, 1981; Boveng et al. 2012; Fisher 1952; Hastings et al. 2004; Lowry et al. 2001; Rehberg and Small 2001; Scheffer and Slipp 1944; Small et al. 2005; Small et al. 2003; Swain et al. 1996).

Small numbers of harbor seals are found hauled out on coastal and island sites and forage in the nearshore waters of Southern California, but are found in only moderate numbers compared to sea lions and elephant seals. In California, there are approximately 400 to 600 harbor seal haul-out sites widely distributed along the mainland and on offshore islands of the state (Lowry et al. 2008). The harbor seal haul-out sites include several areas along the coast of La Jolla in San Diego County and most of the Channel Islands (Lowry et al. 2008; Lowry et al. 2017b). Harbor seals have been reported hauling out on the beach just outside the mouth of Port Hueneme Harbor (a minimum of approximately 300 ft [approximately 91 m] from the pile driving location at Wharf D), but the Integrated Natural Resources Management Plan for NBVC categorizes their presence on the beach as "rare" (Department of the Navy 2019).

Diving behavior analyses of harbor seals in shallow estuarine environments indicated that they spent more than 80 percent of their time diving in the upper portion of the water column at or above 185 ft (56 m), but exhibited relatively long duration dives (4.4 to 5.2 minutes) (Eguchi 1998; Womble et al. 2014). Since the proposed action area is very shallow, with an average depth of 34.5 ft (10.5 m) at mean lower low water, it is likely that harbor seals, when present, would always be at or near the surface (Tetra Tech 2012).

4.1.2 Status of Stock

California harbor seals are not listed as "endangered" or "threatened" under the Endangered Species Act (ESA), nor are they designated as "depleted" under the MMPA. Annual human-caused mortality does not exceed Potential Biological Removal (PBR) threshold for this stock, and they are not considered a "strategic" stock under the MMPA. The estimated abundance of harbor seals in this stock is 30,968, with a PBR of 1,641 (Carretta et al. 2022).

4.1.3 Hearing and Vocalization

Harbor seals hear nearly as well in air as underwater (Kastak and Schusterman 1998). At frequencies above 60 kilohertz (kHz), hearing sensitivity rapidly decreases (Reichmuth 2008). In air, harbor seals hear frequencies ranging from 250 Hertz (Hz) to 30 kHz, with most sensitivity at frequencies between 6 and 16 kHz (Department of the Navy 2006; Reichmuth et al. 2013). Source levels for pinniped vocalizations in-water range from approximately 95 to 190 decibels referenced to 1 micropascal (dB re 1 µPa) at 1 m (Richardson et al. 1995). Phocid hearing limits are estimated to be 75 Hz–30 kHz in air and 75 Hz–75 kHz in water (Kastak and Schusterman 1999; Kastelein 2009; Reichmuth 2008; Terhune and Ronald 1971, 1972).

Pinnipeds produce sounds both in air and in water that range in frequency from approximately 100 Hz to several tens of kHz; it is believed that these sounds only serve social functions (Miller 1991) such as male-male vocal boundary displays, mother-pup recognition, and reproduction. Harbor seal males produce a variety of low frequency (less than 4 kHz) in-air vocalizations including snorts, grunts, and growls. Roaring is one of the primary vocalizations used by male harbor seals, and has a mean frequency of 547 Hz (mean frequency range is 280–810 Hz) (Hanggi and Schusterman 1994) and may function in defining underwater territories.

The response of harbor seals to impulsive noise has been a topic of interest since the residual effect of anthropogenic noise on the hearing of harbor seals was first described by Kastak and Schusterman (1996). This study examined hearing after inadvertent exposure to broadband construction noise, in air, for 6 days, for 6–7 hours per day, after which a harbor seal showed temporary threshold shift (TTS). However, recent work has shown that impacts of anthropogenic noise on seal hearing are minimal. When exposed to 360 minutes of simulated impulsive pile driving noises at a sound exposure level (SEL) of 151 dB re 1 µpa^{2}s (SEL), harbor seals exhibited TTS lasting no more than one hour. Exposure at shorter durations, including a 3 hour exposure underwater, did not result in any detectible hearing loss (Kastelein et al. 2018). Sills et al. (2020) found no evidence of TTS in seals following single shots at 185 dB re 1 µPa^{2}s unweighted SEL and 207 dB re 1 µPa peak-to-peak sound pressure. However transient shifts in hearing thresholds at 400 Hz were apparent following repeated consecutive pulses (cumulative SEL 191–195 dB re 1 µPa^{2}s) (Sills et al. 2020). Harbor seal hearing is less susceptible to TTS after exposure to lower frequencies than after exposure to higher frequencies (Kastelein et al. 2020a; Kastelein et al. 2020b).

4.2 California Sea Lion (*Zalophus californianus*)

There is only one stock of California sea lions, and it is expected to occur in the proposed action area during Navy pile driving training activities. California sea lions are considered for possible take by harassment in the proposed action area.

4.2.1 Regional and Seasonal Distribution

California sea lions occur in the eastern North Pacific from Puerto Vallarta, Mexico, through the Gulf of California and north along the west coast of North America to the Gulf of Alaska (Jefferson et al. 2015; Maniscalco et al. 2004). During the summer, California sea lions typically congregate near rookery islands and specific open-water areas. The primary rookeries off the coast of the U.S. are on San Nicolas, San Miguel, Santa Barbara, and San Clemente Islands (Lowry et al. 2008; Lowry and Forney 2005; Lowry et al. 2017b). In late summer, sub-adult and adult male sea lions, as well as many juveniles, move north from the Channel Islands to forage (Lowry and Forney 2005; Lowry et al. 2017b)

This species is prone to invade human-modified coastal sites that provide good hauling out substrate, such as marina docks and floats, buoys, bait barges, small boats, and rip-rap tidal and wave protection structures. They are known to be present on these structures within the proposed action area, occasionally in large numbers. The primary sea lion haulout at NBVC is on and around the floating docks at Wharf D (approximately 193 ft [59 m] from the location that pile driving would occur), though other areas are occasionally used. California sea lions were also frequently encountered swimming near the channel markers, and their presence within the proposed action area is considered “regular” according to the NBVC Integrated Natural Resources Management Plan (Department of the Navy 2019).

California sea lions are known to feed in both benthic and open-water habitats, and have a broad diet range, feeding on a variety of fish and cephalopod species depending on the environment. Common prey items include salmon, Pacific sardines (*Sardinops sagax*), northern anchovy (*Engraulis mordax*), mackerel, Pacific whiting (*Merluccius productus*), rockfish, market squid (*Loligo opalescens*), bass, cutlassfish, cusk eels, greenlings, dogfish, perch, and various flatfish (Lowry and Forney 2005; Orr et al. 2012; Orr et al. 2011), midshipmen and lanternfish (Lowry and Forney 2005; Orr et al. 2012; Orr et al. 2011). Dive durations range from 1.4 to 5 minutes, with longer dives during El Niño events; sea lions dive about 32 to 47 percent of the time at sea (Feldkamp et al. 1989; Kuhn and Costa 2014; Melin and DeLong 2000; Melin et al. 2008). Adult females alternate between nursing their pup on shore and foraging at sea, spending approximately 67 to 77 percent of time at sea (Kuhn and Costa 2014; Melin and DeLong 2000).

4.2.2 Status of Stock

California sea lions in the U.S. are not listed as "endangered" or "threatened" under the ESA or as "depleted" under the MMPA. The stock is estimated to be approximately 257,606, which is therefore considered within the range of its optimum sustainable population size (Laake et al. 2018; Lowry et al. 2017a; Lowry et al. 2017b). California sea lions are not considered "strategic" under the MMPA because human-caused mortality is less than the PBR (14,011). The fishery mortality and serious injury rate (>320 animals/year) for this stock is less than 10 percent of the calculated PBR and, therefore, is considered to be insignificant and approaching a zero mortality and serious injury rate (Laake et al. 2018).

California sea lions are the most abundant pinniped along the California coast. Overall, the California sea lion population is abundant (Carretta et al. 2022).

4.2.3 Hearing and Vocalization

Hearing in otariids (sea lions & fur seals) is adapted to low-frequency sound with less auditory bandwidth than phocids. Otariids' hearing ranges from 50 Hz–75 kHz in air and 50 Hz–50 kHz in water, with a peak sensitivity between approximately 1 to 28 kHz, based on studies done with California sea lions and northern fur seals (*Callorhinus ursinus*) (Kastak and Schusterman 1998; Moore and Schusterman 1987; National Marine Fisheries Service 2018; Schusterman et al. 1972; Southall 2005). California sea lions predominantly vocalize using low frequency (300 to 700 Hz) barks, but also are capable of making clicking sounds, as well as hearing clicking sounds from predators such as orcas (*Orcinus orca*) (Cunningham and Reichmuth 2016; Viers 2011).

The specific response of California sea lions to pile driving is not as well studied as for harbor seals. Given an approximately similar hearing range, it would be reasonable to expect that California sea lions would respond similarly to harbor seals. Ampela et al. (2014) measured behavioral reaction of California sea lions to pile driving and observed only minor changes in abundance and behavior during days when pile driving was occurring. California sea lions frequently inhabit waters with high level of anthropogenic activity, and may become habituated to the noise.

5 Type of Incidental Taking 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

The Navy requests an IHA under Section 101 (a)(5)(A) of the MMPA, for the incidental take of marine mammals by harassment during proposed pile driving training activities at NBVC. As described in detail in Chapter 6, the Navy requests an IHA for the incidental taking of marine mammals listed in Table 5-1 for a period of one year from the date of IHA issuance.

Table 5-1. Total Number of Acoustic Exposures During NCG-1 Pile Driving Training Activities

Common Name	***Level B Takes Requested***
Harbor seal	2,016
California sea lion	36,960
Total	38,976

The term “take,” as defined in Section 3 (16 United States Code [U.S.C.] § 1362 (13)) of the MMPA, means “to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal.” “Harassment” was further defined in the 1994 amendments to the MMPA. Harassment which has the potential to injure a marine mammal is further defined as Level A harassment. Harassment which has the potential to disturb a marine mammal by causing disturbance of behavioral patterns, including migration, breathing, nursing, breeding, feeding, or sheltering, but which does not have the potential to injure a marine mammal, is further defined as Level B harassment. The NDAA of Fiscal Year 2004 (PL 108-136) amended the definition of “harassment” as applied to military readiness activities or scientific research activities conducted by or on behalf of the federal government, consistent with Section 104(c)(3) [16 U.S.C. § 1374(c)(3)]. The NDAA of Fiscal Year 2004 adopted the definition of “military readiness activity” as set forth in the Fiscal Year 2003 NDAA (PL 107-314). Naval construction personnel pile driving training within the proposed action areas are comprised of military readiness activities as that term is defined in PL 107-314 because training activities constitute “training and operations of the Armed Forces that relate to combat” and “adequate and realistic testing of military equipment, vehicles, weapons, and sensors for proper operation and suitability for combat use.” For military readiness activities, the relevant definition of harassment is any act that:

- Injures or has the significant potential to injure a marine mammal or marine mammal stock in the wild (“Level A harassment”); or
- Disturbs or is likely to disturb a marine mammal or marine mammal stock in the wild by causing disruption of natural behavioral patterns including, but not limited to, migration, surfacing, nursing, breeding, feeding, or sheltering to a point where such behavioral patterns are abandoned or significantly altered (“Level B harassment”) [16 U.S.C. § 1362(18)(B)(i) and (ii)].

5.2 Method of Incidental Taking

This authorization request considers noise from vibratory and impact pile installation, as outlined in Chapters 1 and 2, that has the potential to displace marine mammals or produce a temporary threshold shift in their hearing ability resulting in Level B harassment (behavioral disturbance) as defined above. Level A harassment is not anticipated. See Chapter 11 for more details on proposed mitigation and monitoring measures to minimize the potential for takes of marine mammals and ensure no Level A harassment (Chapter 11).

6 Take Estimates for Marine Mammals

By age, sex, and reproductive condition (if possible), the number of marine mammals (by species) that may be taken by each type of taking identified in Chapter 5, and the number of times such takings by each type of taking are likely to occur.

This chapter summarizes potential incidental take of marine mammals from pile driving activities outlined in Chapters 1 and 2 that have the potential to result in Level B exposure from in-water vibratory and impact pile driving and extraction. Section 6.3 describes the methods used to calculate the estimated Level B Zone of Influence (ZOI) and Section 6.6.2 provides the number of marine mammals by species for which take authorization is requested as identified in Table 5-1.

In-water pile driving would temporarily increase the local underwater and airborne noise levels in the vicinity of NBVC. Increased noise may impact marine mammals in a variety of ways which depends on many factors. These are discussed in more detail in Chapter 7. Due to vibratory and impact pile driving and removal source levels, this request evaluates the incidental take by Level B acoustical harassment of harbor seals and California sea lions. It is anticipated that all of the marine mammals that enter Level B ZOIs will be exposed to pile driving noise. It is possible that harbor seals and California sea lions could be exposed to noise above threshold multiple times during the project.

6.1 Vocalization and Hearing of Marine Mammals

All marine mammals that have been studied are known to make sounds that are used for communication, feeding, and/or navigation. Measurements of marine mammal sound production and hearing capabilities provide some basis for assessment of 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 (Au 1993; Nachtigall et al. 2007; Schusterman 1981; Wartzok and Ketten 1999). Behavioral audiograms, which are plots of animals' exhibited hearing threshold versus frequency, are obtained from captive, trained animals using standard testing procedures with appropriate controls, and are considered to be a more accurate representation of a subject's hearing abilities. Behavioral audiograms of marine mammals can be difficult to obtain because many species are too large, too rare, and too difficult to acquire and maintain for experiments in captivity.

Electrophysiological audiometry measures small electrical voltages produced by neural activity when the auditory system is stimulated by sound. The technique is relatively fast, does not require a conscious response, and is routinely used to assess the hearing of newborn humans although it is not as sensitive as behavioral audiograms. Hearing response in relation to frequency for both methods of evaluating hearing ability is a generalized U-shaped curve, or audiogram, showing the frequency range of best sensitivity (lowest hearing threshold) and frequencies above and below with higher threshold values.

Consequently, understanding of a species' hearing ability may be based on the behavioral audiogram of a single individual or small group of animals. In addition, captive animals may be exposed to local ambient sounds and other environmental factors that may impact their hearing abilities and may not accurately reflect the hearing abilities of free-swimming animals (Houser et al. 2010). For animals not available in captive or stranded settings (including large whales and rare species), estimates of hearing capabilities are made based on physiological structures, vocal characteristics, and extrapolations from related species.

Direct measurement of hearing sensitivity does not exist for all species of marine mammals. Table 6-1 provides a summary of sound production and general hearing capabilities for marine mammal species that are assessed in this authorization request (note that values in this table are not meant to reflect absolute possible maximum ranges, rather they represent the best known ranges of each functional hearing group). For purposes of the analysis in this document, the two pinniped species present are considered based on their functional hearing groups, as defined by NMFS: phocids (harbor seals) and otariids (California sea lions). A detailed discussion of the functional hearing groups can be found in (National Marine Fisheries Service 2018).

Table 6-1. Marine Mammal Functional Hearing Groups[1]

Functional Hearing Group	*Species Which May Be Present in the Area*	*Underwater Sound Production Frequency Range*	*General Hearing Ability Frequency Range*
Phocidae	Harbor seal	20 Hz–24 kHz	In-water: 50 Hz–86 kHz In-air: 75 Hz–30 kHz
Otariidae	California sea lion	80 Hz–8 kHz	In-water: 60 Hz–39 kHz In-air: 50 Hz–75 kHz

[1]Adapted and derived from Southall et al. (2007) and Southall et al. (2019)
Note: dB re 1 µPa @ 1 m: decibels referenced to 1 microPascal at 1 meter underwater; Hz: Hertz; kHz: kilohertz

6.2 Analysis Framework

The potential impacts were analyzed in terms of potential for hearing loss and behavioral reactions as a result of the Proposed Action. This conceptual framework describes potential effects and the pathways by which an acoustic stimulus or sound-producing activity can potentially affect animals. It qualitatively describes costs to the animal (e.g., expended energy or missed feeding opportunity) that may be associated with specific reactions.

6.2.1 Hearing Threshold Shifts

The most familiar effect of exposure to high intensity sound is hearing loss, meaning a shift in the hearing threshold. This phenomenon is called a noise-induced threshold shift, or simply a threshold shift (Miller 1974). The distinction between permanent threshold shift (PTS) and TTS is based on whether there is complete recovery of a threshold shift following a sound exposure. If the threshold shift eventually returns to zero (the threshold returns to the pre-exposure value), the threshold shift is considered a TTS. The recovery to pre-exposure threshold from studies of marine mammals is usually on the order of minutes to hours for the small amounts of TTS induced (Finneran et al. 2005; Nachtigall et al. 2004). The recovery time is related to the exposure duration, SEL, and the magnitude of the threshold shift, with larger threshold shifts and longer exposure durations requiring longer recovery times (Finneran et al. 2005; Mooney et al. 2009). If the threshold shift does not return to zero but leaves some finite amount of threshold shift, then that remaining threshold shift is a PTS.

Studies of marine mammals have been designed to determine relationships between TTS and exposure parameters such as intensity, duration, and frequency. In these studies, hearing thresholds were measured in trained marine mammals before and after exposure to intense sounds. The difference between the pre-exposure and post-exposure thresholds indicates the amount of TTS. Kastelein et al. (2016) studied the effects of intermittent anthropogenic sounds (such as sonar) and the onset of TTS in harbor porpoises. The study found that relatively short, intermittent sounds (such as sonar) had a much

smaller impact on TTS than a constant anthropogenic sound such as pile driving (Kastelein et al. 2016). Other species studied include the bottlenose dolphin (n=9), beluga (n=2), harbor porpoise (n=1), finless porpoise (n=2), California sea lion (n=3), harbor seal (n=1), and northern elephant seal (n=1). Some of the more important data obtained from these studies are onset-TTS levels–exposure levels sufficient to cause a just-measurable amount of TTS, often defined as 6 dB of TTS, for example (Schlundt et al. 2000).

Although there have been no marine mammal studies designed to measure PTS, the potential for PTS in marine mammals can be estimated based on known similarities between the inner ears of marine and terrestrial mammals. Experiments with marine mammals have revealed similarities to terrestrial mammals for features such as TTS, age-related hearing loss, ototoxic drug-induced hearing loss, masking, and frequency selectivity. Therefore, in the absence of marine mammal PTS data, onset-PTS exposure levels may be estimated by assuming some upper limit of TTS that equates to the onset of PTS, then using TTS growth relationships from marine and terrestrial mammals to determine the exposure levels capable of producing this amount of TTS.

6.2.2 Masking

Masking occurs when one sound interferes with the detection or recognition of another sound at similar frequencies and at similar or higher levels. Masking can effectively limit the distance over which a marine mammal can communicate and detect biologically relevant sounds. Masking only occurs in the presence of the masking noise and does not persist after the cessation of the noise. Masking can lead to vocal changes (e.g., increasing amplitude or changing frequency) and behavior changes (e.g., cessation of foraging, leaving an area) to both signalers and receivers, in an attempt to compensate for noise levels (Erbe et al. 2016). Unlike PTS or TTS, which persist after the sound exposure, masking occurs during sound exposure and is not associated with abnormal physiological function; masking is, therefore, not considered a physiological effect, but rather a potential behavioral effect.

Vocalization changes may result from a need to compete with an increase in background noise and include increasing the source level, modifying the frequency, increasing the call repetition rate of vocalizations, or ceasing to vocalize in the presence of increased noise (Hotchkin and Parks 2013). Pinnipeds may be at risk for vocal masking.

Masking is more likely to occur in the presence of broadband, relatively continuous noise sources. Energy distribution of pile driving covers a broad frequency spectrum, and sound from pile driving would be within the audible range of California sea lions and harbor seals present in the proposed action area. While some pile driving during Navy training activities may mask some acoustic signals that are relevant to the daily behavior of pinnipeds, the short-term duration and limited areas affected make it very unlikely that survival would be affected. Masking would only result in take (i.e., harassment) under the MMPA if it resulted in a behavioral response (e.g., animal departing the area); this behavioral response is analyzed below.

6.2.3 Behavioral Reactions or Responses

The response of a marine mammal to an anthropogenic sound will depend on the frequency, duration, temporal pattern, and amplitude of the sound, as well as the animal's prior experience with the sound and the context in which the sound is encountered (i.e., what the animal is doing at the time of the exposure). The distance from the sound source and whether it is perceived as approaching or moving away can also affect the way an animal responds to a sound (Wartzok et al. 2003). For marine mammals, a review of responses to anthropogenic sounds was first conducted by Richardson et al. (1995). More

recent reviews (Nowacek et al. 2007; Southall et al. 2007; Southall et al. 2019) address studies conducted since 1995, and focus on observations where the received sound level of the exposed marine mammal(s) was known or could be estimated.

Southall et al. (2007) and Southall et al. (2019) synthesized data from many past behavioral studies and observations to determine the likelihood of behavioral reactions at specific sound levels. While in general, the louder the sound source the more intense the behavioral response would be, it was clear that the proximity of a sound source and the animal's experience, motivation, and conditioning were also critical factors influencing the response (Southall et al. 2007; Southall et al. 2019). After examining all of the available data, the authors felt that the derivation of thresholds for behavioral response based solely on exposure level was not supported because context of the animal at the time of sound exposure was an important factor in estimating this response. Nonetheless, in some conditions, consistent avoidance reactions were noted at higher sound levels depending on the marine mammal species or group allowing conclusions to be drawn. Phocid seals showed avoidance reactions at or below 190 dB re 1 µPa at 1 m; thus, seals may actually receive levels adequate to produce TTS before avoiding the source.

Several impulsive noise exposure studies have also been conducted without measurable (behavioral) TTS. Finneran and Schlundt (2003) exposed two sea lions to single impulses from an arc-gap transducer with no measurable TTS (maximum unweighted SEL = 163 dB re 1 µPa^{2}s, peak sound pressure level [SPL] = 203 dB re 1 µPa). Reichmuth et al. (2016) exposed two spotted seals (*Phoca largha*) and two ringed seals (*Pusa hispida*) to single impulses from a 10 cubic inch sleeve airgun with no measurable TTS (maximum unweighted SEL = 181 dB re 1 µPa^{2}s, peak SPL ~ 203 dB re 1 µPa).

6.2.4 Criteria and Thresholds for Predicting Impulsive and Non-Impulsive Impacts on Marine Mammals from the Proposed Action

Acoustic criteria were developed in coordination with NMFS to support the Navy's at-sea Phase III environmental analyses and MMPA Letter of Authorization renewals (U.S. Department of the Navy 2017b). In order to derive the weighting function, the most critical data required are TTS onset exposure levels as a function of exposure frequency. These values can be estimated from published literature by examining TTS as a function of SEL for various frequencies.

To estimate TTS onset within the Navy criteria, only TTS data from behavioral hearing tests were used. To determine TTS onset for each subject, the amount of TTS observed after exposures with different SPLs and durations were combined to create a single TTS growth curve as a function of SEL. The use of (cumulative) SEL is a simplifying assumption to accommodate sounds of various SPLs, durations, and duty cycles. This is referred to as an "equal energy" approach, since SEL is related to the total energy of the sound and this approach assumes exposures with equal SEL result in equal effects, regardless of the duration or duty cycle of the sound. It is well-known that the equal energy rule will over-estimate the effects of intermittent noise, since the quiet periods between noise exposures will allow some recovery of hearing compared to noise that is continuously present with the same total SEL (Ward 1997). For continuous exposures with the same SEL but different durations, the exposure with the longer duration will also tend to produce more TTS (Finneran et al. 2010; Kastak et al. 2007; Mooney et al. 2009).

As in previous acoustic effects analysis (Finneran and Jenkins 2012; Southall et al. 2007), the shape of the PTS exposure function for each species group is assumed to be identical to the TTS exposure function for each group. A difference of 20 dB between TTS onset and PTS onset is used for all marine mammals, including pinnipeds. This is based on estimates of exposure levels actually required for PTS

(i.e. 40 dB of TTS) from the marine mammal TTS growth curves, which show differences of 13 to 37 dB between TTS and PTS onset in marine mammals. Details regarding these criteria and thresholds can be found in National Marine Fisheries Service (2018).

These criteria use cumulative SEL metrics and instantaneous peak SPL to determine onset of PTS and TTS. Cumulative SEL is summed across the full frequency range, and then weighted using the appropriate weighting function for the applicable hearing group

Table 6-2 below provides the criteria and thresholds used in this analysis for estimating quantitative acoustic exposures of marine mammals from the Proposed Action. Weighting criteria are factored into the values provided in Table 6-2. Southall et al. (2007) proposed frequency-weighting to account for the frequency bandwidth of hearing in marine mammals. Frequency-weighting functions are used to adjust the received sound level based on the sensitivity of the animal to the frequency of the sound. Details regarding these criteria and thresholds can be found in Department of the Navy (2017a) (National Marine Fisheries Service 2018).

Table 6-2. Criteria for Acoustic Exposures to Pinnipeds by Pile Driving

	Underwater				***Airborne***
Marine Mammal Hearing Group	***Impact Pile Driving (impulsive)***		***Vibratory Pile Driving (non-impulsive, continuous)***		***Impact and Vibratory Pile Driving[1]***
	Level A Threshold SELcum (24-hr) (re $1\mu Pa^2s$) [weighted]	***Level B Threshold (1 μPa) [unweighted]***	***Level A Threshold SELcum (24-hr) (re $1\mu Pa^2s$) [weighted]***	***Level B Threshold(1 μPa) [unweighted]***	***Level B Disturbance Guideline (re 20 mPa) RMS[2] [hauled out]***
Phocid pinnipeds	185 dB	160 dB	201 dB	120 dB	90 dB (unweighted)
Otariid pinnipeds	203 dB	160 dB	219 dB	120 dB	100 dB (unweighted)

[1] Airborne disturbance thresholds not specific to pile driver type.
[2] This is not considered an official threshold, but is used as a guideline.

NMFS equates the onset of PTS, which is a form of auditory injury, with Level A harassment. Level B harassment is considered to have occurred when marine mammals are exposed to impulsive underwater sounds at or above 160 dB root mean square (RMS) re 1µPa from impact pile driving and non-impulsive underwater sounds at or above 120 dB RMS re 1µPa from vibratory pile driving. The onset of TTS is a form of Level B harassment under the MMPA.

NMFS has identified behavioral threshold criteria for airborne noise generated by pile driving for pinnipeds regulated under the MMPA. The Level B harassment threshold for harbor seals is 90 dB RMS re 20µPa (unweighted) and for pinnipeds other than harbor seals (i.e., California sea lions) the threshold is 100 dB RMS re 20µPa (unweighted). There is no Level A threshold criteria for airborne noise generated by pile driving for pinnipeds.

To date, there is no research or data supporting a response by pinnipeds to continuous sounds from vibratory pile driving as low as the 120 dB RMS threshold. The 120 dB RMS threshold level for continuous noise originated from research conducted for California gray whale response to continuous industrial sounds such as drilling operations (Malme et al. 1984; Malme et al. 1986). Southall et al.

(2007) and Southall et al. (2019) reviewed studies conducted to document behavioral responses of harbor seals and northern elephant seals to continuous sounds under various conditions, and concluded that those limited studies suggest that exposures between 90 dB and 140 dB re 1uPa RMS generally do not appear to induce strong behavioral responses. The application of the 120 dB RMS threshold can also sometimes be problematic because this threshold level can be either at or below the ambient noise level of certain locations.

6.2.5 Description of Noise Sources

Two types of pile driving would be employed for this activity using different mechanisms: vibratory and impact. Vibratory pile driving generates continuous, low-frequency noise underwater while impact pile driving creates intermittent short pulses into the water. Vibratory hammers sit on top of a pile and a series of oscillating weights continuously transfer vertical vibrations into the pile at a specific frequency (i.e., 1,000 to 2,400 vibrations per minute). Impact pile driving involves a heavy weight being dropped against the top of a pile approximately once every second, driving the piles into the substrate. Both types of pile driving require use of a combustion engine to operate the pile driver; any noise produced by this engine would not be loud enough to cause potential take to pinnipeds. Sounds from an impact hammer are impulsive, broadband, and dominated by lower frequencies. Sounds produced from a vibratory hammer are similar in frequency to the impact hammer, except the source levels are much lower than the impact hammer and the sound is continuous while operating (University of Rhode Island 2019).

Soft substrates, such as the sand bottom at Wharf 4 or Wharf D, would absorb or attenuate the sound more readily than hard substrates (e.g., rock), which may reflect the acoustic wave. Sound or vibrations generated by both vibratory and impact pile driving may also be transferred via the substrate (University of Rhode Island 2019). Most acoustic energy for both vibratory and impact pile driving would be concentrated below 1,000 Hz (Hildebrand, 2009). Sound signals generated by vibratory pile driving usually consist of a low fundamental frequency, from 20 to 40 Hz, with average, near source, peak SPLs range from 165 to 185 underwater dB (University of Rhode Island 2019). The majority of the energy in pulses from impact pile is at frequencies below 500 Hz. Near source (within 10 m [33 ft] of the pile driving activities) peak SPLs range up to 220 underwater dB (Reyff 2012), depending on the pile size and material.

An exhaustive literature and web-based search generated available data on noise associated with piles likely to be used during these exercises (Table 6-3). Of these sources, CALTRANS (2015), CALTRANS (2020), and NAVFAC SW (2020) provided the most applicable acoustic source data for this Proposed Action. NAVFAC SW (2020) was used for the sheet piles because it provided noise data for the actual site, while CALTRANS (2015) and CALTRANS (2020) provided data for the same or similar pile sizes and installation techniques, but at different locations around the U.S. As documented in the notes section of Table 6-3, vibratory or impact data was not available for 16-inch timber piles. Due to a lack of available data, source levels for impact driving of timber piles at the Ballena Bay in Alameda, California were used as a proxy for source levels of 16-inch timber piles (CALTRANS 2020). The only available data for vibratory timber pile driving were for timber piles of an unknown size used at the Norfolk Naval Station in Norfolk, Virginia (CALTRANS 2020; Illingworth & Rodkin 2015); the measured source level was applied to the 16-inch timber piles for the Proposed Action. Source level data for driving steel H piles is limited. Impact pile driving source levels for 15-inch thick walled H piles at Ballena Isle Marina in Alameda, California were applied herein due to the similar size, use of vertical hammer placement (as opposed to

battering at an angle), and similar water depths. Due to a lack of unattenuated source level data for vibratory pile driving of 14-inch steel H piles, source levels for 10-inch H piles from the San Rafeal Canal project in San Rafeal, California were used (CALTRANS 2020). Source levels for steel sheet piles were measured during previous pile driving at Wharf 4 in NBVC Port Hueneme (NAVFAV SW 2020). All Level B ZOIs were calculated using practical spreading loss (15logR).

Table 6-3. Underwater Sound Pressure Levels for Different Pile Types

Pile Driving Type	***Level B Threshold (dB RMS)***	***Pile Description***	***Unattenuated Single Strike level (dB) [Measured for Impact Pile Driving]***			***Unattenuated Sound Pressure Level (dB RMS) [Measured for Vibratory Pile Driving]***	***Reference***
			Peak	***SEL (single strike)***	***RMS***		
Impact	160	Timber (16-in)[1]	180	160	170	-	CALTRANS (2020) – Table I.2-1d [Ballena Isle Marina]
		Steel H beam (14-in)[2]	195	170	180	-	CALTRANS (2020) – Table I.2-1b [Ballena Isle Marina]
Vibratory (installation and removal)	120	Timber (16-in)	-	-	-	162	CALTRANS (2020) – Table I.2-1d [Norfolk Naval Station]
		Steel sheet (24-in)	-	-	-	159	NAVFAC SW (2020)
		Steel H beam (14-in)[3]	-	-	-	147	CALTRANS (2020) – Table 1.2-b [San Rafael Canal]

Notes: [1]No impact data is available for 16-inch timber piles; therefore, data was used for impact pile driving of 14-inch piles.
[2]No impact data is available for 14-inch steel H beam piles; therefore, data was used for impact pile driving of a 15-inch steel H beam pile.
[3]No vibratory data is available for 14-inch steel H beam piles; therefore, the dB RMS value for vibratory pile driving of 10-inch steel H beam pile was used.

As noted by NMFS (2010), there is limited data on airborne and underwater noise levels associated with vibratory hammer extraction. However, it can reasonably be assumed that vibratory extraction emits SPLs that are no higher than SPLs caused by vibratory hammering of the same materials, and results in lower SPLs than caused by impact hammering comparable piles (National Marine Fisheries Service 2010). Measurements of vibratory timber pile removal at the Port Townsend, Washington Ferry Terminal facility confirm this assumption; received levels at 16 m from the vibratory pile removal averaged 150 dB RMS (Washington State Department of Transportation 2011).

6.2.6 Ambient Noise in Port Hueneme Harbor

No direct data on ambient noise levels within Port Hueneme are available; however, in-water ambient noise levels are considered comparable to similar ports and harbors. McKenna et al. (2013) observed as many as 18 container ships per day transiting through or past Port Hueneme in the Santa Barbara Channel, with sound level per ship varying with vessel speed, but ranging from 175 to 195 decibels referenced to 1 micropascal squared (dB re 1μPa^2) at 1 m with frequencies ranging from 20 to 1,000 Hz. Though this is outside the proposed action area, it illustrates the high vessel volume in the region. Similarly, Kipple and Gabriel (2004) found that ship noise was characterized by a broad frequency range (roughly 0.1 to 35 kHz), with peak noise at higher frequency for smaller vessels. Similar broad-spectrum (10 Hz to >1 kHz) noise has been reported for a variety of categories of ships (National Research Council 2003). Port Hueneme Harbor is co-owned by NBVC, Port Hueneme, and the Oxnard Harbor District, and the commercial port sees $8 billion annually in goods movement, with multiple berths for large cargo ships (Port of Hueneme 2019). Maintenance of the port for accommodation of those large cargo ships includes dredging, which also increases the soundscape underwater.

Ambient noise levels in ports and harbors vary by location, but generally exceed the Level B harassment threshold for continuous noise of 120 dB RMS in heavily trafficked locations. For example, from 2014 to 2015, ambient noise data was collected in the northern portion of the San Diego Bay during ten separate deployments of three days each. During those deployments, ambient noise levels ranged from 126 to 146 dB RMS, with typical ambient levels around 129 to 130 dB RMS (Naval Facilities Engineering Command Southwest (NAVFAC SW) 2020). More recent ambient data collected in the south-central San Diego Bay (an area with less vessel traffic than the north San Diego Bay), showed ambient SPLs ranging from 121 to 131 dB RMS, and an average ambient SPL at 126 dB RMS (Dahl and Dall'Osto 2019). Similar ports with large container ship transits also had ambient levels that were higher than the regulatory 120 dB RMS threshold, with ambient SPLs at different locations in Puget Sound measured at 128 dB RMS (Washington State Department of Transportation 2012) and between 132 and 143 dB RMS (Strategic Environmental Consulting 2005), while in San Francisco Bay ambient SPLs were measured at 133 dB RMS (Laughlin 2006).

While no ambient data is available for the specific proposed project area, it is assumed that, due to both the Navy's and commercial use of Port Hueneme, ambient SPLs will be higher than the 120 dB RMS regulatory threshold for continuous noise. However, all acoustical analyses for continuous noise sources (i.e., vibratory pile driving) will be assessed relative to the 120 dB RMS Level B acoustic threshold.

6.3 Distance to Sound Thresholds

6.3.1 Modeling Potential In-Air Noise Impacts from Pile Driving

Pile driving and removal would generate in-air and underwater noise that potentially could result in disturbance to marine mammals in the proposed action area. In-air noise could result in disturbance to pinnipeds hauled out or at the water's surface. There is no Level A injury for airborne sound for marine mammals. As a result, the Navy considered the potential for pinnipeds to be exposed to airborne SPLs that could result in Level B behavioral harassment. A spherical spreading loss model, assuming average atmospheric conditions, is typically used to estimate the distance to airborne noise thresholds for behavioral disturbance (i.e., 100 dB re 20 μPa rms for otariids and 90 dB re 20 μPa rms for phocids).

The general formula for calculating spherical spreading loss is:

$$TL = 20 \log r$$, where

TL = transmission loss

r = ratio of receiver distance to reference distance (equates to straight line distance from source when reference is at 1 m)

Spherical spreading results in a 6 dB decrease in SPL per doubling of distance.

6.3.2 In-Air Noise from Pile Driving

The intensity of pile driving sounds is greatly influenced by factors such as the type of piles, hammers, and the physical environment in which the activity takes place. No airborne source level data were available for the pile sizes and materials associated with Navy pile driving training activities. Using available data, a maximum sound level for impact driving of 24-inch and 36-inch steel shell piles was conservatively applied. These unweighted source levels were maximum L_{max} of 112 dB re 20 µPa and average L_{max} of 103 dB re 20 µPa at 50 ft (15 m) (Illingworth & Rodkin 2013). Source levels for the smaller piles associated with the Proposed Action would be expected to be lower than those for 24-inch or 36-inch steel shell piles. Applying this value to the airborne transmission loss formula, the ZOI for California sea lions was calculated as 21.2 m and the ZOI for harbor seals was calculated as 67 m. Because areas affected by airborne noise are smaller than the underwater behavioral threshold zones, a separate analysis of Level B take was not conducted for the airborne zones.

6.3.3 Modeling Potential Underwater Noise Impacts from Pile Driving

Pile driving and removal would generate underwater noise that potentially could result in disturbance to marine mammals in the proposed action area. The ZOI is calculated by using a modified version of the passive sonar equation:

$$DT = SL - TL - NL$$, where

DT = detection threshold

SL = source level

TL = transmission loss

NL = noise level

In this case, detection threshold is the threshold for a given criteria (e.g., 160 dB for Level B). Because noise level is not relevant for determining range for criteria, this variable is left as zero. Transmission loss underwater is the decrease in acoustic intensity due to sound spreading and environmental absorption as an acoustic pressure wave propagates out from a source. Transmission loss parameters vary with frequency, temperature, sea conditions, current, source and receiver depth, water depth, water chemistry, and bottom composition and topography.

The general formula for transmission loss is:

$$TL = B \times \log_{10}(\frac{R_1}{R_2}) + C \times (R_1 - R_2)\text{, where}$$

TL = transmission loss

B = logarithmic (predominantly spreading) loss

C = linear (scattering and absorption) loss

R_1 = receiver distance

R_2 = range at which source measurement was made (usually 10 m for pile driving)

Linear loss is strongly dependent on frequency, temperature, and depth, but is conservatively assumed to equal zero for pile driving. Logarithmic loss has a value of 10 for cylindrical spreading and 20 for spherical spreading. A practical spreading value of 15 is often used in shallow water conditions may start of spherically but then end up cylindrical and the sound is constrained by the surface and bottom. As described in Section 6.2.5, a transmission loss of 15 was applied for the Proposed Action.

6.4 Underwater Noise from Pile Driving

Maximum Level A ZOIs were calculated using the RMS SPL source level method identified in the updated 2018 NMFS Technical Guidance (National Marine Fisheries Service 2018) and Optional User Spreadsheet (NMFS 2022); spreadsheets for calculating Level A ZOIs are provided in Appendix A. Level A ZOIs for impact pile driving were calculated using method E.1-1, as it is the preferred method when SEL source levels are available. In all Level A ZOI calculations, the default values for the weighting factor adjustment and propagation loss were used. Table 6-4 provides the calculated Level A and Level B ZOIs associated with the impulsive and continuous sounds that are anticipated during Navy pile driving training activities, based on pile size and materials used. It should be noted that the ZOI for Level A harassment would be closely monitored and subject to shutdowns if a marine mammal approaches or enters the area. The Level B ZOI areas and maximum distances for sound propagation for the activities at Wharf 4 east, Wharf 4 south, and Wharf D are shown in Figure 6-1,

Figure 6-2, and Figure 6-3, respectively. The figures reflect the conventional assumption that the natural or manmade shoreline acts as a barrier to underwater sound, which provides the basis for the anticipated shape of acoustic propagation in the proposed action area. Figures 6-1 through 6-3 represent the maximum distances to Level B behavioral disturbances during impact and vibratory installation. The distance to the 120 dB RMS threshold for vibratory pile driving would be a maximum of 6,310 m (for round timber piles), but due to intersecting land masses, port infrastructure, and the shoreline, the ZOI encompassing the behavior disturbance threshold would be a maximum of 790 m at Wharf 4 South, 795 m at Wharf 4 East, and 655 m at Wharf D (Figures 6-1 through 6-3). Although it is known that there can be leakage or diffraction around such barriers, the assumption herein is that any impervious barriers would contain all pile driving noise associated with the Proposed Action.

The Level B ZOIs and distances were calculated using “practical spreading loss” (15 log[distance/10]) of sound from the source to reach the applicable threshold. Calculated Level A and B ZOIs for pinnipeds are presented in Table 6-4 below. Level A ZOIs are based on cumulative sound exposure, whereas Level B ZOIs are based on practical spreading loss without assessing the cumulative exposure to noise over time. Source levels for impact and vibratory driving of different pile materials is located in Table 6-3.

Table 6-4. Calculated Underwater ZOIs for Pinnipeds due to Pile Driving

Pile Driving Type	*Pile Description*	*Total Number of Piles Driven per Day*	*PTS Onset*		*Level B Onset (m)*[1]
			Otariid Distance to 203 dB SELcum Threshold/ Area of ZOI (m)	*Phocid Distance to 185 SELcum Threshold/ Area of ZOI (m)*	
Impact	Timber (16-in)	3	2.7	36.8	46.4
	Steel H beam (14-inch)	2	12.4	170.6	214.4
Vibratory	Timber (16-in)	3	0.3	4.8	6,310[2]
	Steel sheet (24-in)	3	0.2	3.4	4,379[2]
	Steel H beam (14-inch)	2	0	0.5	631

[1]Level B ZOI is calculated using dB RMS, regardless of whether impact or vibratory pile driving is occurring.
[2]In Port Hueneme, noise is restricted by the landforms. The maximum Monitored ZOIs are approximately 790 m for Wharf 4 South, 795 m for Wharf 4 East, and 655 m for Wharf D.

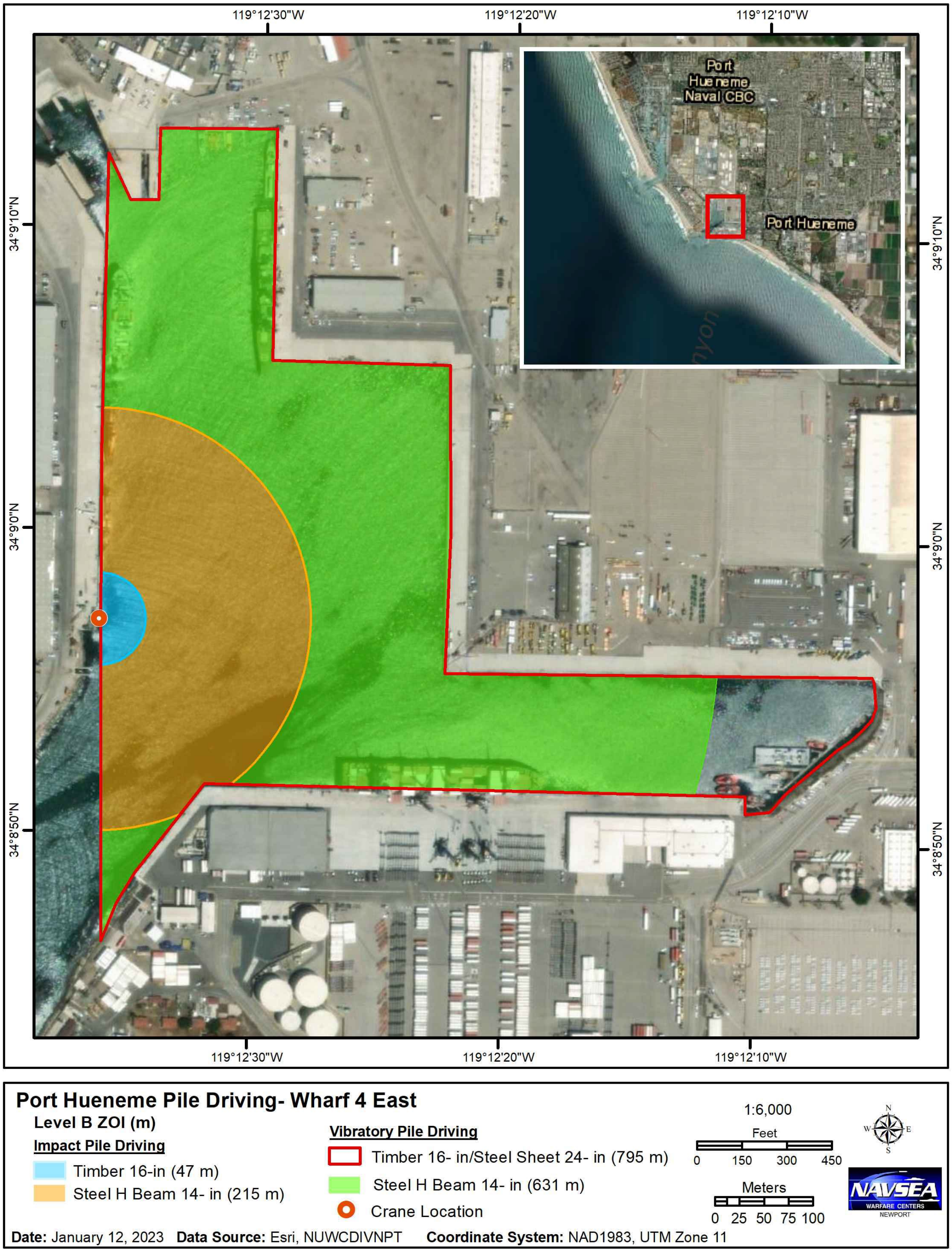

Figure 6-1. Level B Acoustic ZOIs associated with the Proposed Action Area for Pile Driving Exercises (Wharf 4 East)

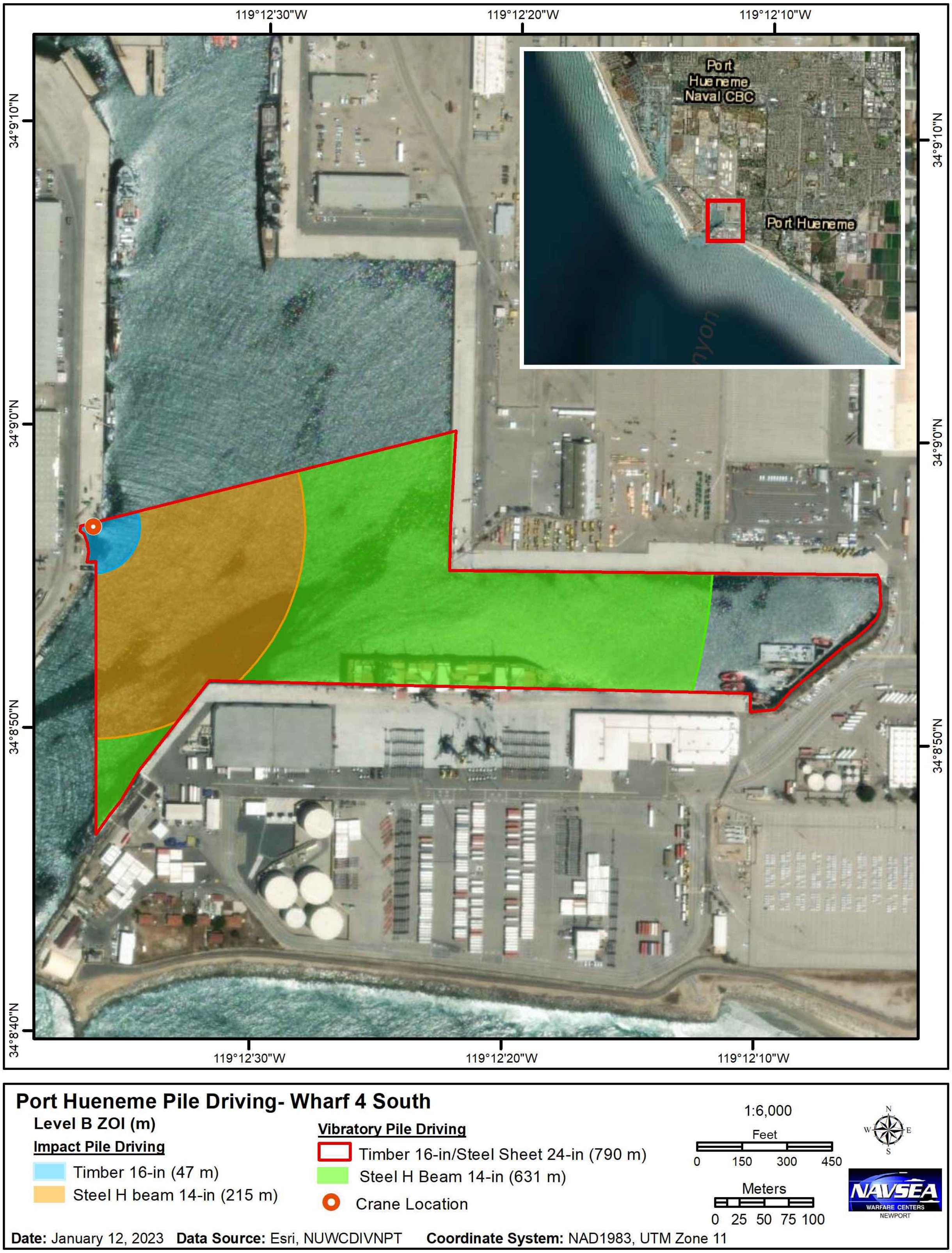

Figure 6-2. Level B Acoustic ZOIs associated with the Proposed Action Area for Pile Driving Exercises (Wharf 4 South)

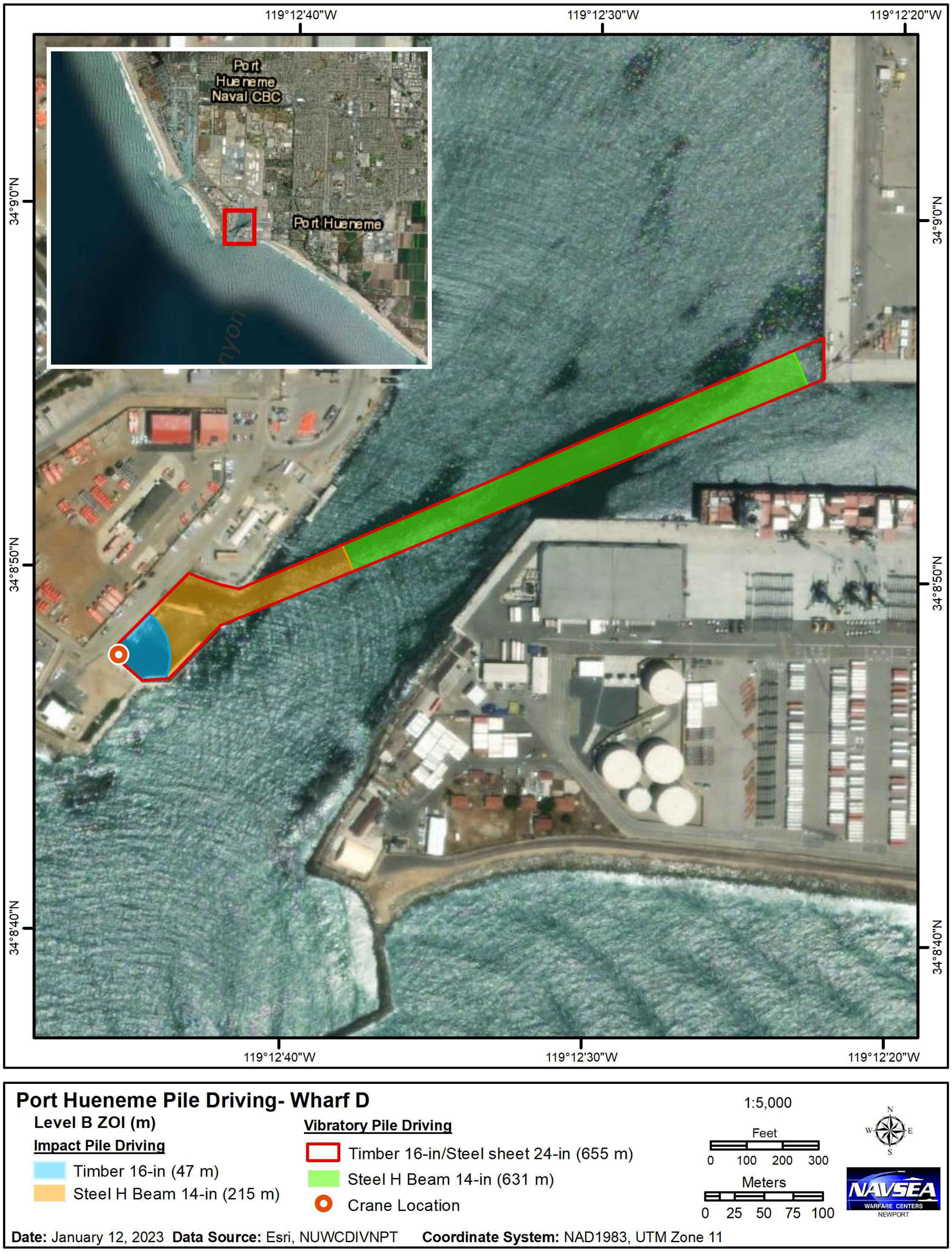

Figure 6-3. Level B Acoustic ZOIs associated with the Proposed Action Area for Pile Driving Exercises (Wharf D)

6.5 Marine Mammals in the Proposed Action Area

California sea lions and harbor seals would both be present in the proposed action area. No density or abundance numbers exist for pinnipeds in Port Hueneme Harbor. NBVC biologists have been conducting surveys of California sea lions hauled out at Wharf D somewhat regularly since 2010. Since the fall of 2020, there have been efforts to count pinnipeds in the water near Wharf 4 as well. These data have not been collected regularly. Due to a paucity of any other presence data, the numbers derived from these data collection efforts are used to calculate acoustic exposure herein.

Pinnipeds swim in and around Port Hueneme Harbor; the majority of those observed has been California sea lions as opposed to harbor seals. Monitoring efforts by NBVC biologists have found that pinnipeds may swim, dive, and mill in the proposed action area at Wharf 4. Recent monitoring efforts have been sporadic, taking place for an hour at a time from a boat launch just south of Wharf 4 (Figure 6-4).

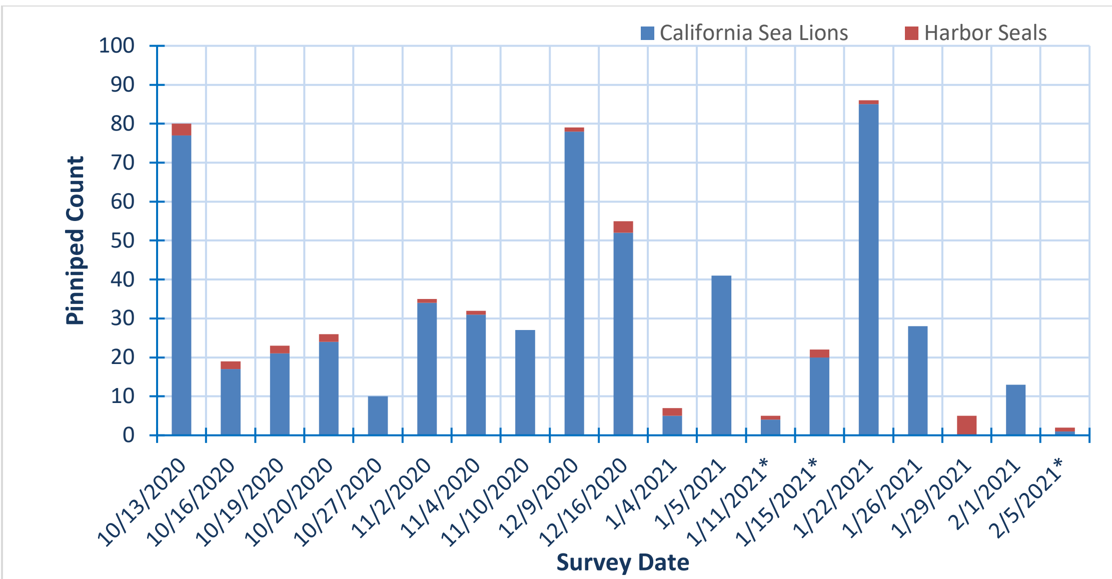

Figure 6-4. Pinniped Presence at Wharf 4 During Surveys in 2020 and 2021

*Harbor maintenance dredging occurring, causing increased turbidity.

As illustrated in Figure 6-4 above, the number of California sea lions present in the proposed action area at Wharf 4 is variable. Ranging from 0 sea lions sighted in an hour (1/29/2021) to 85 sea lions (1/22/2021), there is not a clear number of animals that could be expected at any given time; additionally, the same individuals may have been observed multiple times within the survey period. Therefore, a value of 85 California sea lions is to be assumed to be present per hour in the proposed action area off of Wharf 4.

California sea lions regularly haul out on structures (i.e., docks, barges, and boats) at Wharf D, sometimes in large numbers. They crowd onto these structures; thus, it can be difficult to determine the total number of sea lions present. Some of the counts at Wharf D include pinnipeds present in the water, which could also include harbor seals. California sea lions are the predominant pinniped species at Port Hueneme Harbor, so the assumption is that nearly all animals present would be California sea lions. The number of California sea lions present in the proposed action area at Wharf D is variable by month and by year. Opportunistic counts of California sea lions at Wharf D have been conducted since 2010, and these data are provided in Appendix B. These count data only provide a snapshot of pinniped

presence on the structures at Wharf D. Unfortunately, they cannot provide information on species breakout, animal presence in the water, and the rate of turnover over time of different pinnipeds present in the proposed action area; nor do they provide long-term sea lion presence patterns. The maximum number of California sea lions counted at Wharf D during individual survey day was 342 (1/15/2021). When available, California sea lion counts from 2010 to 2022 are recorded in Appendix B.

6.6 Description of Take Calculation

6.6.1 In-Air Noise Disturbance to Haul-Outs

Disturbance of California sea lions hauled out at Wharf D and surfacing when swimming within the threshold distances is possible. During pile driving and removal, temporary in-air disturbance would be limited to California sea lions hauled out at Wharf D. Although in-air noise levels would likely be below the in-air threshold level (Table 6-2) when sound reaches the docks onto which pinnipeds haul out at Wharf D (25 to 78 m from where pile driving would occur), the area will be monitored for all pinnipeds.

Although many pinnipeds within acoustic ZOIs are likely to be hauled out during in-water activities, it is assumed that they will enter the water at some time during the day and will thereby experience Level B harassment from underwater sound. Some of these animals may also experience airborne sound that exceeds the threshold for Level B harassment, but since an animal is considered to be taken only once per day, and the ZOIs are larger for underwater sound than airborne sound, all animals hauled out are accounted for in the Level B take estimates.

6.6.2 Estimating Potential Exposures to Pile Driving Noise

For the purposes of assessing impacts from underwater sound, the Navy assumes that all pinniped species spend 100 percent of their time in the water. This approach is conservative because pinnipeds spend a portion of their time hauled out and are, therefore, expected to be exposed less than what is estimated by this approach. Additionally, an individual animal can only be taken once per day, and it is assumed that any animal that could be taken by airborne noise would have already been considered taken by in-water noise.

Site-specific abundance estimates are not available at NBVC. Therefore, to quantitatively assess exposure of marine mammals to noise levels from pile driving over the NMFS threshold guidance, estimates were derived from recent monitoring efforts and used to determine the number of animals potentially exposed in a ZOI in any one day of pile driving or extraction. As demonstrated in Section 6.5, limited data exist regarding pinniped presence in the proposed action area, and the data that do exist indicate that the number of animals present over time can be variable. With that, the maximum number of animals sighted at Wharf 4 and Wharf D are used herein as conservative representative numbers for pinniped presence. At Wharf 4, the maximum number of pinnipeds seen over the course of an hour of observation was 85 California sea lions and 5 harbor seals; these maximum sightings occurred on separate days. It is possible that the same individuals could have been sighted multiple times during a single monitoring period at Wharf 4. During semi-regular surveys, California sea lions were the only pinniped species observed as being hauled out at Wharf D, with a maximum of 342 animals hauled out or in the water on a given day. However, because the survey efforts were not performed on a daily basis, harbor seal presence cannot be ruled out. To account for the potential for harbor seals in the proposed action area, 5.88 percent of the maximum number of animals at Wharf D (20.1 [rounded up to

21] animals per day) are assumed to be harbor seals to account for animals in the water; this addition of 21 potential harbor seals is on top of the maximum number of California sea lions that may be present.

The following assumptions were used to determine potential exposures to impact and vibratory pile driving noise for each threshold:

- Each animal can be “taken” by Level B harassment once every 24 hours.
- The pile type, size, and installation method that produce the largest ZOI were used to estimate exposure of marine mammals to noise impacts.
- The peak number of animals sighted is always assumed to be present for the purposes of calculating acoustic exposures.
- Animals exposed during driving of the second, third, or fourth (depending on activity) piles are not the same as those that were exposed earlier in the day. This overestimates take, since an animal cannot be taken more than once in a 24-hour period.
- Thirty minutes of active pile driving was conservatively assumed for each round pile and steel H-pile. Twenty minutes of active pile driving was conservatively assumed for each sheet pile. It is anticipated that active driving time would be lower for each pile type, but considers longer vibratory removal times.
- Any animal present in Port Hueneme Harbor would be exposed to noise reaching threshold of Level B take, regardless of type of pile driving or pile material. Although some pinnipeds may be present in Port Hueneme Harbor outside of a Level B ZOI, the situational details for the individual training activities are developed prior to the individual activity; therefore, distribution of animals in Port Hueneme Harbor is not considered further, and all present animals would be considered for acoustic exposure.

It is unknown what proportion of training exercises would occur at Wharf 4 versus Wharf D, or what activities would require impact or vibratory pile driving, and what material piles would be used. Depending on which location is available for each exercise and time of year, the number of pinnipeds exposed could vary greatly. Estimated take of pinnipeds has been calculated based on maximum number of animals sighted in the proposed action area and the total number of days of pile driving anticipated (Table 6-5). Because presence at Wharf D was typically higher than that at Wharf 4 during surveys, the maximum number of California sea lions (342) and the calculated assumption of maximum number of harbor seals (21) were used to calculate acoustic exposure. Up to 88 days of pile driving and removal are expected to occur, spread over four annual training exercises.

While the numbers generated from the quantitative analysis provide conservative overestimates of marine mammal exposures, the short duration, limited geographic extent of Navy pile driving training activities, and mitigation measures (as detailed in Chapter 11) would further limit actual exposures. The take estimates presented in Table 6-5 would apply to activities occurring at either Wharf 4 or Wharf D, despite the lower anticipated maximum animals present at Wharf 4.

Table 6-5. Estimated Takes for Proposed Navy Pile Driving Training Activities at NBVC for the Duration of the Proposed Action

Common Name	*Level A Harassment*	*Level B Harassment*	*Percentage of Stock Requested to be Taken*
Harbor Seal	0	2,016	6.51
California Sea Lion	0	36,960	14.3

7 Anticipated Impact of the Activity

The anticipated impact of the activity upon the species or stock of marine mammal.

Potential impacts to pinnipeds could result from both impulsive and non-impulsive underwater noise associated with the Proposed Action. Potential non-acoustic effects could result from the physical presence of personnel or assets (e.g., vessels, barges) during activities. However, the proposed action area is highly industrialized, and pinnipeds hauled out nearby are accustomed to high levels of human activity and their routines are not likely to be disturbed by non-acoustic activities associated with the Proposed Action. Visual disturbance caused by the presence of assets associated with the Proposed Action is likely to be minor and brief. Behavioral reactions vary by species and stressor, but none would rise to the level of take under the MMPA.

Additionally, not all effects to marine mammals that could occur from acoustic exposure (i.e., hearing damage, stress) would be expected to occur. Although the Proposed Action would last for up to eight hours per day, pile driving noise would be intermittent. These acoustic sources would not be sufficient to cause any biologically important effects. This IHA application assumes that short-term, non-injurious SELs predicted to cause TTS onset or predicted SPLs predicted to cause temporary behavioral disruptions (non-TTS) qualify as Level B harassment. This approach overestimates disturbances qualifying as harassment under MMPA because there is no established scientific correlation between short-term acoustic impacts use and long-term abandonment or significant alteration of behavioral patterns in marine mammals.

The Navy does not anticipate any Level A takes of pinnipeds from the Proposed Action. As discussed in Chapter 11, all pile driving activity would be shut down if an animal is viewed in or near the Level A ZOI. Port Hueneme Harbor is contained with only one point of entry for marine mammals, which would help limit the potential for marine mammals to enter the area undetected by lookouts. Level A ZOIs for harbor seals are greater than those for California sea lions (Table 6-4); harbor seals are significantly less likely to be present in the Study Area than California sea lions, which means that the Level A ZOI for the majority of the animals that may be present would be reduced. All animals in the area, including those hauled out, are conservatively considered taken; since pinnipeds spend significant amounts of time out of the water, they are unlikely to be exposed to underwater sounds to the extent assumed for this analysis (100 percent of time underwater).

Based on the current state of science, it is not currently possible to distinguish between significant and insignificant behavioral reactions qualitatively. However, it is assumed for the purposes of this analysis that more intense and longer duration activities would lead to a higher probability of animals having significant behavioral reactions. Within the Navy's quantitative analysis, many behavioral reactions are estimated to occur from exposure to a sound source that may exceed an animal's behavioral threshold. It is likely that many of the estimated behavioral reactions within the Navy's quantitative analysis would not constitute significant behavioral reactions; however, the numbers of significant versus non-significant behavioral reactions are currently impossible to predict.

Consideration of negligible impact is required for NMFS to authorize incidental take of marine mammals. By definition, an activity has a "negligible impact" on a species or stock when it is determined that the total taking is not likely to reduce annual rates of adult survival or recruitment (i.e., offspring survival, birth rates).

Behavioral reactions of marine mammals to sound are known to occur but can be difficult to predict. Recent behavioral studies indicate that reactions to sounds, if any, are highly contextual and vary between species and individuals within a species (Moretti et al. 2010; Southall et al. 2011; Thompson et al. 2010; Tyack 2009; Tyack et al. 2011). Depending on the context, marine mammals often change their activity when exposed to disruptive levels of sound. When sound becomes potentially disruptive, feeding or socializing animals often interrupt these events by diving or swimming away. If the disturbance occurs at or near a haulout site, pinnipeds may “flush” and enter the water temporarily before returning to haul out or, depending on the severity and duration of the disturbance, abandon the haulout. When attempting to understand behavioral disruption by anthropogenic sound, a key question to ask is whether the exposures have biologically significant consequences for the individual or population (National Research Council of the National Academies 2005).

If a marine mammal does react to sound by changing its behavior or moving a small distance, the impacts of the change may not be detrimental to the individual. For example, researchers have found, during a study focusing on the response of dolphins to whale watching vessels in New Zealand, that when animals can adapt to vessel presence and move elsewhere, there’s little effect on survival (Lusseau and Bejder 2007). On the other hand, if a sound source displaces marine mammals from an important feeding, breeding, or resting area for a prolonged period and they do not have an alternate area with similar quality of habitat or prey resources available, there could be impacts on that individual’s fitness. Biological parameters or key elements having the greatest importance to a marine mammal include an individual’s ability to mature, reproduce, and survive. These key elements could be impacted by sound exposure as follows:

- Growth: adverse effects on a marine mammal’s ability to feed;
- Reproduction: the range at which reproductive displays can be heard and the quality of mating/calving grounds; and
- Survival: sound exposure may directly affect survival.

The importance of the disruption and degree of consequence for individual marine mammals often has much to do with the frequency, intensity, and duration of the disturbance. Isolated acoustic disturbances usually have minimal consequences or no lasting effects for marine mammals. Marine mammals may respond (e.g., expend energy for that response) to naturally occurring aspects of their environment such as predators, adverse weather, and other natural phenomena in a similar manner that they would to brief anthropogenic disturbances. It is also reasonable to assume that they can tolerate occasional or brief disturbances by anthropogenic sound without significant consequences, particularly since the proposed action area is heavily industrialized.

7.1 The Context of Level B Harassment - Biological Significance to Populations

Consequences to populations due to exposure of sound are difficult to predict, and empirical measurement of population effects from anthropogenic stressors is limited (National Research Council of the National Academies 2005). To predict indirect, long-term, and cumulative effects, the processes must be well understood and the underlying data available for models.

Based on each species’ life history information, expected behavioral patterns in the proposed action area, all estimated exposures resulting in temporary Level B disturbance (Table 6-5), and the application of mitigation procedures proposed in Chapter 11, the Proposed Action is anticipated to have a negligible impact on marine mammal stocks within the proposed action area. While, in general, the louder the

sound source the more intense the behavioral response, the proximity of a sound source and the animal's experience, motivation, and conditioning are critical factors influencing response (Southall et al. 2007; Southall et al. 2019; Southall et al. 2016).

7.2 Effects of Non-Impulsive Acoustic Sources on Pinnipeds

The primary non-impulsive acoustic source associated with the proposed action is vibratory pile driving. Sound signals generated by vibratory pile driving usually consist of a low fundamental frequency, from 20 to 40 Hz (University of Rhode Island 2019). For non-impulsive sounds, data suggest that exposures of pinnipeds to sources above 140 dB re 1 µPa can elicit behavioral responses (Southall et al. 2007; Southall et al. 2019). Reactions of harbor seals were the only available data for which the responses could be ranked on the severity scale in order to predict exposure levels above which adverse effects may be expected. For reactions that were recorded, the majority (17 of 18 individuals/groups) were ranked on the severity scale as a 4 (moderate change in movement, brief shift in group distribution, or moderate change in vocal behavior) or lower; the remaining response was ranked as a 6 (minor or moderate avoidance of the sound source). Captive harbor seals responded differently to three signals at 25 kHz with different waveform characteristics and duty cycles. The seals responded to the frequency modulated signal at received levels over 137 dB re 1µPa by hauling out more, swimming faster, and raising their heads or jumping out of the water, but did not respond to the continuous wave or combination signals at any received level up to 156 dB re 1µPa (Kastelein et al. 2015).

Additional data on hooded seals (*Cystophora cristata*) indicate avoidance responses to signals above 160 to 170 dB re 1 µPa (Kvadsheim et al. 2010), and data on grey (*Halichoerus grypus*) and harbor seals indicate avoidance response at received levels of 135 to 144 dB re 1 µPa (Götz et al. 2010). In each instance where food was available, which provided the seals motivation to remain near the sound source, habituation to the signals occurred rapidly. In the same study, it was noted that habituation was not apparent in wild seals where no food source was available (Götz et al. 2010). This implies that the motivation of the animal is necessary to consider in determining the potential for a reaction. Seals exposed to non-impulsive sources with a received SPL within the range of estimated exposures (164 to 185 dB re 1µPa) have been shown to change their behavior by modifying diving activity and avoidance of the sound source (Götz et al. 2010; Kvadsheim et al. 2010).

Pinnipeds likely use both sound and vibrations to find and capture prey underwater; therefore, it could be more difficult for pinnipeds with TTS to locate food for a short period before their hearing recovers. A single, or even a few, minor TTS (less than 20 dB of TTS) to an individual marine mammal per year are unlikely to have any long-term consequences for that individual. Sources at levels below 165 dB re 1µPa at 1 m have been studied and noted to not cause a response in Steller sea lions (*Eumetopias jubatus*), but a 165 dB re 1µPa source cause the sea lions to haul out (Akamatsu et al. 1996).Pinnipeds exposed to non-impulsive sources with a received SPL within the range of estimated non-impulsive exposures, 165 to 185 dB re 1 µPa, have been shown to change their behavior by modifying diving activity and by avoidance of the sound source.

Ambient noise levels in ports and harbors vary by location, but similar sized ports with similar levels of traffic general range between about 120 to 145 dB RMS, which exceeds the continuous noise 120 dB RMS threshold for marine mammals (Dahl and Dall'Osto 2019; Naval Facilities Engineering Command Southwest (NAVFAC SW) 2020; Strategic Environmental Consulting 2005; Washington State Department of Transportation 2012)

Based on the information provided above, although a minor change to a behavior may occur as a result of exposure to non-impulsive acoustic sources resulting from the Proposed Action, any effects would be minor and short-term.

7.3 Impulsive Noise

The majority of the energy in pulses from impact pile driving is at frequencies below 500 Hz. Near source (within 10 m [33 ft] of the pile driving activities) peak SPLs range up to 220 underwater dB rms depending on the pile size (Reyff 2012). For the materials being used in the Proposed Action, source sound levels are more likely to be between 140 to 180 dB SEL (CALTRANS 2015). Kastak and Schusterman (1996) examined pinniped hearing after inadvertent exposure to broadband construction noise for six days, at from six to seven hours per day, after which a harbor seal showed TTS. However, recent work has shown that impacts of anthropogenic noise on seal hearing are minimal. When exposed to six hours of simulated impulsive pile driving noises at 151 dB re 1 μpa^2s (SEL), harbor seals exhibited TTS lasting no more than one hour. However, exposure at shorter durations, including a three hour exposure, did not result in any detectible hearing loss (Kastelein et al. 2018). Sills et al. (2020) found no evidence of TTS in seals following single shots of an airgun for seismic surveys at 185 dB re 1 μPa^2s (SEL) and 207 dB re 1 µPa peak-to-peak sound pressure. However transient shifts in hearing thresholds at 400 Hz were apparent following repeated consecutive pulses (cumulative SEL 191 to 195 dB re 1 μPa^2s) (Sills et al. 2020).

Based on the sporadic nature of impact pile driving during the Proposed Action, although TTS is theoretically possible, the intermittent nature of the activities and monitoring of shutdown zones for animals makes this outcome unlikely. If TTS were to occur, data suggests that the impact would be temporary. Therefore, while behavioral responses resulting from impulsive acoustic sources are possible, these changes would likely be within the normal range of behaviors for the animal, and no permanent harm or population level effects would be expected.

7.4 Summary

The conclusions and predicted exposures in this analysis find that overall impacts on marine mammal species and stocks would be negligible for the following reasons:

- All of the estimated acoustic harassments for the Proposed Action are within the non-injurious TTS or behavioral effects zones (Level B harassment).
- Ambient noise levels in the proposed action area are highly elevated due to vessel traffic and other industrial activity, and thus, marine mammals regularly using the area are likely habituated to elevated noise levels.
- Pinnipeds hauled out on nearby rocks, riprap and other anthropogenic structures would not be exposed to injurious levels of sound, and pinnipeds in the water would require extended continuous exposure to exhibit TTS, which would be unlikely given the intermittent nature of the Proposed Action.
- Mitigation measures (described in Chapter 11) are designed to reduce sound exposure on marine mammals to achieve the least practicable adverse effect on marine mammal species or stocks.

Because noise from vibratory pile driving activities would occur in a site with soft substrate (which attenuates sound), is short-term and intermittent, occurs within a nearshore environment with high

levels of ambient noise, and with pinniped mitigation measures in place, it is unlikely that a marine mammal would be exposed to noise that would result in more than a behavioral response.

The Navy concludes that Navy pile driving training activities at NBVC would result in Level B harassment, as summarized in Table 6-5. Based on best available science, the Navy concludes that exposures to marine mammal species and stocks due to the Proposed Action would result in only short term effects to most individuals exposed and would likely not affect annual rates of recruitment or survival.

8 Anticipated Impacts on Subsistence Uses

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

Potential impacts resulting from the Proposed Action would be limited to individuals of marine mammal species and stocks located in marine waters at NBVC that are not target species for subsistence, and would not take place in or near a traditional subsistence hunting area. Therefore, no impacts on the availability of species or stocks for subsistence use are considered further.

9 Anticipated Impacts on Habitat

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

Potential impacts to marine mammal habitat due to Navy pile driving training activities are anticipated to be insignificant. Marine mammal habitat and prey species may be temporarily impacted by the Proposed Action. The potential for physical or acoustic stressors to impact marine mammal habitat or prey species is discussed below.

Harbor seals and California sea lions are expected to remain concentrated in Port Hueneme Harbor and to haul out on any docks that are available. There are no known foraging hotspots, or other ocean bottom structures of significant biological importance to marine mammals present in the marine waters in Port Hueneme Harbor. Therefore, the main impact issue associated with the Proposed Action is the temporarily elevated noise levels, and associated direct effects on marine mammals, as discussed in Chapters 6 and 7. Physical effects of pile driving to the water column are also discussed.

9.1 Expected Effects on Physical Habitat

The effects of the introduction of sound into the environment are generally considered to have a lesser impact on marine mammal habitat than the physical alteration of the habitat. Physical alteration of the water column or bottom topography, as a result of acoustic exposure would be of limited duration and intermittent spatial and temporal scale. Considering that all piles would be removed after the training exercise is completed, long term or permanent impacts would be unlikely. Pile driving would likely result in localized turbidity increases, which would not be expected to decrease water quality due to the existing high use of Port Hueneme Harbor by the Navy and Oxnard Harbor District. Port Hueneme Harbor moves over $8 billion annually, and is the only commercial deepwater port between Los Angeles and San Francisco (Port of Hueneme 2019). Additionally, the U.S. Army Corps of Engineers completed a port deepening project in 2021, dredging the commercial harbor to reach a depth of 40 ft for berthings (Port of Hueneme 2021). Given the highly industrial nature of the proposed action area, and likely existing elevated turbidity due to run-off, hardened shorelines, and vessel traffic, the incremental increase in turbidity resulting from the Proposed Action would not have a measurable impact on physical habitat. No permanent structures would be installed in the proposed action area. No permanent impacts to habitat are proposed for, or would occur as a result of, this Proposed Action. Therefore, Navy training activities are not likely to have more than a localized and short-term effect on marine mammal habitat in the proposed action area.

9.2 Effects on Marine Mammal Prey

9.2.1 Invertebrates

Marine invertebrates in the proposed action area encompass a diverse range of species, including mollusks, crabs, shrimp, snails, sponges, sea fans, isopods, and a diverse assemblage of polychaete worms (Chess and Hobson 1997; Dugan et al. 2000; Proctor et al. 1980; Talley et al. 2000; Thompson et al. 1993). Marine invertebrates are important food sources that support the base of the regional food chain (Linacre 2004; Perry 2003) and provide food for both harbor seals, which feed on crustaceans and shellfish, as well as California sea lions, which feed on squid. The benthic habitat within the proposed

action area is predominantly soft bottomed, and heavily impacted by anthropogenic use (e.g., by maintenance dredging).

Very little is known about sound detection by aquatic invertebrates (Hawkins and Popper 2017; Lovell et al. 2005; Popper 2008). While data are limited, studies do suggest that most major invertebrates do not hear well, and crustaceans and cephalopods likely hear only low frequency sounds (Hanlon 1987; Hill 2009; Mooney et al. 2010; Offutt 1970; Roberts and Breithaupt 2016). Acoustic signals produced by crustaceans range from low-frequency rumbles (20 to 60 Hz) to high-frequency signals 20 to 55 kHz (Edmonds et al. 2016; Henninger and Watson 2005; Patek and Caldwell 2006; Roberts and Breithaupt 2016; Staaterman 2016).

In general, organisms may detect sound by sensing either the particle motion or pressure component of sound, or both. However, because any acoustic sensory capabilities of invertebrates (if present at all) are limited to detecting water motion, and water particle motion near a sound source falls off rapidly with distance, aquatic invertebrates are likely limited to detecting nearby low-frequency sound sources rather than sound caused by pressure waves from distant sources unknown (Hawkins and Popper 2017; Lovell et al. 2005; Popper 2008). Recent research suggests that both behavioral and physiological impacts may be possible when crustaceans are exposed to repeated high levels of low frequency, high amplitude anthropogenic noise (Celi et al. 2015; Edmonds et al. 2016; Filiciotto et al. 2014; Roberts and Breithaupt 2016). With respect specifically to pile driving, the substrate borne vibrations can elicit alarm responses in mobile benthic epifauna such as crabs, while particle motion in the water column elicits a similar response in squid. While benthic invertebrates of many types would be expected in the proposed action area, squid would not be common (Jones et al. 2020; Roberts et al. 2016).

It is expected that most marine invertebrates would be sensitive to the low frequency, high amplitude sources, particularly impact pile driving, associated with the Proposed Action, as alarm response to simulated pile driving has been observed in mollusks, crustaceans, and cephalopods (Jones et al. 2020; Roberts et al. 2016). Any marine invertebrate capable of sensing sound may alter its behavior if exposed to sufficiently high levels of sound. Although individuals may be briefly exposed to pile driving noise associated with the Proposed Action, intermittent exposures to pile driving noise are not expected to impact survival, growth, recruitment, or reproduction of widespread marine invertebrate populations, particularly given that invertebrate populations living within this highly industrialized environment are likely acclimated to fairly high levels of background noise. Therefore, impacts to invertebrates are expected to be minor and temporary.

9.2.2 Fishes

The nearshore areas of Port Hueneme are highly industrialized, and thus, represent relatively low quality fish habitat. Nevertheless, this area is inhabited by a range of pelagic and demersal fish species, many of which represent important forage species (Allen et al. 2006; Cross and Allen 1993; Mueter 2004). Small coastal pelagic fishes, such as the pacific sardine and northern anchovy, are important forage species for marine mammals, as are larger piscivorous species including mackerel, kelp bass (*Paralabrax clathratus*), and rockfish, which are also preyed upon by marine mammals (Koslow et al. 2015; Miller and Lea 1972; Roedel 1953).

All fishes have two sensory systems that can detect sound in the water: the inner ear, which functions similarly to the inner ear in other vertebrates, and the lateral line, which consists of a series of receptors along the body of a fish (Popper and Hawkins 2018; Popper and Schilt 2008). The lateral line detects particle motion at low frequencies from below 1 Hz up to at least 400 Hz (Coombs and Montgomery

1999; Hastings and Popper 2005; Higgs and Radford 2013; Webb et al. 2008). The inner ear of fish generally detects relatively higher frequency sounds.

All known fish species would be able to detect low-frequency noise associated with the Proposed Action. Although hearing capability data only exist for fewer than 100 fish species, current data suggest that most fish detect sounds from 50 to 1,000 Hz (Hawkins and Popper 2017; Popper 2008; Popper et al. 2003; Popper et al. 2014). It is believed that most fish have their best hearing sensitivity from 100 to 400 Hz (Hawkins and Popper 2017; Popper 2003a). PTS has not been documented in fish. The sensory hair cells of the inner ear in fish can regenerate after they are damaged, unlike in mammals where sensory hair cells loss is permanent (Lombarte et al. 1993; Smith et al. 2006). As a consequence, any hearing loss in fish may be as temporary as the timeframe required to repair or replace the sensory cells that were damaged or destroyed (Smith et al. 2006).

Since the proposed action area is a relatively enclosed environment, sound would not propagate outside of Port Hueneme Harbor. Furthermore, only a limited number of fish may be exposed to loud sound, while most would be far enough from the sources for the sound level to have attenuated considerably. During a period of disrupted hearing, fish would potentially be less sensitive to sounds produced by predators or prey, or to other acoustic information about their environment. Fish use sounds to detect both predators and prey, as well as for schooling, mating, and navigating (Hawkins and Popper 2017; Popper et al. 2003). Masking can impede the flight response of fish from predators or may not allow fish to detect potential prey in the area. Long-term consequences to fish species are not expected, as any masking would be localized and short term.

Behavioral responses to loud noise could include a startle response, such as the fish swimming away from the source, the fish “freezing” and staying in place, or scattering (Popper 2003b). It is not anticipated that temporary behavioral reactions (e.g., temporary cessation of feeding or avoidance response) would affect the individual fitness of a fish, or a population as individuals are expected to resume normal behavior following the sound exposure.

Limited mortality has been shown to occur when fish are subject to an intense sound source, but only when fish are very close to the source (Hawkins and Popper 2017; Popper 2008; Popper and Hawkins 2018). Those species of fish tested at a distance from the source show no mortality and probably no long-term effects. Since the footprint of high intensity from the sources used in the Proposed Action is minimal, the majority of fish that may be exposed to any sound would be far enough from the sources for the sound level to have attenuated considerably.

Overall effects to fish from acoustic transmissions associated with the Proposed Action would be localized, temporary, and infrequent and would not have any long term or population-level impacts to fish.

9.3 Summary

Based on the discussion above, there would be no effects to marine mammals resulting from loss or modification of marine mammal habitat or prey species related to the Proposed Action.

10 Anticipated Effects of Habitat Impacts on Marine Mammals

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

The Proposed Action for Navy pile driving training activities would not be expected to have any habitat-related effects that could cause significant or long-term consequences for individual marine mammals, their populations, or prey species, because pile driving activities would be limited in duration. Based on the discussions in Chapter 9, the Proposed Action is expected to have no impact on the ability of marine mammals to disperse in their foraging areas. There would be no permanent habitat loss as a result of the Proposed Action. Additionally, there would be no long-term or population-level impacts to any marine mammal prey resulting from the Proposed Action. As a result, no indirect impacts to marine mammal populations would be expected due to pile driving noise.

11 Mitigation Measures

> 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 their availability for subsistence uses, paying particular attention to rookeries, mating grounds, and areas of similar significance.

The exposures outlined in Chapter 6 represent the maximum expected number of marine mammals that could be exposed to pile driving noise reaching Level B harassment levels. The Navy proposed to employ a number of mitigation measures, discussed below, in an effort to minimize the number of marine mammals potentially affected. Each exercise will have different goals and objectives to qualify the Seabee personnel for specific tasks. As a result, while the types of piles anticipated to be used during the exercise (sheet, steel H beam, and timber) and the three main locations for the exercise (Wharf 4 South, Wharf 4 East, and Wharf D) are known, the exact pile size/type and exercise location that will be used for each exercise is not. Therefore, prior to each exercise, a comprehensive monitoring plan will be developed based on the piles likely to be used during that particular training activity and the training location. This monitoring plan will include lookout locations, specific monitoring and shutdown zones, and any relevant information that pertains to the monitoring requirements per the final IHA. An example monitoring plan from a previous training exercise has been included in Appendix C to demonstrate details that would be provided and accounted for. However, the protocols identified below will be implemented for all exercises. The following minimization measures will be implemented (per Protective Measures Assessment Protocol) to minimize takes of marine mammals:

- General Monitoring Protocols:
  - During non-pile installation/removal activities (i.e., pile placement, boat use), a 10 m (33 ft) shutdown zone will be implemented to reduce the likelihood of a physical interaction with any exercise-related in-water assets. If human safety is at risk, the in-water activity will be allowed to continue until it is safe to stop.
  - Pile driving will be restricted to daylight hours, conducted at least 30 minutes after sunrise and up to 30 minutes before sunset. Monitoring data will collected via hard copy datasheets.
  - Monitoring will be conducted by trained lookouts, and requirements for numbers of lookouts would be based on hammer type, pile material, and training location. All lookouts would be trained in marine mammal identification and behaviors; lookouts would complete the Marine Species Awareness Training, which is consistent with other Navy military readiness activities. Trained lookouts will be placed at the best vantage point(s) practicable to monitor for marine mammals. During all pile driving exercises, one lookout will be placed in a position to implement shutdown/delay procedures, when applicable, by notifying the hammer operator of a need for a shutdown of pile driving or removal.
  - Marine mammals observed anywhere within visual range of the lookout will be tracked relative to exercise-related activities, and shutdowns/delays will be initiated, if an animal is observed approaching or within the Level A shutdown zone.
  - Monitoring will occur in all weather and until the pile driving crew has finished for the day. During all observation periods, the lookouts will use binoculars and/or the naked eye to search continuously for marine mammals. Pile driving would only occur during daylight hours.

  - For all impact pile driving only, soft start procedures will be implemented at the start of each day or anytime following a cessation of impact pile driving greater than 30 minutes. These procedures include:
    - Three, three blow sets at reduced energy settings;
    - Each three blow set will be separated by at least 30 seconds;
    - If impact pile driving has stopped for greater than 30 minutes, then the soft start procedure will be repeated.
- The shutdown zone will equate to the Level A Harassment ZOIs:
  - The Level A harassment ZOIs shall include all areas where the underwater SPLs are anticipated to equal or exceed the Level A harassment criteria for marine mammals. The shutdown zone for all vibratory pile driving and removal is 15 m (50 ft). Impact pile driving and removal of timber piles would have a shutdown zone of 40 m (131 ft). The shutdown zone for all impact driving of steel H-beam piles would be 175 m (574 ft).
  - The Navy will allow a sighted marine mammal to leave the shutdown zone prior to the initial start of the activity (by delaying the start) or during the activity (by not recommencing pile driving or pile extraction) until one of the following conditions has been met: (1) the animal is observed exiting the shutdown zone; (2) the animal is thought to have exited the shutdown zone based on a determination of its course, speed, and movement relative to the pile driving location; or (3) the shutdown zone has been clear from any additional sightings for 15 min.
- Level B harassment ZOIs:
  - The Level B ZOIs will be visually monitored to the greatest extent practicable.
- Pre-Installation/Removal Monitoring:
  - Prior to the start of pile driving or removal, the shutdown zones will be monitored for a minimum of 30 minutes to ensure that they are clear of marine mammals. The activity will only commence once lookouts have declared the shutdown zone(s) clear of marine mammals.
  - If a marine mammal is observed inside of the shutdown zone(s) prior to starting pile installation/removal, then the project will be delayed until the animal(s) has left the shutdown zone, or 15 minutes has elapsed without a re-sighting.
  - If a marine mammal is observed inside of the Level B ZOI, but outside of the shutdown zone, then pile driving will be allowed to start.
- During Installation/Removal Monitoring:
  - If an animal is observed inside of the Level B Zone while pile installation/removal is occurring, pile installation/removal will be allowed to continue as long as the animal does not enter the shutdown zone(s).
  - If a marine mammal approaches or enters the shutdown zone(s) during the course of pile installation/removal, the activity 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.
  - Shutdown shall occur if a species, for which authorization has not been granted, approaches or is observed within Port Hueneme Harbor. The Lead lookout shall notify the Navy point of contact, who will then contact NOAA Fisheries immediately. For non-IHA species, pile

installation/removal will be allowed to proceed if the animal(s) is observed to leave the Port Hueneme Harbor, or if one hour has lapsed since the last observation.

- Post-Installation/Removal Monitoring:
    - Monitoring will continue for 30 minutes following completion of pile installation/removal. These surveys will record all marine mammal observations following the same procedures as identified for the pre-construction monitoring time-period, except that no delays will occur. All marine mammals will be documented, regardless of their location relative to the Level A/B ZOIs.

12 Arctic 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.

The Proposed Action would not take place in or near a traditional Arctic subsistence hunting area, and therefore the Navy is not required to complete a plan of cooperation.

13 Monitoring and Reporting

> 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 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 would 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 Monitoring Plan

The U.S. Navy has coordinated with NMFS to develop an overarching program plan in which specific monitoring would occur. This plan is called the Integrated Comprehensive Monitoring Program (ICMP) (U.S. Department of the Navy 2011). The ICMP has been developed in direct response to Navy permitting requirements established in various MMPA Final Rules, ESA consultations, Biological Opinions, and applicable regulations. As a framework document, the ICMP applies by regulation to those activities on ranges and operating areas for which the Navy is seeking or has sought incidental take authorizations. The ICMP is intended to coordinate monitoring efforts across all regions and to allocate the most appropriate level and type of effort based on set of standardized research goals, and in acknowledgement of regional scientific value and resource availability.

The ICMP is focused on Navy training and testing ranges where the majority of Navy activities occur regularly as those areas have the greatest potential for being impacted. Navy pile driving training activities, in comparison, are short duration exercises that would occur at NBVC sporadically for two weeks at a time. As such, there is no specific ICMP monitoring project associated with Navy pile driving training activities. General monitoring procedures, as described in Chapter 11, will be in place for all activities described in this application. Exercise-specific monitoring procedures (e.g., locations of lookouts, ZOIs) will be developed prior to the start of the exercise, and will be presented in a similar manner to the example monitoring plan for Wharf 4 provided in Appendix C. Depending on pile material and type of driving (impact or vibratory), lookouts will be located in a manner that the entire ZOI can be easily observed and shutdowns called for immediately after marine mammal sighting.

13.2 Reporting

Annual reporting would consist of the following: pile size and material, hammer type, start/stop times for each pile, pre- and post- construction survey times, and any information regarding shutdowns.

14 Suggested Means of Coordination

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

At this time the Navy does not anticipate any specific research conducted in conjunction with the Proposed Action.

The Navy strives to be a world leader in marine species research and has provided more than $100 million over the past five 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.

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 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 Navy supports research efforts on acoustic monitoring and will continue to investigate the feasibility of passive acoustics as a potential monitoring tool. 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 future research as previously described.

15 List Of Preparers

Name	Role	Education and Experience
Naval Undersea Warfare Center, Division Newport		
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Emily Robinson	Project Lead, Document Development, Document Review	Masters of Environmental Science and Management, B.S. Integrated Science and Technology. Environmental Planning Experience: 6 years
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16 References

Akamatsu, T., Nakamura, K., Nitto, H., & Watabe, M. (1996). Effects of underwater sounds on escape behavior of Steller sea lions. *Fisheries science, 62*(4), 503-510.

Allen, L. G., Pondella, D. J., & Horn, M. H. (2006). *The Ecology of Marine Fishes: California and Adjacent Waters*. Berkeley, CA: University of California Press.

Ampela, K., Balla-Holden, A., Bacon, C., Fertl, D., & Latusek-Nabholz, J. (2014). *Effects of Pile Driving on Marine Mammal Behavior in Puget Sound, Washington, USA.(Poster)*. Paper presented at the ESOMM - 2014 5th International Meeting on the Effects of Sound in the Ocean on Marine Mammals, Amsterdam, Netherlands.

Au, W. W. L. (1993). *The sonar of dolphins*. New York, NY: Springer_Verlag.

Baird, R. W. (2001). Status of harbour seals, *Phoca vitulina*, in Canada. *Canadian Field Naturalist, 115*(4), 663-675.

Bigg, M. A. (1969). The harbor seal in British Columbia. *Fisheries Research Board of Canada, 172*, 1-33.

Bigg, M. A. (1981). *Harbour seal Phoca vitulina (Linnaeus, 1758) and Phoca largha (Pallas, 1811)* (Vol. Vol. 2: Seals). New York: Academic Press.

Boveng, P. L., London, J. M., Ver Hoef, J. M., & Region, A. O. C. S. (2012). Distribution and Abundance of Harbor Seals in Cook Inlet, Alaska. Task III: Movements, Marine Habitat Use, Diving Behavior, and Population Structure, 2004-2006.

Burns, J. J. (2002). Harbor Seal and Spotted Seal. In *Encyclopedia of Marine Mammals* (pp. 552-560). San Diego, CA: Academic Press.

CALTRANS. (2015). *Technical Guidance for Assessment and Mitigation of the Hydroaucoustic Effects of Pile Driving on Fish*. California Department of Transportation (CALTRANS).

CALTRANS. (2020). *Technical Guidance for the Assessment of Hydroacoustic Effects of Pile Driving on Fish*. Sacramento, CA: California Department of Transportation. p. 532.

Carretta, J. V., Oleson, E. M., Forney, K. A., Muto, M. M., Weller, D. W., Lang, A. R., Baker, J., Hanson, B., Orr, A. J., Barlow, J., Moore, J. E., & Brownell, R. L., Jr. (2022). U.S. Pacific marine mammal stock assessments: 2021. [Technical Memorandum]. doi: https://doi.org/10.25923/246k-7589.

Celi, M., Filiciotto, F., Vazzana, M., Arizza, V., Maccarrone, V., Ceraulo, M., Mazzola, S., & Buscaino, G. (2015). Shipping noise affecting immune responses of European spiny lobster (Palinurus elephas). *Canadian Journal of Zoology, 93*(2), 113-121.

Chess, J. R., & Hobson, E. S. (1997). *Benthic Invertebrates of Four Southern California Marine Habitats Prior to Onset of Ocean Warming in 1976, with Lists of Fish Predators.* . Tiburon, California: National Oceanic and Atmospheric Association. p. 110.

Committee on Taxonomy. (2017). List of marine mammal species and subspecies. Retrieved from www.marinemammalscience.org as accessed on April 18, 2018.

Coombs, S., & Montgomery, J. C. (1999). The enigmatic lateral line system. In *Comparative hearing: Fish and amphibians* (pp. 319-362): Springer.

Cross, J. N., & Allen, L. G. (1993). Fishes. In. Dailey, M. D., Reish, D. J. & Anderson, J. W. (Eds.), *Ecology of the Southern California Bight: A Synthesis and Interpretation* (pp. 459-540). Berkeley, CA: University of California Press.

Cunningham, K. A., & Reichmuth, C. (2016). High-frequency hearing in seals and sea lions. *Hearing Research, 331*, 83-91.

Dahl, P. H., & Dall'Osto, D. R. (2019). *Ambient Underwater Sound at Naval Base San Diego, San Diego Bay, California. Prepared for Naval Facilities Engineering Command Southwest under contract to Tierra Data, Inc.*

Department of the Navy. (2006). *Marine resources assessment for the Gulf of Alaska Operating Area*. Pearl Harbor, HI: Department of the Navy (DoN).

Department of the Navy. (2019). *Integrated Natural Resources Management Plan: Naval Base Ventura County Port Hueneme, Port Hueneme, California*. Port Hueneme, CA: Navy Region Southwest. p. 172.

Dugan, J. E., Hubbard, D. M., Martin, D. L., Engle, J. M., Richards, D. M., davis, G. E., & Ambrose, R. F. (2000). Macrofauna Communities of Exposed Sandy Beaches on the Southern California Mainland and Channel Islands. In. Browne, D. R., Mitchell, K. L. & Chaney, H. W. (Eds.), *Proceedings of the Fifth California Islands Symposium, 29 March - 1 April 1999* (pp. 339-346): Minerals Management Service.

Edmonds, N. J., Firmin, C. J., Goldsmith, D., Faulkner, R. C., & Wood, D. T. (2016). A review of crustacean sensitivity to high amplitude underwater noise: data needs for effective risk assessment in relation to UK commercial species. *Marine Pollution Bulletin, 108*, 5–11.

Eguchi, T. (1998). *Morphology of the Pacific harbor seal (Phoca vitulina richardsi) using Elkhorn Slough, California, and their movements and diving behavior in the Monterey Bay area.* M.S., California State University Fresno, Moss Landing, CA.

Erbe, C., Reichmuth, C., Cunningham, K., Lucke, K., & Dooling, R. (2016). Communication masking in marine mammals: A review and research strategy. *Marine pollution bulletin, 103*(1-2), 15-38. doi: 10.1016/j.Marpolbul.2015.12.007.

Feldkamp, S. D., DeLong, R. L., & Antonelis, G. A. (1989). Diving patterns of California sea lions, *Zalophus californianus*. *Canadian Journal of Zoology, 67*(4), 872-883.

Filiciotto, F., Vazzana, M., Celi, M., Maccarrone, V., Ceraulo, M., Buffa, G., Di Stefano, V., Mazzola, S., & Buscaino, G. (2014). Behavioural and biochemical stress responses of Palinurus elephas after exposure to boat noise pollution in tank. *Marine Pollution Bulletin, 84*(1-2), 104-114.

Finneran, J. J., Carder, D. A., Schlundt, C. E., & Dear, R. L. (2010). Growth and recovery of temporary threshold shift at 3 kHz in bottlenose dolphins: Experimental data and mathematical models. *Journal of the Acoustical Society of America, 127*(5), 3256–3266.

Finneran, J. J., Carder, D. A., Schlundt, C. E., & Ridgway, S. H. (2005). Temporary Threshold Shift in Bottlenose Dolphins (*Tursiops truncatus*) Exposed to Mid-frequency Tones. *Journal of the Acoustic Society of America, 118*(4), 2696-2705.

Finneran, J. J., & Jenkins, A. K. (2012). *Criteria and Thresholds for Navy Acoustic Effects Analysis Technical Report*. SPAWAR Marine Mammal Program.

Finneran, J. J., & Schlundt, C. E. (2003). *Effects of Intense Pure Tones on the Behavior of Trained Odontocetes*. San Diego, CA: Space and Naval Warfare Systems Center. p. 18.

Fisher, H. D. (1952). *The status of the harbour seal in British Columbia, with particular reference to the Skeena River*. (Bulletin No. 93). Ottawa: The Fisheries Research Board of Canada. p. 58.

Götz, T., Janik, V. M. G., T., & Janik, V. M. (2010). Aversiveness of sounds in phocid seals: psycho-physiological factors, learning processes and motivation. *The Journal of Experimental Biology, 213*, 1536-1548.

Hanggi, E. B., & Schusterman, R. J. (1994). Underwater acoustic displays and individual variation in male harbour seals, *Phoca vitulina*. *Animal Behavior, 48*(6), 1275-1283.

Hanlon, R. T. (1987). Why Cephalods Are Probably Not Deaf. *The American Naturalist, 129*(2), 312 - 317.

Hastings, K. K., Frost, K. J., Simpkins, M. A., Pendleton, G. W., Swain, U. G., & Small, R. J. (2004). Regional differences in diving behavior of harbor seals in the Gulf of Alaska. *82*, 1755-1773.

Hastings, M. C., & Popper, A. N. (2005). *Effects of Sound on Fish*. (Contract No. 43A0139, Task Order 1). Sacramento, CA: California Department of Transportation. Prepared by P.C. Jones and Stokes.

Hawkins, A. D., & Popper, A. N. (2017). A sound approach to assessing the impact of underwater noise on marine fishes and invertebrates. *ICES Journal of Marine Biology, 74*(3), 635-751. doi: 10.1093/icesjms/fsw205.

Henninger, H. P., & Watson, W. H. (2005). Mechanisms underlying the production of carapace vibrations and associated waterborne sounds in the American lobster, *Homarus americanus*. *Journal of Experimental Biology, 208*(17), 3421-3429.

Higgs, D. M., & Radford, C. A. (2013). The contribution of the lateral line to 'hearing'in fish. *Journal of Experimental Biology, 216*(8), 1484-1490.

Hill, P. S. (2009). How do animals use substrate-borne vibrations as an information source? *Naturwissenchaften, 96*(12), 1355-1371.

Hotchkin, C., & Parks, S. (2013). The Lombard effect and other noise-induced vocal modifications: insight from mammalian communication systems. *Biological Reviews, 88*(4), 809-824.

Houser, D. S., Moore, K., Sharp, S., & Finneran, J. J. (2010). Rapid acquisition of marine mammal evoked potential audiograms by stranding networks. *Journal of Acoustical Society of America, 128*(4), 2299-2299.

Illingworth & Rodkin, I. (2013). *Naval Base Kitsap at Bangor Trident Support Facilities Explosive Handling Wharf (EHW-2) Project Acoustic Monitoring Report*. Bangor, WA. p. 165.

Illingworth & Rodkin, I. (2015). *Hydroacoustic and Airborne Noise Monitoring at the Naval Station Norfolk during Pile Driving - Interim Report*. Petaluma, CA. p. 25.

Jefferson, T. A., Webber, M. A., & Pitman, R. L. (2008). *Marine Mammals of the World: A Comprehensive Guide to Their Identification*. London, UK: Elsevier.

Jefferson, T. A., Webber, M. A., & Pitman, R. L. (2015). *Marine Mammals of the World: A Comprehensive Guide to Their Identification* (2nd Edition ed.): Academic Press.

Jones, I. T., Stanley, J. A., & Mooney, T. A. (2020). Impulsive pile driving noise elicits alarm responses in squid (Doryteuthis pealeii). *Marine pollution bulletin, 150*, 110792.

Kastak, D., Reichmuth, C., Holt, M. M., Mulsow, J., Southall, B. L., & Schusterman, R. J. (2007). Onset, growth, and recovery of in-air temporary threshold shift in a California sea lion (*Zalophus californianus*). *Journal of the Acoustical Society of America, 122*(5), 2916–2924. doi: 10.1121/1.2783111.

Kastak, D., & Schusterman, R. J. (1996). Temporary threshold shift in a harbor seal (Phoca vitulina). *The Journal of the Acoustical Society of America, 100*(3), 1905-1908.

Kastak, D., & Schusterman, R. J. (1998). Low-frequency amphibious hearing in pinnipeds: methods, measurements, noise, and ecology. *Journal of the Acoustical Society of America, 103*, 2216-2228.

Kastak, D., & Schusterman, R. J. (1999). In-air and underwater hearing sensitivity of a northern elephant seal (Mirounga angustirostris). *Canadian Journal of Zoology, 77*, 1751-1758.

Kastelein, R. A. (2009). Walrus Odobenus rosmarus, 2nd. In *Encyclopedia of Marine Mammals* (pp. 1212-1217). Amsterdam, The Netherlands: Academic Press.

Kastelein, R. A., Gransier, R., & Hoek, L. (2016). Cumulative Effects of Exposure to Continuous and Intermittent Sounds on Temporary Hearing Threshold Shifts Induced in a Harbor Porpoise (Phocoena phocoena). In *The Effects of Noise on Aquatic Life II* (pp. 523-528): Springer.

Kastelein, R. A., Helder-Hoek, L., Cornelisse, S. A., Defillet, L. N., Huijser, L. A. E., & Terhune, J. M. (2020a). Temporary hearing threshold shift in harbor seals (Phoca vitulina) due to one-sixth-octave noise bands centered at 0.5, 1, and 2 kHz. *The Journal of the Acoustical Society of America, 148*(6), 3873-3885. doi: 10.1121/10.0002781.

Kastelein, R. A., Helder-Hoek, L., Cornelisse, S. A., Huijser, L. A. E., & Terhune, J. M. (2020b). Temporary hearing threshold shift in harbor seals (Phoca vitulina) due to a one-sixth-octave noise band centered at 32 kHz. *The Journal of the Acoustical Society of America, 147*(3), 1885-1896. doi: 10.1121/10.0000889.

Kastelein, R. A., Helder-Hoek, L., Janssens, G., Gransier, R., & Johansson, T. (2015). Behavioral responses of harbor seals (*Phoca vitulina*) to sonar signals in the 25-kHz range. *Aquatic Mammals, 41*(4), 388–399. doi: 10.1578/am.41.4.2015.388.

Kastelein, R. A., Helder-Hoek, L., Kommeren, A., Covi, J., & Gransier, R. (2018). Effect of pile-driving sounds on harbor seal (Phoca vitulina) hearing. *The Journal of the Acoustical Society of America, 143*(6), 3583-3594.

Kipple, B., & Gabriele, C. (2004). *Underwater noise from skiffs to ships.* Paper presented at the Proc. of Glacier Bay Science Symposium.

Koslow, J. A., Miller, E. F., & McGowan, J. A. (2015). Dramatic declines in coastal and oceanic fish communities off California. *Marine Ecology Progress Series, 538*, 221-227.

Kuhn, C. E., & Costa, D. P. (2014). Interannual variation in the at-sea behavior of California sea lions (*Zalophus californianus*). *Marine Mammal Science, 30*(4), 1297-1319.

Kvadsheim, P. H., Sevaldsen, E. M., Folkow, L. P., & Blix, A. S. (2010). Behavioural and physiological responses of hooded seals (Cystophora cristata) to 1 to 7 kHz sonar signals. *36*(3), 239-247.

Laake, J. L., Lowry, M. S., DeLong, R. L., Melin, S. R., & Carretta, J. V. (2018). Population growth and status of California sea lions. *The Journal of Wildlife Management, 82*(3), 583-595.

Lamont, M. M., Vida, J., Harvey, J. T., Jeffries, S., Brown, R., Huber, H. H., Delong, R., & Thomas, W. K. (1996). Genetic substructure of the Pacific harbor seal (Phoca vitulina richardsi) off Washington, Oregon, and California. *Marine Mammal Science, 12*(3), 402-413.

Laughlin, J. (2006). *Ambient Underwater Sound Measurements in Elliot Bay, March 21, 2006.* Olympia, WA: Washington Department of Transportation.

Linacre, L. (2004). *Community Structure of Euphausids in the Southern Part of the California Current During October 1997 (El Nino) and October 1998 (La Nina)*. pp. 126-136.

Lombarte, A., Yan, H. Y., Popper, A. N., Chang, J. C., & Platt, C. (1993). Damage and Regeneration of Hair Cell Ciliary Bundles in a Fish ear Following Treament with Gentamicin. *Hearing Research, 66*, 166-174.

Lovell, J. M., Findlay, M. M., Moate, R. M., & Yan, H. Y. (2005). The Hearing Abilities of the Prawn *Palaemon serratus*. *Comparative Biochemistry and Physiology, 140*, 89-100.

Lowry, L. F., Frost, K. J., Ver Hoep, J. M., & Delong, R. A. (2001). Movements of satellite-tagged subadult and adult harbor seals in Prince William Sound, Alaska. *Marine Mammal Science, 17*(4), 835-861.

Lowry, M. S., Carretta, J. V., & K.A., F. (2008). Pacific harbor seal census in California during May-July 2002 and 2004. *California Fish and Game, 94*(4), 180-193.

Lowry, M. S., & Forney, K. A. (2005). Abundance and distribution of California sea lions (*Zalophus californianus*) in central and northern California during 1998 and summer 1999. *Fishery Bulletin, 103*, 331-343.

Lowry, M. S., Melin, S. R., & Laake, J. L. (2017a). Breeding season distribution and population grow of California sea lions, Zalphus californianus, in the United States druing 1964-2014.

Lowry, M. S., Nehasil, S. E., & Jaime, E. M. (2017b). *Distribution of California sea lions, northern elephant seals, pacific harbor seals, and Steller sea lions at the Channel Islands during July 2011-2015*. NMFS-SWFSC. p. 67.

Lusseau, D., & Bejder, L. (2007). The Long-term Consequences of Short-term Responses to Disturbance Experiences from Whalewatching Impact Assessment. *International Journal of Comparative Psychology, 20*(2), 228-236.

Malme, C., Miles, P., Clark, C. W., Tyack, P., & Bird, J. E. (1984). *Investigations of the potential effects of underwater noise from petroleum-industry activities on migrating gray-whale behavior. Phase 2: January 1984 migration*. Bolt, Beranek and Newman, Inc., Cambridge, MA (USA).

Malme, C. I., Würsig, B., Bird, J. E., & Tyack, P. (1986). Behavioral responses of gray whales to industrial noise: Feeding observations and predictive modeling. *Outer Continental Shelf Environmental Assessment Program, Final Report of Principal Investigators, 56*(1988), 393-600.

Maniscalco, J. M., Wynne, K., Pitcher, K. W., Hanson, M. B., Melin, S. R., & Atkinson, S. (2004). The Occurrence of California Sea Lions (*Zalophus californianus*) in Alaska. *Aquatic Mammals, 30*(3), 427-433.

McKenna, M. F., Wiggins, S. M., & Hildebrand, J. A. (2013). Relationship between container ship underwater noise levels and ship design, operational and oceanographic conditions. *Scientific reports, 3*(1), 1-10.

Melin, S. R., & DeLong, R. L. (2000). At-sea distribution and diving behavior of California sea lion females from San Miguel Island, California. In. Dailey, M. D. (Ed.), *Proceedings of the Fifth California Islands Symposium*. Santa Barbara, CA.

Melin, S. R., DeLong, R. L., & Siniff, D. B. (2008). The effects of El Niño on the foraging behavior of lactating California sea lions (*Zalophus californianus californianus*) during the nonbreeding season. *Canadian Journal of Zoology, 86*(3), 192-206.

Miller, D. J., & Lea, R. N. (1972). Guide to the coastal marine fishes of California. *California Fish and Game Bulletin, 157*, 210.

Miller, E. H. (1991). *Communication in pinnipeds, with special reference to non-acoustic signalling*. London: Chapman and Hall.

Miller, J. D. (1974). Effects of noise on people. *Journal of Acoustical Society of America, 56*(3), 729-764.

Mooney, T. A., Hanlon, R. T., Christensen-Dalsgaard, J., Madsen, P. T., Ketten, D. R., & Nachtigall, P. E. (2010). Sound detection by the longfin squid (Loligo pealeii) studied with auditory evoked potentials: sensitivity to low-frequency particle motion and not pressure. *Journal of Experimental Biology, 213*, 3748-3759.

Mooney, T. A., Nachtigall, P. E., Breese, M., Vlachos, S., & Au, W. W. L. (2009). Predicting temporary threshold shifts in a bottlenose dolphin (*Tursiops truncatus*): The effects of noise level and duration. *Journal of Acoustical Society of America, 125*(3), 1816–1826. doi: 10.1121/1.3068456.

Moore, P. W. B., & Schusterman, R. J. (1987). Audiometric assessment of northern fur seals, *Callorhinus ursinus*. *Marine Mammal Science, 3*(1), 31-53.

Moretti, D., Marques, T. A., Thomas, L., DiMarzio, N., Dilley, A., Morrissey, R., McCarthy, E., Ward, J., & Jarvis, S. (2010). A dive counting density estimation method for Blainville's beaked whale (Mesoplodon densirostris) using a bottom-mounted hydrophone field as applied to a Mid-Frequency Active (MFA) sonar operation. *Applied Acoustics, 71*, 1036-1042.

Mueter, F. J. (2004). Gulf of Alaska. In *Marine Ecosystems of the North Pacific* (pp. 153-175): North Pacific Marine Science Organization.

Nachtigall, P. E., Mooney, T. A., Taylor, K. A., & Yuen, M. M. (2007). Hearing and auditory evoked potential methods applied to odontocete cetaceans. *Aquatic Mammals, 33*(1), 6.

Nachtigall, P. E., Supin, A. Y., Pawloski, J., & Au, W. W. L. (2004). Temporary threshold shifts in recovery following noise exposure in the Atlantic bottlnosed dolphin (*Tursiops truncatus*) measured using evoked auditory potentials. *Marine Mammal Science, 20*(4), 673-687.

National Marine Fisheries Service. (2010). *Takes of Marine Mammals Incidental to Specified Activities; Piling and Structure Removal in Woodard Bay Natural Resources Conservation Area, Washington*.

National Marine Fisheries Service. (2018). *2018 Revisions to: Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0): Underwater Thresholds for Onset of Permanent and Temporary Threshold Shifts*. (NOAA Technical Memorandum NMFS-OPR-59). Silver Spring, MD.

National Research Council. (2003). Ocean noise and marine mammals.

National Research Council of the National Academies. (2005). *Marine Mammal Populations and Ocean Noise: Determining when Noise Causes Biologically Significant Effects*. Washington DC: The National Academies Press.

Naval Facilities Engineering Command Southwest (NAVFAC SW). (2020). *Compendium of Underwater and Airborne Sound Data from Pile Driving and In-Water Demolition Activities in San Diego Bay, California*. Naval Facilities Engineering Command Southwest.

NAVFAC SW. (2020). *Analysis of Noise Data for Pile Driving Training Exercises at Naval Base Ventura County (Port Hueneme) February 19 & 20, 2020*. Naval Facilities Engineering Command, Southwest.

NMFS. (2022). Optional Multi-Species Pile Driving Calculator (Version 1.1). Retrieved

Nowacek, D. P., Thorne, L. H., Johnston, D. W., & Tyack, P. L. (2007). Responses of Cetaceans to Anthropogenic Noise. *Mammal Review, 37*(2), 81-115.

Offutt, G. C. (1970). Acoustic Stimulus Perception by the American Lobster *Homarus americanus* (Decapoda). *Experientia, 26*, 1276-1278.

Orr, A. J., Newsome, S. D., Laake, J. L., VanBlaricom, G. R., & DeLong, R. L. (2012). Ontogenetic dietary information of the California sea lion (*Zalophus californianus*) assessed using stable isotope analysis. *Marine Mammal Science, 28*(4), 714-732.

Orr, A. J., VanBlaricom, G. R., DeLong, R. L., Cruz-Escalona, V. H., & Newsome, S. D. (2011). Intraspecific comparison of diet of California sea lions (*Zalophus californianus*) assessed using fecal and stable isotope analyses. *Canadian Journal of Zoology, 89*(2), 109-122.

Patek, S. N., & Caldwell, R. L. (2006). The stomatopod rumble: Low frequency sound production in *Hemisquilla californiensis*. *Marine and Freshwater Behaviour and Physiology, 39*(2), 99-111.

Perry, R. (2003). A Guide to the Marine Plankton of Southern California. Retrieved from UCLA Marine Science Center OceanGLOBE website:

Popper, A. N. (2003a). Effects of Anthropogenic Sounds of Fishes. *Fisheries Bulletin, 28*(10), 24-31.

Popper, A. N. (2003b). Effects of anthropogenic sounds on fishes. *Fisheries Research, 28*(10), 24-31.

Popper, A. N. (2008). *Effects of mid- and high-frequency sonars on fish*. Newport, RI: Department of the Navy (DoN). p. 52.

Popper, A. N., Fay, R. R., Platt, C., & Sand, O. (2003). Sound Detection Mechanisms and Capabilities of Teleost Fishes. In *Sensory Processing in Aquatic Environments* (pp. 3-38). New York, NY: Springer-Verlag.

Popper, A. N., & Hawkins, A. D. (2018). The importance of particle motion to fishes and invertebrates *Journal of Acoustical Society of America, 143*, 470-488.

Popper, A. N., Hawkins, A. D., Fay, R. R., Mann, D. A., Bartol, S., Carlson, T. J., Coombs, S., Ellison, W. T., Gentry, R. L., Halvorsen, M. B., Løkkeborg, S., Rogers, P. H., Southall, B. L., Zeddies, D. G., & Tavolga, W. N. (2014). *Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report prepared by ANSI-Accredited Standards Committee S3/SC1 and registered with ANSI*. Acoustical Society of America. p. 87.

Popper, A. N., & Schilt, C. R. (2008). Hearing and acoustic behavior: basic and applied considerations. In *Fish bioacoustics* (pp. 17-48): Springer.

Port of Hueneme. (2019). Why Hueneme? Retrieved from https://www.portofhueneme.org/wp-content/uploads/2014/11/POH_OverviewBrochure_11-5.pdf as accessed on 6 November 2019.

Port of Hueneme. (2021). History in the Making! Port of Hueneme Celebrates Completion of Deepening Project with Ribbon-Cutting Ceremony *Championing Social Justice and Environmental Leadership for a Sustainable Economy*. Port Hueneme, CA. Retrieved

Retrieved June 28, 2021from https://www.portofhueneme.org/wp-content/uploads/2021/06/Deepening-Project-Completion-Press-Release-6-28-2021-RFS.pdf.

Proctor, C. M., Garcia, J. C., Galvin, D. V., Joyner, T., Lewis, G. B., Loehr, L. C., & Massa, A. M. (1980). *An Ecological Characterization of the Pacific Northwest Coastal Region*. U.S. Fish and Wildlife Service, Biological Services Program.

Rehberg, M. J., & Small, R. J. (2001). Dive behavior, haulout patterns, and movements of harbor seal pups in the Kodiak Archipelago, 1997-2000. *this volume) in: Harbor Seal Investigations in Alaska. Annual Report for NOAA Award NA87FX0300. Alaska Department of Fish and Game, Division of Wildlife Conservation, Anchorage, AK*, 209-293.

Reichmuth, C. (2008). Hearing in marine carnivores. *Bioacoustics, 17*, 89-92.

Reichmuth, C., Ghoul, A., Sills, J., Rouse, A., & Southall, B. (2016). Low-frequency temporary threshold shift not observed in spotted or ringed seals exposed to single air gun impulses. *The Journal of the Acoustical Society of America, 140*(4), 2646.

Reichmuth, C., Holt, M. M., Mulsow, J., Sills, J. M., & Southall, B. L. (2013). Comparative assessment of amphibious hearing in pinnipeds. *Journal of Comparative Physiology A, 199*(6), 491-507.

Reyff, J. (2012). Underwater Sounds From Unattenuated and Attenuated Marine Pile Driving. In. Popper, A. N. & Hawkins, A. D. (Eds.), *The Effects of Noise on Aquatic Life* (Vol. 730, pp. 439-444). New York, NY: Springer New York.

Richardson, W. J., Greene, C. R., Malme, C. I., & Thomson, D. H. (1995). *Marine Mammals and Noise*. San Diego, CA: Academic Press.

Roberts, L., & Breithaupt, T. (2016). Sensitivity of Crustaceans to Substrate-Borne Vibration. In *The Effects of Noise on Aquatic Life II* (pp. 925-931): Springer.

Roberts, L., Harding, H. R., Voellmy, I., Bruintjes, R., Simpson, S. D., Radford, A. N., Breithaupt, T., & Elliott, M. (2016). *Exposure of benthic invertebrates to sediment vibration: from laboratory experiments to outdoor simulated pile-driving.* Paper presented at the Proceedings of Meetings on Acoustics 4ENAL.

Roedel, P. M. (1953). *Common ocean fishes of the California coast*: State of California, Department of Fish and Game, Marine Fisheries Branch.

Scheffer, V. B., & Slipp, J. W. (1944). *The harbor seal in Washington State*. pp. 373-416.

Schlundt, C. E., Finneran, J. J., Carder, D. A., & Ridgway, S. H. (2000). Temporary Shift in Masked Hearing Thresholds of Bottlenose Dolphins, *Tursiops truncatus*, and White Whales, *Delphinapterus leucas*, after Exposure to Intense Tones. *Journal of the Acoustical Society of America, 107*(6), 3496-3508.

Schusterman, R. J. (1981). Behavioral Capabilities of Seals and Sea Lions: A Review of Their Hearing, Visual, Learning, and Diving Skills. *The Psychological Record, 31*, 125-143.

Schusterman, R. J., Balliet, R. F., Nixon, J. S., R. J., Balliet, R. F., & Nixon, J. (1972). Underwater audiogram of the California sea lion by the conditioned vocalization technique. *Journal of the Experimental Analysis of Behavior, 17*, 339-350.

Sills, J. M., Ruscher, B., Nichols, R., Southall, B. L., & Reichmuth, C. (2020). Evaluating temporary threshold shift onset levels for impulsive noise in seals. *The Journal of the Acoustical Society of America, 148*(5), 2973-2986.

Small, R. J., Lowry, L. F., Hoef, J. M. V., Frost, K. J., DeLong, R. A., & Rehberg, M. J. (2005). Differential movements by harbor seal pups in contrasting Alaska environments. *21*(4), 671-694.

Small, R. J., Pendleton, G. W., & Pitcher, K. W. (2003). Trends in abundance of Alaska harbor seals, 1983-2001. *19*(2), 344-362.

Smith, M. E., Coffin, A. B., Miller, D. L., & Popper, A. N. (2006). Anatomical and Functional Recovery of the Goldfish (Carassius auratus) Ear following Noise Exposure. *Journal of Experimental Biology, 209*, 4193-4202.

Southall, B. L. (2005). *Final Report of the National Oceanic and Atmospheric Administration (NOAA) International Symposium: "Shipping Noise and Marine Mammals: A Forum for Science, Management, and Technology," 18-19 May 2004, Arlington, Virginia, U.S.A*. National Oceanic and Atmospheric Administration (NOAA).

Southall, B. L., Bowles, A. E., Ellison, W. T., Finneran, J. J., Gentry, R. L., Greene Jr., C. R., Kastak, D., Ketten, D. R., Miller, J. H., Nachtigall, P. E., Richardson, W. J., Thomas, J. A., & Tyack, P. L. (2007). Marine Mammal Noise Exposure Criteria: Initial Scientific Recommendations. *Aquatic Mammals, 33*(4), 411-521.

Southall, B. L., Calambokidis, J., Tyack, P. L., Moretti, D., Hildebrand, J., Kyburg, C., ..., & Barlow, J. (2011). *Biological and Behavioral Response Studies of Marine Mammals in Southern California, 2010 ("SOCAL-10") Project Report*. p. 29.

Southall, B. L., Finneran, J. J., Reichmuth, C., Nachtigall, P. E., Ketten, D. R., Bowles, A. E., Ellison, W. T., Nowacek, D. P., & Tyack, P. L. (2019). Marine Mammal Noise Exposure Criteria: Updated Scientific Recommendations for Residual Hearing Effects. *Aquatic Mammals, 45*(2), 125-232.

Southall, B. L., Nowacek, D. P., Miller, P. J., & Tyack, P. L. (2016). Experimental field studies to measure behavioral responses of cetaceans to sonar. *Endangered Species Research, 31*, 293-315.

Staaterman, E. (2016). Passive acoustic monitoring in benthic marine crustaceans: A new research frontier. In *Listening in the Ocean*. New York, NY: Springer.

Strategic Environmental Consulting, I. (2005). *FINAL REPORT- Monitoring the Effects of Conventional Pile Driving on Three Species of Fish*.

Swain, U., Lewis, J., Pendleton, G., & Pitcher, K. (1996). Movements, haulout, and diving behavior of harbor seals in southeast Alaska and Kodiak Island. *Annual Report: Harbor seal investigations in Alaska. NOAA Grant NA57FX0367. Alaska Dep. Fish and Game, Division of Wildlife Conservation. Douglas, AK*, 59-144.

Talley, T. S., Dayton, P. K., & Ibarra-Obando, S. E. (2000). Tidal flat macrofaunal communities and their associated environments in estuaries of southern California and northern Baja California, Mexico. *Estuaries, 23*(1), 97-114.

Terhune, J. M., & Ronald, K. (1971). The Harp Seal, Pagophilus groenlandicus (Erxleben, 1777). X. The Air Audiogram. *Canadian Journal of Zoology, 49*(3), 385-390.

Terhune, J. M., & Ronald, K. (1972). The Harp Seal, Pagophilus groenlandicus (Erxleben, 1777). III. The Underwater Audiogram. *Canadian Journal of Zoology, 50*(5), 565-569.

Tetra Tech. (2012). *Integrated Natural Resources Management Plan for Naval Base Ventura County, Port Hueneme*. San Diego CA: Naval Facilities Engineering Command, Southwest. p. 557.

Thompson, B., Tsukada, D., & Laughlin, J. (1993). Megabenthic assemblages of coastal shelves, slopes, and basins off southern California. *Bulletin of the Southern California Academy of Sciences, 92*(1), 25-42.

Thompson, P. M., Lusseau, D., Barton, D., Simmons, D., Rusin, J., & Bailey, H. (2010). Assessing the responses of coastal cetaceans to the construction of offshore wind turbines. *Marine Pollution Bulletin, 60*, 1200-1208.

Tyack, P. L. (2009). Acoustic playback experiments to study behavioral responses of free-ranging marine animals to anthropogenic sound. *Marine Ecology Progress Series*, 395. doi: 10.3354/meps08363.

Tyack, P. L., Zimmer, W., Moretti, D., Southall, B., Claridge, D., Durban, J., & Boyd, I. (2011). Beaked Whales Respond to Simulated and Actual Navy Sonar. *PLoS One, 6*(3), 15. doi: 10.1371/journal.pone.0017009.

U.S. Department of the Navy. (2011). U.S. Navy Integrated Comprehensive Monitoring Program (2010 Update ed.). Retrieved Retrieved 20 February 2010

U.S. Department of the Navy. (2017a). *Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis (Phase III)*. p. 183.

U.S. Department of the Navy. (2017b). *Quantifying Acoustic Impacts on Marine Mammals and Sea Turtles: Methods and Analytical Approach for Phase III Training and Testing*. Technical report prepared by Space and Naval Warfare Systems Center Pacific and Naval Undersea Warfare Center, Newport.

University of Rhode Island. (2019). Pile Driving. *Discovery of Sound in the Sea* Retrieved from https://dosits.org/galleries/audio-gallery/anthropogenic-sounds/pile-driving/ as accessed on 7 November 2019.

Viers, S. (2011). California Sea Lions Bark Into Hydrophones Retrieved from http://www.orcasound.net/2011/11/07/california-sea-lions-bark-into-hydrophones/ as accessed on 12/8/2020.

Ward, W. D. (1997). Effects of high-intensity sound. In. Crocker, M. J. (Ed.), *Encyclopedia of Acoustics* (pp. 1497–1507). New York, NY: Wiley.

Wartzok, D., & Ketten, D. (1999). Marine Mammal Sensory Systems. *Biology of Marine Mammals, 1*.

Wartzok, D., Popper, A. N., Gordon, J., & Merrill, J. (2003). Factors affecting the responses of marine mammals to acoustic disturbance. *Marine Technology Society Journal, 37*(4), 6-15.

Washington State Department of Transportation. (2011). Port Townsend Dolphin Timber Pile Removal - Vibratory Pile Monitoring Technical Memorandum (pp. 5). Retrieved Retrieved January 3, 2011

Washington State Department of Transportation. (2012). UNDERWATER VIBRATORY SOUND LEVELS FROM A BATTERED PILE INSTALLATION AT THE SEATTLE COLMAN DOCK.

Webb, J. F., Montgomery, J. C., & Mogdans, J. (2008). Bioacoustics and the lateral line system of fishes. In *Fish bioacoustics* (pp. 145-182): Springer.

Womble, J. N., Blundell, G. M., Gende, S. M., Horning, M., Sigler, M. F., & Csepp, D. J. (2014). Linking marine predator diving behavior to local prey fields in contrasting habitats in a subarctic glacial fjord. *Marine Biology, 161*, 1361-1374.

Appendix A. Level A ZOI Calculation Spreadsheets

Impact Driving – Timber: pg. A-2

Impact Driving – Steel H Beam: pg. A-3

Vibratory Driving – Timber: pg. A-4

Vibratory Driving – Steel Sheet: pg. A-5

Vibratory Driving – Steel H Beam: pg. A-6

IMPACT PILE DRIVING REPORT

VERSION 1.1-Multi-Species: 2022

PRINT IN LANDSCAPE TO CAPTURE ENTIRE SCREEN
(if OTHER INFO or NOTES get cut-off, please include information elsewhere)

NCG-1 Pile Driving Training ExercisesCONTACT: Emily Robinsonemily.r.robinson13.civ@us.navy.mil

PROJECT INFORMATION	PEAK	SELss	RMS
Attenuated Single strike level (dB)	180	160	170
Distance associated with single strike level (meters)	10	10	10
Transmission loss constant	15		
Number of piles per day	2		
Number of strikes per pile	1800		
Number of strikes per day	3600		
Cumulative SEL at measured distance	196		

OTHER INFO: Timber piles, 16-inch diameter

NOTES: other information

Attenuation: 0

RESULTANT ISOPLETHS
(Range to Effects)

FISHES

	ONSET OF PHYSICAL INJURY			BEHAVIOR
	Peak Isopleth	SEL_{cum} Isopleth: Fish ≥ 2 g	SEL_{cum} Isopleth: Fish < 2 g	RMS Isopleth
ISOPLETHS (meters)	0.2	37.2	46.4	215.4
Isopleth (feet)	0.6	122.1	152.3	706.8

SEA TURTLES

	PTS ONSET		BEHAVIOR
	Peak Isopleth	SEL_{cum} Isopleth	RMS Isopleth
ISOPLETHS (meters)	0.0	2.7	4.6
Isopleth (feet)	0.0	9.0	15.2

MARINE MAMMALS

	LF Cetacean	MF Cetaceans	HF Cetaceans	PW Pinniped	OW Pinnipeds
PTS ONSET (Peak isopleth, meters)	0.0	0.0	0.3	0.0	0.0
PTS ONSET (Peak isopleth, feet)	0.1	0.0	1.1	0.1	0.0
PTS ONSET (SEL_{cum} isopleth, meters)	68.7	2.4	81.8	36.8	2.7
PTS ONSET (SEL_{cum} isopleth, feet)	225.4	8.0	268.5	120.6	8.8

	ALL MM
Behavior (RMS isopleth, meters)	46.4
Behavior (RMS isopleth, feet)	152.3

1

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PRINT IN LANDSCAPE TO CAPTURE ENTIRE SCREEN
(if OTHER INFO or NOTES get cut-off, please include information elsewhere)

NCG-1 Pile Driving Training ExercisesCONTACT: Emily Robinsonemily.r.robinson13.civ@us.navy.mil

PROJECT INFORMATION	PEAK	SELss	RMS
Attenuated Single strike level (dB)	195	170	180
Distance associated with single strike level (meters)	10	10	10
Transmission loss constant	15		
Number of piles per day	2		
Number of strikes per pile	1800		
Number of strikes per day	3600		
Cumulative SEL at measured distance	206		

OTHER INFO: Steel H/S Beam piles, 14 inches

NOTES: 15" thick walled, vertical driving from Ballena Isla Marina project used.

Attenuation: 0

RESULTANT ISOPLETHS
(Range to Effects)

FISHES

	ONSET OF	PHYSICAL	INJURY	BEHAVIOR
	Peak Isopleth	SEL_{cum} Isopleth		RMS Isopleth
		Fish ≥ 2 g	Fish < 2 g	
ISOPLETHS (meters)	1.8	172.8	215.4	1,000.0
Isopleth (feet)	6.1	566.9	706.8	3,280.8

SEA TURTLES

	PTS ONSET		BEHAVIOR
	Peak Isopleth	SEL_{cum} Isopleth	RMS Isopleth
ISOPLETHS (meters)	0.0	12.7	21.5
Isopleth (feet)	0.1	41.7	70.7

MARINE MAMMALS

	LF Cetacean	MF Cetaceans	HF Cetaceans	PW Pinniped	OW Pinnipeds
PTS ONSET (Peak isopleth, meters)	0.3	0.0	3.4	0.3	0.0
PTS ONSET (Peak isopleth, feet)	0.8	0.2	11.2	1.0	0.1
PTS ONSET (SEL_{cum} isopleth, meters)	318.9	11.3	379.8	170.6	12.4
PTS ONSET (SEL_{cum} isopleth, feet)	1,046.1	37.2	1,246.1	559.8	40.8

	ALL MM
Behavior (RMS isopleth, meters)	215.4
Behavior (RMS isopleth, feet)	706.8

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VIBRATORY PILE DRIVING REPORT

PRINT IN LANDSCAPE TO CAPTURE ENTIRE SCREEN

VERSION 1.1-Multi-Species: 2022

(if OTHER INFO or NOTES get cut-off, please include information elsewhere)

NCG-1 Pile Driving Training ExercisesCONTACT: Emily Robinsonemily.r.robinson13.civ@us.navy.mil

PROJECT INFORMATION	RMS
Attenuated Sound pressure level (dB)	162
Distance associated with sound pressure level (meters)	10
Transmission loss constant	15
Number of piles per day	2
Duration to drive pile (minutes)	30
Duration of sound production in day	3600
Cumulative SEL at measured distance	198

OTHER INFO: Timber piles, 16-inch diameter

NOTES: extra information

Attenuation: 0

RESULTANT ISOPLETHS
(Range to Effects)

FISHES

	BEHAVIOR
	RMS Isopleth
ISOPLETHS (meters)	63.1
ISOPLETHS (feet)	207.0

SEA TURTLES

	PTS ONSET	BEHAVIOR
	SEL_{cum} Isopleth	RMS Isopleth
ISOPLETHS (meters)	0.3	1.4
ISOPLETHS (feet)	1.0	4.5

MARINE MAMMALS

	LF Cetacean	MF Cetaceans	HF Cetaceans	PW Pinniped	OW Pinnipeds
PTS ONSET (SELcum isopleth, meters)	8.0	0.7	11.8	4.8	0.3
PTS ONSET (SELcum isopleth, feet)	26.1	2.3	38.6	15.9	1.1

	ALL MM
Behavior (RMS isopleth, meters)	6,309.6
Behavior (RMS isopleth, feet)	20,700.7

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VIBRATORY PILE DRIVING REPORT

PRINT IN LANDSCAPE TO CAPTURE ENTIRE SCREEN

VERSION 1.1-Multi-Species: 2022

(if OTHER INFO or NOTES get cut-off, please include information elsewhere)

NCG-1 Pile Driving Training ExercisesCONTACT: Emily Robinsonemily.r.robinson13.civ@us.navy.mil

PROJECT INFORMATION	RMS
Attenuated Sound pressure level (dB)	159
Distance associated with sound pressure level (meters)	11
Transmission loss constant	15
Number of piles per day	3
Duration to drive pile (minutes)	20
Duration of sound production in day	3600
Cumulative SEL at measured distance	195

OTHER INFO Steel AZ sheet pile, 24-in

NOTES extra information

Attenuation 0

RESULTANT ISOPLETHS

(Range to Effects)

FISHES

	BEHAVIOR
	RMS Isopleth
ISOPLETHS (meters)	43.8
ISOPLETHS (feet)	143.7

SEA TURTLES

	PTS ONSET	BEHAVIOR
	SEL_{cum} Isopleth	RMS Isopleth
ISOPLETHS (meters)	0.2	0.9
ISOPLETHS (feet)	0.7	3.1

MARINE MAMMALS

	LF Cetacean	MF Cetaceans	HF Cetaceans	PW Pinniped	OW Pinnipeds
PTS ONSET (SELcum isopleth, meters)	5.5	0.5	8.2	3.4	0.2
PTS ONSET (SELcum isopleth, feet)	18.1	1.6	26.8	11.0	0.8
	ALL MM				
Behavior (RMS isopleth, meters)	4,379.2				
Behavior (RMS isopleth, feet)	14,367.4				

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VIBRATORY PILE DRIVING REPORT

PRINT IN LANDSCAPE TO CAPTURE ENTIRE SCREEN

VERSION 1.1-Multi-Species: 2022

(if OTHER INFO or NOTES get cut-off, please include information elsewhere)

NCG-1 Pile Driving Training ExercisesCONTACT: Emily Robinsonemily.r.robinson13.civ@us.navy.mil

PROJECT INFORMATION	RMS
Attenuated Sound pressure level (dB)	147
Distance associated with sound pressure level (meters)	10
Transmission loss constant	15
Number of piles per day	2
Duration to drive pile (minutes)	30
Duration of sound production in day	3600
Cumulative SEL at measured distance	183

OTHER INFO: Steel H Beam piles, 14 inches

NOTES: 10 inch H beam

Attenuation: 0

RESULTANT ISOPLETHS (Range to Effects)

FISHES

	BEHAVIOR
	RMS Isopleth
ISOPLETHS (meters)	6.3
ISOPLETHS (feet)	20.7

SEA TURTLES

	PTS ONSET	BEHAVIOR
	SEL_{cum} Isopleth	RMS Isopleth
ISOPLETHS (meters)	0.0	0.1
ISOPLETHS (feet)	0.1	0.4

MARINE MAMMALS

	LF Cetacean	MF Cetaceans	HF Cetaceans	PW Pinniped	OW Pinnipeds
PTS ONSET (SELcum isopleth, meters)	0.8	0.1	1.2	0.5	0.0
PTS ONSET (SELcum isopleth, feet)	2.6	0.2	3.9	1.6	0.1
	ALL MM				
Behavior (RMS isopleth, meters)	631.0				
Behavior (RMS isopleth, feet)	2,070.1				

1

Appendix B. California Sea Lion Counts Data from 2010-Present

The California sea lion counts presented in the table below represent random observation of the presences of animals at Wharf D. Counts were not conducted on a regular basis, making it difficult to ascertain patterns in sea lion presence over time or during different months of the year.

Date	***Time***	***Total***	***Recorder***	***Notes***
4-Jan-10	15:04	36	R.Kelley	
25-Jan-10	14:00	45	R.Kelley	injured sea lion first discovered Nov 25, 2009 still alive
8-Feb-10	14:30	47	R.Kelley	injured sea lion first discovered Nov 25, 2009 still alive; 1 juvenille looked unhealthy,on first observation it appeared dead and was separated from the group
18-Feb-10	16:00	55	R.Kelley	
20-Apr-10	AM	50	R.Kelley	
26-Apr-10	17:00	86	R.Kelley	One just born pup!
10-May-10	11:40	172	F. Ferrara	
19-May-10		42	M. Ruane	
24-May-10		2	J. More	
25-Jun-10		10	S. Murphy	
2-Jul-10	12:30	10	S. Murphy	
8-Jul-10		7	M. Ruane	
9-Jul-10	8:45	5	F. Ferrara	view of dock blocked by boats; may have been a couple more
16-Jul-10	9:00	3	F. Ferrara	view of dock blocked by boats; may have been a couple more
3-Sep-10	11:20	100	R.Kelley	Sea lions very crowded into center of Wharf, total is approximate.
17-Sep-10		70	R.Kelley	
18-Oct-10	7:00	0	R.Kelley	
10-Dec-10	10:00	0	R.Kelley	
1-May-12	14:30	7	F. Ferrara	
7-May-12	12:45	7	F. Ferrara	
14-May-12	13:15	49	F. Ferrara	
22-May-12	14:40	74	F. Ferrara	
1-Jun-12	8:04	99	R.Kelley	
4-Jun-12	14:26	139	R.Kelley	
14-Jun-12	13:00	52	J. More	
20-Jun-12	15:30	43	S. Murphy	
25-Jun-12	12:25	11	M. Ruane	
3-Jul-12	11:00	16	F. Ferrara	could be more: 2 large boats now docked at wharf, difficult to see all
18-Jul-12	15:15	14	F. Ferrara	could be more: 2 large boats now docked at wharf, difficult to see all
26-Jul-12	9:50	20	J. More	could be more: 2 large boats now docked at wharf, difficult to see all
1-Aug-12	13:50	48	F. Ferrara	could be more: 2 large boats now docked at wharf, difficult to see all
9-Aug-12	11:40	30	F. Ferrara	could be more: 2 large boats now docked at wharf, difficult to see all

Date	*Time*	*Total*	*Recorder*	*Notes*
16-Aug-12	12:20	14	F. Ferrara	could be more: 2 large boats now docked at wharf, difficult to see all
14-Jan-13		0	R.Kelley	
23-Jan-13	13:20	3	R.Kelley	
5-Feb-13	14:00	0	F. Ferrara	
11-Feb-13	9:00	0	R.Kelley	
13-Feb-13	9:10	0	R.Kelley	
28-Feb-13	14:30	4	F. Ferrara	
5-Mar-13	9:00	0	R.Kelley	
20-Mar-13	12:24	6	R.Kelley	
1-Apr-13	9:40	38	F. Ferrara	
9-Apr-13	8:19	12	R.Kelley	
16-Apr-13	12:37	32	R.Kelley	
10-May-13	10:03	8	R.Kelley	
29-May-13	14:00	39	F. Ferrara	
5-Jun-13	15:00	19	J. More	
14-Jun-13	13:15	20	S. Murphy	
18-Jun-13	13;45	5	F. Ferrara	
26-Jun-13	9:38	0	F. Ferrara	
2-Jul-13	12:00	0	S. Murphy	
10-Jul-13	17:00	2	S. Murphy	
17-Jul-13	11:00	3	F. Ferrara	
22-Jul-13	16:10	5	S. Murphy	
29-Jul-13	12:00	5	S. Murphy	
6-Aug-13	12:05	20	F. Ferrara	
30-Jan-14	9:25	0	F. Ferrara	
4-Feb-14	9:35	4	F. Ferrara	
11-Feb-14	10:00	2	F. Ferrara	
20-Feb-14	8:45	0	R.Kelley	
6-Mar-14	11:15	1	M. Ruane	
12-Mar-14	11:00	0	F. Ferrara	
20-Mar-14	10:15	0	F. Ferrara	
24-Mar-14	14:15	7	F. Ferrara	
2-Apr-14	12:48	34	M. Ruane	
10-Apr-14	8:45	19	R.Kelley	
18-Apr-14	9:30	47	F. Ferrara	estimate - can't see all
23-Apr-14	9:45	48	R.Kelley	
30-Apr-14	13:20	80	R.Kelley	estimate - can't see all - end of wharf underwater from weight
8-May-14	10:00	17	R.Kelley	
13-May-14	9:15	16	F. Ferrara	
22-May-14	14:00	9	S. Murphy	female attempting to give birth
29-May-14	8:45	3	R.Kelley	1 small dead sea lion pup
2-Jun-14	13:33	8	M. Ruane	
12-Jun-14	11:20	4	R.Kelley	
20-Jun-14	12:50	8	R.Kelley	

Date	*Time*	*Total*	*Recorder*	*Notes*
24-Jun-14	13:41	10	M. Ruane	
3-Jul-14	15:00	8	S. Murphy	
10-Jul-14	10:20	3	R.Kelley	
24-Jul-14	11:50	0	R.Kelley	
8-Jan-15	10:00	50	R.Kelley	
15-Jan-15	10:02	60	R.Kelley	
22-Jan-15	10:20	75	R.Kelley	
29-Jan-15	10:05	130	R.Kelley	
5-Feb-15	10:05	95	R.Kelley	
18-Feb-15	11:26	108	M. Ruane	
19-Feb-15	10:00	112	R.Kelley	
5-Mar-15	10:18	80	R.Kelley	
12-Mar-15	10:10	66	R.Kelley	
1-Apr-15	13:54	102	R.Kelley	
7-Apr-15	11:15	96	F. Ferrara	2 fresh aborted fetuses
4-May-15	13:45	44	R.Kelley	
20-May-15	10:30	26	R.Kelley	
27-May-15	13:10	26	R.Kelley	
5-Jun-15	12:35	27	R.Kelley	
10-Jun-15	12:20	30	F. Ferrara	
18-Jun-15	8:05	20	R.Kelley	
24-Jun-15	10:15	26	R.Kelley	
2-Jul-15	13:13	50	R.Kelley	
17-Jul-15	12:02	21	R.Kelley	1 with tar spots; 1 with orange tag on left front flipper - can't read
31-Jul-15	12:58	52	R.Kelley	2 with orange tags on left front flippers - can't read
14-Aug-15	12:40	139	R.Kelley	
1/27/2016	10:00	30		
2/3/2016	9:50	98		
2/18/2016	13:07	122		
2/25/2016	14:08	104		
3/1/2016	10:24	11		
3/9/2016	10:57	135		
3/16/2016	14:41	91		
3/22/2016	11:31	15		
3/28/2016	12:30	40		
4/8/2016	9:00	2		
5/4/2016	9:30	79		
6/13/2016	15:25	1		
6/17/2016	8:45	0		
6/23/2016	10:05	0		
6/30/2016	12:55	2		
7/5/2016	13:32	0		

Date	***Time***	***Total***	***Recorder***	***Notes***
7/12/2016	14;45	7		
7/15/2016	14:47	0		
7/20/2016	14:34	8		
8/4/2016	15:38	46		
1/12/2017	15:05	0		
1/26/2017	13:28	3		
3/13/2017	12:22	1		
4/14/2017	8:00	0		
4/27/2017	14:43	0		
5/9/2017	9:32	0		
5/22/2017	17:00	1		
1/5/2018	7:25	2		
1/30/2018	11:30	0		
2/12/2018	10:45	0		
3/12/2018	9:00	0		
3/27/2018	11:35	0		
4/2/2018	14:30	0		
4/24/2018	11:10	0		
5/16/2018	14:45	0		
6/21/2018	16:00	0		
8/2/2018	13:45	0		
8/27/2018	11:37	1		
9/4/2018	10:06	5		
12/18/2018	9:38	34		
1/9/2019	12:02	4		
2/15/2019	14:15	3		
3/1/2019	11:40	13		
4/3/2019	13:20	35		
4/9/2019	10:10	45		
4/16/2019	7:45	11		
4/22/2019	14:10	19		
4/30/2019	8:25	19		
5/15/2019	13:00	117		
5/24/2019	13:30	68		
6/4/2019	14:05	11		
6/18/2019	14:05	6		
6/26/2019	15:08	6		
7/2/2019	13:08	7		
7/25/2019	14:02	4		

Date	*Time*	*Total*	*Recorder*	*Notes*
12/15/2020	10:52	252		
12/16/2020	13:20	248		
12/22/2020	11:30	239		
12/29/2020	10:23	307		
1/4/2021	15:07	157		
1/4/2021	13:45	132		
1/5/2021	12:07	191		
1/11/2021	14:10	253		
1/12/2021	13:45	314		
1/15/2021	9:42	342		
1/20/2021	11:30	32		
1/22/2021	11:35	4		
1/26/2021	14:50	3		
1/26/2021	15:05	1		
1/29/2021	8:10	0		
2/1/2021	14:50	3		
2/1/2021	16:05	2		
2/5/2021	11:22	6		
2/5/2021	12:35	6		
2/10/2021	11:04	0		
2/10/2021	12:22	0		
2/12/2021	10:10	3		
2/16/2021	10:30	1		
2/16/2021	11:20	0		
2/17/2021	13:23	0		
2/23/2021	15:02	1		
3/1/2021	12:05	2		
3/2/2021	9:50	0		
3/4/2021	9:25	2		
3/8/2021	12:40	0		
3/11/2021	14:24	1		
3/15/2021	11:45	0		
3/17/2021	11:43	2		
3/22/2021	9:55	1		
3/25/2021	12:40	0		
3/30/2021	9:55	0		
4/1/2021	10:47	0		
4/5/2021	12:00	0		
4/6/2021	12:05	0		
4/20/2021	13:42	0		
4/22/2021	12:40	2		
4/27/2021	13:20	5		
4/29/2021	14:00	150		
5/3/2021	14:13	172		
5/6/2021	14:05	77		
5/13/2021	12:30	40		

Date	*Time*	*Total*	*Recorder*	*Notes*
5/20/2/021	12:15	62		
5/24/2021	13:43	87		
5/26/2021	9:43	62		
6/7/2021	14:48	11		
6/29/2021	14:43	1		
7/14/2021	7:43	0		
7/15/2021	15:43	0		
7/16/2021	8:43	0		
7/29/2021	13:40	1		
8/6/2021	10:10	0		
8/18/2021	13:26	6		
8/23/2021	10:38	9		
8/30/2021	10:50	69		
8/31/2021	18:43	81		
9/2/2021	10:05	67		
9/13/2021	9:57	3		
9/14/2021	15:43	1		
9/20/2021	12:03	0		
9/22/2021	8:03	7		
9/30/2021	10:45	0		
10/5/2021	15:05	0		
10/15/2021	7:42	5		
10/27/2021	12:42	0		
11/9/2021	8:42	0		
11/15/2021	10:42	0		
11/23/2021	9:15	0		
11/29/2021	8:30	0		
11/30/2021	14:30	0		
12/13/2021	8:35	0		
1/5/2022	13:55	1		
3/22/2022	0:15	0		Two of them were on a boat
4/8/2022	14:15	0		
4/26/2022	9:15	0		None seen
5/13/2022	10:52	1		
5/20/2022	10:57	0		
6/3/2022	12:15	0		
6/9/2022	11:10	1		
6/14/2022	10:30	0		
7/1/2022	12:55	0		
7/15/2022	14:00	0		
7/18/2022	9:38	0		
7/25/2022	11:55	0		
8/15/2022	12:15	0		
9/15/2022	10:30	0		
9/21/2022	10:15	0		
9/26/2022	8:10	0		

NBVC Pile Driving Exercise Marine Species Monitoring Protocols (dated December 2020)
ALPHA Position

Points of Contact:

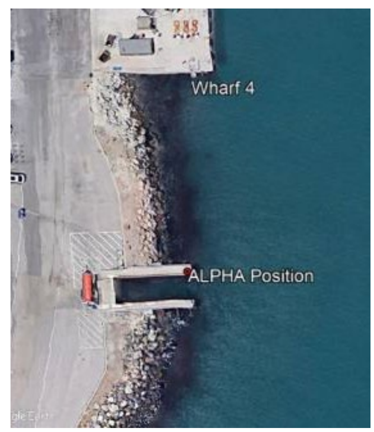
Role	Name	Contact Information	
Exercise OIC	LTJG Brenton Heisserer	228-364-3331 (C)	brenton.heisserer@navy.mil
NBVC Lead Biologist	Martin Ruane	805-861-3955 (C)	martin.ruane@navy.mil
Monitoring SME	Emily Robinson	401-575-8493 (C)	emily.r.robinson@navy.mil
Monitoring SME	Todd McConchie	703-577-9556 (C)	todd.c.mcconchie@navy.mil

Purpose: To prevent exposure of marine mammals to potentially harmful sound. Marine mammals are legally protected from harassment under the Marine Mammal Protection Act (MMPA), and implementation of these protocols is expected to ensure pile driving training exercises are compliant with the MMPA.

Equipment:

- Radio(s)
- Binoculars (7x50 preferred)
- Clipboard
- Pencil
- Activity Log (**Attachment A**)
- PPE (PFD, steel-toed boots, hard-hat, sunscreen, hearing protection, water)
- Detailed SOP (this document)

General Watchstander Protocols:



- The ALPHA position shall be located on the end of the boatlift to the west of the end of Wharf 4 (See figure to right).
- Pile Driving/Removal (PD/R) is restricted to daylight hours (conducted at least 30 minutes after sunrise and up to 30 minutes before sunset).
- Monitoring shall occur in all weather and until the PD/R crew has finished for the day.
- ALPHA Watchstander shall:
  - Monitor for animals anywhere that the Watchstander can see.
  - In Activity Log (**Attachment A**) log all:
    - Changes in type of activity;
    - PD/R shutdowns/delays; and
    - Animals seen entering the appropriate Shutdown Zone (**see Table 1 and figures below**).
- See **Attachment B** for a flow chart of monitoring protocols for shutdowns/delays and logging activity information.
- If monitoring stops for any reason, then a "pre-con" survey must be completed before PD/R can begin again.
- PD/R may be stopped when animals approach/enter specific areas, depending on the pile type/driving type. Stopping PD/R will be based on the number of previous shutdowns:
  - For the first two instances of animals entering the Shutdown Zone after PD/R has started, PD/R shall be halted for any animal in the Shutdown Zone (**See Table and Figures below**).
  - After first two PD/R stops:
    - Implement the Stop Work Zone (20 yds), but allow PD/R to continue if animal is outside of that zone (**See Table below**).
    - Note in the ALPHA activity log if an animal enters the larger Shutdown Zone.

Table 1: Shutdown and Stop Work Zones

Pile Description	Pile Driving Type	Shutdown Zone (yards)	Stop Work Zone (yards)	Number of Watchstanders
Steel Sheet	Vibratory Install/Removal	865***	20	2
Plastic Round	Impact Install	20	20	1
	Vibratory Install/Removal	865***	20	2
Timber	Impact Install	80	20	1
	Vibratory Install/Removal	330	20	2

***Shutdown distance is based on furthest distance to the other side of the Port

<u>Pre-construction ("pre-con") Surveys (30 minutes):</u>

- ALPHA shall check in with BRAVO to ensure they are at the correct position prior to starting "pre-con" survey.
- ALPHA shall log start and end times of "pre-con" survey in Activity Log, including any delays.
- ALPHA shall give PD/R crew a minimum time that they will be "*cleared*" to start PD/R (30 minutes after the "pre-con" survey begins).
- ALPHA/BRAVO shall monitor for at least 30 minutes before PD/R is scheduled to begin:
  - ALPHA shall log the start time of "pre-con" survey on the Activity Log (**Attachment A**).
  - Once the 30 minutes has elapsed, ALPHA shall alert the PD/R crew and BRAVO that they are "*cleared*" to start driving.
  - Keep observing when the 30-minute "pre-con" survey is completed, even if the PD/R crew is not ready to start PD/R. "Pre-con" survey may be longer than 30 minutes, depending on PD/R crew.
  - ALPHA shall log end time of "pre-con" survey (when PD/R begins).
- If marine mammal observed <u>prior to the start of PD/R</u>:
  - *<u>Outside</u>* <u>Shutdown Zone</u>:
    - Allow PD/R to start.
    - Continue to monitor the animal to see if it enters the applicable <u>Shutdown Zone</u>.
  - *<u>Inside</u>* <u>Shutdown Zone</u>:
    - <u>DO NOT</u> allow PD/R to start.
    - Alert PD/R crew as soon as animal enters into <u>Shutdown Zone</u> (see shutdown procedures below).
    - Allow PD/R to start ONLY after animal leaves the <u>Shutdown Zone</u>, and is heading away from, the area.
    - Log event as a "Delay" (DEL) in Activity Log. Include time that PD/R crew was alerted (start time), and time that PD/R crew notified that they can start (end time). Include brief description of what occurred.
    - Log animal information in the Activity Log (Start/end time in <u>Shutdown Zone</u>, species group, and basic description of what happened).
    - A delay during pre-con surveys <u>DOES NOT</u> count towards the shutdowns that occur during PD/R construction.
- Check with BRAVO that <u>Shutdown Zone</u> is "*all clear*" prior to allowing PD/R to start.

During Construction Surveys:

- For each monitoring day, the Shutdown Zones identified in Table 1 above shall be monitored based on type of PD/R.
- ALPHA shall log start and end times of a change in PD/R activity in Activity Log. Information logged includes (see Sample Activity Log in **Attachment A**):
  - Activity type;
  - Start/Stop of PD/R and shutdowns;
  - Pile Type; and
  - Species Group that caused shutdown (if applicable)
- After PD/R has started, if an animal approaches/enters the Shutdown Zone (see Table 1), PD/R shall be stopped until the Shutdown Zone is clear of animals. The same protocol shall be observed the second time animal(s) enter the Shutdown Zone.
- After two complete PD/R stoppages for animals in the Shutdown Zone (see Table 1):
  - PD/R shall only require shutdown/delay if an animal approaches/enters the smaller Stop Work Zone (20 yds).
  - ALPHA shall log when animals only when they enter the Shutdown Zone, but PD/R will not be stopped.
  - Information collected shall include time first observed in the Shutdown Zone, time animal leaves the Shutdown Zone, species group, and any notes on the observation (see Sample Activity Log in **Attachment A**).
- For all PD using an impact hammer, soft start procedures must be implemented. Soft start procedures include:
  - Three, three blow sets at lower energy setting;
  - Each three blow set shall be separated by at least 30 seconds;
  - If impact PD/R has stopped for greater than 30 minutes, then soft start procedure must be repeated.
- No soft start procedures are required for vibratory pile driving.

Pile Driving Shutdown/Delay Procedures

- Any Watchstander can initiate a shutdown/delay, but ALPHA position notifies PD/R crew.
- If BRAVO identifies animal as it approaches/enters shutdown area, BRAVO shall contact ALPHA via radio and initiate work stoppage by calling out "***ALL STOP, ALL STOP, ALL STOP***" on the radio. If BRAVO does not receive a confirmation within a few seconds, they will call out on the radio again.
- If animal observed moving away from shutdown areas, PD/R may be re-started by ALPHA.
- If PD/R is stopped due to animal, and animal is not observed leaving shutdown area, ALPHA must wait 15 minutes from time that animal was last observed (not the initial observation time) before re-starting PD/R. Alert BRAVO to keep watch as well.
- If Watchstander had to leave their primary location to track the animal, they should return to primary monitoring location prior to re-starting PD/R.

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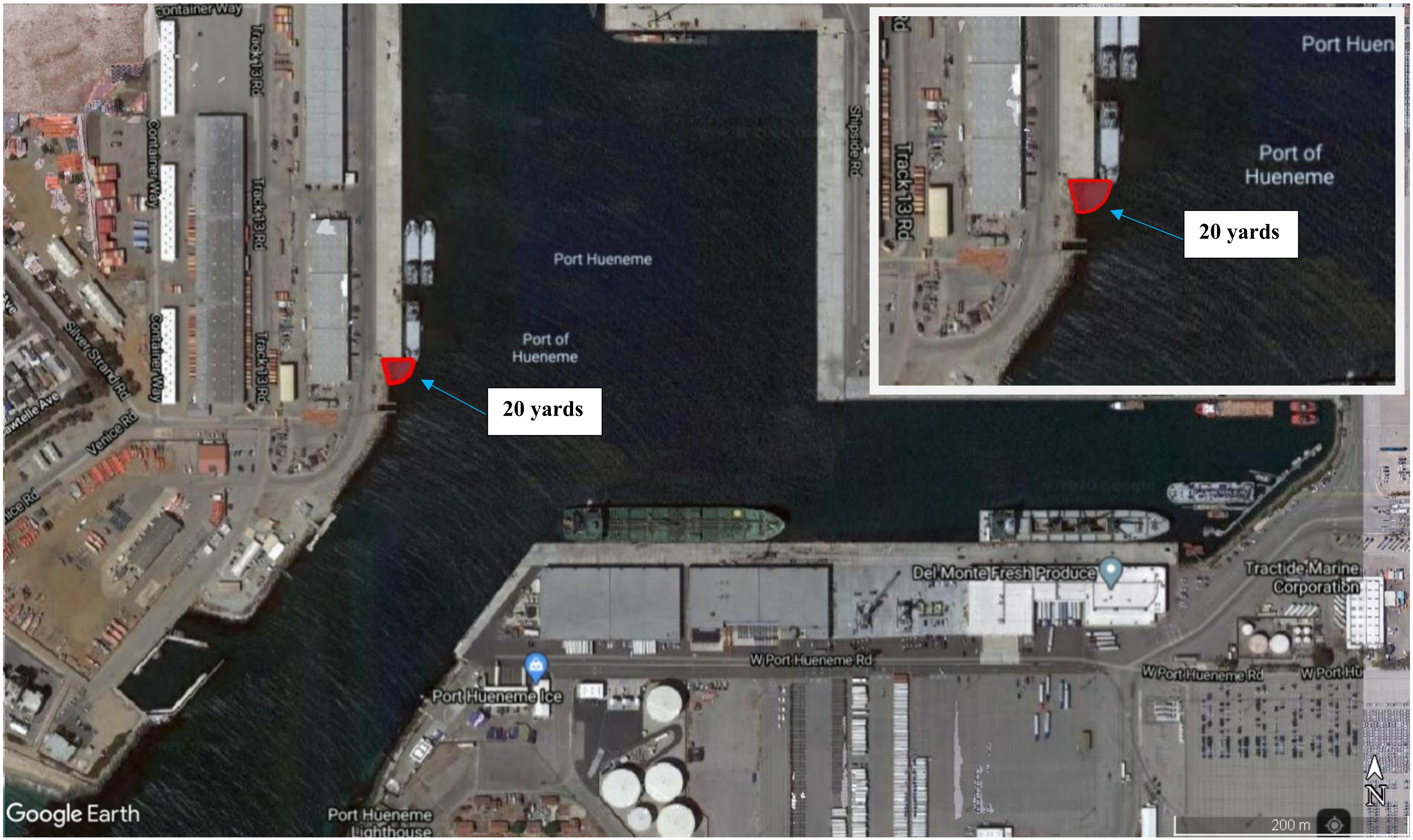
Material: All

Type: All

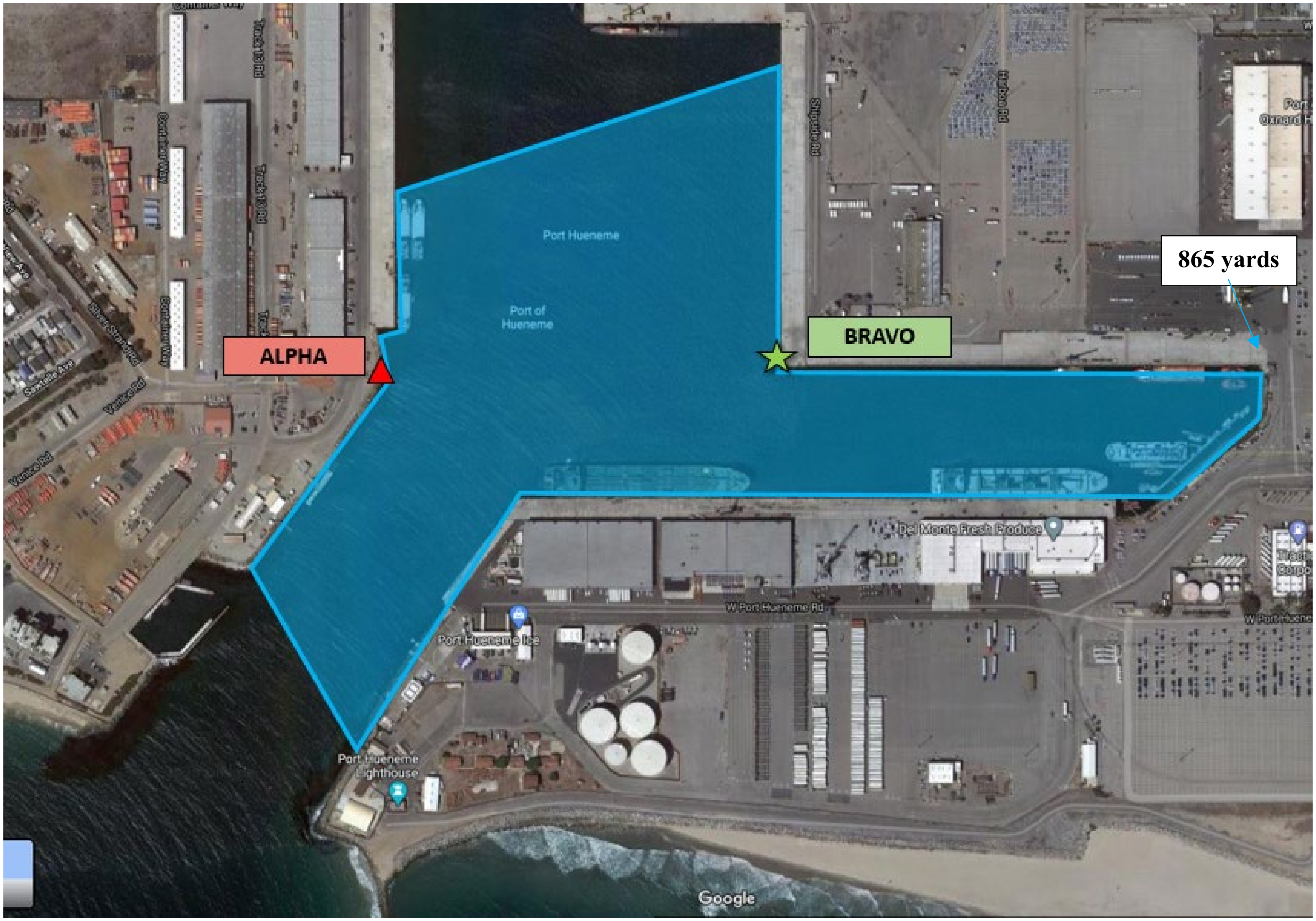
Stop Work Zone: 20 yards



Material: Sheet Pile

Type: Vibratory Install and Removal

Shutdown Distance: 865 yards



Sheet Pile (Vibratory Install and Removal) - ALPHA Monitoring Area

Material: Plastic Pile

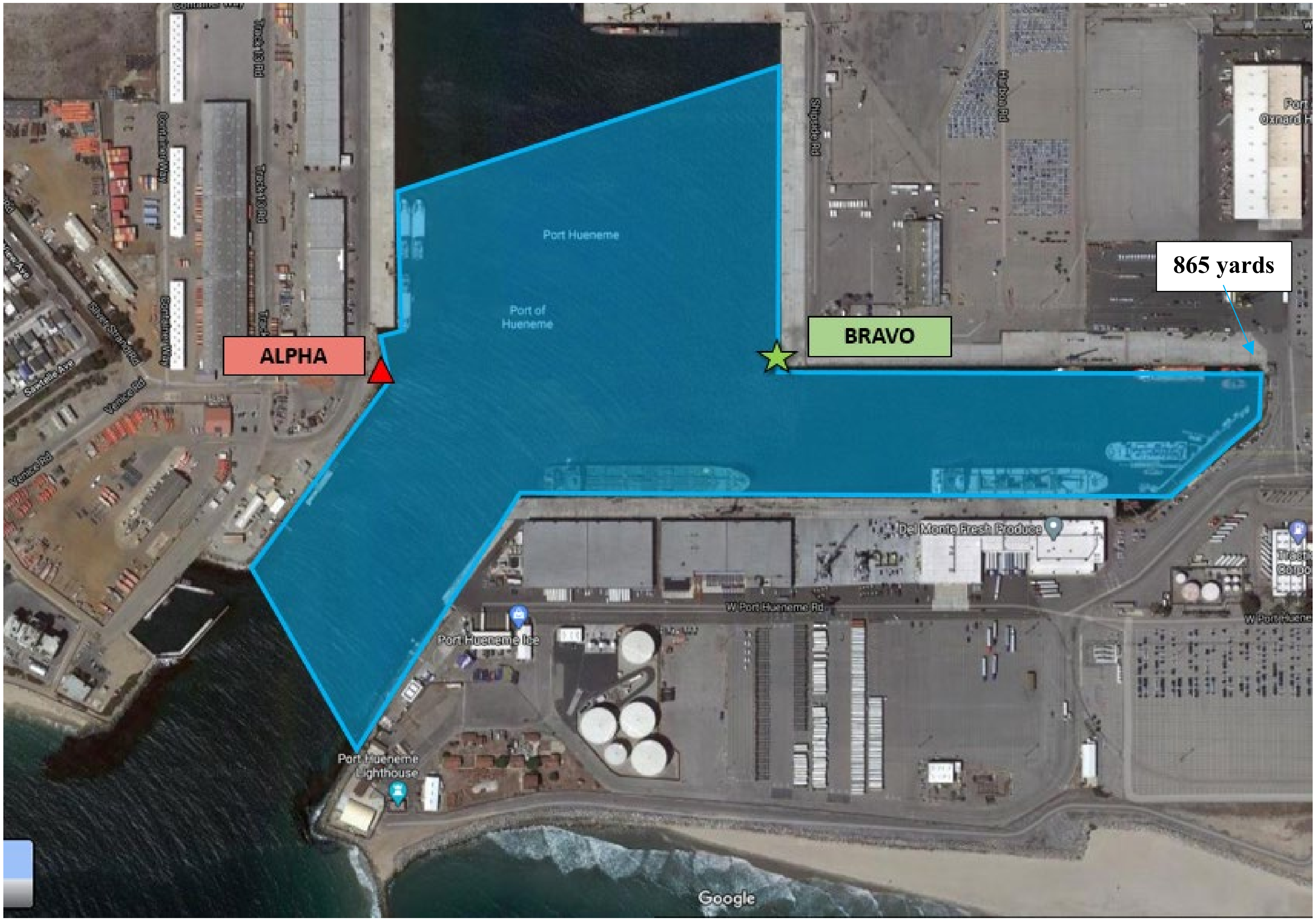
Type: Impact Install

Shutdown Distance: 20 yards

Material: Plastic Pile

Type: Vibratory Install & Removal

Shutdown Distance: 865 yards



Plastic Pile (Vibratory Install and Removal) –ALPHA Monitoring Area

Material: Timber Pile

Type: Impact Install

Shutdown Distance: 80 yards

Material: Timber Pile

Type: Vibratory Install & Removal

Shutdown Distance: 330 yards

Timber Pile (Vibratory Install & Removal) – ALPHA Monitoring Area

NBVC Pile Driving Exercise Marine Species Monitoring Protocols (dated December 2020)
Attachment A (Activity Log)
Activity Log

Date: ____________ Daily Start Time: ________________ Daily End Time: ________________

Watchstander(s): ALPHA: ________________ BRAVO: ________________

	Activity	Start Time (hh:mm:ss)	End Time (hh:mm:ss)	Pile Type	Shutdown Species	Notes	Activity Codes	
1							Pre	Pre-con Monitoring
2							IPD	Impact
3							VPD	Vibratory
4							SD	Shutdown
5							DEL	Delay
6							OTH	Other/Animal in Zone
7							**Pile Type Codes**	
8							PL	Plastic
9							TI	Timber
10							SH	Sheet
11							**Shutdown Species Codes**	
12							SEA	Seal/Sea Lion
13							DOL	Dolphin
14							LWH	Large Whale
15							TUR	Turtle
16							MSP	Multiple Species
17							OTH	Other Species
18							**Shutdown Areas**	
19							***Sheet Piles***	
20							VIB: 865 yds	
21							***Plastic Round Piles***	
22							IMP: 20 yds	
23							VIB: 865 yds	
24							***Timber Piles***	
25							IMP: 80 yds	
26							VIB: 330 yds	

NBVC Pile Driving Exercise Marine Species Monitoring Protocols (dated December 2020)

Attachment A (Activity Log)

SAMPLE Activity Log (ALPHA)

Date: 10/18/2020 Daily Start Time: 0815 Daily End Time: 1400

Watchstander(s): ALPHA: SW2 Jones BRAVO: BUCN Smith

	Activity	Start Time (hh:mm:ss)	End Time (hh:mm:ss)	Pile Type	Shutdown Species	Notes
1	Pre	0830	0915			
2	DEL	0900	0915		SEA	Entered from channel. Went inside Port and outside of shutdown area. Started PD after entered port. Tracked by BRAVO
3	VPD	0915	0922	SH		
4	SD	0922	0930		SEA	BRAVO called SD. Same SEA as DEL at 0900 caused SD. Left shutdown area via channel
5	VPD	0930	0945	SH		
6	SD	0945	0955		SEA	From channel. Left shutdown area into Port
7	VPD	0955	1130	SH		Pile completed @ 1130
8	OTH	0956	1000		SEA	Possibly same as SEA at 0945 that caused SD
9	OTH	1005	1017		SEA	From channel, then back into channel
10	OTH	1018	1025		SEA	From channel. Left shutdown area into Port. Tracked by BRAVI
11						Lunch 1130-1215
12	Pre	1215	1245			
13	VPD	1245	1400	SH		Done for day due to mechanical issue.
14	OTH	1300	1330		DOL	Entered from channel then left via channel
15	OTH	1315	1317		SEA	
16	OTH	1325	1345		SEA	Several SEA swimming in area.
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						

Activity Codes	
Pre	Pre-con Monitoring
IPD	Impact
VPD	Vibratory
SD	Shutdown
DEL	Delay
OTH	Other/Animal in Zone
Pile Type Codes	
PL	Plastic
TI	Timber
SH	Sheet
Shutdown Species Codes	
SEA	Seal/Sea Lion
DOL	Dolphin
LWH	Large Whale
TUR	Turtle
MSP	Multiple Species
OTH	Other Species
Shutdown Zones	
Sheet Piles	
	VIB: 865 yds
Plastic Round Piles	
	IMP: 20 yds
	VIB: 865 yds
Timber Piles	
	IMP: 80 yds
	VIB: 330 yds

NBVC Pile Driving Exercise Marine Species Monitoring Protocols (dated December 2020)
Attachment B - Flowchart of Monitoring Protocols (ALPHA)