INCIDENTAL HARASSMENT AUTHORIZATION APPLICATION FOR THE NAVY'S FUEL PIER REPLACEMENT PROJECT AT NAVAL BASE POINT LOMA, YEAR 5

OCTOBER 8, 2017 THROUGH OCTOBER 7, 2018

Submitted to:

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

Prepared by:

Naval Facilities Engineering Command

For:

Naval Base Point Loma

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ACRONYMS AND ABBREVIATIONS

ac	acre(s)
° C	Celsius
CALTRANS	California Department of Transportation
CFR	Code of Federal Regulations
CISS	cast-in-place steel shell
CSLC	California State Lands Commission
CV	Coefficient of Variation
cy	cubic yards
dB	Decibel
dBA	Decibel with A-weighting filter
DFSP	Defense Fuel Support Point
DFM	diesel fuel marine
DHS	Department of Homeland Security
DoD	Department of Defense
Navy	Department of the Navy
ESA	Endangered Species Act
ESTCP	Environmental Security Technology Certification Program
°F	Fahrenheit
FOR	Fuel Oil Reclamation
ft.	Feet
Hz	Hertz
IHA	Incidental Harassment Authorization
in	inch (es)
IPP	Indicator Pile Program
kHz	Kilohertz
km	Kilometer
LMR	Living Marine Resources
lf	linear ft
lbs	pounds
m	meter
pmin	minute(s)
MHHW	mean higher high water
MLLW	mean lower low water
MOTEMS	Marine Oil Terminal Engineering and Maintenance Standards
MMO	Marine Mammal Observer
MMP	Marine Mammal Program
MMPA	Marine Mammal Protection Act
NAS	Naval Air Station
NAVFAC	Naval Facilities Engineering Command (SW = Southwest)
Navy	U.S. Department of the Navy
NBPL	Naval Base Point Loma
NEPA	National Environmental Policy Act
NMAWC	Naval Mine and Anti-Submarine Warfare Command
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration

NRC	National Research Council
NRSW	Navy Region Southwest
NMSDD	Navy Marine Species Density Database
ONR	Office of Naval Research
Pa	Pascal
PC	precast
POSD	Port of San Diego
PTS	Permanent Threshold Shift
R&D	Research and Development
rms	root mean square
SCB	Southern California Bight
SEL	Sound Exposure Level
SERDP	Strategic Environmental Research and Development Program
sf	square ft
SPAWAR	Space and Naval Warfare Systems Command
SPL	Sound Pressure Level
SSC	SPAWAR Systems Center
TDI	Tierra Data, Inc.
TL	Transmission Loss
TS	Threshold Shift
TTS	Temporary Threshold Shift
µPa	microPascal
UFC	Unified Facilities Criteria
U.S.	United States
USACE	U.S. Army Corp of Engineers
USCG	U.S. Coast Guard
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
WSDOT	Washington State Department of Transportation
ZOI	Zone of Influence

EXECUTIVE SUMMARY

In accordance with the Marine Mammal Protection Act (MMPA) of 1972, as amended, the U.S. Navy (Navy) is applying for an Incidental Harassment Authorization (IHA) for the fifth year of activities (October 8, 2017 through October 7, 2018) associated with the Fuel Pier Replacement Project in the northern part of San Diego Bay at Naval Base Point Loma (NBPL) (MILCON P-151). For this IHA application, the Navy determined that noise from pile driving, pile extraction and demolition has the potential to rise to the level of harassment under the MMPA.

Nine species of marine mammals have a reasonable likelihood of occurrence during the project's timeline, and could thereby be exposed to sound pressure levels (SPLs) associated with vibratory and impulsive pile driving and the removal of existing pier pilings: the California sea lion (*Zalophus californianus*), harbor seal (*Phoca vitulina*), northern elephant seal (*Mirounga angustirostris*), the coastal bottlenose dolphin (*Tursiops truncatus*), the short-beaked and long-beaked common dolphins (*Delphinus delphis* and *D. capensis*, respectively), the Pacific white-sided dolphin (*Lagenorhynchus obliquidens*), Risso's dolphin (*Grampus griseus*), and gray whale (*Eschrichtius robustus*).

The Fuel Pier Replacement Project is needed to ensure the continuation of fueling operations at the pier, which is the primary source of fuel for Navy vessels in southern California. This project replaces the aging and seismically deficient Fuel Pier (Pier 180) located at NBPL. The new pier project will, to the extent practicable, meet current California State Lands Commission - Marine Oil Terminal Engineering and Maintenance Standards (MOTEMS). An environmentally safe and improved fuel receipt and delivery capability at the Defense Fuel Support Point (DFSP), Fleet and Industrial Supply Center (FISC), San Diego will be provided. The Fuel Pier NBPL is an extremely valuable asset to the U.S. Navy as it is the only active fueling facility in the vicinity.

The Approach and North Segment of the pier were constructed in 1908. The South Segment and Quaywall were built in 1942. The average service life of concrete and steel structures in a marine environment is on the order of 50 years. The facility has outlived its anticipated useful service life, and is having difficulty in meeting its core requirements of fueling and de-fueling Fleet assets. Currently, the facility can only de-fuel barges and tankers and is turning away Navy assets. Navy ships are being forced to use other port operation facilities including commercial shipyards.

The Fuel Pier Replacement Project (Navy 2013b) is phased to occur over five years and includes the demolition and removal of the existing T-shaped pier and associated pipelines and appurtenances, and replacement with a generally similar structure but which meets state standards for seismic strength, and is designed to better accommodate modern Navy ships. Existing wood and concrete piles will be extracted using a variety of methods (e.g., vibratory hammer, concrete clipper, diamond wire saw, water jet, dead-pull). During the period covered by this final IHA application, the project includes finishing all the demolition at the Fuel Pier, including removal of 180 square precast (PC) concrete and poly-concrete piles of varying sizes up to 24-in using a hydraulic pile cutter; cutting 30 66-in and 5 84-in concrete-filled steel caissons with a diamond wire saw; and removing 12 30-in steel piles by cutting with a plasma torch. Only the hydraulic pile cutting and diamond saw cutting of caissons reach acoustic thresholds regulated under the MMPA.

The Fuel Pier Replacement Project also includes the relocation of the Navy Marine Mammal Program (MMP) from a temporary location at the Naval Mine and Anti-Submarine Warfare Command (NMAWC) back to its home adjacent to the Project area. Twenty-three 16-in diameter pre-cast (PC) concrete guide piles would be driven (by vibratory and/or impact hammer) at

NMAWC to restore gangway access to the recreational marina. Sixty-four 16-in diameter round PC concrete guide piles will be removed at NMAWC by jetting followed by dry-pulling; jetting and dry pulling do not reach the acoustic thresholds regulated under the MMPA.

The Navy's first IHA (Navy 2013a) for the project covered the pile driving associated with temporary relocation of the MMP and the Indicator Pile Program (IPP). The second IHA included the completion of the pile driving for the IPP, and installation of steel structural piles for the new fuel pier decking. The third IHA involved driving a portion of the new fuel pier fender pile system. The fourth IHA (currently in progress) includes pile driving of fender piles and structural piles for the mooring dolphins for the new fuel pier, including two IPP piles, demolition of the old fuel pier, and pile driving and extraction at NMAWC. This IHA application is based on the updated project design and schedule and is intended to cover pile driving/extraction activities from October 8, 2017 through October 7, 2018. Pile driving and/or pile removal are estimated to occur on a maximum of 196 in-water work days within the period of this IHA.

In this IHA application, the Navy has used National Marine Fisheries Service (NMFS) promulgated thresholds for assessing pile driving impacts (NMFS 2005, NMFS 2009, 2016a-b), as outlined in Section 6. Empirically measured source levels from similar pile driving and demolition events as monitored during the previous IHA periods are used to estimate sound source levels for activities proposed to occur during the fifth IHA period. For these activities, the distance to each relevant zone of influence (ZOI) for potential marine mammal takes has been estimated from either *in situ* data collected during the previous monitoring of similar activities, or from the application of a practical spreading loss model.

During the first IHA period, the Indicator Pile Program (IPP) was performed using 30- and 36-in piles driven in both shallow water (less than 4.7 m [15.4 ft] mean lower low water [MLLW]) and deep (12 to 17 m [39 to 56 ft] MLLW). *In situ* acoustic data were collected during that time to validate a transmission loss model developed by the Navy and researchers from the University of Washington. As a result of the IPP field data, the transmission loss distance to ZOI thresholds was reduced relative to the predictions of the first IHA application. During the second IHA period, the IPP was continued and in-situ acoustic data was collected for 30-in and 36-in piles in depths greater than 6 m (20 ft) MLLW. Acoustic data was also collected for in-water demolition that included hydraulic pile cutters and diamond saws for caissons. For the third IHA, acoustic data were acquired for 24-in x 30-in concrete fender piles and 16-in diameter concrete filled fiberglass fender piles. During the fourth IHA further data was collected on pile clipping and caisson cutting to refine distances to the regulatory thresholds. The data from the IPP and the Navy's and the three subsequent IHAs along with fulfillment of other monitoring requirements during the previous IHAs were provided in monitoring reports (NAVFAC SW 2014, 2015, 2016a-b). The monitoring report from the fourth IHA (NAVFAC SW 2017) has been submitted and is under review by NOAA at this time.

Since data from marine mammal surveys conducted offshore Southern California are not representative of the abundance of the species that occur in the project area, marine mammal abundances have been estimated from a large number of site-specific marine mammal surveys conducted by the Navy. Whereas the first IHA application relied on surveys conducted from 2007-2012, continuing surveys by the Navy have indicated an increasing abundance of all species in more recent surveys. In the second IHA application, the Navy used data from 24 surveys of the project area that were conducted between September 2012 and April 2014 to provide an updated estimate for marine mammal abundances. Marine mammal abundances were low, relative to the second IHA period, during the third and fourth IHA periods, coincident with very warm El Niño conditions, and monitoring was limited to 51 and 81 days during the IHA #3 and IHA #4 monitoring time periods, respectively (NAVFAC SW 2016a-b, 2017). With the return of cooler La Niña conditions now occurring, abundances are anticipated to return to near previous levels, and for this application, the Navy is relying primarily on the robust data set from the second IHA period as the best available information on marine mammal densities in the affected part of northern San Diego Bay. For species that have been rarely or not observed in San Diego Bay, regional density estimates for southern California waters are used (Navy 2017).

California sea lions are by far the dominant marine mammal in the project area with the bulk of the population traditionally hauled out on or swimming next to the Bait Barge located near the entrance of San Diego Bay. When the Bait Barge was temporarily relocated in April-May of 2014 for the IPP, the sea lions were anticipated to relocate with the Bait Barge. However, the animals remained in the same area of northern San Diego Bay utilizing Navy dock and pier structures located in the project area as haulouts. California sea lions likely displayed preference for the project area because of its proximity to their forage areas and utilized the closest haulout structures available. The Bait Barge has subsequently been returned to the same location, and California sea lions have resumed primarily using the two barges as haulout locations. The Bait Barge is now expected to remain in its current traditional location for the foreseeable future, including the period of this IHA.

Potential exposures are calculated in Section 6. Most of the activities to occur in Year 5 pose little to no risk of injury (Level A harassment). NMFS new Technical Guidance has been followed to calculate the limits of potential Level A harassment due to cumulative underwater sound exposure from each activity (NMFS 2016a-b). The Navy monitoring team's experience with the project area and proven effectiveness under previous IHAs will ensure that work does not continue while an animal is within the Level A ("shutdown") ZOI of any activity. As a result, Level A takes are not anticipated and they are not included in this request. The modeling predicts a combined total of 11,012 non-injurious Level B behavioral harassments to California sea lions, harbor seals, northern elephant seals, coastal bottlenose dolphins, common dolphins (long-beaked and short-beaked common dolphins combined), Pacific white-sided dolphins, Risso's dolphins, and gray whales, and as shown in Table ES-1. Harassments are predominantly due to vibratory and/or impact driving of 16-inch concrete piles and non-impulsive extraction and removal of steel and concrete piles using a variety of techniques. No takes due to airborne sound alone are anticipated, but it is estimated that a small number of the estimated takes of California sea lions and Pacific harbor seals will include animals harassed by airborne as well as underwater sound.

To avoid impacts to California least tern (CLT) foraging habitat and per the Navy/Fish and Wildlife Service (FWS) Memorandum of Understanding (MOU) (NAVFAC SW 2004), the Navy will restrict construction activities that could interfere with CLT foraging during the nesting period (1 April to 15 September). Due to unforeseen delays during the first year of the project, the Navy consulted with the FWS under the Endangered Species Act (ESA) to allow for in-water construction into the beginning of CLT nesting season. The result of the consultation allowed for the project to conduct in-water construction up to and not to exceed 30 April each year when it is unavoidable due to the critical path of the project. If the Navy determines that the impacts to the construction schedule are unavoidable, then per the Navy's consultation with USFWS, the in-water construction window can be extended to 30 April.

Table ES-1. Number of Takes Requested per Species (Level B Harassments)

Species	***Number of Level B Takes Requested[1]***
California sea lion	8,971
Harbor seal	281
Northern elephant seal	43
Coastal bottlenose dolphin	704
Common dolphins[2]	861
Pacific white-sided dolphin	28
Risso's dolphin	114
Gray whale	10
Total	***11,012***

Notes[1]. Based on a total of 25 days of pile driving and 171 days of demolition. [2] Includes short-beaked and long-beaked common dolphins.

The proposed action will include specific acoustic monitoring of pile driving and extraction activities not previously validated by repetitive field measurements and analysis, as well as continued observational monitoring of marine mammal occurrences within established ZOIs. This information will be used to validate and refine the take estimates for subsequent IHA applications.

Pursuant to the MMPA Section 101(a)(5)(D)[1], the Navy submits this application to the NMFS for an IHA for the incidental, but not intentional, taking of nine marine mammal species during pile driving and extraction activities as part of the Fuel Pier Replacement Project, for the 1-year period from October 8, 2017 to October 7, 2018. The anticipated take of the species presented in Table ES-1 would be in the form of non-lethal, temporary harassment and is expected to have a negligible impact on these species. In addition, the taking would not have an unmitigable adverse impact on the availability of these species for subsistence use.

Regulations governing the issuance of incidental take under certain circumstances are codified at 50 Code of Federal Regulations (CFR) Part 216, Subpart I (Sections 216.101 – 216.108). Section 216.104 sets out 14 specific items that must be addressed in requests for take pursuant to Section 101 (a) (5) (D) of the MMPA. These 14 items are addressed in Sections 1 through 14 of this IHA application.

[1] 16 U.S.C. § 1371(a)(5); 50 CFR Part 216, Subpart I.

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

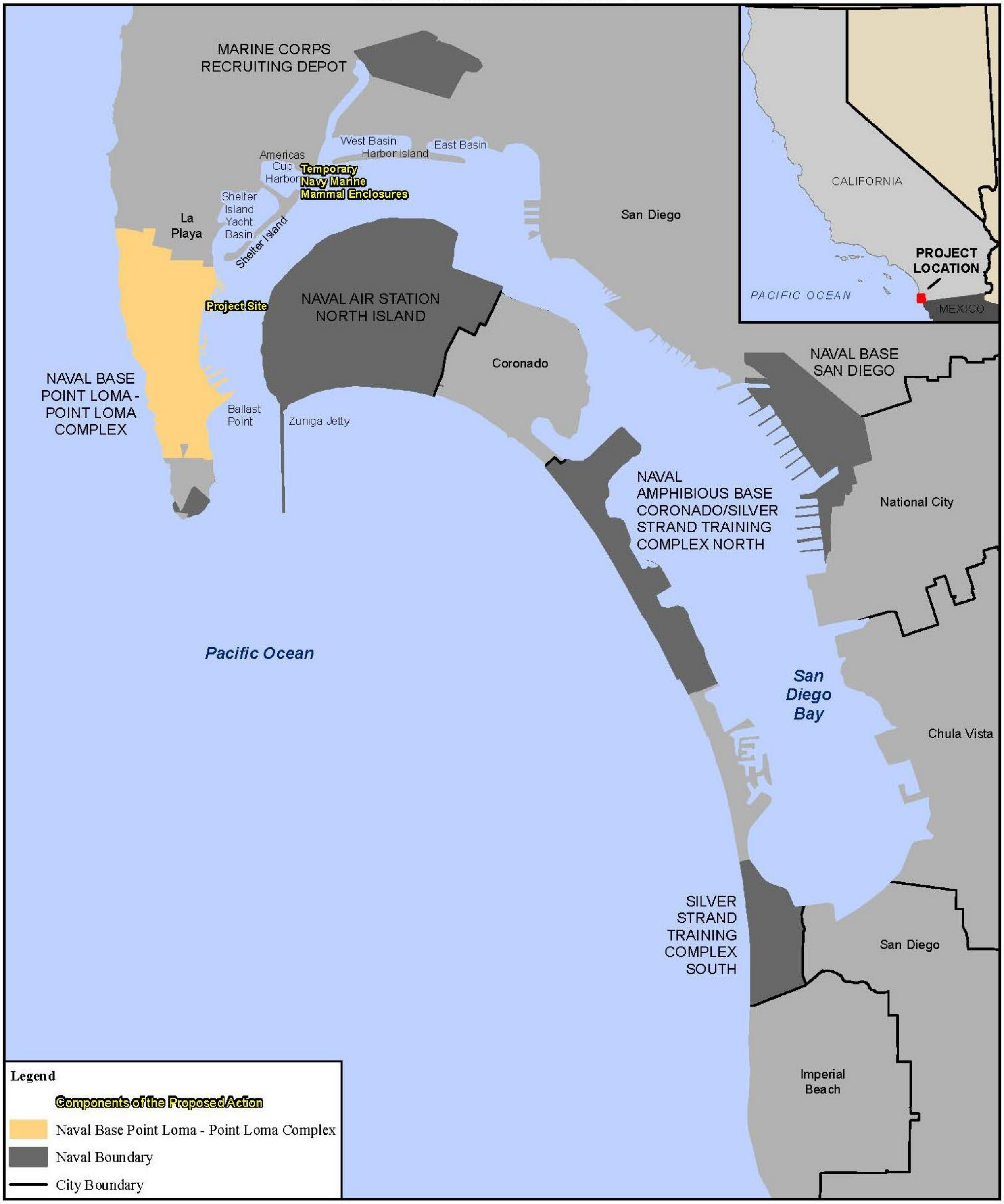
This IHA application covers the fifth year of activities (October 8, 2017, through October 7, 2018) associated with the Fuel Pier Replacement Project at Naval Base Point Loma (NBPL), California. In-water pile driving will be restricted to October 8, 2017 to April 30, 2018 and September 16, 2018 to October 7, 2018, per the Navy/USFWS MOU and the subsequent Informal Consultation. Other demolition activities are proposed to occur as necessary at any time during the 365-day IHA period, with an estimated maximum of 196 days of pile driving and in-water demolition during this period. This section of the application describes the Fuel Pier Replacement Project, referred to as the proposed action, in its entirety to provide context for understanding the fifth year's activities.

1.2 Proposed Action

1.2.1 Background

NBPL is located on the peninsula of Point Loma near the mouth and along the northern edge of San Diego Bay (Figure 1-1). NBPL provides berthing and support services to United States (U.S.) Department of the Navy (Navy) submarines and other fleet assets. The entirety of NBPL is restricted from general public access, although the adjacent waters of San Diego Bay are heavily used by the public as well as the Navy. The Proposed Action (Figure 1-2) involves demolition of the aging and seismically deficient fuel pier (Pier 180) at NBPL; construction of a new enhanced fuel pier with optimum capability to support current and projected fueling needs of the Navy and Department of Homeland Security (DHS); performance of associated dredging, and the beneficial reuse of dredged sediments; the temporary relocation of the Navy's Marine Mammal Program, which is administered by the Space and Naval Warfare Systems Command (SPAWAR) Systems Center (SSC), to avoid potential effects of construction noise on SSC's working mammals; and the temporary relocation of a commercial Bait Barge, which occurred during 2014 as described in the first IHA application and monitoring report (NAVFAC SW 2014) but will not be repeated. Sections 1.2 and 1.3 describe the proposed activities to be conducted during this fifth (final) IHA period in detail. The proposed activities with the potential to affect marine mammals within the waterways adjacent to NBPL that could result in harassment under the Marine Mammal Protection Act (MMPA) of 1972, as amended in 1994, are pile installation by impact and vibratory pile drivers, and pile removal by vibratory hammer or cutting. Whereas this section provides an overview of the entire project, Section 2 provides more specific details on activities proposed to occur during the period of this IHA.

The existing fuel pier (Figure 1-3) serves as a fuel depot for loading and unloading tankers, U.S. Navy underway replenishment vessels that refuel ships at sea ("oilers") fueling Navy, DHS, Department of Defense (DoD), and foreign Navy vessels, as well as transferring fuel to the local replenishment vessels and other small craft operating in San Diego Bay. The fuel pier at NBPL Defense Fuel Support Point (DFSP) is critical to the mission of the Navy and is the only active Navy fueling facility in southern California. More than 42 million gallons of fuel are stored at NBPL DFSP and more than 11 million gallons of fuel are issued and received every month to an



0 0.5 1 2 Kilometers
0 0.5 1 2 Miles

Figure 1-1
Regional Location - Pier 180 Replacement
Naval Base Point Loma - Point Loma Complex

N

Source: Navy, NAVFAC Southwest, and Port of San Diego 2010

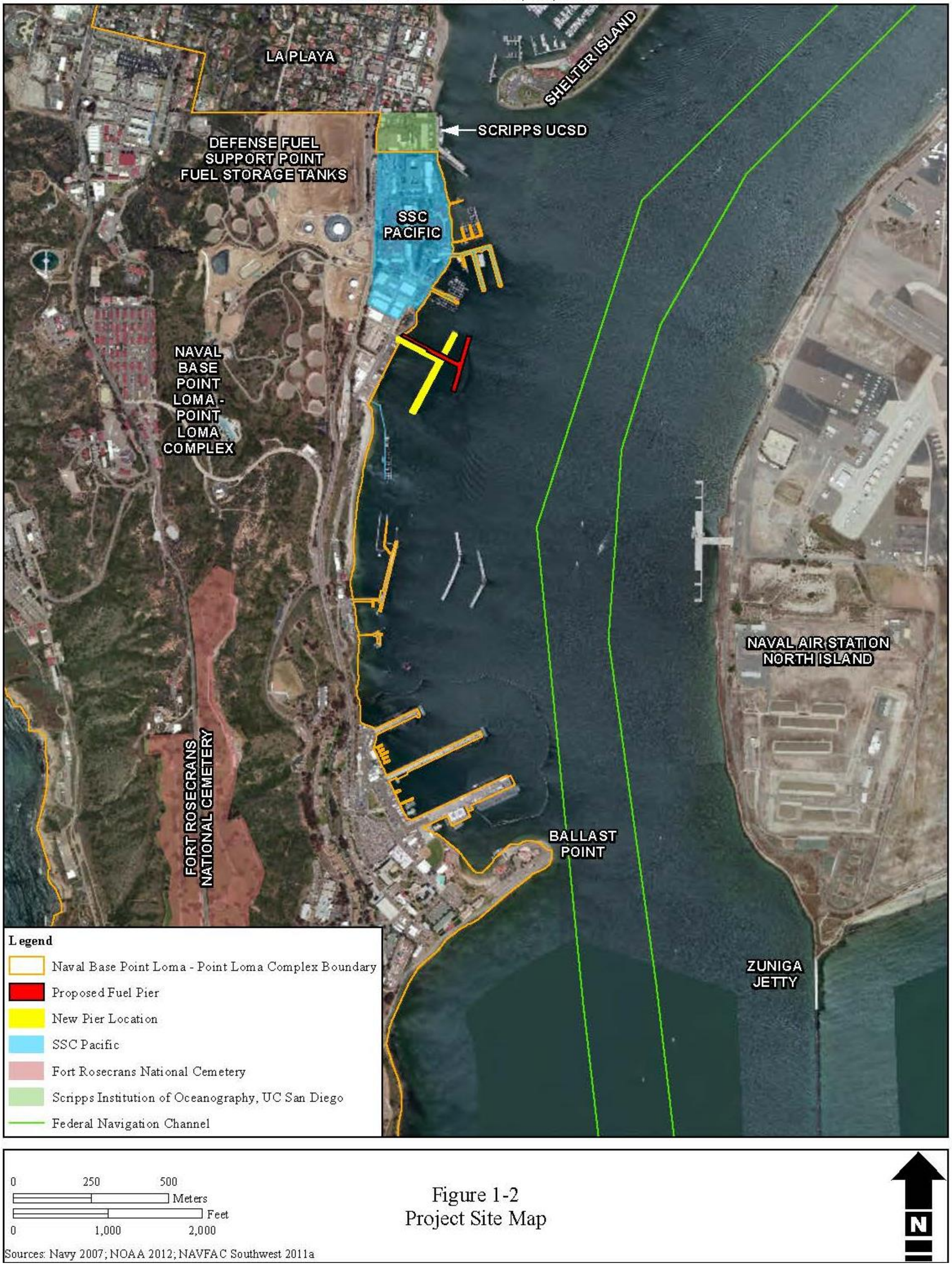


Figure 1-2
Project Site Map

Sources: Navy 2007; NOAA 2012; NAVFAC Southwest 2011a

a) Aerial View of Existing Fuel Pier 180

b) View of Existing Fuel Pier 180 to the Northeast

Figure 1-3 Views of Existing Fuel Pier 180

average of 43 ships including the Military Sealift Command, Expeditionary Warfare Training Groups, three carrier strike groups, National Oceanic and Atmospheric Administration (NOAA), DHS, foreign and small craft. The approach (portion that connects to shore) and north segments are over 100 years old (constructed in 1908 as La Playa Coaling Wharf). The south segment was constructed in 1942. The average design service life of this kind of structure in a marine environment is typically considered to be about 50 years (Navy 2010a). The pier, as such, is significantly past its design service life. Further, the pier does not meet current California State Lands Commission (CSLC) - Marine Oil Terminal Engineering and Maintenance Standards (MOTEMS) Level 1 (operational) and Level 2 (survival) seismic criteria (Navy 2010a, b).

Because of the structural deficiencies, significant damage in a moderate earthquake is considered likely, with potential failure of the pile foundations occurring in a major seismic event. The existing fuel pier is not consistent with the modern standards set out in the MOTEMS regulations which the Navy looks to for guidelines, although the MOTEMS are not literally applicable to or enforceable against the Navy. The poor condition of the existing fuel pier has been noted in the Navy Region Southwest (NRSW), Port Operations Shore Infrastructure Plan, dated April 2009 (Navy 2010a).

Per the Defense Readiness Reporting System an overall rating of "F4" has been assigned to the existing fuel pier facility. This translates into: "Facility has deficiencies that prohibit or severely restrict use of its designated functions." The Port Operations Shore Infrastructure Plan has listed P-151 "Replace Pier 180" as a planned project affecting Port Operations for NRSW. Additionally, the existing fuel pier is situated in waters where the natural bottom depth is 30 to 40 feet (ft) thus requiring maintenance dredging because San Diego Bay has an open hydrologic circulation system that causes infill around piers and infrastructure. Dredging occurred most recently in 1999 to keep the pier accessible for larger vessels.

To support the fueling needs of the Navy and DHS, the NBPL DFSP must be able to provide adequate services, i.e., receive and issue fuel, to multiple ships at a time. To meet this requirement, ships and barges are received on both the inboard and outboard sides of the existing pier. The inboard south side of the pier is primarily used for fuel issues to small cutters, mine sweepers, and barges. The inboard north side is used for fueling small craft. The outboard side of the pier is currently used to issue and receive fuel from large ships, i.e., tankers, oilers, transport ships, dock landing ships, ocean going barges, and various other Navy and DHS vessels. When included with scheduling requirements, the demand of the existing pier has exceeded the facility capacity. In addition, the existing fuel pier has reached a maximum capacity for the deeper outer berth, resulting in the need to turn vessels away due to lack of available docking and mooring space.

It is anticipated future classes of ships would generally be more multi-purpose, require more frequent fueling, and further increase the fuel capacity loading requirement for the new replacement fuel pier (Navy 2010a). The existing fuel pier lacks deep water berthing capability and is therefore limited in the range of vessels that can be accommodated (Navy 2010a).

1.3 Description of Pile Installation and Other Construction Activities for this IHA Period

Table 1-1 below summarizes the work that will be done during the IHA #5 period. More detail is provided below. The total remaining demolition/construction is estimated to be approximately 12 months from the issuance of this IHA on 8 October 2017. This is the final IHA application, to cover the fifth year period of in-water demolition/construction, as required to complete the project.

Table 1-1. Summary of Construction During IHA # 5 Period

1	Demolish remaining decking, caissons and fender piles from south segment of the existing fuel pier.
2	Demolish temporary south dolphin, deck and piles at fuel pier construction site.
3	Extract and drive piles at NMAWC to return pile and gangway configuration back to sailing marina.
4	Return Navy SSC Mammals from NMAWC.

In addition to demolition and construction, which are described in more detail below, the Proposed Action during the period of this IHA will include the following key elements.

- ***Regulated Navigation Zones***. Amendments to the existing navigation zones are needed because the replacement pier will not fit with the existing boundaries of the U.S. Army Corps of Engineers (USACE) Restricted Area and the U.S. Coast Guard (USCG) Security Zone.
- ***Notice to Mariners.*** To ensure safety of all vessels using the San Diego Bay, the Navy will issue a Notice to Mariners when in-water components of this project are occurring, including relocation of the marine mammal enclosures.
- ***Construction Monitoring.*** Sound propagation data will be collected through hydroacoustic monitoring during pile installation and removal. The presence of marine mammals will also be visually monitored during pile installation and removal. The results from acoustic and marine mammal monitoring during each IHA period are reported to NMFS and used by the Navy to validate or revise estimated zones of influence and acoustic effects on marine mammals.

1.3.1 Demolition and Removal of the Existing Fuel Pier

The remainder of the Project's demolition will occur during this IHA #5 period. The old fuel pier has been fully decommissioned and the new pier is now operational, so the remaining utilities, systems and pier features will be demolished.

More detail is provided below only on those aspects of the project involving in-water activity or otherwise might have the potential to result in takings of marine mammals for this IHA period. Other aspects of the project are considered in more detail in the Navy's Environmental Assessment (Navy 2013b). It should be noted that the fuel storage tanks, pipelines, and supporting infrastructure have already been replaced under the P-401 construction project (Navy 2010a).

In addition to fueling vessels, NBPL DFSP supplies JP-5 (jet fuel) to Naval Air Station (NAS) North Island across San Diego Bay to the east via two underwater pipelines (Naval Facilities Engineering Command [NAVFAC] 2009). The NAS North Island pipelines are not included in either the fuel pier or fuel storage facility replacement projects (Navy 2007, 2010a). However the NAS North Island pipelines are in the fuel pier replacement project area, both onshore and offshore. The Navy has worked with contractors to establish a safety buffer zone between the pipelines and the demolition and construction work zone footprint, ensuring that all contractors' equipment and vessels remain outside the buffer zone during demolition and construction.

The majority of the work will be conducted over water and will include removal of the pier, pilings, plastic camels and fenders. All utility infrastructure will be removed, including water and sewer pipelines, lighting systems, and wiring. The fueling systems, including piping and pipe supports will also be removed. Facility information for the existing fuel pier is included in Table 1-2.

Table 1-2. Existing Fuel Pier (Pier 180) Information

Existing Pier 180	***Pier Specifications***
Installation	Naval Base Point Loma (NBPL), San Diego, California
Activity	Defense Fuel Supply Point (DFSP)
Facility Name	Fuel Pier (Pier 180)
Pier Area	71,180 square ft (sf)
Description	T-shaped fuel pier, consisting of 3 sections with concrete deck
Approach Segment	Built in 1908, Size: 34 ft x 500 ft, timber support piles, cast-in-steel-shell (CISS) caissons, steel superstructure, concrete deck, and plastic fender piles
North Segment	Built in 1908, Size: 50 ft x 349 ft, timber support piles, CISS caissons, steel superstructure, concrete deck, and concrete and plastic fender piles
South Segment	Built in 1942, Size: 60 ft x 598 ft, concrete support piles, superstructure, and deck, and plastic fender piles
Function	Loading and off-loading of fuels and contaminated petroleum products
Current Ship Loading	Average: 43 ships/month
Condition of Facility	Facility is aging, is in poor condition, and is seismically deficient
Major Structural Repairs	Repairs to four undermined caissons on the Approach Pier in 1957 and two additional undermined caissons in 1987. The 1987 repairs included the installation of a submerged steel sheet pile bulkhead to prevent further undermining of the caissons.

Source: Navy 2010a.

Demolition Process

Aspects of the demolition process that will occur on or alongside the pier and will not impact marine mammals include hazardous materials abatement, the removal of mechanical and electrical utilities, the evacuation of the fueling system and pipelines, the removal of cleat and bollard bases and removal of the plastic fendering system. These activities do not require analysis here and are described and analyzed further in the Navy's Environmental Assessment.

Concrete Deck and Pier Pilings. Typical pier demolition takes place bayward to landward and from the top down. Table 1-3 below lists the types and numbers of piles to be removed. Section 2 provides more specific details on the activities proposed to occur during the period of this IHA. First, the fender piles and exterior appurtenances (such as utilities and the fuel piping systems) will be removed above and below the pier deck. Then, the deck will be demolished using concrete saws. Next, fender piles will be removed using a Prime Cutter - Model 24 PCPC or similar type cutter/pincher with comparable acoustics (data were collected during the second IHA period [NAVFAC 2015] and indicated source SPLs below the potential for Level B harassment), and then the concrete deck will be demolished. Last, the caissons will be removed using a diamond wire saw. Some of these activities may occur at the same time. Demolition activities that are regulated under this IHA, including pile extraction (vibratory) and diamond wire saw can only occur 45 minutes after sunrise to 45 minutes before sunset which allows the Marine Mammal Observers (MMO's) time to complete their pre- and post-construction surveys.

Table 1-3. Remaining Fuel Pier Piles, Caissons and NMAWC Piles to be Removed During IHA #5 Period

Location and Pile Type or Structure	*Number*
Pier 180 (Fuel Pier)	
Poly-concrete and PC concrete piles up to 24-in square	180
66" concrete filled steel caissons	30
84" concrete filled steel caissons	5
30" steel at temporary south dolphin	12
Total - Pier 180 (Fuel Pier)	**227**
NMAWC	
Extract 16" PC round concrete	64
Total - NMAWC	**64**
Total Piles Removed	**291**

Notes: PC = precast

The removal of utilities attached to the pier will be accomplished by securing the material as needed for capture and disposal once it is detached from the pier; cutting it into manageable segments; severing connections to the pier; capturing and disposing the material. Piles that were removed during the second IHA period were cut off at the mudline. The preferred method of removing the caisson elements is to cut them at the mud-line and into two sections using a diamond wire cutting saw. Then, lift each section of the caisson out of the water and onto the barge using a crane.

Section 2 provides more specific detail on the numbers of piles to be removed and the methods to be used during the period of this IHA. Once extracted, the piles will be loaded on to a support barge where they will be transported to the quay wall for offloading. Once on shore, the debris will be crushed onsite or hauled to a concrete recycling facility. 100% of the concrete material will be recycled. Figure 1-4 shows the location of the contractors' laydown area for materials, equipment, and concrete recycling. The contractor may also stage some equipment and materials on barges. During demolition, floating slick bar booms will be deployed around the active work area to provide a complete barrier to floating debris. Any floating debris will be gathered in work boats and will be disposed of or recycled as appropriate. To minimize sediment disturbance and impacts to eelgrass, steel sheet pile bulkheads along the south side of the approach segment and the outboard side of the north segment will not be removed. The bulkheads protrude about 10 ft above the mudline, and preserve a remnant soil mound that lies beneath the approach pier and main pier structure (Terra Costa Consulting Group 2010). This remnant soil mound was created by dredging the bay floor adjacent to the pier (Terra Costa Consulting Group 2010). Original engineering plans for the sheet pile bulkhead indicate that it was covered in rock rip-rip (Terra Costa Consulting Group 2010).

Figure 1-4
Contractors' Laydown Area

Source: NAVFAC Southwest 2011a

Discarded Military Munitions (DMM)

The project area may contain discarded military munitions (DMM). The Navy will coordinate with the demolition and construction contractors to minimize health and safety risks posed by DMM.

Demolition Debris

Four major types of debris will result from the demolition of the fuel pier: concrete; wood; steel; and plastic. The Proposed Action will be in accordance with the DoD Low-Impact Development Initiative requiring all demolition projects that take place after 2011 to recycle and divert materials from local landfills to the maximum extent practicable. Materials will be reused or recycled as appropriate. 100% of the concrete material will be recycled. Materials that cannot be reused or recycled will be transported to a permitted landfill. No special permits will be required for disposal of non-hazardous solid waste. Debris will not be allowed to fall into San Diego Bay. Disposal and recycling/reuse of debris will not impact marine mammals and hence are not discussed further in this application. The Navy's Environmental Assessment provides additional detail and analysis of this topic.

1.3.2 Demolition/Construction Equipment and Phasing

Per the existing CLT MOU and the subsequent Endangered Species Act Informal Consultation, the Navy will be limiting in-water pile driving to October 8, 2017 to 30 April 30, 2018 and September 16, 2018 to October 7, 2018 (227 work days available). Other construction and demolition activities can occur year round; therefore, this IHA application covers the full year. Pile driving and regulated demolition may only occur 45 minutes after sunrise to 45 minutes before sunset which allows the MMOs time to complete their pre- and post-construction surveys. The new fuel pier is being constructed concurrently with demolition of the existing pier.

Provided below are the remaining Phases of the Project:

Phase I Remaining South Segment Demolition (Oct 2017 to Oct 2018). The remaining south segment including the old gangway and temporary mooring dolphin will be demolished by water access using barges to provide a working area for the crane and equipment. The demolition waste will be placed on barges and hauled to the Fuel Pier quaywall or other offsite location for processing, recycling, and disposal. Water access is preferable for the heavy equipment and demolition waste to keep the existing pier operational during the demolition phase. Access to the existing pier is necessary for laborers, trucks, and removal of pier appurtenances. Equipment used for demolition will include: Prime Cutter - Model 24 PCPC or similar type of pile cutter for fender piles and then the concrete deck will be demolished using concrete cutting saws, cutting torches and cranes. The steel superstructure will be demolished with cutting torches, cranes and cutting sheers attached to an excavator, and any other demolition equipment deemed necessary. Last, the caissons will be cut using a diamond wire cutting saw and lifted to the barge with a crane. The floating barges will be supported by tug boats and small work boats.

1.3.3 Construction of Replacement Fuel Pier

The construction of the new double deck fuel pier is complete. The following is a summary of the design and construction of the new pier. The approach segment is 700 ft long by as much as 50 ft wide. The new pier approach segment connects to shore as a single deck with a ramp leading to the upper deck of the double deck berthing segment. The berthing segment is 605 ft long by 50 ft wide, supplemented with three mooring dolphins and one berthing dolphin to extend berthing length to 1,100 ft. The new approach segment was constructed approximately 5 ft north of the existing pier to minimize disturbance to eelgrass and to facilitate connecting the pier with pipelines to onshore NBPL DFSP fuel storage facilities. The new pier approach segment is 200 ft longer than the existing pier approach segment, so the berthing segment of the new pier stands in a deeper, previously dredged location where most of the area to be used by vessels approaching the pier already meets the minimum depth requirement of 40 ft. This placement accommodates a wider variety of ships than was possible at the existing fuel pier where depths are 30 to 40 ft (Figure 1-5). No dredging was needed alongside the pier during construction, and the need for future maintenance dredging along the pier will be reduced or eliminated. The top of the lower deck is set approximately 5 ft above extreme high tide (13 ft above MLLW). The new pier upper deck elevation is 28 ft above MLLW and 20 ft above extreme high tide. The upper deck has sufficient height needed for the pier fuel load arms to safely reach fuel transfer points on the majority of larger ships (Navy 2010a).

The 1,100 ft berthing length was chosen to provide flexibility in fueling multiple types of vessels at the proposed new fuel pier, including large, medium speed, roll-on/roll-off ships, placing the fuel loading arms near fueling points on each of the vessels. The inner berths provide two additional berthing areas, the south and north inner berths. The south inner berth accommodates vessels up to 500 ft long and the north inner berth provides a small craft berthing area for vessels up to 400 ft long.

Design of the new fuel pier takes into account seismic loading, vessel loading, gravity loads and functionality of the overall system. The State of California enforces special requirements for marine oil terminals, particularly with regard to seismic criteria, and the Navy has agreed to comply with the California marine oil terminal requirements for this facility. The design of the piles is governed by loading conditions that include seismic loads. The structural analysis performed has determined that concrete piles of sizes available in Southern California cannot develop sufficient strength and stiffness to withstand the design loads considering the water depth at the site, the geotechnical conditions, and with the deflection limitations needed for the fuel operations.

The existing sheet pile system will continue to be protected with the existing (protected/reconnected) impressed current cathodic protection system. New abutment (Phase 1) and quaywall (Phase 2) piles have been completed and are protected by coating and new impressed current cathodic protection equipment. New trestle and pier steel piles are protected with a combination of coating and passive cathodic protection systems with anodes (aluminum) that will require replacement approximately every 20 years. The design service life of the entire pier structure is 75 years.

Table 1-4 lists the types and numbers of pilings to be installed during this IHA #5 period. Pile driving may occur 45 minutes after sunrise to 45 minutes before sunset which allows the MMOs time to complete their pre- and post-construction surveys. A vibratory and/or impact hammer will be used to install the 16" concrete guide piles. There is a possibility that pile driving and demolition will occur at the same time. Cumulative acoustics and ZOIs will be adjusted accordingly. Pile driving occur northeast of the fuel pier at the NMAWC location where the Marine Mammal Program was temporarily relocated during construction of the new fuel pier.

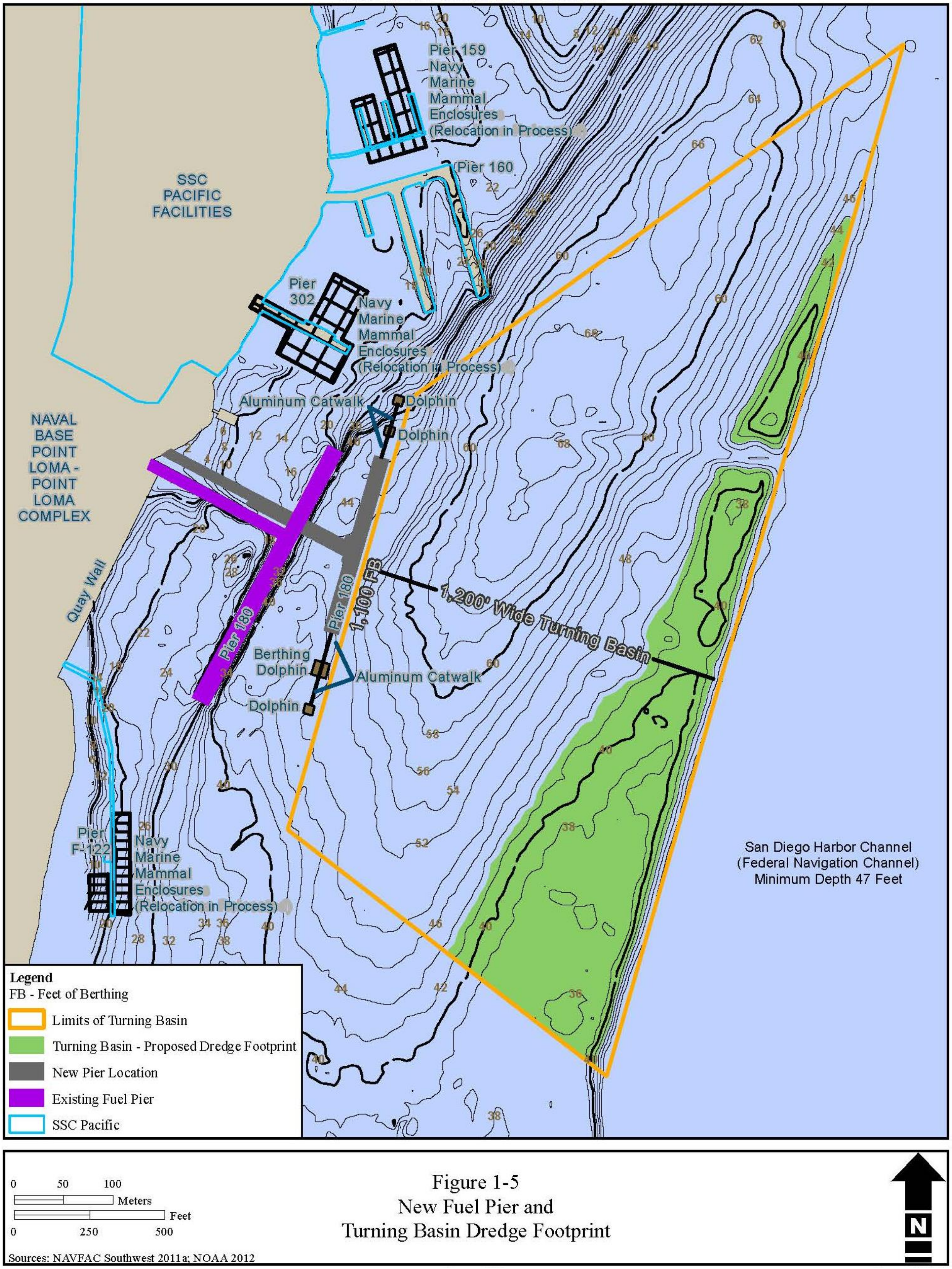


Figure 1-5
New Fuel Pier and
Turning Basin Dredge Footprint

Pile driving at NMAWC is needed to return the docking facilities to their original configuration.

Table 1-4. NMAWC Pilings to Be Installed During IHA #5 Period

Pile Type	*Location*	*Number*	*Estimated Install Period*
16" PC concrete guide piles	Guide piles for gang-ways at NMAWC	23	Oct 2017
Total Piles Installed		**23**	

Aluminum catwalks (approximately 14 ft above MLLW) have been installed connecting the berthing and mooring dolphins to the fuel pier (refer to Figure 1-5). The fuel pier decks are designed for a 50-ton mobile crane, 20-ton truck load and 10-ton forklifts (5-ton forklift on the lower deck); heavy equipment will not be operated on the berthing or mooring dolphins.

There are fueling stations on the upper and lower decks of the new fuel pier berthing segment. Each fueling station will have the capability to supply diesel fuel marine (DFM) and JP-5 turbine (jet) fuel to vessels. The upper deck will be used for offloading fuel from tankers to the tank farm and for supplying fuel to higher profile vessels. The lower deck will be used for fueling smaller profile vessels. Table 1-5 below lists the fueling stations on the two decks of the berthing segment of the new fuel pier.

Table 1-5. New Pier Fueling Stations

Deck	*Side*	*Product*	*Number of Stations*
Upper	Outboard	Fuel	4
Upper	Outboard	Lube Oil	2
Upper	Inboard	Fuel	4
Upper	Inboard	Lube Oil	1
Lower	Outboard	Fuel	4
Lower	Outboard	Lube Oil	1
Lower	Inboard	Fuel	3
Lower	Inboard	Lube Oil	0

The upper deck has six piping connections to receive ballast water from fleet tankers and other larger ships. An 8-in diameter oily water pipe will be used to transfer the ballast water to the NBPL Fuel Oil Reclamation (FOR) facility. The ships could either pump directly to the oily water receipt tank at the treatment facility or transfer to the smaller collection tank located on the pier. A pump at the collection tank will then transfer the oily water to the receipt tank at the treatment system.

Storm water from both pier decks will be captured and routed to the FOR as well. All rainfall accumulating on the lower deck as well as rainfall from the 85th percentile storm event accumulating on the upper deck of the new pier will be collected on the pier and sent to the FOR receipt tank for treatment. The upper deck will be equipped with underflow scuppers that will permit a portion of the runoff from large storm events to discharge to the bay. The underflow design will prevent surface sheen and floating fuel from being discharged to the bay and also allow the "first flush" to be sent to the FOR receipt Tank.

The pier operations will be supported by two pipelines for each fuel product and two for lube oil. There will be a 16-in and an 8-in pipeline for loading/unloading JP-5. For loading and unloading diesel fuel marine (DFM), there will be a 16 in and a 10 in pipeline. There will be two 6-in pipelines for loading lube oil. The 16 in pipes will support the fueling stations on the outboard side while the 8-in JP-5 and 10-in DFM pipes will support the fueling stations on the inboard side.

The 50 ft top-of-deck width is the minimum requirement for a fuel pier per DoD Unified Facilities Criteria (UFC). The new fuel pier will provide adequate deck space on the berthing segment by using a double deck structure to separate the fuel lines from operations on the berthing segment and provide containment for fuel pipelines and utilities. On the berthing segment the pipelines and utilities will be hung beneath the upper deck. Utilities will be in a dedicated vault separate from the pipelines. On the approach segment, fuel lines will be stacked in pipe racks running along one side of the lower deck. At the "T" juncture of the approach and berthing segments, the fuel lines' orientation will transition from horizontal along the lower deck to vertical to reach the upper deck, then horizontal again beneath the upper deck.

Concrete containment curbs will be incorporated into the pier deck design surrounding all fueling arms, fueling risers, and fuel pipes. There will be sumps in curbed containment areas in both pier decks to capture spilled fuel as well as rain water. Sumps located in the upper deck will be fitted with drains that will be piped to a collection tank on the lower deck. Sumps in the lower deck will connect to the FOR. There will be a 1 ft high concrete curb around the perimeter of the lower deck and 3 ½ ft high concrete curb around the upper deck.

The total fuel volume of the new pier pipelines will be 49,000 gallons, an increase of 22,960 gallons (approximately 88%) from the existing pipeline capacity of 26,040 gallons. The dual piping configuration will allow fueling operations to take place on both sides of the pier simultaneously, and include a cross-over capability so that fuel could be transferred from one side of the pier to the other should one side shut down temporarily.

An existing underground trench containing piping from the onshore fuel storage facilities will be extended to the pipelines on the new pier. The connection for the new pipelines will be located between 35 and 65 ft from the existing pier abutment. With the exception of some electrical duct bank work will be located in proximity to the existing pier abutment and the new pier abutment. In addition to the fuel pipelines, an 8-in diameter fire suppression water line will be installed on the new pier and connected to the onshore potable water supply system (Navy 2010c).

The total disturbed area on shore will be less than 1 acre, comprising previously disturbed areas that are paved and unpaved. The paved area northwest of the existing fuel pier will be excavated to extend the underground pipeline trench to the new pier and to install underground utilities and subsequently re-paved. A portion of the landscaped area between the existing fuel pier and lube oil storage tanks will be paved as part of the new pier landside abutment. Three palm trees will be removed from the landscaped area. A new security fence with a motorized gate will be constructed at the entrance to the new pier.

After the existing pier is demolished, the quaywall at the entrance to the old fuel pier will be rebuilt. This work will include the placement of approximately 100 cy of concrete to repair the quay wall. There will also be some grading and asphalt repairs in this area. Repairs to the quaywall will also include removal of two closed storage tanks. The connection between the new and old pier abutments will be constructed by placing closely-spaced 36-in diameter steel-pipe piles along the base of the new and existing bulkhead. The gaps between the piles will be closed by a system of pile interlocks. A concrete cap will be placed at the top of the piles to support the new pier approach and provide a continuous surface. All the work will be performed in the dry, landward side of the bulkhead.

1.3.4 Regulated Navigation Zones

The outboard edge of the new pier, referred to as the headline, will extend 200 ft further east than the existing pier. The Navy has coordinated with the USCG to amend the Security Zone east of the pier. The new pier will also extend beyond Navy waters into waters that are under the jurisdiction of the CSLC.

2 DATES, DURATION, AND LOCATION OF ACTIVITIES

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

2.1 Dates of Construction

Per the existing CLT MOU and the subsequent Informal Consultation, the Navy will be limiting in-water pile driving to October 8, 2017 to April 30, 2018, and September 16 to October 7, 2018 (227 total days, including weekends and holidays). The only pile driving proposed to occur in the fifth IHA period is the installation of 16-inch concrete guide piles at NMAWC to restore gangway access to the docks following the removal of the Navy's Marine Mammal Program (MMP) and return to its original locations near the Fuel Pier. To cover other activities that may nevertheless overlap that period, the Navy is requesting this IHA for the full year from October 8, 2017 through October 7, 2018. All other construction and demolition activities could occur throughout the year. Pile driving and regulated demolition may only occur 45 minutes after sunrise to 45 minutes before sunset which allows the MMO's time to complete their pre- and post-construction surveys.

2.2 Duration of Activities

Table 2-1 summarizes the in-water construction and demolition activities scheduled to take place during the timeframe covered by this IHA application. Additional discussion follows.

Table 2-1. Activity Summary, Fifth Year IHA Application

Activity/Method	Location and Timing[1]	Estimated # of Days	Pile Type	# Piles Installed	# Piles Removed
Construction					
Pile driving to restore dock access at NMAWC following Navy Marine Mammal Program (MMP) re-installation at NMAWC– vibratory and/or impact hammer	NMAWC	25	16-inch PC concrete guide piles	23	
Subtotal		**25**		**23**	
Demolition					
Piles from old south pier cut off at mudline with pile cutter	NBPL old pier south segment and trestle	100	Square PC concrete piles (max size 24-inch)		180
Caissons cut off at mudline with diamond wire saw	NBPL old pier caissons	35	66-inch concrete-filled steel caisson		30
Caissons cut off at mudline with diamond wire saw	NBPL old pier caissons	15	84-inch concrete-filled steel caisson		5

Activity/Method	Location and Timing[1]	Estimated # of Days	Pile Type	# Piles Installed	# Piles Removed
Demolition (continued)					
Piles cut off with plasma torch at mudline	NBPL Temp dolphin south of old pier	6	30-inch steel		12
Pile removal for Navy MMP removal from NMAWC – dead pull or jet out	NMAWC	15	16-inch round PC concrete piles		64
Subtotal		**171**			**291**
Estimated Total In-Water Construction Days - 196					

2.2.1 Pile Driving

The currently proposed construction schedule includes a single episode of pile driving within the period of this IHA application, amounting to an estimated 25 days of pile driving associated with relocation of the Navy's MMP as shown in Table 2-1. The number of piles that can be driven per day varies for different project elements and is subject to change based on work conditions at the time.

2.2.2 Pile Extraction/Demolition

Demolition of the south segment of the pier and the temporary dolphin will continue to completion in this IHA period. This work will include cutting the remaining cement piles, caissons, and temporary dolphin steel piles at the mudline using a hydraulic cutter, diamond wire saw, and plasma torch, respectively. Piles remaining at the temporary location of the MMP at NMAWC will be removed by jetting and dead pull. Demolition and pile extraction are estimated to comprise 171 days.

2.3 Project Area Description

San Diego Bay is a narrow, crescent-shaped natural embayment oriented northwest-southeast with an approximate length of 15 miles and a total area of roughly 11,000 acres (Port of San Diego [POSD] 2007). The width of the bay ranges from 0.2 to 3.6 miles, and depths range from 74 ft MLLW near the tip of Ballast Point (refer to Figure 1-2) to less than 4 ft at the southern end (Merkel and Associates, Inc. 2009). About half of the bay is less than 15 ft deep and most of it is less than 50 ft deep (Merkel and Associates, Inc. 2009).

2.3.1 Bathymetric Setting

The northern and central portions of the bay have been shaped by historic dredging to support large ship navigation, and filling (Merkel and Associates, Inc. 2009). Only the far southern portion retains its natural shallow bathymetry (Merkel and Associates, Inc. 2009). The bathymetry and bedform of the bay are defined by a main navigation channel that steps up to shallower dredged depths toward the sides and bottom of the bay (Merkel and Associates, Inc. 2009). USACE dredges the navigation channel to maintain it a depth of -47 ft MLLW (NOAA 2012a). Outside the navigation channel, the bay floor consists of platforms at depths that vary slightly (Merkel and Associates, Inc. 2009). Within the north bay, typical depths range from 36 to 38 ft MLLW to support large ship turning and anchorage (Merkel and Associates, Inc. 2009). Small vessel marinas are typically dredged to depths of -15 ft MLLW (Merkel and Associates, Inc. 2009).

Bathymetry at the project site has been altered by filling and dredging as well. The quay wall at the fuel pier has been artificially filled to its elevation of approximately 12 ft above MLLW (Terra Costa Consulting Group Inc. 2010). The bay bottom on the south side of the fuel pier approach segment has been dredged to a depth of about -20 ft MLLW, while the bathymetry of the north side retains a more gradual downward slope to the east. Beneath the pier itself, the bottom was protected from historical dredging by the pier pilings and thus stands several ft higher than immediately adjacent depths (Terra Costa Consulting Group Inc. 2010; NAVFAC 2009). Beyond the pier headline, the bottom drops sharply to -30 ft and then -40 ft, the result of dredging. Bayward (east) of the headline, most of the bathymetry out to the navigation channel is at least -41 ft MLLW. However, there is one wedge-shaped high spot along the western edge of the navigation channel where bottom depths rise from -40 to -36 ft MLLW (Figure 2-1).

To the south, at the mouth of the bay, Zuniga Jetty extends approximately 7,500 ft south from Zuniga Point. The jetty is a rock-rubble structure constructed over 100 years ago that was built to direct tidal currents in and out of the bay and thereby maintain an open channel for navigation, while enhancing sand deposition on beaches to the east (NAVFAC SW and POSD 2013). Settlement and flattening of the jetty slopes have occurred over time, and much of the jetty, especially seaward, is awash or submerged at shallow depth depending on tidal conditions (NOAA 2012b).

2.3.2 Tides, Circulation, Temperature, and Salinity

The tides, circulation, temperature, and salinity regime of San Diego Bay are described in the San Diego Bay Integrated Natural Resources Management Plan (INRMP) (NAVFAC SW and POSD 2013), which is the primary source for this section unless noted otherwise. The INRMP may be consulted for historical background and original data sources.

Bay circulation may be driven by wind, tides, temperature, and density gradients associated with seasonal, tidal, and diurnal cycles. In San Diego Bay, circulation is primarily related to tides, because winds are of mild magnitude and there is a low fetch area. Tidal patterns off this coast are mixed, with two unequal highs and lows each day. The diurnal difference in MHHW and low MLLW tides is 5.6 ft (1.7 m), with extremes of 9.8 ft (3 m). The tidal prism, or the volume of water contained between the tides, is about 73 x 106 m3. Highest tides are in January and June.

Tidal exchange in the bay exerts control over the flushing of contaminants, transport of aquatic larvae, salt and heat balance, and residence time of water. Current velocities near the entrance range from 0.5 to 3 knots (0.8 to 5 ft/sec) (POSD 2012) and are much lower in central and south bay. Velocities at depth lead velocities at the surface during flood tides by 30 to 90 min. Variations in velocity are due to variations in depth and width of the bay as the tidal prism moves southward, the presence of side traps such as marinas and basins, and the general reduction in velocity with distance from the entrance. Longitudinal tidal currents will still, however, exceed the strength of wind and wave action, except during periods of high winds.

Figure 2-1
Project Area Bathymetry

Circulation within San Diego Bay is affected by the bay's crescent shape and narrow bay mouth, tides, and seasonal salinity and temperature variations (POSD 2007). San Diego Bay can be divided into four regions based upon circulation characteristics. The North Bay – Marine Region extends from the bay mouth to the area offshore from downtown San Diego. Tidal action has the greatest influence on circulation in this area where bay water is exchanged with sea water over a period of two to three days (POSD 2007). The North-Central Bay – Thermal Region runs from the north bay to Glorietta Bay (south of Coronado Island). In the Thermal Region, currents are mainly driven by surface heating (POSD 2007). The incoming tide brings cold ocean water from deep areas, which is then replaced with warm bay surface water when the tide recedes. These tidal processes lead to strong vertical mixing (POSD 2007). The region between Glorietta Bay and Sweetwater Marsh is characterized as the South-Central Seasonally Hypersaline (i.e., higher salt content than seawater) Region. Here, variations in salinity due to warm-weather evaporation at the surface separate the water into upper and lower zones driven by density differences (POSD 2007). The South Bay estuarine region south of Sweetwater marsh receives occasional freshwater inflows from the Otay and Sweetwater Rivers (POSD 2007). Residence time of bay water in the estuarine region may be greater than one month (POSD 2007). Common salinity values for the bay range from 33.3 to 35.5 practical salinity units for the bay mouth and the south bay, respectively.

In general, tidal currents are strongest near the bay mouth, with maximum velocities of 3 knots (5 ft/sec) (POSD 2012). As discussed in Section 11.1.2, strong tidal currents prevent the effective use of bubble curtains to reduce underwater sound from pile driving at the project site. Tidal current direction generally follows the center of the bay channel. Residence time for water in the bay increases from approximately five to 20 days in mid-bay to over 40 days in south bay. During an average tidal cycle, about 13% of the water in the bay mixes with ocean water and then moves back into the bay (POSD 2007). The complete exchange of all the water in the bay can take 10 to 100 days, depending on the amplitude of the tidal cycle (POSD 2007). Tidal flushing and mixing are important in maintaining water quality within the bay. The tidally-induced currents regulate salinity, moderate water temperature, and disperse pollutants (POSD 2007).

A recent bay-wide water quality monitoring study confirms that the northern part of the bay is essentially marine and well mixed by the tides, while greater stratification and variability prevail farther back in the central and southern parts of the bay (Tierra Data, Inc. [TDI] 2012a). In San Diego Bay, this area of efficient flushing is within perhaps 3 to 4 mi (5 to 6 km) of the entrance, reaching almost to downtown. Residence time of bay water is just a few days. The net result of these circulation patterns in the bay is the presence of cold, clean ocean water at depth, explaining the Mussel Watch Project result that mussels at the mouth of the bay were found to be the cleanest in the county.

Temperature and density gradients, both with depth and along a longitudinal cross-section of the bay, drive tidal exchange of bay and ocean water beginning in the spring and continuing into fall. The seasonal thermal cycle has an amplitude of about 14 to 16 degrees Fahrenheit (° F) (8 to 9 degrees Celsius [° C]). Maximum water temperatures occur in July and August, and minimums in January and February. In the winter, thermal gradients are absent, with cooler air temperatures and higher winds causing the bay to be nearly isothermal. During 1993 surveys, the warmest temperature was 84.7° F (29.3° C) in south bay, and the coolest temperature, 59.2° F (15.1° C), was just north of the Coronado Bridge in January. The average surface temperature is estimated to be 63.3° F (17.4° C). Maximum vertical temperature gradients of about 0.3° F/ft (0.5° C/m) occur during the summer. Typical longitudinal temperature range is about 45 to 50° F (7 to 10° C) (about 0.3 to 0.5° C/km) over the length of the bay during the summer. Temperature inversions also occur diurnally due to night cooling.

Salinities of the project area resemble those of the nearby open ocean, i.e. 32.8 to 33 parts per thousand (TDI 2012a).

2.3.3 Substrates and Habitats

Marine mammal occurrence in San Diego Bay is predominantly in the North Bay – Marine Region as described above. Local and seasonal concentrations of marine mammals in San Diego reflect the opportunistic attraction of marine mammals in general to areas of high prey (fish) abundance, the proximity of pinniped haulouts, and resting sites to feeding areas, and, for cetaceans, the prevalence of marine conditions and access to and from the open ocean. Sediments in northern San Diego Bay are relatively sandy (USACE 2010; NAVFAC SW and POSD 2013) as tidal currents tend to keep the finer silt and clay fractions in suspension, except in harbors and elsewhere in the lee of structures where water movement is diminished. Much of the shoreline consists of riprap and manmade structures as can be seen in aerial views. As indicated by the bathymetry on previous figures (Figures 1-5, 2-1) the predominant habitats of the project area are moderately deep (12 to 20 ft below MLLW) and deep (>20 ft below MLLW) subtidal and artificial hard substrates. Additionally, shallow sandy areas support beds of eelgrass which are ecologically vital nursery and foraging habitats for fish. The current (2011) and recent historic extent of eelgrass beds in the project area are shown in Figure 2-2.

Over-water structures such as the existing fuel pier provide substrates for the growth of algae and invertebrates off the bottom and support abundant fish populations. As noted in Section 1.3.3, the top surface area of the existing pier is 1.63 acres, which is approximately 3.1% of the dock and pier acreage of the North Bay as a whole (NAVFAC SW and POSD 2013).

2.3.4 Vessel Traffic and Ambient Underwater Soundscape

As illustrated by Table 2-2 below, San Diego Bay is heavily used by commercial, recreational, and military vessels, with an average of 82,413 vessel movements (in or out of the bay) per year. This equates to about 225 vessel transits per day, a majority of which are presumed to occur during daylight hours. The number of transits does not include recreational boaters that use San Diego Bay, estimated to number 200,000 (San Diego Harbor Safety Committee 2009).

Figure 2-2
Eelgrass Beds in the Project Area

Table 2-2. Port of San Diego Average Annual Vessel Traffic

VESSEL TYPE	VESSEL MOVEMENTS (Inbound and Outbound)		
	Subtotal by Vessel Type		*Total*
	Cargo	*Others*	
Total Annual Movements for All Vessel Types			**82,413**
Deep Draft Commercial Vessel (Cargo plus Cruise)			1,175
Cargo Ships (largest vessel: 1,000' length,106' beam, 41'draft)	740		740
Bulk	20		
Container Ships	100		
General Cargo	180		
Roll On/Roll Off	440		
Cruise Ships (largest vessel: 1,000' length, 106' beam, 34' draft)		435	435
Excursion Ships (largest vessel: 222' length, 57' beam, 6' draft)		68,000	68,000
Commercial Sportfishing (average vessel size: 123' length, 32' berth, 13' draft)		10,094	10,094
Military (largest vessel: 1,115' length, 252'beam (flight deck), 39' draft)		3,144	3,144

Note: Tug traffic was not included in the above statistics since inner harbor tug movements alone exceed 7,000 for a typical year.

Source: San Diego Harbor Safety Committee 2009.

Refer to Section 6 for background on acoustics and definitions of metrics. Acoustic monitoring of ship noise in Glacier Bay, Alaska (Kipple and Gabriele 2007), found that root mean square (rms) sound source levels from a variety of vessel types and sizes was typically within the range of 160-170 decibels (dB) referenced to 1 microPascal (re 1 µPa) at 1m. Ship noise was characterized by a broad frequency range (roughly 0.1 to 35 kilohertz [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 (NRC 2003). Ship noise in San Diego Bay thus has the potential to obscure underwater sound that would otherwise emanate from the project site to locations farther up the bay or offshore through the mouth.

The Navy has made extensive measurements of ambient underwater sound in the project area of San Diego Bay (Navy 2013b; NAVFAC SW 2014, 2015). Based on the most recent data provided in the 2014-2015 monitoring report (NAVFAC SW 2015), the median ambient underwater sound pressure level in areas of the bay subject to project construction noise averages approximately 128 dB re 1 µPa. Noise from vibratory pile driving and other non-impulsive sources becomes indistinguishable from other background noise as it diminishes to near ambient levels 2,000 to 3,000 meters from the project site. Computed distances to the threshold for acoustic disturbance from non-impulsive sources are based on the distances at which the project sound source declines to ambient.

3 MARINE MAMMAL SPECIES AND NUMBERS

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

Recognizing that the results from regional offshore surveys for marine mammals are not necessarily representative of northern San Diego Bay, the Navy conducted marine mammal surveys in the project area beginning in 2007 and continuing through July 2014 (Merkel and Associates, Inc. 2008; U.S. Pacific Fleet 2009-2012; TDI 2012b; NAVFAC SW 2014; TDI 2014). These surveys (summarized in the previous IHA applications [Navy 2013a, 2014]) and other local information including marine mammal monitoring done for the previous three IHAs (NAVFAC SW 2014, 2015), as well as the Navy Marine Species Density Database (NMSDD) (Navy 2017) and NMFS Stock Assessment Reports (Carretta et al. 2016, 2017) are considered in determining the baseline on the species and numbers of marine mammals that occur in the activity area. Far fewer animals were observed during the third and fourth IHA periods than were estimated (NAVFAC SW 2016a-b). Since the ZOI was intensively monitored during the seasonal periods of activity that mirror those to occur during the fifth IHA period, the Navy, believes the monitoring data from the second (2014-2015) IHA period (NAVFAC SW 2015) represent the best available science on numbers of marine mammals likely to occur during the fifth IHA period, at least for species that were observed on multiple occasions.

Of the approximately 41 marine mammal species that occur in Southern California waters (Carretta et al. 2016), three species occur year-round and are fairly common in northern San Diego Bay: the United States (U.S.) stock of California sea lion (*Zalophus californianus*), California stock of harbor seal (*Phoca vitulina richardii*), and California coastal stock of bottlenose dolphin (*Tursiops truncatus*). Sightings of these species during the 2014-2015 IHA period (from NAVFAC SW 2015) are shown in Figures 3-1 through 3-3. Other species that were previously known or likely to occasionally occur and which were confirmed during the 2014-2015 IHA period include common dolphins, which may be either short-beaked or long-beaked common dolphins (*Delphinus delphis* and *D. capensis*, respectively), Pacific white-sided dolphins (*Lagenorhynchus obliquidens*), and the Eastern North Pacific stock of the gray whale (*Eschrichtius robustus*) (Merkel and Associates 2008; NAVFAC SW and POSD 2013; Navy 2010e, 2012b). Sightings of these species during the 2014-2015 IHA period (from NAVFC SW 2015) are shown in Figure 3-4. A relatively small number of sightings of large whales were too far offshore to be identified to species; these are shown in Figure 3-5).

Although not seen in Navy surveys or monitoring, Risso's dolphin (*Grampus griseus*) is included because it was once common in San Diego Bay (NAVFAC SW and Port of San Diego [POSD] 2013); and because it is common in southern California waters (Carretta et al. 2016; Navy 2017), and may increase if El Niño conditions continue to develop (Shane 1995). In addition, northern elephant seals (*Mirounga angustirostris*) are included based on a) their continuing increase in numbers along the Pacific coast, (Carretta et al. 2016); b) the likelihood that animals that reproduce on the islands offshore of Baja California and mainland Mexico – where the population is also increasing - could move through the project area during migration (Carretta et al. 2016); and c) the observation of a juvenile on the beach just south of the Fuel Pier in April 2015 (NAVFAC SW 2015).

Other species sighted as a single individual each and considered only a remote possibility during the fifth IHA period, include short-finned pilot whale (*Globicephala macrorhynchus*), which normally occurs offshore and was reported off Ballast Point, and Steller sea lion (*Eumetopias* *jubatus*), which is extralimital in southern California and was seen just off of Ballast Point (NAVFAC SW 2015). Both of these species were observed during the 2014-2015 monitoring period, but were not observed during monitoring in 2016. Take authorizations are not requested for these species because they are not expected, and in the unlikely event of their occurrence, they will be detected by monitoring and work will be stopped if and when they entered a potential harassment ZOI.

None of the nine species for which a take authorization is requested are listed under the Endangered Species Act (ESA), whereas all are protected under the MMPA. The occurrence of these species in the project area is summarized in Table 3-1 and the paragraphs that follow.

The U.S. stock of California sea lion and the California stock of harbor seal can be commonly found at haul-out sites on the mainland and on navigation buoys, barges, and docks within California harbors. California sea lions and harbor seals do not typically haul out at the same location at the same time. Within and adjacent to San Diego Bay, California sea lions are the dominant and by far the most numerous pinniped observed, which may explain the absence of harbor seals from most of the area. California sea lions are especially abundant on the two bait barges, which are relatively close to the fuel pier and are within the zone of influence (ZOI, defined in later chapters) for potential harassment.

In the Navy's 2007-2012 surveys, harbor seals were observed hauled out along the shore south of Ballast Point, outside of the ZOI for project pile driving activities, or elsewhere outside of the potential ZOI. However, up to 4 harbor seals were observed during Navy monitoring of another project at Pier 122, roughly 250 m south of the fuel pier (Jenkins 2012), and in the more recent surveys, an average of 7 individuals were present in the ZOI at several locations in the vicinity of the fuel pier (NAVFAC Southwest 2014; TDI 2014).

The Eastern North Pacific stock of gray whale occurs off southern California during their annual migration between summer feeding areas in the Bering and southern Chukchi seas and winter calving areas in Baja California and mainland Mexico. While gray whales may occasionally be found within a kilometer of shore during both their southward and northward migration periods, they are generally found farther offshore (Navy 2010e). There has been only a single sighting of gray whales (one juvenile) during the Navy's surveys. Although this individual was outside of the ZOI for potential harassment by pile driving (TDI 2012b), it likely crossed through the ZOI. During the 2015-2016 monitoring for the previous IHA, there were three observations of five individuals observed to the south of Ballast Point (NAVFAC SW 2015). On several occasions in recent years, an individual gray whale has entered San Diego Bay and lingered for varying lengths of time (NAVFAC SW and POSD 2013; Jenkins 2012; San Diego Union Tribune 2012; KFMB 2014; San Diego Whale Watching Report 2014). Individual gray whales were seen during both the first and second year IHA periods (NAVFAC SW 2014, 2015). Therefore, the gray whale is considered potentially present and affected within ZOIs for behavioral harassment.

Some gray whales belonging to the endangered Western North Pacific stock have been documented in U.S. and Mexican waters (Carretta et al. 2016). The current population estimate for the Western North Pacific stock is 140 (CV = 0.043), which is less than one percent of the abundance of the Eastern North Pacific stock (Table 3-1). Given their rarity, the possibility of occurrence in San Diego Bay is remote, and the project is anticipated to have no effect on individuals of the Western North Pacific stock.

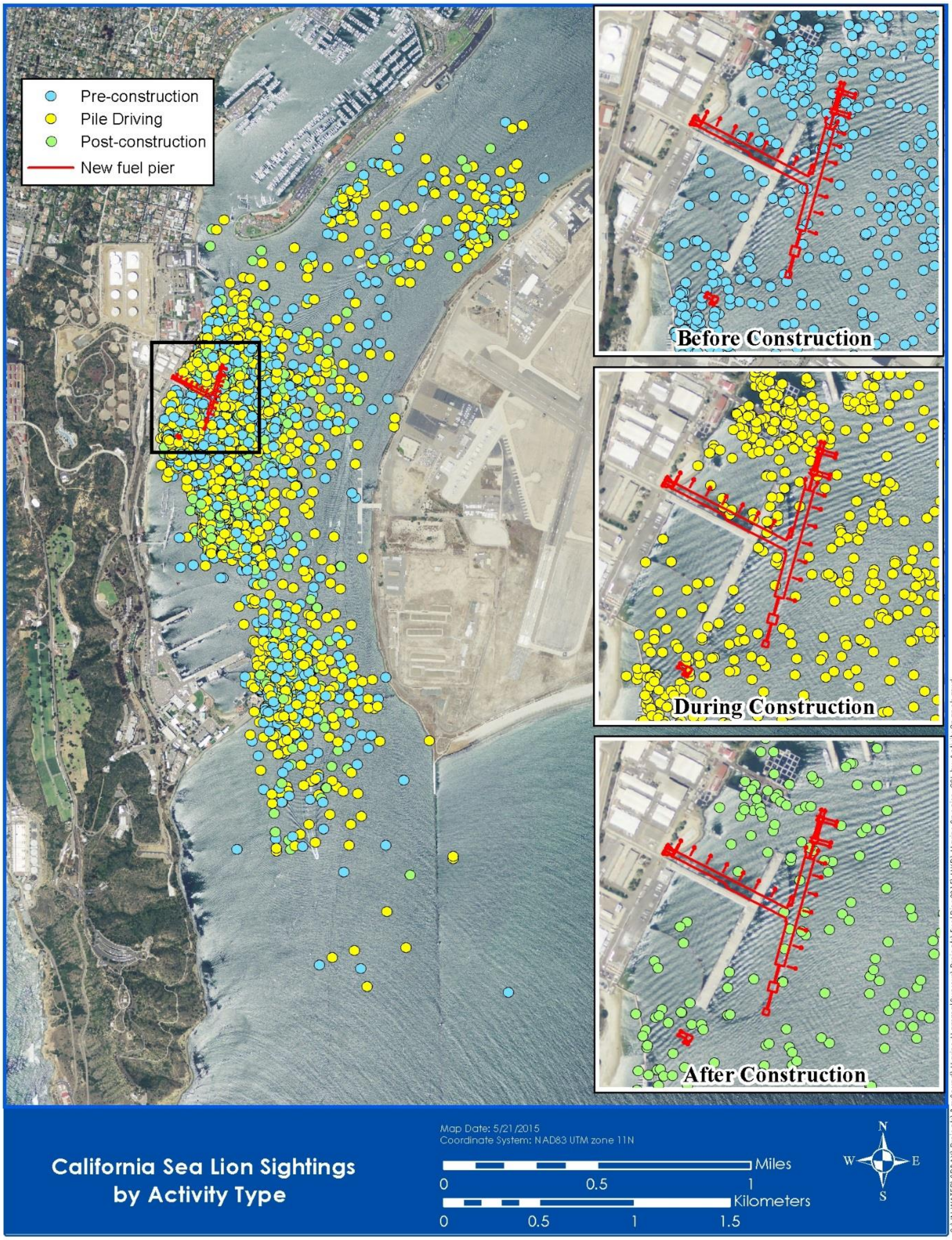


Figure 3-1 Sightings of California Sea Lions during the 2014-2015 IHA Period (NAVFAC SW 2015)

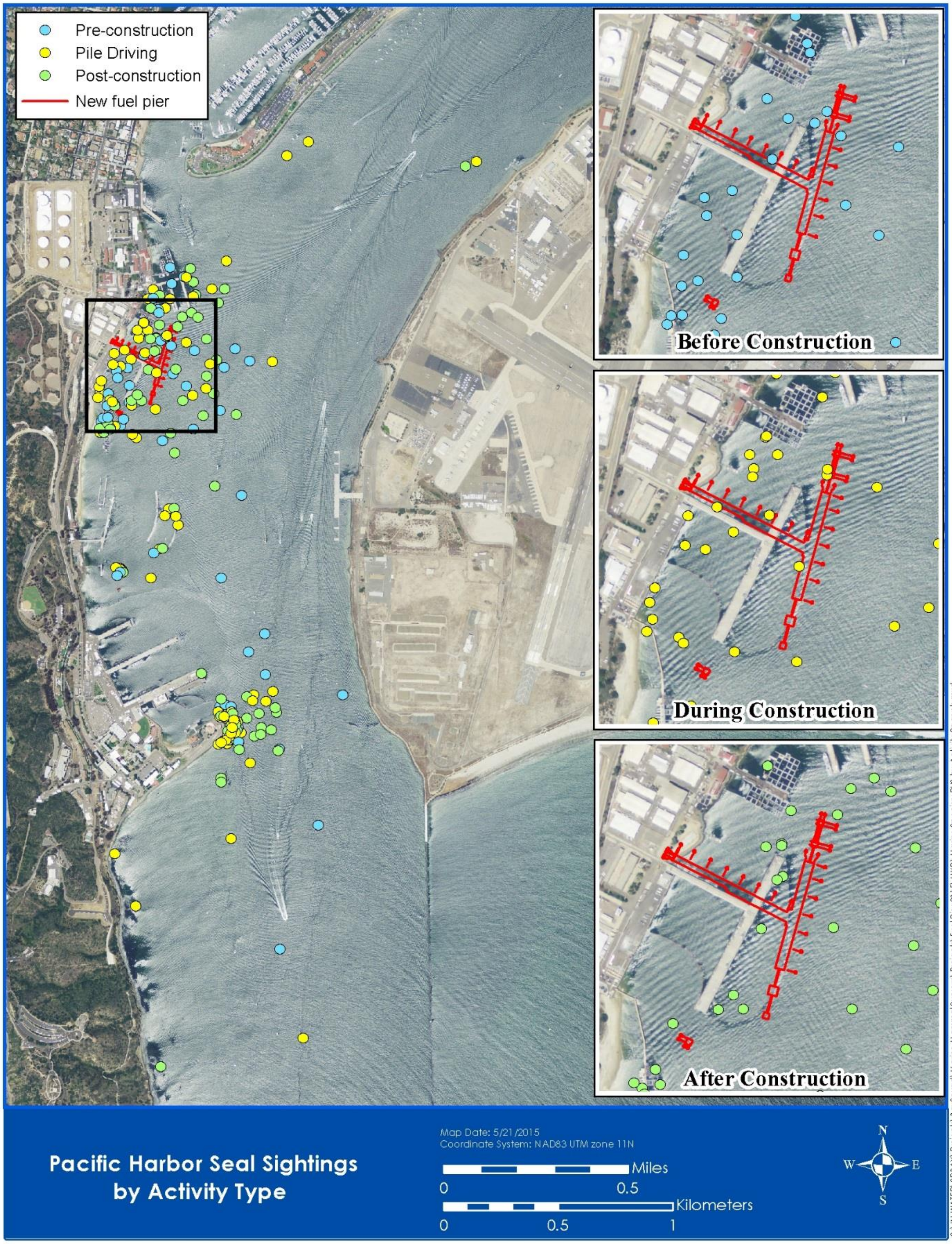


Figure 3-2 Sightings of Harbor Seals during the 2014-2015 IHA Period (NAVFAC SW 2015)

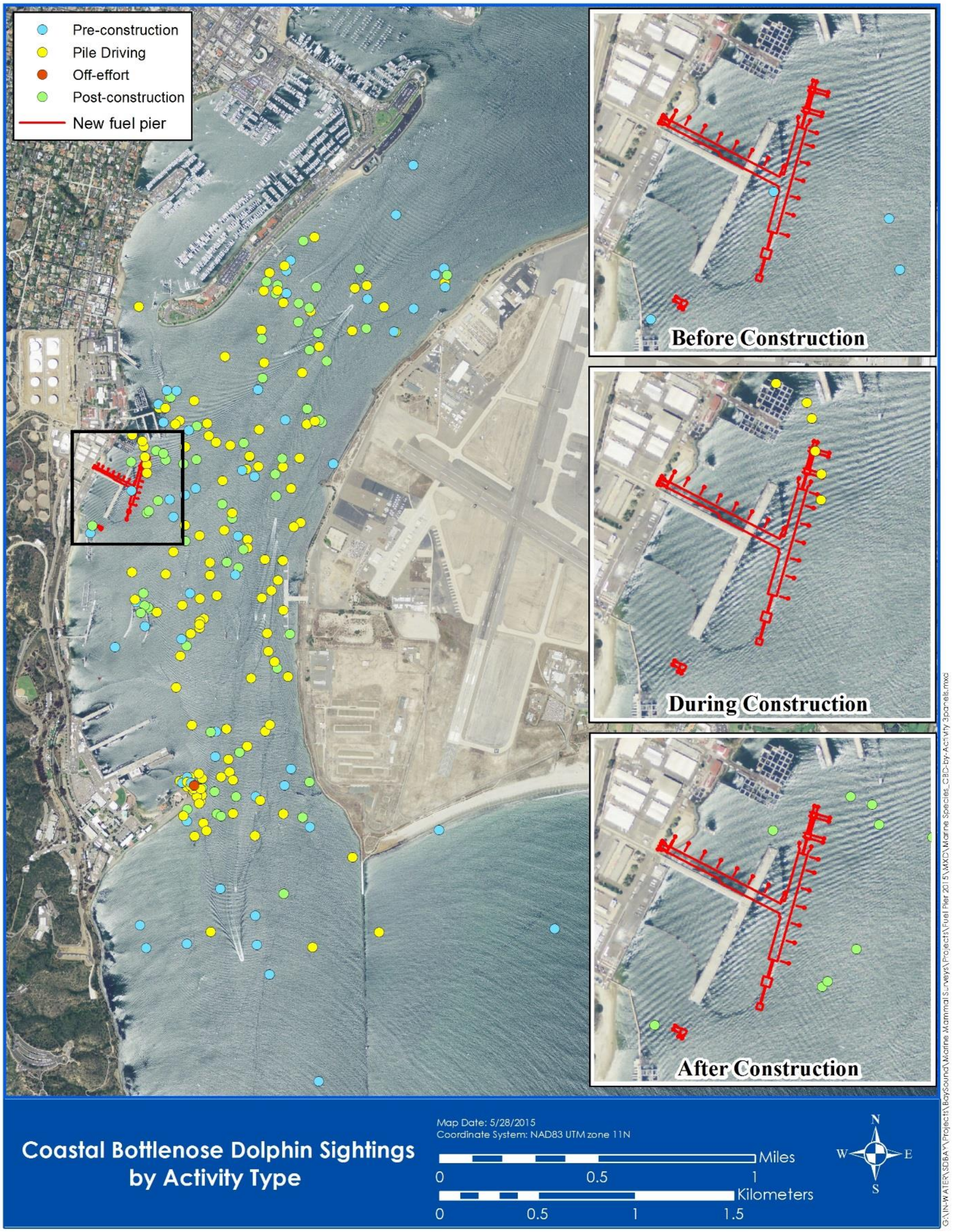


Figure 3-3 Sightings of Coastal Bottlenose Dolphins during the 2014-2015 IHA Period (NAVFAC SW 2015)

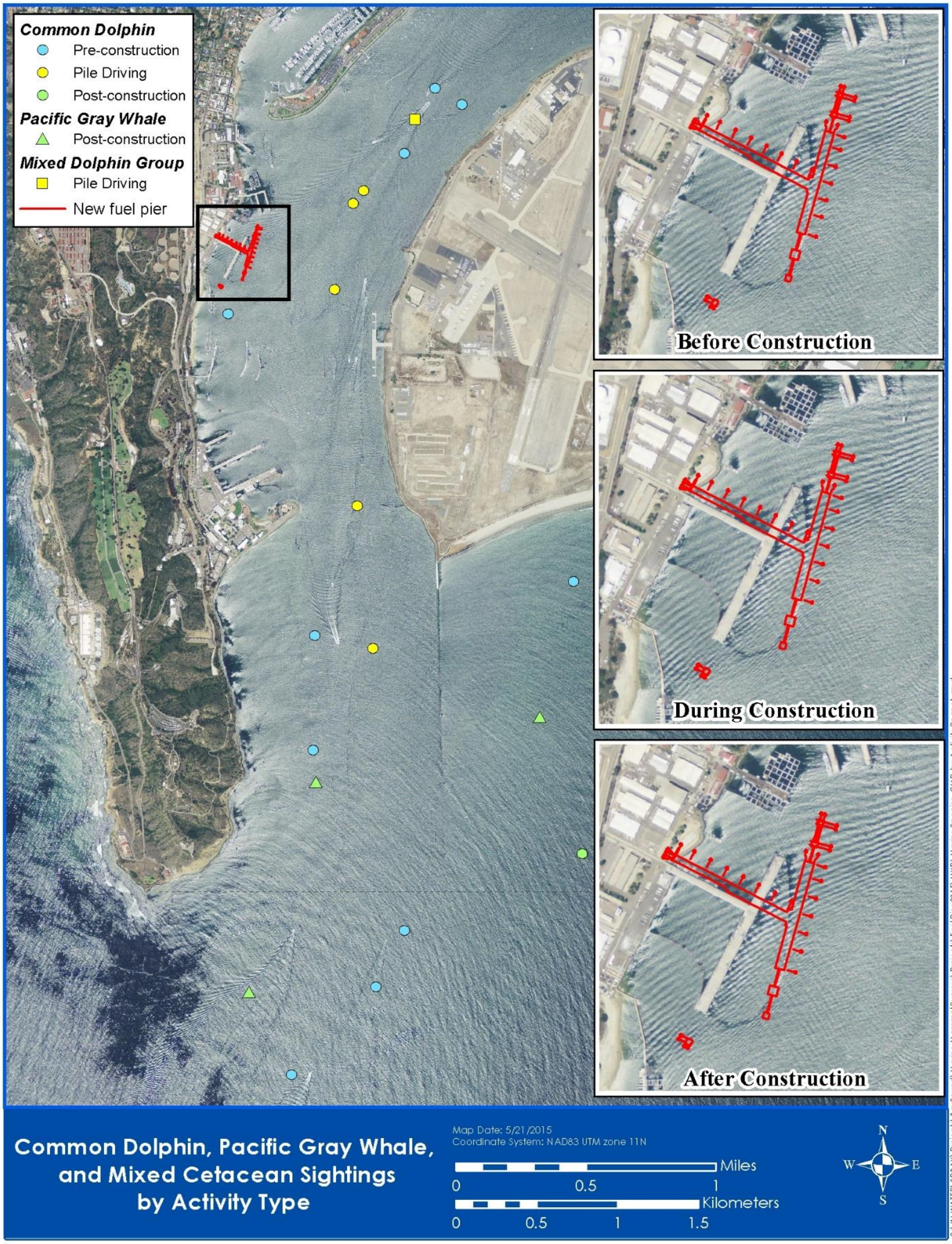


Figure 3-4 Sightings of Common Dolphins, Gray Whale, and Mixed Dolphins (Common + Bottlenose Dolphins) during the 2014-2015 IHA Period (NAVFAC SW 2015)

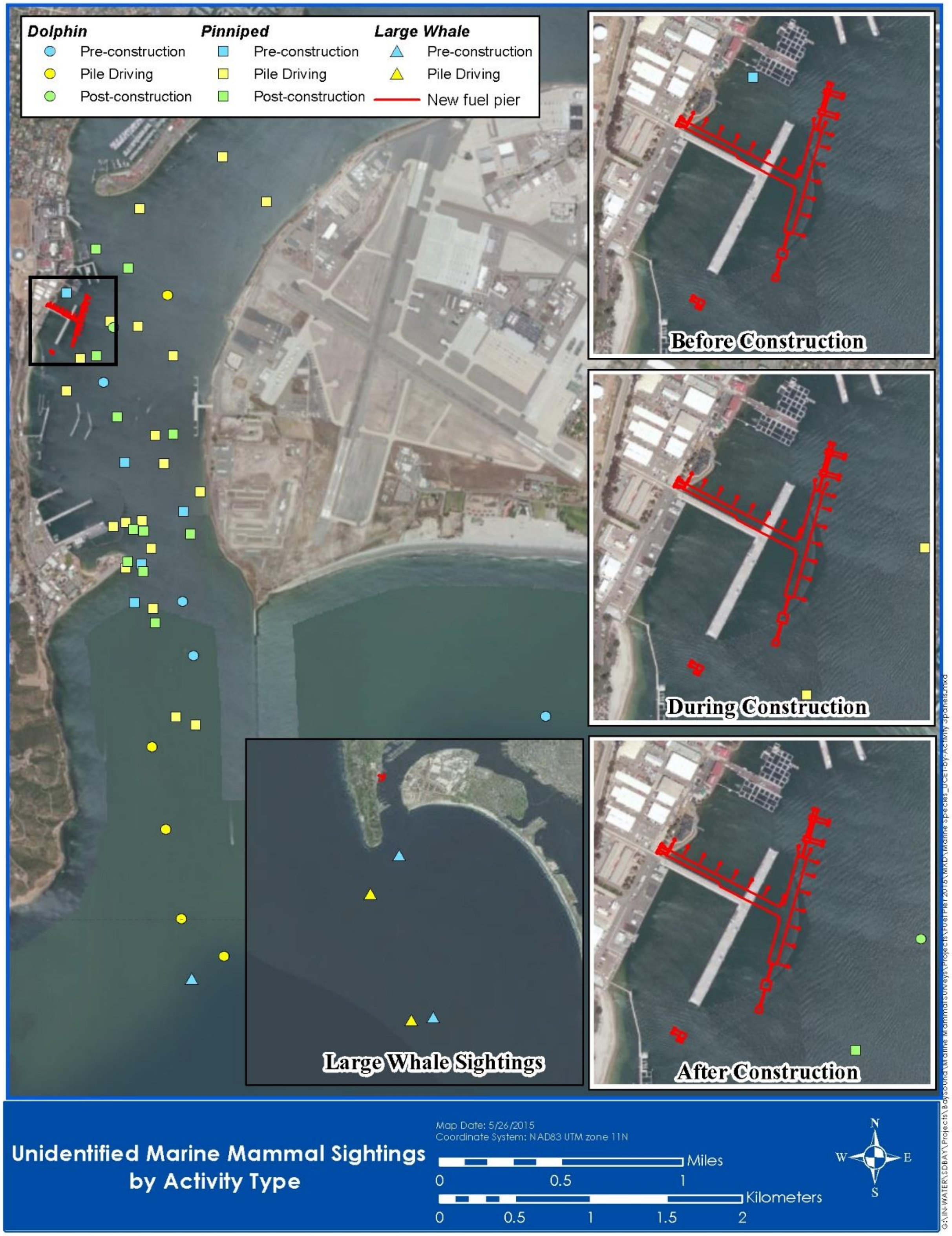


Figure 3-5 Sightings of Unidentified Species during the 2014-2015 IHA Period (NAVFAC SW 2015)

Table 3-1. Marine Mammals Occurring in the Vicinity of Naval Base Point Loma

Species	***Stock Abundance[1]***	***Relative Occurrence in North San Diego Bay***	***Season(s) of Occurrence***	***Density in the Project Area[2]***
California sea lion *Zalophus californianus* U.S. Stock	296,750	Abundant	Year-round	15.9201/km²
Harbor seal *Phoca vitulina* CA stock	30,968	Common	Year-round	0.4987/km²
Northern elephant seal *Mirounga angustirostris*	179,000	Rare	Year-round	0.0760/km²
Bottlenose dolphin *Tursiops truncatus* CA coastal stock	453 (Coefficient of Variation [CV] = 0.06)	Common	Year-round	1.2493/km²
Short-beaked common dolphin *Delphinus delphis* CA/OR/WA stock	969,861 (CV = 0.17)	Occasional	Year-round, more common in warm season	Combined density of 1.5277/km²
Long-beaked common dolphin *Delphinus capensis* CA stock	101,305 (CV = 0.49)	Occasional	Year-round, more common in warm season	
Pacific white-sided dolphin *Lagenorhynchus obliquidens* CA/OR/WA, Northern and Southern stocks	26,814 (CV = 0.28)	Uncommon	Year-round	0.0493/km²
Risso's dolphin *Grampus griseus* CA/OR/WA stock	6,336 (CV = 0.32)	Rare	Year-round, more common in cool season	0.2029/km²
Gray whale *Eschrichtius robustus* Eastern North Pacific Stock	20,990 (CV = 0.05)	Occasional - Seasonal	Winter	0.0179/km²

Sources: [1]NMFS marine mammal stock assessment reports (Carretta et al. 2016, 2017). [2]Abundances of repeatedly observed species are from the 2014-2015 second year IHA Monitoring Report (NAVFAC SW 2015), with density computed as the average number of individuals sighted per day divided by the area of the largest ZOI. For species not or rarely observed, the density is from Navy (2017). Since long-beaked and short-beaked common dolphins are indistinguishable in the field, the same density is assumed for both.

The California Coastal stock of the bottlenose dolphin is a toothed whale (odontocete) that regularly inhabits the nearshore waters of southern California. This species regularly moves along the California coast and occasionally enters northern San Diego Bay. This particular stock has limited site fidelity and can be distributed anywhere between Monterey to northern Baja Mexico depending on localized prey abundance (Navy 2011). Bottlenose dolphins have become increasingly common in San Diego Bay in recent years (TDI 2012b; Jenkins 2012; NAVFAC SW 2014, 2015).

Common dolphins are odontocetes that occur in all tropical and warm-temperate waters. The California/Oregon/Washington stock of long-beaked common dolphin is found in the nearshore coastal waters, whereas the California stock of short-beaked common dolphin has an overlapping distribution that includes both nearshore and offshore waters (Carretta et al. 2016). Common dolphins were seen during the IPP and during the second IHA period (NAVFAC 2014, 2015). The long-beaked common dolphin has been documented on the Silver Strand Training Complex just outside of San Diego Bay (Navy 2012b) and is considered much more likely than the short-beaked common dolphin to occur in the project area.

Three species that are part of this request (northern elephant seal, Pacific white-sided dolphin, and Risso's dolphin) are relatively common offshore (Carretta et al. 2016), and have historic or recent occurrence in San Diego Bay (NAVFAC SW 2015; NAVFAC SW and POSD 2013), indicating a reasonable possibility of occurrence during the fifth IHA period.

3.1 Species Descriptions and Abundances

3.1.1 California Sea Lion

Species Description

The California sea lion is now considered to be a full species, separated from Galapagos sea lion (*Z. wollebaeki*) and the extinct Japanese sea lion (*Z. japonicus*) (Carretta et al. 2016). The breeding areas of the California sea lion are on the Channel Islands, western Baja California, and the Gulf of California. Mitochondrial DNA analysis of California sea lions has identified five genetically distinct geographic populations: (1) Pacific Temperate, (2) Pacific Subtropical, (3) Southern Gulf of California, (4) Central Gulf of California and (5) Northern Gulf of California. The Pacific Temperate population makes up the U.S. stock and includes rookeries within U.S. waters and the Coronado Islands just south of the U.S.-Mexico border.

The California sea lion is sexually dimorphic. Males may reach 1,000 pounds and 8 ft in length; females grow to 300 pounds and 6 ft in length. Their color ranges from chocolate brown in males to a lighter, golden brown in females. At around 5 years of age, males develop a bony bump on top of the skull called a sagittal crest. The crest is visible in the "dog-like" profile of male sea lion heads, and hair around the crest gets lighter with age (National Marine Fisheries Service [NMFS] 2012).

Population Abundance

The entire population cannot be counted because all age and sex classes are never ashore at the same time. In lieu of counting all sea lions, pups are counted when all are ashore, in July during the breeding season, and the number of births is estimated from pup counts (Carretta et al. 2016). The size of the population is then estimated from the number of births and the proportion of pups in the population. Based on these censuses, the U.S. stock has generally increased from the early 1900s, to a current estimate of 296,750, with a minimum estimate of 153,337 (Carretta et al. 2016). There are indications that the California sea lion may have reached or is approaching carrying capacity, although more data are needed to confirm that leveling in growth persists (Carretta et al. 2016).

The second IHA assumed 175 individuals per day based on the recent (at the time) counts of exceptionally large numbers observed during the boat survey transects (Navy 2014). However, during the second IHA, the largest extent of the ZOIs (e.g., during the 30-inch pile driving for the fourth IHA) was intensively monitored during the seasonal periods of activity that mirror those during the fifth IHA period. Based on the data collected during the second IHA, an average daily abundance of 90.35 individuals per day (NAVFAC SW 2015) was calculated, which equates to a density of 15.9201/km^2 in the maximum ZOI for pile driving. Takes documented during the third IHA period were far fewer than had been estimated (NAVFAC SW 2016). As a result, the Navy believes that the monitoring data from the second IHA period represent the best available science on numbers of California sea lions that are likely to occur. Furthermore, there appears to have been an increase in the numbers of California seas lions during the second IHA, which would provide for a conservative estimate of the number of individuals per day.

3.1.2 Harbor Seal

Species Description

Harbor seals, which are members of the family Phocidae ("true seals"), inhabit coastal and estuarine waters and shoreline areas from Baja California to western Alaska. For management purposes, differences in mean pupping date (i.e., birthing), movement patterns, pollutant loads and fishery interactions have led to the recognition of three separate harbor seal stocks along the west coast of the continental U.S. The three distinct stocks are: 1) inland waters of Washington State (including Hood Canal, Puget Sound, and the Strait of Juan de Fuca out to Cape Flattery), 2) outer coast of Oregon and Washington, and 3) California (Carretta et al. 2016). The California stock is the only stock that is expected to occur within the Project Area.

Population Abundance

Based on post-breeding counts of individuals at known haul-outs, corrected for the proportion of the population that is out at sea, the population estimate for the California stock of harbor seal is 30,968. The minimum population size is estimated as 27,348. The population size has increased since the 1980s and fluctuated during the past decade, with the highest counts in 2004 but lower counts in 2009 and 2012 (Carretta et al. 2016).

The second IHA used at the time a reasonable worst-case maximum number of 7 harbor seals, based partly on incidental sightings of animals in or near the project area. Based on observations during the second IHA periods (NAVFAC SW 2015) the average abundance within the maximum ZOI for pile driving is 2.83 individuals, which translates to a site-specific density of 0.4987/km^2. As for sea lions, takes or harbor seals documented during the third IHA period were much less than had been estimated (NAVFAC SW 2016). Since the ZOI was intensively monitored during the seasonal periods of activity that mirror those to occur during the fifth IHA period, the Navy, believes the monitoring data from the second IHA period represent the best available science on numbers of harbor seals that are likely to occur.

3.1.3 Northern Elephant Seal

Species Description

This highly sexually dimorphic seal is found only in the eastern North Pacific. Males are 8-10 times as large as females, reaching a weight of 5,060 lbs (2,300 kg) (Hindell and Perrin 2009).

Both sexes are relatively large and have a large head. Their distinctive profile makes them unlikely to be misidentified with other species that their range overlaps with. Only young individuals could be mistaken for a sea lion or fur seal at sea if viewed quickly or from a distance (Navy 2017).

Population Abundance

As summarized by Carretta et al. (2014b), a complete population count of elephant seals is not possible because all age classes are not ashore simultaneously. Based on elephant seals at U.S. rookeries in 2010, Lowry et al. (2014) reported that 40,684 pups were born. They then applied a multiplier of 4.4 to estimate approximately 179,000 elephant seals. This multiplier is derived from life tables based on published elephant seal fecundity and survival rates, and reflects a population with approximately 23% pups. The population is estimated to have grown at 3.8% annually since 1988 (Lowry et al. 2014).

Given the continuing, long-term increase in the population of northern elephant seals (Lowry et al 2014), there is an increasing possibility of occurrence in the project area. Since no other data are available for the project area, the NMSDD warm season density of 0.0760/km^2 (which is slightly higher than the cool season density of 0.0506) for the Southern California Range Complex (Navy 2017) is used as an average for the project ZOI. Use of the warm season estimate is reasonable because the warm season includes fall (September to December) when work will be occurring, and year-round water temperatures in the San Diego area have been and are likely to continue to be closer to the warm-season norms.

3.1.4 Coastal Bottlenose Dolphin

Species Description

The California coastal stock of bottlenose dolphin is distinct from the offshore population and is resident in the immediate (within 1 km of shore) coastal waters, occurring primarily between Point Conception, California, and San Quintin, Mexico. Bottlenose dolphins have a robust body and a short, thick beak. They range in length from 6 to 12.5 ft (1.8 to 3.8 m) and weight from 300 to 1400 pounds (lbs) (135-635 kilograms [kg]); males are slightly larger than females. They are commonly found in groups of 2 to 15 individuals and in larger herds offshore. Coastal animals feed on benthic fish and invertebrates (NMFS 2012).

Population Abundance

Based on photographic mark-recapture surveys conducted along the San Diego coast from 2009 to 2011 (Weller et al. 2016), two separate population size estimates were generated from open and closed mark-recapture models. The best open model generated an estimate of 515 (95% CI = 470–564, CV= 0.05) animals, while the best closed model produced an estimate of 453 (95% CI = 411–524, CV=0.06) animals. These estimates are for marked animals only and do not include an estimated ~ 40% of animals that are not individually recognizable (Weller et al. 2016). The estimated fraction of unmarked animals is highly uncertain because it is unknown how often unmarked animals are resighted. The new estimates are the largest obtained for this stock, dating back to the 1980s. For comparison with previous estimates of this stock, the closed population estimate of 453 (CV=0.06) animals is used as the best estimate of abundance (Carretta et al. 2017). In the aforementioned surveys of San Diego Bay, numbers of coastal bottlenose dolphins were highly variable (from 0 to 40).

The average daily abundance of coastal bottlenose dolphins observed during the second IHA period was 7.09 (NAVFAC SW 2015), which translates to a density of 1.2493/km^2 within the maximum ZOI for pile driving. This is larger than the estimate of 4 individuals per day used in the previous IHA, and as for other species, the Navy considers the data from intensive monitoring during the second IHA period to be the best available science on numbers likely to occur during the fifth IHA period.

3.1.5 Short-Beaked and Long-Beaked Common Dolphins

Species Descriptions

The California/Oregon/Washington stock of short-beaked common dolphin and the California stock of long-beaked common dolphin both occur in coastal southern California waters. While the long-beaked common dolphin is a nearshore species, the short-beaked common dolphin is widely distributed between the coast and at least 300 nmi offshore (Navy 2017; Carretta et al. 2017). The short-beaked and long-beaked species were only recently separated and are difficult to distinguish at sea. All common dolphins are slender, with a relatively long beak sharply demarcated from the melon, a high, moderately falcate dorsal fin, and a unique crisscross color pattern. In southern California waters, measurements of adult long-beaked common dolphins revealed lengths of 6.4 to 7.8 ft (193 to 235 cm) long and weights of up to about 517 lbs (235 kg), whereas the short-beaked species was found to range from 5.5 to 6.7 ft (164 to 201 cm) in length and to weigh up to about 440 lbs (200 kg) (Perrin 2009).

Population Abundances

The distribution and abundance of common dolphins in coastal California waters varies considerably with oceanographic conditions; therefore a multi-year average abundance estimate is appropriate (Carretta et al. 2017). The most recent estimate of short-beaked common dolphin abundance is the geometric mean of estimates from 2008 and 2014 summer/autumn vessel-based line-transect surveys of California, Oregon, and Washington waters, 969,861 (CV = 0.17) animals (Barlow 2016). This estimate includes new correction factors for animals missed during the surveys. Similarly, based on ship line-transect surveys conducted in 2008 and 2014, the geometric mean abundance estimate for long-beaked common dolphins in California, Oregon and Washington waters is 101,305 (CV = 0.49) (Carretta et al. 2017).

Common dolphins are present in the coastal waters outside of San Diego Bay, but infrequently enter the bay (NAVFAC SW and POSD 2013) and were never seen within the bay in the Navy's surveys. A sighting of common dolphins in the project area during the IPP in 2014 prompted their inclusion in the second IHA application. More sightings occurred during the second IHA period (NAVFAC SW 2015), with an average abundance of 8.67 individuals per day, a density of 1.5277/km^2. Since the two species could not be distinguished in the field, the same density estimate is used as a combined estimate for both species. The second IHA was based on the regional density estimate at the time (Navy 2015b), which was derived from offshore surveys and was much lower than is now estimated. As for other species observed repeatedly, the Navy believes the monitoring data from the second IHA period represent the best available science on numbers of bottlenose dolphins that are likely to occur.

3.1.6 Pacific White-sided Dolphin

Species Description

The Pacific white-sided dolphin is a North Pacific endemic and one of the most abundant pelagic species of dolphins found in the cold-temperate waters of this region. These dolphins are boldly marked, with a dark gray or black dorsal surface and light gray sides, with light gray "suspender stripes" originating near the melon and angling toward the blowhole across each side into the light gray flank patch. The beak is dark with a narrow stripe extending to the bicolored dorsal fin. The beak is dark, with a narrow stripe extending to the bicolored flipper. The dorsal fin has a darker leading edge with light gray covering two-thirds of the posterior portion. Adults range from 5.6 to 6.8 ft (1.7-2.5 m) in length and weigh 165 to 436 lb (75-198 kg), with males slightly larger than females (Black 2009).

Population Abundance

As summarized by Carretta et al. (2017), the most recent estimate of abundance for Pacific white-sided dolphins is the geometric mean of estimates from 2008 and 2014 summer/autumn vessel-based line-transect surveys of California, Oregon, and Washington waters, 26,814 (CV = 0.28) animals (Barlow 2016). This estimate includes new correction factors for animals missed during the surveys. The distribution of Pacific white-sided dolphins throughout this region is highly variable, apparently in response to oceanographic changes on both seasonal and interannual time scales (Forney and Barlow 1998; Becker et al. 2012; Barlow 2016). As oceanographic conditions vary, Pacific white-sided dolphins may spend time outside the U.S. Exclusive Economic Zone, and therefore a multi-year average abundance estimate including California, Oregon and Washington is the most appropriate for management within U.S. waters.

Based on occasional sightings during the second IHA period (NAVFAC SW 2015), an average daily abundance of 0.28 individuals, and density of 0.0493/km^2 are assumed for the maximum ZOI from pile driving.

3.1.7 Risso's Dolphin

Species Description

Risso's dolphins are distributed worldwide in temperate and tropical oceans. Risso's dolphin is the fifth largest member of the family Delphinidae, with adults reaching 13 ft (4 m) in length. Risso's dolphins are distinctive in appearance: the anterior body is extremely robust, tapering to a relatively narrow tail stock; they have one of the tallest dorsal fins in proportion to body length of any cetacean; and the bulbous head has a distinct vertical crease along the anterior surface of the melon (Baird 2009).

Population Abundance

As summarized by Carretta et al (2017), the distribution of Risso's dolphins throughout this region is highly variable, apparently in response to oceanographic changes on both seasonal and interannual time scales (Forney and Barlow 1998). As oceanographic conditions vary, Risso's dolphins may spend time outside the U.S. Exclusive Economic Zone, and therefore a multi-year average abundance estimate is the most appropriate for management within U.S. waters. The most recent estimate of Risso's dolphin abundance is the geometric mean of estimates from 2008 and 2014 summer/autumn vessel-based line-transect surveys of California, Oregon, and Washington waters, 6,336 (CV = 0.32) animals (Barlow 2016). This estimate includes new correction factors for animals missed during the surveys (Carretta et al. 2017).

Since no data are available for San Diego Bay, the upper range of the regional density estimate from the NMSDD (Navy 2017) of 0.2029/km^2 is assumed.

3.1.8 Gray Whale

Species Description

Gray whales are mysticetes or baleen whales and are the only species in the family Eschrichtiidae. They can grow to about 50 ft (15 m) long and weigh approximately 80,000 lb (35,000 kg); females are slightly larger than males. The Eastern North Pacific stock of gray whale occurs off southern California during their annual migration between summer feeding areas in the Bering and southern Chukchi seas and winter calving areas in Baja California and mainland Mexico. An exception to this generality is the relatively small number (100s) of whales that summer and feed along the Pacific coast between Kodiak Island, Alaska, and northern California. These whales, referred to as the Pacific Coast Feeding Group, may warrant consideration as a distinct stock (Carretta et al. 2016). The southward migration occurs during November-December, whereas the return northward migration occurs during February-May (Carretta et al. 2016; De Jesus and Heckel 2014). During migration they travel alone or in small groups. Gray whales are bottom feeders that suck sediment and benthic invertebrates from the sea floor, filtering their prey through coarse baleen plates (NMFS 2012).

Population Abundance

The Eastern North Pacific stock has continued to increase at rate of approximately 3.3% per year on average, with the most recent estimate of abundance being 20,990 individuals (Carretta et al. 2016).

Gray whales can occur near the mouth of San Diego Bay, and occasionally enter the bay (NAVFAC SW and POSD 2013). However, their occurrence in San Diego Bay is sporadic and unpredictable. In recent years, solitary individuals have entered the bay and remained for varying lengths of time during March 2009, April 2010, July 2011, January 2014, and March 2014 (San Diego Union Tribune 2012; KFMB 2014; San Diego Whale Watching Report 2014). The second IHA used a conservative estimate of 1 individual per day in the ZOI during the migration season. Based on monitoring during the previous IHA periods, this considerably overestimated the occurrence of gray whales in the project area. The estimated regional cold season abundance and density in the nearshore waters is 0.0179/km^2 (Navy 2017). This value probably overestimates occurrence inside the bay, but it is realistic for the area near the mouth, and is conservatively applied to the project area.

3.2 Spatial Distribution

Density assumes that marine mammals are uniformly distributed within a given area, although this is rarely the case. Marine mammals are usually clumped in areas of greater importance, for example, areas of high productivity, lower predation, safe calving, foraging, etc. The site-specific surveys of northern San Diego Bay provide high resolution of the distribution of marine mammals within the affected area. The distribution of sightings (Figure 3-2) indicates that the assumption of uniform or random distribution throughout the affected area is reasonable.

3.3 Submergence

Cetaceans spend their entire lives in the water and spend most of their time (>90% for most species) entirely submerged below the surface. When at the surface, cetacean bodies are almost entirely below the water's surface, with only the blowhole exposed to allow breathing. This makes cetaceans difficult to locate visually and also exposes them to underwater noise, both natural and anthropogenic, essentially 100% of the time because their ears are nearly always below the water's surface.

Seals and sea lions (pinnipeds) spend significant amounts of time out of the water during breeding, molting, and "hauling out" (resting out of the water on land or structures) periods. Sea lions in San Diego Bay are most commonly observed out of water, especially on bait barges, navigation aids, and other structures. Within the project area, about three times as many harbor seals were observed hauled out along the NBPL shoreline as were seen swimming in the general vicinity. When not actively diving, pinnipeds at the surface often orient their bodies vertically in the water column and often hold their heads above the water surface. Consequently, pinnipeds will not be exposed to underwater sounds to the same extent as cetaceans occurring in the same location, but will be subject to airborne noise to a greater degree.

For the purpose of assessing impacts from underwater sound at NBPL, the Navy assumed that that both cetaceans and pinnipeds that occur in the vicinity will be submerged and at the same water depth as the source, and will thereby experience the maximum received SPLs predicted to occur at a given distance from the acoustic source on the basis of acoustic modeling. However, pinnipeds are also conservatively assumed to be out of the water for sufficient periods to be exposed to whatever airborne noise is generated by construction activities as well.

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.

There are nine marine mammal species that are known to occur in proximity to the project site and may be affected by project activities: California sea lion, harbor seal, northern elephant seal, gray whale, coastal bottlenose dolphin, the short-beaked and long-beaked common dolphins, Pacific white-sided dolphin, and Risso's dolphin. None of these species are listed as threatened or endangered under the Endangered Species Act (ESA). The stock status, distribution, and site-specific occurrence of each species are described in this section.

4.1 California Sea Lion, U.S. Stock

4.1.1 Status

The U.S. stock is not considered strategic or depleted under the MMPA.

4.1.2 Distribution

More than 95% of the U.S. Stock breeds and gives birth to pups on San Miguel, San Nicolas, and Santa Barbara islands. Some movement has been documented between the U.S. Stock and Western Baja California, Mexico Stock, but rookeries in the United States are widely separated from the major rookeries of western Baja California. Smaller numbers of pups are born on San Clemente Island, the Farallon Islands, and Año Nuevo Island (Lowry et al. 1991). The California sea lion is by far the most commonly-sighted pinniped species at sea or on land in the vicinity of NBPL and northern San Diego Bay. In California waters, sea lions represented 97 percent (381 of 393) of identified pinniped sightings at sea during the 1998–1999 NMFS surveys (Carretta et al. 2000). They were sighted during all seasons and in all areas with survey coverage from nearshore to offshore areas (Carretta et al. 2000). Sea lions while potentially present at-sea, are most commonly seen hauled-out on piers and buoys within and leading into San Diego Bay, (Merkel and Associates, Inc. 2008). In a study of California sea lion reaction to human activity, Holcomb et al. (2009) showed that in general sea lions are rather resilient to human disturbance.

The distribution and habitat use of California sea lions varies with the sex of the animals and their reproductive phase. Adult males haul-out on land to defend territories and breed from mid-to-late May until late July. Individual males remain on territories for 27 to 45 days without going to sea to feed. During August and September, after the mating season, the adult males migrate northward to feeding areas as far away as Washington (Puget Sound) and British Columbia (Lowry et al. 1991). They remain there until spring (March through May), when they migrate back to the breeding colonies. Thus, adult males are present in offshore areas only briefly as they move to and from rookeries. Distribution of immature California sea lions is less well known, but some make northward migrations that are shorter in length than the migrations of adult males (Huber 1991). However, most immature sea lions are presumed to remain near the rookeries for most of the year. Adult females remain near the rookeries throughout the year. Most births occur from mid-June to mid-July (peak in late June).

Survey data from 1975 to 1978 were analyzed to describe the seasonal shifts in the offshore distribution of California sea lions near the Channel Islands (Bonnell and Ford 1987). The seasonal changes in the center of distribution were attributed to changes in the distribution of the prey species. If California sea lion distribution is determined primarily by prey abundance as influenced by variations in local, seasonal, and interannual oceanographic variation, these same areas might not be the center of sea lion distribution every year. Melin et al. (2008) showed that foraging female sea lions showed significant variability in individual foraging behavior, and foraged further offshore and at deeper depths during El Niño years as compared to non-El Niño years.

There are limited published at-sea density estimates for pinnipeds within southern California. At-sea densities likely decrease during warm-water months because females spend more time ashore to give birth and attend their pups. Radio-tagged female California sea lions at San Miguel Island spent approximately 70% of their time at sea during the nonbreeding season (cold-water months) and pups spent an average of 67% of their time ashore during their mother's absence (Melin and DeLong 2000). Different age classes of California sea lions are found in the San Diego region throughout the year (Lowry et al. 1991). Although adult male California sea lions feed in areas north of San Diego, animals of all other ages and sexes spend most, but not all, of their time feeding at sea during winter. During warm-water months, a high proportion of the adult males and females are hauled out at terrestrial sites during much of the period.

The geographic distribution of California sea lions includes a breeding range from Baja California to southern California. During the summer, California sea lions breed on islands from the Gulf of California to the Channel Islands and seldom travel more than about 31 miles (50 km) from the islands (Bonnell et al. 1983). The primary rookeries are located on the California Channel Islands of San Miguel, San Nicolas, Santa Barbara, and San Clemente (Le Boeuf and Bonnell 1980; Bonnell and Dailey 1993). Their distribution shifts to the northwest in fall and to the southeast during winter and spring, probably in response to changes in prey availability (Bonnell and Ford 1987).

4.1.3 Site-Specific Occurrence

The Navy has conducted numerous marine mammal surveys overlapping the north San Diego Bay project area and the potential ZOI for impact and vibratory pile driving operations. California sea lions regularly occur on rocks, buoys and other structures, and especially on bait barges, although numbers vary greatly. Surveys were conducted along two survey routes through the northern part of the bay during 2007-2008 (Merkel and Associates 2008). These original transect surveys were extensively repeated with minor modifications to thoroughly cover the northern part of the bay (U.S. Pacific Fleet 2009-2012; TDI 2012b; NAVFAC SW 2014; TDI 2014; see Figure 3-1 in Navy 2013a, 2014). Sightings include all animals observed, their locations (using geographical positioning systems), and are annotated as to whether animals were swimming or hauled out; the latter account for the great majority of animals counted.

4.1.4 Behavior and Ecology

Sexual maturity occurs at around 4 to 5 years of age for California sea lions, and the pupping and mating season begins in May and continues through July (Heath 2002). California sea lions are gregarious during the breeding season and social on land during other times. California sea lions' food consists of squid, octopus, and a variety of fishes. While no studies have occurred of their diet in the bay, studies of food sources have been done in other California coastal areas (Antonelis et al. 1990; Lowry et al. 1990; Melin et al. 1993; Hanni and Long 1995; Henry et al. 1995). Fish species found in the bay that sea lions most likely feed on include spiny dogfish, jack mackerel, Pacific herring, Pacific sardine, and northern anchovy. They also eat octopus and leopard shark (NAVFAC SW and POSD 2013).

California sea lions show a high tolerance for human activity (Holcomb et al. 2009), modify their foraging in response to spatial and temporal variations in the availability of different prey species (Lowry et al. 1991), and make opportunistic use of almost any available structures as haulouts (NAVFAC SW and POSD 2013).

Sea lions seek a variety of structures, such as rocks, piers, and buoys and low profile docks for hauling out. These behaviors can be destructive to structures due to the weight of the animal and fouling. If sea lions find an easy food source at tourist spots or fishing piers, their presence can become a nuisance at certain areas in the bay as they have at marinas in Monterey and San Francisco Bay (Leet et al.1992). Marina operators and commercial and sport fishermen tend to consider them a major nuisance, leading to some human-caused mortality.

Within the project study area, the vast majority of sea lions have been observed hauled out on buoys and other structures, particularly on the Bait Barge; these locations are shown in Figure 4-1. While the bait barges afford a large area for resting, the animals may also feed on bait fish that escape, are spilled in transfers, or are tossed into the water by fishermen. It is not known whether there are regular daily patterns in haul-out behavior or movements in and out of the bay. The recent increase in numbers of sea lions in northern San Diego Bay is unrelated to the availability of structures that provide haul-out opportunities, which has not changed appreciably. Sea lions will evidently use whatever structures are available to remain in a preferred location, and when the bait barges were moved prior to the IPP, the sea lions did not follow the barges to their new location, but hauled out instead on nearby docks and piers (NAVFAC SW 2014).

While sea lions are common and apparently thrive amid anthropogenic structures and related noise and activities in northern San Diego Bay, it should be noted that this is a small fraction of the population, and that less developed areas of the adjacent mainland (Point Loma to La Jolla and the Silver Strand), as well as the offshore islands area also heavily utilized.

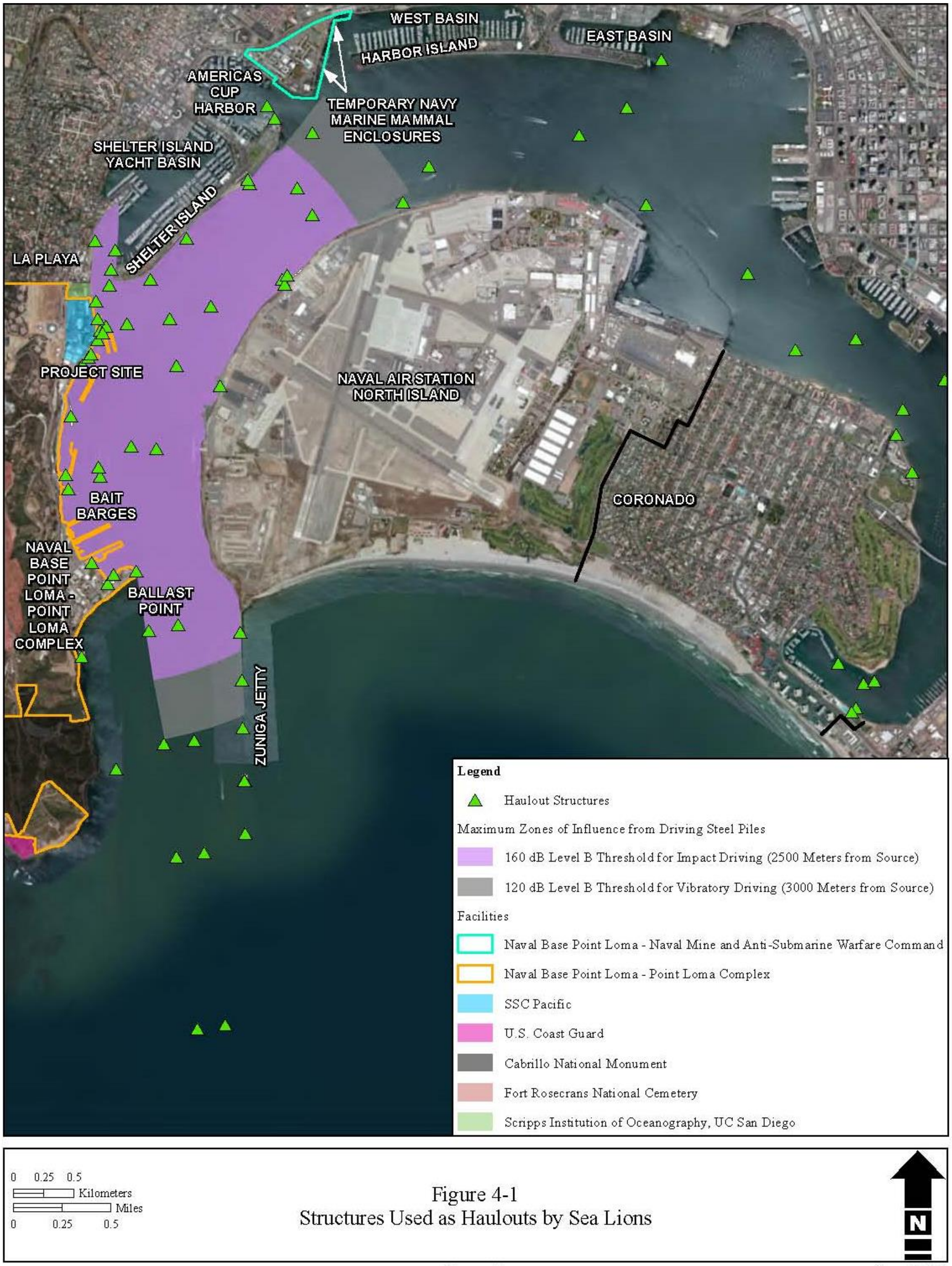


Figure 4-1 Structures Used as Haulouts by Sea Lions

4.1.5 Acoustics

On land, California sea lions make incessant, raucous barking sounds with most of the energy at less than 2 kHz (Schusterman et al. 1967). Males vary both the number and rhythm of their barks depending on the social context; the barks appear to control the movements and other behavior patterns of nearby conspecifics (Schusterman 1977). Females produce barks, squeals, belches, and growls in the frequency range of 0.25 to 5 kHz, while pups make bleating sounds at 0.25 to 6 kHz. California sea lions produce two types of underwater sounds: clicks (or short-duration sound pulses) and barks (Schusterman et al. 1966, 1967, Schusterman and Baillet 1969), both of which have most of their energy below 4 kHz (Schusterman et al. 1967).

The range of maximal hearing sensitivity underwater is between 1 and 28 kHz (Schusterman et al. 1972). Functional underwater high frequency hearing limits are between 35 and 40 kHz, with peak sensitivities from 15 to 30 kHz (Schusterman et al. 1972). The California sea lion shows relatively poor hearing at frequencies below 1 kHz (Kastak and Schusterman 1998). Peak hearing sensitivities in air are shifted to lower frequencies; the effective upper hearing limit is approximately 36 kHz (Schusterman 1974). The best range of sound detection is from 2 to 16 kHz (Schusterman 1974). Kastak and Schusterman (2002) determined that hearing sensitivity generally worsens with depth—hearing thresholds were lower in shallow water, except at the highest frequency tested (35 kHz), where this trend was reversed. Octave band noise levels of 65 to 70 dB RMS above the animal's threshold produced an average temporary threshold shift (TTS) of 4.9 dB RMS in the California sea lion (Kastak et al. 1999). Center frequencies were 1 kHz for corresponding threshold testing at 1 kHz and 2 kHz for threshold testing at 2 kHz; the duration of exposure was 20 min.

4.2 Harbor Seal, California Stock

4.2.1 Status

The California Stock of harbor seal is not considered strategic or depleted under the MMPA.

4.2.2 Distribution

Harbor seals are considered abundant throughout most of their range from Baja California to the eastern Aleutian Islands. An unknown number of harbor seals also occur along the west coast of Baja California, at least as far south as Isla Asuncion, which is about 100 miles south of Punta Eugenia. Peak numbers of harbor seals haul-out on land during late May to early June, which coincides with the peak of their molt. They favor sandy, cobble, and gravel beaches (Stewart and Yochem 1994), with multiple haul-outs identified along the California mainland and Channel Islands (Carretta et al. 2016).

There are limited at-sea density estimates for pinnipeds within southern California. Harbor seals do not make extensive pelagic migrations, but do travel 300 to 500 km on occasion to find food or suitable breeding areas (Carretta et al. 2016). Based on likely foraging strategies, Grigg et al. (2009) reported seasonal shifts in harbor seal movements based on prey availability. When at sea, they remain in the vicinity of haul-out sites and forage close to shore in shallow waters. In relationship to the entire California stock, harbor seals do not have a significant mainland California distribution south of Point Mugu due to beach urbanization and potential disturbance impacts.

4.2.3 Site-Specific Occurrence

Harbor seals are relatively uncommon within San Diego Bay. Sightings in the Navy transect surveys of northern San Diego Bay through March 2012, and were limited to individuals outside of the ZOI, on the south side of Ballast Point (TDI 2012b; Jenkins 2012). However, Navy marine mammal monitoring for another project conducted intermittently at Pier 122 from 2010-2014 documented from zero to 4 harbor seals near Pier 122 (within the ZOI) at various times, with the greatest number of sightings during April and May (Jenkins 2012; Bowman 2014). An individual harbor seal was also frequently sighted near NMAWC during 2014 (McConchie 2014).

4.2.4 Behavior and Ecology

Harbor seals prefer sheltered coastal waters and feed on schooling benthic and epibenthic fish species in shallow water (Bonnell and Dailey 1993). While not studied in the bay, specific prey species have been studied in other California waters (Stewart and Yokem 1985, 1994; Oxman 1993; Henry et al. 1995). Of particular note to San Diego Bay are these potential prey species: specklefin midshipman, plainfin midshipman, jack mackerel, shiner surfperch, yellowfin goby, and English sole. Harbor seals also eat octopus, two species of which are found in the bay (NAVFAC SW and POSD 2013). Although their ecological niche in the bay has not been studied, this pinniped is not likely to play a significant role because of their low numbers (NAVFAC SW and POSD 2012). Harbor seals mate at sea and females give birth during the spring and summer; although the "pupping season" varies by latitude.

4.2.5 Acoustics

In air, harbor seal males produce a variety of low-frequency (<4 kHz) vocalizations, including snorts, grunts, and growls. Male harbor seals produce communication sounds in the frequency range of 100 to 1,000 Hz (Richardson et al. 1995). Pups make individually unique calls for mother recognition that contain multiple harmonics with main energy below 0.35 kHz (Bigg 1981, Thomson and Richardson 1995). Harbor seals hear nearly as well in air as underwater and had lower thresholds than California sea lions (Kastak and Schusterman 1998). Kastak and Schusterman (1998) reported airborne low frequency (100 Hz) sound detection thresholds at 65.4 dB re 20 μPa for harbor seals. In air, they hear frequencies from 0.25 kHz - 30 kHz and are most sensitive from 6 to 16 kHz (Richardson et al. 1995, Terhune and Turnbull 1995, Wolski et al. 2003).

Adult males also produce underwater sounds during the breeding season that typically range from 0.025 to 4 kHz (duration range: 0.1 s to multiple seconds; Hanggi and Schusterman 1994). Hanggi and Schusteman (1994) found that there is individual variation in the dominant frequency range of sounds between different males, and Van Parijs et al. (2003) reported oceanic, regional, population, and site-specific variation that could be vocal dialects. In water, they hear frequencies from 1 to 75 kHz (Southall 2007) and can detect sound levels as weak as 60 to 85 dB re 1 μPa within that band. They are most sensitive at frequencies below 50 kHz; above 60 kHz sensitivity rapidly decreases.

4.3 Northern Elephant Seal, California Breeding Stock

4.3.1 Status

The California breeding stock of northern elephant seal is not considered strategic or depleted under the MMPA. Populations of northern elephant seals in the U.S. and Mexico have recovered after being reduced to near extinction by hunting, undergoing a severe population bottleneck and loss of genetic diversity with the population reduced to only an estimated 10-30 individuals. There are two distinct populations of northern elephant seals: (1) a breeding population in Baja California, Mexico, and (2) a breeding population on U.S. islands off California. Northern elephant seals in the San Diego region could be from either population (Carretta et al. 2016).

4.3.2 Distribution

Northern elephant seals breed and give birth in California (U.S.) and Baja California (Mexico), primarily on offshore islands. Spatial segregation in foraging areas between males and females is evident from satellite tag data. (Carretta et al. 2016; Lowry et al. 2014).

4.3.3 Site-Specific Occurrence

Northern elephant seals occur in the southern California bight, and have the potential to occur in San Diego Bay (NAVFAC SW and POSD 2013), but the only recent documentation of occurrence was of a single distressed juvenile observed on the beach south and inshore of the Fuel Pier during the second year IHA; detailed observations of that individual are provided in the Monitoring Report (NAVFAC SW 2015).

4.3.4 Behavior and Ecology

Northern elephant seals are found in coastal areas and deeper waters of the California Current Large Marine Ecosystem (Carretta et al. 2016; Jefferson et al. 2008). The foraging range of northern elephant seals extends thousands of kilometers offshore from the breeding range into the central North Pacific Transition Zone; however, their range is not considered to be continuous across the Pacific (Simmons et al. 2010; Stewart and Huber 1993). Adult males and females segregate while foraging and migrating (Simmons et al. 2010; Stewart and DeLong 1995; Stewart 1997). Adult females mostly range west to about 173° W, between the latitudes of 40° N and 45° N, whereas adult males range farther north into the Gulf of Alaska and along the Aleutian Islands to between 47° N and 58° N (Le Boeuf et al. 2000; Stewart and Huber 1993; Stewart and DeLong 1995). Adults stay offshore during migration, while juveniles and subadults are often seen along the coasts of Oregon, Washington, and British Columbia (Stewart et al. 1993).

4.3.5 Acoustics

As noted by Kastak and Schusterman (1999), evidence for underwater sound production by this species is scant. Burgess et al. (1998) detected possible vocalizations in the form of click trains that resembled those used by males for communication in air. The audiogram of the northern elephant seal indicates that this species is well-adapted for underwater hearing; sensitivity is best between 3.2 and 45 kHz, with greatest sensitivity at 6.4 kHz and an upper frequency cutoff of approximately 55 kHz (Kastak and Schusterman 1999).

4.4 Gray Whale, Eastern North Pacific Stock

4.4.1 Status

In 1994, due to steady increases in population abundance, the Eastern North Pacific stock of gray whales was removed from listing under the ESA. This stock is not considered strategic or depleted under the MMPA.

4.4.2 Distribution

The Eastern North Pacific population is found from the upper Gulf of California (Tershy and Breese 1991), south to the tip of Baja California, and up the Pacific coast of North America to the Chukchi and Beaufort seas. There is a pronounced seasonal north-south migration. The eastern North Pacific population summers in the shallow waters of the northern Bering Sea, the Chukchi Sea, and the western Beaufort Sea (Rice and Wolman 1971). The northern Gulf of Alaska (near Kodiak Island) is also considered a feeding area; some gray whales occur there year-round (Moore et al. 2007). Some individuals spend the summer feeding along the Pacific coast from southeastern Alaska to central California (Sumich 1984, Calambokidis et al. 1987, 2002). Photo-identification studies indicate that gray whales move widely along the Pacific coast and are often not sighted in the same area each year (Calambokidis et al. 2002). In October and November, the whales begin to migrate southeast through Unimak Pass and follow the shoreline south to breeding grounds on the west coast of Baja California and the southeastern Gulf of California (Braham 1984, Rugh 1984). The average gray whale migrates 4,050 to 5,000 nm (7,500 to 10,000 km) at a rate of 80 nm (147 km) per day (Rugh et al. 2001, Jones and Swartz 2002). Although some calves are born along the coast of California (Shelden et al. 2004), most are born in the shallow, protected waters on the Pacific coast of Baja California from Morro de Santo Domingo (28°N) south to Isla Creciente (24°N) (Urbán- Ramírez et al. 2003). The main calving sites are Laguna Guerrero Negro, Laguna Ojo de Liebre, Laguna San Ignacio, and Estero Soledad (Rice et al. 1981).

Peak abundance of gray whales off the coast of San Diego is January during the southward migration, and in March during the migration north; although females with calves, which depart Mexico later than males or females without calves, can be sighted from March through May or June (Leatherwood 1974; Poole 1984; Rugh et al. 2001; Stevick et al. 2002; Angliss and Outlaw 2008). Gray whales are infrequent migratory transients offshore of San Diego Bay only during cold-water months (Carretta et al. 2000). Migrating gray whales that might infrequently transit the nearshore waters would not be expected to forage, and would likely be present for less than one hour near the mouth of the bay at typical travel speeds of 3 knots (approximately 3.5 miles per hour) (Perryman et al. 1999, Mate and Urbán-Ramirez 2003).

4.4.3 Site-Specific Occurrence

A mean group size of 2.9 gray whales was reported for both coastal (16 groups) and non-coastal (15 groups) areas around SCI. The largest group reported was nine animals. The largest group reported by U.S. Navy (in 1998) was 27 animals (Carretta et al. 2000). Gray whales are not expected in the project area except during the northward migration, when they are closest to the coast (Rice et al. 1981). Gray whale transitory occurrence inside San Diego Bay is sporadic and unpredictable; therefore, use of the regional seasonal density estimate of 0.0179/km^2 for southern California coastal waters (Navy 2017) probably overestimates occurrence inside the bay but is considered conservative for the project area ZOI as a whole.

4.4.4 Behavior and Ecology

Gray whales use their baleen to sift out crustaceans, mollusks, and other invertebrates that they suck from bottom sediments. Bay species of potential benefit to gray whales for food would include medium to large size bivalve mollusks and decapod crustaceans, depending on the spacing between the baleen elements. However, they are unlikely to be feeding in the bay.

Gray whales dive to 160 to 200 ft for 5 to 8 minutes when foraging. In the breeding lagoons, dives are usually less than 6 min (Jones and Swartz, 2002), although dives as long as 26 min have been recorded (Harvey and Mate 1984). Gray whales may remain submerged near the surface for 7 to 10 min and travel 1600 ft or more before resurfacing to breathe when migrating. The maximum known dive depth is 560 ft (Jones and Swartz 2002). Migrating gray whales sometimes exhibit a unique snorkeling behavior—they surface cautiously, exposing only the area around the blow hole, exhale quietly without a visible blow, and sink silently beneath the surface (Jones and Swartz 2002). Mate and Urbán-Ramirez (2003) noted that 30 of 36 locations for a migratory gray whale with a satellite tag were in water <330 ft deep, with the deeper water locations all in the SCB within the Channel Islands. Whales in that study maintained consistent speed indicating directed movement. There has been only one study yielding a gray whale dive profile, and all information was collected from a single animal that was foraging off the west coast of Vancouver Island (Malcolm and Duffus 2000; Malcolm et al. 1996). They noted that the majority of time was spent near the surface on interventilation dives (<10 ft depth) and near the bottom (extremely nearshore in a protected bay with mean dive depth of 60 ft, range 46-72 ft depth). There was very little time spent in the water column between surface and bottom. Foraging depth on summer feeding grounds is between 160-200 ft (50-60 meters [m]) (Jones and Swartz 2002). Based on this very limited information, the following is a rough estimate of depth distribution for gray whales: 50 percent at <13 ft (surface and interventilation dives) and 50 at 13-59 ft. However, most gray whales would be expected at shallower depths during transit through southern California where foraging does not occur due to migration and limited suitable bottom prey habitat.

4.4.5 Acoustics

Au (2000) reviewed the characteristics of gray whale vocalizations. Gray whales produce broadband signals ranging from 100 Hz to 4 kHz (and up to 12 kHz) (Dahleim et al. 1984; Jones and Swartz 2002). The most common sounds on the breeding and feeding grounds are knocks (Jones and Swartz 2002), which are broadband pulses from about 100 Hz to 2 kHz and most energy at 327 to 825 Hz. The source level for knocks is approximately 142 dB re 1µPa at 1 m (Cummings et al. 1968). During migration, individuals most often produce low-frequency moans (Crane and Lashkari 1996). The structure of the gray whale ear is evolved for low-frequency hearing (Ketten 1992). The ability of gray whales to hear frequencies below 2 kHz has been demonstrated in playback studies (Cummings and Thompson 1971; Dahlheim and Ljungblad 1990; Moore and Clark 2002). Gray whale responses to noise include changes in swimming speed and direction to move away from the sound source; abrupt behavioral changes from feeding to avoidance, with a resumption of feeding after exposure; changes in calling rates and call structure; and changes in surface behavior, usually from traveling to milling (e.g., Moore and Clark 2002). Gailey et al. (2007) reported no apparent behavioral disturbance for Western Pacific Gray whales in response to low-frequency seismic survey.

4.5 Bottlenose Dolphin, California Coastal Stock

4.5.1 Status

The California Coastal Stock of bottlenose dolphin is not considered strategic or depleted under the MMPA.

4.5.2 Distribution

The bottlenose dolphin California Coastal stock occurs at least from Point Conception south into Mexican waters, at least as far south as San Quintin, Mexico. In southern California, animals are found within 500 m of the shoreline 99 percent of the time and within 250 m 90 percent of the time (Hanson and Defran 1993). Occasionally, during warm-water incursions such as during the 1982–1983 El Niño events, their range extends as far north as Monterey Bay (Wells et al. 1990). Bottlenose dolphins in the Southern California Bight (SCB) – the coastal waters between Point Conception and just south of the Mexican border - appear to be highly mobile within a narrow coastal zone (Defran et al. 1999), and exhibit little seasonal site fidelity to the SCB region (Defran and Weller 1999) and along the California coast; over 80 percent of the dolphins identified in Santa Barbara, Monterey, and Ensenada have also been identified off San Diego (Navy 2010e).

As seen in the Navy's marine mammal surveys of San Diego Bay (Figures 3-1, 3-2) (Merkel and Associates 2008; U.S. Pacific Fleet 2009-2012; TDI 2012b; NAVFAC SW 2014), coastal bottlenose dolphins have occurred sporadically and in highly variable numbers and locations.

4.5.3 Site-Specific Occurrence

While an average of 2.08 coastal bottlenose dolphins was seen in the 24 Navy surveys from September 2012 through April 2014, 19 were seen in the April 2014 survey alone. Many more observations were made during the second IHA period, which indicated an average abundance of 7.12 individuals per day in the project area ZOI.

4.5.4 Behavior and Ecology

The coastal stock utilizes a limited number of fish prey species with up to 74 percent being various species of surfperch or croakers, a group of non-migratory year-round coastal inhabitants (Defran et al. 1999, Allen et al. 2006). For southern California, common croaker prey species include spotfin croaker, yellowfin croaker, and California corbina, while common surfperch species include barred surfperch and walleye surfperch (Allen et al. 2006). The corbina and barred surfperch are the most common surf zone fish where bottlenose dolphins have been observed foraging (Allen et al. 2006). Defran et al. (1999) postulated that the coastal stock of bottlenose dolphins showed significant movement within their home range (Central California to Mexico) in search of preferred but patchy concentrations of nearshore prey (i.e., croakers and surfperch). Bearzi et al (2009), in an analysis of coastal bottlenose dolphins in the vicinity of Santa Monica, also concluded that low individual re-sighting rates indicates a large coastal bottlenose dolphin distribution influenced by prey distribution. After finding concentrations of prey, animals may then forage within a more limited spatial extent to take advantage of this local accumulation until such time that prey abundance is reduced; the dolphins then shift location once again to be over larger distances (Defran et al.1999, Bearzi et al. 2009). Specific prey items of bottlenose dolphins along the California coast were studied by Defran et al. (1986). San Diego Bay bottlenose dolphins forage on species such as jack mackerel, Cortez grunt, striped mullet, and black croaker, white sea bass, white croaker, spotted croaker, yellowfin croaker, California corbina, queenfish, Pacific mackerel, Pacific bonito, and sierra (NAVFAC SW and POSD 2013).

4.5.5 Acoustics

Sounds emitted by bottlenose dolphins have been classified into two broad categories: pulsed sounds (including clicks and burst-pulses) and narrow-band continuous sounds (whistles), which usually are frequency modulated. Whistles range in frequency from 0.8 to 24 kHz but can also go much higher. Clicks and whistles have a dominant frequency range of 110 to 130 kHz and a source level of 218 to 228 dB re 1 μPa at 1 m (peak to peak levels; Au 1993) and 3.5 to 14.5 kHz with a source level of 125 to 173 dB re 1 μPa at 1 m, respectively (Ketten 1998). The bottlenose dolphin has a functional high-frequency hearing limit of 160 kHz (Au 1993) and can hear sounds at frequencies as low as 40 to 125 Hz (Turl 1993). Inner ear anatomy of this species has been described (Ketten 1992). Electrophysiological experiments suggest that the bottlenose dolphin brain has a dual analysis system: one specialized for ultrasonic clicks and the other for lower-frequency sounds, such as whistles (Ridgway 2000). The audiogram of the bottlenose dolphin shows that the lowest thresholds occurred near 50 kHz at a level around 45 dB re 1 μPa (Nachtigall et al. 2000, Finneran and Houser 2006, 2007). Below the maximum sensitivity, thresholds increased continuously up to a level of 137 dB re 1 μPa at 75 Hz. Above 50 kHz, thresholds increased slowly up to a level of 55 dB re 1 μPa at 100 kHz, then increased rapidly above this to about 135 dB re 1 μPa at 150 kHz. Scientists have reported a range of best sensitivity between 25 and 70 kHz, with peaks in sensitivity occurring at 25 and 50 kHz at levels of 47 and 46 dB re 1 μPa (Nachtigall et al. 2000).

Temporary threshold shifts (TTS) in hearing have been experimentally induced and behavioral responses observed in captive bottlenose dolphins (Ridgway et al. 1997, Schlundt et al. 2000, 2006, Nachtigall et al. 2003, 2004, Finneran et al. 2002, 2005, 2007). Ridgway et al. (1997) observed changes in behavior at the following minimum levels for 1 second tones: 186 dB re 1 μPa at 3 kHz, 181 dB re 1 μPa at 20 kHz, and 178 dB re 1 μPa at 75 kHz. TTS levels were 194 to 201 dB re 1 μPa at 3 kHz, 193 to 196 dB re 1 μPa at 20 kHz, and 192 to 194 dB re 1 μPa at 75 kHz. Schlundt et al. (2000) exposed bottlenose dolphins to intense tones (0.4, 3, 10, 20, and 75 kHz); the animals demonstrated altered behavior at source levels of 178 to 193 dB re 1 μPa, with TTS after exposures between 192 and 201 dB re 1 μPa at 1 m (though one dolphin exhibited TTS after exposure at 182 dB re 1 μPa). Nachtigall et al. (2003) determined threshold for a 7.5 kHz pure tone stimulus. No shifts were observed at 165 or 171 dB re 1 μPa, but when the sound level reached 179 dB re 1 μPa, the animal showed the first sign of TTS. Recovery apparently occurred rapidly, with full recovery apparently within 45 min following sound exposure. In another experiment, TTS occurred after 30 min of exposure to 160 dB re 1 μPa at 4 to 11 kHz. TTS occurred at test frequencies of 8 to 16 kHz but was negligible or absent at higher frequencies (Nachtigall et al. 2004).

4.6 California/Oregon/Washington Stock of Short-beaked Common Dolphin and California Stock of Long-beaked Common Dolphin

4.6.1 Status

Neither of the two stocks of common dolphins is considered strategic or depleted under the MMPA.

4.6.2 Distribution

Short-beaked common dolphins are the most abundant cetacean off California and are widely distributed between the coast and at least 300 nmi offshore. In contrast, long-beaked common dolphins generally occur within 50 nmi of shore. Both species of common dolphin appear to shift their distributions seasonally and annually in response to oceanographic conditions and prey availability (Carretta et al. 2016). The long-beaked species apparently prefers shallower, warmer water than the short-beaked common dolphin (Perrin 2009). Both tend to be more abundant in coastal waters during warm-water months (Bearzi 2005).

4.6.3 Site-Specific Occurrence

Common dolphins are regularly sighted on whale-watching trips out of San Diego (e.g., San Diego Whale Watching Report 2014), but the two species are not usually distinguished. The occurrence of common dolphins inside San Diego Bay is uncommon (NAVFAC SW and POSD 2013). Small groups were observed briefly on several occasions in the northern part of the bay by Navy monitors during the IPP (May 2014). The animals were moving swiftly and could not be distinguished as to species, but the weight of evidence based on distributions of the two species and previous sightings of the long-beaked species near San Diego is that they were probably long-beaked common dolphins.

4.6.4 Behavior and Ecology

Common dolphins are often found in large herds of hundreds or even thousands. They are extremely active, fast moving, and engage in spectacular aerial behavior. They are noted for riding bow and stern waves of boats, often changing course to bow ride the pressure waves of fast-moving vessels and even large whales. Common dolphins can be frequently seen in association with other marine mammal species. They feed on squid and small, schooling fish, sometimes working together to herd fish into tight balls, and occasionally taking advantage of fishing activities to feed on fish escaping from nets or discarded by fishermen (American Cetacean Society 2014).

Common dolphins are an intermittent transient visitor to San Diego Bay and are most commonly observed during the late spring and early summer when bait fish (anchovies and sardines) arrive in increasing numbers. Common dolphins have primarily been observed in the north and north central Bay in pods of 6 to less than 100 animals. The animals typically move rather quickly through the area in tight alignment and occasionally observed riding the bow wave of large ships. In general terms they are much smaller than the common bottlenose dolphin more commonly observed in San Diego Bay and easily identified by distinct markings (Lerma 2014).

4.6.5 Acoustics

While no empirical data on hearing ability exists for common dolphins, functional hearing for both the short- and long- beaked common dolphin is estimated to occur between approximately 150 Hz and 160 kHz, placing them among the group of cetaceans that can hear mid-frequency sounds (Southall et al. 2007).

Recorded *Delphinus* vocalizations (which are similar among species within this genus) include whistles, chirps, barks, and clicks; clicks and whistles have dominant frequency ranges of 23 to 67 kHz and 0.5 to 18 kHz, respectively (see Ketten 1998 for review). For example, Oswald et al. (2003) found that short-beaked common dolphins in the eastern tropical Pacific Ocean have whistles with a mean frequency of 6.3 kHz, mean maximum frequency of 13.6 kHz, and mean duration of 0.8 s. Maximum source levels of approximately 170 dB re 1 μPa at frequencies of 25 and 35 kHz were reported for common dolphins sounds off of southern California (Fish and Turl 1976).

Popov and Klishin (1998) recorded auditory brainstem responses from a short-beaked common dolphin that had stranded off the coast of Russia in the Black Sea. Best sensitivity was observed at 60 to 70 kHz, with responses evoked up to 152 kHz. At this maximum frequency, the stimulus sound level required to evoke a response was 127 dB re 1 μPa received level. Sensitivity decreased more quickly at the higher frequencies than the lower ones, with the resulting U-shaped audiogram for this species similar to that of other dolphins (Finneran et al. 2009).

4.7 Pacific White-Sided Dolphin, California/Oregon/Washington, Northern and Southern Stocks

4.7.1 Status

The stock structure of Pacific white-sided dolphins is dynamic and poorly understood. While the northern and southern stocks are differentiated on the basis of distribution, genetics, and morphological characters, the two forms mix off of Southern California (Carretta et al. 2016). Neither of the two stocks of Pacific white-sided dolphins is considered strategic or depleted under the MMPA.

4.7.2 Distribution

As summarized by Carretta et al. (2014a), Pacific white-sided dolphins are endemic to temperate waters of the North Pacific Ocean, and are common both on the high seas and along the continental margins. Off the U.S. west coast, Pacific white-sided dolphins occur primarily in shelf and slope waters. Sighting patterns from aerial and shipboard surveys conducted in California, Oregon and Washington suggest seasonal north-south movements, with animals found primarily off California during the colder water months and shifting northward into Oregon and Washington as water temperatures increase in late spring and summer (Carretta et al. 2014).

4.7.3 Site-Specific Occurrence

Monitoring during the Year 2 IHA documented 7 sightings of Pacific white-sided dolphins, comprising 27 individuals, with a mean group size of 3.85 individuals per sighting and an average of 0.28 individuals sighted per day of monitoring. These numbers are reasonably close to the upper limit of the regional NMSDD density estimate, which is 0.1006/km^2 during spring (Table 3-1; Navy 2017), and a similar frequency of occurrence and density are assumed during the fifth IHA period.

4.7.4 Behavior and Ecology

Pacific white-sided dolphins are highly social and commonly occur in groups of less than a hundred but can form herds containing several thousands of individuals. They often associate with Risso's dolphins and short-beaked common dolphins, and occasionally feed in associated with California sea lions and mixed-species aggregations of seabirds. Cohesiveness of dolphin groups differences according to behavior: dispersed subgroups while milling, socializing, and feeding, and more tightly grouped while traveling and resting. Pacific white-sided dolphins are highly acrobatic and exhibit a variety of leap types. Three dolphins radiotracked in Monterey Bay for 2 days exhibited a mean respiration rate of 2.5 breaths/minute, a mean dive duration of 24 seconds, and a maximum dive time of 6.2 minutes (Black 2009).

Killer whales (Orcinus orca) are a significant predator, as Pacific white-sided dolphins exhibit a strong flight response when killer whales are near. These dolphins feed opportunistically on fishes (60 species) and cephalopods (20 species) both day and night: schooling epipelagic fishes and cephalopods in California (northern anchovy [*Engraulis mordax*], Pacific whiting [*Merluccius productus*], and squid), and a large variety of primarily mesopelagic species in offshore waters. Females become sexually mature at 8-10 years and males at 9-12 years. Males may live to 42 years and females to 46 years (Black 2009).

4.7.5 Acoustics

Whistles are in the frequency range of 2 to 20 Hz (Richardson et al. 1995). Peak frequencies of the pulse trains for echolocation fall between 50 and 80 kHz; the peak amplitude is 170 dB re 1μPa-m (Fahner et al. 2004). Tremel et al. (1998) measured the underwater hearing sensitivity of the Pacific white-sided dolphin from 75 Hz through 150 kHz with the greatest sensitivities from 4 to 128 kHz.

4.8 Risso's Dolphin, California/Oregon/Washington Stock

4.8.1 Status

The California/Oregon/Washington Stock of Risso's dolphin is not considered strategic or depleted under the MMPA.

4.8.2 Distribution

Risso's dolphins are distributed world-wide in tropical and warm-temperate waters. Off the U.S. west coast, Risso's dolphins are commonly seen on the shelf in the Southern California Bight and in slope and offshore waters of California, Oregon and Washington. Based on sighting patterns from recent aerial and shipboard surveys conducted in these three states during different seasons, animals found off California during the colder water months are thought to shift northward into Oregon and Washington as water temperatures increase in late spring and summer (Carretta et al. 2016).

4.8.3 Site-Specific Occurrence

Although Risso's dolphin has not been documented in San Diego Bay, it is relatively common in the Southern California Bight (Navy 2017; Jefferson et al. 2014; Carretta et al. 2016). After the 1982-1983 El Niño event, Risso's dolphins' presence in southern California waters increased (Shane 1995). As El Niño conditions developed during 2015 (although they are now subsiding), a similar increase in abundance may occur. While Risso's dolphin was not observed in the project area during the third IHA period, its abundance in the Southern California Bight (Jefferson et al. 2014) continues to suggest a reasonable possibility that it could occur within the project ZOI during the fifth IHA period. The NMSDD spring-winter density of $0.2029/km^2$ for the Southern California Bight (Navy 2017) is used to estimate the occurrence of this species during the fifth IHA period.

4.8.4 Behavior and Ecology

Risso's dolphins are relatively gregarious, typically traveling in groups of 10-50 individuals, with the largest observed group estimated at over 4,000 individuals. Based on the age structure of a school killed in a drive fishery in Japan, it has been suggested that mature male Risso's dolphins may move among groups. Risso's dolphins frequently travel with other cetaceans. Off southern California, these dolphins have been documented to "bow ride" on and harass gray whales, and are often seen "surfing" in swells. Aggressive behavior towards short-finned pilot whales has also been observed. Risso's dolphins have been documented with indifference to vessels as well as active avoidance (Baird 2009).

Risso's dolphins are thought to feed almost entirely on squid (neritic and oceanic), with limited research suggesting that they feed primarily at night. No evidence of predation by either killer whales or large sharks is available, but occasional predation by both is likely. Risso's dolphins may be limited by water temperature and occur mostly commonly in waters between 59° F (15° C) and 68° F (20° C). Age at sexual maturity is thought to be 8-10 years for females and 10-12 years for males. The oldest known Risso's dolphin was estimated at 34.5 years old (Baird 2009).

4.8.5 Acoustics

Corkeron and Van Parijs (2001) recorded five different whistle types, ranging in frequency from 4 to 22 kHz. A recent study established empirically that Risso's dolphins echolocate; estimated source levels were up to 216 dB re 1 μPa-m (peak to peak levels) with two prominent peaks in the range of 30-50 kHz and 80-100 kHz (Philips et al. 2003). The range of hearing in Risso's dolphins is 1.6-122.9 kHz with maximum sensitivity occurring between 8 and 64 kHz (Nachtigall et al. 1995).

5 HARASSMENT AUTHORIZATION REQUESTED

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

Under Section 101 (a)(5)(D) of the MMPA, the Navy requests an IHA for the take of small numbers of marine mammals, by Level B behavioral harassment only, incidental to the replacement of the Fuel Pier at NBPL. The Navy requests an IHA for incidental take of marine mammals described within this application for one year commencing on October 8, 2017 (or the issuance date, whichever is later). The Navy previously submitted IHA applications for the first, second, third, and fourth years of construction (Navy 2013a, 2014, 2015, 2016), all of which were approved by NMFS. This is the final IHA application for the project.

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

5.1 Take Authorization Request

The exposure assessment methodology taken in this IHA application attempts to quantify potential exposures to marine mammals resulting from the remaining demolition of the existing pier and pile removal and driving as necessary to complete the relocation of the Navy MMP from NMAWC back to NBPL. Section 6 presents a detailed description of the acoustic exposure assessment methodology. Results from this approach tend to provide an overestimation of exposures because all animals are assumed to be available to be exposed 100% of the time.

Recognizing that the unique shoreline, substrates, and bathymetry of the project area will affect sound transmission, the Navy has collaborated with researchers at the University of Washington to develop a realistic, site-specific model of transmission loss from underwater acoustic sources at the project site. The initial model was described in Appendix A of the first IHA application (Navy 2013a). This model has been replaced with a new model of underwater transmission loss in the project area, which has now been validated with the IPP and production pile data. Sound source levels for the impact and vibratory driving of steel piles, impact driving of 16-in concrete and 24-in x 30-in concrete piles, removal of 16-in concrete piles by dead pull (jetting was used to loosen the piles but did not contribute to SPLs), and the use of cutting tools, were empirically measured during the previous IHA periods, and these empirical values have been used in place of literature-based values used in the first IHA application. Distances to the limits of Level B harassment ZOIs have been empirically measured and have generally validated model predictions.

The in-water demolition and construction activities include a variety of activities and sound sources occurring in the same general location. To provide a realistic worst-case, the Navy has estimated takes by assuming that all in-water sound-generating activities as listed in Table 2-1 will occur on separate days. The total number of in-water work days is estimated as 196.

This analysis predicts 11,013 exposures for all species (see Section 6 for estimates of exposures by species) from pile installation and removal activities during the fifth period of in-water construction and demolition activities that could be classified as Level B harassment under MMPA. The Navy's mitigation procedures, presented in Section 11, include monitoring of mitigation zones prior to the initiation of pile driving and underwater acoustic recordings for which results are available in real-time or nearly so. The Navy believes that these mitigation measures will be effective in avoiding marine mammal exposures to sound levels that would constitute Level A harassment.

5.2 Method of Incidental Taking

Construction activities associated with the Fuel Pier Replacement Project as outlined in Sections 1 and 2 have the potential to disturb small numbers of marine mammals. Specifically, underwater sounds generated from pile installation and removal activities (impact/vibratory pile driving and pile and caisson cutting) may result in "take" in the form of Level B harassment (behavioral disturbance). Although many pinnipeds within acoustic ZOIs are likely to be hauled out during project 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 in almost all cases are much larger for underwater than airborne sound, animals taken by airborne sound are almost all accounted for in the calculation of takes by underwater sound. Estimates of the number of animals exposed to airborne sound at SPLs that would constitute Level B harassment are provided in Chapter 6 and accounted for in the take estimates.

Level A harassment, i.e. the potential to injure a marine mammal, is not anticipated to result from any project activities because monitoring measures will ensure the activities are halted if a marine mammal approaches the "shutdown zone" within which injury could occur. Pile driving will either not start or be halted if marine mammals are within the shutdown zone defined as the distance at which Level A harassment is possible. See Section 11 for more details on the impact reduction and mitigation measures proposed. Furthermore, the pile driving activities analyzed are similar to other construction activities within Washington State and California which have taken place with no reported injuries or mortality to marine mammals (e.g., CALTRANS 2010; NAVFAC 2012).

Table 5-1 below lists the numbers of takes requested for the marine mammal species in the project area for the fifth year of in-water activities.

Table 5-1. Number of Takes Requested per Species (Level B Harassments)

Species	***Number of Level B Takes Requested[1]***
California sea lion	8,971
Harbor seal	281
Northern elephant seal	43
Coastal bottlenose dolphin	704
Common dolphins[2]	861
Pacific white-sided dolphin	28
Risso's dolphin	114
Gray whale	11
Total	***11,013***

Notes[1]. Based on a total of 25 days of pile driving and 171 days of demolition. [2] Includes short-beaked and long-beaked common dolphins.

6 NUMBERS AND SPECIES EXPOSED

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

6.1 Introduction

The NMFS application for an IHA requires applicants to determine the number of marine mammals that are expected to be incidentally harassed by an action and the nature of the harassment (Level A or Level B). Section 5 defines MMPA Level A and Level B and Section 6 below presents how these definitions were relied on to develop the quantitative acoustic analysis methodologies used to assess the potential for the Proposed Action to affect marine mammals.

The project construction and operation as outlined in Sections 1 and 2 have the potential to take marine mammals by harassment only, primarily through construction activities involving in- water pile driving and extraction. Other activities are not expected to result in take as defined under the MMPA. Airborne noise associated with topside demolition and construction activity (as opposed to in-water pile driving and extraction) is not expected reach thresholds at which pinnipeds could be harassed beyond the immediate area of the pier, where no marine mammals will occur.

In-water pile driving and extraction would temporarily increase the local underwater and airborne noise environment in the project area. Research suggests that increased noise may impact marine mammals in several ways and depends on many factors. This will be discussed in more detail in Section 7. The following text provides a background on underwater sound, a description of noise sources in the project area, applicable noise criteria, and the basis for the calculation of take by Level B harassment. Level A harassment of cetaceans and pinnipeds for this project is not expected to occur because, most of the fifth-year project activities have little to no potential to result in Level A harassment; for those that do (i.e. vibratory and/or impact driving the 16-in PC concrete guide piles), sound is likely to deter marine mammals from approaching within the threshold distance. Buffers have been added to the distances for the Level A ZOIs, and if a marine mammal does approach the area of potential Level A harassment, the Navy monitoring team's experience and proven effectiveness will ensure that work is curtailed. Therefore, Level A harassment is not discussed in this application.

6.2 Fundamentals of Sound

Sound is a physical phenomenon consisting of regular pressure oscillations that travel through a medium, such as air or water. Sound frequency is the rate of oscillation, measured in cycles per second or Hertz (Hz). The amplitude (loudness) of a sound is its pressure, whereas its intensity is proportional to power and is pressure squared. The standard international unit of measurement for pressure is the Pascal, which is a force of 1 Newton exerted over an area of 1 square meter; sound pressures are measured in microPascals (μPa).

Due to the wide range of pressure and intensity encountered during measurements of sound, a logarithmic scale is used, based on the decibel (dB), which, for sound intensity, is 10 times the $\log_{10}$ of the ratio of the measurement to reference value. For sound pressure level (SPL), the amplitude ratio in dB is 20 times the $\log_{10}$ ratio of measurement to reference. Hence each increase of 20 dB in SPL reflects a 10-fold increase in signal amplitude (whether expressed in terms of pressure or particle motion). That is, 20 dB means 10 times the amplitude, 40 dB means

100 times the amplitude, 60 dB means 1,000 times the amplitude, and so on. Because the dB is a relative measure, any value expressed in dB is meaningless without an accompanying reference. In describing underwater sound pressure, the reference amplitude is usually 1 µPa, and is expressed as "dB re 1 µPa." For in-air sound pressure, the reference amplitude is usually 20 µPa and is expressed as "dB re 20 µPa."

The method commonly used to quantify airborne sounds consists of evaluating all frequencies of a sound according to a weighted filter that mimics human sensitivity to amplitude as a function of frequency. This is called A-weighting and the decibel level measured is called the A-weighted sound level (dBA). Methods of frequency weighting that reflect the hearing of marine mammals have been proposed (Southall et al. 2007; Finneran and Jenkins 2012) and are being used in new analyses of Navy testing and training effects, but have not been adopted for pile driving and other non-explosive impulsive sounds (Marine Species Modeling Team 2012). Therefore, underwater sound levels are not weighted and measure the entire frequency range of interest. In the case of marine construction work, the frequency range of interest is 20 Hz to 20 kHz.

Table 6-1 summarizes commonly used terms to describe underwater sounds. Two common descriptors are the instantaneous peak SPL and the root mean square (rms) SPL. The peak pressure is the instantaneous maximum or minimum overpressure observed during each pulse or sound event and is presented in dB re 1 µPa. The rms level is the square root of the mean of the squared pressure (= intensity) level as measured over a specified time period. All underwater sound levels throughout the remainder of this application are presented in dB re 1 µPa unless otherwise noted.

Table 6-1. Definitions of Acoustical Terms

Term	***Definition***
Decibel, dB	A unit describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure. The reference pressure for water is 1 microPascal (µPa) and for air is 20 µPa (approximate threshold of human audibility).
Sound Pressure Level, SPL	Sound pressure is the force per unit area, usually expressed in microPascals where 1 Pascal equals 1 Newton exerted over an area of 1 square meter. The SPL is expressed in decibels as 20 times the logarithm to the base 10 of the ratio between the pressure exerted by the sound to a reference sound pressure. SPL is the quantity that is directly measured by a sound level meter.
Frequency, Hz	Frequency is expressed in terms of oscillations, or cycles, per second. Cycles per second are commonly referred to as hertz (Hz). Typical human hearing ranges from 20 Hz to 20 kHz.
Peak Sound Pressure, dB re 1 µPa	Peak SPL is based on the largest absolute value of the instantaneous sound pressure over the frequency range from 20 Hz to 20 kHz. This pressure is expressed in this application as dB re 1 µPa.
Root-Mean-Square (rms), dB re 1µPa	The rms level is the square root of the mean of the squared pressure level(s) as measured over a specified time period. For pulses, the rms has been defined as the average of the squared pressures over the time that comprise that portion of waveform containing 90 % of the sound energy for one impact pile driving impulse.
Sound Exposure Level (SEL), dB re 1 µPa2 sec	Sound exposure level is a measure of energy. Specifically, it is the dB level of the time integral of the squared-instantaneous sound pressure, normalized to a 1-sec period. It can be an extremely useful metric for assessing cumulative exposure because it enables sounds of differing duration, to be compared in terms of total energy.
Waveforms, µPa over time	A graphical plot illustrating the time history of positive and negative sound pressure of individual pile strikes shown as a plot of µPa over time (i.e., seconds).

Term	***Definition***
Frequency Spectrum, dB over frequency range	The amplitude of sound at various frequencies, usually shown as a graphical plot of the mean square pressure per unit frequency (µPa^2/Hz) over a frequency range (e.g., 10 Hz to 10 kHz in this application).
A-Weighting Sound Level, dBA	The SPL in decibels as measured on a sound level meter using the A- or C-weighting filter network. The A-weighting filter de-emphasizes the low and high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective human reactions to noise.
Ambient Noise Level	The background sound level, which is a composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.

6.3 Effects of Pile Installation and Removal Activities

6.3.1 Description of Noise Sources

Underwater sound levels are comprised of multiple sources, including physical noise, biological noise, and anthropogenic noise. Physical noise includes waves at the surface, earthquakes, ice, and atmospheric noise. Biological noise includes sounds produced by marine mammals, fish, and invertebrates. Anthropogenic noise consists of vessels (small and large), dredging, aircraft overflights, and construction noise. Known noise levels and frequency ranges associated with anthropogenic sources similar to those that would be used for this project are summarized in Table 6-2. Details of each of the sources are described in the following text.

Table 6-2. Representative Noise Levels of Anthropogenic Sources

Noise Source	***Frequency Range (Hz)***[1]	***Underwater Noise Level (dB re 1 µPa)***[2]	***Reference***
Small vessels	250 – 1,000	151 dB rms at 1 meter (m)	Richardson et al. 1995
Tug docking gravel barge	200 – 1,000	149 dB rms at 100 m	Blackwell and Greene 2002
Vibratory driving of 72-in steel pipe pile	10 – 1,500	180 dB rms at 10m	CALTRANS 2007
Impact driving of 36-in steel Pipe pile	10 – 1,500	195 dB rms at 10m	WSDOT 2007
Impact driving of 66-in cast-in-steel-shells (CISS) piles	100 – 1,500	195 dB rms at 10 m	Reviewed in Hastings and Popper 2005

[1]These are the dominant frequency ranges but there is often considerable energy outside these ranges.
[2] These are average source SPLs at a particular location; site-specific bathymetry and substrate will affect SPLs.

In-water construction activities associated with the Project would include impact pile driving, vibratory pile driving, hydraulic pile cutting, diamond saw cutting of caissons, and pile extraction activities. The sounds produced by these activities fall into one of two sound types: impulsive and non-impulsive (defined below). Impact pile driving produces impulsive sounds, while vibratory pile driving produce non-impulsive (or continuous) sounds. The distinction between these two general sound types is important because they have differing potential to cause physical effects, particularly with regard to hearing (e.g., Ward 1997 as cited in Southall et al. 2007).

Impulsive sounds (e.g., explosions, gunshots, sonic booms, seismic airgun pulses, and impact pile driving) are brief, broadband, atonal transients (American National Standards Institute 1986; Harris 1998) and occur either as isolated events or repeated in some succession (Southall et al. 2007). Impulsive sounds are all characterized by a relatively rapid rise from ambient pressure to a maximal pressure value followed by a decay period that may include a period of diminishing, oscillating maximal and minimal pressures (Southall et al. 2007). Impulsive sounds generally have an increased capacity to induce physical injury as compared with sounds that lack these features (Southall et al. 2007).

Non-impulsive (intermittent or continuous sounds) can be tonal, broadband, or both (Southall et al. 2007). Some of these sounds can be transient signals of short duration but without the essential properties of pulses (e.g., rapid rise time) (Southall et al. 2007). Examples of non-impulsive sounds include vessels, aircraft, machinery operations such as drilling or dredging, vibratory pile driving, diamond saw cutting, and active sonar systems (Southall et al. 2007). The duration of such sounds, as received at a distance, can be greatly extended in highly reverberant environments (Southall et al. 2007).

6.3.2 Sound Exposure Criteria and Thresholds

Under the MMPA, NMFS has defined levels of harassment for marine mammals. Level A harassment is defined as "Any act of pursuit, torment, or annoyance which has the potential to injure a marine mammal or marine mammal stock in the wild." Level B harassment is defined as "Any act of pursuit, torment, or annoyance which has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including but not limited to migration, breathing, nursing, breeding, feeding or sheltering."

On August 5, 2016, NMFS finalized the acoustic threshold levels for determining the onset of permanent threshold shift (PTS) in marine mammals in response to underwater impulsive and non-impulsive sound sources (NMFS 2016a). The new criteria use cumulative sound exposure level metrics (SEL_{cum}) and instantaneous peak SPL (dB_{pk}) rather than the dB rms metric. NMFS equates the onset of PTS, which is a form of auditory injury, with Level A harassment under the MMPA and "harm" under the ESA. Temporary threshold shifts (TTS) in hearing ability resulting from noise exposure, along with non-injury behavioral disturbances, are considered Level B harassment under the MMPA. Both forms of harassment constitute "incidental take" under these statutes. Under the new Technical Guidance (NMFS 2016a), Level A and Level B Harassment are further defined as:

- **(Level A Harassment)** would result from non-serious injury or permanent (hearing) threshold shift; or
- **(Level B Harassment**) would result from behavioral disturbance or temporary (hearing) threshold shift.

Only PTS was addressed in the final Technical Guidance (NMFS 2016a). Per 81 FR 51693, NMFS does not currently recommend calculations of TTS exposures separate from assessments of Level B harassment using the prior existing thresholds for enumerating Level B (behavioral) takes. Therefore, distances to TTS thresholds were not estimated, and the ZOIs for sound producing activities resulting in Level B (non-injury behavioral) harassment for seals both under and above water were calculated using the prior thresholds, recognizing that TTS is possible within the Level B ZOI. Recent studies of pile driving used to construct offshore wind turbines have validated the distances over which underwater sound from pile driving may exceed NMFS thresholds (Bailey et al. 2010), as well as behavioral responses of harbor porpoises (*Phocoena phocoena*) to intense sound from pile driving (Brandt et al. 2011; Thompson et al. 2010). The updated Level A (injury) and Level B (disturbance) thresholds for underwater sound are shown in Table 6-3.

Table 6-3. Marine Mammal Injury and Disturbance Thresholds for Underwater Sounds

Marine Mammal Hearing Group	UNDERWATER SOUNDS				
	Impulsive (i.e., Impact Pile Driving)			Non-Impulsive, Continuous (i.e., Vibratory Pile Driving, Pile and Caisson Cutting)	
	L_{pk}, flat (re 1 µPa)	L_E, SEL_{cum} (24-hr) (re 1 µPa^{2}s)	Impulsive (dB rms re 1 µPa)	SEL_{cum} (24-hr) (re 1 µPa^2-s)	Non-impulsive (dB rms re 1 µPa)
	Level A Harassment PTS Onset Thresholds (received level)		***Level B Harassment (Behavioral)***	***Level A Harassment (PTS)***	***Level B Harassment (Behavioral)***
Low-frequency cetaceans	219 dB	183 dB	160 dB	199 dB	120 dB
Mid-frequency cetaceans	230 dB	185 dB	160 dB	198 dB	120 dB
High-frequency cetaceans	202 dB	155 dB	160 dB	173 dB	120 dB
Phocid pinnipeds	218 dB	185 dB	160 dB	201 dB	120 dB
Otariid pinnipeds	232 dB	203 dB	160 dB	219 dB	120 dB

Notes: L_{pk} flat - The subscript "flat" indicates peak sound pressure should be flat weighted or unweighted within the generalized hearing group.
L_E - cumulative sound exposure and indicating designated marine mammal auditory weighting function is for the recommended accumulation period of 24 hours.
re 1 µPa^{2}s = referenced to a pressure of 1 microPascal squared per second.
Sources: NMFS 2009, 2016a.

Level A harassment is assumed to result in a "stress response." The stress response per se is not considered injury, but refers to an increase in energetic expenditure that results from exposure to the stressor and which is predominantly characterized by either the stimulation of the sympathetic nervous system or the hypothalamic-pituitary-adrenal axis (Reeder and Kramer 2005). The presence and magnitude of a stress response in an animal depends on the animal's life history stage, environmental conditions, reproductive state, and experience with the stressor (Navy 2010e).

Behavioral harassment (Level B) is considered to have occurred when marine mammals are exposed to sounds at or above 160 dB rms for impulse sounds (*e.g.*, impact pile driving) and 120 dB rms for continuous noise (*e.g.*, vibratory pile driving), but below injurious thresholds. Level B harassment may or may not be result in a stress response. The criteria for vibratory pile driving would also be applicable to vibratory pile extraction or the use of a pneumatic chipper. The application of the 120 dB rms threshold can sometimes be problematic because this threshold level can be either at or below the ambient noise level of certain locations. As a result, these levels are considered precautionary (NMFS 2009, 74 FR 41684).

6.3.3 Limitations of Existing Noise Criteria

To date, there is no research or data supporting a response by pinnipeds or odontocetes 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 by Malme et al. (1984, 1986) for California gray whale response to continuous industrial sounds such as drilling operations. The 120 dB rms continuous sound threshold should not be confused with the 120 dB rms pulsed sound criterion established for migrating bowhead whales in the Arctic as a result of research in the Beaufort Sea (Richardson et al. 1995; Miller et al. 1999). Southall et al. (2007) 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 1 μPa rms generally do not appear to induce strong behavioral responses.

6.3.4 Ambient Noise

Ambient noise by definition is background noise and it has no single source or point. Ambient noise varies with location, season, time of day, and frequency. Ambient noise is continuous, but with much variability on time scales ranging from less than one second to one year (Richardson et al. 1995). Ambient underwater noise in San Diego Bay is highly variable over time, largely because of anthropogenic sources that include vessel engines and cranes, generators, and other types of mechanized equipment on piers and wharves or the adjacent shoreline (Urick 1983).

As discussed in the previous IHA applications (Navy 2013a, 2014, 2015, 2016), underwater noise levels in the project area are commonly 120-130 dB re 1µPa, with an overall average of approximately 129.6 dB re 1µPa and higher maximum rms and peak SPL readings (in excess of 150 dB re 1µPa) due to passing ships. The data for the project area suggest that with increasing distance from the project site, particularly for vibratory pile driving, as received sound levels drop to approximately 130-135 dB re 1µPa rms, project sounds become undetectable with regards to potential monitoring and verification of sound levels (NAVFAC SW 2015), and that it would not be perceived by marine mammals as louder or significantly different than regularly occurring background noise. As such it would be unlikely to elicit biologically significant behavioral reactions, especially considering that there are no associated stimuli, e.g., a moving vessel, to suggest an approaching threat.

6.4 Distance to Sound Thresholds

6.4.1 Underwater Sound Propagation Formula

Pile driving and vibratory pile extraction would generate underwater noise that potentially could result in disturbance to marine mammals swimming by the Project Area. Transmission loss (TL) underwater is the decrease in sound intensity due to sound spreading and chemistry- and viscosity-based absorption as an acoustic pressure wave propagates out from a source. TL 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:

$$TL = B * \log_{10}(R) + C * R, \text{ where}$$

B = logarithmic (predominantly spreading) loss

C = linear (scattering and absorption) loss

R = ratio of receiver distance to source reference distance (usually 1m or 10m)

The C term is strongly dependent on frequency, temperature, and depth, but is conservatively assumed to equal zero for pile driving. The B term 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 where spreading may start out spherically but then end up cylindrically as the sound in constrained by the surface and the bottom. For the first IHA, a site-specific model was developed for TL from pile driving at a central point at the project site (Appendix A of Navy 2013a). The model is based on historical temperature-salinity data and location-dependent bathymetry. In the model, TL is the same for different sound source levels and is applied to each of the different activities to determine the point at which the applicable thresholds are reached as a function of distance from the source. The model's predictions were intended to be conservative and were tested during the IPP conducted between 28 April and 15 May and continued on 24 October 2014 (NAVFAC SW 2014, 2015).

Maximum distances to Level A thresholds for cumulative sound exposure were calculated using the new NMFS Technical Guidance and User Spreadsheet (NMFS 2016a-b).

6.4.2 Underwater Noise from Pile Driving and Extraction

The intensity of pile driving or sounds is greatly influenced by factors such as the type of piles, hammers, and the physical environment in which the activity takes place. For the installation of 30-in steel piles and pile cutting activities, acoustic monitoring during the first and second IHA periods (NAVFAC 2015) resulted in empirical data that are directly applicable to the fifth IHA period in terms of the activities and the location, depth, sizes and types of piles.

Table 6-4 identifies the sound source levels that are used in evaluating impact and vibratory pile driving and extraction in the current IHA application. Sound levels for the hydraulic pile cutter, diamond saw caisson cutting, and pile jetting were measured during the fourth IHA period (NAVFAC SW 2017). No acoustic data are available from the vibratory driving of 16-in concrete piles, so the data for vibratory installation of 30-in steel piles from the second IHA period are used as a conservative proxy (NAVFAC SW 2015). Finally, SPLs were measured for the impact driving of 16-in poly-concrete piles during the third IHA monitoring period (NAVFAC SW 2016a), and are used in this application for the same activities.

Table 6-4. Underwater Sound Pressure Levels from Similar *In Situ* Monitored Construction Activities

Project and Location	***Pile Size and Type***	***Method***	***Water Depth***	***Measured Sound Pressure Levels (rms) at 10 m*** (dB re 1 μPa)	
				Level A[1]	***Level B***
NBPL Fuel Pier, San Diego, CA	13 to 24-in concrete	Hydraulic pile cutting	9 m (30 ft)	145	165.3[2]
NBPL Fuel Pier, San Diego, CA	66- and 84-in steel caisson	Diamond saw cutting	9 m (30 ft)	149	155.6[2]
NBPL Fuel Pier, San Diego, CA	24-in concrete	Jetting	9 m (30 ft)	155	159.9[2]
NBPL Fuel Pier, San Diego, CA	30-in Steel Pipe[2]	Vibratory	9 m (30 ft)	162.5	162.5[3]
NBPL Fuel Pier, San Diego, CA	16-in Poly-Concrete	Impact	9 m (30 ft)	188.9	195[4]

Notes: [1]Mean source levels used from data from previous monitoring reports (NAVFAC SW 2015, 2016a, 2017).
[2]Maximum source levels used from data from previous monitoring reports (NAVFAC SW 2015, 2016a, 2017).
[3]Mean source levels used as a conservative proxy for vibratory driving of 16-in concrete guide piles and are based on 30-in steel pipe piles (NAVFAC SW 2015).
[4]The maximum source level is included for reference only. The distance to the Level B ZOI is based on *in situ* data collected for 16-in poly-concrete piles and was documented in NAVFAC SW (2016a).

As noted by NMFS (2010), there is a paucity of 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 (NMFS 2010). For this application, the same value (162.5 dB re 1µPa) that was obtained for vibratory hammering of the 30-in steel piles at the Fuel Pier (NAVFAC SW 2015) is used for the vibratory hammering of 16-in round concrete piles at NMAWC. None of the peak SPLs for the various sound sources reach the injury thresholds identified in the new NMFS (2016) Technical Guidance; therefore, injury from peak sound levels is not considered further in this IHA application.

Table 6-5 provides the calculated areas of Level A and Level B ZOIs associated with the impulsive and continuous sounds that are anticipated during the fifth-year IHA period. Appendix A provides the data that were used to calculate the distances to the Level A and B ZOIs presented in Table 6-5. It should be noted that the ZOI for level A harassment would be closely monitored and subject to shutdowns if a marine mammal enters the area. The ZOI areas and maximum distances for the activities at the fuel pier and NMAWC are shown in Figures 6-1 and 6-2, respectively. The figures reflect the conventional assumption that the natural or manmade shoreline acts as a barrier to underwater sound. Although it is known that there can be leakage or diffraction around such barriers, the prediction of resulting sound levels remains in the research modeling world, and it is generally accepted practice to model underwater sound propagation from pile driving as continuing in a straight line past a shoreline projection such as Ballast Point (Dahl 2012). Similarly, it is reasonable to assume that project sound would not propagate east of Zuniga Jetty (Dahl 2012).

All of the ZOIs for potential Level A acoustic harassment (Table 6-5) would be buffered and encompassed by a larger shutdown zone as shown in Figures 6-1 and 6-2. For example, the ZOIs for potential Level A acoustic harassment to pinnipeds from impact pile driving (Table 6-5) would be within a 60 m (196 ft) shutdown zone. For impact pile driving at NMAWC, two methods identified in NMFS (2016) were evaluated to determine the most conservative distances to the Level A ZOIs using: 1) RMS SPL Source Levels; and 2) Single Strike Equivalent. The calculations showed that the first method was the most conservative and this method was subsequently used to determine the distances to the Level A ZOIs (Table 6-5). In all Level A ZOI calculations, the default values for the weighting factor adjustment and propagation loss were used (Appendix A).

The Level B ZOIs and distances are based on the validated SPLs directly measured during the IHA monitoring (NAVFAC SW 2014-2017), as available. For example, the distance to the Level B ZOI for impact driving of 16-in poly-concrete piles was 270 m (886 ft) during Year 3 monitoring (NAVFAC SW 2016a). In cases where monitoring data are not available to empirically measure the extent of the Level B ZOI (activities at NMAWC), "practical spreading loss" from the source at 10 m has been assumed (15 log[distance/10]) and used to calculate the maximum extent of the ZOI based on the applicable threshold. Because the mean ambient sound levels in San Diego Bay range from approximately 128 to 130 dB rms (NAVFAC SW 2015), the 120 dB acoustic threshold for the Level B ZOIs are based on an approximate value between 128 and 129 dB. The distances for all activities producing sound at NMAWC will be verified via hydrophone during project activities.

6.4.3 Airborne Sound from Pile Driving

Pile driving and removal generate will airborne noise that could result in disturbance to marine mammals (pinnipeds) hauled out or at the water's surface. As a result, the Navy analyzed the potential for pinnipeds hauled out or swimming at the surface near the project site to be exposed to airborne SPLs that could result in Level B behavioral harassment. The appropriate airborne noise thresholds for behavioral disturbance for all pinnipeds, except harbor seals is 100 dB re 20 µPa rms (unweighted) and for harbor seals is 90 dB re 20 µPa rms (unweighted) (see Table 6-3). A spherical spreading loss model, assuming average atmospheric conditions, is typically used to estimate the distance to the 100 dB and 90 dB re 20 µPa rms (unweighted) airborne thresholds. The 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.

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. As part of the monitoring for the first and second IHAs, the Navy made extensive measurements of airborne sound from impact and vibratory pile driving across a range of distances to determine source levels at a nominal 50 ft (15 m) source distance, and distances near the limits of potential behavioral disturbance to sea lions (100 dB re 20 µPa rms (unweighted)) and harbor seals (90 dB re 20 µPa rms (unweighted)). The full results are provided in the Navy's monitoring reports (NAVFAC SW 2014-2017).

The airborne ZOIs shown in Table 6-5 are based on data collected during the 30-inch vibratory pile driving from IHA #4 (NAVFAC SW 2017). During the first two IHA periods the, sea lions were observed hauled out on structures and swimming within distances where they were probably exposed to airborne noise in excess of the 100 dB threshold, in most cases without noticeable reactions or effects (NAVFAC SW 2014, 2015, 2016a-b).

Table 6-5. Calculated Maximum Areas of ZOIs and Distances Corresponding to MMPA Thresholds[1]

Activity	Measured/Calculated Distances to Thresholds (m) and Areas of ZOIs (m^2 or km^2)							
	Underwater						Airborne	
	Level A[1,2,3]				Level B[4]		Level B	
	LF	MF	PW	OW	160 dB	120 dB[5]	100 dB[6]	90 dB[6]
Old Fuel Pier and Temporary Mooring Dolphin Demolition								
66-inch and 84-inch caissons (Diamond saw cutting)	3.6 m 41 m^2	0.3 m < 1 m^2	2.2 m 15 m^2	0.2m <1 m^2	N/A	631 m 0.7157 km^2	N/A	
Concrete piles (Pile clipping)	1.2 m 4 m^2	0.1 m < 1 m^2	0.7 m < 1 m^2	0.0 m 0 m^2	N/A	2,511 m 4.4512 km^2		
30-inch steel piles (Plasma torch cutting)[7]	N/A							
NMAWC Construction and Demolition								
16-inch concrete piles (Vibratory extraction/driving)[8]	8.3 m 216 m^2	0.7 m < 1 m^2	5.1 m 82 m^2	0.4 m < 1 m^2	N/A	1,848 m 2.4473 km^2	42 m 5,503 m^2	149 m 69,646 m^2
16-inch concrete piles (Impact driving)[9]	63.4 m 0.0126 km^2	2.3 m 17 m^2	33.9 m 3,610 m^2	2.5 m 20 m^2	270 m 0.1408 km^2	N/A		
16-inch concrete piles (Jetting pile extraction)	3.9 m 47.8 m^2	0.3 m <1 m^2	2.4 m 18 m^2	0.2 m <1 m^2	N/A	1,165m 1.4268km^2	N/A	
16-inch concrete piles (Pile dead-pull)	N/A							

Notes: [1] If measured value thresholds are less than 10 m (33 ft), the regulatory requirement is a minimum monitoring distance of 10 m (33 ft).

[2] Based on measured mean source levels. The relevant data have been included in Appendix A, which provides information from previous years' data collected as part of the Fuel Pier Project (NAVFAC SW 2015, 2016a, 2017).

[3] LF = Low-frequency cetaceans; MF = Mid-frequency cetaceans; PW = Phocid pinnipeds; OW = Otariid pinnipeds. The high-frequency cetacean hearing group (HF) is omitted, because no species in the hearing group occur in, or around, the Project area.

[4] Based on measured maximum source levels, unless otherwise stated. The relevant data have been included in Appendix A, which provides information from previous years' data collected as part of the Fuel Pier Project (NAVFAC SW 2015, 2016a, 2017).

[5] Average ambient sound levels in San Diego Bay are approximately 128 to 130 dB rms (NAVFAC SW 2015), and all 120 dB Level B ZOIs are based on an approximate value between 128 and 129, which represents ambient levels in the Bay.

[6] Airborne ZOIs based on conservative representative data (collected during 30-inch vibratory pile driving from IHA #4). Airborne noise levels did not exceed regulatory thresholds during IHA #4 monitoring of demolition activities.

[7] Plasma torch noise levels are not expected to exceed underwater or airborne regulatory thresholds.

[8] Based on conservative representative source levels of 162.5 dB rms (30-inch steel vibratory pile driving, NAVFAC SW 2015).

[9] Based on conservative representative source levels of 188.9 dB rms for Level A calculations, and *in situ* data (16-inch poly-concrete impact pile driving) collected for the Level B ZOI (NAVFAC SW 2016a).

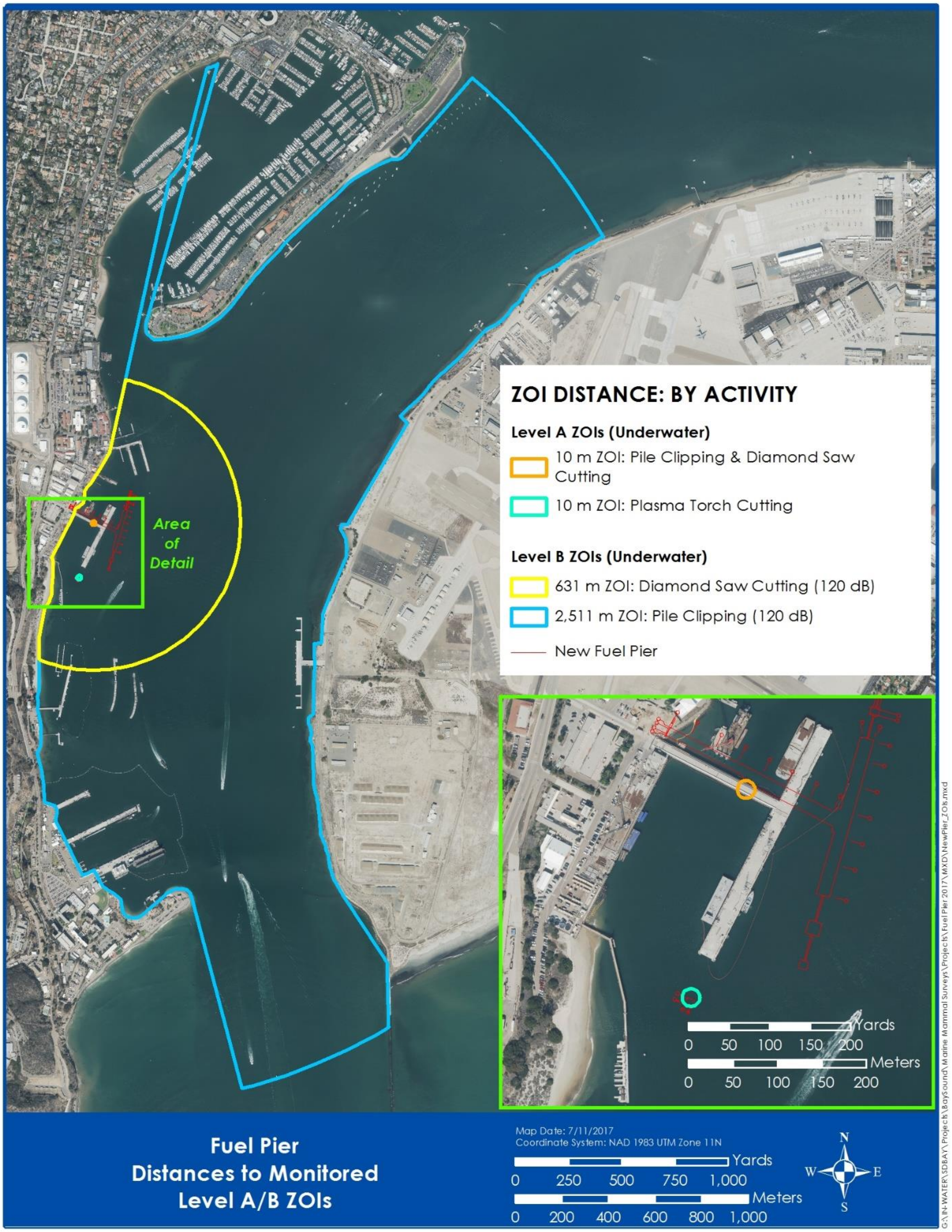


Figure 6-1 Underwater Sound ZOIs from Year 5 Activities at NBPL Fuel Pier

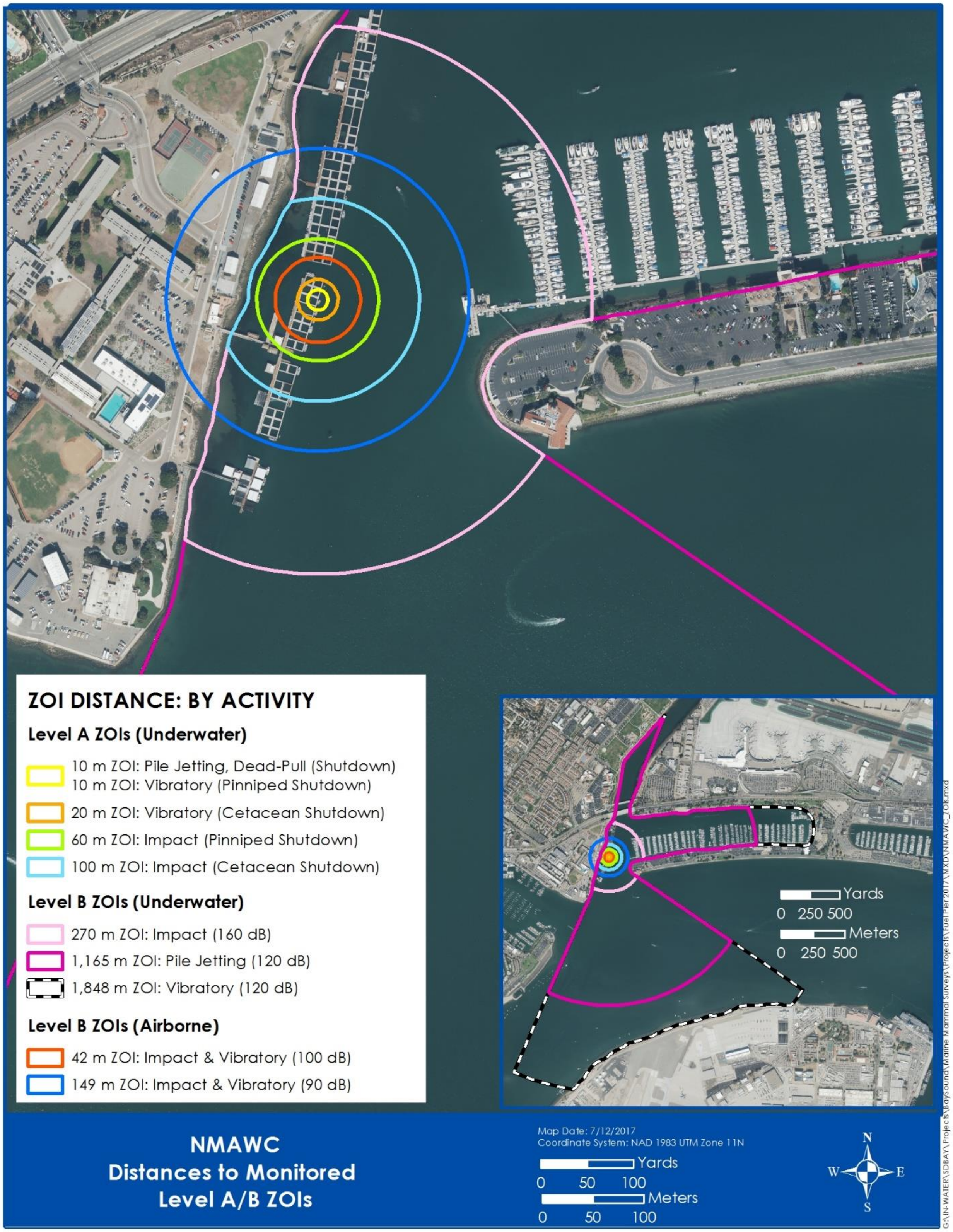


Figure 6-2 Underwater and Airborne Sound ZOIs from Year 5 Activities at NMAWC

6.4.4 Auditory Masking

Natural and artificial sounds can disrupt behavior by masking, or interfering with a marine mammal's ability to hear other sounds. Masking occurs when the receipt of a sound is interfered with by another coincident sound at similar frequencies and at similar or higher levels. If the second sound is manmade and disrupts hearing-related behavior such as communications or echolocation (Wartzok et al. 2003/04), it could be considered harassment under the MMPA. Noise can only mask a signal if it is within a certain "critical band" around the signal's frequency and its energy level is similar or higher (Holt 2008). Noise within the critical band of a marine mammal signal will show increased interference with detection of the signal as the level of the noise increases (Wartzok et al. 2003/04). In delphinid subjects, for example, relevant signals needed to be 17 to 20 dB rms louder than masking noise at frequencies below 1 kHz in order to be detected and 40 dB greater at approximately 100 kHz (Richardson et al. 1995). It is important to distinguish TTS and permanent threshold shift (PTS), which persist after the sound exposure, from masking, which occurs during the sound exposure. Because masking (without a resulting in a threshold shift) is not associated with abnormal physiological function, it is not considered a physiological effect in this IHA application, but rather a potential behavioral effect.

The most intense underwater sounds in the Year 5 of the Project are those produced by vibratory and/or impact pile driving. Given that the energy distribution of pile driving covers a broad frequency spectrum, sound from these sources would be within the audible range of all of the species identified in this application (see Acoustics under species descriptions in Chapter 4). Impact pile driving activity is relatively short-term, with rapid pulses occurring for approximately 15 min per pile. Vibratory pile driving is also relatively short-term, with rapid oscillations occurring for approximately 1.5 hours per pile. It is possible that impact and vibratory pile driving resulting from Year 5 in-water construction may mask some acoustic signals that are relevant to the daily behavior of marine mammal species, but the short-term duration and limited areas affected make it very unlikely that survival would be affected. Masking effects are, therefore, treated as negligible. Any masking event that could possibly rise to Level B harassment under the MMPA would occur concurrently within the zones of behavioral harassment already estimated for vibratory and impact pile driving, and which have already been taken into account in the exposure analysis.

6.5 Basis for Estimating Take by Harassment

The U.S. Navy is seeking authorization for the potential taking of small numbers of California sea lions, harbor seals, northern elephant seals, coastal bottlenose dolphins, common dolphins, Pacific white-sided dolphins, Risso's dolphins, and gray whales in northern San Diego Bay as a result of pile removal and pile driving during demolition and construction activities associated with the Fuel Pier Replacement Project. The takes requested are expected to have no more than a minor effect on individual animals and no effect on the populations of these species. Any effects experienced by individual marine mammals are anticipated to be limited to short-term disturbance of normal behavior or temporary displacement of animals near source of the noise.

6.5.1 California Sea Lion

California sea lions are present in northern San Diego Bay year-round and are by far the dominant marine mammal in the bay. The local population comprises adult females and sub-adult males and females, with adult males being uncommon (Merkel and Associates, Inc. 2008; Navy 2010e; TDI 2012b; NAVFAC SW 2014).

During the second IHA period, an average of 90.35 California sea lions were seen per day within the maximum ZOI for pile driving, an area of 5.6752 km^2 extending 3,000 m from the Fuel Pier. This equates to a density of 15.9201/km^2. This density is used to estimate numbers of takes within the different ZOIs (Table 6-5). Eighty-five percent of the animals were observed in the water, but for the sake of the analysis, all animals are assumed to be exposed to both airborne and underwater sound over the course of a day.

The maximum extents of the potential acoustic Level A ZOIs for cumulative exposure from all of the activities are much less than 10 m from the source (Table 6-5), which is well inside the buffered shutdown distance for physical injury. As a result, no Level A takes of California sea lions are anticipated.

Potential takes would likely involve sea lions that are loafing on or in the vicinity of structures or moving through the area in route to foraging areas or structures where they haul out. California sea lions that are taken could exhibit behavioral changes such as increased swimming speeds, increased surfacing time, or decreased foraging. Most likely, California sea lions may move away from the sound source and be temporarily displaced from the areas of pile driving. As was observed during monitoring for previous IHAs (NAVFAC SW 2014, 2015, 2016a-b), with or without the bait barges, sea lions are expected to remain concentrated in the northern part of the bay, be hauled out or swimming in the general vicinity of the project site. Few, and in any case minimal, reactions were observed from animals that were observed swimming or resting on structures within the Level B ZOIs (NAVFAC SW 2014, 2015, 2016a-b). As such, potential takes by disturbance will have a negligible short-term effect on individual California sea lions and would not result in population-level impacts.

6.5.2 Harbor Seal

Sightings of harbor seals averaged 2.83 individuals per day during the period of the second IHA (NAVFAC SW 2015), a density of 0.4987/km^2 within the maximum ZOI for pile driving. While 89% of the animals were observed while in the water, as for sea lions, it is assumed that all animals present would be exposed to both airborne and underwater sound over the course of a day.

For harbor and elephant seals, the maximum extent of the potential acoustic Level A ZOI for cumulative exposure from impact pile driving extends 34 m from the source; for all other activities, the Level A ZOIs are much less than 10 m from the source, which is well inside the buffered shutdown distance for physical injury (Table 6-5). Accordingly, the shutdown ZOI for harbor seals during pile driving would be expanded to 34 m from source. As a result, the prolonged presence of harbor seals within the ZOI would not occur and no Level A takes are anticipated.

Potential takes would likely involve harbor seals that are on the shoreline or structures at the identified location, or swimming in the vicinity. The most likely movements of harbor seals would be to and from foraging areas in the kelp beds south of Ballast Point. Harbor seals that are taken could exhibit behavioral changes such as entering the water in response to airborne noise, increased swimming speeds, increased surfacing time, or decreased foraging. Most likely, harbor seals may move away from the sound source and be temporarily displaced from the areas of pile driving. With the absence of any major rookeries and only a few isolated haul-out areas near or adjacent to the project site, potential takes by disturbance will have a negligible short-term effect on individual harbor seals and would not result in population-level impacts.

6.5.3 Northern Elephant Seal

Only a single individual elephant seal was sighted during the second IHA period (NAVFAC SW 2015), but with increasing numbers (Carretta et al. 2016), they are considered a reasonable possibility to occur more frequently during the fifth IHA period. The regional density estimate of $0.0760/km^2$ (Navy 2017) is assumed for the project area. As for the sea lions and harbor seals, individuals within the ZOIs are assumed to be exposed to both airborne and underwater sound.

For harbor and elephant seals, the maximum extent of the potential acoustic Level A ZOI for cumulative exposure from impact pile driving extends 34 m from the source; for all other activities, the Level A ZOIs are much less than 10 m from the source, which is well inside the buffered shutdown distance for physical injury (Table 6-5). Accordingly, the shutdown ZOI for harbor and elephant seals during pile driving would be expanded encompass the acoustic Level A cumulative exposure threshold. As a result, the prolonged presence of elephant seals within the ZOI would be prevented and no Level A takes are anticipated.

Potential takes would likely involve single individuals that are on the shoreline or structures at the identified location, or swimming in the vicinity, most likely near the mouth of the bay. Elephant seals that are taken could exhibit behavioral changes such as entering the water in response to airborne noise, increased swimming speeds, increased surfacing time, or decreased foraging. Most likely, elephant seals may move away from the sound source. With the absence of any rookery or regularly used foraging or haul-out sites, potential takes by disturbance will have a negligible short-term effect on individual harbor seals and would not result in population-level impacts.

6.5.4 Coastal Bottlenose Dolphin

Coastal bottlenose dolphins can occur at any time of year in northern San Diego Bay. Numbers sighted have been highly variable but have increased in recent years (NAVFAC SW 2014, 2015). During the second IHA period, an average of 7.09 individuals was seen per day, a density of $1.2493/km^2$.

For coastal bottlenose dolphins, the maximum extents of the potential acoustic Level A ZOI for cumulative exposure all of activities are much less than 10 m from the source, which is well inside the buffered shutdown distance for physical injury (Table 6-5). As a result, no Level A takes are anticipated.

Potential takes could occur if bottlenose dolphins move through the area on foraging trips when pile driving would occur. Bottlenose dolphins that are taken could exhibit behavioral changes such as increased swimming speeds, increased surfacing time, or decreased foraging. Most likely, bottlenose dolphins may move away from the sound source and be temporarily displaced from the areas of pile driving. There are no indications that bottlenose dolphins use or regularly occur in the area near the Fuel Pier. Hence any exposure to project-generated sound is likely to be transient and at relatively large distances. Therefore, potential takes by disturbance will have a negligible short-term effect on individual bottlenose dolphins and would not result in population-level impacts.

6.5.5 Common Dolphins

Common dolphins are generally abundant in the outer coastal waters, and although they have been uncommon in San Diego Bay (NAVFAC SW and POSD 2013), as observed during the first and second IHA periods, they can occur sporadically and in varying numbers within the bay (NAVFAC SW 2014, 2015). Common dolphins are usually moving rapidly such that the two species cannot be distinguished. Hence the Navy is requesting a number of takes that would apply to the long-beaked and short-beaked common dolphins combined.

An average of 8.67 common dolphins was seen per day, a density of 1.5277/km^2 within the maximum ZOI, during the second IHA period (NAVFAC SW 2015). This density is considerably higher than the regional density estimate for long-beaked common dolphins – the species most likely to occur (Navy 2017), but is reasonable for the project area given the group sizes observed for these species. Barlow (2010) reported average group sizes in southern California of 122 for short-beaked common dolphins and 195 for long-beaked common dolphins, and during the second IHA period, groups of approximately 170 and 300 individuals entered the project area on different occasions (NAVFAC SW 2015). Considering the possibility for one or more large groups of common dolphins to enter San Diego Bay during in-water activities and the fact that the Level B ZOIs will extend completely across the bay during pile driving, the density estimate is considered appropriate.

For common dolphins, the maximum extents of the potential acoustic Level A ZOI for cumulative exposure all of activities are much less than 10 m from the source, which is well inside the buffered shutdown distance for physical injury (Table 6-5). As a result, no Level A takes are anticipated.

It is expected that common dolphins would move rapidly through the project area as seen during the first two IHA periods. Therefore, potential takes by disturbance will have a negligible short-term effect on individual common dolphins, and would not result in population-level impacts.

6.5.6 Pacific White-Sided Dolphin

Pacific white-sided dolphins are more commonly seen offshore, but were documented in the project area on several occasions during the second IHA period. An average of 0.28 individuals per day was seen during the second IHA period (NAVFAC SW 2015), a density of 0.0493/km^2 within the maximum ZOI.

For Pacific white-sided dolphins, the maximum extents of the potential acoustic Level A ZOI for cumulative exposure all of activities are much less than 10 m from the source, which is well inside the buffered shutdown distance for physical injury (Table 6-5). As a result, no Level A takes are anticipated.

Potential takes could occur if Pacific white-sided dolphins move through the area on foraging trips when pile driving would occur. Pacific white-sided dolphins that are taken could exhibit behavioral changes such as increased swimming speeds, increased surfacing time, or decreased foraging. Most likely, they may move away from the sound source and be temporarily displaced from the areas of pile driving. There are no indications that Pacific white-sided dolphins use or regularly occur in San Diego Bay. Hence any exposure to project-generated sound is likely to be transient and at relatively large distances. Therefore, potential takes by disturbance will have a negligible short-term effect on individual Pacific white-sided dolphins and would not result in population-level impacts.

6.5.7 Risso's Dolphin

While there have been no sightings of Risso's dolphin within the project area, the species is considered a reasonable possibility for the fifth IHA period given recent El Niño conditions (Shane 1995) and its abundance Southern California coastal waters (Jefferson et al. 2014). The upper limit of the regional density estimate, 0.2029/km^2 (Navy 2017), is used in this application.

For Risso's dolphins, the maximum extents of the potential acoustic Level A ZOI for cumulative exposure all of activities are much less than 10 m from the source, which is well inside the buffered shutdown distance for physical injury (Table 6-5). As a result, no Level A takes are anticipated.

Potential takes could occur if Risso's dolphins move through the area on foraging trips when pile driving would occur. Risso's dolphins that are taken could exhibit behavioral changes such as increased swimming speeds, increased surfacing time, or decreased foraging. Most likely, bottlenose dolphins may move away from the sound source and be temporarily displaced from the areas of pile driving. There are no indications that Risso's dolphins use or regularly occur in San Diego Bay. Hence any exposure to project-generated sound is likely to be transient and at relatively large distances. Therefore, potential takes by disturbance will have a negligible short-term effect on individual bottlenose dolphins and would not result in population-level impacts.

6.5.8 Gray Whale

Gray whale occurrence within northern San Diego Bay is sporadic and would likely consist of one-few individuals that venture close to, or enter the bay for a brief period, and then continue on their migration. A density estimate based on the rare sightings of gray whales near the mouth of the bay during the second IHA period (NAVFAC SW 2015), would be less than 0.01/km^2, which is slightly less than the regional density estimate of 0.0179/km^2 in southern California waters during winter-spring (Navy 2017). The regional density estimate is applied here as a reasonable estimate given the possibility of animals moving closer to shore and entering the mouth of the bay during the fifth IHA period.

For gray whales, the maximum extent of the potential acoustic Level A ZOI for cumulative exposure from impact pile driving extends 63 m from the source; for all other activities, the Level A ZOIs are much less than 10 m from the source, which is well inside the buffered shutdown distance for physical injury (Table 6-5). Accordingly, the shutdown ZOI for gray whales during pile driving would be expanded to encompass the acoustic Level A cumulative exposure threshold. As a result, the prolonged presence of gray whales within the ZOI would be prevented and no Level A takes are anticipated.

Potential takes could occur if gray whales enter the area during pile driving or demolition. Gray whales that are taken could exhibit changes in direction, swimming speeds, or surfacing time. Most likely, if a gray whale were to enter the mouth of the bay during in-water project construction or demolition, it would detect the sound of project activities and be deterred from swimming farther into the bay. Any exposure to project-generated sound is likely to be transient and at relatively large distances. Therefore, potential takes by disturbance will have a negligible short-term effect on individual gray whales and would not result in population-level impacts.

6.6 Description of Take Calculation

The take calculations presented here rely on the best data currently available for marine mammal populations in San Diego Bay. The population data used for each species' take calculation is provided in subsections 6.5.1 through 6.5.4. The formula was developed for calculating take due to pile driving and extraction as applicable and applied to the species-specific noise impact threshold. The formula is based on the densities cited in the previous sections, the sound levels and ZOI areas as shown in Tables 6-4 and 6-5, and the number of days for each type of activity as shown in Table 2-1. The calculation for potential takes of each species by each type of activity is estimated by:

Take estimate = species density * area of ZOI for the activity * days of activity

Only Level B (disturbance) takes are calculated. Given protective monitoring within the potential ZOIs for cumulative Level A acoustic exposures, no Level A acoustic harassment to any species is anticipated. Results of the analysis are shown in Table 6-6. Totals reflect the fact that under the MMPA, an individual can only be taken once per day due to underwater or airborne sound from pile driving, whether from impact or vibratory pile driving, pile and caisson cutting, or pile removal by jetting and dead pull.

Table 6-6. Estimates of Potential Takes for Each Species by Each Type of Activity

***Species* (*density* [#/km^2])**	***Activity (ZOI [km^2], number of days)***						
	66-84" Caisson Cutting with Diamond Saw (0.7157, 50)	***Concrete Pile Cutting (4.4512, 100)***	***Concrete 16" Vibratory Install (2.4473, 25)***	***Concrete 16" Impact Install (0.1408, 25)***	***Concrete 16" Jet/Pull (1.4268, 15)***	***Airborne Level B Exposures***	***Total Takes[1]***
California sea lion (15.9201)	570	7,086	974	(56)	341	(2)	8,971
Harbor seal (0.4987)	18	222	31	(2)	11	(1)	281
Northern elephant seal (0.0760)	3	34	5	(0)	2	0	43
Coastal bottlenose dolphin (1.2493)	45	556	76	(4)	27	N/A	704
Common dolphins (1.5277)	55	680	93	(5)	33	N/A	861
Pacific white-sided dolphin (0.0493)	2	22	3	(0)	1	N/A	28
Risso's dolphin (0.2029)	7	90	12	(1)	4	N/A	114
Gray whale (0.0179)	1	8	1	(0)	0	N/A	10
Totals	700	8,699	1,196	(68)	418	(3)	**11,012**

Notes: N/A = not applicable. Takes that do not add to the totals are in parentheses (). [1]Under MMPA an animal can only be taken once per day, so for takes caused by more than one activity occurring on the same day, the number of takes is based upon the activities that generate the largest number of takes per day – these are the activities with the larger ZOIs. In particular, either or both vibratory and impact driving could be used to install the 16" concrete PC guide piles, and since the Level B ZOI for vibratory is much larger, the maximum number of potential takes is accounted for by vibratory and the potential takes due to impact do not add to the totals. Similarly, since airborne takes are well inside of the ZOIs for underwater takes by pile driving, potential airborne takes do not add to the totals.

6.7 Summary

Based on the modeling results presented above, the total number of takes that the Navy is requesting for the nine marine mammal species that are anticipated to occur within the Project Area during the duration of proposed activities are presented below in Table 6-7.

Table 6-7. Summary of Potential Exposures Constituting Takes for All Species

Species	***Number of Level B Takes Requested[1]***
California sea lion	8,971
Harbor seal	281
Northern elephant seal	43
Coastal bottlenose dolphin	704
Common dolphins	861
Pacific white-sided dolphin	28
Risso's dolphin	114
Gray whale	10
Total	***11,012***

Notes: [1]Based on a total of 25 days of pile driving and 171 days of demolition. [2] Includes short-beaked and long-beaked common dolphins.

7 IMPACTS TO MARINE MAMMAL SPECIES OR STOCKS

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

7.1 Potential Effects of Pile Driving on Marine Mammals

7.1.1 Underwater Noise Effects

The effects of pile driving on marine mammals are dependent on several factors, including the size, type, and depth of the animal; the depth, intensity, and duration of the pile driving sound; the depth of the water column; the substrate of the habitat; the standoff distance between the pile and the animal; and the sound propagation properties of the environment. Impacts to marine mammals from pile driving activities are expected to result primarily from acoustic pathways. As such, the degree of effect is intrinsically related to the received level and duration of the sound exposure, which are in turn influenced by the distance between the animal and the source. The further away from the source, the less intense the exposure should be. The substrate and depth of the habitat affect the sound propagation properties of the environment. Shallow environments are typically more structurally complex which leads to rapid sound attenuation. In addition, substrates which are soft (i.e., mud) will absorb or attenuate the sound more readily than hard substrates (rock) which may reflect the acoustic wave. Soft porous substrates would also likely require less time to drive the pile, and possibly less forceful equipment, which would ultimately decrease the intensity of the acoustic source.

Impacts to marine species are expected to be the result of physiological responses to both the type and strength of the acoustic signature (Viada et al. 2008). Behavioral impacts are also expected, though the type and severity of these effects are more difficult to define due to limited studies addressing the behavioral effects of impulsive sounds on marine mammals. Potential effects from impulsive sound sources can range from brief acoustic effects such as behavioral disturbance, tactile perception, physical discomfort, slight injury of the internal organs and the auditory system, to death of the animal (Yelverton et al. 1973; O'Keeffe and Young 1984; Navy 2001).

Physiological Responses

Direct tissue responses to impact/impulsive sound stimulation may range from mechanical vibration or compression with no resulting injury, to tissue trauma (injury). Because the ears are the most sensitive organ to pressure, they are the organs most sensitive to injury (Ketten, 2000). Sound related trauma can be lethal or sub-lethal. Lethal impacts are those that result in immediate death or serious debilitation in or near an intense source (Ketten 1995). Sub-lethal impacts include hearing loss, which is caused by exposure to perceptible sounds. Severe damage, from a pressure wave, to the ear can include rupture of the tympanum, fracture of the ossicles, damage to the cochlea, hemorrhage, and cerebrospinal fluid leakage into the middle ear (NMFS 2008). Moderate injury implies partial hearing loss. Permanent hearing loss can occur when the hair cells are damaged by one very loud event, as well as prolonged exposure to noise. Instances of temporary threshold shifts (TTS) and/or auditory fatigue are well documented in marine mammal literature as being one of the primary avenues of acoustic impact. Temporary loss of hearing sensitivity (TTS) has been documented in controlled settings using captive marine mammals exposed to strong sound exposure levels at various frequencies (Ridgway et al. 1997; Kastak et al. 1999; Finneran et al. 2005), but it has not been documented in wild marine mammals exposed to pile driving. While injuries to other sensitive organs are possible, they are less likely since pile driving impacts are almost entirely acoustically mediated, versus explosive sounds which also include a shock wave which can result in damage.

No physiological responses are expected from pile driving operations occurring during the Fuel Pier Replacement Project for three reasons. First, vibratory pile driving which is being utilized as a primary installation method, does not generate high enough peak SPLs that are commonly associated with physiological damage. The use of impact pile driving will only occur from a short period of time (~30 to 120 min per pile). Second, the mitigation measures which the Navy will be employing (see Section 11) will greatly reduce the chance that a marine mammal may be exposed to SPLs that could cause physical harm. Third, the Navy will have trained biologists monitoring a shutdown zone that encompasses the Level A acoustic harassment zone (onset of PTS) to ensure no marine mammals are injured.

Behavioral Responses

Behavioral responses to sound are highly variable and context specific. For each potential behavioral change, the magnitude of the change ultimately determines the severity of the response. A number of factors may influence an animal's response to noise, including its previous experience, its auditory sensitivity, it's biological and social status (including age and sex), and its behavioral state and activity at the time of exposure.

Habituation can occur when an animal's response to a stimulus wanes with repeated exposure, usually in the absence of unpleasant associated events (Wartzok et al. 2003/04). Animals are most likely to habituate to sounds that are predictable and unvarying. The opposite process is sensitization, when an unpleasant experience leads to subsequent responses, often in the form of avoidance, at a lower level of exposure. Behavioral state may affect the type of response as well. For example, animals that are resting may show greater behavioral change in response to disturbing noise levels than animals that are highly motivated to remain in an area for feeding (Richardson et al. 1995; National Research Council (NRC) 2003; Wartzok et al. 2003/04).

Controlled experiments with captive marine mammals showed pronounced behavioral reactions, including avoidance of loud sound sources (Ridgway et al. 1997; Finneran et al. 2003, 2015). Observed responses of wild marine mammals to loud pulsed sound sources (typically seismic guns or acoustic harassment devices, and also including pile driving) have been varied but often consist of avoidance behavior or other behavioral changes suggesting discomfort (Morton and Symonds 2002; CALTRANS 2001, 2006; also see reviews in Gordon et al. 2004; Wartzok et al. 2003/04; and Nowacek et al. 2007). Responses to continuous noise, such as vibratory pile installation, have not been documented as well as responses to pulsed sounds.

With both types of pile driving, as well as the proposed methods of pile removal, caisson and pile cutting, it is likely that the onset of the activity could result in temporary, short term changes in the animal's typical behavior and/or avoidance of the affected area. A marine mammal may show signs that it is startled by the noise and/or may swim away from the sound source and avoid the area. Other potential behavioral changes could include increased swimming speed, increased surfacing time, and decreased foraging in the affected area. Pinnipeds may increase their haul-out time, possibly to avoid in-water disturbance (CALTRANS 2001, 2006). Since pile driving will likely only occur for a few hours a day, over a short period of time, it is unlikely to result in permanent displacement. Any potential impacts from pile driving activities could be experienced by individual marine mammals, but would not cause population level impacts, or affect the long-term fitness of the species.

7.1.2 Airborne Noise Effects

Marine mammals that occur in the project area could be exposed to airborne sounds associated with pile driving that have the potential to cause harassment, depending on their distance from pile driving activities. Airborne pile driving noise would have less impact on cetaceans than pinnipeds because noise from atmospheric sources does not transmit well underwater (Richardson et al. 1995); thus, airborne noise would only be an issue for hauled-out pinnipeds in the Project Area. Most likely, airborne sound would cause behavioral responses similar to those discussed above in relation to underwater noise. For instance, anthropogenic sound could cause hauled out pinnipeds to exhibit changes in their normal behavior, such as reduction in vocalizations, or cause them to temporarily abandon their habitat and move further from the source. Studies by Blackwell et al. (2004) and Moulton et al. (2005) indicate a tolerance or lack of response to unweighted airborne sounds as high as 112 dB peak and 96 dB rms. Based on these observations marine mammals could exhibit temporary behavioral reactions to airborne noise, however, exposure is not likely to result in population level impacts. The exposure modeling indicated that harbor seals would be exposed to airborne noise levels at SPLs that would constitute Level B behavioral harassment during either impact or vibratory pile driving (see Section 6 for modeling results). Injury or Level A harassment is not expected to occur from airborne noise. In conclusion, this is a negligible impact.

7.2 Conclusions Regarding Impacts to Species or Stocks

Individual marine mammals may be exposed to SPLs during pile driving and extraction operations at NBPL and NMAWC that are anticipated to result in Level B Behavioral harassment. Any marine mammals which are taken (harassed), may change their normal behavior patterns (i.e., swimming speed, foraging habits, etc.) or be temporarily displaced from the area of construction. The possibility of Level A Injury harassment is mitigated by monitoring the shutdown ZOIs and implementing shutdown as necessary to avoid the possibility of direct injury or PTS. As a result, any takes would likely have only a minor effect on individuals and no effect on the population. Mitigation would avoid most potential adverse impacts to marine mammals from pile driving and demolition activities. Nevertheless, some level of impact is unavoidable. The expected level of unavoidable impact (defined as an acoustic or harassment "take") is described in Sections 6 and 7. This level of effect is not anticipated to have any detectable adverse impact on population recruitment, survival or recovery (i.e., no more than a negligible adverse effect).

8 IMPACT ON SUBSISTENCE USE

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

Potential impacts resulting from the Proposed Action will be limited to individuals of marine mammal species located in the marine waters near NBPL that have no subsistence requirements. Therefore, no impacts on the availability of species or stocks for subsistence use are considered.

9 IMPACTS TO THE MARINE MAMMAL HABITAT AND THE LIKELIHOOD OF RESTORATION

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

The proposed activities at NBPL are expected to have little if any effects on the distribution of sea lions and other marine mammals within northern San Diego Bay. Sea lions are expected to remain concentrated in the same area of northern San Diego Bay and to haul out on the bait barges and other structures as they have traditionally. There are no known foraging hotspots, or other ocean bottom structure of significant biological importance to marine mammals that may be present in the marine waters in the vicinity of the Fuel Pier otherwise. Therefore, the main impact issue associated with the proposed activity will be temporarily elevated noise levels and the associated direct effects on marine mammals, as discussed in Sections 6 and 7. The most likely impact to marine mammal habitat occurs from pile driving effects on likely marine mammal prey (i.e., fish) nearby NBPL and minor impacts to the immediate substrate during installation and removal of piles.

9.1 Pile Driving Effects on Potential Prey (Fish)

Construction activities will produce both pulsed (i.e., impact pile driving) and continuous sounds (i.e., vibratory pile driving). Fish react to sounds which are especially strong and/or intermittent low-frequency sounds. Short duration, sharp sounds can cause overt or subtle changes in fish behavior and local distribution. Hastings and Popper (2005, Popper and Hastings 2009) identified several studies that suggest fish may relocate to avoid certain areas of noise energy. Additional studies have documented effects of pile driving (or other types of continuous sounds) on file, although several are based on studies in support of large, multiyear bridge construction projects (Scholik and Yan 2001, 2002, Govoni et al. 2003, Hawkins 2005, Hastings 1990, 2007, Popper et al. 2006, Popper and Hastings 2009). Sound pulses at received levels of 160 dB re 1 μPa may cause subtle changes in fish behavior. SPLs of 180 dB may cause noticeable changes in behavior (Chapman and Hawkins 1969; Pearson et al. 1992; Skalski et al. 1992). SPLs of sufficient strength have been known to cause injury to fish and fish mortality (CALTRANS 2001; Longmuir and Lively 2001). The most likely impact to fish from pile driving activities at the Project Area would be temporary behavioral avoidance of the immediate area. The duration of fish avoidance of this area after pile driving stops is unknown, but a rapid return to normal recruitment, distribution and behavior is anticipated. In general, impacts to marine mammal prey species are expected to be minor and temporary.

9.2 Pile Driving Effects on Potential Foraging Habitat

The area likely impacted by the Fuel Pier Replacement Project is relatively small compared to the available habitat in northern San Diego Bay. Given that the Navy's marine mammal surveys have documented no marine mammal occurrences in the immediate vicinity of the fuel pier (Figure 3-2), the affected area is used little, if at all, as foraging habitat. As a result, the removal and replacement of pilings, substrate disturbance, and high levels of activity at the project site would be inconsequential in terms of effects on marine mammal foraging.

The duration of fish avoidance of this area after pile driving stops is unknown, but a rapid return to normal recruitment, distribution and behavior is anticipated. Any behavioral avoidance by fish of the disturbed area would still leave significantly large areas of fish and marine mammal foraging habitat in northern San Diego Bay.

The project design has minimized effects on eelgrass beds and would mitigate any unavoidable losses by replacement. Hence the project would not negatively impact eelgrass beds and the important nursery and foraging habitat functions they provide for fish, which in turn serve as prey for marine mammals.

9.3 Summary of Impacts to Marine Mammal Habitat

Given the short daily duration of noise associated with individual pile driving\removal, seasonal limitations on the in-water activities that have the greatest potential to disturb marine mammals and their prey, and the relatively small areas being affected, pile driving and extraction activities associated with the Project Year 5 are not likely to have a permanent, adverse effect on any EFH, or population of fish species. Therefore, pile driving\removal is not likely to have a permanent, adverse effect on marine mammal foraging habitat at the Project Area.

10 IMPACTS TO MARINE MAMMALS FROM LOSS OR MODIFICATION OF HABITAT

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

The Project Year 5 activities at NBPL are not expected to have any habitat-related effects that could cause significant or long-term consequences for individual marine mammals or their populations. The new fuel pier will have a smaller surface area than the existing pier, but as noted above, the pier is not used by marine mammals as foraging or resting habitat. Based on the discussions in Section 9, there will be no impacts to marine mammals resulting from loss or modification of marine mammal habitat.

11 MEANS OF EFFECTING THE LEAST PRACTICABLE ADVERSE IMPACTS – 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 on their availability for subsistence uses, paying particular attention to rookeries, mating grounds, and areas of similar significance.

The exposures outlined in Section 6 represent the maximum expected number of marine mammals that could be exposed to acoustic sources reaching Level B harassment levels. Navy proposes to employ a number of mitigation measures, discussed below, in an effort to minimize the number of marine mammals potentially affected.

11.1 Mitigation for Construction and Demolition Activities

11.1.1 Proposed Measures

The modeling results for zones of influences (ZOIs) discussed in Section 6 were used to develop mitigation measures for construction and demolition activities at NBPL. The ZOIs effectively represent the mitigation zone that would be established to prevent Level A harassment to marine mammals. A monitoring plan will be developed further and submitted to NMFS for approval well in advance of the start of construction during the fifth IHA period. The monitoring plan includes the following components: acoustic measurements and visual observations.

1. Level A and Level B Harassment ZOIs During Pile Driving and Removal

   - During all activities, the Level A harassment (shutdown) ZOI shall include all areas where the underwater SPLs are anticipated to equal or exceed the Level A (acoustic injury) harassment criteria for marine mammals. Buffers will be added to the underwater pinniped and cetacean shutdown ZOIs to reduce the likelihood of a Level A "take" during all in-water activities.

   - During activities with calculated Level A ZOIs, buffers will be added to the maximum calculated Level A ZOIs for cetaceans and pinnipeds (see Table 6-5 for the calculated Level A ZOIs). This will provide conservative shutdown zones to reduce the likelihood of injury to marine mammal species due to exposure to potentially injurious noise. If an animal enters the buffered shutdown zones, the activity would be stopped until the individual(s) has left the zone of its own volition, or not been sighted for 30 minutes for gray whales, or 15 minutes for all other marine mammal species. During all in-water construction or demolition, a minimum shutdown ZOI of 10 m (33 ft) will be in place, regardless of the activity. The distances encompassing the underwater Level A zones will be adjusted to accommodate any difference between predicted and measured sound levels.

   - During in-water activities, the underwater Level B ZOIs shall include areas where the underwater SPLs are anticipated to equal, or exceed, the 160 dB rms isopleths for impulsive noise sources, and the 120 dB rms isopleth for continuous noise sources. Because the average ambient levels inside of San Diego Bay have been shown to be approximately 129.6 dB (NAVFAC 2015), all Level B ZOIs that were calculated using a practical spreading loss model have been modeled to 129.6 dB rms, not 120 dB rms. The airborne Level B ZOI shall include areas within the 90 dB rms isopleth for harbor seals and 100 dB isopleth for sea lions. The distances encompassing both underwater and airborne Level B zones will be adjusted to accommodate any difference between predicted and measured sound levels. Buffers will not be added to the distances associated with these isopleths.

- The Level A/B harassment ZOIs will be monitored throughout the time required to complete pile installation, as well as during demolition activities. If a marine mammal is observed entering the Level B ZOI, an exposure would be recorded and behaviors documented; however, that activity would be completed without cessation. If the individual or group of animals approaches, or enters, the shutdown zone the activities will be halted.
- Initial estimates of the Level A/B ZOIs were based on a combination of *in situ* data collected during previous IHAs, and calculations from either NMFS (2016) or a simple practical spreading loss model. During the fifth IHA, when sufficient data from *in situ* acoustic monitoring has been collected and analyzed to provide a robust estimate of the actual distances to these threshold zones, the Level A /B harassment ZOIs will be adjusted accordingly

2. Visual Monitoring

   a. Visual monitoring will be conducted within the Level A/B harassment ZOIs (caisson cutting, pile clipping, vibratory and impact pile driving/extraction, and pile jetting) before, during, and after all activities with identified Level A/B ZOIs. Monitoring will take place from 15 min prior to initiation through 30 min post-completion of project-related activities.

   b. The Level A ZOIs will be buffered to minimize the risk to marine mammals and will range from 10 m (33 ft) to 100 m (238 ft) for pinnipeds and cetaceans, respectively. The Level B ZOI will be visually monitored to the greatest extent practicable, and will range from 270 m (886 ft) to 2,511 m (8,238 ft; Table 6-5).

   b. Monitoring will be conducted by qualified observers. All observers would be trained in marine mammal identification and behaviors, and have experience conducting marine mammal monitoring or surveys. Trained observers will be placed at the best vantage point(s) practicable (e.g., from a small boat, project-related barge, on shore, or any other suitable location) to monitor for marine mammals and implement shutdown/delay procedures, when applicable, by notifying the hammer operator of a need for a shutdown of construction.

   c. Prior to the start activities with in-water noise sources, the buffered shutdown zones will be monitored for 15 min to ensure that they are clear of marine mammals. The activity will only commence once observers have declared the buffered shutdown zones clear of marine mammals; Animals will be allowed to remain in the Level B ZOI and their behavior will be monitored and documented.

   d. If a marine mammal approaches/enters the buffered shutdown zone during the course of an in-water activity, the activity will be halted and delayed until either the animal has voluntarily left, and been visually confirmed beyond the shutdown zone, or 30 minutes for gray whales, or 15 minutes for all other marine mammal species have passed without re-detection of the animal.

   e. In the unlikely event of conditions that prevent the visual detection of marine mammals, such as heavy fog, activities with the potential to result in Level A harassment will not be initiated.

4. Acoustic Measurements – Acoustic measurements will continue during the fifth IHA and will be used to empirically adjust the shutdown and buffer zones. For further detail regarding our acoustic monitoring plan see Section 13.

5. Timing Restrictions - The Navy intends to avoid noise and turbidity generating in-water construction and demolition activities in designated foraging habitat during the nesting season of the ESA-listed California least tern, which is nominally from 1 April through 15 September. If the Navy determines that the impacts to the construction schedule are unavoidable, then per the Navy's consultation with USFWS, the in-water construction window can be extended to 30 April. This is not an absolute restriction; some activities may occur within this period when there would be no adverse effects to the least tern. In-water demolition activities at the old Fuel Pier may extend beyond 30 April.

6. Soft Start - The use of a soft-start procedure is believed to provide additional protection to marine mammals by providing a warning and/or giving marine mammals a chance to leave the area prior to the hammer operating at full capacity. The Fuel Pier Replacement Project will utilize soft-start techniques (ramp-up/dry fire) recommended by NMFS for impact pile driving. These measures are as follows:

   "Soft start for impact pile driving must be conducted at beginning of day's activity and at any time pile driving has ceased for more than 30 minutes. If vibratory pile driving has been occurring but impact has not for more than 30 minutes, soft start for the impact hammer must occur. The soft-start requires contractors to provide an initial set of three strikes from the impact hammer at 40 percent energy, followed by a 30-second waiting period, then two subsequent 3-strike sets."

   The 30-second waiting period is proposed based on the Navy's recent experience and consultation with NMFS on a similar project at Naval Base Kitsap at Bangor.

7. Daylight Construction – For in-water construction and demolition activities (i.e., impact and vibratory pile driving, pile clipping, caisson cutting, and pile jetting), monitoring will be conducted during daylight hours, no earlier than 45 minutes after sunrise and no later than 45 minutes before sunset. If lighting conditions do not allow MMOs to observe the Level A/B ZOIs effectively, construction will not be allowed to start (or continue) until conditions improve.

12 MINIMIZATION OF ADVERSE EFFECTS ON SUBSISTENCE USE

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

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

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

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

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

There is no subsistence use of marine mammal species or stocks in the project area.

13 MONITORING AND REPORTING MEASURES

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 following monitoring measures would be implemented along with the mitigation measures (Section 11) to reduce impacts to marine mammals to the lowest extent practicable during the period of this fifth IHA. A marine mammal monitoring plan will be developed further and submitted to NMFS for approval well in advance of the start of construction during the fifth IHA period. The monitoring plan includes the following components: acoustic measurements and visual observations.

13.1.1 Acoustic Measurements

All pile driving activities at the new fuel pier have been completed for the Project. In-water activities at this location will entail demolition of the old fuel pier and temporary mooring dolphin. These activities will be accomplished via pile cutting with a plasma torch (temporary mooring dolphin), or a pile clipper (old fuel pier piles), and caisson cutting with a wire saw (old fuel pier caissons). At NMAWC, both construction and demolition activities will occur via pile driving with vibratory or impact hammers, as well as pile removal via a vibratory hammer, high pressure water jetting, or dead-pulling. The Navy will continue to implement *in-situ* acoustic monitoring to measure SPLs from in-water construction activities to verify and, if appropriate, to adjust previously determined ZOI boundaries. The Navy will not collect acoustic data on the demolition of the 30-inch steel pipe piles (via a plasma torch) for the temporary mooring dolphin, nor for dead-pulling of piles at NMAWC. Neither of these actions are expected to produce noise that would exceed Level A/B thresholds during the demolition process. Table 13-1 provides a summary of the activities that will be acoustically monitored as well as generalized acoustic monitoring locations.

Data from previous Monitoring Reports show that the average ambient noise in San Diego Bay is approximately 129.6 dB rms (NAVFAC SW 2015). No further ambient underwater data will be collected because data collected during previous IHAs has sufficiently demonstrated ambient underwater levels are louder than the 120 dB regulatory threshold. As a result, the Navy considers the limits of the largest Level B ZOI to be at the farthest points where noise from non-impulsive construction and demolition is no longer distinguishable from ambient.

Table 13-1. Acoustic Data Collection Activities and Locations.

Activity	*Acoustic Recording Location*			
	Underwater		*Airborne*	
	Source	*Far-field*	*Source*	*Far-field*
Old Fuel Pier and Temporary Mooring Dolphin Demolition				
66-inch caissons (Diamond saw cutting)	X	N/A	N/A	N/A
Concrete piles[1] (Pile clipping)	N/A	X	N/A	N/A
30-inch steel piles (Plasma torch cutting)	N/A	N/A	N/A	N/A
NMAWC Construction and Demolition				
16-inch concrete piles (Vibratory extraction/driving)	X	X	X	X
16-inch concrete piles (Impact driving)	X	X	X	X
16-inch concrete piles (Jetting pile extraction)	X	X	N/A	N/A
16-inch concrete piles (Pile dead-pull)	N/A	N/A	N/A	N/A

Notes: N/A: Not applicable (No data recorded);
[1]Far-field acoustic data will only be collected during pile clipping of 24-in piles. Source data was previously recorded during IHA #3 (NAVFAC SW 2015) and IHA #4 (NAVFAC SW 2016b) and was deemed as sufficient.

At a minimum, the acoustic monitoring effort will include the following:

Airborne:

- For the purposes of this monitoring year, the pinniped harassment thresholds of 100 dB re 20 µPa rms (unweighted) for sea lions will be conservatively set at 42 m (138 ft), and the 90 dB re 20 µPa rms (unweighted) for harbor seals will be set at 149 m (489 ft) at NMAWC. The distances to these thresholds were established based on airborne SPLs from 30-in impact pile during the Year #4 IHA (NAVFAC SW 2017) and are assumed to be conservative, considering the pile size and type they are based on.
- Airborne levels would be recorded as unweighted, in dB, and the distance to marine mammal injury and behavioral disturbance thresholds measured and established during the previous IHA will be maintained. Environmental data would be collected including but not limited to: wind speed and direction, air temperature, humidity, surface water temperature, water depth, wave height, weather conditions and other factors that could contribute to influencing the airborne and underwater sound levels (e.g., aircraft, boats, etc.);
- Airborne acoustic data at source (at 15 m [50 ft]) and multiple far-field distances will be collected for several iterations of the 16-in concrete pile installation or extraction at NMAWC. These recordings will validate that source and far-field SPLs for vibratory or impact hammers are no greater than previously documented levels during pile driving from previous IHAs. If the airborne ZOIs for 16-in concrete piles are found to be appreciably

different than those for the 30-in piles, then the airborne ZOIs at NMAWC may be adjusted to reflect real-time data.

- The construction manager will supply the data for the hammer model and size, depth of the pile being driven, blows per foot as well as the hammer energy settings and any changes to those settings during the construction or demolition monitoring efforts.
- No other demolition activities at the fuel pier or NMAWC locations are expected to exceed airborne regulatory thresholds, and no airborne data will be collected for those activities.

Underwater:

- At the old fuel pier, underwater acoustic data will be collected at the beginning of diamond saw cutting removal of 66-in caissons. This data will be compared to previous data reported in the Year 4 report (NAVFAC SW 2016a) for 84-in caissons. The Level B ZOIs may be adjusted, depending on the results of the data collection.
- Pile clipping at the old fuel pier will use a hydraulic ram to pinch and cut the concrete and rebar. For acoustic data from the pile clipper during IHA #3 and IHA #4, the source levels for all pile sizes exceeded Level B threshold for continuous noise sources (120 dB), with the 24-in piles shown to have the greatest source levels. However, attempts to identify the distance to the Level B ZOI for the 24-in piles was inconclusive (NAVFAC 2016b). As a result, if the 24-in piles are clipped during IHA #5, far-field data will be collected to further identify the Level B ZOI for pile clipping.
- At NMAWC, both underwater source and far-field data will be collected during pile driving/extraction using the vibratory and/or impact hammers. This data will be compared to 30-in pile driving data collected during IHA #4 (NAVFAC SW 2017) and the Level A and/or B ZOIs may be adjusted, depending on the results of the data collection.
- At NMAWC, underwater acoustic data will be collected at source (10 m [33 ft]) and multiple far-field distances, during high pressure water jetting. This data will be compared to jetting data collected during IHA #4 (NAVFAC SW 2017). The Level B ZOIs may be adjusted, depending on the results of the data collection.
- No other demolition activities at the old fuel pier or NMAWC are expected to exceed underwater regulatory thresholds, and no underwater acoustic data will be collected for those activities.
- The construction manager will supply the data for the hammer model and size, depth of the pile being driven, blows per foot as well as the hammer energy settings and any changes to those settings during the construction or demolition monitoring efforts.

13.1.2 Visual Marine Mammal Observations

The Navy will collect sightings data and behavioral responses to construction for marine mammal species observed in the region of activity during the period of construction. All observers will be trained in marine mammal identification and behaviors.

13.1.3 Methods of Monitoring

The Navy will monitor the Level A (shutdown) and Level B ZOIs before, during, and after pile driving activities. Based on NMFS requirements, the Marine Mammal Monitoring Plan would include the following procedures:

- MMOs will be primarily located on boats, barges, docks, and/or piers at the best vantage point(s) to properly observe the entire shutdown zone(s).
- MMOs will be located at the best vantage point(s) to observe the zone associated with behavioral impact thresholds.
- During all observation periods, observers will use binoculars and/or the naked eye to search continuously for marine mammals.
- Monitoring distances will be measured with range finders.
- Distances to animals will be based on the best estimate of the MMO, relative to known distances to objects within visual range of the MMO.
- Bearing to animals will be determined using a compass.
- In-water activities will be curtailed under conditions of fog or poor visibility that might obscure the presence of a marine mammal within the shutdown zone.
- Pre-Activity Monitoring:
    - The shutdown and buffer zones will be monitored for 15 min prior to in-water construction/demolition activities. If a marine mammal is present within the shutdown zone, the activity will be delayed until the animal(s) leave the shutdown zone. Activity will resume only after the MMO has determined that, through sighting or by waiting at least 30 minutes for gray whales, or 15 minutes for all other marine mammal species, the animal(s) has moved outside the shutdown zone. If a marine mammal is observed approaching the shutdown zone, the MMO who sighted that animal will notify all other MMOs of its presence.
- During Activity Monitoring:
    - If a marine mammal is observed entering the Level B ZOI, that activity will be completed without cessation, unless the animal enters or approaches the buffered shutdown zone, at which point all activities will be halted. If an animal is observed within the shutdown zone during pile driving, then the activity will be stopped as soon as it is safe to do so. Construction or demolition activities can only resume once the animal has left the shutdown zone of its own volition or has not been re-sighted for a period of at least 30 minutes for gray whales, or 15 minutes for all other marine mammal species.
    - All times when the activity is stopped, but the activity has not completely stopped, will also be monitored.
- Post-Activity Monitoring:
    - Monitoring of the shutdown and buffer zones will continue for 30 minutes following the completion of the activity.

13.1.4 Data Collection

NMFS requires that the MMOs use NMFS-approved sighting forms. NMFS requires that, at a minimum, the following information be collected on the sighting forms:

- Date and time that pile driving or removal begins or ends;
- Construction activities occurring during each observation period;
- Weather parameters (e.g., wind, humidity, temperature);
- Tide state and water currents;
- Visibility;
- Species, numbers, and if possible sex and age class of marine mammals;
- Marine mammal behavior patterns observed, including bearing and direction of travel, and if possible, the correlation to SPLs;
- Distance from pile driving activities to marine mammals and distance from the marine mammal to the observation point;
- Locations of all marine mammal observations;
- Other human activity in the area.

To the extent practicable, the Navy will record behavioral observations that may make it possible to determine if the same or different individuals are being "taken" during project activities over the course of a day.

13.2 Reporting

A draft report would be submitted to NMFS within 45 calendar days of the completion of acoustic measurements and marine mammal monitoring. The results would be summarized in graphical form and include summary statistics and time histories of sound values based upon the data from the piles monitored for this IHA period. A final report would be prepared and submitted to the NMFS within 30 days following receipt of comments on the draft report from the NMFS. At a minimum, the report shall include:

- General data:
    - Date and time of activities,
    - Water conditions (e.g., sea-state, tidal state),
    - Weather conditions (e.g., percent cover, visibility).
- Specific pile data for acoustically monitored piles:
    - Description of the activities being conducted,
        - Size and type of piles,
        - The machinery used for installation or removal,
    - The power settings of the machinery used for installation or removal.

- Specific acoustic monitoring information:
  - A description of the monitoring equipment,
  - The distance between hydrophone(s) and pile,
  - The depth of the hydrophone(s),
  - The physical characteristics of the bottom substrate where the piles were driven or extracted (if possible),
  - Acoustic data (per Section 13.1.1 above) for each monitored pile and activity.
- Pre-activity observational survey-specific data:
  - Dates and time survey is initiated and terminated,
  - Description of any observable marine mammal behavior in the immediate area during monitoring,
  - If possible, the correlation to underwater sound levels occurring at the time of the observable behavior,
  - Actions performed to minimize impacts to marine mammals.
- During-activity observational survey-specific data:
  - Description of any observable marine mammal behavior within monitoring zones or in the immediate area surrounding monitoring zones,
  - If possible, the correlation to underwater or airborne sound levels occurring at the time of this observable behavior,
  - Actions performed to minimize impacts to marine mammals,
  - Times when pile extraction is stopped due to presence of marine mammals within the shutdown zones and time when pile driving resumes.
- Post-activity observational survey-specific data:
  - Results, which include the detections of marine mammals, species and numbers observed, sighting rates and distances, behavioral reactions within and outside of safety zones,
  - A refined take estimate based on the number of marine mammals observed during the course of construction and/or demolition.

14 RESEARCH

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

The U.S. Navy is one of the world's leading organizations in assessing the effects of human activities the marine environment including marine mammals. From 2004 through 2013, the Navy has funded over $240M specifically for marine mammal research. Navy scientists work cooperatively with other government researchers and scientists, universities, industry, and non-governmental conservation organizations in collecting, evaluating, and modeling information on marine resources. They also develop approaches to ensure that these resources are minimally impacted by existing and future Navy operations. It is imperative that the Navy's research and development (R&D) efforts related to marine mammals are conducted in an open, transparent manner with validated study needs and requirements. The goal of the Navy's R&D program is to enable collection and publication of scientifically valid research as well as development of techniques and tools for Navy, academic, and commercial use. Historically, R&D programs are funded and developed by the Navy's Chief of Naval Operations Energy and Environmental Readiness and Office of Naval Research (ONR), Code 322 Marine Mammals and Biological Oceanography Program. Primary focus of these programs since the 1990s is on understanding the effects of sound on marine mammals, including physiological, behavioral and ecological effects.

ONR's current Marine Mammals and Biology Program thrusts include, but are not limited to: (1) monitoring and detection research; (2) integrated ecosystem research including sensor and tag development; (3) effects of sound on marine life (such as hearing, behavioral response studies, physiology [diving and stress], and the Population Consequences of Acoustic Disturbance (PCAD) model; and (4) models and databases for environmental compliance.

To manage some of the Navy's marine mammal research programmatic elements, OPNAV N45 developed in 2011 a new Living Marine Resources (LMR) Research and Development Program (http://www.lmr.navy.mil/). The goal of the LMR Research and Development Program is to identify and fill knowledge gaps and to demonstrate, validate, and integrate new processes and technologies to minimize potential effects to marine mammals and other marine resources. Key elements of the LMR program include:

- Providing science-based information to support Navy environmental effects assessments for research, development, acquisition, testing, and evaluation as well as Fleet at-sea training, exercises, maintenance, and support activities.
- Improving knowledge of the status and trends of marine species of concern and the ecosystems of which they are a part.
- Developing the scientific basis for the criteria and thresholds to measure the effects of Navy-generated sound.
- Improving understanding of underwater sound and sound field characterization unique to assessing the biological consequences resulting from underwater sound (as opposed to tactical applications of underwater sound or propagation loss modeling for military communications or tactical applications).
- Developing technologies and methods to monitor and, where possible, mitigate biologically significant consequences to living marine resources resulting from naval

activities, emphasizing those consequences that are most likely to be biologically significant.

Other National Department of Defense Funded Initiative - Strategic Environmental Research and Development Program (SERDP) and Environmental Security Technology Certification Program (ESTCP) are the DoD's environmental research programs, harnessing the latest science and technology to improve environmental performance, reduce costs, and enhance and sustain mission capabilities. The Programs respond to environmental technology requirements that are common to all of the military Services, complementing the Services' research programs. SERDP and ESTCP promote partnerships and collaboration among academia, industry, the military Services, and other Federal agencies. They are independent programs managed from a joint office to coordinate the full spectrum of efforts, from basic and applied research to field demonstration and validation.

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Appendix A: Data Used to Calculate Distances to the Level A and Level B ZOIs

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Table A-1. Data Used to Calculate Distances to the Level A ZOIs.

Activity		Pile Jetting	Caisson Cutting	Pile Clipping	16-in Concrete	
					Vibratory Pile Driving	Impact Pile Driving
References for Source Level and Duration		Year 4 report (NAVFAC SW 2017)	Year 3 report #1 (NAVFAC SW 2016a)	Year 4 report (NAVFAC SW 2017)	Year 2 report (NAVFAC SW 2015)	Year 3 report #1 (NAVFAC SW 2016a)
Size & Type of Piles used for Source Data		24x30-in concrete piles	84-in caissons	24-in concrete piles	30-in steel piles[2]	16-in poly-concrete piles
Level A[1]	Weighting Factor[1]	2.5	2.5	2.5	2.5	2
	Propagation Loss (xLogR)[1]	15	15	15	15	15
	Distance from Source (m)	10	10	10	10	10
	Mean Source Level (RMS SPL)	155	149	145	162.5	188.9
	Activity Duration (hours) within 24-hr period	1.74	6	2.82	0.96	0.71
	Pulse Duration (seconds)	N/A	N/A	N/A	N/A	0.03

Notes: [1]Default values from NMFS (2016).

[2]The *in situ* mean source level for vibratory driving of 30-inch steel pipe piles (NAVFAC SW 2015) is used as a conservative proxy for vibratory driving of 16-in concrete guide piles in this application.

Table A-2. Data Used to Calculate/Identify Distances to the Level B ZOIs.

Activity		Pile Jetting	Caisson Cutting	Pile Clipping	16-in Concrete	
					Vibratory Pile Driving	Impact Pile Driving
References for Source Level and Duration		Year 4 report (NAVFAC SW 2017)	Year 3 report #1 (NAVFAC SW 2016a)	Year 4 report (NAVFAC SW 2017)	Year 2 report (NAVFAC SW 2015)	Year 3 report #1 (NAVFAC SW 2016a)
Size & Type of Piles used for Source Data		24x30-in concrete piles	84-in caissons	24-in concrete piles	30-in steel piles	16-in poly-concrete piles
Level B	Source Level (RMS SPL)	159.9[1]	155.6[1]	165.3[1]	162.5[2]	195[1,3]
	dB RMS at the Level B ZOI	128.9	128.6	129.3	128.5	N/A
	Distance to Level B ZOI (m)	1,165	631	2,511	1,848	270[3]

Notes: [1]Maximum source levels from data presented in previous monitoring reports (NAVFAC SW 2015, 2016a, 2017), unless otherwise specified.

[2] The *in situ* mean source level for vibratory driving of 30-inch steel pipe piles (NAVFAC SW 2015) is used as a conservative proxy for vibratory driving of 16-in concrete guide piles in this application

[3]The maximum source level is included for reference only. The distance to the Level B ZOI was based on *in situ* data collected for 16-in poly-concrete piles and was documented in NAVFAC SW (2016a).