INCIDENTAL HARASSMENT AUTHORIZATION APPLICATION FOR THE NAVY'S FUEL PIER REPLACEMENT PROJECT AT NAVAL BASE POINT LOMA, YEAR 3

OCTOBER 8, 2015 THROUGH OCTOBER 7, 2016

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
° 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
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
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
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 third year of activities (October 8, 2015 through October 7, 2016) 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 four 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 crane, vibratory hammer, water jet, and/or pneumatic chipper. During the period covered by this IHA application, the project includes the installation of 6, 30-inch (in) diameter steel pipe piles, 88 30" x 24" concrete fender piles and 132 16-inch diameter concrete filled fiberglass fender piles, for a total of 226 piles. The steel pilings would be installed using a vibratory hammer to refusal and then driven the last 10-15 ft with an impact hammer for structural stability. The concrete piles would be jetted to within five feet of tip elevation and then driven with an impact hammer. Fiberglass piles would be driven entirely with an impact hammer. The Fuel Pier Replacement Project also includes the temporary relocation of the Navy Marine Mammal Program (MMP), an Indicator Pile Program

(IPP), dredging, and a one-time seasonal relocation of the Everingham Brothers San Diego Bay Bait Barge which occurred only during the first IHA period.

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 in-water demolition and construction activities 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.

The Navy's first IHA (Navy 2013a) for the project covered the pile driving associated with temporary relocation of the MMP and the IPP. The second IHA for the project covered the driving of 252 30" and 36" steel structural piles and the partial demolition of the northern section of the existing pier. This IHA application is based on the updated project design and schedule and is intended to cover pile driving/extraction activities from October 8, 2015 through October 7, 2016, with pile driving to occur predominantly between October and April. Pile driving is estimated to occur on 61 days with a maximum of 135 in-water work days. A new IHA application will be submitted for the subsequent year's work that would begin on October 8, 2016.

In this IHA application, as in the previous two IHAs for pile driving and extraction activities, the Navy has used National Marine Fisheries Service (NMFS) promulgated thresholds for assessing pile driving impacts (NMFS 2005, NMFS 2009), outlined in Section 6. Empirically measured source levels from similar pile driving events were used to estimate pile driving sound source levels for this project. For pile driving associated with fuel pier construction, the Navy worked with researchers from the University of Washington to develop a rigorous model of underwater transmission loss, taking into account site-specific bathymetry and shoreline characteristics. The transmission loss model was used to calculate the distance to each relevant zone of influence (ZOI) for potential marine mammal takes associated with pile driving for the new pier.

During the first IHA period, the 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 the model results discussed above. 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- 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 purposes of this new IHA application, we will be referring to the actual field data produced during the IPP for ZOI discussions. The data from the IPP and the Navy's fulfillment of other monitoring requirements during the first and second IHAs were provided in monitoring reports (NAVFAC SW 2014, 2015).

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. For this application, the Navy is relying primarily on the monitoring data gathered during 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.

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 3 pose little to no risk of injury (Level A harassment). The loudest sound-generating activity, impact driving of steel piles, would only occur at the completion of the installation of 6 piles, estimated as occurring on 6 days. The Navy monitoring team's experience with the project area and proven effectiveness under previous IHAs will ensure that work does not occur if 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 4,370 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 underwater sound caused by the use of the impact and/or vibratory pile drivers to drive steel piles; other activities will occur during an overlapping timeframe but generate lower levels of sound. No takes due to airborne sound alone are anticipated, but it is estimated that a small proportion of the estimated takes of California sea lions and Pacific harbor seals will include animals harassed by airborne as well as underwater sound.

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

Species	***Number of Level B Takes Requested[1]***
California sea lion	3,548
Harbor seal	111
Northern elephant seal	11
Coastal bottlenose dolphin	278
Common dolphins	340
Pacific white-sided dolphin	11
Risso's dolphin	45
Gray whale	26
Total	***4,370***

Notes[1]. Based on a total of 61 days of pile driving and 54 days of demolition.

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, 2015 to October 7, 2016. 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

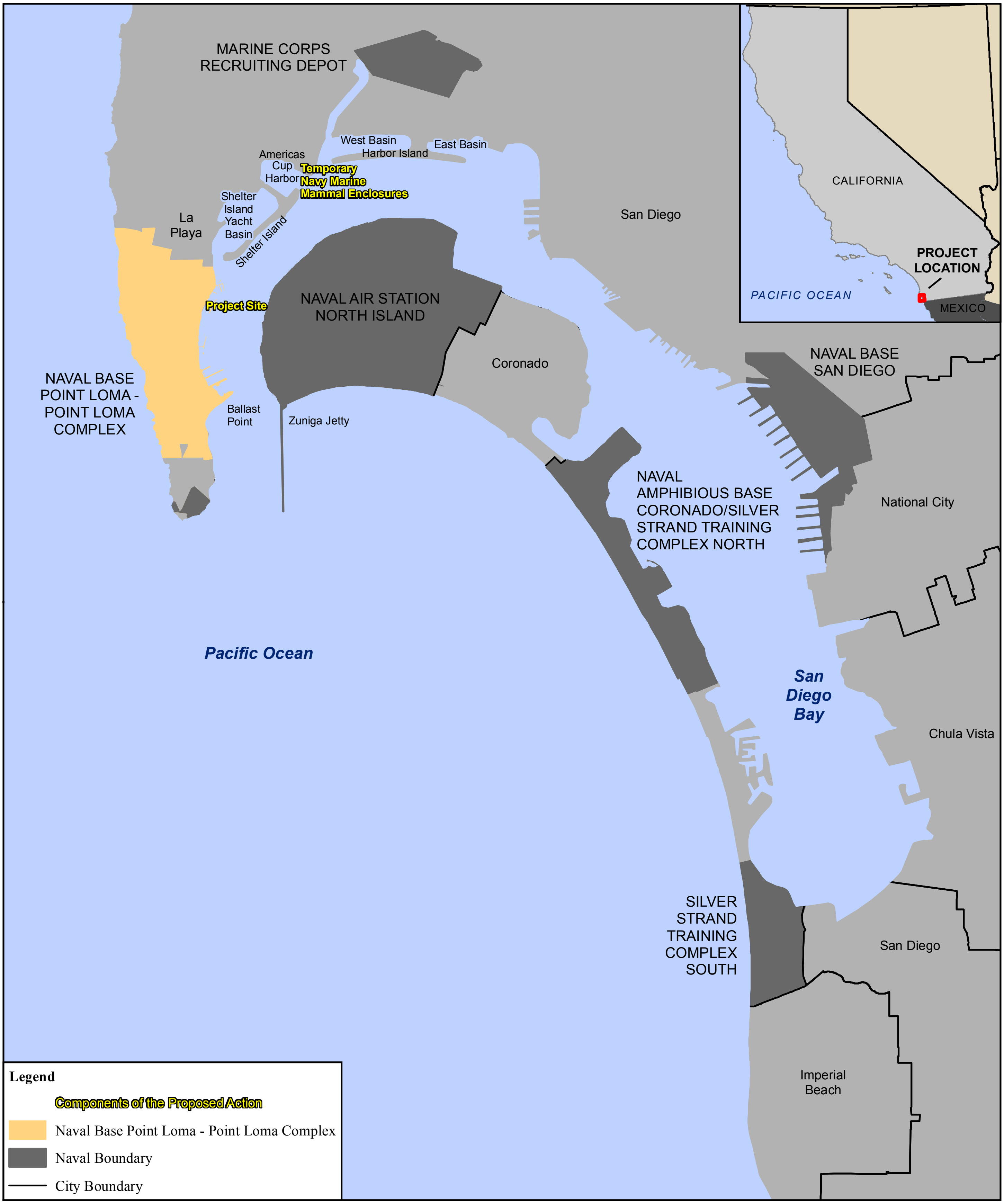
This IHA application covers the third year of activities (October 8, 2015, through October 7, 2016) associated with the Fuel Pier Replacement Project at Naval Base Point Loma (NBPL), California. The in-water pile driving, construction and demolition identified in this IHA will be restricted to October 8, 2015 to April 30, 2016 and September 16, 2016 to October 7, 2016, with a maximum of 135 in-water work days, per the Navy/USFWS MOU and the subsequent Informal Consultation. It is estimated that approximately 61 days of pile driving and 54 days of in-water demolition/extraction would occur 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 third 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 previous IHA application and monitoring report (?NAVF?AC SW 2014) but will not be repeated. Project demolition, construction, and dredging would occur over the course of four years, beginning in 2013 and be completed in 2017. Sections 1.2 and 1.3 describe the proposed activities to be conducted 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



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

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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

NBPL DFSP and more than 11 million gallons of fuel are issued and received every month to an 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

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

- ***Regulated Navigation Zones***. Amendments to the existing navigation zones are needed because the replacement pier would 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 would 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 will be reported to NMFS and used by the Navy to validate or revise estimated zones of influence and acoustic effects on marine mammals in each subsequent IHA application.

1.3.1 Demolition and Removal of the Existing Fuel Pier

Demolition and construction would occur in three phases to maintain the fueling capabilities of the existing fuel pier while the new pier is being constructed. Each of the utilities, systems and pier features would be demolished, but on a segment-by-segment basis to allow for continuous fueling operations during demolition and construction. To expedite the pile driving for the structural part of the new pier, a small segment of the existing pier was removed during the previous IHA period (IHA #2). In particular, the south side of the existing pier would remain operational while the north side is undergoing demolition and the new pier is being constructed. When the new pier is operational, the remainder of the old pier would be demolished. Table 1-1 below summarizes the work that would be done during the period of this IHA. More detail is provided in Section 1.3.2. The total duration of demolition/construction is estimated to be approximately four years (2013 through 2017). Whereas this IHA application is for the third year period of in-water demolition/construction, at least one subsequent IHA applications will be submitted for subsequent activities.

Table 1-1. Summary of Construction During this IHA Period

1	Construct the new pier: ramped approach pier (lower and upper deck) and double deck fueling pier.
2	Drive the six remaining 30" steel piles at the north dolphin
3	Drive 88 24"x 30" primary concrete fender piles along bay-ward side of new pier
4	Drive 132 16" concrete filled fiberglass piles at the corners of new pier
5	Demolish remaining decking, caissons and fender piles from north segment of the existing fuel pier.
6	Demolish temporary south dolphin, deck and piles

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 would be conducted over water and would include removal of the pier, pilings, plastic camels and fenders. All utility infrastructure would be removed, including water and sewer pipelines, lighting systems, and wiring. The fueling systems, including piping and pipe supports would 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.

<u>Demolition Process</u>

Aspects of the demolition process that would occur on or alongside the pier and would 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) would be removed above and below the pier deck. Then, the deck would be demolished using concrete saws. Next, fender piles would be removed using a Prime Cutter - Model 24 PCPC or similar type cutter with comparable acoustics, and then the concrete deck would be demolished. Last, the caissons would be removed. Some of these activities may occur at the same time.

Table 1-3. Remaining Fuel Pier (Pier 180) Piles and Caissons to be Removed During Third IHA Period

Pile Type or Structure	*Number*
14-, 16- and 24-in concrete fender piles	56
13-in plastic fender piles	34
84-in diameter concrete-filled steel caissons – north section	20
30-in steel temp south dolphin	12
Total	**122**

The removal of utilities attached to the pier would 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 2nd 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 would be loaded on to a support barge where they would be transported to the quaywall for offloading. Once on shore, the debris would be crushed onsite or hauled to a concrete recycling facility. 100% of the concrete material would 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 would be deployed around the active work area to provide a complete barrier to floating debris. Any floating debris would be gathered in work boats and would 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 would 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).

Discarded Military Munitions (DMM)

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

Figure 1-4
Contractors' Laydown Area

Demolition Debris

Four major types of debris would result from the demolition of the fuel pier: concrete; wood; steel; and plastic. The Proposed Action would 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 would be reused or recycled as appropriate. 100% of the concrete material would be recycled. Materials that cannot be reused or recycled would be transported to a permitted landfill. No special permits would be required for disposal of non-hazardous solid waste. Debris would not be allowed to fall into San Diego Bay. Disposal and recycling/reuse of debris would 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 Informal Consultation, the Navy will be limiting in-water activities that generate an acoustic impact under the MMPA to October 8, 2015 to 30 April 30, 2016 and September 16, 2016 to October 7, 2016. Therefore, this IHA application covers the full year. The new fuel pier would be constructed concurrently with demolition of the existing pier. The north segment of the existing pier would be demolished first while the existing approach and south segment would remain operational. Fueling capabilities would be provided by the south segment. During the estimated construction period of approximately four years, fuel pier operations would continue with minimal interruption. As described below, the two phases are designed with some overlap to maintain operational capability and make full use of the available construction timeframe.

To maintain continuous fueling capability, access to the existing south pier would be required during early construction phases. Access to the new north pier would be required during later phases for both construction and fueling activities. Figure 1-5 shows the construction and navigation zones, as well as the construction area for an unrelated project at the Scripps Institute of Oceanography pier. In the event that construction of both projects takes place concurrently, there is sufficient space to accommodate both operations and normal nonmilitary boat traffic. Previous IHA applications determined that simultaneous pile driving by both projects would not have an appreciable combined effect.

Construction would take place adjacent to the San Diego Harbor navigation channel. The proposed fuel pier construction zone is approximately 1,200 ft from the channel. Most of the vessels involved with the project would transit the channel intermittently.

Phase II – Northern Mooring Dolphin Completion (Oct 2015-Dec 15). The north mooring dolphin with a deck approximately 14 ft above mean lower low water (MLLW) is being constructed to allow vessels to berth and load/unload fuel. The remaining piles consist of 6, 30-inch diameter steel piles that would be driven during construction. The same pile driving equipment and barges used to construct the north mooring dolphin is the same that was used to construct the new fuel pier.

Phase I1 – Fender Piles for Bay-ward Section of New Fuel Pier. (Dec 15 to Mar 16) Upon completion of the lower deck of the new pier, fenders piles for the bay-ward side of the pier will be driven. The primary fenders are 24"x30" concrete piles and will be stabbed using the pile

Figure 1-5
Navigation/Construction Zone

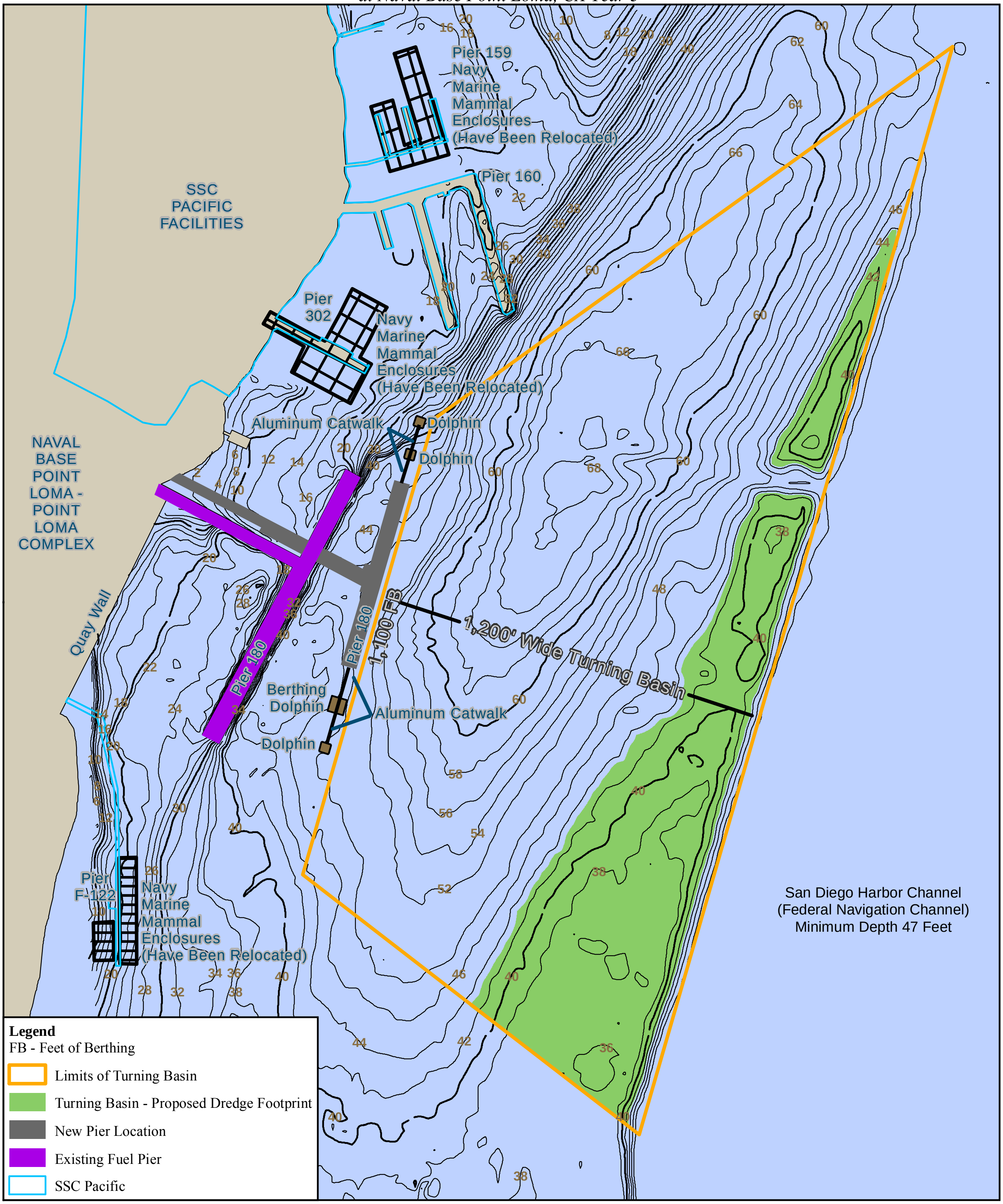
Sources: NAVFAC Southwest 2011a; NOAA 2012 crane, jetted to within approximately five feet of design tip elevation, then driven using an impact hammer to tip elevation. Secondary and corner fender system will be 16" fiberglass piles filled with concrete. These piles will be stabbed using the pile crane and driven using an impact hammer.

Phase I North Segment Demolition (350 lf) (Oct 15-Feb 16). The remaining north segment would be demolished by water access using barges to provide a working area for the crane and equipment. The demolition waste would be placed on barges and hauled to the 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 would be demolished using concrete cutting saws, cutting torches and cranes. The steel superstructure would be demolished with cutting torches, cranes and cutting sheers attached to an excavator, and any other demolition equipment deemed necessary. Last, the caissons would be cut using a diamond wire cutting saw and lifted to the barge with a crane. The floating barges would be supported by tug boats and small work boats.

1.3.3 Construction of Replacement Fuel Pier

The Proposed Action is construction of a new double deck fuel pier. The approach segment would be 700 ft long by as much as 50 ft wide. The new pier approach segment would connect to shore as a single deck with a ramp leading to the upper deck of the double deck berthing segment. The berthing segment would be 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 approach segment would be 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 would be 200 ft longer than the existing pier approach segment, so the berthing segment of the new pier would stand 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 would accommodate a wider variety of ships than is currently possible at the existing fuel pier where depths are 30 to 40 ft (Figure 1-6). No dredging would be needed alongside the pier during construction, and the need for future maintenance dredging along the pier would be reduced or eliminated. The top of the lower deck would be set approximately 5 ft above extreme high tide (13 ft above MLLW). The new pier upper deck elevation would be 28 ft above MLLW and 20 ft above extreme high tide. The upper deck would have 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. The existing fuel pier total area is 71,180 square ft/1.63 acres (sf/ac). The total area of the new pier (including the 700 ft long approach segment and dolphins) would be 65,865 sf/1.51 ac. This would be a decrease of 5,315 sf/0.12 ac of bay shading compared to the area of the existing fuel pier.



0 50 100 Meters
0 250 500 Feet

Sources: NAVFAC Southwest 2011a; NOAA 2012

Figure 1-6
New Fuel Pier and
Turning Basin Dredge Footprint

The replacement pier structure, including the mooring dolphins, would consist of steel pipe piles, supporting concrete pile caps and cast-in-place concrete deck slabs. The upper 10 ft of the steel wall pipe piles would be filled with concrete as part of the connection between the piles and the pier deck. Approximately 518 total piles will be installed at the completion of the project, 252 during the previous IHA #2 period and 226 for this IHA #3 Period. Design of the 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 would continue to be protected with the existing (protected/reconnected) impressed current cathodic protection system. New abutment (Phase 1) and quaywall (Phase 2) piles will also be protected by coating and new impressed current cathodic protection equipment. New trestle and pier steel piles would be protected with a combination of coating and a passive cathodic protection systems with anodes (aluminum) that would 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 period. The project construction schedule calls for pile driving at various times during Phase II. During Phase I the contractor got the majority of the structural piles driven after the least tern nesting/foraging season. Pile driving would occur during normal working hours (0730 to 1800) or the earliest time after the Marine Mammal Monitors (MMO's) have time to complete their pre-construction survey. The impact pile driver would be used for all three types of piles (steel, concrete and fiberglass). A vibratory hammer or jetting will be used to get the pile to refusal, and then an impact hammer will be used until the pile meets the structural requirement. Only one hammer at a time would be operated.

Table 1-4. Replacement Fuel Pier Pilings to Be Installed During Third IHA Period

Pile Type	***Location***	***Number***	***Estimated Install Period***	***Pile size (inches)***		
				30	30 x 24	16
30-in diameter x 1/2-in steel wall pipe piles	North Mooring Dolphin Batter Piles	6	October 2015	6		
Concrete Fender Piles - Primary	Bayward side of new pier,	88	Nov-Dec 2015		88	
Concrete Filled Fiberglass Piles - Secondary	Bayward side of new pier,	132	Nov-Dec 2015			132
Total Piles Installed		**226**		**6**	**88**	**132**

Aluminum catwalks (approximately 14 ft above MLLW) would connect the berthing and mooring dolphins to the main pier (refer to Figure 1-6). The approach segment would be of similar construction to the berthing pier. The main pier decks would be designed for a 50 ton mobile crane, 20 ton truck load and 10 ton forklifts (5 ton forklift on the lower deck); heavy equipment would not be operated on the berthing or mooring dolphins.

There would be fueling stations on the upper and lower decks of the new fuel pier berthing segment. Each fueling station would have the capability to supply diesel fuel marine (DFM) and JP-5 turbine (jet) fuel to vessels. The upper deck would be used for offloading fuel from tankers to the tank farm and for supplying fuel to higher profile vessels. The lower deck would 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 would also have six piping connections to receive ballast water from fleet tankers and other larger ships. An 8-in diameter oily water pipe would 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 would then transfer the oily water to the receipt tank at the treatment system.

Storm water from both pier decks would 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 would be collected on the pier and sent to the FOR receipt tank for treatment. The upper deck would be equipped with underflow scuppers that would permit a portion of the runoff from large storm events to discharge to the bay. The underflow design would 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 would be supported by two pipelines for each fuel product and two for lube oil. There would be a 16-in and an 8-in pipeline for loading/unloading JP-5. For loading and unloading diesel fuel marine (DFM), there would be a 16 in and a 10 in pipeline. There would be two 6-in pipelines for loading lube oil. The 16 in pipes would support the fueling stations on the outboard side while the 8-in JP-5 and 10-in DFM pipes would 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 would 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 would be hung beneath the upper deck. Utilities would be in a dedicated vault separate from the pipelines. On the approach segment, fuel lines would 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 would transition from horizontal along the lower deck to vertical to reach the upper deck, then horizontal again beneath the upper deck.

Concrete containment curbs would be incorporated into the pier deck design surrounding all fueling arms, fueling risers, and fuel pipes. There would 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 would be fitted with drains that would be piped to a collection tank on the lower deck. Sumps in the lower deck would connect to the FOR. There would 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 would 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 would 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 would be extended to the pipelines on the new pier. The connection for the new pipelines would be located between 35 and 65 ft from the existing pier abutment. With the exception of some electrical duct bank work would 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 would be installed on the new pier and connected to the onshore potable water supply system (Navy 2010c).

The total disturbed area on shore would be less than 1 acre, comprising previously disturbed areas that are paved and unpaved. The paved area northwest of the existing fuel pier would 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 would be paved as part of the new pier landside abutment. Three palm trees would be removed from the landscaped area. A new security fence with a motorized gate would 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 would be rebuilt. This work would include the placement of approximately 100 cy of concrete to repair the quay wall. There would also be some grading and asphalt repairs in this area. Repairs to the quaywall would also include removal of two closed storage tanks. The connection between the new and old pier abutments would 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 would be closed by a system of pile interlocks. A concrete cap would be placed at the top of the piles to support the new pier approach and provide a continuous surface. All the work would be performed in the dry, landward of the bulkhead.

1.3.4 Regulated Navigation Zones

The outboard edge of the new pier, referred to as the headline, would 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 would also extend beyond Navy waters into waters that are under the jurisdiction of the CSLC. Following completion of the National Environmental Policy Act (NEPA) process, Navy counsel would provide written notification to CSLC of the extension of Navy facilities into state waters (NAVFAC Southwest 2010).

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 activities that generate an acoustic impact under the MMPA to October 8, 2015 to April 30, 2016 and September 16 to October 7, 2016 to cover activities that may nevertheless overlap that period; the Navy is requesting this IHA for the full year, October 8, 2015 through October 7, 2016. The final IHA will be applied for to cover additional construction continuing into 2017. Pile-driving and in-water demolition that requires jetting and vibratory pile extraction would occur predominantly between September and April, inclusive, whereas all other construction and demolition activities could occur throughout the year.

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, Third Year IHA Application

Activity/Method	*Location and Timing*	*Estimated # Days*	*Pile Type*	*# Piles Installed*	*# Piles Removed*
Concrete Fender Piles	Bayward side of new pier, Nov-Dec 2015	22	24" x 30" concrete piles	88	
Concrete Filled Fiberglass Piles	Corners of Bayward side of new pier, Nov-Dec 2015	33	16" dia	132	
North Mooring Dolphin Batter Piles	NBPL approx. 150 ft southwest of existing fuel pier, Oct 2015	6	30"-dia steel pipe	6	
Totals		**61**		**226**	
Piles cut off at mudline with pile cutter	NBPL old pier north segment-new pier footprint, Nov-Dec 2015	6	24"-in square concrete fender		12
Piles cut off at mudline with pile cutter	NBPL old pier north segment, Nov-Dec 2015	12	16"- square concrete fender		44
Piles dry pulled with barge-mounted crane or cut off at mudline.	NBPL old pier north segment, Nov-Dec 2015	10	13" dia poly filled with concrete		34
Cut off at mudline with diamond belt saw	NBPL old pier north segment, Nov-Dec 2015	20	7'-0" & 5-6" concrete-filled steel caisson		20
Piles vibrated out or cut off at mudline	Temp dolphin south of old pier (Sept 2016)	6	30" - steel		12
Totals		**54**			**120**

2.2.1 Pile Driving

The currently proposed construction schedule includes six non-overlapping episodes of pile driving within the period of this IHA application, amounting to an estimated 61 days of pile driving, 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. The piles to be driven are 30" diameter steel pipe pipes, 24"x 30" concrete fender piles, and 16" concrete filled fiberglass fender piles. Steel pipe piles would be driven initially with a vibratory hammer, and then finished as necessary with an impact hammer. Concrete piles will only use the impact hammer after being jetted to refusal. Only one pile driver at a time would be operated, and demolition and construction would not occur on the same day.

2.2.2 Pile Extraction

Demolition of the north segment of the pier piles and caissons is scheduled to begin within the window of this IHA application. This work is estimated to comprise 54 days. Demolition of the temporary south dolphin is tentatively scheduled for September 2016. Removal of the 12, 30" steel piles should require 6 days to complete.

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 some 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.

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

Figure 2-1
Project Area Bathymetry

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) 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 1-6, 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).

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.

Figure 2-2
Eelgrass Beds in the Project Area

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 becomes indistinguishable from other background noise as it diminishes to near ambient levels 2,000 to 3,000 meters from the project site.

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 two IHAs (NAVFAC SW 2014, 2015), as well as the Navy Marine Species Density Database (NMSDD) (Hanser et al. 2012) and NMFS Stock Assessment Reports (Carretta et al. 2014a-b) are considered in determining the baseline on the species and numbers of marine mammals that occur in the activity area. For this IHA application, the intensive monitoring of the project area conducted during the 2014-2015 IHA period is considered to be the best indicator of marine mammal abundances during the third IHA period, at least for species that were observed on multiple occasions (NAVFAC SW 2015).

Of the approximately 41 marine mammal species that occur in Southern California waters (Carretta et al. 2014a), 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. 2014a; Hanser et al. 2012), 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. 2014b); 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. 2014b); 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 third 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). Take authorizations are not requested for these species because they are

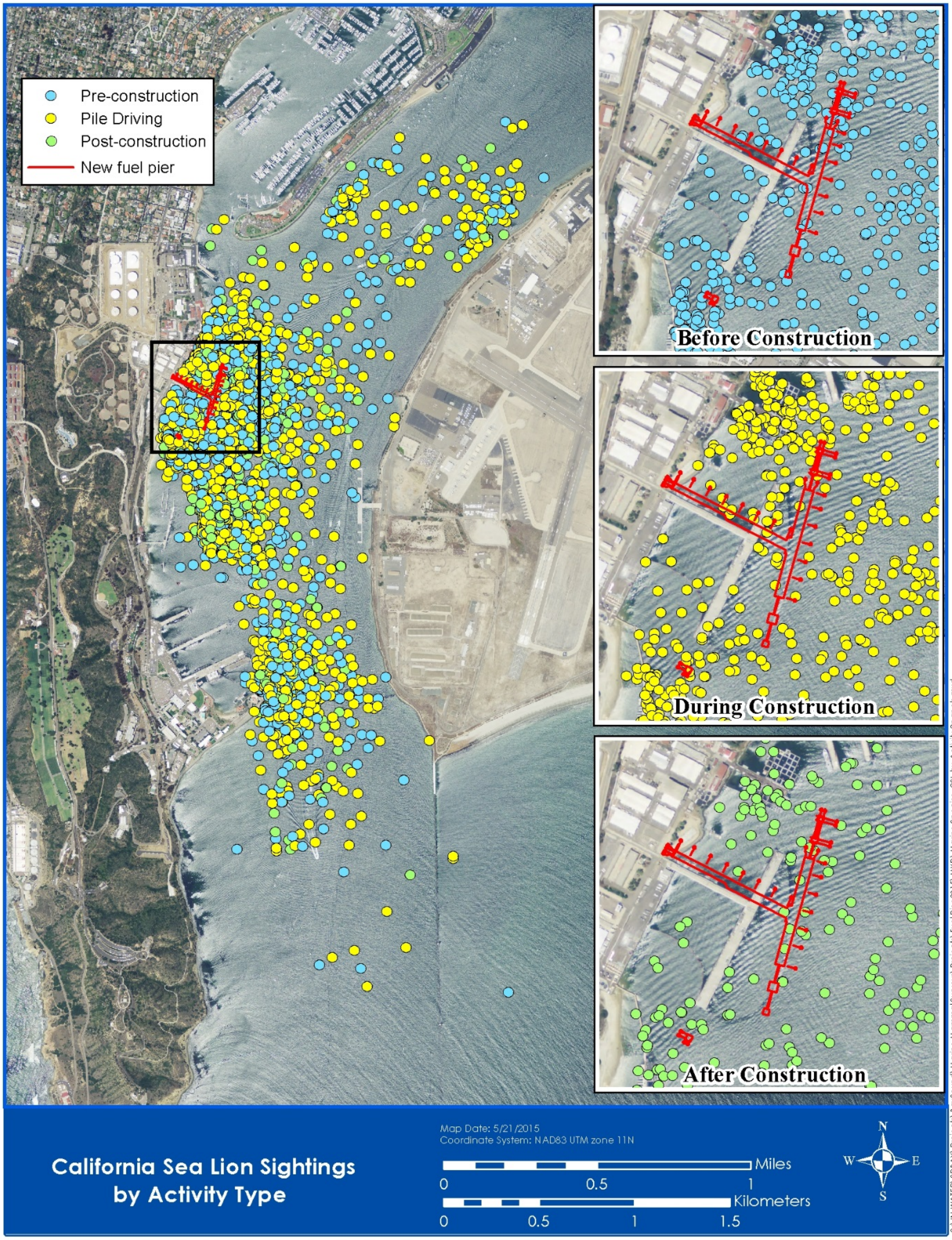


Figure 3-1 Sightings of California Sea Lions during the 2014-2015 IHA Period (NAVFAC SW 2015)

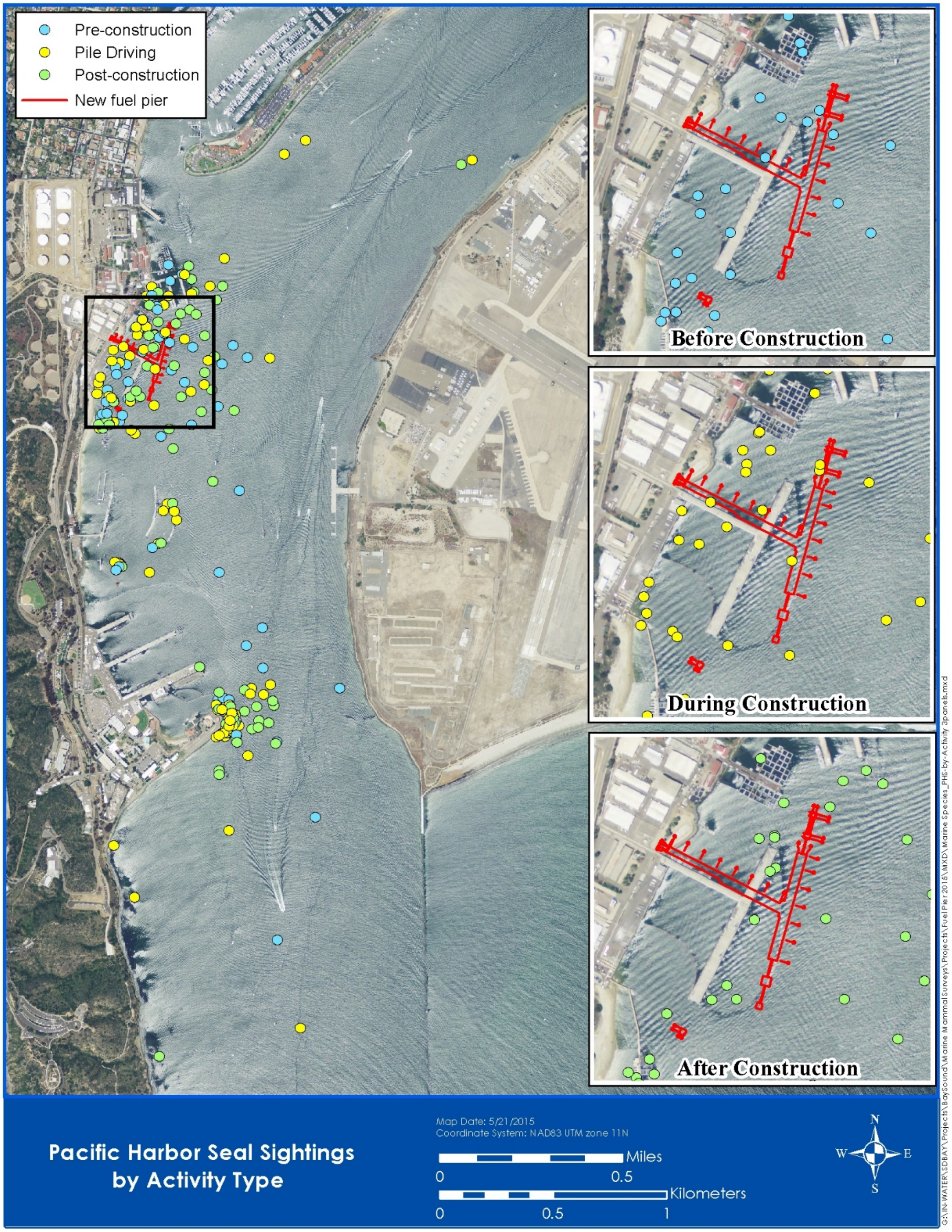


Figure 3-2 Sightings of Harbor Seals during the 2014-2015 IHA Period (NAVFAC SW 2015)

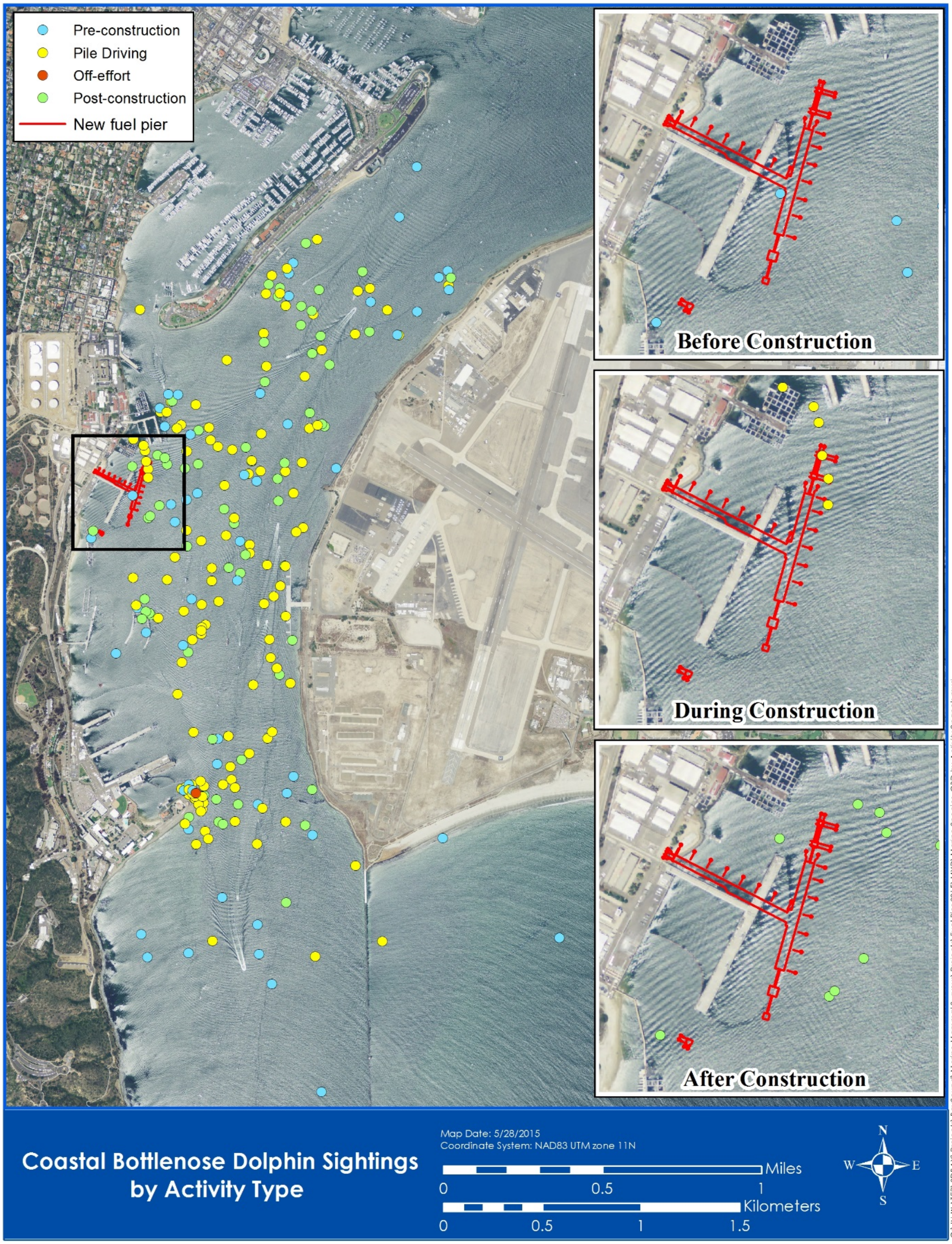


Figure 3-3 Sightings of Coastal Bottlenose Dolphins during the 2014-2015 IHA Period (NAVFAC SW 2015)

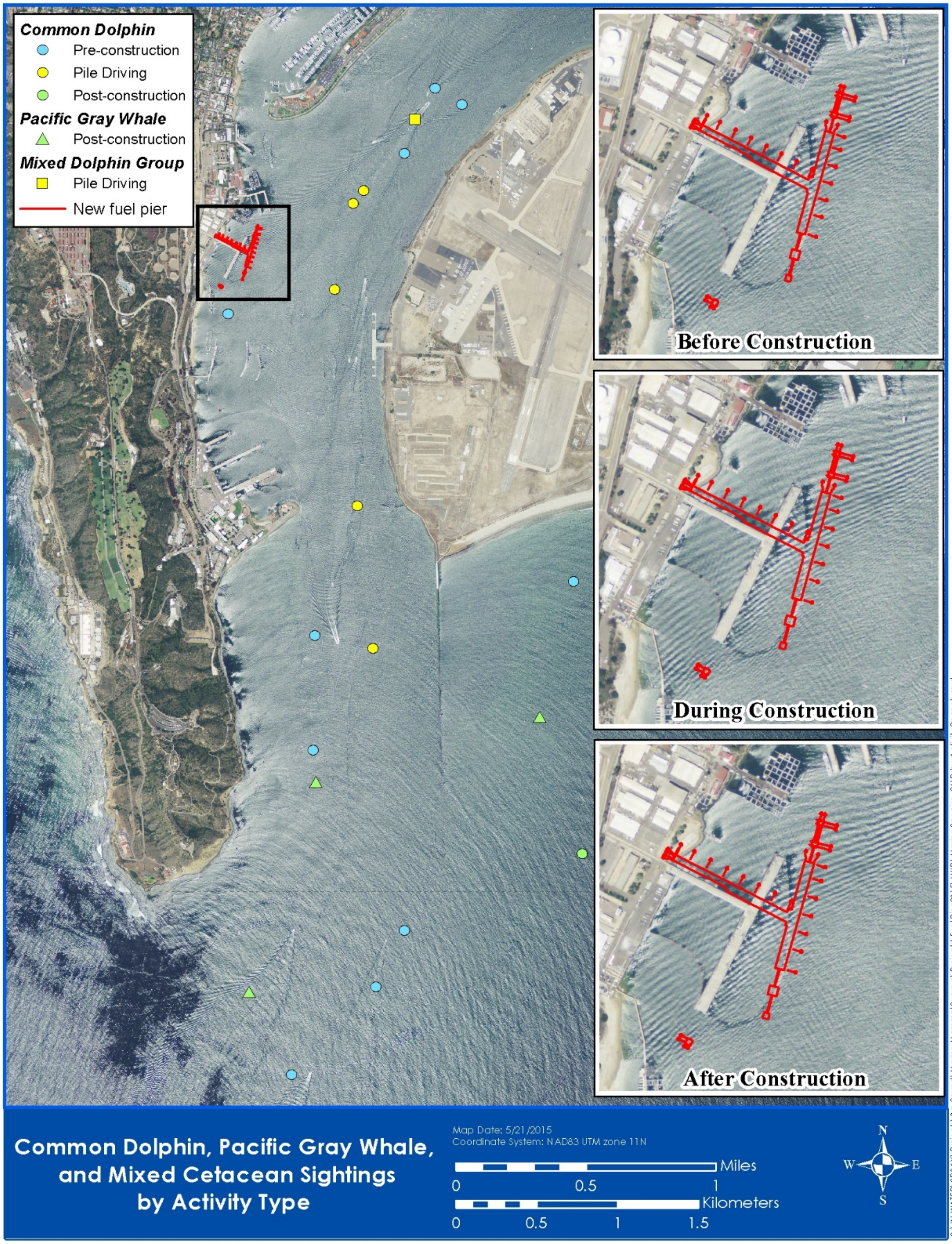


Figure 3-4 Sightings of Common Dolphins, Gray Whale, and Mixed Dolphins (Common + Bottlenose Dolphins) during the 2014-2015 IHA Period (NAVFAC SW 2015)

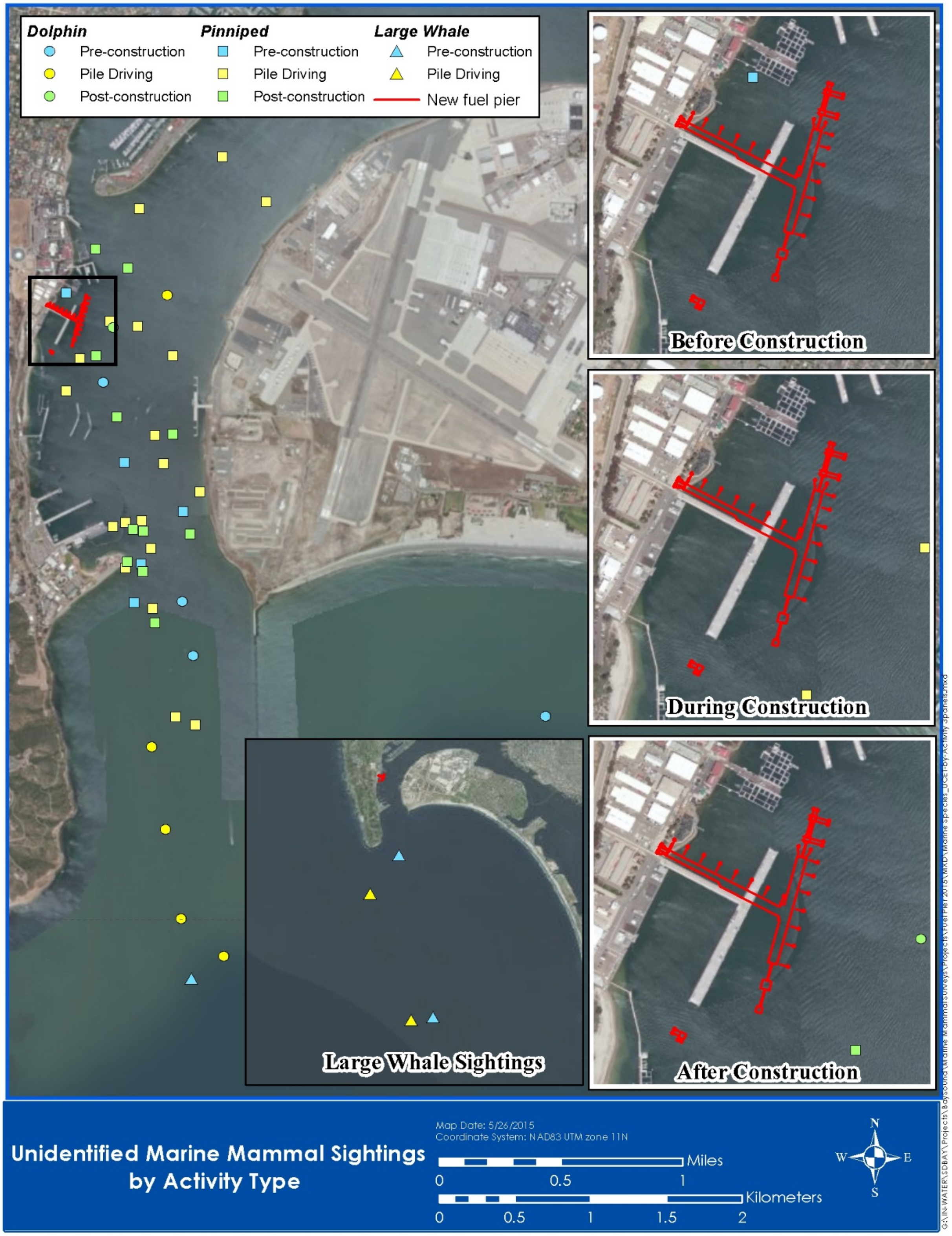


Figure 3-5 Sightings of Unidentified Species during the 2014-2015 IHA Period (NAVFAC SW 2015)

not expected, and in the unlikely event of their occurrence, they would be detected by monitoring and work would 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.

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/km^2
Harbor seal *Phoca vitulina* CA stock	30,968 (Coefficient of Variation [CV] = 0.157)	Common	Year-round	0.4987/km^2
Northern elephant seal *Mirounga angustirostris*	179,000	Rare	Year-round	0.0508/km^2
Bottlenose dolphin *Tursiops truncatus* CA coastal stock	323 (CV = 0.13)	Common	Year-round	1.2493/km^2
Short-beaked common dolphin *Delphinus delphis* CA/OR/WA stock	411,211 (CV = 0.21)	Occasional	Year-round, more common in warm season	Combined density of 1.5277/km^2
Long-beaked common dolphin *Delphinus capensis* CA stock	107,016 (CV = 0.42)	Occasional	Year-round, more common in warm season	
Pacific white-sided dolphin *Lagenorhyncus obliquidens* CA/OR/WA, Northern and Southern stocks	26,930 (CV = 0.28)	Uncommon	Year-round	0.0493/km^2
Risso's dolphin *Grampus griseus* CA/OR/WA stock	6,272 (CV = 0.30)	Rare	Year-round, more common in cool season	0.2029/km^2
Gray whale *Eschrichtius robustus* Eastern North Pacific Stock	20,990 (CV = 0.05)	Occasional - Seasonal	Winter	0.1150/km^2

Sources: [1]NMFS marine mammal stock assessment reports (Carretta et al. 2014a-b). [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 maximum ZOI. For species not or rarely observed, the density is from Hanser et al. (2012). Since long-beaked and short-beaked common dolphins are indistinguishable in the field, the same density is assumed for both.

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. On several occasions in recent years, an individual gray whale has entered San Diego Bay and lingered for up to 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.

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. 2014a). 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.

For the three new species that are part of this request (northern elephant seal, Pacific white-sided dolphin, and Risso's dolphin), all are relatively common offshore (Carretta et al. 2014a-b), 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 third 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. 2014a). 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. 2014a). 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. 2014a). 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. 2014a).

The previous 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, monitoring during the second IHA period established an average daily abundance of 90.35 individuals (NAVFAC SW 2015), which equates to a density of 15.9201/km^2 in the maximum ZOI for pile driving. Takes documented during the second IHA period were far fewer than had been estimated (NAVFAC SW 2015). Since the ZOI was intensively monitored during the seasonal periods of activity that mirror those to occur during the third IHA period, the Navy, believes the monitoring data from the second IHA period represent the best available science on numbers of California sea lions that are likely to occur.

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. 2014a). 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 (CV = 0.157). 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. 2014b).

The previous 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 second IHA period were much less than had been estimated (NAVFAC SW 2015). Since the ZOI was intensively monitored during the seasonal periods of activity that mirror those to occur during the third 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 (Hanser et al. 2012).

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 $0.0508/km^2$ (which is slightly higher than the cool season density of 0.0339) for the Southern California Range Complex (Hanser et al. 2012) 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 in 2004 and 2005, population size for the California Coastal Stock is estimated to be 323 individuals, with a 95% confidence interval of 259-430 (Carretta et al. 2014a). If the 35% of animals encountered that lack identifiable dorsal fin marks were included within this stock, the true population size would be closer to 450-500 animals (Carretta et al. 2014a). 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 third 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 (Hanser et al. 2012; Carretta et al. 2014a). 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. 2014a). Based on shipboard surveys within 300 nmi of the coasts of California, Oregon, and Washington during 2005 and 2008, the geometric mean abundance estimate of the California/Oregon/Washington stock of short-beaked common dolphins is 411,211 (CV = 0.21). Similarly, based on ship line-transect surveys conducted in 2008 and 2009, the geometric mean abundance estimate of the California stock of long-beaked common dolphin is 107,016 (CV = 0.42) (Carretta et al. 2014a).

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 previous IHA was based on the regional density estimate (Hanser et al. 2012), which was derived from offshore surveys and was much lower than is now estimated. As for other species, 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. (2014), the most recent estimates of abundance for Pacific white-sided dolphins are based on two summer/autumn shipboard surveys conducted within 300 nmi of the coasts of California, Oregon, and Washington in 2005 (Forney 2007) and 2008 (Barlow 2010). 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). 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. The 2005-2008 geometric mean abundance estimate for California, Oregon and Washington waters based on the two most recent ship surveys is 26,930 (CV=0.28) Pacific white-sided dolphins (Forney 2007, Barlow, 2010).

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 (2014), current estimates of population size are derived from two shipboard surveys within 300 nmi of the coasts of California, Oregon, and Washington in summer/autumn of 2005 (Forney 2007) and 2008 (Barlow 2010). 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 2005-2008 geometric mean abundance estimate for California, Oregon and Washington waters based on the two most recent ship surveys is 6,272 (CV=0.30) Risso's dolphins (Forney, 2007, Barlow 2010).

Since no data are available for San Diego Bay, the regional density estimate from the NMSDD (Hanser et al. 2012) 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. 2014a). The southward migration occurs during November-December, whereas the return northward migration occurs during February-May (Carretta et al. 2014a; 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. 2014b).

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 previous 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 0.1150/km^2 (Hanser et al. 2012). 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 3 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 would not be exposed to underwater sounds to the same extent as cetaceans occurring in the same location, but would 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 would be submerged and at the same water depth as the source, and would 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 is 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.

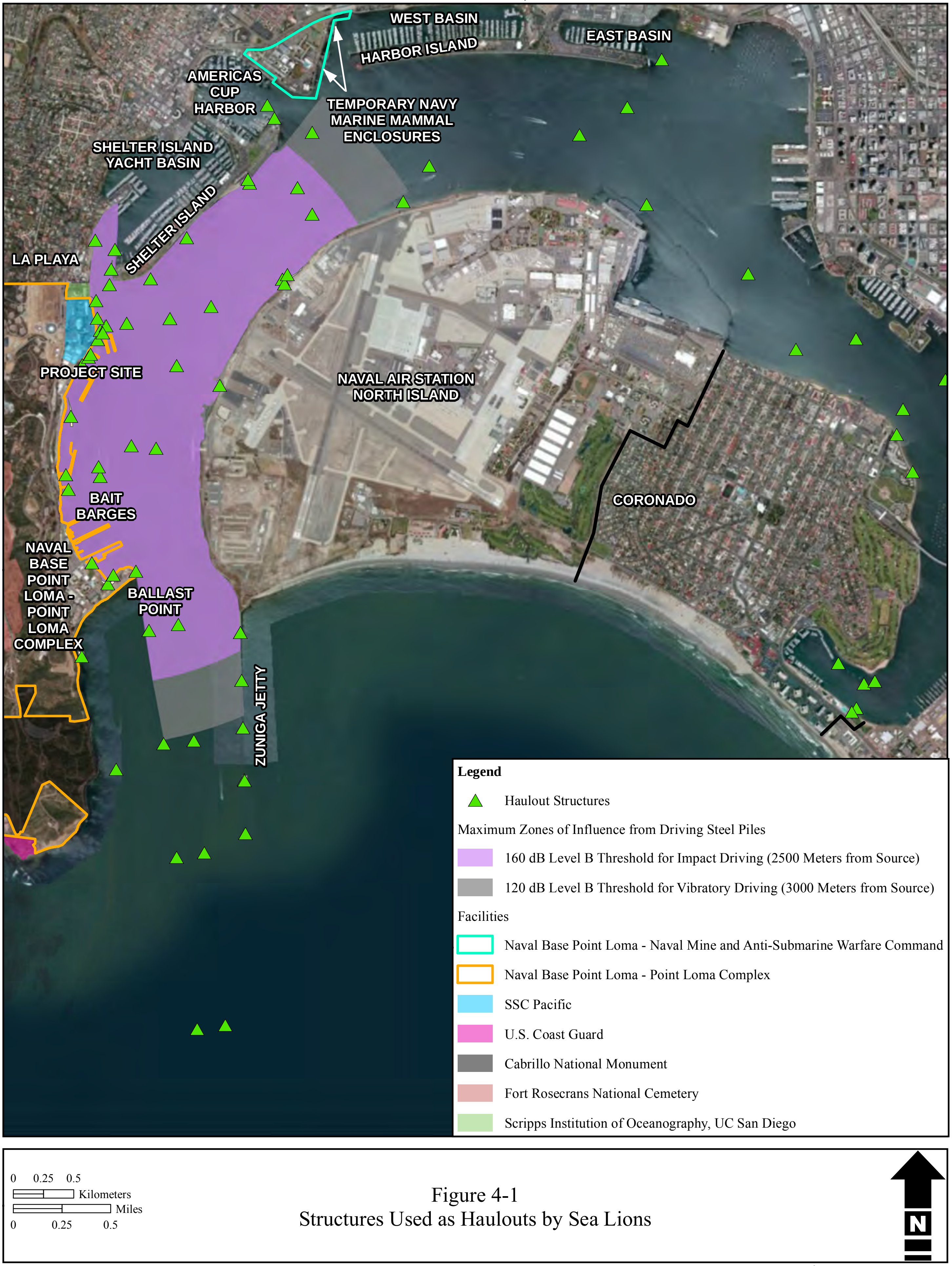


Figure 4-1
Structures Used as Haulouts by Sea Lions

4.1.5 Acoustics

On land, California sea lions make incessant, raucous barking sounds; these have most of their 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. 2014a).

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. 2014a). 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, of which two species 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. 2014b).

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. 2014b; 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. 2014b; 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 0.1150/km^2 for southern California coastal waters (Hanser et al. 2012) 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, molluscs, 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 molluscs 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; Dalhheim 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 event, 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).

The Navy Marine Species Density Database (Hanser et al. 2012) estimated the density of coastal bottlenose dolphins throughout the waters of the Southern California Range Complex as 0.36/km^2. As seen in the Navy's marine mammal surveys of San Diego Bay (Figure 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, 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. 2014a). 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 or 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. 2014a). 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 reasionably consistent with the regional NMSDD density estimate of 0.05732/km^2 (Table 3-1; Hanser et al. 2012), and a similar frequency of occurrence and density are assumed during the 3rd 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/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. 2014a).

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 (Hanser et al. 2012; Carretta et al. 2014a). After the 1982-1983 El Niño event, Risso's dolphins' presence in southern California waters increased (Shane 1995). As El Niño conditions are developing during 2015, a similar increase in abundance may occur, and there is a reasonable possibility that it could occur within the project ZOI during the third IHA period, especially during the winter-spring months, when it is most common and when pile driving would occur. The NMSDD cool season density of 0.20294/km^2 for the Southern California Bight (Hanser et al. 2012) is used to estimate the occurrence of this species during the third 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, 2015 (or the issuance date, whichever is later). The Navy previously submitted IHA applications for the first and second years of construction (Navy 2013a, 2014), both of which were approved by NMFS, and will submit a subsequent IHA application for the final year of construction.

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 demolition of the existing pier and pile driving as necessary to construct the new pier. 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 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. The transmission loss model has been combined with the expected source levels (discussed in Section 6.4.2) to map the distances to critical ZOI thresholds.

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, with the exception that vibratory and impact driving of steel piles will occur on the same days. The total number of in-water work days will not exceed 105.

This analysis predicts 5,189 exposures (see Section 6 for estimates of exposures by species) from pile installation and removal activities during the third 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 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 would enter the water at some time during the day and would thereby experience Level B harassment from underwater sound. Some of these animals may also experience airborne sound that exceeds the threshold for Level B harassment, but since an animal is considered to be taken only once per day, and the ZOIs are much larger for underwater than airborne sound, no separate take estimates are provided for airborne sound. Level A harassment is not anticipated to result from any of the construction activities, and monitoring measures will be implemented to minimize the possibility of injury to marine mammals. Specifically, vibratory hammers will be the primary method of installation, which are not expected to cause injury to marine mammals due to the relatively low source levels (≤ 165 dB rms) and the continuous as opposed to impulsive nature of the sound. Also, pile driving will either not start or be halted if marine mammals approach 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 third 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	3,548
Harbor seal	111
Northern elephant seal	11
Coastal bottlenose dolphin	278
Common dolphins	340
Pacific white-sided dolphin	11
Risso's dolphin	45
Gray whale	26
Total	***4,370***

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 would 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, 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 third-year project activities have little to no potential to result Level A harassment; for those that do (i.e. impact driving the 30-inch steel piles), sound is likely to deter marine mammals from approaching within the threshold distance; 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.

Term	*Definition*
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).
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 6-3. Details of each of the sources are described in the following text.

Table 6-3. 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 and vibratory pile driving. 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, 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."

Since 1997, NMFS has used generic sound exposure thresholds to determine when an activity in the ocean that produces sound might result in impacts to a marine mammal such that a take by harassment might occur (NMFS 2005). 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). Current NMFS practice regarding exposure of marine mammals to high level sounds is that cetaceans and pinnipeds exposed to impulsive sounds of 180 and 190 dB rms or above, respectively, are considered to have been taken by Level A (injurious) harassment.

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). NMFS is developing new science-based thresholds to improve and replace the current generic exposure level thresholds, but the criteria have not been finalized (Southall et al. 2007; NMFS 2013b). The current Level A (injury) and Level B (disturbance) thresholds are provided in Table 6-4.

Table 6-4. Injury and Disturbance Thresholds for Underwater and Airborne Sounds

Marine Mammals	*Airborne Marine Construction Criteria (Impact and Vibratory Pile Driving) (re 20 µPa)*	*Underwater Vibratory Pile Driving Criteria (e.g., non-pulsed/continuous sounds) (re 1 µPa)*		*Underwater Impact Pile Driving Criteria (e.g., pulsed sounds) (re 1 µPa)*	
	Disturbance Guideline Threshold (Haulout)[1]	*Level A Injury Threshold*	*Level B Disturbance Threshold*	*Level A Injury Threshold*	*Level B Disturbance Threshold*
Cetaceans (whales, dolphins, porpoises)	*N/A*	*180 dB rms*	*120 dB rms*	*180 dB rms*	*160 dB rms*
Pinnipeds (seals, sea lions, walrus; except harbor seal)	*100 dB rms (unweighted)*	*190 dB rms*	*120 dB rms*	*190 dB rms*	*160 dB rms*
Harbor seal	*90 dB rms (unweighted)*	*190 dB rms*	*120 dB rms*	*190 dB rms*	*160 dB rms*

[1] Sound level at which pinniped haulout disturbance has been documented. Not an official threshold, but used as a guideline.
N/A = not applicable

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), underwater noise levels in the project area are commonly 120-130 dB re 1µPa, with substantially 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 sound 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).

6.4.2 Indicator Pile Program (IPP)

The IPP was a robust in-situ monitoring effort to measure SPLs from different project activities, including driving the 30 and 36 inch steel piles with an impact and vibratory hammer, to validate the acoustic ZOIs and the contours (isopleths) developed through the TL modeling effort (Navy

2013a). Whereas the preliminary design for the pier suggested the possible need for 48-inch steel piles, the final design indicates that 30- and 36-inch steel piles will be adequate and that 48-inch steel piles are not necessary, at least during this phase of the work. The IPP conducted between 28 April and 15 May, and resumed on 24 October 2014 and comprised 10 steel pipe indicator piles (2 30-in and 8 36-in diameter), driven by both the vibratory and impact pile driver. The IPP is more fully described in the monitoring reports (NAVFAC SW 2014, 2015).

Based on additional research by Dahl et al. (2012), which built on the results described in the first IHA, a revised model of TL for the project was developed and validated by the IPP, as shown below in Figure 6-1. The graphical model is used in this application to predict the extent of ZOIs from source levels that were also empirically validated in the IPP. As compared to the original model developed for the first IHA application, this model indicates a greater rate of transmission loss with distance, as was supported by the IPP data.

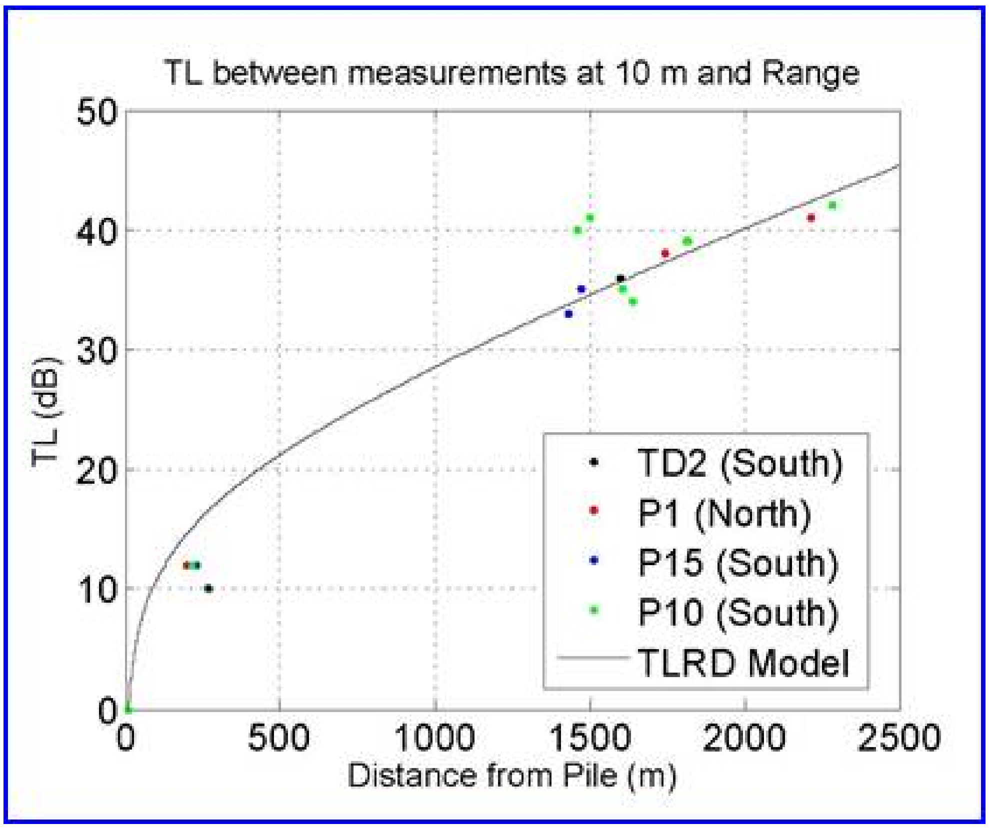


Figure 6-1 Transmission Loss Model for Pile Driving During Fuel Pier IHA Year 2, Based on Dahl et al. (2012) and IPP Data

6.4.3 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-inch 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 third IHA period in terms of the activities and the location, depth, sizes and types of piles. For the other activities that are part of this application, literature was reviewed to identify SPLs from similar activities under similar conditions. In situations where data from similar activities are not available or provide a range of values, a reasonable worst case is used.

Table 6-4 identifies the sound source levels that are used in evaluating impact and vibratory pile driving in the current IHA application. For the installation of 30-inch steel piles, the source SPLs represent the larger of two values obtained during acoustic monitoring (NAVFAC SW 2015) and are 196 dB and 165 dB re 1 µPa for impact and vibratory installation, respectively (Table 6-4). No measurements are available for 24-by-30 inch concrete fender piles; however, numerous measurements exist for 24-inch octagonal concrete piles, which should generate similar to slightly smaller SPLs. Accordingly, the largest value obtained from the 24-inch piles is used here, a maximum rms source SPL of 176 dB re 1 µPa (Table 1) (WSDOT 2007; CALTRANS 2012). The value used for the installation of the 16-inch concrete-in-fiberglass fender piles, 173 dB re 1 µPa, is based on the maximum SPL measured in a project that installed 16-inch solid concrete piles (Table 1). The values used here for the 24- and 16-inch piles are the same as were used in the EA and first IHA application (Navy 2013a-b).

Table 6-4. Underwater Sound Pressure Levels from Similar *in-situ* Monitored Construction Activities

Project and Location	*Pile Size and Type*	*Installation Method*	*Water Depth*	*Measured Sound Pressure Levels (rms) at 10 m*
NBPL Fuel Pier, San Diego, CA[1]	30-in Steel Pipe	Impact	9 m (30 ft)	**196 dB re 1 µPa**
		Vibratory		**165 dB re 1 µPa**
Mukilteo Ferry Terminal, WA[2]	24-in Concrete	Impact	8 m (26 ft)	170 dB re 1 µPa
Berth 32, Port of Oakland, CA[3]	24-in Concrete	Impact	7-8 m (23-26 ft)	173 dB re 1 µPa
Berth 32, Port of Oakland, CA[3]	24-in Concrete	Impact	8 m (26 ft)	174 dB re 1 µPa
Berth 23, Port of Oakland, CA[3]	24-in Concrete	Impact	4 m (13 ft)	172 dB re 1 µPa
Berth 22, Port of Oakland, CA[3]	24-in Concrete	Impact	10-15 m (33-50 ft)	**176 dB re 1 µPa**
Humboldt Bay, CA[3]	24-in Concrete	Impact	3-4 m (10-13 ft)	158 dB re 1 µPa
Naval Weapons Station Concord, CA[3]	16-in Concrete	Impact	10 m (33 ft)	**173 dB re 1 µPa**

Note: **Bolded** values are used in this application. Sources: [1]NAVFAC SW 2015; [2]WSDOT 2007; [3]CALTRANS 2012.

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 (165 dB re 1µPa) that was obtained for vibratory hammering of the 30-inch steel piles at the Fuel Pier (NAVFAC SW 2015) is used for the vibratory extraction of 30-inch steel piles.

There is scant information on underwater sound produced by underwater cutting tools. The only data cited in recent IHA and LOA applications (http://www.nmfs.noaa.gov/pr/permits/incidental.htm) were combined from a variety of diver tools, including jackhammers, drills, grinders, bolt guns, and hydraulic wrenches, showing peak source levels of up to 200 dB re 1µPa at 1 m and averaged levels of up to 161 dB re 1µPa at 1 m (Nedwell and Howell 2004). The averaged source levels would equate to approximately 141 dB re 1µPa at 10 m (assuming spherical spreading loss). However, construction monitoring during the second IHA period provided directly applicable SPLs, which are as follows: for cutting the caisson piles with an underwater saw, 155 dB re 1µPa; and for cutting a variety of other piles at the mudline, 152 dB re 1µPa (NAVFAC SW 2015).

Table 6-5 provides the calculated areas of ZOIs associated with the maximum sound levels for the maximum impulsive and continuous sounds that are anticipated during the third-year IHA period. It should be noted that the ZOI for level A harassment would be closely monitored and subject to shutdowns if a marine mammal approaches the area. The ZOI areas and maximum distances for the 30-inch piles (Figure 6-2) are based on the acoustic monitoring results from this type of pile during the second IHA period (NAVFAC SW 2015). Figure 6-2 reflects 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). The limits of ensonification due to the project for impact driving smaller piles, and for continuous noise associated with pile cutting (Table 6-5) are much less than those depicted in in Figure 6-2.

The ZOIs and distances for the 24-by-30 inch and 16-inch piles are based on the original modeling as described previously and used in the EA and first IHA application (Navy 2013a-b) because there are no acoustic measurements as yet for installing these types of piles at the Fuel Pier. The original modeled distances are similar to, albeit slightly larger than what would be predicted by the curve shown in Figure 6-1, making them conservative for this analysis but within the range expected given variance in the data and the steepness of the curve between 10 and 20 dB.

No transmission loss data specific to pile cutting tools are available, but given sources of 152-155 dB, reference to the transmission loss model in Figure 6-1 suggests a distance of approximately 1,500 m to the limit of the 120 dB threshold for non-impulsive sound (Table 6-5). Given ambient underwater noise of approximately 128 dB (NAVFAC SW 2015), the distance at which noise from the cutting tools becomes indistinguishable from ambient should be much less – closer to 1,000 m (Figure 6-1), making this calculation very conservative with respect to potential takes of marine mammals.

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

Description	***Figure***	***Area of ZOI (km^2) and Maximum Distance (m)***			
		Pinniped Level A – 190 dB	***Cetacean Level A – 180 dB***	***Impact Level B – 160 dB***	***Vibratory Level B – 120 dB[2]***
Impact and vibratory driving, vibratory removal of steel 30-in piles	6-2	0.0018, 75	0.3302, 350	3.8894, 2,000	5.6572, 3,000
Impact driving 24-by-30-inch concrete fender piles	-	<0.0001, 2.0	< 0.0001, 6.3	0.1914, 505	N/A
Impact driving 16-inch concrete-in-fiberglass fender piles	-	<0.0001, 1.4	<0.0001, 4.5	0.0834, 259	N/A
Pile cutting tools	-	N/A	N/A	N/A	3.0786, 1,500

Notes: [1]All sound levels expressed in dB re 1 µPa rms; N/A = not applicable to activity.

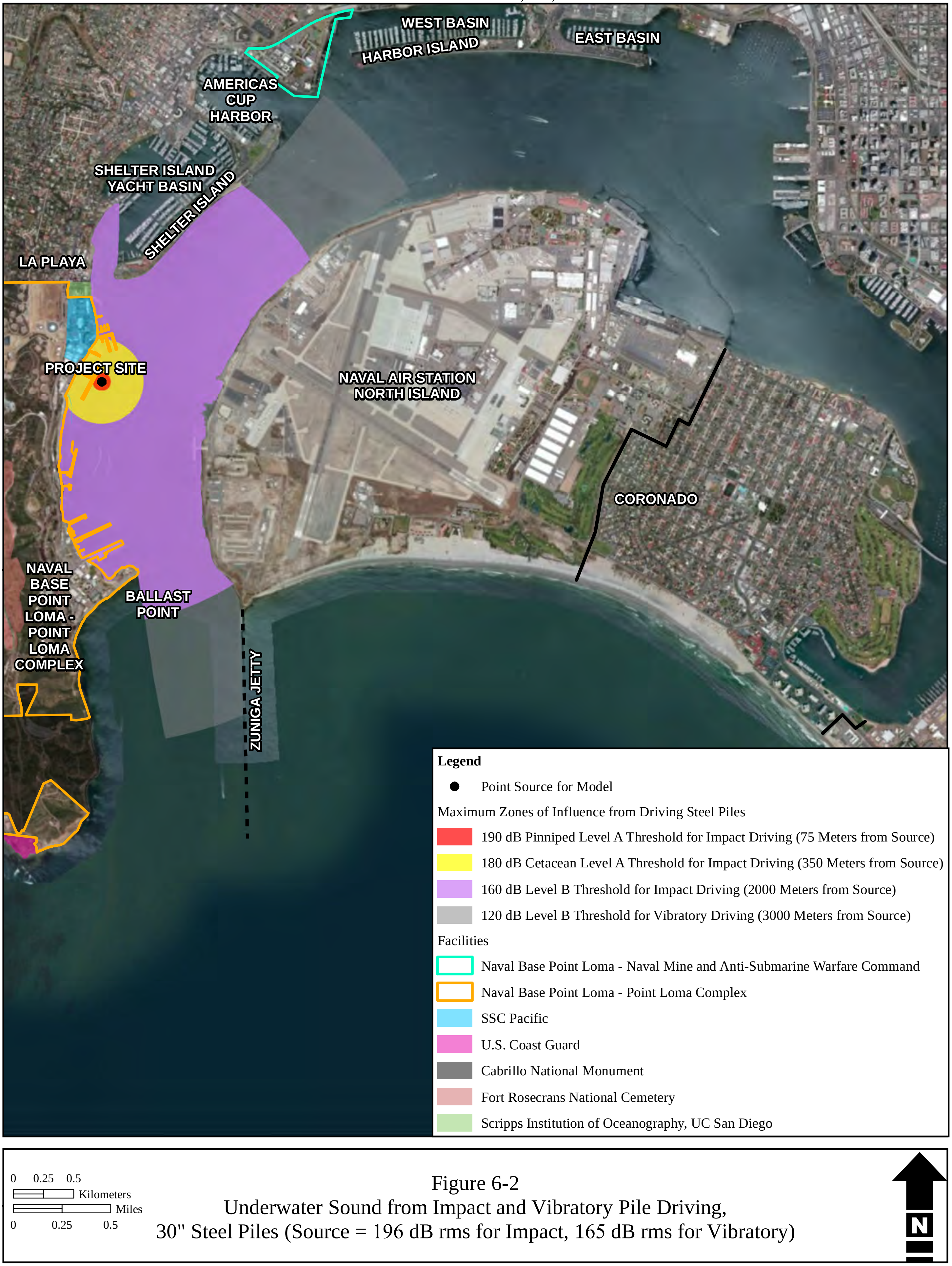


Figure 6-2
Underwater Sound from Impact and Vibratory Pile Driving,
30" Steel Piles (Source = 196 dB rms for Impact, 165 dB rms for Vibratory)

6.4.4 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, 2015).

During the first IHA period, airborne maximum SPLs ranging from 100 to 115 dB re 20 µPa rms (unweighted) at the source (50 ft [15 m]). Airborne transmission loss was calculated from sets of paired measurements at the source and at distance, and was found to be slightly less than the spherical spreading model, with a logarithmic loss rate of approximately 19.4 as opposed to 20 with spherical spreading. Using this empirically derived transmission loss rate, distances to airborne harassment thresholds are estimated as 234 ft (71 m) to the 100 dB threshold for sea lions, and 764 ft (233 m) to the 90 dB threshold for harbor seals; both are somewhat smaller than was estimated from literature in the first IHA (NAVFAC SW 2014).

Airborne sound measurements were also made for 24-inch concrete piles driven at NMAWC during the first IHA period (NAVFAC SW 2014). Source values were similar to those obtained for the steel piles at the Fuel Pier, but transmission loss was much less, a fact attributed to unique features of the environment at NMAWC, specifically the configuration of the site within a relatively narrow channel and the built environment including nearby buildings and infrastructure.

During the second IHA period (NAVFAC SW 2015), more measurements were obtained from impact driving 36-inch steel production piles, resulting in an average source rms SPL of 107 dB re 20 µPa at 50 ft (15 m), and average distances to Level B thresholds of 597 ft (182 m) for harbor seals and 256 ft (78 m) for other pinnipeds. Threshold distances were calculated from regression analysis of the data, which indicated a logarithmic loss rate of 15.1, which approximates "practical spreading."

Since the data collected indicate airborne source SPL measurements from concrete and steel piles of different sizes broadly overlap, and that features of the local environment affecting transmission loss are as important as the source levels in determining distances to the effects thresholds, the most recent data from the Fuel Pier during the second IHA period (NAVFAC SW 2015) are used in this application. No data are available for airborne sound associated with pile cutting or from vibratory removal of 30-inch steel piles; therefore, airborne source levels and rates of transmission loss for these activities are assumed to be similar to the values obtained for the steel piles. These threshold distances and ZOI areas are shown in Table 6-6.

Table 6-6. Calculated Distances and Areas for Airborne Noise Thresholds during Year 3 Activities at the Fuel Pier

Species	*Threshold*	*Maximum Distance*	*Area Encompassed by the Threshold*
Pinnipeds (except harbor seal)	100dB re 20 µPa rms (unweighted)	256 ft (78 m)	0.0191 km^2
Harbor seal	90dB re 20 µPa rms (unweighted)	597 ft (182 m)	0.1041 km^2

Since protective measures are in place out to the distances (75 m) calculated for the underwater Level A thresholds (Table 6-5), the distances for the airborne thresholds will be essentially covered by monitoring. 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).

6.4.5 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 proposed action are those produced by 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 this proposed action 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 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, 6-6). 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 underwater Level A threshold extends 75 m from the source, whereas the airborne Level B threshold is within 78 m of the source. Since the monitoring and protective measures to exclude sea lions from the underwater Level A ZOI will apply to any animal that could rapidly swim into the Level A ZOI, these measures would incidentally protect California sea lions from airborne Level B harassment as well.

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 the IHA (NAVFAC SW 2014, 2015), 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). 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.

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. 2014b), they are considered a reasonable possibility to occur more frequently during the third IHA period. The regional density estimate of 0.0508/km^2 (Hanser et al. 2012) 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.

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 were seen per day, a density of 1.2493/km^2.

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 were 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 (Hanser et al. 2012), 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, a 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.

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. This is close to the regional density estimate (0.0573/km^2) from Hanser et al. (2012), and is considered realistic for the project area.

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 third IHA period given developing El Niño conditions (Shane 1995). The regional density estimate of 0.2029/km^2 (Hanser et al. 2012) is used in this application.

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, 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, significantly less than the regional density estimate of 0.1150/km^2 in southern California waters (Hanser et al. 2012). The regional density estimate is applied here as a reasonable worst case that would account for the possibility of animals moving closer to shore and entering the mouth of the bay during the third IHA period.

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 ZOIs as shown in Tables 6-5 and 6-6, 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

Results of the analysis are shown in Table 6-7. 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, or vibratory extraction.

Table 6-7. Estimates of Potential Takes for Each Species by Each Type of Activity

Species	***Activity***							
	Steel 30" Pile Impact Driving	***Steel 30" Pile Vibratory Driving***	***Steel 30" Pile Vibratory Removal***	***Concrete 24" Fender Pile Driving***	***Concrete-Fiber 16" Fender Pile Driving***	***Pile Cutting***	***Airborne Level B Exposure[1]***	***Total Takes[2]***
California sea lion	372	542	542	67	44	2,353	32	**3,548**
Harbor seal	12	17	17	2	1	74	5	**111**
Northern elephant seal	1	2	2	0	0	8	0	**11**
Coastal bottlenose dolphin	29	43	43	5	3	185	N/A	**278**
Common dolphins	36	52	52	6	4	226	N/A	**340**
Pacific white-sided dolphin	1	2	2	0	0	8	N/A	**11**
Risso's dolphin	5	7	7	1	1	30	N/A	**45**
Gray whale	3	4	4	0	0	17	N/A	**26**
Totals[3]	**458**	**668**	**668**	**54**	**54**	**2,898**	**37**	**4,370**

Notes: N/A = not applicable. [1] rms of 100 dB re 20 µPa for California sea lion and northern elephant seal, 90 dB re 20 µPa for harbor seal. [2] 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. [3] Due to rounding off takes to the nearest whole number of animals, totals may not always equal the sum of the takes from individual activities.

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 6-8. Takes are anticipated to occur during fall to spring, between September and April, from multiple causes as shown in Table 6-7.

Table 6-8. Summary of Potential Exposures Constituting Takes for All Species

Species	***Number of Level B Takes Requested[1]***
California sea lion	3,548
Harbor seal	111
Northern elephant seal	11
Coastal bottlenose dolphin	278
Common dolphins	340
Pacific white-sided dolphin	11
Risso's dolphin	45
Gray whale	26
Total	***4,370***

Notes[1]. Based on a total of 61 days of pile driving and 54 days of demolition.

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 several reasons. Firstly, vibratory pile driving which is being utilized as the primary installation method, does not generate high enough peak SPLs that are commonly associated with physiological damage. Any use of impulsive pile driving will only occur from a short period of time (~30 to 120 min per steel pile). Additionally, 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. The Navy will have trained biologists monitoring a shutdown zone equivalent to the Level A Harassment zone (inclusive of the 180 dB re 1 µ Pa (cetaceans) and 190 dB re 1 µ Pa (pinnipeds) isopleths 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, it is likely that the onset of pile driving 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 may 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. Any takes would likely have only a minor effect on individuals and no effect on the population. The sound generated from vibratory pile driving is non-pulsed (e.g., continuous) which is not known to cause injury to marine mammals. Mitigation is likely to avoid most potential adverse underwater impacts to marine mammals from impact pile driving. 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, with the return of the bait barges, to haul out on them 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 proposed action 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 proposed 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 Pile Driving 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 pile driving and demolition activities at NBPL. The ZOIs effectively represent the mitigation zone that would be established to prevent Level A harassment to marine mammals.

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

   - During pile driving and removal, the Level A harassment (shutdown) ZOI shall include all areas where the underwater SPLs are anticipated to equal or exceed the Level A (injury) harassment criteria for marine mammals (190 dB rms isopleth for pinnipeds; 180 dB rms isopleth for cetaceans). Buffers will be added to the underwater pinniped and cetacean shutdown ZOIs to reduce the likelihood of a Level A "take" during pile driving

   - During impact pile driving of 30-inch piles, buffers of 75 m (246 ft) and 100 m (328 ft) shall be added to the underwater pinniped and cetacean Level A ZOIs, respectively. This will provide conservative 150 m (492 ft) and 450 m (1,476 ft) shutdown zones, respectively, to reduce the likelihood of injury to marine mammal species due to exposure to noise. If an animal enters the buffered shutdown zones, pile driving would be stopped until the individual(s) has left the zone of its own volition, or not been sighted for 15 min.

   - During vibratory pile driving of 30-inch piles, a buffer of 10 m (33 ft) will be added to the required 10 m (33 ft) Level A ZOI. This will provide a conservative 20 m (66 ft) shutdown zone to reduce the likelihood of injury to marine mammal species due to exposure to noise. If an animal enters the buffered shutdown zones, pile driving would be stopped until the individual(s) has left the zones of its own volition, or not been sighted for 15 min.

   - During fender pile installation and all removal activities, regardless of predicted SPLs, 10 m (33 ft) will be added to the required 10 m (33 ft) Level A ZOI. This will provide a conservative 20 m (66 ft) shutdown zone to reduce the likelihood of injury to marine mammal species due to physical interaction with construction equipment during in-water activities. If an animal enters the buffered shutdown zone, pile driving would be stopped until the individual(s) has left the zone of its own volition, or not been sighted for 15 min

- During pile driving and removal, the underwater Level B ZOI shall include areas where the underwater SPLs are anticipated to equal or exceed the 160 dB rms isopleths for impact pile driving, and the 120 dB rms isopleth for vibratory pile driving. 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 these 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 drive or extract a pile. If a marine mammal is observed entering the Level B ZOI, an exposure would be recorded and behaviors documented. However, that pile segment would be completed without cessation, unless the animal approaches or enters the shutdown zone, at which point pile driving or extraction will be halted.
- As under previous IHAs, the distances to the furthest extents of the Level A/B ZOIs for activities that have not yet been acoustically monitored will initially be based on the distances from the source which were predicted for each threshold level. However, when sufficient data from in-situ acoustic monitoring from the third year of production pile driving 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. <u>Impact Installation</u>: Monitoring will be conducted within the Level A/B harassment ZOIs during impact pile driving before, during, and after pile driving activities. Monitoring will take place from 15 min prior to initiation through 30 min post-completion of pile driving activities.

   <u>Vibratory Installation and Removal</u>: Monitoring will be conducted for a 20 m (66 ft) shutdown zone and within the Level B ZOI before, during, and after pile driving activities. The Level B ZOI would be adjusted based on acoustic monitoring results. Monitoring will take place from 15 min prior to initiation through 30 min post-completion of vibratory installation/removal activities.

   <u>Other In-Water Activities</u>: Monitoring will take place from 15 min prior to initiation until the action is complete through 30 min post-completion of activities.

   b. Monitoring will be conducted by qualified observers. All observers would be trained in marine mammal identification and behaviors, have experience conducting marine mammal monitoring or surveys, and would have no other construction-related tasks while monitoring. Trained observers will be placed at the best vantage point(s) practicable (e.g., from a small boat, the pile driving barge, on shore, or any other suitable location) to monitor for marine mammals and implement shutdown/delay procedures, when applicable, by notifying the hammer operator of a need for a shutdown of construction.

   c. Prior to the start of pile driving activity, the buffered shutdown zones will be monitored for 15 min to ensure that they are clear of marine mammals. Pile driving 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 pile driving operations, pile driving will be halted and delayed until either the animal has voluntarily left and been visually confirmed beyond the shutdown zone or 15 min 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 or Level B harassment will not be initiated. Impact pile driving would be curtailed, but vibratory pile driving or extraction would be allowed to continue if such conditions arise after the activity has begun.

4. Acoustic Measurements – Acoustic measurements will continue during the Year 3 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.
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 and vibratory pile driving. These measures are as follows:

   "Soft start 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 initiate noise from vibratory hammers for 15 seconds at reduced energy followed by a 30-second waiting period. This procedure should be repeated two additional times. If an impact hammer is used, contractors are required 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 – Pile driving (vibratory as well as impact) will only be conducted during daylight hours.

11.1.2 Measures Considered but not Proposed

The use of bubble curtains to reduce underwater sound from impact pile driving was considered but is not proposed because the piles would be installed in relatively deep water and strong tidal currents (up to 3 knots) at the project site would disperse the bubbles and compromise the effectiveness of sound attenuation (CALTRANS 2009). Other considerations were that the potential for Level A exposures and the number and relative intensity of Level B exposures has already been reduced by 1) return of the bait barges to their original locations, because based on the IPP, the presence of the bait barges serves to concentrate sea lions in a location farther from the pile driving activity compared to sites that the animals used after the barges were relocated; and 2) primary reliance on vibratory installation of steel piles – in itself an accepted mitigation measure to reduce the intensity of underwater sound from pile driving (CALTRANS 2009) - except for final testing of load bearing capacity and structural integrity as needed with an impact hammer.

The use of a coffer dam surrounding each pile to absorb sound was also considered. The installation and take-down of the coffer dam around each pile would substantially increase the time required to drive each pile. With the construction schedule already maximizing the amount of work that can be done during daylight hours and outside of the least tern nesting season, this would translate into several additional years of construction. Reasons 1 through 3 above also indicated this measure would not be cost effective.

Silt curtains were considered but rejected as a mitigation measure for turbidity because 1) the sediments of the project site are sandy and will settle out rapidly when disturbed; 2) fines that do remain suspended would be rapidly dispersed by tidal currents; and 3) tidal currents would tend to collapse the silt curtains and make them ineffective.

11.2 Mitigation Effectiveness

It should be recognized that although marine mammals will be protected from Level A harassment by marine mammal observers (MMOs) monitoring the near-field injury zones, mitigation may not be one hundred percent effective at all times in locating marine mammals in the buffer zone. The efficacy of visual detection depends on several factors including the observer's ability to detect the animal, the environmental conditions (visibility and sea state), and monitoring platforms.

All observers utilized for mitigation activities will be experienced biologists with training in marine mammal detection and behavior. Due to their specialized training the Navy expects that visual mitigation will be highly effective. Trained observers have specific knowledge of marine mammal physiology, behavior, and life-history which may improve their ability to detect individuals or help determine if observed animals are exhibiting behavioral reactions to construction activities.

Visual detection conditions in northern San Diego Bay are generally excellent. By its orientation, the bay is sheltered from large swells and infrequently experiences strong winds; winds are less than 17 knots 98% of the time between November and April (San Diego Bay Harbor Safety Committee 2009). Fog is anticipated on 10-20% of the days, typically in late night and early morning hours (San Diego Bay Harbor Safety Committee 2009) and could occasionally limit visibility for marine mammal monitoring. However, observers will be positioned in locations which provide the best vantage point(s) for monitoring, such as on nearby piers or on a small boat, and the shutdown and buffer zones cover relatively small and accessible areas of the bay. As such, proposed mitigation measures are likely to be very effective.

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) in order to reduce impacts to marine mammals to the lowest extent practicable during the period of this third 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 third IHA period. The monitoring plan includes the following components: acoustic measurements and visual observations.

13.1.1 Acoustic Measurements

The Navy will continue to implement in-situ acoustic monitoring efforts to measure SPL from in-water construction activities not previously monitored or validated during the previous IHA. The Navy will record, evaluate, and report acoustic SPLs for impact pile driving of five (5) fender piles of each size (16-, and 30- x 24-inches), as well as for removal activities including hydraulic cutting of (16- and 24-inch) concrete fender piles, torch cutting of 30-inch steel piles, and diamond saw cutting of 66- and 84-inch caisson cutting conducted adjacent to the fuel pier. Acoustic data collected during the previous IHA (2014/2015) was used to determine the extent of the Level A/B ZOIs. The Navy will not collect data on the remaining pile driving of 30-inch steel pipe piles for the northern mooring dolphins, and will use the existing data for 36-inch steel pipe piles to determine the conservative ZOIs for steel pipe piles. Pile driving activities are scheduled to commence at the temporary mooring dolphin location north of the existing fuel pier and then shift to the fender pile installation at the new fuel pier, a then to demolition of the existing fuel pier. If data collected during the removal of the structure and fender piles associated with the existing fuel pier exceed 180 or 190 dB rms at the source, monitoring zones will be re-evaluated and adjusted as needed.

The Navy will conduct continuous acoustic monitoring for pile driving of (5) fender piles of each size (16-, and 30- x 24-inches), as well as for removal activities including hydraulic cutting of (16- and 24-inch) concrete fender piles, torch cutting of 30-inch steel piles, and diamond saw cutting of 66- and 84-inch caisson cutting at the source (10 m [33 feet]) and at Level B ZOI boundaries. The Level B ZOI boundaries will initially be from estimated modeling of previous production or IPP acoustic data measurements, but will be measured in sufficient repetition to validate source levels as well as the 160 and 120 dB rms SPL isopleths.

At a minimum, the methodology includes:

- Airborne sound source measurements will only be taken at 15 m (50 ft) from the source to document that maximum SPLs measured during production pile driving are not exceeded and assure that airborne ZOIs are consistently applied. For the purposes of this monitoring year, the pinniped harassment threshold of 100 dB re 20 µPa rms (unweighted) for sea lions will be conservatively set at 80 m (263 ft) and the 90 dB re 20 µPa rms (unweighted) for harbor seals will be set at 233 m (764 ft). The distances to these thresholds were established based on airborne SPLs from impact pile driving of 36-inch steel pipe piles. Airborne acoustic source measurements will be made for several iterations of each different type of pile installation or removal activity to assure source SPLs are no greater than previously documented during driving of source levels documented during the 2014/2015 production or IPP.

- 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.);
- Ambient conditions, both airborne and underwater, will be measured at the project site in the absence of construction activities to determine background sound levels. Ambient levels are intended to be recorded over a minimum frequency range from 7 Hz to 20 kHz. Ambient conditions will be recorded at least three times during the IHA period consistent with current NOAA guidance. Ambient data will be collected for eight hour periods for three days during typical working hours (0700 to 1800 Monday through Saturday) in the absence of in-water construction activities.
- The chief inspector would supply the acoustics specialist with the substrate composition, hammer model and size, hammer energy settings and any changes to those settings during the piles being monitored, depth of the pile being driven, and blows per foot for the piles monitored.
- Acoustic monitoring will be conducted for pile driving of five (5) fender piles of each size (13-, 16-, and 24-inches), as well as for removal activities including hydraulic cutting of (16- and 24-inch) concrete fender piles, torch cutting of 30-inch steel piles, and diamond saw cutting of 66- and 84-inch caisson cutting at the source (10 m [33 ft]).

For hydroacoustic monitoring:

- For each of the five (5) different types of piles and activities acoustically measured, 100% of the source data will be analyzed and reported as well as representative data collections from the 160 and 120 dB rms isopleths sufficient to document the Level B boundary distances for source SPLs approaching, or above, 180 dB rms.
- For two (2) of each acoustically monitored fender pile, data from the continuous source monitoring location (e.g., ~10m) will be post-processed to obtain the reporting metrics as identified in the Monitoring Plan.
- A stationary hydrophone system with the ability to measure SPLs will be placed in accordance with NMFS most recent guidance for the collection of source levels.
- Hydrophones will be placed using a static line deployed from a pier, dock, or stationary (temporarily moored) vessel. Locations of acoustic recordings will be collected via GPS.

A depth sounder and/or weighted tape measure will be used to determine the depth of the water. The hydrophone will be attached to a weighted nylon cord to maintain a constant depth and distance from the pile. The nylon cord or chain will be attached to a float or tied to a static line.

- Each hydrophone (underwater) and microphone (airborne) will be calibrated at the start of each action and will be checked frequently to the applicable standards of the hydrophone manufacturer.
- For each monitored location, a single hydrophone will be suspended midway in the water column in order to evaluate site specific attenuation and propagation characteristics that may be present throughout the water column.
- For each of the three different fender pile sizes driven and acoustically recorded, underwater SPLs would be continuously measured for the entire duration of pile driving, including soft starts. Sound pressure levels will be monitored in real time.

13.1.2 Visual Marine Mammal Observations

The Navy will collect sighting 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. NMFS requires that the observers have no other construction related tasks while conducting monitoring.

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, docks, and piers at the best vantage point(s) in order to properly see the entire shut down 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 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 in the vicinity 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 approximately 15 minutes, 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 pile segment will be completed without cessation, unless the animal enters or approaches the buffered shutdown zone, at which point all pile driving activities will be halted. If an animal is observed within the shutdown zone during pile driving, then pile driving will be stopped as soon as it is safe to do so. Pile driving 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 15 minutes.
- 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 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 identified in the acoustic monitoring (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" as a result of 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.

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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