FINAL ACOUSTIC AND MARINE SPECIES MONITORING PLAN FOR THE NAVY'S FUEL PIER REPLACEMENT PROJECT AT NAVAL BASE POINT LOMA

Submitted to:

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

Prepared by:

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For:

Naval Base Point Loma

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ACRONYMS

µPa	micropascal
APE	American Piledriving Equipment
dB	decibel(s)
EA	Environmental Assessment
ESA	Endangered Species Act
ft	feet
GPS	Global Positioning System
Hz	hertz
IHA	Incidental Harassment Authorization
IPP	Indicator Pile Program
kHz	kilohertz
LD	Larson Davis
LZeq	z-weighted sound levels
m	meters
MMO	Marine Mammal Observer
NAVFAC	Naval Facilities Engineering Command
NBPL	Naval Base Point Loma
NEPA	National Environmental Policy Act
NIST	National Institute of Standards and Technology
NMAWC	Naval Mine and Antisubmarine Warfare Center
NMFS	National Marine Fisheries Service
R	distance to the receiver
re 1 µPa	referenced to one micropascal
rms	root mean square
RVS	receiving voltage sensitivity
SEL	sound exposure level
SLM	Sound Level Meter
SPAWAR	Space and Naval Warfare
SPL	sound pressure level
SSC	Systems Center
UW	University of Washington
V	volts
VM	Variable Moment
ZOI	zone of influence

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1 INTRODUCTION

1.1 Purpose of the Monitoring Plan

The purpose of this Monitoring Plan is to provide protocols for acoustic and marine species monitoring implemented during pile driving and removal activities associated with the completion of the Indicator Pile Program (IPP), as well as the initial production phase of the Navy's Fuel Pier Replacement Project at Naval Base Point Loma (NBPL), California (Figure 1-1). The previous monitoring plan was modified to integrate adaptive changes to the monitoring methodologies as well as updates to the scheduled construction activities. These revisions are nominally consistent with the methods implemented for the previous (NMFS 2013a) and current (Navy 2014) National Marine Fisheries Service (NMFS) Incidental Harassment Authorization (IHA). The monitoring plan has been designed to avoid conflict with the many military and non-military activities that occur continually in San Diego Bay. Monitoring locations will avoid the federal navigation channel and other primary routes of vessel transit.

The components associated with the activities identified in the second-year IHA Application (Navy 2013a) have been adjusted to account for modifications to equipment used, data collected during the first year IHA, and changes to scheduled construction milestones. Based on modifications to the methodologies used during the monitoring of the pile removal and driving at NMAWC and Fuel Pier Replacement project (IPP), future acoustic monitoring methodologies will be implemented to achieve the following objectives:

1. Monitor Production and IPP in-water construction activities– Implement in-situ acoustic monitoring efforts to continue to measure sound pressure levels (SPL) from in-water construction activities not previously monitored or validated during the previous IHA. Collect and evaluated acoustic sound record levels for 10% of the pile driving activities conducted along the outboard section of the fuel pier sufficient to confirm measured contours associated with the acoustic zones of influence (ZOIs). Acoustic sound recordings will be collected sufficient to document sound source levels for vibratory and chipping removal activities for the first 10% of the proposed piles to be driven along the outboard section the installed outboard piles.
2. Monitor marine mammal and other protected species occurrence and behavior during in-water construction activities to minimize marine species impacts and effectively document marine species occurring within ZOI boundaries
3. Continue the Navy's collection of ambient underwater sound measurements in the absence of project activities to develop a rigorous baseline for the San Diego Bay region.

Marine mammal and other protected species monitoring will be conducted before, during, and after pile driving and extraction activities within the appropriate ZOIs for potential injury and behavioral disturbance thresholds. The proposed monitoring will enumerate the occurrence of species in proximity to the project site and document the number of marine mammal species exposed to underwater and airborne sound levels that would constitute takes under the Marine

Mammal Protection Act (MMPA). Endangered Species Act (ESA) listed species (e.g., California Least terns and green sea turtles) will also be monitored, as appropriate. As statistically robust results from acoustic monitoring become available, marine species monitoring protocols based on modeled ZOIs will be adjusted accordingly, and will be applied in the development of future IHA Applications.

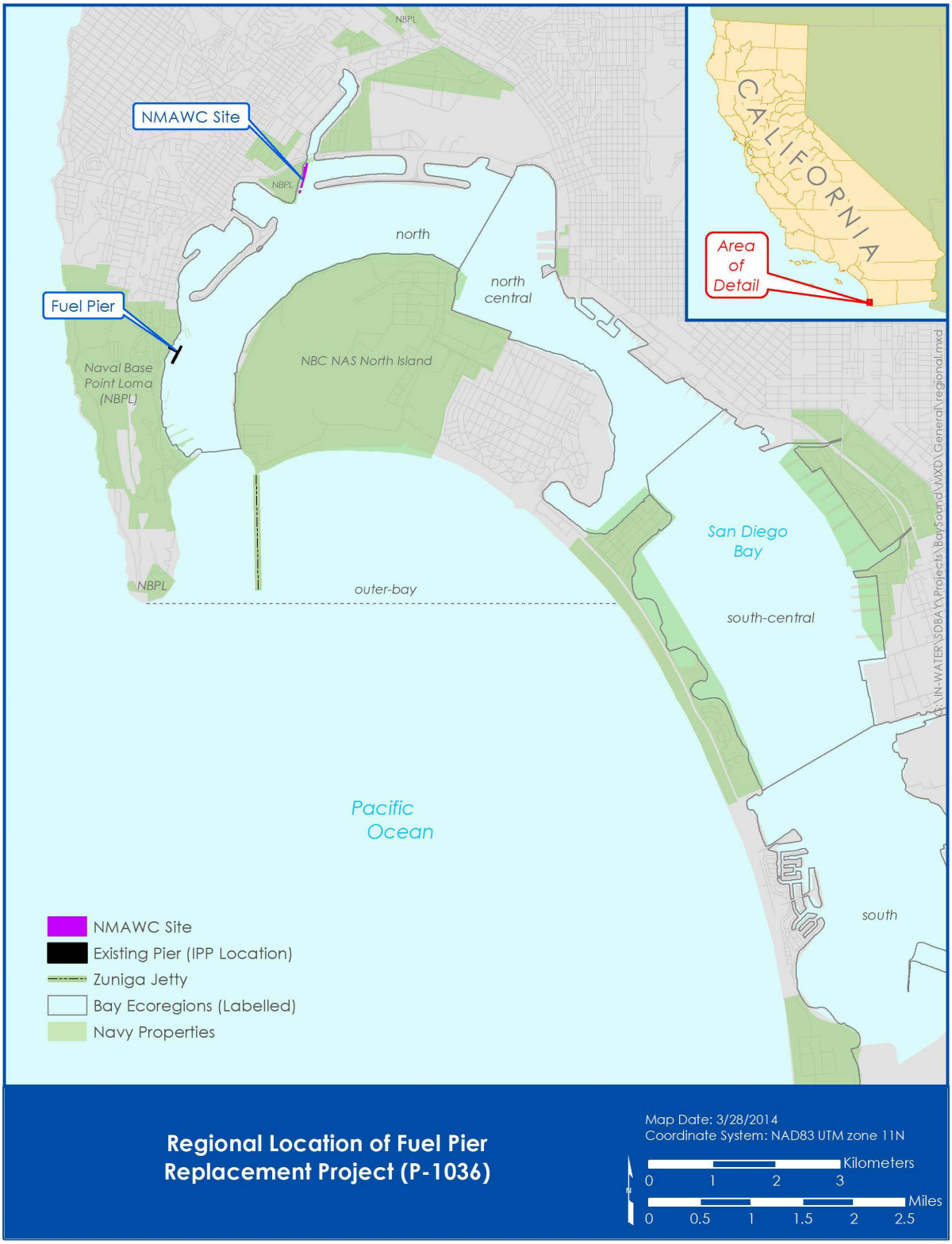

Figure 1-1. Regional Location – Fuel Pier Replacement Project, Naval Base Point Loma.

1.2 Scope and Timing

The scope of the Monitoring Plan includes pile driving and pile extraction activities for the initial production efforts at the Navy's Fuel Pier Replacement Project and the final portions of IPP. The scope of monitoring encompasses acoustics and marine species monitoring developed to comply with environmental monitoring mutually agreed upon as a result of the Navy's National Environmental Policy Act (NEPA) Environmental Assessment (EA) (Navy 2013b) or as a condition of approval by other regulatory agencies.

This Monitoring Plan will be implemented during phased construction scheduled to take place from September 15, 2014 through September 14, 2015. Based on the monitoring methods implemented during this time period, modifications or additions may be made to the Monitoring Plan, in which case those changes would be submitted for review and approval to NMFS as part of the application for the subsequent IHAs.

Apart from this Monitoring Plan, the Navy intends to continue its baseline marine mammal and hydroacoustic surveys of San Diego Bay as described in detail in the IHA Application (Merkel and Assoc, 2008; TDI 2014). This data is collected on a monthly basis and adheres to line-transect methodologies in the northern part of San Diego Bay in order establish baseline marine mammal species data for the Bay. The Navy will continue to share and discuss the results with NMFS.

1.3 Management

The Monitoring Plan will be managed by Naval Facilities Engineering Command (NAVFAC) Southwest. Acoustic and marine species monitoring will be carried out by private contractors supported by local technical staff from NAVFAC Southwest and the Space and Naval Warfare (SPAWAR) Systems Center (SSC) Pacific, and researchers from the University of Washington,. NAVFAC Southwest will also be responsible for preparation of the Monitoring Reports for all IHAs.

2 FUEL PIER REPLACEMENT PROJECT

2.1 Project Description

Refer to the EA (Navy 2013b) and IHA Applications (Navy 2013a, 2014) for a full description of the Fuel Pier Replacement Project.

2.2 Project Area

The project area is in northern San Diego Bay and radiates outwards from the existing fuel pier (P-180) on NBPL (Figure 2-1). These areas will be monitored both acoustically and for the presence/absence of marine species (marine mammals, green sea turtles and California least terns).

Figure 2-1. Fuel Pier Replacement Project Area

2.3 Construction-related Activities

Table 2-1 presents an amended summary of the in-water demolition and construction activities during the time frame covered by the 2014-2015 IHA. Due to design and logistical constraints encountered during the first year of construction and covered by the previous IHA, a greater number of piles are anticipated to be driven for the second IHA than described in the EA. Table 2-1 provides the anticipated number of piles to be driven and removed during the final portions of the IPP and production pile driving based on the submitted pile driving plan provided by the construction contractor and approved by the Navy. Descriptions of pile installation and removal activities are provided in the IHA Applications (Navy 2013a, 2014).

2.4 Activities Monitored During this IHA Period

2.4.1 Pile Installation during Production Pile Driving and Final Portions of IPP

The Navy estimates that the contractor will drive approximately two to four steel piles per day during the production phase of construction. Each steel pile is assumed to require up to two hours of driving. Steel piles would initially use vibratory pile driving; with impact pile driving utilized to complete the installation to the required depth. The installation of batter piles will require extensive use of the vibratory hammer to initially set the piles. Soft start[1] procedures will be employed throughout the IHA period.

Pile installation will utilize a range of equipment, depending on several different factors (e.g., pile size or substrate). An American Pile driving Equipment (APE) Variable Moment 250 (model 250 VM; 2,389 kilo Newton drive force) vibratory driver will be utilized for all vibratory driving. Two impact hammers will be used during impact pile driving: 1) APE D80 (127,000 to 198,450 foot-pound) and 2) APE D62 (76,899 to 153,799 foot-pound), or other equivalent equipment. The variation in power for the pile driving equipment is not expected to substantively influence the SPLs produced during pile installation/removal activities (WSDOT 2005). Other factors such as pile materials and size, subsurface conditions, and propagation parameters at the project site would likely override any influence from the machinery.

[1] Soft-start procedures, in which vibratory and impact driver energy levels are gradually increased, are believed to allow time for fish and wildlife to move away from the pile driving site before the highest noise levels are produced. For the Fuel Pier Replacement Project, there is a deviation from those methods typically requested by the NMFS which utilize one minute period between hammer blows for soft-start. Results from the Test Pile Program and EHW-1 project in Puget Sound indicated a one minute wait period may be too long between hammer blows; Longer breaks between the sounds may be interpreted by the animals as a transient sound and may not serve the intended purpose of providing an indication that louder sounds are about to begin. The Navy consulted with NMFS regarding using a shorter waiting period (i.e. 30 seconds) and NMFS found that the Navy's reasoning was valid and accepted the requested modification. For the Fuel Pier Replacement Project, the soft starts for vibratory hammers require initial starts of 15 seconds at reduced energy followed by a 30-second waiting period. This measure is repeated two additional times. The soft starts for impact hammers require one dry fire followed by a 30-second waiting period. This procedure is repeated two additional times.

Table 2-1. Activity Summary, Pile Driving and Demolition.

Activity/Method	*Location and Timing*	*# Days*	*Pile Type*	*# Piles Installed*	*# Piles Removed*
Temporary mooring dolphin pile driving	NBPL approx. 150 ft southwest of existing fuel pier, Sept 2014	5	30"-dia steel pipe	10	
Indicator Piles	NBPL (outboard piles at fuel pier, Oct 2014)	1	36"-dia steel pipe	2	
Existing Pier Temp Shoring Piles	Existing Fuel Pier at approach and pier intersection	5	18" – dia. steel pipe	4	
Temporary Trestle piles	North of new approach trestle for NBPL pier, Oct 2014	14	24" dia. steel pipe	16	
Abutment pile driving	NBPL new pier shoreline, Dec 2014	10	36"-dia steel pipe	18	
Structural pile driving	NBPL new pier footprint, Oct 2014-Feb 2015	90	36"-dia steel pipe	199	
North Mooring dolphin piles	NBPL approx. 150 ft southwest of existing fuel pier, Feb-Mar 2015	10	30"-dia steel pipe	23	
Totals		**135**		**272**	
Piles dry pulled with barge-mounted crane	NBPL old pier north segment-new pier footprint, Oct-Nov 2014	4[1]	16"- square concrete fender		8
Piles dry pulled with barge-mounted crane	NBPL old pier north segment-new pier footprint, Oct-Nov 2104	4[1]	24"-in square concrete fender		6
Piles cut at mudline	NBPL old pier north segment, Oct-Dec 2014	4[1]	16"- square concrete fender		4[2]
Piles cut at mudline	NBPL old pier north segment, Oct-Dec 2014	4[1]	12" dia timber		91[2]
Extraction with crane or clamshell dredging bucket	NBPL old pier north segment, Oct-Dec 2014	5[1]	7'-0" concrete-filled steel caisson		7[2]
Totals (see Notes)		**21**			**116[2]**

Notes: " = inches; ' = feet; dia = diameter; # = number

[1]Pile and caisson demolition/removal are estimated to require use of vibratory extraction and/or pneumatic chipper, generating underwater sound, on approximately one-fourth (21 days total) of the above-water demolition time (84 days). This is included as a contingency in the event other methods of extraction are unsuccessful. This IHA application covers work from September 15, 2014 through September 14, 2015. The subsequent IHA application would address the resumption of work in September 2015.

[2]The timber piles are within the caissons (13 per caisson). Contractor could cut up to this number of piles at mudline and remove up to this number of caissons.

Amendments to the pile driving plan submitted by the contractor, include plans to drive a total of 272 piles. The specific location of each pile, will be reviewed and approved by the Navy and its consulting engineering firm. The contractor will implement soft start techniques for all vibratory and impact pile driving activities.

Pile driving activities are scheduled to commence at the temporary mooring dolphin location south of the existing fuel pier and then shift to the temporary trestle along the interior portion from the shore outward. Marine species monitoring will be conducted during pile driving and pile removal activities. Acoustic monitoring and sound level recording processing will be conducted for the first 10% of the piles driven along the outside portions of the existing fuel pier.

2.4.2 Monitoring Equipment Used During All Construction-related Activities

The following equipment will be required to conduct acoustic observations and marine species monitoring:

- Survey boats (with elevated observation points) will include: a fixed marine radio for the Captain to communicate on Ch. 16 and other marine channels independent of observers communicating on a dedicated channel, depth finder, measuring tape, navigational plotting equipment, and both fixed and hand-held Global Positioning System (GPS) Units. Vessels will comply with all Coast Guard regulations and be able to pass a Coast Guard safety inspection;
- Sound Level Meters (SLMs) and hydrophones (see below for further detail);
- Hearing protection for acoustic data collectors and boat operators near the source;
- Portable marine radios for the observers to communicate with the monitoring coordinator, construction contractor, and other observers;
- Cellular phones, (one per boat/observing location), and the contact information for the other observers, and monitoring coordinator;
- Flags (one green, one red per boat/observing location) as back-up for radio communication;
- Nautical charts;
- Daily tide tables for the project area within San Diego Bay;
- Watch or Chronometer;
- Binoculars with built-in rangefinder and/or separate range finder – (quality 7 x 50 or better);
- Monitoring plan, IHA permit, and/or other relevant permit requirement specifications in sealed clear plastic cover;
- Tablets with marine species and acoustic databases for data collection;
- Notebook with pre-standardized monitoring Marine Mammal Observation Record forms on non-bleeding paper (e.g., Rite-in-the Rain);

- Marine mammal identification guides on waterproof paper;
- Clipboard; and
- Pen / Pencil.

Sound data acquisition during production pile driving will utilize a combination of equipment used during the IPP (Table 2-2). DSG-Ocean (loggerhead) acoustic data loggers will be the primary equipment used for hydroacoustic measurements throughout production pile driving and ambient data collection. The acoustic monitoring location at the source (10 m [32.8 ft]) and a second representative monitoring location at an intermediate distance between the cetacean and pinniped shutdown zones (at approximately 300 m [984 ft]) will include both DSG-ocean acoustic data logger (Loggerhead) fitted with a single hydrophone (HTI-96-min) as well as a Larson Davis (LD) 831 Class 1 integrated SLMs equipped with Reson TC-4033 spherical hydrophones, as a secondary hydrophone system.

Table 2-2. Acoustic Monitoring Equipment.

Item	Make	Model
Sound Level Meter	Larson Davis	LD 831
Firmware Interval Logging	Larson Davis	LD Log
Firmware 1/3 Octave Analysis	Larson Davis	831-OB3
Firmware GPS Integration	Larson Davis	831-GPS
Microphone	PCB	377B02
Preamplifier for Microphone	PCB	PRM 831
Preamplifier for Hydrophone	PCB	ADP 097
Hydrophone (LD 831)	Reson	TC-4033
Pistonphone, HI Pressure	ETMC Technologies	42AC
DSG-ocean acoustic data logger	Loggerhead	DSG-Ocean
Hydrophone (Loggerhead® DSG-Ocean)	HTI	96-min
Hydro DB Real Time SLM	UW (custom)	
Hydrophone (Hydro DB SLM)	HTI	96-min

Additionally, UW's Applied Physics Laboratory will deploy a Hydro DB real time SLM that allows the acoustician to view near real time rms SPL values. The Hydro DB real time SLM will be used to monitor SPLs at far field locations for both impact and vibratory pile driving events. Raw wav files from the LD 831 and Loggerheads will be compared for consistency. All monitoring systems will deploy hydrophones at middepth at each station. The LD 831 Class 1 integrated SLM will be used to record and observe both in-water real time LZ_{eq} (1sec) SPLs and airborne SPLs. The LD 831 is equipped with data logging firmware capable of recording a variety of metrics including LZF_{max} (rms value), and LZ_{eq} (1sec, SEL value) for each recorded event. The LZF_{max} can only be viewed when raw wav files are not being recorded on the LD 831. LZF_{max} is the rms value over 125 milliseconds and the LZ_{eq} is an SEL value over 1 second. Also, LD 831 SLMs with

detachable LD microphones will be placed on tripods to collect airborne sound levels at source (15 m [50 ft]) and far field locations sufficient to document airborne SPLs.

During the production pile driving and pile removal activities, for the purpose of further verifying acoustic SPLs, two LD 831 SLMs and two Loggerhead Instruments fitted with hydrophones will be used to record acoustic data at source (10 m [32.8 ft]) and intermediate distance between the cetacean and pinniped shutdown zones (at approximately 300 m [984 ft]). Raw data collected by the Hydro DB custom system is concurrently stored to a lap top computer for comparison and post processing analysis. The custom system will provide real time verification of the modeled 180, 160, and 120 dB rms SPL thresholds and observed rms SPL levels compared to post processed raw wav files from both the loggerhead and LD units as well as to internal reporting metrics from the LD 831 SLMs.

For all phases, hydrophones, microphones, and recording systems will be checked daily, or for each deployment to ensure proper operation. All sensors, signal conditioning equipment, and sampling equipment will be calibrated at the start of the monitoring period to National Institute of Standards and Technology (NIST) standards and will be re-checked at the start of each day.

3 ACOUSTIC MONITORING

3.1 Objectives

The primary purpose of acoustic monitoring during production pile driving and the final portions of the IPP is to continually refine the empirically verified modeled injury ("shutdown") and behavioral disturbance ("buffer") zones for marine mammals and wildlife species. These zones are defined by thresholds established by NMFS. Each zone encompasses the area within the underwater or airborne isopleths. The Navy has committed to a shutdown of pile driving when any marine mammal or green sea turtle is present within the defined injury zone. See definitions below:

a. Injury (Shutdown) Zones:
   i. Underwater

      The underwater injury (shutdown) zone includes the area within the 180 dB rms (see footnote[2]) isopleth for cetaceans; and within the 190 dB rms isopleth for pinnipeds and green sea turtles.

   ii. Airborne

      There is no airborne injury threshold for marine mammals; only a behavioral disturbance threshold discussed below.

b. Behavioral Disturbance (Buffer) Zones:
   i. Underwater

      The behavioral disturbance zone includes the area within the 160 dB rms isopleth for marine mammals and green sea turtles during impact pile driving, and the 120 dB rms isopleth for marine mammals during vibratory pile driving; the latter may be adjusted upward based on ambient sound levels that exceed the threshold, subject to concurrence from NMFS.

   ii. Airborne

      The distance to marine mammal disturbance thresholds will be measured. These are currently 90 dB re 20µPa (unweighted) for harbor seals and 100 dB re 20µPa (unweighted) for all other pinnipeds. Shutdowns are not required within the airborne zones.

Empirical acoustic monitoring data will be used to document transmission loss values determined from measurements collected during the IPP and examine site-specific differences in SPL and affected ZOIs on an as needed basis. Acoustic monitoring will implement the use of the loggerhead DSG-Ocean acoustic data logger as the primary data collection device, implementation of a more

[2] For impact pile driving, rms is calculated over the period of the pulse that contains 90% of the acoustical energy (typically the time interval between 5 percent and 95 percent). For vibratory pile driving, rms refers to the SPL of the signal averaged over 10 seconds of continuous operation.

intermittent calibration protocol, and amend reporting metrics to those agreed upon in the IHA, through collaboration between Dr. Peter Dahl of University of Washington and NMFS headquarters.

3.2 Methods

The acoustic component of this monitoring plan was developed by the Navy, taking into consideration the logistical, environmental, and security requirements for working in the project area. During production and the final phase of the IPP, acoustic monitoring (both airborne and hydroacoustic) will be used to document distances to regulatory thresholds determined from measurement collected during the IPP during Year 1 of this project. Any recorded variations in the distances to regulatory thresholds determined from hydroacoustic and airborne measurement collected during production pile driving, or the final phases of the IPP, will be presented to NMFS for concurrence to amend marine species monitoring locations. Approved and adopted changes to threshold distance would be implemented for the remainder of in-water construction activities and for the subsequent development of future IHAs. The methods described below were specifically designed to address these issues.

3.2.1 Acoustic Data Collection

3.2.1.1 Acoustic Monitoring during IPP and Production Pile Driving and Pile Removal.

Hydroacoustic monitoring for vibratory and impact driving of steel piles in areas bayward of the existing fuel pier will occur during the first 10% of all pile driving events in order to document SPL's at the measured distances to the 180 dB and 190 dB re 1µPa (rms) isopleths. In conjunction with measurements of SPLs at the source and shutdown monitoring locations, there will also be intermittent verification of the 120 dB and 160 dB rms thresholds throughout pile driving. Of the 10% of pile driving events acoustically measured, 100% of the data will be analyzed. The Navy will also conduct acoustic monitoring for pile removal activities that utilize equipment and/or methods not previously evaluated.

3.2.1.2 Data Collection

Two hydroacoustic and two airborne monitoring stations will be located at various distances away from the in-water construction activities (Figure 3-1):

- One hydroacoustic and one airborne sound monitoring station at the source (located per NMFS 2012);
- One airborne monitoring station to detect the 90/100 dB rms behavioral threshold for pinnipeds during impact pile driving;
- One hydroacoustic monitoring station positioned to detect the 180/190 dB rms isopleths (injury thresholds for cetaceans/pinnipeds during impact pile driving).
- At varying times throughout the pile driving process, a third hydroacoustic monitoring station would be located at the entrance to San Diego Bay, or inside San Diego Bay to further validate the 160 and 120 dB rms ZOIs as established during the Year 1 IHA time period.

Vessel-based platforms will be utilized in nearly all cases as they allow for acoustic measurements to be collected at multiple locations based on the location of pile driving. The exact locations will vary depending on whether impact or vibratory driving is occurring. The number, locations, and methods of deployment will vary based on the targeted isopleths, measured results, and local knowledge of suitable locations that avoid conflict with Naval or civilian activities.

Impact pile driving is treated as an impulsive sound source, in that it provides definitive peaks in SPL over a given time frame. The deployed SLMs will provide the capability to observe real time estimates of peak, rms, and SEL SPLs, depending on the individual SLM, for each individual pile driving event. Each of the three SLMs independently store raw acoustic data files that will be post processed to develop comparison of the required reporting metrics. The real-time display of rms SPLs observed from the Hydro DB system will be used in the field to adjust monitoring locations and make comparisons to observed SPLs from the SLMs, as well as examine relative differences.

For vibratory pile driving, which is treated as a continuous sound source, source levels measured during the IPP documented that peak SPLs never exceeded 180 dB rms. Additional sound level recordings will be collected for the first 10% of the outside (bayward) piles to confirm previously documented levels.

Airborne sound source measurements will be taken at approximately 15 m (50 ft) from the source. A single mobile airborne monitoring station will also be placed in the nearshore area of NBPL to monitor measured distances, to the threshold sound levels for pinniped harassment by airborne sound, documented during the IPP; these are 100 dB re 20 µPa rms (unweighted) for sea lions (71 m [233 ft]) and 90 dB re 20 µPa rms (unweighted) for harbor seals (233 m [764 ft]). Airborne acoustic measurements will be made for several iterations of each different type of pile installation or removal activity. Locations of the farfield airborne acoustic monitoring station will be positioned, as much as possible, to reduce the potential for acoustic interference.

Hydrophone positions will be adjusted relative to the pile driving location to accommodate the required distance and to continuously record the entire event of each pile being driven. Additional systems will be occasionally deployed from anchored vessels at various locations along the predicted outer limits of the behavioral ZOI for impact pile driving (160 and 120 dB rms), to the northeast near Shelter Island Boat Basin, and to the south near the entrance to San Diego Bay.

Vessels will also serve as marine species monitoring platforms and an observer will be stationed on each vessel during all in-water construction activities. After the completion of the acoustic monitoring period, these vessels will remain on-site for the duration of the project to continue providing support to the marine mammal monitoring effort.

For all recording sessions, SLMs will be used to display an approximate real time output of the sound pressure levels received by the hydrophone. Acousticians in the field would use this display to note the instantaneous values during the event and estimate the instantaneous LZ_{eq} (1sec) SPL. Reporting of actual sound pressure levels and required reporting metrics will be based on

continuously recorded data at source and vessel recordings post-processed to the appropriate frequency range at the end of the recording period.

During all vessel-based recordings the vessel will be anchored and the engine off. Recording will be made for the duration of each individual pile. GPS positions will be logged for each recording position. Prior to the driving of the next pile the vessel may move a distance of approximately 100 to 200 m (328 ft to 656 ft) to another location to examine differences in attenuation rates and effectively bracket the targeted isopleths. Continuous SLM recordings of the piles will occur at the source (10 m [32.8 ft]) stationed hydrophone and at the shutdown locations for the outside (bayward) piles (approximately 300 m [984 ft] from source). Because the shutdown ZOIs for pinnipeds and cetaceans are over 350 m (1,148 ft) from each other, an intermediate monitoring location was chosen to provide the best location for visual monitoring of the ZOIs, as well as providing a location for relevant acoustic data collection.

In summary, acoustic monitoring includes the following components:

- Hydroacoustic monitoring will be conducted for the first 10% of the outside pile driving events. Monitoring will occur at source (10 m [32.8 ft]) and at a location intermediate of the pinniped and cetacean shutdown ZOIs. The resulting data set will be analyzed to examine and confirm sound pressure levels and rates of transmission loss for each separate in water construction activity. With NMFS' concurrence, these metrics will be used to recalculate the limits of injury and disturbance zones, and to make corresponding adjustments in marine mammal monitoring of these zones.
- For underwater recordings, SLM systems will follow methods in accordance with NMFS most recent guidance (NMFS 2012) for the collection of source levels.
- For airborne recordings, to the extent that logistics and security allow, reference recordings will be collected at approximately 15 m (50 ft) from the source via a sound meter with integrated microphone. Other distances may also be utilized to obtain better data if the signal cannot be isolated clearly due to other sound sources (i.e., barges or generators).
- Hydrophones will be placed at the source; at 300 m (984 ft) intermediate between the 180/190 dB rms, and occasionally near the predicted ZOIs for Level B (behavioral) harassment; using a static line deployed from a 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.
- Each hydrophone (underwater) and microphone (airborne) will be calibrated at the start monitoring time frame and for applicable systems be checked at the beginning of each day of monitoring activity.
- For each monitored location, a hydrophone will be deployed at mid-depth in order to evaluate site specific attenuation and propagation characteristics.

- In order to determining the area encompassed by the 190, 180, 160, and 120 dB rms isopleths for marine mammals, hydrophones will collect data at various distances from the source to accurately capture deviations in the pressure levels as well as examine geospatial differences in the spreading loss model caused by physical conditions and bathymetric properties throughout the sound field.
- 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 the frequency range from 7 Hz to 20 kilohertz (kHz). Ambient conditions will be recorded at least three times during the IHA period consistent with current NOAA guidance (NOAA 2012). Ambient data will be collected for eight hour periods for three days during typical working hours (0700 to 1600 Monday through Friday) in the absence of in-water construction activities. Sound levels associated with soft-start techniques will also be measured but will be differentiated from source level measurements.
- Underwater SPLs would be measured at the source and at the shutdown ZOIs for the entire duration of each recoded event. The SPLs will be monitored in real time by observing the LZ_{eq} (1 sec) expressed in dB during each pile driving event. Acoustic data recordings will be post processed to determine maximum RMS SPLs. Sound levels will be measured in Pascals which are easily converted to dB.
- Airborne levels would be recorded as unweighted in dB and the distance to marine mammal behavioral disturbance thresholds would be calculated.
- 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.).
- The monitoring coordinator will 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.
- For acoustically monitored piles, data from the continuous monitoring locations (~10 m and ~300 m [32.8 and 984 ft] from source) will be post-processed to obtain the following sound measures:
    - Maximum peak pressure level recorded for all the strikes associated with each pile, expressed in dB re 1 µPa. This maximum value will originate from the phase of pile driving during which hammer energy was also at maximum (referred to as Level 4.)

From all the strikes associated with each pile occurring during the Level 4 phase these additional measures will be made:

- mean, minimum, and maximum rms pressure level in dB re 1 µPa

- mean duration of a pile strike (based on the 90% energy criterion)
- number of hammer strikes
- mean, minimum, and maximum single strike Sound Exposure Level (SEL) in [dB re μPa^2 sec]
- cumulative SEL as defined by the mean single strike SEL + 10*log (# hammer strikes) in [dB re μPa^2 sec]
- A frequency spectrum (pressure spectral density) in [dB re μPa^2 per Hz] based on the average of up to eight successive strikes with similar sound. Spectral resolution will be 1 Hz and the spectrum will cover nominal range from 7 Hz to 20 kHz.

Finally, the cumulative SEL will be computed from all the strikes associated with each pile occurring during all phases (i.e., soft start, Level 1-to-Level 4). This measure is defined as the sum of all single strike SEL values. The sum is taken of the antilog, with log10 taken of result to express in dB re μPa^2 sec.

3.2.1.3 Acoustic Monitoring Locations

During production pile driving, monitoring locations will generally be based on acoustic data from the IPP. For all acoustic monitoring, variation to vessel locations may occur due to logistical or security constraints, or based on the best professional judgment of the acoustics contractor in order to utilize the best positions to obtain the necessary data. The measured Level A/B (injury/behavioral) thresholds based on data collected during the IPP are presented in Table 3-3**Error! Reference source not found.**. These distances formed the basis for all (acoustic and MMO) observation locations.

Table 3-3. Measured Distances to Injury and Disturbance Thresholds for Sound (Outside piles).

Activity	Measured Distances to Threshold (meters [feet])					
	Underwater				Airborne[1]	
	Level A		Level B		Level B	
	190 dB	180 dB	160 dB	120 dB[2]	100 dB	90 dB
Impact driving, steel piles[3]	75 (246)	450 (1,476)	2,500 (8,202)	n/a	71 (232)	233 (764)
Vibratory driving, steel piles[3,]	10[4] (32.8)	10[4] (32.8)	n/a	3,000 (9,842)		

[1] Distances are based on impact pile driving with steel piles, which is a worst-case scenario.
[2] The ambient sound levels in San Diego Bay are louder than 120 dB.
[3] Based on 36-inch steel piles, and source levels of 174 dB rms for vibratory pile driving, and 200 dB rms for impact pile driving.
[4] Measured values are less than 10 m (32.8 ft). For measured distances of less than 10 m (32.8 ft), the regulatory requirements is a minimum monitoring distance of 10 m (32.8 ft).

Considering the phased approach to the Fuel Pier construction activities, and the range and complexity necessitating monitoring of multiple sound monitoring methodologies will be employed:

- A barge-based hydrophone system will be utilized to collect acoustic data at the source (10 m [32.8 ft]);
- A vessel-based hydrophone system will be utilized to collect data in conjunction with the shutdown MMO at an intermediate distance between the cetacean and pinniped shutdown zones (at approximately 300 m [984 ft]; Figure 3-1); and
- In conjunction with measurements of SPLs at the source and shutdown monitoring locations, there will also be intermittent verification of the 120 dB and 160 dB rms thresholds throughout pile driving. Because the outside MMO (at the mouth of San Diego Bay) will be shore-based, a secondary boat will be used as a data collection platform. Acoustic data collected inside San Diego Bay will likely utilize the same observation platform as the MMOs stationed inside the Bay.

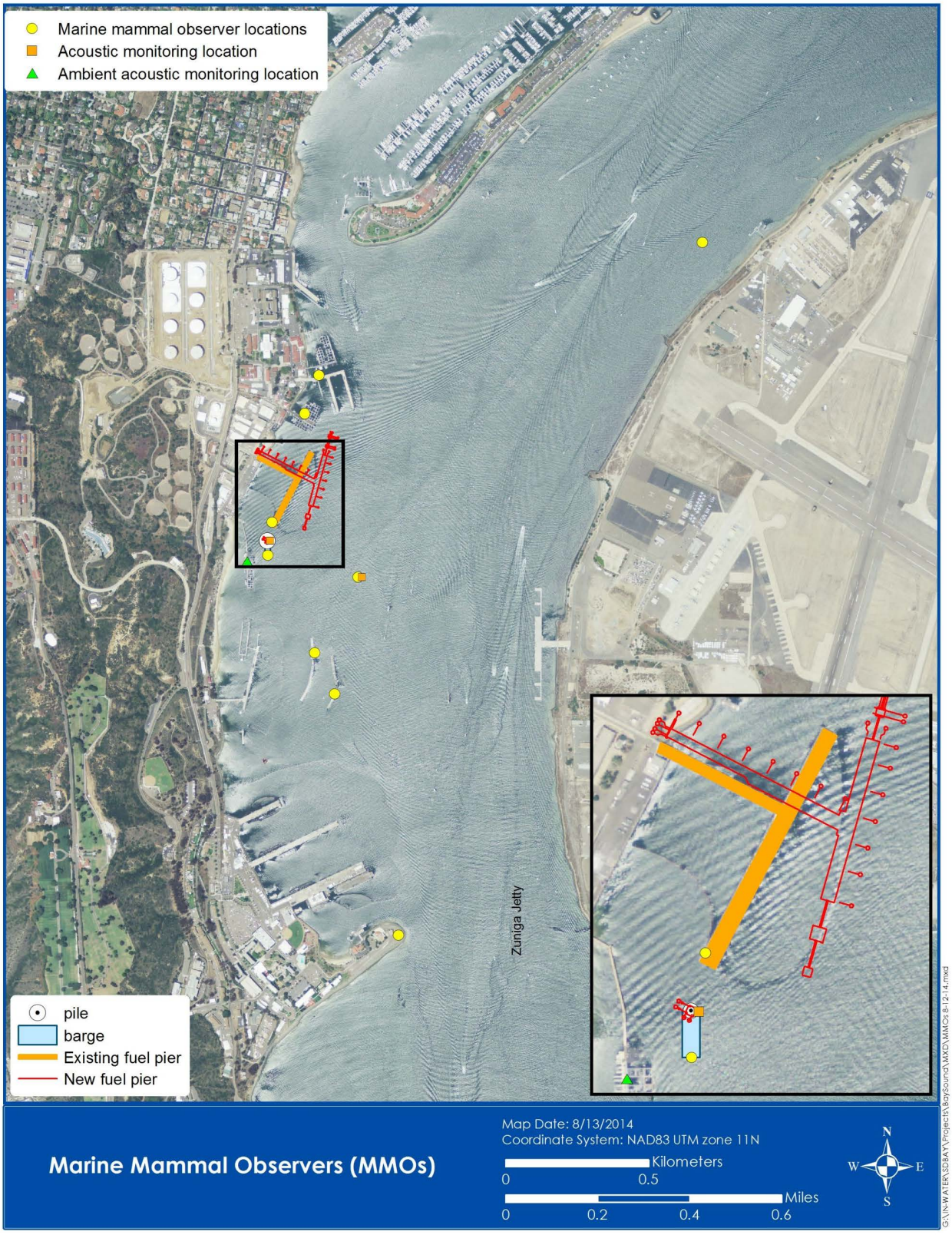

Figure 3-1. Acoustic and Marine Species Monitoring Locations.

4 MARINE SPECIES MONITORING

4.1 Objectives

The objective of marine species monitoring is to monitor for the presence of marine mammals and other protected species in San Diego Bay relative to the injury ("shutdown") and behavioral disturbance ("buffer") zones. In doing so, the intent is to minimize the potential impacts of the project on those species, while still allowing the project to achieve the projected construction milestones.

4.2 Methods

The marine species monitoring component of this monitoring plan was developed by the Navy, taking into consideration the logistical, environmental, and security requirements for working in the project area. During the production pile driving and removal activities, marine mammal monitoring locations will be based on the acoustic thresholds identified in NMFS (2012) and measured during the IPP. ZOI boundaries determined during the IPP will be used to determine marine species monitoring locations for the remainder of the Fuel Pier demolition and construction. Green sea turtle and California least tern monitoring will also occur to address the most-likely ESA-listed species to occur in the project area. The methods described below were specifically designed to address these issues.

4.2.1 Marine Species Data Collection

4.2.1.1 Marine Species Observer Qualifications

Monitoring will be conducted by qualified observers, who will be placed at the best vantage point(s) practicable to monitor for marine species and implement shutdown/delay procedures. Marine Mammal Observers (MMO) will initiate shutdown procedures, when applicable, by calling the monitoring coordinator located on the pile driving barge. All marine species observers will have no other construction-related tasks while conducting monitoring.

Monitoring of in-water construction activities will be conducted by an approved marine species monitor with the following qualifications:

- Visual acuity in both eyes (correction is permissible) sufficient for discernment of moving targets at the water's surface with ability to estimate target size and distance; use of binoculars may be necessary to correctly identify the target;
- Bachelor's degree in biological science, wildlife management, mammalogy, or related field;
- Prior training and experience conducting at-sea marine mammal monitoring and/or surveys, including the identification of marine mammal behavior;
- Sufficient training, orientation, or experience with the construction operation to provide for personal safety during observations; and
- Ability to communicate orally, by radio or in person, with project personnel to provide real-time information on marine mammals observed in the area as necessary.

4.2.1.2 Data Collection

NMFS requires that at a minimum, the following information be collected by MMOs:

- 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 MMOs;
- Other human activity in the area.

The required fields will be incorporated into paper-based and electronic forms that will be used by the MMOs. To the extent practicable, the MMOs will also 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.

Marine species monitoring will take place at the same locations at which acoustic data collection is occurring. Marine species monitors will identify and document any occurrences of marine mammals, green sea turtles, or California least terns. Marine species monitors will be positioned at the boundaries of the applicable ZOIs and an additional observer may be added to monitor the large buffer zone between the injury and disturbance isopleths, if needed.

A dedicated monitoring coordinator will be on-site during all construction days. The monitoring coordinator will oversee the environmental monitoring staff, including all acousticians and MMOs. The monitoring coordinator will serve as the liaison between the environmental monitoring staff and the construction contractor to assist in the distribution of information.

The Navy will monitor the shutdown and buffer zones before, during, and after pile driving and removal. Based on NMFS requirements, the Marine Mammal Monitoring Plan would include the following procedures:

- The MMOs will be located at the best vantage point(s) during in-water construction activities in order to properly see the entirety of the shutdown zones and as much of the disturbance zone as possible. The MMOs will primarily concentrate on monitoring the shutdown zones; however, monitoring of the disturbance zone will continue provided that it will not interfere with the effectiveness at sighting marine mammals in the shutdown zone. Depending on the pile location, the MMOs may be stationed on a pier or docks near in-water construction activities and/or in small vessels. A MMO will always be present on the barge associated with pile driving. The number of marine mammal observers will vary

depending on the size and complexity of the shutdown and disturbance zones determined by the size and type of pile (i.e., concrete and steel) being installed or removed.

- All in-water construction activities will be conducted during daylight hours (between the hours of 0630 and 1630).
- Monitoring will be conducted before, during, and after pile driving/removal activities. Pile driving activities include the time to remove a single pile or series of piles, as long as the time elapsed between uses of the pile driving equipment is no more than 30 minutes.
    - During all observation periods, the MMOs will use binoculars and/or the naked eye to search continuously for marine mammals.
    - Prior to the start of pile driving activity, the shutdown and disturbance zones will be monitored for 15 minutes to ensure that driving will only commence once observers have declared the shutdown zone clear of marine mammals; animals will be allowed to remain in the shutdown zone (i.e., must leave of their own volition) and their behavior will be monitored and documented. The shutdown zone may only be declared clear, and pile driving started, when the entire shutdown zone is visible (i.e., when not obscured by dark, rain, fog, etc.). If the shutdown zones are obscured by fog or poor lighting conditions, pile driving at the location will not be initiated until that zone is visible. Should such conditions arise while pile driving is underway, the activity would be halted.
    - Monitoring will take place for 15 minutes post-completion of pile driving activities.
    - Observers shall record all incidences of marine mammal occurrence and behavioral observations using an approved paper-based or electronic data form.
        - Marine mammal observations shall include the following information:
            - Observer's location;
            - Location of the pile being driven;
            - Species, number of individuals (if more than one), sex, age class (if possible), distance to animal, bearing and direction of travel;
            - If acoustic monitoring is being conducted for that pile, a received SPL may be estimated, or the received level may be estimated on the basis of past or subsequent acoustic monitoring; and
            - Photographs would be taken of any gray whales observed.
        - Behavioral observations may include:
            - Changing durations of surfacing and diving, number of blows (cetaceans) per surfacing, moving direction and/or speed;
            - Reduced/increased vocal activities of pinnipeds;
            - Changing/cessation of certain behavioral activities (e.g., socializing or feeding);
            - Visible startle response or aggressive behavior (e.g., tail/fluke slapping or jaw clapping);
            - Avoidance of areas where sound sources are located;
            - Flight responses (e.g., pinnipeds flushing into water from haul outs); and
            - Increased haul out time and/or changes in vocalizations (pinnipeds)
        - The following additional information should be collected on the data form:

- Date and time that pile driving begins or ends;
- Construction activities occurring during each observation period;
- Weather parameters (e.g., percent cover, visibility);
- Water conditions (e.g., sea state, tide state); and
- Other human activity in the area

- If a marine mammal approaches or enters the shutdown zone during the course of pile driving operations, activity will be halted and delayed until either the animal has voluntarily left and been visually confirmed beyond the shutdown zone or 15 minutes have assessed without re-detection of the animal.
- During non-pile driving, in-water heavy machinery work with the potential to affect marine mammals (e.g., movement of the barge to the pile locations, removal of the pile from the water column/substrate via a crane), operations shall cease and vessels shall reduce speed to the minimum level required to maintain steerage and safe work conditions if marine mammals comes within 10 m (32.8 ft).

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.

4.2.1.3 Marine Species Monitoring during Production Pile Driving and IPP

The acoustic results presented within the monitoring report for the 2013-2014 IHA year (Navy 2014) were used to develop the shutdown zones for pile installation activities associated with the Fuel Pier Replacement Project. The shutdown zone delineates areas in which marine mammals may be exposed to injurious underwater sound levels due to pile driving and extraction. Marine mammal monitoring will also occur for additional areas beyond the shutdown zone, referred to as the buffer zone, where sound pressure levels may cause harassment of marine mammal species.

For all in-water construction and demolition activities, a minimum in-water protective shutdown zone of 10 m (32.8 ft) is proposed.

4.2.1.4 MMO monitoring locations

In order to effectively monitor the shutdown zones, MMOs will be positioned at the best practicable vantage point(s), taking into consideration the behavior of marine mammal species likely to enter the buffer zone, security, safety, and space limitations at the NBPL waterfront. Observers may be stationed in small vessels or on one of the piers or docks at locations that will provide adequate visual coverage for the marine mammal shutdown and buffer zones. Marine species monitors will frequently be co-located with the acoustic monitors (see Figure 3-1).

One MMO will be placed on the active pile driving rig in order to observe the respective shutdown zones for vibratory and impact pile driving. Monitoring would be primarily dedicated to observing the shutdown zone; however, MMOs would record all marine mammal sightings beyond these distances provided it did not interfere with their effectiveness at carrying out the shutdown procedures. Additionally, three to seven land, pier, or vessel-based MMOs will be positioned to

monitor the shutdown zones and the buffer zones (one to the northeast and one to the south at the mouth of San Diego Bay). Because there are different threshold distances for different types of marine mammals (pinniped and cetacean), the observation platform at the shutdown zone will concentrate on the 190 dB rms and 180 dB rms isopleths locations and station the observers and vessels accordingly. The MMOs associated with these platforms will record all visible marine mammal sightings. Confirmed "takes" will be registered once the sightings data has been overlaid with the isopleths identified in Table 3-3**Error! Reference source not found.**, or based on refined acoustic data, if amendments to the ZOIs are needed. The acousticians on board will be noting SPLs in real-time, but, to avoid biasing the observations, will not communicate that information directly to the MMOs. These platforms may move closer to, or farther from, the source depending on whether received SPLs are less than or greater than the regulatory threshold values.

All MMOs will be in radio communication with each other so that the MMOs will know when to anticipate incoming marine mammal species and when they are tracking the same animals observed elsewhere.

5 ACTIVITIES ASSOCIATED WITH SUBSEQUENT IHAs

The Navy will apply for subsequent IHAs to cover in-water construction and demolition activities scheduled for each production year (September 1 to August 31). Construction-related activities, including production pile driving, will start in September 2014. Activities to be monitored under subsequent IHAs will include the removal of the existing pier structure, and the installation of steel structural piles, steel mooring dolphin piles, and concrete and fiberglass-concrete fender piles. Each subsequent IHA Application will update the estimated numbers and types of piles to be installed based on the final pier design and progress made during the previous IHA period(s). Components associated with the Fuel Pier demolition/construction will be evaluated and included as part of each subsequent IHA application.

6 INTERAGENCY NOTIFICATION

The Navy anticipates that the monitoring/shutdown zones may be modified as a result of acoustic data obtained during the monitoring period, and to reflect other conditions related to construction activities and marine mammal species occurrence. In the event that the Navy needs to immediately modify terms of this monitoring plan (e.g., if source levels and measured isopleths differ substantially from modeled results), a NMFS representative will be promptly contacted for discussion of the requested modification.

In addition, if the Navy finds an injured, sick, or dead marine mammal, the Navy will notify NMFS immediately. All of these marine mammal sightings will be called into the NMFS Stranding Coordinator for the Southwest, Sarah Wilkin (562-980-3230), unless the marine mammal's condition is a direct result of the project, in which case additional notification should be made to Ben Laws (NMFS headquarters) (301-427-8425). The Navy will provide NMFS with a data sheet detailing the species or description of the animal(s), the condition of the animal (including carcass condition if the animal is dead), location, the date and time of first discovery, observed behaviors (if alive), and photo or video (if available).

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

7 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 for each pile. 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 3 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 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 during monitoring.
  - 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.

8 REFERENCES

Merkel and Associates, Inc. 2008. Marine Mammals Surveys in the Vicinity of the Point Loma Naval Complex, San Diego, California. Final Report. Prepared for NAVFAC SW. September.

Navy. 2014. Incidental Harassment Authorization Application for the Navy's Fuel Pier Replacement Project at Naval Base Point Loma. Submitted to Office of Protected Resources, National Marine Fisheries Service, National Oceanographic and Atmospheric Administration. Update 1 – June 2014.

Navy. 2013a. Incidental Harassment Authorization Application for the Navy's Fuel Pier Replacement Project at Naval Base Point Loma. Submitted to Office of Protected Resources, National Marine Fisheries Service, National Oceanographic and Atmospheric Administration. Update 1 – December 2012.

_____. 2013b. Final Environmental Assessment, Naval Base Point Loma (NBPL) Fuel Pier Replacement and Dredging (P-151/DESC1306) San Diego, CA. Prepared by NAVFAC, June

_____. 2014. Incidental Harassment Authorization Application for the Navy's Fuel Pier Replacement Project at Naval Base Point Loma. Submitted to Office of Protected Resources, National Marine Fisheries Service, National Oceanographic and Atmospheric Administration. Update 2 – April 2014.

NMFS (National Marine Fisheries Service). 2012. Memorandum from NMFS Northwest Region and Northwest Fisheries Science Center to Interested Parties. Subject: Guidance Document: Data Collection Methods to Characterize Impact and Vibratory Pile Driving Source Levels Relevant to Marine Mammals. 31 January.

Tierra Data, Inc. (TDI). 2014. Marine Mammal Surveys, February-April 2012. Unpublished data. Prepared under contract to NAVFAC SW. WSDOT (Washington State Department of Transportation). 2005. Underwater sound levels associated with restoration of the Friday Harbor Ferry Terminal. Prepared for Washington Department of Transportation. May 2005.