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DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

RIN 0648-XE671

Taking of Marine Mammals Incidental to Specified Activities; Construction of the East Span of the San Francisco-Oakland Bay Bridge

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Notice; issuance of an incidental harassment authorization.

SUMMARY: In accordance with the regulations implementing the Marine Mammal Protection Act (MMPA) as amended, notification is hereby given that we have issued an incidental harassment authorization (IHA) to California Department of Transportation (CALTRANS) to incidentally harass, by Level B harassment only, seven species of marine mammals during activities associated with the East Span of the San Francisco-Oakland Bay Bridge (SFOBB) in the San Francisco Bay (SFB), California.

DATES: This authorization is effective from September 19, 2016 through September 18, 2017.

FOR FURTHER INFORMATION CONTACT: Shane Guan, Office of Protected Resources, NMFS, (301) 427-8401.

SUPPLEMENTARY INFORMATION:

Background

Sections 101(a)(5)(A) and (D) of the MMPA (16 U.S.C. 1361 *et seq*.) direct the Secretary of Commerce to allow, upon request, the incidental, but not intentional, taking of small numbers of marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing) within a specified geographical region if certain findings are made and either regulations are issued or, if the taking is limited to harassment, a notice of a proposed authorization is provided to the public for review.

An authorization for incidental takings shall be granted if NMFS finds that the taking will have a negligible impact on the species or stock(s), will not have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses (where relevant), and if the permissible methods of taking and requirements pertaining to the mitigation, monitoring and reporting of such takings are set forth. NMFS has defined "negligible impact" in 50 CFR 216.103 as "...an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival."

Section 101(a)(5)(D) of the MMPA established an expedited process by which citizens of the U.S. can apply for a one-year authorization to incidentally take small numbers of marine mammals by harassment, provided that there is no potential for serious injury or mortality to result from the activity. Section 101(a)(5)(D) establishes a 45-day time limit for NMFS review of an application followed by a 30-day public notice and comment period on any proposed authorizations for the

incidental harassment of marine mammals. Within 45 days of the close of the comment period, NMFS must either issue or deny the authorization.

Summary of Request

On March 11, 2016, CALTRANS submitted a request to NMFS for the potential harassment of a small number of marine mammals incidental to the dismantling of the East Span of the original SFOBB in SFB, California, between July 16, 2016, and July 15, 2017. On May 16, 2016, CALTRANS submitted a revision of its IHA application based on NMFS comments. NMFS determined that the IHA application was complete on May 19, 2016.

Description of the Specified Activity

CALTRANS proposes removal of the East Span of the original SFOBB by mechanical dismantling and by use of controlled charges to implode the pier into its open cellular chambers below mudline. Activities associated with dismantling the original East Span potentially may result in incidental take of marine mammals. These activities include vibratory pile driving, vibratory pile extraction/removal, impact pile driving, and the use of highly controlled charges to dismantle the Pier E4 and Pier E5 marine foundations.

A one-year IHA was previously issued to CALTRANS for pile driving/removal and mechanical dismantling activities on July 17, 2015 (80 FR 43710; July 23, 2015), based on activities described on CALTRANS' IHA application dated April 13, 2013. This IHA is valid until July 16, 2016. On September 9, 2015, NMFS issued another IHA to CALTRANS for demolition of Pier E3 of the original SFOBB by highly controlled explosives (80 FR 57584; September 24, 2015). This IHA

expired on December 30, 2015. Since the construction activities related with the original SFOBB dismantling will last for another two years, CALTRANS is requesting an IHA that covers take of marine mammals from both pile driving/removal and confined explosion.

Construction activities for the replacement of the SFOBB east span commenced in 2002 and are expected to be completed in 2016 with the completion of the bike/pedestrian path and eastbound on ramp from Yerba Buena Island. The new east span is now open to traffic. On November 10, 2003, NMFS issued the first project-related IHA to CALTRANS, authorizing the take of small numbers of marine mammals incidental to the construction of the SFOBB Project. Over the years, CALTRANS has been issued a total of nine IHAs for the SFOBB Project to date, excluding the application currently under review.

The demolition of Piers E4 and E5 through controlled implosion are planned to occur in October, November, or December 2016, and pile driving and pile removal activities may occur at any time of the year.

The SFOBB project area is located in the central San Francisco Bay (SFB or Bay), between Yerba Buena Island (YBI) and the city of Oakland. The western limit of the project area is the east portal of the YBI tunnel, located in the city of San Francisco. The eastern limit of the project area is located approximately 1,312 ft (400 m) west of the Bay Bridge toll plaza, where the new and former spans connect with land at the Oakland Touchdown in the city of Oakland. Detailed description of CALTRANS East Span Removal Project is provided in the **Federal Register** notice for the proposed IHA (81 FR 48745; July 24, 2016). No changes have been made

since the publication of that notice. A summary of CALTRANS activities is provided below.

1. Vibratory and Impact Driving of Temporary Piles

CALTRANS anticipates temporary access trestles, in-water falsework, and cofferdams may be required to dismantle the existing bridge. Temporary access trestles, supported by temporary marine piles, and cofferdams may be needed to provide construction access. CALTRANS estimates that a maximum of 200 temporary piles may be installed during the 1-year period of IHA coverage. Types of temporary piles to be installed may include sheet piles, 14-in (0.34-m) H-piles, and steel pipe piles, equal to or less than 36-in (0.91-m) in diameter. A maximum of 132 days of pile driving may be required to install and/or remove piles during the one-year period of IHA coverage.

2. Removal of Piers E4 and E5

CALTRANS proposes the removal of Piers E4 and E5 of the original East Span by use of controlled charges to implode each pier into its open cellular chambers below the mudline. A Blast Attenuation System (BAS) will be used to minimize potential impacts on biological resources in the Bay. Both NMFS and CALTRANS believe that the results from the Pier E3 Demonstration Project support the use of controlled charges as a more expedient method of removal that will cause less environmental impact as compared to approved mechanical methods using a dry (fully dewatered) cofferdam.

Piers E4 and E5 of the original East Span are located between the OTD area and YBI, and just south of the SFOBB new East Span. These piers are concrete

cellular structures that occupy areas deep below the mudline, within the water column, and above the water line of the Bay.

Comments and Responses

A notice of NMFS' proposal to issue an IHA was published in the **Federal Register** on July 24, 2016 (81 FR 48745). During the 30-day public comment period, NMFS received a comment letter from the Marine Mammal Commission (Commission). Specific comments and responses are provided below.

Comment 1: The Commission states that the method used to estimate the numbers of takes, which sums fractions of takes for each species across days, does not account for NMFS's 24-hour reset policy. The Commission states that instead of summing fractions of takes across days and then rounding to estimate total takes, NMFS should have calculated a daily take estimate (determined by multiplying the estimated density of marine mammals in the area by the daily ensonified area) and then rounding that to a whole number before multiplying it by the number of days that activities would occur. Thus, the Commission recommends that NMFS (1) follow its policy of a 24-hour reset for enumerating the number of each species that could be taken, (2) apply standard rounding rules before summing the numbers of estimated takes across days, and (3) for species that have the potential to be taken but model-estimated or calculated takes round to zero, use group size to inform the take estimates—these methods should be used consistently for all future incidental take authorizations.

Response: While for certain projects NMFS has rounded to the whole number for daily takes, the circumstance for projects like this one when the objective

of take estimation is to provide more accurate assessments for potential impacts to marine mammals for the entire project, the rounding in the middle of calculation will introduce large errors into the process. In addition, while NMFS uses a 24-hour reset for its take calculation to ensure that individual animals are not counted as a take more than once per day, that fact does not make the calculation of take across the entire activity period inherently incorrect. There is no need for daily (24-hour) rounding in this case because there is no daily limit of takes, so long as total authorized takes of marine mammal are not exceeded. In short, the calculation of predicted take is not an exact science and there are arguments for taking different mathematical approaches in different situations, and for making qualitative adjustments in other situations. NMFS is currently engaged in developing a protocol to guide more consistent take calculation given certain circumstances. We believe, however, that the prediction for this action remains appropriate.

Comment 2: The Commission notes that in the proposed IHA NMFS would require protected species observers (PSOs) to implement 100 percent monitoring for Level A harassment zones of all pile driving, but only 20 percent monitoring for Level B harassment zones for vibratory pile driving and removal. The Commission recommends that NMFS require CALTRANS to implement full-time monitoring of Level A and B harassment zones during all pile driving and pile removal activities.

Response: NMFS agrees with the Commission's recommendation, and discussed it with CALTRANS. CALTRANS agrees that 100 percent monitoring is feasible and will conduct visual monitoring for all pile driving and pile removal activities. The IHA issued to CALTRANS includes such measures.

Description of Marine Mammals in the Area of the Specified Activity

Seven species of marine mammals regularly inhabit or rarely or seasonally enter the San Francisco Bay (Table 1). The two most common species observed are the Pacific harbor seal (*Phoca vitulina richardii*) and the California sea lion (*Zalophus californianus*). Juvenile northern elephant seals (*Mirounga angustirostris*) seasonally enter the Bay (spring and fall), while harbor porpoises (*Phocoena phocoena*) may enter the western side of the Bay throughout the year, but rarely occur near the SFOBB east span. Gray whales (*Eschrichtius robustus*) may enter the Bay during their northward migration in the late winter and spring. In addition, though rare, northern fur seals (*Callorhinus ursinus*) and bottlenose dolphins (*Tursiops truncatus*) have also been sighted in the Bay. None of these species are listed as endangered or threatened under the Endangered Species Act (ESA), or as depleted or a strategic stock under the MMPA.

Table 1. Marine Mammal Species Potentially Present in Region of Activity

Common Name	Scientific Name	Status	Occurrence	Seasonality	Range	Abundance
Harbor seal	*Phoca vitulina richardii*	-	Common	Year round	California	30,968
California sea lion	*Zalophus californianus*	-	Common	Year round	California	296,750
Northern fur seal	*Callorhinus ursinus*	-	Rare	Year round	California	12,844
Northern elephant seal	*Mirounga angustirostris*	-	Occasional	Spring & fall	California	179,000
Gray whale	*Eschrichtius robustus*	-*	Rare	Spring & fall	Mexico to the U.S. Arctic Ocean	20,990

Harbor porpoise	*Phocoena phocoena*	-	Rare	Year round	California	9,886
Coastal Bottlenose dolphin	*Tursiops truncatus*	-	Rare	Year round	California	323

* The E. North Pacific population is not listed under the ESA.

More detailed information on the marine mammal species found in the vicinity of the SFOBB construction site can be found in CALTRANS IHA application, and in NMFS stock assessment report (Caretta *et al.,* 2015), which is available at the following URL: *http://www.nmfs.noaa.gov/pr/sars/pdf/pacific_sars_2014_final_noaa_swfsc_tm_549.pdf*. Refer to these documents for additional information on these species.

Potential Effects of the Specified Activity on Marine Mammals

This section includes a summary and discussion of the ways that the types of stressors associated with the specified activity (*e.g.*, pile removal and pile driving) have been observed to impact marine mammals. This discussion may also include reactions that we consider to rise to the level of a take and those that we do not consider to rise to the level of a take (for example, with acoustics, we may include a discussion of studies that showed animals not reacting at all to sound or exhibiting barely measurable avoidance). This section is intended as a background of potential effects and does not consider either the specific manner in which this activity will be carried out or the mitigation that will be implemented, and how either of those will shape the anticipated impacts from this specific activity. The "Estimated Take by Incidental Harassment" section later in this document will include a quantitative analysis of the number of individuals that are expected to be taken by this activity. The "Analysis and Determinations" section will include the analysis of how this

specific activity will impact marine mammals and will consider the content of this section, the "Estimated Take by Incidental Harassment" section, the "Mitigation" section, and the "Anticipated Effects on Marine Mammal Habitat" section to draw conclusions regarding the likely impacts of this activity on the reproductive success or survivorship of individuals and from that on the affected marine mammal populations or stocks.

When considering the influence of various kinds of sound on the marine environment, it is necessary to understand that different kinds of marine life are sensitive to different frequencies of sound. Based on available behavioral data, audiograms have been derived using auditory evoked potentials, anatomical modeling, and other data, NMFS (2016) designate "marine mammal hearing groups" for marine mammals and estimate the lower and upper frequencies of hearing of the groups. The marine mammal groups and the associated frequencies are indicated below (though animals are less sensitive to sounds at the outer edge of their functional range and most sensitive to sounds of frequencies within a smaller range somewhere in the middle of their hearing range):

- Low frequency cetaceans (13 species of mysticetes): functional hearing is estimated to occur between approximately 7 hertz (Hz) and 35 kilohertz (kHz);
- Mid-frequency cetaceans (32 species of dolphins, seven species of larger toothed whales, and 19 species of beaked and bottlenose whales): functional hearing is estimated to occur between approximately 150 Hz and 160 kHz;

- High frequency cetaceans (eight species of true porpoises, seven species of river dolphins, Kogia, the franciscana, and four species of cephalorhynchids): functional hearing is estimated to occur between approximately 275 Hz and 160 kHz;
- Phocid pinnipeds in Water: functional hearing is estimated to occur between approximately 50 Hz and 86 kHz; and
- Otariid pinnipeds in Water: functional hearing is estimated to occur between approximately 60 Hz and 39 kHz.

As mentioned previously in this document, seven marine mammal species (three cetacean and four pinniped species) are likely to occur in the vicinity of the SFOBB pile driving/removal and controlled pier detonation area. Of the two cetacean species, one belongs to low-frequency cetacean (gray whale), one mid-frequency cetacean (bottlenose dolphin), and one high-frequency cetacean (harbor porpoise). two species of pinniped are phocid (Pacific harbor seal and northern elephant seal), and two species of pinniped is otariid (California sea lion and northern fur seal). A species' functional hearing group is a consideration when we analyze the effects of exposure to sound on marine mammals.

Potential Effects from In-water Pile Driving and Pile Removal

The CALTRANS SFOBB construction work using in-water pile driving and pile removal could adversely affect marine mammal species and stocks by exposing them to elevated noise levels in the vicinity of the activity area.

Exposure to high intensity sound for a sufficient duration may result in auditory effects such as a noise-induced threshold shift—an increase in the auditory

threshold after exposure to noise (Finneran *et al.*, 2005). Factors that influence the amount of threshold shift include the amplitude, duration, frequency content, temporal pattern, and energy distribution of noise exposure. The magnitude of hearing threshold shift normally decreases over time following cessation of the noise exposure. The amount of threshold shift just after exposure is the initial threshold shift. If the threshold shift eventually returns to zero (*i.e.*, the threshold returns to the pre-exposure value), it is a temporary threshold shift (Southall *et al.*, 2007).

Threshold Shift (noise-induced loss of hearing) – When animals exhibit reduced hearing sensitivity (*i.e.*, sounds must be louder for an animal to detect them) following exposure to an intense sound or sound for long duration, it is referred to as a noise-induced threshold shift (TS). An animal can experience temporary threshold shift (TTS) or permanent threshold shift (PTS). TTS can last from minutes or hours to days (*i.e.*, there is complete recovery), can occur in specific frequency ranges (*i.e.*, an animal might only have a temporary loss of hearing sensitivity between the frequencies of 1 and 10 kHz), and can be of varying amounts (for example, an animal's hearing sensitivity might be reduced initially by only 6 decibel (dB) or reduced by 30 dB). PTS is permanent, but some recovery is possible. PTS can also occur in a specific frequency range and amount as mentioned above for TTS.

For marine mammals, published data are limited to the captive bottlenose dolphin, beluga, harbor porpoise, and Yangtze finless porpoise (Finneran *et al.*, 2000, 2002, 2003, 2005, 2007, 2010a, 2010b; Finneran and Schlundt, 2010; Lucke *et al.*, 2009; Mooney *et al.*, 2009a, 2009b; Popov *et al.*, 2011a, 2011b; Kastelein *et al.*, 2012a; Schlundt *et al.*, 2000; Nachtigall *et al.*, 2003, 2004). For pinnipeds in water,

data are limited to measurements of TTS in harbor seals, an elephant seal, and California sea lions (Kastak *et al*., 1999, 2005; Kastelein *et al*., 2012b).

Lucke *et al*. (2009) found a threshold shift (TS) of a harbor porpoise after exposing it to airgun noise with a received sound pressure level (SPL) at 200.2 dB (peak–to-peak) re: 1 micropascal (μPa), which corresponds to a sound exposure level of 164.5 dB re: 1 μPa^2 s after integrating exposure. NMFS currently uses the root-mean-square (rms) of received SPL at 180 dB and 190 dB re: 1 μPa as the threshold above which permanent threshold shift (PTS) could occur for cetaceans and pinnipeds, respectively. Because the airgun noise is a broadband impulse, one cannot directly determine the equivalent of rms SPL from the reported peak-to-peak SPLs. However, applying a conservative conversion factor of 16 dB for broadband signals from seismic surveys (McCauley, *et al*., 2000) to correct for the difference between peak-to-peak levels reported in Lucke *et al*. (2009) and rms SPLs, the rms SPL for TTS would be approximately 184 dB re: 1 μPa, and the received levels associated with PTS (Level A harassment) would be higher. This is still above NMFS' current 180 dB rms re: 1 μPa threshold for injury. However, NMFS recognizes that TTS of harbor porpoises is lower than other cetacean species empirically tested (Finneran & Schlundt, 2010; Finneran *et al*., 2002; Kastelein and Jennings, 2012).

Marine mammal hearing plays a critical role in communication with conspecifics, and interpretation of environmental cues for purposes such as predator avoidance and prey capture. Depending on the degree (elevation of threshold in dB), duration (*i.e.*, recovery time), and frequency range of TTS, and the context in which it is experienced, TTS can have effects on marine mammals ranging from discountable

to serious (similar to those discussed in auditory masking, below). For example, a marine mammal may be able to readily compensate for a brief, relatively small amount of TTS in a non-critical frequency range that occurs during a time where ambient noise is lower and there are not as many competing sounds present. Alternatively, a larger amount and longer duration of TTS sustained during time when communication is critical for successful mother/calf interactions could have more serious impacts. Also, depending on the degree and frequency range, the effects of PTS on an animal could range in severity, although it is considered generally more serious because it is a permanent condition. Of note, reduced hearing sensitivity as a simple function of aging has been observed in marine mammals, as well as humans and other taxa (Southall *et al*., 2007), so one can infer that strategies exist for coping with this condition to some degree, though likely not without cost.

In addition, chronic exposure to excessive, though not high-intensity, noise could cause masking at particular frequencies for marine mammals that utilize sound for vital biological functions (Clark *et al.,* 2009). Acoustic masking is when other noises such as from human sources interfere with animal detection of acoustic signals such as communication calls, echolocation sounds, and environmental sounds important to marine mammals. Therefore, under certain circumstances, marine mammals whose acoustical sensors or environment are being severely masked could also be impaired from maximizing their performance fitness in survival and reproduction.

Masking occurs at the frequency band that the animals utilize. Therefore, since noise generated from vessels dynamic positioning activity is mostly

concentrated at low frequency ranges, it may have less effect on high frequency echolocation sounds by odontocetes (toothed whales). However, lower frequency man-made noises are more likely to affect detection of communication calls and other potentially important natural sounds such as surf and prey noise. It may also affect communication signals when they occur near the noise band and thus reduce the communication space of animals (*e.g.*, Clark *et al.*, 2009) and cause increased stress levels (*e.g.*, Foote *et al.*, 2004; Holt *et al.*, 2009).

Unlike TS, masking, which can occur over large temporal and spatial scales, can potentially affect the species at population, community, or even ecosystem levels, as well as individual levels. Masking affects both senders and receivers of the signals and could have long-term chronic effects on marine mammal species and populations. Recent science suggests that low frequency ambient sound levels have increased by as much as 20 dB (more than three times in terms of sound pressure level) in the world's ocean from pre-industrial periods, and most of these increases are from distant shipping (Hildebrand 2009). For CALTRANS' SFOBB construction activities, noises from vibratory pile driving contribute to the elevated ambient noise levels in the project area, thus increasing potential for or severity of masking. Baseline ambient noise levels in the Bay are very high due to ongoing shipping, construction and other activities in the Bay.

Finally, marine mammals' exposure to certain sounds could lead to behavioral disturbance (Richardson *et al.*, 1995), such as: changing durations of surfacing and dives, number of blows per surfacing, or moving direction and/or speed; reduced/increased vocal activities; changing/cessation of certain behavioral activities

(such as socializing or feeding); visible startle response or aggressive behavior (such as tail/fluke slapping or jaw clapping); avoidance of areas where noise sources are located; and/or flight responses (*e.g.*, pinnipeds flushing into water from haulouts or rookeries).

The onset of behavioral disturbance from anthropogenic noise depends on both external factors (characteristics of noise sources and their paths) and the receiving animals (hearing, motivation, experience, demography) and is also difficult to predict (Southall *et al.*, 2007). Currently NMFS uses a received level of 160 dB re 1 μPa (rms) to predict the onset of behavioral harassment from impulse noises (such as impact pile driving), and 120 dB re 1 μPa (rms) for continuous noises (such as vibratory pile driving). For the CALTRANS SFOBB construction activities, both of these noise levels are considered for effects analysis because CALTRANS plans to use both impact and vibratory pile driving, as well as vibratory pile removal.

The biological significance of many of these behavioral disturbances is difficult to predict, especially if the detected disturbances appear minor. However, the consequences of behavioral modification could be biologically significant if the change affects growth, survival, and/or reproduction, which depends on the severity, duration, and context of the effects.

Potential Effects from Controlled Pier Implosion

It is expected that an intense impulse from the Piers E4 and E5 controlled implosion would have the potential to impact marine mammals in the vicinity. The majority of impacts would be startle behavior and temporary behavioral modification

from marine mammals. However, a few individual animals could be exposed to sound levels that would cause TTS.

The underwater explosion would send a shock wave and blast noise through the water, release gaseous by-products, create an oscillating bubble, and cause a plume of water to shoot up from the water surface. The shock wave and blast noise are of most concern to marine animals. The effects of an underwater explosion on a marine mammal depends on many factors, including the size, type, and depth of both the animal and the explosive charge; the depth of the water column; and the standoff distance between the charge and the animal, as well as the sound propagation properties of the environment. Potential impacts can range from brief 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; DoN, 2001). Non-lethal injury includes slight injury to internal organs and the auditory system; however, delayed lethality can be a result of individual or cumulative sublethal injuries (DoN, 2001). Immediate lethal injury would be a result of massive combined trauma to internal organs as a direct result of proximity to the point of detonation (DoN, 2001). Generally, the higher the level of impulse and pressure level exposure, the more severe the impact to an individual.

Injuries resulting from a shock wave take place at boundaries between tissues of different density. Different velocities are imparted to tissues of different densities, and this can lead to their physical disruption. Blast effects are greatest at the gas-liquid interface (Landsberg 2000). Gas-containing organs, particularly the lungs and gastrointestinal tract, are especially susceptible (Goertner 1982; Hill 1978; Yelverton

et al., 1973). In addition, gas-containing organs including the nasal sacs, larynx, pharynx, trachea, and lungs may be damaged by compression/expansion caused by the oscillations of the blast gas bubble. Intestinal walls can bruise or rupture, with subsequent hemorrhage and escape of gut contents into the body cavity. Less severe gastrointestinal tract injuries include contusions, petechiae (small red or purple spots caused by bleeding in the skin), and slight hemorrhaging (Yelverton *et al.*, 1973).

Because the ears are the most sensitive to pressure, they are the organs most sensitive to injury (Ketten 2000). Sound-related damage associated with blast noise can be theoretically distinct from injury from the shock wave, particularly farther from the explosion. If an animal is able to hear a noise, at some level it can damage its hearing by causing decreased sensitivity (Ketten 1995). Sound-related trauma can be lethal or sublethal. Lethal impacts are those that result in immediate death or serious debilitation in or near an intense source and are not, technically, pure acoustic trauma (Ketten 1995). Sublethal impacts include hearing loss, which is caused by exposures to perceptible sounds. Severe damage (from the shock wave) to the ears includes tympanic membrane rupture, fracture of the ossicles, damage to the cochlea, hemorrhage, and cerebrospinal fluid leakage into the middle ear. Moderate injury implies partial hearing loss due to tympanic membrane rupture and blood in the middle ear. Permanent hearing loss also can occur when the hair cells are damaged by one very loud event, as well as by prolonged exposure to a loud noise or chronic exposure to noise. The level of impact from blasts depends on both an animal's location and, at outer zones, on its sensitivity to the residual noise (Ketten 1995).

However, the above discussion concerning underwater explosion only pertains to open water detonation in a free field. CALTRANS' Pier E4 and E5 demolition project using controlled implosion uses a confined detonation method, meaning that the charges would be placed within the structure. Therefore, most energy from the explosive shock wave would be absorbed through the destruction of the structure itself, and would not propagate through the open water. Measurements and modeling from confined underwater detonation for structure removal showed that energy from shock waves and noise impulses were greatly reduced in the water column (Hempen *et al.,* 2007; CALTRANS 2016). Therefore, with monitoring and mitigation measures discussed above, CALTRANS Pier E4 and E5 controlled implosions are not likely to cause injury or mortality to marine mammals in the project vicinity. Instead, NMFS believes that CALTRANS' Pier E4 and E5 controlled implosions in the San Francisco Bay are most like to cause Level B behavioral harassment and maybe TTS in a few individual of marine mammals, as discussed below.

Changes in marine mammal behavior are expected to result from an acute stress response. This expectation is based on the idea that some sort of physiological trigger must exist to change any behavior that is already being performed. The exception to this rule is the case of auditory masking, which is not likely since the CALTRANS' controlled implosion is only two short, sequential detonations that last for approximately 3-4 seconds.

Potential Effects on Marine Mammal Habitat

The removal of the SFOBB East Span is not likely to negatively affect the habitat of marine mammal populations because no permanent loss of habitat will

occur, and only a minor, temporary modification of habitat will occur. The original SFOBB area is not used as a haul-out site by pinnipeds or as a major foraging area. Therefore, demolition of the concrete marine foundations and pile installation and removal activities are unlikely to permanently decrease fish populations in the area and are unlikely to affect marine mammal populations.

Project activities will not affect any pinniped haul-out sites or pupping sites. The YBI harbor seal haul-out site is on the opposite site of the island from the SFOBB Project area. Because of the distance and the island blocking the sound, underwater noise and pressure levels from the SFOBB Project will not reach the haul-out. Other haul-out sites for sea lions and harbor seals are at a sufficient distance from the SFOBB Project area that they will not be affected. The closest recognized harbor seal pupping site is at Castro Rocks, approximately 8.7 mi (14 km) from the SFOBB Project area. No sea lion rookeries are found in the Bay.

The addition of underwater sound from SFOBB Project activities to background noise levels can constitute a potential cumulative impact on marine mammals. However, these potential cumulative noise impacts will be short in duration.

SPLs from impact pile driving and pier implosion have the potential to injure or kill fish in the immediate area. During previous pier implosion and pile driving activities, CALTRANS has reported mortality to marine mammals' prey species, including northern anchovies and Pacific herring (CALTRANS 2016). These few isolated fish mortality events are not anticipated to have a substantial effect on prey species population or their availability as a food resource for marine mammals.

Studies also suggest that larger fish are generally less susceptible to death or injury than small fish. Moreover, elongated forms that are round in cross section are less at risk than deep-bodied forms. Orientation of fish relative to the shock wave may also affect the extent of injury. Open water pelagic fish (*e.g.*, mackerel) seem to be less affected than reef fishes. The results of most studies are dependent upon specific biological, environmental, explosive, and data recording factors.

The huge variation in fish populations, including numbers, species, sizes, and orientation and range from the detonation point, makes it very difficult to accurately predict mortalities at any specific site of detonation. Most fish species experience a large number of natural mortalities, especially during early life-stages, and any small level of mortality caused by the CALTRANS' two controlled implosions will likely be insignificant to the population as a whole.

Mitigation Measures

In order to issue an incidental take authorization under section 101(a)(5)(D) of the MMPA, NMFS must set forth the permissible methods of taking pursuant to such activity, and other means of effecting the least practicable adverse impact on such species or stock and its habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance, and on the availability of such species or stock for taking for certain subsistence uses.

1. Mitigation Measures for In-water Pile Driving and Pile Removal

For the CALTRANS SFOBB construction activities, NMFS requires the following mitigation measures to minimize the potential impacts to marine mammals in the project vicinity. The primary purpose of these mitigation measures is to detect

marine mammals within or about to enter designated exclusion zones corresponding to NMFS current injury thresholds and to initiate immediate shutdown or power down of the piling hammer, making it very unlikely potential injury or TTS to marine mammals would occur, and to reduce the intensity of Level B behavioral harassment.

Use of Noise Attenuation Devices

To reduce impact on marine mammals, CALTRANS shall use a marine pile driving energy attenuator (*i.e.*, air bubble curtain system), or other equally effective sound attenuation method (*e.g.*, dewatered cofferdam) for all impact pile driving, with the exception of pile proofing and H-piles.

Establishment of Exclusion and Level B Harassment Zones

Before the commencement of in-water construction activities, which include impact pile driving and vibratory pile driving, CALTRANS shall establish "exclusion zones" where received underwater SPLs are higher than 180 dB (rms) and 190 dB (rms) re 1 µPa for cetaceans and pinnipeds, respectively, and "Level B behavioral harassment zones" where received underwater sound pressure levels (SPLs) are higher than 160 dB (rms) and 120 dB (rms) re 1 µPa for impulse noise sources (impact pile driving) and non-impulses noise sources (vibratory pile driving), respectively. Before the sizes of actual zones are determined based on hydroacoustic measurements, CALTRANS shall establish these zones based on prior measurements conducted during SFOBB constructions, as described in Table 2 of this document.

Table 2. Temporary Exclusion and Level B Harassment Zones for Various Pile Driving Activities

Pile Driving / Dismantling Activities	Pile Size (m)	Distance to 120 dB re 1 µPa (rms) (m)	Distance to 160 dB re 1 µPa (rms) (m)	Distance to 180 dB re 1 µPa (rms) (m)	Distance to 190 dB re 1 µPa (rms) (m)

Vibratory Driving	24	2,000	NA	NA	NA
	36	2,000	NA	NA	NA
	Sheet pile	2,000	NA	NA	NA
Attenuated Impact Driving	24	NA	1,000	235	95
	36	NA	1,000	235	95
Unattenuated Proofing	24	NA	1,000	235	95
	36	NA	1,000	235	95
Unattenuated Impact Driving	H-pile	NA	1,000	235	95

Once the underwater acoustic measurements are conducted during initial test pile driving, CALTRANS shall adjust the size of the exclusion zones and Level B behavioral harassment zones, and monitor these zones accordingly.

NMFS-approved protected species observers (PSO) shall conduct initial survey of the exclusion zones to ensure that no marine mammals are seen within the zones before impact pile driving of a pile segment begins. If marine mammals are found within the exclusion zone, impact pile driving of the segment would be delayed until they move out of the area. If a marine mammal is seen above water and then dives below, the contractor would wait 15 minutes for pinnipeds and small cetaceans (harbor porpoises and bottlenose dolphins), and 30 minutes for gray whales. If no marine mammals are seen by the observer in that time it can be assumed that the animal has moved beyond the exclusion zone.

If pile driving of a segment ceases for 30 minutes or more and a marine mammal is sighted within the designated exclusion zone prior to commencement of pile driving, the observer(s) must notify the Resident Engineer (or other authorized individual) immediately and continue to monitor the exclusion zone. Operations may not resume until the marine mammal has exited the exclusion zone.

Soft Start

In order to provide additional protection to marine mammals near the project area by allowing marine mammals to vacate the area prior to receiving a higher noise exposure, CALTRANS and its contractor will also "soft start" the hammer prior to operating at full capacity. This should expose fewer animals to loud sounds both underwater and above water. This would also ensure that, although not expected, any pinnipeds and cetaceans that are missed during the initial exclusion zone monitoring will not be injured.

Shut-down Measure

CALTRANS shall implement shutdown measures if a marine mammal is sighted approaching the Level A exclusion zone, or within 10 m of the pile driving and pile removal equipment, whichever is smaller. In-water construction activities shall be suspended until the marine mammal is sighted moving away from the exclusion zone, or if a pinniped, harbor porpoise, or bottlenose dolphin is not sighted for 15 minutes after the shutdown, or if a gray whale is not sighted for 30 minutes after the shutdown.

CALTRANS shall implement shutdown if a species for which authorization has not been granted (including but not limited to Guadalupe fur seals) or if a species for which authorization has been granted but the authorized takes are met, approaches or is observed within the Level B harassment zone.

2. Mitigation Measures for Confined Implosion

For CALTRANS' Piers E4 and E5 controlled implosion, NMFS requires the following mitigation measures to minimize the potential impacts to marine mammals in the project vicinity. The primary purposes of these mitigation measures are to

minimize sound levels from the activities, to monitor marine mammals within designated exclusion zones and zones of influence (ZOI). Specific mitigation measures are described below.

Time Restriction

Implosion of Piers E4 and E5 would only be conducted during daylight hours and with enough time for pre and post implosion monitoring, and with good visibility when the largest exclusion zone can be visually monitored.

Installation of Blast Attenuation System

Prior to the Piers E4 and E5 demolition, CALTRANS shall install a Blast Attenuation System (BAS) as described above to reduce the shockwave from the implosion.

Establishment of Level A Exclusion Zone

Due to the different hearing sensitivities among different taxa of marine mammals, NMFS has established a series of take thresholds from underwater explosions for marine mammals belonging to different functional hearing groups (Table 3). Under these criteria, marine mammals from different taxa will have different impact zones (exclusion zones and zones of influence).

CALTRANS will establish an exclusion zone for both the mortality and Level A harassment zone (permanent hearing threshold shift or PTS, GI track injury, and slight lung injury) using the largest radius estimated harbor and northern elephant seals. CALTRANS will use measured distances to marine mammal threshold distances from the implosion of Pier E3 as predicted distances to the thresholds for the implosions of Piers E4 and E5 (Table 4). The use of measured peak pressure,

cumulative sound exposure level (SEL), and impulse levels from the Pier E3 implosion provide a conservative estimate for the implosions of Piers E4 and E5. The Piers E4 and E5 caisson structures are smaller than the Pier E3 caisson structure and will require fewer explosive charges to implode. The maximum charge weight for the implosions of Piers E4 and E5 is 35 pounds/delay, the same as used for the implosion of Pier E3. However, the total explosive weight, number of individual detonations, and total time of implosion event will be less for these smaller piers.

Table 3. NMFS Take Thresholds for Marine Mammals from Underwater Implosions

Group	Species	Level B harassment		Level A harassment	Serious injury		Mortality
		Behavioral	TTS	PTS	Gastro-intestinal tract	Lung	
Mid-freq cetacean	Bottlenose dolphin	167 dB SEL	172 dB SEL or 224 dB SPL_{pk}	187 dB SEL or 230 dB SPL_{pk}	237 dB SPL or 104 psi	$39.1M^{1/3}(1+[D/10.081])^{1/2}$ Pa-sec where: M = mass of the animals in kg D = depth of animal in m	$91.4M^{1/3}(1+[D/10.081])^{1/2}$ Pa-sec where: M = mass of the animals in kg D = depth of animal in m
High-freq cetacean	Harbor porpoise	141 dB SEL	146 dB SEL or 195 dB SPL_{pk}	161 dB SEL or 201 dB SPL_{pk}			
Phocidae	Harbor seal & northern elephant seal	172 dB SEL	177 dB SEL or 212 dB SPL_{pk}	192 dB SEL or 218 dB SPL_{pk}			
Otariidae	California sea lion & northern fur seal	195 dB SEL	200 dB SEL or 212 dB_{pk}	215 dB SEL or 218 dB SPL_{pk}			

* Note: All dB values are referenced to 1 µPa. SPL_{pk} = Peak sound pressure level; psi = pounds per square inch.

Table 4. Measured Distances to Underwater Blasting Threshold Criteria for Levels A and B Harassment and Mortality from the Pier E3 Implosion

Species	Level B Criteria		Level A Criteria			Mortality
	Behavioral Response	TTS Dual Criteria*	PTS Dual Criteria*	Gastro-intestinal Track	Lung Injury	
Harbor Seal	2,460 ft (750 m)	**1,658 ft (505 m)** 104 ft (32 m)	**507 ft (155 m)** 65 ft (20 m)	<100 ft (30 m)	<100 ft (30 m)	<100 ft (30 m)
California Sea Lion	387 ft (118 m)	**261 ft (80 m)** 104 ft (32 m)	**80 ft (24 m)** 65 ft (20 m)	<100 ft (30 m)	<100 ft (30 m)	<100 ft (30 m)
Northern Elephant Seal	2,460 ft (750 m)	**1,658 ft (505 m)** 104 ft (32 m)	**507 ft (155 m)** 65 ft (20 m)	<100 ft (30 m)	<100 ft (30 m)	<100 ft (30 m)
Northern fur seal	387 ft (118 m)	**261 ft (80 m)** 104 ft (32 m)	**80 ft (24 m)** 65 ft (20 m)	<100 ft (30 m)	<100 ft (30 m)	<100 ft (30 m)
Harbor Porpoise	8,171 ft (2,491 m)	**5,580 ft (1,701 m)** 400 ft (122 m)	**1,777 ft (542 m)** 249 ft (76 m)	<100 ft (30 m)	<100 ft (30 m)	<100 ft (30 m)
Bottlenose Dolphin	1,255 ft (383 m)	**855 ft (261 m)** 202 ft (62 m)	**271 ft (83 m)** 112 ft (34 m)	<100 ft (30 m)	<100 ft (30 m)	<100 ft (30 m)

Note:
* For the TTS and PTS criteria thresholds with dual criteria, the largest criteria distances (*i.e.*, more conservative) are shown in bold.

Establishment of Level B Temporary Hearing Threshold Shift (TTS) Zone of Influence

As shown in Table 3, for harbor and northern elephant seals, this will cover the area out to 212 dB peak SPL or 177 dB SEL, whichever extends out the furthest. Hydroacoustic modeling indicates this isopleth would extend out to 1,658 ft (505 m) from the pier. For harbor porpoises, this will cover the area out to 195 dB peak SPL or 146 dB SEL, whichever extends out the furthest, to 5,580 ft (1,701 m) from the pier. As discussed previously, the presence of harbor porpoises in this area is unlikely but monitoring will be employed to confirm their absence. For California sea lions, the distance to the Level B TTS zone of influence will cover the area out to

212 dB peak SPL or 200 dB SEL. This distance was calculated at 261 ft (80 m) from Pier E3, well within the exclusion zone previously described. Hearing group specific Level B TTS zone of influence ranges are provided in Table 4.

Establishment of Level B Behavioral Zone of Influence

As shown in Table 3, for harbor seals and northern elephant seals, this will cover the area out to 172 dB SEL. Hydroacoustic measurement indicates this isopleth would extend out to 2,460 ft (750 m) from the pier. For harbor porpoises, this will cover the area out to 141 dB SEL. Hydroacoustic measurement indicates this isopleth would extend out to 8,171 ft (2,941 m) from the pier. As discussed previously, the presence of harbor porpoises in this area is unlikely but monitoring will be employed to confirm their absence. For California sea lions, the distance to the Level B behavioral harassment ZOI will cover the area out to 195 dB SEL. This distance was calculated at 387 ft (118 m) from the pier, well within the exclusion zone previously described. Hearing group specific Level B TTS zone of influence ranges are provided in Table 4.

Communication

All PSOs will be equipped with mobile phones and a VHF radio as a backup. One person will be designated as the Lead PSO and will be in constant contact with the Resident Engineer on site and the blasting crew. The Lead PSO will coordinate marine mammal sightings with the other PSOs. PSOs will contact the other PSOs when a sighting is made within the exclusion zone or near the exclusion zone so that the PSOs within overlapping areas of responsibility can continue to track the animal and the Lead PSO is aware of the animal. If it is within 30 minutes of blasting and an

animal has entered the exclusion zone or is near it, the Lead PSO will notify the Resident Engineer and blasting crew. The Lead PSO will keep them informed of the disposition of the animal.

Mitigation Conclusions

NMFS has carefully evaluated the mitigation measures and considered a range of other measures in the context of ensuring that NMFS prescribes the means of effecting the least practicable impact on the affected marine mammal species and stocks and their habitat. Our evaluation of potential measures included consideration of the following factors in relation to one another:

- The manner in which, and the degree to which, the successful implementation of the measure is expected to minimize adverse impacts to marine mammals.
- The proven or likely efficacy of the specific measure to minimize adverse impacts as planned.
- The practicability of the measure for applicant implementation.

Any mitigation measure(s) prescribed by NMFS should be able to accomplish, have a reasonable likelihood of accomplishing (based on current science), or contribute to the accomplishment of one or more of the general goals listed below:

(1) Avoidance or minimization of injury or death of marine mammals wherever possible (goals 2, 3, and 4 may contribute to this goal).

(2) A reduction in the numbers of marine mammals (total number or number at biologically important time or location) exposed to received levels of pile driving

and pile removal or other activities expected to result in the take of marine mammals (this goal may contribute to 1, above, or to reducing harassment takes only).

(3) A reduction in the number of times (total number or number at biologically important time or location) individuals would be exposed to received levels of pile driving and pile removal, or other activities expected to result in the take of marine mammals (this goal may contribute to 1, above, or to reducing harassment takes only).

(4) A reduction in the intensity of exposures (either total number or number at biologically important time or location) to received levels of pile driving, or other activities expected to result in the take of marine mammals (this goal may contribute to (1) above, or to reducing the severity of harassment takes only).

(5) Avoidance or minimization of adverse effects to marine mammal habitat, paying special attention to the food base, activities that block or limit passage to or from biologically important areas, permanent destruction of habitat, or temporary destruction/disturbance of habitat during a biologically important time.

(6) For monitoring directly related to mitigation – an increase in the probability of detecting marine mammals, thus allowing for more effective implementation of the mitigation.

Based on our evaluation of the applicant's proposed mitigation measures, as well as other measures considered by NMFS, NMFS has determined that the mitigation measures provide the means of effecting the least practicable adverse impact on marine mammal species or stocks and their habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance.

Monitoring and Reporting

In order to issue an incidental take authorization (ITA) for an activity, section 101(a)(5)(D) of the MMPA states that NMFS must set forth, "requirements pertaining to the monitoring and reporting of such taking." The MMPA implementing regulations at 50 CFR 216.104 (a)(13) indicate that requests for ITAs must include the suggested means of accomplishing the necessary monitoring and reporting that will result in increased knowledge of the species and of the level of taking or impacts on populations of marine mammals that are expected to be present in the proposed action area. CALTRANS has proposed marine mammal monitoring measures as part of the IHA application. It can be found at *http://www.nmfs.noaa.gov/pr/permits/incidental.htm*.

Monitoring measures prescribed by NMFS should accomplish one or more of the following general goals:

(1) An increase in the probability of detecting marine mammals, both within the mitigation zone (thus allowing for more effective implementation of the mitigation) and in general to generate more data to contribute to the analyses mentioned below;

(2) An increase in our understanding of how many marine mammals are likely to be exposed to levels of pile driving that we associate with specific adverse effects, such as behavioral harassment, TTS, or PTS;

(3) An increase in our understanding of how marine mammals respond to stimuli expected to result in take and how anticipated adverse effects on individuals (in different ways and to varying degrees) may impact the population, species, or

stock (specifically through effects on annual rates of recruitment or survival) through any of the following methods:

- Behavioral observations in the presence of stimuli compared to observations in the absence of stimuli (need to be able to accurately predict received level, distance from source, and other pertinent information);
- Physiological measurements in the presence of stimuli compared to observations in the absence of stimuli (need to be able to accurately predict received level, distance from source, and other pertinent information);
- Distribution and/or abundance comparisons in times or areas with concentrated stimuli versus times or areas without stimuli;

(4) An increased knowledge of the affected species; and

(5) An increase in our understanding of the effectiveness of certain mitigation and monitoring measures.

Monitoring Measures

1. Monitoring for Pile Driving and Pile Removal

(1) Visual Monitoring

NMFS made changes to the visual monitoring protocol during CALTRANS' pile driving and pile removal activities based, on a comment from the Marine Mammal Commission. Specifically, the revised visual monitoring protocol requires that PSOs conduct 100 percent visual monitoring of marine mammals during all pile driving and pile removal activities. In the proposed IHA, only 20 percent visual

monitoring would have been required for Level B harassment zones during vibratory pile driving and pile removal activities. A complete description of the monitoring measure is provided below.

Besides using monitoring for implementing mitigation (ensuring exclusion zones are clear of marine mammals before pile driving begins and after shutdown measures), marine mammal monitoring will also be conducted to assess potential impacts from CALTRANS construction activities. CALTRANS will implement onsite marine mammal monitoring for all unattenuated impact pile driving of H-piles for 180- and 190-dB re 1 µPa exclusion zones and 160-dB re 1 µPa Level B harassment zone and attenuated impact pile driving (except pile proofing) for 180- and 190-dB re 1 µPa exclusion zones. CALTRANS will also monitor all attenuated impact pile driving for the 160-dB re 1 µPa Level B harassment zone, and all vibratory pile driving for the 120-dB re 1 µPa Level B harassment zone.

(2) Protected Species Observers

Monitoring of the pinniped and cetacean exclusion zones shall be conducted by a minimum of three qualified NMFS-approved PSOs. Observations will be made using high-quality binoculars (*e.g.*, Zeiss, 10 x 42 power). PSOs will be equipped with radios or cell phones for maintaining contact with other observers and CALTRANS engineers, and range finders to determine distance to marine mammals, boats, buoys, and construction equipment.

(3) Data Collection

Data on all observations will be recorded and will include the following information:

- Location of sighting;
- Species;
- Number of individuals;
- Number of calves present;
- Duration of sighting;
- Behavior of marine animals sighted;
- Direction of travel; and
- When in relation to construction activities did the sighting occur (*e.g.*, before, "soft-start", during, or after the pile driving or removal).

2. Monitoring for Confined Implosion of Piers E4 and E5

Monitoring for implosion impacts to marine mammals will be based on the SFOBB pile driving monitoring protocol. Pile driving has been conducted for the SFOBB construction project since 2000 with development of several NMFS-approved marine mammal monitoring plans (CALTRANS 2004; 2013). Most elements of these marine mammal monitoring plans are similar to what would be required for underwater implosions. These monitoring plans would include monitoring an exclusion zone and ZOIs for TTS and behavioral harassment described above.

(1) Protected Species Observers

A minimum of 8-10 PSOs would be required during the Piers E4 and E5 controlled implosion so that the exclusion zone, Level B Harassment TTS and Behavioral ZOIs, and surrounding area can be monitored. One PSO would be designated as the Lead PSO and would receive updates from other PSOs on the

presence or absence of marine mammals within the exclusion zone and would notify the Environmental Compliance Manager of a cleared exclusion zone prior to the implosion.

(2) Monitoring Protocol

Implosions of Piers E4 and E5 will be conducted only during daylight hours and with enough time for pre and post-implosion monitoring, and with good weather (*i.e.*, clear skies and no high winds). This work will be conducted so that PSOs will be able to detect marine mammals within the exclusion zones and beyond. The Lead PSO will be in contact with other PSOs. If any marine mammals enter an exclusion zone within 30 minutes of blasting, the Lead PSO will notify the Environmental Compliance Manager that the implosion may need to be delayed. The Lead PSO will keep the Environmental Compliance Manager informed about the disposition of the animal. If the animal remains in the exclusion zone, blasting will be delayed until it has left the exclusion zone. If the animal dives and is not seen again, blasting will be delayed at least 15 minutes. After the implosion has occurred, the PSOs will continue to monitor the area for at least 60 minutes.

(3) Data Collection

Each PSO will record the observation position, start and end times of observations, and weather conditions (*i.e.*, sunny/cloudy, wind speed, fog, visibility). For each marine mammal sighting, the following will be recorded, if possible:

- Species.
- Number of animals (with or without pup/calf).
- Age class (pup/calf, juvenile, adult).

- Identifying marks or color (*e.g.*, scars, red pelage, damaged dorsal fin).
- Position relative to Piers E4 or E5 (distance and direction).
- Movement (direction and relative speed).
- Behavior (*e.g.*, logging [resting at the surface], swimming, spy-hopping [raising above the water surface to view the area], foraging).

(4) Post-implosion Survey

Although any injury or mortality from the implosions of Piers E4 and E5 is very unlikely, boat or shore surveys will be conducted for three days following the event, to determine whether any injured or stranded marine mammals are in the area. If an injured or dead animal is discovered during these surveys or by other means, the NMFS-designated stranding team will be contacted to pick up the animal. Veterinarians will treat the animal or will conduct a necropsy to attempt to determine whether it stranded because of the Piers E4 and E5 implosions.

Reporting Measures

CALTRANS would be required to submit a draft monitoring report within 90 days after completion of the construction work or the expiration of the IHA, whichever comes earlier. This draft report would detail the monitoring protocol, summarize the data recorded during monitoring, and estimate the number of marine mammals that may have been harassed. NMFS would have an opportunity to provide comments on the draft report within 30 days, and if NMFS has comments, CALTRANS would address the comments and submit a final report to NMFS within 30 days. If no comments are provided by NMFS after 30 days receiving the report, the draft report is considered to be final.

Marine Mammal Stranding Plan

A stranding plan for the Pier E3 implosion was prepared in cooperation with the local NMFS-designated marine mammal stranding, rescue, and rehabilitation center. An updated version of this plan will be implemented during implosions of Piers E4 and E5. Although avoidance and minimization measures likely will prevent any injuries, preparations will be made in the unlikely event that marine mammals are injured. Elements of the plan will include the following:

1. The stranding crew will prepare treatment areas at an NMFS-designated facility for cetaceans or pinnipeds that may be injured from the implosions. Preparation will include equipment to treat lung injuries, auditory testing equipment, dry and wet caged areas to hold animals, and operating rooms if surgical procedures are necessary.
2. A stranding crew and a veterinarian will be on call near the Piers E4 and E5 area at the time of the implosions, to quickly recover any injured marine mammals, provide emergency veterinary care, stabilize the animal's condition, and transport individuals to an NMFS-designated facility. If an injured or dead animal is found, NMFS (both the regional office and headquarters) will be notified immediately, even if the animal appears to be sick or injured from causes other than the implosions.
3. Post-implosion surveys will be conducted immediately after the event and over the following three days to determine whether any injured or dead marine mammals are in the area.

4. Any veterinarian procedures, euthanasia, rehabilitation decisions, and time of release or disposition of the animal will be at the discretion of the NMFS-designated facility staff and the veterinarians treating the animals. Any necropsies to determine whether the injuries or death of an animal was the result of an implosion or other anthropogenic or natural causes will be conducted at an NMFS-designated facility by the stranding crew and veterinarians. The results will be communicated to both the CALTRANS and to NMFS as soon as possible, followed by a written report within a month.

Estimated Take by Incidental Harassment

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).

The distance to marine mammal threshold criteria for pile driving and blasting activities, and corresponding ZOI have been determined based on underwater sound and pressure measurements collected during pervious activities in the SFOBB Project area. The numbers of marine mammals by species that may be taken by each type of take were calculated based on distance to the specific marine mammal harassment

thresholds, number of days of the activity, and the estimated density of each species in the ZOI.

Estimates of Species Densities of Marine Mammals

No systematic line transect surveys of marine mammals have been performed in the San Francisco Bay. Therefore, the in-water densities of harbor seals, California sea lions, and harbor porpoises were calculated based on 15 years of observations during monitoring for the SFOBB construction and demolition. The amount of monitoring performed per year varied depending on the frequency and duration of construction activities with the potential to affect marine mammals. During the 237 days of monitoring from 2000 through 2015 (including 15 days of baseline monitoring in 2003), 822 harbor seals, 77 California sea lions, and nine harbor porpoises were observed within the waters of the SFOBB east span. Density estimates for other species were made from stranding data, provided by the Marine Mammal Center (MMC).

1. Pacific Harbor Seal Density Estimates

Harbor seal density was calculated from all observations of animals in water during SFOBB Project monitoring from 2000 to 2015, divided by the size of the project area. These observations included data from baseline, pre-, during and post-pile driving, mechanical dismantling, onshore blasting, and offshore implosion activities. During this time, the population of harbor seals in the Bay remained stable (Manugian 2013). Therefore, substantial differences in numbers or behaviors of seals hauling out, foraging, or in their movements are not anticipated. All harbor seal observations within a 1 km^2 area were used in the estimate. Distances were recorded

using a laser range finder (Bushnell Yardage Pro Elite 1500; ± 1.0 yard accuracy). Care was taken to eliminate multiple observations of the same animal, although this was difficult when more than three seals were foraging in the same area.

Density of harbor seals was highest near YBI and Treasure Island, probably because of the haul-out site and nearby foraging areas in Coast Guard and Clipper coves. Therefore, density estimates were calculated for a higher density area within 4,921 ft (1,500 m) west of Piers E4 and E5, which included the two foraging coves. A lower density estimate was calculated from the areas east of Piers E4 and E5, and beyond 4,921 ft (1,500 m) north and south of the bridge. Harbor seal densities in these two areas in spring-summer and fall-winter seasons are provided in Table 5.

2. California Sea Lion Density Estimates

Within the SFOBB Project area, California sea lion density was calculated from all observations of animals in water during SFOBB Project monitoring from 2000 to 2015, divided by the size of the project area. These observations included data from baseline, pre, during, and post-pile driving, mechanical dismantling, onshore blasting, and offshore implosion activities. All sea lion observations within a 1 km^2 area were used in the estimate. Distances were recorded using a laser range finder (Bushnell Yardage Pro Elite 1500; ± 1.0 yard accuracy). Care was taken to eliminate multiple observations of the same animal, although most sea lion observations involve a single animal.

California sea lion densities in late spring-early summer and late summer-fall seasons are provided in Table 5.

3. Northern Elephant Seal Density Estimates

Northern elephant seal density in the project area was calculated from the stranding records of the MMC, from 2004 to 2014. These data included both injured or sick seals and healthy seals. Approximately 100 elephant seals were reported in the Bay during this time; most of these hauled out and likely were sick or starving. The actual number of individuals in the Bay may have been higher because not all individuals would necessarily have hauled out. Some individuals may have simply left the Bay soon after entering. Data from the MMC show several elephant seals stranding on Treasure Island, and one healthy elephant seal was observed resting on the beach in Clipper Cove in 2012. Elephant seal pups or juveniles also may have stranded after weaning in the spring and when they returned to California in the fall (September through November). Density of northern elephant seal is estimated as the number of stranded seals over the SFOBB project area, which is 0.03 animal/km^2 (Table 5).

4. Harbor Porpoise Density Estimates

Harbor porpoise density was calculated from all observations during SFOBB Project monitoring, from 2000 to 2015. These observations included data from baseline, pre, during and post-pile driving, and onshore implosion activities. Over this period, the number of harbor porpoises that were observed entering and using the Bay increased. During the 15 years of monitoring in the SFOBB Project area, only nine harbor porpoises were observed, and all occurred between 2006 and 2015 (including two in 2014 and five in 2015). Density of harbor porpoise is estimated to be 0.021 animal/km^2 (Table 5).

5. Gray Whale Density Estimate

Gray whale density was estimated for the entire Bay as no observations have occurred of gray whales in the SFOBB Project area. Each year, two to six gray whales enter the Bay, presumably to feed, in the late winter through spring (February through April), per the MMC. Gray whales rarely occur in the Bay from October through December. The gray whale density was estimated based on a maximum of 6 whales occurring within the main area of San Francisco Bay, which yielded a density of 0.00004/km^2 (Thorson, pers. comm., 2014).

Table 5. Estimated In-Water Density of Marine Mammals in the SFOBB Project Area

Species	Main Season of Occurrence	Density West of Piers E4 and E5 within 1,500 m of SFOBB (animals/km^2)	Density East of Piers E4 and E5 and/or beyond 1,500 m of SFOBB (animals/km^2)
Harbor Seal	Spring–Summer	0.32	0.17
Harbor Seal	Fall–Winter	0.83	0.17
California Sea Lion	Late Summer–Fall (post breeding season)	0.09	0.09
California Sea Lion	Late Spring–Early Summer (breeding season)	0.04	0.04
Northern Elephant Seal	Late Spring–Early Winter	0.03	0.03
Harbor Porpoise	All Year	0.021	0.021
Gray Whale	Late Winter and Spring	0.00004	0.00004
Note: Densities for Pacific harbor seals, California sea lions and harbor porpoises are based on monitoring for the east span of the SFOBB from 2000 to 2013. Gray whale and elephant seal densities are estimated from sighting and stranding data from the MMC.			

Estimated Takes by Pile Driving and Pile Removal

The numbers of marine mammals by species that may be taken by pile driving were calculated by multiplying the ensonified area above a specific species exposure

threshold by the days of the activity and by the estimated density of each species in the ensonified area. As discussed above, threshold distances were determined based on previously measured distances to thresholds during the driving of 42-inch-diameter (1.07 meters) pipe piles. The same threshold distances have been applied to all types and sizes of piles proposed for installation and removal (*i.e.*, H-piles, and pipe piles equal to or less than 36 inches (0.91 meter)). The take estimate is based on 132 days of pile driving to install 200 piles.

For rare species of which the density estimates are unknown, such as northern fur seal and bottlenose dolphin, NMFS worked with CALTRANS and allotted 20 northern fur seals and 10 bottlenose dolphin for incidental take by Level B behavioral harassment to cover the chance encounter in case these animals happen to occur in the project area.

A summary of estimated takes by in-water pile driving and pile removal is provided in Table 6.

Table 6. Estimated Take of Marine Mammals from Pile Driving and Pile Removal Activities

Species	Level B Harassment (Behavioral Response)	Level A Harassment
Pacific Harbor Seal	862	0
California Sea Lion	108	0
Northern Elephant Seal	13	0
Harbor Porpoise	13	0
Gray Whale	1	0
Northern fur seal	20	0
Bottlenose dolphin	10	0

The number of marine mammals by species that may be taken by implosion of Piers E4 and E5 were calculated based on distances to the marine mammal threshold for explosions (Table 4) and the estimated density of each species in the ensonified areas (Table 5). A summary of estimated and requested takes by controlled implosion is provided in Table 8.

Table 7. Estimated Exposures of Marine Mammals to the Pier E4 and E5 Implosions for Levels A and B, and Mortality

Species	Level B Exposures		Level A Exposures			Mortality
	Behavioral Response	TTS	PTS	Gastro-Intestinal Track Injury	Slight Lung Injury	
Pacific Harbor Seal	1	1	0	0	0	0
California Sea Lion	0	0	0	0	0	0
Northern Elephant Seal	0	0	0	0	0	0
Harbor Porpoise	0	0	0	0	0	0

However, the number of marine mammals in the area at any given time is highly variable. Animal movement depends on time of day, tide levels, weather, and availability and distribution of prey species. Therefore, to account for potential high animal density that could occur during the short window of controlled implosion, NMFS worked with CALTRANS and adjusted the estimated number upwards for the requested takes. These adjustments were based on likely group sizes of these animals.

A summary of estimated takes by implosion of Piers E4 and E5 is provided in Table 8.

Table 8. Summary of requested takes of marine mammals for the Pier E4 and E5 Implosions

Species	Level B Behavioral	Level B TTS
Pacific harbor seal	12	6
California sea lion	3	2
Northern elephant seal	2	1
Harbor porpoise	6	3
Northern fur seal	1	1
Bottlenose dolphin	2	2

A summary of the request incidental takes of marine mammals for CALTRANS SFOBB construction activity, including from in-water pile driving/pile removal and controlled implosion for Piers E4 and E5 is provided in Table 9. These take estimates represent "instances" of take and are likely overestimates of the number of individual animals taken, since some individuals are likely taken on multiple days. The more likely the individuals are to remain in the action area for multiple days, the greater the overestimate of individuals.

Table 9. Summary of Authorized Takes of Marine Mammals for CALTRANS SFOBB Project

Species	Level B Behavioral	Level B TTS	Population	% take population
Pacific harbor seal	874	6	30,968	2.84%
California sea lion	111	2	296,750	0.04%
Northern elephant seal	15	1	179,000	0.01%
Harbor porpoise	19	3	9,886	0.22%
Northern fur seal	21	1	12,844	0.17%
Gray whale	1	0	20,990	0.00%
Bottlenose dolphin	12	2	323	4.33%

Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing

On August 4, 2016, NMFS released its Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Guidance). This new

guidance established new thresholds for predicting auditory injury, which equates to Level A harassment under the MMPA. In the **Federal Register** notice (81 FR 51694), NMFS explained the approach it would take during a transition period, wherein we balance the need to consider this new best available science with the fact that some applicants have already committed time and resources to the development of analyses based on our previous guidance and have constraints that preclude the recalculation of take estimates, as well as where the action is in the agency's decision-making pipeline. In that Notice, we included a non-exhaustive list of factors that would inform the most appropriate approach for considering the new Guidance, including: the scope of effects; how far in the process the applicant has progressed; when the authorization is needed; the cost and complexity of the analysis; and the degree to which the guidance is expected to affect our analysis. In this case, CALTRANS submitted an adequate and complete application in a timely manner and indicated that they would need to receive an IHA (if issued) by early September 2016. The CALTRANS analysis put forth in the proposed IHA contemplated the potential for small numbers of permanent or temporary threshold shift, but ultimately concluded that permanent threshold shift will not occur. Consideration of the new Guidance suggested that in the absence of mitigation a small number of Level A takes could potentially occur to one harbor seal. However, CALTRANS has a robust and practicable monitoring and mitigation program – and in addition they enlarged the exclusion zone for pile driving from 95 m to 156 m for 14" H-pile and to 183 m for 36" steel pipe when driven by an impact hammer, providing further protection. When this mitigation is considered in combination with the fact that a fair number of marine mammals are expected to

intentionally avoid approaching within distances of this slow-moving source that would result in injury, we believe that injury is unlikely. In summary, we have considered the new Guidance and believe that the likelihood of injury is adequately addressed in the analysis and appropriate protective measures are in place in the IHA.

Analysis and Determinations

Negligible Impact

Negligible impact is "an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival" (50 CFR 216.103). A negligible impact finding is based on the lack of likely adverse effects on annual rates of recruitment or survival (*i.e.*, population-level effects). An estimate of the number of Level B harassment takes, alone, is not enough information on which to base an impact determination. In addition to considering estimates of the number of marine mammals that might be "taken" through behavioral harassment, NMFS must consider other factors, such as the likely nature of any responses (their intensity, duration, *etc*.), the context of any responses (critical reproductive time or location, migration, *etc*.), as well as the number and nature of estimated Level A harassment takes, the number of estimated mortalities, and effects on habitat.

To avoid repetition, this introductory discussion of our analyses applies to all the species listed in Table 9, given that the anticipated effects of CALTRANS' SFOBB construction activities involving pile driving and pile removal and controlled implosions for Piers E4 and E5 on marine mammals are expected to be relatively similar in nature. There is no information about the nature or severity of the impacts,

or the size, status, or structure of any species or stock that would lead to a different analysis for this activity, or else species-specific factors would be identified and analyzed.

No injuries or mortalities are anticipated to occur as a result of CALTRANS' SFOBB construction activity associated with pile driving and pile removal and controlled implosion to demolish Piers E4 and E5, and none are authorized. The relatively low marine mammal density, relatively small Level A harassment zones, and robust mitigation plan make injury takes of marine mammals unlikely, based on take calculation described above. In addition, the Level A exclusion zones would be thoroughly monitored before the implosion, and detonation activity would be postponed if an marine mammal is sighted within the exclusion zone.

The takes that are anticipated and authorized are expected to be limited to short-term Level B harassment (behavioral and TTS). Marine mammals (Pacific harbor seal, northern elephant seal, California sea lion, northern fur seal, gray whale, harbor porpoise, and bottlenose dolphin) present in the vicinity of the action area and taken by Level B harassment would most likely show overt brief disturbance (startle reaction) and avoidance of the area from elevated noise level during pile driving and pile removal and the implosion noise. A few marine mammals could experience TTS if they occur within the Level B TTS ZOI during the two implosion events. However, as discussed early in this document, TTS is a temporary loss of hearing sensitivity when exposed to loud sound, and the hearing threshold is expected to recover completely within minutes to hours. Therefore, it is not considered an injury. In addition, even if an animal receives a TTS, the TTS would be a one-time event

from a brief impulse noise (about 5 seconds), making it unlikely that the TTS would involve into PTS. Finally, there is no critical habitat or other biologically important areas in the vicinity of CALTRANS' Pier E4 and E5 controlled implosion areas (Calambokidis *et al*., 2015).

The project also is not expected to have significant adverse effects on affected marine mammals' habitat, as analyzed in detail in the "**Anticipated Effects on Marine Mammal Habitat**" section. There is no biologically important area in the vicinity of the SFOBB project area. The project activities would not permanently modify existing marine mammal habitat. The activities may kill some fish and cause other fish to leave the area temporarily, thus impacting marine mammals' foraging opportunities in a limited portion of the foraging range; but, because of the short duration of the activities and the relatively small area of the habitat that may be affected, the impacts to marine mammal habitat are not expected to cause significant or long-term negative consequences.

Based on the analysis contained herein of the likely effects of the specified activity on marine mammals and their habitat, and taking into consideration the implementation of the monitoring and mitigation measures, NMFS finds that the total marine mammal take from CALTRANS's SFOBB construction activity and the associated Piers E4 and E5 demolition via controlled implosion will have a negligible impact on the affected marine mammal species or stocks.

Small Numbers

The requested takes represent less than 4.33 percent of all populations or stocks potentially impacted (see Table 9 in this document). These take estimates

represent the percentage of each species or stock that could be taken by Level B behavioral harassment and TTS (Level B harassment). The numbers of marine mammals estimated to be taken are small proportions of the total populations of the affected species or stocks. In addition, the mitigation and monitoring measures (described previously in this document) prescribed in the IHA are expected to reduce even further any potential disturbance to marine mammals.

Based on the analysis contained herein of the likely effects of the specified activity on marine mammals and their habitat, and taking into consideration the implementation of the mitigation and monitoring measures, NMFS finds that small numbers of marine mammals will be taken relative to the populations of the affected species or stocks.

Impact on Availability of Affected Species for Taking for Subsistence Uses

There are no subsistence uses of marine mammals in the project area; and, thus, no subsistence uses impacted by this action. Therefore, NMFS has determined that the total taking of affected species or stocks would not have an unmitigable adverse impact on the availability of such species or stocks for taking for subsistence purposes.

Endangered Species Act

NMFS has determined that issuance of the IHA will have no effect on listed marine mammals, as none are known to occur in the action area.

National Environmental Policy Act

NMFS prepared an Environmental Assessment (EA) for the take of marine mammals incidental to construction of the East Span of the SFOBB and made a

Finding of No Significant Impact (FONSI) on November 4, 2003. Due to the modification of part of the construction project and the mitigation measures, NMFS reviewed additional information from CALTRANS regarding empirical measurements of pile driving noises for the smaller temporary piles without an air bubble curtain system and the use of vibratory pile driving. NMFS prepared a Supplemental Environmental Assessment (SEA) and analyzed the potential impacts to marine mammals that would result from the modification of the action. A FONSI was signed on August 5, 2009. In addition, for CALTRANS' Piers E4 and E5 demolition using controlled implosion, NMFS prepared an SEA and analyzed the potential impacts to marine mammals that would result from the modification. A FONSI was signed on September 3, 2015. The activity and expected impacts remain within what was previously analyzed in the EA and SEAs. Therefore, no additional NEPA analysis is warranted. A copy of the SEA and FONSI is available upon request (see **ADDRESSES**).

Authorization

As a result of these determinations, NMFS has issued an IHA to CALTRANS for the take of marine mammals, by Level B harassment, incidental to conducting SFOBB project in the San Francisco Bay, which also includes the mitigation, monitoring, and reporting requirements described in this Notice.

Dated: September 26, 2016.

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Donna S. Wieting,

Director, Office of Protected Resources

National Marine Fisheries Service

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