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DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

RIN 0648-XF318

Takes of Marine Mammals Incidental to Specified Activities; Taking Marine Mammals Incidental to the San Francisco Ferry Terminal Expansion Project, South Basin Improvements Project

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

ACTION: Notice; Issuance of an Incidental Harassment Authorization.

SUMMARY: NMFS received a request from the San Francisco Bay Area Water Emergency Transportation Authority (WETA) for authorization to take marine mammals incidental to construction activities as part of a ferry terminal expansion and improvements project. Pursuant to the Marine Mammal Protection Act (MMPA), NMFS is announcing our issuance of an incidental harassment authorization (IHA) to WETA to incidentally take marine mammals, by Level B harassment only, during the specified activity.

DATES: This Authorization is effective from June 1, 2017 through May 31, 2018.

FOR FURTHER INFORMATION CONTACT: Laura McCue, Office of Protected Resources, NMFS, (301) 427-8401. Electronic copies of the applications and supporting documents, as well as a list of the references cited in this document, may be obtained online at: www.nmfs.noaa.gov/pr/permits/incidental/construction.htm. In case of problems accessing these documents, please call the contact listed above.

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.

The MMPA states that the term “take” means to harass, hunt, capture, kill or attempt to harass, hunt, capture, or kill any marine mammal.

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).

National Environmental Policy Act

To comply with the National Environmental Policy Act of 1969 (NEPA; 42 U.S.C. 4321 *et seq.*) and NOAA Administrative Order (NAO) 216-6A, NMFS must review our proposed action with respect to environmental consequences on the human environment.

NMFS published an Environmental Assessment (EA) in 2016 on WETA's ferry terminal construction activities. NMFS found that there would be no significant impacts to the human environment and signed a finding of no significant impact (FONSI) on June 28, 2016. Because the activities and analysis are the same as WETA's 2016 activities, NMFS used the existing EA and signed a FONSI in May 2017 for WETA's 2017 activities.

Summary of Request

NMFS received a request from WETA for an IHA to take marine mammals incidental to pile driving and removal in association with the San Francisco Ferry Terminal Expansion Project, South Basin Improvements Project (Project) in San Francisco Bay, California. In-water work associated with the project is expected to be completed within 23 months. This IHA is for the first phase of construction activities (June 1, 2017 - May 31, 2018).

The use of both vibratory and impact pile driving and removal is expected to produce underwater sound at levels that have the potential to result in behavioral harassment of marine mammals. Seven species of marine mammals have the potential to be affected by the specified activities: harbor seal (*Phoca vitulina*), California sea lion (*Zalophus californianus*), Northern elephant seal (*Mirounga angustirostris*), Northern fur seal (*Callorhinus ursinus*), harbor porpoise

(*Phocoena phocoena*), gray whale (*Eschrichtius robustus*), and bottlenose dolphin (*Tursiops truncatus*). These species may occur year round in the action area.

WETA received authorization for take of marine mammals incidental to these same activities in 2016 (81 FR 43993; July 6, 2016); however construction activities did not occur. Therefore, the specified activities described in the previous IHA are identical to the activities described here. In addition, similar construction and pile driving activities in San Francisco Bay have been authorized by NMFS in the past. These projects include construction activities at the Exploratorium (75 FR 66065; October 27, 2010), Pier 36 (77 FR 20361; April 4, 2012), and the San Francisco-Oakland Bay Bridge (71 FR 26750; May 8, 2006, 72 FR 25748; August 9, 2007, 74 FR 41684; August 18, 2009, 76 FR 7156; February 9, 2011, 78 FR 2371; January 11, 2013, 79 FR 2421; January 14, 2014, and 80 FR 43710; July 23, 2015).

Description of the Specified Activity

Overview

The WETA is expanding berthing capacity at the Downtown San Francisco Ferry Terminal (Ferry Terminal), located at the San Francisco Ferry Building (Ferry Building), to support existing and future planned water transit services operated on San Francisco Bay by WETA and WETA's emergency operations. A detailed description of the planned construction project is provided in the **Federal Register** notice for the proposed IHA (82 FR 17799; April 13, 2017). Since that time, no changes have been made to the planned activities. Therefore, a detailed description is not provided here. Please refer to that **Federal Register** notice for the description of the specific activity.

Comments and Responses

A notice of NMFS's proposal to issue an IHA to WETA was published in the **Federal Register** on April 13, 2017 (82 FR 17799). That notice described, in detail, WETA's activity, the marine mammal species that may be affected by the activity, and the anticipated effects on marine mammals. During the 30-day public comment period, NMFS received comments from the Marine Mammal Commission (Commission) and one private citizen.

Comment 1: The Commission recommends that NMFS consult with both internal and external scientists and acousticians to determine the appropriate accumulation time that action proponents should use to determine the extent of the Level A harassment zones based on the associated Permanent Threshold Shift (PTS) cumulative sound exposure level (SEL_{cum}) thresholds for stationary sound sources.

Response: NMFS will take the Commission's recommendation into consideration and will consult with internal scientists on this issue in the future; however it does not change our isopleths or the number of takes for this specific action. We also welcome the Commission and its Committee of Scientific Advisors on Marine Mammals to provide guidance on this issue.

Comment 2: One private citizen requested clarification on Level B harassment.

Response: NMFS defines Level B harassment in the *Background* and *Estimated Take by Incidental Harassment* sections. Level B harassment is defined, under the MMPA, as any act of pursuit, torment, or annoyance which has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering.

Description of Marine Mammals in the Area of the Specified Activity

We have reviewed WETA’s species information—which summarizes available information regarding status and trends, distribution and habitat preferences, behavior and life history, and auditory capabilities of the potentially affected species—for accuracy and completeness and refer the reader to Sections 4 and 5 of the applications, as well as to NMFS’s Stock Assessment Reports (SAR; www.nmfs.noaa.gov/pr/sars/), instead of reprinting all of the information here. Additional general information about these species (*e.g.*, physical and behavioral descriptions) may be found on NMFS’s website www.nmfs.noaa.gov/pr/species/mammals/. Table 1 lists all species with expected potential for occurrence in San Francisco Bay and summarizes information related to the population or stock, including potential biological removal (PBR), where known. For taxonomy, we follow Committee on Taxonomy (2016). A detailed description of the of the species likely to be affected by WETA’s project, including brief introductions to the species and relevant stocks as well as available information regarding population trends and threats, and information regarding local occurrence, were provided in the **Federal Register** notice for the proposed IHA (82 FR 17799; April 13, 2017); since that time, we are not aware of any changes in the status of these species and stocks; therefore, detailed descriptions are not provided here. Please refer to that **Federal Register** notice for these descriptions. Please also refer to NMFS’ website www.nmfs.noaa.gov/pr/species/mammals/ for generalized species accounts.

Table 1. Marine Mammals Potentially Present in the Vicinity of San Francisco Ferry Terminal.

Species	Stock	ESA/MMPA status; Strategic (Y/N) ¹	Stock abundance (CV, N _{min} , most recent abundance survey) ²	PBR ³	Relative occurrence in San Francisco Bay; season of occurrence
Order Cetartiodactyla – Cetacea – Superfamily Odontoceti (toothed whales, dolphins, and porpoises)					
Family Phocoenidae (porpoises)					

Harbor porpoise (<i>Phocoena phocoena</i>)	San Francisco-Russian River	-; N	9,886 (0.51; 6,625; 2011)	66	Common
Order Cetartiodactyla – Cetacea – Superfamily Odontoceti (toothed whales, dolphins, and porpoises)					
Family Delphinidae (dolphins)					
Bottlenose dolphin ⁴ (<i>Tursiops truncatus</i>)	California coastal	-; N	453 (0.06; 346; 2011)	2.4	Rare
Order Cetartiodactyla – Cetacea – Superfamily Odontoceti (toothed whales, dolphins, and porpoises)					
Family Eschrichtiidae					
Gray whale (<i>Eschrichtius robustus</i>)	Eastern N. Pacific	-; N	20,990 (0.05; 20,125; 2011)	624	Rare
Order Cetartiodactyla – Cetacea – Superfamily Mysticeti (baleen whales)					
Family Balaenopteridae					
Humpback whale (<i>Megaptera novaeangliae</i>)	California/Oregon/Washington stock	T ⁵ ; S	1,918 (0.05; 1,876; 2014)	11	Unlikely
Order Carnivora – Superfamily Pinnipedia					
Family Otariidae (eared seals and sea lions)					
California sea lion (<i>Zalophus californianus</i>)	U.S.	-; N	296,750 (n/a; 153,337; 2011)	9,200	Common
Guadalupe fur seal ⁵ (<i>Arctocephalus philippii townsendi</i>)	Mexico to California	T; S	20,000 (n/a; 15,830; 2010)	91	Unlikely
Northern fur seal (<i>Callorhinus ursinus</i>)	California stock	-;N	14,050 (n/a; 7,524; 2013)	451	Unlikely
Family Phocidae (earless seals)					
Harbor seal (<i>Phoca vitulina</i>)	California	-; N	30,968 (n/a; 27,348; 2012)	1,641	Common; Year-round resident
Northern elephant seal (<i>Mirounga angustirostris</i>)	California breeding stock	-; N	179,000 (n/a; 81,368; 2010)	4,882	Rare

¹ESA status: Endangered (E), Threatened (T)/MMPA status: Depleted (D). A dash (-) indicates that the species is not listed under the ESA or designated as depleted under the MMPA. Under the MMPA, a strategic stock is one for which the level of direct human-caused mortality exceeds PBR (see footnote 3) or which is determined to be declining and likely to be listed under the ESA within the foreseeable future. Any species or stock listed under the ESA is automatically designated under the MMPA as depleted and as a strategic stock.

²CV is coefficient of variation; N_{\min} is the minimum estimate of stock abundance. In some cases, CV is not applicable. For certain stocks, abundance estimates are actual counts of animals and there is no associated CV. The most recent abundance survey that is reflected in the abundance estimate is presented; there may be more recent surveys that have not yet been incorporated into the estimate.

³Potential biological removal, defined by the MMPA as the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population size (OSP).

⁴Abundance estimates for these stocks are greater than eight years old and are, therefore, not considered current. PBR is considered undetermined for these stocks, as there is no current minimum abundance estimate for use in calculation. We nevertheless present the most recent abundance estimates and PBR values, as these represent the best available information for use in this document.

⁵The humpback whales considered under the MMPA to be part of this stock could be from any of three different DPSs. In CA, it would be expected to primarily be whales from the Mexico DPS but could also be whales from the Central America DPS.

Potential Effects of the Specified Activity on Marine Mammals and their Habitat

The effects of underwater noise from WETA's pile-driving and removal activities for the San Francisco Ferry Terminal, South Basin Improvements project have the potential to result in behavioral harassment of marine mammals in the vicinity of the action area. The **Federal Register** notice for the proposed IHA (82 FR 17799; April 13, 2017) included a discussion of the effects of anthropogenic noise on marine mammals, therefore that information is not repeated here; please refer to that **Federal Register** notice for that information.

Estimated Take by Incidental Harassment

This section provides an estimate of the number of incidental takes authorized through this IHA, which informed both NMFS' consideration of whether the number of takes is "small" and the negligible impact determination.

Harassment is the only type of take expected to result from these activities. Except with respect to certain activities not pertinent here, Section 3(18) of 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).

Authorized takes will be by Level B harassment only, in the form of disruption of behavioral patterns for individual marine mammals resulting from exposure to vibratory and impact pile driving and removal. Based on the nature of the activity and the anticipated effectiveness of the mitigation measures (*i.e.*, bubble curtain, soft start, *etc.* – discussed in detail

below in *Mitigation Measures* section), Level A harassment is neither anticipated nor authorized. The death of a marine mammal is also a type of incidental take. However, as described previously, no mortality is anticipated or authorized for this activity. Below we describe how the take is estimated.

Given the many uncertainties in predicting the quantity and types of impacts of sound on marine mammals, it is common practice to estimate how many animals are likely to be present within a particular distance of a given activity, or exposed to a particular level of sound. In practice, depending on the amount of information available to characterize daily and seasonal movement and distribution of affected marine mammals, it can be difficult to distinguish between the number of individuals harassed and the instances of harassment and, when duration of the activity is considered, it can result in a take estimate that overestimates the number of individuals harassed. In particular, for stationary activities, it is more likely that some smaller number of individuals may accrue a number of incidences of harassment per individual than for each incidence to accrue to a new individual, especially if those individuals display some degree of residency or site fidelity and the impetus to use the site (*e.g.*, because of foraging opportunities) is stronger than the deterrence presented by the harassing activity.

The area where the ferry terminal is located is not considered important habitat for marine mammals, as it is a highly industrial area with high levels of vessel traffic and background noise. While there are harbor seal haul outs within 2 miles of the construction activity at Yerba Buena Island, and a California sea lion haul out approximately 1.5 miles away at Pier 39, behavioral disturbances that could result from anthropogenic sound associated with these activities are expected to affect only a relatively small number of individual marine mammals that may venture near the ferry terminal, although those effects could be recurring over

the life of the project if the same individuals remain in the project vicinity. WETA has requested authorization for the incidental taking of small numbers of harbor seals, northern elephant seals, northern fur seals, California sea lions, harbor porpoise, bottlenose dolphin, and gray whales near the San Francisco Ferry Terminal that may result from construction activities associated with the project described previously in this document.

In order to estimate the potential instances of take that may occur incidental to the specified activity, we must first estimate the extent of the sound field that may be produced by the activity and then consider in combination with information about marine mammal density or abundance in the project area. We first provide information on applicable sound thresholds for determining effects to marine mammals before describing the information used in estimating the sound fields, the available marine mammal density or abundance information, and the method of estimating instances of take.

Sound Thresholds

We use generic sound exposure thresholds to determine when an activity that produces sound might result in impacts to a marine mammal such that a take by Level B harassment might occur. These thresholds (Table 2) are used to estimate when harassment may occur (*i.e.*, when an animal is exposed to levels equal to or exceeding the relevant criterion) in specific contexts; however, useful contextual information that may inform our assessment of effects is typically lacking and we consider these thresholds as step functions.

Table 2. Current Acoustic Exposure Criteria.

Criterion	Definition	Threshold
Level B harassment (underwater)	Behavioral disruption	160 dB (impulsive source) / 120 dB (continuous source) (rms)
Level B harassment (airborne)	Behavioral disruption	90 dB (harbor seals) / 100 dB (other pinnipeds) (unweighted)

On August 4, 2016, NMFS released its Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Guidance) (NMFS 2016, 81 FR 51694). This new Guidance established new thresholds for predicting auditory injury, which equates to Level A harassment under the MMPA. WETA used this new Guidance to determine sound exposure thresholds to determine when an activity that produces sound might result in impacts to a marine mammal such that a take by injury, in the form of permanent threshold shift (PTS), might occur. These acoustic thresholds are presented using dual metrics of cumulative sound exposure level (SEL_{cum}) and peak sound level (PK) (Table 3). The lower and/or upper frequencies for some of these functional hearing groups have been modified from those designated by Southall *et al.* (2007), and the revised generalized hearing ranges are presented in the new Guidance. The functional hearing groups and the associated frequencies are indicated in Table 3 below.

Table 3. Summary of PTS Onset Acoustic Thresholds¹.

Hearing Group	PTS Onset Acoustic Thresholds* (Received Level)	
	Impulsive	Non-impulsive
Low-frequency cetaceans	<i>Cell 1</i> Lpk,flat: 219 dB LE,LF,24h: 183 dB	<i>Cell 2</i> LE,LF,24h: 199 dB
Mid-frequency cetaceans	<i>Cell 3</i> Lpk,flat: 230 dB LE,MF,24h: 185 dB	<i>Cell 4</i> LE,MF,24h: 198 dB
High-frequency cetaceans	<i>Cell 5</i> Lpk,flat: 202 dB LE,HF,24h: 155 dB	<i>Cell 6</i> LE,HF,24h: 173 dB
Phocid Pinnipeds (underwaters)	<i>Cell 7</i> Lpk,flat: 218 dB LE,PW,24h: 185 dB	<i>Cell 8</i> LE,PW,24h: 201 dB
Otariid Pinnipeds (underwater)	<i>Cell 9</i> Lpk,flat: 232 dB LE,OW,24h: 203 dB	<i>Cell 10</i> LE,OW,24h: 219 dB

¹NMFS 2016

Distance to Sound Thresholds

Underwater Sound Propagation Formula – Pile driving and removal generates underwater noise that can potentially result in disturbance to marine mammals in the project area. Transmission loss (TL) is the decrease in acoustic intensity as an acoustic pressure wave propagates out from a source. TL parameters vary with frequency, temperature, sea conditions, current, source and receiver depth, water depth, water chemistry, and bottom composition and topography. The general formula for underwater TL is:

$$TL = B * \log_{10}(R_1/R_2), \text{ where}$$

R_1 = the distance of the modeled sound pressure level (SPL) from the driven pile, and

R_2 = the distance from the driven pile of the initial measurement.

This formula neglects loss due to scattering and absorption, which is assumed to be zero here. The degree to which underwater sound propagates away from a sound source is dependent on a variety of factors, most notably the water bathymetry and presence or absence of reflective or absorptive conditions including in-water structures and sediments. Spherical spreading occurs in a perfectly unobstructed (free-field) environment not limited by depth or water surface, resulting in a 6 dB reduction in sound level for each doubling of distance from the source ($20 * \log[\text{range}]$). Cylindrical spreading occurs in an environment in which sound propagation is bounded by the water surface and sea bottom, resulting in a reduction of 3 dB in sound level for each doubling of distance from the source ($10 * \log[\text{range}]$). A practical spreading value of 15 is often used under conditions, such as at the San Francisco Ferry Terminal, where water increases with depth as the receiver moves away from the shoreline, resulting in an expected propagation environment that would lie between spherical and cylindrical spreading loss conditions. Practical spreading loss (4.5 dB reduction in sound level for each doubling of distance) is assumed here.

Underwater Sound – The intensity of pile driving and removal sounds is greatly influenced by factors such as the type of piles, hammers, and the physical environment in which the activity takes place. A number of studies, primarily on the west coast, have measured sound produced during underwater pile driving projects. These data are largely for impact driving of steel pipe piles and concrete piles as well as vibratory driving of steel pipe piles.

In order to determine reasonable SPLs and their associated effects on marine mammals that are likely to result from vibratory or impact pile driving or removal at the ferry terminal, we considered existing measurements from similar physical environments (*e.g.* estuarine areas of soft substrate where water depths are less than 16 feet).

Level A thresholds (Table 4)

The values used to calculate distances at which sound would be expected to exceed the Level A thresholds for impact driving of 24-inch (in) and 36-in piles include peak values of 210 dB for 36-in piles and 207 dB for 24-in piles (Caltrans 2015a). Anticipated SELs for unattenuated impact pile-driving would be 183 dB for 36-in pile driving and 178 dB for 24-in piles (Caltrans 2015a). Bubble curtains will be used during the installation of these piles, which is expected to reduce noise levels by about 10 dB rms (Caltrans 2015a). Vibratory driving source levels include 165 dB RMS for 24-in piles and 175 dB RMS for 36-in piles (Caltrans 2015a). In the user spreadsheet from NMFS' Guidance, 1800 strikes per pile with 2 piles per day was used for impact driving of 36-in piles, and 1800 strikes per pile with 3 piles per day was used for impact driving of 24-in piles. Total duration for vibratory driving of 24-in or 36-in piles is one hour. Both pile sizes are analyzed, but only 36-in piles are used to conservatively calculate take.

The values used to calculate distances at which sound would be expected to exceed the Level A thresholds for impact driving of 14-in wood piles include a peak value of 180 dB and

SEL value of 148 dB (Caltrans 2015a). Vibratory driving source level is assumed to be 150 dB RMS (Caltrans 2015a). In the user spreadsheet from NMFS' Guidance, 200 strikes per pile and 6 piles per day were used. Total duration for vibratory driving of 14-in wood piles is one hour.

The most applicable noise values for 12 to 18 in wooden pile removal from which to base estimates for the terminal expansion project are derived from measurements taken at the Port Townsend dolphin pile removal in the State of Washington. During vibratory pile extraction associated with this project, measured peak noise levels were approximately 164 decibel (dB) at 16 m, and the root mean square (rms) was approximately 150 dB (WSDOT 2011). In the user spreadsheet from NMFS' Guidance, activity duration is estimated at 1.33 hours, pulse duration of 1 second, and 1/repetition rate of 1 second.

Table 4. Expected Pile-Driving Noise Levels and Distances of Level A Threshold Exceedance with Impact and Vibratory Driver.

Project Element Requiring Pile Installation	Source Levels at 10 meters (dB) ¹			Distance to Level A Threshold in meters				
	Peak ¹	SEL	RMS	Phocids	Otariids	LF* Cetaceans	MF* Cetaceans	HF* Cetaceans
18-In Wood Piles – Vibratory Extraction	-	-	150 ¹	1.5	0.1	2.4	0.2	3.6
18-In Concrete Piles – Vibratory Extraction	-	-	150 ¹	1.5	0.1	2.4	0.2	3.6
24-In Steel Piles – Vibratory Driver ^{3*}	-	-	175*	35.6	2.5	58.6	5.2	86.6
24-In Steel Piles – Impact Driver (BCA) ^{2,3}	207 ²	178 ²	-	164.5	12.0	307.4	10.9	366.1
36-In Steel Piles – Vibratory Extraction	-	-	175	35.6	2.5	58.6	5.2	86.6
36-In Steel Piles – Vibratory Driver	-	-	175	35.6	2.5	58.6	5.2	86.6
36-In Steel Piles – Impact Driver (BCA) ²	210 ²	183 ²	-	270.4	19.7	505.4	18.0	602.0
14-In Wood Piles- Vibratory Driver	-	-	150 ¹	1.5	0.1	2.4	0.2	3.6
14-In Wood Piles – Impact Driver	180	148	-	2.8	0.2	5.2	0.2	6.2

*Low frequency (LF) cetaceans, Mid frequency (MF) cetaceans, High frequency (HF) cetaceans

¹All distances to the peak Level A thresholds are less than 33 feet (10 meters) except 18-in wood and concrete piles, which were measured at 16 feet

²Bubble curtain attenuation (BCA). A bubble curtain will be used for impact driving and is assumed to reduce the source level by 10dB. Therefore, source levels were reduced by this amount for take calculations.

³Either 24-in or 36-in piles will be used for the Embarcadero Plaza and East Bayside Promenade, but not both. Source levels used for 36 in piles using a vibratory hammer are also conservatively used for 24 in piles using a vibratory hammer. .

Level B thresholds (Table 5)

Impact pile driving

Measured source levels for 24- and 36-in steel piles using an impact hammer were found in a summary table for near-source unattenuated SPLs from Caltrans (2015). The average SPL for 24 in steel pipe piles was 178 dB SEL and peak at 207 dB (Caltrans 2015). The average SPL for 36 in steel pipe piles was 183 dB and peak at 210 dB (Caltrans 2015). Projects conducted under similar circumstances with similar piles were reviewed to approximate the noise effects of the 14-in wood piles. The best match for estimated noise levels is from the impact driving of timber piles at the Port of Benicia. Noise levels produced during this installation were an average of 148 dB SEL and 180 dB peak at 33 feet (10 meters) from the pile (Caltrans 2015).

Vibratory pile-driving

Measured source levels for 36-in steel piles using an impact hammer were found in a summary table for near-source unattenuated SPLs from Caltrans (2015). Because there are no representative 24 in steel pipe piles installed with a vibratory hammer, the 36 in steel pipe piles were used as a proxy. The average SPL for 36 in steel pipe piles (and 24 in steel pipe piles) was 175 dB rms (Caltrans 2015). This value was also used for 36 in steel pipe pile vibratory extraction.

Approximately 350 wood and concrete piles, 12- to 18-in in diameter, will be removed using a vibratory pile-driver. With the vibratory hammer activated, an upward force would be applied to the pile to remove it from the sediment. On average, 12 of these piles will be extracted per work day. Extraction time needed for each pile may vary greatly, but could require approximately 400 seconds (approximately 7 minutes) from an APE 400B King Kong or similar

driver. The most applicable noise values for wooden pile removal from which to base estimates for the terminal expansion project are derived from measurements taken at the Port Townsend dolphin pile removal in the State of Washington. During vibratory pile extraction associated with this project, measured peak noise levels were approximately 164 dB at 16 m, and the rms was approximately 150 dB (WSDOT 2011). Applicable sound values for the removal of concrete piles could not be located, but they are expected to be similar to the levels produced by wooden piles described above, because they are similarly sized, nonmetallic, and will be removed using the same methods. These same values will be used as a proxy for the vibratory driving of 14 in wood piles. It is estimated that an average of four of these piles will be installed per day with a vibratory hammer.

Tables 4 and 5 show the expected underwater sound levels for pile driving activities and the estimated distances to the Level A (Table 4) and Level B (Table 5) thresholds.

Table 5. Expected Pile-Driving Noise Levels and Distances of Level B Threshold Exceedance with Impact and Vibratory Driver.

Project Element Requiring Pile Installation	Source Levels at 10 meters (dB rms)	Distance to Level B Threshold, in meters ¹	Area of Potential Level B Threshold Exceedance in square kilometers ¹
		160/120 dB RMS (Level B) ²	
South Basin Pile Demolition and Removal			
18-In Wood Piles – Vibratory Extraction	150*	1,600	2.98
18-In Concrete Piles – Vibratory Extraction	150*	1,600	2.98
36-In Steel Piles – Vibratory Extraction	175	46,416	115.27
Embarcadero Plaza and East Bayside Promenade³			
36-In Steel Piles – Vibratory Driver	175	46,416	115.27
36-In Steel Piles – Impact Driver (BCA)	193 ⁴	341	0.18
24-In Steel Piles – Vibratory Driver	175	46,416	115.27

24-In Steel Piles – Impact Driver (BCA)	194 ⁴	398	0.23
Fender Piles			
14-In Wood Piles- Vibratory Driver	150*	1,600	2.98
14-In Wood Piles – Impact Driver	165	22	0.002

*This value was measured at 16m (not 10m)

¹Where noise will not be blocked by land masses or other solid structures.

²For underwater noise, the Level B harassment (disturbance) threshold is 160 dB for impulsive noise and 120 dB for continuous noise.

³Either 24-in or 36-in piles will be used for the Embarcadero Plaza and East Bayside Promenade, but not both. To be conservative, 36-in piles were used in the take estimation.

⁴Bubble curtain attenuation (BCA). A bubble curtain will be used for impact driving and is expected to reduce the source level by 10dB

Marine Mammal Densities

At-sea densities for marine mammal species have been determined for harbor seals and California sea lions in San Francisco Bay based on marine mammal monitoring by Caltrans for the San Francisco-Oakland Bay Bridge Project from 2000 to 2015 (Caltrans 2016); all other estimates here are determined by using observational data taken during marine mammal monitoring associated with the Richmond-San Rafael Bridge retrofit project, the San Francisco-Oakland Bay Bridge (SFOBB), which has been ongoing for the past 15 years, and anecdotal observational reports from local entities.

Description of Take Calculation

All estimates are conservative and include the following assumptions:

- All pilings installed at each site would have an underwater noise disturbance equal to the piling that causes the greatest noise disturbance (*i.e.*, the piling farthest from shore) installed with the method that has the largest zone of influence (ZOI). The largest underwater disturbance (Level B) ZOI would be produced by vibratory driving steel piles; therefore take estimates were calculated using the vibratory pile-driving ZOIs. The ZOIs for each threshold are not spherical and are truncated by land masses on either side of the channel which would dissipate sound pressure waves.
- Exposures were based on estimated total of 106 work days. Each activity ranges in amount of days needed to be completed.

- In absence of site specific underwater acoustic propagation modeling, the practical spreading loss model was used to determine the ZOI.
- All marine mammal individuals potentially available are assumed to be present within the relevant area, and thus incidentally taken;
- An individual can only be taken once during a 24-hour period; and,
- Exposures to sound levels at or above the relevant thresholds equate to take, as defined by the MMPA.

The estimation of marine mammal takes typically uses the following calculation:

For harbor seals and California sea lions: Level B exposure estimate = D (density * Area of ensonification) * Number of days of noise generating activities.

For all other marine mammal species: Level B exposure estimate = N (number of animals) in the area * Number of days of noise generating activities.

To account for the increase in California sea lion density due to El Niño, the daily take estimated from the observed density has been increased by a factor of 10 for each day that pile driving or removal occurs.

There are a number of reasons why estimates of potential instances of take may be overestimates of the number of individuals taken, assuming that available density or abundance estimates and estimated ZOI areas are accurate. We assume, in the absence of information supporting a more refined conclusion, that the output of the calculation represents the number of individuals that may be taken by the specified activity. In fact, in the context of stationary activities such as pile driving and in areas where resident animals may be present, this number represents the number of instances of take that may accrue to a smaller number of individuals, with some number of animals being exposed more than once per individual. While pile driving and removal can occur any day throughout the in-water work window, and the analysis is

conducted on a per day basis, only a fraction of that time (typically a matter of hours on any given day) is actually spent pile driving/removal. The potential effectiveness of mitigation measures in reducing the number of takes is typically not quantified in the take estimation process. For these reasons, these take estimates may be conservative, especially if each take is considered a separate individual animal, and especially for pinnipeds.

Table 6 lists the total estimated instances of expected take.

Table 6. Calculations for Incidental Take Estimation.

Pile Type	Pile-Driver Type	# of driving Days	Authorized Take by Level B Harassment						
			Harbor Seal	CA Sea Lion ¹	Northern Elephant Seal ²	Harbor Porpoise ²	Gray Whale ²	Northern fur seal ²	Bottlenose dolphin ²
Wood/concrete pile removal	Vibratory	30	74	80	NA	NA	NA	NA	NA
36-in dolphin pile removal	Vibratory	1	96	100	NA	NA	NA	NA	NA
Embarcadero Plaza 36-in steel piles	Vibratory ³	65	6,219	6,743	NA	NA	NA	NA	NA
14-in wood pile	Vibratory ³	10	25	27	NA	NA	NA	NA	NA
Project Total (2016) ⁴		106	6,414	6,950	26	9	2	10	30

¹ To account for potential El Niño conditions, take calculated from at-sea densities for California sea lion has been increased by a factor of 10.

² Take is not calculated by activity type for these species with a low potential to occur, only a yearly total is given.

³ Piles of this type may also be installed with an impact hammer, which would reduce the estimated take.

⁴ This total assumes the more conservative use of 36-in steel piles used for the Embarcadero Plaza; however, an alternative would be to use 24 in steel piles, which would result in smaller take numbers.

Description of Marine Mammals in the Area of the Specified Activity.

Harbor Seals

Monitoring of marine mammals in the vicinity of the SFOBB has been ongoing for 15 years; from those data, Caltrans has produced at-sea density estimates for Pacific harbor seal of 0.83 animals per square kilometer for the fall season (Caltrans 2016). Using this density, the potential average daily take for the areas over which the Level B harassment thresholds may be exceeded are estimated in Table 7.

Table 7. Take Calculation for Harbor Seal.

Activity	Pile type	Density	Area (km ²)	Number of days of activity	Take estimate
Vibratory driving and extraction	36-in steel pile ¹	0.83 animal/km ²	115.27	65; 1	6,219; 96
Vibratory extraction	18-in Wood and concrete piles	0.83 animal/km ²	2.98	30	74
Vibratory driving	14-in Wood piles	0.83 animal/km ²	2.98	10	25

¹The more conservative use of 36-in steel piles for the Embarcadero Plaza was used here; however, an alternative would be to use 24 in steel piles, which would result in smaller take numbers (2,054 vs 4,668)

A total of 6,414 harbor seal takes are estimated for 2017 (Table 6). This take number changed from the proposed rule based on changes to the source levels used for equipment type. Level A take is not expected for harbor seal based on area of ensonification and density of the animals in that area. While the Level A zone is relatively large for this hearing group (approximately 270 m), there will be 2 MMOs monitoring the zone in the most advantageous locations to spot marine mammals. If a harbor seal (or any other marine mammal) is seen approaching the Level A zone, a shutdown will be in place. We do not anticipate that Level A harassment will occur.

California sea lion

Monitoring of marine mammals in the vicinity of the SFOBB has been ongoing for 15 years; from those data, Caltrans has produced at-sea density estimates for California sea lion of 0.09 animal per square kilometer for the post-breeding season (Caltrans 2016). Using this density, the potential average daily take for the areas over which the Level B harassment thresholds may be exceeded is estimated in Table 8.

Table 8. Take Calculation for California Sea Lion.

Activity	Pile type	Density	Area (km ²)	Number of days of activity	Take Estimate
Vibratory driving and extraction	36-in steel pile ¹	0.09 animal/km ²	115.27	65; 1	6,743*; 100*
Vibratory extraction	18-in Wood and concrete piles	0.09 animal/km ²	2.98	30	80*
Vibratory driving	14-in Wood piles	0.09 animal/km ²	2.98	10	27*

* All California sea lion estimates were multiplied by 10 to account for the increased occurrence of this species due to El Niño.

¹The more conservative use of 36-in steel piles for the Embarcadero Plaza was used here; however, an alternative would be to use 24 in steel piles, which would result in smaller take numbers (2,230 vs 5,060)

All California sea lion estimates were multiplied by 10 to account for the increased occurrence of this species due to El Niño. A total of 6,950 California sea lion takes is estimated for 2017 (Table 6). This take number changed from the proposed rule based on changes to the source levels used for equipment type. Level A take is not expected for California sea lion based on area of ensonification and density of the animals in that area.

Northern elephant seal

Monitoring of marine mammals in the vicinity of the SFOBB has been ongoing for 15 years; from those data, Caltrans has produced an estimated at-sea density for northern elephant seal of 0.03 animal per square kilometer (Caltrans, 2016). Most sightings of northern elephant seal in San Francisco Bay occur in spring or early summer, and are less likely to occur during the periods of in-water work for this project (June through November). As a result, densities during pile driving and removal for the planned action would be much lower. Therefore, we estimate that it is possible that a lone northern elephant seal may enter the Level B harassment area once per week during pile driving or removal, for a total of 26 takes in 2017 (Table 6). Level A take of Northern elephant seal is not requested, nor is it authorized because although one animal may approach the large Level B zones, it is not expected that it will continue in the area of ensonification into the Level A zone. Further, if the animal does approach the Level A zone, construction will be shut down. We do not anticipate that Level A harassment will occur.

Northern fur seal

During the breeding season, the majority of the worldwide population is found on the Pribilof Islands in the southern Bering Sea, with the remaining animals spread throughout the North Pacific Ocean. On the coast of California, small breeding colonies are present at San Miguel Island off southern California, and the Farallon Islands off central California (Carretta *et al.*, 2014). Northern fur seals are a pelagic species and are rarely seen near the shore away from breeding areas. Juveniles of this species occasionally strand in San Francisco Bay, particularly during El Niño events, for example, during the 2006 El Niño event, 33 fur seals were admitted to the Marine Mammal Center (TMMC 2016). Some of these stranded animals were collected from shorelines in San Francisco Bay. Due to the recent El Niño event, northern fur seals were observed in San Francisco Bay more frequently, as well as strandings all along the California coast and inside San Francisco Bay (TMMC, personal communication); a trend that may continue this summer through winter if El Niño conditions occur. Because sightings are normally rare; instances recently have been observed, but are not common, and based on estimates from local observations (TMMC, personal communication), it is estimated that ten northern fur seals will be taken in 2017 (Table 6). Level A take is not requested or authorized for this species.

Harbor porpoise

In the last six decades, harbor porpoises were observed outside of San Francisco Bay. The few harbor porpoises that entered were not sighted past central Bay close to the Golden Gate Bridge. In recent years, however, there have been increasingly common observations of harbor porpoises in central, north, and south San Francisco Bay. Porpoise activity inside San Francisco Bay is thought to be related to foraging and mating behaviors (Keener 2011; Duffy 2015). According to observations by the Golden Gate Cetacean Research team as part of their multi-

year assessment, over 100 porpoises may be seen at one time entering San Francisco Bay; and over 600 individual animals are documented in a photo-ID database. However, sightings are concentrated in the vicinity of the Golden Gate Bridge and Angel Island, north of the project area, with lesser numbers sighted south of Alcatraz and west of Treasure Island (Keener 2011). Harbor porpoise generally travel individually or in small groups of two or three (Sekiguchi 1995).

Monitoring of marine mammals in the vicinity of the SFOBB has been ongoing for 15 years. From those data, Caltrans has produced an estimated at-sea density for harbor porpoise of 0.021 animal per square kilometer (Caltrans 2016). However, this estimate would be an overestimate of what would actually be seen in the project area. In order to estimate a more realistic take number, we assume it is possible that a small group of individuals (three harbor porpoises) may enter the Level B harassment area on as many as three days of pile driving or removal, for a total of nine harbor porpoise takes per year (Table 6). It is possible that harbor porpoise may enter the Level A harassment zone for high frequency cetaceans. However, two MMOs will be monitoring the area and WETA will implement a shutdown for the entire zone if a harbor porpoise (or any other marine mammal) approaches the Level A zone, therefore, Level A take is not being requested, nor authorized for this species.

Gray whale

Historically, gray whales were not common in San Francisco Bay. The Oceanic Society has tracked gray whale sightings since they began returning to San Francisco Bay regularly in the late 1990s. The Oceanic Society data show that all age classes of gray whales are entering San Francisco Bay, and that they enter as singles or in groups of up to five individuals. However, the data do not distinguish between sightings of gray whales and number of individual whales

(Winning 2008). Caltrans Richmond-San Rafael Bridge project monitors recorded 12 living and two dead gray whales in the surveys performed in 2012. All sightings were in either the central or north Bay; and all but two sightings occurred during the months of April and May. One gray whale was sighted in June, and one in October (the specific years were unreported). It is estimated that two to six gray whales enter San Francisco Bay in any given year. Because construction activities are only occurring during a maximum of 106 days in 2017, it is estimated that two gray whales may potentially enter the area during the construction period, for a total of 2 gray whale takes in 2017 (Table 6).

Bottlenose dolphin

Since the 1982-83 El Niño, which increased water temperatures off California, bottlenose dolphins have been consistently sighted along the central California coast (Carretta *et al.*, 2008). The northern limit of their regular range is currently the Pacific coast off San Francisco and Marin County, and they occasionally enter San Francisco Bay, sometimes foraging for fish in Fort Point Cove, just east of the Golden Gate Bridge. In the summer of 2015, a lone bottlenose dolphin was seen swimming in the Oyster Point area of South San Francisco (GGCR 2016). Members of this stock are transient and make movements up and down the coast, and into some estuaries, throughout the year. Bottlenose dolphins are being observed in San Francisco bay more frequently in recent years (TMMC, personal communication). Groups with an average group size of five animals enter the bay and occur near Yerba Buena Island once per week for a two week stint and then depart the bay (TMMC, personal communication). Assuming groups of five individuals may enter San Francisco Bay approximately three times during the construction activities, and may enter the ensonified area once per week over the two week stint, we estimate 30 takes of bottlenose dolphins for 2017 (Table 6).

Mitigation Measures

In order to issue an IHA 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 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 (latter not applicable for this action). NMFS regulations require applicants for incidental take authorizations to include information about the availability and feasibility (economic and technological) of equipment, methods, and manner of conducting such activity or other means of effecting the least practicable adverse impact upon the affected species or stocks and their habitat (50 CFR 216.104(a)(11)).

In evaluating how mitigation may or may not be appropriate to ensure the least practicable adverse impact on species or stocks and their habitat, as well as subsistence uses where applicable, we carefully balance two primary factors: 1) the manner in which, and the degree to which, the successful implementation of the measure(s) is expected to reduce impacts to marine mammals, marine mammal species or stocks, and their habitat – which considers the nature of the potential adverse impact being mitigated (likelihood, scope, range), as well as the likelihood that the measure will be effective if implemented; and the likelihood of effective implementation, and; 2) the practicability of the measures for applicant implementation, which may consider such things as cost, impact on operations, and, in the case of a military readiness activity, personnel safety, practicality of implementation, and impact on the effectiveness of the military readiness activity.

Measurements from similar pile driving events were coupled with practical spreading loss to estimate zones of influence (ZOI; see *Estimated Take by Incidental Harassment*); these

values were used to develop mitigation measures for pile driving and removal activities at the ferry terminal. The ZOIs effectively represent the mitigation zone that will be established around each pile to prevent Level A harassment to marine mammals, while providing estimates of the areas within which Level B harassment might occur. In addition to the specific measures described later in this section, WETA will conduct briefings between construction supervisors and crews, marine mammal monitoring team, and WETA staff prior to the start of all pile driving activity, and when new personnel join the work, in order to explain responsibilities, communication procedures, marine mammal monitoring protocol, and operational procedures.

Monitoring and Shutdown for Construction Activities

The following measures will apply to WETA's mitigation through shutdown and disturbance zones:

Shutdown Zone – For all pile driving activities, WETA will establish a shutdown zone intended to contain the area in which SPLs equal or exceed the auditory injury criteria for cetaceans and pinnipeds. The purpose of a shutdown zone is to define an area within which shutdown of activity will occur upon sighting of a marine mammal (or in anticipation of an animal entering the defined area), thus preventing injury of marine mammals (as described previously under *Potential Effects of the Specified Activity on Marine Mammals*, serious injury or death are unlikely outcomes even in the absence of mitigation measures). Modeled radial distances for shutdown zones are shown in Table 4. However, a minimum shutdown zone of 10 m will be established during all pile driving activities, regardless of the estimated zone.

Disturbance Zone – Disturbance zones are the areas in which SPLs equal or exceed 160 and 120 dB rms (for impulse and continuous sound, respectively). Disturbance zones provide utility for monitoring conducted for mitigation purposes (*i.e.*, shutdown zone monitoring) by

establishing monitoring protocols for areas adjacent to the shutdown zones. Monitoring of disturbance zones enables observers to be aware of and communicate the presence of marine mammals in the project area but outside the shutdown zone and thus prepare for potential shutdowns of activity. However, the primary purpose of disturbance zone monitoring is for documenting instances of Level B harassment; disturbance zone monitoring is discussed in greater detail later (see *Monitoring and Reporting*). Nominal radial distances for disturbance zones are shown in Table 5.

Given the size of the disturbance zone for vibratory pile driving, it is impossible to guarantee that all animals will be observed or to make comprehensive observations of fine-scale behavioral reactions to sound, and only a portion of the zone (*e.g.*, what may be reasonably observed by visual observers stationed within the turning basin) may be observed. In order to document observed instances of harassment, monitors record all marine mammal observations, regardless of location. The observer's location, as well as the location of the pile being driven, is known from a GPS. The location of the animal is estimated as a distance from the observer, which is then compared to the location from the pile. It may then be estimated whether the animal was exposed to sound levels constituting incidental harassment on the basis of predicted distances to relevant thresholds in post-processing of observational and acoustic data, and a precise accounting of observed incidences of harassment created. This information may then be used to extrapolate observed takes to reach an approximate understanding of actual total takes.

Monitoring Protocols – Monitoring will be conducted before, during, and after pile driving and vibratory removal activities. In addition, observers shall record all instances of marine mammal occurrence, regardless of distance from activity, and shall document any behavioral reactions in concert with distance from piles being driven. Observations made outside

the shutdown zone will not result in shutdown; that pile segment would be completed without cessation, unless the animal approaches or enters the shutdown zone, at which point all pile driving activities will be halted. Monitoring will take place from 15 minutes prior to initiation through thirty minutes post-completion of pile driving and removal activities. Pile driving activities include the time to install or 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. Please see the Monitoring Plan (www.nmfs.noaa.gov/pr/permits/incidental/construction.htm), developed by WETA in agreement with NMFS, for full details of the monitoring protocols.

The following additional measures apply to visual monitoring:

(1) Monitoring will be conducted by qualified observers, who will be placed at the best vantage point(s) practicable to monitor for marine mammals and implement shutdown/delay procedures when applicable by calling for the shutdown to the hammer operator. A minimum of two observers will be required for all pile driving/removal activities. Marine Mammal Observer (MMO) requirements for construction actions are as follows:

- (a) Independent observers (*i.e.*, not construction personnel) are required;
- (b) At least one observer must have prior experience working as an observer;
- (c) Other observers (that do not have prior experience) may substitute education (undergraduate degree in biological science or related field) or training for experience;
- (d) Where a team of three or more observers are required, one observer should be designated as lead observer or monitoring coordinator. The lead observer must have prior experience working as an observer; and
- (e) NMFS will require submission and approval of observer CVs.

Qualified MMOs are trained biologists, and need the following additional minimum qualifications:

(a) 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;

(b) Ability to conduct field observations and collect data according to assigned protocols

(c) Experience or training in the field identification of marine mammals, including the identification of behaviors;

(d) Sufficient training, orientation, or experience with the construction operation to provide for personal safety during observations;

(e) Writing skills sufficient to prepare a report of observations including but not limited to the number and species of marine mammals observed; dates and times when in-water construction activities were conducted; dates and times when in-water construction activities were suspended to avoid potential incidental injury from construction sound of marine mammals observed within a defined shutdown zone; and marine mammal behavior; and

(f) 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.

(2) Prior to the start of pile driving activity, the shutdown zone will be monitored for thirty minutes to ensure that it is clear of marine mammals. Pile 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.*). In addition, if such conditions should arise during impact pile driving that is already underway, the activity will be halted.

(3) If a marine mammal approaches or enters the shutdown zone during the course of pile driving operations, the activity will be halted and delayed until either the animal has voluntarily left and been visually confirmed beyond the shutdown zone or fifteen minutes have passed without re-detection of small cetaceans and pinnipeds, and thirty minutes for gray whales. Monitoring will be conducted throughout the time required to drive a pile.

(4) Using delay and shut-down procedures, if a species for which authorization has not been granted (including but not limited to Guadalupe fur seals and humpback whales) 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, activities will shut down immediately and not restart until the animals have been confirmed to have left the area.

Soft Start

The use of a soft start procedure is believed to provide additional protection to marine mammals by warning or providing a chance to leave the area prior to the hammer operating at full capacity, and typically involves a requirement to initiate sound from the hammer at reduced energy followed by a waiting period. This procedure is repeated two additional times. It is difficult to specify the reduction in energy for any given hammer because of variation across drivers and, for impact hammers, the actual number of strikes at reduced energy will vary because operating the hammer at less than full power results in “bouncing” of the hammer as it strikes the pile, resulting in multiple “strikes.” For impact driving, we require an initial set of three strikes from the impact hammer at reduced energy, followed by a thirty-second waiting period, then two subsequent three strike sets. Soft start will be required at the beginning of each

day's impact pile driving work and at any time following a cessation of impact pile driving of thirty minutes or longer.

Sound Attenuation Devices

Two types of sound attenuation devices will be used during impact pile-driving: bubble curtains and pile cushions. WETA will employ the use of a bubble curtain during impact pile-driving, which is assumed to reduce the source level by 10 dB. Bubble curtains will not be used during impact driving of wood piles because the sound levels produced would be significantly less than those from steel piles. WETA will also employ the use of 12-in-thick wood cushion block on impact hammers to attenuate underwater sound levels.

We have carefully evaluated WETA's planned mitigation measures and considered their effectiveness in past implementation to determine whether they are likely to effect the least practicable impact on the affected marine mammal species and stocks and their habitat.

Any mitigation measure(s) we prescribe 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 number (total number or number at biologically important time or location) of individual marine mammals exposed to stimuli expected to result in incidental take (this goal may contribute to 1, above, or to reducing takes by behavioral harassment only);
- (3) A reduction in the number (total number or number at biologically important time or location) of times any individual marine mammal would be exposed to stimuli expected to

result in incidental take (this goal may contribute to 1, above, or to reducing takes by behavioral harassment only);

(4) A reduction in the intensity of exposure to stimuli expected to result in incidental take (this goal may contribute to 1, above, or to reducing the severity of behavioral harassment only);

(5) Avoidance or minimization of adverse effects to marine mammal habitat, paying particular attention to the prey base, blockage or limitation of passage to or from biologically important areas, permanent destruction of habitat, or temporary disturbance of habitat during a biologically important time; and

(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 WETA's planned measures, as well as any other potential measures that may be relevant to the specified activity, we have determined that the mitigation measures provide the means of effecting the least practicable 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 IHA 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 authorizations 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 action area. Effective reporting is critical both to compliance as well as to ensure that the most value is obtained from the required monitoring.

Monitoring and reporting requirements prescribed by NMFS should contribute to improved understanding of one or more of the following:

- Occurrence of marine mammal species in action area (*e.g.*, presence, abundance, distribution, density);
- Nature, scope, or context of likely marine mammal exposure to potential stressors/impacts (individual or cumulative, acute or chronic), through better understanding of: (1) action or environment (*e.g.*, source characterization, propagation, ambient noise); (2) affected species (*e.g.*, life history, dive patterns); (3) co-occurrence of marine mammal species with the action; or (4) biological or behavioral context of exposure (*e.g.*, age, calving or feeding areas);
- Individual marine mammal responses (behavioral or physiological) to acoustic stressors (acute, chronic, or cumulative), other stressors, or cumulative impacts from multiple stressors;
- How anticipated responses to stressors impact either: (1) Long-term fitness and survival of individual marine mammals; or (2) population, species, or stock;
- Effects on marine mammal habitat (*e.g.*, marine mammal prey species, acoustic habitat, or other important physical components of marine mammal habitat); and
- Mitigation and monitoring effectiveness.

WETA's monitoring and reporting measures are also described in their Marine Mammal Monitoring Plan, online at www.nmfs.noaa.gov/pr/permits/incidental/construction.htm.

Hydroacousting Monitoring

Hydroacoustic monitoring will be conducted in consultation with the California Department of Fish and Wildlife (CDFW) during a minimum of ten percent of all pile driving activities. The monitoring will be done in accordance with the methodology outlined in this Hydroacoustic Monitoring Plan (see WETA's Hydroacoustic Monitoring Plan online at www.nmfs.noaa.gov/pr/permits/incidental/construction.htm for more information on this plan, including the methodology, equipment, and reporting information). The monitoring will be conducted based on the following:

- Be based on the dual metric criteria (Popper *et al.*, 2006) and the accumulated SEL;
- Establish field locations that will be used to document the extent of the area experiencing 187 dB SEL accumulated;
- Establish the distance to the Marine Mammal Level A and Level B shutdown and Harassment zones;
- Describe the methods necessary to continuously measure underwater noise on a real-time basis, including details on the number, location, distance and depth of hydrophones, and associated monitoring equipment;
- Provide a means of recording the time and number of pile strikes, the peak sound energy per strike, and interval between strikes; and
- Provide all monitoring data to the CDFW and NMFS.

Visual Marine Mammal Observations

WETA will collect sighting data and behavioral responses to construction for marine mammal species observed in the region of activity during the period of activity. All marine mammal observers (MMOs) will be trained in marine mammal identification and behaviors and are required to have no other construction-related tasks while conducting monitoring. A minimum of two MMOs will be required for all pile driving/removal activities. WETA will

monitor the shutdown zone and disturbance zone before, during, and after pile driving, with observers located at the best practicable vantage points. Based on our requirements, WETA will implement the following procedures for pile driving and removal:

- MMOs will be located at the best vantage point(s) in order to properly see the entire shutdown zone and as much of the disturbance zone as possible;
- During all observation periods, observers will use binoculars and the naked eye to search continuously for marine mammals;
- If the shutdown zones are obscured by fog or poor lighting conditions, pile driving at that location will not be initiated until that zone is visible. Should such conditions arise while impact driving is underway, the activity will be halted; and
- The shutdown and disturbance zones around the pile will be monitored for the presence of marine mammals before, during, and after any pile driving or removal activity.

Individuals implementing the monitoring protocol will assess its effectiveness using an adaptive approach. The monitoring biologists will use their best professional judgment throughout implementation and seek improvements to these methods when deemed appropriate. Any modifications to protocol will be coordinated between NMFS and WETA.

In additions, the MMO(s) will survey the potential Level A and nearby Level B harassment zones (areas within approximately 2,000 feet of the pile-driving area observable from the shore) on 2 separate days—no earlier than 7 days before the first day of construction—to establish baseline observations. Monitoring will be timed to occur during various tides (preferably low and high tides) during daylight hours from locations that are publicly accessible (*e.g.*, Pier 14 or the Ferry Plaza). The information collected from baseline monitoring will be used for comparison with results of monitoring during pile-driving activities.

Data Collection

We require that observers use approved data forms. Among other pieces of information, WETA will record detailed information about any implementation of shutdowns, including the distance of animals to the pile and description of specific actions that ensued and resulting behavior of the animal, if any. In addition, WETA will attempt to distinguish between the number of individual animals taken and the number of incidences of take. We require that, at a minimum, the following information be collected on the sighting forms:

- Date and time that monitored activity 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);
- Species, numbers, and, if possible, sex and age class of marine mammals;
- Description of any observable marine mammal behavior patterns, including bearing and direction of travel, and if possible, the correlation to SPLs;
- Distance from pile driving or removal activities to marine mammals and distance from the marine mammals to the observation point;
- Description of implementation of mitigation measures (*e.g.*, shutdown or delay);
- Locations of all marine mammal observations; and
- Other human activity in the area.

Hydroacousting Monitoring

Hydroacoustic monitoring will be conducted in consultation with the CDFW during a minimum of ten percent of all pile driving activities (*i.e.*, the first two piles of the 24-in and 36-in

piles). The monitoring will be done in accordance with the methodology outlined in this Hydroacoustic Monitoring Plan. The monitoring will be conducted based on the following:

- Be based on the dual metric criteria (Popper *et al.*, 2006) and the accumulated SEL;
- Establish field locations that will be used to document the extent of the area experiencing 187 dB SEL accumulated;
- Establish the distance to the Marine Mammal Level A and Level B shutdown and Harassment zones;
- Describe the methods necessary to continuously measure underwater noise on a real-time basis, including details on the number, location, distance and depth of hydrophones, and associated monitoring equipment;
- Provide a means of recording the time and number of pile strikes, the peak sound energy per strike, and interval between strikes; and
- Provide all monitoring data to the CDFW and NMFS.

Reporting

A draft report will be submitted to NMFS within 90 days of the completion of marine mammal monitoring, or sixty days prior to the requested date of issuance of any future IHA for projects at the same location, whichever comes first. The report will include marine mammal observations pre-activity, during-activity, and post-activity during pile driving and removal days, and will also provide descriptions of any behavioral responses to construction activities by marine mammals and a complete description of all mitigation shutdowns and the results of those actions and an extrapolated total take estimate based on the number of marine mammals observed during the course of construction. A final report must be submitted within 30 days following resolution of comments on the draft report.

Analyses and Determinations

Negligible Impact Analysis

NMFS has defined negligible impact 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 (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 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 harassment, NMFS considers other factors, such as the likely nature of any responses (*e.g.*, intensity, duration), the context of any responses (*e.g.*, critical reproductive time or location, migration), as well as effects on habitat, and the likely effectiveness of the mitigation. We also assess the number, intensity, and context of estimated takes by evaluating this information relative to population status. Consistent with the 1989 preamble for NMFS’s implementing regulations (54 FR 40338; September 29, 1989), the impacts from other past and ongoing anthropogenic activities are incorporated into this analysis via their impacts on the environmental baseline (*e.g.*, as reflected in the regulatory status of the species, population size and growth rate where known, ongoing sources of human-caused mortality, or ambient noise levels).

Pile driving and removal activities associated with the ferry terminal construction project, as outlined previously, have the potential to disturb or displace marine mammals. Specifically, the specified activities may result in take, in the form of Level B harassment (behavioral disturbance) only, from underwater sounds generated from pile driving and removal. Potential takes could occur if individuals of these species are present in the ensonified zone when pile driving and removal occurs.

No injury, serious injury, or mortality is anticipated given the nature of the activities and measures designed to minimize the possibility of injury to marine mammals. The potential for these outcomes is minimized through the construction method and the implementation of the planned mitigation measures. Specifically, vibratory hammers will be the primary method of installation (impact driving is included only as a contingency). Impact pile driving produces short, sharp pulses with higher peak levels and much sharper rise time to reach those peaks. If impact driving is necessary, implementation of soft start and shutdown zones significantly reduces any possibility of injury. Given sufficient “notice” through use of soft start (for impact driving), marine mammals are expected to move away from a sound source that is annoying prior to it becoming potentially injurious. WETA will also employ the use of 12-in-thick wood cushion block on impact hammers, and a bubble curtain as sound attenuation devices. Environmental conditions in San Francisco Ferry Terminal mean that marine mammal detection ability by trained observers is high, enabling a high rate of success in implementation of shutdowns to avoid injury.

WETA’s activities are localized and of relatively short duration (a maximum of 106 days for pile driving and removal in the first year). The entire project area is limited to the San Francisco ferry terminal area and its immediate surroundings. These localized and short-term noise exposures may cause short-term behavioral modifications in harbor seals, northern fur seals, northern elephant seals, California sea lions, harbor porpoises, bottlenose dolphins, and gray whales. Moreover, the planned mitigation and monitoring measures are expected to reduce the likelihood of injury and behavior exposures. Additionally, no important feeding and/or reproductive areas for marine mammals are known to be within the ensonified area during the construction time frame.

The project also is not expected to have significant adverse effects on affected marine mammals' habitat. The project activities will not modify existing marine mammal habitat for a significant amount of time. The activities may cause some fish to leave the area of disturbance, thus temporarily 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.

Effects on individuals that are taken by Level B harassment, on the basis of reports in the literature as well as monitoring from other similar activities, will likely be limited to reactions such as increased swimming speeds, increased surfacing time, or decreased foraging (if such activity were occurring) (*e.g.*, Thorson and Reyff 2006; Lerma 2014). Most likely, individuals will simply move away from the sound source and be temporarily displaced from the areas of pile driving, although even this reaction has been observed primarily only in association with impact pile driving. Thus, even repeated Level B harassment of some small subset of the overall stock is unlikely to result in any significant realized decrease in fitness for the affected individuals, and thus will not result in any adverse impact to the stock as a whole.

In summary and as described above, the following factors primarily support our determination that the impacts resulting from this activity are not expected to adversely affect the species or stock through effects on annual rates of recruitment or survival:

- No mortality or serious injury is anticipated or authorized;
- Injurious takes are not expected due to the presumed efficacy of the planned mitigation measures in reducing the effects of the specified activity to the level of least practicable impact;
- Level B harassment may consist of, at worst, temporary modifications in behavior (*e.g.*, temporary avoidance of habitat or changes in behavior);

- The lack of important feeding, pupping, or other areas in the action area;
- The high level of ambient noise already in the ferry terminal area; and
- The small percentage of the stock that may be affected by project activities (< 21 percent for all species).

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 planned monitoring and mitigation measures, NMFS finds that the total marine mammal take from WETA's ferry terminal construction activities will have a negligible impact on the affected marine mammal species or stocks.

Small Numbers Analysis

Table 9 details the number of instances that animals could be exposed to received noise levels that could cause Level B behavioral harassment for the planned work at the ferry terminal project site relative to the total stock abundance. The numbers of animals authorized to be taken for all species are considered small relative to the relevant stocks or populations even if each estimated instance of take occurred to a new individual – an extremely unlikely scenario. The total percent of the population (if each instance was a separate individual) for which take is requested is approximately 21 percent for harbor seals, approximately 7 percent for bottlenose dolphins, less than 3 percent for California sea lions, and less than 1 percent for all other species (Table 9). For pinnipeds, especially harbor seals occurring in the vicinity of the ferry terminal, there will almost certainly be some overlap in individuals present day-to-day, and the number of individuals taken is expected to be notably lower. We find that small numbers of marine mammals will be taken relative to the populations of the affected species or stocks.

Table 9. Estimated Numbers and Percentage of Stock That May Be Exposed to Level B Harassment.

Species	Authorized Takes	Stock(s) Abundance Estimate ¹	Percentage of Total Stock (%)
Harbor Seal (<i>Phoca vitulina</i>) <i>California stock</i>	6,414	30,968	20.7
California sea lion (<i>Zalophus californianus</i>) <i>U.S. Stock</i>	6,950	296,750	2.34
Northern elephant seal (<i>Mirounga angustirostris</i>) <i>California breeding stock</i>	26	179,000	0.015
Northern fur seal (<i>Callorhinus ursinus</i>) <i>California stock</i>	10	14,050	0.07
Harbor Porpoise (<i>Phocoena phocoena</i>) <i>San Francisco-Russian River Stock</i>	9	9,886	0.09
Gray whale (<i>Eschrichtius robustus</i>) <i>Eastern North Pacific stock</i>	2	20,990	0.01
Bottlenose dolphin (<i>Tursiops truncatus</i>) <i>California coastal stock</i>	30	453	6.6

¹ All stock abundance estimates presented here are from the 2015 Pacific Stock Assessment Report

Unmitigable Adverse Impact Analysis and Determination

There are no relevant subsistence uses of the affected marine mammal stocks or species implicated by this action. Therefore, NMFS has determined that the total taking of affected species or stocks will not have an unmitigable adverse impact on the availability of such species or stocks for taking for subsistence purposes.

Endangered Species Act (ESA)

No incidental take of ESA-listed marine mammal species is authorized or expected to result from these activities. Therefore, NMFS has determined that formal consultation under Section 7 of the ESA is not required for this action.

National Environmental Policy Act (NEPA)

NMFS published an EA in 2016 on WETA’s ferry terminal construction activities. NMFS found that there would be no significant impacts to the human environment and signed a finding of no significant impact (FONSI) on June 28, 2016. Because the activities and analysis

are the same as WETA's 2016 activities, NMFS determined that a new or supplemental EA is not required for WETA's 2017 activities.

Authorization

NMFS has issued an IHA to WETA for the potential harassment of small numbers of seven species of marine mammals incidental to the San Francisco Ferry Terminal, South Basin Improvements Project in San Francisco, CA, provided the previously mentioned mitigation, monitoring, and reporting.

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