Marine Mammal Protection Act
Letter of Authorization Request

San Francisco-Oakland Bay Bridge East Span Seismic Safety Project
Dismantling of the Existing East Span

Alameda County and San Francisco County
District 4 – Interstate 80
EA 04-0120T1 & 04-012091

April 2012

Caltrans
CALIFORNIA DEPARTMENT OF TRANSPORTATION

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Request for Letter of Authorization for the Incidental Harassment of Marine Mammals Resulting From Activities Associated with the Dismantling of the Existing East Span of the San Francisco-Oakland Bay Bridge

Alameda County and San Francisco County
District 4 – Interstate 80
EA 04-0120T1 & 04-012091

April 2012

STATE OF CALIFORNIA
Department of Transportation

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Abbreviated Terms

µPa	micro Pascal
Bay	San Francisco Bay
BCDC	San Francisco Bay Conservation and Development Commission
Caltrans/Department	California Department of Transportation
CIDH	cast-in-drill-hole
dB	decibel(s)
dBA	A-weighted decibel(s)
DMMO	Dredged Material Management Office
ESA	Endangered Species Act
IHA	Incidental Harassment Authorization
LOA	Letter of Authorization
NMFS	National Marine Fisheries Service
MCE	maximum credible earthquake
MMPA	Marine Mammal Protection Act
MMSZ	marine mammal safety zone
RMS	root mean square
SAS	Self-Anchored Suspension
SFOBB	San Francisco-Oakland Bay Bridge
SFOBB Project	San Francisco-Oakland Bay Bridge East Span Seismic Safety Project
USCG	United States Coast Guard
YBI	Yerba Buena Island
ZOI	zone of influence

1. DETAILED DESCRIPTION OF THE ACTIVITY

The California Department of Transportation (Department) is replacing the east span of the San Francisco-Oakland Bay Bridge (SFOBB) with a new bridge immediately to the north of the existing span. The SFOBB East Span Seismic Safety Project (SFOBB Project) includes both the construction of the new east span and the dismantling of the existing east span. The Department is requesting a Letter of Authorization (LOA) to allow for the potential incidental take of marine mammals resulting from the dismantling of the existing east span and limited in-water construction activities related to the completion of the new east span.

1.1. Background and Project History

The SFOBB is a critical transportation component of the San Francisco Bay Area's transportation network that provides regional access between the San Francisco Peninsula and the East Bay. Approximately 280,000 vehicles currently use the SFOBB, part of Interstate 80, each day. The SFOBB Project will provide a seismically upgraded vehicular crossing for current and future users. The existing east span is being replaced because it is not expected to withstand a maximum credible earthquake (MCE)[1] on the San Andreas or Hayward faults, it does not meet lifeline[2] criteria for providing emergency relief access following a MCE, and it does not meet current operational and safety design standards.

Dismantling of the existing SFOBB east span is an important element of overall seismic safety and completion of the project. While in place, the structural vulnerability of the existing east span is a threat to the new bridge, its users, marine traffic and the environment. The United States Coast Guard (USCG) requires removal of the existing bridge for the safety of marine traffic once the replacement bridge is constructed. The dismantling of the existing bridge will remove a potential source of lead and other hazardous materials from the San Francisco Bay (Bay). The San Francisco Bay Conservation and Development Commission's (BCDC) permit for the SFOBB Project also requires the removal of the existing bridge as mitigation for Bay fill associated with construction of the new east span.

1.1.1. New East Span

Construction activities for the replacement of the east span of the SFOBB commenced in 2002 and are currently ongoing.

The new bridge will consist of four structural sections including (1) the Yerba Buena Island (YBI) Transition Structure, (2) the Self-Anchored Suspension (SAS) Span, (3) the Skyway, and (4) the Oakland Touchdown. Construction of the Skyway was completed in 2007. The remaining three structural sections are currently under construction. The entire Skyway and portions of both the SAS and Oakland Touchdown span the Bay and have required in-water construction.

[1] An MCE is the largest earthquake reasonably capable of occurring, based on current geological knowledge.
[2] Lifelines are the systems and facilities that provide services vital to the function of an industrialized society and are critical to the emergency response and recovery after a natural disaster. These systems and facilities include hospitals, fire control and policing, food distribution, communication, electric power, liquid fuel, natural gas, transportation (airports, highways, ports, rail, and transit), water, and wastewater.

The foundations for the piers of the new east span consist of large-diameter steel pipe piles driven into the Bay floor. Construction of pier foundations required driving a total of 259 in-Bay large-diameter permanent steel pipe piles. Of these, 189 piles were 2.5 meters (8.2 feet) in diameter and 70 piles were 1.8 meters (5.9 feet) in diameter. The larger 2.5-meter (8.2-foot) diameter piles support the Skyway and SAS sections of the replacement bridge, and were driven to depths ranging from about -66 meters to about -108 meters (about -217 feet to about -354 feet). The smaller 1.8-meter (5.9-foot) diameter piles support the Oakland Touchdown structures, and were driven to tip elevations ranging from about -41 meters to about -65 meters (-135 feet to about –213 feet). All in-Bay pier foundations for the new east span have been constructed and the driving of in-Bay large-diameter permanent steel pile piles was complete, as of 2009.

To construct all permanent structures, it was necessary to install temporary piles to support temporary structures, supports, falsework, and trestles. These temporary structures were required to facilitate construction and support the permanent structures until they were self-supporting. Since the temporary structures were contractor-designed, their exact nature (size, type, quantity, etc.) was not known until the contractors submitted their plans to the Department. To date a total of 2,180 temporary piles have been installed. This includes H-piles, cast-in-drill-hole (CIDH) piles and steel pipe piles ranging from 0.61 meter (24 inches) to 1.52 meters (60 inches) in diameter. All in-water temporary pile installation for the construction of the east span was complete, as of 2009.

On November 10, 2003, the National Marine Fisheries Service (NMFS) issued an Incidental Harassment Authorization (IHA) to the Department, authorizing the take of a small number of marine mammals incidental to the construction of the SFOBB Project. The authorization was issued based on information provided in the Department's IHA request submitted in September 2001 (Caltrans 2001b). The Department was issued four subsequent IHAs (Caltrans 2005, 2007, 2009 and 2011) for the SFOBB Project based on monitoring reports (Caltrans 2004a, 2004b, 2006, 2010) and information provided in IHA renewal requests.

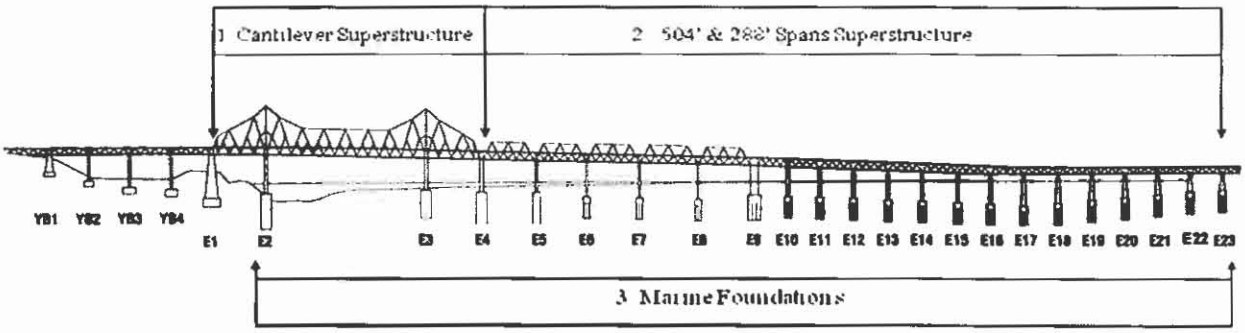
The Department has adhered to all mitigation, monitoring and reporting requirements of its IHAs. During all in-water permanent impact pile driving a marine pile driving energy attenuator (i.e., air bubble curtain system) (see Appendix A: Marine Pile Driving Energy Attenuator) or dewatered cofferdam was used to attenuate sound pressure levels. Hydroacoustic data were collected to determine and verify the radii of the marine mammal safety zones (MMSZs). Marine mammal monitoring was performed by qualified NMFS-approved observers prior to, during and following all in-water permanent impact pile driving (but not within a dewatered cofferdam), and during the impact and vibratory driving of temporary piles for the SAS temporary tower. As part of the monitoring effort, a control site was established at a harbor seal haul-out located at Point Bonita, approximately 14.5 kilometers (9 miles) northwest of the project area; this site was selected due to its distance from the Project thereby removing the potential for project-related impacts. During both permanent in-water pile driving and the driving of temporary piles to construct SAS temporary towers, twice-weekly monitoring was performed at the harbor seal haul-out on YBI and the control site.

To prepare a LOA application, the Department has evaluated monitoring data collected through the course of the SFOBB Project to assess potential incidental take from remaining construction activities.

1.1.2. Existing East Span

Construction of the existing east span connecting YBI and the Oakland shoreline was completed in 1936. The east span is a double-deck structure 3,696 meters (12,127 feet) in length and approximately 18 meters (58 feet) wide, carrying five traffic lanes in east-and westbound directions. The east span is supported by 22 in-water bridge piers (Piers E2 through E23), as well as land-based bridge piers and bents on both YBI and Oakland. As shown in Figure 1-1 below, the existing east span can be divided into three major sections.

Figure 1-1. Schematic of the Existing East Span



1. Cantilever Superstructure – The Cantilever section is comprised of three major elements: two cantilever anchor arm elements that are 154.8 meters (508 feet) long and 156 meters (512 feet) long, respectively; and a 426.7-meter (1,400-foot) long main span over the navigation channel consisting of a suspended segment which is supported on either side by anchor arms. The superstructure of this segment includes the trusses, road deck and steel support towers.

2. 504' & 288' Spans Superstructure – This segment of the bridge is comprised of five 153.6-meter (504-foot) long steel truss spans and fourteen 87.8-meter (288-foot) long steel truss spans. The vertical clearance beneath the 504-foot spans is approximately 50 meters (165 feet) above mean high water levels, while the vertical clearance beneath the 288-foot spans varies greatly as the structure descends towards the Oakland shoreline. The superstructure of this segment includes the trusses, road deck and steel and/or concrete support towers.

3. Marine Foundations - The in-water or marine foundations vary in type. Piers E2 through E5 consist of concrete caissons founded on deep bedrock. Piers E6 through E23 consist of lightly reinforced concrete foundations that are supported by timber piles.

1.2. Activities with the Potential to Result in Incidental Take of Marine Mammals

Construction activities associated with both the completion of new east span construction and the dismantling of the existing east span have the potential to result in the incidental take of marine mammals.

1.2.1. Completion of New East Span Construction

All in-water pile driving of both permanent and temporary piles for the construction of the new east span is complete. The only remaining in-water work with the potential to result in the incidental take of marine mammals will be the removal of temporary piles. Temporary piles may be cut off 0.46 meter (1.5 feet) below the mud line or completely removed. The removal of piles may employ the use of a vibratory pile driver/extractor.

1.2.2. Dismantling of the Existing East Span

East span dismantling activities with the potential to result in incidental take of marine mammals may include: dredging and dredged material disposal, vibratory and impact driving of temporary piles, and dismantling of marine foundations by mechanical means.

1.2.2.1. Dredging and Dredged Material Disposal

Due to shallow water depth near the Oakland shore, dredging may be required to create a barge access channel to dismantle the existing bridge. Dredging will also be required to remove piers from the existing bridge. It is anticipated that 145,785 cubic meters (190,680 cubic yards) of material would be dredged to create the barge access channel for dismantling the existing bridge. This material may be disposed of at the San Francisco Deep Ocean disposal site, at an upland wetland reuse site, or at a landfill reuse site, as directed by the Dredged Material Management Office[3] (DMMO). For removal of the existing piers, it is anticipated that 17,374 cubic meters (22,724 cubic yards) of material will be dredged. This material may be disposed of at the Alcatraz Island disposal site, or as directed by the DMMO.

1.2.2.2. Vibratory and Impact Driving of Temporary Piles

The Department anticipates that two temporary access trestles and in-water falsework may be required to dismantle the existing bridge. These temporary structures, to be designed by the contractor, may be required to facilitate support of the existing east span until it is completely removed and provide for construction access. Since the temporary structures will be contractor-designed, their exact nature (size, type, number of piles, etc.) will not be known until the dismantling begins. However, the Department has developed conservative estimates as to the approximate size, location and number of piles needed for these temporary structures. The anticipated temporary structures are described below and the quantity and size of piles needed to support these structures are presented in Table 1-1.

[3] The DMMO is a joint program of BCDC, San Francisco Bay Regional Water Quality Control Board, State Lands Commission, the San Francisco District U.S. Army Corps of Engineers, and the U.S. Environmental Protection Agency. Other participating agencies include the California Department of Fish and Game, the NMFS, and the U.S. Fish and Wildlife Service who provide advice and expertise. The purpose of the DMMO is to cooperatively review sediment quality sampling plans, analyze the results of sediment quality sampling and make suitability determinations for material proposed for disposal in the San Francisco Bay.

Two trestles may be needed to facilitate construction access and allow for the off-haul of materials. One of the trestles would extend into the Bay from the YBI shoreline (YBI Access Trestle). The other trestle would extend into the Bay from the Oakland shoreline (Oakland Access Trestle).

YBI Access Trestle: It is anticipated that a small, approximately 650 square meter (7,000 square foot), H-pile supported trestle would be constructed on the southeast side of YBI. The YBI Access Trestle would primarily be used for the off-haul of materials during the dismantling of the cantilever superstructure. Installation of the YBI Access Trestle is anticipated as one of the first orders of work for the dismantling and would likely be constructed during summer or fall 2012.

Oakland Access Trestle: It is anticipated that an approximately 8,920 square meter (96,000 square foot) pipe pile-supported trestle will be constructed parallel to the southern side of the existing east span. The trestle would likely have fingers extending under the bridge, perpendicular to the main trestle to allow for access between the foundations. It is anticipated that the trestle would extend westward from the Oakland shoreline, potentially as far as Pier E9 of the existing east span. The trestle would be used for construction access during the dismantling of the superstructure and/or marine foundation removal. The Oakland Access Trestle may be constructed between 2014 and 2017, depending on construction schedules.

Temporary falsework supports would be necessary to ensure the stability of portions of the structure not yet removed. It is anticipated that marine pile-supported falsework would be needed to facilitate the removal of the superstructure.

Table 1-1. Conservative Estimate of Number and Size of Piles for Temporary Structures

Temporary Structure	Pile sizes & type	Maximum no. of piles
Temporary Supports for the Cantilever Superstructure	24" to 36" pipe piles	440
Temporary Supports for the 504' Superstructure	24" to 36" pipe piles	450
Temporary Supports for the 288' Superstructure	18" to 36" pipe piles	700
Oakland Access Trestle	18" to 36" pipe piles	700
YBI Access Trestle	H-piles	100
Other (spud, fender, access, etc.)	18" to 36" pipe piles	150

It is conservatively estimated that a maximum of 2,540 temporary piles may be installed to support all temporary structures, including the two access trestles, and falsework needed to support the structural sections of the existing bridge until completely removed. These piles are expected to be 0.45 meter (18 inches) to 0.91 meter (36 inches) in diameter. When no longer needed, all temporary piles will be retrieved or cut off 0.46 meter (1.5 feet) below the mudline, per USCG requirements.

All pipe piles will be installed with a vibratory hammer. The vibratory hammer will be used to drive the majority of the total pile lengths. The remainder of the pile may be impact-driven with the use of a marine pile driving energy attenuator (i.e., air bubble curtain system), or other equally effective sound attenuation method (e.g., dewatered cofferdam). A maximum of twenty piles may be impact-driven per day.

In the event a pipe pile is entirely installed with a vibratory hammer, it will still be subject to final "proofing" with an impact hammer. "Proofing" will be accomplished by using a limited number of blows with an impact hammer intended to test integrity and seating of the pile. A maximum of 10% of the piles installed completely with a vibratory hammer may be proofed with an impact hammer, without the use of a marine pile driving energy attenuator. Proofing of piles will be limited to a maximum of two piles per day, for less than 1 minute per pile, administering a maximum of twenty blows per pile.

All H-piles needed for the construction of the YBI Access Trestle will be installed with an impact hammer, without the use of a marine pile driving energy attenuator. Impact driving (with the exception of pile proofing) will be restricted to the period between June 1st and November 30th to avoid the peak migration period for salmonids and spawning adult green sturgeon. Vibratory driving and proofing of piles may be performed year round.

In addition to the temporary pipe piles and H-piles described above, sheet piles would be driven with a vibratory hammer to construct temporary cofferdams. A cofferdam is temporary enclosure, built within a body of water, usually composed of sheet piles welded together. The enclosures are generally water tight allowing them to be pumped dry so that construction may take place in a dry environment. The proposed cofferdams will be contractor-designed; therefore, the exact number and exact nature will be dependent on the contractor's means and methods. It is anticipated that a maximum of 22 cofferdams may be constructed around in-water marine foundations to facilitate the dismantling of the foundations. A typical sheet pile is approximately 0.3 meters (1 foot) long. To construct cofferdams completely surrounding each of the 22 marine foundations a maximum of 7700 individual sheet piles may be needed. Due to the physical conditions of the project site (e.g., water depths) it is very unlikely that all or even a majority of the cofferdams will be fully dewatered. Some of the cofferdams may be fully dewatered while others may solely be used to isolate the work area; preventing water temporarily impacted by construction activities from mixing with the surrounding waters of the Bay.

1.2.2.3. Dismantling of Marine Foundations by Mechanical Means

Dismantling of concrete foundations would require reducing the reinforced concrete to pieces small enough to be hauled away, which could be done by mechanical means such as saw cutting,

flame cutting, mechanical splitting, drilling, pulverizing and/or hydro-cutting. Dismantling of the marine foundations will be one of the last orders of work, and will not be undertaken until the superstructures and towers are removed.

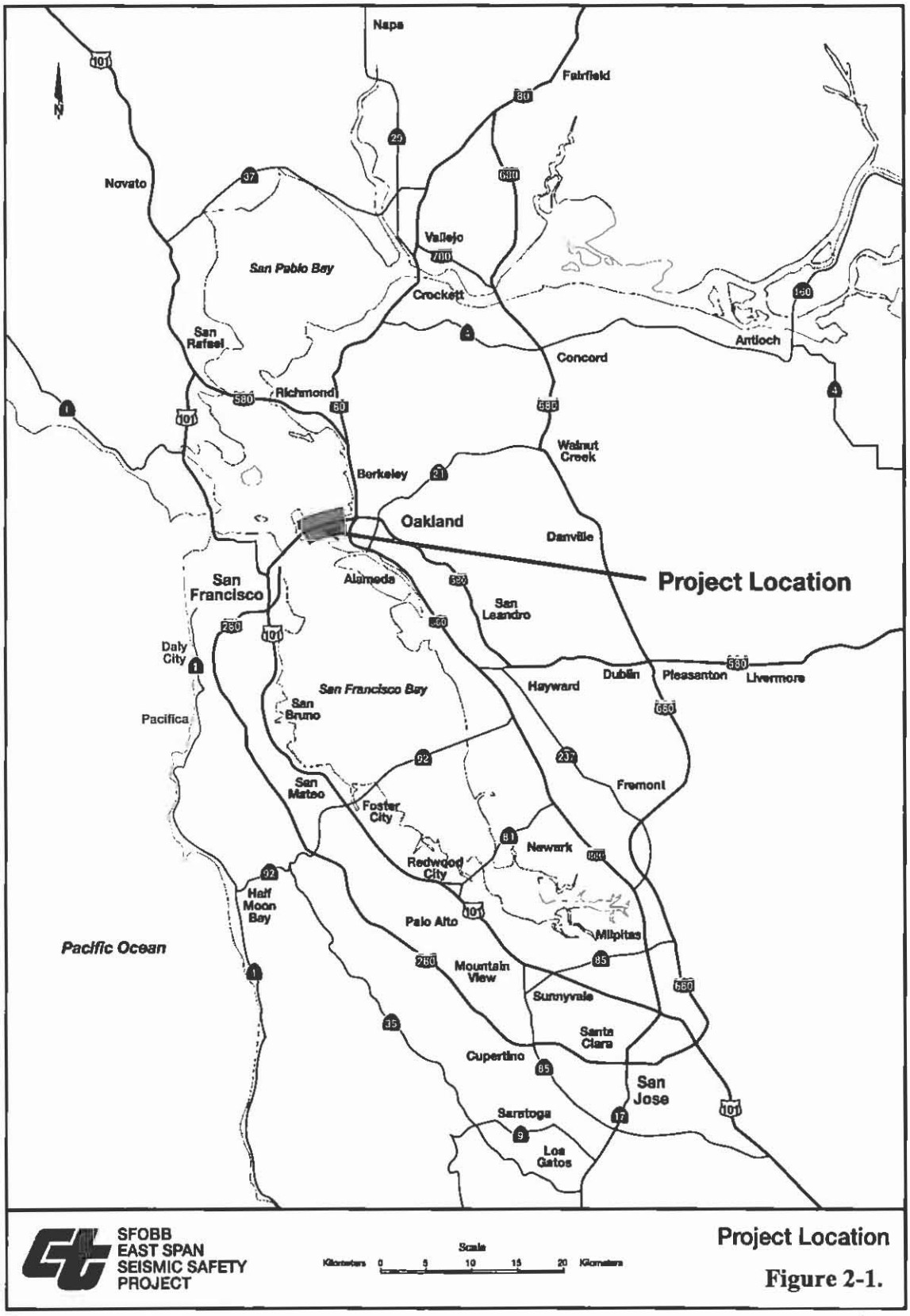
2. DATES, DURATION AND GEOGRAPHIC LOCATION OF THE ACTIVITIES

2.1. Dates and Durations

Construction activities for the replacement of the east span of the SFOBB commenced in 2002 and are currently ongoing. The majority of the construction activities to build the new east span are now complete. The dismantling of the existing span is anticipated to take place immediately following the opening of the new east span to traffic, currently expected in the fall of 2013. Dismantling of the existing east span may take up to five years to complete. Some preparatory construction activities related to the dismantling may take place as early as the summer of 2012, with completion of the dismantling targeted for 2017. The actual work schedule will be determined by the contractor.

2.2. Location

The SFOBB Project site is located in central San Francisco Bay, between YBI (which is within the jurisdictional boundaries of the City and County of San Francisco) and the City of Oakland, in Alameda County in California (Figure 2-1).


Napa
Fairfield
Novato
Vallejo
San Pablo Bay
Crockett
San Rafael
Antioch
Concord
Richmond
Walnut Creek
Berkeley
Oakland
Danville
Project Location
San Francisco
Alameda
San Leandro
Daly City
Dublin
Pleasanton
Livermore
Hayward
San Francisco Bay
San Bruno
Pacifica
Fremont
San Mateo
Foster City
Newark
Redwood City
Half Moon Bay
Palo Alto
Milpitas
Pacific Ocean
Mountain View
Sunnyvale
Santa Clara
Cupertino
San Jose
Saratoga
Los Gatos
SFOBB
EAST SPAN
SEISMIC SAFETY
PROJECT
Scale
Kilometers 0 5 10 15 20 Kilometers
Project Location
Figure 2-1.
3/30/99

3. SPECIES AND NUMBER OF MARINE MAMMALS IN THE AREA

Although many species of marine mammals are found in the coastal waters of California, there are only four species of marine mammals likely to enter or inhabit San Francisco Bay. These include the Pacific harbor seal (*Phoca vitulina richardii*[4]), California sea lion (*Zalophus californianus californianus*), gray whale (*Eschrichtius robustus*), and harbor porpoise (*Phocoena phocoena*). Only the Pacific harbor seal and the California sea lion are regularly found within San Francisco Bay, in the vicinity of the SFOBB east span.

Pacific harbor seals were the most commonly sighted marine mammal species during monitoring of SFOBB Project construction activities conducted from September 2003 to May 2009 (Caltrans 2004a, 2004b, 2006, 2010). There are numerous harbor seal haul-out sites throughout the Bay that are used for resting, pupping and breeding (Harvey and Goley in press). In contrast to other marine mammal species, harbor seals do not travel far to forage and a resident population of about 550 seals exists in the Bay (Nickel 2003; Harvey and Goley in press).

California sea lions were the second most sighted marine mammal species during monitoring of SFOBB Project construction activities (Caltrans 2004a, 2004b, 2006, 2010). California sea lions are commonly found hauling out on buoys and unused docks in the Bay (e.g., Pier 39) but do not have any natural haul-out sites in the Bay. The nearest sea lion haul-out site to the SFOBB east span is the Pier 39 site approximately 5.7 kilometers (3.5 miles) to the west. Sea lions were occasionally seen transiting or foraging near the SFOBB east span area (Caltrans 2004a, 2004b, 2006, 2010).

Several gray whales enter the Bay each year, usually during the northern migration. Most observations have been in northern San Francisco Bay, north of Treasure Island, although there were two sightings near YBI in the 1990's (Green et al. 2006). No sightings of gray whales have occurred near the SFOBB east span during the marine mammal monitoring for the SFOBB Project (Caltrans 2004a, 2004b, 2006, 2010). The Marine Mammal Center collects reports of whale sightings in the Bay from the public and the USCG. Department and the monitoring team have an established protocol with the Marine Mammal Center and will be notified of any whale sightings in the Bay.

Harbor porpoises are generally found outside of San Francisco Bay, but do enter a short distance, approximate 2-4 kilometers (1-2 miles) into the Bay. Harbor porpoises were observed once in 2000[5] and again in 2006[6] in the vicinity of the SFOBB Project area (Caltrans 2006).

[4] The Pacific harbor seal has, at times, been listed in various documents and scientific literature as *Phoca vitulina richardsi;* but according to Rice (1998) and the Society of Marine Mammalogy (2011), the proper scientific name is *Phoca vitulina richardii.*

[5] One harbor porpoise was sighted in the vicinity of the SFOBB Project area, near YBI, in 2000. This sighting was reported to marine mammal monitors in 2005 through personal communication with Melissa Barrow, the former SFOBB Project Environmental Compliance Manager.

[6] A crew boat captain working on the SFOBB Project informed marine mammal monitors that he had observed a small pod of harbor porpoises on August 3, 2006, along the eastern portion of the SFOBB east span.

Humpback whales (*Megaptera novaeangliae*) rarely enter San Francisco Bay, but there are two records from the northern San Francisco Bay and delta area in the last 30 years including Humphrey the Whale in 1985 and 1990 and a mother – calf pair in 2007 (Gulland et al. 2008). The Department and the monitoring team will be notified by the Marine Mammal Center, of any whale sightings in the Bay.

4. STATUS AND DISTRIBUTION OF AFFECTED SPECIES OR STOCK

Marine mammals are protected under the Marine Mammal Protection Act (MMPA) of 1972, as amended. The MMPA defines "stock" as a group of marine mammals of the same species or smaller taxa in a common spatial arrangement that interbreed when mature. Under the MMPA, species and population stock of marine mammals can be classified as "depleted" or "strategic" stock. Species and population stock which has been determined to be below the optimum sustainable population or are listed as endangered or threatened under the Endangered Species Act (ESA) of 1972 are considered depleted. Strategic stock is defined as population stock for which the level of direct human-caused mortality exceeds biological removal levels; which is declining and is likely to be listed as a threatened species in the foreseeable future; or is listed as threatened or endangered under the ESA or designated as depleted under the MMPA.

4.1. Pacific Harbor Seals

Pacific harbor seals with the potential to be affected by SFOBB Project activities are part of the California stock. The Pacific harbor seal is not listed as threatened or endangered under the ESA and is not considered a strategic or depleted species under the MMPA (Carretta et al. 2011). The population of Pacific harbor seal has been increasing since 1972, but at a slower rate since 1990 (Carretta et al. 2011).

Pacific harbor seals are considered abundant throughout most of their range from Baja California, Mexico to the eastern Aleutian Islands, Alaska. Harbor seals generally do not migrate. Most seals tagged within San Francisco Bay remained in the Bay, although several did migrate to the Farallon Islands, or to mainland haul-out sites from Point Reyes in the north to Half Moon Bay in the south (Harvey and Goley in press).

Although generally solitary in the water, harbor seals come ashore at communal sites known as "haul-outs," which are used for resting, thermoregulation, birthing, and nursing pups. Harbor seals primarily haul-out on remote mainland and island beaches and tend to forage locally, within 85 km (53 miles) of the haul-outs (Harvey and Goley 2011). Haul-out sites are relatively consistent from year to year (Kopec and Harvey 1995), and females have been recorded returning to their own natal haul-out when breeding (Green et al. 2006). Bay harbor seals haul out in groups ranging in size from a few individuals to several hundred seals. Bay haul-out sites that support some of the largest concentrations of seals include Mowry Slough in the south Bay, Corte Madera Marsh and Castro Rocks in the north Bay, and YBI in the central Bay (Figure 4-1) (Goals Project 2000). Mowry Slough and Castro Rocks are the two major pupping sites for the San Francisco Bay. Pups have been observed in small numbers at Corte Madera Marsh and YBI, although births have not been witnessed at these sites (Green et al. 2006).

Pupping in California begins in late February (late March in central California), and pups start to become weaned in May. Mother-pup pairs spend more time on shore; therefore, during the pupping season, the percentage of seals on shore increases (Stewart and Yochem 1994).

Tide levels can affect haul-out behavior in areas where haul-out sites are below water at higher tides. However, time of day and the season have the greatest influence on haul-out behavior (Stewart and Yochem 1994).

Numerous harbor seals haul out at YBI. The Richmond Bridge Harbor Seal Survey[7] reported a maximum count of 213 harbor seals observed at YBI in July 1998 (San Francisco State University, unpublished records 1998-9). During monitoring of the YBI haul-out for prior SFOBB east span construction activities the number of harbor seal hauled out at the site ranged from 0-188 individuals (Caltrans 2004a, 2004b, 2006, 2010).

In San Francisco Bay, harbor seals forage in shallow, intertidal waters on a variety of fish, crustaceans, and a few cephalopods (e.g., octopus). The most numerous prey species identified in harbor seal fecal samples from haul-out sites in the Bay is yellowfin goby (*Acanthogobius flavimanus*), an introduced species. Other major prey species identified include northern anchovy (*Engraulis mordax*), Pacific herring (*Clupea harengus pallasi*), staghorn sculpin (*Leptocottus armatus*), plainfin midshipman (*Porichthys notatus*), and white croaker (*Genyonemus lineatas*) (Harvey and Torok 1994.)

4.2. California Sea Lions

California sea lions with the potential to be affected by SFOBB Project activities are part of the United States stock. California sea lions are not listed as threatened or endangered under the ESA and they are not considered a depleted or strategic stock under the MMPA (Carretta et al. 2011). The total estimated stock is 238,000 individuals (Carretta et al. 2011).

California sea lions are endemic to the Northern Pacific Ocean, breeding in Southern California and along the Channel Islands during the spring, May through July (Heath and Perrin 2008). The primary rookeries are located on the California Channel Islands of San Miguel and San Nicolas Islands with small breeding rookeries at Ano Nuevo, Santa Barbara, and San Clemente Islands (Carretta et al. 2011).

The distribution and habitat use of California sea lions vary with the sex of the animals and their reproductive phase. After the breeding season, adult and sub-adult males migrate northward along the coast to central and northern California, Oregon, Washington and Vancouver Island, to feeding areas as far away as the Gulf of Alaska (Lowry et al. 1992). They remain there until spring (March-May), when they migrate back south to the breeding colonies. Distribution of immature California sea lions is less well known, but some make northward migrations that are shorter in length than the migrations of adult males (Huber 1991). However, most immature seals

[7] The Richmond Bridge Harbor Seal Survey was a joint project of the Department and San Francisco State University. Starting in May 1998, the project produced weekly reports to the Department and NMFS concerning the potential effects of the seismic retrofit of the Richmond-San Rafael Bridge on the harbor seals at Castro Rocks, located just beneath the bridge. The study included regular monitoring of two alternate haul out sites, YBI and Mowry Slough, which had the potential to be affected due to the disturbance of harbor seals at Castro Rocks. Baseline data were collected at all three sites until the start of the seismic retrofit work on the Richmond-San Rafael Bridge in the spring of 2001. Monitoring continued at all sites until the completion of the seismic retrofit construction work on the bridge, in September 2005.

are presumed to remain near the rookeries (Lowry et al. 1992). Adult females remain near the rookeries throughout the year as they continue to alternate between foraging and nursing their pups on shore until near the next pupping/breeding season. Most births occur from mid-June to mid-July (peak in late June).

While California sea lions are known to have historically used San Francisco Bay to feed and sleep at the surface of the Bay's calmer waters, they were rarely observed hauling out in the Bay (Bauer 1999). However, since at least 1987, sea lions have been observed occupying the docks near Pier 39 in San Francisco, about 5.7 kilometers (3.5 miles) from the project site (Figure 4-1). According to the Marine Mammal Center in Sausalito, the number of sea lions hauled out at Pier 39 ranged from 5 to 906 in 1997 and from 63 to 737 in 1998. For both years, the lows occurred in June and the highs occurred in August. Approximately 85 percent of the animals hauled out at this site are males, and no pupping has been observed at this site or any other site in San Francisco Bay (Lander, M. 1999 personal communication). At this time, no other sea lion haul-out sites have been identified in the Bay. However, in addition to the Pier 39 haul-out, California sea lions haul out on buoys and similar structures throughout the Bay. In the Bay, they feed primarily on Pacific herring, northern anchovy, and sardines (*sardines asgax caerlrus*).

4.3. Gray Whales

Gray whales with the potential to be affected by SFOBB Project activities are part of the Eastern North Pacific stock. The Eastern North Pacific stock of gray whales was delisted in 1994 based on an increase in the population; therefore, gray whales are not considered threatened or endangered under the ESA. The Eastern North Pacific gray whale stock is not classified as strategic or depleted under the MMPA. The population estimate for the Eastern North Pacific stock is 18,178 individuals (Angliss and Outlaw 2008).

The Eastern North Pacific gray whale makes a well-defined seasonal north-south migration. Most of the population summers in the shallow waters of the northern Bering Sea, the Chukchi Sea, and the western Beaufort Sea (Rice and Wolman 1971), whereas some individuals also summer along the Pacific coast from Vancouver Island to central California (Rice and Wolman 1971; Darling 1984; Nerini 1984). In October and November, the whales begin to migrate following the shoreline south to breeding grounds on the west coast of Baja California and the southeastern Gulf of California (Braham 1984; Rugh 1984). The main calving sites are Laguna Guerrero Negro, Laguna Ojo de Liebre, Laguna San Ignacio, and Estero Soledad (Rice et al. 1981).

Their migrations take them past the coast of San Francisco from December through February, heading south, and again from mid-February through July, heading north. During the migration, gray whales will occasionally enter rivers and bays (such as San Francisco Bay) along the coast. Reports from the Sea Training Institute, the Oceanic Society, the Richmond-San Rafael Bridge marine mammal monitors, and local news reports indicate that, since 1999, gray whale sightings in the Bay have become more common, with at least two to six whales entering the Bay annually.

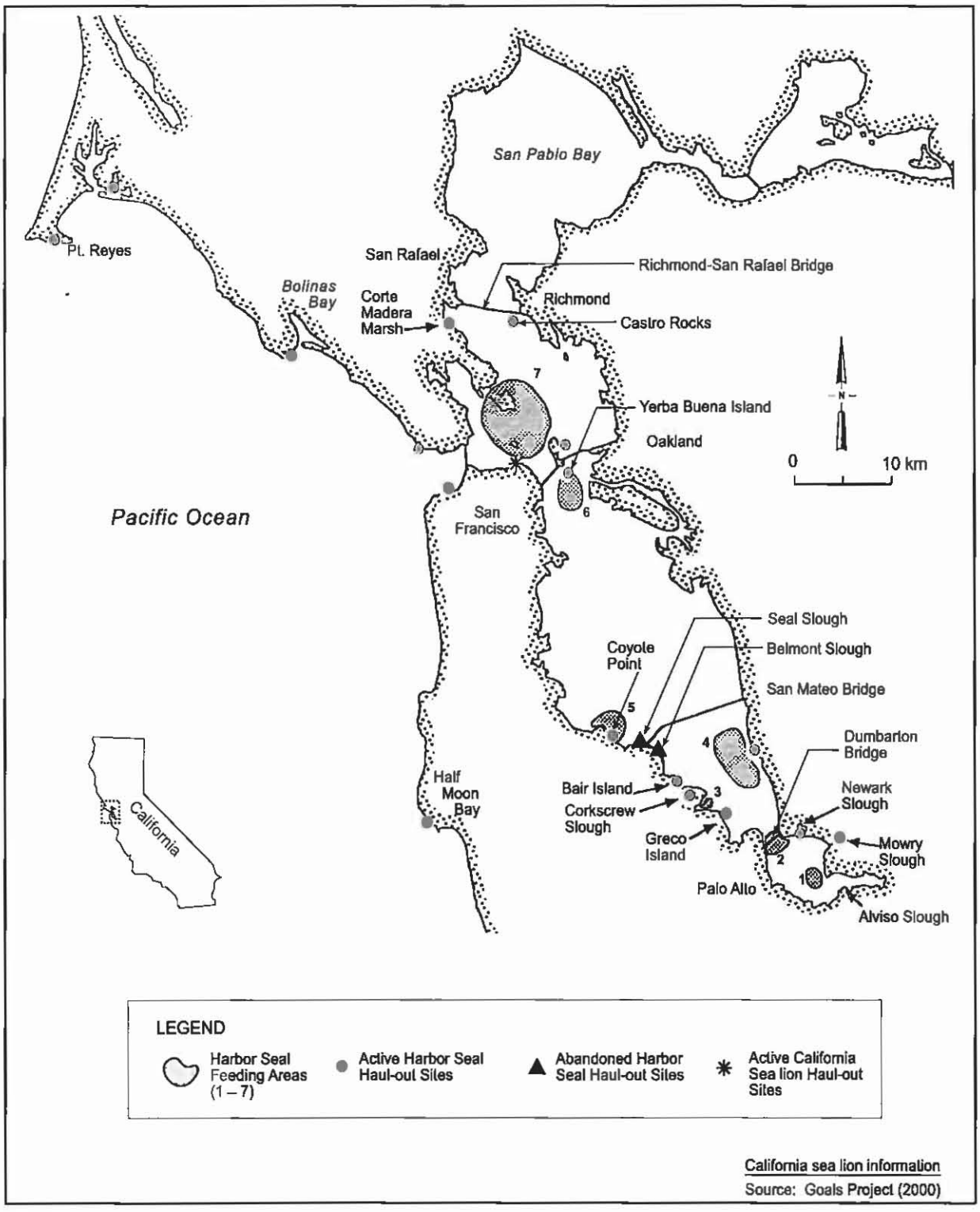
4.4. Harbor Porpoise

Harbor porpoises with the potential to be affected by SFOBB Project activities are part of the San Francisco-Russian River stock. The harbor porpoise population has been increasing since 1993 (Carretta et al. 20011). The harbor porpoise is not listed as endangered or threatened under the ESA and is not considered a strategic or depleted stock under the MMPA (Carretta et al. 2011). Census data suggest a stable population trend. The latest NMFS stock estimates for the San Francisco-Russian River stock is 9,189 porpoises (Carretta et al. 2011).

Harbor porpoises are generally found in cool temperate-to-subarctic waters over the continental shelf in both the North Atlantic and North Pacific (Read 1999). In the North Pacific, they are found from Japan north to the Chukchi Sea and from Monterey Bay, California to the Beaufort Sea. Harbor porpoise are usually observed in groups of two to five individuals. Calves are born in late spring (Read and Hohn 1995).

For the past 65 years harbor porpoises were generally found outside of San Francisco Bay, occasionally entering a short distance into the Bay. In recent years, the number of harbor porpoises observed foraging in San Francisco Bay has increased. In 2009 researchers with Golden Gate Cetacean Research began a multi-year assessment to document the San Francisco Bay harbor porpoise population. The Golden Gate Cetacean Research team has compiled a catalog of 225 individuals observed inside the bay (Stern, J. 2011 personal communication)

Figure 4-1. Harbor Seal and California Sea Lion Haul-Out Sites and Feeding Areas in the San Francisco Bay



5. TYPE OF INCIDENTAL TAKE AUTHORIZATION BEING REQUESTED

The Department requests both an IHA and LOA pursuant to Section 101 (a)(5)(A) of the MMPA for incidental take by Level B harassment (as defined by Title 50 Code of Federal Regulations Part 216.3) of small numbers of marine mammals incidental to construction and dismantling activities for the east span of the SFOBB in the central San Francisco Bay. SFOBB east span construction and dismantling activities have the potential to result in the take of marine mammals by temporary underwater noise and habitat disturbance. These activities include dredging and dredged material disposal, impact and vibratory pile driving, and mechanical means of dismantling marine foundations. Because of the minimization measures outlined in Section 11 below, no serious injury (Level A) is anticipated. No intentional or lethal takes are expected.

Due to the time involved in the issuance of a LOA rule the Department is requesting an IHA renewal to cover pre-dismantling in-water construction activities that may take place as early as June of 2012. Specific activities that may be undertaken during the period between June 2012 and June 2013, which have the potential to result in the take of marine mammals, may include, but are not limited to, the construction of the YBI Access Trestle and temporary supports for the cantilever superstructure.

It is understood that a LOA rule is applicable for up to five years. The Department requests that the IHA renewal process and LOA rulemaking be undertaken concurrently, such that an LOA can be issued prior to the expiration of the one year IHA. The LOA request is for a 5-year period commencing in June 2013.

6. NUMBER OF EACH SPECIES TO BE TAKEN BY AGE, SEX, AND REPRODUCTIVE CONDITION

Under the MMPA "take" is defined as "harass, hurt, capture, kill or collect, or attempt to harass, hurt, capture, kill or collect." Under the 1994 Amendment to the MMPA, harassment is statutorily defined as "any act of pursuit, torment, or annoyance which has the potential to injure or disturb a marine mammal or marine mammal stock in the wild." Harassment which has the potential to injure a marine mammal is further defined as Level A harassment. Harassment which has the potential to disturb a marine mammal by causing disturbance of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering, but which does not have the potential to injure a marine mammal, is further defined as Level B harassment.

Sound is important for marine mammal communication, navigation and foraging. Exposure to high sound pressure levels has the potential to result in harassment of marine mammals. NMFS has established interim sound threshold guidance for marine mammals (Tables 6-1 and 6-2). The underwater sound pressure threshold for Level A (injury) harassment is 180 decibel (dB) root-mean-squared (RMS) for cetaceans (whale, dolphins and porpoises) and 190 dB RMS for pinnipeds (seals and sea lions). The underwater sound pressure threshold for Level B (behavioral) harassment is 160 dB RMS for impulse noise (e.g., impact pile driving) and 120 dB RMS for continuous noise (e.g., vibratory pile driving) for both cetaceans and pinnipeds. The in-air threshold for Level B (behavioral) harassment is 90 A-weighted decibels (dBA) RMS for harbor seals and 100 dBA RMS for all other pinnipeds (non-harbor seals). No in-air sound threshold has been established for Level A (injury) harassment.

Table 6-1. Interim Underwater Noise Threshold Guidance for Marine Mammals

Marine Mammal Taxa	Level A (Injury)	Level B (Behavioral) *impulse sound*	Level B (Behavioral) *continuous sound*
Cetaceans	180 dB RMS	160 dB RMS	120 dB RMS
Pinnipeds	190 dB RMS	160 dB RMS	120 dB RMS

All decibels referenced to 1 micro Pascal (re: 1μPa)(Source: NMFS 2010)

Table 6-2. Interim Airborne Noise Threshold Guidance for Marine Mammals

Marine Mammal Taxa	Level A (Injury)	Level B (Behavioral)
Cetaceans	NA	NA
Harbor Seals	None established	90 dBA RMS
Pinnipeds (non-harbor seal)	None established	100 dBA RMS

All decibels referenced to 20 micro Pascals (re: 20μPa)(Source: NMFS 2010)

6.1. Noise Levels from Pile Driving

To estimate underwater sound pressure levels for the proposed project, measurements from a number of underwater pile driving projects conducted under similar conditions were compiled (see Appendix B: Pile Driving Projects Considered in Development of Underwater Sound Level Estimate). Based on this information, the Department's hydroacoustic consultant has provided an estimate of underwater sound levels during vibratory driving, attenuated impact pile driving and unattenuated proofing of both 0.61-meter (24-inch) and 0.91-meter (36-inch) diameter piles and during impact driving of H-piles to determine the distance at which sound levels may exceed the interim threshold guidance for Level A and Level B harassment (Table 6-3). The distances from the pile to the sound level threshold represent the respective zone of influence (ZOI) for Level A and Level B harassment.

Sound level estimates were not prepared for 0.46-meter (18-inch) diameter piles. Given that estimated sound levels for 0.61-meter (24-inch) diameter piles are lower than those estimated for the 0.91-meter (36-inch) diameter piles, it is assumed that sound levels from the vibratory and impact driving of 0.46-meter (18-inch) diameter piles will be lower than those for the 0.61-meter (24-inch) diameter piles.

Table 6-3. Estimated Distance Which Sound Levels May Exceed Interim Sound Threshold Guidance for Marine Mammals

Pile Installation Method	Pile Size (in)	Estimated Duration Per Pile (min)	Distance to Level B (vibratory) 120 dB RMS (m)	Distance to Level B (impact) 160 dB RMS (m)	Distance to Level A (cetaceans) 180 dB RMS (m)	Distance to Level A (pinnipeds) 190 dB RMS (m)
Vibratory Driving	24	5	1,800 – 2,000	NA	< 10*	< 10*
	36	5	1,800 – 2,000	NA	< 10*	< 10*
Attenuated Impact Driving	24	3.5	NA	50	< 10	< 10
	36	4.3	NA	65	< 10	< 10
Unattenuated Proofing	24	< 1	NA	385	25	< 10
	36	< 1	NA	500	35	< 10
Unattenuated Impact Driving	H-pile	10	NA	330	25	< 10

* Sound pressure levels from vibratory pile driving are not expected to reach 180 dB RMS or 190 dB RMS at any distance from the pile. However, sound level measurements are generally not taken within less than 10 meters (32.8 feet) of piles and the behavior of sound within the near field is not well documented or reliably predicted.

During vibratory pile driving of both 0.61-meter (24-inch) and 0.91-meter (36-inch) diameter piles, underwater sound pressure levels are not anticipated to exceed 120 dB beyond 2,000 meters (6,561 feet) from the pile being driven (Caltrans 2010). Therefore, only marine mammals within 2,000 meters (6,561 feet) of the pile are expected to be taken by Level B harassment during vibratory driving. Sound pressure levels from vibratory pile driving are not expected to

reach levels that could result in Level A harassment at any distance from the pile (Caltrans 2010).

During attenuated impact driving of 0.61-meter (24-inch) and 0.91-meter (36-inch) diameter piles, sound pressure levels are not anticipated to exceed 160 dB RMS beyond 50 meters (164 feet) and 65 meters (213 feet) from the pile, respectively. Therefore, only marine mammals within 50 meters (164 feet) of a 0.61-meter (24-inch) pile and within 65 meters (213 feet) of a 0.91-meter (36-inch) pile have the potential to be taken by Level B harassment during attenuated impact driving. Sound pressure waves from attenuated impact pile driving are not expected to reach levels that could result in Level A harassment beyond 10 meters (33 feet) from the pile.

During the unattenuated proofing of 0.61-meter (24-inch) and 0.91-meter (36-inch) diameter piles, sound pressure levels are not anticipated to exceed 160 dB RMS beyond 385 meters (1,263 feet) and 500 meters (1,640 feet) from the pile, respectively. Therefore, only marine mammals within 385 meters (1,263 feet) of a 0.61-meter (24-inch) pile and within 500 meters (1,640 feet) of a 0.91-meter (36-inch) pile have the potential to be taken by Level B harassment during the unattenuated proofing.

During the unattenuated proofing of 0.61-meter (24-inch) and 0.91-meter (36-inch) diameter piles, sound pressure levels are not anticipated to exceed 180 dB RMS beyond 25 meters (82 feet) and 35 meters (115 feet) from the pile, respectively. Sound pressure waves from unattenuated proofing are not expected to exceed 190 dB RMS beyond 10 meters (33 feet) from the piles. Therefore, only cetaceans within 25 meters (82 feet) of a 0.61-meter (24-inch) pile and within 35 meters (115 feet) of a 0.91-meter (36-inch) pile have the potential to be taken by Level A harassment during unattenuated proofing. Sound pressure waves from the unattenuated proofing of piles are not expected to reach levels that could result in Level A harassment of pinnipeds beyond 10 meters (33 feet) from the piles.

During impact driving of H-piles for the YBI access trestle, sound pressure levels are not anticipated to exceed 160 dB RMS beyond 330 meters (1,083 feet) from the pile. Therefore, only marine mammals within 330 meters (1,083 feet) have the potential to be taken by Level B harassment during pile driving for the YBI access trestle.

Sound pressure waves from the driving of H-piles are not anticipated to exceed the 180 dB RMS beyond 25 meters (82 feet) from the pile. Sound pressure waves from the driving of H-piles are not expected to exceed 190 dB RMS beyond 10 meters (33 feet) from the piles. Therefore, only cetaceans within 25 meters (82 feet) of the H-pile have the potential to be taken by Level A harassment. Sound pressure waves from the driving of H-piles are not expected to reach levels that could result in Level A harassment of pinnipeds beyond 10 meters (33 feet) from the piles.

6.2. Noise Levels from Vibratory Driving of Cofferdam Sheet Piles and the Extraction of Temporary Piles

The vibratory driving of cofferdam sheet piles and the removal of temporary piles with a vibratory pile extractor will produce similar underwater sound pressure levels as the vibratory

driving of 0.61-meter (24-inch) and 0.91-meter (36-inch) pipe piles. Therefore, the installation of cofferdam sheet piles and the vibratory extraction of temporary piles may exceed the 120 dB RMS threshold for Level B harassment out to a distance of 1,800 to 2,000 meters (5,906 to 6,562 feet), but is not expected to exceed the 180 dB RMS or 190 dB RMS thresholds for Level A harassment beyond 10 meters (33 feet) from the pile (Caltrans 2010).

6.3. Marine Mammal Monitoring of Prior Project Pile Driving Activities

In compliance with prior IHAs for the SFOBB Project, the Department has performed monitoring of marine mammals (Caltrans 2001a, 2004a, 2004b, 2006 & 2010). This effort included establishing an in-water marine mammal safety zone (MMSZ) during all in-water large-diameter[8] permanent pile driving, with the use of a marine pile driving energy attenuator (i.e., air bubble curtain). The radius of the MMSZ would initially be set at 500 meters (1,640 feet) based on estimated sound pressure levels. The radius would then be adjusted based on measured sound pressure levels corresponding with the ZOI for Level A harassment (180 dB RMS for cetaceans and 190 dB RMS for pinnipeds). Sound levels varied during the pile driving operations, primarily due to environmental conditions (e.g., water depth and substrate). Therefore, the radius of the 190 dB RMS MMSZ isopleth ranged from 100 to 500 meters (328 to 1,640 feet) from the pile being driven. Hydroacoutic monitors identified the distance to the 180 dB RMS noise criteria for cetaceans. However, because no cetaceans were ever observed during pile driving, implementation of a MMSZ based on this criterion was never applicable.

Impact pile driving at bridge Pier T1 was performed in January and February of 2006 while the Department was in the process of renewing its IHA (Caltrans 2006). Due to the lack of coverage for the incidental take of marine mammals, NMFS directed the Department to implement a more conservative MMSZ based on the impact pile driving ZOI for Level B harassment (160 dB RMS). The radius of the 160 dB RMS MMSZ was determined to be less than 500 meters (1,640 feet) in all directions from the pile being driven.

The MMSZs were monitored by a team of NMFS-approved observers, at least 30 minutes prior to, during, and for at least 30 minutes following all in-water large-diameter permanent pile driving. If a marine mammal was visually sighted in the MMSZ prior to the start of pile driving, the operation was delayed until the animal moved out of the ZOI. Verification was based on visual observation or by waiting until enough time had elapsed without sighting (at least 15 minutes) to assume the animal had moved beyond the MMSZ. Monitoring was conducted in this manner during all in-water impact pile driving of large-diameter permanent piles, from 2003-2006.

During the installation of smaller diameter temporary piles (needed for the construction of SAS temporary towers), monitoring of marine mammals was also performed (Caltrans 2010). These piles were installed intermittently from June 2008 to May 2009. The smaller diameter temporary piles were 1.07 meter (42 inches) and 1.22 meter (48 inches) in diameter. These temporary piles were installed using both vibratory and impact pile drivers, without the use of a marine pile driving energy attenuator. This operation was performed while the Department was in the

[8] Large-diameter permanent piles were 1.8-meter (5.9 feet) and 2.5-meter (8.2 feet) in diameter.

process of renewing its IHA. Due to the lack of coverage for the incidental take of marine mammals, NMFS directed the Department to implement a more conservative MMSZ based on the ZOI for Level B harassment: 160 dB RMS for impact pile driving and 120 dB RMS for vibratory pile driving.

During impact pile driving of SAS temporary tower piles, the distance to the 160 dB RMS isopleth varied considerably from tower to tower and varied in different directions from the pile. The radius of the 160 dB RMS MMSZ for this operation varied from 500 to 2,000 meters (1,640 to 6,561 feet) for the pile being driven.

During vibratory pile driving of SAS temporary tower piles, hydroacoustic monitors were unable to locate the distance at which sound levels dropped to 120 dB RMS. Background sound levels in the Bay near the project site often equaled or exceeded 120 dB RMS. At a distance of 1,900 meters (6,234 feet) from the vibratory pile driving, monitors could no longer distinguish the pile driving sound from background sound levels. The Department notified NMFS of this limitation and, for the purpose of marine mammal monitoring, the MMSZ was set at 1,900 meters (6,234 feet) for vibratory pile driving.

A summary of SFOBB pile driving operations, MMSZ radii and marine mammal observations are presented in Table 6-4 (Caltrans 2004a, 2004b, 2006 & 2010). To date, a total of 119 days of marine mammal monitoring during pile driving has been conducted for the SFOBB Project. Throughout this monitoring, a total of 211 marine mammals were observed either within the 30 minutes prior to, during, or within the 30 minutes following pile driving. Of the 211 animals observed, 41 were sea lions and 170 were harbor seals. No gray whales or harbor porpoises have been observed during marine mammal monitoring for the SFOBB Project. However, on two occasions once in 2000 and again in 2006 harbor porpoises were reportedly observed within the vicinity of the SFOBB Project area. Details of these observations are provided in Section 3.

Of the 41 sea lions observed during marine mammal monitoring, only four were observed to have entered the MMSZ during pile driving. Three were observed within a MMSZ corresponding with Level A harassment noise criteria and one was observed within a MMSZ corresponding with Level B harassment noise criteria. Therefore, throughout the approximately nine years of SFOBB east span construction, a total of one sea lion has been taken by Level B (behavioral) harassment and three have been taken by Level A (injury) harassment.

Of the 170 harbor seals observed during marine mammal monitoring, only 20 were observed to have entered the MMSZ during pile driving. Five were observed within a MMSZ corresponding with Level A harassment noise criteria and fifteen were observed within a MMSZ corresponding with Level B harassment noise criteria. Therefore, throughout the approximately nine years of SFOBB east span construction, a total of fifteen harbor seals have been taken by Level B (behavioral) harassment and five have been taken by Level A (injury) harassment.

The previous and existing IHA's for the SFOBB Project authorized the take of small number s of marine mammals by Level B harassment incidental to the construction of the east span of the SFOBB. When marine mammals were observed within MMSZ corresponding with Level A

harassment (during pile driving) it was reported to Monica DeAngelis at the Southwest Regional Office, NMFS via phone, as required by the IHAs. No serious injury or mortality of marine mammals was ever observed.

In addition to MMSZ monitoring, the Department also performed marine mammal and acoustic monitoring at the YBI harbor seal haul-out site (Caltrans 2004). The haul-out site is shielded from pile-driving sounds by the island terrain. To avoid unnecessary disturbance to the seals, sound level measurements were made about 200 – 300 meters (656 – 984 feet) southwest of the haul-out site. Sound levels generated by pile-driving were audible near the haul-out site on YBI, but could not be measured above the background. Background sound levels at the haul-out site included existing SFOBB west span traffic noise of about 60 dBA and jet traffic to and from Oakland International Airport of 60 to 80 dBA. Monitoring of seals at the haul-out site was conducted during 44 days of impact pile driving. Harbor seals at the haul-out site only had a minimal response to pile driving -- a head-up alert by several seals, but no movement -- on three occasions. In addition, this only occurred when the sound was reflected off of a passing cargo container ship.

Table 6-4. Summary of Marine Mammal Monitoring and Observations for Project Activities to Date

Project Phase	Pile Size	Date Range	Days of Observation	MMSZ Noise Criteria	MMSZ Radii (m)	California Sea Lions		Pacific Harbor Seals	
						Total # Observed	Entered MMSZ During Pile Driving	Total # Observed	Entered MMSZ During Pile Driving
Eastbound Skyway	Large[1]	Sept. 2003 - Feb. 2004	26	190 dB RMS[3]	100 – 500	24*	1	33**	2
Westbound Skyway	Large[1]	Mar. - Nov. 2004	25	190 dB RMS[3]	100	10	2	24	2
SAS Piers E2 and T1	Large[1]	Jan. - Sept. 2006	22	160 dB RMS[4]	100 – 500	2	0	33	4
				190 dB RMS[3]			0		1
SAS Temporary Towers	Small[2]	June 2008 - May 2009	46	120 dB RMS[5]	500 – 2,000	5	1	80	0
				160 dB RMS[4]			0		11
TOTAL			119			41	4	170	20

[1] Large-diameter permanent piles were 1.8 meters (5.9 feet) and 2.5 meters (8.2 feet) in diameter.

[2] Small-diameter temporary piles were 1.07 meters (42 inches) and 1.22 meters (48 inches) in diameter.

[3] Hydroacoutic monitors identified the distance to the 180 dB RMS noise criteria for cetaceans. However, because no cetaceans were ever observed during pile driving, implementation of a MMSZ based on this criterion was never applicable.

[4] A MMSZ based on the 160 dB RMS noise criteria was implemented for impact pile driving, performed during the IHA renewal process.

[5] A MMSZ based on the 120 dB RMS noise criteria was implemented for vibratory pile driving, performed during the IHA renewal process.

* Twenty of these sea lions were observed on a single day, January 27, 2004. The sea lions were foraging on a school of herring moving through the area (Caltrans 2004a).

** Twenty-one of these harbor seals were observed on a single day, January 30, 2004. The harbor seals were foraging on a school of herring moving through the area (Caltrans 2004a).

6.4. Marine Foundation Removal

Dismantling of marine foundations by mechanical means has the potential to create high sound pressure levels which could result in the take of marine mammals by harassment. This may include, but is not limited to saw cutting, mechanical splitting, drilling and pulverizing. Saw cutting and drilling constitute continuous noise, whereas mechanical splitting and pulverizing constitute impulse noise. Drilling and saw cutting is anticipated to produce underwater sound pressure levels in excess of 120 dB RMS, but is not anticipated to exceed the 180 dB RMS or 190 dB RMS thresholds for Level A harassment. The mechanical splitting and pulverizing of concrete with equipment such as a hammer hoe has the potential to generate high sound pressure levels in excess of the 180 dB RMS and 190 dB RMS thresholds for Level A harassment. However, the avoidance and minimization measures identified in Section 11.2. are intended to prevent Level A harassment. This includes establishing a preliminary 500-meter (1,640-foot) MMSZ around each foundation prior to splitting or pulverizing concrete via a mechanical means, adjusting the radii of the MMSZ based on identified noise levels and delaying work if a marine mammal enters the MMSZ.

6.5. Conservative Take Estimates

Based on estimated underwater sound levels from proposed activities and prior SFOBB Project marine mammal monitoring results, the Department anticipates that very few individuals will be taken by Level B harassment, and does not anticipate any individuals will be taken by Level A harassment.

Each of the large-diameter permanent piles which support the new east span required over an hour of impact driving to install. In comparison, temporary piles needed for the dismantling of the east span will only require a few minutes or less of impact driving to install. Even the installation of piles with a vibratory hammer will only require on the order of minutes to install. The short duration of pile driving events will reduce the potential exposure of marine mammals to high sound pressure levels.

During prior SFOBB Project pile driving operations, the ZOI for Level A harassment ranged from less than 100 to 500 meters (328 to 1,640 feet) from the piles being driven (Caltrans 2004a, 2004b, 2006 & 2010). In comparison, the ZOI for Level A harassment for the proposed dismantling pile driving is anticipated to range from less than 10 meters to 35 meters (33 to 115 feet) from the pile being driven, depending on the installation method.

The ZOI for Level B harassment from prior SFOBB Project pile driving operation ranged from less than 500 to 2,000 meters (1,640 to 6,561 feet) from the pile being driven (Caltrans 2004a, 2004b, 2006 & 2010). The ZOI for Level B harassment from vibratory piles driving for proposed dismantling will be consistent with prior vibratory pile driving for the project and is anticipated to range from 1,800 to 2,000 meters (5,906 to 6,561 feet) from the piles. In comparison, the ZOI for Level B harassment from impact pile driving for the proposed dismantling is anticipated to range from 50 to 500 meters (164 to 1,640 feet) from the pile, depending on the pile and installation method. The reduced size of the ZOI for both Level A and Level B harassment will

reduce the potential exposure of marine mammals to high sound pressure levels. The most significant reduction is the potential exposure to Level A (injury) harassment.

6.5.1. Estimated Take of Harbor Seals

Harbor seals are the most frequent visitors to the SFOBB east span area. Based on previous monitoring, a small number of harbor seals may be exposed to continuous sounds greater than 120 dB RMS and impulse sounds greater than 160 dB RMS. While not anticipated, harbor seals could enter the MMSZ after the commencement of activities and, therefore, could be exposed to impulse sounds greater than 190 dB RMS.

Many of the harbor seals observed during prior monitoring appeared to be transiting the area but some did remain in the area to forage (15 minutes to two hours). Seals observed foraging in the MMSZ did not appear affected by activities. Although harbor seals could enter the MMSZ during activities, the exposure to sound would generally be for a short duration and those seals that may remain to forage are expected to be unaffected.

Both juvenile and adult harbor seals were observed during prior monitoring. Establishing the gender of harbor seals in the water is difficult, unless the animal rolls over. However it is assumed that both male and female harbor seals have the potential to be present in the project area. While YBI is an important haul-out site in the Central Bay, it is not a pupping site. It is unlikely that pups will be exposed to noise from pile driving or dismantling activities.

Based on the behavioral patterns, results of past monitoring, reduced sound levels and the implementation of procedure mitigation measures presented in Section 11, the Department finds that the pile driving and dismantling activities would not result in any mortality to harbor seals. However, pile driving and dismantling activities may result in behavioral harassment of a small number of both juvenile and adult harbor seals transiting or foraging in the project area.

Airborne noise levels from the project are not expected to result in harassment of the harbor seals hauled out at the YBI haul-out site as sound levels would attenuate to below harassment levels due to the distance and the island blocking the sound.

6.5.2. Estimated Take of Sea Lions

While less frequent visitors than harbor seals, sea lions have been observed in the SFOBB east span area during prior monitoring. Based on previous pile driving monitoring, a small number of sea lions may be exposed to continuous sounds greater than 120 dB RMS and impulse sounds greater than 160 dB RMS. While not anticipated, sea lions could enter the MMSZ after the commencement of activities and, therefore, could be exposed to sounds greater than 190 dB RMS.

Generally, during prior SFOBB Project pile driving activities, sea lions were only transiting through the area and did not stop to forage with the exception of one day during the herring spawn (Caltrans 2004a). If a sea lion entered the MMSZ during work activities, it was in the outer half of the MMSZ and it did not remain for long. Although sea lions may enter the MMSZ during activities, the exposure to sound would be short. Exposure to the pile driving and

dismantling sounds may cause a short-term behavior response, such as altering their path of travel through the area, but is unlikely to affect their reproductive, foraging or hearing abilities.

Sub-adult and adult male sea lions can be distinguished from females by the sagital crest on the head, but in the water, the gender of juveniles up to three years is indistinguishable. During prior monitoring, sub-adult males, adult males and juveniles (gender undistinguished) were observed. This is expected, as female sea lions are less common in the San Francisco Bay than males. Adult females remain near the rookeries in Southern California throughout the year as they continue to alternate between foraging and nursing their pups on shore until close to the next pupping/breeding season. After the breeding season, adult and sub-adult males migrate northward along the coast to northern California. Because of the gender- and reproductive phase-specific distribution of animals, it is assumed that fewer females than males, and no pups, would be affected by project activities.

Based on the behavioral pattern of California sea lions, results of past monitoring, anticipated sound levels and the implementation of mitigation measures presented in Section 11, the Department finds that pile driving and dismantling activities would not result in the mortality of California sea lions. However, pile driving and dismantling activities may result in harassment of a small number of adult male, sub-adult male and juvenile sea lions transiting or foraging in the project area.

Airborne noise levels from the project are not expected to result in harassment of the sea lions hauled out at Pier 39 as sound pressure levels would attenuate to below harassment levels by the time they reach the haul-out site, 5.7 kilometers (3.5 miles) from the project site.

6.5.3. Estimated Take of Cetaceans

It is unlikely that any cetaceans (i.e., gray whales or harbor porpoises) would be exposed to sounds above 180 dB RMS from the pile driving or dismantling activities. No gray whales or harbor porpoises have been observed during prior pile driving monitoring. As discussed in Section 3, gray whales are infrequent visitors to the San Francisco Bay. The marine mammal monitoring team will be notified if a gray whale is reported in the Bay via contact with the Marine Mammal Center which receives reports of whale activity within the San Francisco Bay. In addition, gray whales are easily sighted as they surface to breath because of their large size and distinctive blow. Harbor porpoises usually travel in small pods and are easy to sight during monitoring. Therefore, marine mammal monitors would very likely sight cetaceans prior to any dismantling activities.

Based on the behavioral pattern of both harbor porpoises and gray whales, results of past monitoring, anticipated sound levels and the implementation of procedure mitigation measures presented in Section 11, the Department finds that pile driving and dismantling activities would not result in injury to or mortality of cetaceans. Though unlikely, pile driving and dismantling activities could result in harassment of a small number harbor porpoises and gray whales.

7. ANTICIPATED IMPACT ON THE SPECIES OR STOCK

Consideration of negligible impact is required for NMFS to authorize incidental take of marine mammals. By definition, an activity has a "negligible impact" on a species or stock when it is determined that the total taking is not likely to reduce annual rates of adult survival or recruitment (i.e., offspring survival, birth rates). Based on each species' life history information, the expected behavioral patterns in the project area, an analysis of the behavioral disturbance levels in comparison to the overall population, and an analysis of the potential impacts, the Department concludes the proposed activities would have a negligible impact on marine mammals.

The overall conclusion of negligible impact to marine mammal species and stocks is supported by the following reasons:

- Proposed activities will not result in any mortality of marine mammals.
- A small number of adult and juvenile pinnipeds may be exposed to sound levels for short periods of time that could constitute take by harassment. This take is not anticipated to affect survival or recruitment. Relative to the size of the overall population, these potential impacts would be negligible.
- It is very unlikely that any adult female sea lions would be affected by project activities.
- No sea lion pups would be affected by project activities.
- It is very unlikely that any harbor seal pups would be affected by project activities.
- Project activities will not affect any pinniped haul-outs or pupping sites.
- It is unlikely that any cetaceans would be affected by project activities. Should any take by harassment occur, it would be limited to a small number of individuals and would not affect survival or recruitment. Relative to the size of the overall populations, these potential impacts would be negligible.
- Additionally, the minimization and avoidance measures described in Section 11 are designed to reduce sound exposure of marine mammals to levels below those that may cause behavioral disruptions and to achieve the least practicable adverse effect on marine mammal species or stocks.

8. ANTICIPATED IMPACT OF THE ACTIVITY ON THE AVAILABILITY OF THE SPECIES OR STOCKS OF MARINE MAMMALS FOR SUBSISTENCE USES

There is no subsistence use of marine mammals within the San Francisco Bay.

9. ANTICIPATED IMPACT OF THE ACTIVITY UPON THE HABITAT OF THE MARINE MAMMAL POPULATIONS, AND THE LIKELIHOOD OF RESTORATION OF THE AFFECTED HABITAT

There are no designated critical habitats for marine mammals within the San Francisco Bay. The primary source of effects to marine mammal habitat is exposures resulting from pile driving, dredging and dismantling activities associated with the project. Sources that may affect marine mammal habitat include noise and isolated changes in water quality.

The SFOBB Project is not expected to result in any significant impacts to marine mammal habitat. There will be short-term impacts to water clarity resulting from minimal disturbance of sediment during proposed dredging for a barge access channel, dredging around pier foundations during removal, potential in-Bay or deep ocean disposal of dredged material and, to a lesser degree, small isolated turbidity plumes for pile installation and removal activities.

As previously discussed, 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 project area. Due to the distance and the island blocking the sound, noise levels from the project would attenuate to below harassment levels before reaching the haul-out. During previous monitoring efforts, the pile driving noise could, on occasion, be faintly heard by the monitors at the YBI haul-out site or when the sound reflected off passing cargo ships. In addition, harbor seals on YBI are commonly subjected to high levels of disturbance, primarily from watercraft, ship wakes, and traffic noise. This is particularly true during the summer, when the numbers of small recreational watercrafts in San Francisco Bay increase (San Francisco State University 1999b). Other haul-out sites for sea lions and harbor seals are at a sufficient distance from the project site that they will not be affected. The closest recognized harbor seal pupping site is at Castro Rocks, approximately 14 kilometers (8.7 miles) from the project site. There are not sea lion rookeries in San Francisco 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 would be short in duration and are assumed negligible given the high background noise in the Bay from other anthropogenic sources. During breaks in prior pile driving, the Department's hydroacoustic monitors took background noise measurements of San Francisco Bay near the project site. Measurements indicate that background levels ranged from about 110 to 140 dB RMS, but more typically range from 110 to 120 dB RMS (Caltrans 2005). Boat traffic including cargo ship, powerboats and tugboats utilize the shipping channel south of the project site and contribute to background noise levels.

Sound pressure levels from impact pile driving have the potential to injure or kill fish in the immediate area. During prior pile driving, the Department has reported mortality to marine mammals' prey species including northern anchovies and Pacific herring. These few isolated fish mortality events are not anticipated to have a signification impact on prey species population or

their availability as a food resource for marine mammals. In addition, the reduced sound levels, as compared to prior activities, will also reduce potential impacts to prey species.

Based on the discussion in this section, there will be no effects to marine mammals resulting from loss or modification of marine mammal habitat including changes to food resources or haul-out habitat.

10. ANTICIPATED IMPACT OF THE LOSS OR MODIFICATION OF HABITAT ON THE MARINE MAMMAL POPULATIONS INVOLVED

Based on the discussions in Section 9, there will be no impacts to marine mammals resulting from loss or modification of marine mammal habitat. There is no designated critical habitat within San Francisco Bay. The SFOBB Project is not expected to result in significant loss of marine mammal habitat (i.e., no destruction of haul-out sites or destruction of important reef areas); therefore, no impacts would occur.

11. MEANS OF EFFECTING THE LEAST PRACTICABLE ADVERSE IMPACT UPON THE AFFECTED SPECIES OR STOCKS

11.1. Minimization of Impacts from Pile Driving

To minimize potential impacts to marine mammals, the Department will limit both the size of piles and duration of impact pile driving, to the extent feasible. Larger piles are expected to generate higher sound pressure levels than smaller piles. Limiting the size of piles to 0.91 meter (36 inches) in diameter or smaller will minimize potential noise impacts.

All pipe piles will be initially installed with a vibratory hammer. The vibratory hammer will be used to drive the majority of the total pile lengths. In the event a pipe pile is entirely installed with a vibratory hammer, it will still be subject to final "proofing" with an impact hammer. A maximum of 10% of the piles installed completely with a vibratory hammer may be proofed with an impact hammer, without the use of a marine pile driving energy attenuator. Proofing of piles will be limited to a maximum of two piles per day, for less than 1 minute per pile, administering a maximum of twenty blows per pile. While both vibratory and impact pile driving have the potential to affect marine mammals, impact driving is expected to generate higher sound pressure levels. Requiring the use of the vibratory hammer will reduce the duration of impact driving and potential exposure to higher sound pressure levels.

Use of a marine pile driving energy attenuator (i.e., air bubble curtain system), or other equally effective sound attenuation method (e.g., dewatered cofferdam) will be required during impact driving of all pipe piles, with the exception of pile proofing. Requiring the use of sound attenuation will reduce sound pressure levels to below levels which could result in Level A harassment and minimize the ZOI for Level B harassment.

11.2. Monitoring and Establishment of Safety/Buffer Zones

During prior in-water permanent and some temporary pile driving, a preliminary 500-meter (1,640-foot) radius MMSZ was established prior to the commencement of pile driving. Once pile driving commenced, acoustical monitoring data was used to determine the radii at which underwater sound pressure levels equaled or exceeded 180 dB RMS for cetaceans and 190 dB RMS for pinnipeds. NMFS-approved observers would survey the MMSZ to ensure no marine mammals were seen within the MMSZ before pile driving began. If marine mammals were found within the MMSZ, pile driving was to be delayed until they moved out of the area.

Based on hydroacoustic sound level estimates presented in Section 6, it is unlikely that sound pressure levels from any of the pile installation methods (see Table 6-3) will equal or exceed 190 dB RMS beyond 10 meters (33 feet) from the piles. Therefore, the Department will not establish or survey a 190 dB RMS, pinniped MMSZ during vibratory or impact pile driving.

Further, it is unlikely the sound pressure levels from the vibratory driving of piles or the attenuated impact driving of pipe piles will equal or exceed the 180 dB RMS beyond 10 meters

(33 feet) from the piles. Only the unattenuated impact driving of H-piles (for the YBI access trestle) and the unattenuated proofing of pipe piles is expected to equal or exceed the 180 dB RMS to a distance of 25 to 35 meters (82 to 115 feet) depending on the pile type and size (see Table 6-3). However, it is extremely unlikely that a cetacean would be within 25 to 35 meters (82 to 115 feet) of an H-pile during impact driving. This assertion is based on multiple factors: (1) the relatively small ZOI, (2) limited number of cetaceans in the bay, and (3) the location of the trestle in a shallow shoreline cove. It is also extremely unlikely that a cetacean would be within 25 to 35 meters (82 to 115 feet) of a pipe pile during unattenuated proofing. This assertion is also based on multiple factors: (1) the relatively small ZOI, (2) the limited number of cetaceans in the bay, and (3) the short duration of event (less than one minute per pile). Therefore, the Department will not establish or survey a 180 dB RMS, cetacean MMSZ during vibratory or impact pile driving.

The Department will perform hydroacoustic monitoring during initial impact pile driving events for each of the temporary structures identified in Table 1-1 to verify estimated underwater sound pressure levels. Should it be determined through monitoring that sound levels from the impact driving of pipe piles have the potential to exceed 180 or 190 dB RMS, corresponding MMSZs will be established and surveyed in a manner consistent with the Department's prior IHAs for the SFOBB Project.

As discussed in Section 6 a small number of marine mammals may be exposed to continuous sounds greater than 120 dB RMS and impulse sounds greater than 160 dB RMS. To document the number of marine mammals exposed to impulse sounds greater than 160 dB RMS the Department will monitor marine mammals during at least 20% of attenuated impact driving of pipe piles and 100% of unattenuated impact driving of H-piles. As the Department is requesting authorization to take a small number of marine mammals (level B harassment), operations will not be delayed should marine mammals be observed within the 160 dB RMS isopleth.

The Department will not perform marine mammal monitoring during the unattenuated proofing, since the proofing of a pipe pile would require less than 1 minute of impact driving (Table 6-3). The logistics of scheduling and mobilizing a monitoring team for activities that will last less than one minute is not practical.

The Department will not perform marine mammal monitoring during vibratory pile driving. As discussed in Section 6 background sound levels in the Bay near the project site often equal or exceed the 120 dB RMS interim threshold for level B harassment. Given the environmental setting monitoring this type of exposure would not have much value.

Data gathered on the abundance of marine mammals in the project area during the monitoring of both the unattenduated impact driving of H-piles and attenuated impact driving of pipe piles will be used to estimate the number of marine mammals exposed to sound levels in excess of 120 dB RMS during vibratory pile driving and 160 dB RMS during the proofing of piles with an impact hammer.

Due to the uncertainty associated with potential sound levels from mechanical means of dismantling marine foundations, the Department will establish a preliminary 500-meter radius MMSZ around each foundation, prior to splitting or pulverizing concrete via mechanical means. Once removal of concrete foundations commences, acoustical monitoring data will be used to determine the radii at which underwater sound pressure levels equal or exceed 180 dB RMS for cetaceans and 190 dB RMS for pinnipeds. The radii of the MMSZ will then be adjusted to correspond with noise thresholds.

NMFS-approved marine mammal monitors located on construction barges, trestles, bridge piers, YBI and/or Treasure Island will survey the MMSZ to ensure that no marine mammals are seen within the zone before activities begin. If marine mammals are found within the MMSZ, work will be delayed until the monitors are confident the animal has moved out of the area. If a marine mammal is seen above water and then dives below, the contractor will be instructed to wait until enough time has elapsed without a sighting (at least 15 minutes for pinnipeds and 30 minutes for cetaceans) to assume the animal has moved beyond the MMSZ.

If marine mammals enter the MMSZ after the activities have commenced, the operation will continue unabated and marine mammal observers will monitor and record their numbers and behavior. Should the activities stop for a period of 30 minutes or more, then the restart of the activity will be treated in the same manner as described above.

Should it be determined through acoustic monitoring that sound levels from the mechanical splitting and pulverizing of concrete foundations will not have the potential to equal or exceed 180 or 190 dB RMS, monitoring of the MMSZs will be discontinued.

In addition, the Department will ensure construction equipment complies with noise standards of the U.S. Environmental Protection Agency and that all equipment has noise control devices not less effective than those provided on the original equipment.

12. MINIMIZING ADVERSE EFFECTS ON SUBSISTENCE USE

There is no subsistence use of marine mammals within the San Francisco Bay.

13. MEANS OF ACCOMPLISHING THE NECESSARY MONITORING AND MITIGATION MEASURES

13.1. Marine Mammal Monitoring

MMSZ monitoring will be conducted during the dismantling of marine foundations by mechanical means having the potential to generate sound levels in excess of 180 dB RMS. Monitoring of the pinniped and cetacean MMSZs will be conducted by a minimum of three qualified NMFS-approved observers. The observers will begin monitoring at least 30 minutes prior to startup of the activity and for at least 30 minutes following the activity. Observers will likely conduct the monitoring from construction barges, trestles, bridge piers, YBI and/or Treasure Island depending on the location of the activity. As discussed under Section 11, the activity will not begin until the MMSZ is clear of marine mammals. However, once the activities have commenced, the operation will continue uninterrupted.

Observations will be made using high-quality binoculars (e.g., Zeiss, 10 x 42 power). Monitors will be equipped with radios or cell phones for maintaining contact with other observers and Department engineers, and range finders to determine distance to marine mammals, boats, buoys, and construction equipment. Data on all observations will be recorded and will include items such as species, age class and gender (if possible), numbers, time of observation, location, direction of travel, and behavior.

MMSZ monitoring will not be conducted during pile driving activities. Based on underwater sound level estimates presented in Section 6 and further discussed in Section 12, it is extremely unlikely that pile driving will generate sound levels that would necessitate establishment and monitoring of a MMSZ. Should it be determined through hydroacoustic monitoring that sound levels from pile driving have the potential to equal or exceed 180 or 190 dB RMS, corresponding MMSZs will be established and monitored.

To document the number of marine mammals exposed to impulse sounds greater than 160 dB RMS the Department will monitor marine mammals during at least 20% of attenuated impact driving of pipe piles and 100% of unattenuated impact driving of H-piles. This monitoring which is not for the purpose of implementing a MMSZ will be conducted by a minimum of two qualified NMFS-approved observers. The observers will begin monitoring at least 30 minutes prior to startup of the activity and for at least 30 minutes following the activity. Observers will likely conduct the monitoring from construction barges, trestles, bridge piers, YBI and/or Treasure Island depending on the location of the activity. Data on all observations will be recorded and will include items such as species, age class and gender (if possible), numbers, time of observation, location, direction of travel, and behavior.

13.2. Hydroacoustic Monitoring

The purpose of the underwater sound monitoring during dismantling of concrete foundations via mechanical means is to establish the MMSZs of 180 dB RMS for cetaceans and 190 dB RMS for pinnipeds. Monitoring will occur during the initial use of concrete dismantling equipment with the potential to generate sound pressure levels in excess of 180 dB RMS. Monitoring will likely be conducted from construction barges and/or boats. Measurements will be taken at various distances as needed to determine the distance to the 180 and 190 dB RMS contours.

The purpose of underwater sound monitoring during impact pile driving will be to verify sound level estimates (presented in Section 6) and confirm that sound levels do not equal or exceed 180 dB RMS. This monitoring will likely be conducted from construction barges and/or boats.

A more detailed marine mammal and hydroacoustic monitoring plan will be prepared by the Department and the monitoring contractors prior to the start of east span dismantling activities. This plan will be made available to NMFS for review and comment.

13.3. Reporting

NMFS will be notified prior to the initiation of the pile driving and dismantling activities for the removal of the existing east span. NMFS will be informed of the initial sound pressure levels measurements for both pile driving and foundation dismantling activities, including sound level measurements taken at the 500-meter (1,640-foot) contour and the final MMSZ radii established for marine foundation dismantling activities.

Monitoring memoranda will be posted on the SFOBB Project's biological mitigation website (www.biomitigation.org) on a weekly basis during monitoring. Marine mammal monitoring memoranda will include species and numbers of marine mammals observed, time and location of observation and behavior of the animal. In addition, the memoranda will include an estimate of the number and species of marine mammals that may have been harassed as a result of activities. The Department will provide NMFS with a final report detailing: (1) the monitoring protocol, (2) a summary of the data recorded during monitoring, and (3) an estimate of the species and number of marine mammals that may have been harassed due to activities.

14. SUGGESTED MEANS OF LEARNING OF, ENCOURAGING, AND COORDINATING RESEARCH OPPORTUNITIES, PLANS, AND ACTIVITIES RELATING TO REDUCING SUCH INCIDENTAL TAKING AND EVALUATING ITS EFFECTS

Data gathered to date during the SFOBB Project has provided valuable information on the sound levels generated by pile driving and on marine mammal behavior. This information will be useful in avoiding future incidental take of marine mammals for future aspects of the SFOBB Project and other similar projects.

The marine mammal monitors for the SFOBB Project have close ties with the Marine Mammal Center, Long Marine Laboratory (UC Santa Cruz) and Moss Landing Marine Laboratory, and have assisted in population and radio telemetry studies in San Francisco Bay.

Hydrocoustic monitors for the SFOBB Project have independently published monitoring results, used data from the project in developing a *Compendium of Pile Driving Sound Data* (Caltrans 2007) for the Department and serve as technical experts to the Fisheries and Hydroacoustic Working Group.[9]

As previously discussed, limited data are currently available on underwater sound levels from mechanical means of dismantling concrete. Data collected during monitoring will be useful in evaluating and avoiding future incidental take from other similar infrastructure dismantling projects.

[9] The Fisheries and Hydroacoustic Working Group is composed of representatives from the Department, Washington Department of Transportation, Oregon Department of Transportation, Federal Highway Administration, California Department of Fish and Game, United States Fish and Wildlife Service, United States Army Corp of Engineers and NMFS. The goal of the group is to reach agreement on: 1) the nature and extent of knowledge about the current scientific basis for underwater noise effects on fish, 2) interim guidance for project assessment, mitigation, and monitoring for effects of pile-driving noise on fish species, and 3) future scientific research needed to resolve uncertainties regarding hydroacoustic impacts on fish.

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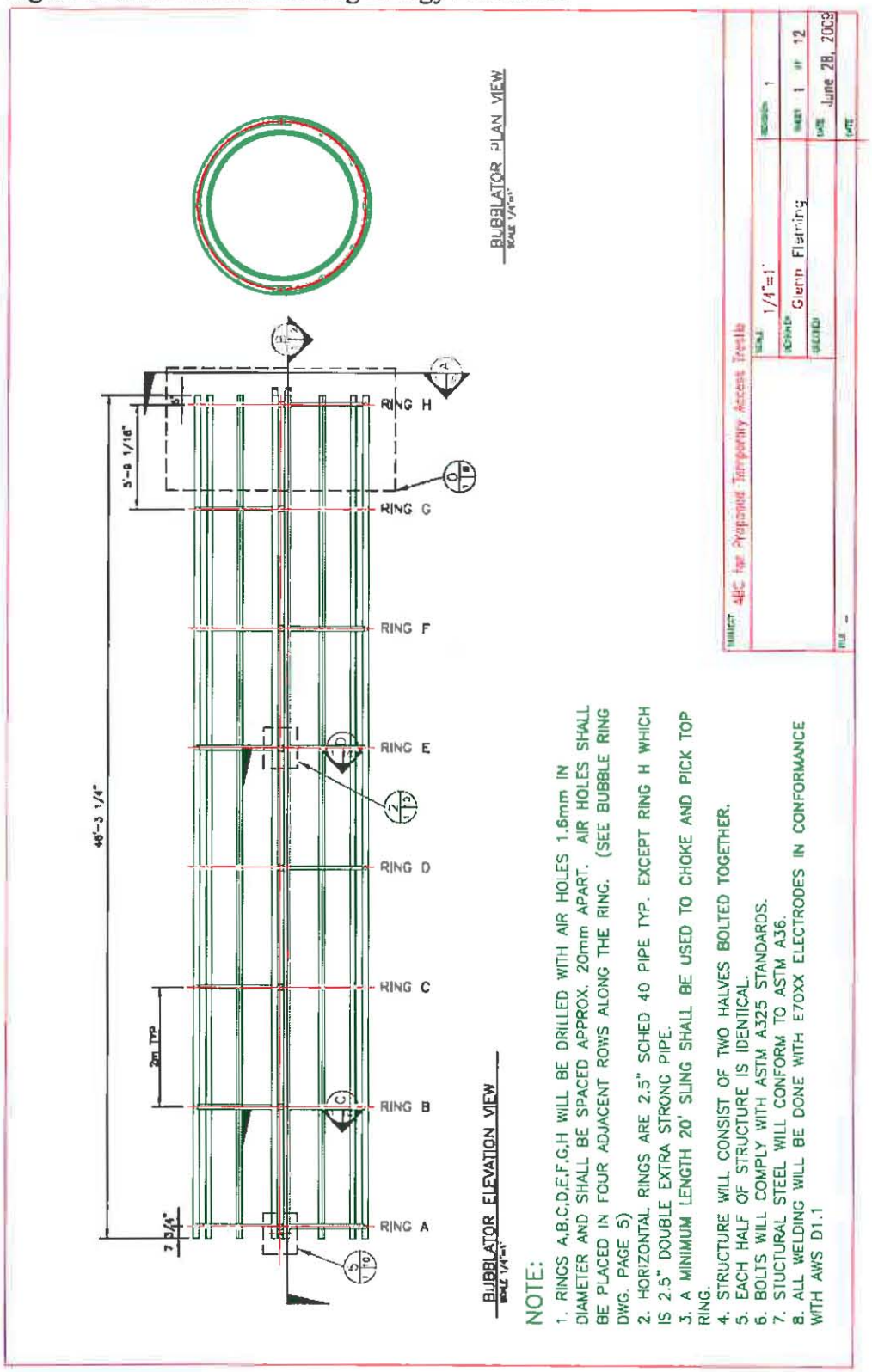
APPENDIX A. MARINE PILE DRIVING ENERGY ATTENUATOR

A marine pile driving energy attenuator, also known as an air bubble curtain system is used to attenuate underwater energy. These systems can be used to disrupt the propagation of acoustic waves from pile diving, reducing underwater sound pressures.

An air bubble curtain system is generally composed of an air compressor(s), supply lines to deliver the air, distribution manifolds or headers, perforated aeration pipes, and a frame. Compressed air is delivered to vertically staked rings of aeration pipe. The number of staked rings required is dependent on the water depth and tidal conditions.

The air bubble curtain systems used during impact pile driving from the dismantling of the existing east span will be contractor designed, but must comply with the following criteria. The entire length of the pile shall be completely surrounded by the bubble flux. The rings of perforated aeration pipe will be spaced not more than 2 vertical meters (6.56 vertical feet) apart. The lowest aeration pipe will be designed to ensure contact with the mud line without sinking in to the mud. Each aeration ring will have four adjacent rows of approximately 1.6 millimeter (0.06 inches) diameter air holes spaced approximately 22 millimeters (0.87 inches) apart. The system will provide a bubble flux of 2 to 3 cubic meters (70 to 106 cubic feet) per minute, per linear meter (3.28 feet) of pipe in each ring layer. Valves and gauges to measure air pressure and flow rates will be installed in the main air supply lines and at branch locations. Gauges will be monitored to ensure the system is performing properly. Figure A-1 shows a schematic of a preliminary air bubble curtain design that was developed for prior project pile driving activities.

Figure A-1. Marine Pile Driving Energy Attenuator



APPENDIX B. PILE DRIVING PROJECTS CONSIDERED IN DEVELOPMENT OF UNDERWATER SOUND LEVEL ESTIMATE

Data Sources from Projects with Underwater Sound Measurements

Typical Measured Sound Levels

Pile Size	Project/Location	Pile Position	Hammer Type	Position	Peak	SEL
20in	Stockton WWTP/San Joaquin River	Land adjacent to river	Impact	10m	198	171
				20m	188	163
36in	Stockton WWTP/San Joaquin River	Land adjacent to river	Impact	10m	201	173
				20m	198	170
			Vibrate	10m	165	160
				20m	160	150
36in	Humboldt Bay	Unattenuated In-water	Impact	10m	210	183
				50m	198	–
		Confined Bubble-Ring	Impact	10m	195	170
				50m	185	–
		Un-Confined Bubble-Ring	Impact	10m	192	170
				50m	183	–
24in	Geyserville Bridge/Russian River	On shore adjacent to river	Impact	15m	190	160
				90m	180	155
48in	Geyserville Bridge/Russian River	Immediately adjacent to shore	Impact	10m	200	175
				20m	200	172
				50m	190	165
24in	Ten Mile River/Pier 6	Cofferdam at shoreline	Vibrate	10m	175	~150
				100m	<165	<150
24in	Ten Mile River/Pier 6	Cofferdam at shoreline	Impact	10m	185	~165
				100m	170	~150

Condition	Distance	Peak	RMS	SEL	Source
24" SSP in deep water	10m	209	193	--[a]	Klamath River Bridge
24" SSP in shallow water	14m	200	185	172	Russian River Bridge
20" SSP in deep water	10m	210	186	173	San Joaquin River
24" CISS driven in water	10m	205	190	175	Various Projects
48" CISS driven on Land adjacent to water	10m	200	188	165	Russian River Bridge
24" SSP driven in water With Bubble Ring	10m	189	172	160	Tounge Point
24" SSP driven in water un-attenuated	10m	207	189	175	Tounge Point
48" CISS Piles driven in shallow water	10m	205	185	165	Russian River Bridge
24" CISS piles in deep water un-attenuated	10m	202-211	185-194	175-182	Siuslaw River
24" CISS piles in deep water with Bubble ring	10m	194-205	178-192	164-178	Siuslaw River
36" temp Tower D	20m	206-210		180-183	SFOBB
H- Piles	10m Deep	210-212	195[b]	179-182	American River
H- Piles	10m Shallow	205-206	190[b]	173-174	American River

[a] Not measured

[b] Estimated