PORT OF SAN FRANCISCO PROPOSED

MISSION BAY FERRY LANDING AND WATER TAXI LANDING PROJECT

INCIDENTAL HARASSMENT AUTHORIZATION PERMIT APPLICATION

Jolie Harrison, Division Chief
Permits and Conservation Division, Office of Protected Resources
1315 East-West Highway, F/PR1 Room 13805
Silver Spring, MD 20910
Jolie.Harrison@noaa.gov

Applicant and Property Owner:
Port of San Francisco
Pier 1, The Embarcadero
San Francisco, CA 94111

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LIST OF ACRONYMS

asl	above sea level
BA	Biological Assessment
BO	Biological Opinion
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CV	curriculum vitae
dB	decibel(s)
dB RMS	dB root mean square
EFH	Essential Fish Habitat
FESA	Federal Endangered Species Act
GGCR	Golden Gate Cetacean Research
Hz	Hertz
IHA	Incidental Harassment Authorization
MMPA	Marine Mammal Protection Act
µPa	microPascal
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service (also known as National Atmospheric and Oceanic Administration Fisheries)
NMSP	National Marine Sanctuary Program
NOAA	National Oceanic and Atmospheric Administration
PTS	Permanent Threshold Shift
RMS	route mean square
SEL	sound exposure level
cSEL	cumulative sound exposure level
SFOBB	San Francisco/Oakland Bay Bridge
sq km	square kilometers
TMMC	The Marine Mammal Center
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
YBI	Yerba Buena Island

INCIDENTAL HARASSMENT AUTHORIZATION PERMIT APPLICATION

1) A detailed description of the specific activity or class of activities that can be expected to result in incidental taking of marine mammals

This Incidental Harassment Authorization (IHA) Permit Application has been prepared for the proposed construction of the Mission Bay Ferry Landing (MBFL) and Water Taxi Landing (WTL) on San Francisco Bay, within the Port of San Francisco's Southern Waterfront in the Mission Bay/Central Waterfront area (see Figure 1**,** Location Map). The single-float, two-berth Ferry Landing will provide critical regional ferry service to and from the Mission Bay neighborhood, one of the fastest growing neighborhoods in San Francisco, as well as the Dogpatch, Potrero Hill, Pier 70, and the Central Waterfront neighborhoods. The separate single float, two-berth Water Taxi Landing will provide local water taxi access to the Mission Bay area and surrounding neighborhoods. The Ferry Landing will further activate existing maritime activity along our working waterfront.

A summary of anticipated project components is provided in Tables 1 and 2 below. Proposed project elements are shown in Figure 2, Ferry Landing and Water Taxi Landing Layout Plan and Dredge Areas.

Dredging of approximately 108,650 cubic yards (cy) to a design depth of -15 ft MLLW + 2 ft overdepth is proposed to provide adequate depth and safe navigation and approach for vessels to utilize the MBFL. An additional 3,118 is proposed to be dredged to meet design depth of -8 ft MLLW +1 ft overdepth for the WTL. The overall dredge boundary for both proposed landings encompasses approximately 8.4 acres. Table 3 below provides the proposed dredging volumes for the project. Sediment has been characterized for multiple disposal options through the Dredge Material Management Office (DMMO) regulatory process. The Sediment Characterization Results Report was submitted to the DMMO in December 2017. Suitability determinations were provided by the DMMO regulatory agencies for various disposal options as per current state and federal guidance.

Table 1 - Fixed Pier Platforms, Gangways, Floating Docks for MBFL and WTL

Location	Type of Structure	Type of Fill	Dimensions		Total Square Footage (sq ft)	Total Above Mean High Water (sq ft)	Total Below Mean High Water (sq ft)
			Length (ft)	Width (ft)			
Mission Bay Ferry Landing	Connecting Ramp	Pile Supported	26	22	572	528	44
	Pier	Pile Supported	108	22	2,376	0	2,376
	Gangway	Cantilevered	80	10	800	0	800
	Float	Floating	135	42	5,670	0	5,670
	Total Cumulative square footage over water					**528**	**8,890**
Water Taxi Landing	Platform	Pile-Supported	20	10.6	212	159	53
	Gangway	Cantilevered	80	6.2	496	0	496
	Float	Floating	65	16	1,040	0	1,040
	Total Cumulative square footage over water					**159**	**1,589**
TOTAL PROJECT FILL							**10,479**

Table 2 - Summary of Piles to be Installed for MBFL and WTL

Location	Type of Structure	No. Piles	Type of Pile	Surface Area Affected (sq.ft)	Total Above Mean High Water (sq.ft.)	Total Below Mean High Water (sq.ft.)
Mission Bay Ferry Landing	Connecting Ramp Piles	4	24-inch Octagonal Concrete	13	13	**0**
	Pier Piles	10	24- inch Octagonal Concrete	33	0	33
	Float Guide Piles	6	36-inch Steel	42	0	42
	Donut Fender Piles	2	36- inch Steel	14	0	14
	Total Cumulative Fill from Piles				**13**	**89**
Water Taxi Landing	Platform Piles	2	16-inch Steel	1.4	0	3
	Guide Piles	4	20-inch Square Concrete	11	0	11
	Total Cumulative Fill from Piles				**0**	**14**
TOTAL CUMULATIVE PROJECT FILL FROM PILES					**13**	**103**

Table 3 - Proposed Dredge Volumes

Dredge Area	Proposed Dredge Depth (feet MLLW)	Dredge Depth Estimated Volume (cy)	Overdepth (feet)	Overdepth Estimated Volume (cy)	Project Depth Plus Overdepth Estimated Volume (cy)	Dredge Boundary (acres)
Mission Bay Ferry Landing	-15	83,266	2	25,384	108,650	7.9
Water Taxi Landing	-8	2,337	1	781	3,118	0.5
Total Project		**85,603**		**26,165**	**111,768**	**8.4**

Demolition

Based on preliminary bathymetric surveys and historic information; it is anticipated that buried remnants of concrete and wood debris from the former Pier 64-66 aprons may be encountered within the Ferry Landing dredge boundary. All debris encountered during dredging operations will be removed and disposed of at an approved upland location.

In addition, existing piles will be pulled with cable choker or removed with a vibratory hammer and every effort will be made to remove the entire pile length. If it is necessary to utilize a vibratory hammer to remove a pile the process will consist of approximately 1-2 minutes of initial vibratory use while pulling the pile up to loosen it from the sediment. The barge/crane then moves to the next pile to loosen. The operator will do this for 5-8 piles then remove vibratory driver and go back to dead pull the loosened piles and place them on a debris barge for disposal at a permitted facility. The vibratory use is minimal and only to loosen the pile. Bay Area projects have been deferring to the Programmatic Biological Opinion (BO) for the U.S. Army Corps of Engineers Proposed Procedures for Permitting Projects that will Not Adversely Affect Selected Listed Species in California. Within this document, vibratory installation and removal of any pile may typically occur year round without significant impacts to biological resources. It is highly unlikely that the brief period of vibratory use for pulling piles would cause the ambient noise levels to escalate to a detrimental level beyond that which the marine mammals are accustomed to in this industrial waterfront.

Dredging

As presented in Table 3 above, dredging of approximately 111,768 cy will be conducted to a depth of – 15 ft MLLW + 2 ft of overdepth within the MBFL dredge boundary, and to a depth of -8ft MLLW +1 ft overdepth within the WTL dredge boundary. See Figure 2 for a depiction of the proposed dredge footprint for both landings.

Best Management Practices (BMPs) will be implemented and detailed in a Dredge Operations Plan (DOP) submitted to the regulatory agencies for approval before dredging begins. Dredging will be performed from a barge-mounted crane with a clamshell bucket. Sediment will be transferred into

adjacent barges for transport to permitted placement site(s). All debris encountered during dredging operations will be removed and disposed of at an approved upland location.

Pile Installation

Concrete piles used for in-water construction of the pier structure for the MBFL will involve installation of a steel caisson sleeve followed by drilling of the rock socket. Four 14-inch steel H piles will be driven with a vibratory driver to provide support for a 30-inch steel caisson sleeve. The steel sleeve will also be installed using a vibratory driver until refusal. Once the caisson is in place sediment/soil/rock will be drilled out using a Bauer BG18 drill or similar. All drilled sediment/soil/rock will be collected for disposal and transported to an appropriate permitted facility. The concrete piles are then inserted after the hole has been drilled. The 24-inch concrete piles will then be placed/seated in bedrock for grouting , following whichthe outer caisson and four H-piles will be pulled. Figure 3 provides a depiction of this process. This method of construction creates less overall noise and turbidity during installation than driven piles. Drilling also is beneficial as it reduces the stress and therefore the chance of breakage or damage to the pile during installation.

20-inch concrete piles for the MBFL guide piles and donut fenders and 16-inch steel piles for the WTL platform will be installed with a combination of vibratory driver and/or impact hammer. All other concrete piles will be installed with an impact hammer.

Piles installed using an impact hammer will use a Delmag D36/D46/D62 or similar diesel hammer. All impact pile driving will employ a “soft start” technique. It should be noted that the contractor will be instructed to implement vibratory installation as much as possible.

All pile driving will be performed in compliance with the “U.S. Army Corps of Engineers Proposed Procedures for Permitting Projects that will Not Adversely Affect Selected Listed Species in California” and the associated USFWS and NOAA Fisheries Section 7 Consultation documents associated with these procedures.

Installation of Ferry Landing Structural Elements

Pier Deck – The pier deck would be constructed overwater working from both the land and water-based vessels. Formwork would be constructed, rebar placed, and concrete poured. Equipment would consist of generators and a small land-based crane for placement of formwork and rebar. Concrete trucks and a concrete pump truck would work from land during placement of concrete.

Pier Canopy – Steel frame and railings would be fabricated off-site. The canopy would be assembled and installed on-site.

Float and Gangway – Both the float and gangway would be constructed off-site at the fabrication yard. The float would be towed to the project site for installation. The gangway with canopy would

be loaded on either a truck or barge and delivered to the project site. A derrick crane would lift and install the gangway.

Float Guide Piles and Donut Fender Piles – The float guide piles would be installed through the pile collars on the float. The donut fender piles would be installed at the specified locations and the 6-foot diameter floating fender would be placed over the piles.

2) The date(s) and duration of such activity and the specific geographical region where it will occur

The specific geographic location for the Project is provided in Figures 1 and 2 . Table 4 provides approximate durations for pile driving. It is anticipated that the production rate for pile driving could be 2 to 6 piles per day. However, Table 4 provides the maximum construction days possible for debris removal (1 day) and pile driving (14 days) totaling 15 days of potential construction. Vibratory and impact pile driving for installation of pier and floating docks will occur June through November of 2019 (established environment working windows for this region of the San Francisco Bay). Dredging will also occur within this window and duration of dredging activities is anticipated to be from 30 to 55 days.

3) The species and numbers of marine mammals likely to be found within the activity area

Very few species of marine mammals are found within San Francisco Bay; only Pacific harbor seals (*Phoca vitulina richardsi*), California sea lions (*Zalophus californianus*), and possibly harbor porpoises (*Phocoena phocoena*) are sighted year-round. Other marine mammal species that have been occasionally or rarely seen in San Francisco Bay include the gray whale (*Eschrichtius robustu*s), individual humpback whales (*Megaptera novaeangliae*), the bottlenose dolphin (*Tursiops truncates*), the northern elephant seal (*Mirounga angustirostris*), the Guadalupe fur seal (*Arctocephalus townsendi*), and the northern fur seal (*Callorhinus ursinus*). These species have been documented to rarely occur within San Francisco Bay (AECOM 2017, Caltrans 2015) and even less likely to occur within the project area during the periods of in-water work for this project. Most cetacean sightings tend to occur in the Central Bay (the area bound by the Golden Gate Bridge, the San Francisco – Oakland Bay Bridge (SFOBB), and Richmond Bridge), which is north of the Project area. The most common marine mammals cited year round in San Francisco Bay are Pacific harbor seals and California sea lions, which are the species most likely to occur in the project area. Occasionally, harbor porpoise may also be in proximity to the project site. Table 5 summarizes the status of marine mammal stocks potentially present in San Francisco Bay.

Table 4 - Summary of Pile Installation

Locations	Project Element	Pile Diameter	Pile Type	# Piles	Method	# Pile /day	# Construction Days
Debris Removal		12-inch	steel	12	If necessary, a vibratory hammer will be used to remove upto 12 piles 60-120 seconds/pile while pulling the pile up to loosen it from the sediment.	12	1
MBFL	Pier	14-inch	H-pile steel	4	Four 14-inch steel H beams will be driven with Vibratory Driver 600 seconds/pile to support 30-inch steel caisson sleeve driven with Vibratory Driver (900 sec/pile) to refusal, drill out hole removing soils, place and position concrete pile, grout pile in place while simultaneously pulling the caisson.	4	10
		30-inch	Steel Caisson	1		1	
		24-inch	Octagonal Concrete	10		1	
	Float Guide Piles	36-inch	Steel	6	Vibratory Driver 1200 sec/pile then Impact Hammer last 15 ft (150 strikes/pile ~ 20 minutes); bubble curtain will be used during impact duration	5	2
	Donut Fender Piles	36-inch	Steel	2	Vibratory Driver 1200 sec/pile then Impact Hammer last 15 ft (150 strikes/pile ~ 20 minutes); bubble curtain will be used during impact duration	5	
WTL	Platform	16-inch	Steel	2	Vibratory Driver 600 sec/pile then Impact Hammer last 15 ft (500 strikes/pile ~ 20 minutes); bubble curtain will be used during impact duration	2	1
	Guide Piles	20-inch	Square Concrete	4	Impact Hammer 500 strikes/pile (max 20 minutes); if necessary bubble curtain will be used during impact duration	4	1

Table 5 - Marine Mammals Potentially Present in San Francisco Bay

Species	Stock Name/ Status[1]	Stock Abundance	Relative Occurrence in San Francisco Bay	Season(s) of Occurrence
Pacific harbor seal *(Phoca vitulina)*	California stock/NS	30,968	Common	Year-round
California sea lion *(Zalophus californianus)*	U.S. stock/NS	296,750	Common	Year-round
Harbor porpoise *(Phocoena phocoena)*	San Francisco-Russian River Stock/NS	9,886	Common in the vicinity of the Golden Gate and Richardson's Bay. Rare elsewhere.	Year-round
Gray whale *(Eschrichtius robustus)*	Eastern North Pacific stock/NS	20,990	Rare to occasional, in the vicinity of the Golden Gate	Winter and Spring
Humpback whale (*Megaptera novaeangliae*)	California/Oregon/ Washington stock/ D,S; ESA-E	1,918	Rare to occasional, in the vicinity of the Golden Gate	Summer and fall
Bottlenose dolphin *(Tursiops truncates)*	California Coastal stock/NS	453	Common in the vicinity of the Golden Gate and Richardson's Bay. Rare elsewhere.	Year-round
Northern elephant seal (*Mirounga angustirostris*)	California Breeding Stock/NS	81,368	Rare	Spring and fall
Guadalupe fur seal (*Arctocephalus townsendi*)	Entire/D,S; ESA-T	20,000	Rare; stranding may occur in San Francisco Bay during El Niño years.	Year-Round
Northern fur seal (*Callorhinus ursinus*)	California stock/NS	14,050	Rare; stranding may occur in San Francisco Bay during El Niño years.	Year-round

Notes:
Table Source: NMFS 2017
1 Status: NS = No special designation under the MMPA, not listed in the Endangered Species Act (ESA).
D.S = Designated as Depleted and Strategic under the MMPA.
ESA-E = listed in the ESA as Endangered.
ESA-T = listed in the ESA as Threatened.

Marine mammal species likely to be found in the activity area include the Pacific harbor seal (*Phoca vitulina richardii*) and California sea lion (*Zalophus californianus*) as well as harbor porpoises (*Phocoena phocoena*). Harbor seals and California sea lion are found within the Bay at multiple sites either resting or foraging. There are no documented haul outs in the project vicinity of construction other than Yerba Buena Island (YBI) for harbor seals, which is more than three miles from the project site. Various sources have observed pinnipeds resting on channel marker buoys throughout the Bay, on the shorelines of Alcatraz or Angel Island and along San Francisco waterfront but these locations are not defined as "haul out" sites by the NMFS Southwest Regional Office. Over the last few years increasing numbers of harbor porpoise have been observed within San Francisco Bay. The Golden Gate Cetacean Research team has been monitoring this species and has reported more than 100 porpoises at one time entering San Francisco Bay.

This IHA concludes that harbor seals, sea lions, and harbor porpoises are the only marine mammal species that have the potential to be present in the vicinity of the proposed construction activities for the Mission Bay Ferry Landing and Water Taxi Landing Project. However, to address agency concerns and to be highly conservative, the Port will also evaluate the gray whale, the bottlenose dolphin, the northern elephant seal, and the northern fur seal to address Level B Harassment in the rare event they are present within the project area.

Typically, there is minimal marine mammal activity in the waters immediately adjacent to San Francisco waterfront facilities where the pier, floating dock and associated pile driving are proposed to be constructed for the Project. A lack of marine mammal activities in these areas may be due to the level of human disturbance along the San Francisco waterfront within Central Basin. A dry dock facility located at Pier 70 adjacent to the proposed MBFL location was actively repairing large vessels until 2016. The primary route for shipping traffic into and out of the Port of San Francisco and Port of Oakland is located between the San Francisco waterfront (project sites) and Angel Island. Marine shipping and cargo transport to Piers 80 A-D and Piers 92, 94-96 and other water dependent maritime uses frequently occur along the San Francisco waterfront. Ambient underwater noise for a major harbor like San Francisco is estimated to range between 120 to 155 dB based on sound monitoring conducted for the SFOBB Project (Caltrans 2009).

Figures 4-9 provide examples of anticipated Level A and Level B harassment zones for impact pile driving and vibratory pile driving.

The following sections describe each species that have the potential to be present within the project site where construction will take place.

Harbor Seal (Phoca vitulina richardii)

There are up to 500 haul out sites for the harbor seal distributed along their Pacific coast range. California's population is estimated at 30,968 individuals (NOAA 2016). The harbor seal is a permanent resident in San Francisco Bay. Harbor seals have established haul out sites at Castro Rocks in San Pablo Bay, YBI in the Central Bay, and Mowry Slough in the South Bay (NOAA 2007a).

The south side of YBI is the nearest haul out area to the Project site (approximately 3.3 miles from the project site).

As noted above, the YBI haul-out site is on the south side of the island, on USCG property. Harbor seals use Yerba Buena Island year-round, with the largest numbers seen during winter months, when Pacific Herring spawn (Grigg, 2008). During marine mammal monitoring for construction of the new Bay Bridge, harbor seal counts at Yerba Buena Island ranged from zero to 188 individuals (Caltrans, 2012). Foraging areas in the vicinity are concentrated between Yerba Buena Island and Treasure Island, and an area southeast of Yerba Buena Island (Caltrans, 2015).

WETA constructed a floating haul-out platform to replace a deteriorating dock that was removed as part of their Central Bay Operations and Maintenance Facility project located in Alameda, CA. The new platform was constructed in 2016 and is approximately 4.7 miles from the MBFL project site. Volunteer monitoring of harbor seal use of the Alameda haul-out platform has been conducted since its installation and reported 15 animals hauled out between June 2016 to April 2017 (AECOM 2017).

San Francisco Bay Pacific harbor seal counts ranged from 524 to 641 seals from 1987 to 1999 (Goals Project 2000). Marine mammal monitoring conducted by the California Department of Transportation (Caltrans) from May 1998 to February 2002 reported that at least 500 harbor seals populate San Francisco Bay (Green et al., 2006). The San Francisco Estuary Partnership in their 2015 Status update reported a mean of 328 harbor seals, excluding pups, which was based on the annual maximum number of seals counted at YBI and Castro Rocks from 2000-2010 (SFEP 2015).

The main pupping areas in San Francisco Bay are at Mowry Slough and Castro Rocks (Caltrans, 2012). Pupping season for harbor seals in San Francisco Bay spans from approximately March 15 through May 31, with pup numbers generally peaking in late April or May. Births of harbor seals have not been observed at Corte Madera Marsh and Yerba Buena Island, but a few pups have been seen at these sites. The Bay-Delta harbor seal population is estimated at between 500 and 700 individuals (NOAA 2007b). The haul-out area on YBI is approximately 3.3 miles from the project site.

California harbor seals are not listed under the endangered species act (ESA) or considered strategic under the MMPA (NOAA 2016).

California Sea Lion (Zalophus californianus)

California sea lions reside in the Eastern North Pacific Ocean in shallow coastal and estuarine waters. The most current NMFS stock assessment report estimates the U.S. stock population size at approximately 296,750 individuals (NOAA 2016). A common, abundant marine mammal, they are found throughout the west coast, generally within 10-miles of shore. California sea lions occur within the Bay-Delta in their highest numbers while migrating to and from their primary breeding areas on the Farallon and California Channel Islands, and when Pacific herring and salmon inhabit Bay-Delta waters to spawn or migrate to upriver spawning areas. They haul out on offshore rocks, sandy beaches, and onto floating docks, wharfs, vessels, and other man-made structures in the Bay and

coastal waters of the state. Winter numbers of California sea lion in the Bay are generally over 500 animals (Goals Project 2000).

In San Francisco Bay, California sea lions have been observed at Angel Island and occupying the docks near Pier 39 which is the largest California sea lion haul-out in San Francisco Bay. Up to 1,706 sea lions were historically counted at Pier 39 in 2009. However, since then the population has averaged at about 50-300 depending upon the season (TMMC 2017). This group of sea lions has decreased in size in recent years, coincident with a fluctuating decrease in the herring population in the Bay. There are no known breeding sites within San Francisco Bay. Their primary breeding site is in the Channel Islands (USACE 2011). The sea lions appear at Pier 39 after returning from the Channel Islands at the beginning of August (Bauer 1999). No other sea lion haul-out sites have been identified in the Bay and no pupping has been observed at the Pier 39 site or any other site in San Francisco Bay under normal conditions (USACE 2011). Although there has been documentation of pupping on docks in the Bay, this event was during a domoic acid event. It is not anticipated that any domoic events will occur during the project construction activities. The project site is approximately 4 miles away from Pier 39.

Although there is little information regarding the foraging behavior of the California sea lion in southern San Francisco Bay, they have been observed foraging on a regular basis in the shipping channel south of Yerba Buena Island. Foraging grounds have also been identified for pinnipeds, including sea lions, between Yerba Buena Island and Treasure Island, as well as off the Tiburon Peninsula (Caltrans, 2006). The California sea lions that use the Pier 39 haul-out site may be feeding on Pacific herring (*Clupea harengus*), northern anchovy (*Engravlis mordax)*, and other prey in the waters of San Francisco Bay (Caltrans, 2013). In addition to the Pier 39 haul-out, California sea lions haul out on buoys and similar structures throughout San Francisco Bay. They mainly are seen swimming off the San Francisco and Marin shorelines within San Francisco Bay, but may occasionally enter the project area to forage.

California sea lions in the U.S. are not listed under the ESA or considered depleted under the MMPA (NOAA 2016). They are also not considered a strategic stock under the MMPA (NOAA 2016).

Harbor Porpoise (Phocoena phocoena)

Harbor porpoise is a near-shore species that inhabits northern temperate and subarctic coastal and offshore waters. In the North Pacific, they are found from Japan (34°N) north to the Chukchi Sea and from Monterey Bay, CA to the Beaufort Sea. They are most often observed in Bays, estuaries, harbors, and fjords less than 650 feet (200 m) deep, like the San Francisco Bay-Delta. The San Francisco-Russian River Stock, identified as a unique genetic group, ranges from Point Arena to Monterey Bay. The most recent estimate of abundance for the San Francisco-Russian River stock, based on 2007-2011 aerial surveys is 9,886 (NOAA 2016). Harbor porpoises are non-social animals usually seen in groups of 2 to 5 individuals near the Golden Gate Bridge and open water areas of Central Bay. Unlike some of their cousins, harbor porpoises typically avoid boats and humans. Little information is known about their social behavior. Harbor porpoises feed on schooling fish such as herring and anchovies and invertebrates, including squid.

Occasional sightings of harbor porpoises (*Phocoena phocoena*) in the Bay, including near the Yerba Buena Island harbor seal haul-out site, were reported by the revised Caltrans marine mammal monitoring program (SRS 2004 as cited in WRA 2010) and the Golden Gate Cetacean Research (GGCR) Organization suggests that the species is returning to San Francisco Bay after an absence of approximately 65 years (GGCR 2010). This re-immergence is not unique to San Francisco Bay, but rather indicative of the harbor porpoise in general along the west coast. GGCR has begun a NMFS authorized, multi-year assessment to document porpoise population abundance and distribution in the Bay. Recent observations of harbor porpoises have been reported by GGCR researchers off Cavallo Point, outside Raccoon Strait between Tiburon and Angel Island, off Fort Point and as far into the Bay as Carquinez Strait (Perlman 2010). Based on the Caltrans and GGCR monitoring, over 100 porpoises were seen at one time entering San Francisco Bay; and over 600 individual animals have been documented in a photo-ID database. Reported sightings are concentrated in the vicinity of the Golden Gate Bridge and Angel Island, with lesser numbers sighted south of Alcatraz and west of Treasure Island (AECOM 2017).

Harbor porpoises have been observed in the central and north Bay and could potentially occur within the project site. Harbor porpoise in California are not listed under the ESA or considered depleted under the MMPA (NOAA 2016).

Northern Elephant Seal (Mirounga angustirostris)

Northern elephant seals spend approximately 9 months out of the year in the ocean. They usually dive underwater to depths ranging between 1,000-2,500 ft for 20-30-minute intervals with only short breaks at the surface. Due to this behavior, they are rarely seen out at sea. Northern elephant seals are found in the eastern and central North Pacific Ocean and range as far north as Alaska and as far south as Mexico, they typically breed in the Channel Islands of California or Baja California in Mexico. Breeding occurs between December and March. While on land they prefer sandy beaches.

Elephant seals do not have any established haul out sites in the San Francisco Bay, but occasional sightings have occurred. The most recent sighting was in 2012 on the beach at Clipper Cove on Treasure Island, when a healthy yearling elephant seal hauled out for a day. Approximately 100 juvenile northern elephant seals strand in San Francisco Bay each year, including individual strandings at Yerba Buena Island and Treasure Island (fewer than 10 strandings per year) (Caltrans 2018). The northern elephant seal is protected under the MMPA but is not listed as a strategic or depleted species under the MMPA or listed as endangered or threatened under the FESA.

Northern Fur Seal (Callorhinus ursinus)

The range of the northern fur seal extends from southern California, north to the Bering Sea and west to the Okhotsk Sea and Honshu Island, Japan (NMFS 2017). During the breeding season, the majority of the worldwide population is found on the Pribilof Islands in the southern Bering Sea, with the remaining animals spread throughout the North Pacific Ocean. The Eastern Pacific stock breeds and pups on islands in the Bering Sea, but females and juveniles move south to California waters to forage in the fall and winter months. Breeding occurs on the offshore islands of California and in the Bering Sea from May through July. On the coast of California, small breeding colonies are present at San Miguel Island off southern California, and the Farallon Islands off central California (NMFS 2017). The northern fur seal forages in the offshore waters of California, but only sick, emaciated, or injured fur seals enter the Bay. The Marine Mammal Center (TMMC) occasionally picks up stranded fur seals around YBI and Treasure Island. The rare occurrence of a northern fur seal near the project site makes it unlikely that the species will be exposed to construction activities. The California northern fur seal stock is protected under the MMPA but is not listed as a strategic or depleted species under the MMPA or listed as endangered or threatened under the FESA.

Bottlenose Dolphin (Tursiops truncates)

The California coastal stock of bottlenose dolphin is relatively small. They spend the majority of time in nearshore waters and thus can be frequently seen. Bottlenose dolphins are most often observed just east of the Golden Gate Bridge and within the Golden Gate; their presence may depend on the tides (GGCR, 2016). One dolphin has been sighted repeatedly in San Francisco Bay off Alameda since July 2016 (GGCR, 2016). Despite this sighting, this stock is highly transitory in nature, and is not expected to spend extended periods of time in San Francisco Bay nor at the project site. However, over the last few years the number of sightings in the Central Bay has increased, which may indicate they are becoming more of a resident species. The common bottlenose dolphin is protected under the MMPA but is not listed as a strategic or depleted species under the MMPA, or listed as endangered or threatened under the FESA.

Gray Whale (Eschrichtius robustus)

Gray whales are one of the most frequently seen whales along the California Coast. Adult whales carry heavy loads of attached barnacles, which add to their mottled appearance. Gray whales are the only baleen whales known to feed on the sea floor, where they scoop up bottom sediments to filter out benthic crustaceans, mollusks, and worms (NMFS 2017). They feed in northern waters primarily off the Bering, Chukchi, and western Beaufort seas during the summer, before heading south to the breeding and calving grounds off Mexico over the winter. Southward migration occurs between December and January. The northward migration occurs between February and March. Coastal waters just outside San Francisco Bay are considered a migratory Biologically Important Area for the northward progression of gray whales (Calambokidis 2015). A few individuals will enter into the San Francisco Bay during their northward migration. The gray whale is protected under the

MMPA but is not listed as a strategic or depleted species under the MMPA or listed as endangered or threatened under the FESA.

A description of the status, distribution, and seasonal distribution (when applicable) of the affected species or stocks of marine mammals likely to be affected by such activities.

See information provided in response to **Question 5**.

4) The type of incidental taking authorization that is being requested (i.e., takes by harassment only; takes by harassment, injury and/or death) and the method of incidental taking

Under Section 101 (a)(5)(D) of the MMPA, the Port of San Francisco requests an authorization from the NMFS for incidental take by Level B harassment (behavioral disturbance only) as defined by Title 50 CFR, Part 216.3 (i.e., IHA) of small numbers of marine mammals. The Port of San Francisco is requesting Level B harassment of Pacific harbor seals, California sea lions and harbor porpoise during pile driving activities during construction of the Mission Bay Ferry Landing and Water Taxi Landing project. Incidental take by Level B Harassment of bottlenose dolphin, gray whale, elephant seal, and northern fur seal is also being requested in the rare event they are present in San Francisco Bay during the two weeks of proposed pile driving.

Specific activities associated with the Project that may result in "take by harassment" include:

a) Acoustic disturbance/harassment only associated with pile driving using vibratory and impact hammers

   Implementation of measures detailed in **Question 11** will prevent slight injury from Permanent Threshold Shift (PTS) in an animal's hearing (Level A harassment), serious injury, or mortality of marine mammals.

   See **Table 5** and the response to **Question 6** below for a detailed description of the anticipated take associated with these activities. The noise exposure estimates presented in this IHA request attempts to quantify potential exposures to marine mammals resulting from underwater noise generated during pile driving activities. These calculations are based on a conservative approach to provide an overestimation of exposures as it is assumed all animals are exposed 100 percent of the time to the highest production rate of pile driving. Appendix A provides complete sound calculation tables with estimates of exposures by species.

   The on land components associated with the Project will not affect marine mammals. Therefore, no impacts to marine mammals will occur due to installation associated with these elements.

5) By age, sex, and reproductive condition (if possible), the number of marine mammals (by species) that may be taken by each type of taking identified in paragraph (a)(5) of this section, and the number of times such takings by each type of taking are likely to occur

The potential numbers of marine mammals that may be exposed to take as defined in the MMPA is determined by comparing the calculated areas over which the Level B and Level A harassment thresholds may be exceeded with the expected distribution of marine mammal species within the vicinity of the proposed project. Estimates here are determined by using densities from CalTrans monitoring and reporting (Caltrans 2018). Take requested is expected to have no more than a behavioral effect on individual marine mammals and no effect on the populations of these species.

Any effects experienced by an individual are anticipated to be limited to short-term disturbance of normal behavior or temporary displacement near the source of the noise. As previously stated monitoring will be conducted during pile driving activities and will ensure that marine mammals do not enter into the Level A harassment area. Table 6 provides a summary of the requested take coverage.

The age, sex, and reproductive condition of individuals of each species that may potentially be taken is difficult to estimate given the lack of information on the class distribution of these species within the project area and greater San Francisco Bay. Provided below are estimates for each species potentially affected.

Pacific Harbor Seal and California Sea Lion

As previously described, the nearest known haul out site (Yerba Buna Island) for the Pacific harbor seal is approximately 3.3 miles and 4.7 miles from the new platform installed offshore of Alameda from the MBFL project site. The nearest haul out site at Pier 39 for the California sea lion is approximately 4 miles from the project site. These species may use the waters adjacent to the project site for foraging or for daily migrations between foraging and haul out locations. California sea lions breed and give birth in spring, primarily in the Channel Islands, and Pacific harbor seals in San Francisco Bay generally pup March through May, within the Bay. The impact pile driving activities within the project area will avoid the pupping season (March – May) for these species. Therefore, it is expected that only adults, juveniles, and weaned pups would be the age classes impacted.

Daily movements of and foraging by harbor seals and California sea lions have been observed at various locations along the San Francisco waterfront. Monitoring data collected by Caltrans for the SFOBB project over 17 years presents the most recent and pertinent data that can be used to approximate density of these species at the project site. The monitoring work by Caltrans was located in the vicinity of the YBI haul out site whereas the MBFL and WTL construction activities will occur over 3 miles from known haul out sites.

Monitoring for the SFOBB project has been conducted over the past 17 years, therefore, the in-water densities of harbor seals and California sea lions established from the most recent Caltrans report will be utilized for these species (Caltrans 2018). The most conservative CalTrans data for the estimation of the density of harbor seals and California sea lions will be used; 3.957 seals/sq km/day

and 0.161 sea lions/sq km/day respectively (Caltrans 2018). The numbers of individual pinnipeds counted for the SFOBB project are likely higher than those where pile driving activities will occur for this project.

Northern Elephant Seal

As stated previously, elephant seals breed between December and March and have been rarely cited in the Bay. It is anticipated that if an elephant seal is encountered at all during pile driving it would be a juvenile. To address agency concerns and to be highly conservative, take of one elephant seal that could potentially be present during construction activities is requested.

Northern Fur Seal

Observations of northern fur seals are too few to establish a density for this species. TMMC reported only two to four northern fur seal strandings in the Bay in 2015 and 2016 (in Marin, San Francisco, and Santa Clara counties) (TMMC 2017). To address agency concerns and to be highly conservative, take of one northern fur seal that could potentially be present during construction activities is requested.

Harbor Porpoise

Sightings of harbor porpoise greater than ½ mile inside the Golden Gate Bridge are infrequent (NOAA 2009). However, as previously stated the species is returning to San Francisco Bay. Monitoring of marine mammals in the vicinity of the SFOBB has been ongoing for 17 years; from those data, Caltrans has estimated at-sea density for harbor porpoise of 0.167 animal per square kilometer (Caltrans, 2018). It is possible that small groups of individuals may enter the project area within ranges for - Level B isopleths as shown in Figures 4-8. In order to estimate take for harbor porpoises, the CalTrans density of 0.167 per/sq km/ day will be utilized (CalTrans 2018). The numbers of harbor porpoises counted for the SFOBB project are likely higher than those where pile driving activities will occur for this project.

Bottlenose Dolphin

Sightings of bottlenose dolphins are too few to establish a density for this species. As stated previously, there have been limited observations within Central and South San Francisco Bay. To address agency concerns and to be highly conservative, take of one bottlenose dolphin that could potentially be present during construction activities is requested.

Gray Whale

Sightings of gray whales are too few to establish a density for this species. There have been no observations of gray whales within the project area. According to TMMC, two to six gray whales enter the Bay each year in late winter through spring (February through April), presumably to feed. Gray whales rarely occur in the Bay from September through December. To address

agency concerns and to be highly conservative, take of one gray whale that could potentially be present during construction activities is requested.

Pile Driving

The disturbance to marine mammals from pile driving is likely to consist only of avoidance behavior and potential reduction in foraging. Details regarding the pile driving are explained in response to **Question 1** and within this section. All pile driving will occur between June through November 2019. Coordination with the California Department of Fish and Wildlife (CDFW) and NMFS has been ongoing and Biological Assessments have been submitted to both agencies. Final concurrence of the Biological Assessment that was submitted to CDFW is pending as well as the final Biological Opinion for ESA and EFH from NMFS.

A total of 18 piles are proposed to be driven for the MBFL and 6 piles will be driven for the WTL. It is anticipated that actual construction activities associated with pile driving will encompass approximately 15 days. Pile driving activities have the potential to incidentally take marine mammals through harassment due to acoustic disturbance. Tables 2 and 4 above provide detail on the number and type of piles proposed to be installed as well as estimated construction days to drive each pile type. To calculate estimates for take request, Table 6 provides the maximum number of potential construction days that a marine mammal may be exposed to sound impacts related to each type of pile to be driven. Impact pile driving calculations are included for informational purposes, because this application covers both types of pile driving. Only vibratory pile driving take calculations are used for the take request in this application, because they are more conservative (i.e., they result in a higher amount of Level B take). The following provides an example of the formula used to provide a conservative estimate of the number of harbor seals that may be potentially affected by noise from pile driving activities:

Level B Exposure estimate = N (estimated animals/day) × days of noise generating activities

Both impact and vibratory pile driving are expected to occur each day and may include installation of multiple piles per day. Therefore, the largest monitoring zone area was used to calculate Level B take estimates. As shown in Table 8 the Level B 120 dB zone is the largest for any given day of pile driving. For each calculation, the calculated number was rounded up to the nearest whole animal.

36 -inch steel pile driving with an impact hammer: Based on an at-sea density of 3.975 animal per square kilometer and the area over which the Level B harassment may be exceeded as shown in Table 8 and Figures 4-8. 3.975 animal/sq km x 47.16 sq km = 186.62 animals per day may be exposed to Level B harassment.

Most species will be present only occasionally. It is assumed that the take request includes multiple harassments of the same individuals.

Appendix A provides tables which detail sound estimate calculations as well as take estimates. **Table 6** provides a summary of the take requested for the entire Project timeline. The applicant is requesting Level B Take for only pile driving activities; there is no request for Level A or B Harassment for any other project components.

Table 6 - Summary of Estimated Take by Species (Level B Harassment)

Pile Type	Pile Driver	# Piles /day	# days	Estimated Take by Level B Harassment (take per day/total)		
				Harbor Seal Density = 3.957/sqkm/day[a]	California Sea Lion Density = 0.161/sqkm/day[a]	Harbor Porpoise Density = 0.167/ sqkm/day[a]
12-inch steel	Vibratory	12	1	12.47/12.47	0.51/0.51	0.53/0.53
14- inch steel H-pile	Vibratory	8	10	30.24/302.44	1.23/12.31	1.28/12.76
30-inch steel caisson	Vibratory	2		186.62/1,866.15	7.59/75.93	7.88/78.76
36-inch steel	Impact	8	2	186.62/373.23	7.59/15.19	7.88/15.75
20-inch concrete	Impact	4	1	186.62/186.62	7.59/7.59	7.88/7.88
16-inch steel	Impact	2	1	186.62/186.62	7.59/7.59	7.88/7.88
Total Take Requested for Project				**2,927.52**	**119.11**	**123.55**
Total Take Requested For Project Rounded To Whole Number				**2,928**	**120**	**124**

Notes:

a – species density obtained from CalTrans monitoring 2018

In addition to take requested for species listed in Table 6 and as stated previously, to address agency concerns and to be highly conservative, take of **one** of each of the following that could potentially be present during construction activities will be requested: elephant seal, northern fur seal, bottlenose dolphin and gray whale.

6) The anticipated impact of the activity upon the species or stock

Project construction activities may temporarily impact marine mammal species by disrupting foraging behavior. However, this type of harassment would be temporary in nature and would only affect those marine mammals within the immediate vicinity of the Project. Accordingly, no long term impacts to the species or stocks are expected to occur as a result of the Project.

Pile Driving

Pile driving for installation of the piers and floating docks may impact marine mammal species through temporary avoidance and disruption of foraging behavior, but no long term impacts to the species or stock are expected to occur as a result of the project. As stated previously, typically there is moderate marine mammal activity in the waters immediately adjacent to waterfront facilities where the project site is located and associated vibratory and impact pile driving are proposed. As described above in **Question 3,** the San Francisco waterfront experiences a high level of commercial and recreational aquatic activities. The primary route for shipping traffic into and out of the Port of San Francisco and Port of Oakland is located between the San Francisco waterfront and Angel Island. Marine shipping and cargo transport to Piers 80 A-D, Piers 90-92, and Piers 94-96 as well as other water dependent maritime uses frequently occur along the San Francisco waterfront in the project vicinity. Ambient underwater noise for a major harbor like San Francisco is estimated at approximately 150 dB based on sound monitoring conducted for the SFOBB Project (Caltrans 2009). These levels of noise exceed the NMFS threshold for continuous sound levels of 120 dB for marine mammal disturbance under ambient conditions.

As previously detailed in **Question 1**, vibratory pile driving will only occur for the 14-inch H piles and 30- inch caisson sleeve which will be used to drill out a hole for the 24-inch and 20-inch concrete piles to be placed/seated in bedrock for grouting then the outer caisson and four H-piles will be pulled. The 36-inch steel piles for the guide piles and donut fenders will most likely be installed with an impact hammer, however, the selected contractor may decide to use a vibratory hammer to start and then switch to the impact hammer. All other concrete piles will be installed with an impact hammer.

All impact pile driving will employ a "soft start" technique. Tables 7 and 8 summarize pile size and associated sound levels (in dB RMS) estimated for each pile type. Harassment threshold isopleths for pile driving were based on the sound level produced at the source and the expected attenuation rate of sound with distance from the source. Based on the anticipated sound levels given in Tables 7 and 8, the expected distance from the source sound to the NMFS thresholds for acoustic impacts to marine mammals was calculated.

Noise Effects from Pile Driving

Concrete and steel piles that are driven within the water column can produce high-intensity noise resulting in damage to soft tissues, and/or result in harassment of fish and marine mammals such that they alter swimming, sleeping, or foraging behavior or abandon temporarily forage habitat. Based on the sound calculations, mitigation measures, and recent monitoring results from projects

within San Francisco Bay, fish kills or injuries are not anticipated during pile driving activities. Sound monitoring will be implemented to confirm that noise levels remain below established thresholds. The striking of a pile by a pile-driving hammer creates a pulse of sound that propagates through the pile, radiating out through the water column, seafloor, and air. Sound pressure pulses, as a function of time are referred to as a waveform. Peak waveform pressure underwater is typically expressed in decibels (dB) referenced to 1 micro Pascal (µPa). Sound levels are generally reported as peak levels (peak) and sound exposure levels (SEL). In addition to the pressure pulse of the waveform, the frequency of the sound, expressed in Hertz (Hz) is also important to evaluating the potential for sound impacts. Low frequency sounds are typically capable of traveling over greater distances with less reduction in the pressure waveform than high frequency sounds.

Vibratory pile drivers work on a different principle than pile-driving hammers and produce a different sound profile. A vibratory driver works by inducting particle motion to the substrate immediately below and around the pile causing liquefaction of the immediately adjacent sediment, allowing the pile to sink downward or to be removed. Vibratory pile driving is only suitable where soft substrate is present. The noise produced by vibratory drivers driving concrete and steel piles in water range between 165-195 dB (Peak) and 150-180 dB (SEL) (Caltrans 2009). These sound levels are typically 10-20 dB lower in intensity relative to the higher, pulse-type noise produced by an impact hammer (Caltrans 2009).

To estimate isopleths distances for each pile size and type, the sound levels from pile driving the closest pile size and type from the existing monitoring data were used to provide a potential dB RMS range that pinnipeds may encounter (Tables 6 and 7). Tables 6 and 7 present estimated sound levels which were calculated using the compendium data and associated isopleths distances for various NMFS thresholds. Note that noise impacts related to drilling activities resulted in calculated distances to cumulative SEL and behavioral thresholds of less than 10 meters; thus impact areas and take were not calculated (see Appendix A) for this activity.

A Sound Monitoring Plan (SMP) will be developed for the pile driving activities to ensure thresholds are not exceeded (**Question 11** provides greater detail).

Table 7 - Estimated Pile-Driving Noise Levels and Distances of Level A Threshold Isopleths with Vibratory and Impact Driver

Pile Diameter & Type	Installation method	Source Levels At 10 meters (dB)		Distance to Level A Thresholds (vibratory & impact) in meters				
		PEAK	cSEL	Phocids (harbor seals) 201dB/185 dB	Otariids (sea lions, fur seals) 219dB/203 dB	Low- Frequency Cetaceans (gray, humpback whales) 199dB/183 dB	Mid- Frequency Cetaceans (bottlenose dolphin) 198 dB/185 dB	High- Frequency Cetaceans (harbor porpoise) 173 dB/155 dB
12-inch steel	vibratory	171	155	0.9	0.1	1.5	0.1	2.2
14-inch steel H pile [1]	Vibratory	165	158	1.3	0.1	2.1	0.2	3.0
30- inch steel Caisson [1]	Vibratory	180	170	6.6	0.5	10.8	1	16
36-inch Steel	Impact[2]	186	176	129.8	9.5	242.6	8.6	288.9
16-inch Steel	Impact[2]	177	151	3.9	0.3	7.3	0.3	8.8
20-inch Concrete	Impact[2]	172	160	24.8	1.8	46.4	1.7	55.3

Notes:

Source levels taken from Caltrans, 2015; Level A thresholds are based on the NMFS 2016 Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing; cSEL threshold distances are shown.

1. As noted in Table 4 for the MFBL pier and WTL platform for each concrete pile installed Four 14 inch steel H beams will be driven with Vibratory driver 600 sec/pile to support 30 inch steel caisson sleeve driven with vibratory (900 sec/pile) to refusal, drill out hole removing soils, place and position concrete pile, grout pile in place while simultaneously pulling the caisson.
2. A 7-dB reduction was assumed for impact driving due to the use of bubble curtains and highest production rate of piles per day (See Appendix A Sound Calculation Tables).

Table 8 - Estimated Pile Driving Noise Levels and Distances of Level B Threshold Isopleths with Impact and Vibratory Drive

Pile Diameter	Pile Type	# Piles	Source Levels at 10 meters (dB)		Distance to Level B Threshold in meters	
			PEAK	cSEL	160 dB	120 dB
12-inch steel	Vibratory	12	171	155	4.6	2,154.4
14-inch steel H pile[1]	Vibratory	4	165	158	7.4	3414.5
30- inch steel Caisson[1]	Vibratory	1	180	170	46.4	21,544
36-inch Steel	Impact[2]	8	194	173	541.2	NA[3]
16-inch Steel	Impact[2]	2	198	151	135.9	NA[3]
20-inch Concrete	Impact[2]	4	178	160	63.1	NA[3]

Notes:

Source levels taken from Caltrans, 2015.

1. As noted in Table 4 for the MFBL pier and WTL platform for each concrete pile installed Four 14 inch steel H beams will be driven with Vibratory driver 600 sec/pile to support 30 inch steel caisson sleeve driven with vibratory (900 sec/pile) to refusal, drill out hole removing soils, place and position concrete pile, grout pile in place while simultaneously pulling the caisson
2. A 7dB reduction was assumed for impact driving due to the use of bubble curtains and highest production rate of piles per day (See Appendix A Sound Calculation Tables)
3. Behavioral disruption for impulsive noise (e.g., impact pile driving) is set at 160 dB for impact hammer (http://www.westcoast.fisheries.noaa.gov/protected_species/marine_mammals/threshold_guidance.html)

Noise Effects to Marine Mammals

In-water construction activities associated with the project would include impact pile driving and vibratory pile driving. The sounds produced by these activities fall into one of two general sound types: Pulsed and non-pulsed (defined in the following). The distinction between these two sound types is important because they have differing potential to cause physical effects, particularly with regard to hearing (Southall et al., 2007).

Airborne noise will primarily be an issue for pinnipeds that are swimming or hauled out near the project site within the range of noise levels elevated above the acoustic criteria. The airborne threshold for harbor seals is 90 dB RMS re 20µPa and for other pinnipeds is 100 dB RMS re 20µPa. We recognize that pinnipeds in the water could be exposed to airborne sound that may result in behavioral harassment when looking with their heads above water. Most likely, airborne sound would cause behavioral responses similar to those discussed above in relation to underwater sound. For instance, anthropogenic sound could cause hauled-out pinnipeds to exhibit changes in their normal behavior, such as reduction in vocalizations, or cause them to temporarily abandon the area and move further from the source. However, these animals would previously have been `taken' as a result of exposure to underwater sound above the behavioral harassment thresholds, which are in all cases larger than those associated with airborne sound. Thus, the behavioral harassment of these animals is already accounted for in these estimates of potential take. Multiple instances of exposure to sound above NMFS' thresholds for behavioral harassment are not believed to result in increased behavioral disturbance, in either nature or intensity of disturbance reaction. Therefore, we do not believe that authorization of incidental take resulting from airborne sound for pinnipeds is warranted, and airborne sound is not discussed further here.

Updated NOAA guidance includes sound thresholds for slight injury to an animal's hearing, or PTS (Level A Harassment). The underwater sound pressure threshold for slight injury or PTS (Level A harassment) is a dual metric criterion for impulse noise (e.g., impact pile-driving), including both a peak pressure and cSEL threshold, which is specific to the species hearing group (i.e., high-frequency cetaceans [i.e., harbor porpoise], mid-frequency cetaceans [i.e., bottlenose dolphin], low-frequency cetacean [i.e., gray whale], phocids [i.e., Pacific harbor seal and northern elephant seal], and otariids [i.e., California sea lion and northern fur seal]) (NOAA 2016 b). For continuous noise (e.g., vibratory pile extraction or driving), the PTS threshold is based on cSEL for each species hearing group. Table 6 presents estimated noise levels for Level A harassment.

The thresholds for Level B behavioral harassment levels of 160 dB RMS for impulse sounds and 120 dB for non-impulsive or continuous sounds previously established are still applicable. Level B behavioral harassment is considered to have occurred when marine mammals are exposed to noise of 160 dB RMS or greater for impulse noise and 120 dB RMS for continuous noise. In some instances, ambient noise levels may be used in place of the 120-dB RMS threshold for continuous noise. Level B behavioral harassment thresholds for underwater noise are shown in Table 7.

Figures 4 through 7 provide calculated NMFS Threshold isopleths for each anticipated pile to be driven either by vibratory or impact hammers for construction activities. The Bay waters adjacent

to locations where pile driving will occur can be used by harbor seals, California sea lions, and harbor porpoises for foraging and transit within the Bay. The potential for disturbance exists. However, the implementation of a Sound Monitoring Plan (SMP) as required in the NMFS programmatic review for pile driving activities in San Francisco Bay is expected to further reduce the potential for noise effects on these and any other marine mammals.

The SMP plan will describe a process for establishing Level A marine mammal safety zones (MMSZs) and Level B buffer zones (collectively 'safety zones') based on the isopleth thresholds for marine mammals. Predicting audibility (or detectability) with any certainty at distances beyond 1,000 meters is not possible (CalTrans 2009). Therefore, the maximum safety zone distance will be at 1,000 meters, but is likely to be smaller. Monitoring sound within an active maritime waterfront such as San Francisco includes these ambient noise and monitoring at greater distances from the source (>1,000ft) can cause uncertainty in determining if the sound level recorded is strictly attributable to only the pile driving. As previously stated, ambient sound levels range from 120 to155 dB in the Bay, which exceeds the NMFS threshold for continuous sound levels of 120 dB.

To address the potential conflict with ambient noise conditions, the SMP will recommend sound monitoring stations, which could be located at 10 m, 100m, and 300m. Safety zones will be established and finalized in the Project SMP.

Marine mammal monitors will be present during pile driving activities (as further described in **Question 11**). The monitors will record observations of marine mammals within the safety zones before, during, and after pile driving activities. Should a marine mammal come within or approach a safety zone prior to the start of pile driving, pile driving activities will be delayed until the mammal is either seen exiting the safety zone or if the marine mammal has not been observed within the area for a period of 15 minutes or more.

7) The anticipated impact of the activity on the availability of the species or stocks of marine mammals for subsistence uses

Marine mammals in San Francisco Bay are not harvested for subsistence use. Therefore, no impact would occur to subsistence uses.

8) The anticipated impact of the activity upon the habitat of the marine mammal populations, and the likelihood of restoration of the affected habitat

No permanent impacts are expected to marine mammals. Impacts related to installation of the MBFL and WTL and noise disturbances from pile driving are temporary and would not require restoration. Site conditions are anticipated to be substantively unchanged from existing conditions for marine mammals following project implementation and completion.

As described in detail above under **Question 7**, the proposed Project is not anticipated to cause any long term impacts to marine mammal species.

9) The anticipated impact of the loss or modification of the habitat on the marine mammal populations involved

Construction of the MBFL and WTL structures and dredging for the project will result in the disturbance of up to approximately 8.4 acres of predominantly fine-grained sediment and the associated benthic infaunal community. Total habitat disturbed from the project activities is estimated at 0.000071% of the total South San Francisco Bay subtidal habitat available (NOAA 2007c).

Altering benthic habitat and associated infaunal and epifaunal communities can result in the loss or reduction of suitability as fish foraging habitat, especially for sensitive species including salmon, steelhead, green sturgeon, and groundfish as well as potentially for marine mammals. This community and the fine grained sediment it inhabits is one of the most common in San Francisco Bay-Delta. Following dredging, the deposition of sediments, comparable to pre-dredging conditions, would begin almost immediately and the benthic community inhabiting those sediments is expected to recover to pre-dredging composition and abundances within a few months to up to two years, depending on when dredging occurs and other ecological factors affecting recolonization.

Given the total area calculated above, the MBFL and WTL construction activities including dredging affects an area comprising 0.000071% of the active layer in the South San Francisco Bay. Beyond the consideration of the relatively extremely small fraction of this area relative to the total available area for foraging and transit for marine mammals, it is questionable whether the project activities could contribute measurably to impacting foraging habitat or introducing elevated contaminant exposure through biological receptors because much of the same sediments are disturbed by the effects of ship and tugboat activity that characterize the Project area, and even more so from tidal currents, storm events and other natural processes.

To minimize impacts, in-water construction will be limited to locally established environmental work windows between June and November. As noted previously in **Question 5**, coordination with the CDFW and NMFS has been ongoing and biological assessments have been submitted.

10) The availability and feasibility (economic and technological) of equipment, methods, and manner of conducting such activity or other means of effecting the least practicable adverse impact upon the affected species or stocks, their habitat, and on their availability for subsistence uses, paying particular attention to rookeries, mating grounds, and areas of similar significance

The Project is not anticipated to result in any Level A impacts to marine mammals, but may result in Level B harassment of Pacific harbor seals, California sea lions and harbor porpoises. Level B harassment associated with the proposed project would be temporary in duration and is not expected to result in long term effects to marine mammals or their habitat in the region. Avoidance and minimization measures for each related impact are provided below:

General In-water Construction

During in-water construction using heavy machinery (e.g., using standard barges, tug boats, barge-mounted excavators, or clamshell equipment used to place or remove material), a minimum 10 meters shutdown zone shall be implemented. If a marine mammal comes within 10 meters of equipment being used, operators shall pause and vessels shall reduce speed to the minimum level required to maintain steerage and safe working conditions until the marine mammal has moved out of the 10- meter zone. Workers on board will make observations 15 minutes prior to initiating operation of equipment.

Pile Driving

Level B harassment would be temporary in duration, and is not expected to result in any long term effects to marine mammal stocks or habitat in the region. The vibratory hammers anticipated to be used will substantially minimize potential affects to marine mammals. When an impact hammer is used a "soft-start" procedure at the start of vibratory hammer activity will be used to allow animals within the area a chance to leave before full energy is reached. The soft-start requires contractors to initiate noise from vibratory hammers for 15 seconds at reduced energy followed by a 1-minute waiting period. The procedure will be repeated two additional times before full energy is achieved. This procedure will be conducted prior to driving each pile if vibratory pile-driving ceases for more than 30 minutes.

Avoidance and Minimization Measures that will be implemented for pile driving include the following:

- All in-water construction will be conducted within the established Bay Area environmental work windows between June and November. These windows were approved within a programmatic biological opinion (NMFS and CDFW) for the Long-Term Management Strategy (LTMS) program for managing sediment within the San Francisco Bay.

- Vibratory pile drivers will be used for the installation of all steel pilings (36-inch and 18-inch diameter). Vibratory pile driving will be conducted following the USACE "Proposed Procedures for Permitting Projects that will Not Adversely Affect Selected Listed Species in California". USFWS and NMFS completed Section 7 consultation on this document which establishes general procedures for minimizing impacts to natural resources associated with projects in or adjacent to jurisdictional waters (NMFS 2007). Under this guidance a vibratory hammer may be used year-round to install steel, wood, or concrete piles of any size and in any number.

- Sound attenuation methods will be implemented for the duration of impact to install 36 -inch and 18-inch steel and 20-inch concrete piles (i.e., cushion block, bubble curtain, sleeve etc.) and shall implement the following bubble curtain performance standards:

    - The bubble curtain must distribute air bubbles around 100 percent of the piling perimeter for the full depth of the water column.

- The lowest bubble ring shall be in contact with the mudline for the full circumference of the ring, and the weights attached to the bottom ring shall ensure 100 percent mudline contact. No parts of the ring or other objects shall prevent full mudline contact.

- The selected contractor will ensure that personnel are trained in the proper balancing of air flow to the bubblers and shall require that construction contractors submit an inspection/performance report for approval by the Port within 72 hours following the performance test. Corrections to the attenuation device to meet the performance standards shall occur prior to impact driving

- As described in detail in **Question 6 above**, the Port will develop a NMFS-approved Sound Monitoring Plan (SMP) prior to the start of pile driving. The SMP will provide detail on the methods used to monitor and verify sound levels during pile driving activities. The sound monitoring results will be made available to NMFS. Examples of conditions for marine mammal observers may include the following:

  - MMOs would be located at the best vantage point(s) in order to properly see as much of the disturbance zone as possible;

  - During all observation periods, observers will use binoculars and the naked eye to search continuously for marine mammals;

  - If the Level A zone is obscured by fog or poor lighting conditions, pile driving at that location will not be initiated until that zone is visible. Should such conditions arise while impact driving is underway, the activity would be paused; and

  - The Level A Zone and observable portion of the disturbance zone around the pile will be monitored for the presence of marine mammals 30 minutes before, during, and 30 minutes after any pile driving activity.

- An approved biological monitor will be available to conduct surveys before and during pile driving to inspect the work zone and adjacent Bay waters for marine mammals. A marine mammal observer will have the following qualifications:

  - Independent observers (not construction personnel) are required.

  - At least one observer must have prior experience working as an observer.

  - Other observers may substitute education (undergraduate degree in biological science or related field) or training for experience.

  - Where a team of three or more observers are required, one observer should be designated as lead observer or monitoring coordinator. The lead observer must have prior experience working as an observer.

  - Submission and approval of observer CVs by NMFS.

  - Ability to conduct field observations and collect data according to assigned protocols

- Experience or training in the field identification of marine mammals, including the identification of behaviors
- Sufficient training, orientation, or experience with the construction operation to provide for personal safety during observations
- Writing skills sufficient to prepare a report of observations including but not limited to the number and species of marine mammals observed; dates and times when in-water construction activities were conducted; dates and times when in-water construction activities were suspended to avoid potential incidental injury from construction sound of marine mammals observed within a defined shutdown zone; and marine mammal behavior
- Ability to communicate orally, by radio or in person, with project personnel to provide real-time information on marine mammals observed in the area as necessary.

- The monitor will be present as specified by NMFS during impact pile-driving phases of construction and ensure the following:
  - Maintain the safety zones established in the sound monitoring plan around sound source, for the protection of marine mammals in association with sound monitoring station distances, as approved by NMFS.
  - Halt work activities when a marine mammal enters the Level A safety zone and resume only after the animal has been gone from the area for a minimum of 15-minutes.
  - Maintain sound levels below 100 dBA in air when pinnipeds (seals and sea lions) are present (http://www.westcoast.fisheries.noaa.gov/protected_species/marine_mammals/threshold_guidance.html).

11) Where the proposed activity would take place in or near a traditional Arctic subsistence hunting area and/or may affect the availability of a species or stock of marine mammal for Arctic subsistence uses, the applicant must submit either a plan of cooperation or information that identifies what measures have been taken and/or will be taken to minimize any adverse effects on the availability of marine mammals for subsistence uses

The proposed activity would not take place in or near a traditional Arctic subsistence hunting area nor affect the availability of a species or stock of marine mammal for Arctic subsistence uses.

12) The suggested means of accomplishing the necessary monitoring and reporting that will result in increased knowledge of the species, the level of taking or impacts on populations of marine mammals that are expected to be present while conducting activities and suggested means of minimizing burdens by coordinating such reporting requirements with other schemes already applicable to persons conducting such activity. Monitoring plans should include a description of the survey techniques that would be used to determine the movement and activity of marine mammals near the activity site(s) including migration and other habitat uses, such as feeding. Guidelines for

developing a site-specific monitoring plan may be obtained by writing to the Director, Office of Protected Resources, and

Proposed monitoring recommendations are listed in **Question 10** above. All observational monitoring results during construction will be provided to NMFS within 90 days after the authorization expires and monitoring results will be presented as stipulated in the approved monitoring plan.

13) Suggested means of learning of, encouraging, and coordinating research opportunities, plans, and activities relating to reducing such incidental taking and evaluating its effects

To encourage learning and coordinate research opportunities related to incidental taking of marine mammals, any data gathered during construction and operation will be made available to NMFS.

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Figures

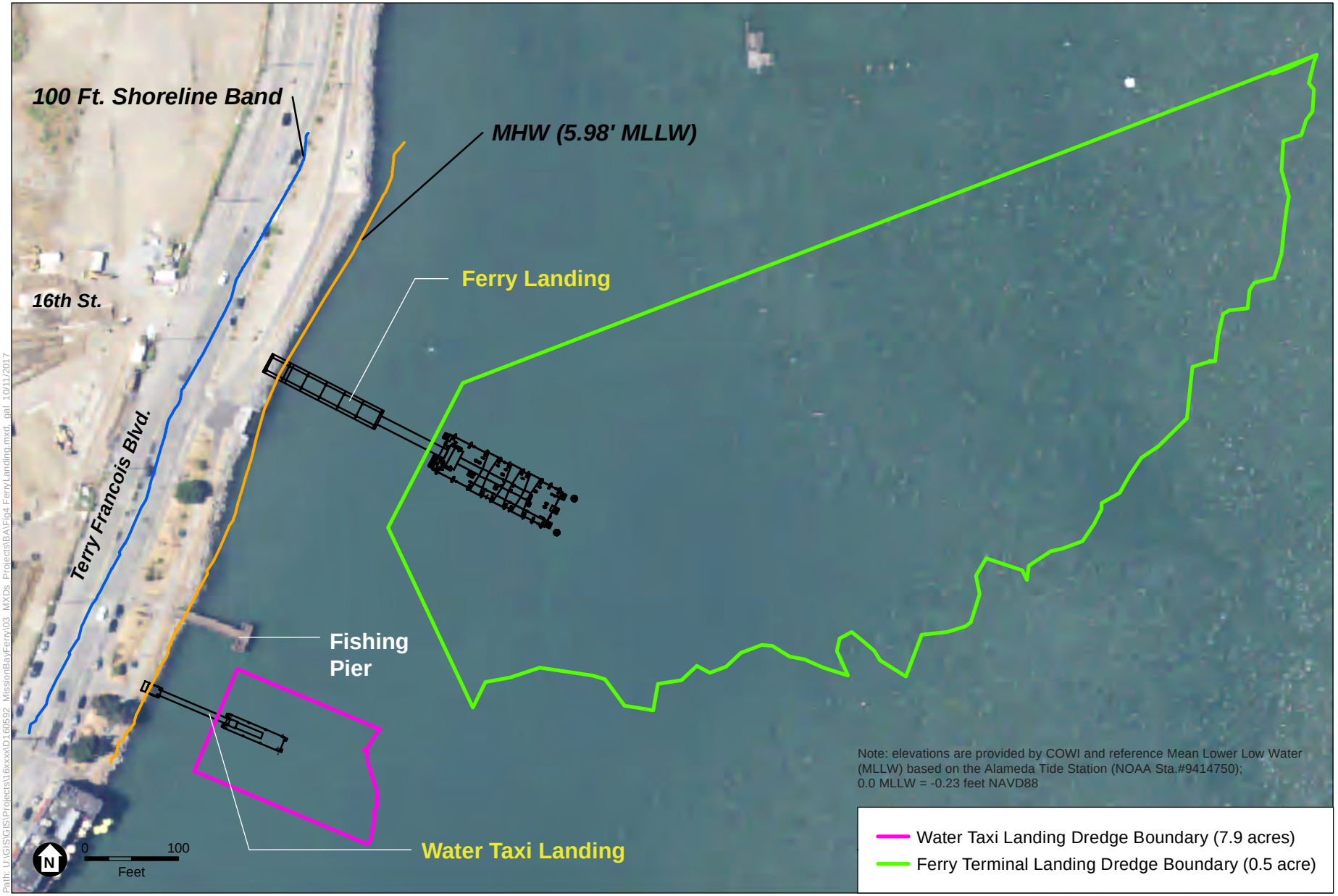
SAN FRANCISCO PORT COMMISSION
PORT OF SAN FRANCISCO
DEPARTMENT OF ENGINEERING

DESIGNER
COWI·OLMM

FIGURE 1

MISSION BAY FERRY LANDING AND WATER TAXI LANDING

LOCATION MAP



SOURCE: COWI 2017

Mission Bay Ferry Landing and Water Taxi Landing Project

Figure 2
Ferry Landing and Water Taxi Landing Layout Plans and Dredge Areas

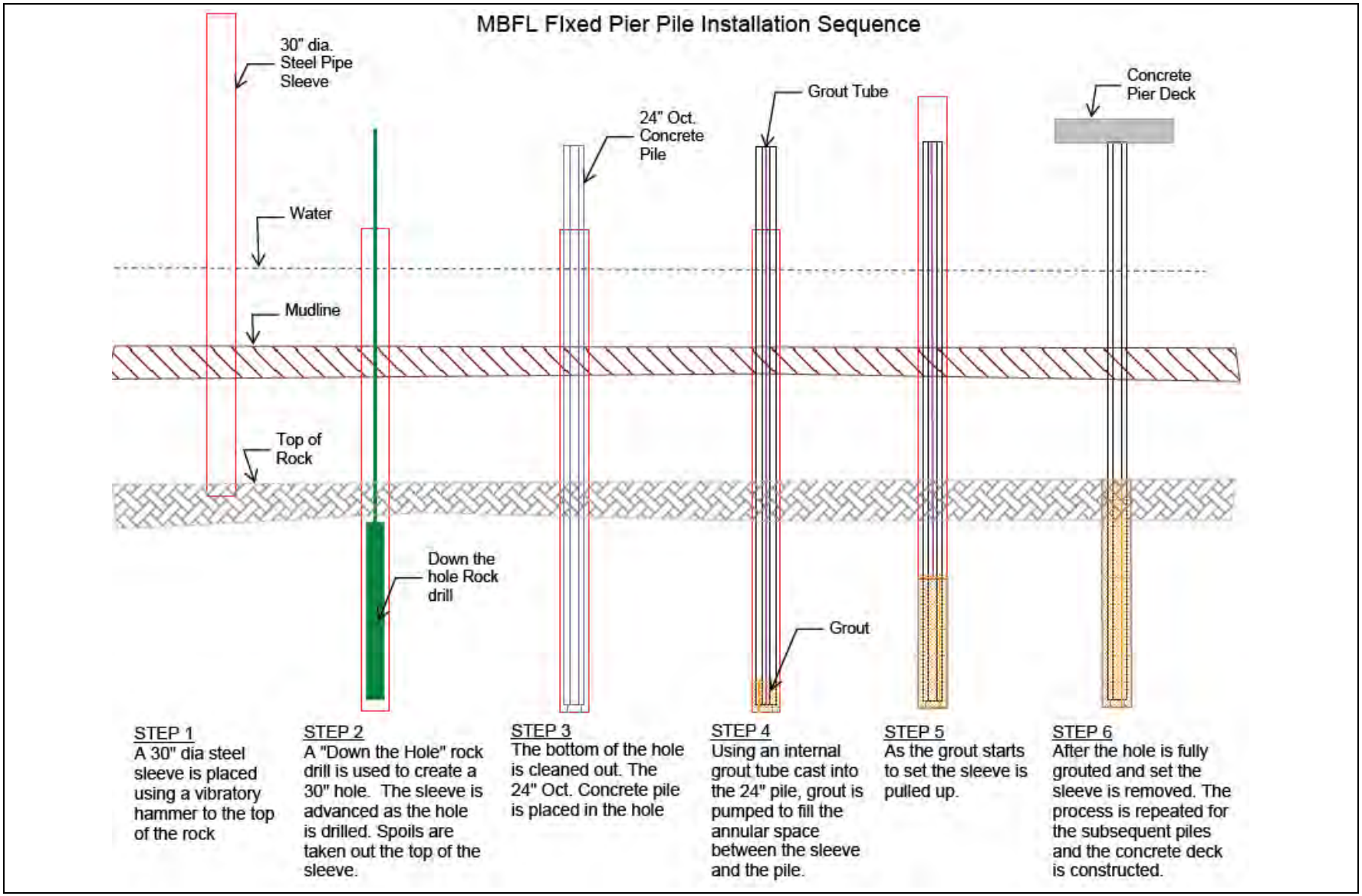


Figure 3

Fixed Pier Pile Installation Sequence

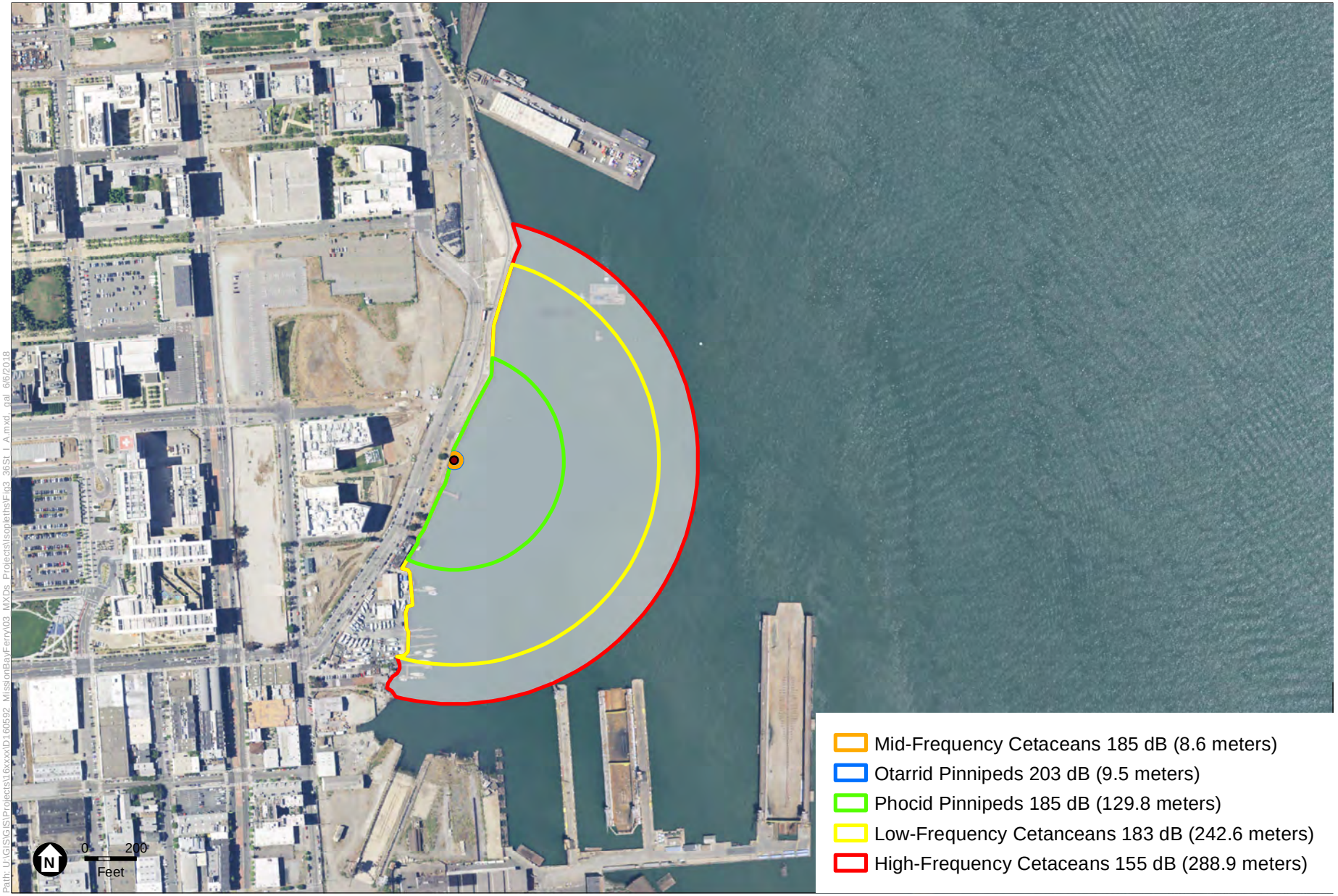
SOURCE: NMFS 2016

Mission Bay Ferry Landing

Figure 4

Harassment Zone for Marine Mammals from the Vibratory Driving of 30-inch steel caissons
Based on Level A Cumulative SEL Thresholds

ESA



SOURCE: NOAA 2016

Mission Bay Ferry Landing

Figure 5

Harassment Zone for Marine Mammals from the Impact Driving of 36-inch steel piles Based on Attenuated Level A Cumulative SEL Thresholds

ESA

Path: U:\GIS\GIS\Projects\16xxxx\D160592_MissionBayFerry\03_MXDs_ProjectsIsopleths\VibratoryFig6_36St_V.mxd, pal, 6/29/2018

SOURCE: NOAA 2016

Mission Bay Ferry Landing

Figure 6

Harassment Zone for Marine Mammals from the Vibratory Driving of 36-inch steel piles
Based on Level A Cumulative SEL Thresholds

ESA

Path: U:\GIS\GIS\Projects\16xxxx\D160592_MissionBayFerry\03_MXDs_Projects\Isopleths\Fig7_20_I_A.mxd_nal_7/30/2018

SOURCE: NMFS 2016

Mission Bay Ferry Landing

Figure 7

Harassment Zone for Marine Mammals from the Impact Driving of 20-inch concrete piles
Based on Attenuated Level A Cumulative SEL Thresholds

ESA

SOURCE: NMFS 2016

Mission Bay Ferry Landing

Figure 8

Harassment Zone for Marine Mammals from the Impact Driving of 16-inch steel piles Based on Attenuated Level A Cumulative SEL Thresholds

ESA

SOURCE: NOAA 2016

Mission Bay Ferry Landing

Figure 9

Harassment Zone for Marine Mammals from the Impact and Vibratory Driving of steel and concrete piles
Based on Attenuated Level B RMS Thresholds

ESA

APPENDIX A

Sound Level Calculations

Site	Location	Method	Pile Type/Size	Total Piles	Piles/Day	Strikes/Pile	Strikes/Day	Data Source	Attenuation	Transmission Loss Constant / Propagation Rate	Distance of Single Strike SEL measurement (meters)	Source Level (Single Strike / shot SEL)	Source Level (RMS SPL)	Distance to Cumulative SEL Threshold (meters)					Distance to Behvaior (RMS) Threshold (meters)	
														Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otarrid Pinnipeds	Cetaceans	Pinnipeds
														183 dB	185 dB	155 dB	185 dB	203 dB	120 dB	160 dB
Ferry Landing	in-water	Impact Hammer	36-inch steel	8	4	150	600	Caltrans 2015. Table I.2-1. Summary Table.	None	15	10	183	193	710.4	25.3	846.2	380.2	27.7	735642.3	1584.9
Ferry Landing	in-water	Impact Hammer	36-inch steel	8	4	150	600	Caltrans 2015. Table I.2-1. Summary Table.	Bubble Curtain (-7 dB)	15	10	176	186	242.6	8.6	288.9	129.8	9.5	251188.6	541.2
Water Taxi Landing	in-water	Impact Hammer	20-inch concrete	4	4	500	2000	Caltrans 2015. Table I.5-4. 24-inch concrete pile driven at Port of Oakland, CA.	None	15	10	167	179	136	4.8	162	72.8	5.3	85769.6	184.8
Water Taxi Landing	in-water	Impact Hammer	20-inch concrete	4	4	500	2000	Caltrans 2015. Table I.5-4. 24-inch concrete pile driven at Port of Oakland, CA.	Bubble Curtain (-7 dB)	15	10	160	172	46.4	1.7	55.3	24.8	1.8	29286.4	63.1
Water Taxi Landing	in-water	Impact Hammer	16-inch steel	2	2	500	1000	Caltrans 2015. Table I.2-1. Summary Table.	None	15	10	158	184	21.5	0.8	25.6	11.5	0.8	184785.0	398.1
Water Taxi Landing	in-water	Impact Hammer	16-inch steel	2	2	500	1000	Caltrans 2015. Table I.2-1. Summary Table.	Bubble Curtain (-7 dB)	15	10	151	177	7.3	0.3	8.8	3.9	0.3	63095.7	135.9

Site	Location	Method	Pile Type/Size	Total Piles	Piles/Day	Data Source	Attenuation	Driving Time / Pile[1]	Activity Duration (hours) within 24-h period	Transmission Loss Constant / Propagation Rate	Distance of source level measurement (meters)	Source Level (RMS SPL)	Distance to Cumulative SEL Threshold (meters)					Distance to Behvaior (RMS) Threshold (meters)	
													Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otarrid Pinnipeds	Cetaceans	Pinnipeds
													199 dB	198 dB	173 dB	201 dB	219 dB	120 dB	160 dB
Ferry Landing	in-water	Vibratory Hammer	14-inch steel H Pile	10	1	NOAA 2018. Navy Dive Project	None	600 seconds	0.17	15	10	158	2.1	0.2	3	1.3	0.1	3414.5	7.4
Ferry Landing	in-water	Vibratory Hammer	14-inch steel H Pile	10	1	NOAA 2018. Navy Dive Project	Bubble Curtain (-7 dB)	600 seconds	0.17	15	10	151	0.7	0.1	1	0.4	0.0	1165.9	2.5
Ferry Landing	in-water	Vibratory Hammer	30-inch steel caisson	10	1	Caltrans 2015. Table I.2-2. vibratory driving summary (36-inch steel)	None	900 seconds	0.25	15	10	170	10.8	1	16	6.6	0.5	21544.3	46.4
Ferry Landing	in-water	Vibratory Hammer	30-inch steel caisson	10	1	Caltrans 2015. Table I.2-2. vibratory driving summary (36-inch steel)	Bubble Curtain (-7 dB)	900 seconds	0.25	15	10	163	3.7	0.3	5.4	2.2	0.2	7356.4	15.8
Ferry Landing	in-water	Vibratory Hammer	36-inch steel	8	5	Caltrans 2015. Table I.2-2. vibratory driving summary (36-inch steel)	None	1200 seconds	1.67	15	10	170	38.3	3.4	56.6	23.3	1.6	21544.3	46.4
Ferry Landing	in-water	Vibratory Hammer	36-inch steel	8	5	Caltrans 2015. Table I.2-2. vibratory driving summary (36-inch steel)	Bubble Curtain (-7 dB)	1200 seconds	1.67	15	10	163	13.1	1.2	19.3	7.9	0.6	7356.4	15.8
Water Taxi Landing	in-water	Vibratory Hammer	16-inch steel	2	2	Caltrans 2015. Table I.2-3. 18-inch steel at Prichard Lake, Sacramento, CA.	None	600 seconds	0.33	15	10	158	2.1	0.2	3	1.3	0.1	3414.5	7.4
Water Taxi Landing	in-water	Vibratory Hammer	16-inch steel	2	2	Caltrans 2015. Table I.2-3. 18-inch steel at Prichard Lake, Sacramento, CA.	Bubble Curtain (-7 dB)	600 seconds	0.33	15	10	151	0.7	0.1	1	0.4	0.00	1165.9	2.5

Site	Location	Method	Pile Type/Size	Total Piles	Piles/Day	Data Source	Attenuation	Driving Time / Pile	Activity Duration (hours) within 24-h period	Transmission Loss Constant / Propagation Rate	Distance of source level measurement (meters)	Source Level (RMS SPL)	Distance to Cumulative SEL Threshold (meters)					Distance to Behvaior (RMS) Threshold (meters)	
													Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otarrid Pinnipeds	Cetaceans	Pinnipeds
													199 dB	198 dB	173 dB	201 dB	219 dB	120 dB	160 dB
Ferry Landing	in-water	Removal Vibratory Hammer	12-inch steel	12	12	Caltrans 2015. Table I.2-2. 12-inch steel, standard sound levels for vibratory driving/extraction.	None	120 seconds	0.4	15	10	155	1.5	0.1	2.2	0.9	0.1	2154.4	4.6
Ferry Landing	in-water	Removal Vibratory Hammer	12-inch steel	12	12	Caltrans 2015. Table I.2-2. 12-inch steel, standard sound levels for vibratory driving/extraction.	Bubble Curtain (-6 dB)	120 seconds	0.4	15	10	148	0.5	0.00	0.7	0.3	0.00	735.6	1.6

Site	Location	Method	Pile Type/Size	Total Piles	Piles/Day	Data Source	Attenuation	Activity Duration (hours) within 24-h period	Transmission Loss Constant / Propagation Rate	Distance of source level measurement (meters)	Source Level (RMS SPL)	Distance to Cumulative SEL Threshold (meters)					Distance to Behvaior (RMS) Threshold (meters)	
												Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otarrid Pinnipeds	Cetaceans	Pinnipeds
												199 dB	198 dB	173 dB	201 dB	219 dB	120 dB	160 dB
Ferry Landing	in-water	Drilling	30-inch steel caisson	10	1	NOAA 2018	None	5.5	15	10	168	6.3	0.4	5.5	3.4	0.2	15848.9	34.1
Ferry Landing	in-water	Drilling	30-inch steel caisson	10	1	NOAA 2018	Bubble Curtain (-7 dB)	5.5	15	10	161	2.1	0.1	1.9	1.1	0.1	5411.7	11.7

When modeled isopleth distances are less than 10 meters, impact areas are not calculated
All Isopleth areas are for modeled attenuated distances (assumes 7dB reduction)
Some behavior thresholds capped at area of 11,653 acres which represents the full extent possible within the Bay

Location	Project Element	Pile Diameter & Type	Installation method	Area within Level A Threshold in acres					Area within Level B Thresholds in acres	
				Phocids	Otariids	Low- Frequency Cetaceans	Mid- Frequency Cetaceans	High- Frequency Cetaceans	120 dB	160 dB
MBFL	Pier Piles	14-inch steel H pile	Vibratory	N/A	N/A	N/A	N/A	N/A		
		30-inch steel Caisson	Vibratory						11,653.68	0.91
	Float Guide Piles	36-inch Steel	Impact						11,653.68	91.41
	Float Guide Piles	36-inch Steel	Vibratory						11,653.68	0.91
	Donut Fender Piles	36-inch Steel	Impact						11,653.68	91.41
	Pier Piles	30-inch steel Caisson	Drilling	N/A	N/A	N/A		N/A	11,653.68	0.50
WTL	Platform Piles	30-inch steel Caisson	Vibratory						11,653.68	0.91
		16-inch steel	Impact						11,653.68	
		16-inch steel	Vibratory	N/A	N/A	N/A	N/A	N/A	11,653.68	0.04
	Guide Piles	20-inch Concrete	Impact						11,653.68	1.64
Demo	Demo Piles	12-inch steel	Vibratory	N/A	N/A	N/A	N/A	N/A	778.64	7.37

Location	Project Element	Pile Diameter & Type	Installation method	Area within Level A Threshold in square Kilometers					Area within Level B Thresholds in sq. km	
				Phocids	Otariids	Low- Frequency Cetaceans	Mid- Frequency Cetaceans	High- Frequency Cetaceans	120 dB	160 dB
MBFL	Pier Piles	14-inch steel H pile	Vibratory	N/A	N/A	N/A	N/A	N/A	7.643081	0.000144
		30-inch steel Caisson	Vibratory	0.000102	0.000003	0.000240	0.000001	0.000485	47.160818	0.003674
	Float Guide Piles	36-inch Steel	Impact	0.026995	0.000206	0.093091	0.000174	0.131634	47.160818	0.369932
	Float Guide Piles	36-inch Steel	Vibratory	0.001023	0.000036	0.002559	0.000008	0.005389	47.160818	0.003674
	Donut Fender Piles	36-inch Steel	Impact	0.026995	0.000206	0.093091	0.000174	0.131634	47.160818	0.369932
	Pier Piles	30-inch steel Caisson	Drilling	N/A	N/A	N/A	N/A	N/A	47.160818	0.002011
WTL	Platform Piles	30- inch steel Caisson	Vibratory	0.000253	0.000007	0.000590	0.000002	0.001189	47.160818	0.003674
		16-inch steel	Impact	0.000041	0.000000	0.000120	0.000000	0.000164	47.160818	0.029822
		16-inch steel	Vibratory	N/A	N/A	N/A	N/A	N/A	47.160818	0.000144
	Guide Piles	20-inch Concrete	Impact	0.001123	0.000010	0.003605	0.000009	0.005067	47.160818	0.006650
Demo	Demo Piles	12-inch steel	Vibratory	N/A	N/A	N/A	N/A	N/A	3.151053	0.000065

Pile Diameter & Type	Installation method	# Piles / day	# days	Estimated Take by Level B Harrassment					
				Harbor Seal		California Sea Lion		Harbor Porpoise	
				Density (animal/sq.km.) 3.957	Project Total	Density (animal/sq.km.) 0.161	Project Total	Density (animal/sq.km.) 0.167	Project Total
12-inch stel	Vibratory	12	1	12.47	12.47	0.51	0.51	0.53	0.53
14-inch steel H-pile	Vibratory	8	10	30.24	302.44	1.23	12.31	1.28	12.76
30-inch steel Caisson	Vibratory	2		186.62	1866.15	7.59	75.93	7.88	78.76
36-inch Steel	Impact	8	2	186.62	373.23	7.59	15.19	7.88	15.75
20-inch Concrete	Impact	4	1	186.62	186.62	7.59	7.59	7.88	7.88
16-inch steel	Impact	2	1	186.62	186.62	7.59	7.59	7.88	7.88
Total Take Requested for Project					**2927.52**		**119.11**		**123.55**
Total Take Requested for Project rounded up to next whole number					**2928**		**120**		**124**

E.1: IMPACT PILE DRIVING (STATIONARY SOURCE: Impulsive, Intermittent)

VERSION: 1.1 (Aug-16)

KEY

	Action Proponent Provided Information
	NMFS Provided Information (Acoustic Guidance)
	Resultant Isopleth

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE	Mission Bay Ferry and Water Taxi Landing Project
PROJECT/SOURCE INFORMATION	Caltrans 2015. Table I.2-3. 36-inch steel pile driven at Kitsap Naval Base, WA.
Please include any assumptions	
PROJECT CONTACT	

STEP 2: WEIGHTING FACTOR ADJUSTMENT Specify if relying on source-specific WFA, alternative weighting/dB adjustment, or if using default value

Weighting Factor Adjustment (kHz)[¥]	2	Impact Pile Driving

[¥] Broadband: 95% frequency contour percentile (kHz) OR Narrowband: frequency (kHz); For appropriate default WFA: See INTRODUCTION tab

† If a user relies on alternative weighting/dB adjustment rather than relying upon the WFA (source-specific or default), they may override the Adjustment (dB) (row 64), and enter the new value directly. However, they must provide additional support and documentation supporting this modification.

*** BROADBAND Sources: Cannot use WFA higher than maximum applicable frequency (See GRAY tab for more information on WFA applicable frequencies)**

STEP 3: SOURCE-SPECIFIC INFORMATION

NOTE: Choose either E1-1 OR E.1-2 method to calculate isopleths (not required to fill in sage boxes for both)

E.1-1: METHOD USING RMS SPL SOURCE LEVEL

Source Level (RMS SPL)	
a) Activity Duration (h) within 24-h period OR b) Number of piles per day•	
Pulse Duration[Δ] **(seconds)**	
a) Number of strikes in 1 h OR b) Number of strikes per pile•	
Activity Duration (seconds)	0
10 Log (duration)	#NUM!
Propagation (xLogR)	
Distance of source level measurement (meters)*	

[Δ]Window that makes up 90% of total cumulative energy (5%-95%) based on Madsen 2005

• For cells B27 & B29 users should supply information for both cells as either a) OR b); Don't mix-n-match.

*Unless otherwise specified, source levels are referenced 1 m from the source.

Marine Mammal Hearing Group
Low-frequency (LF) cetaceans: baleen whales
Mid-frequency (MF) cetaceans: dolphins, toothed whales, beaked whales, bottlenose whales
High-frequency (HF) cetaceans: true porpoises, *Kogia*, river dolphins, cephalorhynchid, *Lagenorhynchus cruciger* & *L. australis*
Phocid pinnipeds (PW):true seals
Otariid pinnipeds (OW):sea lions and fur seals

RESULTANT ISOPLETHS* *Note: For impulsive sounds, action proponent must also consider isopleths peak sound pressure level (PK) thresholds (dual thresholds).

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	183	185	155	185	203
PTS Isopleth to threshold (meters)	**#NUM!**	**#NUM!**	**#NUM!**	**#NUM!**	**#NUM!**

E.1-2: ALTERNATIVE METHOD (SINGLE STRIKE EQUIVALENT)

Unweighted SEL_{cum} (at measured distance) = SEL_{ss} + 10 Log (# strikes)	**210.8**

Source Level (Single Strike/shot SEL)	183
a) Number of strikes in 1 h OR b) Number of strikes per pile•	150
a) Activity Duration (h) within 24-h period OR b) Number of piles per day•	4
Propagation (xLogR)	15
Distance of single strike SEL measurement (meters)*	10

• For cells B47 & B48 users should supply information for both cells as either a) OR b); Don't mix-n-match.

*Unless otherwise specified, source levels are referenced 1 m from the source.

Marine Mammal Hearing Group
Low-frequency (LF) cetaceans: baleen whales
Mid-frequency (MF) cetaceans: dolphins, toothed whales, beaked whales, bottlenose whales
High-frequency (HF) cetaceans: true porpoises, *Kogia*, river dolphins, cephalorhynchid, *Lagenorhynchus cruciger* & *L. australis*
Phocid pinnipeds (PW):true seals
Otariid pinnipeds (OW):sea lions and fur seals

RESULTANT ISOPLETHS* *Note: For impulsive sounds, action proponent must also consider isopleths peak sound pressure level (PK) thresholds (dual thresholds).

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	183	185	155	185	203
PTS Isopleth to threshold (meters)	**710.4**	**25.3**	**846.2**	**380.2**	**27.7**

WEIGHTING FUNCTION CALCULATIONS

Weighting Function Parameters	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
a	1	1.6	1.8	1	2
b	2	2	2	2	2
f_1	0.2	8.8	12	1.9	0.94
f_2	19	110	140	30	25
C	0.13	1.2	1.36	0.75	0.64
Adjustment (dB)†	**-0.01**	**-19.74**	**-26.87**	**-2.08**	**-1.15**

$$W(f) = C + 10\log_{10}\left\{\frac{(f/f_1)^{2a}}{[1+(f/f_1)^2]^a[1+(f/f_2)^2]^b}\right\}$$

E.1: IMPACT PILE DRIVING (STATIONARY SOURCE: Impulsive, Intermittent)

VERSION: 1.1 (Aug-16)

KEY

	Action Proponent Provided Information
	NMFS Provided Information (Acoustic Guidance)
	Resultant Isopleth

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE	Mission Bay Ferry and Water Taxi Landing Project
PROJECT/SOURCE INFORMATION	Caltrans 2015. Table I.2-3. 36-inch steel pile driven at Kitsap Naval Base, WA.
Please include any assumptions	
PROJECT CONTACT	

STEP 2: WEIGHTING FACTOR ADJUSTMENT — Specify if relying on source-specific WFA, alternative weighting/dB adjustment, or if using default value

Weighting Factor Adjustment (kHz)[¥]	2	Impact Pile Driving

[¥] Broadband: 95% frequency contour percentile (kHz) OR Narrowband: frequency (kHz); For appropriate default WFA: See INTRODUCTION tab

† If a user relies on alternative weighting/dB adjustment rather than relying upon the WFA (source-specific or default), they may override the Adjustment (dB) (row 64), and enter the new value directly. However, they must provide additional support and documentation supporting this modification.

*** BROADBAND Sources: Cannot use WFA higher than maximum applicable frequency (See GRAY tab for more information on WFA applicable frequencies)**

STEP 3: SOURCE-SPECIFIC INFORMATION

NOTE: Choose either E1-1 OR E.1-2 method to calculate isopleths (not required to fill in sage boxes for both)

E.1-1: METHOD USING RMS SPL SOURCE LEVEL

Source Level (RMS SPL)	
a) Activity Duration (h) within 24-h period OR b) Number of piles per day•	
Pulse Duration[Δ] **(seconds)**	
a) Number of strikes in 1 h OR b) Number of strikes per pile•	
Activity Duration (seconds)	0
10 Log (duration)	#NUM!
Propagation (xLogR)	
Distance of source level measurement (meters)*	

[Δ]Window that makes up 90% of total cumulative energy (5%-95%) based on Madsen 2005

• For cells B27 & B29 users should supply information for both cells as either a) OR b); Don't mix-n-match.

*Unless otherwise specified, source levels are referenced 1 m from the source.

Marine Mammal Hearing Group
Low-frequency (LF) cetaceans: baleen whales
Mid-frequency (MF) cetaceans: dolphins, toothed whales, beaked whales, bottlenose whales
High-frequency (HF) cetaceans: true porpoises, *Kogia*, river dolphins, cephalorhynchid, *Lagenorhynchus cruciger* & *L. australis*
Phocid pinnipeds (PW):true seals
Otariid pinnipeds (OW):sea lions and fur seals

RESULTANT ISOPLETHS*

*Note: For impulsive sounds, action proponent must also consider isopleths peak sound pressure level (PK) thresholds (dual thresholds).

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	183	185	155	185	203
PTS Isopleth to threshold (meters)	**#NUM!**	**#NUM!**	**#NUM!**	**#NUM!**	**#NUM!**

E.1-2: ALTERNATIVE METHOD (SINGLE STRIKE EQUIVALENT)

Unweighted SEL_{cum} (at measured distance) = SEL_{ss} + 10 Log (# strikes)	**203.8**

Source Level (Single Strike/shot SEL)	176
a) Number of strikes in 1 h OR b) Number of strikes per pile•	150
a) Activity Duration (h) within 24-h period OR b) Number of piles per day•	4
Propagation (xLogR)	15
Distance of single strike SEL measurement (meters)*	10

• For cells B47 & B48 users should supply information for both cells as either a) OR b); Don't mix-n-match.

*Unless otherwise specified, source levels are referenced 1 m from the source.

Marine Mammal Hearing Group
Low-frequency (LF) cetaceans: baleen whales
Mid-frequency (MF) cetaceans: dolphins, toothed whales, beaked whales, bottlenose whales
High-frequency (HF) cetaceans: true porpoises, *Kogia*, river dolphins, cephalorhynchid, *Lagenorhynchus cruciger* & *L. australis*
Phocid pinnipeds (PW):true seals
Otariid pinnipeds (OW):sea lions and fur seals

RESULTANT ISOPLETHS*

*Note: For impulsive sounds, action proponent must also consider isopleths peak sound pressure level (PK) thresholds (dual thresholds).

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	183	185	155	185	203
PTS Isopleth to threshold (meters)	**242.6**	**8.6**	**288.9**	**129.8**	**9.5**

WEIGHTING FUNCTION CALCULATIONS

Weighting Function Parameters	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
a	1	1.6	1.8	1	2
b	2	2	2	2	2
f_1	0.2	8.8	12	1.9	0.94
f_2	19	110	140	30	25
C	0.13	1.2	1.36	0.75	0.64
Adjustment (dB)†	**-0.01**	**-19.74**	**-26.87**	**-2.08**	**-1.15**

$$W(f) = C + 10\log_{10}\left\{\frac{(f/f_1)^{2a}}{[1+(f/f_1)^2]^a[1+(f/f_2)^2]^b}\right\}$$

E.1: IMPACT PILE DRIVING (STATIONARY SOURCE: Impulsive, Intermittent)

VERSION: 1.1 (Aug-16)

KEY

	Action Proponent Provided Information
	NMFS Provided Information (Acoustic Guidance)
	Resultant Isopleth

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE	Mission Bay Ferry and Water Taxi Landing Project
PROJECT/SOURCE INFORMATION	Caltrans 2015. Table I.2-3. 24-inch concrete pile driven at Port of Oakland, CA.
Please include any assumptions	
PROJECT CONTACT	

STEP 2: WEIGHTING FACTOR ADJUSTMENT

Specify if relying on source-specific WFA, alternative weighting/dB adjustment, or if using default value

Weighting Factor Adjustment (kHz)[¥]	2	Impact Pile Driving

[¥] Broadband: 95% frequency contour percentile (kHz) OR Narrowband: frequency (kHz); For appropriate default WFA: See INTRODUCTION tab

† If a user relies on alternative weighting/dB adjustment rather than relying upon the WFA (source-specific or default), they may override the Adjustment (dB) (row 64), and enter the new value directly. However, they must provide additional support and documentation supporting this modification.

*** BROADBAND Sources: Cannot use WFA higher than maximum applicable frequency (See GRAY tab for more information on WFA applicable frequencies)**

STEP 3: SOURCE-SPECIFIC INFORMATION

NOTE: Choose either E1-1 OR E.1-2 method to calculate isopleths (not required to fill in sage boxes for both)

E.1-1: METHOD USING RMS SPL SOURCE LEVEL

Source Level (RMS SPL)	
a) Activity Duration (h) within 24-h period OR b) Number of piles per day[•]	
Pulse Duration[Δ] **(seconds)**	
a) Number of strikes in 1 h OR b) Number of strikes per pile[•]	
Activity Duration (seconds)	0
10 Log (duration)	#NUM!
Propagation (xLogR)	
Distance of source level measurement (meters)[*]	

[Δ]Window that makes up 90% of total cumulative energy (5%-95%) based on Madsen 2005

• For cells B27 & B29 users should supply information for both cells as either a) OR b); Don't mix-n-match.

*Unless otherwise specified, source levels are referenced 1 m from the source.

Marine Mammal Hearing Group
Low-frequency (LF) cetaceans: baleen whales
Mid-frequency (MF) cetaceans: dolphins, toothed whales, beaked whales, bottlenose whales
High-frequency (HF) cetaceans: true porpoises, *Kogia*, river dolphins, cephalorhynchid, *Lagenorhynchus cruciger* & *L. australis*
Phocid pinnipeds (PW):true seals
Otariid pinnipeds (OW):sea lions and fur seals

RESULTANT ISOPLETHS*

*Note: For impulsive sounds, action proponent must also consider isopleths peak sound pressure level (PK) thresholds (dual thresholds).

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	183	185	155	185	203
PTS Isopleth to threshold (meters)	**#NUM!**	**#NUM!**	**#NUM!**	**#NUM!**	**#NUM!**

E.1-2: ALTERNATIVE METHOD (SINGLE STRIKE EQUIVALENT)

Unweighted SEL_{cum} (at measured distance) = SEL_{ss} + 10 Log (# strikes)	**200.0**

Source Level (Single Strike/shot SEL)	167
a) Number of strikes in 1 h OR b) Number of strikes per pile[•]	500
a) Activity Duration (h) within 24-h period OR b) Number of piles per day[•]	4
Propagation (xLogR)	15
Distance of single strike SEL measurement (meters)[*]	10

• For cells B47 & B48 users should supply information for both cells as either a) OR b); Don't mix-n-match.

*Unless otherwise specified, source levels are referenced 1 m from the source.

Marine Mammal Hearing Group
Low-frequency (LF) cetaceans: baleen whales
Mid-frequency (MF) cetaceans: dolphins, toothed whales, beaked whales, bottlenose whales
High-frequency (HF) cetaceans: true porpoises, *Kogia*, river dolphins, cephalorhynchid, *Lagenorhynchus cruciger* & *L. australis*
Phocid pinnipeds (PW):true seals
Otariid pinnipeds (OW):sea lions and fur seals

RESULTANT ISOPLETHS*

*Note: For impulsive sounds, action proponent must also consider isopleths peak sound pressure level (PK) thresholds (dual thresholds).

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	183	185	155	185	203
PTS Isopleth to threshold (meters)	**136.0**	**4.8**	**162.0**	**72.8**	**5.3**

WEIGHTING FUNCTION CALCULATIONS

Weighting Function Parameters	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
a	1	1.6	1.8	1	2
b	2	2	2	2	2
f_1	0.2	8.8	12	1.9	0.94
f_2	19	110	140	30	25
C	0.13	1.2	1.36	0.75	0.64
Adjustment (dB)†	**-0.01**	**-19.74**	**-26.87**	**-2.08**	**-1.15**

$$W(f) = C + 10\log_{10}\left\{\frac{(f/f_1)^{2a}}{[1+(f/f_1)^2]^a[1+(f/f_2)^2]^b}\right\}$$

E.1: IMPACT PILE DRIVING (STATIONARY SOURCE: Impulsive, Intermittent)

VERSION: 1.1 (Aug-16)

KEY

	Action Proponent Provided Information
	NMFS Provided Information (Acoustic Guidance)
	Resultant Isopleth

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE	Mission Bay Ferry and Water Taxi Landing Project
PROJECT/SOURCE INFORMATION	Caltrans 2015. Table I.2-3. 24-inch concrete pile driven at Port of Oakland, CA.
Please include any assumptions	
PROJECT CONTACT	

STEP 2: WEIGHTING FACTOR ADJUSTMENT Specify if relying on source-specific WFA, alternative weighting/dB adjustment, or if using default value

Weighting Factor Adjustment (kHz)[¥]	2	Impact Pile Driving

[¥] Broadband: 95% frequency contour percentile (kHz) OR Narrowband: frequency (kHz); For appropriate default WFA: See INTRODUCTION tab

† If a user relies on alternative weighting/dB adjustment rather than relying upon the WFA (source-specific or default), they may override the Adjustment (dB) (row 64), and enter the new value directly. However, they must provide additional support and documentation supporting this modification.

*** BROADBAND Sources: Cannot use WFA higher than maximum applicable frequency (See GRAY tab for more information on WFA applicable frequencies)**

STEP 3: SOURCE-SPECIFIC INFORMATION

NOTE: Choose either E1-1 OR E.1-2 method to calculate isopleths (not required to fill in sage boxes for both)

E.1-1: METHOD USING RMS SPL SOURCE LEVEL

Source Level (RMS SPL)	
a) Activity Duration (h) within 24-h period OR b) Number of piles per day[•]	
Pulse Duration[Δ] **(seconds)**	
a) Number of strikes in 1 h OR b) Number of strikes per pile[•]	
Activity Duration (seconds)	0
10 Log (duration)	#NUM!
Propagation (xLogR)	
Distance of source level measurement (meters)[*]	

[Δ]Window that makes up 90% of total cumulative energy (5%-95%) based on Madsen 2005

• For cells B27 & B29 users should supply information for both cells as either a) OR b); Don't mix-n-match.

*Unless otherwise specified, source levels are referenced 1 m from the source.

Marine Mammal Hearing Group
Low-frequency (LF) cetaceans: baleen whales
Mid-frequency (MF) cetaceans: dolphins, toothed whales, beaked whales, bottlenose whales
High-frequency (HF) cetaceans: true porpoises, *Kogia*, river dolphins, cephalorhynchid, *Lagenorhynchus cruciger* & *L. australis*
Phocid pinnipeds (PW):true seals
Otariid pinnipeds (OW):sea lions and fur seals

RESULTANT ISOPLETHS* *Note: For impulsive sounds, action proponent must also consider isopleths peak sound pressure level (PK) thresholds (dual thresholds).

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	183	185	155	185	203
PTS Isopleth to threshold (meters)	**#NUM!**	**#NUM!**	**#NUM!**	**#NUM!**	**#NUM!**

E.1-2: ALTERNATIVE METHOD (SINGLE STRIKE EQUIVALENT)

Unweighted $SEL_{cum\ (at\ measured\ distance)}$ = SEL_{ss} + 10 Log (# strikes)	**193.0**

Source Level (Single Strike/shot SEL)	160
a) Number of strikes in 1 h OR b) Number of strikes per pile[•]	500
a) Activity Duration (h) within 24-h period OR b) Number of piles per day[•]	4
Propagation (xLogR)	15
Distance of single strike SEL measurement (meters)[*]	10

• For cells B47 & B48 users should supply information for both cells as either a) OR b); Don't mix-n-match.

*Unless otherwise specified, source levels are referenced 1 m from the source.

Marine Mammal Hearing Group
Low-frequency (LF) cetaceans: baleen whales
Mid-frequency (MF) cetaceans: dolphins, toothed whales, beaked whales, bottlenose whales
High-frequency (HF) cetaceans: true porpoises, *Kogia*, river dolphins, cephalorhynchid, *Lagenorhynchus cruciger* & *L. australis*
Phocid pinnipeds (PW):true seals
Otariid pinnipeds (OW):sea lions and fur seals

RESULTANT ISOPLETHS* *Note: For impulsive sounds, action proponent must also consider isopleths peak sound pressure level (PK) thresholds (dual thresholds).

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	183	185	155	185	203
PTS Isopleth to threshold (meters)	**46.4**	**1.7**	**55.3**	**24.8**	**1.8**

WEIGHTING FUNCTION CALCULATIONS

Weighting Function Parameters	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
a	1	1.6	1.8	1	2
b	2	2	2	2	2
f_1	0.2	8.8	12	1.9	0.94
f_2	19	110	140	30	25
C	0.13	1.2	1.36	0.75	0.64
Adjustment (dB)†	**-0.01**	**-19.74**	**-26.87**	**-2.08**	**-1.15**

$$W(f) = C + 10\log_{10}\left\{\frac{(f/f_1)^{2a}}{[1+(f/f_1)^2]^a[1+(f/f_2)^2]^b}\right\}$$

E.1: IMPACT PILE DRIVING (STATIONARY SOURCE: Impulsive, Intermittent)

VERSION: 1.1 (Aug-16)

KEY

	Action Proponent Provided Information
	NMFS Provided Information (Acoustic Guidance)
	Resultant Isopleth

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE	Mission Bay Ferry and Water Taxi Landing Project
PROJECT/SOURCE INFORMATION	Caltrans 2015. Table I.2-3. 20-inch steel at San Joaquin River, Stockton, CA.
Please include any assumptions	
PROJECT CONTACT	

STEP 2: WEIGHTING FACTOR ADJUSTMENT Specify if relying on source-specific WFA, alternative weighting/dB adjustment, or if using default value

Weighting Factor Adjustment (kHz)[¥]	2	Impact Pile Driving

[¥] Broadband: 95% frequency contour percentile (kHz) OR Narrowband: frequency (kHz); For appropriate default WFA: See INTRODUCTION tab

† If a user relies on alternative weighting/dB adjustment rather than relying upon the WFA (source-specific or default), they may override the Adjustment (dB) (row 64), and enter the new value directly. However, they must provide additional support and documentation supporting this modification.

*** BROADBAND Sources: Cannot use WFA higher than maximum applicable frequency (See GRAY tab for more information on WFA applicable frequencies)**

STEP 3: SOURCE-SPECIFIC INFORMATION

NOTE: Choose either E1-1 OR E.1-2 method to calculate isopleths (not required to fill in sage boxes for both)

E.1-1: METHOD USING RMS SPL SOURCE LEVEL

Source Level (RMS SPL)	
a) Activity Duration (h) within 24-h period OR b) Number of piles per day•	
Pulse Duration[Δ] **(seconds)**	
a) Number of strikes in 1 h OR b) Number of strikes per pile•	
Activity Duration (seconds)	0
10 Log (duration)	#NUM!
Propagation (xLogR)	
Distance of source level measurement (meters)*	

[Δ]Window that makes up 90% of total cumulative energy (5%-95%) based on Madsen 2005

• For cells B27 & B29 users should supply information for both cells as either a) OR b); Don't mix-n-match.

*Unless otherwise specified, source levels are referenced 1 m from the source.

Marine Mammal Hearing Group
Low-frequency (LF) cetaceans: baleen whales
Mid-frequency (MF) cetaceans: dolphins, toothed whales, beaked whales, bottlenose whales
High-frequency (HF) cetaceans: true porpoises, *Kogia*, river dolphins, cephalorhynchid, *Lagenorhynchus cruciger* & *L. australis*
Phocid pinnipeds (PW):true seals
Otariid pinnipeds (OW):sea lions and fur seals

RESULTANT ISOPLETHS* *Note: For impulsive sounds, action proponent must also consider isopleths peak sound pressure level (PK) thresholds (dual thresholds).

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	183	185	155	185	203
PTS Isopleth to threshold (meters)	**#NUM!**	**#NUM!**	**#NUM!**	**#NUM!**	**#NUM!**

E.1-2: ALTERNATIVE METHOD (SINGLE STRIKE EQUIVALENT)

Unweighted $SEL_{cum\ (at\ measured\ distance)}$ = SEL_{ss} + 10 Log (# strikes)	**188.0**

Source Level (Single Strike/shot SEL)	158
a) Number of strikes in 1 h OR b) Number of strikes per pile•	500
a) Activity Duration (h) within 24-h period OR b) Number of piles per day•	2
Propagation (xLogR)	15
Distance of single strike SEL measurement (meters)*	10

• For cells B47 & B48 users should supply information for both cells as either a) OR b); Don't mix-n-match.

*Unless otherwise specified, source levels are referenced 1 m from the source.

Marine Mammal Hearing Group
Low-frequency (LF) cetaceans: baleen whales
Mid-frequency (MF) cetaceans: dolphins, toothed whales, beaked whales, bottlenose whales
High-frequency (HF) cetaceans: true porpoises, *Kogia*, river dolphins, cephalorhynchid, *Lagenorhynchus cruciger* & *L. australis*
Phocid pinnipeds (PW):true seals
Otariid pinnipeds (OW):sea lions and fur seals

RESULTANT ISOPLETHS* *Note: For impulsive sounds, action proponent must also consider isopleths peak sound pressure level (PK) thresholds (dual thresholds).

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	183	185	155	185	203
PTS Isopleth to threshold (meters)	**21.5**	**0.8**	**25.6**	**11.5**	**0.8**

WEIGHTING FUNCTION CALCULATIONS

Weighting Function Parameters	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
a	1	1.6	1.8	1	2
b	2	2	2	2	2
f_1	0.2	8.8	12	1.9	0.94
f_2	19	110	140	30	25
C	0.13	1.2	1.36	0.75	0.64
Adjustment (dB)†	**-0.01**	**-19.74**	**-26.87**	**-2.08**	**-1.15**

$$W(f) = C + 10\log_{10}\left\{\frac{(f/f_1)^{2a}}{[1+(f/f_1)^2]^a[1+(f/f_2)^2]^b}\right\}$$

E.1: IMPACT PILE DRIVING (STATIONARY SOURCE: Impulsive, Intermittent)

VERSION: 1.1 (Aug-16)

KEY

	Action Proponent Provided Information
	NMFS Provided Information (Acoustic Guidance)
	Resultant Isopleth

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE	Mission Bay Ferry and Water Taxi Landing Project
PROJECT/SOURCE INFORMATION	Caltrans 2015. Table I.2-3. 20-inch steel at San Joaquin River, Stockton, CA.
Please include any assumptions	
PROJECT CONTACT	

STEP 2: WEIGHTING FACTOR ADJUSTMENT — Specify if relying on source-specific WFA, alternative weighting/dB adjustment, or if using default value

Weighting Factor Adjustment (kHz)[¥]	2	Impact Pile Driving

[¥] Broadband: 95% frequency contour percentile (kHz) OR Narrowband: frequency (kHz); For appropriate default WFA: See INTRODUCTION tab

† If a user relies on alternative weighting/dB adjustment rather than relying upon the WFA (source-specific or default), they may override the Adjustment (dB) (row 64), and enter the new value directly. However, they must provide additional support and documentation supporting this modification.

*** BROADBAND Sources: Cannot use WFA higher than maximum applicable frequency (See GRAY tab for more information on WFA applicable frequencies)**

STEP 3: SOURCE-SPECIFIC INFORMATION

NOTE: Choose either E1-1 OR E.1-2 method to calculate isopleths (not required to fill in sage boxes for both)

E.1-1: METHOD USING RMS SPL SOURCE LEVEL

Source Level (RMS SPL)	
a) Activity Duration (h) within 24-h period OR b) Number of piles per day•	
Pulse Duration[Δ] **(seconds)**	
a) Number of strikes in 1 h OR b) Number of strikes per pile•	
Activity Duration (seconds)	0
10 Log (duration)	#NUM!
Propagation (xLogR)	
Distance of source level measurement (meters)*	

[Δ]Window that makes up 90% of total cumulative energy (5%-95%) based on Madsen 2005

• For cells B27 & B29 users should supply information for both cells as either a) OR b); Don't mix-n-match.

*Unless otherwise specified, source levels are referenced 1 m from the source.

Marine Mammal Hearing Group
Low-frequency (LF) cetaceans: baleen whales
Mid-frequency (MF) cetaceans: dolphins, toothed whales, beaked whales, bottlenose whales
High-frequency (HF) cetaceans: true porpoises, *Kogia*, river dolphins, cephalorhynchid, *Lagenorhynchus cruciger* & *L. australis*
Phocid pinnipeds (PW):true seals
Otariid pinnipeds (OW):sea lions and fur seals

RESULTANT ISOPLETHS*

*Note: For impulsive sounds, action proponent must also consider isopleths peak sound pressure level (PK) thresholds (dual thresholds).

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	183	185	155	185	203
PTS Isopleth to threshold (meters)	**#NUM!**	**#NUM!**	**#NUM!**	**#NUM!**	**#NUM!**

E.1-2: ALTERNATIVE METHOD (SINGLE STRIKE EQUIVALENT)

Unweighted $SEL_{cum\ (at\ measured\ distance)}$ = SEL_{ss} + 10 Log (# strikes)	**181.0**

Source Level (Single Strike/shot SEL)	151
a) Number of strikes in 1 h OR b) Number of strikes per pile•	500
a) Activity Duration (h) within 24-h period OR b) Number of piles per day•	2
Propagation (xLogR)	15
Distance of single strike SEL measurement (meters)*	10

• For cells B47 & B48 users should supply information for both cells as either a) OR b); Don't mix-n-match.

*Unless otherwise specified, source levels are referenced 1 m from the source.

Marine Mammal Hearing Group
Low-frequency (LF) cetaceans: baleen whales
Mid-frequency (MF) cetaceans: dolphins, toothed whales, beaked whales, bottlenose whales
High-frequency (HF) cetaceans: true porpoises, *Kogia*, river dolphins, cephalorhynchid, *Lagenorhynchus cruciger* & *L. australis*
Phocid pinnipeds (PW):true seals
Otariid pinnipeds (OW):sea lions and fur seals

RESULTANT ISOPLETHS*

*Note: For impulsive sounds, action proponent must also consider isopleths peak sound pressure level (PK) thresholds (dual thresholds).

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	183	185	155	185	203
PTS Isopleth to threshold (meters)	**7.3**	**0.3**	**8.8**	**3.9**	**0.3**

WEIGHTING FUNCTION CALCULATIONS

Weighting Function Parameters	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
a	1	1.6	1.8	1	2
b	2	2	2	2	2
f_1	0.2	8.8	12	1.9	0.94
f_2	19	110	140	30	25
C	0.13	1.2	1.36	0.75	0.64
Adjustment (dB)†	**-0.01**	**-19.74**	**-26.87**	**-2.08**	**-1.15**

$$W(f) = C + 10\log_{10}\left\{\frac{(f/f_1)^{2a}}{[1+(f/f_1)^2]^a[1+(f/f_2)^2]^b}\right\}$$

A: STATIONARY SOURCE: Non-Impulsive, Continuous

VERSION: 1.1 (Aug-16)

KEY

	Action Proponent Provided Information
	NMFS Provided Information (Acoustic Guidance)
	Resultant Isopleth

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE	Mission Bay Ferry and Water Taxi Landing
PROJECT/SOURCE INFORMATION	Caltrans 2015. Table I.2-2. vibratory driving summary (12-inch H-type)
Please include any assumptions	
PROJECT CONTACT	

STEP 2: WEIGHTING FACTOR ADJUSTMENT — Specify if relying on source-specific WFA, alternative weighting/dB adjustment, or if using default value

Weighting Factor Adjustment (kHz)¥	2.5

Vibratory Installation

¥ Broadband: 95% frequency contour percentile (kHz) OR Narrowband: frequency (kHz); For appropriate default WFA: See INTRODUCTION tab

† If a user relies on alternative weighting/dB adjustment rather than relying upon the WFA (source-specific or default), they may override the Adjustment (dB) (row 43), and enter the new value directly. However, they must provide additional support and documentation supporting this modification.

*** BROADBAND Sources: Cannot use WFA higher than maximum applicable frequency (See GRAY tab for more information on WFA applicable frequencies)**

STEP 3: SOURCE-SPECIFIC INFORMATION

Source Level (RMS SPL)	150
Activity Duration (hours) within 24-h period	0.17
Activity Duration (seconds)	612
10 Log (duration)	27.87
Propagation (xLogR)	15
Distance of source level measurement (meters)ᵛ	10

ᵛUnless otherwise specified, source levels are referenced 1 m from the source.

Marine Mammal Hearing Group
Low-frequency (LF) cetaceans: baleen whales
Mid-frequency (MF) cetaceans: dolphins, toothed whales, beaked whales, bottlenose whales
High-frequency (HF) cetaceans: true porpoises, *Kogia*, river dolphins, cephalorhynchid, *Lagenorhynchus cruciger* & *L. australis*
Phocid pinnipeds (PW):true seals
Otariid pinnipeds (OW):sea lions and fur seals

RESULTANT ISOPLETHS

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	199	198	173	201	219
PTS Isopleth to threshold (meters)	**0.4**	**0.0**	**0.6**	**0.2**	**0.0**

WEIGHTING FUNCTION CALCULATIONS

Weighting Function Parameters	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
a	1	1.6	1.8	1	2
b	2	2	2	2	2
f_1	0.2	8.8	12	1.9	0.94
f_2	19	110	140	30	25
C	0.13	1.2	1.36	0.75	0.64
Adjustment (dB)†	**-0.05**	**-16.83**	**-23.50**	**-1.29**	**-0.60**

$$W(f) = C + 10\log_{10}\left\{\frac{(f/f_1)^{2a}}{[1+(f/f_1)^2]^a[1+(f/f_2)^2]^b}\right\}$$

A: STATIONARY SOURCE: Non-Impulsive, Continuous

VERSION: 1.1 (Aug-16)

KEY

	Action Proponent Provided Information
	NMFS Provided Information (Acoustic Guidance)
	Resultant Isopleth

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE	Mission Bay Ferry and Water Taxi Landing
PROJECT/SOURCE INFORMATION	Caltrans 2015. Table I.2-2. vibratory driving summary (12-inch H-type)
Please include any assumptions	
PROJECT CONTACT	

STEP 2: WEIGHTING FACTOR ADJUSTMENT — Specify if relying on source-specific WFA, alternative weighting/dB adjustment, or if using default value

Weighting Factor Adjustment (kHz)¥	2.5

Vibratory Installation

¥ Broadband: 95% frequency contour percentile (kHz) OR Narrowband: frequency (kHz); For appropriate default WFA: See INTRODUCTION tab

† If a user relies on alternative weighting/dB adjustment rather than relying upon the WFA (source-specific or default), they may override the Adjustment (dB) (row 43), and enter the new value directly. However, they must provide additional support and documentation supporting this modification.

*** BROADBAND Sources: Cannot use WFA higher than maximum applicable frequency (See GRAY tab for more information on WFA applicable frequencies)**

STEP 3: SOURCE-SPECIFIC INFORMATION

Source Level (RMS SPL)	143
Activity Duration (hours) within 24-h period	0.17
Activity Duration (seconds)	612
10 Log (duration)	27.87
Propagation (xLogR)	15
Distance of source level measurement (meters)*	10

*Unless otherwise specified, source levels are referenced 1 m from the source.

Marine Mammal Hearing Group
Low-frequency (LF) cetaceans: baleen whales
Mid-frequency (MF) cetaceans: dolphins, toothed whales, beaked whales, bottlenose whales
High-frequency (HF) cetaceans: true porpoises, *Kogia*, river dolphins, cephalorhynchid, *Lagenorhynchus cruciger* & *L. australis*
Phocid pinnipeds (PW):true seals
Otariid pinnipeds (OW):sea lions and fur seals

RESULTANT ISOPLETHS

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	199	198	173	201	219
PTS Isopleth to threshold (meters)	**0.1**	**0.0**	**0.2**	**0.1**	**0.0**

WEIGHTING FUNCTION CALCULATIONS

Weighting Function Parameters	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
a	1	1.6	1.8	1	2
b	2	2	2	2	2
f_1	0.2	8.8	12	1.9	0.94
f_2	19	110	140	30	25
C	0.13	1.2	1.36	0.75	0.64
Adjustment (dB)†	**-0.05**	**-16.83**	**-23.50**	**-1.29**	**-0.60**

$$W(f) = C + 10\log_{10}\left\{\frac{(f/f_1)^{2a}}{[1+(f/f_1)^2]^a[1+(f/f_2)^2]^b}\right\}$$

A: STATIONARY SOURCE: Non-Impulsive, Continuous

VERSION: 1.1 (Aug-16)

KEY

	Action Proponent Provided Information
	NMFS Provided Information (Acoustic Guidance)
	Resultant Isopleth

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE	Mission Bay Ferry and Water Taxi Landing
PROJECT/SOURCE INFORMATION	Caltrans 2015. Table I.2-2. vibratory driving summary (36-inch steel)
Please include any assumptions	
PROJECT CONTACT	

STEP 2: WEIGHTING FACTOR ADJUSTMENT — Specify if relying on source-specific WFA, alternative weighting/dB adjustment, or if using default value

Weighting Factor Adjustment (kHz)¥	2.5

Vibratory Installation

¥ Broadband: 95% frequency contour percentile (kHz) OR Narrowband: frequency (kHz); For appropriate default WFA: See INTRODUCTION tab

† If a user relies on alternative weighting/dB adjustment rather than relying upon the WFA (source-specific or default), they may override the Adjustment (dB) (row 43), and enter the new value directly. However, they must provide additional support and documentation supporting this modification.

*** BROADBAND Sources: Cannot use WFA higher than maximum applicable frequency (See GRAY tab for more information on WFA applicable frequencies)**

STEP 3: SOURCE-SPECIFIC INFORMATION

Source Level (RMS SPL)	170
Activity Duration (hours) within 24-h period	0.25
Activity Duration (seconds)	900
10 Log (duration)	29.54
Propagation (xLogR)	15
Distance of source level measurement (meters)ǂ	10

ǂUnless otherwise specified, source levels are referenced 1 m from the source.

Marine Mammal Hearing Group
Low-frequency (LF) cetaceans: baleen whales
Mid-frequency (MF) cetaceans: dolphins, toothed whales, beaked whales, bottlenose whales
High-frequency (HF) cetaceans: true porpoises, *Kogia*, river dolphins, cephalorhynchid, *Lagenorhynchus cruciger* & *L. australis*
Phocid pinnipeds (PW):true seals
Otariid pinnipeds (OW):sea lions and fur seals

RESULTANT ISOPLETHS

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	199	198	173	201	219
PTS Isopleth to threshold (meters)	**10.8**	**1.0**	**16.0**	**6.6**	**0.5**

WEIGHTING FUNCTION CALCULATIONS

Weighting Function Parameters	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
a	1	1.6	1.8	1	2
b	2	2	2	2	2
f_1	0.2	8.8	12	1.9	0.94
f_2	19	110	140	30	25
C	0.13	1.2	1.36	0.75	0.64
Adjustment (dB)†	**-0.05**	**-16.83**	**-23.50**	**-1.29**	**-0.60**

$$W(f) = C + 10\log_{10}\left\{\frac{(f/f_1)^{2a}}{[1+(f/f_1)^2]^a[1+(f/f_2)^2]^b}\right\}$$

A: STATIONARY SOURCE: Non-Impulsive, Continuous

VERSION: 1.1 (Aug-16)

KEY

	Action Proponent Provided Information
	NMFS Provided Information (Acoustic Guidance)
	Resultant Isopleth

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE	Mission Bay Ferry and Water Taxi Landing
PROJECT/SOURCE INFORMATION	Caltrans 2015. Table I.2-2. vibratory driving summary (36-inch steel)
Please include any assumptions	
PROJECT CONTACT	

STEP 2: WEIGHTING FACTOR ADJUSTMENT — Specify if relying on source-specific WFA, alternative weighting/dB adjustment, or if using default value

Weighting Factor Adjustment (kHz)¥	2.5

Vibratory Installation

¥ Broadband: 95% frequency contour percentile (kHz) OR Narrowband: frequency (kHz); For appropriate default WFA: See INTRODUCTION tab

† If a user relies on alternative weighting/dB adjustment rather than relying upon the WFA (source-specific or default), they may override the Adjustment (dB) (row 43), and enter the new value directly. However, they must provide additional support and documentation supporting this modification.

*** BROADBAND Sources: Cannot use WFA higher than maximum applicable frequency (See GRAY tab for more information on WFA applicable frequencies)**

STEP 3: SOURCE-SPECIFIC INFORMATION

Source Level (RMS SPL)	163
Activity Duration (hours) within 24-h period	0.25
Activity Duration (seconds)	900
10 Log (duration)	29.54
Propagation (xLogR)	15
Distance of source level measurement (meters)ǂ	10

ǂUnless otherwise specified, source levels are referenced 1 m from the source.

Marine Mammal Hearing Group
Low-frequency (LF) cetaceans: baleen whales
Mid-frequency (MF) cetaceans: dolphins, toothed whales, beaked whales, bottlenose whales
High-frequency (HF) cetaceans: true porpoises, *Kogia*, river dolphins, cephalorhynchid, *Lagenorhynchus cruciger* & *L. australis*
Phocid pinnipeds (PW):true seals
Otariid pinnipeds (OW):sea lions and fur seals

RESULTANT ISOPLETHS

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	199	198	173	201	219
PTS Isopleth to threshold (meters)	**3.7**	**0.3**	**5.4**	**2.2**	**0.2**

WEIGHTING FUNCTION CALCULATIONS

Weighting Function Parameters	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
a	1	1.6	1.8	1	2
b	2	2	2	2	2
f_1	0.2	8.8	12	1.9	0.94
f_2	19	110	140	30	25
C	0.13	1.2	1.36	0.75	0.64
Adjustment (dB)†	**-0.05**	**-16.83**	**-23.50**	**-1.29**	**-0.60**

$$W(f) = C + 10\log_{10}\left\{\frac{(f/f_1)^{2a}}{[1+(f/f_1)^2]^a[1+(f/f_2)^2]^b}\right\}$$

A: STATIONARY SOURCE: Non-Impulsive, Continuous

VERSION: 1.1 (Aug-16)

KEY

	Action Proponent Provided Information
	NMFS Provided Information (Acoustic Guidance)
	Resultant Isopleth

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE	Mission Bay Ferry and Water Taxi Landing
PROJECT/SOURCE INFORMATION	Caltrans 2015. Table I.2-2. vibratory driving summary (36-inch steel)
Please include any assumptions	
PROJECT CONTACT	

STEP 2: WEIGHTING FACTOR ADJUSTMENT — Specify if relying on source-specific WFA, alternative weighting/dB adjustment, or if using default value

Weighting Factor Adjustment (kHz)¥	2.5

Vibratory Installation

¥ Broadband: 95% frequency contour percentile (kHz) OR Narrowband: frequency (kHz); For appropriate default WFA: See INTRODUCTION tab

† If a user relies on alternative weighting/dB adjustment rather than relying upon the WFA (source-specific or default), they may override the Adjustment (dB) (row 43), and enter the new value directly. However, they must provide additional support and documentation supporting this modification.

*** BROADBAND Sources: Cannot use WFA higher than maximum applicable frequency (See GRAY tab for more information on WFA applicable frequencies)**

STEP 3: SOURCE-SPECIFIC INFORMATION

Source Level (RMS SPL)	170
Activity Duration (hours) within 24-h period	1.67
Activity Duration (seconds)	6012
10 Log (duration)	37.79
Propagation (xLogR)	15
Distance of source level measurement (meters)ǂ	10

ǂUnless otherwise specified, source levels are referenced 1 m from the source.

Marine Mammal Hearing Group
Low-frequency (LF) cetaceans: baleen whales
Mid-frequency (MF) cetaceans: dolphins, toothed whales, beaked whales, bottlenose whales
High-frequency (HF) cetaceans: true porpoises, *Kogia*, river dolphins, cephalorhynchid, *Lagenorhynchus cruciger* & *L. australis*
Phocid pinnipeds (PW):true seals
Otariid pinnipeds (OW):sea lions and fur seals

RESULTANT ISOPLETHS

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	199	198	173	201	219
PTS Isopleth to threshold (meters)	**38.3**	**3.4**	**56.6**	**23.3**	**1.6**

WEIGHTING FUNCTION CALCULATIONS

Weighting Function Parameters	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
a	1	1.6	1.8	1	2
b	2	2	2	2	2
f_1	0.2	8.8	12	1.9	0.94
f_2	19	110	140	30	25
C	0.13	1.2	1.36	0.75	0.64
Adjustment (dB)†	**-0.05**	**-16.83**	**-23.50**	**-1.29**	**-0.60**

$$W(f) = C + 10\log_{10}\left\{\frac{(f/f_1)^{2a}}{[1+(f/f_1)^2]^a[1+(f/f_2)^2]^b}\right\}$$

A: STATIONARY SOURCE: Non-Impulsive, Continuous

VERSION: 1.1 (Aug-16)

KEY

	Action Proponent Provided Information
	NMFS Provided Information (Acoustic Guidance)
	Resultant Isopleth

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE	Mission Bay Ferry and Water Taxi Landing
PROJECT/SOURCE INFORMATION	Caltrans 2015. Table I.2-2. vibratory driving summary (36-inch steel)
Please include any assumptions	
PROJECT CONTACT	

STEP 2: WEIGHTING FACTOR ADJUSTMENT — Specify if relying on source-specific WFA, alternative weighting/dB adjustment, or if using default value

Weighting Factor Adjustment (kHz)¥	2.5	Vibratory Installation

¥ Broadband: 95% frequency contour percentile (kHz) OR Narrowband: frequency (kHz); For appropriate default WFA: See INTRODUCTION tab

† If a user relies on alternative weighting/dB adjustment rather than relying upon the WFA (source-specific or default), they may override the Adjustment (dB) (row 43), and enter the new value directly. However, they must provide additional support and documentation supporting this modification.

*** BROADBAND Sources: Cannot use WFA higher than maximum applicable frequency (See GRAY tab for more information on WFA applicable frequencies)**

STEP 3: SOURCE-SPECIFIC INFORMATION

Source Level (RMS SPL)	163
Activity Duration (hours) within 24-h period	1.67
Activity Duration (seconds)	6012
10 Log (duration)	37.79
Propagation (xLogR)	15
Distance of source level measurement (meters)ǂ	10

ǂUnless otherwise specified, source levels are referenced 1 m from the source.

Marine Mammal Hearing Group
Low-frequency (LF) cetaceans: baleen whales
Mid-frequency (MF) cetaceans: dolphins, toothed whales, beaked whales, bottlenose whales
High-frequency (HF) cetaceans: true porpoises, *Kogia*, river dolphins, cephalorhynchid, *Lagenorhynchus cruciger* & *L. australis*
Phocid pinnipeds (PW):true seals
Otariid pinnipeds (OW):sea lions and fur seals

RESULTANT ISOPLETHS

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	199	198	173	201	219
PTS Isopleth to threshold (meters)	**13.1**	**1.2**	**19.3**	**7.9**	**0.6**

WEIGHTING FUNCTION CALCULATIONS

Weighting Function Parameters	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
a	1	1.6	1.8	1	2
b	2	2	2	2	2
f_1	0.2	8.8	12	1.9	0.94
f_2	19	110	140	30	25
C	0.13	1.2	1.36	0.75	0.64
Adjustment (dB)†	**-0.05**	**-16.83**	**-23.50**	**-1.29**	**-0.60**

$$W(f) = C + 10\log_{10}\left\{\frac{(f/f_1)^{2a}}{[1+(f/f_1)^2]^a[1+(f/f_2)^2]^b}\right\}$$

A: STATIONARY SOURCE: Non-Impulsive, Continuous

VERSION: 1.1 (Aug-16)

KEY

	Action Proponent Provided Information
	NMFS Provided Information (Acoustic Guidance)
	Resultant Isopleth

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE	Mission Bay Ferry and Water Taxi Landing
PROJECT/SOURCE INFORMATION	Caltrans 2015. Table I.2-2. vibratory driving summary (36-inch steel)
Please include any assumptions	
PROJECT CONTACT	

STEP 2: WEIGHTING FACTOR ADJUSTMENT — Specify if relying on source-specific WFA, alternative weighting/dB adjustment, or if using default value

Weighting Factor Adjustment (kHz)¥	2.5

Vibratory Installation

¥ Broadband: 95% frequency contour percentile (kHz) OR Narrowband: frequency (kHz); For appropriate default WFA: See INTRODUCTION tab

† If a user relies on alternative weighting/dB adjustment rather than relying upon the WFA (source-specific or default), they may override the Adjustment (dB) (row 43), and enter the new value directly. However, they must provide additional support and documentation supporting this modification.

*** BROADBAND Sources: Cannot use WFA higher than maximum applicable frequency (See GRAY tab for more information on WFA applicable frequencies)**

STEP 3: SOURCE-SPECIFIC INFORMATION

Source Level (RMS SPL)	158
Activity Duration (hours) within 24-h period	0.33
Activity Duration (seconds)	1188
10 Log (duration)	30.75
Propagation (xLogR)	15
Distance of source level measurement (meters)ᵛ	10

ᵛUnless otherwise specified, source levels are referenced 1 m from the source.

Marine Mammal Hearing Group
Low-frequency (LF) cetaceans: baleen whales
Mid-frequency (MF) cetaceans: dolphins, toothed whales, beaked whales, bottlenose whales
High-frequency (HF) cetaceans: true porpoises, *Kogia*, river dolphins, cephalorhynchid, *Lagenorhynchus cruciger* & *L. australis*
Phocid pinnipeds (PW):true seals
Otariid pinnipeds (OW):sea lions and fur seals

RESULTANT ISOPLETHS

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	199	198	173	201	219
PTS Isopleth to threshold (meters)	**2.1**	**0.2**	**3.0**	**1.3**	**0.1**

WEIGHTING FUNCTION CALCULATIONS

Weighting Function Parameters	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
a	1	1.6	1.8	1	2
b	2	2	2	2	2
f_1	0.2	8.8	12	1.9	0.94
f_2	19	110	140	30	25
C	0.13	1.2	1.36	0.75	0.64
Adjustment (dB)†	**-0.05**	**-16.83**	**-23.50**	**-1.29**	**-0.60**

$$W(f) = C + 10\log_{10}\left\{\frac{(f/f_1)^{2a}}{[1+(f/f_1)^2]^a[1+(f/f_2)^2]^b}\right\}$$

A: STATIONARY SOURCE: Non-Impulsive, Continuous

VERSION: 1.1 (Aug-16)

KEY

	Action Proponent Provided Information
	NMFS Provided Information (Acoustic Guidance)
	Resultant Isopleth

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE	Mission Bay Ferry and Water Taxi Landing
PROJECT/SOURCE INFORMATION	Caltrans 2015. Table I.2-2. vibratory driving summary (36-inch steel)
Please include any assumptions	
PROJECT CONTACT	

STEP 2: WEIGHTING FACTOR ADJUSTMENT — Specify if relying on source-specific WFA, alternative weighting/dB adjustment, or if using default value

Weighting Factor Adjustment (kHz)¥	2.5	Vibratory Installation

¥ Broadband: 95% frequency contour percentile (kHz) OR Narrowband: frequency (kHz); For appropriate default WFA: See INTRODUCTION tab

† If a user relies on alternative weighting/dB adjustment rather than relying upon the WFA (source-specific or default), they may override the Adjustment (dB) (row 43), and enter the new value directly. However, they must provide additional support and documentation supporting this modification.

*** BROADBAND Sources: Cannot use WFA higher than maximum applicable frequency (See GRAY tab for more information on WFA applicable frequencies)**

STEP 3: SOURCE-SPECIFIC INFORMATION

Source Level (RMS SPL)	151
Activity Duration (hours) within 24-h period	0.33
Activity Duration (seconds)	1188
10 Log (duration)	30.75
Propagation (xLogR)	15
Distance of source level measurement (meters)*	10

*Unless otherwise specified, source levels are referenced 1 m from the source.

Marine Mammal Hearing Group
Low-frequency (LF) cetaceans: baleen whales
Mid-frequency (MF) cetaceans: dolphins, toothed whales, beaked whales, bottlenose whales
High-frequency (HF) cetaceans: true porpoises, *Kogia*, river dolphins, cephalorhynchid, *Lagenorhynchus cruciger* & *L. australis*
Phocid pinnipeds (PW):true seals
Otariid pinnipeds (OW):sea lions and fur seals

RESULTANT ISOPLETHS

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	199	198	173	201	219
PTS Isopleth to threshold (meters)	**0.7**	**0.1**	**1.0**	**0.4**	**0.0**

WEIGHTING FUNCTION CALCULATIONS

Weighting Function Parameters	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
a	1	1.6	1.8	1	2
b	2	2	2	2	2
f_1	0.2	8.8	12	1.9	0.94
f_2	19	110	140	30	25
C	0.13	1.2	1.36	0.75	0.64
Adjustment (dB)†	**-0.05**	**-16.83**	**-23.50**	**-1.29**	**-0.60**

$$W(f) = C + 10\log_{10}\left\{\frac{(f/f_1)^{2a}}{[1+(f/f_1)^2]^a[1+(f/f_2)^2]^b}\right\}$$

A: STATIONARY SOURCE: Non-Impulsive, Continuous

VERSION: 1.1 (Aug-16)

KEY

	Action Proponent Provided Information
	NMFS Provided Information (Acoustic Guidance)
	Resultant Isopleth

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE	Mission Bay Ferry and Water Taxi Landing
PROJECT/SOURCE INFORMATION	Caltrans 2015. Table I.2-2. vibratory driving summary (36-inch steel)
Please include any assumptions	
PROJECT CONTACT	

STEP 2: WEIGHTING FACTOR ADJUSTMENT — Specify if relying on source-specific WFA, alternative weighting/dB adjustment, or if using default value

Weighting Factor Adjustment (kHz)¥	2.5	Vibratory Installation

¥ Broadband: 95% frequency contour percentile (kHz) OR Narrowband: frequency (kHz); For appropriate default WFA: See INTRODUCTION tab

† If a user relies on alternative weighting/dB adjustment rather than relying upon the WFA (source-specific or default), they may override the Adjustment (dB) (row 43), and enter the new value directly. However, they must provide additional support and documentation supporting this modification.

*** BROADBAND Sources: Cannot use WFA higher than maximum applicable frequency (See GRAY tab for more information on WFA applicable frequencies)**

STEP 3: SOURCE-SPECIFIC INFORMATION

Source Level (RMS SPL)	170
Activity Duration (hours) within 24-h period	0.5
Activity Duration (seconds)	1800
10 Log (duration)	32.55
Propagation (xLogR)	15
Distance of source level measurement (meters)ǂ	10

ǂUnless otherwise specified, source levels are referenced 1 m from the source.

Marine Mammal Hearing Group
Low-frequency (LF) cetaceans: baleen whales
Mid-frequency (MF) cetaceans: dolphins, toothed whales, beaked whales, bottlenose whales
High-frequency (HF) cetaceans: true porpoises, *Kogia*, river dolphins, cephalorhynchid, *Lagenorhynchus cruciger* & *L. australis*
Phocid pinnipeds (PW):true seals
Otariid pinnipeds (OW):sea lions and fur seals

RESULTANT ISOPLETHS

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	199	198	173	201	219
PTS Isopleth to threshold (meters)	**17.1**	**1.5**	**25.3**	**10.4**	**0.7**

WEIGHTING FUNCTION CALCULATIONS

Weighting Function Parameters	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
a	1	1.6	1.8	1	2
b	2	2	2	2	2
f_1	0.2	8.8	12	1.9	0.94
f_2	19	110	140	30	25
C	0.13	1.2	1.36	0.75	0.64
Adjustment (dB)†	**-0.05**	**-16.83**	**-23.50**	**-1.29**	**-0.60**

$$W(f) = C + 10\log_{10}\left\{\frac{(f/f_1)^{2a}}{[1+(f/f_1)^2]^a[1+(f/f_2)^2]^b}\right\}$$

A: STATIONARY SOURCE: Non-Impulsive, Continuous

VERSION: 1.1 (Aug-16)

KEY

	Action Proponent Provided Information
	NMFS Provided Information (Acoustic Guidance)
	Resultant Isopleth

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE	Mission Bay Ferry and Water Taxi Landing
PROJECT/SOURCE INFORMATION	Caltrans 2015. Table I.2-2. vibratory driving summary (36-inch steel)
Please include any assumptions	
PROJECT CONTACT	

STEP 2: WEIGHTING FACTOR ADJUSTMENT — Specify if relying on source-specific WFA, alternative weighting/dB adjustment, or if using default value

Weighting Factor Adjustment (kHz)¥	2.5	Vibratory Installation

¥ Broadband: 95% frequency contour percentile (kHz) OR Narrowband: frequency (kHz); For appropriate default WFA: See INTRODUCTION tab

† If a user relies on alternative weighting/dB adjustment rather than relying upon the WFA (source-specific or default), they may override the Adjustment (dB) (row 43), and enter the new value directly. However, they must provide additional support and documentation supporting this modification.

*** BROADBAND Sources: Cannot use WFA higher than maximum applicable frequency (See GRAY tab for more information on WFA applicable frequencies)**

STEP 3: SOURCE-SPECIFIC INFORMATION

Source Level (RMS SPL)	163
Activity Duration (hours) within 24-h period	0.5
Activity Duration (seconds)	1800
10 Log (duration)	32.55
Propagation (xLogR)	15
Distance of source level measurement (meters)ᵠ	10

ᵠUnless otherwise specified, source levels are referenced 1 m from the source.

Marine Mammal Hearing Group
Low-frequency (LF) cetaceans: baleen whales
Mid-frequency (MF) cetaceans: dolphins, toothed whales, beaked whales, bottlenose whales
High-frequency (HF) cetaceans: true porpoises, *Kogia*, river dolphins, cephalorhynchid, *Lagenorhynchus cruciger* & *L. australis*
Phocid pinnipeds (PW):true seals
Otariid pinnipeds (OW):sea lions and fur seals

RESULTANT ISOPLETHS

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	199	198	173	201	219
PTS Isopleth to threshold (meters)	**5.8**	**0.5**	**8.6**	**3.6**	**0.2**

WEIGHTING FUNCTION CALCULATIONS

Weighting Function Parameters	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
a	1	1.6	1.8	1	2
b	2	2	2	2	2
f_1	0.2	8.8	12	1.9	0.94
f_2	19	110	140	30	25
C	0.13	1.2	1.36	0.75	0.64
Adjustment (dB)†	**-0.05**	**-16.83**	**-23.50**	**-1.29**	**-0.60**

$$W(f) = C + 10\log_{10}\left\{\frac{(f/f_1)^{2a}}{[1+(f/f_1)^2]^a[1+(f/f_2)^2]^b}\right\}$$

A: STATIONARY SOURCE: Non-Impulsive, Continuous

VERSION: 1.1 (Aug-16)

KEY

	Action Proponent Provided Information
	NMFS Provided Information (Acoustic Guidance)
	Resultant Isopleth

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE	Mission Bay Ferry and Water Taxi Landing
PROJECT/SOURCE INFORMATION	Caltrans 2015. Table I.2-3. 18-inch steel at Prichard Lake, Sacramento, CA.
Please include any assumptions	
PROJECT CONTACT	

STEP 2: WEIGHTING FACTOR ADJUSTMENT — Specify if relying on source-specific WFA, alternative weighting/dB adjustment, or if using default value

Weighting Factor Adjustment (kHz)¥	2.5	Vibratory Installation

¥ Broadband: 95% frequency contour percentile (kHz) OR Narrowband: frequency (kHz); For appropriate default WFA: See INTRODUCTION tab

† If a user relies on alternative weighting/dB adjustment rather than relying upon the WFA (source-specific or default), they may override the Adjustment (dB) (row 43), and enter the new value directly. However, they must provide additional support and documentation supporting this modification.

*** BROADBAND Sources: Cannot use WFA higher than maximum applicable frequency (See GRAY tab for more information on WFA applicable frequencies)**

STEP 3: SOURCE-SPECIFIC INFORMATION

Source Level (RMS SPL)	158
Activity Duration (hours) within 24-h period	0.33
Activity Duration (seconds)	1188
10 Log (duration)	30.75
Propagation (xLogR)	15
Distance of source level measurement (meters)*	10

*Unless otherwise specified, source levels are referenced 1 m from the source.

Marine Mammal Hearing Group
Low-frequency (LF) cetaceans: baleen whales
Mid-frequency (MF) cetaceans: dolphins, toothed whales, beaked whales, bottlenose whales
High-frequency (HF) cetaceans: true porpoises, *Kogia*, river dolphins, cephalorhynchid, *Lagenorhynchus cruciger* & *L. australis*
Phocid pinnipeds (PW):true seals
Otariid pinnipeds (OW):sea lions and fur seals

RESULTANT ISOPLETHS

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	199	198	173	201	219
PTS Isopleth to threshold (meters)	**2.1**	**0.2**	**3.0**	**1.3**	**0.1**

WEIGHTING FUNCTION CALCULATIONS

Weighting Function Parameters	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
a	1	1.6	1.8	1	2
b	2	2	2	2	2
f_1	0.2	8.8	12	1.9	0.94
f_2	19	110	140	30	25
C	0.13	1.2	1.36	0.75	0.64
Adjustment (dB)†	**-0.05**	**-16.83**	**-23.50**	**-1.29**	**-0.60**

$$W(f) = C + 10\log_{10}\left\{\frac{(f/f_1)^{2a}}{[1+(f/f_1)^2]^a[1+(f/f_2)^2]^b}\right\}$$

A: STATIONARY SOURCE: Non-Impulsive, Continuous

VERSION: 1.1 (Aug-16)

KEY

	Action Proponent Provided Information
	NMFS Provided Information (Acoustic Guidance)
	Resultant Isopleth

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE	Mission Bay Ferry and Water Taxi Landing
PROJECT/SOURCE INFORMATION	Caltrans 2015. Table I.2-3. 18-inch steel at Prichard Lake, Sacramento, CA.
Please include any assumptions	
PROJECT CONTACT	

STEP 2: WEIGHTING FACTOR ADJUSTMENT — Specify if relying on source-specific WFA, alternative weighting/dB adjustment, or if using default value

Weighting Factor Adjustment (kHz)¥	2.5	Vibratory Installation

¥ Broadband: 95% frequency contour percentile (kHz) OR Narrowband: frequency (kHz); For appropriate default WFA: See INTRODUCTION tab

† If a user relies on alternative weighting/dB adjustment rather than relying upon the WFA (source-specific or default), they may override the Adjustment (dB) (row 43), and enter the new value directly. However, they must provide additional support and documentation supporting this modification.

*** BROADBAND Sources: Cannot use WFA higher than maximum applicable frequency (See GRAY tab for more information on WFA applicable frequencies)**

STEP 3: SOURCE-SPECIFIC INFORMATION

Source Level (RMS SPL)	151
Activity Duration (hours) within 24-h period	0.33
Activity Duration (seconds)	1188
10 Log (duration)	30.75
Propagation (xLogR)	15
Distance of source level measurement (meters)*	10

*Unless otherwise specified, source levels are referenced 1 m from the source.

Marine Mammal Hearing Group
Low-frequency (LF) cetaceans: baleen whales
Mid-frequency (MF) cetaceans: dolphins, toothed whales, beaked whales, bottlenose whales
High-frequency (HF) cetaceans: true porpoises, *Kogia*, river dolphins, cephalorhynchid, *Lagenorhynchus cruciger* & *L. australis*
Phocid pinnipeds (PW):true seals
Otariid pinnipeds (OW):sea lions and fur seals

RESULTANT ISOPLETHS

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	199	198	173	201	219
PTS Isopleth to threshold (meters)	**0.7**	**0.1**	**1.0**	**0.4**	**0.0**

WEIGHTING FUNCTION CALCULATIONS

Weighting Function Parameters	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
a	1	1.6	1.8	1	2
b	2	2	2	2	2
f_1	0.2	8.8	12	1.9	0.94
f_2	19	110	140	30	25
C	0.13	1.2	1.36	0.75	0.64
Adjustment (dB)†	**-0.05**	**-16.83**	**-23.50**	**-1.29**	**-0.60**

$$W(f) = C + 10\log_{10}\left\{\frac{(f/f_1)^{2a}}{[1+(f/f_1)^2]^a[1+(f/f_2)^2]^b}\right\}$$

A: STATIONARY SOURCE: Non-Impulsive, Continuous

VERSION: 1.1 (Aug-16)

KEY

	Action Proponent Provided Information
	NMFS Provided Information (Acoustic Guidance)
	Resultant Isopleth

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE	Mission Bay Ferry and Water Taxi Landing
PROJECT/SOURCE INFORMATION	Caltrans 2015. Table I.2-2. 12-inch steel, standard sound levels for vibratory driving/extraction.
Please include any assumptions	
PROJECT CONTACT	

STEP 2: WEIGHTING FACTOR ADJUSTMENT — Specify if relying on source-specific WFA, alternative weighting/dB adjustment, or if using default value

Weighting Factor Adjustment (kHz)¥	2.5

Vibratory Extraction

¥ Broadband: 95% frequency contour percentile (kHz) OR Narrowband: frequency (kHz); For appropriate default WFA: See INTRODUCTION tab

† If a user relies on alternative weighting/dB adjustment rather than relying upon the WFA (source-specific or default), they may override the Adjustment (dB) (row 43), and enter the new value directly. However, they must provide additional support and documentation supporting this modification.

*** BROADBAND Sources: Cannot use WFA higher than maximum applicable frequency (See GRAY tab for more information on WFA applicable frequencies)**

STEP 3: SOURCE-SPECIFIC INFORMATION

Source Level (RMS SPL)	155
Activity Duration (hours) within 24-h period	0.4
Activity Duration (seconds)	1440
10 Log (duration)	31.58
Propagation (xLogR)	15
Distance of source level measurement (meters)*	10

*Unless otherwise specified, source levels are referenced 1 m from the source.

Marine Mammal Hearing Group
Low-frequency (LF) cetaceans: baleen whales
Mid-frequency (MF) cetaceans: dolphins, toothed whales, beaked whales, bottlenose whales
High-frequency (HF) cetaceans: true porpoises, *Kogia*, river dolphins, cephalorhynchid, *Lagenorhynchus cruciger* & *L. australis*
Phocid pinnipeds (PW):true seals
Otariid pinnipeds (OW):sea lions and fur seals

RESULTANT ISOPLETHS

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	199	198	173	201	219
PTS Isopleth to threshold (meters)	**1.5**	**0.1**	**2.2**	**0.9**	**0.1**

WEIGHTING FUNCTION CALCULATIONS

Weighting Function Parameters	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
a	1	1.6	1.8	1	2
b	2	2	2	2	2
f_1	0.2	8.8	12	1.9	0.94
f_2	19	110	140	30	25
C	0.13	1.2	1.36	0.75	0.64
Adjustment (dB)†	**-0.05**	**-16.83**	**-23.50**	**-1.29**	**-0.60**

$$W(f) = C + 10\log_{10}\left\{\frac{(f/f_1)^{2a}}{[1+(f/f_1)^2]^a[1+(f/f_2)^2]^b}\right\}$$

A: STATIONARY SOURCE: Non-Impulsive, Continuous

VERSION: 1.1 (Aug-16)

KEY

	Action Proponent Provided Information
	NMFS Provided Information (Acoustic Guidance)
	Resultant Isopleth

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE	Mission Bay Ferry and Water Taxi Landing
PROJECT/SOURCE INFORMATION	Caltrans 2015. Table I.2-2. 12-inch steel, standard sound levels for vibratory driving/extraction.
Please include any assumptions	
PROJECT CONTACT	

STEP 2: WEIGHTING FACTOR ADJUSTMENT — Specify if relying on source-specific WFA, alternative weighting/dB adjustment, or if using default value

Weighting Factor Adjustment (kHz)¥	2.5

Vibratory Extraction

¥ Broadband: 95% frequency contour percentile (kHz) OR Narrowband: frequency (kHz); For appropriate default WFA: See INTRODUCTION tab

† If a user relies on alternative weighting/dB adjustment rather than relying upon the WFA (source-specific or default), they may override the Adjustment (dB) (row 43), and enter the new value directly. However, they must provide additional support and documentation supporting this modification.

*** BROADBAND Sources: Cannot use WFA higher than maximum applicable frequency (See GRAY tab for more information on WFA applicable frequencies)**

STEP 3: SOURCE-SPECIFIC INFORMATION

Source Level (RMS SPL)	148
Activity Duration (hours) within 24-h period	0.4
Activity Duration (seconds)	1440
10 Log (duration)	31.58
Propagation (xLogR)	15
Distance of source level measurement (meters)*	10

*Unless otherwise specified, source levels are referenced 1 m from the source.

Marine Mammal Hearing Group
Low-frequency (LF) cetaceans: baleen whales
Mid-frequency (MF) cetaceans: dolphins, toothed whales, beaked whales, bottlenose whales
High-frequency (HF) cetaceans: true porpoises, *Kogia*, river dolphins, cephalorhynchid, *Lagenorhynchus cruciger* & *L. australis*
Phocid pinnipeds (PW):true seals
Otariid pinnipeds (OW):sea lions and fur seals

RESULTANT ISOPLETHS

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	199	198	173	201	219
PTS Isopleth to threshold (meters)	**0.5**	**0.0**	**0.7**	**0.3**	**0.0**

WEIGHTING FUNCTION CALCULATIONS

Weighting Function Parameters	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
a	1	1.6	1.8	1	2
b	2	2	2	2	2
f_1	0.2	8.8	12	1.9	0.94
f_2	19	110	140	30	25
C	0.13	1.2	1.36	0.75	0.64
Adjustment (dB)†	**-0.05**	**-16.83**	**-23.50**	**-1.29**	**-0.60**

$$W(f) = C + 10\log_{10}\left\{\frac{(f/f_1)^{2a}}{[1+(f/f_1)^2]^a[1+(f/f_2)^2]^b}\right\}$$

A: STATIONARY SOURCE: Non-Impulsive, Continuous

VERSION 2.0: 2018

KEY

	User Provided Information
	NMFS Provided Information (Technical Guidance)
	Resultant Isopleth

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE	Mission Bay Ferry Landing
PROJECT/SOURCE INFORMATION	Drilling
Please include any assumptions	
PROJECT CONTACT	

STEP 2: WEIGHTING FACTOR ADJUSTMENT

Specify if relying on source-specific WFA, alternative weighting/dB adjustment, or if using default value.

Weighting Factor Adjustment (kHz)¥	2

¥ Broadband: 95% frequency contour percentile (kHz) OR Narrowband: frequency (kHz); For appropriate default WFA: See INTRODUCTION tab

† If a user relies on alternative weighting/dB adjustment rather than relying upon the WFA (source-specific or default), they may override the Adjustment (dB) (row 47), and enter the new value directly. However, they must provide additional support and documentation supporting this modification.

*** BROADBAND Sources: Cannot use WFA higher than maximum applicable frequency (See GRAY tab for more information on WFA applicable frequencies)**

STEP 3: SOURCE-SPECIFIC INFORMATION

Source Level (RMS SPL)	168
Duration of Sound Production (hours) within 24-h period	5.5
Duration of Sound Production (seconds)	19800
10 Log (duration of sound production)	42.97
Propagation (xLogR)	15

NOTE: The User Spreadsheet tool provides a means to estimates distances associated with the Technical Guidance's PTS onset thresholds. Mitigation and monitoring requirements associated with a Marine Mammal Protection Act (MMPA) authorization or an Endangered Species Act (ESA) consultation or permit are independent management decisions made in the context of the proposed activity and comprehensive effects analysis, and are beyond the scope of the Technical Guidance and the User Spreadsheet tool.

RESULTANT ISOPLETHS

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	199	198	173	201	219
PTS Isopleth to threshold (meters)	**6.3**	**0.4**	**5.5**	**3.4**	**0.2**

WEIGHTING FUNCTION CALCULATIONS

Weighting Function Parameters	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
a	1	1.6	1.8	1	2
b	2	2	2	2	2
f_1	0.2	8.8	12	1.9	0.94
f_2	19	110	140	30	25
C	0.13	1.2	1.36	0.75	0.64
Adjustment (dB)†	**-0.01**	**-19.74**	**-26.87**	**-2.08**	**-1.15**

$$W(f) = C + 10\log_{10}\left\{\frac{(f/f_1)^{2a}}{[1+(f/f_1)^2]^a[1+(f/f_2)^2]^b}\right\}$$

Marine Mammal Behavior Thresholds - Formulas Derived from NMFS Noise Calculator

Transmisison Loss Constant	15
Distance (m)	10

Pile Type	Installation Method	RMS (dB)	Distance (m) to Threshold Behavior Thresholds RMS (dB) 120	160	Data Source
36-inch steel	Impact	193	735,642.3	1,584.9	Caltrans 2015. Table I.2-1. Summary Table.
36-inch steel (attenuated)	Impact	186	251,188.6	541.2	Caltrans 2015. Table I.2-1. Summary Table.
20-inch concrete	Impact	179	85,769.6	184.8	Caltrans 2015. Table I.2-3. 24-inch concrete pile driven at Port of Oakland, CA.
20-inch concrete (attenuated)	Impact	172	29,286.4	63.1	Caltrans 2015. Table I.2-3. 24-inch concrete pile driven at Port of Oakland, CA.
16-inch steel	Impact	184	184,785.0	398.1	Caltrans 2015. Table I.2-3. 20-inch steel at San Joaquin River, Stockton, CA.
16-inch steel (attenuated)	Impact	177	63,095.7	135.9	Caltrans 2015. Table I.2-3. 20-inch steel at San Joaquin River, Stockton, CA.
14-inch steel H Pile	Vibratory	158	3,414.5	7.4	Caltrans 2015. Table I.2-2. vibratory driving summary (12-inch H-type)
14-inch steel H Pile (attenuated)	Vibratory	151	1,165.9	2.5	Caltrans 2015. Table I.2-2. vibratory driving summary (12-inch H-type)
30-inch steel caisson	Vibratory	170	21,544.3	46.4	Caltrans 2015. Table I.2-2. vibratory driving summary (36-inch steel)
30-inch steel caisson (attenuated)	Vibratory	163	7,356.4	15.8	Caltrans 2015. Table I.2-2. vibratory driving summary (36-inch steel)
36-inch steel	Vibratory	170	21,544.3	46.4	Caltrans 2015. Table I.2-2. vibratory driving summary (36-inch steel)
36-inch steel (attenuated)	Vibratory	163	7,356.4	15.8	Caltrans 2015. Table I.2-2. vibratory driving summary (36-inch steel)
14-inch steel H Pile	Vibratory	150	1,000.0	2.2	Caltrans 2015. Table I.2-2. vibratory driving summary (12-inch H-type)
14-inch steel H Pile (attenuated)	Vibratory	143	341.5	0.7	Caltrans 2015. Table I.2-2. vibratory driving summary (12-inch H-type)
30-inch steel caisson	Vibratory	170	21,544.3	46.4	Caltrans 2015. Table I.2-2. vibratory driving summary (36-inch steel)
30-inch steel caisson (attenuated)	Vibratory	163	7,356.4	15.8	Caltrans 2015. Table I.2-2. vibratory driving summary (36-inch steel)
16-inch steel	Vibratory	158	3,414.5	7.4	Caltrans 2015. Table I.2-3. 18-inch steel at Prichard Lake, Sacramento, CA.
16-inch steel (attenuated)	Vibratory	151	1,165.9	2.5	Caltrans 2015. Table I.2-3. 18-inch steel at Prichard Lake, Sacramento, CA.
12-inch steel	Vibratory	155	2,154.4	4.6	Caltrans 2015. Table I.2-2. 12-inch steel, standard sound levels for vibratory driving/extraction.
12-inch steel (attenuated)	Vibratory	148	735.6	1.6	Caltrans 2015. Table I.2-2. 12-inch steel, standard sound levels for vibratory driving/extraction.
24-inch concrete	Drilling	168	15,848.9	34.1	NOAA 2018
24-inch concrete (attenuated)	Drilling	161	5,411.7	11.7	NOAA 2018