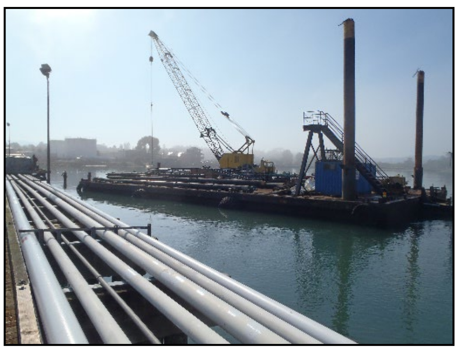

H. T. HARVEY & ASSOCIATES
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Chevron Eureka Terminal 2025 Repairs—Underwater Noise and Marine Mammal Monitoring Plan

DRAFT

Project No. 3606-07

Prepared for:

Pacific Affiliates
205 I Street, Suite B
Eureka, CA 95501

and

Chevron
3400 Christie Street
Eureka, CA 95501

Prepared by:

H. T. Harvey & Associates

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List of Preparers

Erica Escajeda, Ph.D., Wildlife Ecologist
Carolyn Belak, M.S., Aquatic Ecologist
Sharon Kramer, Ph.D., Principal/Senior Fish Ecologist
Ellen Pimentel, M.S., Project Manager
Joy DeBruyn, Senior Technical Support
Sadie Trush, GIS Analyst

Section 1.0 Introduction

The Chevron Eureka Terminal, hereafter referred to as the 'Terminal,' consists of a timber trestle and wharf situated on the tidelands of Humboldt Bay, California, and a bulk fuel storage facility on an adjacent upland parcel in the city of Eureka, Humboldt County (Figures 1 and 2). The Terminal trestle and wharf extend westward from shore through shallow waters to the margin of the north channel of the bay. The trestle is located approximately 365.8 meters north of the present mouth of the Elk River. The Terminal serves fuel barges that arrive once every 10−12 days to deliver bulk fuel products. The fuel products are transferred from the barges to the bulk fuel storage facility through the unloading platform on the wharf and the fuel transfer pipeway on the trestle.

In 2017, a retrofit project for the Terminal was completed to bring the pipeway and unloading platform into compliance with California Building Code Chapter 31F Marine Oil Terminals and support the structures in the case of a seismic event. In 2025, Chevron is proposing to make additional repairs and upgrades to the Terminal, including replacement of piles and pile bracing, guide piles and guides, and a beam on the working platform. The Terminal repairs require construction activities that will affect the acoustic habitat adjacent to the project site. All in-water work will be conducted during a work window from July 1–October 15. The project will occur in three discrete areas: replacement of piles and pile bracing on the dock causeway at Bents 8, 20, 21, 22, and 23; replacement of guide piles and guides at the floating dock; and replacement of a beam at the working platform. Pile installation and removal will be performed from a barge that will access the trestle from the south side. The barge will be anchored in place by setting two 0.71-meter-diameter spud poles.

Figure 1. Map of the Terminal Location ("Project Site")

Figure 2. Image of the Terminal Site

Section 2.0 Project Site

The Terminal consists of a timber trestle and wharf situated on the tidelands on Humboldt Bay, California, and bulk fuel storage facility on an adjacent upland parcel in the city of Eureka, Humboldt County (Figure 1 and Figure 2). The project site is located at the west end of Truesdale Street, in the city of Eureka along the eastern shore of Humboldt Bay, and west of Highway 101. The project is surrounded by Humboldt Bay to the west and the city to the east. Chevron leases the tideland portion of the terminal area from the City of Eureka. The Terminal is T-shaped with an approximately 182.9-m-long trestle connected to an approximately 45.7-m-long wharf. Five mooring dolphins are connected to the wharf by timber catwalks. The overall length of the wharf and the catwalks is approximately 131.1 m. The Terminal trestle and wharf extend westward from shore through shallow waters to the margin of the North Bay Channel. The trestle is located approximately 365.8 m north of the present mouth of Elk River.

The Terminal serves fuel barges that arrive once every 10-12 days to deliver bulk fuel products. The fuel products are transferred from the barges to the bulk fuel storage facility through the unloading platform on the wharf and the fuel transfer pipeway on the trestle. Nearly all of the fuel used by the greater Eureka area is delivered via barge to the Terminal. Believed to have been originally constructed in the early 1900s, the facility has been expanded, upgraded, and repaired numerous times since. Serving fuel barges only, which provide their own hoses and pumps, the Terminal does not have any equipment, rack, towers, or loading arms on the wharf. Construction of the trestle and wharf are typical of a timber structure – wood pilings driven in rows are connection with a 12x12-inch (in) timber cap, and stringers span between piling caps and are covered with 4x12-in decking. Wood pilings are primarily creosote-treated, but a number of pressure-treated pilings have been installed over the years during repairs.

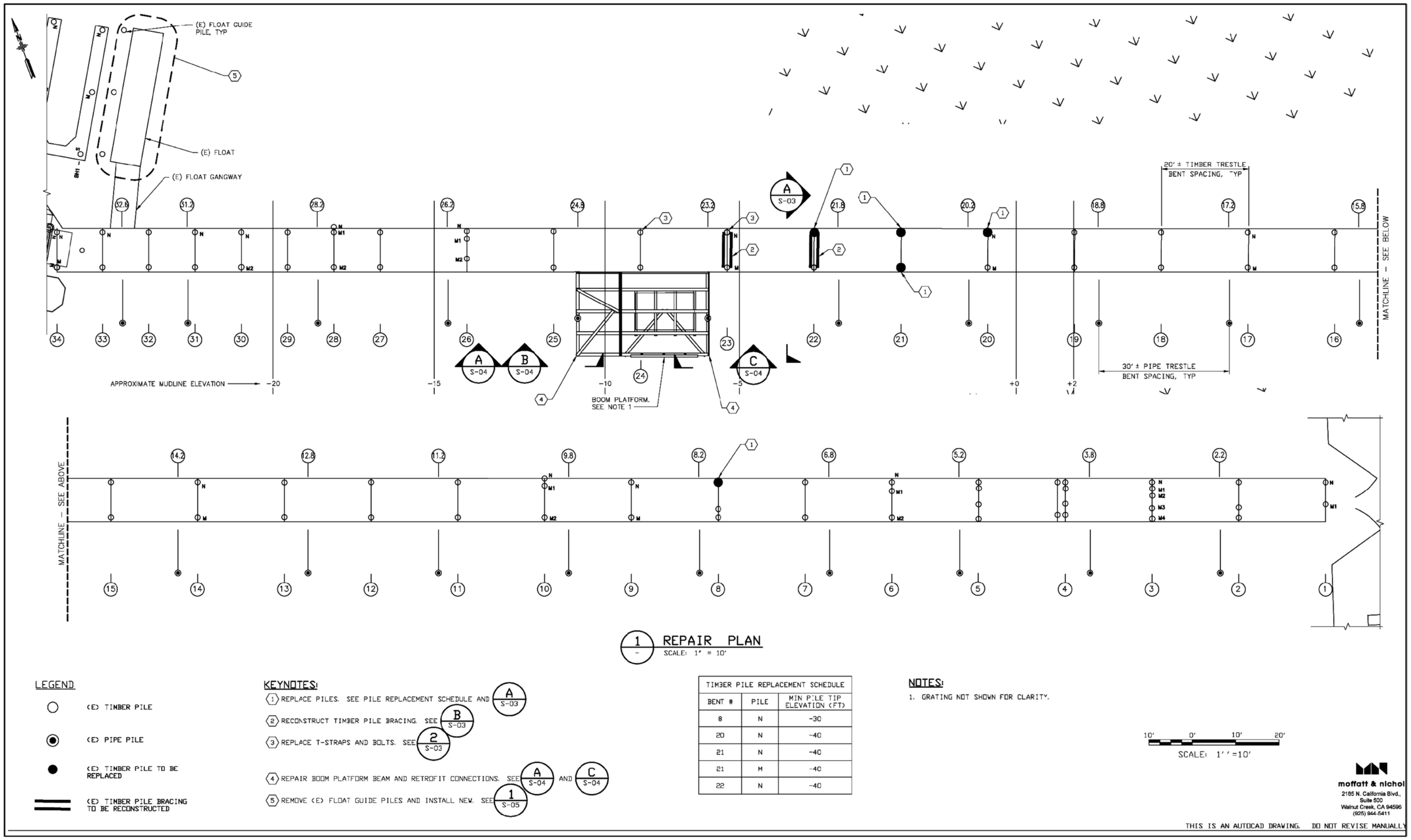
Section 3.0 Project Description

In accordance with Marine Oil Terminal Engineering and Maintenance Standards, Chevron USA is proposing repairs and upgrades to the Eureka Terminal. The work will be conducted in a single phase with construction repairs scheduled for a work window between July 1, 2025 and October 15, 2025.

The project has three main objectives: 1) replacement of piles and pile bracing on the dock causeway at Bents 8, 20, 21, 22, and 23; 2) replacement of guide piles and guides at the floating dock; and 3) replacement of a beam at the working platform (Figure 3). Work includes the removal of five timber piles at Bents 8, 20, 21, and 22 and three concrete piles at the floating dock. Timber piles will first be cut off 1 ft (0.3 m) below the mudline and will then be removed using a crane located on a floating barge; the barge will be anchored in place by setting two 28-inch (0.71-meter) diameter spud poles. The exact method of removal using the crane will be determined by the contractor. Timber piles (14-inch [0.36-meter] diameter) will be replaced with 16-inch (0.41-meter) diameter timber piles, fully coated with polyurea, installed to a depth of 40 feet (12.2 m). Existing concrete piles anchoring the floating dock will be removed and replaced with two 14-inch (0.36-m) diameter steel guide float piles; once piles are replaced, new guide systems, bracing systems, and hardware will be installed as required to connect and reinforce the newly installed piles and the causeway.

Construction activities will be performed from a flat-bottomed barge that has an approximately 4.9-foot (1.5-meter) draft when loaded (e.g., the Moondoor II, a 113.8-foot [34.7-meter] long and 78.1-foot [23.8-meter] wide barge). The barge will be powered and maneuvered into position by a push boat (e.g., the Tug *Joseph George*). The barge will approach the trestle from the south side and will be repositioned as needed to access work locations. A crane (e.g., Kobelco CK1000-III Crawler Crane, with a 120.4-foot [36.7-meter] boom) will be positioned on the barge and will be used to install and remove piles and other components of the structures.

All steel and timber piles will be driven to tip elevation or refusal using a crane and a vibratory hammer. If refusal occurs before tip elevation is reached, an impact pile-driving hammer will be used to drive the piles to the required tip elevation, completing the installation. Timber piles will be removed using a crane, with the method to be determined by the contractor. It is not known how long it will take to perform pile installation and removal procedures; however, on-water work will occur only during high tides. After the old piles are removed, they will be placed on the barge in a containment area and later offloaded and transported to an approved upland disposal facility.



BENT #	PILE	MIN PILE TIP ELEVATION (FT)
8	N	-30
20	N	-40
21	N	-40
21	M	-40
22	N	-40

Figure 3. General Plan for Causeway Repairs at the Chevron Eureka Terminal

Section 4.0 Underwater Noise Generation

Sounds generated by pile removal and pile driving are transferred to the water column and may affect fish and marine mammals present in waters adjacent to the project site. Table 1presents sound levels in decibels (dB) measured during pile driving for projects similar to the Terminal project. Note that peak sound pressure levels (SPL) are measured in dB in reference to 1 microPascal (re 1 µPa) whereas sound exposure levels (SEL) are constant sound levels (i.e., received levels) for one second that have the same amount of energy as the original sound, which varies over time (units: dB re 1 μPa^2s) (Molnar et al. 2020). Cumulative sound exposure levels (SEL_{cum}) are measured over a specified duration (e.g., over the time it takes to drive a single pile, over 24 hours, etc.). Both peak SPL and SEL_{cum} are used for monitoring noise impacts on marine organisms.

Table 1. Sound Pressure Levels (SPL) and Sound Exposure Levels (SEL) Measured at 10 Meters Distance from Pile Driving

Project Location	Pile Type	Diameter	Water Depth	Hammer Type	Peak SPL (dB re 1 µPa)	SEL (dB re 1 μPa^2s)
Richmond, CA – San Francisco Bay	Steel pipe	14-in	3–15 m	Diesel impact	199	169
San Rafael, CA – San Francisco Bay	Steel pipe	14-in	>15 m	Diesel impact	198*	170*
San Francisco, CA – Pier 39	Timber	14-in	5 m	Drop	184	145
Benicia, CA – Port of Benicia	Timber	~14-16-in †	10.7 m	Impact	180	148
Oakley, CA – Sand Mound Slough	Steel pipe	16-in	3 m	Drop	182	158
Eureka, CA – Humboldt Bay	CISS Steel pipe	36-in	10 m	Diesel impact	210	183

Notes: lb = pounds; m = meter; in = inches; CISS = castin-steel-shell. Humboldt Bay project included due to location.

* Sound levels measured at a distance of 22 m

† No data given on pile size; diameter estimated from reference photo (pg. I-108 in Molnar et al. 2020)

Source: Molnar et al. (2020)

Underwater sound thresholds for injury to fish have been identified by the Fisheries Hydroacoustic Working Group (FHWG; Table 2). The FHWG identified peak sounds pressure levels of 206 dB re 1 µPa at 10 m as being injurious to fish, whereas injurious SEL_{cum} differed based on the fish's weight (Table 2). If SEL_{cum} exceed 183 dB re 1 μPa^2s during impact pile driving, an Incidental Take Permit will be requested from the California Department of Fish and Wildlife to permit incidental take of juvenile longfin smelt (*Spirinchus thaleichthys*).

Table 2. Underwater Sound Level Thresholds for Injury to Fish for Impact Pile Driving

Interim Criteria for Injury	Underwater Noise Threshold
Peak SPL	206 dB re 1 μPa for all fish sizes
SEL_{cum}	187 dB re 1 μPa²s for fish ≥ 2 g 183 dB re 1 μPa²s for fish < 2 g

Notes: μPa = microPascal; dB = decibels; SPL = sound pressure level; SEL = sound exposure level. Sources: Fisheries Hydroacoustic Working Group (2008); Molnar et al. (2020).

The thresholds presented in Table 2 were developed for impact pile driving only and should not be used to assess sound from vibratory pile driving. Injury thresholds for impact driving are likely to be much lower than the injury thresholds for non-impulsive vibratory pile driving (Molnar et al. 2020).

Marine mammals are separated into groups based on their hearing sensitivity: low-frequency cetaceans (baleen whales), mid-frequency cetaceans (dolphins, toothed whales), high-frequency cetaceans (porpoises), phocid pinnipeds (seals), and otariid pinnipeds (sea lions; NMFS 2018, 2023). Five marine mammal species are known to occur in Humboldt Bay: two otariid species, Steller sea lions (*Eumetopias jubatus*) and California sea lions (*Zalophus californianus*); one phocid species, harbor seals (*Phoca vitulina richardii*), one mid-frequency cetacean, killer whales (*Orcinus orca*); and one high-frequency cetacean, harbor porpoise (*Phocoena phocoena*). Behavioral disturbance and injury thresholds across a flat frequency range for each hearing group are listed in Table 3. Acoustic thresholds for the onset of behavioral disturbance (e.g., avoidance, surfacing, rapid swimming) are measured as root-mean-square (RMS) sound levels (dB re 1 μPa). Here 'injury' refers to a permanent shift in an animal's hearing sensitivity threshold (i.e., permanent threshold shift). Auditory injury thresholds for impact pile driving are given for both the peak SPL (dB re 1 μPa) and SEL_{cum} for a 24-hr period (dB re 1 μPa²s). Only the threshold for SEL_{cum} is specified for injury related to vibratory pile driving (NMFS 2018, 2023).

Table 3. Underwater Sound Threshold Levels for Disturbance and Injury to Marine Mammals

	Impact Pile Driving			Vibratory Pile Driving	
	Injury Threshold		Behavioral Disturbance Threshold	Injury Threshold	Behavioral Disturbance Threshold
Hearing Group	Peak SPL (dB re 1 μPa)	SEL_{cum} (dB re 1 μPa²s)	RMS Sound Level (dB re 1 μPa)	SEL_{cum} (dB re 1 μPa²s)	RMS Sound Level (dB re 1 μPa)
Mid-frequency Cetaceans	230	185	160	198	120
High-frequency Cetaceans	202	155	160	173	120
Phocid Pinnipeds	218	185	160	201	120
Otariid Pinnipeds	232	203	160	219	120

Notes: SEL = sound exposure level; dB = decibels; RMS = root-mean-square; μPa = microPascal. Only the marine mammal hearing groups that are expected to occur in Humboldt Bay are included. Source: NMFS (2018, 2023).

To demonstrate how attenuation affects thresholds, the NMFS Multi-Species Pile Driving Calculator Tool spreadsheet (NMFS 2022) was used to estimate the distance to injury caused by impact pile driving on fish (Table 4). Peak sound levels and single-strike sound exposure levels for 14-inch, 16-inch steel pipe and timber piles recorded during various projects (Table 1; Molnar et al. 2020) were used as inputs into the calculator tool and the distance to the onset of injury for fish was calculated. Due to a lack of available data, source levels for impact driving of 14-inch timber piles at Pier 39 in San Francisco, CA, were used as a proxy for source levels of 16-inch timber piles (Molnar et al. 2020). The calculations were then repeated with the addition of an attenuation level of 5 dB for the use of a bubble curtain (Molnar et al. 2020). The model was run assuming that it would take 100 strikes to drive a single pile, and one pile would be driven per day. These calculations indicate that the use of a bubble curtain significantly reduces the distances to the onset of injury for peak and cumulative sound exposure levels. In predicting fish injury thresholds, NMFS considers the concept of "effective quiet," at which point the received SEL from an individual pile strike is below a certain level and the accumulated energy from multiple strikes would not contribute to injury regardless of how many pile strikes occur (Molnar et al. 2020). Effective quiet is assumed to be 150 dB; as the single strike SEL for 16-in timber piles is estimated at 145 dB, it is therefore assumed that driving 16-in timber piles will not accumulate to cause injury to fish.

Table 4. Modeled Distance to Injury for Unattenuated and Attenuated (with Bubble Curtain) Pile Driving Using 100 Strikes

					Distance (m) to onset of physical injury		
						Cumulative SEL	
Piling Type	Attenuated with Bubble Curtain?	Strike Peak SPL at 10 m (dB re 1 μPa)	Single-Strike SEL at 10 m (dB re 1 μPa²/s)	Cumulative Strike SEL at 10 m (dB re 1 μPa²/s)	Peak SPL (206 dB)	Fish ≥ 2 g (187 dB re 1 μPa²/s)	Fish < 2 g (183 dB re 1 μPa²/s)
14-in pipe	No	199	169	189	3.4	13.6	25.1
14-in pipe	Yes	194	164	184	1.6	6.3	11.7
16-in timber	No	184	145	165*	0.3	0.3	0.6
16-in timber	Yes	179	140	160*	0.2	0.2	0.3

Notes: μPa = microPascal. Guide piles are assumed to be steel pipes. Assumed 100 hammer strikes to finish setting the pilings.

* See description above of "effective quiet" (150 dB): as single strike SEL for 16-in timber piles is estimated at 145 dB, it is assumed that these pile strikes will not accumulate to cause injury to fish.

Peak sound pressure levels for vibratory hammers can exceed 180 dB re 1 μPa; however, the sound levels generated by vibratory hammers increase relatively slowly. Although peak sound levels can be lower than those produced by impact hammers, total energy is comparable to impact driving because the vibratory hammer operates continuously, and it often takes longer to install the pile (Buehler et al. 2015). Unattenuated peak and cumulative SELs are not expected to exceed injury threshold levels if a vibratory hammer is used to place the pilings for the project.

Section 5.0 Monitoring and Minimization Measures

5.1 Monitoring and Minimization Measures for Fish

To minimize the potential for injury to fish associated with pile removal and pile driving, the following minimization measures will be implemented:

- In-water pile driving and other underwater noise-generating activities will be limited to July 1 through October 15, when sensitive fish species (e.g., salmonids) are least likely to be present in the area.
- Whenever possible, a vibratory hammer will be used to drive piles to prescribed tip elevations.
- When piles are being driven with an impact hammer, a pile cap and a bubble curtain will be used to minimize underwater noise generated by hammer strikes. The attenuated sound levels will be measured to ensure that sound levels are below peak (206 dB re 1μPa) and cumulative (187 dB re $1\mu Pa^2s$) underwater noise thresholds.
- The use of bubble curtains during pile driving will be limited to periods when current speeds do not diminish their use as an effective attenuation measure; this would be around the slack tide although specific timing will depend on the amount of tidal exchange. The hydroacoustic monitor will visually confirm that the bubble curtain is operating effectively during impact pile driving.
- All impact pile driving activities will incorporate a "soft start" approach whereby the piles are lightly tapped before the full hammer strength is applied. The first few taps of the hammer on the pile should cause fish to swim away from the piles before full impact hammer strength is applied, thereby reducing the potential for fish to be exposed to harmful sound levels.

5.2 Monitoring and Minimization Measures for Marine Mammals

To minimize the potential for injury to marine mammals associated with pile driving, the following minimization measures will be implemented:

- Hydroacoustic monitoring will be conducted during all pile driving to determine whether generated underwater noise reaches injury threshold levels.
- If threshold noise levels are recorded during pile driving, a shutdown zone equal to the distance at which injury threshold sound levels were recorded will be established around each pile.
- A qualified biological monitor will visually scan the project site and surrounding waters for the presence of marine mammals at least 30 minutes before and continuously throughout periods of impact pile driving. If any marine mammal is sighted in the shutdown zone before pile driving begins, the contractor (or other authorized individual) will delay pile-driving activities until the animal has

moved outside the shutdown zone or the animal is not resighted (within 15 minutes for pinnipeds or 30 minutes for cetaceans).

- If any marine mammal is about to enter or is observed in the shutdown zone during pile driving, the pile-driving activities will be shut down until the animal has moved outside the shutdown zone, or the animal is not resighted (within 15 minutes for pinnipeds or 30 minutes for cetaceans).

5.3 Hydroacoustic Monitoring

Hydroacoustic monitoring is not required for vibratory pile driving and removal. Hydroacoustic monitoring will only be conducted if and when an impact hammer is being used.

A qualified acoustic technician will document sound levels during hydroacoustic monitoring. Sound level measurements will be taken with calibrated, industry-standard sound level meters (e.g., Larson-Davis 831 data logging sound level meter) and hydrophones (e.g., Reson TC4013 hydrophones). Two hydrophones will be used during hydroacoustic monitoring: one hydrophone will be placed in the middle of the water column, 10 meters from each pile being driven during sound testing, and a second hydrophone will be placed in the middle of the water column and repositioned during pile driving to establish the maximum horizontal distance from the pile at which threshold sound levels are reached. A weighted tape measure will be used to determine the depth of the water before the hydrophones are positioned. The acoustic technician will ensure that the acoustic path (line of sight) between the pile and the hydrophone(s) is unobstructed during data collection.

Appropriate measures will be taken to ensure that flow-induced noise will not interfere with the recording and analysis of the relevant sounds (NMFS 2012). As a rule, current speeds of ≥ 1.5 meters per second (2.9 knots) generate significant flow-induced noise, which may interfere with the detection and analysis of low-level sounds (e.g., sounds from a distant pile driver or background sounds). If it becomes necessary to reduce the flow-induced noise at the hydrophone (i.e., tidal flow of ≥ 1.5 meters per second), a flow shield will be installed around the hydrophone to provide a barrier between the current and the hydrophone. If no flow shield is used, the current velocity will be measured, and a correlation between the sound levels (background or pile driving) and current speed will be made to determine whether the data are valid and can be included in the analysis.

The contractor will coordinate with the acoustic technician to ensure that the monitoring equipment is in place and operational before pile driving begins. Underwater sound levels will be monitored continuously for the duration of each pile driving event. Pile driving sound levels will be measured with a standard (e.g., minimum one-third octave) band frequency resolution. Peak and root-mean-square pressures will be reported in decibels (dB re 1 μPa) and the cumulative SEL will be reported in decibels (dB re 1 $\mu Pa^2 s$).

Section 6.0 Reporting

A draft report describing the hydroacoustic monitoring methods and results will be submitted to the California Coastal Commission (CCC) within 90 days after the project is completed. The results will be summarized in graphical form and will include summary statistics and time histories of impact sound values for each pile. The report will:

- Summarize the results of hydroacoustic monitoring
- Identify pile-driving episodes during which thresholds (Tables 2 and 3) were met or exceeded
- Summarize the statistics of impact sound values for each pile
- Identify the total number of strikes from impact hammers, or the duration of vibratory hammering, required to drive each pile
- Identify the total number of strikes from impact hammers or the cumulative duration of vibratory hammering, during each 24-hr period when pile driving occurs
- Identify the number and size of piles removed and installed each day
- Identify the distance between the hydrophones and the piles being driven
- Identify the depth of the hydrophones and the depth of the water at the hydrophone locations
- Identify the horizontal distance from piles at which thresholds (Tables 2 and 3) were met or exceeded
- Identify the depth of water in which the piles were driven
- Identify the depth into the substrate that the piles were driven
- Describe any observable reaction by fish or marine mammals to pile driving
- Identify the number and species of marine mammals observed during marine mammal monitoring

A final report will be submitted to the CCC within 30 days following receipt of the agency's comments on the draft report.

Section 7.0 References

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