Incidental Harassment Authorization Application

Murray Street Bridge (#36C-0108) Seismic Retrofit Project

APRIL 2022
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Murray Street Bridge
Santa Cruz Small Craft Harbor
City of Santa Cruz
Santa Cruz County, CA
Federal Project Number STPLX-5025 (048)

CITY OF SANTA CRUZ
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Table of Contents

SECTION **PAGE NO.**

TABLE(S)

ATTACHMENTS

Acronyms and Abbreviations

Acronym/Abbreviation	Definition
AOI	Area of Influence
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CIDH	Cast-in-drilled hole
CISS	Cast-in-steel-shell
dB	decibel
GPS	Global Positioning System
IHA	Incidental Harassment Application
MMMP	Marine Mammal Mitigation Plan
MMPA	Marine Mammal Protection Act
NOAA	National Oceanic and Atmospheric Administration
NMFS	National Marine Fisheries Service
RMS	Root Mean Square
UCSC	University of California Santa Cruz
USFWS	U.S. Fish and Wildlife Service
USCG	U.S. Coast Guard
ZOI	Zone of Influence

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1 Description of the Activity

1.1 Location and Setting

The proposed project is located at the eastern edge of the City of Santa Cruz in the county of Santa Cruz (see Figure 1 in Attachment A). The project area includes the Murray Street Bridge which spans the Santa Cruz Small Craft Harbor, portions of lands within the Santa Cruz Port District harbor area, portions of the harbor waters, and the area along the Murray Street road right-of-way west of Lake Avenue (see Figure 2 in Attachment A). The GPS coordinates (from Caltrans Structure Inventory and Appraisal [SI&A] sheet) are:

- Latitude: N 36 degrees, 58 minutes 4 seconds
- Longitude: W 122 degrees, 00 minutes 10 seconds

Three marine mammals are known to occur within the Santa Cruz Small Craft Harbor: southern sea otter (*Enhydra lutris nereis*), harbor seal (*Phoca vitulina richardii);* and the California sea lion (*Zalophus californianus*). All marine mammals are protected under the Marine Mammal Protection Act, and the southern sea otter has additional protection under the federal Endangered Species Act. The docks and other features within the study area are haul-out sites for harbor seal and California sea lion. The open water of the study area provides habitat for the southern sea otter, the harbor seal, and the California sea lion.

1.2 Project Overview and Purpose

The proposed project consists of a seismic retrofit of the existing Murray Street Bridge, which spans the Santa Cruz Small Craft Harbor and additional minor modifications to replace deficient bridge barriers (widening shoulders to standard widths and replacement and improvement of sidewalks and railings). The seismic retrofit project will provide the bridge with additional vertical support and resistance to lateral seismic forces by installing additional pilings and supplemental structural elements. In order to provide sufficient area for construction operations, some boats, Harbor facilities, and commercial businesses will require temporary relocation.

1.3 Project Description

The proposed project consists of the following components: 1) seismic retrofit of the existing Murray Street Bridge through addition of new land and in-water piles and supports; 2) replacement of deficient bridge barriers to bring the bridge up to current standards; 3) widening of the bridge to provide two 11-foot travel lanes and 6-foot shoulders for bicycle lanes and a separate 7.5-foot wide pedestrian sidewalk; and 4) relocation of the East Cliff Transmission Main (ECTM) to the north side of the bridge. In order to provide sufficient area for construction operations, some boats, Harbor facilities, and commercial businesses will require temporary relocation. Note that because this IHA Application is solely to cover work in years 2023 and 2024, Project work extending to 2025 is generally not described here. Year 2025 activities will be described in a subsequent IHA application.

Bridge Seismic Retrofit

The nine-span bridge is supported by two abutments (identified as Abutments 1 and 10, located at the western and eastern ends of the bridge, respectively) and 8 “bents” (identified as Bents 2 through 9, located at 60-foot intervals

between the abutments). Sheets B-1 through B-3 of the bridge plans provide cross sections showing the abutment and bents and proposed improvements. The seismic retrofit project consists of the following basic elements:

1. Installation of concrete infill walls at Bents 2, 3, 4, and 9 to span the voids between the existing concrete support columns. The infill walls will also span the void between the existing and new columns at Bent 9.
2. Installation of shear keys and seat extenders at Abutments 1 and 10 and Bents 2 through 9.
3. Retrofit of foundations with 16-inch diameter CISS (cast-in-steel-shell) piles at Bent 9 and Abutments 1 and 10. These piles will extend to depths of approximately –100 feet at Bent 9 and to depths of approximately –40 feet to –55 feet at Abutment 10.
4. Retrofit abutment with two 96-inch diameter CIDH piles (cast-in-drilled-hole) piles behind Abutment 10 to a depth of -55 feet.
5. Retrofit of both outriggers and bents with 30-inch diameter CISS piles at Bents 5, 6, 7, and 8 and 30-inch diameter CIDH piles at Bents 2, 3, and 4. These piles will extend to depths of approximately -55 feet to -85 feet at Bent 5 and at approximately –100 feet to –120 feet at Bents 6-8.
6. Installation of fenders to protect boats passing by the pier foundations, new pile caps at Bents, 5, 6, 7, and 8, and replacement of existing fenders.
7. Installation of four new retaining walls.

The bridge seismic retrofit will include removal and installation of piles as summarized on Table 1, including on-land piles for the bridge structure and associated retaining walls. The installation of new piles will include a total of 84 bridge piles. Nine on-land piles will be added on the north side of the bridge to support relocation of the ECTM. In addition, 4 14-inch diameter concrete piles would be removed at Bent 6 and 35 14-inch diameter concrete piles would be removed at Docks FF and BY to accommodate project construction with reinstallation of the dock piles upon completion of construction. A total of 113 on-land piles will be driven to support three on-land retaining walls. If a temporary trestle is constructed to facilitate installation of the permanent bridge piles, it is estimated that 120 12-inch diameter steel piles or 72 20-inch diameter steel piles would be installed and removed upon completion of construction.

Figure 3 provides a cross section showing the abutment and bents.

East Cliff Transmission Main Relocation

Constructed in 1974, the ECTM (force main) conveys wastewater approximately 4 miles from the East Cliff Pump Station to the City's Wastewater Treatment Facility (WWTF). Three portions of the ECTM are in conflict with the proposed pile driving operations on the southwest side of the bridge, requiring the ECTM to be abandoned and relocated. The relocated ECTM consists of a 36-inch diameter force main on the north side of the Murray Street Bridge. No in-water piles will be required, but a total of nine (9) new piles will be added on land on the east and west sides of the bridge. The approximately 600-foot long pipeline will be supported by the bridge bent caps, except for approximately 240 feet, from Abutment 1 to Bent 5, where the pipeline will be supported by a steel truss. A rendering of the pipeline is shown on the following page. The truss structure would be approximately 6.5 feet tall by 3 feet wide. The phasing of the bridge project construction will incorporate a temporary bypass pipe on the north side of the bridge in one of Murray Street travel lanes during construction of the southern portion of the bridge, and then a temporary bypass pipe on the south side of the bridge as the north side improvements are constructed, until

the permanent placement of the force main on the north side of the Murray Street Bridge is complete. Further construction details are provided below.

Table 1. Summary of Bridge Pile Types and Numbers for 2023 and 2024 Year Work

	Location	Number	Pile Type
In Water			
• Remove Dock FF & BY Piles	Dock FF & BY	35	14-inch P/C Concrete
• Install New Permanent Bridge Piles	Bridge Bent 4	2	30-inch CIDH[1]
	Bridge Bent 5	4	30-inch CISS
	Bridge Bent 6	4	30-inch CISS
	Bridge Bent 7	4	30-inch CISS
	Bridge Bent 8	4	30-inch CISS
Bridge Subtotal		*18*	
On Land			
• Install New Permanent Bridge Piles	Abutment 1	8	16-inch CISS
	Bridge Bent 2	2	30-inch CIDH[1]
	Bridge Bent 3 South	2	30-inch CIDH[1]
	Bridge Bent 3 North	1	30-inch CISS
	Abutment 10	8	16-inch CISS
	Anchor Piles	2	96-inch CIDH
Bridge Subtotal		*23*	
• Install New Retaining Wall Piles	Retaining Wall 11	20	24-inch CISS
	Retaining Wall 17	38	24-inch CISS
	Retaining Wall 18	32	24-inch CISS
Total On Land Bridge Pile Installation		**113**	
Optional In Water			
• Install and Remove Trestle:			
Install Temporary Piles	Adjacent to Bridge	120	12-inch steel pipe piles
Remove Temporary Piles	Adjacent to Bridge	120	12-inch steel pipe piles

Note:
[1] Permanent casing will be driven or vibrated into place.

Other Bridge Improvements

The project also includes replacement of deficient bridge barriers. In order to bring the bridge up to current standards, the narrow shoulders will be widened to provide standard 5-foot shoulders. The shoulder widening will consist of approximately an additional 2 feet on the north side of the bridge and 5-6 feet on the south side of the bridge. It is not anticipated that any work other than an overhang extension will be required on the north side widening. In addition, the construction of new bridge railings is required to conform to current codes. Roadway lane widths will remain the same as currently exists.

1. Removal of existing curbs, sidewalks, and barrier railings on the bridge.
2. Installation of new girders, road foundations, and road surfacing along the entire southern edge of the bridge, providing 5.5 feet of additional width. (The girders will be supported by the new 30-inch diameter piles at Bents 5 through 8 and the 16-inch diameter piles at Abutments 1 and 10 and at Bents 2, 3, 4, and 9.
3. Installation of a new cantilevered extension along the entire northern edge of the bridge, providing approximately two feet of additional width. (This will not require additional foundation work.)
4. Repaving of the bridge surface with 11-foot wide travel lanes, 6-foot wide, bicycle lanes (shoulders) and a new 7.5–foot wide sidewalk on the south (ocean) side of the bridge. Class 2 bike lanes will be provided in the roadway shoulders.
5. Installation of new metal bridge railings on both the southern and northern edges of the bridge and a pedestrian railing at the sidewalk.

1.4 Description of Activity Construction

In-water and on-land construction activities that result in noise and vibration may result in incidental take (harassment) of marine mammals present in the area at the time of construction. Construction will occur within harbor waters and on lands adjacent to the harbor. The construction phasing and approximate schedule is presented on Table B-1 in Attachment B.

1.4.1 In-Water Construction Activities

The Murray Street Bridge Retrofit project is tentatively proposed for construction in nine phases over an approximate 2-year, 4-month period, commencing in summer of 2023. Most in-water activity is scheduled to occur over an approximate 3-month period between July and September 2024, with limited in water work related to removing and reconstructing a dock area outside that three-month window. Due to in-water work timing restrictions to protect federally listed salmonids, all in-water construction activities including pile removal/installation would occur during the period from July 1 to mid-November unless otherwise permitted by NOAA Fisheries.

In-water construction activities include removal and temporary relocation of docks to accommodate construction access; potential installation of piles for a construction trestle from the bridge; pile driving; transport of materials; and replacement of harbor docks upon completion of the bridge seismic retrofit project.

- Removal and Replacement of Boat Berths. The temporary use of portions of the eastern harbor boat yard and the western parking lot for contractor staging, in combination with provision of construction access to the bridge from the waterway, will result in temporary disruptions of harbor activities including temporary removal of existing boat berths and replacement upon completion of the project. To accommodate construction staging and in-water construction, the project calls for the temporary relocation of berths at Dock FF and Dock BY (Boat Yard on east side) to existing visitor berths with reconstruction of Dock FF and Dock BY upon completion of the bridge seismic retrofit construction. Dock FF accommodates University of California Santa Cruz (UCSC) boats that are used for university classes. A walking dock (gangway) would be constructed to connect the existing parking lot area to the portion of Dock FF that will remain during construction. Six temporary berths may be constructed adjacent to the gangway to minimize relocation of

some of the existing boats. The reinstalled berths would be plastic, wood or concrete over polyethylene floats and would be anchored with pilings. Piles would be driven into the harbor floor by mechanical hammer. There would be no dredging or placement of fill in harbor waters with reinstallation of docks and both berths.

- Construction Barge and/or Trestle. Installation of an in-water barge or temporary bridge trestle is planned to accommodate equipment for pile installation. Work within the waterway will require either the use of barges or the construction of temporary trestles to provide work platforms. If barges are utilized, prefabricated modular units may be brought to the site and locked together. This type of platform can be installed, reconfigured, and removed relatively quickly, but the system is not suitable for areas that are too narrow to accommodate the modules. For example, footings from the Union Pacific Railroad Bridge to the north and footings from the Murray Street Bridge appear too close together to allow use of a modular barge between footings. In these areas, a trestle likely will need to be constructed.

  Construction of a trestle could vary depending on materials available to contractors. One possible trestle configuration would be 60-foot long steel girders over the Harbor navigation channel. The spans would be supported on falsework bents, perhaps constructed of steel piles which are a fairly common falsework material. Piles would be driven in the water by a crane sitting over the land. Preliminary estimates by the project engineer indicate that up to 120 12-inch steel beams would be required for a trestle spanning the channel; vibratory drivers would be used.

- Installation of Piles. The most intense activity would be the installation of new bridge support piles, which will also involve the demolition of the existing piles at Bent 6. CISS piles at Bents 5 through 8 will be installed within the waterway by driving 30-inch diameter steel casings either to refusal at rock or into a shaft drilled within rock (depending on the location). The installation of new piles at Bents 5 through 8 will include two piles on each side for a total of 16 piles in the water (and 2 additional piles at Bent 4 that are partially in the water). The work activity will be focused within the area of the bridge. Overall, the installation of piles is expected to take a total of approximately 23 days, with 1.5 days required for each 30-inch diameter pile. The installation of these piles requires the use of a crane(s), a drilling rig, a pile driver, excavation and earthmoving equipment, concrete trucks and pumps, concrete vibrators, supply trucks, welding equipment, and other machinery. Based on the geotechnical site characteristics, permanent bridge piles will be partially or entirely vibrated into the Harbor substrate rather than driving them entirely by means of “hammering”. A vibratory hammer would be used to start driving all sheet piles, but an impact hammer may be required to complete driving depending on the density of subsurface materials.

A summary of in-water pile driving information for Year 1 (2023) and Year 2 (2024) is provided below in Table 2 for both vibratory driving and impact pile driving.

Table 2. Years 1 and 2 Proposed In-Water Pile Driving or Removal

Project Element	Pile Size and Type	Method	Number of Piles	Max Piles per Day	Strikes per Pile	Estimated Days of Work
Year 1 (2023), Vibratory Option						
Remove Dock FF South (including pile removal)	14-inch precast concrete	Vibratory extractor	30	10 (0.8 hours per pile)	N/A	14
					Total days of work	14
Year 2 (2024), Vibratory Option						
Dock FF temporary relocation	14-inch precast concrete	Vibratory	30	4 (assumes two drivers, 4 hours per pile)	N/A	14
BY Dock portion removal	14-inch precast concrete	Vibratory extractor	5	5 (1.6 hours per pile)	N/A	1
Install South Bent 4-8 Piles, Pile Caps, Columns	30-in CISS (piles 5-8), 30-in CIDH (pile 4)	Vibratory	4 each for Bents 5-8 2 for Bent 4	0.67 (12 hours per pile)	N/A	23
Install temporary trestle (optional)	12-inch steel pipe	Vibratory	120[1]	4[1] (2 hours per pile)	N/A	60
					Total days of work (without optional trestle) Total days of work (with optional trestle)	38 98
Year 1 (2023), Impact Option						
Remove Dock FF South (including pile removal)	14-inch precast concrete	Vibratory extractor	30	10	N/A	14
					Total days of work	14
Year 2 (2024), Impact Option						
Dock FF temporary relocation	14-inch precast concrete	Impact Driver	30	4 (assumes two drivers	200	14
BY Dock portion removal	14-inch precast concrete	Vibratory extractor	5	5 (1.6 hours per pile)	N/A	1

Project Element	Pile Size and Type	Method	Number of Piles	Max Piles per Day	Strikes per Pile	Estimated Days of Work
Install South Bent 4-8 Piles, Pile Caps, Columns	30-in CISS (piles 5-8), 30-in CIDH (pile 4)	Impact Driver	4 each for Bents 5-8 2 for Bent 4	0.67 (assumes one driver)	2,500	23
Install temporary trestle (optional)	12-inch steel pipe	Impact Driver	120	4	100	60
					Total days of work (without optional trestle) Total days of work (with optional trestle)	38 98

[1] In the event that 20-inch steel piles are used instead, 72 piles would be installed at a rate of 3 per day using vibratory installation methods.

1.4.2 Land Construction Activities

The proposed project includes the other construction activities that are located on land as follows:

- Demolition: Demolition activities include temporary removal of the gangway under Bent 4, the removal of existing sidewalks and railings along the entire length of the bridge, and the removal of pavement at both ends of the bridge. Equipment for demolition activities includes cranes, excavators, front-end loaders, dump trucks, concrete saws, and jackhammers.

- Pile and Anchor Installation Outside Waterway: The CISS piles at Abutment 1, Bent 9 and Abutment 10 will be installed by driving 16-inch diameter steel casing to depths of approximately –30 to –100 feet and filling them with concrete. The 96-inch diameter anchor pile for Abutment 10 will require excavation and installation of a temporary steel casing, which will be filled with concrete. The 30-inch CIDH piles at Bents 2-4 will be installed by first driving 30-inch steel casing to depths of approximately -45 to -65 feet and filling them with concrete. The anchor pile excavation will be dewatered by pumping, if necessary. Additionally, nine (9) piles may be installed (at Abutments 1 and 10 and Bent 3) to support a relocation of the sewer line.

- Bridge Construction: The project includes installation of new girders on the southern edge of the bridge, the installation of a cantilevered extension along the northern edge of the bridge, and the construction of barrier railings as well as the installation and construction of various project features below the bridge road surface and above the piles. Four retaining walls are planned on the south side of the bridge with two each on the east side and the west side. Excavation of existing road approaches up to 200 feet from each end of the bridge will be performed. Gravel base and asphalt concrete will be placed to match the new widened bridge deck.

- Contractor Staging: Contractor staging activities will take place in an approximately 8,000 square-foot portion of an existing boat yard near the eastern edge of the bridge for construction activities on the east side of the Harbor. Contractor staging activities for construction activities on the west side of the Harbor will take place in the northern portion (approximately 11,000 square feet) of a parking lot situated at the

western edge of the bridge. This staging area will be used through the end of the construction stages, when original facilities will be restored.

- Temporary Bypass Sewer Line. A temporary ECTM bypass pipeline will be established on the top of the Murray Street Bridge during the approximate 2-year construction period and phased to facilitate the bridge project construction. With in-water and on-bridge work occurring on both sides of the bridge, it would not be feasible to keep the temporary bypass staged in one lane for the duration of construction, so the temporary bypass is proposed in two phases. For Phase 1, the temporary bypass will be staged on the northern (west-bound) lane of the Murray St bridge. For Phase 2, the temporary bypass will be relocated to the southern (east-bound) lane or new sidewalk of the expanded Murray St bridge. The bypass tie-in to the ECTM on the east side of the Harbor will be a wye and two valves, allowing for future phasing of the temporary bypass from the Phase 1 northerly alignment to the Phase 2 southerly alignment.

  The temporary/permanent portion of the force main on the east side of the Harbor will be installed by trenchless (bore and jack) methods. The pipeline will head westerly and transition vertically to grade. Phase 1 of temporary bypass will connect to the northeast side of the Murray Street temporary/permanent pipeline at a point near its transition to grade and will be staged in the northern, west-bound lane of the Murray Street Bridge.

- Temporary Harbor Facility Relocation. The temporary use of portions of the eastern harbor boat yard and the western parking lot for contractor staging as described above, in combination with provision of construction access to the bridge from the waterway, will result in temporary removal, relocation and replacement of some Harbor facilities, including temporary relocation of boats in the on-land boat yard on the east side of the Harbor that will be temporarily relocated to boat storage for approximately 12 months. On the west side, 60 rowing boats stored under the existing Murray Street bridge will be temporarily relocated to an on-land dry boat storage facility near docks A and B (see Figure 2), and an additional 200+ square feet of storage area will be constructed to accommodate the temporary row boat storage. Row boats stored under Span 2 and UCSC Rowing Facility boats under Span 1 will be temporarily relocated to the US Coast Guard parking lot temporary construction easement and fenced.

  Uses at existing offices, bathroom facilities, and storage areas located north of the western staging area (and within the City of Santa Cruz's right-of-way) will be displaced during Phases 3, 4, and 5 of the project. The buildings will be protected during construction, and a temporary 600 square foot facility (modular) will be installed on the US Coast Guard parking area for a period of approximately six months, which will temporarily house these businesses.

2 Dates, Duration and Geographic Region

The Murray Street Bridge Retrofit project is currently planned to commence in March 2023. The project area includes waters within the Santa Cruz Small Craft Harbor and adjacent lands managed by the Santa Cruz Port District (see Figure 2). The study area consists of the open waters, docks, and other potential haul-out features of the Harbor from the Harbor Launch Ramp area (including the fuel dock and Vessel Assist dock) to 500 feet upstream of the boundary of the Area of Impact (see Figure 2).

The Murray Street Bridge Retrofit project is proposed for construction in nine stages between July 2023 and November 2025 with the majority of the in-water work occurring during the summer of 2024. This application includes requests for take during the 2023 and 2024 work years. A subsequent application will be prepared after the conclusion of the 2023 work year to seek take authorization for the 2025 work year. Generally, work will begin on the eastern side of the Harbor and progress to the western side. The timing of each phase and a brief description of work to be performed during each phase is provided in Table 3, including the full project to completion in 2025.

In-water activity will primarily occur in Stages 3, 4, and 7 over approximately 3 months. Stages may overlap. Work tasks will vary throughout the phase. The in-water pile driving for the bridge piles would occur over a total of 38 days within this period.

Due to in-water work timing restrictions to protect federally-listed salmonids, all in-water construction activities including pile removal/installation would occur during the period from July 1 to mid-November unless otherwise permitted by NOAA Fisheries.

3 Species and Numbers of Marine Mammals

Three marine mammals are known to occur within the Santa Cruz Small Craft Harbor:

- Southern sea otter (*Enhydra lutris nereis*), federally listed as threatened and listed by the California Department of Fish and Wildlife as “Fully Protected”;
- Harbor seal (*Phoca vitulina richardsi);* and
- California sea lion (*Zalophus californianus*).

The open water of the study area provides habitat for the southern sea otter, the harbor seal, and the California sea lion. Southern sea otters appear to be incidental visitors to the Harbor, using the site for foraging. Harbor seals use the harbor for foraging and use Docks F and FF as haul-out areas. California sea lions use the harbor only occasionally for hauling out and are incidental visitors to the Harbor, using the waters for foraging and the docks and other features within the study area as occasional haul-out sites. California sea lions are present when fish runs occur within the harbor. Weather, currents, seasonal upwelling conditions, and other oceanographic factors periodically bring anchovies, sardines, and other prey species into the Harbor, in turn drawing great numbers of birds and marine mammals. Table 4 summarizes the status, local occurrence, and total range/population for these species.

Table 3. Murray Street Bridge Seismic Retrofit Project Schedule Summary with Pile Work Highlighted

	Activities	Dates	In-Water	On Land
	NOTICE TO PROCEED – March 27, 2023			
	▪ Submittal Reviews ▪ RFI Reviews ▪ Contractor Required Trainings ▪ Contractor Supplied Biologist Surveys			
	STAGE 1 – Preliminary Work	**Jul-Nov 2023**		
1	West Harbor ▪ Remove dock FF south (including pile removal)		July 2023: 14 days	
	Bridge North and Bridge South ▪ Set up detour ▪ Coordinate utilities ▪ North CDH Pile Abutment 10 Pile Install ▪ Bent 9, Abutment 10 North Pile Install ▪ Install temporary sewer bypass on bridge ▪ Temporary pedestrian access ▪ South CDH Pile to Abutment 10			Oct 2023: 4 days Oct 2023: 3 days Oct 2023: 5 days
	STAGE 2 – Sanitary Sewer Temporary Bypass	**Nov-Dec 2023**		
2	▪ Establish traffic control ▪ Sewer bore & jack under Murray St for sewer line			
	STAGE 3 – West Harbor and East Harbor Prep	**Dec 2023, July-Aug 2024**		
3A	West Harbor Prep ▪ Traffic Controls, Pedestrian Access ▪ Dock FF remove portion/temporary relocation		July 2024:14 days	
3B	East Harbor Prep ▪ Traffic Controls ▪ Close East Harbor Access Road ▪ Provide pedestrian access ▪ Construction Temporary Sheetpile Wall ▪ Remove portion of BY dock		Aug 2024: 1 day	
	STAGE 4 – Bridge Work	**Aug-Nov 2024**		
4A	In-Water Substructure Work on South Side ▪ Install South Bent 4-8 Piles, pile caps, columns ▪ Construct Fender System-Bents 5-8 ▪ Construct wall at Bent 4		Aug-Sept 2024: 23 days	
4B	East Side Land Substructure Work ▪ Install Bent 9, Abutment 10 piles, caps, footings ▪ Construct Abutment 10			Oct 2024: 2 days

	Activities	Dates	Pile Driving Duration	
			In-Water	On Land
4C	West Side Land Substructure Work ▪ Remove pedestrian stairs ▪ Install Bents 2-3 piles, caps, walls			Nov 2024: 2 days
	STAGE 5–Bridge Widening	**Nov 2024-May 2025**		
5A	Southwest Side Widening ▪ Install Temporary Railing ▪ Construct retaining wall #9 (soldier pile), #11 (24-in CISS) ▪ Construct South side Piles at Abutment 1 ▪ Construct Abutment 1 widening ▪ Construct west side stairs			Dec 2024-Jan 2025: 22 days Jan 2025; 2 days
5B	Southwest Side Widening ▪ Construct retaining wall #17, 18 ▪ Utility work ▪ Removal temporary sheet pile wall			Mar-Apr 2025:20 days
	STAGE 6–Utilities and Phase 2 Sewer Bypass	**May-June 2025**		
	▪ Remove pedestrian enclosure from bridge ▪ Relocate utilities from north to south side of bridge ▪ Construct temporary sewer on south side of bridge			
	STAGE 7–In-Water Bridge Work, North Side	**Jul-Aug 2025**		
7A	▪ Install North Side Piles at Bents 5-8, columns, caps		July 2025: 15 days (not included in this IHA application)	
7B	East Side Land Based Substructure Work			
7C	West Side Land Based Substructure Work ▪ Install North Piles at Bent 3 ▪ Construct Abutment 1			Aug 2025: 2 days
	STAGE 8–North Side Bridge Work	**Sept-Nov 2025**		
	▪ Demo north bridge overhang and construct new overhang ▪ Install permanent sanitary sewer force main ▪ Remove Phase 2 temporary sewer bypass			
	STAGE 9–Project Completion	**Sept-Nov 2025**		
	▪ Roadway work ▪ Reopen bridge and road ▪ Restore West Harbor conditions ▪ Landscaping ▪ Reconstruct Dock FF		Oct-Nov 2025: 20 days(not included in this IHA application)	

Green Text: On-Land Pile Work Blue Text: In-Water Pile WorK

Table 4. Marine Mammal Populations

Common Name	Scientific Name	Federal Status	Occurrence in Santa Cruz Harbor		Total Range and Population	
			Numbers	Seasonality	Range	Abundance
California Sea Lion	*Zalophus californianus*	Not Listed[1]	1-15	Occasional, especially when prey species are present	California to Canada	257,606 (NMFS 2021a)
Harbor Seal (Eastern Pacific subspecies)	*Phoca vitulina richardii*	Not Listed[1]	1-11	Summer, Fall, Winter-outside breeding seasons	Mexico to Alaska	30,968 in California (NMFS 2014)
Southern Sea Otter	*Enhydra lutris nereis*	Threatened	0-2	Incidental Visitor	California, Santa Barbara to San Mateo County	2,863[2] (USGS 2019)

Source: NMFS 2021a.
Note: [1] Not listed as "endangered" or "threatened" under the Endangered Species Act nor as "depleted" under the Marine Mammal Protection Act.
[2] Sea otter population abundance is reported as a running 3-year average; therefore, this value represents the most recent published 3-year running average from 2017-2019.

In addition to these species that are known to occur within the Santa Cruz Harbor, small cetaceans such as bottlenose dolphins (*Tursiops truncatus*) and harbor porpoise (*Phocoena phocoena*) may transit nearshore areas just outside the mouth of the harbor. These two species are not listed and are widely distributed. The most recent Marine Mammal Stock Assessment (NMFS 2016) indicated a minimum population size of 453 for the California Coastal Stock of common bottlenose dolphin, and the most recent assessment for the Monterey Bay Stock of harbor porpoise (NMFS 2020) indicating a minimum population of 2,197 animals. For both species, population trends appear to be stable or increasing. These species were not detected during any surveys of the harbor area and are expected to generally remain outside the harbor and beyond the area of effects.

4 Affected Species and Distribution

This section describes the observed and expected occurrence and distribution of the three species known to occur within the harbor: California sea lion, harbor seal, and southern sea otter. Although bottlenose dolphin and harbor porpoise may occur just outside the harbor, they would be far outside any Level A harassment area and their occurrence or timing is unknown.

4.1 Survey Methods

Nineteen marine mammal surveys were conducted between December 2006 and October 2009 by EcoSystems West Consulting Group. Numbers of each of three species (California sea lion, harbor seal, and southern sea otter)

using the area surrounding the Murray Street Bridge (Bridge) were estimated. The type of use, especially during the period of time when in-water construction activities are proposed for the project, was determined. A total of 40 survey hours were conducted, including early morning, midday, evening, and nighttime surveys with an emphasis on early morning and midday surveys. In an effort to determine the diurnal and nocturnal movement patterns of the harbor seals, initially 3-4 site visits/day were conducted, 2 times per week.

Once a general understanding of the harbor seals' use of the area was gained, the surveys were focused on estimating the number of individuals present in the study area in the morning (when pile driving or other in-water activities might be expected to begin for the day) and around midday (when pile driving and other in-water activities might resume after a lunch break). An effort was made to determine the maximum number of individuals using haul-outs within the study area by arriving pre-dawn, when animals were still at rest and had not been flushed into the water by Harbor activities.

For each survey, the following were recorded: the time of the survey, the temperature, visibility, wind speed, tide, and moon phase. During surveys, one or two biologists walked and sat at key observations points, or rowed a small boat, throughout the study area, using binoculars to examine the site for presence of marine mammals. A general census of the area was taken on each site visit, counting the numbers of each species present, noting the activity of the animals, as well as their location, with reference to an aerial map of the Area of Influence and vicinity. Notations were made on the aerial map of the site, when necessary, to clarify locations of observed animals. When feasible, observed animals were photographed, and the sex of California sea lions was noted.

It was not possible to determine with certainty whether or not an individual had already been counted (unless all animals remain hauled-out for the duration of the survey); however, an effort was made to avoid duplicating counts by taking into account the time and location of the observation with reference to previous observations. Where we were unable to determine if counts were redundant, we noted this on data tables.

Ecosystems West biologists also made note of fish activity, when they observed evidence such as jumping fish or congregations of feeding birds and mammals. EcoSystems West biologists also noted relevant personal communications with Port District employees, Harbor business employees, and marine mammal experts regarding marine mammal presence. Further, EcoSystems West biologists noted incidental observations of other wildlife species, such as bats or bird species, and recorded all observations on a standard data sheet designed for the Project's marine mammal surveys.

Dudek biologists conducted updated surveys for activity in February and March 2022, again focusing on early morning and early afternoon timing for the reasons stated above. All 2022 surveys were conducted from land and dock areas, using binoculars to scan the water and potential haul-out areas for two-hour durations in the early morning (before 9AM) and early afternoon (generally between 12PM and 2PM). General locations of species observations (e.g., lower harbor, work area, upper harbor) were recorded rather than specific locations, as individuals were detected while in motion.

4.2 Distribution of Marine Mammals

Table B-2 in Attachment B presents the estimates of marine mammals present in the survey area during 2009 surveys. Table B-3 in Attachment B presents the number of animals observed hauled-out and the haul-out locations during 2009 surveys. Figure 4 shows the spatial distribution of observed marine mammals throughout the survey area from 2009 surveys. Figure 2 provides an aerial view of the study area and shows the location of the docks

referenced on the x-axis of the spatial distribution figure. Figure 5 shows photographs of mammals observed during the 2009 surveys.

4.2.1 California Sea Lion

During the December 2006 surveys, one California sea lion was observed swimming under the western section of the Murray Street Bridge. During the September/October 2009 surveys, California sea lions were observed foraging and hauling-out within the Harbor on 18 of 19 survey visits (the exception was a nighttime survey where visibility was limited). The numbers of California sea lions observed varied widely throughout the survey period, from 1 animal to 13-15 animals/survey. The larger numbers of animals were observed when "rafts" of sea lions were present foraging throughout the survey area and fish presence was evident (September 30 –October 2).

During February and March 2022 surveys, harbor seals were observed within the survey area on two of six morning visits, and two of seven afternoon visits; sea lions were observed within the survey area on one of the six morning visits and four of the seven afternoon visits. No more than one harbor seal or one sea lion was seen at one time, and the biologists conducting the surveys suspected based on markings that the same individuals were being sighted on repeated days. Sea lion activity, though minimal, appeared to be greatest around the drainage area just north of the harbor by the UC Santa Cruz crew and sailing dock, as well as along the docks of the west harbor opposite the small vessel boat yard.

California sea lions use the harbor only occasionally for hauling out and the specific haul-out location varied throughout the 2009 marine mammal survey period, as well as during prior and subsequent incidental observations of the harbor. The closest regular haul-out location for large numbers of California sea lions is at the Municipal Wharf west of the harbor. Individuals and occasionally pairs of sea lions were observed hauled-out on docks throughout the survey area during 2006 and 2009 surveys, on the fuel dock, and more commonly, on the Vessel Assist dock, and the docks on the western side of the Harbor, from AA to FF (see Attachment B, Table B-3). See Figure 3 for dock locations. One individual was observed hauled-out on the rubber Kayak docks under the Bridge. Figure 2 provides an aerial view of the survey area, with docks and other haul-out features identified. Some of the animals that were observed hauled-out appeared to be lethargic, remaining on the same or proximate dock for two or more days in a row, sometimes with a cough, or swimming without vigor in the adjacent waters. One juvenile was observed hauled-out on the cement wall on the western border of the Harbor between E and F Docks (see Figure 5). Observations of sea lions during the 2006 and 2009 surveys were distributed throughout the Survey Area, with a spike of observations in the area near the launch ramp, fuel dock, and Vessel Assist dock (see Figure 4. Observations during the 2022 surveys indicated reduced marine mammal activity as compared to the 2006 and 2009 surveys and no haul-outs were observed.

California sea lions appear to be incidental visitors to the Harbor, appearing in the greatest numbers when schools of fish are abundant within the Harbor, as evidenced by jumping fish and large congregations of feeding birds and "rafts" of sea lions. Sick and weakened sea lions also appear to use the Harbor as a haul-out refuge. Young-of-the-year sea lions faced an 85% mortality in 2009 due to starvation. This is likely caused by an El Niño-like response in prey resources (G. Oliver, personal communication, 2009). While juvenile rockfish were abundant, anchovies were essentially absent, and while sardines were abundant, juvenile sardines were scarce (G. Oliver, personal communication, 2009; K. Carney, personal communication, 2009). Rockfish and adult sardines provide an adequate prey base for healthy adult sea lions but may be too fast for juveniles or weakened adults to catch. In addition, more varied and scarce prey resources may require greater traveling distances and deeper diving for

successful hunting, placing too great a metabolic demand on young of the year or weakened sea lions (M. Weise, personal communication, 2009; G. Oliver, personal communication, 2009). Spring and fall algal blooms causing domoic acid poisoning in sea lions may have also been a factor in the presence of hauled-out sea lions in the Harbor in 2009 (N. Crane, personal communication, 2009). Similar influences will affect the presence of sea lions in the Harbor on an ongoing basis, but numbers will likely vary. The Harbor does not provide mating or breeding habitat or other habitat of a similar ecological significance for the California sea lion.

4.2.2 Harbor Seal

During December 2006 surveys, six harbor seals were observed hauled-out on dock FF at night. During Fall 2009 surveys, harbor seals were observed foraging and telescoping on 18 out of 19 surveys. Numbers of observed harbor seals varied widely from 1 to 11 animals. Harbor Seals were only observed hauled-out on F and FF Docks, only during early morning surveys, and when biologists arrived prior to the onset of nearby early morning Harbor activities, such as the arrival of kayakers at FF Dock and "Velocity" Crew at F Dock. (Velocity is a private sports fishing and whale watching charter boat.) With any proximate activity, such as boat and human activities occurring in the harbor area, harbor seals may be flushed from their haul-out locations into the water.

Observations of harbor seals were concentrated in two locations: to a lesser degree in the area around the launch ramp, fuel dock and Vessel Assist dock; and primarily in the area around Docks F and FF and Dock S, the Live Bait dock, where harbor seals were frequently observed telescoping just off Dock S. The Live Bait dock clerk, Kevin Carney, and well as Port District staff report that five or six of the harbor seals appear to be residents, hauling-out, foraging, and telescoping in the area of Docks FF through S throughout the year (K. Carney, personal communication, 2009; B. Foss, personal communication, 2009).

The entire Upper Harbor, upstream (north) of the Bridge was surveyed once in 2009 to assess potential use of the Upper Harbor during midday. Six harbor seals were observed foraging in the Upper Harbor. Harbor seals were residents within the lower Harbor during the 2009 surveys, using Docks F and FF as a primary haul-out and the surrounding area as foraging habitat. The Harbor does not provide breeding or molting habitat. Nearby known breeding and molting locations include Point Lobos, Elkhorn Slough (NOAA 2007), and Lover's Point State Marine Reserve (SIMON 2020), which are approximately 20+ miles south of the Santa Cruz Small Craft Harbor. The harbor seals are not present on the beaches adjacent to the Harbor. The numbers of harbor seals occupying the Harbor are likely to be highest during late summer, fall and winter, outside of breeding (March - May) and molting (June - July) seasons. Nineteen visits were conducted within two periods: one in December and a second survey two years later in September and October. Thus, the estimates reflect maximum numbers as the surveys were conducted during all of these periods. Individuals that are not sexually reproductive may remain at the Harbor later into the spring, until molting season.

Surveys conducted in February and March 2022 (7 afternoon surveys and 6 morning surveys) didn't include any observations of harbor seal haul-out activity, and few harbor seals were detected. As noted above, the February/March survey period may not represent a peak time for marine mammal activity, as a mild winter could have led to earlier breeding activity and time spent away from the harbor area. Results may also vary substantially from the 2009 surveys because they precede annual blooms of *Pseudonitzschia* spp., which may cause increased abundance of marine mammals in harbor areas as they seek haul-out areas to rest during domoic acid poisoning events which were apparently intensive in 2009.

When they have been observed hauling out within the study area, harbor seals only used Docks F and FF in 2009 as haul-out sites at night, when disturbances in the Harbor are at a minimum. The animals flush with any disturbance in the early morning. In comparison, harbor seals at haul-outs in less disturbed areas will typically haul out mid-day to late afternoon (Allen et al. 1987). The total number of hours of haul-out time/day for harbor seals outside of breeding and molting season averages seven hours. It is unknown if the harbor seals occupying the Harbor use the site exclusively as their haul-out during the fall and winter or if they use other nearby haul-outs in conjunction with the Harbor. Use of haul-out sites and movements for foraging appear to vary depending on a variety of factors, including location, season, and abundance of prey species.

During a study of harbor seals in Oregon, seals spent an average of approximately 27 consecutive hours in the ocean, returning to haul out for an average of approximately 9 hours between trips. This is generally consistent with behavior observed at other natural coastal and estuarine sites, and roughly corresponds with the tidal cycle. A study in Point Reyes found that females traveled farther than males (Allen et al. 1987), though others (e.g., Steingass et al. 2019) found that males tend to make longer movements, including trips of greater than 100 km. In a monitoring study of harbor seals for the Richmond San Rafael Bridge retrofit project, 65% used more than one haul-out site, and mean in-water distances from the haul-out site for most seals was ≤ 5 km (i.e. foraging areas were located close to the primary haul-out site) (Green et al. 2006). Seasonal patterns have also been observed, with harbor seals either moving to different haul-out sites in the winter or spending more time at sea (Allen et al. 1987).

In an unpublished study of harbor seal prey base, harbor seals using the San Lorenzo River in Santa Cruz were found to use the river as their haul-out exclusively, foraging in the ocean and returning during the night when disturbances were at a minimum (Weise, M. personal communication, 2009). Nearby known haul-outs for the eastern Pacific harbor seal include Pleasure Point in Live Oak; the Cement Boat at Seacliff State Beach in Aptos; Table Rock, off Wilder State Park; as well as numerous other sites along the north coast from Wilder State Park to Ano Nuevo State Park (NOAA 2007).

4.2.3 Southern Sea Otter

The southern sea otter is regularly sighted in the Harbor waters. During the December 2006 field surveys, one sea otter was observed swimming in the open water of the main Harbor channel, north (upstream) of the Murray Street bridge. During September/October 2009 surveys, southern sea otters were observed foraging in the Harbor during five of the nineteen surveys conducted, with observations concentrated during one week of the four-week-long survey period, between September 17 and 23 (Attachment B, Table B-2). On four of these visits, only one sea otter was observed. On one visit, a mother and juvenile were observed and heard calling and responding until the pair reunited. No sea otters were observed during 13 survey visits in February and March 2022.

Southern sea otters appear to be incidental visitors to the Harbor. Otters occur in the kelp forests just off the coast, where separate groupings of females and young, territorial males, and non-territorial males breed, forage, and groom, in close proximity to the Harbor. Availability of food resources based both on seasonal variation and seasonal and El Nino-influenced ocean currents, as well as Spring and Fall algal blooms of a diatomic species of *Pseudonitzschia australis* (SIMON 2002), causing domoic acid poisoning may have been factors influencing the presence of otters in the Harbor during Fall 2009 surveys. Similar factors are likely to exist in subsequent years, but numbers will likely vary. The Harbor does not provide mating or breeding habitat or other habitat of a similar ecological significance for the southern sea otter.

5 Type of Incidental Take Authorization Requested

The incidental harassment authorization request is for Level B incidental take (behavioral harassment) of the marine mammals (California sea lions, harbor seals, and southern sea otters) for incidental harassment of any marine mammal that might enter the 120 dB Zone of Influence (ZOI) during active pile driving activity. Noise, vibrations, and other physical disturbances can harass marine mammals. The range of effects potentially includes behavioral changes, physiological stress, physical injury (including hearing loss), and mortality.

The method of take is incidental harassment from disturbance associated with construction activities, personnel and equipment, and noise, deterring regular foraging and haul-out activities as well as from temporary removal of primary haul-out sites (Dock FF) for harbors seals. In addition, animals present in the Upper Harbor may be temporarily restricted (until the end of daily construction activities) from moving through the project area under the bridge to access the Harbor exit and other areas for foraging or hauling out.

Construction activities that may impact marine mammals primarily include pile removal (concrete and steel), augering, and pile installation (concrete dock pile, steel trestle pile and steel bridge pile). Other construction activities and noise sources include trucks delivering materials and other construction on land construction activities on the bridge, abutments, and roadway. The construction activities will be limited to the area around the bridge. Both in-water and in-air noise is expected during the course of construction, and potential impacts are discussed below in Section 7. In-water activities principally consist of pile driving.

All noise-generating construction activities will take place during daylight hours, and would begin each day after harbor seals have already flushed from their haulouts, and during which time harbor seals might normally be congregating and foraging around Dock S and throughout the harbor. California sea lions may be foraging throughout the Harbor, particularly if prey fish species are abundant, and southern sea otters might be occasional visitors, foraging or seeking refuge in the Harbor. California sea lions may also use the docks within the Harbor for day-time haul-outs and be flushed by in-air noise. Behavioral effects, as further described below in Section 7, would be similar for all three noise-generating activities, with the main differences being the duration, frequency, and total hours associated with each activity (see Table 2).

6 Take Estimates of Marine Mammals

Incidental harassment of marine mammals during the Murray Street Bridge Retrofit Project may occur to all three marine mammal species (southern sea otter, California sea lion, and harbor seal) present in the Area of Impact and vicinity. Avoidance and minimization measures will be implemented to reduce the potential for harassment to the maximum extent possible, as detailed in the Section 11 below.

Incidental take is estimated for each species by estimating the maximum number of marine mammals being present within a ZOI during active pile driving based on estimates of numbers of animals identified during the marine mammal surveys. Numbers of residential harbor seals are expected to be at a maximum during the season in which surveys were conducted (outside of breeding and molting seasons).

In-water pile driving estimates are based on the maximum number of days that pile driving could potentially occur for the project described in Section 1.3. In total, up to 37 days of in-water pile driving and 15 days of in-water pile

removal are anticipated for the bridge and dock piles. It is expected that actual days of pile driving and removal would be less than this estimate, as this includes time to mobilize and set up equipment for such work. Installation of a temporary construction trestle would require up to 60 days for installation of 120 piles. Removal of the temporary trestle would occur in the 2025 year under a separate application. Therefore, a total of up to 112 days is estimated for all in-water pile installation and removal activities in the 2023 and 2024 work years, including the optional trestle, as shown in Table 2 and summarized below.

2023 Total Estimated Duration of In-Water Pile Installation =	0	days
2023 Total Estimated Duration of In-Water Pile Removal =	14	days
2024 Total Estimated Duration of In-Water Pile Installation =	37	days
2024 Total Estimated Duration of In-Water Pile Removal =	1	days
2024 Trestle Installation (optional) =	*60*	*days*
TOTAL IN WATER (without optional trestle	**52**	**days**
TOTAL IN WATER (with optional trestle)	**112**	**days**

For the exposure estimate, it is conservatively assumed that the highest count of sea lions, harbor seals, and sea otters observed during multiple years of surveys (Table 4) will be foraging within the ZOI and be exposed multiple times during the Project. The 2009 survey results provide the most conservative high estimate for marine mammal occurrence in the exposure area. The calculation for marine mammal exposures is estimated by:

*Exposure estimate = N * ("X" days of pile driving activity + "X" days of pile removal), where:*
N = # of animals
*Exposure estimate = N animals * "X" days*

Enumeration of the anticipated incidental takes from is shown on Table 5 based on the estimated number of piles and days of pile installation/removal shown above.

Table 5. Estimated Maximum Level B Harassments (including optional trestle work)

	Maximum Number of Animals/Day	Maximum Total Days In-Water Work[1]	Maximum Level B Harassments During Construction
Southern sea otter	2	112 (14 in 2023, 98 in 2024)	224 (28 in 2023, 196 in 2024)
California sea lion	15	112 (14 in 2023, 98 in 2024)	1,680 (210 in 2023, 1,470 in 2024)
Harbor seal	11	112 (14 in 2023, 98 in 2024)	1,232 (154 in 2023, 1,078 in 2024)

[1]Timing for confirmed activities include 14 days in 2023, 38 in 2024– optional trestle installation would occur in 2024 (60 days) .

Therefore, the City of Santa Cruz is requesting authorization for Level B acoustical harassment of up to 230 southern sea otters, 1,725 California sea lions, and 1,265 harbor seals due to pile driving and project-related activities. In addition, the City of Santa Cruz requests authorization for Level A acoustical harassment of up to 74 harbor seals during impact pile driving, in the event they do not leave the construction area (Table 6).

Table 6. Estimated Maximum Level A Harassments of Harbor Seals

Maximum Number of Animals/Day	Maximum Total Days In-Water Work	Maximum Level A Harassments During Construction
2	37	0 in 2023, 74 in 2024

This assumes a worst-case scenario of up to two harassment episodes per day of impact pile driving (37 days [excluding pile removal] X 2 per day). It is assumed that these number estimates include multiple harassments of the same individuals.

7 Anticipated Impact of the Activity

The waters and haul-out features within the Harbor do not provide rookery, mating, breeding, molting, or other habitat of a similar ecological significance for sea otters, California sea lions or harbor seals. However, construction activities may impact marine mammals using the Harbor for foraging and haul-out activities. Construction activities that may impact marine mammals include pile removal (concrete and steel), augering, and pile installation (concrete dock pile, steel trestle pile and steel bridge pile). These activities will be limited to the area around the bridge. Both in-water and in-air noise is expected throughout the duration of construction, with the most noise generated during pile installation operations, as pile removal and installation radiates sound into the water, the substrate, as well as the air. Other noise events would include trucks delivering materials, bridge removal equipment, concrete pumps, etc., none of which should generate as much noise as pile installation and are not included in calculations of noise activity.

Current NOAA Fisheries practice regarding exposure of marine mammals to high-level underwater sounds sets thresholds that vary by species groupings and sound frequencies: (e.g., (low-frequency cetacean, phocid pinniped) (Appendix C). NOAA Fisheries considers the potential for behavioral (Level B) harassment to occur when marine mammals are exposed to sounds below injury thresholds at or above the 160 dB (RMS) threshold for impulse sounds (e.g., impact pile-driving) and the 120 dB (RMS) threshold for continuous noise (e.g., vibratory pile-driving).

Currently, no data are available describing baseline levels of underwater sound in Santa Cruz Harbor waters. Normal ambient noise levels in the harbor include vessel motors, heavy vehicular traffic on the bridge, construction noise from the dry dock repair facility, commercial charters, kayakers, and significant water traffic, to which marine mammals in the harbor are assumed to be habituated. Ambient underwater noise levels in the project area are likely similar to those measured in Monterey Harbor (Illingworth & Rodkin 2012) which ranged from 110 to 120 dB. Frequent acoustic events such as boat traffic caused noise levels to frequently exceed 120 dB during the Monterey Harbor monitoring, and the same is expected to occur in the Harbor.

The existing airborne noise environment in the project area is dominated by motor vehicle movement on Murray Street/Eaton Street, Lake Avenue, Seventh Avenue, and other nearby arterial streets. Trains utilizing the tracks adjacent to the site, the operation of commercial and private boats in the harbor, and operation of boat yards

engaged in repair activities also contribute sporadic noise incidents. Ambient noise levels were monitored as part of the preparation of the CEQA (California Environmental Quality Act) environmental review documents at the Lake Avenue entrance to the Santa Cruz Harbor on Lake Avenue. Noise levels were measured and are reported using percentile noise descriptors: L90 (the background noise level exceeded 90 % of the time), L50 (the median noise level exceeded 50% of the time), L1 (the peak level exceeded 1% of the time), and Leq (the average energy-equivalent noise level). Monitored noise levels are shown in Attachment B, Table B-5.

7.1 Construction Impacts

Steel pile driving construction activities associated with the bridge seismic retrofit project could result in behavioral responses by marine mammals and rise to the level of harassment. However, construction-generated underwater noise would not rise to the level associated with injury based on the results of noise propagation calculations prepared by Dudek based on the NOAA tables for the City of Santa Cruz (Attachment C). The analysis calculated the distances to the cumulative and peak sound criteria for a range of different pile types and for the five groups of marine mammals specified by NOAA. The criteria used by NOAA are shown in Table 7.

Table 7. Cumulative and Peak Sound Criteria for Marine Mammal Groupings

	Species Grouping				
	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
Cumulative Impact Criteria	183 dB	185 dB	155 dB	185 dB	203 dB
Cumulative Vibration Criteria	199 dB	198 dB	173 dB	201 dB	219 dB
Peak Impact Criteria	219 dB	230 dB	202 dB	218 dB	232 dB
Peak Vibration Criteria	N/A	N/A	N/A	N/A	N/A

7.1.1 Pile Driving Construction Impacts

The most intense in-water activity would be the installation of new bridge support piles. CISS (cast-in-steel-shell) piles at Bents 5 through 8 will be installed within the waterway by driving 30-inch diameter steel casing either to refusal at rock or into a shaft drilled within rock (depending on the location). The installation of new piles at Bents 5-8 will include two piles on each side for a total of 16 piles in the water. Table B-4 in Appendix B lists the duration of each pile installation. The installation of these piles requires the use of cranes, a drilling rig, a pile driver, extraction and earthmoving equipment, and other equipment.

The results of the hydroacoustic analysis are presented on Table 1, in Attachment C and are summarized below. The calculations are based on source levels for similar piles driven for similar projects, based on information provided in Caltrans' *Technical Guidance for Assessment and Mitigation of the Hydroacoustic Effects of Pile Driving*

on Fish (Caltrans, 2020)[1]. In accordance with NOAA Fisheries guidance[2] referenced in Caltrans (2020), an attenuation rate of 4.5 dB per doubling of distance was assumed. The results of the analysis (Appendix C) indicate the following:

1. The distance at which the cumulative sound exposure level threshold for impact driving for low-frequency cetaceans is predicted to be exceeded is a maximum of 4447 meters (for 30-inch CISS) or less, and 34 meters (for 30-inch CIDH) or less for vibratory driving.

2. The distance at which the cumulative sound exposure level threshold for impact driving for mid-frequency cetaceans is predicted to be exceeded is a maximum of 158 meters (for 30-inch CISS) or less, and 3 meters (for 30-inch CIDH) or less for vibratory driving.

3. The distance at which the cumulative sound exposure level threshold for impact driving for high-frequency cetaceans is predicted to be exceeded is a maximum of 5,297 meters (for 30-inch CISS) or less, and 51 meters (for 30-inch CIDH) or less for vibratory driving.

4. The distance at which the cumulative sound exposure level threshold for impact driving for phocid pinnipeds is predicted to be exceeded is a maximum of 2,380 meters (for 30-inch CISS) or less, and 21 meters (for 30-inch CIDH) or less for vibratory driving.

5. The distance at which the cumulative sound exposure level threshold for impact driving for otariid pinnipeds is predicted to be exceeded is a maximum of 173 meters (for 30-inch CISS) or less, and 1 meter or less for any vibratory driving

6. The distance at which the peak criterion threshold would be exceeded would range from less than 34 meters (for 30-inch CISS) for high-frequency cetaceans to less than three meters for other mammalian groups.

These predicted distances are based on an open water attenuation rate of 4.5 dB per doubling of distance, but do not consider additional attenuation effects that will likely occur at the. Because no empirical data is available on the extent of attenuation by the breakwater into Monterey Bay, this additional attenuation is not factored into the above. However, if an additional attenuation of 15 dB were to occur (as an example), the 5,297-meter distance noted above for high-frequency cetaceans would be reduced to approximately 529.7 meters.

The 120 dB disturbance threshold associated with vibratory pile driving is extremely low. The disturbance threshold for impact pile driving is 40 dB higher (i.e. less restrictive) than the threshold for vibratory driving. The difference between impact driving and vibratory driving source levels for the same pile is typically in the range of about 15 to 25 dB. Accordingly, the disturbance effect distances for impact driving are typically far less than the distances for vibratory driving. Because it is impractical to monitor within several thousand kilometers of the pile driving, it is proposed that the assumption for the maximum distance for Level B harassment is 1,000 meters (Figure 6). The distance from the Murray Street Bridge to the breakwater is about 780 meters. Therefore, the assumed maximum distance for Level B harassment will extend about 220 meters into Monterey Bay as shown on Figure 6. It is highly likely that the complex arrangement of manmade infrastructure in the harbor such as docks and berths will

[1] Attenuation rates vary widely based on substrate, the frequency of the sound, and various other factors. However, NOAA Fisheries recommends using a standard factor of 4.5 dB attenuation per doubling of distance unless site-specific information is available.

attenuate sound as it approaches the harbor mouth, and that the breakwater will reflect sound waves back in such a way that very little sound energy will escape the harbor into the open ocean (refer again to Figure 6).

Under this assumption, the contractor will be allowed to use vibratory driving if the contractor can demonstrate, by underwater monitoring conducted during actual pile driving, that the 120 dB vibratory threshold will not be exceeded within 1,000 meters of pile driving. If this cannot be achieved, the contractor will then be required to use impact driving only and limit measured sound levels to 160 dB or less at 1,000 meters (ICF International, November 2016). To achieve those levels, the contractor may be obligated to employ measures such as a bubble curtain when driving piles; however, use of a bubble curtain is not proposed as a standard measure under the project.

Pile-driving activities within harbor waters may deter otters from regular foraging in the project area and temporarily disrupt otter movement within the harbor waters. These activities may also deter sea lions from foraging or hauling out in the project area. Pile-driving activities will affect harbor seals congregating and foraging around Dock S, immediately downcoast of the project area, as well as harbor seals using the nighttime haul-outs (Dock F and FF) immediately adjacent to the Bridge. Dock FF will be removed temporarily for the duration of construction and will be reconstructed at the southern end of the current FF dock immediately adjacent to the project area. No alterations to sea lion habitat are anticipated as a result of the project. No other direct or indirect impacts are anticipated.

7.1.2 Other On-Land Construction Activities

In-air noise will be generated primarily during pile installation operations; other noise sources include trucks delivering materials, bridge removal equipment, concrete pumps, and other typical construction equipment, none of which should generate as much noise as the pile installation. Construction-related noise levels would vary throughout the day, depending on the type of equipment in use at any one time and the distance to the receptors. Anticipated equipment includes but is not limited to equipment that would be used for excavation, installation of bridge piles, and surface improvements, such as cranes, excavators, concrete saws and jackhammers, a pile driver or vibrator, and concrete trucks and pumps. Table B-6 in Attachment B shows typical noise levels associated with different types of construction equipment. Conventional construction activities (such as demolition, construction of bridge superstructure elements, and construction of new road approaches to the bridge) are expected to generate airborne noise levels in the range of approximately 80 to 90 dBA at a distance of 50 feet. A typical airborne noise value for impact hammers would be 100 dBA at 50 feet.

Sea otters were observed in the Harbor only incidentally (a maximum of 2 or less otters/day) and all observations were made in the lower Harbor; therefore, it is unlikely that sea otters would be exposed to elevated in-air sound levels. In the event that an otter was observed within the monitoring buffer, this detection would initially be made near the launch ramp, far from the project area, where in-air noise levels would not exceed normal ambient levels for the Harbor. Work would be stopped until the animal departed. No incidental harassment of otters as a result of in-air noise is predicted. Because of the range of normal ambient noise-generating activities in the Harbor and ongoing occurrence of animals in the Harbor, it is assumed that the marine mammals are habituated to human-generated noises at this level.

In addition, animals foraging in the Upper Harbor may be impacted by construction activities. During Fall 2009 surveys harbor seals were observed regularly in the Upper Harbor, while greater numbers of California sea lions were observed sporadically, largely depending on available prey resources. No southern sea otters were observed in the Upper Harbor, although an individual was observed immediately under the Murray Street Bridge. Marine mammals may travel into the Upper Harbor in the morning before construction begins for the day or during a lunch

break, but one navigable channel will always be open for boats and passage of animals. Because these animals are inquisitive by nature, they may approach the work area and become subject to airborne or underwater noise levels that may cause harassment or injury. This is the reason why a limited amount of Level A acoustical harassment is assumed for harbor seals, as described in Section 6 and 7.2.

7.2 Species Impacts

The harbor seal population in California is approximately 30,968 individuals (Table 4). This application requests incidental taking by Level B acoustical harassment of up to 1,232 harbor seals and Level A acoustical harassment of up to 74 harbor seals. Although the estimate assumes repeated incidental harassment of a few individuals (not single takes of 1,306 individuals), the requested number of takes represents approximately 4.2% of the California stock.

The Pacific stock of California sea lion population is approximately 257,606 individuals (Table 4). This application requests incidental taking by Level B acoustical harassment of up to 1,680 sea lions. Although the estimate assumes repeated incidental harassment of a few individuals (not single takes of 1,680 individuals), the requested number of takes represents approximately 0.65 % of the Pacific stock.

The California southern sea otter population is approximately 2,863 individuals (Table 4). This application requests incidental taking by Level B acoustical harassment of up to 224 southern sea otters. Although the estimate assumes repeated incidental harassment of a few individuals (not single takes of 224 individuals), the requested number of takes represents 7.8% of the California stock.

If incidental take occurs it is only expected to result in short-term changes in behavior and potential temporary hearing threshold shift. These takes would be unlikely to have any impact on stock recruitment or survival and therefore, would have a negligible impact on the U.S. stock. No cetacean species occur within the Harbor. It should also be noted that surveys conducted in February and March 2022 found substantially reduced marine mammal activity in the harbor as compared to the 2009 survey findings. It is possible that 2009 survey results were inflated due to increased levels of domoic acid poisoning in that year and more animals seeking refuge. However, the timing of 2022 surveys was coincident with generally lower periods of nearshore and haul-out activities, so the higher (more conservative) estimate of marine mammal abundance from the 2009 surveys was used.

With implementation of avoidance and minimization efforts, potential effects will be minimized; however, temporary harassment may occur. With implementation of the proposed work restrictions, monitoring and other mitigation measures specified in the Section 11, disturbance from project-related construction activities is expected to have only a short-term impact. No long-term avoidance or permanent abandonment of sites or nearby areas is expected.

8 Anticipated Impacts on Subsistence Uses

Not applicable. There are no known subsistence uses of sea otters, sea lions or harbor seals in the project area.

9 Anticipated Impacts on Habitat

The proposed activities are not expected to have any long-term detrimental impact on the habitat of harbor seals, California sea lions or sea otters. Construction-related effects will be temporary and minimized with implementation of the proposed avoidance/minimization and mitigation measures. No permanent habitat removal will occur. The project includes installation of temporary boat docks during construction to replace those temporarily removed, and replacement of boat docks in the original location upon completion of the bridge retrofit.

10 Anticipated Effects of Habitat Impacts on Marine Mammals

There is no anticipated impact of habitat loss or habitat modification on harbor seal, California sea lion or southern sea otter populations as a result of the Murray Street Bridge Seismic Retrofit Project.

11 Mitigation Measures

Avoidance/minimization and other mitigation measures will be implemented to avoid or minimize the potential construction-related effects to marine mammals at or near the Murray Street Bridge Seismic Retrofit site. These measures generally include:

- Limitation on timing of pile driving;
- Pre-construction monitoring and hydroacoustic monitoring during construction; and
- Establishment of a buffer and monitoring of noise levels.

The following mitigation measures will be implemented to avoid or minimize potential project-related effects to southern sea otters, harbor seals, and California sea lions.

1. Timing of Pile Driving. In-water pile-driving activities within Harbor waters will be limited to the period of July 1 to mid-November, unless otherwise permitted by NOAA Fisheries.

2. Pre-Construction Monitoring. Prior to initiation of in-water construction, a qualified biological monitor, approved by the U.S. Fish and Wildlife Service (USFWS) and/or NOAA Fisheries, will conduct monitoring of marine mammals to update existing information on the animals' occurrence in and near the project area, their movement patterns, and their use of any haul-out sites. This preconstruction monitoring will take place at least five days prior to the start of in-water construction and will cover a period of at least one week (with at least 5 days of actual observation over a period of 4 hours each day), 2 hours in the morning at the time that construction activities would begin and 2 hours at midday, when construction activities would resume after a lunch break.

3. Pre-Construction Removal of Haul-out Sites. All known and potential haul-out sites that occur in the construction work area shall be removed, preferably to a near-by location outside of the work area prior to

construction. These sites could include floating docks (i.e. Dock FF) rubber docks, or boats, such as those used by UCSC.

4. Pre-Construction Workers Training. Prior to in-water construction, the approved monitor will conduct a workers training to instruct construction crews regarding the status and sensitivity of the target species in the area and the actions to be taken to avoid or minimize impacts in the event of a target species entering the in-water work area.

5. In-Water Construction Biological Monitoring. The qualified biological monitor will be present during in-water construction activities to search for target marine mammal species and halt project activities that could result in injury or mortality to these species [an estimated 8 hour/day (or for the duration of in-water construction activities each day) during the estimated 10 months of in-water activities plus an additional 16 days of on-land pile driving]. Each day, before pile driving (or other loud in-water construction activity) begins, the monitor will survey the buffer zone for marine mammals for a minimum of 30 minutes. The monitor will also scan for target species throughout the project vicinity, i.e., the areas adjacent to the project site and buffer zone. At the daily conclusion of pile installation, the monitor will also conduct 30 minutes of clearance monitoring before leaving the site.

6. Establish Buffer Area. The commencement of pile driving activities will be delayed if marine mammals are present within a 500-foot radius[2] of the work area. This 500-foot radius is based on pile-driving activities for similar projects (Sandholdt Bridge) and on the ability to quickly detect animals entering the Harbor from the open waters of the Monterey Bay. The buffer radius may be reduced or increased based on a measurement of the distance the 160 db pressure travels in the underwater harbor waters. This radius will be visibly flagged on the banks of the harbor during these activities. Each day prior to the start of pile-driving, the approved monitor will survey the buffer zone for marine mammals. If a marine mammal is detected, pile driving will be delayed until the marine mammal(s) has moved beyond the buffer zone, verified by visual confirmation or lack of visual sighting within the next 15 minutes of the last sighting, to assume that the animal has moved beyond the buffer zone. If the animal should move back into the buffer zone after the commencement of pile-driving, no further work stoppage will be necessary, unless the animal comes within an unsafe distance of the work area that may result in injury to the animal, as determined by the monitor. At this point, work will cease to avoid physical injury to the animal. This distance will be determined by USFWS and/or NOAA Fisheries. The monitor will record the species, numbers and behaviors of any animal(s) entering the buffer zone after commencement of work and notify the City of Santa Cruz within 48 hours.

7. Buffer Changes – Acoustical Monitoring. Acoustical monitoring will be conducted during pile driving activities to determine sound generation and propagation within the Harbor. The buffer radius may be reduced or increased based on a measurement of the distance the 160 db pressure travels in the underwater harbor waters and/or through the air. This shall be determined using approved in-water and

[2] The 500 ft radius is intended to be an initial buffer, prior to tests that determine the actual distance at which pile driving noise is recorded to be 160 dBs. This initial buffer was selected based on estimates that underwater noise levels can be conservatively predicted to fall below 160 dB outside of a radius of between 33 and 300 feet for driving steel piles as large as 30-inch diameter (ICF Jones and Stokes 2010); 500 ft is safely outside of this radius. In addition, an initial 500-foot buffer was used for a project of a similar scale, the Sandholdt Road Bridge Replacement Project (LSA Associates, Inc. 2004), the project that Caltrans initially recommended that EcoSystems West Consulting Group use as a comparative standard.

in-air acoustic monitoring devices operated in accordance with a Hydroacoustic Monitoring Plan approved by NOAA Fisheries. The City of Santa Cruz shall notify NOAA Fisheries and USFWS in writing of the proposed change in buffer zone area. A USFWS and NOAA Fisheries approved biologist will operate the monitoring devices during pile driving and any other loud construction activities, such as bridge demolition or use of hydraulic tools. The devices, placed at the determined buffer, will produce acoustic data for the duration of noise-producing activities. An alarm would alert the monitor to sound levels approaching 160 db. If the 160 db threshold is exceeded at a greater distance than 500 feet from the work area, the buffer will be increased to the distance along the edges of the harbor where the in-water sound pressure drops below 160 db. This would be a dynamic buffer and would be expected to change as project activities change (e.g., different pile types or sizes are driven), potentially on a daily or weekly basis.

8. Underwater Acoustical Monitoring-Use of Vibratory Pile Driving Equipment. The contractor will be allowed to use vibratory driving if the contractor can demonstrate, by underwater monitoring conducted during actual pile driving, that the 120 dB vibratory threshold will not be exceeded within 1,000 meters of pile driving. If this cannot be achieved, the contractor will be then required to use impact driving only and limit measured sound levels to 160 dB or less at 1,000 meters. The distance from the bridge to the breakwater is about 780 meters. This means that the impact distance will extend about 220 meters into Monterey Bay (Figure 6).

9. Disturbance Prohibition. No disturbance or noise will be used to encourage the movement of the target species from the work area. The City of Santa Cruz will contact USFWS and NOAA Fisheries to determine the best approach for exclusion of the target species from the in-water work area.

10. Disturbance Prohibition. No intentional hazing will be used on eastern Pacific harbor seals, California sea lions, southern sea otters, or other state- or federally-listed threatened or endangered species. The City of Santa Cruz will contact USFWS and CDFW if sea otters begin to occur in the vicinity of the bridge work, to determine whether any changes to this mitigation plan may be required.

11. Non-Pile Driving Construction Buffer. Other in-water construction activities, such as the use of heavy equipment to construct bridge abutments (i.e., activities not involving loud, impulsive hammering sounds) will generate noise levels equivalent to that of a diesel truck. For these activities, a 50-foot radius buffer zone will be established. This buffer zone will be clearly marked by highly visible stakes securely placed into the banks. Each day, before construction begins, the monitor will search the 50-foot radius for marine mammals. If a marine mammal is sighted within the buffer zone, the monitor will require the contractor to delay in-water construction activities until the approved biologist determines that no marine mammals are present within the buffer area.

12. Construction Monitoring Records. The approved biological monitor will keep a record of all observations of the target species. The information on each observation will include: a) species identification and approximate number of animals observed; b) age and sex class of each animal (if possible); c) activity and direction of movement; d) ongoing project activities at the time of observation; e) responses of target species to project activities; f) any unusual behavior or circumstances observed (project- or non-project related); and g) location, date and time of each observation. Summary monitoring reports will be submitted to the City of Santa Cruz, who will forward reports to NOAA Fisheries and USFWS by December 31 of each year that in-water construction activities take place.

13. Notification of Injury. In the event that the monitor determines that a marine mammal has been injured by project activities, all work shall cease, and the City of Santa Cruz shall be notified. The City of Santa Cruz will consult with NOAA Fisheries and/or USFWS to determine if additional measures are necessary. Work may resume upon notification by NOAA Fisheries.

14. Post-Construction Replacement of Haul-out Areas. All known and potential haul-out sites that were removed from the work area prior to construction will be returned to their approximate location.

15. Post-Construction Monitoring. Post-construction monitoring will be conducted to determine if harbor seals resume their use of Dock F and FF as primary haul-out sites. NOAA Fisheries may require additional project conditions, to be applied depending on the outcome of post-construction monitoring.

12 Arctic Plan of Cooperation

Not applicable; the project location is not within the Arctic region.

13 Monitoring and Reporting

To assess the level of project-specific impacts(s), the City of Santa Cruz will implement monitoring and reporting measures as summarized below:

- Pre-construction monitoring (#2) and worker training (#4)
- Monitoring during construction (#5) and prior to daily pile driving activities (#16)
- Acoustical monitoring and Equipment Requirements (#7 and 8)
- Maintenance of monitoring record/observations (#12)
- Reporting (#13)
- Post-construction monitoring (#15)

The City of Santa Cruz shall submit, annually, a post-construction compliance report prepared by the on-site biologist to Caltrans, who will forward the reports to NOAA Fisheries and USFWS. A compliance closeout report will also be submitted to NOAA Fisheries and USFWS within 90 calendar days of IHA expiration. These reports shall detail the following:

1. Dates that construction occurred.
2. Pertinent information concerning the success of the Project in meeting the avoidance and minimization measures.
3. An explanation of failure to meet such measures, if any.
4. Known Project effects on marine mammals, if any.
5. Marine mammal sightings:
    a. number of animals sighted within exclusion and harassment zones and actions taken,
    b. animal behavior and behavior change,
    c. animals' age (pup, juvenile, adult),
    d. environmental condition such as weather, visibility, sea state, etc.
6. Occurrences of incidental harassment, if any.
7. Documentation of employee environmental education.

8. Any other pertinent information.

14 Suggested Means of Coordination

All marine mammal monitoring data collected during the pre-construction and in-construction phases of the project will be submitted to Caltrans for submittal to NOAA Fisheries. This information will also be made available by the City to the Santa Cruz Port District, marine mammal researchers (i.e., at UCSC, Moss Landing Marine Lab), other interested agencies and the general public.

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15.3 Preparation

Prepared by Dudek, updating materials prepared by EcoSystems West Consulting Group, Strelow Consulting and TRC (with technical assistance from ICF) in collaboration with the City of Santa Cruz and National Marine Fisheries Service.

16 Glossary

Abutments: The mass of concrete supporting the beams at each end of the bridge.

Bents: Also known as piers, the vertical concrete elements supporting the ends of beams (but not at the ends of the bridge-those are abutments)

CIDH (cast-in-drilled-hole) Piles: To support bents and piers, holes are drilled into the ground and steel reinforcement and concrete are then placed into the holes to form the piles.

CISS (cast-in-steel-shell) Piles: Hollow steel pipes that are driven into the ground to support bents and piers. Concrete is then placed into the pipe for added support.

Diatomic: Any of various microscopic one-celled or colonial algae of the class Bacillariophyceae, having cell walls of silica.

Domoic Acid Poisoning: Nerve toxin caused by naturally occurring algal blooms consumed by sardines, anchovies, and shellfish, and that, in turn, accumulates in birds and marine mammals. Exposure to the biotoxin affects the brain, causing animals to become lethargic, disoriented, and have seizures that sometimes result in death. In sea lions exposed to domoic acid during pregnancy, domoic acid is concentrated and retained in the mother's amniotic fluid, thus subjecting the fetus to repeated direct absorption, resulting in abnormal development of brain neurons which affects the animal in later life stages, through seizures and abnormal behavioral changes.

Harassment: Under the 1994 Amendments to the MMPA, harassment is statutorily defined as, any act of pursuit, torment, or annoyance which—

- *(Level A Harassment)* has the potential to injure a marine mammal or marine mammal stock in the wild; or,
- *(Level B Harassment)* has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering but which does not have the potential to injure a marine mammal or marine mammal stock in the wild.

Haul-out Sites: the location where animals, such as pinnipeds, crawl or pull themselves out of the water and onto land, ice, or other object, such as a buoy or dock.

Incidental take: an unintentional, but not unexpected, taking, where take is defined—

- *Under the MMPA* as "harass, hunt, capture, kill or collect, or attempt to harass, hunt, capture, kill or collect."

- *Under the ESA* as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct."

Outriggers: Portions of bents or piers that extend outside the limits of the bridge, usually because of obstructions on the ground preventing the piers from being placed at the location bents or piers would ideally be placed.

Rafts of sea lions: a mass of sea lions or other pinnipeds on the surface or the water in very close proximity.

Seasonal upwelling: Cold, nutrient rich water coming to the surface from depths of over 50 meters. Along the central California coast, during the summer, wind blows from the north to the south, pulling the surface water with it. As the surface water leaves an area, the 'hole' left behind is filled in by water 'upwelling' from below. Subsurface water that rises to the surface as a result of upwelling is typically biologically productive; therefore, good fishing grounds typically are found where upwelling is common.

Shear Keys: Masses of concrete on an abutment, bent, or pier that prevent beams from sliding off their supports.

Attachment A
Figures

1. Project Location
2. Area of Potential Impact
3. Bridge Cross Section
4. Distribution of Observed Marine Mammals
5. Photographs of Marine Mammals
6. 1,000 Meter Limit From Construction Area
7. Construction Buffers

FIGURE 1: Project Location

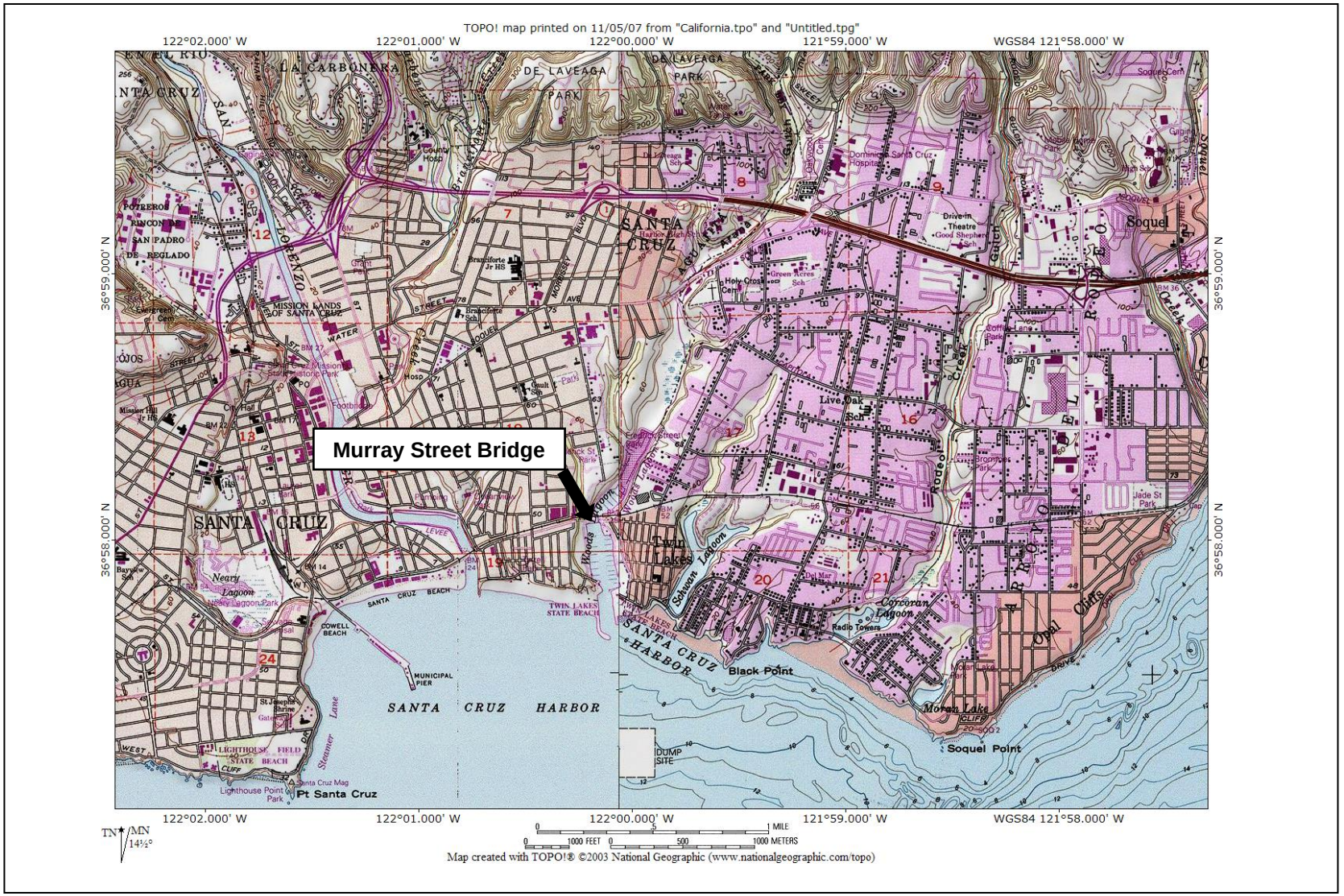


FIGURE 2: Area of Potential Impact

FIGURE 3: Bridge Cross Section

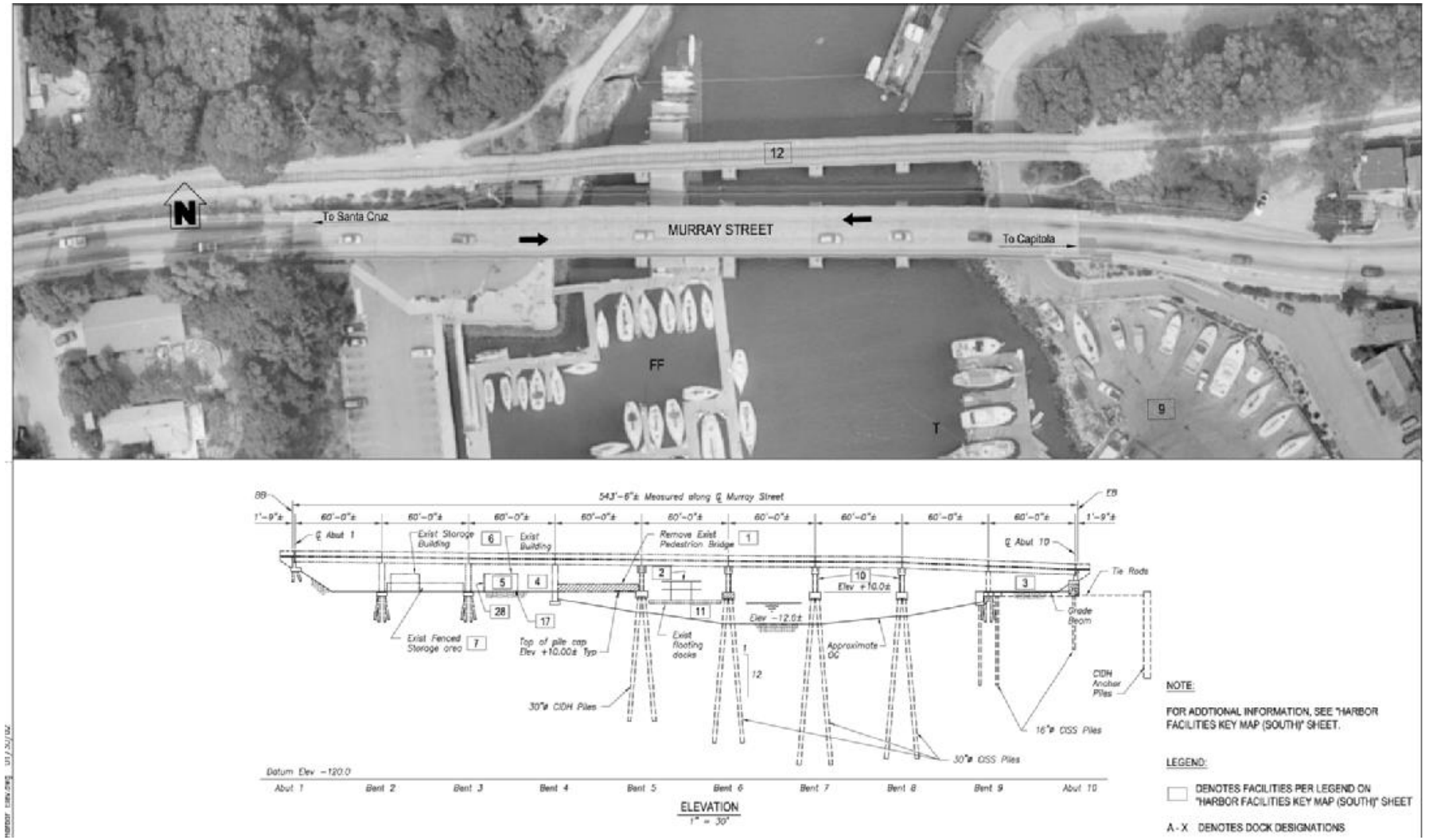


FIGURE 4: Distribution Of Observed Marine Mammals

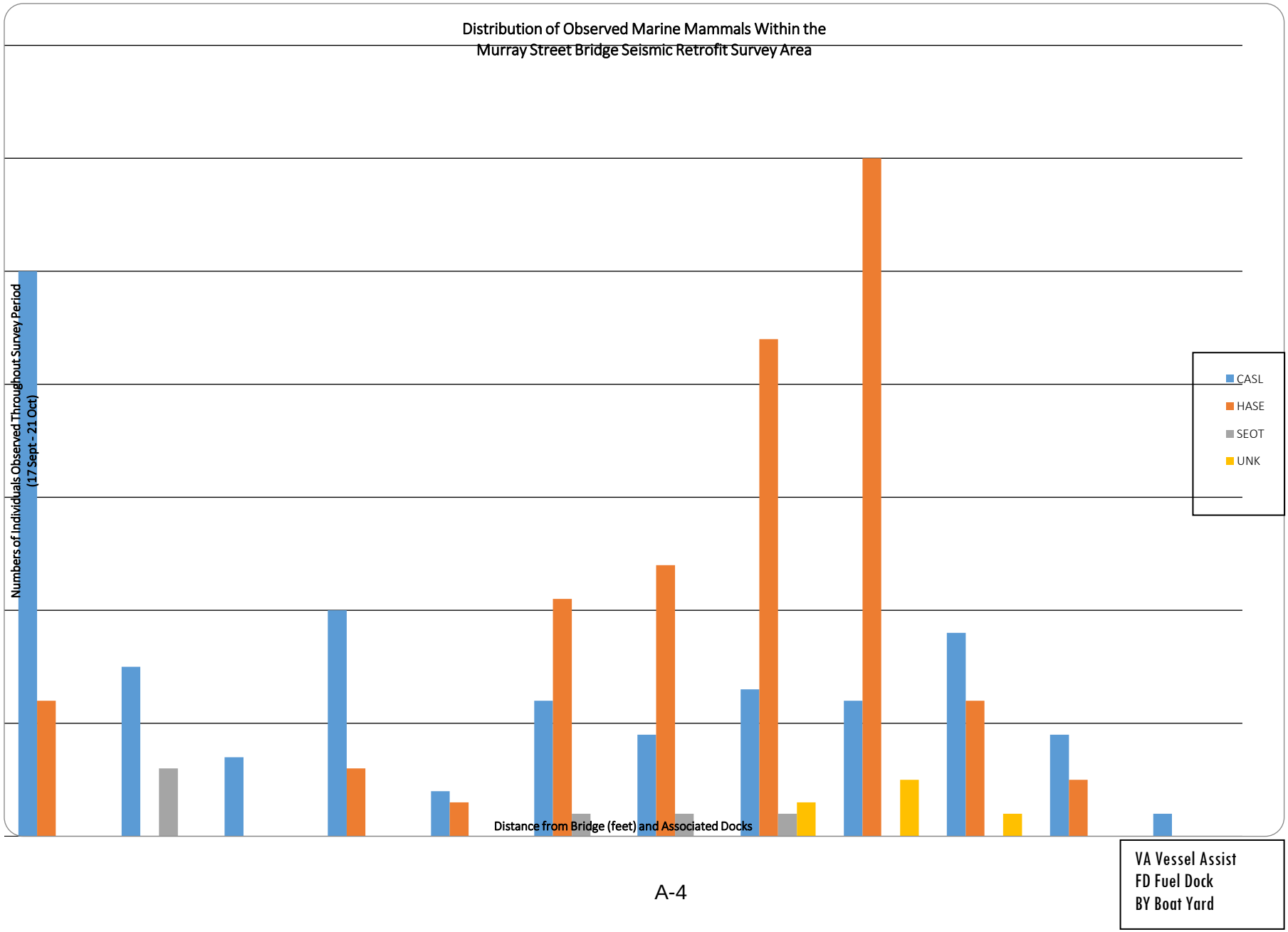


FIGURE 5: Photographs of Hauled-Out Marine Mammals During Fall 2009 Surveys

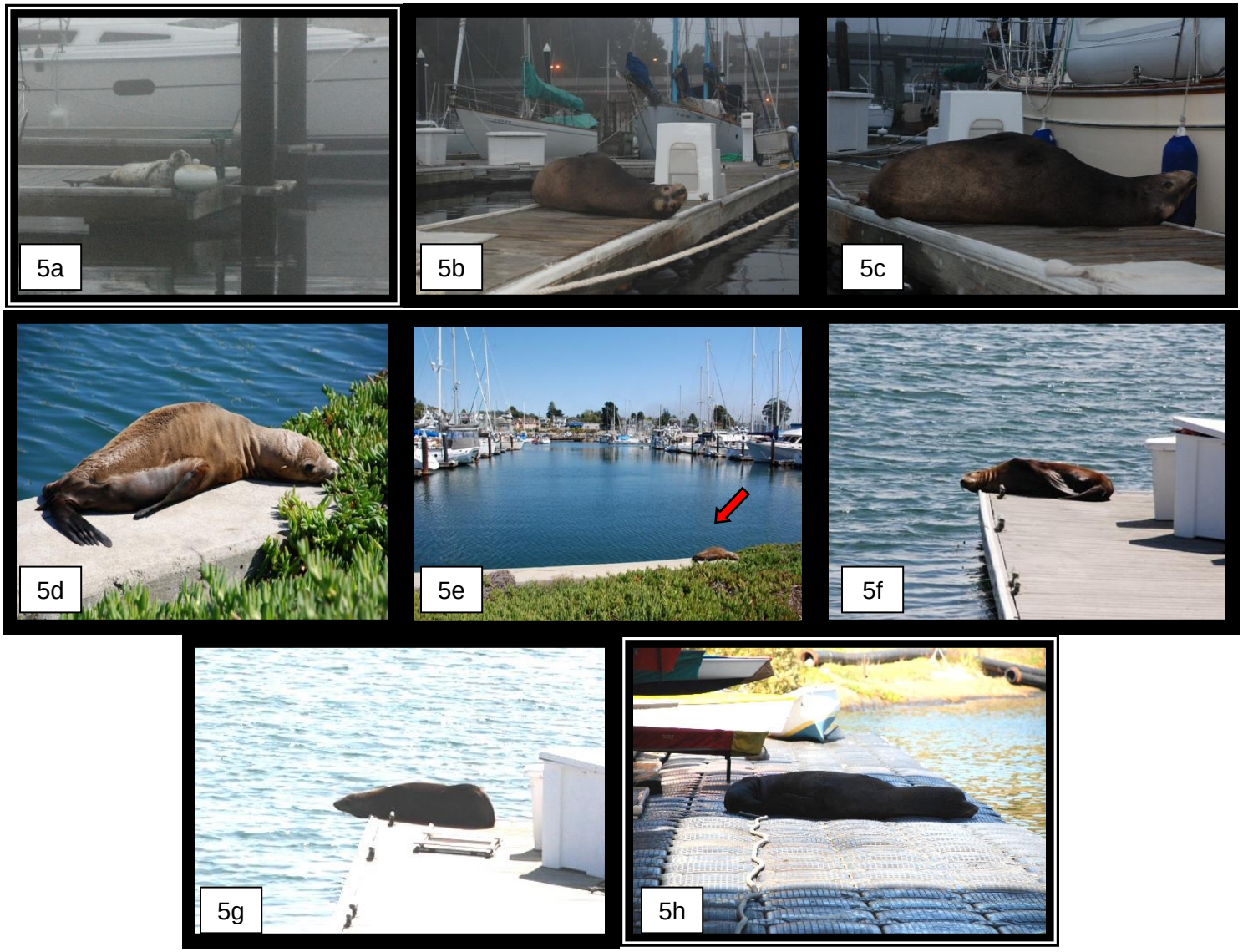
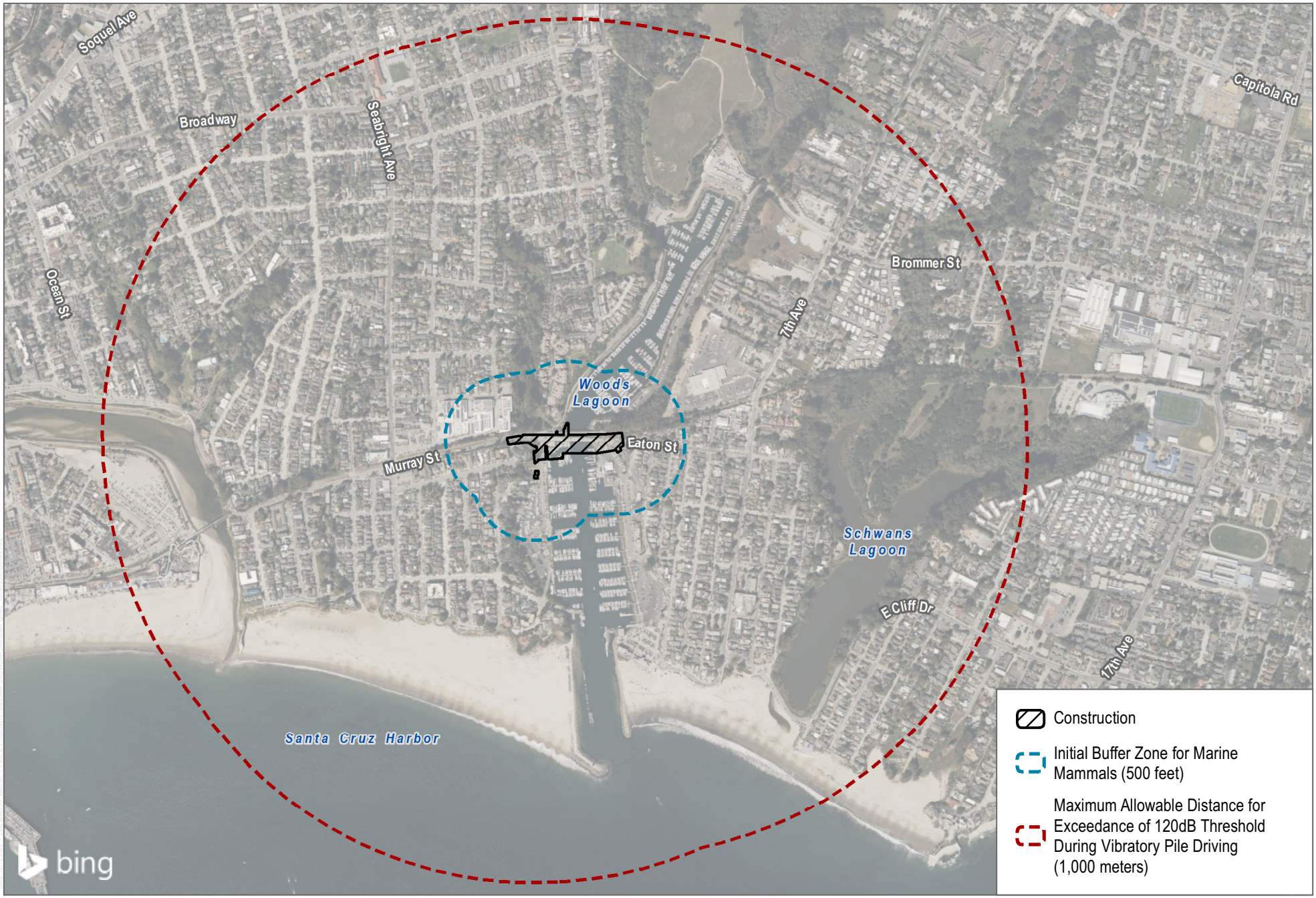


FIGURE 6: 1,000 Meter Limit From Construction Area



SOURCE: Bing

DUDEK

0 500 1,000 Feet

FIGURE 7

Construction Buffers

Attachment B
Technical Tables

1. Estimated Numbers of Marine Mammals in Survey Area
2. Numbers of Animals Hauled Out & Haul-out Locations
3. Existing Noise Levels
4. Noise Levels of Construction Equipment Noise
5. Pile Driving Estimated Strikes

TABLE B-1. Estimated Numbers of Marine Mammals in the Murray Street Bridge Seismic Retrofit Survey Area[1] during 2009 Surveys

		Work Area[2]				Upper Harbor[3]				Lower Harbor[4]				Total in Survey Area			
Date	Time	CASL	HASE	SEOT	Unk[5]	CASL	HASE	SEOT	Unk[5]	CASL	HASE	SEOT	Unk[5]	CASL	HASE	SEOT	Unk[5]
17-Sep	Morning		3							1				1	3		
17-Sep	Midday						1			1	1			1	2		
17-Sep	Evening									1	1	1		1	1	1	
17-Sep	Night											2				2	
20-Sep	Evening									1				1			
20-Sep	Night	1								3	3			4	3		
21-Sep	Morning				1					1	4	1		1	4	1	1
21-Sep	Midday		1							2	1			2	2		
22-Sep	Night		1							2	2			2	3		
23-Sep	Morning		2							4		1		4	2	1	
23-Sep	Midday		1							2		1		2	1	1	
29-Sep	Night	1	2		2				1					1	2		3
30-Sep	Midday	6	8							9*	6*			9 to 15	8 to 11		
1-Oct	Morning		6 to 9							10	4*			10	6 to 11		
2-Oct	Morning	8	2							13*	4*			13 to 15[6]	4 to 6		
6-Oct	Midday	1	2				1			3	1			4	3		
7-Oct	Morning	1	3			4	1*			2	6			7	9 to 10		
17-Oct	Midday		3				6			1	1 to 2			1	10 to 11		
21-Oct	Midday	1	2				1							1	3		

Notes: CASL – California Sea Lion; HASE – Eastern Pacific Harbor Seal; SEOT – Southern Sea Otter

1. Survey Area = Harbor Launch Area to 500 ft north of the Area of Impact ; 17-Oct midday survey included entire Upper Harbor ≈ 2300 ft north of the Murray St Bridge

2. Work Area = Immediate Area around Murray St Bridge

3. Upper Harbor = Work Area to 500 north of Work Area

4. Lower Harbor = Work Area to Harbor Launch

5. Unknown Marine Mammal due to Darkness

6. "Raft" of 7 CASL foraging throughout the survey area

* Some individuals may have already been counted in other locations

TABLE B-2. Numbers of Animals Hauled Out & Haul-Out Locations within Murray Street Bridge Surveys

		CASL		HASE	
Date	**Time**	**# of animals-dock**	**Notes**	**# of animals-dock**	**Notes**
17-Sep	Morning			3-FF	2 flushed into water when I came within ≈ 30 ft[1]
17-Sep	Midday				
17-Sep	Evening				
17-Sep	Night				
20-Sep	Evening	1-AA			
20-Sep	Night	1-AA, 1-F	same CASL as evening survey still present on AA Dock, large bull CASL with white topknot on D Dock, coughing[2]		
21-Sep	Morning	1-F	large bull CASL with white topknot from 20-Sept still present		
21-Sep	Midday	1-AA, 1-E/F	Sub-adult male or female on end of AA Dock[3]; juvenile on cement wall along harbor[4]		
22-Sep	Night	1-D	large bull CASL with white topknot		
23-Sep	Morning	1-FD, 1-D	CASL on Fuel Dock, flushed when approached by fishermen; large bull CASL with white topknot on D Dock	1-FF, 1-F	HASE on F Dock flushed with arrival of "Velocity" charter boat crew
23-Sep	Midday				
29-Sep	Night				
30-Sep	Midday				
1-Oct	Morning	1-AA	sub-adult male or female CASL on end of AA Dock	2-FF	2 HASE on F Dock, growling at HASE in-water
2-Oct	Morning	1-AA	sub-adult male or female CASL on end of AA Dock	2-FF, 1-F	HASEs on FF flushed when I approached
6-Oct	Midday	1-AA	sub-adult male or female CASL on end of AA Dock[6]		
7-Oct	Morning			3-FF, 6-F	2 of 3 HASE on FF Dock flushed with arrival of kayakers
17-Oct	Midday				
21-Oct	Midday	1-FF	large bull CASL on rubber docks by UCSC Kayaks[7]		

Notes: CASL – California Sea Lion; HASE – Eastern Pacific Harbor Seal; *Survey Area = Harbor Launch Ramp Area (including Fuel Dock and Vessel Assist Dock) to 500 ft upstream of the Area of Impact

1. See Figure 5a
2. See Figure 5b
3. See Figure 5c
4. See Figure 5d, e
5. See Figure 5f
6. See Figure 5g
7. See Figure 5h

TABLE B-3: Existing Noise Levels – Murray Bridge Area (dBA)

Location	L_{90}	L_{50}	L_{eq}	L_1
Harbor entrance – 20 feet from Lake Avenue	51	60	62	69

TABLE B-4: Noise Levels of Construction Equipment (in dBA)

Equipment	Typical Noise Level (dBA) 50 ft from Source
Air Compressor	81
Backhoe	80
Compactor	82
Concrete Mixer	85
Concrete Pump	82
Concrete Vibrator	76
Crane, Derrick	88
Crane, Mobile	83
Dozer	85
Generator	81
Grader	85
Impact Wrench	85
Jack Hammer	88
Loader	85
Paver	89
Pile-driver (Impact)	101
Pile-driver (Sonic)	96
Pneumatic Tool	85
Pump	76
Rock Drill	98
Roller	74
Saw	76
Scraper	89
Truck	88

SOURCE: Transit Noise And Vibration Impact Assessment, May 2006, Federal Transit Administration, FTA-VA-90-1003-06 as cited in the City of Santa Cruz General Plan 2030 Draft EIR (September 2011).

TABLE B-5: **Murray Street Bridge Pile Driving - estimatedblows per pile for each pile type**

PILE TYPE	Estimated number of blows per pile*	Driving Duration (day/pile)
12-inch steel pipe piles	100	0.25
14-inch P/C Concrete	200	0.5
16-inch CISS	1000	0.5
24-inch CISS	1500	0.5
30-inch CIDH/CISS (land)	2500	1
30-inch CIDH/CISS (water)	2500	1.5
96-inch CIDH (land)	5000	1.5

* Pile blows estimate from data in "Technical Guidance for the Assessment of Hydroacoustic Effects of Pile Driving on Fish, October 2020.

hydroacoustic manual.2020

Estimate by mjc-January 2022

Attachment C
NOAA Tables

Table 1. Summary of Pile Driving Sound Impact Calculations for Marine Mammals - Murray Street Bridge (December 9, 2022)

Activity	Location	Pile in Water or on Land	Pile Type/Size	Driving Type	Data Source	Assumed Source Levels (dB) at 10 meters			Source Reference Distance	Attenuation K Factor		Distance to SELcum Criterion Threshold (meters)						Distance to Peak Criterion Threshold (meters)					
												Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds		Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
						Peak	SEL	RMS			Impact Criteria	183 dB	185 dB	155 dB	185 dB	203 dB		219	230	202	218	232
											Vibration Criteria	199 dB	198 dB	173 dB	201 dB	219						
Removal of existing bridge piles. Removal of dock FF&T piles	Bridge Bent 6. Dock FF&BY	water	14-inch P/C concrete	vibratory extractor	20" concrete proxy based upon NAVFAC SW (2022)	171	155	163	10	15		49	4	72	30	2						
Install new permanent bridge piles	Bridge Bents 5 though 8	water	30-in CISS	impact driver	Caltrans 2015. 30-inch steel pipe driven with impact driver.	210	NA	190	10	15		4447	158	5297	2380	173		3	NA	34	3	NA
Install new permanent bridge piles	Bridge Bents 5 though 8	water	30-in CISS	vibratory driver	Caltrans 2015. 30-inch steel pipe driven with vibratory driver.	196	175	159	10	15		14	1	20	8	1						
Install new permanent bridge piles	Bridge Bents 9	water	16-in CISS	impact driver	NMFS recommendations	200	175	185	10	15		464	17	553	248	18		NA	NA	7	NA	NA
Install new permanent bridge piles	Bridge Bents 9	water	16-in CISS	vibratory driver	Caltrans 2015. Table I.2-3. 18-inch steel pipe with vibratory driver. Prichard Lake	196	158	158	10	15		23	2	33	14	1						
Install new permanent bridge piles	Dock FF&T piles	water	14-inch P/C concrete	impact	NMFS recommendations	185	160	170	10	15		16	1	19	8	1		NA	NA	NA	NA	NA
Install new permanent bridge piles	Dock FF&T piles	water	14-inch P/C concrete	vibratory	Caltrans 2015. Table I.2-3. 18-inch steel pipe driven with vibratory driver. Prichard Lake	196	158	158	10	15		23	2	33	14	1						
Install new permanent bridge piles, Install new retaining wall piles	Bridge Bent 2 though 4	land[2]	30-in CIDH	impact	Caltrans 2015. Table I.2-3. 36-inch steel pipe driven on land with impact driver. North Fork Payette River Bridge.	202	171	185	10	15		241	9	287	129	9		NA	NA	10	NA	NA
Install new permanent bridge piles, Install new retaining wall piles	Bridge Bent 2 through 4	land[2]	30-in CIDH	vibratory[1]	Caltrans 2015. Table I.2-3. 36-inch steel pipe driven on land with impact driver. North Fork Payette River Bridge. 20 dB subtracted for vibratory.	NA	NA	165	10	15		34	3	51	21	1						
Install temporary trestle piles	Adjacent to bridge	water	12-inch steel pipe[3]	impact	Caltrans 2015. Table I.2-3. 12-in steel pipe driven with impact driver. Point Isabell Foundation repair.	192	NA	177	10	15		216	8	257	116	8		NA	NA	2	NA	NA
Install and remove temporary trestle piles	Adjacent to bridge	water	12-inch steel pipe[3]	vibratory	Caltrans 2015. Table I.2-2. 12-in steel pipe driven with vibratory driver.	171	155	155	10	15		23	2	33	14	1						

The reliability of predictions beyond 1,000 meters is limited. Caltrans recommends limiting prediction distances to 1,000 meters. (Caltrans 2015)

Attenuation calculated using the practical spreading model with K factor of 15. This equates to 4.5 dB per doubling of distance.

[1] Data in Caltrans 2015 suggests that vibratory RMS levels for large diameter steel pipes are about 20 dB less than impact RMS levels. Vibratory RMS level is estimated by subtracting 20 dB from impact RMS.

[2] Bent 4 is located in water during high tide. Results for 30-in CISS in water shown in 2nd and 3rd rows above would apply.

[3] 16-inch steel pipes may be used. Results for 16-in CISS shown in 4th and 5th rows above would apply.

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