SR 520 Pontoon Construction Site – Marine Piling Removal Project
UNDERWATER NOISE MONITORING REPORT

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INTRODUCTION

The Washington State Department of Transportation (WSDOT) removed 19 of 68 pilings and associated launch guide appurtenances associated with the State Route 520 (SR 520) floating bridge replacement project between January 26 and 28, 2021. The pilings and appurtenances had been used to guide completed pontoons out of the terrestrial casting basin and into Grays Harbor in preparation for transport to Lake Washington for the replacement of the SR 520 floating bridge. As part of the state-owned aquatic lands lease agreement with the Washington State Department of Natural Resources, the termination of the lease requires WSDOT remove 19 of the 68 pilings and associated launch guide appurtenances from the casting basin launch channel, which are located on state-owned aquatic lands.

The project occurred at the mouth of the Chehalis River where it enters Grays Harbor estuarine waters (Figures 1 and 2). Several marine mammal species may occur near the project site. The Marine Mammal Protection Act of 1972 prohibits the taking of marine mammals, which is defined as to "harass, hunt, capture or kill, or attempt to harass, hunt, capture or kill," except under certain situations. Section 101 (a) (5)(D) allows for the issuance of an incidental harassment authorization, provided an activity would result in no more than negligible impacts on marine mammals and would not adversely affect subsistence use of these animals.

The 19-steel pilings removed included the following:

- 48-inch steel piling – 1
- 24-inch steel piling – 17
- 18-inch steel piling – 1

The 19 pilings were in Grays Harbor at water depths ranging from -3.1 to -9.9 feet mean lower low water (MLLW).

Each of the 17 24-inch steel pilings were removed completely using a vibratory extractor. The 18-inch steel piling was removed by use of a barge-mounted crane, and did not require use of the vibratory extractor. The vibratory extractor was unable to remove the 48-inch steel piling. Scuba divers were deployed to cut the 48-inch steel piling 2 feet below the mud line. A crane was then used to remove the cut pile from Grays Harbor.

Underwater noise monitoring occurred on January 26, 2021, and included 3 distinct periods of operations:

- Baseline (no activity at or near the site)
- Vessel operations/barge positioning
- Piling removal

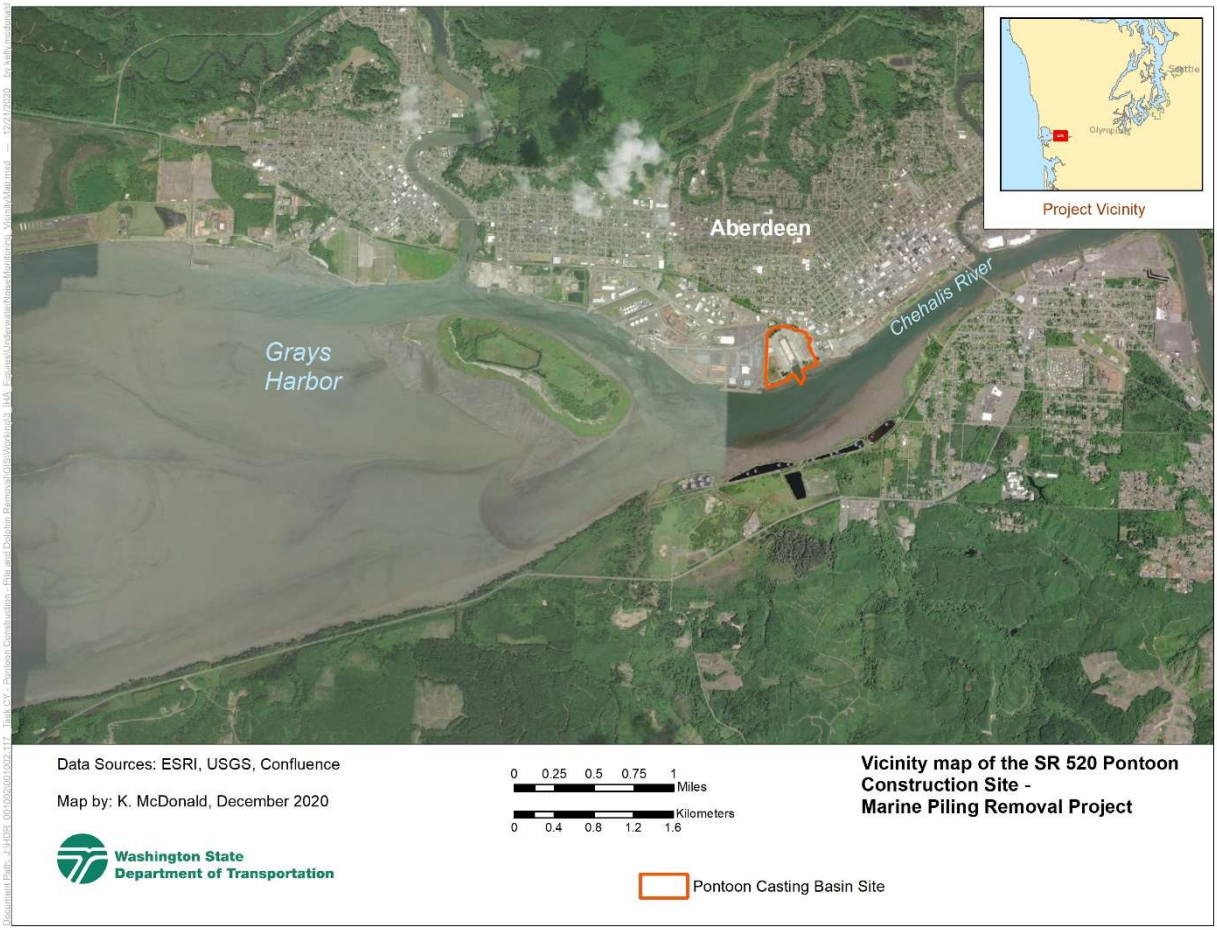

Figure 1. Vicinity Map of SR 520 Pontoon Construction Site – Marine Piling Removal Project

PROJECT AREA

The project was located at the mouth of the Chehalis River where it enters Grays Harbor estuarine waters (Figure 1), in USGS hydrologic unit 17100105 – Grays Harbor. Pilings were in water depths ranging from -3.1 to -9.9 feet (ft) mean lower low water (MLLW).

PILE REMOVAL LOCATION

The proposed activities occurred waterward of the Pontoon Casting Basin located in Grays Harbor in the City of Aberdeen, Washington (see Figures 1 and 2). Figure 2 indicates the location of the pile removal.

Figure 2. Location of 19 Pilings that were Removed

MONITORING EQUIPMENT

Table 2 below describes the equipment used for the underwater noise monitoring. The equipment was calibrated by the technicians at The Modal Shop.

Table 1. Equipment for underwater sound monitoring (hydrophone, signal amplifier, and calibrator). All have current National Institute of Standards and Technology traceable calibration.

Item	Specifications	Minimum Quantity	Usage
Hydrophone	Reson hydrophone 1Hz-170kHz, -211dB ±3dB re 1V/uPa[1]	2	Capture underwater sound pressures near the source and convert to voltages that can be recorded/analyzed by other equipment.
Environmental Noise & Building Acoustics Analyzer	Larson Davis Class 1 Integrating SLM/Analyzer. 831 with ELA LOG, and IH options.	1	Capture airborne sound and environmental noise.
Calibrator (pistonphone-type)	GRAS Pistonphone Calibrator, for 1", 1/2", and ¼" microphone, 114Db @ 250Hz.	1	Conduct calibration check of hydrophone in the field.
Digital Signal Analyzer	Sampling Rate- 48kHz or greater	1	Analyze and transfer digital data to laptop hard drive.
Laptop computer or Digital Audio Recorder	Compatible with digital signal analyzer	1	Record digital data on hard drive or digital tape.
Real Time and Post-analysis software	-	1	Monitor real-time signal and post-analysis of sound signals.

[1] Confluence was unable to rent a more sensitive hydrophone for background measurement and WSDOT agreed that this hydrophone would suffice.

UNDERWATER NOISE MONITORING

Monitoring and removal operations occurred on January 26, 2021, from a monitoring vessel, with baseline monitoring occurring at location A, and removal operations monitoring occurring at locations B-D (Figure 3). During monitoring, the monitoring vessel was either tied to a piling

for baseline monitoring (location A) or anchored for removal operations (locations B-D). The hydrophone was at a depth of approximately 2 meters for all monitoring efforts. On January 26, low tide was at 3:00 AM with a predicted height of 4.49 feet MLLW, and high tide was at 11:03 AM with a predicted height of 10.64 feet MLLW (NOAA Station 9441187, Aberdeen, WA). Weather was overcast, with light to moderate wind during the noise monitoring period and light, intermittent rain occurring at the end of the monitoring period. The configuration of the barge, crane, and vibratory hammer during typical operations is shown in Figure 4. Underwater noise levels observed are reported in Table 2.

Baseline Conditions (Location A)

Underwater noise monitoring for baseline conditions began at approximately 6:30 AM on January 26, 2021, and continued for slightly more than 1 hour until about 7:45 AM. During the baseline monitoring period, a U.S. Army Corps of Engineers dredge operation was occurring approximately 1.2 miles downstream of Port of Grays Harbor Terminal 2. No vessel operations or marine mammals were observed during the monitoring period. The monitoring vessel was moored at the most waterward piling on the eastern edge of the launch channel during baseline monitoring, which was the 18-inch steel pile. The hydrophone was suspended approximately 2 meters (6 feet) below the water's surface.

Vessel Relocation (Location B)

Monitoring equipment collected underwater noise levels during the arrival and positioning of the barge-mounted crane. During this monitoring period, the hydrophone was approximately 2 meters (6 feet) below the water's surface and the monitoring vessel was anchored just west of the outermost piling along the western edge of the site.

Vibratory Pile Removal – 48-inch steel pipe pile (Location B)

The monitoring vessel was at anchor on the west side of the pile, approximately 20 meters from the 48-inch steel pile and removal operation at the closest point deemed safe for monitoring. During the pile removal attempt at the 48-inch pile the work crew made 2 distinct attempts. The initial attempt lasted approximately 15 minutes. Following a brief pause a second attempt was made to extract the pile with a notably higher level of energy exerted by the vibratory hammer on the pile. Underwater noise levels were correlated with the level of energy exerted by the hammer on the pile during the respective phases of removal. Ultimately, the 48-inch pile did not release from the substrate during either phase of the removal attempt. Scuba divers were deployed on a subsequent day to cut the pile below the mudline and the cut pile was extracted by barge-mounted crane.

Vibratory Pile Removal – 24-inch steel pipe pile (Location C)

The monitoring vessel was at anchor on the west side of the 24-inch pile, approximately 25 meters from the pile. During pile removal, the crew lifted the pile released after approximately 30 seconds of vibration and was raised to a height of approximately 40 feet above initial location, with the vibratory pile driver still operating. In total, the vibratory hammer was active for approximately 7 minutes 40 seconds. At this point the removal operation paused as lifting points were cut in the upper segment of the pile. The pile was cut approximately 10 feet above the waterline. The upper pile segment was then lifted onto the barge, and the lower pile

segment was refitted with a loop and the crane was used to simply pull the remaining pile segment from the substrate. The removal of the remaining pile segment was rapid.

Vibratory Pile Removal – 24-inch steel pipe pile (Location D)

Prior to removal, lifting points were added to the top of the pile. During pile removal, the crew lifted the pile after approximately 30 seconds of vibration and the pile was raised to a height of approximately 40 feet above initial height while the pile driver continued to operate. In total, the vibratory hammer was active for approximately 6 minutes 40 seconds. At this point the removal operation paused as the pile was cut approximately 10 feet above the waterline. The remaining segment of the pile was removed by the crane, as described in the section above.

FINDINGS

The underwater noise monitoring receiver (Larson Davis 831) experienced a memory failure at approximately 8 AM, just prior to initiation of pile removal with the vibratory pile driver. This failure caused most previously recorded data to become unavailable and prevented the storage of monitoring data during pile removal. The equipment continued to provide real-time measurements that were similar to measurements pre-failure and were therefore considered to be valid. Efforts to re-calibrate the equipment with the pistonphone also suggested the equipment was providing valid real-time readings despite its failure to transfer those readings to memory.

Real-time readings after 9:40 AM were made by recording a video of the Larson Davis receiver screen during each activity. This provided a real-time readout of dB_{RMS} and dB_{PEAK} values, which are those reported in Table 2.

Observations during the background monitoring period appeared to be below the sensitivities of the microphone and receiver set-up used for this monitoring effort. The only detected sounds above baseline were transient noise associated with the vessel hitting the piling to which it was moored. These observations suggest that the monitoring noise reported in Table 2 for baseline underwater noise are maximum noise levels and that actual noise levels were below these levels.

The failure of the onboard memory prevents more detailed spectral analysis and evaluation of the electronic recordings of background and pile removal monitoring.

Figure 3. Location of the Monitoring at the Casting Basin Pile Removal Site

Figure 4. Vibratory Hammer Removal Operation on 24-Inch Piling

Table 2. Underwater Noise Observations

Underwater Noise Monitoring Activity	Time (AM)	Observer Distance	Approx. Water Depth (ft)	Distance to Water's Edge (ft)	dB_{rms}	dB_{peak}	SEL	Sound Exposure A	Activity Duration
(A) Baseline	6:30-7:45	N/A	13	180	112.0*	150.9*			75:00
(B) Vessel Relocation	7:45-7:50	30 m	10	250	141.2	179.1	165.7	14.99MPa2s	04:45
(B) Pile Removal (48-inch: initial effort)	9:30- 9:47	20 m	12	280	145.4	161.3			5:20
(B) Pile Removal (48-inch: high power)		20 m	12	280	154.6	171.0			0:55
(C) Pile Removal (24-inch: initial pull)	10:15-10:26	25 m	11	350	144.4	161.3			3:39
(C) Pile Removal (24-inch: second pull)		25 m	11	350	143.6	157.2			4:05
(D) Pile Removal (24-inch)	11:18-11:27	25 m	11	350	145.3	163.9			7:24

* Observations at or near minimum reportable values by receiver equipment and represent the maximum potential values of underwater noise at the site. Actual underwater noise levels are likely lower and would require more sensitive equipment than available for this monitoring effort.