

Naval Base Kitsap-Bangor Explosives Handling Wharf 2

Year 2 Marine Mammal Monitoring Report (2013–2014)

BANGOR, WASHINGTON



April 2014



Prepared by:



Suggested Citation

Department of Navy (DoN), 2014. Naval Base Kitsap at Bangor Explosives Handling Wharf 2, Bangor Washington. Draft Year 2 Marine Mammal Monitoring Report. Prepared by Hart Crowser, Inc. for Naval Facilities Engineering Northwest, Silverdale, WA. March 2014.

ACRONYMS AND ABBREVIATIONS

APE	American Piledriving Equipment
BSS	Beaufort sea state
cfm	cubic feet per minute
cm	centimeters
CMP	Construction Monitoring Program
dB	decibel
° F	degrees Fahrenheit
EHW-1	Explosives Handling Wharf #1
EHW-2	Explosives Handling Wharf #2
ESA	Endangered Species Act
ft	foot/feet
ft-lbs	foot-pounds
GPS	global positioning system
IHA	Incidental Harassment Authorization
km	kilometers
km ²	square kilometers
m	meters
MC	monitoring coordinator
MMO	marine mammal observer
MMPA	Marine Mammal Protection Act
mph	miles per hour
NBK	Naval Base Kitsap
NMFS	National Marine Fisheries Service
PPE	personal protective equipment
PSB	Port Security Barrier
re	referenced to
μPa	micropascal
TPP	Test Pile Program
WRA	Waterfront Restricted Area

Table of Contents

ACRONYMS AND ABBREVIATIONS.....	INSIDE FRONT COVER
SECTION 1 INTRODUCTION.....	3
SECTION 2 METHODS	3
SECTION 3 RESULTS	24
SECTION 4 RECOMMENDATIONS.....	46
SECTION 5 LIST OF PREPARERS.....	47
SECTION 6 REFERENCES.....	47

Tables

Table 1. Project Staff	6
Table 2. Summary of Construction Monitoring Effort	9
Table 3. Total Number of Unique Animals and Sightings by Species (Primary Surveys).....	25
Table 4. Total Number of Unique Animals and Sightings by Species (Non-Primary Surveys)	28
Table 5. Summary of Unique Marine Mammal Sightings during Pile Installation and Removal Activities (Primary Surveys)	29
Table 6. Summary of Observed Level B Harassment Takes	30
Table 7. Summary of Observed Level B Harassment Takes Per Production Pile.....	31
Table 8. Extrapolated Level B Harassment Takes in the Unmonitored Area of the Behavioral Harassment Zone	32
Table 9. Summary of Observed and Extrapolated Level B Harassment Takes.....	32
Table 10. Marine Mammal Mitigation Delays and Shutdowns.....	34

Figures

Figure 1. Vicinity Map.....	4
Figure 2. Project Area	5
Figure 3. Typical Observer Monitoring Platforms during Marine Mammal Monitoring.....	8
Figure 4. Marine Mammal Monitoring Zones for Impact and Vibratory Pile Driving	14
Figure 5. Modeled Vibratory Harassment Zone for Marine Mammals	16

Figure 6. Year 2 Production Pile Locations.....21

Figure 7. All California Sea Lion Sightings26

Figure 8. All Harbor Seal Sightings.....27

Figure 9a. Sightings by Sea State36

Figure 9b. Sightings by Weather Condition36

Figure 10a. California Sea Lion Behaviors Before, During and After Construction:
Primary.....38

Figure 10b. California Sea Lion Behaviors By Construction Type: Primary.....38

Figure 11a. Harbor Seal Behaviors Before, During and After Construction: Primary.....39

Figure 11b. Harbor Seal Behaviors By Construction Type: Primary39

Figure 12. Marine Mammal Behaviors: Non-Primary Based Surveys40

Figure 13. Relative Motion of Marine Mammals by Construction Event41

Figure 14. Average Air and Water Temperatures in the WRA44

Figure 15. Wind Speed in the WRA45

Appendices

- A. Department of the Navy Trident Support Facilities Explosives Handling Wharf (EHW-2) Final Marine Mammal Monitoring Plan
- B. All In-Water Noise-Producing Events during the Year 2 EHW-2 CMP
- C. Marine Mammal Sighting Form and Data Codes
- D. Pile Survey Table
- E. Bubble Curtain and Bubble Pile Specifications
- F. Marine Mammal Sightings
- G. Weather Conditions

Section 1 Introduction

This report summarizes the Year 2 marine mammal monitoring effort implemented for the Trident Support Facilities Explosives Handling Wharf #2 (EHW-2) Construction Monitoring Program (CMP) that occurred from 16 July 2013 to 15 February 2014 at Naval Base Kitsap (NBK) at Bangor. The purpose of the EHW-2 CMP is to provide marine mammal and marbled murrelet monitoring during pile installation required to construct the new wharf (DoN 2012).

Discussion of the Year 1 EHW-2 CMP, which occurred from 28 September 2012 to 14 February 2013, is presented in a separate report (DoN 2013). Marine mammal monitoring for the Year 2 EHW-2 CMP occurred from 16 July 2013 to 15 February 2014. Work consisted of marine mammal monitoring during EHW-2 pile driving activities with impact and vibratory hammers.

The marine mammal monitoring performed for this project was intended to meet all requirements of applicable permits and consultations in order to ensure compliance with the Marine Mammal Protection Act (MMPA) permit and Endangered Species Act (ESA). Marine mammal monitoring performed for this project followed procedures and requirements in the EHW-2 Marine Mammal Monitoring Plan (Monitoring Plan; **Appendix A**). The Monitoring Plan was developed in coordination with the National Marine Fisheries Service (NMFS) to ensure compliance with the terms and conditions of the Incidental Harassment Authorization (IHA) issued for in-water construction (NMFS 2013). The Monitoring Plan included the requirement that a marine mammal monitoring report be prepared and submitted to the Navy. This document is meant to satisfy that reporting requirement.

Section 2 Methods

Project Area

NBK at Bangor, Washington is located on the Hood Canal approximately 20 miles (32.2 kilometers [km]) due west of Seattle, Washington (**Figure 1**). NBK at Bangor provides berthing and support services to U.S. Navy submarines and other fleet assets. The EHW-2 site was located within the Waterfront Restricted Area (WRA) at NBK at Bangor, immediately south of the existing Explosives Handling Wharf #1 (EHW-1) structure (**Figure 2**). Marine mammal

monitoring was focused within this area and the waters immediately adjacent to the WRA, where sound pressure levels associated with pile installation and removal activities could potentially be transmitted at levels that could affect marine mammals.



Figure 1. Vicinity Map

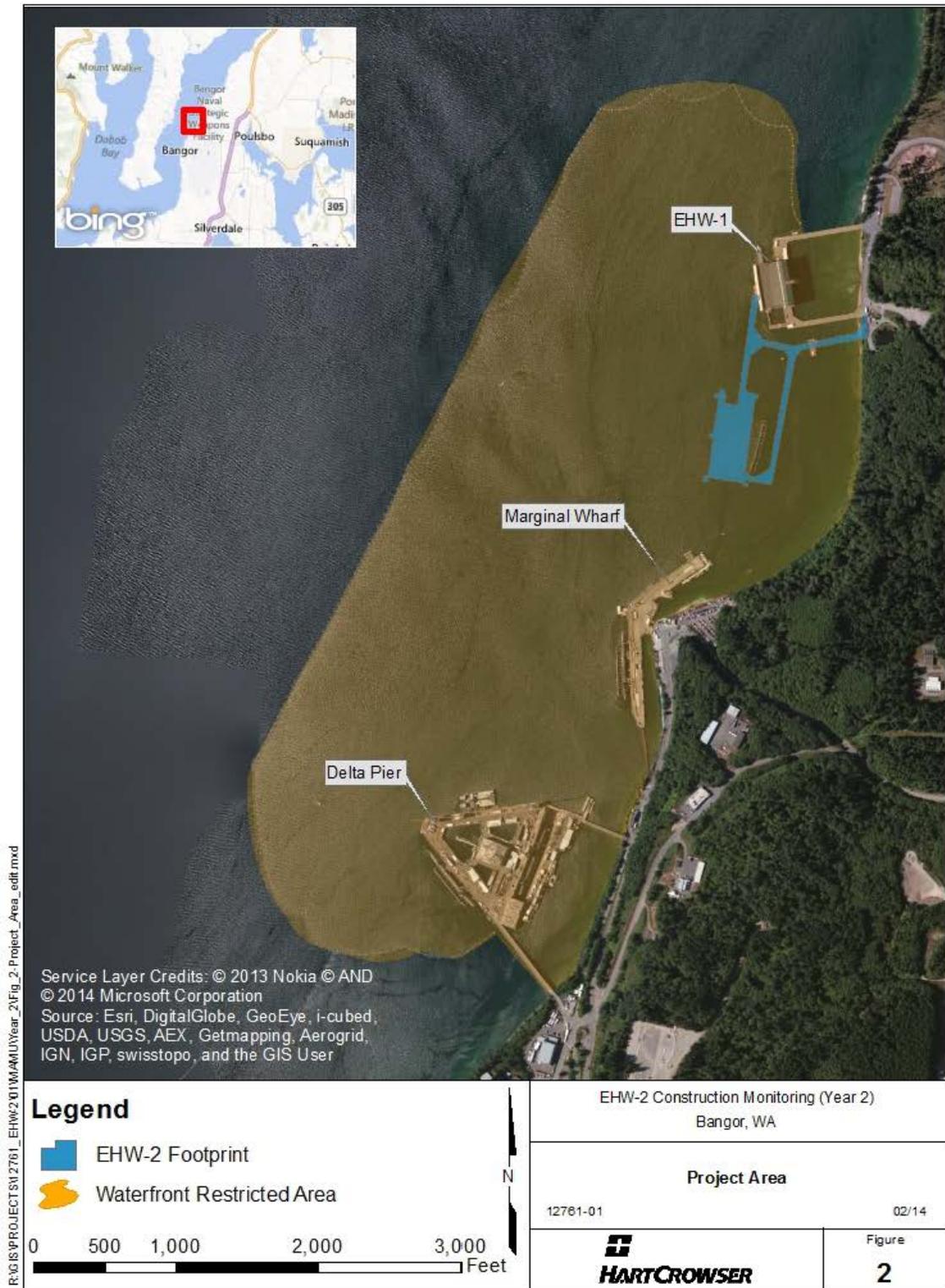


Figure 2. Project Area

Project Staffing

Staff for the Year 2 EHW-2 CMP (**Table 1**) included the Project Managers, the Monitoring Coordinators (MC), Marbled Murrelet Observers, and Marine Mammal Observers (MMOs). All MCs and MMOs were experienced in marine mammal identification, and had extensive knowledge of the biology and behavior of locally occurring marine species. With few exceptions, all MCs and MMOs had been observers for one or more of the following previous marine mammal monitoring efforts at Bangor: (1) the 2011 Test Pile Program (TPP) for NBK at Bangor, (2) the 2011/2012 EHW-1 Pile Replacement Project, and (3) the Year 1 EHW-2 CMP monitoring efforts. All marine mammal observers were dedicated to that task and served no other function while conducting observations.

Table 1. Project Staff

Name	Role(s)	Company
Hans Hurn	Project Manager / MC	Hart Crowser
Jeff Barrett	Project Manager / MC	Hart Crowser
Caanan Cowles	MC	Hart Crowser
Emily Duncanson	MC	Hart Crowser
Jim Starkes	MC	Hart Crowser
Michelle Havey	MC	Hart Crowser
Beth Sosik	MMO	Hart Crowser
Diane Hennessey	MMO	Hart Crowser
Dana Spontak	MMO	HDR
Jamey Selleck	MMO	Hart Crowser
Jim Shannon	MMO	Hart Crowser
Kelsey Donahue	MMO	Hart Crowser
Kerry Hosken	MMO	Hart Crowser
Nick Galvin	MMO	Hart Crowser
Maria Sandercock	MMO	Hart Crowser
Paula von Weller	MMO	Hart Crowser
Pete Heltzel	MMO	Hart Crowser
Stephanie Hawks-Johnson	MMO	Hart Crowser
Steve Hall	MMO	Hart Crowser
Suzanne Faubl	MMO	Hart Crowser

Marine Mammal Monitoring Platforms

The Monitoring Plan required that MMOs be positioned at the best practicable vantage points, taking into consideration security, safety, and space limitations on the waterfront. A minimum of two monitors were used for marine mammal monitoring (one MC dedicated to monitor the shutdown zone and one boat-based monitor focused on observations on the buffer zone; **Figure 3**). Typically, the MC was stationed with a supplementary MMO to provide additional monitoring of the shutdown zone from the barge. This allowed the MC to effectively coordinate with observers and the pile driving foreman. Additional MMOs were used to monitor the shutdown zone as needed. For example, if more than one pile was being driven simultaneously; additional MMOs were assigned to observe the shutdown zone of each pile.

Vessel-based Monitoring. Vessels were used as observation platforms and for transportation to pile driving barges. The year 2 EHW-2 CMP included one 32-foot (9.8-meter [m]) fiberglass-hulled Bayliner, which was used as the primary monitoring platform for the MMO conducting surveys of the buffer zone. A 26-foot tugboat and several other smaller vessels were used for transportation of personnel and equipment, and as monitoring platforms as needed. Vessels were equipped with VHF radios and depth sounders. All captains were United States Coast Guard-certified and were familiar with the Puget Sound waterways and the unique characteristics of the region. MMO monitoring vessels were equipped with elevated observation platforms, which provided maximum viewing capability. The MMO monitoring vessels' observation platforms were approximately 3 to 4 m (9.8 to 13.1 feet [ft]) above the water line.

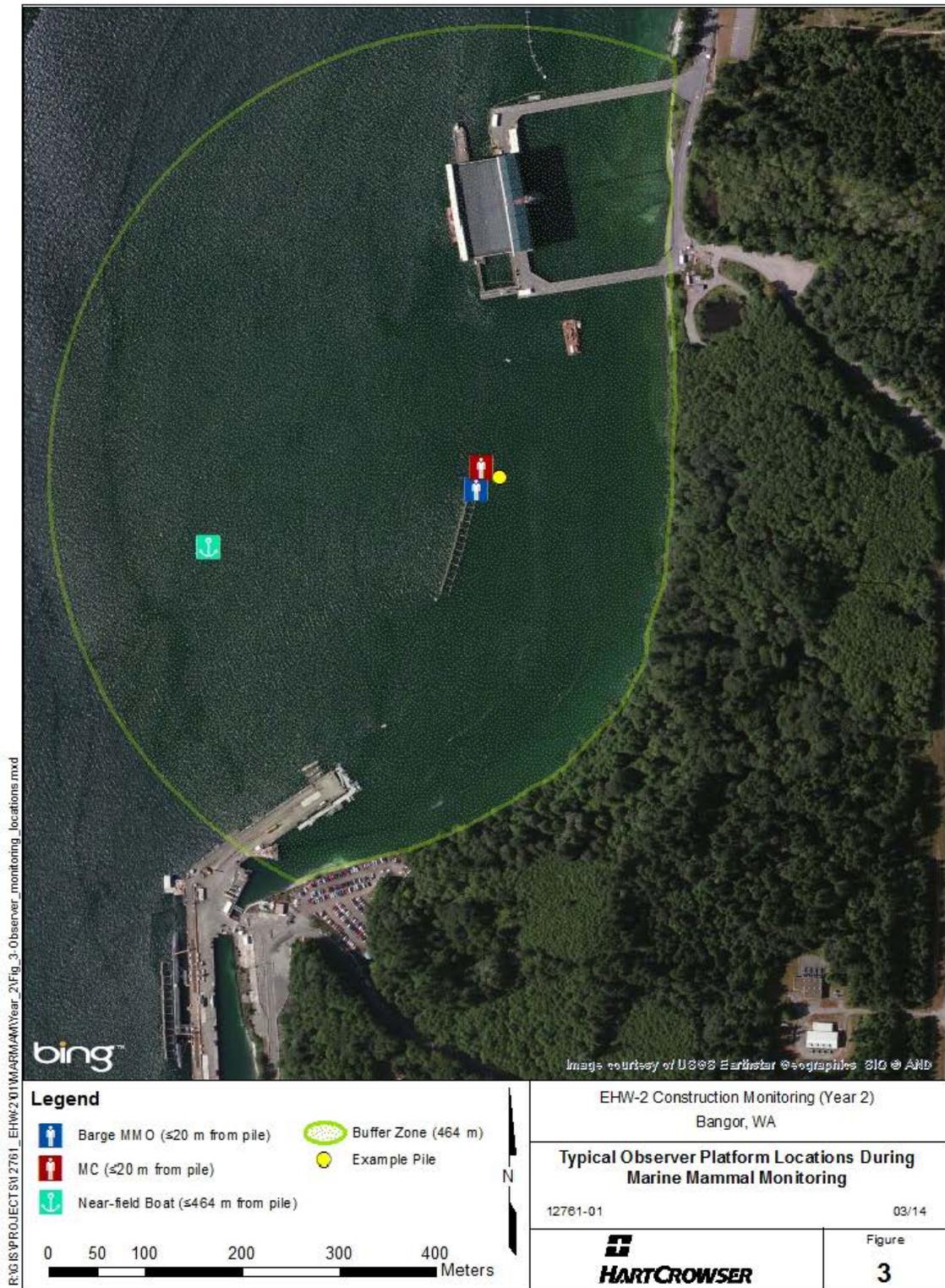


Figure 3. Typical Observer Monitoring Platforms during Marine Mammal Monitoring

Pier- and Barge-based Monitoring. The MC was typically located on the construction barge, and served as an additional marine mammal observer as needed from that relatively stationary location. The MC was typically 5–20 m (16–66 ft) from the pile, and at all times had a view of most of the shutdown zone. Since the MC typically served as an additional marine mammal observer to compliment the boat- and barged-based MMOs required by the protocol, the MCs were not required to have full observation of the shutdown zone at all times. However, in the event that the MC was the primary observer of the shutdown zone, the MC was positioned to provide full coverage of the shutdown zone. The MC was positioned in close proximity to the construction foreman or in the foreman’s line-of-sight, and each pile driving event was communicated between the foreman and MC. The MC would transmit the pile specifications and other details to the observers and vessel captains, all of whom monitored the same radio channel. The MC logged pile driving times and related construction activities for each pile (**Appendix B**). This served as the basis for data quality control of marine mammal sightings.

Monitoring Summary

In total, 1,247 hours and 27 minutes of marine mammal surveys were conducted on 162 construction days during the course of the Year 2 EHW-2 CMP (**Table 2**).

Table 2. Summary of Construction Monitoring Effort

Date	Start Time (hh:mm)	End Time (hh:mm)	Total Time (hh:mm)
7/18/2013	7:00 AM	9:15 AM	2:15
7/19/2013	7:20 AM	2:30 PM	7:10
7/22/2013	9:00 AM	5:00 PM	8:00
7/23/2013	8:15 AM	4:44 PM	8:29
7/24/2013	8:50 AM	4:38 PM	7:48
7/25/2013	7:39 AM	6:35 PM	10:56
7/26/2013	7:35 AM	5:28 PM	9:53
7/27/2013	7:40 AM	4:49 PM	9:09
7/29/2013	8:30 AM	5:00 PM	8:30
7/30/2013	9:00 AM	5:14 PM	8:14
7/31/2013	8:05 AM	5:26 PM	9:21
8/1/2013	7:41 AM	6:06 PM	10:25
8/2/2013	8:22 AM	5:22 PM	9:00
8/3/2013	7:15 AM	2:18 PM	7:03
8/5/2013	7:40 AM	4:57 PM	9:17
8/6/2013	7:31 AM	4:28 PM	8:57

Date	Start Time (hh:mm)	End Time (hh:mm)	Total Time (hh:mm)
8/7/2013	7:23 AM	5:03 PM	9:40
8/8/2013	7:25 AM	5:12 PM	9:47
8/9/2013	7:25 AM	5:32 PM	10:07
8/12/2013	7:51 AM	4:34 PM	8:43
8/13/2013	7:13 AM	4:55 PM	9:42
8/14/2013	7:19 AM	5:21 PM	10:02
8/15/2013	7:30 AM	5:21 PM	9:51
8/16/2013	7:17 AM	3:36 PM	8:19
8/19/2013	7:20 AM	5:32 PM	10:12
8/20/2013	7:30 AM	4:40 PM	9:10
8/21/2013	8:21 AM	4:42 PM	8:21
8/22/2013	7:00 AM	4:40 PM	9:40
8/26/2013	7:20 AM	5:23 PM	10:03
8/27/2013	7:20 AM	2:55 PM	7:35
8/28/2013	8:00 AM	4:47 PM	8:47
8/29/2013	8:00 AM	4:37 PM	8:37
8/30/2013	7:48 AM	3:53 PM	8:05
9/3/2013	8:56 AM	4:27 PM	7:31
9/4/2013	7:50 AM	4:22 PM	8:32
9/5/2013	8:35 AM	5:47 PM	9:12
9/6/2013	7:35 AM	4:54 PM	9:19
9/9/2013	9:55 AM	5:44 PM	7:49
9/10/2013	10:00 AM	6:10 PM	8:10
9/11/2013	7:50 AM	5:12 PM	9:22
9/12/2013	8:00 AM	5:06 PM	9:06
9/13/2013	8:44 AM	5:23 PM	8:39
9/16/2013	9:04 AM	4:27 PM	7:23
9/17/2013	7:40 AM	4:24 PM	8:44
9/18/2013	7:40 AM	4:37 PM	8:57
9/19/2013	7:40 AM	3:30 PM	7:50
9/23/2013	8:25 AM	4:48 PM	8:23
9/24/2013	7:40 AM	5:39 PM	9:59
9/25/2013	7:58 AM	4:53 PM	8:55
9/26/2013	7:58 AM	4:58 PM	9:00
9/27/2013	1:05 PM	3:57 PM	2:52
9/28/2013	8:00 AM	10:45 AM	2:45
9/30/2013	9:08 AM	4:46 PM	7:38
10/1/2013	7:30 AM	5:12 PM	9:42
10/2/2013	7:30 AM	3:48 PM	8:18
10/3/2013	8:00 AM	3:57 PM	7:57
10/4/2013	7:46 AM	5:35 PM	9:49
10/7/2013	9:46 AM	5:35 PM	7:49
10/8/2013	7:45 AM	4:48 PM	9:03
10/9/2013	9:15 AM	5:38 PM	8:23
10/10/2013	8:30 AM	6:00 PM	9:30
10/11/2013	7:45 AM	5:59 PM	10:14

Date	Start Time (hh:mm)	End Time (hh:mm)	Total Time (hh:mm)
10/12/2013	7:05 AM	2:00 PM	6:55
10/14/2013	8:00 AM	4:00 PM	8:00
10/15/2013	8:00 AM	6:33 PM	10:33
10/16/2013	8:00 AM	3:30 PM	7:30
10/17/2013	9:13 AM	5:20 PM	8:07
10/18/2013	8:45 AM	6:06 PM	9:21
10/19/2013	11:20 AM	5:15 PM	5:55
10/21/2013	10:45 AM	5:25 PM	6:40
10/22/2013	8:40 AM	6:11 PM	9:31
10/23/2013	10:30 AM	6:14 PM	7:44
10/24/2013	12:30 PM	5:32 PM	5:02
10/25/2013	8:20 AM	5:28 PM	9:08
10/26/2013	8:16 AM	6:09 PM	9:53
10/29/2013	10:45 AM	6:09 PM	7:24
10/30/2013	8:30 AM	5:57 PM	9:27
10/31/2013	8:15 AM	4:54 PM	8:39
11/1/2013	8:15 AM	5:45 PM	9:30
11/4/2013	8:45 AM	5:08 PM	8:23
11/5/2013	7:15 AM	5:20 PM	10:05
11/6/2013	8:15 AM	4:38 PM	8:23
11/8/2013	8:30 AM	12:35 PM	4:05
11/9/2013	8:20 AM	5:01 PM	8:41
11/11/2013	7:54 AM	4:44 PM	8:50
11/12/2013	8:01 AM	5:23 PM	9:22
11/13/2013	8:04 AM	4:05 PM	8:01
11/14/2013	8:30 AM	5:01 PM	8:31
11/15/2013	8:00 AM	3:50 PM	7:50
11/16/2013	8:00 AM	4:23 PM	8:23
11/18/2013	9:00 AM	3:52 PM	6:52
11/19/2013	8:15 AM	3:28 PM	7:13
11/20/2013	8:05 AM	3:52 PM	7:47
11/21/2013	8:37 AM	3:05 PM	6:28
11/22/2013	10:00 AM	3:20 PM	5:20
11/23/2013	7:45 AM	2:49 PM	7:04
11/25/2013	9:00 AM	1:43 PM	4:43
11/26/2013	10:45 AM	2:05 PM	3:20
11/27/2013	2:20 PM	3:37 PM	1:17
12/2/2013	10:10 AM	1:39 PM	3:29
12/3/2013	10:11 AM	3:00 PM	4:49
12/4/2013	8:15 AM	3:27 PM	7:12
12/5/2013	8:15 AM	4:00 PM	7:45
12/6/2013	8:30 AM	3:15 PM	6:45
12/7/2013	8:20 AM	12:35 PM	4:15
12/9/2013	12:30 PM	3:50 PM	3:20
12/10/2013	8:33 AM	3:20 PM	6:47
12/11/2013	8:48 AM	2:42 PM	5:54

Date	Start Time (hh:mm)	End Time (hh:mm)	Total Time (hh:mm)
12/12/2013	8:30 AM	3:30 PM	7:00
12/13/2013	8:10 AM	2:20 PM	6:10
12/14/2013	9:20 AM	3:30 PM	6:10
12/16/2013	1:30 PM	4:03 PM	2:33
12/17/2013	10:10 AM	4:03 PM	5:53
12/18/2013	9:10 AM	3:33 PM	6:23
12/19/2013	7:55 AM	4:22 PM	8:27
12/21/2013	8:15 AM	3:58 PM	7:43
12/23/2013	8:27 AM	12:06 PM	3:39
12/23/2013	12:07 PM	4:28 PM	4:21
12/24/2013	8:11 AM	11:37 AM	3:25
12/27/2013	8:30 AM	3:17 PM	6:47
12/28/2013	8:00 AM	4:30 PM	8:30
12/30/2013	9:00 AM	2:30 PM	5:30
12/31/2013	8:00 AM	2:42 PM	6:42
12/31/2013	11:01 AM	1:47 PM	2:46
1/2/2014	8:25 AM	4:38 PM	8:13
1/3/2014	8:30 AM	3:16 PM	6:46
1/4/2014	8:30 AM	3:48 PM	7:18
1/6/2014	1:45 PM	2:15 PM	0:30
1/7/2014	9:01 AM	3:18 PM	6:17
1/8/2014	8:05 AM	2:17 PM	6:12
1/9/2014	8:05 AM	5:08 PM	9:03
1/10/2014	8:05 AM	3:34 PM	7:29
1/12/2014	9:00 AM	2:27 PM	5:27
1/13/2014	11:45 AM	4:01 PM	4:16
1/14/2014	8:30 AM	4:53 PM	8:23
1/15/2014	7:45 AM	4:57 PM	9:12
1/16/2014	10:00 AM	4:35 PM	6:35
1/17/2014	9:20 AM	5:06 PM	7:46
1/18/2014	8:10 AM	4:49 PM	8:39
1/20/2014	8:15 AM	2:34 PM	6:19
1/21/2014	8:10 AM	4:12 PM	8:02
1/22/2014	8:00 AM	4:58 PM	8:58
1/23/2014	7:58 AM	4:18 PM	8:20
1/24/2014	8:45 AM	4:34 PM	7:49
1/25/2014	8:15 AM	5:00 PM	8:45
1/26/2014	8:10 AM	1:30 PM	5:20
1/27/2014	8:10 AM	4:08 PM	7:58
1/28/2014	8:18 AM	4:55 PM	8:37
1/29/2014	9:07 AM	4:37 PM	7:30
1/30/2014	8:15 AM	5:32 PM	9:17
1/31/2014	8:00 AM	5:02 PM	9:02
2/1/2014	8:00 AM	5:39 PM	9:39
2/3/2014	8:11 AM	12:15 PM	4:04
2/4/2014	8:20 AM	4:36 PM	8:16

Date	Start Time (hh:mm)	End Time (hh:mm)	Total Time (hh:mm)
2/5/2014	8:20 AM	5:42 PM	9:22
2/6/2014	8:50 AM	5:30 PM	8:40
2/7/2014	7:45 AM	5:08 PM	9:23
2/8/2014	7:40 AM	5:16 PM	9:36
2/10/2014	8:15 AM	3:40 PM	7:25
2/13/2014	7:15 AM	5:46 PM	10:31
2/14/2014	7:00 AM	4:54 PM	9:54
2/15/2014	7:00 AM	3:22 PM	8:22
TOTAL			1247:27:48

Monitoring Zones

The analysis of TPP and Year 1 EHW-2 CMP acoustic data (Illingworth and Rodkin 2013), and modeling results (presented within the Environmental Assessment, Biological Assessment, and the IHA) were used to develop the shutdown and buffer zones for pile installation and removal activities associated with the EHW-2 CMP. While the acoustic zones of influence varied among the different diameter piles and types of installation and removal methodologies, shutdown and buffer zones were based on the maximum zone of influence for all pile installation and removal activities. Monitoring of these zones and the implementation of other minimization measures, such as the use of sound attenuation devices, were designed to reduce the impacts of underwater sound from pile driving and removal on marine mammals.

Shutdown Zone. The shutdown zone included all areas where the underwater sound pressure levels were anticipated to equal or exceed the Level A (injury) Harassment criteria for marine mammals (180 decibels referenced to 1 micropascal [dB re 1 μ Pa] isopleths for cetaceans; 190 dB re 1 μ Pa isopleths for pinnipeds). For vibratory pile installation and removal, monitors enforced a 10-m (32.8-ft) shutdown zone, which encompassed the Level A Harassment zones for cetaceans and pinnipeds (**Figure 4**). For impact pile installation, monitors enforced a 20-m (65.6-ft) shutdown zone for pinnipeds and an 85-m (278.9-ft) shutdown zone for cetaceans (**Figure 4**). The 10-m shutdown zone was also monitored during other activities with the potential to affect marine mammals, including movement of a barge to the pile location, and the removal or insertion of a pile from the water column via a crane (“dead pull” and “stabbing,” respectively).

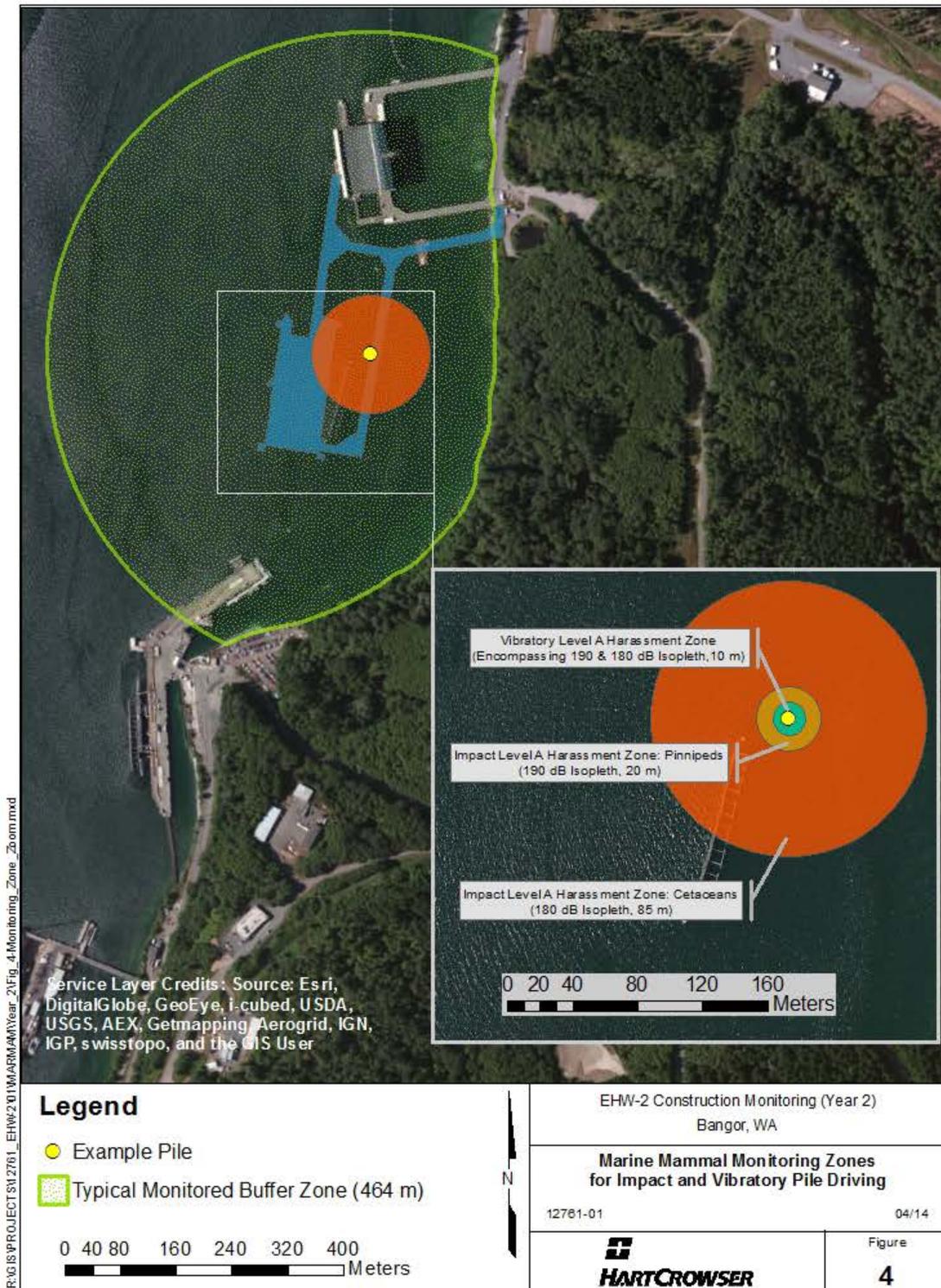


Figure 4. Marine Mammal Monitoring Zones for Impact and Vibratory Pile Driving

Buffer Zone. Although a buffer zone (Level B harassment, 120 dB isopleth) for vibratory pile removal was predicted to have an area of 41.4 square kilometers (km²; 16.0 square miles), monitoring an area of that size would have been impractical (**Figure 5**). Instead, MMOs used the NMFS-approved 464-m (1522-ft)-radius buffer zone (160 dB isopleth) as a guideline for placement of marine mammal monitoring platforms during vibratory pile driver activity (**Figure 4**; DoN 2012). However, all identifiable marine mammals, regardless of whether inside or outside the 464-m zone, were recorded.

Observer Monitoring Locations

In order to monitor buffer and shutdown zones, MMOs were positioned at various vessel-, pier-, and land-based vantage points, taking into consideration security, safety, and space limitations at the NBK at Bangor waterfront (**Figure 3**). One monitoring vessel was positioned inside the WRA. MMOs also frequently monitored the shutdown zone from the construction barge. The MC was stationed with a supplementary MMO to provide additional monitoring of the shutdown zone from the barge. This allowed the MC to effectively coordinate with observers and the pile driving foreman. Additional MMOs were placed on barges to monitor the shutdown zone as needed. For example, if more than one pile was being driven simultaneously, additional MMOs were assigned to observe the shutdown zone of each pile.

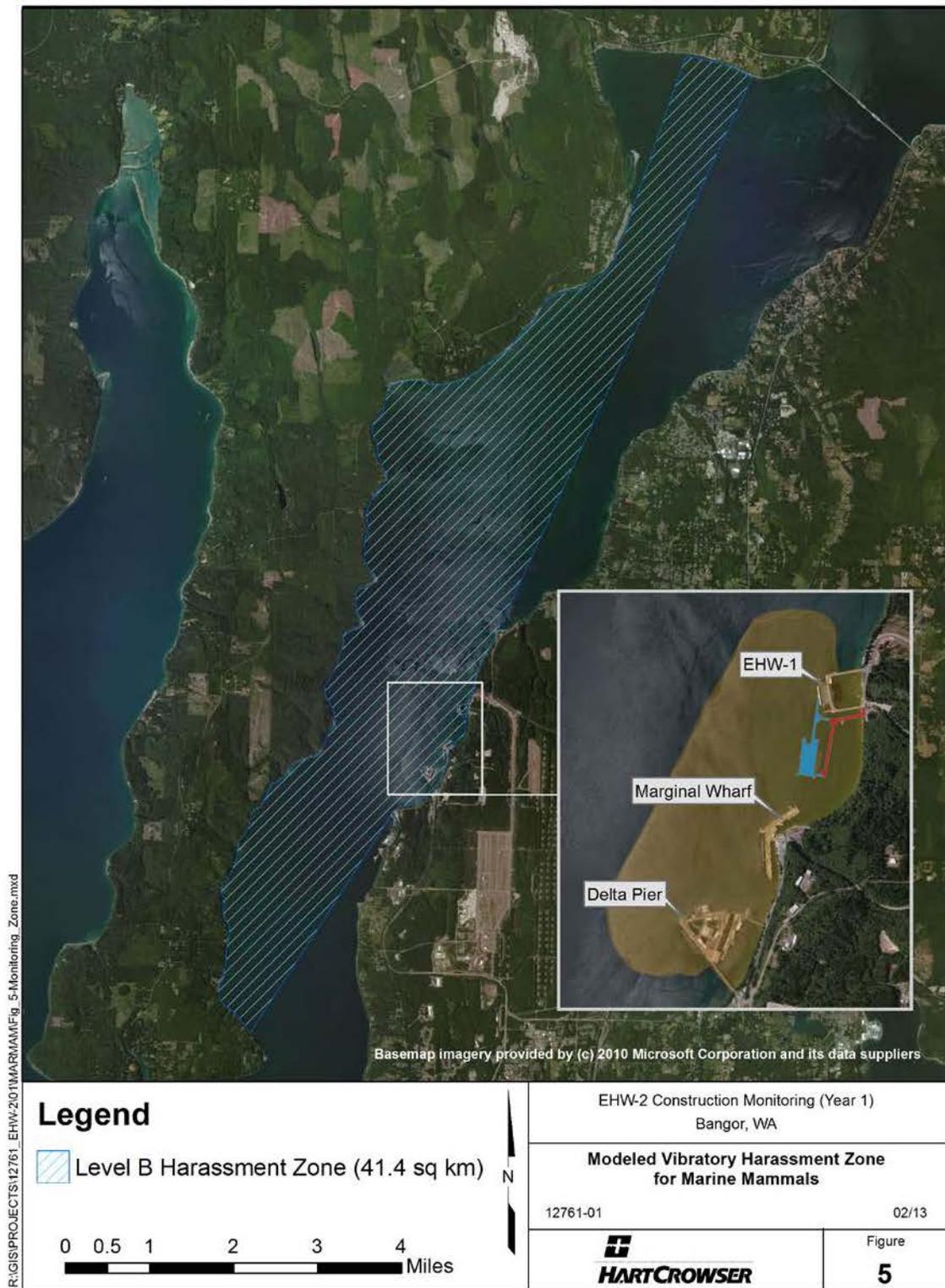


Figure 5. Modeled Vibratory Harassment Zone for Marine Mammals

Monitoring Techniques

Pile installation and removal activities occurred intermittently throughout each construction day. In order to best characterize marine species occurrence and behavior in the area, MMOs surveyed throughout the day, regardless of whether or not pile driving was occurring at that time. Therefore, data gathered on construction days includes observations made during construction and non-construction periods. Construction monitoring began at least 15 minutes prior to the initiation of pile driving (pre-construction monitoring) and ended at least 30 minutes after completion of all pile driving (post-construction monitoring). Observers recorded time, number of animals, behavior, distance and bearing to the animal(s), and distance to pile for each sighting using the standardized Marine Mammal Sightings form (**Appendix C**). This form was digitally reproduced for the beginning of production pile driving, allowing MMOs to enter data directly into a database using handheld tablet computers. A sheet of data codes was supplied to each MMO as a reference to project-specific codes for construction type, weather, and marine mammal species and behavior (**Appendix C**). At the end of each day, all digitized sightings underwent a rigorous quality control process before being appended to the primary database. Other standard MMO equipment included personal protective equipment (PPE), binoculars with rangefinders, a GPS unit, a VHF radio, a clipboard, and a marine mammal identification guide. The required PPE for all observers while on site was a personal flotation device, hardhat, steel toe boots, gloves, and hearing and eye protection.

To minimize the probability of multiple observers counting a single animal (and thereby potentially overestimating takes), sightings were tracked on a continuous basis by an observer on one monitoring platform, and then “handed off” to an observer on a second vessel if the animal(s) headed in the direction of the second monitoring platform. Observers kept detailed sighting data and, whenever possible, indicated in their field notes if an animal was a re-sight.

Every attempt was made to protect marine mammals from Level A (injury) Harassment via the use of sound attenuation devices and continuous monitoring of the behavioral harassment and near-field injury zones. Monitor coverage of the Level A shutdown zone was consistently excellent. It was not always possible to have 100% coverage of the Level B (behavioral) harassment zone during vibratory pile driving/removal due to the large area, the presence of

construction barges and vessels, and the limited number of monitoring vessels. The efficacy of visual detection of marine mammals depended on several factors, including the observer's ability to detect the animal, the environmental conditions (visibility and sea state), and the position of the monitoring platforms. Pile driving was not initiated until the shutdown zone was clear of marine mammals. In addition, pile driving was halted when a marine mammal was sighted within or approaching the shutdown zone during pile driving activities.

Visual Monitoring Protocol

Pre-Construction Monitoring. Prior to the start of pile operations, the shutdown and buffer zones were monitored for at least 15 minutes to document the presence of marine mammals. The following monitoring methodology was implemented prior to commencing pile installation/removal activities:

- MMOs monitored the shutdown zone and buffer zones. They ensured that no marine mammals were seen within the shutdown zone before pile driving began.
- If marine mammals were present within or approaching the shutdown zone prior to pile driving, monitoring continued and the start of pile driving was delayed until the animals left the shutdown zone voluntarily and had been visually confirmed beyond the shutdown zone, or if 15 minutes had elapsed without re-detection of the animal.
- If marine mammals were not within the shutdown zone (i.e., if the zone was deemed clear of marine mammals), the observers radioed the Monitoring Coordinator who then notified the pile driving foreman that pile driving could commence.
- If marine mammals were detected within the buffer zone, pile driving and removal or other in-water construction activities (activities not involving a pile driver, but having the potential to affect marine mammals; e.g., “stabbing” the pile) were not delayed, but observers monitored and documented the behavior of marine mammals that remained in the buffer zone.
- Marine Mammal Sightings forms were used to document observations (**Appendix C**).

During Construction Monitoring. The shutdown and buffer zones were monitored throughout the time required to install or remove a pile and during other in-water construction activities. The following monitoring methodology was implemented during pile operations:

- If a marine mammal was observed entering the buffer zone, an “exposure” was recorded and behaviors documented. However, that pile segment would be completed without cessation unless the animal entered or approached the shutdown (injury) zone, at which point all pile installation/removal activities associated with that rig were halted. The observers immediately radioed to alert the MC, who alerted the pile driving foreman. This action required an immediate “all-stop” to pile operations. Shutdown at one pile driving location did not necessarily trigger shutdowns at other locations where pile driving was occurring simultaneously.
- Under certain construction circumstances where initiating the shutdown and clearance procedures would result in an imminent concern for human safety, the Monitoring Plan provided that the shutdown provision would be waived. The shutdown provision was not waived during the Year 2 EHW-2 CMP.
- Pile installation/removal activities were delayed until the animal voluntarily left the shutdown zone and had been visually confirmed beyond the shutdown zone, or 15 minutes had passed without re-detection of the animal.
- During the pile driving delay, monitoring continued to be conducted and pile driving did not resume until the shutdown zone had been deemed clear of all marine mammals.
- Once marine mammals were no longer detected within the shutdown zone, or 15 minutes had elapsed without the resighting of the animal in the shutdown zone, the observers radioed the MC that activities could re-commence.
- If marine mammals were detected outside the shutdown zone, the observers continued to monitor these individuals and recorded their behavior, but pile driving proceeded. Any marine mammals detected outside the shutdown zone after pile driving was initiated continued to be monitored and their behaviors recorded.

- Marine Mammal Sighting forms were used to document observations (**Appendix C**).
- Any monitoring boats engaged in marine mammal monitoring maintained speeds equal to or less than 10 knots.
- Experienced marine mammal observers were trained to accurately verify species sighted.
- Observers used binoculars and the naked eye to search continuously for marine mammals.
- In case of fog or reduced visibility, the observers had to be able to see the shutdown and buffer zones; otherwise, pile driving was not initiated until visibility in these zones improved to acceptable levels.
- During impact pile driving, marbled murrelet monitoring protocols were run concurrently with the above described monitoring efforts.

Post-Construction Monitoring. Monitoring of the shutdown and buffer zones continued for 30 minutes following completion of pile installation and removal activities. The post-monitoring period was not required for other in-water construction. These monitoring efforts focused on observing and reporting unusual or abnormal behavior of marine mammals. During these efforts, if any injured, sick, or dead marine mammals were observed, the U.S. Navy was to notify NMFS immediately. Monitoring results were noted on the Marine Mammal Sighting form (**Appendix C**).

Piles and Pile Driving Equipment

Pile Descriptions. During the EHW-2 CMP, 411 production steel piles (piles that will remain as part of the EHW-2 structure) were driven by vibratory and impact hammers. All 411 piles were driven by a vibratory hammer, and 383 of those piles were subsequently driven by an impact hammer. Piles impacted consisted of 299 plumb piles and 84 batter piles. Production piles ranged in diameter from 36 to 48 inches (0.92 to 1.22 m) (**Figure 6; Appendix D**).

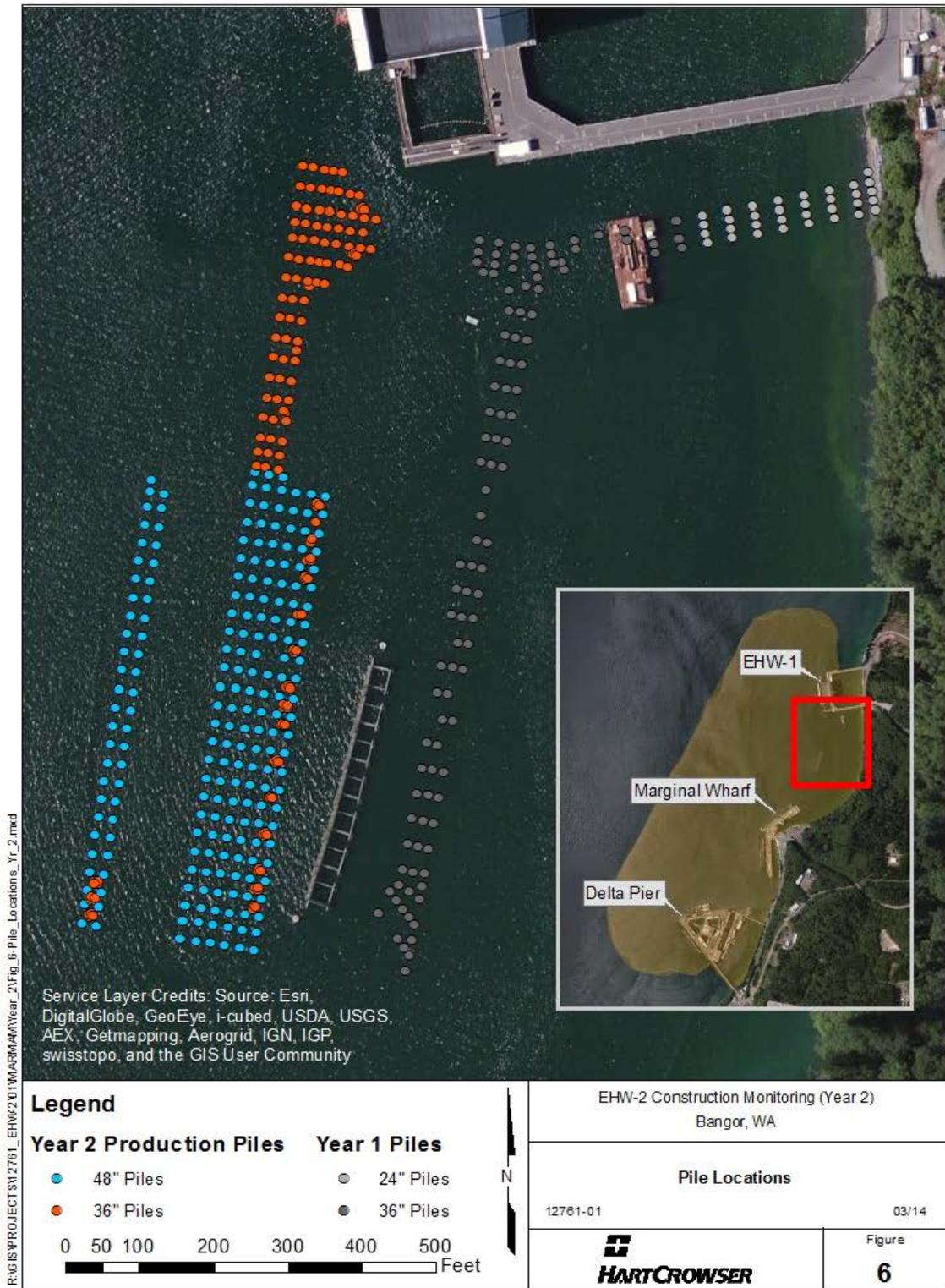


Figure 6. Year 2 Production Pile Locations

During Year 2 of the EHW-2 CMP, template pin piles and falsework (referred to as “temp” piles in **Appendix D**) were also installed and removed with vibratory hammers. These temporary piles ranged in size from 24 to 48 inches (0.61 to 1.22 m) in diameter (**Figure 6; Appendix D**).

Pile Driving Equipment. Pile driving equipment was provided and operated by EHW Constructors’ pile driving crews. Vibratory (American Piledriving Equipment [APE] 400 and APE 600) and impact hammers (APE D100) were used during the project, though only one impact hammer was in operation at any time.

The APE 400 and APE 600 have drive forces of 361 tons and 556 tons, respectively. The APE 400 was used on 24- and 36-inch piles, while APE 600 was used for 36- and 48-inch piles, as well as a few 24-inch piles. The impact hammer APE D100 was rated for 248,063 foot-pounds (ft-lbs). The APE D100 was used to impact 36- and 48-inch piles (**Appendix D**). In total, there were 503 instances where piles were driven with an impact hammer (some of the 383 piles subject to impact driving were driven on more than 1 occasion), and therefore required formal monitoring for marbled murrelets. Marbled murrelet monitoring methods and findings are presented in a separate report (DON 2014).

A sound attenuation bubble curtain or bubble pile was utilized during all impact driving events except during the final three days of the Year 2 EHW-2 CMP (discussed further below; see **Appendix E** for design specifications of the air bubble curtain and air bubble pile sound attenuation systems). The bubble curtain was used for sound attenuation during impact pile driving of all plumb piles. The curtain was designed with an adjustable number of rings spaced no further than 15 feet (4.6 m) apart vertically, and were constructed of 3-inch (7.6 centimeter [cm])-diameter pipe rolled into a circle 4 feet, 10 inches (1.5 m) in diameter. Vent holes were 1/16 inches (0.16 cm) in diameter in three sets with a set of center top holes and two additional sets of holes at 45-degree angles to the inside and outside of the ring. The top sets of holes were spaced 1 inch apart (2.5 cm) and the inside/outside sets were spaced 3 inches (7.6 cm) apart around the ring. Each ring was required to pass approximately 501 cubic feet per minute (cfm; 14.2 cubic meters per minute) of oil-free air to meet design requirements.

Batter piles are driven into the substrate at an angle. The bubble curtain was difficult to place on the batter piles due to the presence of the template used to maintain the required angle during

pile driving. In addition, given their angle through the water column, batter piles were not as effectively covered with bubbles using the bubble curtain as for vertical or plumb piles. To reduce the inefficiencies and ineffectiveness of the bubble curtain for use during impact pile driving of batter piles, EHW Constructors designed an air bubble pile. The bubble pile was used during impact pile driving of batter piles during the Year 2 EHW-2 CMP. The bubble pile was designed with ten 3-inch (7.6 cm) by 9.5-foot (2.90 m) pipes installed vertically around a 110-foot (33.5 m), 24-inch (61 cm)-diameter pile. The 3-inch pipes were installed end-to-end along the length of the pile and were connected to hoses to supply air to the system. Vent holes were 1/16 inches (0.16 cm) in diameter in three sets with a set of center holes spaced 1 inch (2.5 cm) apart and two additional sets of holes offset at 45 degree angles spaced 3 inches (7.6 cm) apart. The bubble pile was placed within 10 feet (3 m) of the pile during impact pile driving.

At the end of the Year 2 EHW-2 CMP, sound attenuation was suspended for a period of 3 days in order to prevent possible volatilization of toxic chemical compounds after an accidental spill in the WRA on 10 February 2014 unrelated to EHW construction. At the time of the spill, which covered most of the construction area, staff reported strong hydrocarbon smells, and some respiratory distress (sore throats, coughing) was reported. Construction was halted on the afternoon of 10 February 2014 and did not resume until 12 February 2014. Before evacuation for safety concerns, observers recorded all bird and mammal species present, behaviors, and any noticeable changes in the consistency of the spill during and between construction activities. Environmental chemists at Hart Crowser concluded that the bubble curtain could result in additional volatilization of organic compounds and/or generation of airborne particulates containing chemicals from the remaining spill material, thereby potentially resulting in staff exposure. On being so advised, Hart Crowser's Principal in Charge for the Monitoring Program (Jeff Barrett) provided EHW Constructors and the Navy, on 11 February 2014, with notification that bubble curtain use was being suspended to protect the health and safety of observers and construction crews while pile driving continued, and that the suspension would last until all remaining traces of the spill were gone from the construction area. The seasonal cutoff for pile driving (February 15) occurred before the spill completely disappeared.

Environmental Data

Environmental parameters were initially measured at intervals inside the WRA from Marginal Wharf. A Kestrel 4000 anemometer was used to determine wind speed and air temperature. A HOBO Water Temperature Pro Data Logger was deployed to collect water temperatures. The weather meter malfunctioned on several occasions, and at other times was rendered inoperable (i.e., knocked over) by high winds. In addition, for wind data, there was some concern that a ground-based sensor might be subject to variations in wind speed based on the location of nearby buildings or vessels, thereby yielding results that were not fully representative of those on the waters surrounding the EHW construction activities. Based on these concerns, a decision was made to collect environmental data from permanent weather stations. Environmental parameters were obtained from a coastal weather station in Lofall, WA, 5.25 miles to the northeast of the work site. Water temperature data were obtained from the New Dungeness Buoy, 45 miles to the northwest. Water temperature data from New Dungeness Buoy were compared to a limited number of temperature readings taken at Marginal Wharf. Readings at the buoy were zero to four degrees Fahrenheit lower than temperatures recorded at Marginal Wharf, with the maximum difference occurring during summer months. Visual observations of wave height, wind direction, and weather conditions continued to be based on observations within the WRA, and were included in the sightings data.

Section 3 Results

The MC logged pile driving times and related construction activities for each pile, which served as the basis for marine mammal sightings data quality control (**Appendix B**).

Marine Mammal Sightings

Three marine mammal species were observed during the Year 2 EHW-2 CMP: harbor seal (*Phoca vitulina*), California sea lion (*Zalophus californianus*), and Steller sea lion (*Eumetopias jubatus*). The Steller sea lion was the only ESA-listed marine mammal observed during the Year 2 EHW-2 CMP. Stellar sea lions were removed from ESA-listing at the end of October 2013 (NOAA 2013). All marine mammals sighted in Hood Canal are regulated by NMFS.

Analyses of marine mammal sightings are presented in two groups: the marine mammal sightings made during construction monitoring of the buffer and shutdown zones (Primary) and sightings of marine mammals hauled out on submarines, barrier fence floats, and pier-structures at Delta and Marginal Pier, which are outside of the buffer zone (Non-Primary). These non-primary sightings of marine mammal haul outs are presented separately as protocols do not include monitoring of these areas and observations were irregular, typically occurring during large breaks of construction monitoring or at the end of day.

All Marine Mammal Sightings. All marine mammal sightings include those (both primary and secondary) made during pile driving activities and those made during down time (non-construction periods). Observers typically surveyed for marine mammals during the entire construction day (8–10 hours). Results from all marine mammal sightings are presented in **Figures 7** and **8**.

Primary Surveys. A total of 3,123 sightings of 3,312 individual animals were observed during primary marine mammal surveys of the Year 2 EHW-2 CMP (**Table 3, Appendix F**). A sighting could include more than one animal, which is why the total number of sightings is less than the total number of animals. Of the two marine mammal species identified (harbor seal and California sea lion), harbor seals were the most abundant. Harbor seals and California sea lions were usually observed singularly, with mean group sizes of one for both species. Two observations during primary surveys were recorded as unidentified pinnipeds. These two observations are not included in the following analyses but are included in **Appendix F**.

Table 3. Total Number of Unique Animals and Sightings by Species (Primary Surveys)

Species	Total # of Animals	Total # of Sightings	Mean Group Size	Min Group Size	Max Group Size
California Sea Lion	83	77	1	1	3
Harbor Seal	3,229	3,046	1	1	5
Total	3,312	3,123	--	--	--

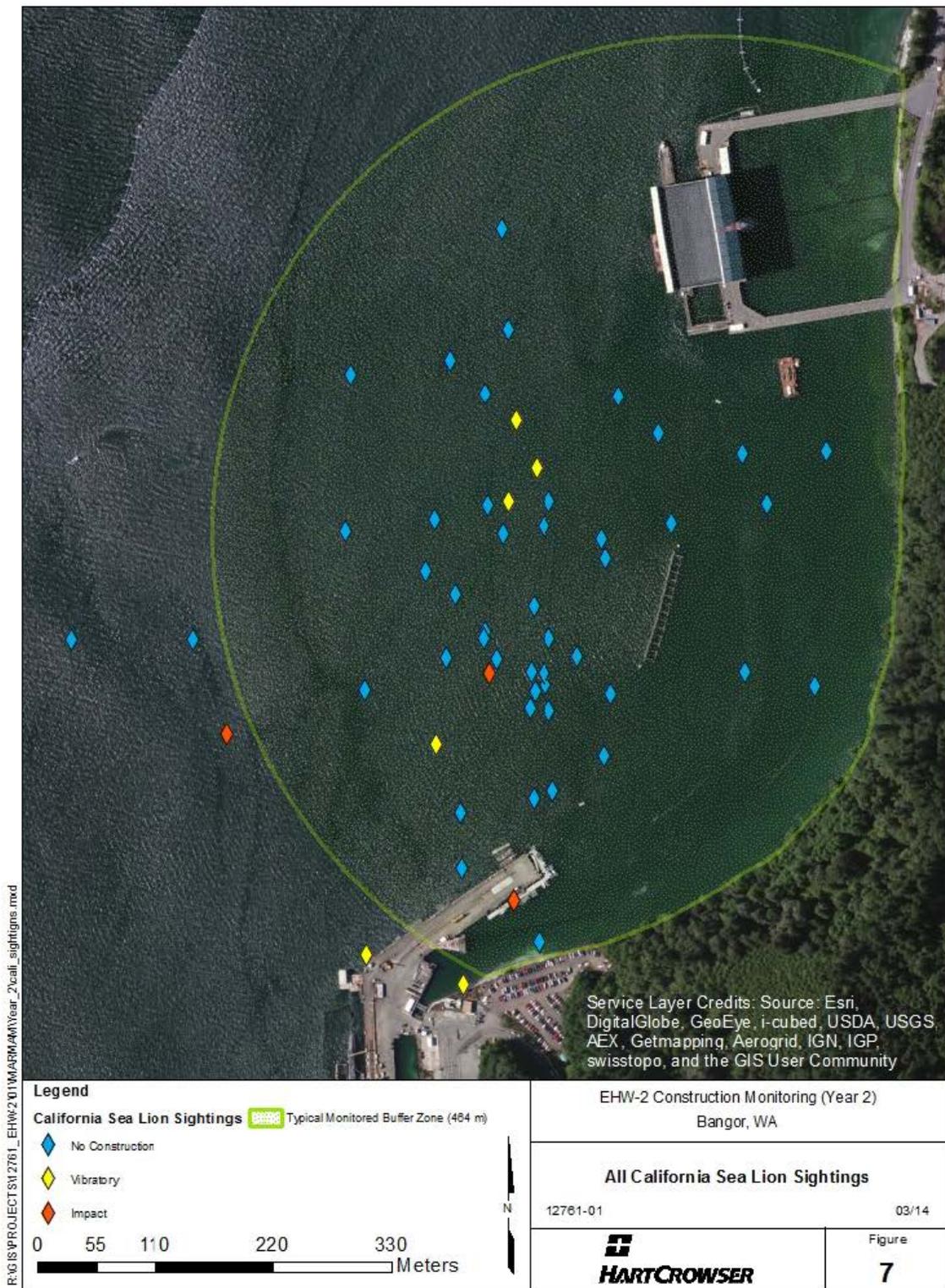


Figure 7. All California Sea Lion Sightings

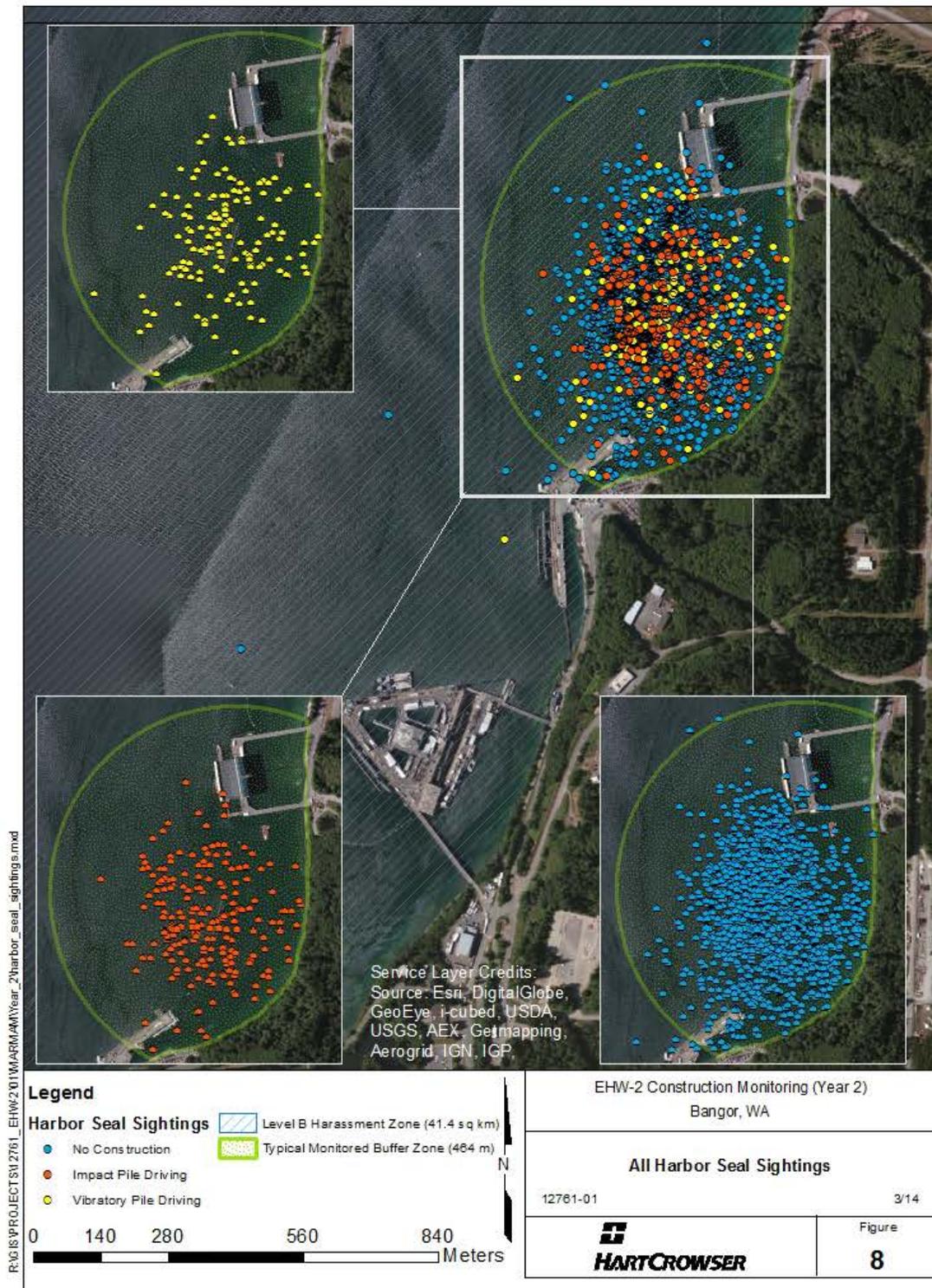


Figure 8. All Harbor Seal Sightings

Non-Primary Surveys. A total of 43 sightings of 962 individual marine mammals were observed during surveys of Delta and Marginal Pier and along the WRA fence floats (**Table 4, Appendix F**). Of the three species identified (harbor seal, California sea lion and Steller sea lion), California sea lions were the most abundant. California sea lions were observed hauled out in large groups, with a mean survey size of 29 animals. The maximum survey count of 96 California sea lions included those hauled out on two submarines at Delta Pier and additional individuals observed on floats of the port security barrier. Harbor seals were seen hauled out on two occasions, in one instance eight individuals were observed hauled out on overwater structures under Marginal Pier and a single individual was seen hauled out on a WRA fence float. Steller sea lions were observed singularly or in larger groups of up to 11 individuals and only observed on or adjacent submarines at Delta Pier.

Table 4. Total Number of Unique Animals and Sightings by Species (Non-Primary Surveys)

Species	Total # of Animals	Total # of Sightings	Mean Survey Count	Min Survey Count	Max Survey Count
California Sea Lion	917	32	29	1	96
Harbor Seal	9	2	5	1	8
Stellar Sea Lion	36	9	4	1	11
Total	962	43	--	--	--

Marine Mammal Sightings during Pile Installation and Removal Activities. Pile installation and removal activities included installation and removal by vibratory and impact hammers including soft start (soft start was only required for impact pile driving during the Year 2 EHW-2 CMP). Therefore, there were three types of construction: vibratory pile driving (V), impact pile driving (I), and soft start impact (SSI) pile driving. Soft starts were intended to provide an opportunity for nearby marine animals to voluntarily leave the area, and thus avoid potential harassment or injury. Vibratory pile driving typically required more time per pile, and all piles were subject to pile driving. Vibratory driving times ranged from 1 second to 1 hour and 34 minutes, with a total time for all piles combined of 101 hours, 37 minutes, and 45 seconds. Impact pile driving was of shorter duration, on average, and only a subset of piles were subject to impact driving. Impact drives lasted between 1 second and 32 minutes, with a total time for all piles of 14 hours, 46 minutes, and 24 seconds.

Two marine mammal species were observed during pile driving, harbor seals and California sea lions. Although Steller sea lions were observed during the Year 2 EHW-2 CMP, none were observed during pile driving or removal events and none were observed inside the 464-m buffer zone at any time.

No fish kills were observed or reported during the Year 2 EHW-2 CMP.

Primary Surveys. A total of 697 sightings of 723 marine mammals were observed during primary marine mammal surveys of pile installation and removal activities (impact and vibratory pile driving; **Table 5; Figures 7 and 8**). There were 10 California sea lion sightings, all of which were of individual animals. Harbor seals were by far the most frequently sighted species during impact and vibratory pile driving, accounting for 98% of all sightings. Although harbor seals were observed in pairs, most often they were seen individually (98% of sightings).

Table 5. Summary of Unique Marine Mammal Sightings during Pile Installation and Removal Activities (Primary Surveys)

Species	Total # of Animals	Total # of Sightings	Mean Group Size	Min Group Size	Max Group Size	Construction Type*		
						V	SSI	I
California Sea Lion	10	10	1.00	1	1	8	--	2
Harbor Seal	713	687	1.05	1	2	304	30	379
TOTAL	723	697	1.02	--	--	312	30	381

*V= Vibratory Driving, SSI= Impact Hammer Soft Start, I= Impact Hammer

Despite the much greater total time of vibratory driving (101:37:45 versus 14:46:32), more animals were observed during impact pile driving than during vibratory driving (**Table 5**).

Non-Primary Surveys. Non-primary surveys outside of the buffer zone took place during long breaks of no construction, and there were no observations during these surveys while pile installation or removal activities occurred.

Observed Exposures (Takes)

Injury and behavioral harassment takes were calculated based on marine mammals sighted during impact and vibratory pile driving for the Year 2 EHW-2 CMP. Takes were calculated by: (1)

measuring sighting distance to the pile for all animals observed during construction activities, and (2) comparing this distance to underwater and airborne injury and behavioral harassment thresholds (based on EHW-2 acoustic data) on a per-species and per-pile basis (**Appendix F**). Distance to pile was estimated (typically verified using laser rangefinders) and recorded by observers on field data sheets. Whenever possible, observers noted if an animal was likely a resighting (**Appendix F**) and communicated with nearby observers in the field to “hand off” sightings of the same animal(s). This information was taken into account when calculating takes to avoid double-counting exposed animals. Takes are reported as the number of individuals observed and as the number of sightings within a given zone.

There were 14 sightings within the Level A Injury zone during the Year 2 EHW-2 CMP which resulted in Level A Takes, 12 during impact pile driving, and two during vibratory pile driving. These sightings are discussed in the Marine Mammal Mitigation Procedures section below.

The total number of Level B Harassment takes for marine mammal during the Year 2 EHW CMP are summarized in **Table 6**. All animal sightings, including resightings of previously identified animals, are included here (i.e., “All Sightings”) to provide a conservative estimate of takes. No Dall’s porpoise, harbor porpoise, or killer whales were observed during construction monitoring or at any other time during the Year 2 EHW-2 CMP. Consequently, no observed takes were recorded for any of these species. No exceedances of any of the IHA-authorized Level B harassment take numbers occurred during the Year 2 EHW-2 CMP (NMFS 2013).

Table 6. Summary of Observed Level B Harassment Takes

Species	Takes During Vibratory Driving	Takes During Impact Driving	Total Takes	Takes Per Day	Allowed Takes	Takes Allowed Per Day
California Sea Lion	8	2	10	0.06	6,045	36
Harbor Seal	365	505	870	5.21	10,530	63

Takes were also calculated on a per-pile basis (all Level B Harassment takes per number of production piles driven) and summarized in **Table 7**. Per-pile takes are more than 100 times higher for harbor seals than for California sea lions, in keeping with the higher observed abundance of seals in the construction area.

Table 7. Summary of Observed Level B Harassment Takes Per Production Pile

Species	Takes Per Pile
California Sea Lion	0.02
Harbor Seal	2.12

Extrapolated Exposures (Takes)

The calculated behavioral harassment zone during vibratory pile driving was defined as the marine area within the average distance to the 120 dB isopleth during the Year 2 EHW-2 CMP. This is a large area, with a 7,146 m radius from the construction location, for a total covered area of 34.5 km². Only a subset of this area was consistently monitored (464-m radius from the pile, or 0.68 km² as outlined in the monitoring plan). It is therefore appropriate to estimate the number of potential Level B marine mammal takes that may have occurred in the ensonified, but unmonitored, zone.

Marine mammal density numbers taken from the IHA Application were used to develop this extrapolation. Specifically, extrapolated takes were calculated by multiplying the density of marine mammals in Hood Canal near the WRA (i.e., total animal sightings per km² per day) by the total unmonitored area inside the 120 dB isopleth (33.8 km²). This product was then multiplied by the total days of vibratory pile driving during the Year 2 EHW-2 CMP to arrive at the extrapolated number of takes in the unmonitored zone (**Table 8**).

Extrapolated take levels, were summed with observed takes to derive an estimate of the total number of behavioral harassments takes during the Year 2 EHW-2 CMP (**Table 9**). The total takes ranged from an estimate of zero for Dall’s porpoise to 5,631 for harbor porpoise (**Table 9**). For all species, the estimate of total takes was less than the IHA-authorized take levels for the Year 2 EHW-2 CMP.

Table 8. Extrapolated Level B Harassment Takes in the Unmonitored Area of the Behavioral Harassment Zone

Species	Density Estimate* (IHA)	Unmonitored Level B Harassment Zone (Area, km ²)	Estimated Abundance In the Unmonitored Area	EHW-2 CMP Total Vibratory Pile Driving Days	Extrapolated Takes
California Sea Lion	0.28	33.8	9.5	133	1,263
Dall's Porpoise	0.000001		0.0		0
Harbor Porpoise	0.149		5.0		665
Harbor Seal	1.06		35.8		4,761
Steller Sea Lion	0.025		0.8		106
Killer Whale	0.001914		0.1		13

*Density=observed animals/km²/day

Table 9. Summary of Observed and Extrapolated Level B Harassment Takes

Species	Observed Takes - Vibratory Driving	Extrapolated Takes – Vibratory Driving	Observed Takes - Impact Driving	Total Takes	Allowed Takes
California Sea Lion	8	1,263	2	1,273	6,045
Dall's Porpoise	-	0	-	0	195
Harbor Porpoise	-	665	-	665	1,950
Harbor Seal	365	4,761	505	5,631	10,530
Steller Sea Lion	-	106	-	106	390
Killer Whale	-	13	-	13	180

Marine Mammal Mitigation Procedures: Construction Delays and Shutdowns

If a marine mammal was observed in or approaching the shutdown zone, ongoing construction was to be stopped, and imminent construction was to be delayed. During the Year 2 EHW-2 CMP there were four construction delays due to a harbor seal observed within or near the shutdown zone just prior to planned pile driving, and 17 construction shutdowns due to harbor seals surfacing within or near the shutdown zone during vibratory or impact pile driving. Of the 17 construction shutdowns, 14 were because of animals close enough to the pile to result in a

Level A take. These construction delays and shutdowns with associated sightings are summarized in Table 10. The majority of the construction shutdowns were during impact pile driving (n=14, 82%). These 17 shutdowns occurred over a total of 14 days. In most cases, only a single delay/shutdown occurred on any individual day; but on 21 November 2013, three delay/shutdown events occurred. Impact pile shutdowns resulted from animals located from 15 to 22 meters from the impacted pile. The closest marine mammal sighted during vibratory pile driving was 8 m from the pile. No adverse behaviors were noted for any of the sightings within the Level A zone.

Table 10. Marine Mammal Mitigation Delays and Shutdowns

Date	Event code	Take	Event		Const. Type	Species	Sighting		Dist. To pile	# of Animals	Relative Motion	Behav. Code ^a	Behav 2 ^a	Behav 3 ^a	Comments
			Start Time	End Time			Start Time	End Time							
7/25/2013	MD	No	10:25:08	10:25:14	NONE	HSEA	10:25:08	10:25:14	25	1	Away	SW-SW	DI	--	Delayed the start of vibe for TT-3. Started after HSEA clear. Observed HSEA swim out of the SD zone.
7/31/2013	MD	No	14:11:27	14:14:37	NONE	HSEA	14:12:26	14:12:33	9	1	None	LO	RE	SI	Delay of onset of vibe driving when animal surfaced in to zone between drives.
						HSEA	14:13:38	14:13:50	18	1	None	LO	DI	--	Seal observed outside SD zone, resumed pile driving
8/2/2013	MS	Yes	14:00:56	14:01:59	V	HSEA	14:00:56	14:01:59	8	1	None	FL	LO	DI	Shutdown when animal surfaced in to zone. Resumed work after sighting animal outside zone.
8/5/2013	MD	No	15:23:55	16:00:00	NONE	--	--	--	--	--	--	--	--	--	MD due to Beaufort 3. Crew called it a day at 16:00 after freeing stuck hammer from pile, as wind was not laying down.
10/21/2013	MS	Yes	16:51:48	16:55:10	I	HSEA	16:58:26	16:59:20	20	1	None	MI	SI	--	SD due to seal 20 m N of pile. Construction did not resume since it was too close to sunset. Seal not resighted.
11/12/2013	MS	No	14:13:53	14:17:28	I	HSEA	14:13:59	14:13:49	25	1	Away	SW-W	DI	--	Shutdown to confirm distance of animal to pile.
						HSEA	14:17:35	14:17:27	25	1	Away	SW-N	DI	--	Confirmed seal observed outside SD zone, resumed pile driving
11/13/2013	MS	Yes	15:09:48	15:12:47	V	HSEA	15:10:40	15:11:56	8	1	Toward	SW-NE		--	Shutdown when animal surfaced in to zone. Resumed work after sighting animal outside zone.
11/14/2013	MS	Yes	14:57:14	15:02:30	I	HSEA	15:00:23	15:00:30	20	1	Away	SW-N	DI	--	Seal within shutdown zone
						HSEA	15:01:52	15:02:53	55	1	Toward	SW-NW		--	Seal observed outside SD zone, resumed pile driving
	MS	Yes	15:04:17	15:17:02	I	HSEA	15:04:10	15:04:12	15	1	None	LO	DI	--	Shutdown work when animal surfaced within shutdown zone, resumed work when we saw animal swim out of zone
11/16/2013	MS	Yes	15:40:00	15:45:52	I	HSEA	15:39:00	15:41:41	18	1	Away	SW-E	SI	--	Shutdown when animal surfaced in to zone. Resumed work after sighting animal outside zone.
11/21/2013	MS	Yes	9:31:05	9:38:15	I	HSEA	9:31:05	9:36:15	15	1	Away	SW-W	SW-NE	--	Shutdown work when animal surfaced within shutdown zone, resumed work when we saw animal swim out of zone
	MS	Yes	9:42:05	9:46:44	I	HSEA	9:42:05	9:42:48	22	1	Away	PO	CD	MI	Animal initially porpoising rapidly then changed direction, surfaced looking then appeared to be foraging near surface.
						HSEA	9:43:52	9:43:57	15	1	Toward	SW-E			Shutdown when animal surfaced in zone. Resumed work after sighting animal outside zone.
MS	No	10:08:10	10:13:12	I	HSEA	10:08:40	10:11:00	35	1	Toward	SW-NE	LO		Shutdown when animal surfaced near zone. Resumed work after sighting animal outside zone.	
11/23/2013	MS	Yes	14:16:46	14:18:18	I	HSEA	14:17:15	14:17:41	15	1	Away	LO	SI	SW-N	Shutdown work when animal surfaced within shutdown zone, resumed work when we saw animal swim out of zone
12/4/2013	MS	Yes	11:26:49	11:30:46	I	HSEA	11:26:00	11:26:19	15	1	None	LO			Shutdown work when animal surfaced within shutdown zone, resumed work when we saw animal swim out of zone
12/5/2013	MS	Yes	11:26:49	11:28:47	I	HSEA	11:25:51	11:26:10	9	1	Parallel	RE	DI		Shutdown work when animal surfaced within shutdown zone, resumed work when we saw animal swim out of zone
12/14/2013	MS	No	10:12:19	10:18:20	V	HSEA	10:12:22	10:12:40	13	1	Parallel	SW-N	FL	DI	Shutdown vibratory pile driving to confirmed distance of seal to pile. Once confirmed, resumed vibe.

Date	Event code	Take	Event		Const. Type	Species	Sighting		Dist. To pile	# of Animals	Relative Motion	Behav. Code ^a	Behav 2 ^a	Behav 3 ^a	Comments
			Start Time	End Time			Start Time	End Time							
1/15/2014	MS	Yes	13:09:24	13:10:08	I	HSEA	13:09:24	13:09:34	17	1	Away	SW-N			Shutdown when animal surfaced in to zone. Resumed work after sighting animal outside zone.
1/17/2014	MD	No	15:42:15	15:58:03	NONE	HSEA	15:42:32	15:43:08	12	1	Toward	LO	--	--	Delay of onset of impact driving when animal surfaced in to zone between drives. Reinitiated work after waiting 15 minutes to resight seal.
1/22/2014	MS	Yes	13:38:22	13:53:22	I	HSEA	13:38:12	13:38:14	14	1	Parallel	RE	DI		Shutdown impact driving when animal surfaced in to zone. Reinitiated work after waiting 15 minutes to resight seal.
1/23/2014	MS	Yes	11:57:21	12:08:48	I	HSEA	12:00:00	12:00:05	16	1	Toward	SW-SW			Shutdown when animal surfaced in to zone. Resumed work after sighting animal outside zone.

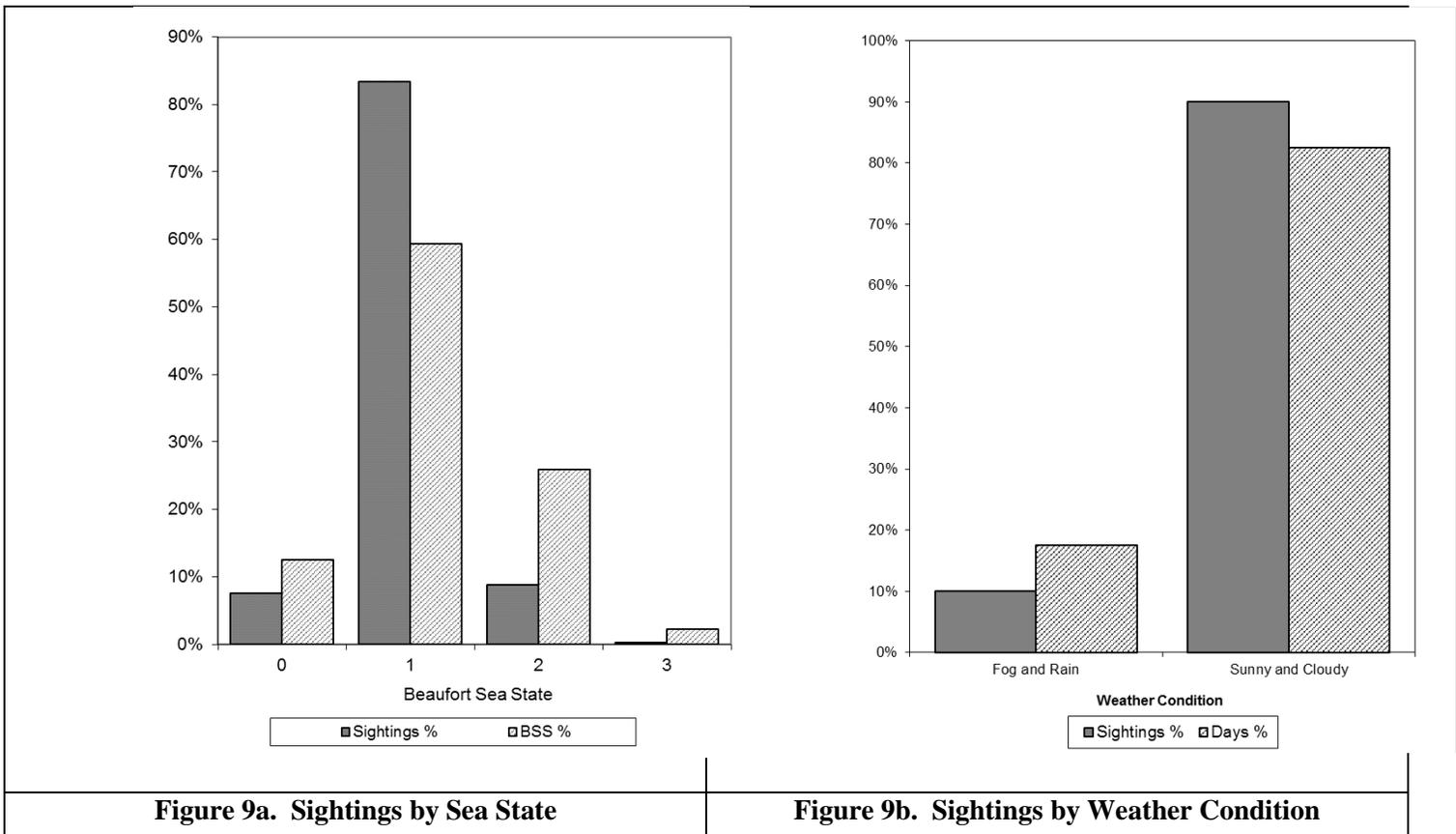
^{a)} Definitions for Behavior Codes can be found in Appendix C

MS = Mitigation Shutdown

MD = Mitigation Delay

Marine Mammal Sightings and Environmental Conditions

Most marine mammal sightings were made in calm conditions with low wave height (**Figures 9a** and **9b**). All marine mammal sightings (including resightings) were made during Beaufort sea state (BSS) conditions of 0–3 (winds at or below 16 knots; see **Appendix C** for the Beaufort scale). Sightings declined significantly at BSS 2 and above. This appeared to be due, at least in part, to reduced activity and movement by marine mammals, as the MMOs often reported good monitoring visibility at a BSS of 3. Favorable weather persisted throughout construction and shutdowns due to reduced visibility were not required at any time. All construction and marine mammal surveys occurred during sea states of BSS 3 or below.



Favorable weather conditions (cloudy and sunny) occurred on 82% of construction days; 90% of all sightings occurred under those conditions. Weather that produced reduced visibility (fog and rain) occurred on 18% of construction days; 10% of all sightings occurred under those conditions.

Marine Mammal Behavior

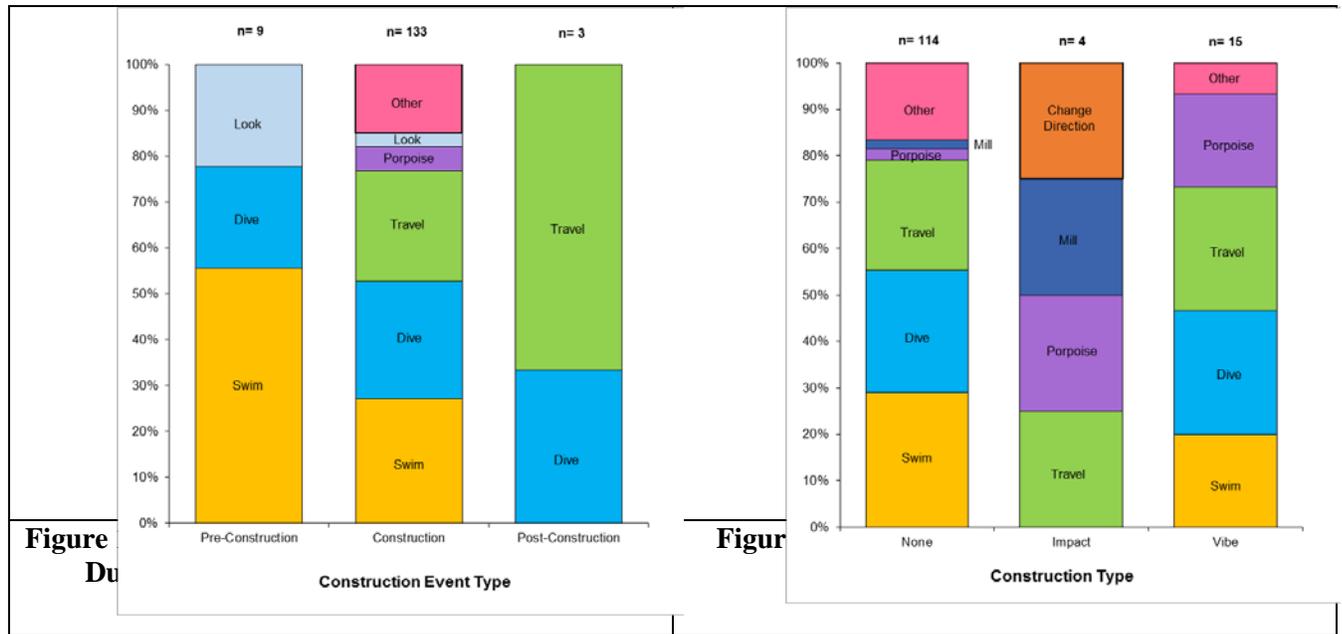
Quantitative Analysis. Observers typically searched for marine mammals continuously. When animals were observed, data were recorded continuously (excluding restroom breaks in which monitors were sequentially rotated off and then back on to their monitoring locations) from the beginning of pre-watch until the end of the monitoring effort for the day (see **Table 2** for a summary of the monitoring effort). Behavior was recorded during both construction and non-construction periods (**Appendix F**). Behavioral analyses are reported separately by Primary and Non-Primary surveys and are presented by species where applicable. Behavior codes are found in **Appendix C**. The number of observed animals and the number of observed behaviors is not necessarily the same due to: (1) instances where multiple animals were observed exhibiting the same behavior, and (2) situations where individual animals performed multiple behaviors during a single observation.

Primary Surveys. Primary surveys of the buffer and shutdown zones occurred throughout the project, before, during and after all pile driving events. California sea lions and harbor seals were the only marine mammal species observed during Primary Surveys.

California Sea Lion. During pre-construction monitoring, California sea lions were observed “swimming” (56%, n=5), and “diving” and “looking” (each 22%, n=2) (**Figure 10a**). During construction, California sea lions were frequently observed “swimming” (27%, n=36), “diving” (26%, n=34), and “traveling” (24%, n=32). In addition to these dominant behaviors observed during construction, California sea lions also exhibited a range of other behaviors (e.g., porpoise, look, mill, and spyhop), but less frequently, with only 2 to 3 animals demonstrating. In the table, these behaviors were collectively grouped under “other” during construction. During post-construction monitoring, California sea lions were frequently observed “diving” (33%, n=1) and “traveling” (66%, n=2).

When analyzed by construction event type, California sea lions were frequently observed “traveling” (24%, n=27), “swimming” (29%, n=33), and “diving” (26%, n=30) during construction events other than pile driving (**Figure 10b**). The four California sea lions observed during impact driving were seen “traveling”, “porpoising”, “milling” and “change direction” (each 25%, n=1). During vibratory pile driving, California sea lions were most frequently

observed “diving” and “traveling” (each 27%, n=4), in addition to “porpoising” and “swimming” (each 20%, n=3).



Harbor Seal. During pre-construction monitoring, harbor seals were most frequently observed “swimming” (22%, n=65), “diving” (20%, n=58), “sinking” (17%, n=51), and “looking” (20%, n=59) (**Figure 11a**). During construction, harbor seals were frequently observed “swimming” (29%, n=1766), “diving” (22%, n= 1311), “sinking” (15%, n=884), “looking” (14%, n=858), and “resting” (11%, n=684). During post-construction monitoring, harbor seals exhibited similar behaviors as observed during construction. Of these behaviors “swimming” (25%, n=72), “diving” (23%, n=66), and “looking” (17%, n=50) were most common.

When analyzed by construction event type, harbor seals were frequently observed “swimming” (28%, n=1265), “diving” (22%, n=981), and “sinking” (15%, n=686) during construction other than pile driving (**Figure 11b**). During impact pile driving, harbor seals were most frequently observed “swimming” (32%, n=281), “diving” (23%, n=197), and “looking” (15%, n=131). During vibratory pile driving, harbor seals were most frequently observed “swimming” (33%, n=220), “diving” (21%, n=140), and “sinking” (16%, n=104).

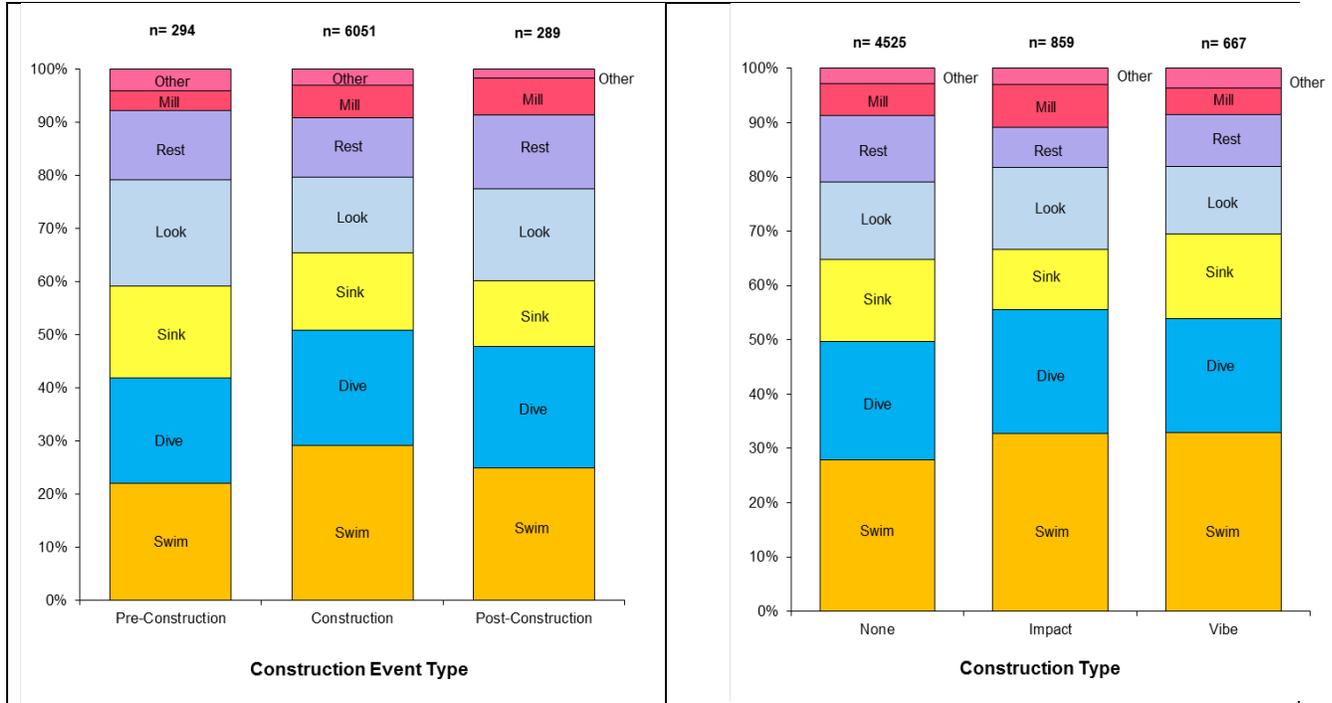


Figure 11a. Harbor Seal Behaviors Before, During and After Construction: Primary

Figure 11b. Harbor Seal Behaviors By Construction Type: Primary

Harbor Porpoise and Steller Sea Lion. No harbor porpoise or Steller sea lions were observed during Primary Surveys.

Non-Primary Based Surveys. All non-primary surveys were conducted during large breaks in construction activities, and all sightings were of animals on or near Navy submarines, pier structures, or WRA fence floats. California sea lions, harbor seals, and Steller sea lions were observed during these surveys.

California sea lions were most often seen “resting” (41%, n=516), “hailed out” (32%, n=396), and “playing” (21%, n=260; **Figure 12**). Harbor seals were only observed “hailed out” (100%, n=9). Steller sea lions were seen “resting” (62%, n=26) and “fighting” (26%, n=11) while hailed out on the submarines (**Figure 12**).

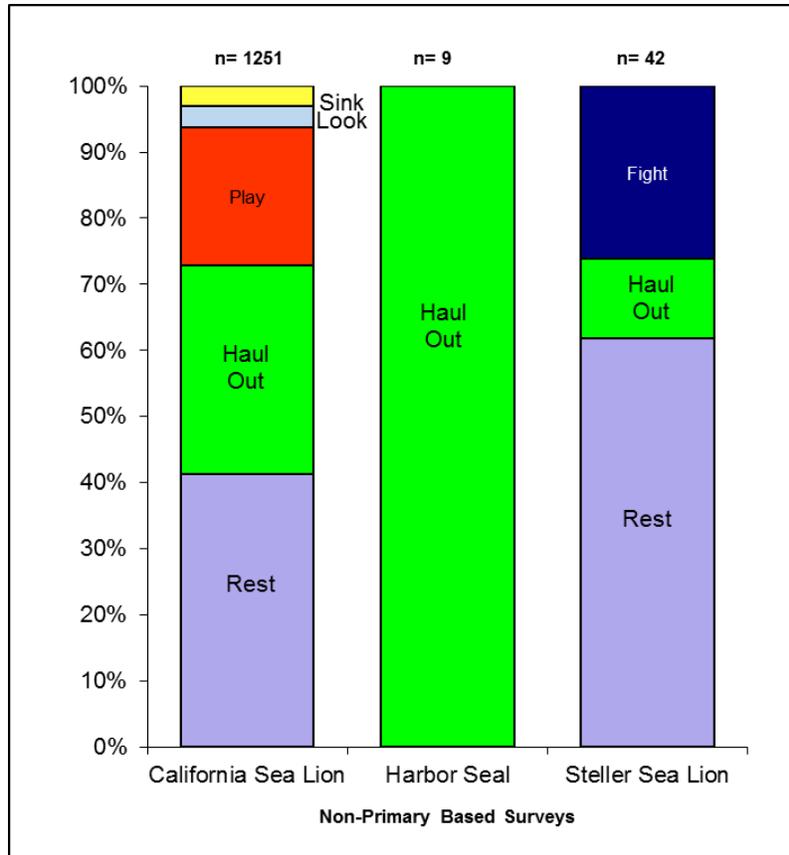


Figure 12. Marine Mammal Behaviors: Non-Primary Based Surveys

Summary of Quantitative Analysis. During periods of construction other than pile driving events, marine mammals were most frequently observed swimming parallel or having no relative motion to the construction area (38%, n=561; **Figure 13**). During vibratory pile driving, marine mammals were equally observed moving away from the pile or having no relative motion (each 34%, n=80). There was also a slight increase in the percentage of animals that moved toward the pile during vibratory pile driving (31%, n=73) compared to non-pile driving periods (27%, n=397; **Figure 13**). During impact driving events, animals were most frequently observed moving away (38%, n=108) and moving parallel to or having no relative motion to the pile (35%, n=98). Marine mammals moved toward the pile as frequently during impact pile driving (27%, n=77) as during periods of no construction (27%, n=397).

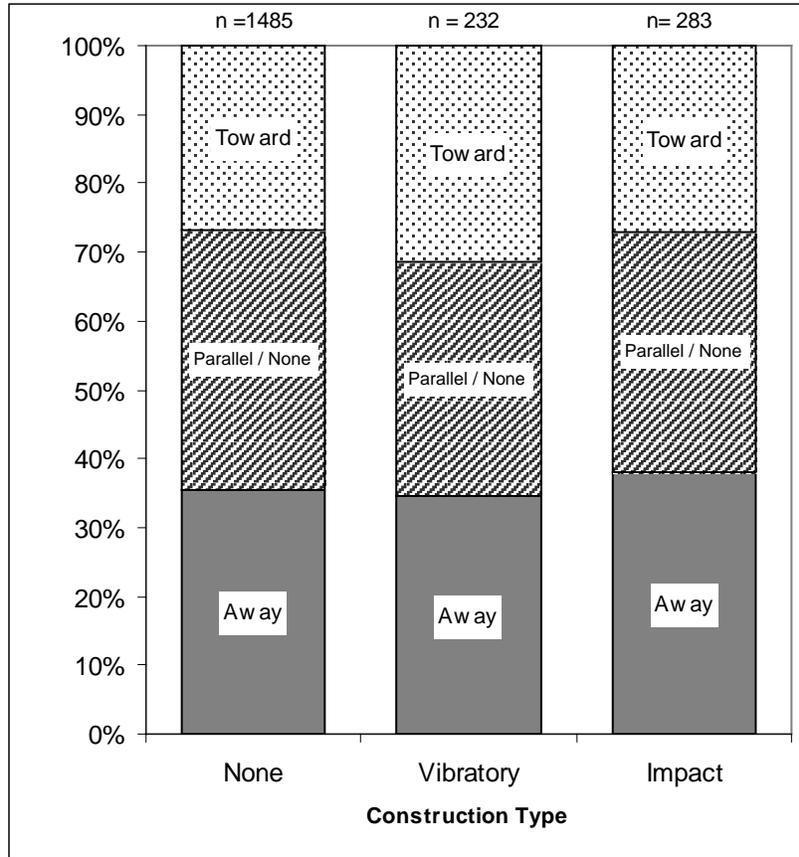


Figure 13. Relative Motion of Marine Mammals by Construction Event

California Sea Lion. California sea lion sightings in the buffer zone were infrequent. California sea lions were most frequently observed “swimming” and “traveling” during pre- and post-construction monitoring. Behaviors during non-construction and vibratory pile driving periods were similar: animals were seen frequently “swimming,” “diving,” and “traveling.” Overall, California sea lions exhibited a similar range of behaviors during pile driving and non-pile driving periods, except that porpoising, which involves rapid transiting through the construction zone, was more prominent during pile driving periods. With only 19 observations during pile driving activity, trends should be interpreted with caution.

Harbor Seal. Harbor seals were by far the most frequently sighted marine mammal species during the Year 2 EHW-2 CMP. Harbor seals displayed a wide range of behaviors, but were more frequently observed “swimming” during construction monitoring periods than during non-construction periods. However, harbor seals exhibited a remarkably similar range of behaviors

during pile driving and non-pile driving periods, a trend that is supported by the large sample size of sightings and anecdotal evidence from observers.

Steller Sea Lion. The small sample size of Steller sea lions makes identifying trends difficult. Steller sea lions were only observed hauled out on or near submarines and never during pile driving.

Qualitative Behavioral Observations. MMOs made a number of qualitative observations on the movements and distribution of animals, and on the potential effects of pile driving activities on marine mammal behavior during the Year 2 EHW-2 CMP, in addition to the quantitative results presented above. In the areas where pile driving was conducted, many animals observed were in transit, generally moving along a north-south axis parallel to the shoreline. Aside from these sightings, observations of pinnipeds were generally of single animals, of which the majority (>97%) were harbor seals.

Understanding that subjective observations can be a useful adjunct to quantitative measurements, the MMOs were asked on a daily basis whether they had observed any behaviors consistent with injury, distress, or high-speed flight from the construction area. For pinnipeds, they did not report any such observations. In addition, the MCs on many occasions asked the marine mammal observers to watch an individual seal or sea lion just as impact or vibratory driving commenced to look for any instantaneous change in behavior potentially associated with the onset of pile driving noise. In some cases, individual animals would submerge with the onset of pile driving, or would begin swimming away from the construction site. However, in many other cases, individual animals did not exhibit any change in behavior with the onset of pile driving. Occasionally, harbor seals that had not been observed near the pile field appeared near or inside the shutdown zone during impact pile driving. Based on these qualitative observations the MMOs generally felt that the behaviors of harbor seals and California sea lions did not indicate adverse reaction to in-water construction activities. This is consistent with the quantitative analysis presented above.

An accidental spill of diesel and other unknown substances occurred within the WRA from Navy operations independent of EHW-2 in the afternoon on 10 February 2014. The use of the bubble curtain was suspended during this time due to human health concerns regarding the potential for

volatilizing toxic chemical compounds in the water, or of creating airborne particulates containing spill material. Because impact surveys involve use of a moving vessel and additional marbled murrelet observers who often call out mammal sightings to the MMOs, observers had a very high confidence of detecting marine mammals located within 150-200 meters of the construction area during this 3-day period. There were nine sightings of marine mammals after the spill, all of which were harbor seals. Of these nine, there were three harbor seal sightings during impact pile driving without use of the bubble curtain, with the closest sighting 45 m from the pile, and two others at approximately 150m from the pile (i.e., all sightings were outside of the 20-m shutdown zone). These individual animals were observed swimming or resting, and did not exhibit behaviors consistent with an adverse response to impact pile driving activities. These behaviors were similar to those observed when sound attenuation from a bubble curtain was present. Recorded observations of marine mammal behaviors after the spill did not indicate any adverse effect from impact pile driving.

Three dead harbor seals were observed during the Year 2 EHW-2 CMP:

- On 25 July 2013, Hart Crowser was notified by the contractor of a dead harbor seal that was hauled out in a workboat near the construction site. EHW Constructors had independently contacted the Navy as to the animal's location and disposition as it occurred before Hart Crowser's biologists arrived for work on that day. NMFS was contacted on 25 July 2013. WDFW personnel, acting on delegated authority from NMFS, came onto the base and conducted a necropsy on the seal on 26 July 2013.
- On 24 October 2013, Hart Crowser notified the contractor of a dead harbor seal that had floated within the construction work area. The observers contained the seal adjacent to the monitoring boat; they noted that it was decapitated and that its death therefore was not likely caused by the project. The contractor then notified the Navy of the animal's location and disposition. The Navy contacted NMFS and directed the contractor and Hart Crowser to release the seal, which drifted out of the area on the tide.
- On 14 November 2013, Hart Crowser notified the contractor of a dead harbor seal floating into the construction work area. Observers noted that the seal appeared to be dead for at least a couple of days due to the level of decomposition, and that the death

was therefore not likely caused by the project. The contractor then informed the Navy of the animal’s location and disposition. The Navy contacted NMFS, and the seal was monitored by Hart Crowser biologists until it floated north out of sight.

Environmental Data

Environmental data can be found in **Appendix G** and are summarized by week in **Figures 14** and **15**. Average weekly air temperatures fluctuated from 65 degrees Fahrenheit (° F) in July to the lowest recorded average temperature of 31° F in early February. Water temperatures steadily decreased from 53° F to 44° F by mid-February when monitoring ended. Neither air nor water temperatures had any effect on the observers’ ability to identify marine mammals within the WRA.

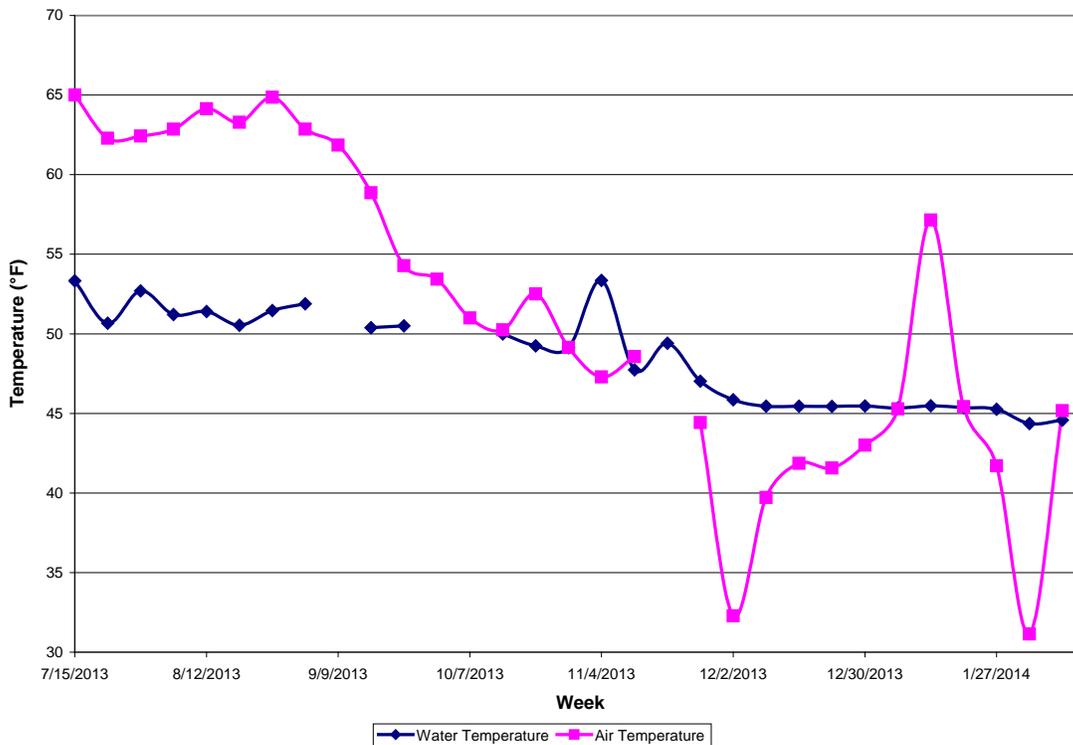


Figure 14. Average Air and Water Temperatures in the WRA

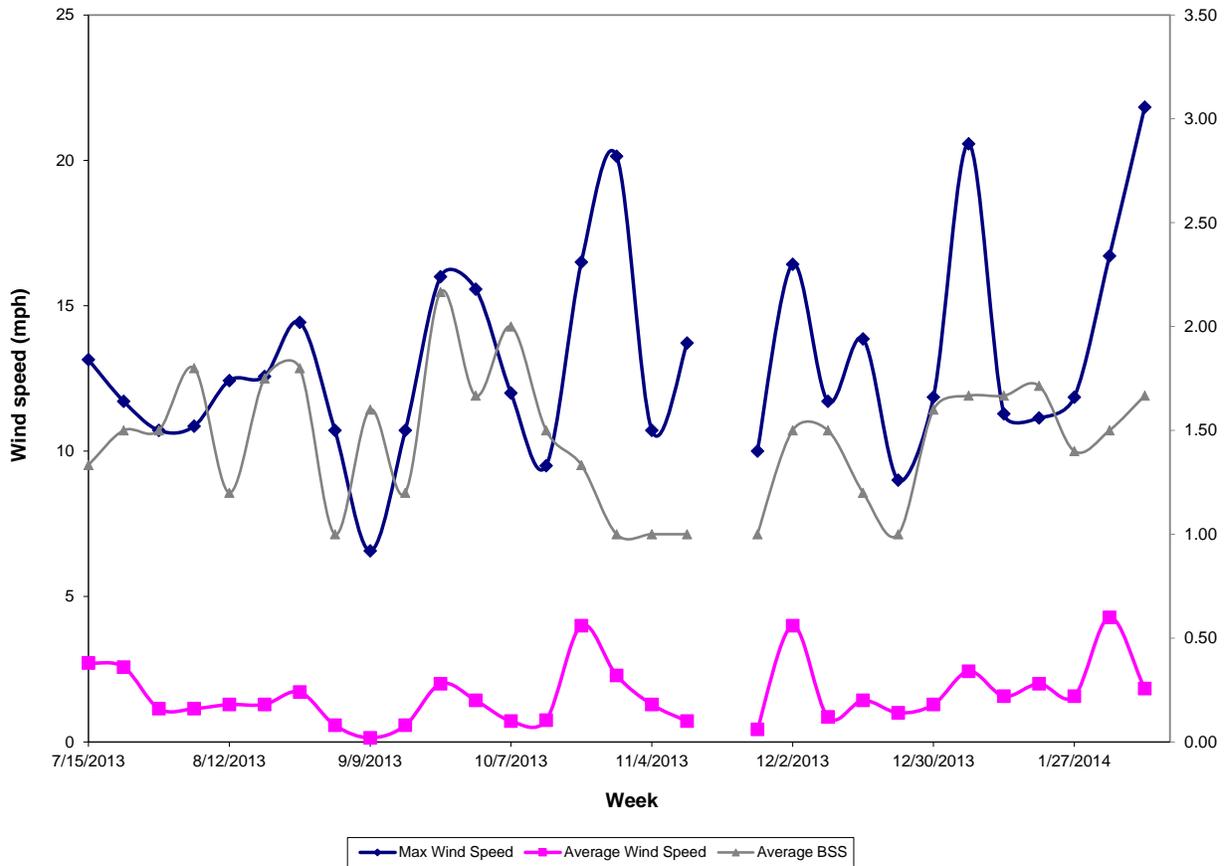


Figure 15. Wind Speed in the WRA

Average weekly wind speeds ranged from 0 to 4.3 miles per hour (mph), with the maximum wind speed of 29 mph on 19 December 2013 (no impact pile driving occurred during high wind periods due to the Marbled Murrelet Monitoring Plan protocol limiting sea state to less than BSS 3 during impact pile driving; **Figure 15**). Wind speeds did not result in unacceptable visibility ranges during pile driving activity, and resulted in a maximum BSS 3 (typically BSS 1–2). Observers found that localized wind “chop” was the primary determinant of the quality of viewing conditions. This benefited observers in the WRA as conditions in this area were generally calmer due, in part, to the location of the project area between EHW-1 and Marginal Wharf and in part, to the security fence, which provided a degree of shelter and dissipated wind and wave energy from the open waters of Hood Canal. Construction barges and boats also tended to reduce sea state in the vicinity of the construction work area.

Section 4 Recommendations

1. In order to ensure the effectiveness of the sound attenuation bubble curtain, crews should continuously monitor to make certain the bottom ring rests on the seafloor. The bubble curtain often did not extend to the seafloor due to inadequate bubble curtain length. Crews must measure water depth throughout the day to account for tidal changes and adjust the bubble equipment accordingly to ensure the length of the setup is adequate to reach the seafloor.
2. Improvements were made to the bubble curtain design to address issues identified during the Year 1 EHW-2 CMP. One significant improvement was that each ring was controlled separately and required pile driving crews to open valves to attain correct pressures to each ring. These values were measured when accessible by the MC. However, these flow gauges were often not functional or crews set the rings to a specific pressure. Different pressure requirements needed to regulate flow at different depths were not fully implemented. In Year 3, more attention to ensuring even flow across rings is advised.
3. No harbor porpoise were observed during the Year 2 EHW-2 CMP. This is likely because harbor porpoise did not enter the WRA, and no outside boat was positioned in the main channel of Hood Canal where porpoise are present. Without the outside boat MMO, there is no means of evaluating behavioral changes of harbor porpoise during vibratory driving. If observations of harbor porpoise or other cetacean baseline behaviors and changes in behavior during pile driving are desired, MMO surveys outside the WRA would likely be required.
4. Co-locating one MMO on the boat in the WRA with marbled murrelet observers worked well during the Year 2 EHW-2 CMP. Marbled murrelet observers sometimes made observations that they then “handed off” to the MMO. It is recommended that future versions of the Marine Mammal and Marbled Murrelet Monitoring Plans formally include this approach.

Section 5 List of Preparers

Jeffrey Barrett, Ph.D.

Hart Crowser

Principal-in-Charge and Lead Biologist/Monitoring Coordinator/Observer

Hans Hurn

Hart Crowser

Project Manager, Monitoring Coordinator/GIS and Data Analysis

Emily Duncanson

Hart Crowser

Monitoring Coordinator/Database Manager/Data Analysis

Beth Sosik

Observer/Data Analysis

Section 6 References

DoN, 2012. Final Marine Mammal Monitoring Plan. Trident Support Facilities Explosives Handling Wharf (EHW-2). Naval Base Kitsap at Bangor, Silverdale, Washington. July, 2012.

DoN, 2013. Naval Base Kitsap-Bangor Explosives, Handling Wharf 2 Draft Year 1 Marine Mammal Monitoring Report (2012–2013), Bangor, Washington. Prepared by Hart Crowser for Naval Facilities Engineering Northwest, Silverdale, Washington. April 2013.

DoN, 2014. Naval Base Kitsap-Bangor, Explosives Handling Wharf 2, Bangor, Washington. Draft Year 2 Marbled Murrelet Monitoring Report. Prepared by Hart Crowser, Inc. for Naval Facilities Engineering Northwest, Silverdale, Washington. March 2014.

Illingworth & Rodkin Inc., 2013. Naval Base Kitsap at Bangor EHW-2 Construction Monitoring Program, Bangor, Washington. Draft Marine Acoustic Monitoring Report. Prepared for Hart Crowser Inc., Seattle, Washington and Naval Facilities Engineering Northwest, Silverdale, Washington. March 2013.

National Marine Fisheries Service (NMFS), 2013. Incidental Harassment Authorization to take small numbers of marine mammals, by Level B Harassment only, incidental to a pile replacement project in the Hood Canal, Washington. Issued July 13 2013.

National Oceanic Atmospheric Administration (NOAA), 2013. NOAA Removes the Eastern Stellar Sea Lion from the Endangered Species Act List. Accessed March 6 2013. <https://alaskafisheries.noaa.gov/newsreleases/2013/easternssl102313.htm>.