PORTSMOUTH NAVAL SHIPYARD
KITTERY, MAINE

2022 MONITORING REPORT FOR NOAA FISHERIES INCIDENTAL HARASSMENT AUTHORIZATION (IHA) FOR CONCLUSION OF YEAR TWO P-310 IHA ACTIVITIES AND PRELIMINARY YEAR ONE P-381 IHA ACTIVITIES

FROM JANUARY 18, 2022, TO DECEMBER 30, 2022

for

MODIFICATION AND EXPANSION OF DRY DOCK 1:

Super Flood Basin (P-310) and

Multifunctional Expansion of Dry Dock 1 (P-381)

Date: January 30, 2023

Revised April 14, 2023

TABLE OF CONTENTS

SECTION

LIST OF FIGURES:

LIST OF TABLES:

1. INTRODUCTION

The United States Navy (Navy) is in the process of expanding and modifying Dry Dock 1 at the Portsmouth Naval Shipyard in Kittery, Maine. The expansion and modification of Dry Dock 1 consists of three projects that have been phased to support Navy mission schedules. In-water work associated with the first two projects, construction of a Super Flood Basin (P-310) and extension of the portal crane rail and utilities (P-1074), began in 2020 and concluded in February 2022. In-water construction associated with the third project, Multifunctional Expansion of Dry Dock 1 (P-381), began in May 2022 and involves modifying the constructed super flood basin to create two additional dry-dock positions (Dry Dock 1 North and Dry Dock 1 West), west of the current dry dock (Dry Dock 1 East; Figure 1).

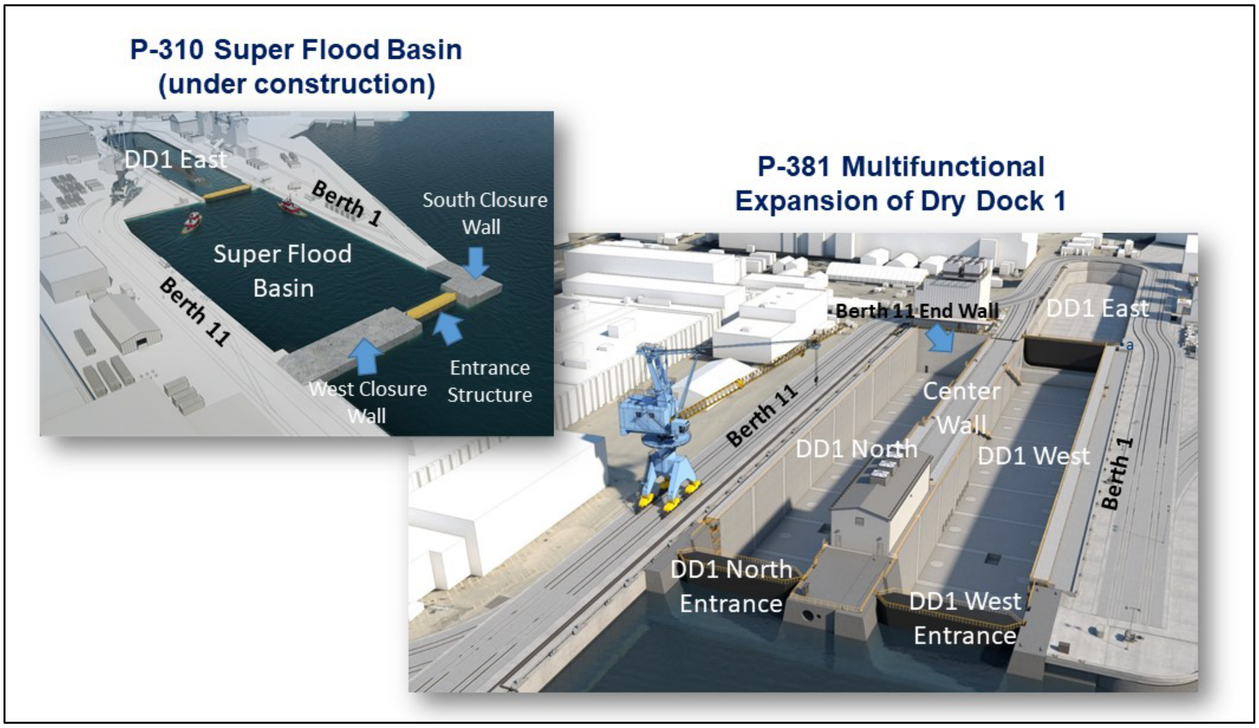


Figure 1. Conceptual Rendering of P-310 and P-381.

This report covers in-water work activities ranging from January 18, 2022, through December 30, 2022 with the exception of hydroacoustic monitoring results from rock hammering activities on January 12, 2023. During this timeframe, the Navy performed emergency repair actions associated with P-310 Super Flood Basin and initiated P-381 activities. The P-381 activities monitored during this reporting period include the installation of the Berth 11 guide wall, installation of center wall temporary launching piles, construction of center wall foundation support piles, and mechanical rock removal along Berth 11 and the West Closure Wall.

Past IHA Authorizations

In November 2018, the Navy submitted an Incidental Harassment Authorization (IHA) application to the National Marine Fisheries Service (National Oceanic and Atmospheric Administration

[NOAA] Fisheries) to request authorization to take marine mammals incidental to Year One activities associated with in-water construction of P-310. The application was deemed complete in March 2019 and NOAA Fisheries issued the IHA on May 20, 2019, for activities to occur between October 1, 2019, and September 30, 2020 (NAVFAC 2019). As a result of Project schedule changes and construction delays, work did not begin in October 2019 as planned, and in November 2019, the Navy requested a change in coverage dates for its Year One P-310 IHA activities. On December 3, 2019, NOAA Fisheries re-issued the IHA for P-310 Year One activities with new effective dates of March 1, 2020, through February 28, 2021. In-water construction for P-310 commenced on May 12, 2020.

On January 21, 2021, the Navy submitted a request for Renewal of the IHA for P-310 Year One activities, to cover in-water construction that had been assessed but could not be completed prior to the expiration of the Year One IHA. NOAA Fisheries issued the Renewal IHA Authorization for the Project on March 12, 2021. The Renewal IHA Authorization expired on February 27, 2022. The Navy submitted an IHA application for Year Two activities for P-310 to NOAA Fisheries on October 13, 2020, with a subsequent revision submitted on February 12, 2021. NOAA Fisheries issued the IHA for Year Two activities on June 2, 2021, providing immediate coverage for in-water activities through June 1, 2022, and superseding the Renewal IHA.

To support the first year of the P-381 activities, the Navy submitted an IHA application to NOAA Fisheries on September 2, 2021 and a revised application on December 21, 2021. NOAA Fisheries issued the IHA for Year One P-381 activities on April 1, 2022 with coverage until March 31, 2023. For P-381 work activities after March 31, 2023, the Navy submitted a Letter of Authorization LOA) request to NOAA Fisheries on May 5, 2022 with an amendment added on October 25, 2022. The LOA has requested coverage for P-381 work activities expected to occur between April 1, 2023 and March 31, 2028.

This report is being prepared to meet the P-381 Year One IHAs' reporting conditions that the Navy provide a draft report 60 days prior to the issuance of any subsequent IHA or LOA. As noted above, the LOA covering the remaining four years of P-381 in-water work activities is expected to be issued by April 1, 2023. A previous Year One IHA monitoring report was submitted to NOAA Fisheries on January 15, 2021, detailing the results of marine mammal monitoring during P-310 activities from May 12, 2020, to December 9, 2020 (NAVFAC 2021)[1]. The following year, the Navy submitted the Year Two IHA monitoring report to NOAA Fisheries, again covering P-310 activities, on January 24, 2022, with revisions provided in April and June 2022 (NAVFAC 2022). The current report details the results of marine mammal monitoring activities during in-water construction activities beginning January 18, 2022, through December 30, 2022. This reporting period falls under the coverage of two separate authorizations; the conclusion of Year Two IHA P-310 activities (through February 19, 2022) and the initiation of P-381 activities from May 3, 2022 through December 30, 2022.

[1] This report did not cover the full reporting period because of IHA requirements that a summary report be provided to NOAA Fisheries within 60 days of any subsequent IHA authorization period. The remainder of the reporting period was presented in a subsequent report to NOAA Fisheries.

2. IN-WATER CONSTRUCTION ACTIVITIES DURING REPORTING PERIOD

Construction activities during the P-310 Year Two IHA reporting period included installation of 220 25-inch Z-shaped sheet piles to perform emergency repairs to the P-310 Super Flood Basin along Berth 1 and the South Closure Wall. In addition, 71 25-inch Z-shaped sheet piles and 15 30-inch pipe piles forming the blast wall protecting the current Dry Dock 1 were removed to support emergency repairs along Berth 1. Completion of these in-water activities between January 18, 2022 and February 24, 2022 concluded the P-310 phase of the Project.

Under the P-381 Year One IHA reporting period, activities included installation of 30 28-inch Z-shaped sheet piles for the secant pile guide wall at Berth 11, excavation with down-the-hole (DTH) mono-hammer of six 42-inch diameter shafts for center wall temporary launching piles, rotary drilling eight 102-inch casings and eight 102-inch rock sockets, and cluster drilling DTH of two 78-inch diameter shafts for center wall foundation support piles. A mono-hammer DTH was used to install 60 42-inch diameter casings for mechanical rock excavation along the west closure wall established during the P-310 phase. Finally, a hydraulic rock hammer was utilized for mechanical rock removal from the basin floor.

Sheet piles were installed using cranes equipped with vibratory or impact hammers. Vibratory hammers were the primary method for sheet pile installation; however, impact hammers were used in a limited capacity to complete installation if the sheet could not be driven to refusal with solely the vibratory hammer. For drilling activities, a rotary action drill was used to initially set 102-inch diameter casings and excavate rock sockets into bedrock. A second 78-inch diameter casing (without the need for further drilling) was then set into the concrete prior to removal of the larger 102-inch diameter casing. Although it was anticipated removal of the outer 102-inch diameter casings would require a rotary drill, to date the casings have been removed by utilizing a dead pull method. A cluster drill DTH and rotary drill then operated within the 78-inch casing to create support piles for the center wall. Disturbed sediments generated during drilling were contained within casings. Air was then injected into the casing to lift spoils into a barge during drilling. Further details on in-water construction activities are provided below and Table 1 summarizes the construction materials and methods used.

3. PURPOSE OF MONITORING PROGRAM AND METHODS

The marine mammal and hydroacoustic monitoring program for the conclusion of P-310 activities was implemented during the reporting period in accordance with the Year Two IHA, and in adherence to the avoidance and minimization measures, to minimize impacts to marine mammals. A similar program was followed for the P-381 activities in accordance with the more recently issued IHA for Year One P-381 activities. Objectives and monitoring protocols were established in the Marine Mammal Monitoring Plans (MMMP) prepared by Cianbro [P-310] and 381 Constructors [P-381] for the Project and submitted to NOAA Fisheries on May 19, 2021 and April 21, 2022, respectively (Cianbro 2021; 381 Constructors 2022). Comments on the P-310 Year Two MMMP and P-381 Year One MMMP were not provided by NOAA Fisheries. Cianbro and 381 Constructors provided Protected Species Observers (PSOs) and completed the monitoring and data collection during this reporting period. Stantec Consulting Services Inc. (Stantec) provided technical support, data review, and the preparation of this monitoring report. The following subsections describe the marine mammal and hydroacoustic monitoring objectives and methods.

Table 1. Summary of Construction Activities During Reporting Period

Activity	IHA Period	Pile Purpose	Pile Count/Activity	Pile Type and Size	Method of Install
Berth 1 Emergency Repairs	P-310 Year Two	***Berth 1 Cutoff***	220 – Install	25-inch Z-sheet	Vibratory/Impact
	P-310 Year Two	***Remove Dry Dock 1 Blast Wall***	71 – Remove	25-inch Z-sheet	Vibratory
			15 – Remove	30-inch pipe pile	Vibratory
Center Wall	P-381 Year One	***Foundation Support Piles***	8 – Install	102-inch outer casing	Rotary Drill
	P-381 Year One		8 - Install	102-inch socket	Rotary Drill
	P-381 Year One		2 – Install	78-inch diameter shaft	Cluster drill DTH
	P-381 Year One	***Temporary Launching Piles***	6 – Install	42-inch diameter shaft	Mono-hammer DTH
Berth 11 End Wall	P-381 Year One	***Install Secant Pile Guide Wall***	30 – Install	28-inch Z-sheet	Vibratory/Impact
P-310 West Closure Wall	P-381 Year One	***Mechanical Rock Excavation – Rock Borings***	60 – Install	42-inch diameter casing	Mono-hammer DTH
Berth 11 Face	P-381 Year One	***Mechanical Rock Removal at Basin Floor***	Bedrock Excavation	225 cy[1]	Hydraulic Rock Hammer

[1] Volume of bedrock fractured during the reporting period is an estimate. This material has not been removed from the basin.

3.1 MARINE MAMMAL MONITORING

Marine mammal species authorized for taking and identified in the P-310 Year Two and P-381 Year One IHA Periods with the potential to occur in the Piscataqua River are as follows:

- High-frequency (HF) cetaceans:
  - Harbor porpoise (*Phocoena phocoena*)
- Phocids:
  - Harbor seal (*Phoca vitulina*)
  - Gray seal (*Halichoerus grypus*)
  - Harp seal (*Pagophilus groenlandicus*)
  - Hooded seal (*Cystophora cristata*)

Between January 18, 2022, and December 30, 2022 (i.e., during the P-310 Year Two and P-381 Year One IHA Periods), three approved PSOs monitored shutdown zones and Level A and B harassment zones before, during, and after activities with the potential to generate levels of underwater sound potentially harassing or injurious (i.e., harmful) to marine mammals. No monitoring occurred for dredging or other in-water work not expected to generate potentially harmful or harassing levels of underwater sound. Tables 2 and 3 summarize the distances to harassment zones, and shutdown distances, respectively for the marine mammal species identified above during the conclusion of the P-310 Year Two IHA period, respectively. Table 4 summarizes the distances to harassment zones and shutdown distances for the P-381 Year One IHA period. Appendix A provides figures from both IHA applications (P-310 and P-381) showing the spatial coverage of the various harassment zones.

Table 2. Level A and B Harassment Zones for P-310 Year Two IHA[1]

	Level A Harassment		Level B Harassment
	HF Cetacean	Phocid	
Pile Type, Size & Driving Method	Distance (meter)	Distance (meter)	Distance (meter)
Impact drive 25-in steel sheet piles[2]	2,056	923	Entire ROI[3]
Vibratory drive 25-in steel sheet piles[2]	25	10	Entire ROI[3]
Vibratory drive 30-in steel pipe piles	10	4	Entire ROI[3]

[1] Distances shown are for activities during the period from January 18, 2022, to February 24, 2022
[2] No acoustic details were available for 25-inch sheet piles so the Project used modeled 28-inch sheet pile distances.
[3] Entire ROI is 0.418 km

Table 3. Shutdown Distances for P-310 Year Two IHA[1]

Pile Type, Size & Driving Method	Shutdown distance (m)	
	HF Cetacean	Phocid
Impact drive 25-in steel sheet piles[2]	110	50
Vibratory drive 25-in steel sheet piles[2]	110	50
Vibratory drive 30-in steel pipe piles	70	30

[1] Distances shown are for activities during the period from January 18, 2022, to February 24, 2022
[2] No acoustic details were available for 25-inch sheet piles he Project used modeled 28-inch sheet pile distances.

Table 4. Shutdown Zones and Level B Harassment Zones for P-381 Year One IHA[1]

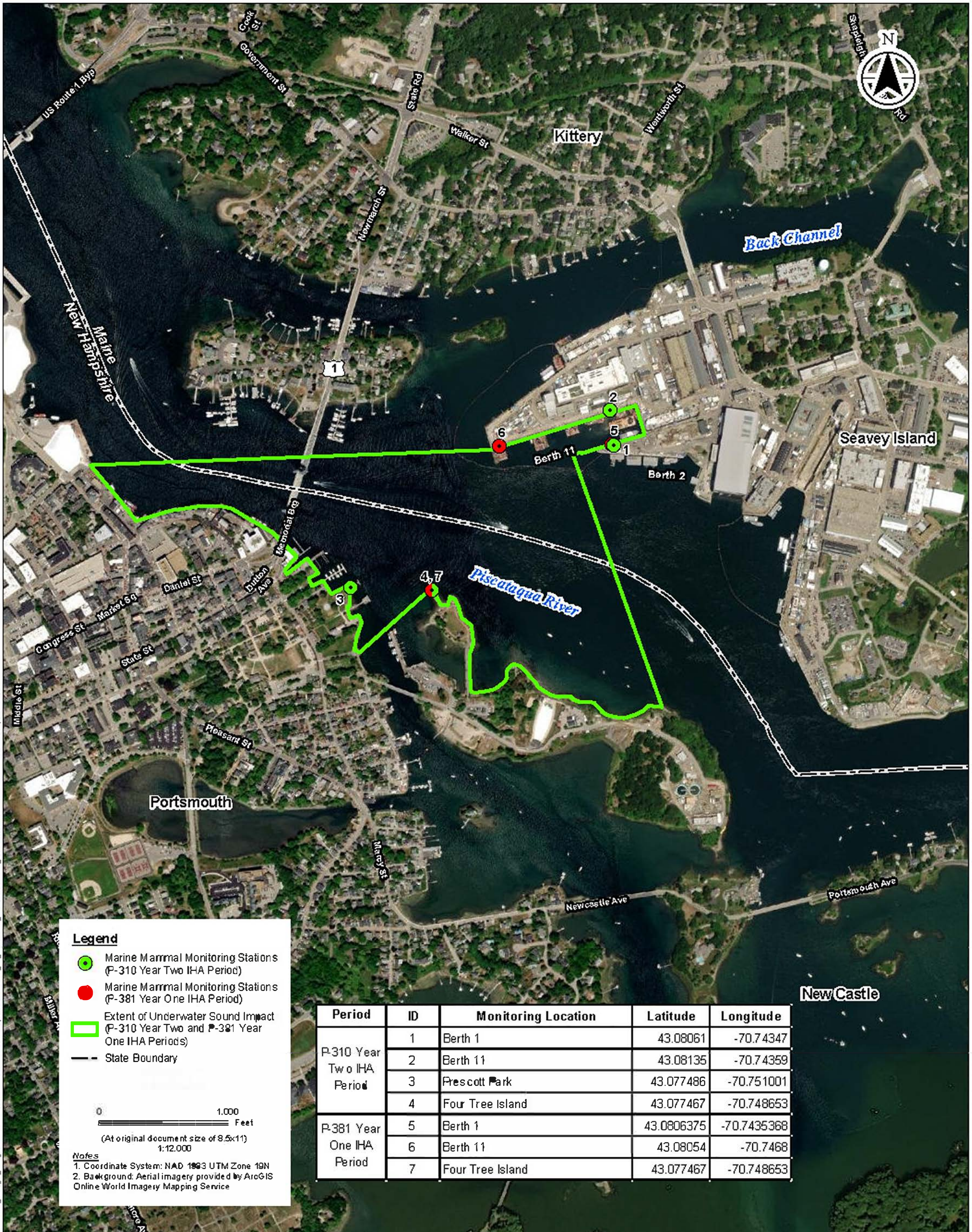
Pile Type, Size & Driving Method	Shutdown Zone (m)		Level B Harassment[2] (m)
	HF Cetacean	Phocids	
78-inch cluster drill	200[3]	50[3]	ROI
DTH monohammer- 42-inch	200[3]	50[3]	ROI
Impact install of sheet piles (60) 28-inch sheets Secant pile guide wall	200[3]	50[3]	ROI
Vibratory pile driving (60) 28-inch sheets	20	10	ROI
Rock hammering – all durations	200[3]	50[3]	ROI
Rotary drilling – Install 102-inch casing	10	10	ROI
Rotary drilling –Predrill 102-inch socket	10	10	ROI

[1] Distances shown are for activities during the period from May 3, 2022 to December 30, 2022
[2] In instances where the harassment zone is larger than the ROI, the entire ROI is indicated as the limit of monitoring.
[3] Reduced monitoring area distance negotiated with NOAA Fisheries

During both IHA periods, the PSOs continued to monitor from the positions previously used for the Project, including locations at Prescott Park and Four Tree Island (Figure 2). However, because some construction activities associated with P-381 were located westward (and closer to the Piscataqua River), Berth 1 and Berth 11 monitoring locations were also shifted to the west during P-381 Year One IHA activities. While monitoring, PSOs were assigned no other tasks and were responsible for using a combination of binoculars and naked eye to search for marine mammals. Distances to sightings were measured using range finders and bearings were taken using a compass. In addition, PSOs recorded information on:

- Weather parameters (e.g., wind, humidity, temperature, cloud cover);
- Visibility;
- Tidal state and sea state conditions;
- Behaviors of any sighted marine mammals, including bearing from construction and the direction of travel, and;
- Other human activity in the area (e.g., boat traffic).

A lead PSO, positioned near active construction, was responsible for recording the start and stop times of construction activities and coordinating communications with other PSOs. Data was recorded electronically on the Project-specific monitoring Application (App), which was deployed onto cellular-enabled iPads, as discussed in the approved monitoring plans. Paper datasheets (Appendix B) were used as a backup in case of cellular connectivity issues. When paper datasheets were used, data was manually entered into the monitoring App or Project website by either the PSO or a Stantec biologist. These data were typically entered within 24 to 48 hours of the original observation.



Period	ID	Monitoring Location	Latitude	Longitude
P-310 Year Two IHA Period	1	Berth 1	43.08061	-70.74347
	2	Berth 11	43.08135	-70.74359
	3	Prescott Park	43.077486	-70.751001
	4	Four Tree Island	43.077467	-70.748653
P-381 Year One IHA Period	5	Berth 1	43.0806375	-70.7435368
	6	Berth 11	43.08054	-70.7468
	7	Four Tree Island	43.077467	-70.748653

Figure 2. Marine Mammal Monitoring Stations for P-310 Year Two and P-381 Year One IHA Periods

3.2 HYDROACOUSTIC MONITORING

NOAA Fisheries required hydroacoustic monitoring of the sound field during in-water activities for 10% (with a limit of 10 instances) of the pile types and installation methods used during both the P-310 Year Two and P-381 Year One IHA activities. All P-310 Year Two IHA hydroacoustic monitoring requirements were completed before January 2022 and were described in the previous annual report submitted to NOAA Fisheries (NAVFAC 2022).

For the P-381 Year One IHA Period, NOAA Fisheries required the following specific hydroacoustic monitoring requirements:

- Nine 102-in socket/casings installed via rotary drill;
- Nine 78-in shafts installed via down-the-hole (DTH) cluster drill;
- Ten 42-in casing/shafts installed via DTH mono-hammer;
- Ten 9-in holes installed via DTH mono-hammer;
- Ten 4 to 6-in holes installed via DTH mono-hammer;
- Ten instances of rock hammering

381 Constructors deployed Cetacean Research CR3 omnidirectional piezoelectric element hydrophones roughly mid-depth in the water column at a near-field distance (generally 10 meters [m]) and at a far-field distance when possible. A Spectra DAQ-200 was used to record the measurements collected by the hydrophones. Hydrophones were suspended midway in the water column and attached to a weighted nylon cord to maintain constant depth and distance. The nylon cord was also attached to a float or tied to a static line. Calibration of both the hydrophones and data acquisition system was performed at the start of each day to verify performance. Information captured from the hydrophone was transmitted to a data acquisition system and recorded onto an external LaCie hard drive. Sound measurements, including root mean square (RMS) sound pressure level (SPL), peak SPL, frequency content, and cumulative sound exposure level (cSEL) computed from the hydrophone data were displayed in real time. 381 Constructors' final Hydroacoustic Monitoring Plans for the P-381 Year One IHA period is provided in Appendix C. All sound measurements recorded during this reporting period were analyzed as unweighted values.

Near-Field Data Collection

381 Constructors captured near-field data from various locations during the reporting period. Due to the congestion in the basin from barges and material for the various concurrent activities most of the data had to be collected from a location greater than 10 meters (e.g., 70 meters on December 13, 2022). This led to most of the data collected being saturated with non in-water construction activities such as interference from boat traffic and barge moves. Also, demolition work on Berth 11A precluded its use as an alternate location to deploy a near field hydrophone. Data was reviewed and sorted by day with the most accurate/representative data free of interference submitted in the daily reports. Data determined to include interference is not provided in this report but is available upon request.

Far-Field Data Collection

Similar challenges existed for collection of far field data as were noted above for near-field measurements. Far-field hydroacoustic measurements were sampled primarily using davit arms placed on the entrance structure as well as Berth 11C. One challenge that was encountered when collecting far field samples was that due to the configuration of the basin, entrance structure and west closure wall and source location of the different in-water activities, no direct line of sight was available for the far-field hydrophone location (see Map figure in respective daily reports in Appendix D – Hydroacoustic Reports).

Deploying the far-field hydrophone outside of the basin and bubble curtain had other logistical challenges to work around. In some instances, the hydrophone was deployed but local boats and construction vessels caused too much interference to collect a quality sample representative of the item and tooling that was intended. In some instances, it was determined placement of the far-field hydrophone was not achievable due to location of barges, barge traffic and ancillary shipyard activities (e.g., security gate movement and security operations). In these instances, it was determined collection of the nearfield data was still essential as the far-field results could be calculated following methods from Caltrans (2020). It was also challenging to collect a sample of certain tooling, such as the rotary drill, due to its acoustic impacts being smaller than anticipated. For other activities, the bubble curtain attenuation reduced the impacts from tooling that may have been above ambient without the bubble curtain to below ambient. For these activities the far-field hydrophone would have been either on Berth 11 C and occluded by the West Closure Wall or at the South Closure Wall outside of the bubble curtain and within the barge traffic route. More information can be found in Appendices D and E – Barge Congestion Figure.

In summary, due to the various interferences observed in the field during monitoring, the engineer determined that the far field hydrophone data would not result in accurate data capture. The focus on a single nearfield hydrophone location allowed for more focused tracking of changing field conditions and more accurate sound data. Due to these challenges in capturing far field data, 381 Constructors extrapolated far field acoustic values from captured near field data using the practical spreading loss model when hydrophones were not used. Calculations followed the methods outlined by Caltrans (2020) and used by NMFS to develop spreadsheet models for evaluating underwater sound. Extrapolations were calculated with the F value of 15 or 20 (i.e., conservative method). A F-value of 15 was selected for locations where sound would have not passed through the bubble curtain while a F-value of 20 was used for distances outside of the bubble curtain. Extrapolated data includes data collected after November 28th. Data collected prior was post processed with the observed far-field data. More details on use of the practical spreading loss model are provided in Appendix D.

4. RESULTS – MARINE MAMMAL MONITORING

4.1 CONSTRUCTION ACTIVITIES

Between January 18, 2022, and December 30, 2022, in-water pile driving, drilling, mono-hammering, and rock hammering activities occurred on 111 days, over a total of 309 hours and 31 minutes. Total in-water work time was highest during the months of September and November.

Mono-hammering was the most common installation method (with a total time of 158 hours and 56 minutes across 45 days), followed by rotary drilling (64 hours and 41 minutes across 20 days). There was limited use of impact pile driving (4 hours and 49 minutes across nine days and only during P-310 Year Two activities), and cluster drilling (4 hours and 20 minutes across four days). Table 5 provides a monthly breakdown of construction methods by total time. Construction tracking data are provided to NOAA Fisheries in an electronic format (i.e., Excel) as a supplement to this report.

Table 5. Summary of Construction Time by Month (Days in Brackets)

Month	IHA Period	Total In-Water Construction Time (hh:mm)	Vibratory Driving (hh:mm)	Impact Driving (hh:mm)	Cluster Drilling (hh:mm)	Rotary Drilling (hh:mm)	Mono Hammer (hh:mm)	Hydraulic Rock Hammer (hh:mm)
January	P-310 Year Two	8:06 [8]	6:25 [8]	1:41 [3]	0:00 [0]	0:00 [0]	0:00 [0]	0:00 [0]
February	P-310 Year Two	28:54 [18]	25:46 [18]	3:08 [6]	0:00 [0]	0:00 [0]	0:00 [0]	0:00 [0]
May	P-381 Year One	9:44 [10]	9:44 [10]	0:00 [0]	0:00 [0]	0:00 [0]	0:00 [0]	0:00 [0]
June	P-381 Year One	11:48 [12]	0:00 [0]	0:00 [0]	0:00 [0]	0:00 [0]	11:48 [12]	0:00 [0]
August	P-381 Year One	23:04 [6]	0:00 [0]	0:00 [0]	0:00 [0]	22:04 [5]	1:00 [1]	0:00 [0]
September	P-381 Year One	67:36 [15]	0:00 [0]	0:00 [0]	3:06 [3]	14:22 [3]	50:08 [13]	0:00 [0]
October	P-381 Year One	43:34 [11]	0:20 [2]	0:00 [0]	1:14 [1]	0:00 [0]	42:00 [8]	0:00 [0]
November	P-381 Year One	65:39 [16]	0:15 [1]	0:00 [0]	0:00 [0]	11:24 [4]	54:00 [11]	0:00 [0]
December	P-381 Year One	51:06 [15]	0:00 [0]	0:00 [0]	0:00 [0]	16:51 [7]	0:00 [0]	34:15 [8]
TOTAL		**309:31 [111]**	**42:30 [39]**	**4:49 [9]**	**4:20 [4]**	**64:41 [19]**	**158:56 [45]**	**34:15 [8]**

4.2 MONITORING EFFORT

Between January 18, 2022, and December 30, 2022, three PSOs a day monitored the Project's activities and associated harassment zones over 152 days for a total of 4,507 hours and 11 minutes across the entire reporting period (Table 6). Active in-water activities with potential to generate underwater noise above Level A or B thresholds occurred during 7.6% (309 hours and 31 minutes) of the total time spent monitoring.. Daily monitoring log data are provided to NOAA Fisheries in an electronic format (i.e., Excel) as a supplement to this report. During both the P-310 Year Two and P-381 Year One IHA periods, PSOs monitored the full ROI and associated harassment and shutdown zones for 100% of the time when in-water activities with potential to generate harmful underwater sound levels were occurring.

Overall, weather conditions while monitoring were generally cloudy (60.0%; n=528) with occasional occurrences of rain, fog, or snow (11.3%; n=99). Visibility during monitoring activities was predominately fair to good, with PSOs completing daily weather observations twice a day (once in the morning and once in the afternoon). Out of a total of 879 weather observations, poor visibility conditions were reported during 22 entries (or approximately 2.5%). During periods of poor visibility, in-water work continued only if PSOs could continue to monitor the 200-meter shutdown zone as detailed in the IHA (Condition 4(j)). On May 4, 2022, PSOs ended in-water construction activities early in the afternoon due to poor visibility and the inability to accurately monitor the shutdown zone. On September 13, 2022, poor visibility of the shutdown zone delayed construction activities for 2 hours and 20 minutes until weather conditions improved. Figures 4 and 5 provide a summary of weather conditions and visibility, respectively. Weather observations are provided to NOAA Fisheries in an electronic format (i.e., Excel) as a supplement to this report.

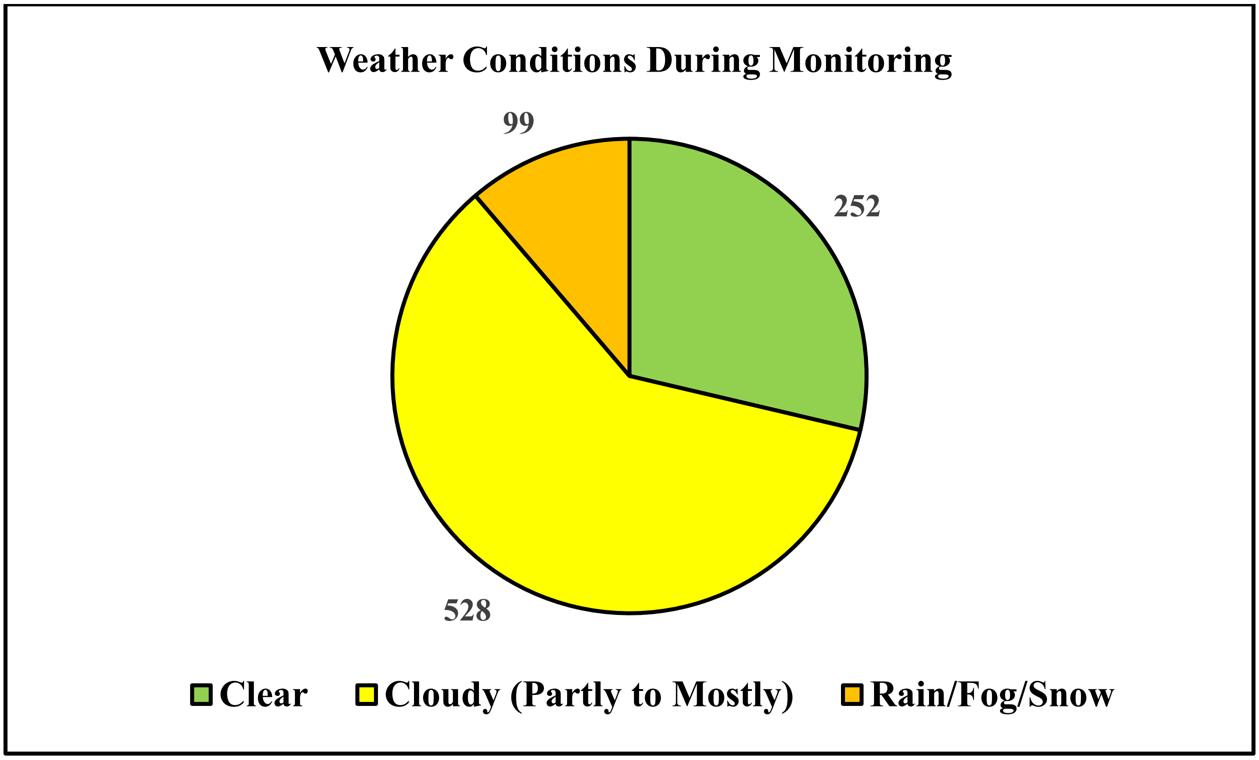


Figure 3. Weather Conditions by Number of Observation Records

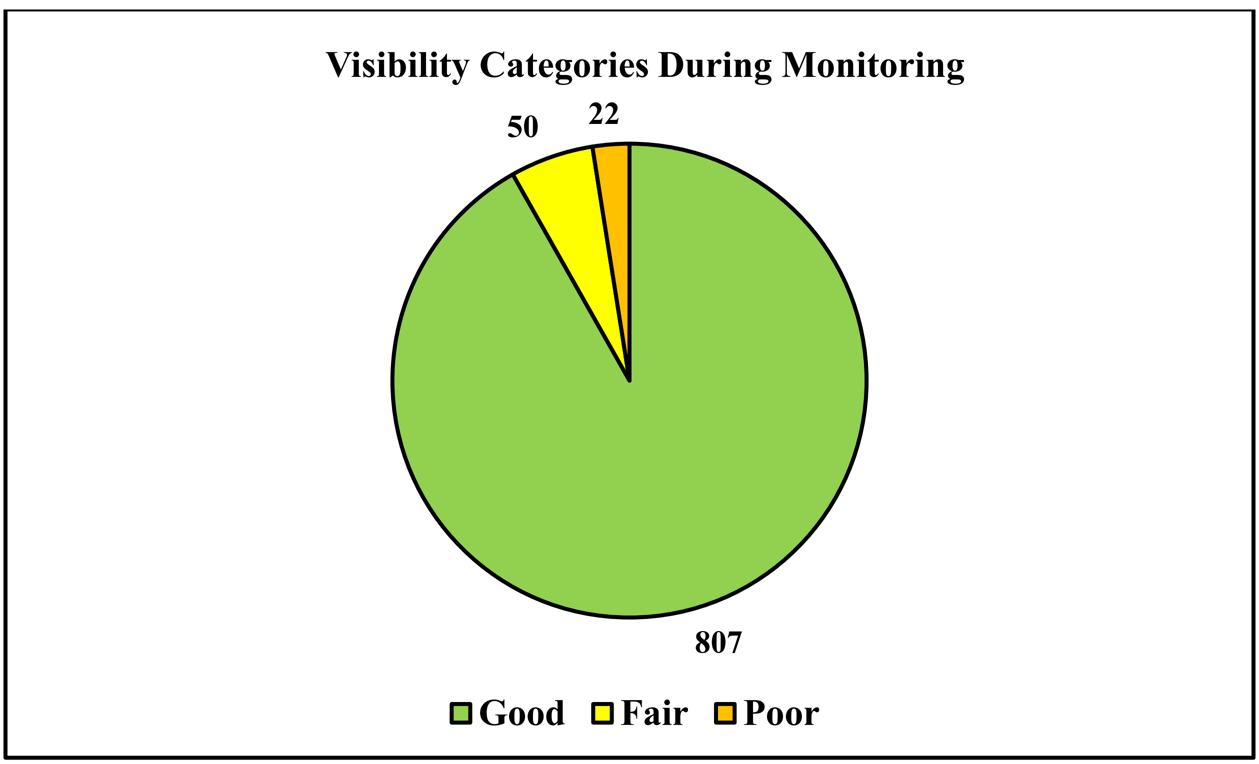


Figure 4. Visibility Categories by Number of Observation Records

Table 6. Summary of Monitoring Effort

Month	IHA Period	Total Days	Total Time Monitoring (hh:mm)	Total In-Water Construction Time (hh:mm)	Percent In-Water Work During Total Monitoring Time (%)	Total Time with Only Level A Monitoring (hh:mm)	Percent of Total Time with Only Level A Monitoring (%)	In-Water Work Time with Complete Level A & B Monitoring (hh:mm)	Percent of Total In-Water Work Time with Complete Level A & B Monitoring (%)
January	P-310 Year Two	11	275:41	8:06	2.9	0:00	0	8:06	100
February	P-310 Year Two	20	557:56	28:54	5.2	0:00	0	28:54	100
May	P-381 Year One	18	458:04	9:44	2.1	0:00	0	9:44	100
June	P-381 Year One	14	428:19	11:48	2.8	0:00	0	11:48	100
August	P-381 Year One	11	296:18	23:04	7.8	0:00	0	23:04	100
September	P-381 Year One	22	591:37	67:36	11.4	0:00	0	67:36	100
October	P-381 Year One	15	363:43	43:34	12.0	0:00	0	43:34	100
November	P-381 Year One	20	540:26	65:39	12.1	0:00	0	65:39	100
December	P-381 Year One	21	545:07	51:06	9.4	9:38[1]	2.0	51:06	100
TOTAL		152	4057:11	309:31	7.3	9:38	0.2	309:31	100

[1] On a single day (12/6/2022), one PSO was on standby at Berth 11 in case of in-water work activities. No in-water work was performed but Table 6 has been updated to reflect that only Level A zones were monitored on this date.

4.3 MARINE MAMMAL OBSERVATIONS

During the reporting period between January 18, 2022 and December 30, 2022, there were a total of 213 observations (including re-sightings) of 159 identified marine mammals. Re-sightings accounted for 25.4% (n=54) of observations and were recorded when the PSO could confidently conclude the same animal was observed after being previously counted. Harbor seals and two unknown seals were the only observed species. No gray seals, harp seals, hooded seals, or harbor porpoise were observed. Each harbor seal was observed in water; there were no observations of individuals hauled out on buoys, barges, or docks. Figure 6 shows the spatial distribution of marine mammal observations. Table 7 summarizes the species and individuals observed during the reporting period. Approximately 64.3% (n=137) of the 213 total observations occurred when construction was not occurring; either during pre- or post-construction periods or on days when no in-water work occurred. Marine mammal observational data is provided to NOAA Fisheries in an electronic format (i.e., Excel) as a supplement to this report.

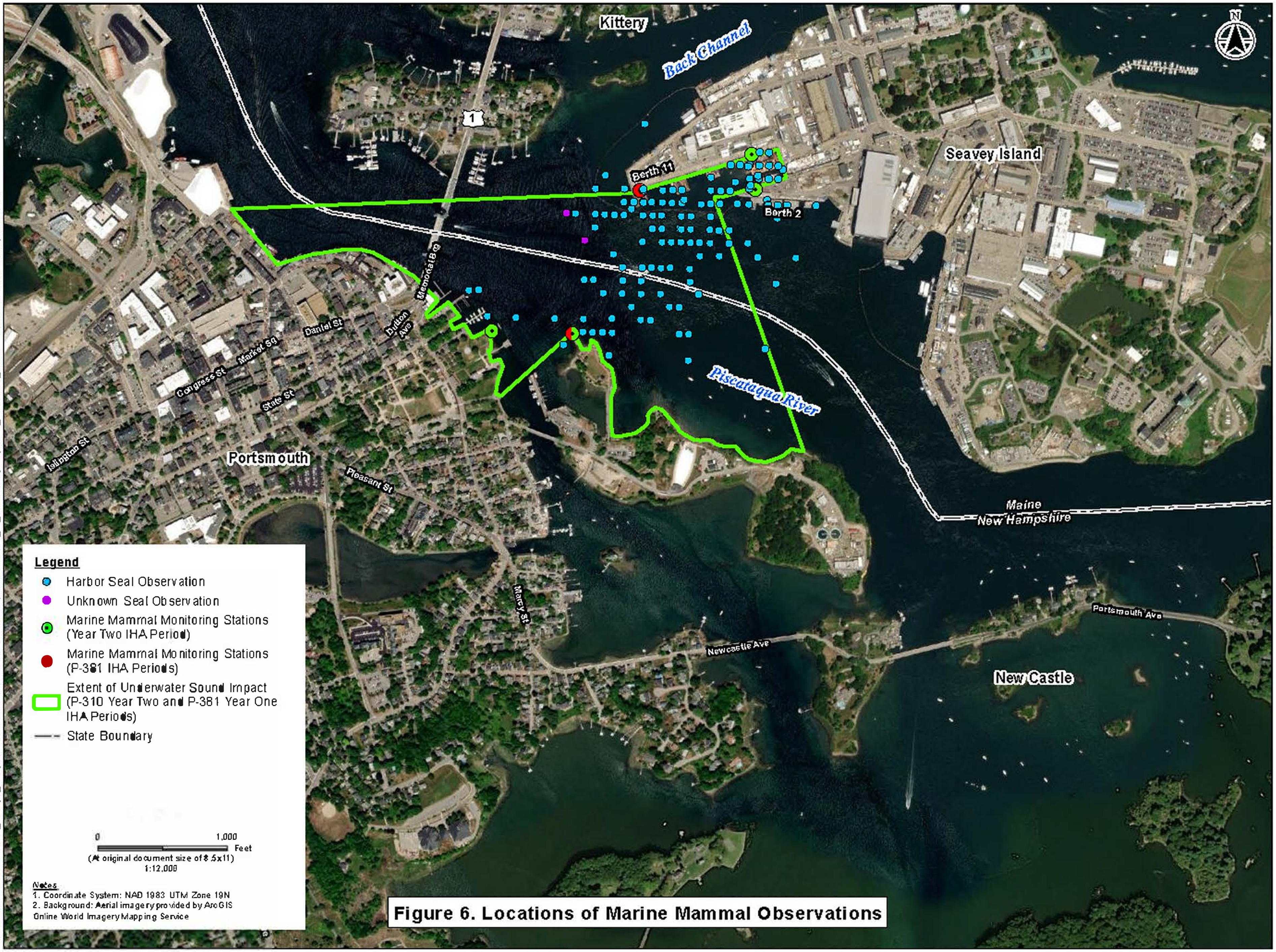


Figure 6. Locations of Marine Mammal Observations

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.

Table 7. Summary of Marine Mammal Observations

Month	IHA Period	Total Observations (Obs)	Harbor Seal Obs	# of Unique Harbor Seals	# of Repeat Harbor Seals	Unknown Seal Obs	# of Unique Unknown Seals	# of Repeat Unknown Seals
January	P-310 Year Two	4	4	4	0	0	0	0
February	P-310 Year Two	3	3	2	1	0	0	0
May	P-381 Year One	14	14	12	2	0	0	0
June	P-381 Year One	1	1	1	0	0	0	0
August	P-381 Year One	37	37	20	17	0	0	0
September	P-381 Year One	54	54	38	16	0	0	0
October	P-381 Year One	16	14	10	4	2	1	1
November	P-381 Year One	47	47	39	8	0	0	0
December	P-381 Year One	37	37	32	5	0	0	0
TOTAL		**213**	**211**	**158**	**53**	**2**	**1**	**1**

During marine mammal observations, the most noted behavior was no response (77.9%; n=166), followed by other behaviors (11.3%; n=24). Other behaviors observed include diving (n=6), no description (n=5), milling (n=4), foraging (n=3), swimming (n=3), and bottling, breaching, and drifting (all n=1). These behaviors were observed regardless of whether active construction was underway at the time. PSOs recorded nine observations where harbor seals were observed retreating or flushing (presumably in response to some stimulus) and this is detailed further in Table 8. Figure 7 provides a visual summary of the behaviors recorded during the reporting period.

Table 8. Summary of Retreat/Flushing Observations During Reporting Period

Species	Date – Time	Distance from Source (km)	Construction Activity	Material Type & Method	Take Occurred?
Harbor Seal	08/17/2022 – 0825	0.087	Pre-Construction	No Construction	No
Harbor Seal	09/16/2022 – 0905	0.212	Mono Hammer – DTH	42” Casing/Shaft	Yes (1 Level A)
Harbor Seal	10/23/2022 – 1403	0.392	Post-Construction	No Construction	No
Harbor Seal (2x)	11/21/2022 – 0912	0.099	Rotary Drill	102” Casing/Shaft	Yes (2 Level B)
Harbor Seal (2x)	11/29/2022 – 1143	0.172	Rotary Drill	102” Casing/Shaft	Yes (2 Level B)
Harbor Seal	12/5/2022 – 1003	0.178	Pre-Construction	No Construction	No
Harbor Seal	12/30/2022 – 1231	0.158	Post-Construction	No Construction	No

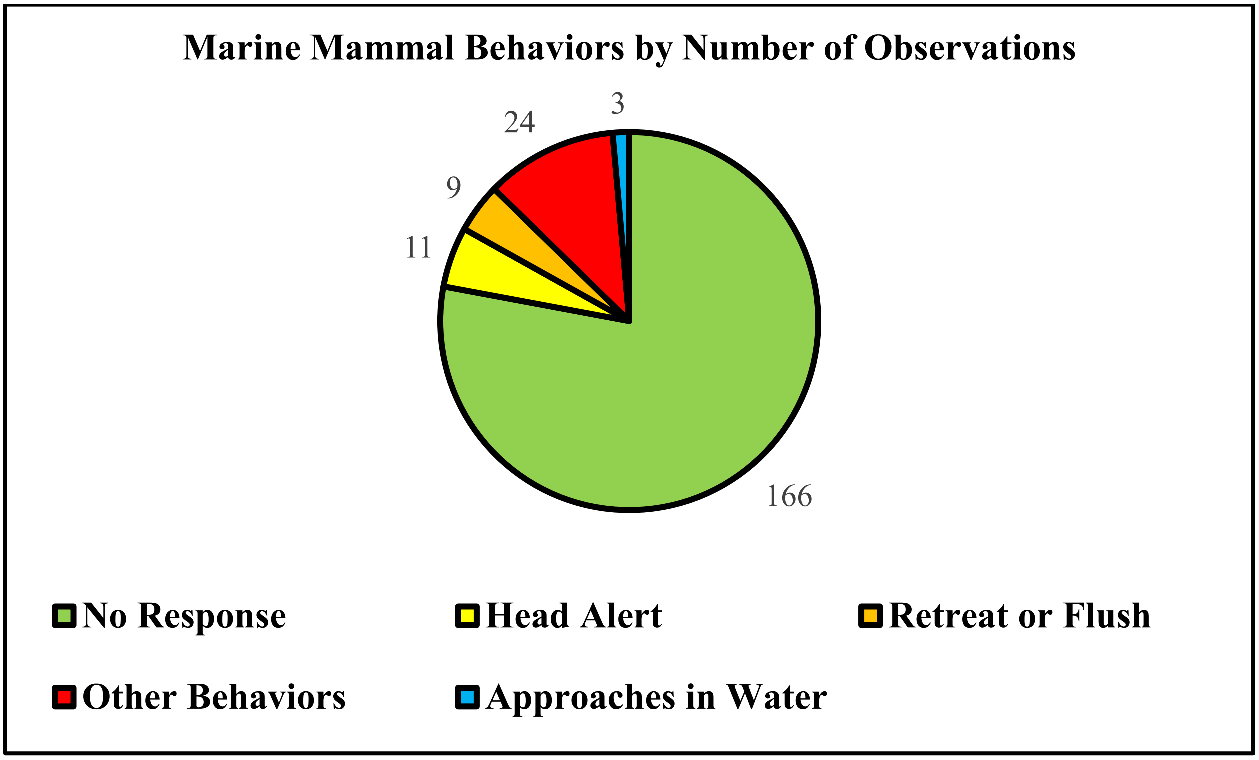


Figure 6. Summary of Observed Behaviors

Table 9 summarizes the age classes and sex (if known) for the species of marine mammals observed during the reporting period. Generally, most harbor seal individuals could be identified by age with adult individuals making up most of the observations. The determination of sex was generally not possible unless the species had clear morphology (e.g., larger size) that made it possible to determine sex.

Table 9. Summary of Age Classes and Sex for Unique Individuals

Species	# Adults	# Juveniles	# Unknown Age	# Females	# Males	# Unknown Sex
Harbor Seal	137	15	59	0	0	211
Unknown Seal	0	0	2	0	0	2
TOTAL	**137**	**15**	**61**	**0**	**0**	**213**

4.4 ESTIMATES OF LEVEL A AND LEVEL B TAKES

Observed take during the reporting period was exclusively based on the number of marine mammals observed by PSOs within the ensonified area previously determined in the Project's IHAs and if the observation occurred during active in-water construction activities. PSOs positioned at auxiliary locations monitoring Level A and Level B zones without clear line-of-sight to construction activities received updates from the Lead PSO on activities. If PSOs were unsure whether in-water work was occurring or not, they recorded observations under the conservative assumption that work was occurring. These observations and evaluation of potential take were either compared with the Lead PSO's daily construction log at the end of the workday or verified by the Stantec biologist during subsequent QA/QC of the data. Tables 10 and 11 summarize the observed take by month and species for the reporting period.

Table 10. Observed Level A Takes by Month and Species

Month	IHA Period	Harbor Seal Level A Takes	Unknown Seal Level A Takes
January	P-310 Year Two	0	0
February	P-310 Year Two	0	0
May	P-381 Year One	0	0
June	P-381 Year One	0	0
July	P-381 Year One	0	0
August	P-381 Year One	0	0
September	P-381 Year One	15	0
October	P-381 Year One	7	1
November	P-381 Year One	8	0
December	P-381 Year One	2	0
TOTAL		**32**	**1**

Table 11. Observed Level B Takes by Month and Species

Month	IHA Period	Harbor Seal Level B Takes	Unknown Seal Level B Takes
January	P-310 Year Two	0	0
February	P-310 Year Two	2	0
May	P-381 Year One	4	0
June	P-381 Year One	0	0
July	P-381 Year One	0	0
August	P-381 Year One	4	0
September	P-381 Year One	4	0
October	P-381 Year One	0	0
November	P-381 Year One	7	0
December	P-381 Year One	4	0
TOTAL		**25**	**0**

There were no instances where a Level A take was observed during the conclusion of the P-310 Year Two IHA. During the conclusion of the P-310 Year Two IHA period (i.e., January and February 2022), there were an observed total of 2 Level B takes, all of which were to harbor seals. During the conclusion of the P-310 Year Two IHA period, the Project's full ROI (both Level A and Level B zones) was fully monitored for 100% of the total in-water work time. As a result, there is no need to estimate an additional amount of extrapolated take to harbor seals during this reporting period. Section 6 of this report provides a summary of total Level A and B takes to marine mammals during the full P-310 IHA Period for ease of review.

During the P-381 Year One IHA (May to December 2022) period, there was an observed total of 33 Level A takes. This includes harbor seals (n=32) and an unknown seal (n=1) during pile driving and drilling activities. There were a total of 25 Level B (all harbor seals) during this reporting period. The Project's full ROI (both Level A and B zones) was fully monitored for 100% of the total in-water work time between May and December 2022. As a result, there is no need to estimate an additional amount of extrapolated take to harbor seals during this reporting period.

4.5 CONSTRUCTION DELAYS/SHUTDOWNS AND MITIGATION MEASURES

There were no construction delays or shutdowns required during the conclusion of the P-310 Year Two IHA period (January to February 2022). There were a total of two construction delays (lasting a total of one hour) during the P-381 Year One IHA period due to the presence of marine mammals. Delays occurred on 05/03 (15 minutes) and on 09/29 (45 minutes) when harbor seals were observed within the shutdown zone. In addition, the Project experienced early work stoppage on 05/04/22 and a 2 hours and 20-minute weather-related construction delay on 09/13/22, both of which were related to poor visibility of the 200-m shutdown zone. As previously described, PSOs directed in-water work activities to cease during these events.

4.6 OBSERVATIONS OF INJURED OR DEAD MARINE MAMMALS

On August 23, 2022 at approximately 1230, an injured adult harbor seal was observed in the eastern end of the basin (43.08113920845339, -70.74279055332816). No in-water work was occurring at the time of observation. The seal was observed milling around in the basin for approximately 15 minutes. A long laceration was observed on its face and upper body. The wound was described as old and scabbed over. The seal left the area before any photo documentation could occur. In accordance with the issued IHA, the sighting was reported to the Office of Protected Resources (OPR), NMFS (PR.ITP.MonitoringReports@noaa.gov) and to the Greater Atlantic Region New England/Mid-Atlantic Regional Stranding Coordinator later that day. To the Navy's knowledge, there were no external observations or reports of any injured or dead marine mammals during P-310 Year Two and P-381 Year One IHA activities within the Project's harassment zones or near the Shipyard.

5. RESULTS – HYDROACOUSTIC MONITORING

Hydroacoustic monitoring was required under the P-381 Year One IHA for a subset of in-water installation methods and materials. Below is a summary of the hydroacoustic monitoring completed by 381 Constructors during the reporting period and per the IHA conditions:

- Ten instances of Mono-Hammer DTH on 42-inch casings (IHA requires ten)
- Fourteen instances of Rotary Drill activities on 102-inch casings (IHA requires nine)
- Twelve instances of Rock Hammering activities (IHA requires ten)

Tables 12 through 14 summarize hydroacoustic results of the construction activities monitored by 381 Constructors during the reporting period. Appendix D provides copies of the associated hydroacoustic reports completed for these instances and includes details on when the practical spreading loss model was used for estimated far-field distance values. Additional hydroacoustic monitoring expected in the remainder of the P-381 Year One IHA Period include the additional three instances of rock hammering and use of the DTH cluster drill on 78-inch shafts. Results from these monitoring activities will be provided in subsequent reports to NOAA Fisheries.

For the remainder of the P-381 Year One IHA Period, 381 Constructors will continue to collect data in a way that is representative of the in-water construction activities while also trying to reduce any environmental interference. Coordination with ancillary in-water work is ongoing to attempt to gain representative far-field data. 381C would welcome suggestions from NMFS on the use of extrapolated data in the event far field data cannot be obtained due to the aforementioned constraints detailed in this report. As previously noted, and as shown in Appendix E , the basin is and will continue to be congested and there often is limited ability to gain a clear line of site location for far-field monitoring of the current activities. Also, as noted previously, use of the bubble curtain and continued presence of the West Closure Wall during this reporting period have resulted in lower than anticipated hydroacoustic results for the monitored activities. Please refer to data collected earlier in the construction process, where basin congestion was less, in June and September.

Table 12. Hydroacoustic Monitoring Results for Mono-Hammer DTH Activities.

Pile #	Date	Pile Type	Hammer Make/Model	Noise Type	Start Time	Stop Time	Active Hammer Duration (seconds)	Hammer Strikes	Pulse Duration (seconds)	Distance From Pile (meters)	Protected by Bubble Curtain	RMS unweighted (SPL dB re 1uPa)			Peak unweighted (SPL dB re 1uPa)			SELss unweighted (dB re 1uPa^2.s)			SELcum unweighted (dB re 1uPa^2.s)
												Median	Average	Range	Median	Average	Range	Median	Average	Range	
1	6/10/2022	42" Pipe Pile	Mincon MP340	Impulsive	10:22	10:28	358	2,864	0.055	10[1]	No	167.87	168.00	162.26-173.76	180.38	180.98	163.41 – 188.15	158.84	158.96	153.23 – 164.73	193.41
										65	No	155.68	155.81	150.07 - 161.57	168.19	168.79	151.22 - 175.96	146.65	146.77	141.04 - 152.54	181.22
										84[1]	Yes	154.01	154.14	148.40 – 159.90	166.52	167.12	149.55 – 174.29	144.98	145.10	139.37 – 150.87	179.55
										258[1]	Yes	146.70	146.83	141.09 – 152.59	159.21	159.81	142.24 -166.98	137.67	137.79	132.06 – 143.56	172.24
2	6/10/2022	42" Pipe Pile	Mincon MP340	Impulsive	10:28	10:32	195	1,755	0.056	10[1]	No	167.66	168.28	142.70 – 175.03	182.09	182.74	150.58 – 189.09	158.63	159.25	133.67 – 166.00	191.08
										65	No	155.47	156.09	130.51 - 162.84	169.90	170.55	138.39 - 176.90	146.44	147.06	121.48 - 153.81	178.88
										84	Yes	137.49	137.21	125.09 - 149.28	148.06	148.16	131.51 - 166.94	128.46	128.18	116.06 - 140.25	160.90
										258[1]	Yes	130.18	129.90	117.78 – 141.97	140.75	140.85	124.20 – 159.63	121.15	120.87	108.75 – 132.94	153.59
3	6/10/2022	42" Pipe Pile	Mincon MP340	Impulsive	10:59	11:14	901	8,109	0.056	10[1]	No	168.23	168.43	136.44 – 177.27	182.27	182.84	148.68 – 194.41	159.20	159.40	127.41 – 168.24	198.29
										65	No	156.04	156.24	124.25 - 165.08	170.08	170.65	136.49 - 182.22	147.01	147.21	115.22 - 156.05	186.09
										84	Yes	137.21	137.21	120.68 - 141.99	148.85	148.83	130.77 - 153.94	128.18	128.18	111.65 - 132.96	167.27
										258[1]	Yes	129.90	132.03	115.50 – 136.81	143.67	143.65	125.59 – 148.76	123.00	123.00	106.47 – 127.78	162.09
4	6/10/2022	42" Pipe Pile	Mincon MP340	Impulsive	11:33	11:55	1,328	13,280	0.060	10[1]	No	169.73	171.64	133.61 – 188.24	183.88	185.53	144.74 – 202.14	159.73	161.64	123.61 – 178.24	200.97
										65	No	157.54	159.45	121.42 - 176.05	171.69	173.34	132.55 - 189.95	147.54	149.45	111.42 - 166.05	188.78
										84	Yes	138.04	139.63	121.64 - 160.37	149.80	151.11	129.51 - 176.28	129.01	130.59	110.92 - 145.61	170.24
										258[1]	Yes	130.73	132.32	114.33 – 153.06	142.49	143.80	122.20 – 168.97	121.70	123.28	103.61 – 138.30	162.93
5	9/7/2022	42" Pipe Pile	Mincon MP340	Impulsive	10:42	11:07	1,543	13,887	0.054	10[2]	No	158.94	158.61	143.13 – 169.34	171.61	172.49	159.12 – 186.28	149.91	147.51	134.10 – 160.30	191.34
										65[2]	No	142.68	142.35	126.87 – 153.08	155.35	156.23	142.86 – 170.02	133.65	131.25	117.84 – 144.04	175.08
										84[a]	Yes	138.73	138.40	122.92 – 149.13	151.40	152.28	138.91 – 166.07	129.70	127.30	113.89 – 140.09	171.12
										186	Yes	133.55	133.22	117.74 - 143.95	146.22	147.1	133.73 - 160.89	124.52	122.12	108.71 - 134.91	165.94
6	9/7/2022	42" Pipe Pile	Mincon MP340	Continuous	14:43	15:49	3,866	N/A	N/A	10	No	138.78	143.30	127.30 - 155.72	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	181.05
										186	Yes	109.67	110.73	103.61 - 121.10	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	147.75
6	9/7/2022	42" Pipe Pile	Mincon MP340	Impulsive	15:49	15:57	475	4,275	0.058	10	No	167.22	167.52	130.56 - 180.31	183.83	184.19	139.25 - 194.57	158.42	164.53	121.53 - 167.52	194.73
										186	Yes	119.90	120.45	104.84 - 132.76	134.56	135.04	120.39 - 144.81	110.87	111.42	95.81 - 123.73	147.18
7	9/8/2022	42" Pipe Pile	Mincon MP340	Continuous	11:03	11:25	1,330	N/A	N/A	10[1]	No	146.85	147.75	142.91 – 155.31	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	180.31
										188	Yes	127.74	128.64	123.80 - 136.20	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	161.20
8	9/8/2022	42" Pipe Pile	Mincon MP340	Continuous	11:26	11:54	1,829	N/A	N/A	10	No	135.18	135.72	129.64 - 143.55	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	169.19
										188	Yes	128.66	130.03	118.27 – 143.34	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	164.32
8	9/8/2022	42" Pipe Pile	Mincon MP340	Impulsive	11:54	12:25	1,711	17,110	0.059	10	No	165.57	168.32	132.61 - 184.79	182.09	184.80	142.02 - 199.26	155.39	157.14	122.61 - 170.21	197.72
										188	Yes	135.76	135.85	126.44 - 144.17	147.41	147.61	138.03 - 158.96	125.76	125.85	116.45 - 134.17	167.13
9	9/9/2022	42" Pipe Pile	Mincon MP340	Continuous	9:33	10:45	4,490	N/A	N/A	10	No	134.69	135.55	125.17 - 153.71	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	163.56
										188	Yes	136.50	136.62	121.75 – 147.05	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	176.80
9	9/9/2022	42" Pipe Pile	Mincon MP340	Impulsive	10:45	11:03	837	7,533	0.057	10	No	162.28	162.57	127.99 - 177.07	177.83	178.08	137.28 - 192.25	152.24	146.51	117.99 - 166.25	191.01
										188	Yes	136.99	137.6	124.09 - 147.01	147.16	147.54	137.31 - 156.15	127.96	128.57	115.06 - 137.98	170.29
10	9/9/2022	42" Pipe Pile	Mincon MP340	Continuous	11:23	12:22	3,972	N/A	N/A	10	No	134.98	135.74	127.61 - 146.17	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	171.94
										188	Yes	127.67	129.76	118.98 – 144.87	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	N/A[3]	169.32
10	9/9/2022	42" Pipe Pile	Mincon MP340	Impulsive	12:22	12:48	1,127	11,270	0.058	10	No	163.95	165.94	131.76 - 183.04	178.41	180.94	141.42 - 197.38	153.89	155.17	121.76 - 169.52	194.41
										188	Yes	132.99	132.59	118.74 - 142.77	144.76	146.14	135.40 - 159.70	123.96	123.56	109.71 - 133.74	164.48

[1] Data extrapolated from field-captured data using practical spreading loss model; F value = 15
[2] Data extrapolated from field-captured data using practical spreading loss model; F value = 20
[3] SELss was not applicable to the mono-hammer DTH when the piston was not firing as there were no strikes. Peak data was also not reported as it was assumed SELcum would result in a larger isopleth compared to the peak threshold.

Table 13. Hydroacoustic Monitoring Results for Rotary Drill Activities.

Date	Pile Type	Hammer Make/Model	Noise Type	Start Time	Stop Time	Active Hammer Duration (seconds)	Distance From Pile (meters)	Protected by Bubble Curtain	RMS unweighted (SPL dB re 1uPa)			SELcum unweighted (dB re 1uPa^2.s)
									Median	Mean (average)	Maximum	
11/28/2022	102" Casing	Rotary Drill	Continuous / Vibratory	9:17	9:49	1901	10	No	155.28	155.44	159.58	188.36
							300[1]	No	133.12	133.28	137.42	166.20
							300[2]	Yes	125.74	125.90	130.04	158.82
11/28/2022	102" Casing	Rotary Drill	Continuous / Vibratory	10:15	10:40	1484	10	No	156.89	157.02	161.81	188.75
							300[1]	No	134.73	134.86	139.65	166.59
							300[2]	Yes	127.35	127.48	132.27	159.21
11/28/2022	102" Casing	Rotary Drill	Continuous / Vibratory	10:44	11:08	1482	10	No	156.86	157.12	161.57	189.02
							300[1]	No	134.70	134.96	139.41	166.86
							300[2]	Yes	127.32	127.58	132.03	159.48
11/28/2022	102" Casing	Rotary Drill	Continuous / Vibratory	11:21	11:38	1031	10	No	143.93	142.13	148.74	175.09
							300[1]	No	121.77	119.97	126.58	152.93
							300[2]	Yes	114.39	112.59	119.20	145.55
11/28/2022	102" Casing	Rotary Drill	Continuous / Vibratory	12:16	13:09	3199	10	No	142.59	142.68	148.45	175.01
							300[1]	No	120.43	120.52	126.29	152.85
							300[2]	Yes	113.05	113.14	118.91	145.47
11/28/2022	102" Casing	Rotary Drill	Continuous / Vibratory	13:23	13:47	857	10	No	142.02	141.92	145.20	173.70
							300[1]	No	119.86	119.76	123.04	151.54
							300[2]	Yes	112.48	112.38	115.66	144.16
12/02/2022	102" Casing	Rotary Drill	Continuous / Vibratory	11:15	11:21	399	10	No	156.35	156.31	167.07	183.79
							300[1]	No	134.19	134.15	144.91	161.63
							300[2]	Yes	126.81	126.77	137.53	154.25
12/02/2022	102" Casing	Rotary Drill	Continuous / Vibratory	11:29	11:42	753	10	No	152.55	152.33	162.59	182.76
							300[1]	No	130.39	130.17	140.43	160.60
							300[2]	Yes	123.01	122.79	133.05	153.22
12/02/2022	102" Casing	Rotary Drill	Continuous / Vibratory	12:17	12:20	180	10	No	142.84	141.98	149.01	165.94
							300[1]	No	120.68	119.82	126.85	143.78
							300[2]	Yes	113.30	112.44	119.47	136.40

Date	Pile Type	Hammer Make/Model	Noise Type	Start Time	Stop Time	Active Hammer Duration (seconds)	Distance From Pile (meters)	Protected by Bubble Curtain	RMS unweighted (SPL dB re 1uPa)			SELcum unweighted (dB re 1uPa^2.s)
									Median	Mean (average)	Maximum	
12/02/2022	102" Casing	Rotary Drill	Continuous / Vibratory	12:32	12:39	412	19	No	135.67	134.80	145.36	162.14
							300[1]	No	113.51	112.64	123.20	139.98
							300[2]	Yes	106.13	105.26	115.82	132.60
12/02/2022	102" Casing	Rotary Drill	Continuous / Vibratory	13:04	13:08	222	10	No	142.95	143.55	159.05	168.85
							300[1]	No	120.79	121.39	136.89	146.69
							300[2]	Yes	113.41	114.01	129.51	139.31
12/02/2022	102" Casing	Rotary Drill	Continuous / Vibratory	13:30	13:56	1584	10	No	135.51	137.47	151.79	171.03
							300[1]	No	113.35	115.31	129.63	148.87
							300[2]	Yes	105.97	107.93	122.25	141.49
12/02/2022	102" Casing	Rotary Drill	Continuous / Vibratory	14:11	14:24	778	10	No	132.67	133.97	147.02	164.73
							300[1]	No	110.51	111.81	124.86	142.57
							300[2]	Yes	103.13	104.43	117.48	135.19
12/02/2022	102" Casing	Rotary Drill	Continuous / Vibratory	14:32	15:11	2368	10	No	139.2	139.04	155.48	174.23
							300[1]	No	117.04	116.88	133.32	152.07
							300[2]	Yes	109.66	109.50	125.94	144.69

[1] Data extrapolated from field-captured data using practical spreading loss model; F value = 15
[2] Data extrapolated from field-captured data using practical spreading loss model; F value = 20 [Bubble curtain increases attenuation rate]

Table 14. Hydroacoustic Monitoring Results for Rock Hammering

Date	Hammer Make/Model	Noise Type	Start Time	Stop Time	Active Hammer Duration (seconds)	Hammer Strike(s)	Pulse Duration (seconds)	Distance From Pile (meters)	Protected by Bubble Curtain	RMS unweighted (SPL dB re 1uPa)			Peak unweighted (SPL dB re 1uPa)			SEL unweighted (dB re 1uPa^2.s)			SELcum unweighted (dB re 1uPa^2.s)
										Median	Mean (average)	Maximum	Median	Mean (average)	Maximum	Median	Mean (average)	Maximum	
12/13/2022	Rock Hammer	Impulsive	13:57	14:08	250	673	0.061	10[1]	No	171.90	172.53	185.37	188.88	189.54	197.15	165.72	166.16	172.63	194.00
								70	No	159.22	159.85	172.69	176.20	176.86	184.47	153.04	153.48	159.95	181.32
								247[2]	Yes	148.27	148.90	161.74	165.25	165.91	173.52	142.09	142.53	149.00	170.37
12/20/2022	Rock Hammer	Impulsive	11:48	12:08	750	1815	0.045	10[1]	No	169.62	170.61	185.72	186.72	187.57	200.10	163.24	163.93	175.97	195.83
								71	No	156.85	157.84	172.95	173.95	174.80	187.33	150.47	151.16	163.20	183.06
								248[2]	Yes	145.99	146.98	162.09	163.09	163.94	176.47	139.61	140.30	152.34	172.19
12/20/2022	Rock Hammer	Impulsive	12:11	12:20	389	999	0.052	10[1]	No	170.52	170.88	183.00	189.40	189.42	196.46	164.35	164.60	171.45	194.34
								71	No	157.75	158.11	170.23	176.63	176.65	183.69	151.58	151.83	158.68	181.57
								248[2]	Yes	146.89	147.25	159.37	165.77	165.79	172.83	140.72	140.97	147.82	170.71
12/20/2022	Rock Hammer	Impulsive	12:56	13:03	183	513	0.049	10[1]	No	168.71	169.49	203.21	185.48	184.56	194.61	161.97	162.12	197.19	189.07
								88	No	154.54	155.32	189.04	171.31	170.39	180.44	147.80	147.95	183.02	174.90
								265[2]	Yes	144.96	145.74	179.46	161.73	160.81	170.86	138.22	138.37	173.44	165.33
12/20/2022	Rock Hammer	Impulsive	13:04	13:15	277	723	0.055	10[1]	No	169.71	170.56	184.12	185.75	185.98	196.18	162.43	163.02	172.91	191.02
								88	No	155.54	156.39	169.95	171.58	171.81	182.01	148.26	148.85	158.74	176.85
								265[2]	Yes	145.96	146.81	160.37	162.00	162.23	172.43	138.68	139.27	149.16	167.28
12/20/2022	Rock Hammer	Impulsive	14:06	14:18	414	1081	0.053	10[1]	No	171.97	172.35	184.72	188.11	188.08	195.77	165.36	165.47	172.54	195.70
								88	No	157.80	158.18	170.55	173.94	173.91	181.60	151.19	151.30	158.37	181.52
								265[b]	Yes	148.22	148.60	160.97	164.36	164.33	172.02	141.61	141.72	148.79	171.95
12/21/2022	Rock Hammer	Impulsive	9:52	10:36	1307	3361	0.055	10[1]	No	168.91	169.70	180.31	183.55	183.86	193.50	162.56	163.28	172.63	197.82
								80	No	155.36	156.15	166.76	170	170.31	179.95	149.01	149.73	159.08	184.28
								257[2]	Yes	145.22	146.01	156.62	159.86	160.17	169.81	138.87	139.59	148.94	174.14
1/12/2022	Rock Hammer	Impulsive	8:48	9:05	704	2721	0.046	10[1]	No	157.78	160.97	175.44	174.88	178.90	192.44	152.03	154.77	167.36	186.34
								40	No	149.75	151.94	166.41	165.85	169.87	183.41	143.00	145.74	158.33	177.31
								270[2]	Yes	133.16	135.35	149.82	149.26	153.28	166.82	126.41	129.15	141.71	160.72
1/12/2022	Rock Hammer	Impulsive	9:07	9:44	1451	5829	0.047	10[1]	No	162.14	162.87	179.17	179.31	181.04	196.09	155.66	156.75	169.79	193.31
								40	No	153.11	153.84	170.14	170.28	172.01	187.06	146.63	147.72	160.76	184.28
								270[2]	Yes	136.52	137.25	153.55	153.69	155.42	170.47	130.04	131.13	144.17	167.69

1/12/2022	Rock Hammer	Impulsive	10:55	11:03	291	1013	0.039	10[1]	No	174.55	173.76	192.46	194.58	193.32	207.00	168.36	167.33	177.79	198.41
								30	No	167.39	166.60	185.30	187.42	186.16	199.84	161.20	160.17	170.63	191.25
								260[2]	Yes	148.63	147.84	166.54	168.66	167.40	181.08	142.44	141.41	151.87	172.49
1/12/2022	Rock Hammer	Impulsive	11:07	11:28	735	2833	0.042	10[1]	No	171.38	172.24	191.47	190.10	191.32	205.29	164.94	165.85	178.30	199.46
								30	No	164.22	165.08	184.31	182.94	184.16	198.13	157.78	158.69	171.14	192.30
								260[2]	Yes	145.46	146.32	165.55	164.18	165.40	179.37	139.02	139.93	152.38	173.54
1/12/2022	Rock Hammer	Impulsive	11:41	11:47	279	940	0.050	10[1]	No	167.21	166.77	178.37	185.47	184.46	194.76	160.52	160.42	172.35	190.26
								35	No	159.05	158.61	170.21	177.31	176.30	186.60	152.36	152.26	164.19	182.10
								255[2]	Yes	141.80	141.36	152.96	160.06	159.05	169.35	135.11	135.01	146.94	164.85

[1] Data extrapolated from field-captured data using practical spreading loss model; F value = 15
[2] Data extrapolated from field-captured data using practical spreading loss model; F value = 20

6. CONCLUSIONS

There were no Level A takes observed during the conclusion of P-310 Year Two IHA activities between January 18, 2022, and February 24, 2022. Active monitoring by PSOs reduced the likelihood of Level A injury takes without jeopardizing construction activities by providing a mechanism for identifying and communicating the occurrence of marine mammals traveling through the ROI to the contractor. There were a total of two observed Level B takes (all to harbor seals) during this period. The total combined observed and extrapolated Level B take under the entire P-310 Year Two IHA Period were well below the amount authorized (see Table 15). Extrapolated P-310 take estimates in Table 15 are additive from the totals presented in the Preliminary P-310 Year Two IHA Report to NOAA Fisheries (NAVFAC 2022). These values should be considered as the final estimate of take for the P-310 Year Two IHA Period. As previously noted, harbor seals made up the majority of observations as well as takes during the entire P-310 Year Two IHA Period.

There were 33 Level A takes, and 23 Level B takes, observed during P-381 Year One IHA activities between May 3, 2022 and December 30, 2022. The observed Level A and B takes were below the amount of take authorized under the IHA (see Table 16). Note that there are no estimates of extrapolated take for this period because PSOs monitored the full ROI 100% of the time when in-water activities were occurring. Harbor seals comprised the majority of all observed Level A and B takes, with a single unknown seal being subject to a Level A take on October 18, 2022. Other known marine mammal species with potential to occur in the area were not observed and there were limited instances where a seal could not be identified to species.

Based on the species' presence and estimated densities in the region as described in the Project's IHA applications, the construction activities occurring during the conclusion of the P-310 Year Two and preliminary P-381 Year One IHA Periods did not result in levels of take that would be expected to have a significant impact on local populations or require reinitiation with NOAA Fisheries.

This report was originally submitted to NOAA Fisheries on January 30, 2023. Between February and March 2023, NOAA Fisheries provided initial review and questions to the Navy. Appendix F of this report revision contain a comment matrix detailing these questions and the Project's official response. Additionally, portions of this report revision have been updated with additional details as requested by NOAA Fisheries during their review. As such, this report revision should be considered as the final and most up-to-date record.

Table 15. Summary of Marine Mammal Take During Entire P-310 Year Two IHA Period[1]

Species	Observed "Take"	Extrapolated "Take"	Total "Take"	IHA Authorized "Take"	Percent of Authorized "Take"[2]
Harbor porpoise	Level A: 0 Level B: 0	Level A: 0 Level B: 0	Level A: 0 Level B: 0	Level A: 2 Level B: 2	Level A: 0% Level B: 0%
Harbor seal	Level A: 0 Level B: 39	Level A: 0 Level B: 6	Level A: 0 Level B: 45	Level A: 12 Level B: 795	Level A: 0% Level B: 5.7%
Gray seal	Level A: 0 Level B: 3	Level A: 0 Level B: 1	Level A: 0 Level B: 4	Level A: 1 Level B: 50	Level A: 0% Level B: 8.0%
Hooded seal	Level A: 0 Level B: 0	Level A: 0 Level B: 0	Level A: 0 Level B: 0	Level A: 0 Level B: 5	Level A: 0% Level B: 0%
Harp seal	Level A: 0 Level B: 0	Level A: 0 Level B: 0	Level A: 0 Level B: 0	Level A: 0 Level B: 5	Level A: 0% Level B: 0%

[1] Values include totals presented in the previously submitted preliminary P-310 Year Two IHA Period Report (NAVFAC 2022) and those takes recorded between January 18, 2022 and February 24, 2022
[2] Percent of authorized take was determined by combining observed and extrapolated take.

Table 16. Summary of Marine Mammal Take During P-381 Year One IHA Period[1]

Species	Observed "Take"	Extrapolated "Take"	Total "Take"	IHA Authorized "Take"	Percent of Authorized "Take"[2]
Harbor porpoise	Level A: 0 Level B: 0	Level A: 0 Level B: 0	Level A: 0 Level B: 0	Level A: 15 Level B: 9	Level A: 0% Level B: 0%
Harbor seal	Level A: 32 Level B: 23	Level A: 0 Level B: 0	Level A: 32 Level B: 23	Level A: 1,269 Level B: 1,125	Level A: 2.5% Level B: 2.0%
Gray seal	Level A: 0 Level B: 0	Level A: 0 Level B: 0	Level A: 0 Level B: 0	Level A: 85 Level B: 75	Level A: 0% Level B: 0%
Hooded seal	Level A: 0 Level B: 0	Level A: 0 Level B: 0	Level A: 0 Level B: 0	Level A: 0 Level B: 5	Level A: 0% Level B: 0%
Harp seal	Level A: 0 Level B: 0	Level A: 0 Level B: 0	Level A: 0 Level B: 0	Level A: 0 Level B: 5	Level A: 0% Level B: 0%
Unknown Seal	Level A: 1 Level B: 0	Level A: 0 Level B: 0	Level A: 1 Level B: 0	Level A: N/A Level B: N/A	Level A: N/A Level B: N/A

[1] Takes recorded between May 3, 2022 and December 30, 2022
[2] Percent of authorized take was determined by combining observed and extrapolated take. During this reporting period, the complete Level A and B zones were monitored during 100% of in-water construction activities. As a result, there was no need to determine a value for extrapolated take.

7. REFERENCES

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NAVFAC. 2022. 2021 Monitoring Report for NOAA Fisheries Incidental Harassment Authorization (IHA) for Conclusion of Year One, Renewal, and Preliminary Year Two Activities from January 6, 2021, to December 20, 2021 for Modification and Expansion of Dry Dock 1: Super Flood Basin (P-310). April 8, 2022.

NAVFAC. 2021. Preliminary Monitoring Report for NOAA Fisheries Incidental Harassment Authorization (IHA) For Year One Activities from May 12, 2020 To December 9, 2020 for Modification And Expansion Of Dry Dock 1: Super Flood Basin (P-310). January 15.

Appendix A
Hydroacoustic Zones of Influence
(Figures from P-310 Year Two and P-381 Year One IHA Applications)

P-310 Year Two IHA Zones of Influence

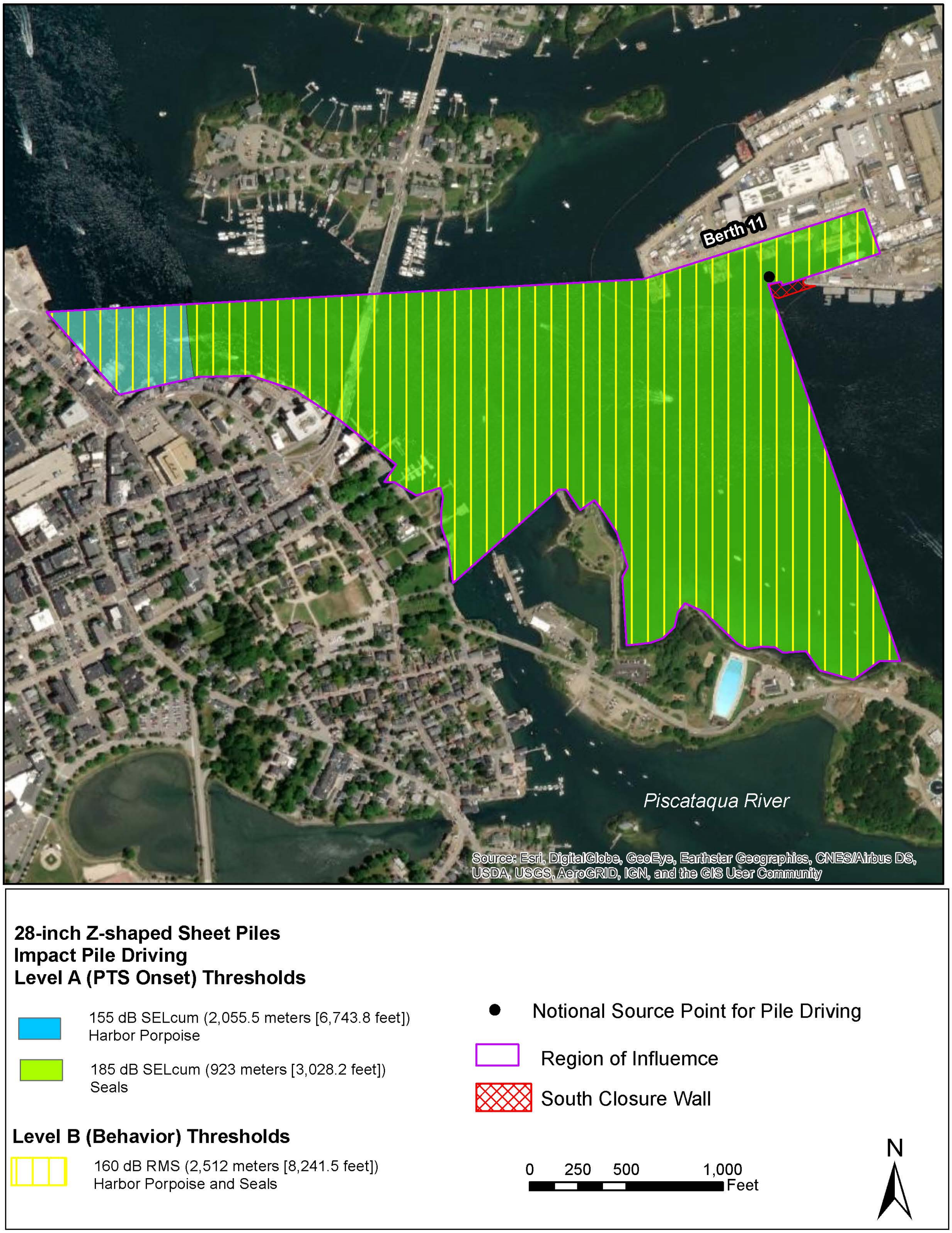


Figure 6-1. Distances to Level A (PTS onset) and Level B (Behavioral) Harassment from Impact Driving 28-inch, Z-shaped Sheet Piles Sheet Piles

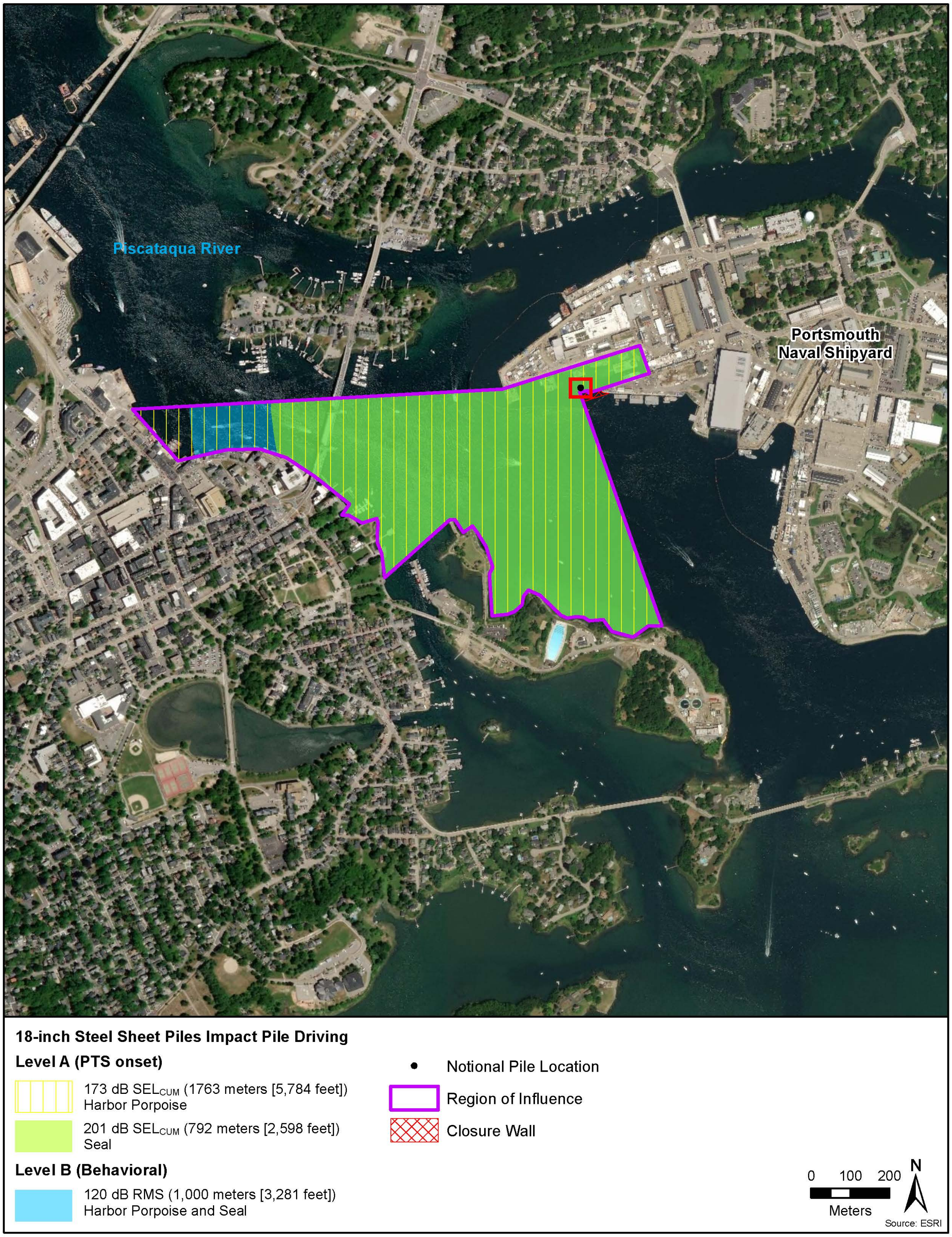


Figure 6-2. Distances to Level A (PTS onset) and Level B (Behavioral) Harassment from Impact Driving 18-inch, Flat-Webbed Sheet Piles Sheet Piles

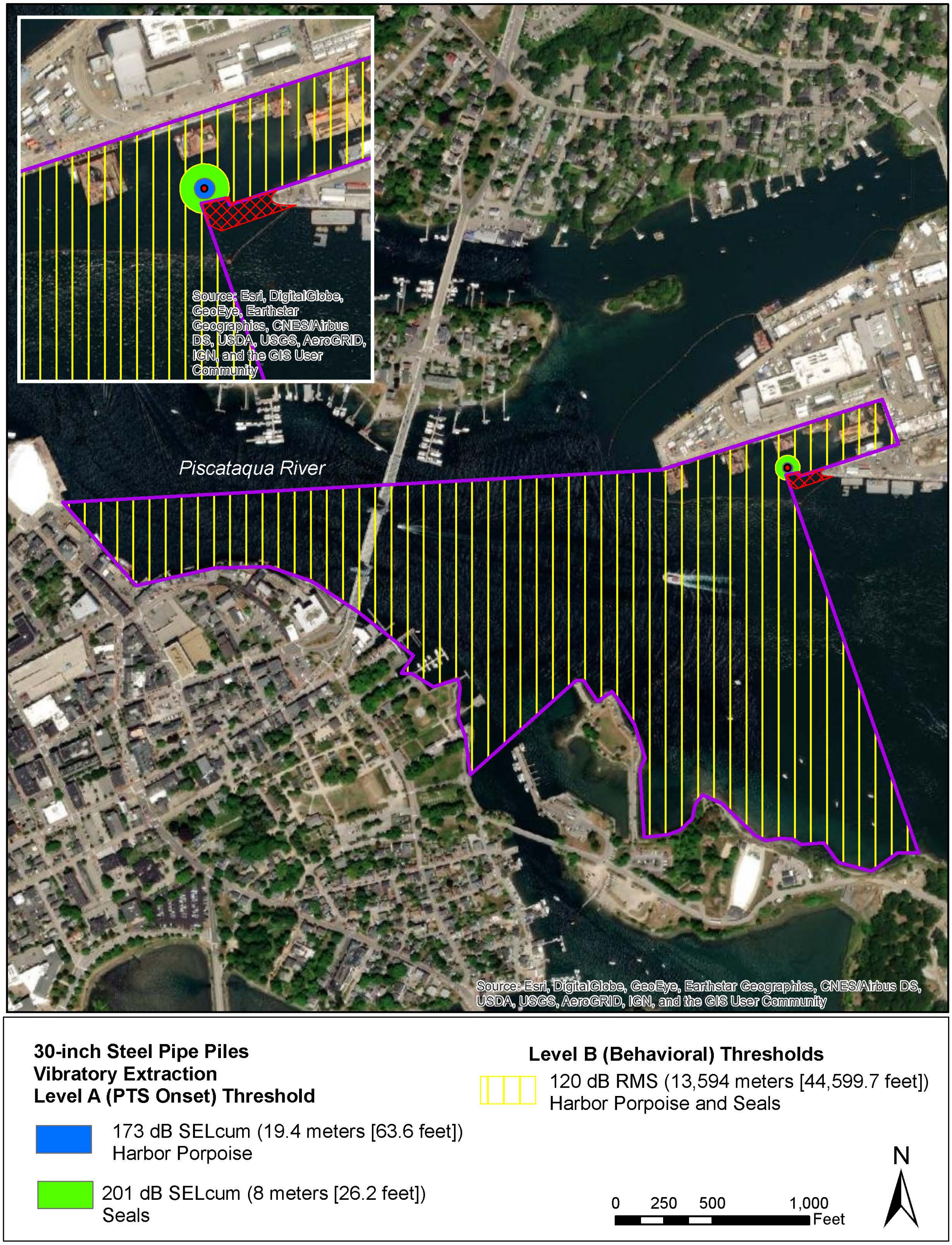


Figure 6-3. Distances to Level A (PTS onset) and Level B (Behavioral) Harassment from Vibratory Extraction of 30-inch Steel Pipe Piles

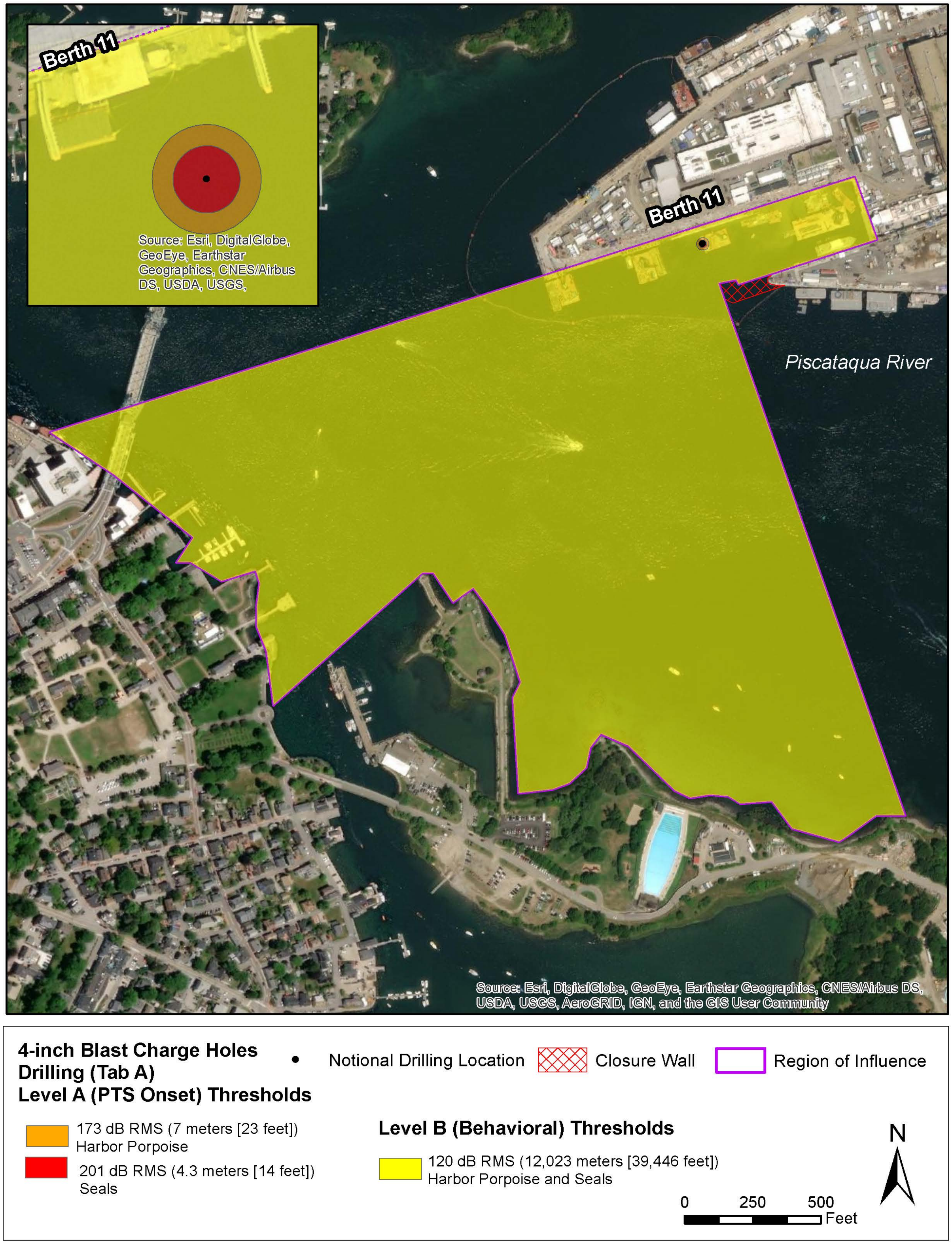


Figure 6-4. Distances to Level A (PTS onset) and Level B (Behavioral) Harassment from Drilling Activities (Tab A)

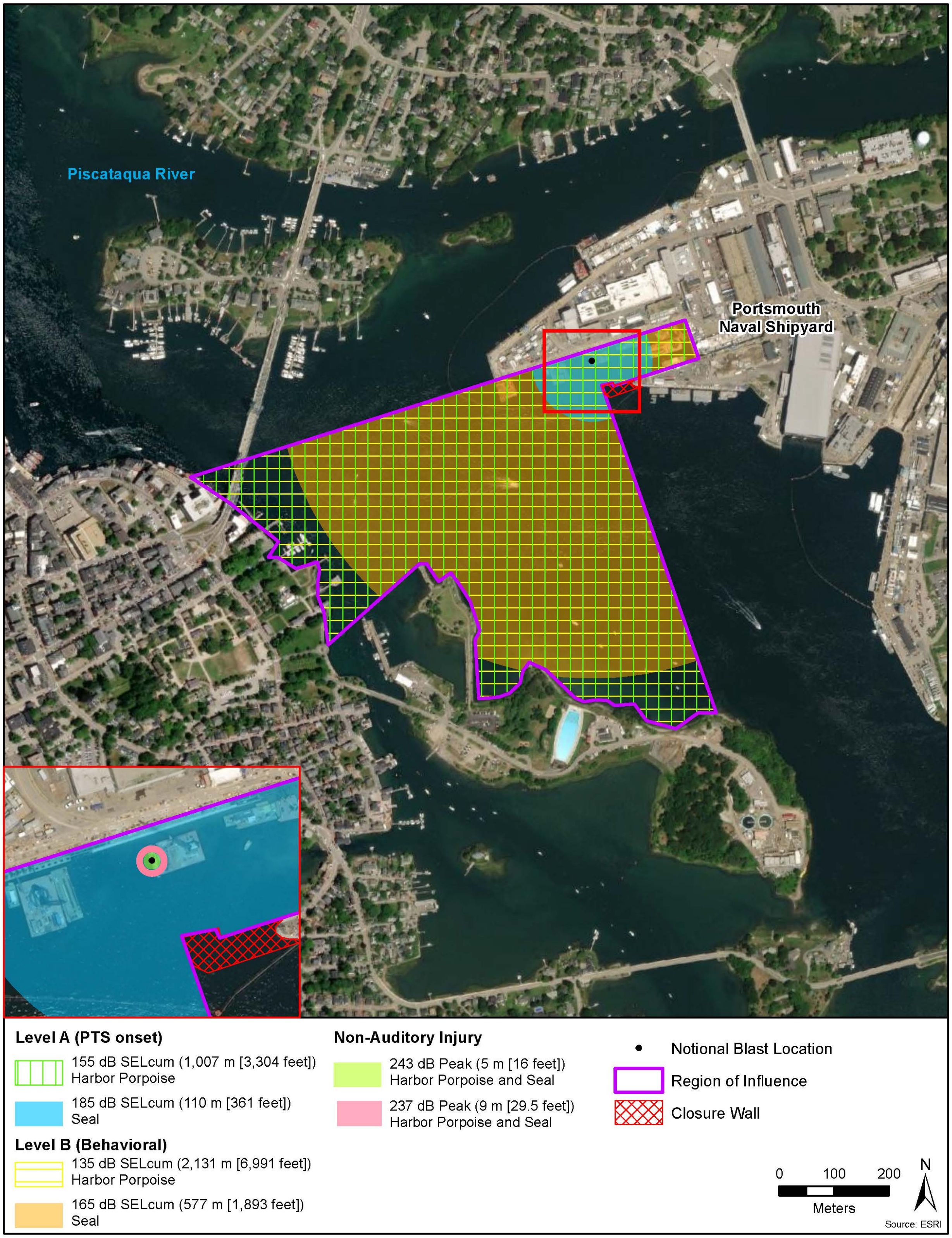


Figure 6-5. Distances to Level A (PTS onset) and Level B (Behavioral) Harassment from Blasting Activities

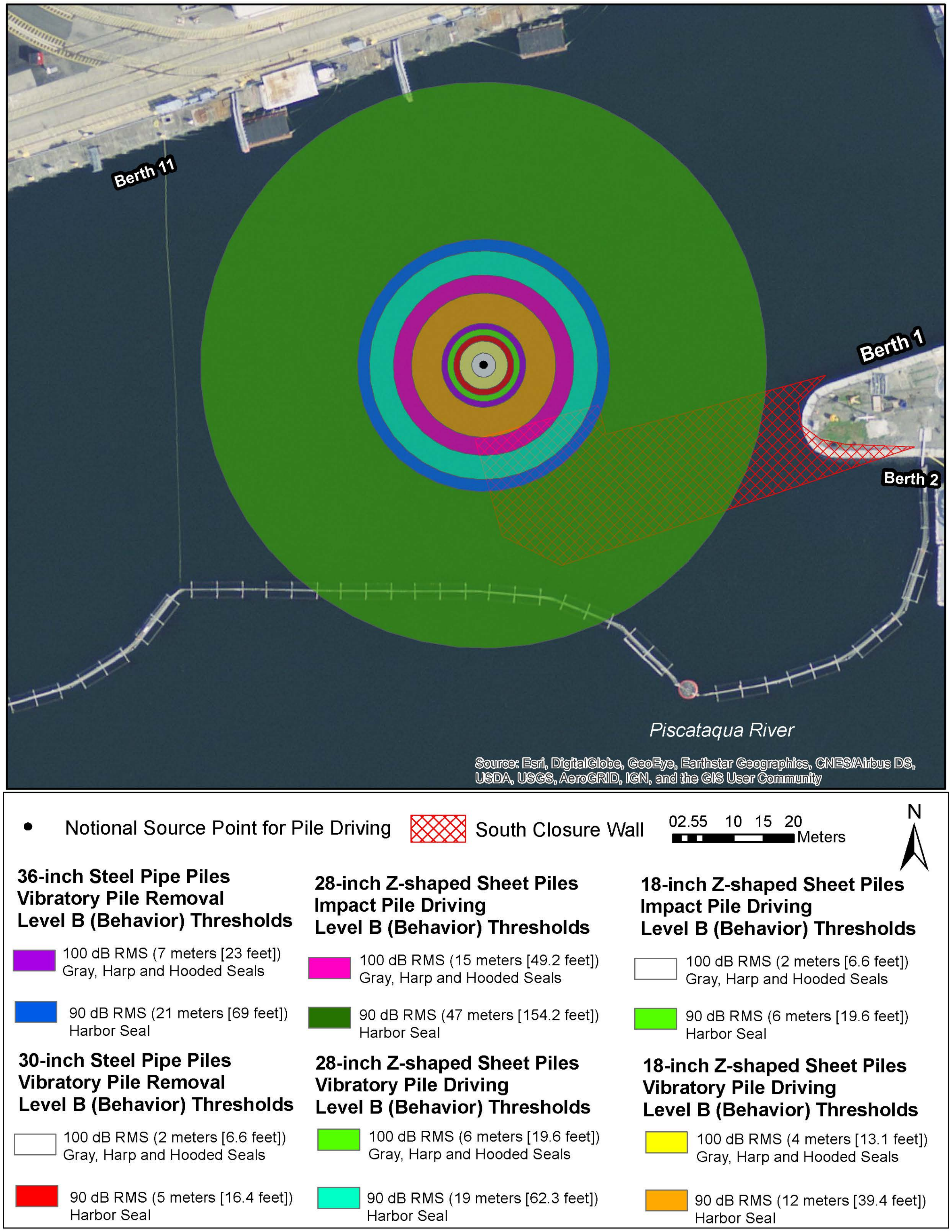


Figure 6-6. Representative ZOI for Level B (Behavioral) Harassment due to Airborne Pile-Driving Noise

P-381 Year One IHA Zones of Influence

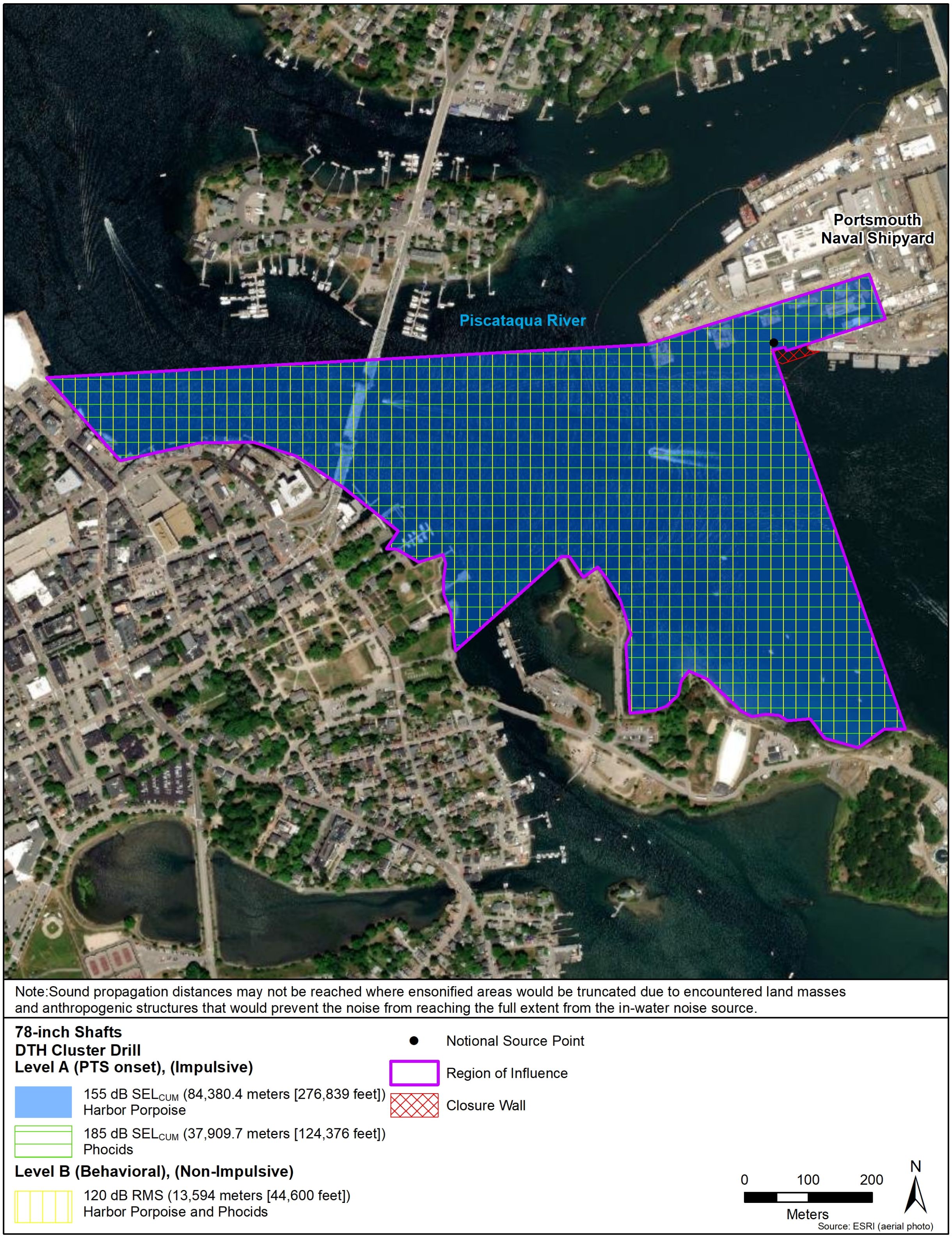


Figure 6-1. Level A Injury (PTS Onset) and Level B (Behavioral) Harassment Zones from DTH Cluster Drill of 78-inch Shafts (Impulsive)

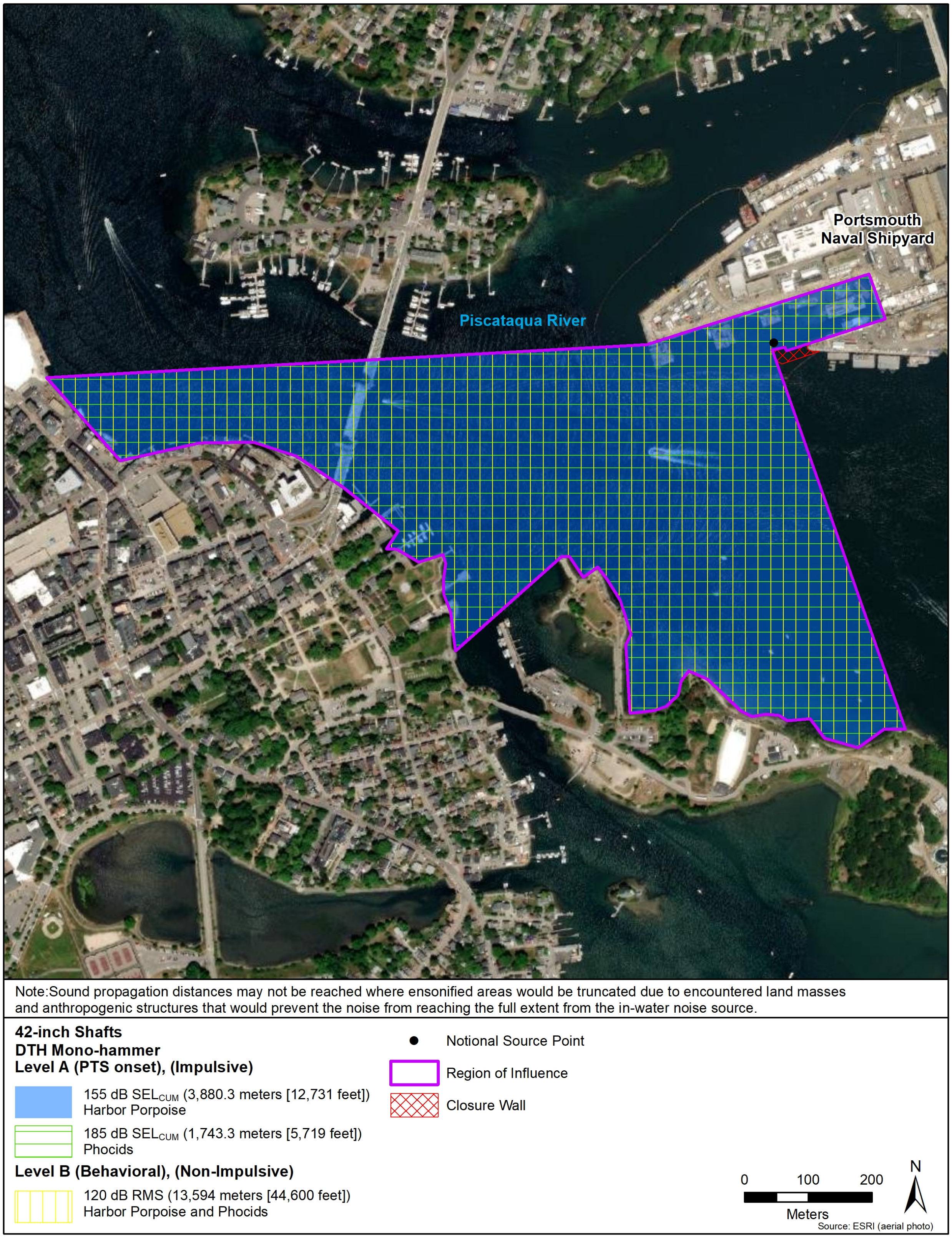


Figure 6-2. Level A Injury (PTS Onset) and Level B (Behavioral) Harassment Zones from DTH Mono-Hammer for 42-inch Shafts and Casing Advancements (Impulsive)

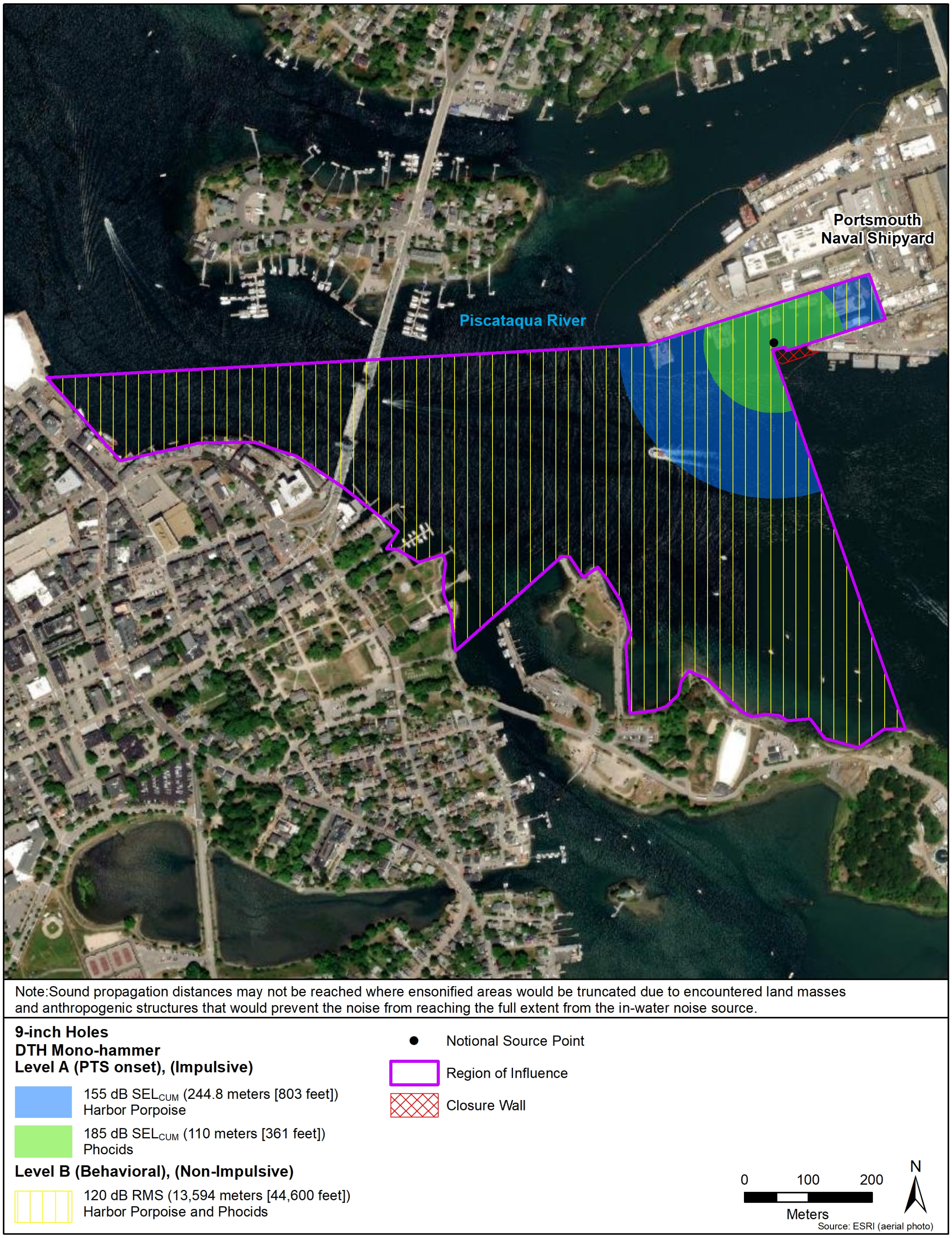


Figure 6-3. Level A Injury (PTS Onset) and Level B (Behavioral) Harassment Zones from DTH Mono-hammer for 36 and 18 Count of 9-inch Holes

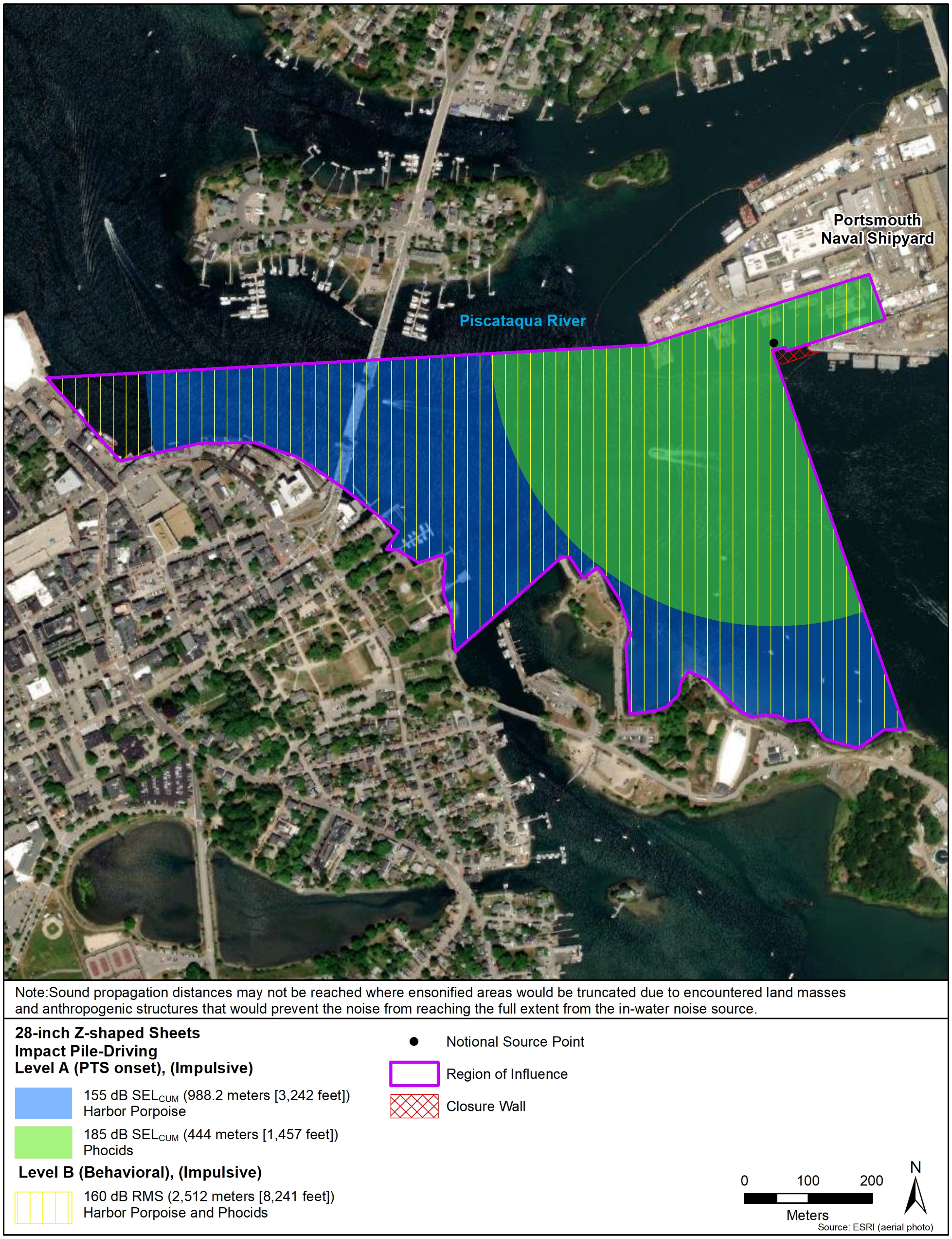


Figure 6-4. Level A Injury (PTS Onset) and Level B (Behavioral) Harassment Zones from Impact Pile Driving for 16 Count of 28-inch Z-Shaped Sheets (Impulsive)

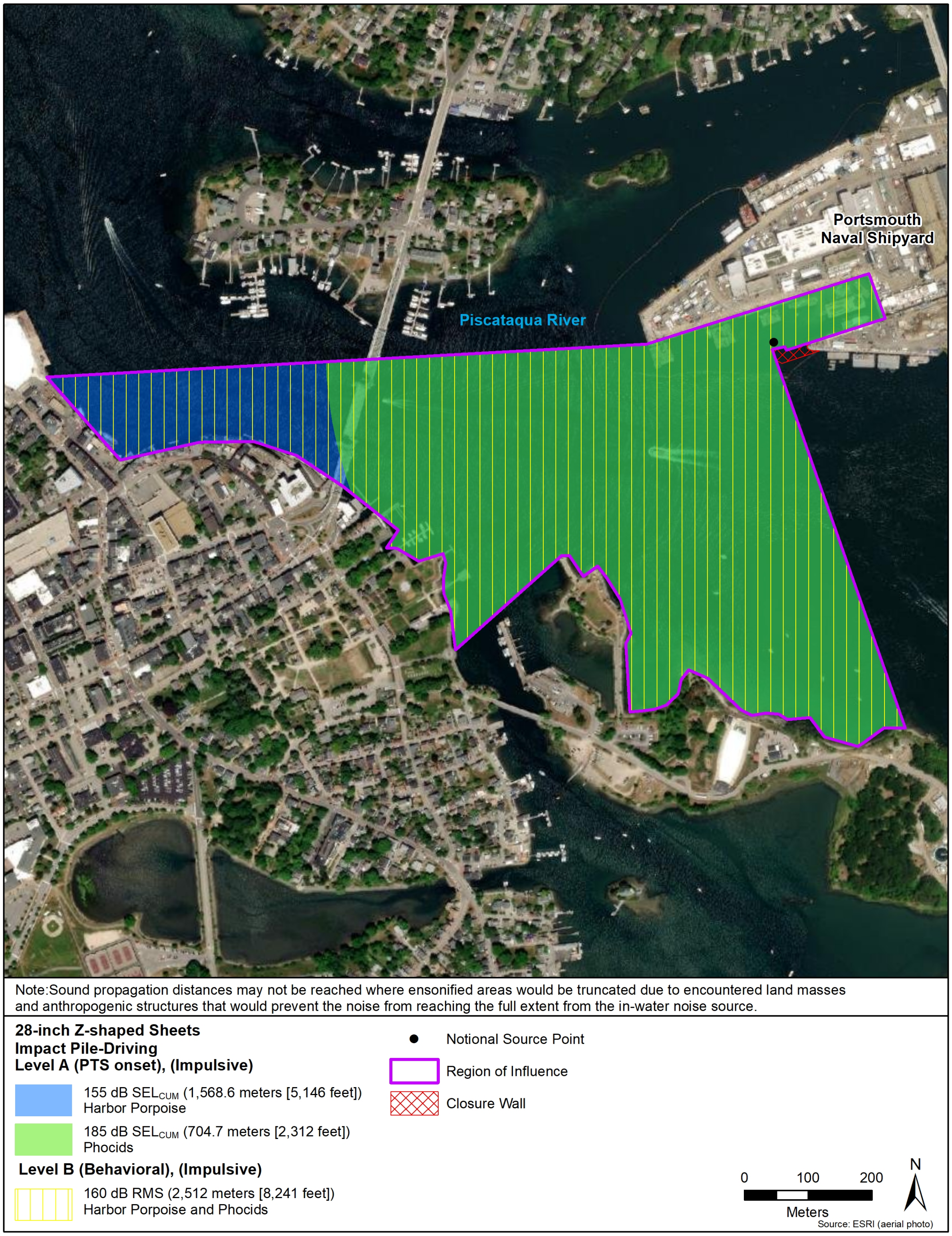


Figure 6-5. Level A Injury (PTS Onset) and Level B (Behavioral) Harassment Zones from Impact Pile Driving for 60 and 96 Count 28-inch Z-Shaped Sheets (Impulsive)

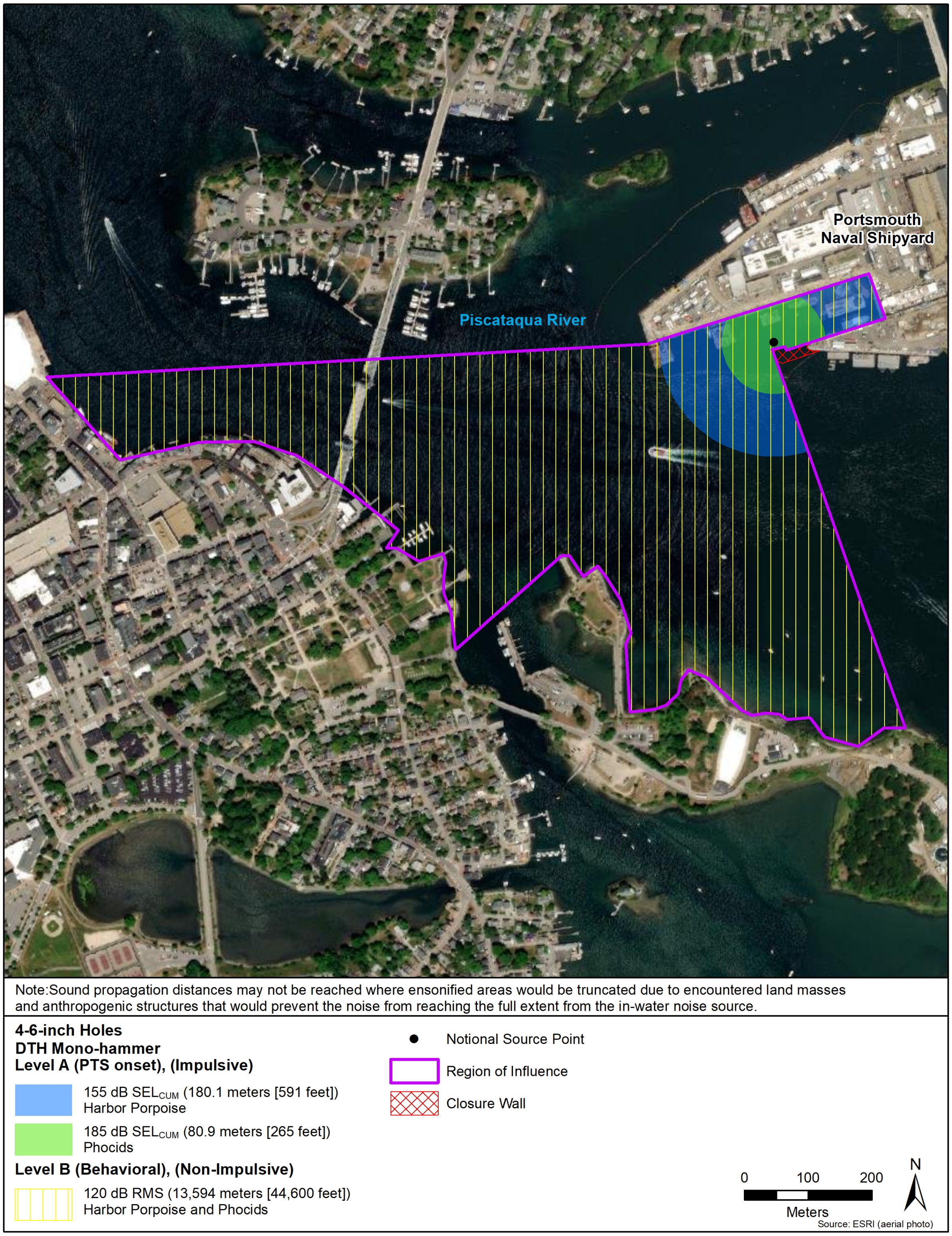


Figure 6-6. Level A Injury (PTS Onset) and Level B (Behavioral) Harassment Zones due to Underwater Noise from DTH Mono-Hammer for 500 and 2,201 Count 4- to 6-inch Holes (Impulsive)

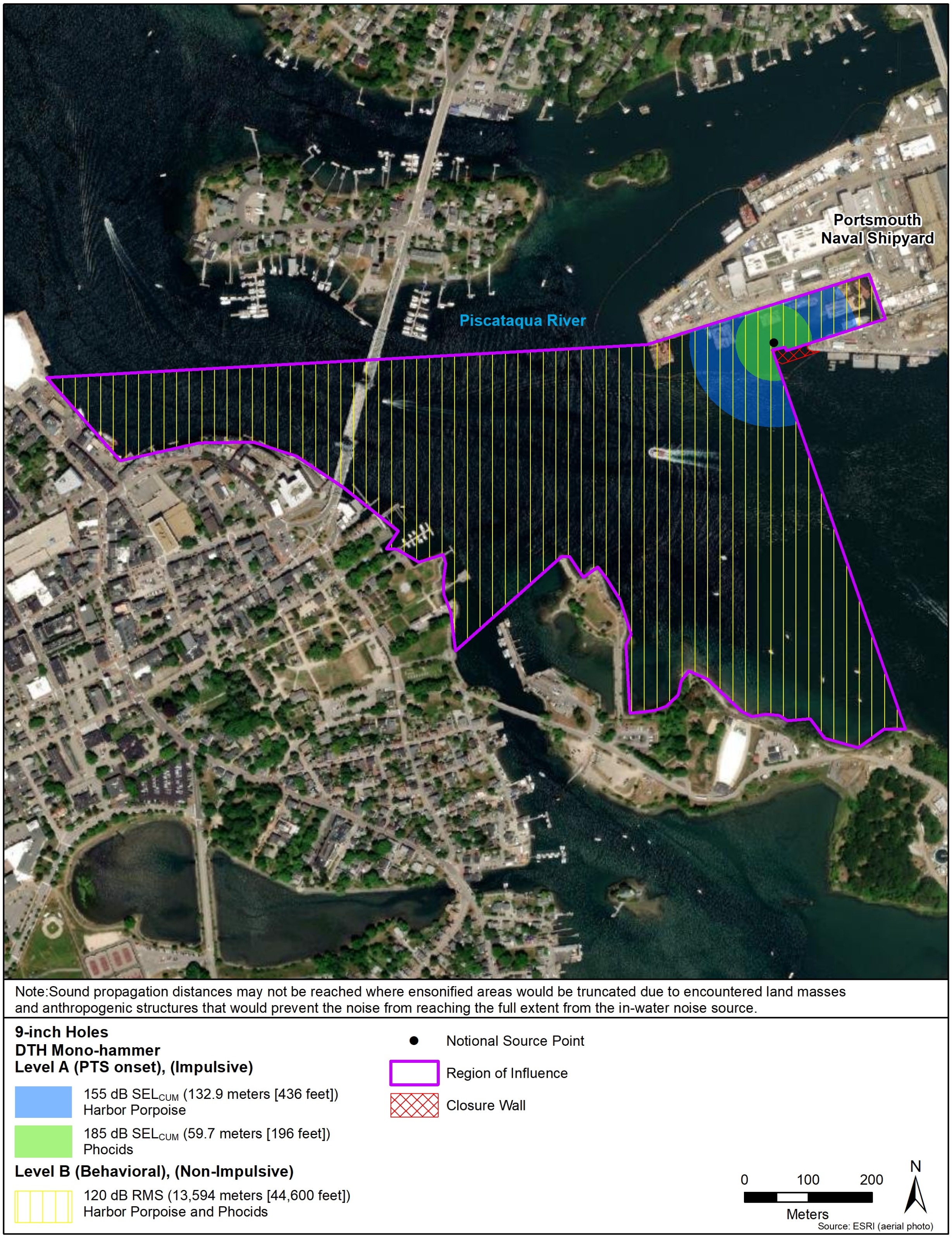


Figure 6-7. Level A Injury (PTS Onset) and Level B (Behavioral) Harassment Zones due to Underwater Noise from DTH Mono-Hammer for 100 Count of 9-inch holes (Impulsive)

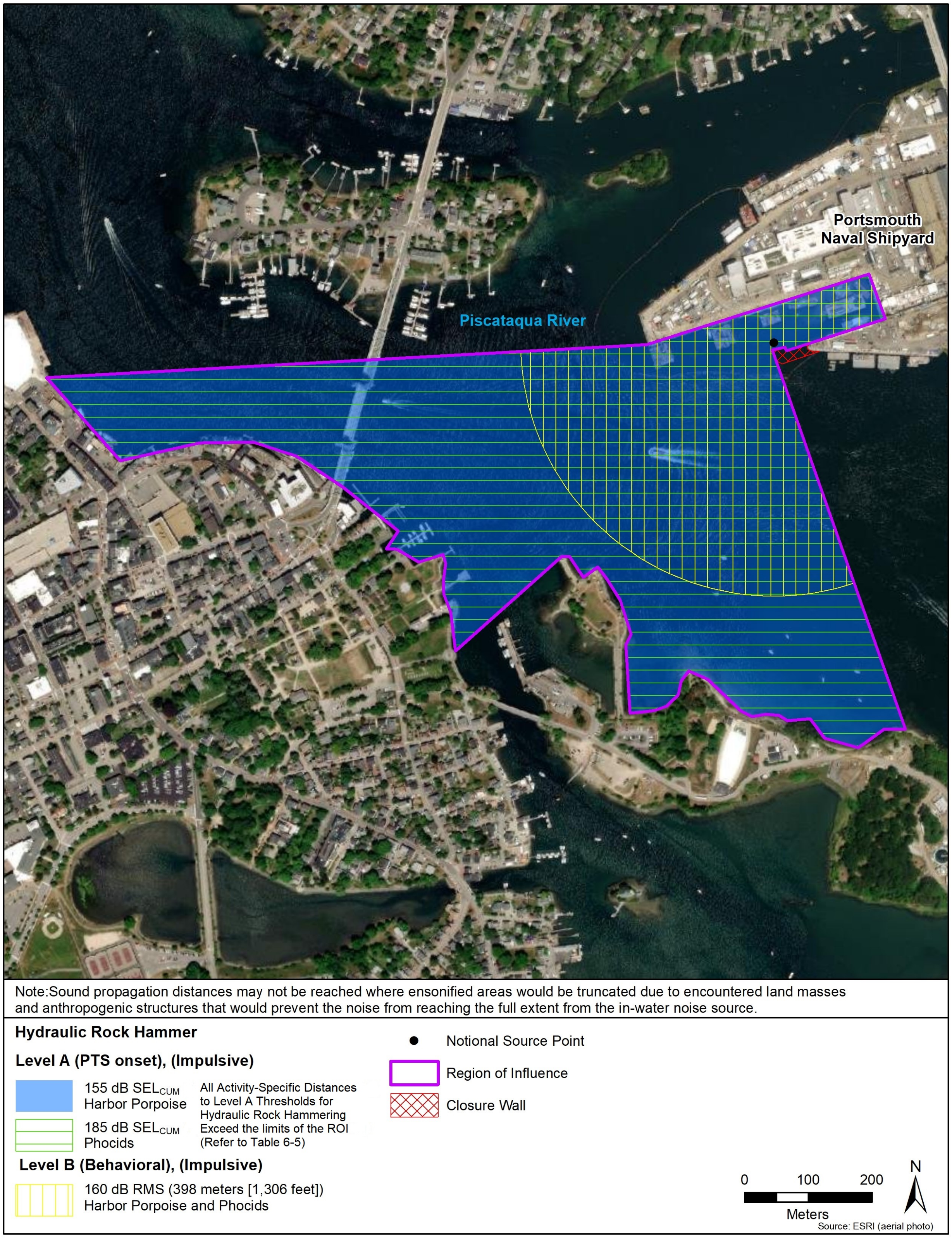


Figure 6-8. Level A Injury (PTS Onset) and Level B (Behavioral) Harassment Zones due to Underwater Noise during Hydraulic Rock Hammering (Impulsive)

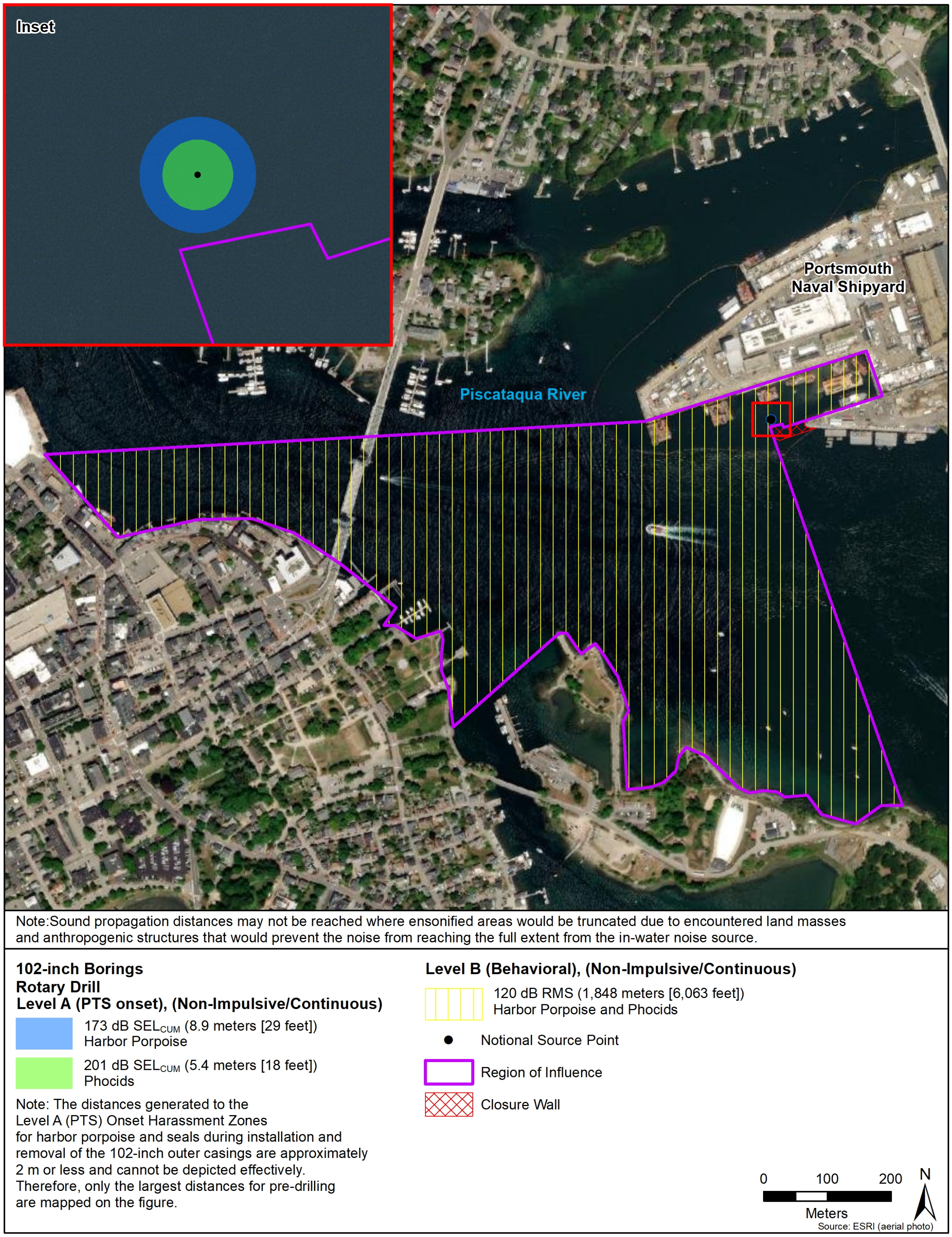


Figure 6-9. Level A Injury (PTS Onset) and Level B (Behavioral) Harassment Zones from Rotary Drilling for 18 and 38 Count 102-inch Casings and Borings (Non-Impulsive/Continuous)

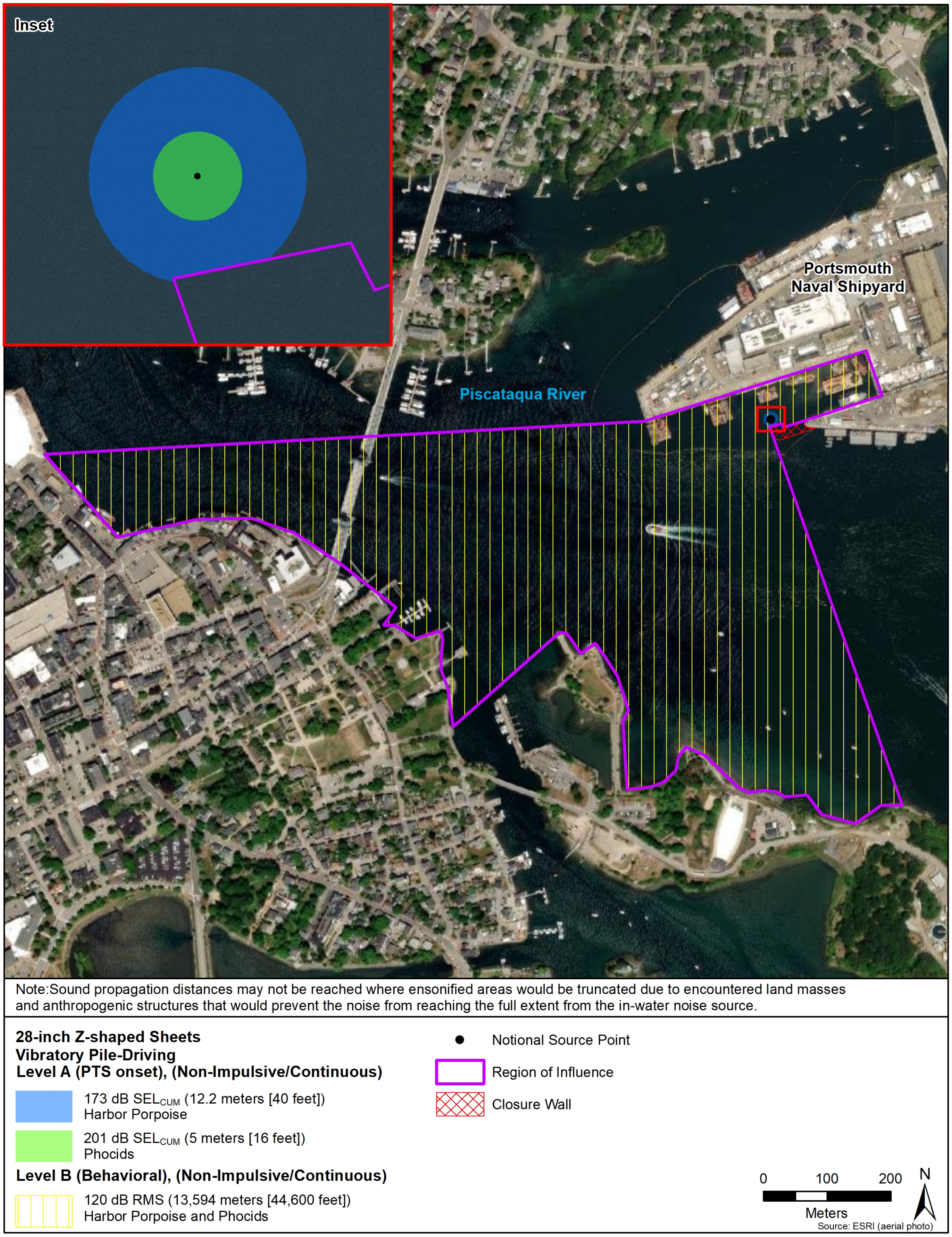


Figure 6 10. Level A Injury (PTS Onset) and Level B (Behavioral) Harassment Zones from Vibratory Pile Driving for 16 Count 28-inch Z-Shaped Sheets (Non-Impulsive/Continuous)

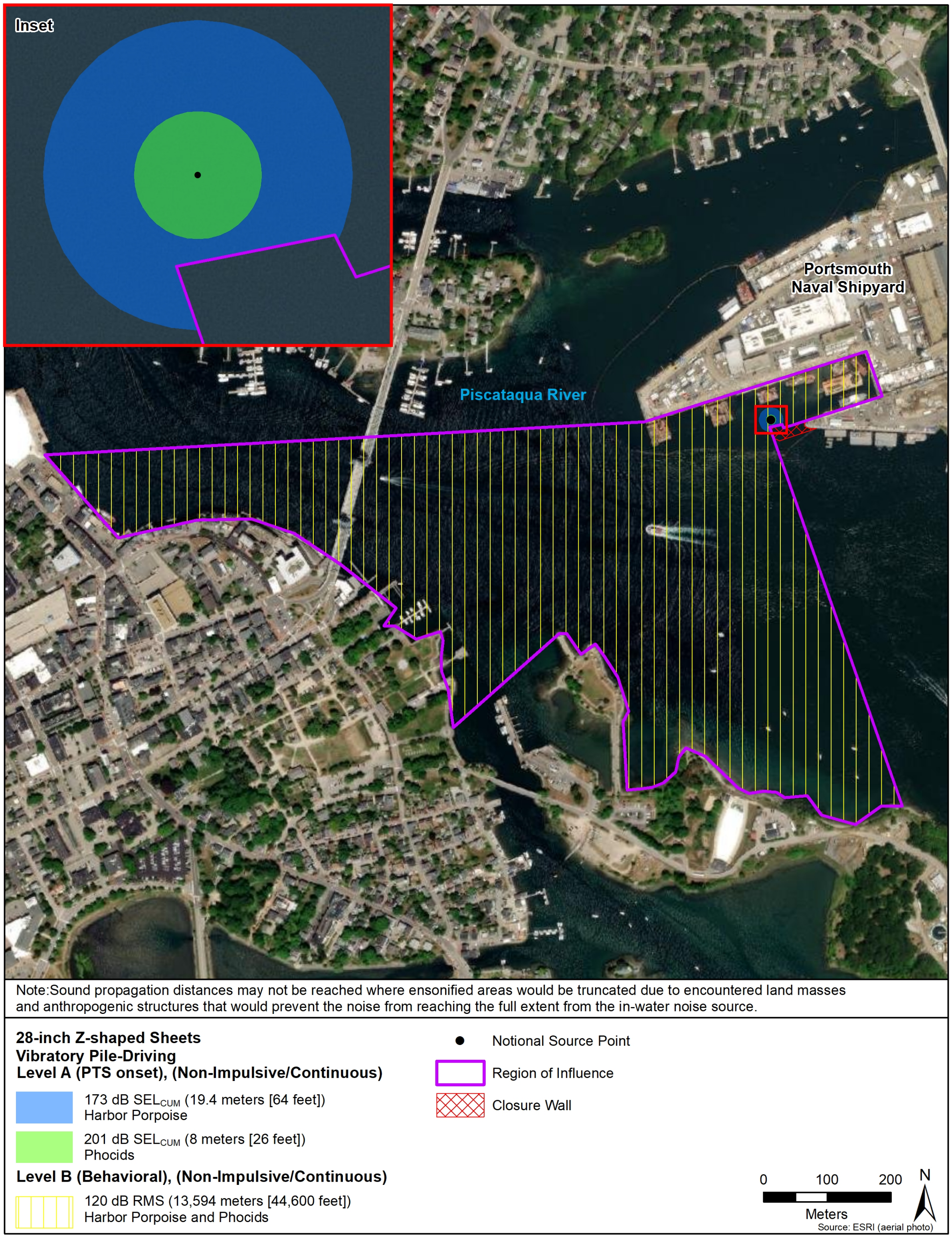


Figure 6-11. Level A Injury (PTS Onset) and Level B (Behavioral) Harassment Zones from Vibratory Pile Driving for 60 and 96 Count 28-inch Z-Shaped Sheets (Non-Impulsive/Continuous)

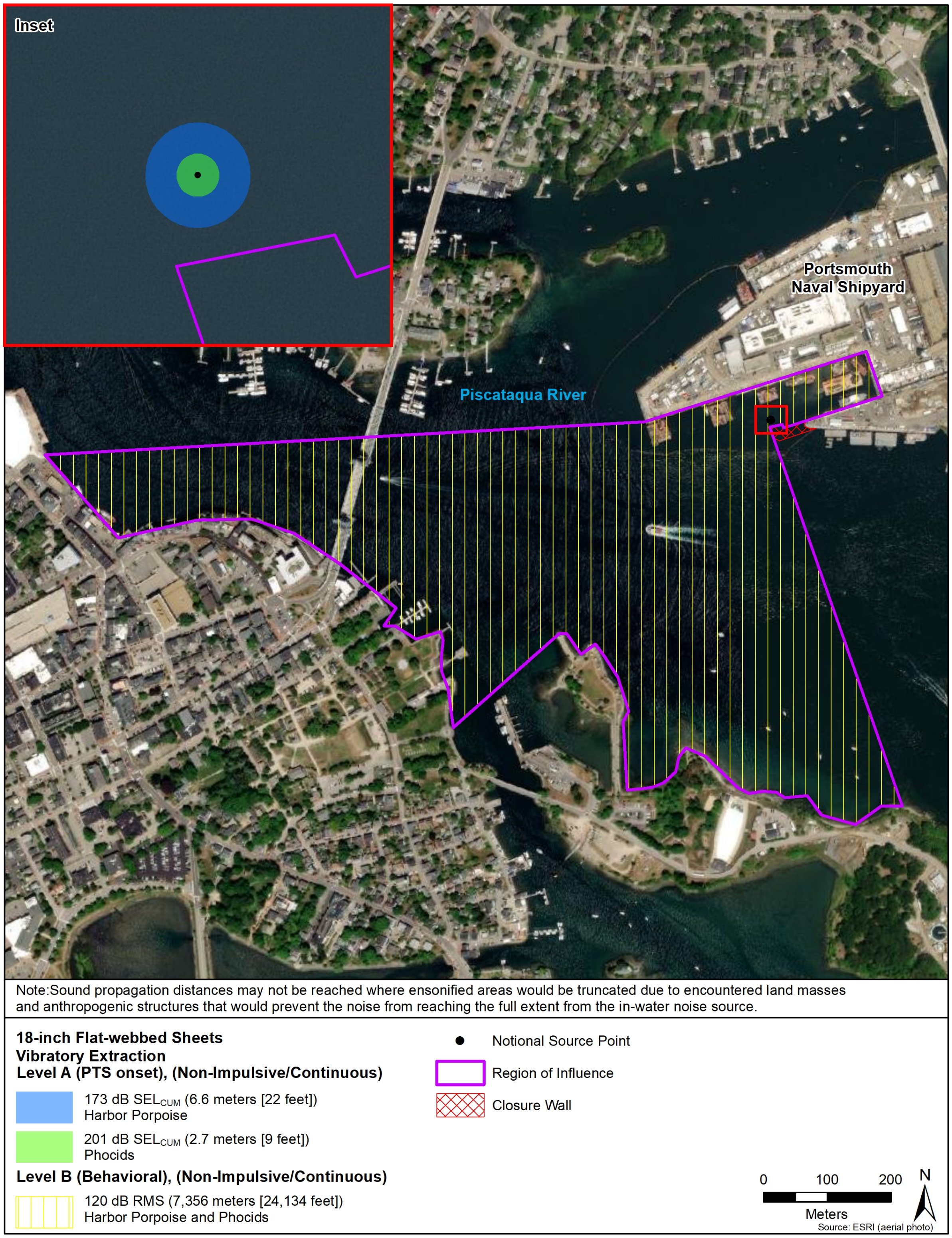


Figure 6-12. Level A Injury (PTS Onset) and Level B (Behavioral) Harassment Zones from Vibratory Extraction of 238 Count 18-inch Flat Sheets (Non-Impulsive/Continuous)

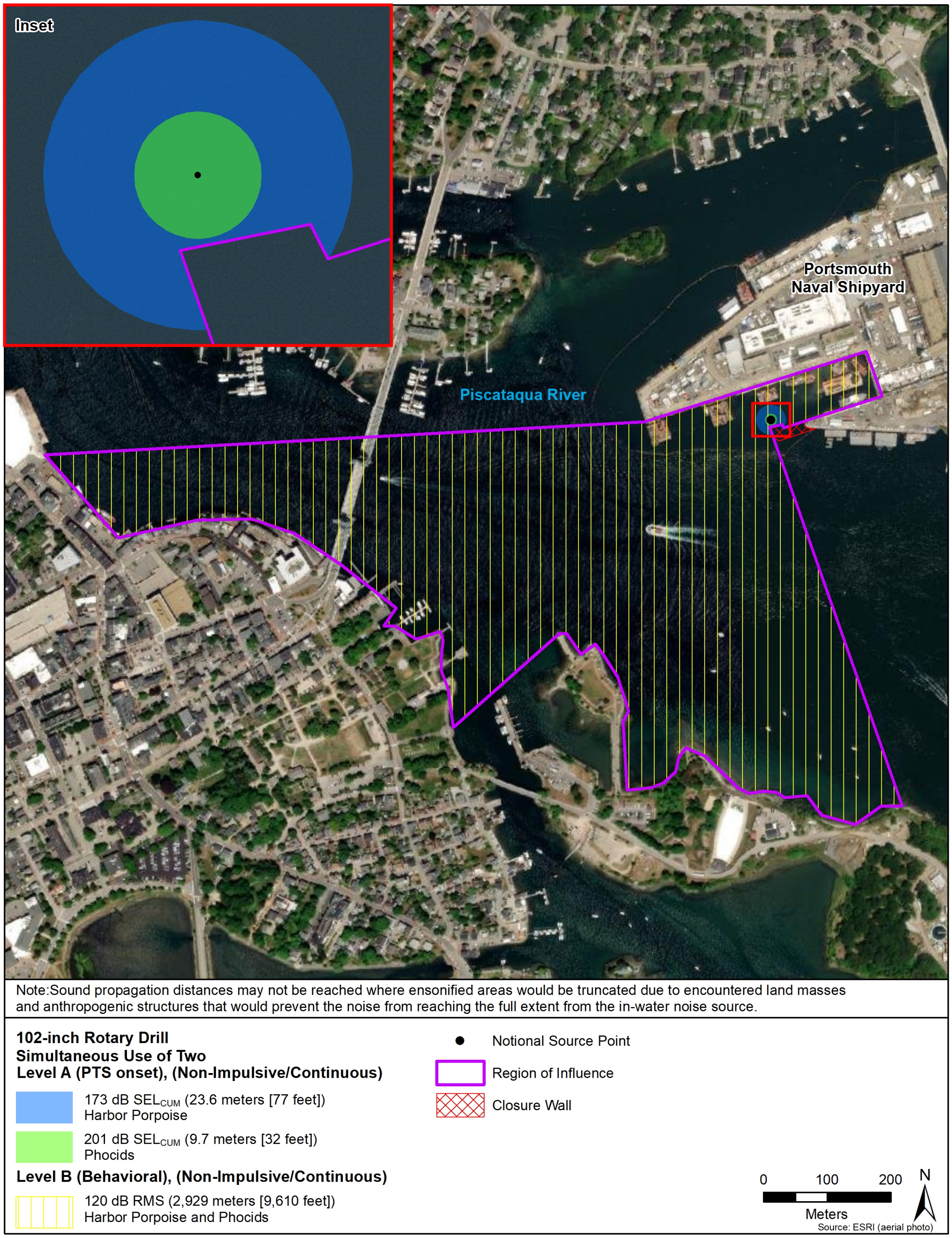


Figure 6-13. Level A Injury (PTS Onset) and Level B (Behavioral) Harassment Zones due to Underwater Noise during Simultaneous Use of Two, 102-inch Diameter Rotary Drills (Non-Impulsive/Continuous)

Appendix B
Examples of Paper Datasheets

Project Name:	Portsmouth Naval Shipyard - Superflood	PSO:	S. Rancourt	Page:	1	of 1
PSO Location:	Berth 11	Lead PSO Info:	207-614-4240	Date:	8-16-22	

Weather		Time	Wind Spd/Dir	Temp (F)	Cld Cover (%)	Humid(%)	BSS	Visibility
AM	Cloudy	0730	0	75	75	75	1	Good
PM	P. Cloudy	1300	5 →	86	25	75	2	Good

Construction Activity Info					Marine Mammal Observation*					
Event Info (circle all applicable)	Pile Material Used (circle all applicable)	Time of Event (start and end if applicable)	PSO Name	Tidal State	Species (use code)	Distance and Bearing from PSO (m and degrees)	# Animals & Sex (min/max/best est) # of calves	Movement Relative to Noise	Behavior Code Note Any Change in Behavior	Take Types / Number
(Start of Day), End of Day, Vibratory, Impact, Drilling, Blasting, Sighting, Delay, Shutdown	NZ26 / NZ14 / W24, PZC18 / 30" Pipe, 4.5" Bore Hole	06:30 / :	SR	Ebb		___m ___°	/ / ; ___M ___F ___UNK; ___AD ___JV ___UNK	Towards, Away, Parallel		Level A: ___ indvs; Level B: ___ indvs
Start of Day, End of Day, Vibratory, Impact, Drilling, Blasting, **(Sighting)**, Delay, Shutdown	NZ26 / NZ14 / W24, PZC18 / 30" Pipe, 4.5" Bore Hole	11:28 / 11:28	↓	Flow	HBSE	150 m 0°	1/1/1; ___M 1 F ___UNK; ___AD 1 JV ___UNK	Towards, Away, **(Parallel)**	Breaching along fast moving boat - Possibly startled	Level A: ___ indvs; Level B: 1 indvs
Start of Day, End of Day, Vibratory, Impact, Drilling, Blasting, **(Sighting)**, Delay, Shutdown	NZ26 / NZ14 / W24, PZC18 / 30" Pipe, 4.5" Bore Hole	11:38 / 11:40	↓	Flow	HBSE	100 m 270°	1/1/1; ___M 1 F ___UNK; ___AD 1 JV ___UNK	**(Towards)**, Away, Parallel	Headed/milling next to berth. Same seal	Level A: ___ indvs; Level B: 1 indvs
Start of Day, End of Day, Vibratory, Impact, Drilling, Blasting, **(Sighting)**, Delay, Shutdown	NZ26 / NZ14 / W24, PZC18 / 30" Pipe, 4.5" Bore Hole	17:33 / 17:34	↓	Ebb	HBSE	75 m 290°	1/1/1; ___M 1 F ___UNK; ___AD 1 JV ___UNK	Towards, Away, **(Parallel)**	Swimming upriver	~~Level A: ___ indvs; Level B: ___ indvs~~
Start of Day, **(End of Day)**, Vibratory, Impact, Drilling, Blasting, Sighting, Delay, Shutdown	NZ26 / NZ14 / W24, PZC18 / 30" Pipe, 4.5" Bore Hole	19:30 / :	↓	Flow		___m ___°	/ / ; ___M ___F ___UNK; ___AD ___JV ___UNK	Towards, Away, Parallel		Level A: ___ indvs; Level B: ___ indvs
Start of Day, End of Day, Vibratory, Impact, Drilling, Blasting, Sighting, Delay, Shutdown	NZ26 / NZ14 / W24, PZC18 / 30" Pipe, 4.5" Bore Hole	: / :				___m ___°	/ / ; ___M ___F ___UNK; ___AD ___JV ___UNK	Towards, Away, Parallel		Level A: ___ indvs; Level B: ___ indvs
Start of Day, End of Day, Vibratory, Impact, Drilling, Blasting, Sighting, Delay, Shutdown	NZ26 / NZ14 / W24, PZC18 / 30" Pipe, 4.5" Bore Hole	: / :				___m ___°	/ / ; ___M ___F ___UNK; ___AD ___JV ___UNK	Towards, Away, Parallel		Level A: ___ indvs; Level B: ___ indvs
Start of Day, End of Day, Vibratory, Impact, Drilling, Blasting, Sighting, Delay, Shutdown	NZ26 / NZ14 / W24, PZC18 / 30" Pipe, 4.5" Bore Hole	: / :				___m ___°	/ / ; ___M ___F ___UNK; ___AD ___JV ___UNK	Towards, Away, Parallel		Level A: ___ indvs; Level B: ___ indvs
Start of Day, End of Day, Vibratory, Impact, Drilling, Blasting, Sighting, Delay, Shutdown	NZ26 / NZ14 / W24, PZC18 / 30" Pipe, 4.5" Bore Hole	: / :				___m ___°	/ / ; ___M ___F ___UNK; ___AD ___JV ___UN	Towards, Away, Parallel		Level A: ___ indvs; Level B: ___ indvs

* For all species observations entered, note physical location on attached map with species code, date, and time.

Species Codes: HBPP (Harbor porpoise); HBSE (Harbor seal); GRSE (Gray seal); HDSE (Hooded seal); HPSE (Harp seal); OTHR (Other species; list name)
Behavioral Codes: 1) no response, 2) head alert (looks towards disturbance), 3) approaches in water, or 4) retreat or flush (leaves the area or flushes from haul-out site).

Other Monitoring Notes:
Was there noise making today? **(Yes)** No 102" casing // Rotary Drill
Were there mammal sightings today? **(Yes)** No

Comments: [illegible]

PSNY POC: Ian Trefry at ian.trefry@navy.mil or 207.438.4362
NAVFAC MIDLANT POC: Jessica Bassi at jessica.bassi@navy.mil or 757.341.0493

Form Revised: January 11, 2021

Project Name: PNSY - P381	PSO: Sabrina Rancourt	Page: 1 of 1
PSO Location: Berth 11	Lead PSO Info:	Date: 9 / 21 / 2022

Weather								
AM	overcast	Time: 0700	Wind Spd/Dir: 5→W	Temp (F): 60	Cld Cover (%): 100	Humid (%): 100	BSS: 1	Visibility: Good
PM	M.Cloudy	Time: 1400	Wind Spd/Dir: 5→E	Temp (F): 65	Cld Cover (%): 75	Humid (%): 75	BSS: 2	Visibility: Good

Construction Acitvity Info					Marine Mammal Observation Info					
Event Info		Material Used	Time of Event	Tidal State	Species Code	Distance and Bearing from PSO (m and deg)	# Animals & Sex (min/max/best est)	Movement Relative to Noise	Behavior Code - Note Any Change in Behavior	Take Types & Number
(Start of Day), End of Day, Vibratory, Impact, Cluster Drill, Monohammer, Rock Hammer, Rotary Hammer	Install Remove	42-inch, 9-inch, 4-6-inch, 102-inch, 28-inch, N/A	06:30 :	Flow		m deg	/ / __M, __F, __UNK __AD, __JV, __UNK	Towards, Away, Parallel		A: ___ B: ___
Start of Day, End of Day, Vibratory, Impact, Cluster Drill, Monohammer, Rock Hammer, Rotary Hammer Sighting	Install Remove	42-inch, 9-inch, 4-6-inch, 102-inch, 28-inch, N/A	07:29 07:30	Flow	HBSE	200 m S(180) deg	1 / 1 / 1 __M, __F, 1 UNK __AD, __JV, 1 UNK	Towards, Away, (Parallel)	Headed upriver	A: X B: X
Start of Day, End of Day, Vibratory, Impact, Cluster Drill, Monohammer, Rock Hammer, Rotary Hammer Sighting	Install Remove	42-inch, 9-inch, 4-6-inch, 102-inch, 28-inch, N/A	07:39 07:40	Flow	HBSE	25 m 220 deg	1 / 1 / 1 __M, __F, 1 UNK __AD, 1 JV, __UNK	Towards, Away, (Parallel)	JV seal milling next to hut.	A: X B: X
Start of Day, End of Day, Vibratory, Impact, Cluster Drill, Monohammer, Rock Hammer, Rotary Hammer Sighting	Install Remove	42-inch, 9-inch, 4-6-inch, 102-inch, 28-inch, N/A	09:28 09:30	Ebb	HBSE	100 m 220 deg	1 / 1 / 1 __M, __F, 1 UNK __AD, __JV, 1 UNK	Towards, (Away), Parallel	outside fence headed upriver	A: 0 B: 1
Start of Day, End of Day, Vibratory, Impact, Cluster Drill, Monohammer, Rock Hammer, Rotary Hammer Sighting	Install Remove	42-inch, 9-inch, 4-6-inch, 102-inch, 28-inch, N/A	09:31 09:32	Ebb	HBSE	200 m 160 deg	1 / 1 / 1 __M, __F, 1 UNK __AD, __JV, 1 UNK	(Towards), Away, Parallel	Headed downriver now-Same Seal	A: X B: X
Start of Day, (End of Day), Vibratory, Impact, Cluster Drill, Monohammer, Rock Hammer, Rotary Hammer	Install Remove	42-inch, 9-inch, 4-6-inch, 102-inch, 28-inch, N/A	16:00 :	Flow		m deg	/ / __M, __F, __UNK __AD, __JV, __UNK	Towards, Away, Parallel		A: ___ B: ___
Start of Day, End of Day, Vibratory, Impact, Cluster Drill, Monohammer, Rock Hammer, Rotary Hammer	Install Remove	42-inch, 9-inch, 4-6-inch, 102-inch, 28-inch, N/A	: :			m deg	/ / __M, __F, __UNK __AD, __JV, __UNK	Towards, Away, Parallel		A: ___ B: ___
Start of Day, End of Day, Vibratory, Impact, Cluster Drill, Monohammer, Rock Hammer, Rotary Hammer	Install Remove	42-inch, 9-inch, 4-6-inch, 102-inch, 28-inch, N/A	: :			m deg	/ / __M, __F, __UNK __AD, __JV, __UNK	Towards, Away, Parallel		A: ___ B: ___

Other Monitoring Notes:	Comments: Please include how many items were installed/removed for each activity.
Was there noise making today? (Yes) / No	DTH mono-hammer - WCW rock kerf
Did you have any marine mammal sightings today? (Yes) No	
Was the bubble curtain used today? (Yes) No	
Was a soft start implemented today? Yes (No)	

Project Name: PNSY - P381	PSO: Ellen Rusley	Page: 1 of 1
PSO Location: Four the	Lead PSO Info:	Date: 11 / 21 / 2020

Weather		Time	Wind Spd/Dir	Temp (F)	Cld Cover (%)	Humid (%)	BSS	Visibility
Clear/partly cloudy	AM	630	5	21	40	37	1	Good
	PM	1530	10	38	50	37	2	Good

Construction Acitvity Info: Event Info		Material Used	Time of Event	Tidal State	Marine Mammal Observation Info: Species Code	Distance and Bearing from PSO (m and deg)	# Animals & Sex (min/max/best est)	Movement Relative to Noise	Behavior Code - Note Any Change in Behavior	Take Types & Number
(Start of Day) circled, End of Day, ~~Vibratory, Impact~~, Cluster Drill, Monohammer, Rock Hammer, Rotary Hammer	Install Remove	42-inch, 9-inch, 4-6-inch, 102-inch, 28-inch, N/A	6:30 / :	Rising tide		m / deg	/ / ; __M, __F, __UNK __AD, __JV, __UNK	Towards, Away, Parallel		A: ____ B: ____
Start of Day, End of Day, Vibratory, Impact, Cluster Drill, Monohammer, Rock Hammer, Rotary Hammer	Install Remove	42-inch, 9-inch, 4-6-inch, 102-inch, 28-inch, N/A	9:40 / 9:52	Falling tide	HASE	200 m / 90 deg	1 / 1 / 1 ; __M, __F, 1 UNK 1 AD, __JV, __UNK	Towards, Away, Parallel	Feeding diving	A: ____ B: ____
Start of Day, (End of Day) circled, Vibratory, Impact, Cluster Drill, Monohammer, Rock Hammer, Rotary Hammer	Install Remove	42-inch, 9-inch, 4-6-inch, 102-inch, 28-inch, N/A	3:30 / :	Rising tide		m / deg	/ / ; __M, __F, __UNK __AD, __JV, __UNK	Towards, Away, Parallel		A: ____ B: ____
Start of Day, End of Day, Vibratory, Impact, Cluster Drill, Monohammer, Rock Hammer, Rotary Hammer	Install Remove	42-inch, 9-inch, 4-6-inch, 102-inch, 28-inch, N/A	: / :			m / deg	/ / ; __M, __F, __UNK __AD, __JV, __UNK	Towards, Away, Parallel		A: ____ B: ____
Start of Day, End of Day, Vibratory, Impact, Cluster Drill, Monohammer, Rock Hammer, Rotary Hammer	Install Remove	42-inch, 9-inch, 4-6-inch, 102-inch, 28-inch, N/A	: / :			m / deg	/ / ; __M, __F, __UNK __AD, __JV, __UNK	Towards, Away, Parallel		A: ____ B: ____
Start of Day, End of Day, Vibratory, Impact, Cluster Drill, Monohammer, Rock Hammer, Rotary Hammer	Install Remove	42-inch, 9-inch, 4-6-inch, 102-inch, 28-inch, N/A	: / :			m / deg	/ / ; __M, __F, __UNK __AD, __JV, __UNK	Towards, Away, Parallel		A: ____ B: ____
Start of Day, End of Day, Vibratory, Impact, Cluster Drill, Monohammer, Rock Hammer, Rotary Hammer	Install Remove	42-inch, 9-inch, 4-6-inch, 102-inch, 28-inch, N/A	: / :			m / deg	/ / ; __M, __F, __UNK __AD, __JV, __UNK	Towards, Away, Parallel		A: ____ B: ____
Start of Day, End of Day, Vibratory, Impact, Cluster Drill, Monohammer, Rock Hammer, Rotary Hammer	Install Remove	42-inch, 9-inch, 4-6-inch, 102-inch, 28-inch, N/A	: / :			m / deg	/ / ; __M, __F, __UNK __AD, __JV, __UNK	Towards, Away, Parallel		A: ____ B: ____

Other Monitoring Notes:

- Was there noise making today? (Yes) / No
- Did you have any marine mammal sightings today? (Yes) / No
- Was the bubble curtain used today? Yes / No
- Was a soft start implemented today? Yes / No

Comments: Please include how many items were installed/removed for each activity.

Start of day 630

End of day 1530

Appendix C
Final Hydroacoustic Monitoring Plans for P-310 Year Two and P-381 Year One IHA Periods

P-310 Year Two IHA Hydroacoustic Monitoring Plan

Submittal 0052B.4 Hydroacoustic Monitoring Plan

Rev.4

Specification Section 01 57 19.00 22

SD-01 Preconstruction Submittal

P 310 DD1 Super Flood Basin and P1074 Portal Crane Rail Extension

May 14, 2021

Presented To:

PNSY Public Works Department

Portsmouth Naval Shipyard

Kittery, Maine 03904

By:

Cianbro Corporation

Pittsfield, Maine 04967

TABLE OF CONTENTS

APPENDICES

FIGURES

LIST OF TABLES

A. Introduction

The following is the hydroacoustic monitoring plan for Portsmouth Naval Shipyard (PNSY) DD1 Super Flood Basin and Portal Crane Rail Extension project. Over the course of this project, in-water pile driving/excavating, drilling, and blasting work will be necessary to complete the super flood basin. This work will produce a variety of high intensity sound within the project area, propagating out to portions of the Piscataqua River. These high levels of sound pressure have the potential to harass and possibly injure marine mammals that can be found living in the Piscataqua River.

Sound is one of the main methods marine mammals use to communicate, navigate, and forage for food. The impacts to marine mammals by introducing temporary threshold shifts (TTS) and permanent threshold shifts (PTS) are still being researched as more data is collected. However, it is known that the impact of high pressure levels have the potential to affect an animal's physical condition.

The main course of action is to collect acoustical data from various pile driving equipment, drilling, and blasting to determine the source level produced by those sound sources.

The ROI for year 2 has been reduced from the ROI for year 1. This change is due to the positioning of the activities taking place behind the construction of the south closure wall. It can be noted that while the south closure wall is not complete, all further work occurring during year 2 would involve concrete placement and additional above water work that would have no impact to underwater sound levels.

All NAVFAC and NMFS approved zones can also be found in Appendix B – Acoustic Model ROI.

The numbers of piles to be monitored for pile driving per the draft IHA are:

- 4 30-inch steel pipe piles for vibratory driving
- 10 28-inch Z-shaped sheet piles for impact and vibratory driving
- 10 18-inch flat-webbed sheet piles for impact and vibratory driving
- 10 120 lb. blasting events
- 10 blast charge hole drilling events

Due to the dynamic nature of this construction project, it is possible that the number of piles and/or pile types may change depending on site conditions. If any changes need to be made, they will be brought to the attention of the Navy and NMFS to discuss and adjust monitoring as needed. Appendix C – In-water Pile-Driving, Drilling, and Blasting for Construction Year 2 denotes the current list of pile types as well as the updated schedule for installation/removal of year 2 work.

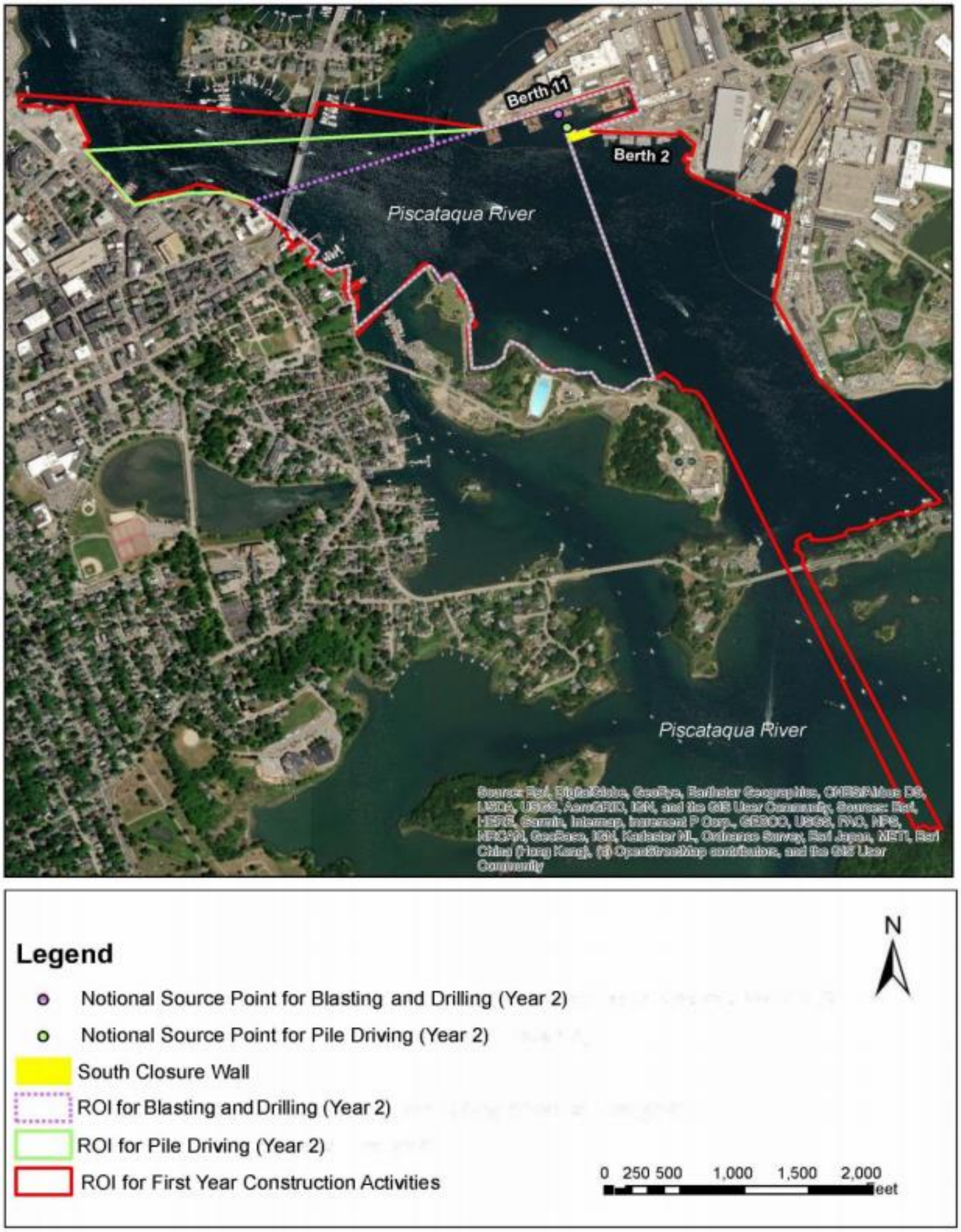


Figure 1. Region of Influence for Underwater Noise for Year 1 versus Year 2

Source: NOAA Fisheries. IHA Request. 2021.

B. Requirements

Hydroacoustic monitoring will comply with the ***Final Request for Incidental Harassment Authorization for Modification, Expansion, and Future Operations of Dry Dock 1 at Portsmouth Naval Ship Yard*** and the issued Incidental Harassment Authorization Draft dated April 2021.

For the activity that will be monitored, 100% of the data will be analyzed and reported (including “soft starts” of impact hammers). Monitoring is necessary as specified in the draft IHA, section 5(d). Hydroacoustic monitoring will be conducted for each different type of pile and each method of installation and removal as well as for blast hole charge drilling and blast events.

Near-field monitoring will occur 10 meters (33 feet) for vibratory hammer, impact hammer, and drilling activities. The location of a near-field hydrophone for blasting will depend a safe distance for personnel and equipment. With the intent of the specifications being to have a monitoring location outside the bubble curtain at the entrance structure (i.e. representing the hydro-acoustics emitted into the river); the near-field hydrophone will be installed as close to the blasting as safely possible under guidance of blasting experts.

Locations for far-field hydrophone deployment have been chosen based on NMFS data collection guidance; however, where the distance criteria for far-field monitoring cannot be met due to proximity to the navigable channel, the equipment will be placed as far as practicable from the location of the activity. Proposed placement locations for the far-field monitoring point can be seen in Figure 5 through 12.

The approximate distance for placement of the far-field hydrophone was found through review of Project specification plans (Figure 2) to find the best possible location to monitor that as closely met the NMFS guidance as practicable. Final location will reflect strategical deployment as to avoid flat surfaces, fixed structures, other obstructions (concrete batch plant, barges, etc.), and interference from channel traffic that may reflect frequencies and further obscure data. For reference, that available monitoring distance between the work and the navigable channel of the river is approximately 139.6 meters (458 feet) from the Point between Berth 1 and Berth 2.

Blasting Subcontractor requirements such as reporting, equipment, and procedures will be discussed in later sections.

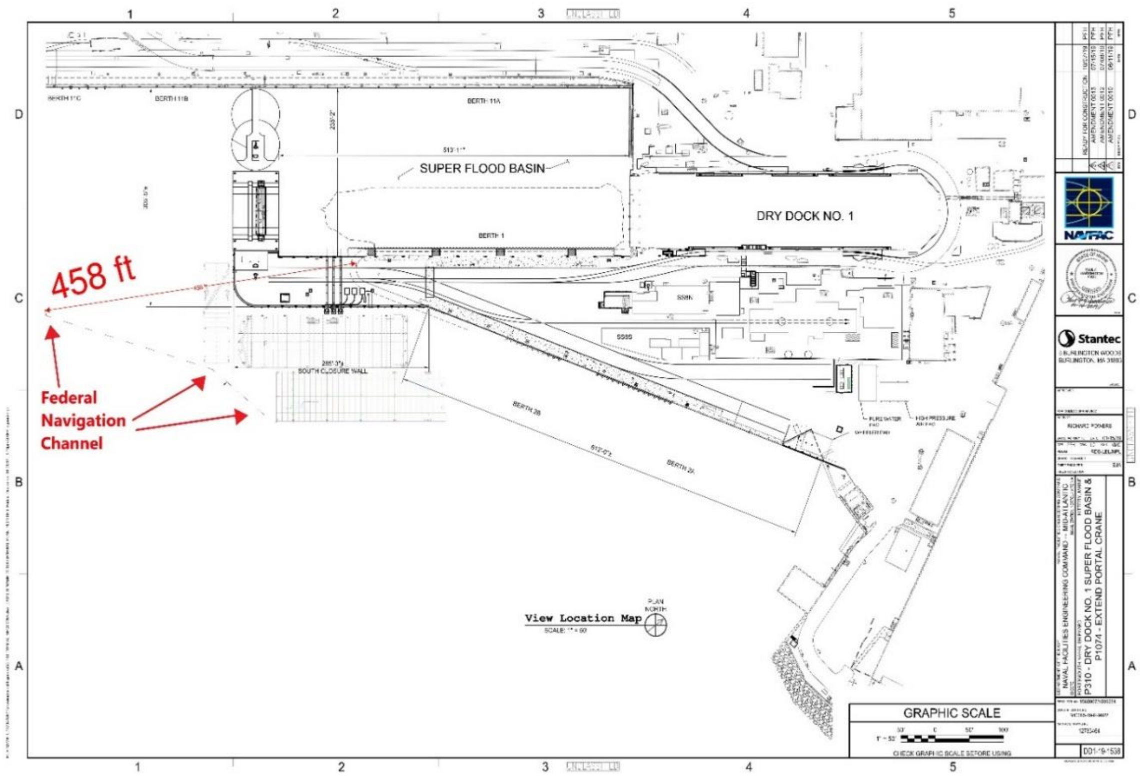


Figure 2. Plan View of Project Site

Original Figure Sourced from Project Specifications. 2020.
Modified by Cianbro to show proposed locations for pile driving monitoring.

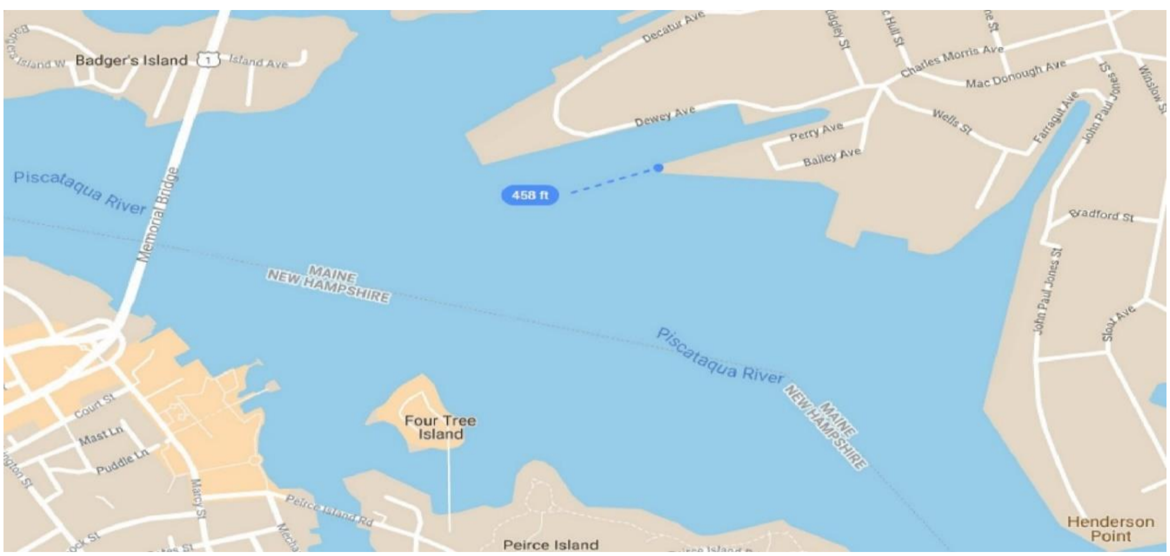


Figure 3. Representative Map Version of Distance between Point and Federal Navigation Channel

Original Figure Sourced Google Maps. 2020.
Modified by Cianbro to show proposed locations for pile driving monitoring.

The furthest source pile will be seated approximately 60.96 meters (200 feet) from the Point between Berth 1 and Berth 2. The depth at this pile will be 19.812 meters (65 feet) between the water surface and river floor bed. Following NMFS guidance of 20m x 19.812m (the depth of the pile), this leaves the monitoring location 396.24 meters (1300 feet) from the source pile. This can be seen in Figure 4. Monitoring at this location would reflect various interferences from channel traffic and obstructions related to the project construction.

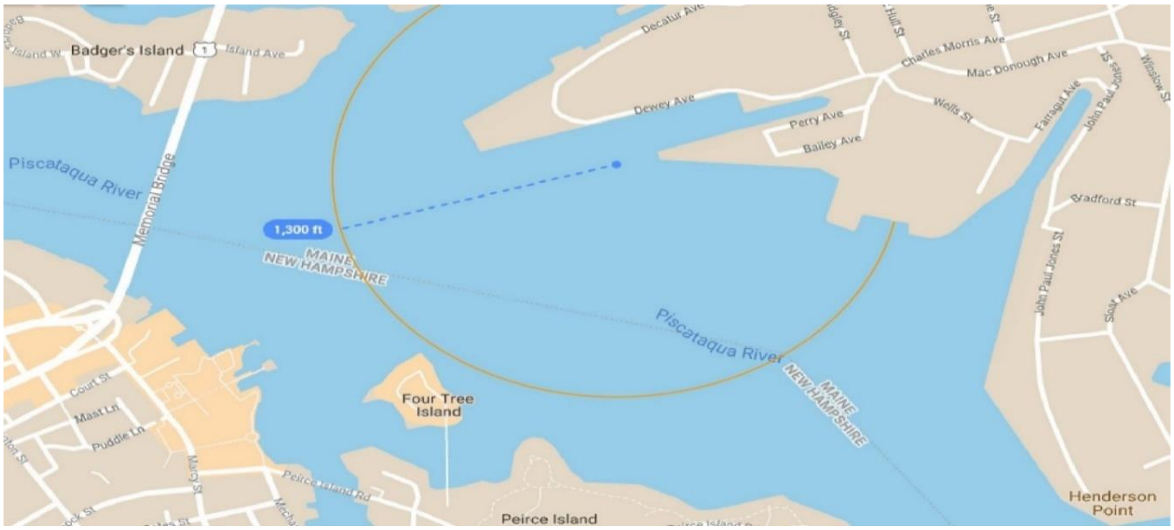


Figure 4. Representative Map Version of Distance between Source Pile and 20x Depth at Pile

Original Figure Sourced Google Maps. 2020.
Modified by Cianbro to show proposed locations for pile driving monitoring.

Direct communication between the pile driving crew, observers and hydroacoustic monitors is critical. There will always be a direct line of communication between the operations crew and marine mammal monitoring team to ensure no pile driving activity or blasting occurs before the hydrophone(s) is appropriately set and operational. Should activity type change, work will cease and the hydrophone will be repositioned, recording the new location with a GPS to confirm the correct distance for the next respective pile type/activity as required by the IHA.

If there is concurrent noise (i.e. drilling and vibratory hammer), the most conservative location will be utilized for far-field monitoring. All concurrent activities will be recorded and will be included in the reporting.

Figures 5 through 12 show the proposed locations for deployment of a far-field hydrophone for each respective activity, as close to the Federal Navigation Channel as possible without unsafely intruding. More details can be found in Appendix B - Table 5. Marine Mammal Shutdown Distances with Monitoring Locations Distances.

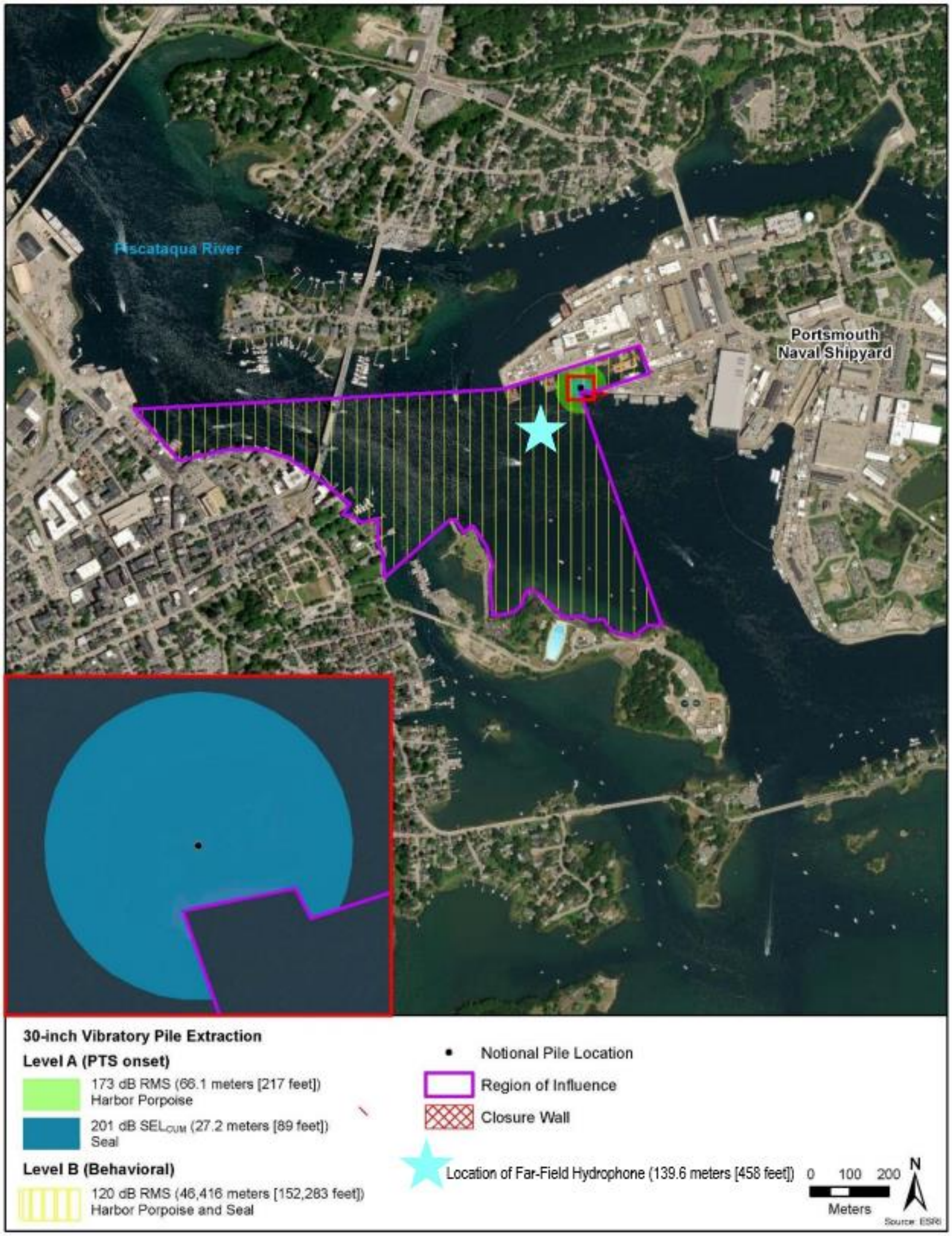


Figure 5. Representative Far-Field Monitoring Location for Underwater Pile Driving Noise from Vibratory Driving 30-Inch Steel Pipe Pile*

Original Figure Sourced from NOAA Fisheries. IHA Request. 2021.
Modified by Cianbro to show proposed location for pile driving monitoring.
*Location may be adjusted based on proximity to the navigable channel

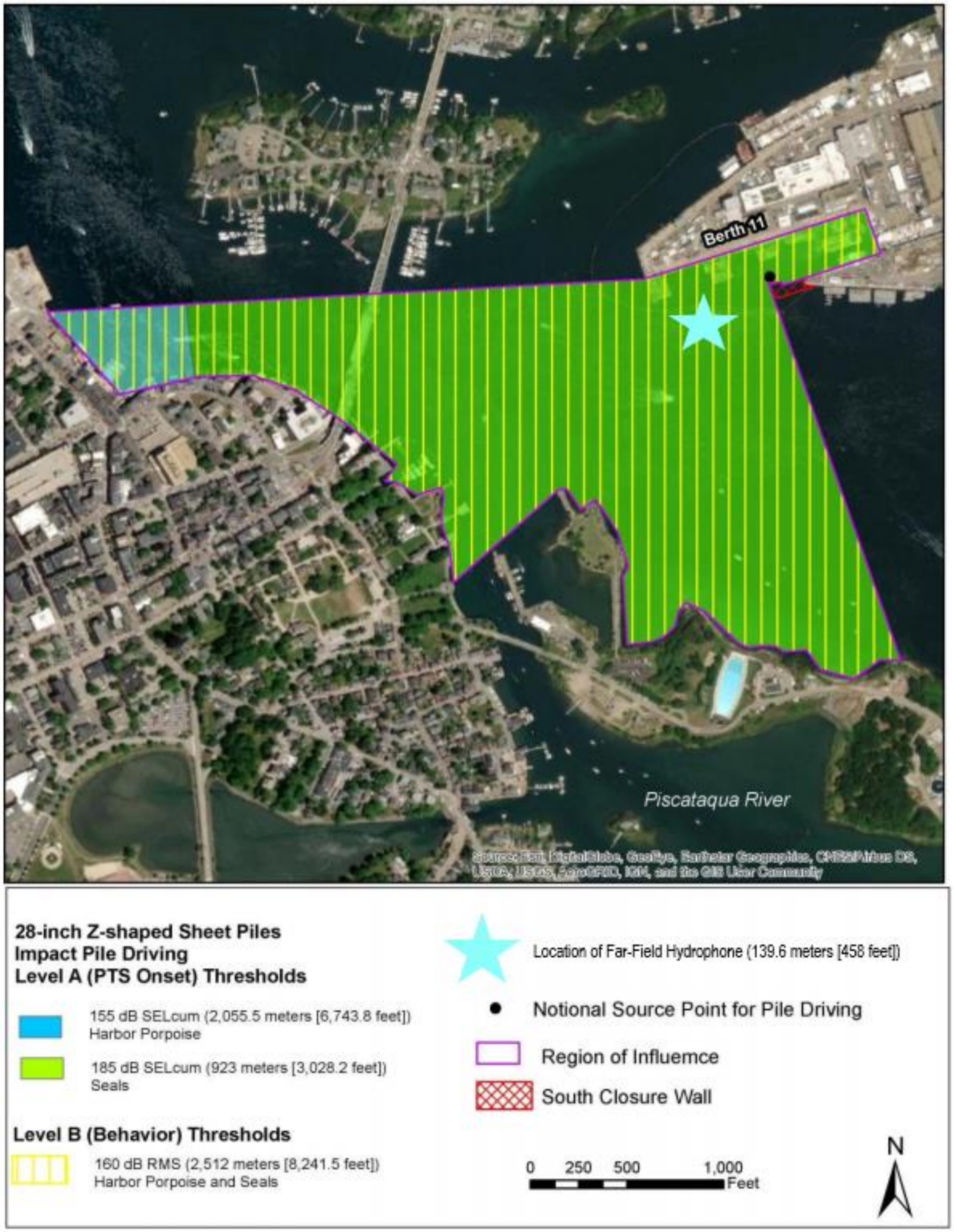


Figure 6. Representative Far-Field Monitoring Location for Underwater Pile Driving Noise from Impact Driving of 28-inch, Z-shaped Sheet Piles*

Original Figure Sourced from NOAA Fisheries. IHA Request. 2021.
Modified by Cianbro to show proposed location for pile driving monitoring.
*Location may be adjusted based on proximity to the navigable channel

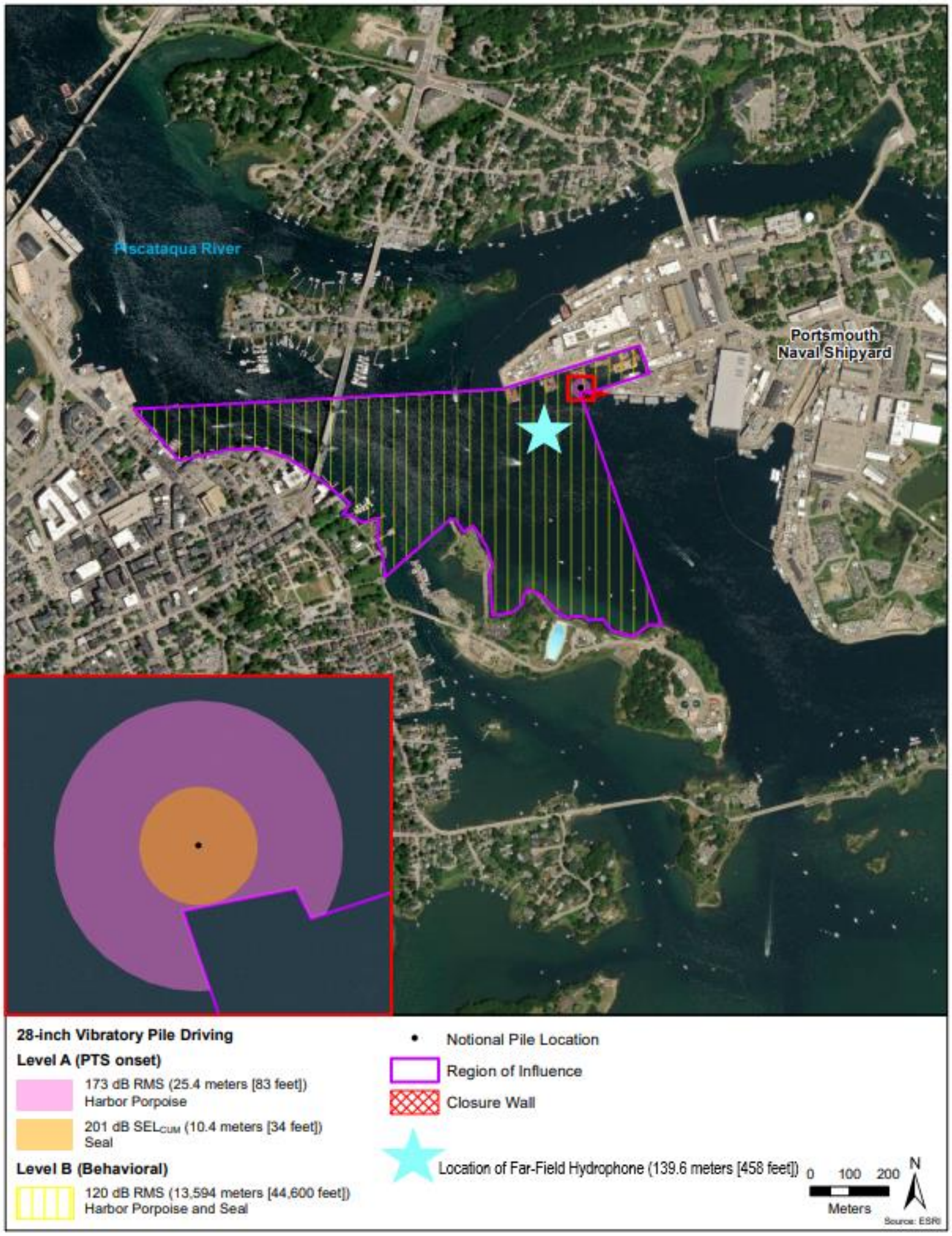


Figure 7. Representative Far-Field Monitoring Location for Underwater Pile Driving Noise from Vibratory Driving of 28-inch, Z-shaped Sheet Piles*

Original Figure Sourced from NAVFAC. 2021.
Modified by Cianbro to show proposed location for pile driving monitoring.
*Location may be adjusted based on proximity to the navigable channel

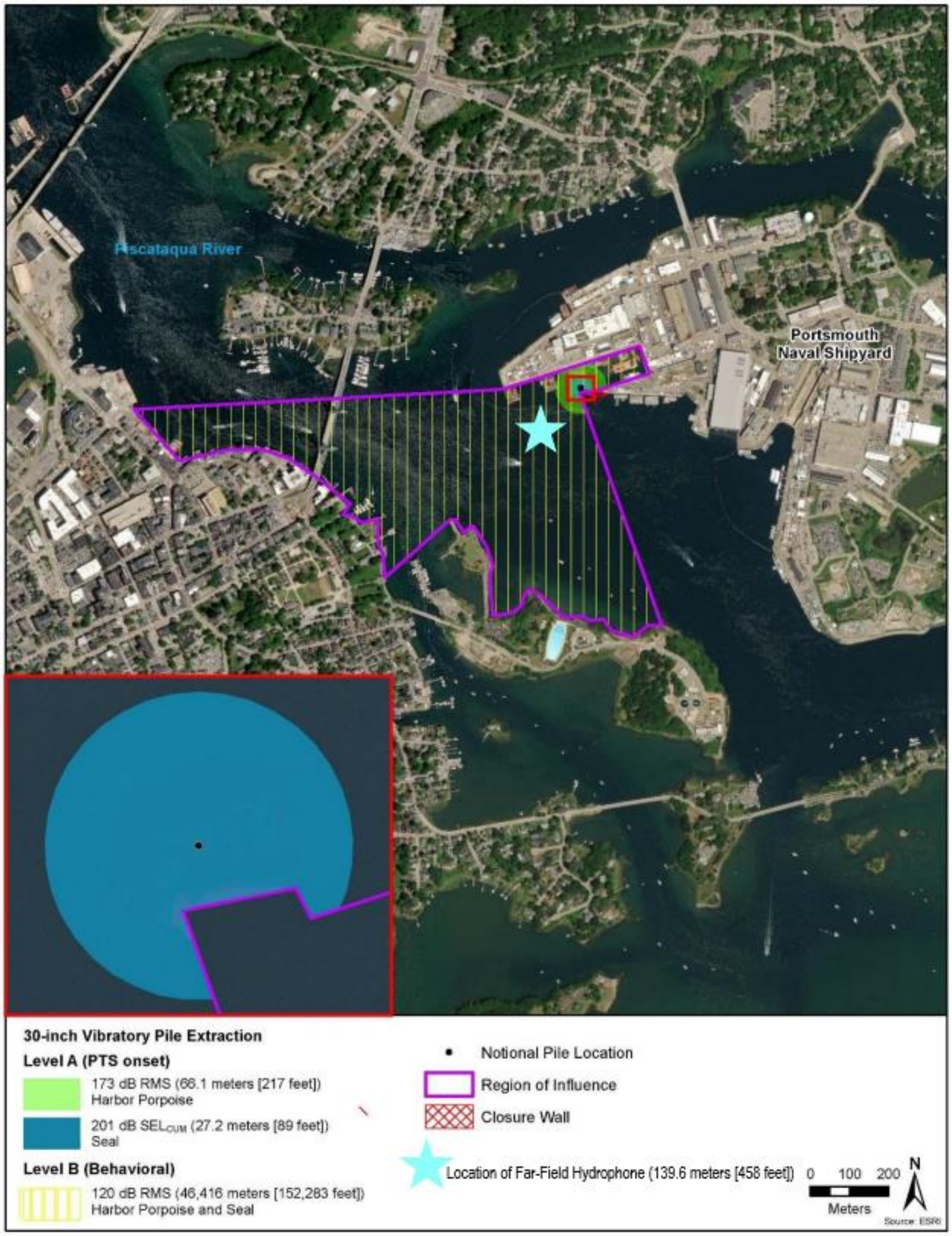


Figure 8. Representative Far-Field Monitoring Location for Underwater Pile Driving Noise from Vibratory Driving of 24-inch, Steel Pipe Pile*

Original Figure Sourced from NOAA Fisheries. IHA Request. 2021.
Modified by Cianbro to show proposed location for pile driving monitoring.
*Location may be adjusted based on proximity to the navigable channel.

NOTE: 30-inch Pipe Pile Figure to be used at direction of NAVFAC.

Figure 9. Representative Far-Field Monitoring Location for Underwater Pile Driving Noise from Impact Driving of 18-inch, Flat-Webbed Sheet Piles*

Original Figure Sourced from NOAA Fisheries. IHA Request. 2021.
Modified by Cianbro to show proposed location for pile driving monitoring.
*Location may be adjusted based on proximity to the navigable channel

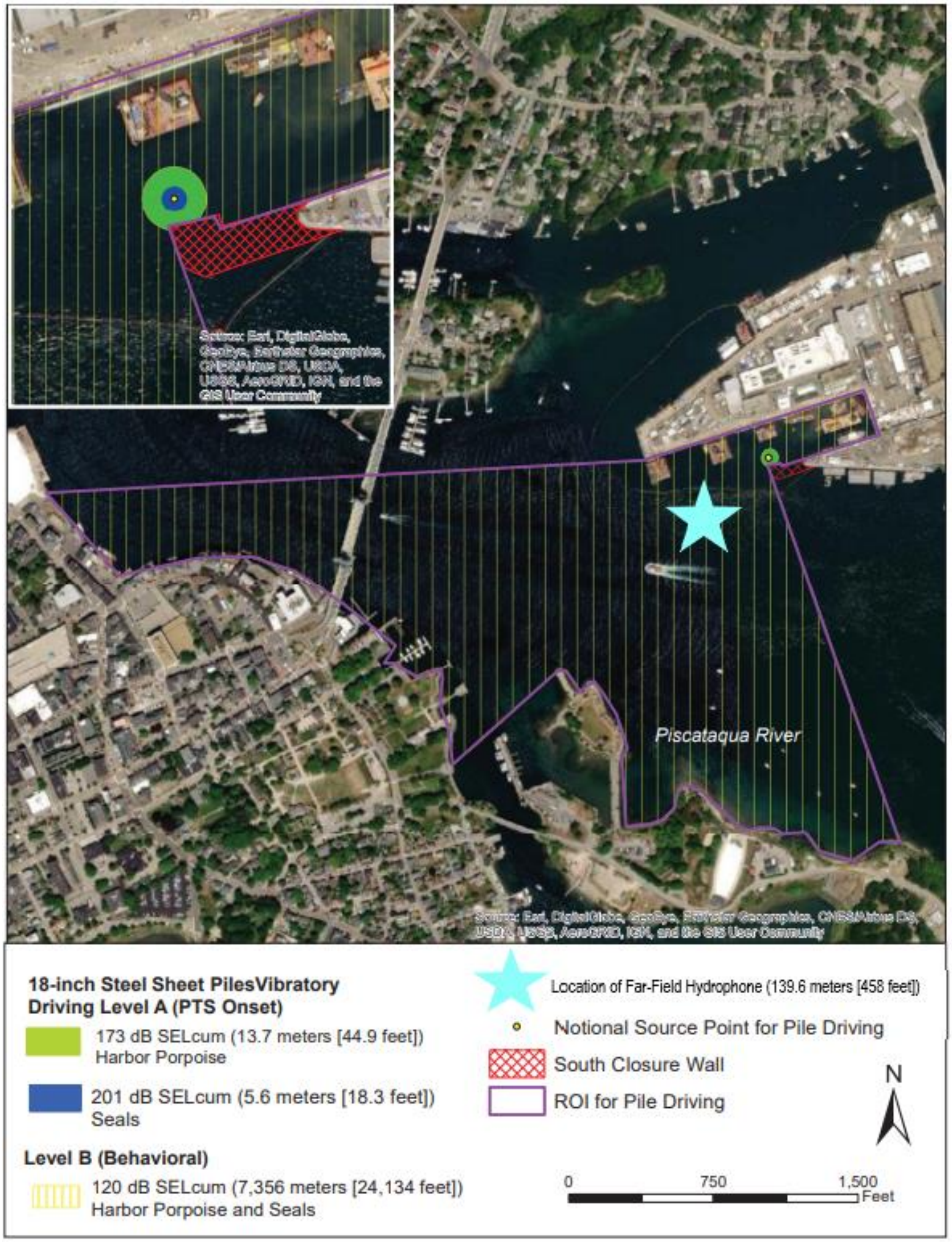


Figure 10. Representative Far-Field Monitoring Location for Underwater Pile Driving Noise from Vibratory Driving of 18-inch, Flat-Webbed Sheet Piles*

Original Figure Sourced from NAVFAC. 2021.
Modified by Cianbro to show proposed location for pile driving monitoring.
*Location may be adjusted based on proximity to the navigable channel

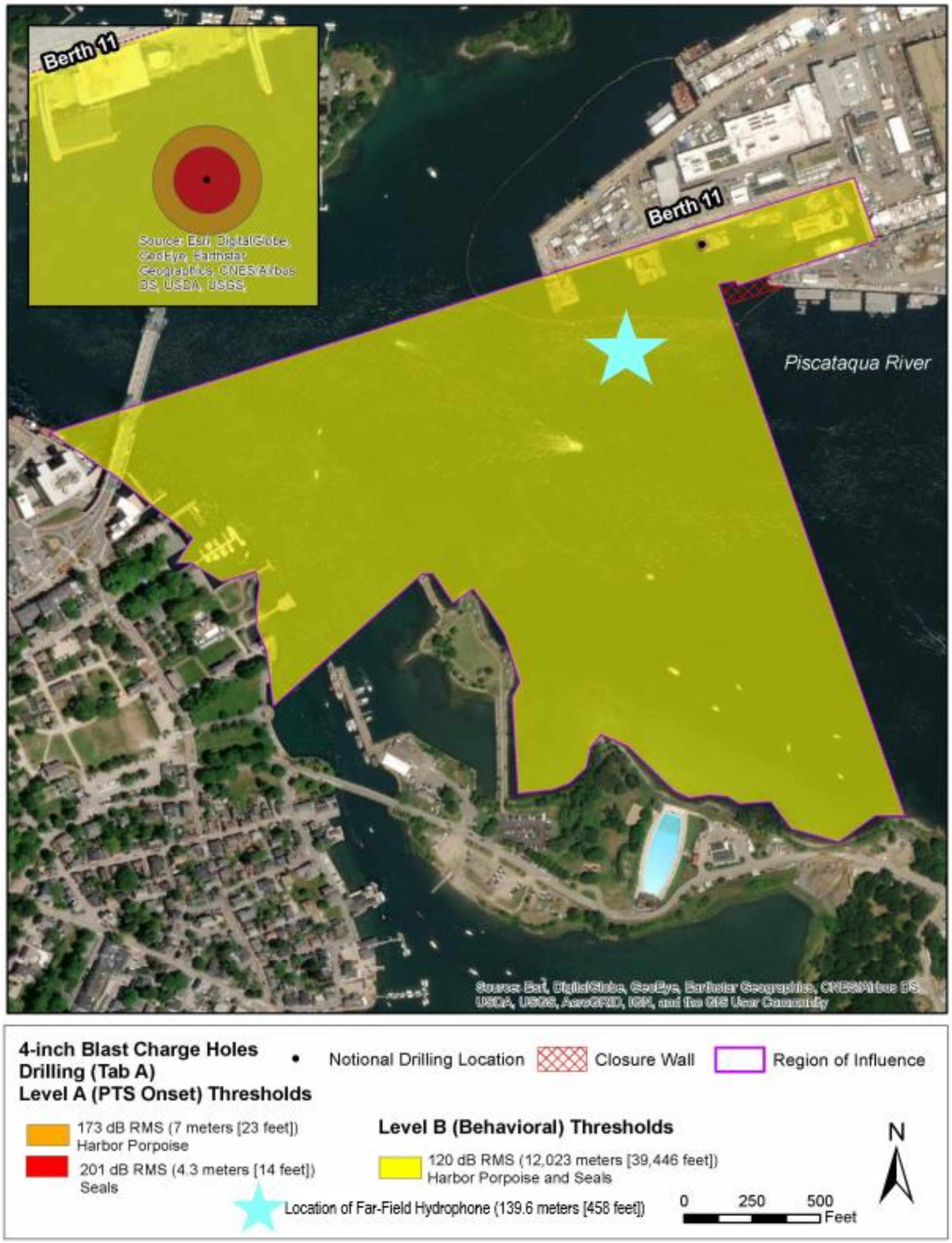


Figure 11. Representative Far-Field Monitoring Location for Underwater Pile Driving Noise from Drilling Activities

Original Figure Sourced from NOAA Fisheries. IHA Request. 2021.
Modified by Cianbro to show proposed location for pile driving monitoring.
*Location may be adjusted based on proximity to the navigable channel

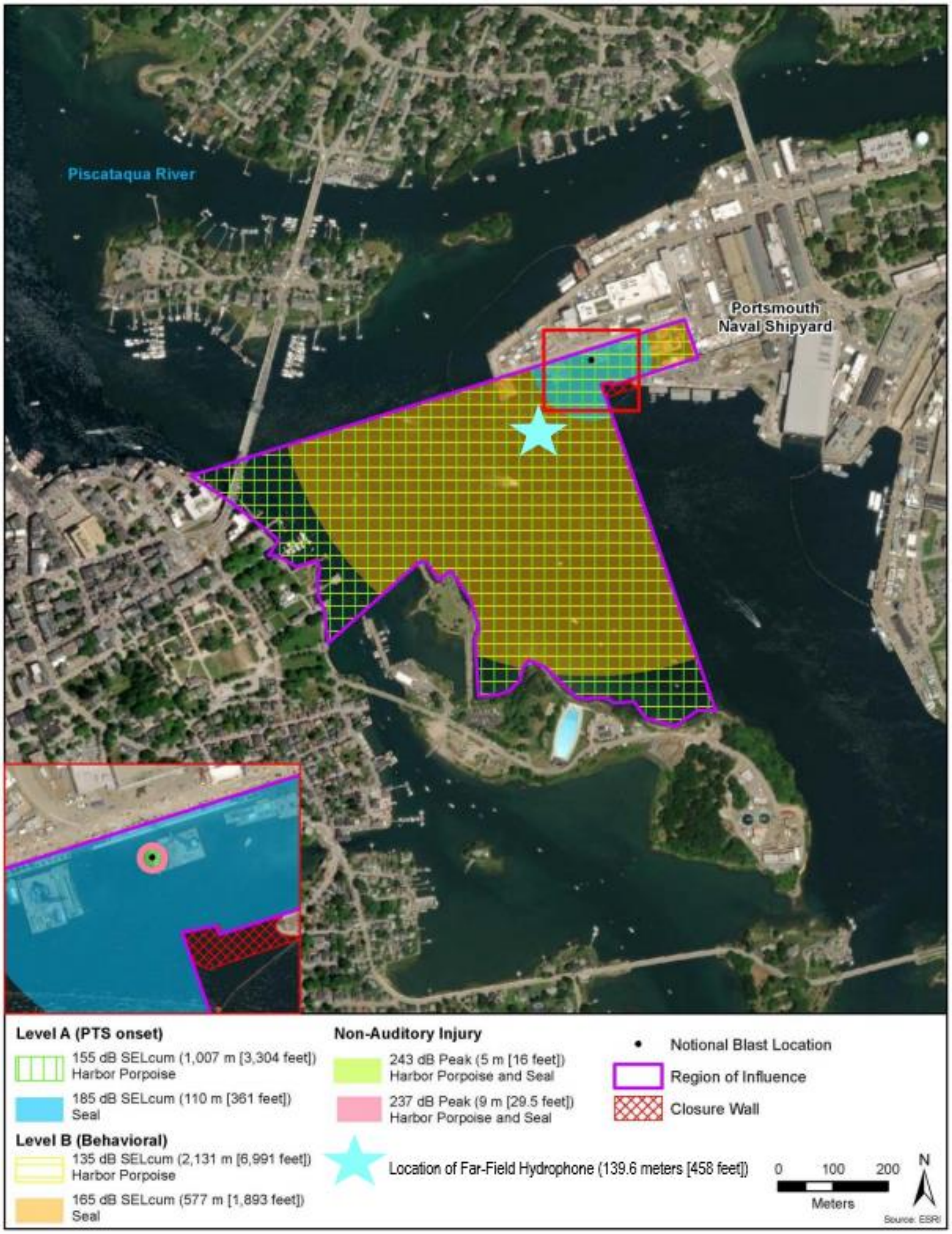


Figure 12. Representative Far-Field Monitoring Location for Underwater Pile Driving Noise from Blasting Activities

Original Figure Sourced from NOAA Fisheries. IHA Request. 2021.
Modified by Cianbro to show proposed location for blast monitoring.
*Location may be adjusted based on proximity to the navigable channel

C. Reporting

Measuring Hydroacoustics

A reference value is necessary if one is to give absolute pressure (or intensity levels) in dB. The pressure reference used for underwater acoustics is: 1 µPa. As well as a reference value, a pressure definition must also be clearly defined. There are three pressure definitions that are commonly used in underwater acoustics: peak, peak-to-peak, and RMS.

When analyzing noise, instantaneous values of sound pressure are constantly fluctuating. It becomes necessary to average data as one specific instant in time cannot represent the statistical variations in the values fluctuating over time.

An RMS value requires a duration over which to average the pressure of the signal. RMS will vary drastically depending on the duration over which the signal is averaged. The longer the duration, the lower the RMS value will be.

All RMS SPL measurements will be based on a time window that consists of 90% of the acoustic energy. RMS 90% energy window measures the average or effective pressure over the duration of post-processed data. This method omits the first and last 5% of the post-processed data taken from RMS SPL.

Daily Reporting:

Monitoring for Impact Hammer Use Daily Reports:

Impact hammers are typically used to install pile to approved stability ("seat" the pile). Impact hammers are also utilized to install pile through coarse or difficult substrates, such as cobbled or fractured rock. It is not anticipated that the impact hammer will be utilized significantly on this project beyond seating pile to appropriate depth/stability. The majority of pile work will utilize a vibratory hammer. Impact hammers produces a greater level of sound pressure compared to the vibratory hammer. Impact hammers use pistons that are lifted by a variety of ways such as ignition, hydraulics, or steam; once the piston is lifted to a desired height, it is released and will drop against the head of the pile to drive it into the sediment. This method is considered an impulsive noise source. Impact hammers on this project will by controlled by hydraulics.

The piles being driven for this project will be initially placed with a vibratory hammer, and then driven to refusal with an impact hammer.

Pile-driving days are not consecutive and certain activities may occur simultaneously.

Hydroacoustic daily reports for impact hammer use will include the following informational elements:

- Hydrophone equipment and methods: recording device, sampling rate, distance (m) from the pile where recordings were made; depth of water and recording device(s);
- Type and size of pile being driven, substrate type, hammer model/energy, total pile driving duration
- Number of strikes and strike rate
- Depth of substrate to penetrate and sediment type at the recording location

- SEL_{cum}: Cumulative sound exposure level an animal is exposed to during a specified duration of time. This will be computed from all the strikes associated with each pile occurring during all phases, i.e., soft start, Level 1 to Level 4.
    - Reference: dB re 1 μPa^2 · sec
        - Pressure Definition: RMS
            - RMS Duration: 90% energy window (applied to calculate $SEL_{s\text{-}s}$ before calculating SEL_{cum})
                - Formula: $SEL_{cum} = SEL_{s\text{-}s} + 10*\log$ (# of hammer strikes)
- SPL_{peak}: Maximum absolute amplitude value in the signal
    - Reference: dB re 1 μPa
        - Pressure Definition: RMS
            - RMS Duration: 90% energy window
- $SEL_{s\text{-}s}$: Determined by the squared sound pressure integrated over the duration of the strike.
    - Reference: dB re 1 μPa^2 · sec
        - Pressure Definition: RMS
            - RMS Duration: 90% energy window (single strike)
    - Median, mean, maximum, and minimum $SEL_{s\text{-}s}$
        - Pressure Definition: RMS
            - RMS Duration: 90% energy window
- SPL_{rms}: Log transformed square root of the average square pressure of the signal over a specific time interval
    - Reference: dB re 1 μPa
        - Pressure Definition: RMS
            - RMS Duration: 90% energy window
    - Median, mean, maximum, and minimum SPL_{rms}
        - Pressure Definition: RMS
            - RMS Duration: 1-second intervals
- Power Spectral Density: The average power in a sound during a certain time range and in a certain frequency range. This will be able to give a visualization for which frequency variations are strong and which are weak.
    - Reference: dB re μPa^2 per Hz
        - For impact driving, the power spectral density will be computed based on the average of up to eight successive strikes with a similar sound. The FFT of each hammer strike will be computed for the portion of the signal within each 90% energy strike duration and then averaged.

Monitoring for Vibratory Hammer Use Daily Reports:

Vibratory hammers are used to install piles when allowed by the sediment type. This style of hammer produces a significantly lower source level of sound pressure when compared to the impact hammer. For this reason, vibratory hammers will be the primary method of steel pile installation. These hammers lack the rapid rise in amplitude but have longer durations of an event. Vibratory hammers are considered a non-impulsive source as the hammer uses counterweights that spin to create a vibration. The vibration of the hammer will “liquefy” the soil allowing the pile to move into or out of the sediment.

Pile-driving days are not consecutive and certain activities may occur simultaneously.

Hydroacoustic daily reports for vibratory hammer use will include the following informational elements:

- Hydrophone equipment and methods: recording device, sampling rate, distance (m) from the pile where recordings were made; depth of water and recording device(s);
- Type and size of pile being driven, substrate type, hammer model/energy, total pile driving duration
- Depth of substrate to penetrate and sediment type at the recording location
- SPL_{rms}: Log transformed square root of the average square pressure of the signal over a specific time interval
    - Reference: dB re 1 μPa
        - Pressure Definition: RMS
            - RMS Duration: 90% energy window
    - Median, mean, maximum, and minimum SPL_{rms}
        - Pressure Definition: RMS
            - RMS Duration: 1-second intervals
- SEL_{cum}: Cumulative sound exposure level an animal is exposed to during a specified duration of time.
    - Reference: dB re 1 $\mu Pa^2 \cdot sec$
        - Pressure Definition: RMS
            - RMS Duration: 24-hour cumulative SEL
                - If duration is less than 24-hours, timeframe over which the sound is averaged will be noted.
    - Median, mean, maximum, and minimum SEL
        - Pressure Definition: RMS
            - RMS Duration: 1-second intervals
- Power Spectral Density: The average power in a sound during a certain time range and in a certain frequency range. This will be able to give a visualization for which frequency variations are strong and which are weak.
    - Reference: dB re μPa^2 per Hz
        - For vibratory driving/removal, the power spectral density will be computed over the entire duration of the total active vibratory driving/removal. This will exclude periods of hammer shut-down to ensure results computed only include duration of total active vibratory driving/removal time.

Monitoring for Drilling Use Daily Reports:

A barge-mounted rotary action drill will be used to bore into bedrock to excavate the holes where the blasting charges will be placed. The drill will operate within a casing that will temporarily contain sediments disturbed during drilling. Sediment will be airlifted out of the casing during drilling. Underwater drilling noise is expected to produce sound levels below those of typical pile driving.

Blasting activities would require the drilling of approximately 1,580, 4.5" diameter holes into bedrock. The 4.5" diameter holes will accommodate the blast charges as well as provide a means of isolating blasting impacts from adjacent structures. Charge holes would be approximately 10 to 25 feet deep, depending on the depth of the rock needed to be removed.

Hydroacoustic daily reports for drilling use will include the following informational elements:

- Hydrophone equipment and methods: recording device, sampling rate, distance (m) from the pile where recordings were made; depth of water and recording device(s);
- Type and size of pile being driven, substrate type, hammer model/energy, total pile driving duration
- Depth of substrate to penetrate and sediment type at the recording location
- SPL_{rms}: Log transformed square root of the average square pressure of the signal over a specific time interval
    - Reference: dB re 1 µPa
        - Pressure Definition: RMS
            - RMS Duration: 90% energy window
    - Median, mean, maximum, and minimum SPL_{rms}
        - Pressure Definition: RMS
            - RMS Duration: 1-second intervals
- SEL_{cum}: Cumulative sound exposure level an animal is exposed to during a specified duration of time.
    - Reference: dB re 1 $\mu Pa^2 \cdot sec$
        - Pressure Definition: RMS
            - RMS Duration: 24-hour cumulative SEL
                - If duration is less than 24-hours, timeframe over which the sound is averaged will be noted.
    - Median, mean, maximum, and minimum SEL
        - Pressure Definition: RMS
            - RMS Duration: 1-second intervals
- Power Spectral Density: The average power in a sound during a certain time range and in a certain frequency range. This will be able to give a visualization for which frequency variations are strong and which are weak.
    - Reference: dB re μPa^2 per Hz
        - For drilling, the power spectral density will be computed over the entire duration of the total active drilling. This will exclude periods of drill shut-down to ensure results computed only include duration of total active drill time.

Monitoring for Blasting Use Daily Reports:

Contractor

Blasting will be necessary for bedrock removal in the basin area. Blasting activities would not begin until the in-water portion of the southern closure wall, the temporary blast wall, and at least one face of the sheet pile west closure wall has been completed. Underwater blasting noise will be contained by the south closure wall constructed during year 1. During the first rounds of blasting, neither the entrance structure nor the caisson will not be in place. Underwater blasting noise impacts will be further contained by the use of a bubble curtain extending the entire opening of the basin.

Blasting daily reports written by the Contractor will include the following informational elements:

- SPL_{peak}: Maximum absolute amplitude value in the signal
    - Reference: dB re 1 μPa
        - Pressure Definition: RMS
            - RMS Duration: 90% energy window
- SEL_{cum}: Cumulative sound exposure level an animal is exposed to during a specified duration of time.
    - Reference: dB re 1 $μPa^2$ · sec
        - Pressure Definition: RMS
            - RMS Duration: 24-hour cumulative SEL
                - If duration is less than 24-hours, timeframe over which the sound is averaged will be noted.

Blasting Subcontractor

The Blasting Subcontractor will utilize pressure sensors to capture pressure/overpressure. Hydrophones will be utilized to capture underwater pressure that falls below the limit of pressure sensors to capture (e.g. 0.8 PSI).

Blasting daily reports written by the Blasting Subcontractor will at a minimum include the following informational elements:

- Total number of charges/delays
- Maximum net explosive weight (NEW) of a single charge
- Total NEW of the event
- Timeframe between delays
- Total timeframe of the event
- Calculation of impulse
    - Pa-sec
- Sound levels in the nearfield will be reported as peak overpressure in PSI and dB

Final Reporting

Per IHA requirements, a draft report will be prepared by the Navy's consultant Stantec and submitted to NMFS within ninety days of mammal monitoring completion or sixty days prior to the issuance of any subsequent IHA for this project. The Contractor will coordinate with the Navy's consultant Stantec to review supporting data no less than 30 days before the report is due to NMFS. Within thirty days of receiving comments from NOAA on the draft report, a final report will be prepared and submitted to NMFS. For internal review purposes, the Contractor will submit the required supporting documents to the Navy a minimum of twenty days prior to submittal to NMFS and the final documents to the Navy fifteen days prior to submittal to NMFS.

Final reporting submitted will contain the specific data for acoustically monitored activities:

- Hydrophone equipment and methods: recording device, sampling rate, distance (m) from the pile where recordings were made; depth of water and recording device(s);
- Type and size of pile being driven*, substrate type*, method of driving during recordings (e.g., hammer model and energy)*, and total pile driving duration;
- For impact pile driving: Number of strikes and strike rate; depth of substrate to penetrate; pulse duration and mean, median, minimum, and maximum sound levels (dB re: 1 μPa): root mean square sound pressure level (SPL_{rms}); cumulative sound exposure level (SEL_{cum}), peak sound pressure level (SPL_{peak}); single-strike sound exposure level (SEL_{ss});
- For vibratory driving/removal and drilling: Duration of driving per pile, or drilling; mean, median, minimum maximum sound levels (dB re: 1 μPa): root mean square sound pressure level (SPL_{rms}); cumulative sound exposure level (SEL_{cum}) (and timeframe over which the sound is averaged);
- For blast events: peak sound pressure level (SPL_{peak}), and cumulative sound exposure level (SEL_{cum}); and
- One-third octave band spectrum and/or power spectral density plot.

*The chief inspector will supply the acoustics specialist with this information.

If any results of monitoring are analyzed and weighted by respective marine mammal functional hearing groups to report on sound attenuation or distances, Cianbro will follow the guidance as defined by NMFS. The two groups being monitored in the Piscataqua River are; phocid pinnipeds (PW) and high frequency (HF) cetaceans. The hearing range of these two groups are as follows:

Table 1. Marine Mammal Hearing Groups

Hearing Group	Generalized Hearing Range*
High-frequency (HF) cetaceans	275 Hz to 160 kHz
Phocid pinnipeds (PW) underwater	50 Hz to 86 kHz
* Represents the generalized hearing range for the entire group as a composite (i.e., all species within the group), where individual species' hearing ranges are typically not as broad. Generalized hearing range chosen based on ~65 dB threshold from normalized composite audiogram, with the exception for lower limits for LF cetaceans (Southall et al. 2007) and PW pinniped (approximation).	

Source: NOAA Fisheries. Marine Mammal Acoustic Technical Guidance. 2021.

Auditory weighting and exposure parameters have been set by NOAA by respective hearing groups. Applying auditory weighting functions is necessary as it gives a more accurate representation of how animals will perceive the loudness of various frequencies. The weighted functions take into account sensitivity to a range of frequencies in the respective hearing group. These functions often result in smaller isopleths as certain frequencies are attenuated.

These weightings take into account a variety of factors based on studies of each respective hearing group. Filters with various weightings (A, B, C, D, and Z weighted) attempted to correspond to loudness as perceived by respective hearing group. This example can be found in humans as the typically hearing range is 20 Hz – 20 kHz. Although this is a spectrum of frequencies, A-weighting is commonly used as it has been found to be the most accurate at representing the average perceived loudness of the human ear.

Weighted functions will not be applied until post processing. This is recommended as it leaves the total spectrum of frequencies captured to be fully analyzed. This is important as one could potentially find a source beyond the frequencies of interest that is producing a frequency that in turn, is producing harmonics/subharmonics that fall into the interested frequency range. Attempts to attenuate the source could then be made to ensure harmonics/subharmonics in the interested frequency range are also attenuated to more acceptable levels.

Both received level and duration of exposure are taken into account when factoring the weighted SEL_{cum} metric. This metric is recommended to apply to individual activities/sources, not multiple activities occurring within the same area. The SEL_{cum} metric is used to determine the TTS and PTS ROI for marine mammals.

For each species group, a low frequency cutoff (f_{low}) and high frequency cutoff (f_{high}) is applied to filter out data below the range of functional hearing for that group. For high frequency cetaceans f_{low} is 200 Hz and for pinnipeds f_{low} is 75 Hz. For all hearing groups, f_{high} is 20 kHz, the frequency above which minimal sound energy is typically produced by pile driving activities.

If any weighting is applied in post processing, reports will include both weighted and non-weighted analytics.

D. Equipment and Procedures

Contractor Pile Driving, Drilling, and Blasting:

The hydrophones to be used for mammal monitoring hydroacoustic aspects of year 2 are Cetacean Research CR3 omnidirectional piezoelectric element hydrophones. These hydrophones have a receiving sensitivity of -210 dB re 1uV/Pa and a linear frequency response from 25Hz – 92kHz (usable from 10Hz – 93kHz). Hydrophones will be placed in the same manner as for year 1 construction activities. Hydrophones will be suspended midway in the water column in order to evaluate site-specific attenuation and propagation characteristics. The hydrophone will be attached to a weighted nylon cord to maintain a constant depth and distance from the pile/blast area. The nylon cord or chain will be attached to a float or tied to a static line. Hydrophones will be strategically deployed as to avoid flat surfaces, fixed structures, or other obstructions that may reflect frequencies and further obscure data. Depth will be confirmed by weighted tape measure and/or depth sounder.

Data acquired from the hydrophones will be via a 30m coaxial cable to a SpectraDAQ-200. The length of cable will be adequate to reach the shallowest depth of the river (15 ft) and the deepest depths of the river (69 ft). The DAQ is a custom designed precision data acquisition sound card that allows for real time, recording/playback and post processing of up to two channels. The data acquired from the SpectraDAQ-200 will be processed at a sample rate of 192kHz per channel with a resolution of 24 bits. This will allow for 144 dB of headroom in the recording. The overall system will be able to handle up to 230 dB before overloading. Use of a higher bit depth will reduce the risk of clipping without increasing quantization errors.

The input channels of the SpectraDAQ-200 provides 4 fixed gain steps (+/- 10V, +/- 2.5V, +/- 625mV, +/- 156mV). This allows SpectraPLUS-SC to be calibrated directly to volts, millivolts, or to the transducer sensitivity providing quick and accurate calibration for the CR3 hydrophones. Maximum input voltage for the A/D converters can be set in any of the 4 fixed gain steps. If the input range is changed, the calibration will automatically apply the correct gain to the measurement. The input range is applied to both channels.

Information captured from the hydrophone and transmitted through the DAQ will be recorded into a 2 TB external LaCie hard drive. The hard drive will remain in the Cianbro Trailer within the CIA. NAVFAC will develop a security plan that Cianbro will be required to follow regarding the safeguard of recorded data.

RMS SPL, peak SPL, and frequency content computed from the hydrophone data will be displayed in real time, monitored and inspected frequently during all measurements.

Monitoring will not take place if any kind of vessel in the surrounding area is creating enough noise to affect the recordings. No monitoring may occur when a submarine is moving anywhere near the Shipyard, both via tug or under its own power. No monitoring may occur when a submarine is within line of sight of the hydrophone. The hydrophone will be removed from the water prior to a submarine moving to a berth within line of sight of noise creating activities. NAVFAC will provide 7 days' notice before any submarine movements. Three days prior to a submarine moving near the Shipyard, Cianbro will submit recorded data to Shipyard security for review before being removed from the Shipyard or stored on non-Government devices. It is not anticipated that there will be acoustic monitoring of pile installation work while submarines are at berth or in transit. If monitoring is allowed when a submarine is at berth on the Shipyard, Cianbro will coordinate with NAVFAC and Shipyard security on best practices for submitting all recordings for review before the data is removed from the Shipyard or stored on non-Government devices.

The GPS position of hydrophone locations will be recorded with a Garmin eTrex 20x, handheld GPS navigator. Information from GPS will be directly linked with acoustic data ensure synchronization between the two. The location reported for each measurement will be the average position during the time of recording. Distances to piles will be verified with a laser rangefinder when possible.

Calibration on both the hydrophones and data acquisition system will be performed at the start of each day. Calibration will be performed with a Cetacean intelligent pistonphone with electronic temperature and pressure compensation. It produces 10 Pa (114 dB re 20 μPa air) (140 dB re 1 μPa water) @ 250Hz. This pistonphone will be custom made with a coupler that will create an airtight locking seal to the CR3 hydrophone.

All data will be monitored, recorded, and post-processed in SpectraPLUS-SC software (version 5.3.0.11A) as well as Aquatic Acoustic Metric Interface software (version 1.3.0).

Equipment data sheets are included in Appendix A – Equipment Data Sheets of this document.

Blasting Subcontractor:

The hydrophones to be used for capturing blasting pressure/overpressure aspects of year 2 are Reson TC4013 miniature reference omnidirectional piezoelectric hydrophones. These hydrophones have a receiving sensitivity of -211 dB re 1uV/Pa and frequency response from 1Hz – 170kHz. Hydrophones will be installed 10 feet off the bottom, or in the middle of the water column if there is insufficient water depth, at each monitoring location. An anchor and buoy installation method will be used to place the hydrophone at a known depth of water (tide-adjusted) and vertical distance from top of rock. These sensors have been selected to sufficiently cover the anticipated range of underwater overpressures. Appropriate amplifiers and signal conditioners were selected for each sensor type.

The data acquisition system (DAS) selected for performing near field hydroacoustic monitoring is a DataTrap II high-speed transient data recorder. The data from the pressure sensors will be collected by the DAS, at a sample rate of 1 MHz (1,000,000 samples per second) per channel (one sensor per channel). This high sample rate is required because of the potential for very fast rise time of the pressure peak. Data recordings will be long enough in duration to include a three second pre-trigger, about a second for the blasting event itself, and additional time to capture post-blast effects. The pre-trigger time margin is analyzed to assess the system and ambient noise as installed and at the time of the blast event.

When necessary, a monitoring vessel will be deployed with the monitoring engineer and data collection system onboard to install a temporary monitoring point, prior to a particular blasting event.

During blasting, measurement of underwater overpressure and impulse will be performed. Hydrophones will be utilized to capture underwater pressure that falls below the limit of pressure sensors to capture (e.g. 0.8 PSI). The near-field hydrophone locations have been chosen based on operationally safe locations, representing various spatial relations such as distance and direction to the blast area. A site-specific relationship between peak underwater overpressure and blasting parameters such as scaled distance will be developed from field measurements, and the peak pressure at 200 ft. from the blast calculated from this equation to compare with compliance criteria for environmental protection.

Underwater overpressure is limited by contract at various locations (see table below).

Table 2. PSI Limit per Structure

Structure Description	Limit (psi)
Berth 1	100
Berth 11	150
DD#1 Caisson	0.8
P-310 West Closure Wall	100
P-310 South Closure Wall	100
P-310 Entrance Structure (inside bubble curtain)	100
P-310 Entrance Structure (riverside of the bubble curtain	40
Monitoring Point at 200 ft (monitoring environmental impact)	25

Impulse must be kept below 15 psi.ms at the 200 ft monitoring distance.

Spare sensors, signal conditioners and data acquisition devices will be on hand in the unlikely event of malfunction of individual components of the monitoring system. A separate hydrophone and data acquisition system manufactured by Instantel will be used as a backup to capture in-water overpressure data in the near-field in case of failure of the entire primary monitoring system.

Hydrophones, pressure sensors, and data acquisition systems were calibrated prior to the start of blasting, with field verification performed prior to the start of Test Blasting.

An onsite dynamic testing of the tourmaline-based in-water blasting monitoring pressure sensors will be performed prior to the start of the blasting program to verify the calibration values stated by the manufacturer and dynamic values measured under transient blast pressure loading.

Pressure sensors will be placed equidistant from a small explosives charge acting as an open water point source for the blasting overpressure, and measurements compared with a reference value measured by a hydrophone with a piezoelectric sensor element. At a distance of 75 ft from the explosives source, the expected underwater pressure will be about equal to what would be expected from the first test blast event at the unprotected side of the blast wall in front of Dry Dock 1.

During this dynamic field verification test of the sensors, the operational effectiveness of the blast wall at the Dry Dock 1 entrance and of the bubble curtain at the west closure wall entrance will also be tested, by placing a sensor on each side of the protective barrier and measure the pressure difference across the barrier.

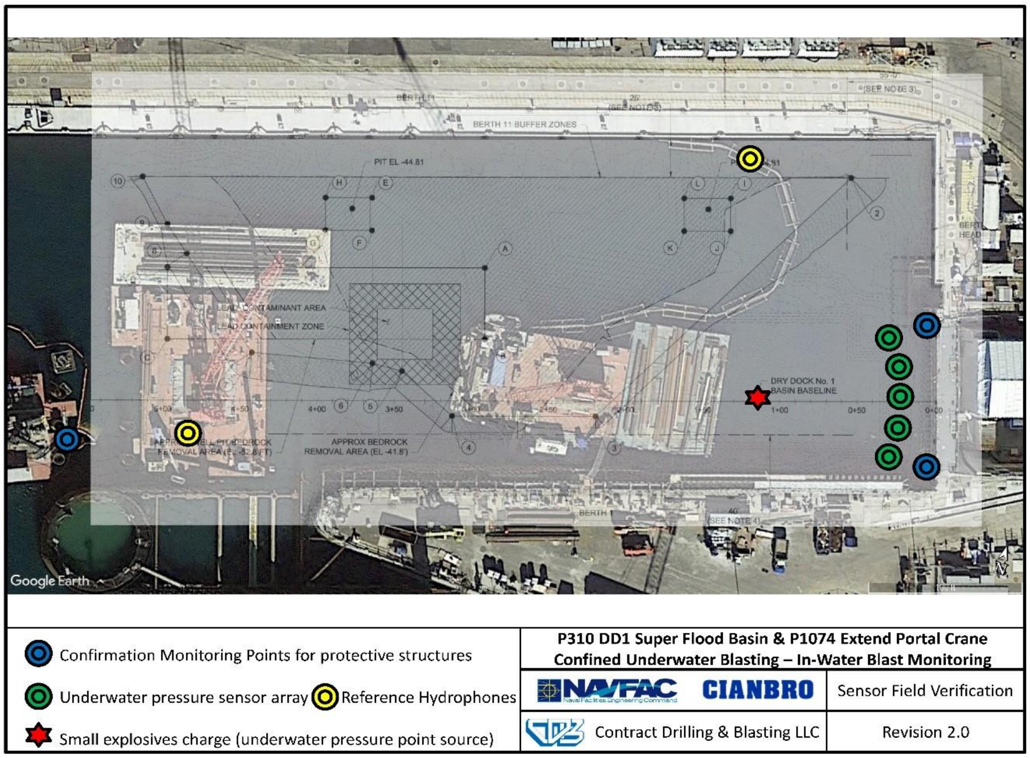


Figure 13. Field Calibration Verification Test Sensor Locations

Original Figure Sourced Google Maps. 2021.
Modified by CDB to show sensor locations for calibration verification testing

Equipment data sheets are included in <u>Appendix A – Equipment Data Sheets</u> of this document.

Appendix A – Equipment Data Sheet

Cetacean Research Technology
4728 12th Avenue NE Seattle, Washington 98105-4402 (206) 297-1310
crtinfo@cetrestec.com www.cetrestec.com

Hydrophone Specifications

Model Number	CR1A	CR2	CR3
Linear Frequency Range (±3dB) [kHz]	0.00016† – 48	0.0019† – 28	0.0004† – 180
Useable Frequency Range (+3/-12dB) [kHz]	0.00005† – 68	0.0005† – 60	0.0001† – 240
Sensitivity [dB, re 1V/μPa]	-199‡	-214	-207‡
SPL Equiv. Noise at 1kHz [dB, re 1μPa/√Hz]	38 (< *Sea State Zero*)	68	54
Maximum Operating Depth [m]	500	370	980
Operating Temperature Range [ºC]	-25 to 60‡	-40 to 70	-40 to 90‡
Capacitance [nF]	12	0.82	6.7
Dimensions [mm]	85L x 32 dia.	56L x 14 dia.	50L x 18 dia.
Coaxial Cable Length [m]	15	10	15
Directionality	Omni below 10kHz	Omni below 10kHz	Omnidirectional

† Requires a preamplifier with 100MΩ input impedance, such as VP1000. If a preamplifier with 330kΩ input impedance is used, such as the USB Dual Pre, then the low frequency -3dB point will be increased by a factor of 300 (e.g. 48Hz instead of 0.16Hz for the CR1A).

‡ Hydrophone is spot calibrated at the factory; calibration is guaranteed between -5C and 30C. Calibrated frequency response measurements can be performed for an additional fee.

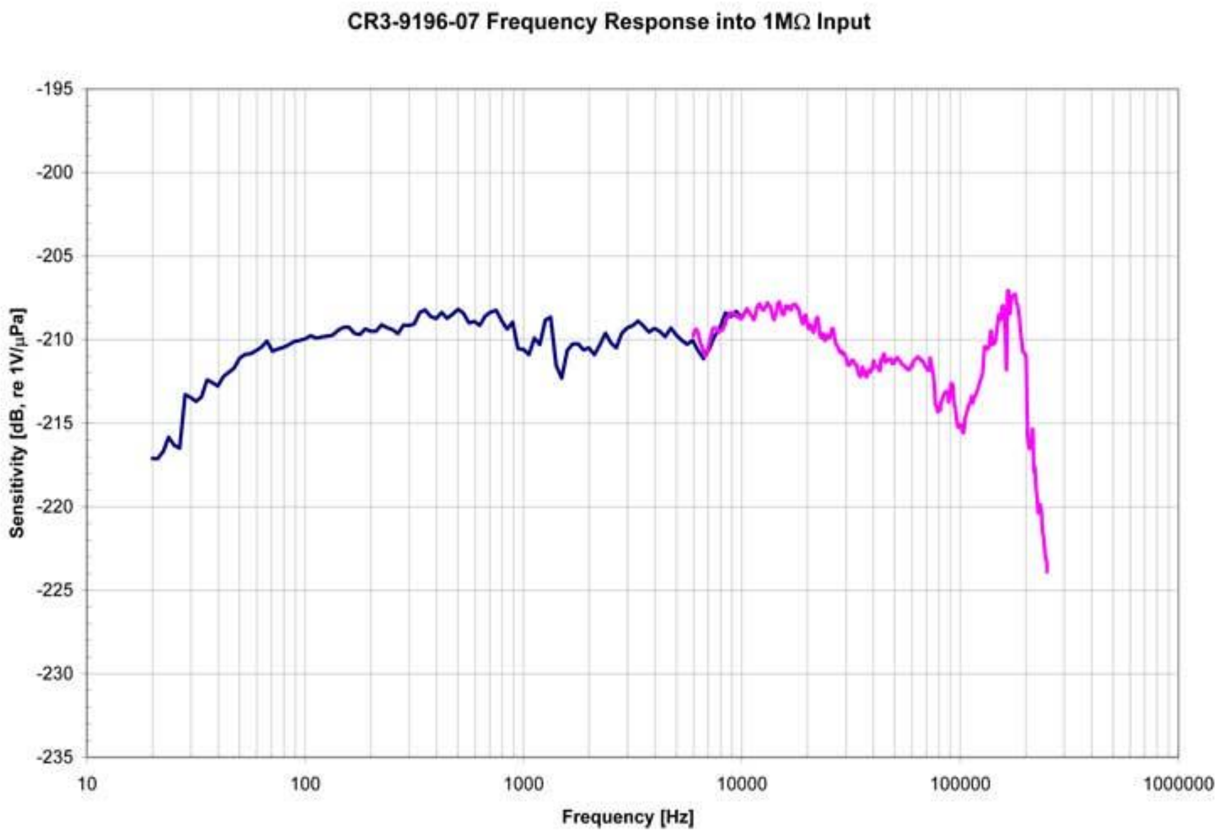
Hydrophones not in stock will ship within 8 weeks of the receipt of payment. Add 4 weeks to delivery time for custom orders. Acceptable payment includes: check or money order made out in US funds and drawn on a US bank; VISA, MasterCard, Discover or American Express cards; or money wire transfers. There is an added fee for foreign wire transfers. Qualifying nonprofit organizations may receive discounts.

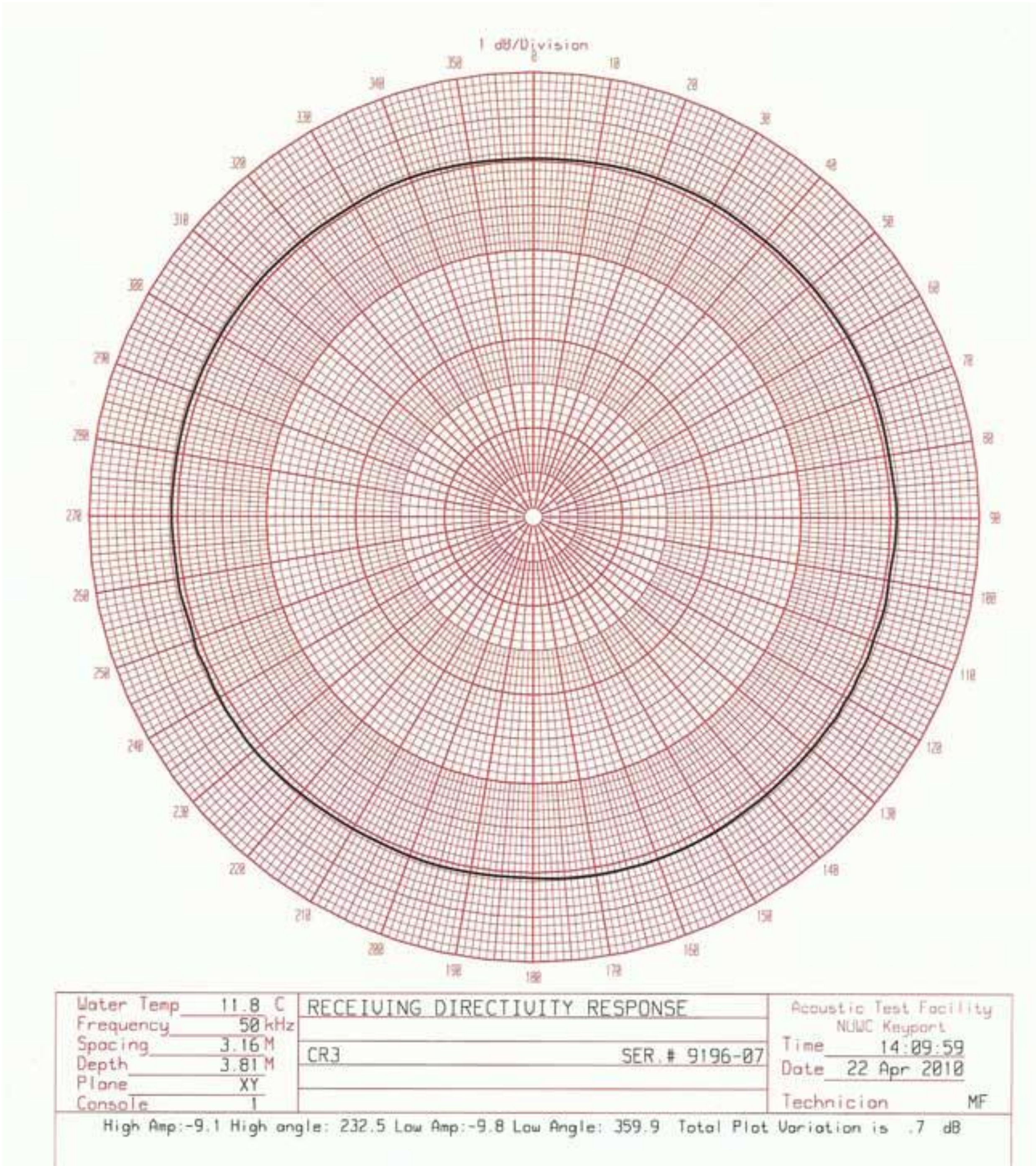
All hydrophones carry a 90-day limited warranty. Extended warranties are available. Units will either be repaired or replaced at the discretion of Cetacean Research Technology. Misuse or damage to the connectors or cable voids the warranty. Prices are for *advance payment only* and subject to change without notice. **All sales are final**.

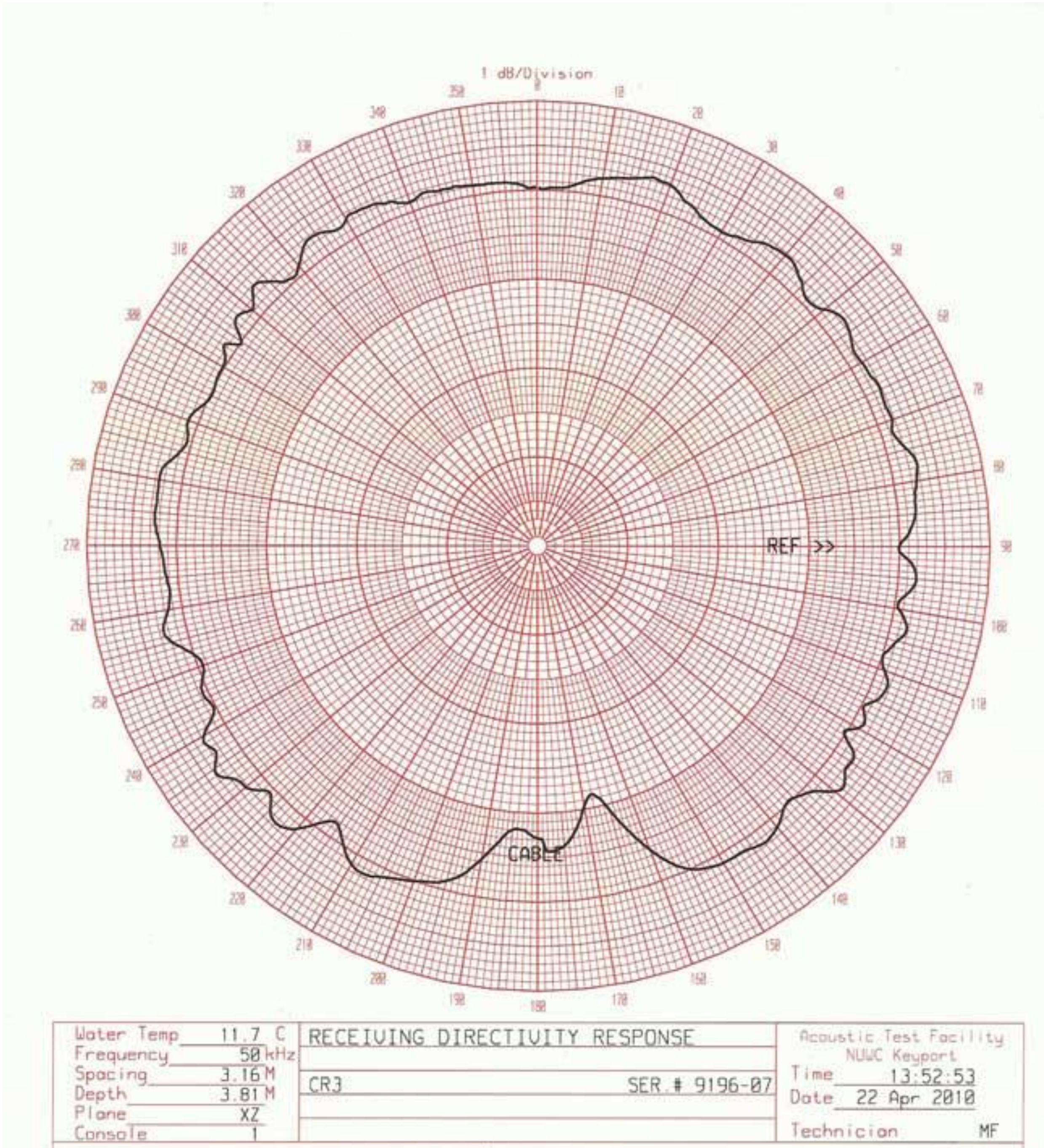
7511 Greenwood Avenue N #615 - Seattle, Washington 98103 USA
Telephone: 206-650-8676 E-mail: crtinfo@cetrestec.com
Website: www.cetrestec.com Hydrophone Specifications — March 2019

CR3 Hydrophone Specifications

Linear Frequency Range (±3dB) [kHz]	0.0004‡ to 180
Usable Frequency Range (+3/-12dB) [kHz]	0.0001‡ to 240
Transducer Sensitivity [dB, re 1V/μPa]	-207‡
Preamplifier Gain [dB]	N/A
SPL Equiv. Self Noise at 1kHz [dB, re 1μPa/√Hz]	54
Power Requirement [Vdc]	N/A
RMS Overload Acoustic Pressure [dB, re 1μPa]	N/A
Maximum Operating Depth [m]	980
Operating Temperature Range [°C]	-40 to 90‡
Capacitance [nF]	6.7
Dimensions [mm]	50 L x 18 dia
Coaxial Cable Length [m]	30m
Directionality	omnidirectional
Battery / Connector box	no power required


CR3-9196-07 Frequency Response into 1MΩ Input
Sensitivity [dB, re 1V/µPa]
-195
-200
-205
-210
-215
-220
-225
-230
-235
10
100
1000
10000
100000
1000000
Frequency [Hz]


1 dB/Division
Water Temp 11.8 C
Frequency 50 kHz
Spacing 3.16 M
Depth 3.81 M
Plane XY
Console 1
RECEIVING DIRECTIVITY RESPONSE
CR3
SER.# 9196-07
Acoustic Test Facility
NUWC Keyport
Time 14:09:59
Date 22 Apr 2010
Technician MF
High Amp:-9.1 High angle: 232.5 Low Amp:-9.8 Low Angle: 359.9 Total Plot Variation is .7 dB


1 dB/Division
REF >>
CABLE
Water Temp 11.7 C
Frequency 50 kHz
Spacing 3.16 M
Depth 3.81 M
Plane XZ
Console 1
RECEIVING DIRECTIVITY RESPONSE
CR3
SER.# 9196-07
Acoustic Test Facility
NUWC Keyport
Time 13:52:53
Date 22 Apr 2010
Technician MF

SPECTRADAQ-200

SpectraDAQ-200 is a precision data acquisition sound card optimized for test and measurement applications. Designed specifically for use with SpectraPLUS it features fixed gain steps for easy calibration to the transducer sensitivity, IEPE power for accelerometers or microphones, and standard BNC connectors. It is housed in a rugged steel case and powered by USB 3.0.

Excellent Performance

The A/D and D/A converters are state of the art and provide incredible dynamic range and extremely low distortion.

Direct Calibration

The input channels provide 4 fixed gain steps. This allows SpectraPLUS to be calibrated directly to volts, millivolts or to the transducer sensitivity providing quick and accurate calibration for microphones, accelerometers and other sensors.

IEPE Power

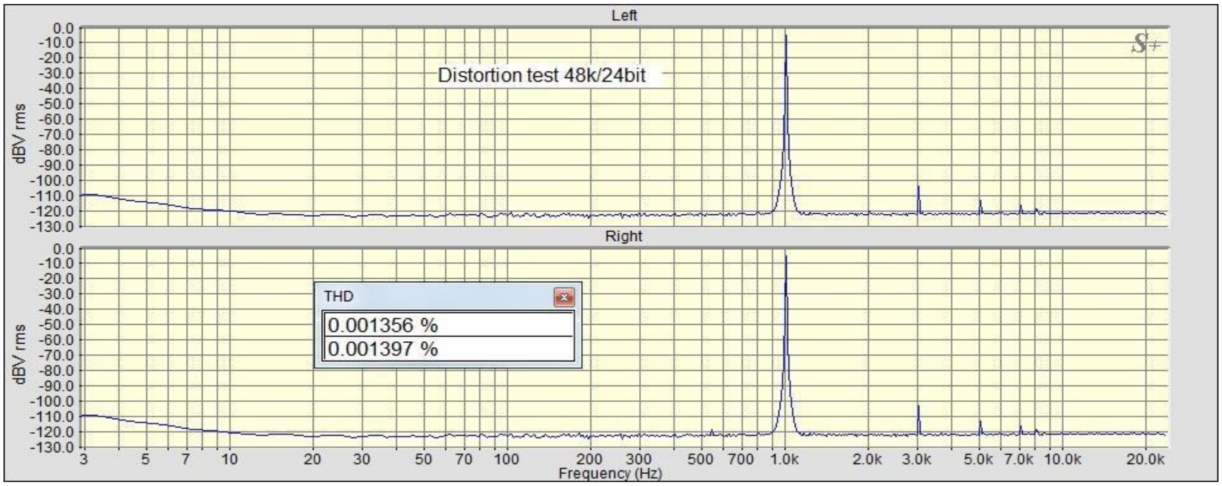
Accelerometers, microphones and hydrophones often use IEPE powered sensors; IEPE power is a 4ma constant current supply that is built-in to the input circuitry of the module. It is enabled via the SpectraPLUS software. IEPE is also known as ICP (trademarked by PCB electronics).

Input Voltage Ranges (software selectable)	+/-10V, +/-2.5, +/-625mV, +/-156mV
Sampling Rate	Up to 192kHz
Sampling Precision	24 bit
Input Channels	2
Input Impedance	0.5 Meg Ohm
IEPE power (software selectable)	4ma constant current
Frequency Response	4 Hz to 92 kHz (-1dB)
Low Frequency cutoff	2 Hz (-3dB)
Total Harmonic Distortion (THD)	< 0.002% (0.5 Vrms signal level, 2.5 V gain)
Spurious Free Dynamic Range	> 95 dB
Noise Floor (terminated inputs)	< -130 dBVrms
Channel Separation	> 90 dB
Input Connectors	2 BNC (single ended)
Output Voltage	+/-1.4 V (1 Vrms)
Output Channels	2

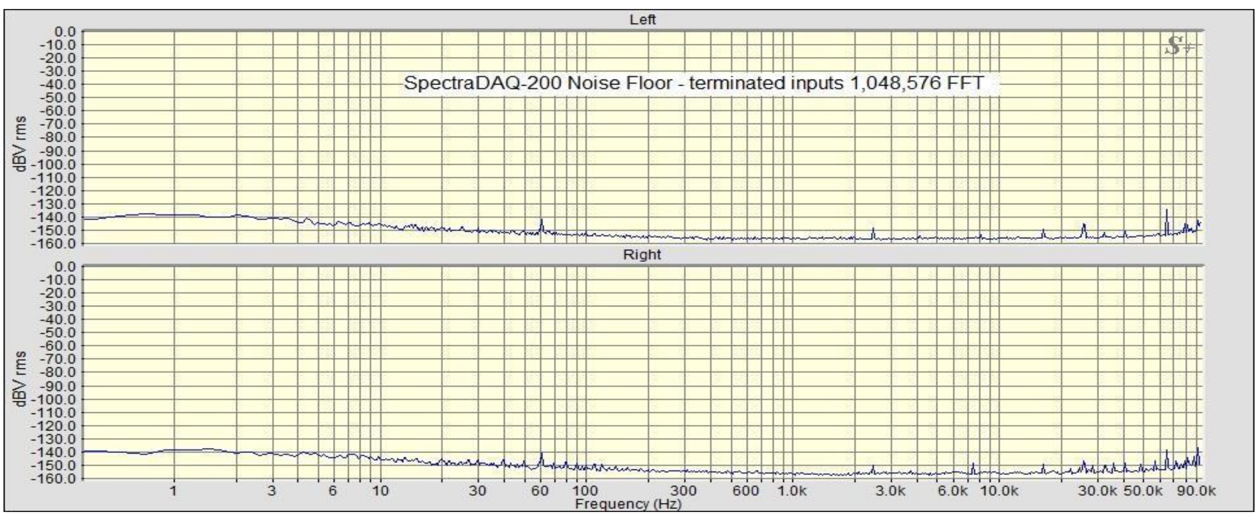
Output Connectors	1 BNC, 3.5 mm stereo
Digital I/O	3 Input, 3 Output (RJ45 connectors)
Drivers (Vista/Win7/8/10, x32 and x64)	MME (Windows Multimedia Extensions) ASIO (Steinberg Audio Stream Input/Output)
PC Interface	USB 3.0 (cable included)
Operating Temperature range	0 to 50 C
Dimensions	5.5 x 3 x 1 in (140 x 77 x 26 mm)
Weight	9 oz (250 grams)
Warranty	I year

Pricing, availability and specifications are subject to change without notice

Distortion measurement with the output looped back to the inputs



Noise floor measured with terminated inputs



Cetacean Research Technology

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SpectraPLUS Features and Specifications

Key Feature	SpectraPLUSRT	SpectraPLUS-SC	SpectraPLUS-DT
Hardware Supported	Multimedia Sound Cards	Multimedia Sound Cards	Data Translation DT9800 Industrial A/D modules
Maximum Sampling Rate	200 kHz*	200 kHz*	2.0 MHz*
Maximum Channels	2	2	16
Maximum Sampling Precision	24 bit*	24 bit*	24 bit*
Composite Channels (Transfer Function, Multichannel average, etc)	0	1	16
Supported Modes	Real Time	Real Time, Record/Playback, Post Process	Real Time, Record/Playback, Post Process
Available Displays	Spectrum	Time Series, Spectrum, Phase, Spectrogram, 3-D Surface	Time Series, Spectrum, Phase, Spectrogram, 3-D Surface
Frequency Resolution	Fixed FFT size, 1/1 Octave, 1/3 Octave	Selectable FFT size, 1/1 through 1/96 Octave	Selectable FFT size, 1/1 through 1/96 Octave
Input Gain	Variable* (4 fixed steps#)	Variable* (4 fixed steps#)	Fixed Steps*
Calibrated Inputs	Uncalibrated (Volts or Millivolts#)	Uncalibrated (Volts or Millivolts#)	Volts or Millivolts
Calibration to Transducer	Use external reference signal (use transducer sensitivity#)	Use external reference signal (use transducer sensitivity#)	Use actual transducer sensitivity or external reference signal
Transducer Power	Phantom* (IEPE#)	Phantom* (IEPE#)	IEPE*
Triggering	No	Analog Input	Analog or TTL with User Accept/Reject option
Tachometer channel support	No	No	Yes
Order Analysis	No	No	Yes
Automation Support	No	Yes	Yes
** Hardware dependent* *#When SpectraDAQ-200 is used*			

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SpectraPLUS-SC Options

SpectraPLUS-SC consists of a base analyzer plus a set of 10 additional options so you can purchase only the features you need. Additional options can be purchased at anytime and activated with a simple phone call. The downloaded software includes all options for the 30 day evaluation period.

Base Analyzer		**Features include Single Channel Operation, Real Time Mode, Spectrum, Time Series, and Phase displays, Narrowband FFT sizes through 32,768 points, 1/1, and 1/3 Octave Analysis, Triggering, Markers, Overlays, Averaging, Peak Hold, Decimation, Mic Compensation, A, B, C Spectral Weighting**
Option /01	Dual Channel Processing	Dual Channel Operations - Real and Complex Transfer Functions, Coherence, Average, Cross Spectrum and cross channel delay compensation
Option /02	Recording and Post Processing Modes	Recorder and Post Processing modes - allows direct hard disk recording and playback. Post Processing mode provides comprehensive analysis from WAV files. Includes Digital Filtering capability
Option /03	Signal Generator Utility	Advanced Signal Generation - Pink/White noise, Noise Burst, Frequency Sweep, Frequency Step, Level Sweep, 1 kHz tone, Multiple Tones, Saw, Square, Pulse, IMD test tones and User Defined WAV source. Can generate different signals in each channel
Option /04	Color Spectrogram Display	Spectrogram View - displays the spectrum versus time in greyscale or color format for advanced joint time-frequency analysis.
Option /05	3-D Surface Display	3-D Surface View - displays the spectrum versus time in a 3-Dimensional perspective format
Option /06	Distortion Analysis Utilities	Distortion Analysis - measurement utilities for THD, THD+N, IMD, SNR, NF, SINAD. Each measurement is displayed in real time in a separate resizeable window. Also includes a dedicated THD+N versus Frequency utility that quickly and conveniently measures the distortion characteristics of your device over a range of frequencies.

Option /07	High Resolution Analysis	Adds 24 bit sampling precision and sampling rates above 48kHz (sound card dependent). Adds FFT sizes up to 1,048,576 points, and Octave scaling to 1/96
Option /08	Advanced Scaling and Calibration	Adds independent channel calibration and scaling for left and right channels with separate views for each. Useful for applications requiring separate channel scaling and calibration such as simultaneous sound and vibration measurements. This option also includes calibration conversions from Acceleration to Velocity or Displacement; also adds Power Specral Density scaling option for accurate noise measurements
Option /09	Acoustic Tools	Reverberation Time (RT60) utility features bar graph of reverberation time versus frequency band, 3-D Surface plot of the decay versus frequency and individual decay plots versus time. Delay Finder measures delay between two channels in milliseconds, feet or meters. Speed of sound - converts the delay value between milliseconds, feet or meters. Equivalent Noise (Leq) utility provides comprehensive noise level calculations for LeqT, Leq, Lpk , Lsel, Lmax, Lmin, L10, L50, L90. Stereo Phase Scope for real-time monitoring and analysis of signal phase. Phase scope mode displays a standard oscilloscope X- Y orientation (lissajous pattern) for analysis of phase, polarity, missing channel detection and stereo separation monitoring
Option /10	Automation Tools	Macro Command Processor utility allows you to easily automate measurements, record SPL and spectral data at user specified intervals/duration with time/date stamp, save files with user-defined names using a script-based programming language. It uses the underlying DDE syntax for an automation solution without requiring a third party program. Automation interface API allows the capability for an external program to control and read results from the analyzer in real time. Works with any program that supports COM such as C++, VB, Excel, and others. Dynamic Data Exchange (DDE) allows the capability for an external program to control and read results from the analyzer in real time. Works with any program that supports DDE such as C++, VB, Excel, Access and others. Data Logging utility produces an output text file containing selected spectral parameters + time-stamp for dynamic signal tracking and unattended event monitoring.

Garmin eTrex 20

Our Most Popular Handheld GPS Made Even Better

- Worldwide basemap
- 2.2" 65K color, sunlight-readable display
- GPS and GLONASS satellites for faster positioning
- Paperless geocaching
- 25-hour battery life with 2 AA batteries

eTrex 20 takes one of the most popular and reliable GPS handhelds and makes it better. Redesigned ergonomics, an easier-to-use interface, paperless geocaching and expanded mapping capabilities add up to serious improvements for an already legendary GPS handheld.

See the Way

eTrex 20 has an enhanced 2.2", 65K color, sunlight-readable display. Durable and water resistant, eTrex 20 is built to withstand the elements. It has an upgraded interface yet retains its legendary toughness to withstand dust, dirt, humidity or water.

Go Anywhere

With an array of compatible mounts, eTrex 20 is designed for use on ATVs, bicycles, in boats, as a handheld or in your car. Use the auto mount capability and City Navigator NT® maps for turn-by-turn driving directions, or the rugged mount for your motorcycle or ATV. Wherever you think you might take eTrex, it has the mapping and mounts to get you there.

Go Global

The new eTrex series is the first-ever consumer-grade receivers that can track both GPS and GLONASS satellites simultaneously. GLONASS is a system developed by the Russian Federation that will be fully operational in 2012. When using GLONASS satellites, the time it takes for the receiver to “lock on” to a position is (on average) approximately 20 percent faster than using GPS.

And when using both GPS and GLONASS, the receiver has the ability to lock on to 24 more satellites than using GPS alone.

Add Maps

With its microSD™ card slot and 1.7 GB of internal memory, eTrex 20 lets you load TOPO 24K maps and hit the trail, plug in BlueChart® g2 preloaded cards for a great day on the water or City Navigator NT map data for turn-by-turn routing on roads (see maps tab for compatible maps). eTrex 20 also supports BirdsEye Satellite Imagery (subscription required), that lets you download satellite images to your device and integrate them with your maps.

Keep Your Fix

With its high-sensitivity, WAAS-enabled GPS receiver and HotFix® satellite prediction, eTrex locates your position quickly and precisely and maintains its GPS location even in heavy cover and deep canyons.

Find Fun

eTrex 20 supports geocaching GPX files for downloading geocaches and details straight to your unit. Visit Geocaching.com to start your geocaching adventure. By going paperless, you're not only helping the environment but also improving efficiency. eTrex 20 stores and displays key information, including location, terrain, difficulty, hints and descriptions, which means no more manually entering coordinates and paper printouts. Simply upload the GPX file to your unit and start hunting for caches.

Plan Your Next Trip

Take charge of your next adventure with BaseCamp™, software that lets you view and organize maps, waypoints, routes, and tracks. This free trip-planning software even allows you to create Garmin Adventures that you can share with friends, family or fellow explorers. BaseCamp displays topographic map data in 2-D or 3-D on your computer screen, including contour lines and elevation profiles. It also can transfer an unlimited amount of satellite images to your device when paired with a BirdsEye Satellite Imagery subscription.

General

PHYSICAL DIMENSIONS	2.1" x 4.0" x 1.3" (5.4 x 10.3 x 3.3 cm)
DISPLAY SIZE	1.4" x 1.7" (3.5 x 4.4 cm); 2.2" diag (5.6 cm)
DISPLAY RESOLUTION	176 x 220 pixels
DISPLAY TYPE	transflective, 65-K color TFT
WEIGHT	5 oz (141.7 g) with batteries
BATTERY	2 AA batteries (not included); NiMH or Lithium recommended

BATTERY LIFE	25 hours
WATER RATING	IPX7
MEMORY/HISTORY	1.7GB
HIGH-SENSITIVITY RECEIVER	YES
INTERFACE	USB

Maps & Memory

ABILITY TO ADD MAPS	YES
BASEMAP	YES
MEMORY STORAGE AND POWER CAPACITY	microSD™ card (not included)
WAYPOINTS/FAVORITES/LOCATIONS	2000
ROUTES	200
TRACK LOG	10,000 points, 200 saved tracks

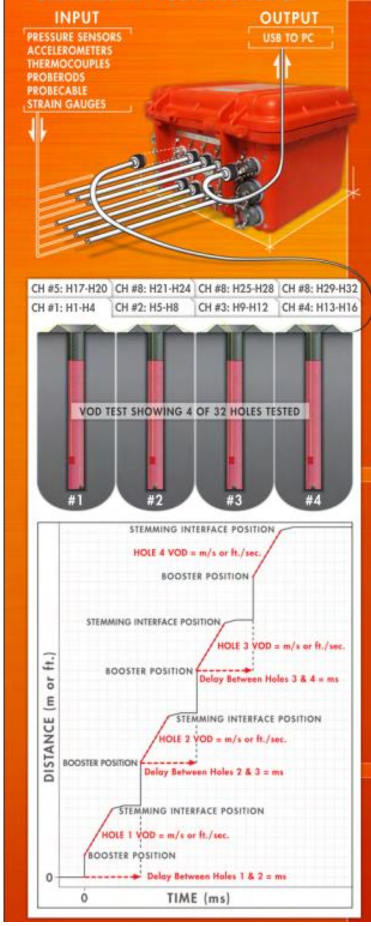
Outdoor Recreation Features

AREA CALCULATION	YES
AUTOMATIC ROUTING (TURN BY TURN ROUTING ON ROADS)	Yes (with optional mapping for detailed roads)
GEOCACHING-FRIENDLY	Yes (Paperless)
CUSTOM MAPS COMPATIBLE	YES
SUN AND MOON INFORMATION	YES

PICTURE VIEWER	YES


MREL
BLASTING INSTRUMENTATION
DATATRAP II™ DATA/VOD RECORDER
RESOLUTION: 14 BITS, 1 PART IN 16,384.
CHANNELS: 8 SCOPE/VOD/STRAIN CHANNELS.
MEMORY: UPGRADABLE TO 256 MILLION DATA POINTS.
SENSORS: ACCELEROMETERS, PRESSURE, TEMP., ETC.
EXPLOSIVES SAMPLES: UP TO 8 SAMPLES PER TEST.
EXPLOSIVES IN BLASTHOLES: UP TO 32 BLASTHOLES PER TEST.
HOURS OF OPERATION
PANEL
BACK
18cm (7")
28cm (11")
25cm (10")
TEMPERATURE RANGE
DATATRAP II
DATA/VOD RECORDER
Your PC based Data Acquisition System (DAS) could cause failure of your testing program. When confronted by dust, high or low temperatures, moisture, or even rough handling, a typical DAS will fail.
If you want to record acceleration, pressure, and other dynamic sensors under tough outdoor conditions, then the DataTrap II™ Data/VOD Recorder is the only rugged recorder that provides this capability and the optional ability to record dynamic strain, and explosives velocity of detonation (VOD) continuously along explosives columns in multiple blastholes, along explosives samples, as well as to determine the delay times between blastholes.
RESEARCHERS OF HIGH-RATE PHENOMENA
You are running a sophisticated testing program involving measurement of the performance and/or effect of energetic materials. The DataTrap II™ Data/VOD Recorder is used by corporate, university and government researchers to record signals from airblast overpressure and underwater pressure sensors, accelerometers, thermocouples, strain gauges, VOD probes in explosives samples, and other sensors on outdoor testing ranges without the requirement of running long signal cables to a distant instrumentation shelter.
EXPLOSIVES CONSUMERS AND MANUFACTURERS
Your explosives and delay detonators must provide the energy and timing your blasts need under your specific blasting conditions. The DataTrap II™ Data/VOD Recorder is used to document the VOD performance of the explosives and delay times of the delay detonators during blasts to compare the actual VOD and delay time results to the published specifications. It also records near-field blast vibrations using high-G uniaxial and triaxial accelerometers.
Easy to use, extremely rugged and portable.
10 MHz recording rate per channel, 14 bit resolution.
Outstanding operational temperature range.
Long operational battery life & non-volatile memory.
8 channels, expandable to 56 channels.
DataTrap II™ Advanced Analytical Software for Windows.
MREL's 1 year Comprehensive Parts & Labour Warranty.
MREL Group of Companies Limited //
1555 Sydenham Road // Kingston, Ontario K7L 4V4 // Canada //
Tel: +1.613.545.0466 // Fax: +1.613.542.8029
www.mrel.com
MREL
GROUP OF COMPANIES

DATATRAP II™ CONNECTIONS:



RECORDING DYNAMIC SENSORS

Begin by connecting the DataTrap II™ Data/VOD Recorder to a PC using USB. Set the recording parameters using the DataTrap II™ Advanced Analytical Software or using the LCD panel on the recorder without a PC. Disconnect the PC – it is not required on the range. Connect the sensor to its signal conditioner and the voltage output from the signal conditioner to one of **the eight DataTrap II™ Data/VOD Recorder channels** using coaxial cable. Turn ON the DataTrap II™ Data/VOD Recorder. Press the NEXT TEST button and then the START button. *You can even bury the recorder below the ground surface if conducting large airblast tests*. Retreat from the testing area and conduct the test at any time. The DataTrap II™ Data/VOD Recorder will **record the signals from the sensors automatically without** operator assistance. Download the data from the DataTrap II™ Data/VOD Recorder to a PC at any time and view the graphs of voltage versus time. Apply the sensor conversion factors to the voltage graphs to convert them to engineering units versus time. Point and click to zoom in and analyze each graph. The DataTrap II™ Data/VOD Recorder data files are also available in the standard TDMS format so that they can be opened and analyzed by popular analytical software such as LabVIEW™, MATLAB™, Origin™ and others.

TEST EXPLOSIVES IN ONE OR MORE BLASTHOLES

With the optional VOD Upgrade installed, the eight channels of the DataTrap II™ Data/VOD Recorder can be independently set to record a sensor or VOD or turned OFF. Using the same standard procedure as the World's most popular VOD recorder, the MicroTrap™ VOD/Data Recorder, the DataTrap II™ Data/VOD Recorder will record the VODs of up to 8 explosives samples **simultaneously (1 per channel), and up to 32 blastholes** (typically, from 1 to 4 per channel) and determine the delay times between holes and decks of explosives. Operators can connect accelerometers (or other sensors) on several channels and VOD on other channels to determine the explosives performance and the effects on the rock walls simultaneously in one blast on a common **time base.**

EXAMPLES

Contact MREL to request a link to download a variety of typical VOD results from augered, pumped, cartridge, and decked explosives in dry and wet blastholes; explosives samples; and other sensors such as accelerometers, strain gauges, and airblast overpressure sensors.

DATATRAP II™ DATA/VOD RECORDER SPECIFICATIONS:

Number of Channels: Standard = 8 Scope channels. Multiple recorders can be connected together and time-synched for up to 56 channels.
Optional = Conduct VOD testing on one or more channels with the VOD Upgrade.
Optional = Conduct strain testing on one or more channels with the Strain Upgrade.
Input Ranges: OFF, 0-2.5 VDC, 0-5 VDC, 0-7.5 VDC, 0-10 VDC, +/-2.5 VDC, +/-5 VDC, +/-7.5 VDC, +/-10 VDC, VOD, STRAIN.
Resolution: 14 bits, 1 part in 16,384.
Recording Rates: Selectable from 1 Hz to 10 MHz per channel.
Non-Volatile Memory: Standard = 64 million data points allocated across the channels in use. Optional = 128 million data points or 256 million data points.
Trigger Mode: Trigger internally on the signal from the event (2 to 98%) or trigger externally from TTL or a trigger wire.
Multiple Event Storage: 1 to 32 tests can be stored in the internal memory.
Power: AC mains or internal rechargeable NiCad battery providing 6 hours of active operation on a full charge. Charger provided. Optional = Battery Adapter.
Size and Weight: 28 x 25 x 18 cm (11 x 10 x 7 in.) 4 kg (8.8 lbs.).
Environmental: Fully operational at -40 to +60 °C (-40 to +140 °F). Snow, rain, dust and sand proof.
PC Connection: At any time after recording, the operator can connect the DataTrap II™ Data/VOD Recorder to a computer's USB port.
Software: The DataTrap II™ Advanced Analytical Software operates under Windows XP™ and later. DataTrap II™ data files are also available in TDMS format for opening and analyses with analytical software including LabVIEW™, MATLAB™, Origin™ and others.
System Components Provided: DataTrap II™ Data/VOD Recorder, 120 or 230 VAC Battery Charger, USB Communications Cable, Operations Manual, DataTrap II™ Advanced Analytical Software for Windows XP™ and later.
Warranty: MREL's 1 year Comprehensive Parts and Labour Warranty.
Technical Support: MREL's Unlimited Technical Support Program by secure customer portal, email, and telephone.

UPGRADES:

Enhanced Memory Upgrade: Provides a total memory of 128 million data points.
Maximum Memory Upgrade: Provides a total memory of 256 million data points.
VOD Upgrade: Installed in the DataTrap II™ Data/VOD Recorder. Provides VOD recording capability to each of the 8 channels allowing the Operator to select VOD or Scope input on each channel independently. The recorder is physically unable to output as much as 50 mA of current to a VOD PROBEROD or VOD PROBECABLE.
Strain Upgrade: Can be attached to the lid of the recorder by the Operator and provides 8 channels of strain recording capabilities.
12 VDC Battery Adapter: Allows the operator to operate the DataTrap II™ Data/VOD Recorder for an extended time from external 12 VDC power sources.

ACCESSORIES:

SENSORS: A variety of calibrated uniaxial and triaxial accelerometers, airblast and underwater pressure sensors, signal conditioners, signal cables and mounts.
VOD PROBEROD: A variety of types of calibrated resistance probes for use in explosive samples.
VOD PROBECABLE: A variety of types of calibrated resistance cables for use in blastholes.
COAXIAL CABLE REEL: A variety of lengths used to carry the signals from the VOD PROBEs to the recorder.
STRAIN: Strain gauges and associated signal cables.

MREL is committed to product innovation; accordingly product may undergo specification improvements without notice.

v7.0 - 14122009

Hydrophone TC4013
Miniature Reference Hydrophone

TC4013

- High sensitivity
- Omnidirectional to high frequencies
- Broad banded
- O-ring sealed mounting
- Individually calibrated

The TC4013 offers a usable frequency range of 1Hz to 170kHz and a high sensitivity relative to its size. It further-more provides uniform omnidirectional sensitivities in both horizontal and vertical planes up to high frequencies.
The TC4013 is an excellent transducer for making absolute sound measurements and calibrations within a broad frequency range. It can also be applied as an omnidirectional reference projector.
The overall characteristics makes TC4013 extremely applicable for laboratory as well as industrial uses.

TECHNICAL SPECIFICATIONS	
Usable Frequency range:	1Hz to 170kHz
Receiving Sensitivity:	-211dB ±3dB re 1V/µPa
Transmitting Sensitivity:	130dB ±3dB re 1µPa/V at 1m at 100kHz
Horizontal Directivity Pattern:	Omnidirectional ±2dB at 100kHz
Vertical Directivity Pattern:	270° ±3dB at 100kHz
Nominal capacitance:	3.4nF
Operating depth:	700m
Survival depth:	1000m
Operating temperature range:	-2°C to +80°C
Storage temperature range:	-40°C to +80°C
Weight (in air):	75g
Cable length:	Standard length 6m Optional cable lengths available on request
Encapsulating material:	Special formulated NBR

NBR means Nitrile Rubber

The NBR rubber is first of all resistant to sea and fresh water but also resistant to oil. It is limited resistant to petrol, limited resistant to most acids and will be destroyed by base, strong acids, halogenated hydrocarbons (carbon tetrachloride, trichloroethylene), nitro hydrocarbons (nitrobenzene, aniline), phosphate ester hydraulic fluids, Ketones (MEK, acetone), Ozone and automotive brake fluid.

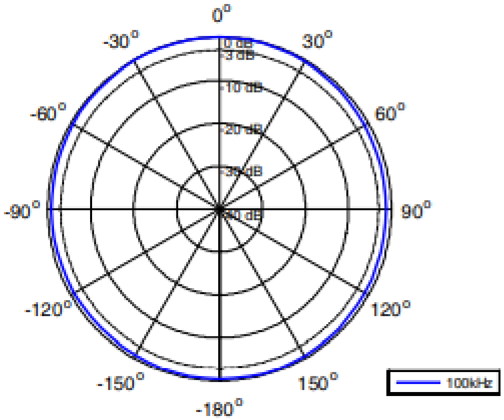
TELEDYNE RESON
Everywhereyoulook™

Teledyne RESON Hydrophone TC4013

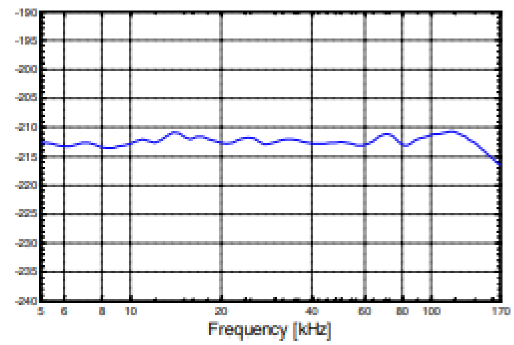
Hydrophone TC4013

Miniature Reference Hydrophone

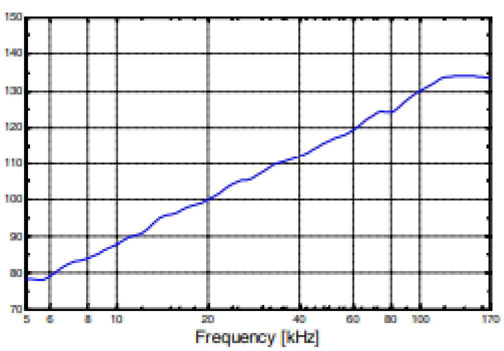
Horizontal directivity pattern



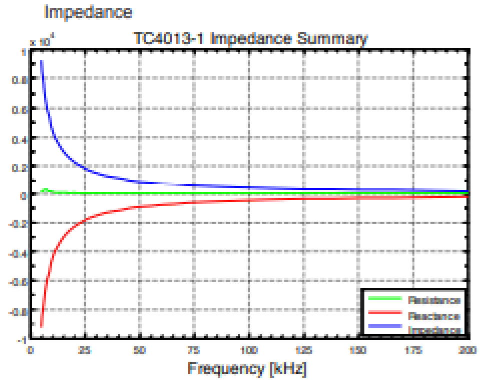
Receiving Sensitivity [dB re 1V/µPa @ 1m]



Transmitting Sensitivity [dB re 1µPa/V @ 1m]



Impedance



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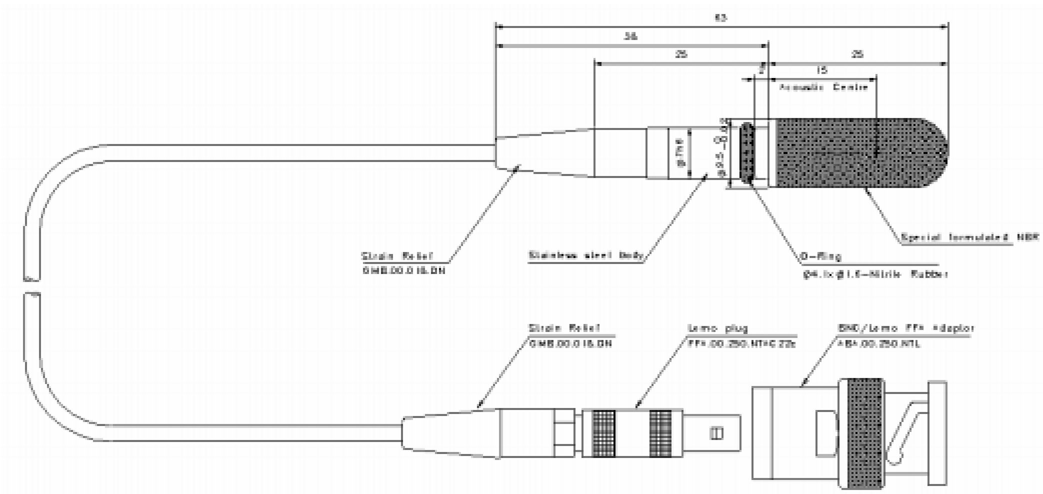
Teledyne RESON Hydrophone TC4013

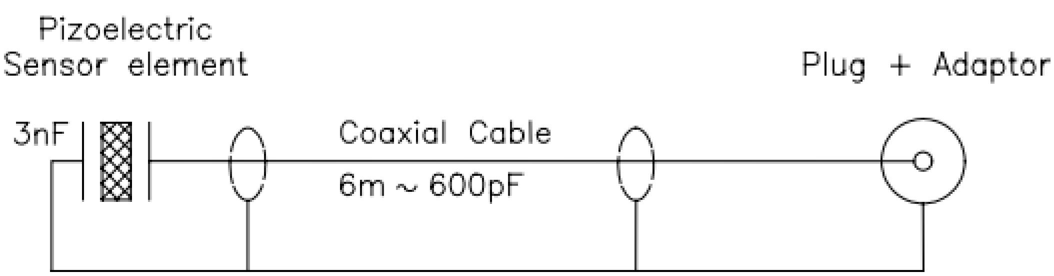
Hydrophone TC4013

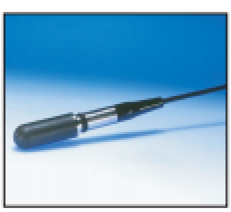
Miniature Reference Hydrophone

Outline Dimensions



Electrical Diagram





Version: B1080707/11 / US

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TELEDYNE RESON Everywhereyoulook™

Teledyne RESON Conditioning Charge Amplifier EC6067

Teledyne RESON PLD16847-1

EC6067

CCA 1000 Conditioning Charge Amplifier

EC6067

The CCA 1000 is a compact low-noise conditioning charge amplifier designed for use with piezoelectric hydrophones and other piezoelectric detectors. The CCA 1000 enables the uses of long cables between hydrophone and amplifier without affecting the hydrophone sensitivity.

The input capacitance can be selected to match the hydrophone capacitance for close unity gain or to achieve input gain up to 20dB. The input resistance, control the lower frequency limit -3dB break frequency. The output gain can be selected from 0 to 32dB.

AT A GLANCE

- 1Hz to 1MHz bandwidth Input capacitance, selectable
- Lower frequency limit, selectable
- 6 levels voltage gain 0 to 32dB
- Water stain resistant

TECHNICAL SPECIFICATIONS

Input:	
Impedance max.:	1GOhm
Max input at (unity gain):	$2V_p$
Estimating Input gain:	(dB) = 20 log C_{tr}/C_{in}
Input capacitance selector:	12 steps: 22pF to 10nF
Input resistance selector:	12 steps: 3.3kohm to 1GOhm
Output:	
Output gain settings 6 steps:	0, 6, 12, 20, 26, 32dB
Signal output, max:	$2V_p$
Output impedance:	20ohm
DC off-set:	0
Bandwidth:	
Operating -3dB Frequency range at 20dB gain:	1Hz to 1MHz
Noise:	
Input termination:	1nF to GND
Output noise with selector settings	
1nF/1GOhm/0dB:	2-4μV_{rms}/A
10nF/1GOhm/20dB:	8-10μV_{rms}/A
1nF/1GOhm/20dB:	14-20μV_{rms}/A
100pF/1GOhm/20dB:	80-110μV_{rms}/A
Power supply:	
Voltage:	min. 12VDC max.24VDC
Current consumption:	40mA ±10mA at 12Vdc

TELEDYNE RESON Everywhereyoulook™

Conditioning Charge Amplifier EC6067

TECHNICAL SPECIFICATIONS

Lower frequency limit:	
Frequency limits (-3dB) versus input resistance at 1nF input load:	
1GOhm	0.3Hz
330Mohm	0.5Hz
100Mohm	1.5Hz
33Mohm	4.5Hz
10Mohm	15Hz
3.3Mohm	45Hz
1ohm	150Hz
330kOhm	450Hz
100kOhm	1.5kHz
33kOhm	4.5kHz
10kOhm	15kHz
3.3kOhm	45kHz
Weight:	
Including supply cable:	530g
Accessories included:	Supply cable TL 8088 at one end.

Input capacitance settings:
To obtain close unity input gain from a hydrophone, - set the input capacitance selector to a capacitance value close as possible to the hydrophone (end of cable capacitance).
The input gain is then calculated from: transducer capacitance Ctr. divided by the input capacitance Cin x 20 log = dB gain

Example:

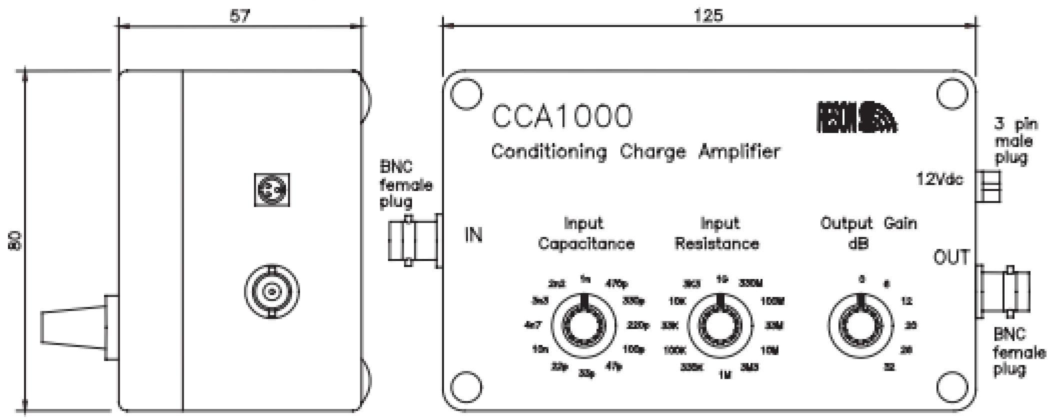
a. 20 log (1nF/1nF) = 0dB

b. 20 log (8nF/4.7nF) = +4.62 dB gain

USER INSTRUCTIONS

Voltage supply:
Connect the supply cable to a battery or AC powered DC supply.
The required voltage is 12 to 24VDC. DC supply common/ground should be connected to water for minimum noise.

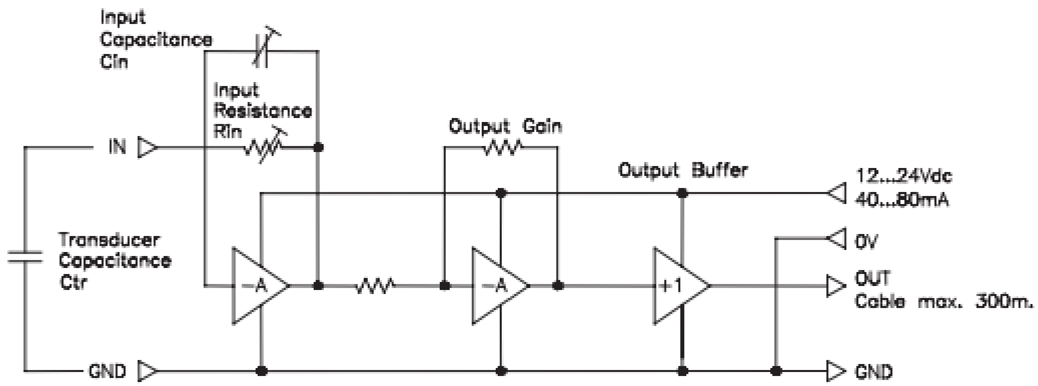
CCA 1000 outline dimensions and layout



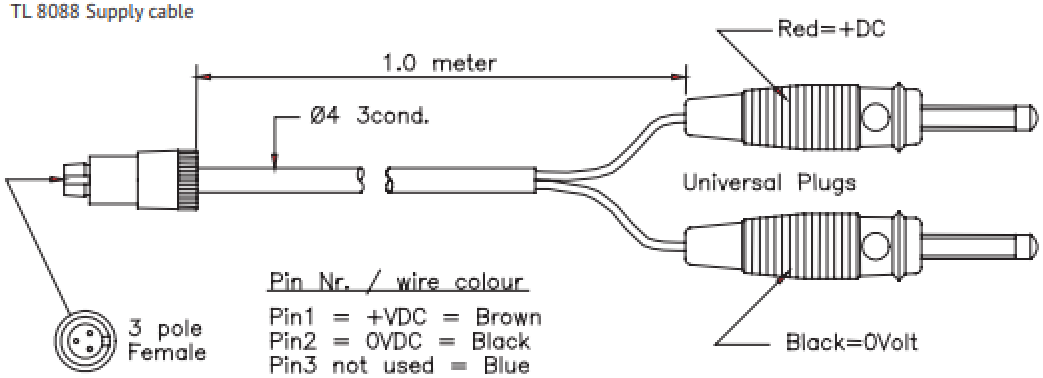
TELEDYNE RESON
Everywhereyoulook™

Conditioning Charge Amplifier EC6067

Simplified block diagram



TL 8088 Supply cable



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Appendix B – Acoustic Model ROI

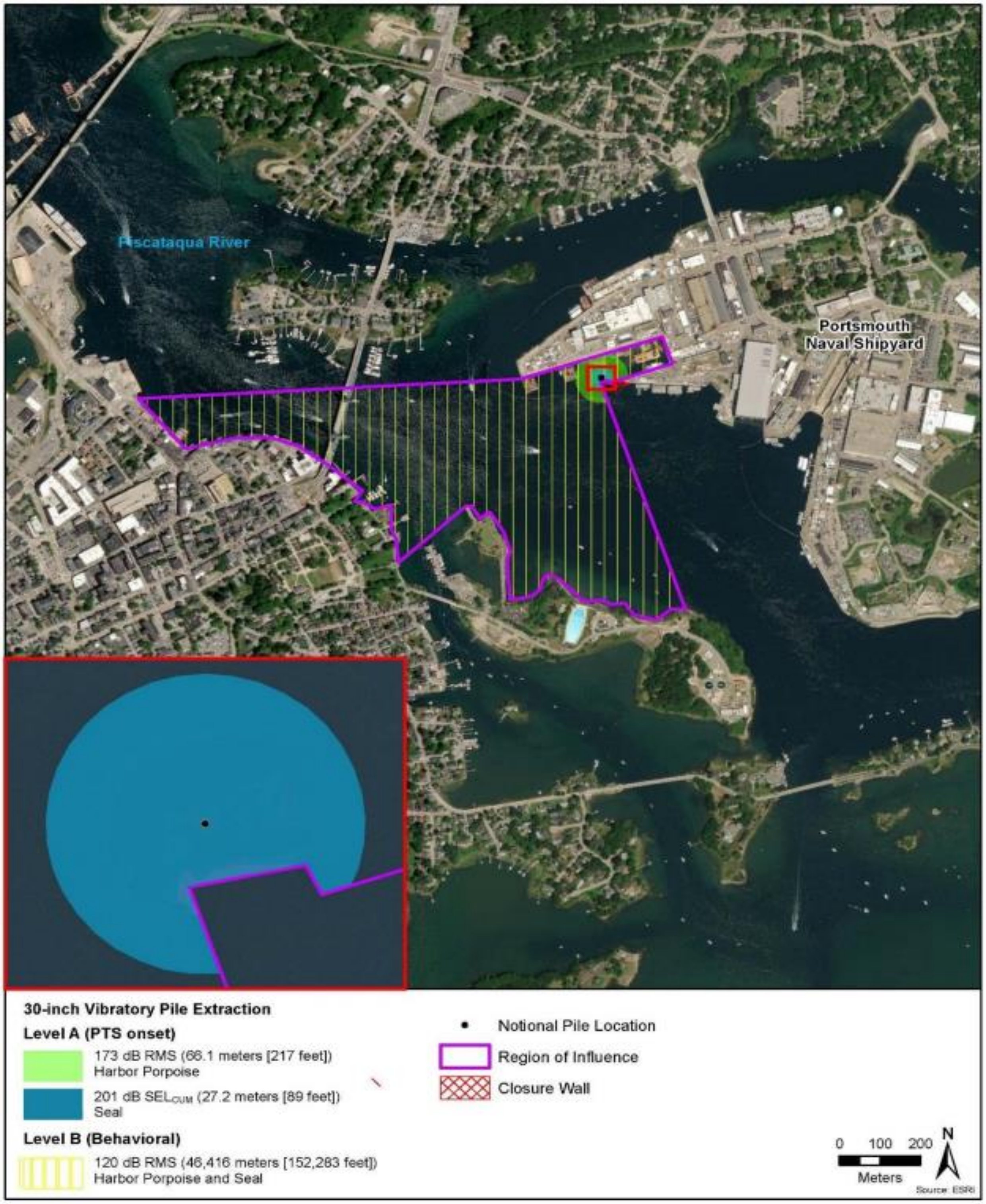

Figure 14. Distances to Level A and Level B from Vibratory Extraction of 30-inch Steel Pipe Piles

Original Figure Sourced from NOAA Fisheries. IHA Request. 2021.

Figure 15. Distances to Level A and Level B from Impact Driving of 28-inch, Z-shaped Sheet Piles

Original Figure Sourced from NOAA Fisheries. IHA Request. 2021

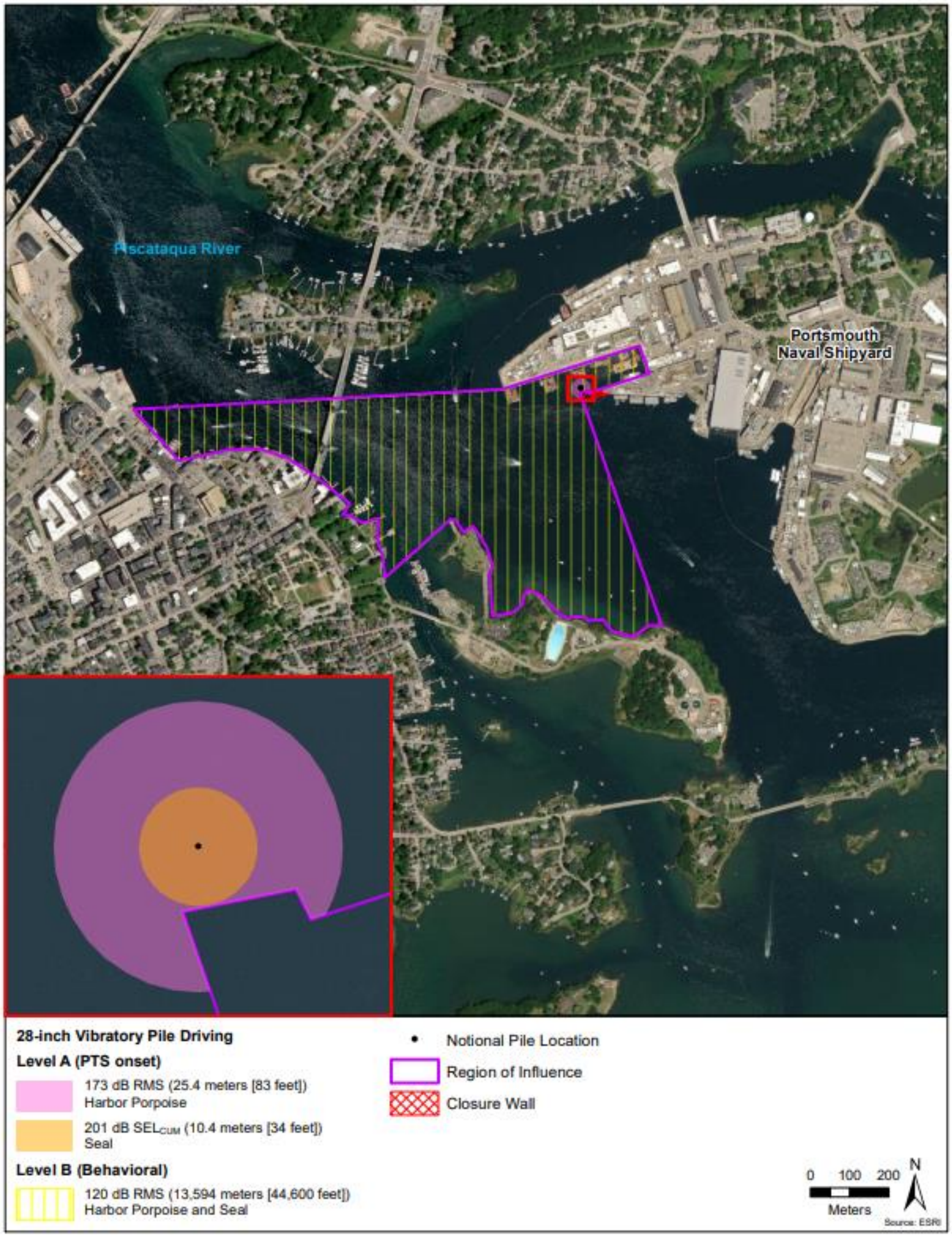

Figure 16. Distances to Level A and Level B from Vibratory Driving of 28-inch, Z-shaped Sheet Piles

Original Figure Sourced from NAVFAC. 2021.

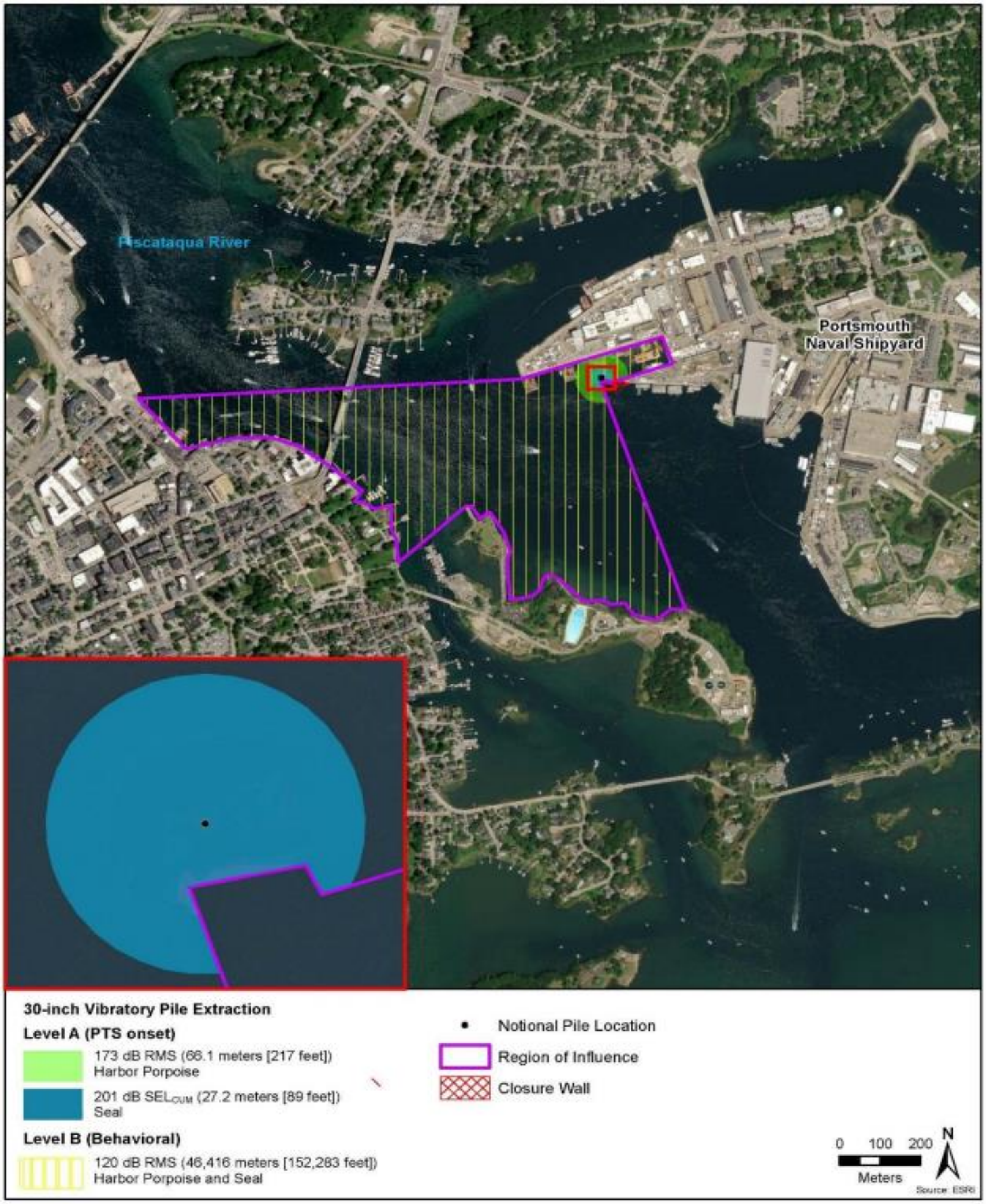

Figure 17. Distances to Level A and Level B from Vibratory Driving of 24-inch, Steel Pipe Pile

Original Figure Sourced from NOAA Fisheries. IHA Request. 2021.

NOTE: 30-inch Pipe Pile Figure to be used at direction of NAVFAC.

Figure 18. Distances to Level A and Level B from Impact Driving of 18-inch, Flat-Webbed Sheet Piles

Original Figure Sourced from NOAA Fisheries. IHA Request. 2021.

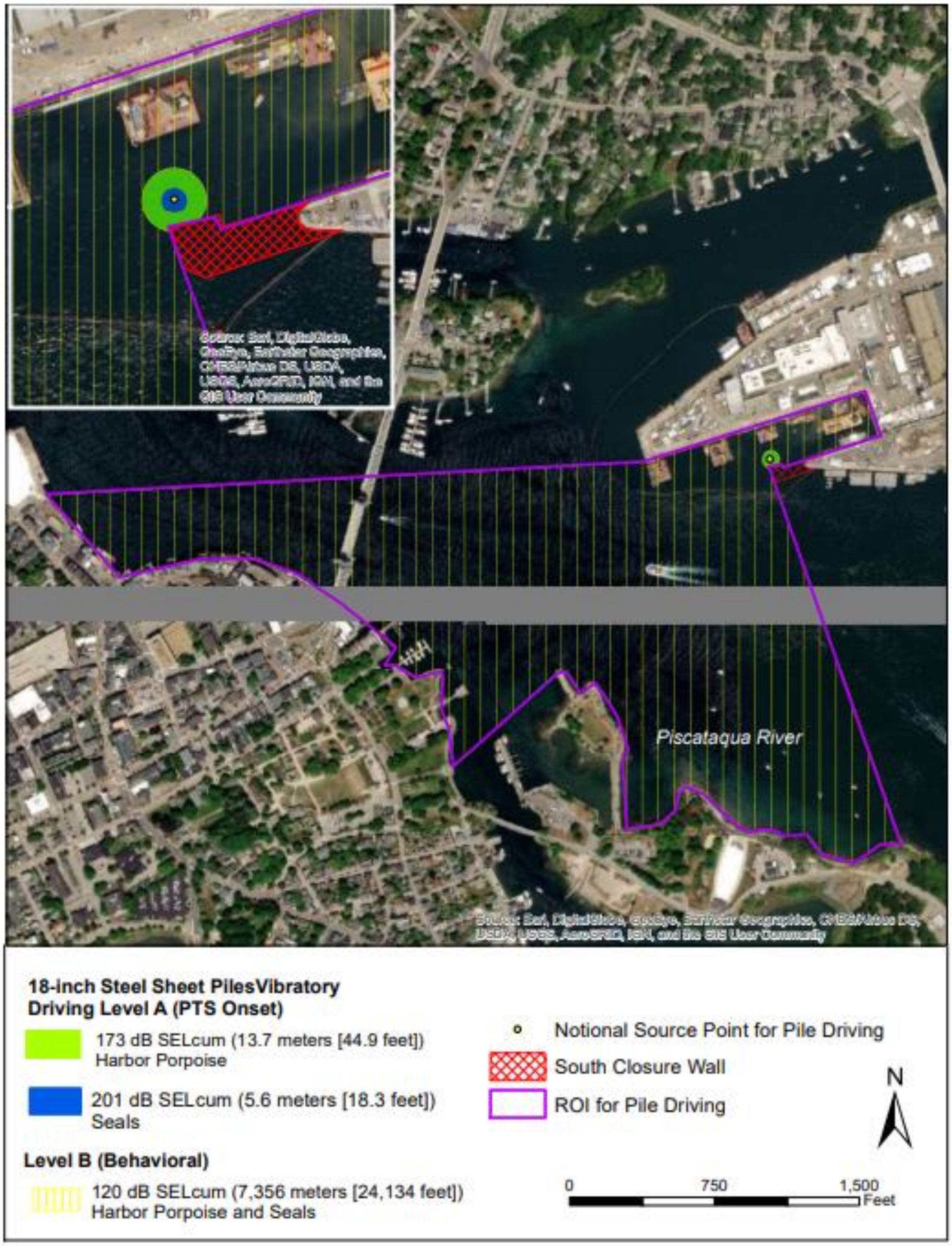

Figure 19. Distances to Level A and Level B from Vibratory Driving of 18-inch, Flat-Webbed Sheet Piles

Original Figure Sourced from NAVFAC. 2021.

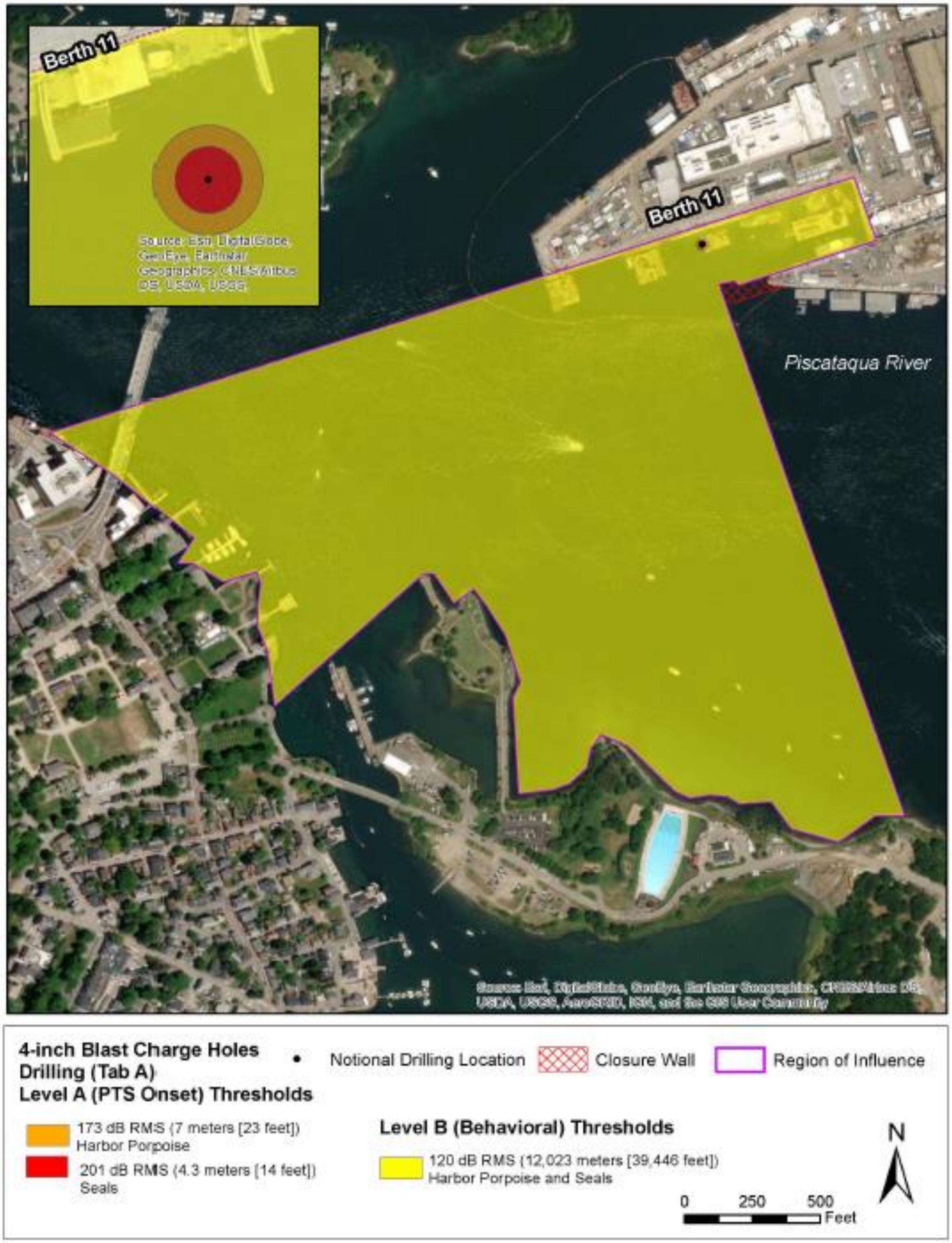

Figure 20. Distances to Level A and Level B from Drilling Activities

Original Figure Sourced from NOAA Fisheries. IHA Request. 2021.

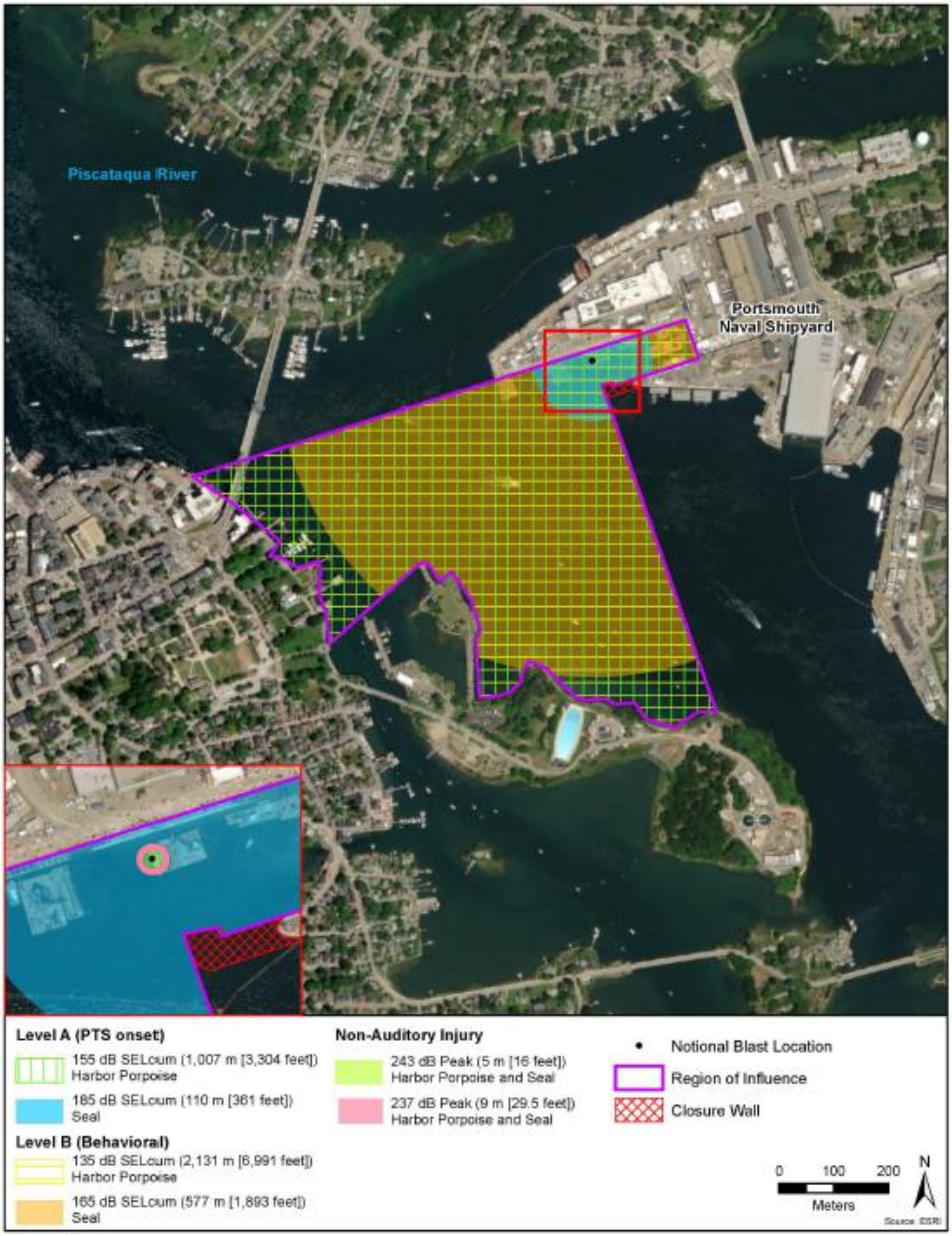

Figure 21. Distances to Level A and Level B from Blasting Activities

Original Figure Sourced from NOAA Fisheries. IHA Request. 2021.

Table 3. Shutdown Zone Distances by Activity

Pile type, size & driving method	Shutdown Distance (m)	
	HF Cetacean	Phocid
Vibratory drive 30-inch steel pipe piles	70	30
Vibratory extraction 30-inch steel pipe piles	70	30
Impact drive 28-inch steel sheet piles	110	50
Vibratory drive 28-inch steel sheet piles	25	10
Vibratory drive 24-inch steel pipe piles	70	30
Vibratory extraction 24-inch steel pipe piles	70	30
Impact drive 18-inch sheet piles	110	50
Vibratory drive 18-inch sheet piles	15	10
Drilling 4.5-inch blast charge holes	10	10
Blasting 120 lb. charge	Entire ROI*	Entire ROI

*0.418km^2

Source: NMFS. Draft IHA. 2021.

Modified by Cianbro to include driving and excavating of 24-inch steel pipe pile

Table 4. Marine Mammal Level A and Level B Harassment Zones for Monitoring

Year 2 Pile type, size & driving method	Level A harassment		Level B harassment
	HF cetacean	Phocid	
	Dist. (m)	Dist. (m)	Dist (m.)
Vibratory drive 30-inch steel pipe piles	10	4	Entire ROI*
Vibratory extraction of 30-inch steel pipe piles	10	4	Entire ROI*
Impact drive 28-inch sheet piles	2,056	923	Entire ROI*
Vibratory drive 28-inch sheet piles	25	10	Entire ROI*
Vibratory drive 24-inch steel pipe piles	10	4	Entire ROI*
Vibratory extraction of 24-inch steel pipe piles	10	4	Entire ROI*
Impact drive 18-inch sheet piles	1,763	792	Entire ROI*
Vibratory drive 18-inch sheet piles	14	6	Entire ROI*
Drilling of 4.5-inch blast charge holes	7	4	Entire ROI*
Blasting 120 lb. charge	1,007	110	Entire ROI*

*0.418km^2

Source: NMFS. Draft IHA. 2021.

Modified by Cianbro to include driving and excavating of 24-inch steel pipe pile

Table 5. Marine Mammal Shutdown Distances by Activity with Monitoring Location Distances

Pile type, size & driving method	Shutdown Distance (m)		Hydrophone Location (m)	
	HF Cetacean	Phocid	Near-Field[1]	Far-Field[2]
Vibratory drive 30-inch steel pipe piles	70	30	10	139.6
Vibratory extraction 30-inch steel pipe piles	70	30	10	139.6
Impact drive 28-inch steel sheet piles	110	50	10	139.6
Vibratory drive 28-inch steel sheet piles	25	10	10	139.6
Vibratory drive 24-inch steel pipe piles	70	30	10	139.6
Vibratory extraction 24-inch steel pipe piles	70	30	10	139.6
Impact drive 18-inch sheet piles	110	50	10	139.6
Vibratory drive 18-inch sheet piles	15	10	10	139.6
Drilling 4.5-inch blast charge holes	10	10	10	139.6
Blasting 120 lb. charge	Entire ROI*	Entire ROI	TBD	139.6

*0.418km^2

[1]Relative to pile location.

[2]Relative to Point between Berth 1 and Berth 2. Hydrophone location distance from pile will change depending on location of pile

Source: NMFS. Draft IHA. 2021.

Modified by Cianbro to include driving and excavating of 24-inch steel pipe pile as well as hydrophone deployment locations

Appendix C – In-water Pile-Driving, Drilling, and Blasting for Construction Year 2

DFOW Activity	Pile Purpose	Pile Count	Pile Type and Size	Method of Install	Piles Installed/ Extracted per Day	Total Pile Driving Days	Estimated Start Date	Included in Year 1 IHA (Y/N)	Included in Interim IHA (Y/N)	Included in Year 2 IHA (Y/N)	Cianbro Comments
Entrance Structure Float In (Ongoing)	*Entrance Structure*	8 - Install	30" Pipe Pile	Vibratory	4/day	2 Days	March/April	Y	N**	N	(Complete) **Carry over activity**
		15 - Remove	30" Pipe Pile	Vibratory	4/day	4 Days	April	N	N	Y	(Complete)
		44 - Install	NZ26	Vibratory	12/day	4 days	March/April	N	Y	Y	(Complete) **20 is listed in the IHA Renwal LTR; 44 listed in YR IHA applicaton**
	Mooring Dolphins	13 - Install	30" Pipe Pile	Vibratory	1/day	12 days	April/May	N	Y	N	(Complete) **Removal is noted in YR 2, but does not specifically call out install**
		13 - Remove	30" Pipe Pile	Vibratory	1/day	12 days	June	N	N	Y	
Blasting	*Temporary Blast Wall*	15 - Install	30" Pipe Pile	Vibratory/Impact	2/day	8 days	Feb/March	N	Y	N*	**Blast Wall design is still under review. ** Cianbro believes removal of 30" has been authorized under Interim IHA**
		15 - Remove	30" Pipe Pile	Vibratory	4/day	4 days	April/June	N	N	Y	
		71 - Install	PZC18	Vibratory	12/day	6 days	April/June	N	Y	N	
		71 - Remove	PZC18	Vibratory	12/day	6 days	Feb/March	N	N	Y	
	Drilling Blast Charge Hole	Loaded - 1,260	4.5" Hole	Drilling	12/day	130 days	May/March	N	N	Y	
		Unloaded - 320					May/March	N	N	Y	
	Blasting	13,000cy - 150 blast events	120lbs Max Charge	Blasting	5-30 gikes detonated per blast event	130 days	May/March	N	N	Y	
West Closure Wall	*West Closure Wall (#1)*	4 - Install	24" Pipe Pile	Vibratory	2/day	2 days	April/May	N	N	N*	**This is a short duration activity to set the guide; revised design to shorten drive time; temporary pile**
		4 - Remove	24" Pipe Pile	Vibratory	2/day	2 days	April/May	N	N	N*	
		8 - Install	30" Pipe Pile	Vibratory	2/day	4 days	April/May	N	Y	Y	
		8 - Remove	30" Pipe Pile	Vibratory	2/day	4 days	June/July	N	N	Y	
		Install - 134	18" Flat Web	Vibratory Impact	12/day	9	April/June	N	N	Y	
	West Closure Wall (#2)	4 - Install	24" Pipe Pile	Vibratory	2/day	2 days	April/May	N	N	N*	**This is a short duration activity to set the guide; revised design to shorten drive time; temporary pile**
		4 - Remove	24" Pipe Pile	Vibratory	2/day	2 days	July/August	N	N	N*	
		6 - Install	30" Pipe Pile	Vibratory	2/day	3 days	July/August	N	N	Y	
		6 - Remove	30" Pipe Pile	Vibratory	2/day	3 days	Aug/Sept	N	N	Y	
		Install - 74	18" Flat Web	Vibratory Impact	12/day	5	April/July	N	N	Y	

Key:		**Totals:**			Year 1 IHA	Interim IHA	Year 2 IHA	Cianbro Comments
Key:	*** - Piles not included on the March 12 2021 Interim IHA or Yr 2 IHA application 17Feb2021. Sent to NAVFAC Jan 11 2021**	**Totals:**	**30" Pipe Pile**	Install	**8**	**35**	**6**	
Year 1 IHA				Remove	**0**	**15**	**41**	**Most Installed YR 1**
Interim	**** - NAVFAC received notice to continue from Yr 1.**		**24" Pipe Pile**	Install	**0**	**8**	**0**	
Year 2 IHA				Remove	**0**	**0**	**8**	
PILE NUMBER/TYPES ARE SUBJECT TO CHANGE DUE TO DESIGN CHANGES			**18" Flat Web**	Install	**0**	**8**	**208**	**Increased from 160**
				Remove		**Permanent**		
			PZC18	Install	**65**	**20**	**115**	
4/29/2021				Remove	**0**	**0**	**71**	

P-381 Year One IHA Hydroacoustic Monitoring Plan

Submittal #01 57 19-10R4

Hydroacoustic Monitoring Plan

Multi-Mission Expansion of Dry Dock 1

P-381

Year 1 IHA

April 2022

Presented To:

PNSY Public Works Department

Portsmouth Naval Shipyard Kittery, ME 03904

By: 381 Constructors

TABLE OF CONTENTS

APPENDICES

FIGURES

LIST OF TABLES

ACRONYMS AND ABBREVIATIONS

μPa	micropascal
dB	decibel
dBA	decibel with A-weighted filter
dB SELcum	cumulative sound exposure level
DTH	down-the-hole
Hz	hertz
IHA	Incidental Harassment Authorization
kHz	kilohertz
km	kilometer
LOA	Letter of Authorization
Leq	equivalent sound level
m	meter
Navy	United States Department of the Navy
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
PTS	permanent threshold shift
re 1μPa	referenced at 1 micropascal
re 20μPa	referenced at 20 micropascal
ROI	Region of Influence
RMS	root mean square
sec	second
SEL	sound exposure level
Shipyard	Portsmouth Naval Shipyard
SPL	sound pressure level
TL	transmission loss
TTS	temporary threshold shift
WFA	weighted factor adjustment

A. Introduction

The following is the hydroacoustic monitoring plan for Portsmouth Naval Shipyard (PNSY) P-381 Multi-Mission Dry Dock #1 project. In-water pile-driving, rock hammering, and drilling activities are expected to occur between April 2022 and March 2027. All hydroacoustic monitoring will be done in compliance with the April 1, 2022 issued Incidental Harassment Authorization (IHA). The IHA covers in-water construction activities occurring from April 1, 2022 through March 31, 2023. All work beyond year 1 of the P-381 Multi-Mission Dry Dock #1 project will be described in a future Letter of Authorization (LOA) and will have its own respective hydroacoustic monitoring plan.

The work activities occurring from 2022 to 2023 may produce a variety of high intensity sound within the project area, propagating out into portions of the Piscataqua River. These high levels of sound pressure have the potential to harass and possibly injure marine mammals that can be found in the Piscataqua River.

Sound is one of the main methods marine mammals use to communicate, navigate, and forage for food. The impacts to marine mammals by introducing temporary threshold shifts (TTS) and permanent threshold shifts (PTS) are still being researched as more data is collected. However, it is known that the impact of high pressure levels have the potential to affect an animal's physical condition.

The main course of action is to collect acoustical data from various pile driving and drilling and rock hammering equipment not previously monitored as part of the P-310 project to determine the source level produced by those sound sources. All in-water work capable of producing noise harmful to marine mammals will be limited to daylight hours.

The Navy will collect and evaluate data from 10 percent of the new drilling, rock hammering and down the hole (DTH) activities not previously recorded during the P-310 project. The numbers of piles to be monitored for pile driving are as follows and as noted in Table 3 of the P-381 issued IHA:

- 9 102-inch steel pipe piles for rotary drilling
- 9 78-inch steel pipe piles for DTH Cluster Drill
- 10 42-inch steel pipe piles for DTH Mono-hammer
- 10 9-inch steel pipe piles for DTH Mono-hammer
- 10 4 to 6-inch steel pipe piles for DTH Mono-hammer
- 10 Rock Hammering events

Due to the dynamic nature of this construction project, it is possible that the number of piles and/or pile types may change depending on site conditions. If any changes need to be made, they will be brought to the attention of the Navy and NMFS to discuss and adjust monitoring as needed. Appendix B – In-water Pile-Driving and Drilling for Construction Year 1 denotes the current list of pile types as well as the updated schedule for installation/removal of year 1 work.

B. Requirements

Hydroacoustic monitoring will comply with the ***Request for Authorization for the Incidental Harassment of Marine Mammals Resulting from Multifunctional Expansion of Dock 1 at Portsmouth Naval Ship Yard*** dated August/December 2021 and the ***Incidental Harassment Authorization*** dated April 2022.

For the activities that will be monitored, 100% of the data will be analyzed and reported (including "soft starts" of impact hammers). Monitoring is necessary as specified in the request for authorization to NMFS. Hydroacoustic monitoring will be conducted for each different noise generating activity not previously monitored in P-310.

At a minimum, two hydrophones will be deployed in the near field and far field for activities. Near-field monitoring will occur 10 meters (33 feet) from noise generating equipment when possible. The near-field deployment will be considered a fluid location as 10 meters is dependent on the location of pile being installed. It is likely the near-field hydrophone will be deployed from the barge performing in-water work as it will have adequate access to the noise generating activity. Far-field hydrophone deployment will remain at a fixed location via a davit arm anchored into Berth 11. This location will be independent of the location of pile being installed. See Figure 1 for proposed approximate far-field fixed location.

The notional source point for pile driving, as seen in Figure 1, is located near the future Dry Dock 1 North and Dry Dock 1 West future entrances. The depth at this pile is 19.812 meters (65 feet) between the water surface and river floor bed. Following NMFS guidance of 20 meters x 19.812 meters (the depth of river at pile installation location), this leaves the monitoring location 396.24 meters (1300 feet) from the source pile. Monitoring at this location would reflect various interferences from channel traffic and obstructions related to the project construction.

A davit arm is a mechanical device made of metal attached to a support pillar. The top half of the device will rotate independent of the support pillar. This will allow monitoring engineers the ability to attach the hydrophone to the end of the davit arm on land and then swing the arm out over the water. The hydrophone can then be safely lowered into the water halfway down the water column.

Placement of the davit arm on Berth 11 will allow for a consistent fixed location for hydroacoustic monitoring. The davit arm will be installed in such a manner that will allow the hydrophone adequate enough distance from the Berth 11 wall to help eliminate potential phasing issues. The hydrophone cable will be marked with a buoy to inform vessels of its location to help avoid disturbance/interference.

Monitoring from a consistent location will allow for a better understanding of noise propagation and transmission loss in individual and concurrent activity. Deploying a hydrophone from land and not from a vessel will help decrease the likelihood of electrical noise generated by engines. Measured data may also be contaminated by signals originating from platforms such as flexifloats/shugarts. These contaminated signals originate from interaction of these platforms with the surrounding environments such as waves against the platform.

Due to the requirement of a bubble curtain, additional hydrophones may be deployed. All additional hydrophone data collected will be processed and reported.

Direct communication between the in-water construction crew, PSOs, and hydroacoustic engineers is critical. There will always be a direct line of communication between all teams to ensure no in-water construction activity occurs before the hydrophone(s) is appropriately set and operational if the construction activity is scheduled to be monitored.

In order to maintain project schedules, it is likely that multiple pieces of equipment will operate at the same time within the basin. Given the spatial constraints of the project area, a maximum of five pieces of equipment could potentially operate in the project area at a single time. It is assumed such overlap could occur up to five times per day at the peak of construction activity.

The extent to which simultaneous construction activities could occur within a day is unknown and difficult to quantify. With the exception of DTH drilling of large shafts, the construction activities would be intermittent with multiple stops and starts of the equipment occurring to allow for adjustments and for progress to be measured and documented. Therefore, while some activities, such as DTH drilling may occur for hours, overlapping activities such as vibratory pile driving or rock hammering would occur intermittently.

For all concurrent activities, distance from the hydrophones to all noise generating activities will be noted as well as the stop and start times for each respective activity. Isolated events will be monitored if possible.

The Contractor shall operate a bubble curtain across the openings of the basin to help attenuate sound for the sound sources that encompass the entire ROI. The Contractor will record hydroacoustic measurements inside and outside of the bubble curtain at the start of operations. Should the results of the recording inside the bubble curtain show that thresholds are not being exceeded by the activity occurring, the Contractor may submit results for review to reduce the requirement for the bubble curtain. The bubble curtain will remain in use until data is reviewed and approved by Navy and NMFS.

The bubble curtain will be utilized during the following activities:

- 78-inch Cluster Drill
- DTH Monohammer, 42-in
- DTH Monohammer, 9-in Center Wall Tie-In
- Impact Install of Sheet Piles (16) West Closure Wall Tie-In
- Impact Install of Sheet Piles (60) Secant Pile Guide Wall; (96) Temporary Coffer Dam
- Rock Hammering (all duration)

Figure 1. Far Field Monitoring Location for all Noise Generating Activity

Original Figure Source: PNSY. IHA Request. 2021.
Modified by P-381 Constructors

C. Reporting

Measuring Hydroacoustics

A reference value is necessary if one is to give absolute pressure (or intensity levels) in dB. The pressure reference used for underwater acoustics is: 1 µPa. As well as a reference value, a pressure definition must also be clearly defined. There are three pressure definitions that are commonly used in underwater acoustics: root mean square (RMS), peak, and peak-to-peak.

When analyzing noise, instantaneous values of sound pressure are constantly fluctuating. It becomes necessary to average data as one specific instant in time cannot represent the statistical variations in the values fluctuating over time.

An RMS value requires a duration over which to average the pressure of the signal. RMS will vary drastically depending on the duration over which the signal is averaged. The longer the duration, the lower the RMS value will be.

A Peak value is the maximum absolute amplitude value in the signal. This value is measured from zero to the maximum absolute amplitude. This could be the crest or trough, whichever is greater. Peak-to-peak value is the amplitude of a waveform that is measured from the crest (top of the waveform) to the trough (bottom of the waveform).

The hydroacoustic monitoring reports will include, at minimum, the following informational elements for IHA required noise generating activities based on the IHA dated April 2022:

- Hydrophone equipment and methods: location/coordinates, recording device, sampling rate, distance (m) from the pile where recordings were made; depth of water and recording device(s);
- Type and size of pile being driven, substrate type, method of driving during recordings (e.g., hammer model and energy), and total pile driving duration;
- Whether a sound attenuation device is used and, if so, a detailed description of the device used and the duration of its use per pile;
- For impact pile driving (per pile) of DTH: Number of strikes and strike rate; depth of the substrate to penetrate; pulse duration and mean, median, and maximum sound levels (dB re: 1uPa): root mean square sound pressure level (SPL_{rms}); cumulative sound exposure level (SEL_{cum}), peak sound pressure level (SPL_{peak}), and single-strike sound exposure level (SEL_{s-s});
- For vibratory pile driving/removal (per pile), rotary drilling, and rock hammering: Duration of driving per pile; mean, median, and maximum sound levels (dB re: 1uPa): root mean square sound pressure level (SPL_{rms}), cumulative sound exposure level (SEL_{cum}) (and timeframe over which the sound is averaged); and
- One-third octave band spectrum and power spectral density plot; and
- Environmental data will be collected, including but not limited to, the following: wind speed and direction, air temperature, humidity, surface water temperature, water depth, wave height (BSS), weather conditions, and other factors that could contribute to influencing the airborne and underwater sound levels (*e.g.*, aircraft, boats, etc.).

Monitoring for IHA Required Impulsive Noise Activities:
Rock Hammering, DTH Cluster Drill, DTH Mono-Hammer, and/or DTH Hammering (per pile) Use

A hydraulic rock hammer or hoe ram will be utilized for demolition of concrete shutter panels and granite blocks as well as removal of bedrock. A hoe ram operates by using a chisel-like hammer to rapidly strike the exposed rock or concrete to break it up into smaller pieces.

A DTH cluster drill uses both rotary drilling in conjunction with percussive hammering (approximately 13 strikes per second) to fracture rock inside shafts greater than 42-inches in diameter. As the drill bit rotates under pressure from the drill rig, multiple hammers located within the bit are forced into the rock repeatedly.

A DTH mono-hammer will be utilized for mechanical bedrock removal as well as installation of shafts 42-inches in diameter and smaller. A DTH mono-hammer operates similar to a DTH cluster drill in the fact as a drill bit rotates under pressure from the drill rig, a hammer located within the bit is forced into the rock repeatedly.

Because DTH hammering involves both drilling (non-impulsive) and hammering (impulsive) to penetrate rocky substrates, it is treated as both an impulsive and non-impulsive noise source. This section will cover the informational elements that will be reported on based on impulsive (hammering) elements of DTH hammering.

Hydroacoustic reports for IHA required impulsive noise activities will include the following informational elements:

- Hydrophone equipment and methods: location/coordinates, recording device, sampling rate, distance (m) from the pile where recordings were made; depth of water and recording device(s);
- Type and size of pile being driven, substrate type, hammer model/energy, total pile driving duration, number of strikes and strike rate, and depth of substrate to penetrate;
- Whether a sound attenuation device is used and, if so, a detailed description of the device used and the duration of its use per pile;
- Pulse Duration: Duration for each pulse is calculated based the 90% energy criterion. This calculation refers to when the cumulative signal energy exceeds 5% of the total signal energy and ends when it reaches 95%. The pulse duration is expressed in units of seconds (s).
- SPL_{peak}: Maximum absolute amplitude value in the signal. This maximum value will originate from the phase of pile driving during which hammer energy was also at maximum (referred to as Level 4).
    - Reference: dB re 1 μPa
        - Pressure Definition: Peak
            - Peak Duration: 90% energy window
- SPL_{rms}: Log transformed square root of the average square pressure of the signal over a specific time interval
    - Median, mean, and maximum SPL_{rms}
        - Reference: dB re 1 μPa
            - Pressure Definition: RMS
                - RMS Duration: 1-second intervals

- SEL$_{s\text{-}s}$: Determined by the squared sound pressure integrated over the duration of the strike.
    - Median, mean, maximum, and minimum SEL$_{s\text{-}s}$
        - Reference: dB re 1 μPa^2 · sec
            - Pressure Definition: RMS
                - RMS Duration: 90% energy window (single strike)
- SEL$_{cum}$: Cumulative sound exposure level an animal is exposed to during a specified duration of time. This will be computed from all the strikes associated with each pile occurring during all phases, i.e., soft start, Level 1 to Level 4.
        - Reference: dB re 1 μPa^2 · sec
            - Pressure Definition: RMS
                - RMS Duration: 90% energy window (applied to calculate SEL$_{s\text{-}s}$ before calculating SEL$_{cum}$)
                    - Formula: $SEL_{cum} = SEL_{s\text{-}s} + 10*\log$ (# of hammer strikes)
- Power Spectral Density: The average power in a sound during a certain time range and in a certain frequency range. This will be able to give a visualization for which frequency variations are strong and which are weak.
        - Reference: dB re μPa^2 per Hz
            - For impact driving, the power spectral density will be computed based on the average of up to eight successive strikes with a similar sound. The fast Fourier transform (FFT) of each hammer strike will be computed for the portion of the signal within each 90% energy strike duration and then averaged.
- One-Third Octave Band Spectrum: A frequency band whose bandwidth is one third of an octave, where an octave represents a doubling of frequency. For accurate representation of third-octave band levels at low frequencies, a long duration is required (sufficient accuracy at 10 Hz required a duration of at least 30 seconds).

Monitoring for IHA Required Continuous Noise Activities:
Rotary Drilling and/or DTH Hammering (per pile) Use

A rotary drill will be utilized to set 102-inch diameter casings into bedrock as well as excavating 5-foot deep rock sockets. In rotary drilling, the drill bit rotates on the rock while the drill rig applies pressure. The bit rotates and grinds continuously to fracture the rock and create a hole. Rotary drilling is considered an intermittent, non-impulsive noise source, similar to vibratory pile-driving.

Because DTH hammering involves both drilling (non-impulsive) and hammering (impulsive) to penetrate rocky substrates, it is treated as both an impulsive and non-impulsive noise source. This section will cover the informational elements that will be reported on based on continuous (drilling) elements of DTH hammering.

Hydroacoustic reports for IHA required continuous noise activities will include the following informational elements:

- Hydrophone equipment and methods: location/coordinates, recording device, sampling rate, distance (m) from the pile where recordings were made; depth of water and recording device(s);
- Type and size of pile being driven, substrate type, hammer model/energy, and total pile driving duration;
- Whether a sound attenuation device is used and, if so, a detailed description of the device used and the duration of its use per pile;
- SPL_{rms}: Log transformed square root of the average square pressure of the signal over a specific time interval
    - Median, mean, and maximum SPL_{rms}
        - Reference: dB re 1 μPa
            - Pressure Definition: RMS
                - RMS Duration: 1-second intervals
- SEL_{cum}: Cumulative sound exposure level an animal is exposed to during a specified duration of time.
        - Reference: dB re 1 $\mu Pa^2 \cdot$ sec
            - Pressure Definition: RMS
                - RMS Duration: Timeframe over which the sound is averaged will be noted
- Power Spectral Density: The average power in a sound during a certain time range and in a certain frequency range. This will be able to give a visualization for which frequency variations are strong and which are weak.
        - Reference: dB re μPa^2 per Hz
            - For vibratory driving/removal, the power spectral density will be computed over the entire duration of the total active vibratory driving/removal. This will exclude periods of hammer shut-down to ensure results computed only include duration of total active vibratory driving/removal time.
- One-Third Octave Band Spectrum: A frequency band whose bandwidth is one third of an octave, where an octave represents a doubling of frequency. For accurate representation of third-octave band levels at low frequencies, a long duration is required (sufficient accuracy at 10 Hz required a duration of at least 30 seconds).

Final Reporting

Reports on all monitoring conducted by the Contractor under the 2022-2023 IHA will be submitted to the Navy within 90 calendar days of the completion of monitoring or 60 calendar days prior to the requested issuance of the subsequent LOA for construction activity at the same location. A final comprehensive report for all monitoring conducted under the 2022-2023 IHA will be submitted by the Navy within 30 calendar days following receipt of any NMFS comments on the draft report. If no comments are received from NMFS within 30 calendar days of receipt of the draft report, the report shall be considered final.

All draft and final monitoring reports must be submitted to PR.ITP.MonitoringReports@noaa.gov and analystname@noaa.gov.

If any results of monitoring are analyzed and weighted by respective marine mammal functional hearing groups to report on sound attenuation or distances, P-381 Constructors will follow the guidance as defined by NMFS. The two groups being monitored in the Piscataqua River are; phocid pinnipeds (PW) and high frequency (HF) cetaceans. The hearing range of these two groups are as follows:

Table 1. Marine Mammal Hearing Groups

Hearing Group	Generalized Hearing Range*
High-frequency (HF) cetaceans	275 Hz to 160 kHz
Phocid pinnipeds (PW) underwater	50 Hz to 86 kHz

* Represents the generalized hearing range for the entire group as a composite (i.e., all species within the group), where individual species' hearing ranges are typically not as broad. Generalized hearing range chosen based on ~65 dB threshold from normalized composite audiogram, with the exception for lower limits for LF cetaceans (Southall et al. 2007) and PW pinniped (approximation).

Source: NOAA Fisheries. Marine Mammal Acoustic Technical Guidance. 2021.

Auditory weighting and exposure parameters have been set by NOAA by respective hearing groups. Applying auditory weighting functions is necessary as it gives a more accurate representation of how animals will perceive the loudness of various frequencies. The weighted functions take into account sensitivity to a range of frequencies in the respective hearing group. These functions often result in smaller isopleths as certain frequencies are attenuated.

These weightings take into account a variety of factors based on studies of each respective hearing group. Filters with various weightings (A, B, C, D, and Z weighted) attempted to correspond to loudness as perceived by respective hearing group. This example can be found in humans as the typically hearing range is 20 Hz – 20 kHz. Although this is a spectrum of frequencies, A-weighting is commonly used as it has been found to be the most accurate at representing the average perceived loudness of the human ear.

Weighted functions will not be applied until post processing. This is recommended as it leaves the total spectrum of frequencies captured to be fully analyzed. This is important as one could potentially find a source beyond the frequencies of interest that is producing a frequency that in turn, is producing harmonics/subharmonics that fall into the interested frequency range.

Attempts to attenuate the source could then be made to ensure harmonics/subharmonics in the interested frequency range are also attenuated to more acceptable levels.

Both received level and duration of exposure are taken into account when factoring the weighted SEL_{cum} metric. This metric is recommended to apply to individual activities/sources, not multiple activities occurring within the same area. The SEL_{cum} metric is used to determine the TTS and PTS ROI for marine mammals.

For each species group, a low frequency cutoff (f_{low}) and high frequency cutoff (f_{high}) is applied to filter out data below the range of functional hearing for that group. For high frequency cetaceans f_{low} is 200 Hz and for pinnipeds f_{low} is 75 Hz. For all hearing groups, f_{high} is 20 kHz, the frequency above which minimal sound energy is typically produced by pile driving activities.

If any weighting is applied in post processing, reports will include both weighted and non-weighted analytics.

D. Equipment and Procedures

The hydrophones to be used for hydroacoustic aspects of P-381 are Cetacean Research CR3 omnidirectional piezoelectric element hydrophones. These hydrophones have a receiving sensitivity of -210 dB re 1uV/Pa and a linear frequency response from 25Hz – 92kHz (usable from 10Hz – 93kHz). Hydrophones will be suspended midway in the water column. The hydrophone will be attached to a weighted nylon cord to maintain a constant depth and distance from the pile. The nylon cord or chain will be attached to a float or tied to a static line. Hydrophones will be strategically deployed as to avoid flat surfaces, fixed structures, or other obstructions that may reflect frequencies and further obscure data. Depth will be confirmed by weighted tape measure and/or depth sounder.

Data acquired from the hydrophones will be routed via coaxial cable to a SpectraDAQ-200. The length of the coaxial cable will be adequate to reach the shallowest depth of the river (4.5 meters) and the deepest depths of the river (21 meters). The SpectraDAQ-200 is a custom designed precision data acquisition sound card that allows for real time, recording/playback and post processing of up to two channels. The data acquired from the SpectraDAQ-200 for continuous and impulsive noise will be captured at a sample rate of 92kHz per channel with a resolution of 24 bit. The use of a 24 bit resolution will allow for 144 dB of headroom in the recording.

The overall system will be able to handle up to 230 dB before overloading. Use of a higher bit depth will reduce the risk of clipping without increasing quantization errors.

The input channels of the SpectraDAQ-200 provides 4 fixed gain steps (+/- 10V, +/- 2.5V, +/- 625mV, +/- 156mV). This allows SpectraPLUS-SC to be calibrated directly to volts, millivolts, or to the transducer sensitivity providing quick and accurate calibration for the CR3 hydrophones. Maximum input voltage for the A/D converters can be set in any of the 4 fixed gain steps. If the input range is changed, the calibration will automatically apply the correct gain to the measurement. The input range is applied to both channels. Hydrophones are calibrated to the transducer sensitivity which will be verified by the use of a pistonphone daily.

Information captured from the hydrophone and transmitted through the DAQ will be recorded into an external LaCie hard drive. The hard drive will remain in the CIA. NAVFAC will develop a security plan that P-381 Constructors will be required to follow regarding the safeguard of recorded data.

RMS SPL, peak SPL, and frequency content computed from the hydrophone data will be displayed in real time, monitored and inspected frequently during all measurements.

Monitoring will not take place if any kind of vessel in the surrounding area is creating enough noise to affect the recordings. No monitoring may occur when a submarine is moving anywhere near the Shipyard, both via tug or under its own power. No monitoring may occur when a submarine is within line of sight of the hydrophone. The hydrophone will be removed from the water prior to a submarine moving to a berth within line of sight of noise creating activities. NAVFAC will provide 7 days' notice before any submarine movements. Three days prior to a submarine moving near the Shipyard, P-381 Constructors will submit recorded data to Shipyard security for review before being removed from the Shipyard or stored on non-Government devices. It is not anticipated that there will be acoustic monitoring of pile installation work while submarines are at berth or in transit. If monitoring is allowed when a submarine is at berth on the Shipyard, P-381 Constructors will coordinate with NAVFAC and Shipyard security on best practices for submitting all recordings for review before the data is removed from the Shipyard or stored on non-Government devices.

The GPS position of the hydrophone locations will be recorded using a Garmin eTrex 10. Distances to piles will be verified with a laser rangefinder.

Calibration on both the hydrophones and data acquisition system will be performed at the start of each day. Calibration will be performed with a Cetacean intelligent pistonphone with electronic temperature and pressure compensation. It produces 10 Pa (114 dB re 20 μPa air) (140 dB re 1 μPa water) @ 250Hz. This pistonphone will be custom made with a coupler that will create an airtight locking seal to the CR3 hydrophone.

All data will be monitored, recorded, and post-processed in SpectraPLUS-SC software (version 5.3.0.14) as well as Aquatic Acoustic Metric Interface software (version 1.3.0).

Equipment data sheets are included in <u>Appendix A – Equipment Data Sheets</u> of this document.

Appendix A – Equipment Data Sheet

Cetacean Research Technology
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Hydrophone Specifications

Model Number	CR1A	CR2	CR3
Linear Frequency Range (±3dB) [kHz]	0.00016† – 48	0.0019† – 28	0.0004† – 180
Useable Frequency Range (+3/-12dB) [kHz]	0.00005† – 68	0.0005† – 60	0.0001† – 240
Sensitivity [dB, re 1V/μPa]	-199‡	-214	-207‡
SPL Equiv. Noise at 1kHz [dB, re 1μPa/√Hz]	38 (< *Sea State Zero*)	68	54
Maximum Operating Depth [m]	500	370	980
Operating Temperature Range [ºC]	-25 to 60‡	-40 to 70	-40 to 90‡
Capacitance [nF]	12	0.82	6.7
Dimensions [mm]	85L x 32 dia.	56L x 14 dia.	50L x 18 dia.
Coaxial Cable Length [m]	15	10	15
Directionality	Omni below 10kHz	Omni below 10kHz	Omnidirectional

† Requires a preamplifier with 100MΩ input impedance, such as VP1000. If a preamplifier with 330kΩ input impedance is used, such as the USB Dual Pre, then the low frequency -3dB point will be increased by a factor of 300 (e.g. 48Hz instead of 0.16Hz for the CR1A).

‡ Hydrophone is spot calibrated at the factory; calibration is guaranteed between -5C and 30C. Calibrated frequency response measurements can be performed for an additional fee.

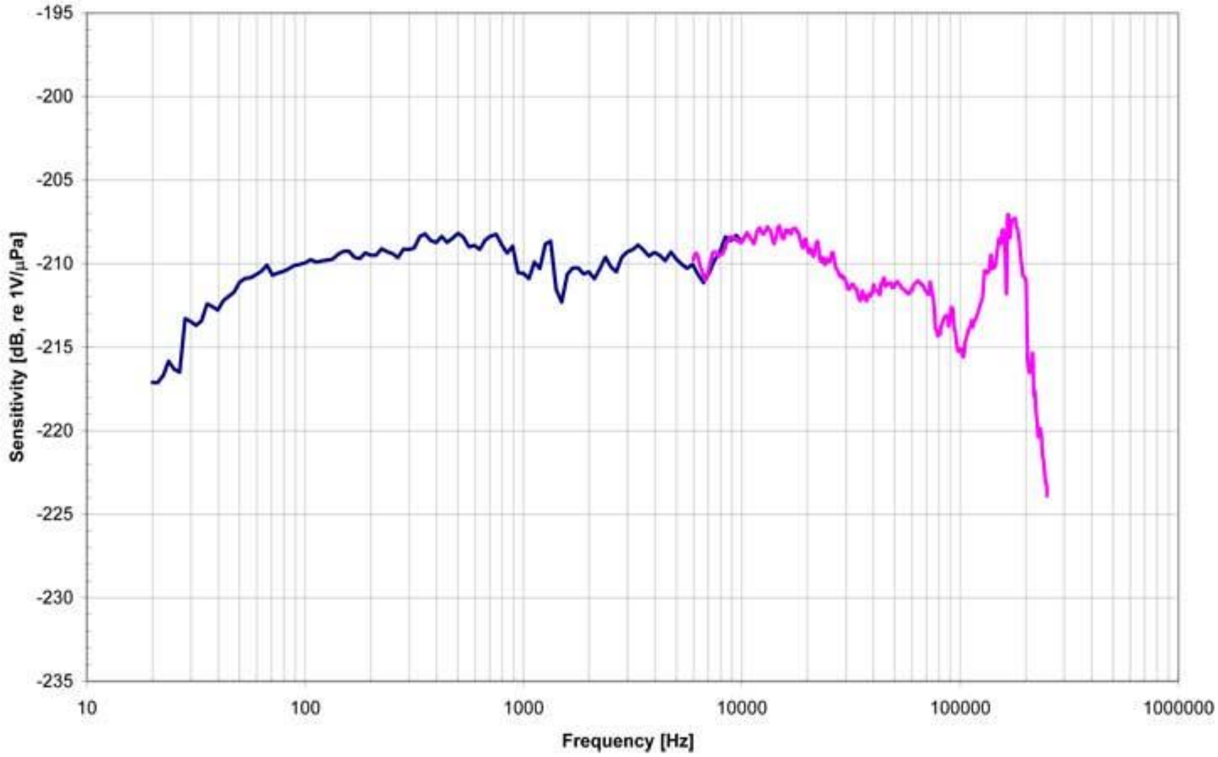
Hydrophones not in stock will ship within 8 weeks of the receipt of payment. Add 4 weeks to delivery time for custom orders. Acceptable payment includes: check or money order made out in US funds and drawn on a US bank; VISA, MasterCard, Discover or American Express cards; or money wire transfers. There is an added fee for foreign wire transfers. Qualifying nonprofit organizations may receive discounts.

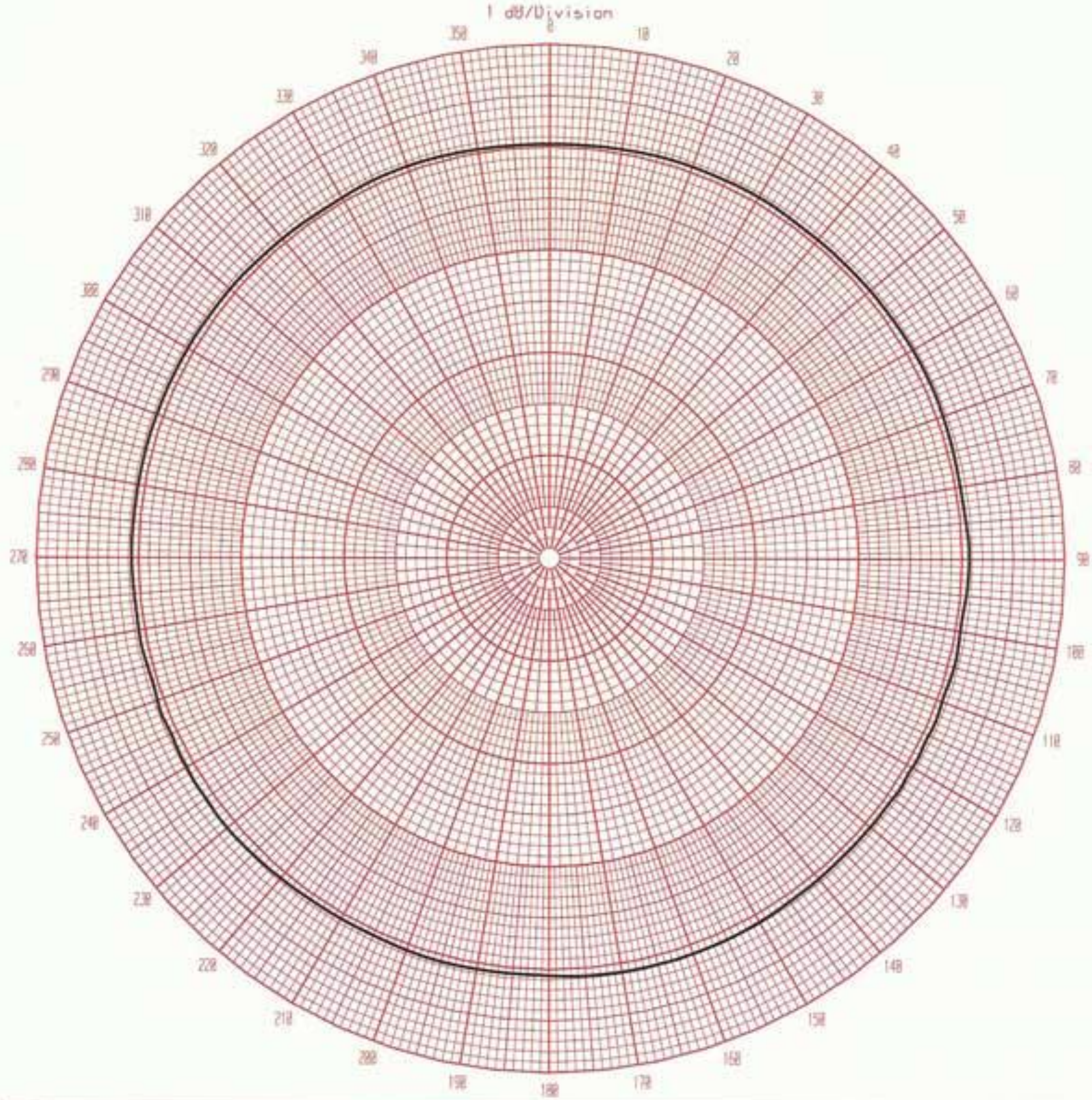
All hydrophones carry a 90-day limited warranty. Extended warranties are available. Units will either be repaired or replaced at the discretion of Cetacean Research Technology. Misuse or damage to the connectors or cable voids the warranty. Prices are for *advance payment only* and subject to change without notice. **All sales are final**.

CR3 Hydrophone Specifications

Linear Frequency Range (±3dB) [kHz]	0.0004‡ to 180
Usable Frequency Range (+3/-12dB) [kHz]	0.0001‡ to 240
Transducer Sensitivity [dB, re 1V/µPa]	-207‡
Preamplifier Gain [dB]	N/A
SPL Equiv. Self Noise at 1kHz [dB, re 1µPa/√Hz]	54
Power Requirement [Vdc]	N/A
RMS Overload Acoustic Pressure [dB, re 1µPa]	N/A
Maximum Operating Depth [m]	980
Operating Temperature Range [°C]	-40 to 90‡
Capacitance [nF]	6.7
Dimensions [mm]	50 L x 18 dia
Coaxial Cable Length [m]	30m
Directionality	omnidirectional
Battery / Connector box	no power required

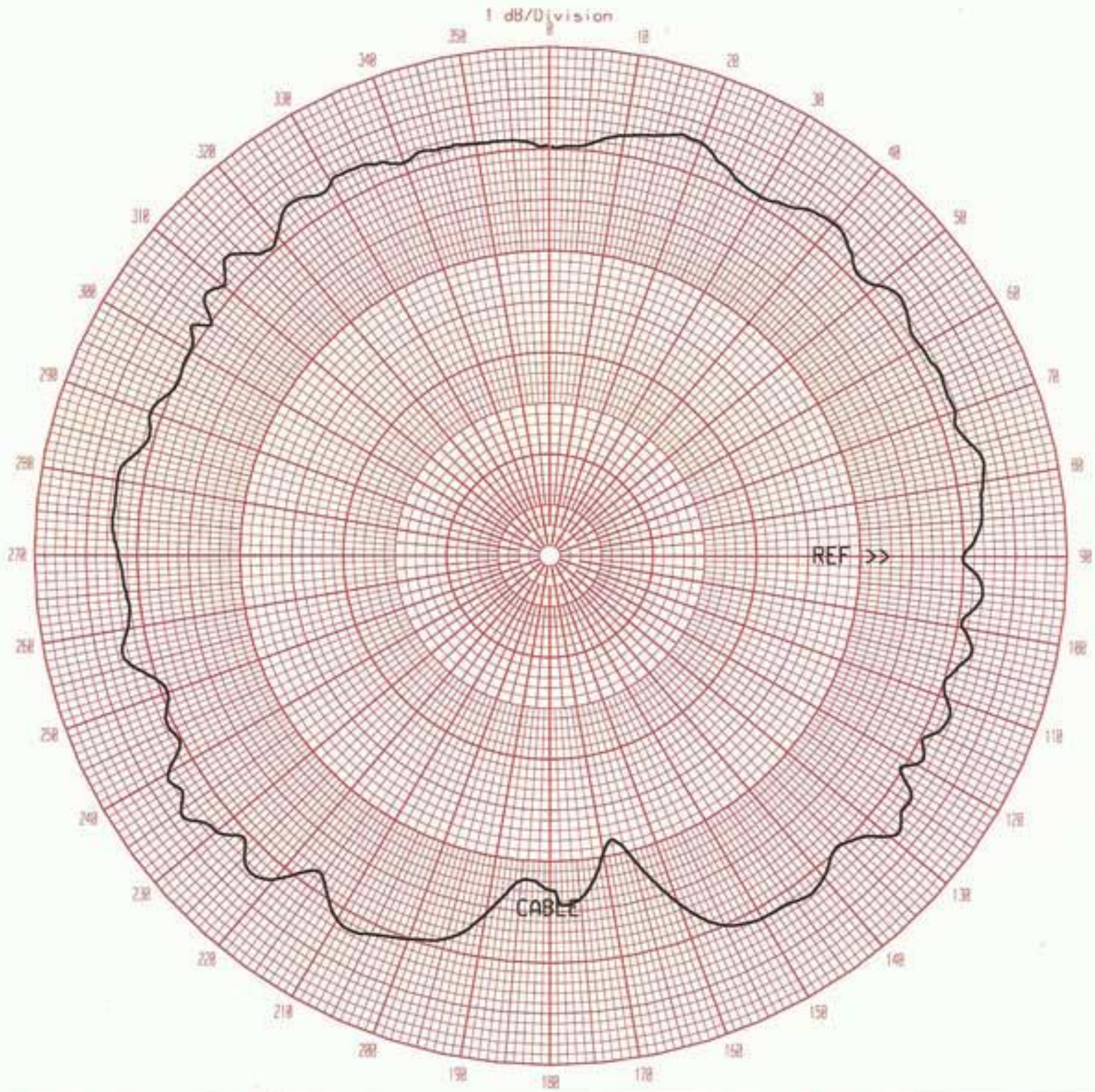
CR3-9196-07 Frequency Response into 1MΩ Input





Water Temp	11.8 C	RECEIVING DIRECTIVITY RESPONSE	Acoustic Test Facility NUWC Keyport
Frequency	50 kHz		
Spacing	3.16 M	CR3 SER.# 9196-07	Time 14:09:59
Depth	3.81 M		Date 22 Apr 2010
Plane	XY		
Console	1		Technician MF

High Amp:-9.1 High angle: 232.5 Low Amp:-9.8 Low Angle: 359.9 Total Plot Variation is .7 dB



Water Temp 11.7 C	RECEIVING DIRECTIVITY RESPONSE		Acoustic Test Facility NUWC Keyport
Frequency 50 kHz			
Spacing 3.16 M			Time 13:52:53
Depth 3.81 M	CR3	SER.# 9196-07	Date 22 Apr 2010
Plane XZ			
Console 1			Technician MF

SpectraDAQ-200

SpectraDAQ-200 is a precision data acquisition sound card optimized for test and measurement applications. Designed specifically for use with SpectraPLUS it features fixed gain steps for easy calibration to the transducer sensitivity, IEPE power for accelerometers or microphones, and standard BNC connectors. It is housed in a rugged steel case and powered by USB 3.0.

Excellent Performance

The A/D and D/A converters are state of the art and provide incredible dynamic range and extremely low distortion.

Direct Calibration

The input channels provide 4 fixed gain steps. This allows SpectraPLUS to be calibrated directly to volts, millivolts or to the transducer sensitivity providing quick and accurate calibration for microphones, accelerometers and other sensors.

IEPE Power

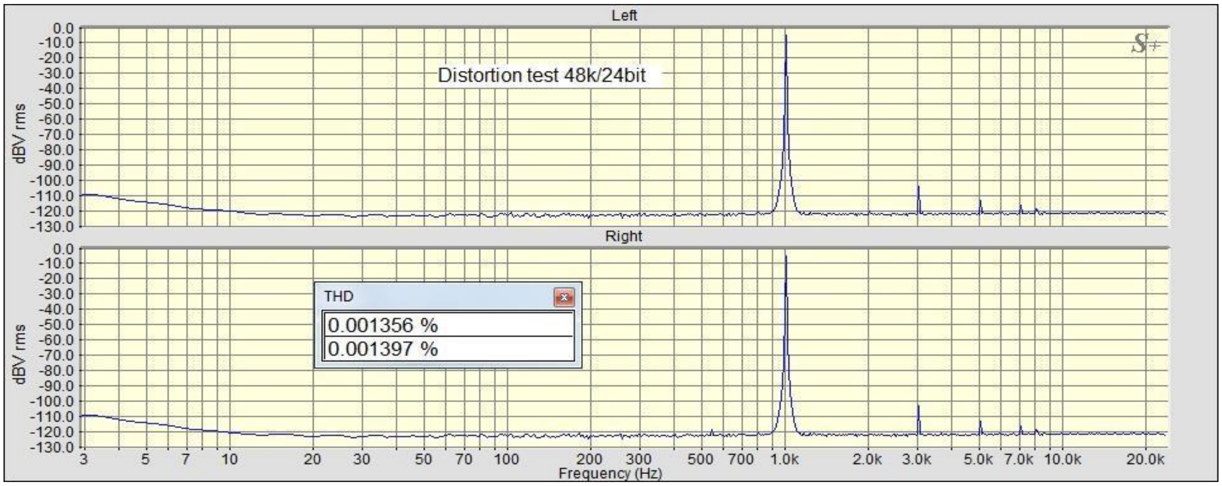
Accelerometers, microphones and hydrophones often use IEPE powered sensors; IEPE power is a 4ma constant current supply that is built-in to the input circuitry of the module. It is enabled via the SpectraPLUS software. IEPE is also known as ICP (trademarked by PCB electronics).

Input Voltage Ranges (software selectable)	+/-10V, +/-2.5, +/-625mV, +/-156mV
Sampling Rate	Up to 192kHz
Sampling Precision	24 bit
Input Channels	2
Input Impedance	0.5 Meg Ohm
IEPE power (software selectable)	4ma constant current
Frequency Response	4 Hz to 92 kHz (-1dB)
Low Frequency cutoff	2 Hz (-3dB)
Total Harmonic Distortion (THD)	< 0.002% (0.5 Vrms signal level, 2.5 V gain)
Spurious Free Dynamic Range	> 95 dB
Noise Floor (terminated inputs)	< -130 dBVrms
Channel Separation	> 90 dB
Input Connectors	2 BNC (single ended)
Output Voltage	+/-1.4 V (1 Vrms)
Output Channels	2

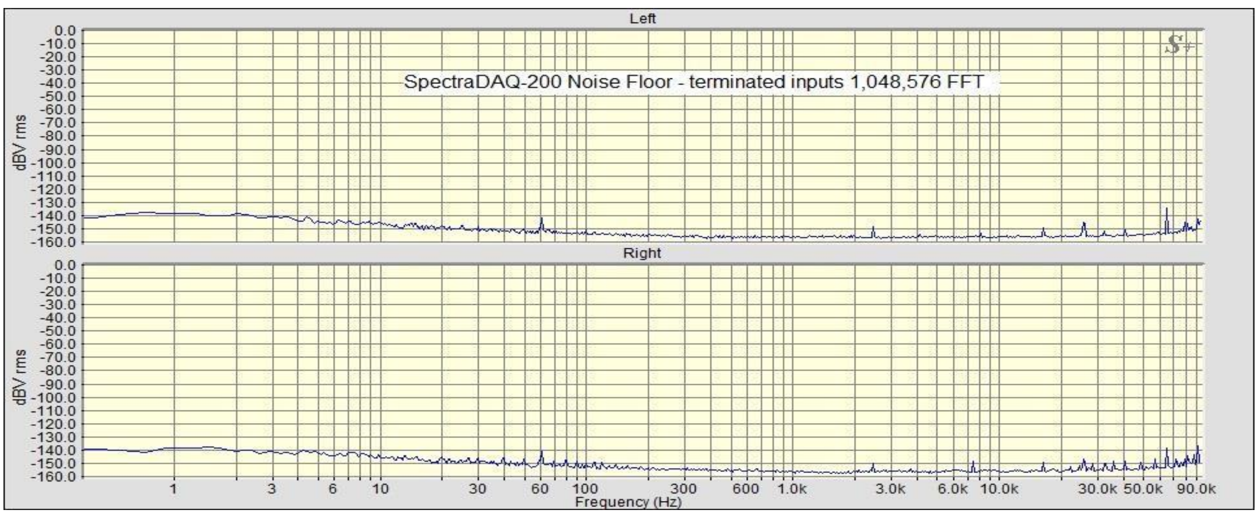
Output Connectors	1 BNC, 3.5 mm stereo
Digital I/O	3 Input, 3 Output (RJ45 connectors)
Drivers (Vista/Win7/8/10, x32 and x64)	MME (Windows Multimedia Extensions) ASIO (Steinberg Audio Stream Input/Output)
PC Interface	USB 3.0 (cable included)
Operating Temperature range	0 to 50 C
Dimensions	5.5 x 3 x 1 in (140 x 77 x 26 mm)
Weight	9 oz (250 grams)
Warranty	I year

Pricing, availability and specifications are subject to change without notice

Distortion measurement with the output looped back to the inputs



Noise floor measured with terminated inputs



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SpectraPLUS Features and Specifications

Key Feature	SpectraPLUSRT	SpectraPLUS-SC	SpectraPLUS-DT
Hardware Supported	Multimedia Sound Cards	Multimedia Sound Cards	Data Translation DT9800 Industrial A/D modules
Maximum Sampling Rate	200 kHz*	200 kHz*	2.0 MHz*
Maximum Channels	2	2	16
Maximum Sampling Precision	24 bit*	24 bit*	24 bit*
Composite Channels (Transfer Function, Multichannel average, etc)	0	1	16
Supported Modes	Real Time	Real Time, Record/Playback, Post Process	Real Time, Record/Playback, Post Process
Available Displays	Spectrum	Time Series, Spectrum, Phase, Spectrogram, 3-D Surface	Time Series, Spectrum, Phase, Spectrogram, 3-D Surface
Frequency Resolution	Fixed FFT size, 1/1 Octave, 1/3 Octave	Selectable FFT size, 1/1 through 1/96 Octave	Selectable FFT size, 1/1 through 1/96 Octave
Input Gain	Variable* (4 fixed steps#)	Variable* (4 fixed steps#)	Fixed Steps*
Calibrated Inputs	Uncalibrated (Volts or Millivolts#)	Uncalibrated (Volts or Millivolts#)	Volts or Millivolts
Calibration to Transducer	Use external reference signal (use transducer sensitivity#)	Use external reference signal (use transducer sensitivity#)	Use actual transducer sensitivity or external reference signal
Transducer Power	Phantom* (IEPE#)	Phantom* (IEPE#)	IEPE*
Triggering	No	Analog Input	Analog or TTL with User Accept/Reject option
Tachometer channel support	No	No	Yes
Order Analysis	No	No	Yes
Automation Support	No	Yes	Yes
** Hardware dependent* *#When SpectraDAQ-200 is used*			

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SpectraPLUS-SC Options

SpectraPLUS-SC consists of a base analyzer plus a set of 10 additional options so you can purchase only the features you need. Additional options can be purchased at anytime and activated with a simple phone call. The downloaded software includes all options for the 30 day evaluation period.

Base Analyzer		**Features include Single Channel Operation, Real Time Mode, Spectrum, Time Series, and Phase displays, Narrowband FFT sizes through 32,768 points, 1/1, and 1/3 Octave Analysis, Triggering, Markers, Overlays, Averaging, Peak Hold, Decimation, Mic Compensation, A, B, C Spectral Weighting**
Option /01	Dual Channel Processing	Dual Channel Operations - Real and Complex Transfer Functions, Coherence, Average, Cross Spectrum and cross channel delay compensation
Option /02	Recording and Post Processing Modes	Recorder and Post Processing modes - allows direct hard disk recording and playback. Post Processing mode provides comprehensive analysis from WAV files. Includes Digital Filtering capability
Option /03	Signal Generator Utility	Advanced Signal Generation - Pink/White noise, Noise Burst, Frequency Sweep, Frequency Step, Level Sweep, 1 kHz tone, Multiple Tones, Saw, Square, Pulse, IMD test tones and User Defined WAV source. Can generate different signals in each channel
Option /04	Color Spectrogram Display	Spectrogram View - displays the spectrum versus time in greyscale or color format for advanced joint time-frequency analysis.
Option /05	3-D Surface Display	3-D Surface View - displays the spectrum versus time in a 3-Dimensional perspective format
Option /06	Distortion Analysis Utilities	Distortion Analysis - measurement utilities for THD, THD+N, IMD, SNR, NF, SINAD. Each measurement is displayed in real time in a separate resizeable window. Also includes a dedicated THD+N versus Frequency utility that quickly and conveniently measures the distortion characteristics of your device over a range of frequencies.
Option /07	High Resolution Analysis	Adds 24 bit sampling precision and sampling rates above 48kHz

		(sound card dependent). Adds FFT sizes up to 1,048,576 points, and Octave scaling to 1/96
Option /08	Advanced Scaling and Calibration	Adds independent channel calibration and scaling for left and right channels with separate views for each. Useful for applications requiring separate channel scaling and calibration such as simultaneous sound and vibration measurements. This option also includes calibration conversions from Acceleration to Velocity or Displacement; also adds Power Specral Density scaling option for accurate noise measurements
Option /09	Acoustic Tools	Reverberation Time (RT60) utility features bar graph of reverberation time versus frequency band, 3-D Surface plot of the decay versus frequency and individual decay plots versus time. Delay Finder measures delay between two channels in milliseconds, feet or meters. Speed of sound - converts the delay value between milliseconds, feet or meters. Equivalent Noise (Leq) utility provides comprehensive noise level calculations for LeqT, Leq, Lpk , Lsel, Lmax, Lmin, L10, L50, L90. Stereo Phase Scope for real-time monitoring and analysis of signal phase. Phase scope mode displays a standard oscilloscope X- Y orientation (lissajous pattern) for analysis of phase, polarity, missing channel detection and stereo separation monitoring
Option /10	Automation Tools	Macro Command Processor utility allows you to easily automate measurements, record SPL and spectral data at user specified intervals/duration with time/date stamp, save files with user-defined names using a script-based programming language. It uses the underlying DDE syntax for an automation solution without requiring a third party program. Automation interface API allows the capability for an external program to control and read results from the analyzer in real time. Works with any program that supports COM such as C++, VB, Excel, and others. Dynamic Data Exchange (DDE) allows the capability for an external program to control and read results from the analyzer in real time. Works with any program that supports DDE such as C++, VB, Excel, Access and others. Data Logging utility produces an output text file containing selected spectral parameters + time-stamp for dynamic signal tracking and unattended event monitoring.

Specification GARMIN GPS Etrex-10

Physical & Performance:	
Unit dimensions, WxHxD:	2.1" x 4.0" x 1.3" (5.4 x 10.3 x 3.3 cm)
Display size, WxH:	1.4" x 1.7" (3.6 x 4.3 cm); 2.2" diag (5.6 cm)
Display resolution, WxH:	128 x 160 pixels
Display type:	transflective, monochrome
Weight:	5 oz (141.7 g) with batteries
Battery:	2 AA batteries (not included); NiMH or Lithium recommended
Battery life:	25 hours
Waterproof:	yes (IPX7)
Floats:	no
High-sensitivity receiver:	yes
Interface:	USB
Maps and Memory:	
Basemap:	yes
Waypoints/favorites/locations:	1000
Routes:	50
Track log:	10,000 points, 100 saved tracks
Features and Benefits:	
Camera:	no
Geocaching-friendly:	yes (paperless)
Custom maps compatible:	no
Photo navigation (navigate to geotagged photos):	no
Hunt/fish calendar:	yes
Sun and moon information:	yes

Appendix B – In-water Pile-Driving and Drilling for Construction Year 1

Activity	Total Amount and Estimated Dates	Activity Component	Method	Daily Production Rate	Total Production Days
Center Wall - Install Foundation Support Piles	38 drilled shafts *Mar-22 to Mar-23*	Install 102-inch diameter outer casing	Rotary Drill	1 shaft/day 1 hour/day	38
		Pre-drill 102-inch diameter socket	Rotary Drill	1 shaft/day 9 hours/day	38
		Remove 102-inch outer casing	Rotary Drill	1 casing/day 15 minutes/casing	38
		Drill 78-inch diameter shaft	Cluster drill DTH	6.5 days/shaft 10 hours/day	247
Center Wall – Install Diving Board Shafts	18 drilled shafts *Mar-22 to Mar-23*	Install 102-inch diameter outer casing	Rotary Drill	1 shaft/day 1 hour/day	18
		Pre-drill 102-inch diameter socket	Rotary Drill	1 shaft/day 9 hours/day	18
		Remove 102-inch outer casing	Rotary Drill	1 casing/day 15 minutes/casing	18
		Drill 78-inch diameter shaft	Cluster drill DTH	6.5 days/shaft 10 hours/day	117
Center Wall – Access Platform Support	38 drilled shafts *Mar-22 to Mar-23*	Install 102-inch diameter outer casing	Rotary Drill	1 shaft/day 1 hour/day	38
		Pre-drill 102-inch diameter socket	Rotary Drill	1 shaft/day 9 hours/day	38
		Remove 102-inch outer casing	Rotary Drill	1 casing/day 15 minutes/casing	38
		Drill 78-inch diameter shaft	Cluster drill DTH	3.5 days/shaft 10 hours/day	133
Center Wall – Temporary Launching Piles	6 drilled shafts *Mar-22 to Apr-22*	42-inch diameter shaft	Mono-hammer DTH	1 shaft/day 10 hours/day	6
Center Wall Tie Downs	Install 36 rock anchors *Mar-22 to Mar-23*	9-inch diameter holes	Mono-hammer DTH	2 holes/day 5 hours/hole	18
Center Wall – Access Platform Tie Downs	Install 18 rock anchors *Mar-22 to Mar-23*	9-inch diameter holes	Mono-hammer DTH	2 holes/day 5 hours/hole	9
Center Wall – Install Tie-In to Existing West Closure Wall	16 sheet piles *Mar-22 to Mar-23*[+]	28-inch wide Z-shaped sheets	Impact with initial vibratory set	4 piles/day 5 minutes and 300 blows/pile	4*
Berth 11 End Wall - Install Secant Pile Guide Wall	60 sheet piles *Feb-22 to Mar-23*	28-inch wide Z-shaped sheets	Impact with initial vibratory set	8 piles/day 5 minutes and 300 blows/pile	8
Berth 1 – Remove Granite Block Quay Wall	610 cy *May-22 to Mar-23*[+]	Granite block demolition	Hydraulic rock hammering	2.5 hours/day	10*
P-310 West Closure Wall – Remove Closure Wall	238 sheet piles *Aug-22 to Oct-22*	18-inch wide flat-sheets	Vibratory extraction	4 piles/day 5 minutes/pile	60

Activity	Total Amount and Estimated Dates	Activity Component	Method	Daily Production Rate	Total Production Days
P-310 West Closure Wall - Mechanical Rock Hammering	985 cy *Nov-22 to Feb-23*	Excavate bedrock	Hydraulic rock hammering	9 hours/day	77
P-310 West Closure Wall - Mechanical Rock Hammering	Drill 500 relief holes *Nov-22 to Feb-23*	4-6 inch holes	Mono-hammer DTH	25 holes/day 24 minutes/hole	20
	Drill 46 rock borings (50 cy) *May-22 to Jun-22*	42-inch diameter casing	Mono-hammer DTH	2 borings/day 5 hours/boring	24
West closure wall-Berth 11 Abutment – Install Piles	Drill 28 shafts *Aug-22 to Mar-23*	42-inch diameter casing	Mono-hammer DTH	1 shaft/day 10 hours/day	28
Berth 11 – Remove Shutter Panels	112 panels *Oct-22 to Mar-23*+	Demolish shutter panels	Hydraulic rock hammering	5 hours/day	56*
Berth 11 Face - Mechanical Rock Removal at Basin Floor	3,500 cy *Oct-22 to Mar-23*+	Excavate Bedrock	Hydraulic rock hammering	12 hours/day	100*
	Drill 2,201 relief holes *Oct-22 to Mar-23*+	4-6 inch holes	Mono-hammer DTH	27 holes/day 22.2 minutes /hole	82*
Berth 11 Face - Mechanical Rock at Abutment	Drill 365 rock borings (1,220 cy) *Jul-22 to Jan-23*	42-inch diameter casing	Mono-hammer DTH	2 borings/day 5 hours/boring	183
Dry Dock 1 North Entrance - Drill Tremie Tie Downs	Drill 100 rock anchors *Jan-23 to Mar-23*	9-inch holes	Mono-hammer DTH	2 holes/day 2 hours/hole	52
Dry Dock 1 North Entrance - Install Temporary Cofferdam	Install 96 sheet piles *Dec-22 to Mar-23*	28-inch wide Z-shaped sheets	Impact with initial vibratory set	8 sheets/day 5 minutes and 300 blows/pile	12
Berth 1 – Remove Sheet Piles	Remove 12 sheet piles *Mar-23*+	25-inch wide Z-shaped sheets	Hydraulic rock hammering	6 hours/day	3*
Berth 1 Top of Wall - Demolition For Waler Installation	30 lf+ *Mar-23*+	Mechanical concrete demolition	Hydraulic rock hammering	10 hours/day	6*
Totals	539 shafts/borings 2,855 holes 422 sheet piles				1,537 days

+These activities will continue into subsequent construction years

* These activities will begin in year 1 of this IHA request and continue into following construction years. ONLY the number of production days occurring in year 1 are presented.

Appendix C – Hydroacoustic Monitoring Report: Impact Sample

P381 Constructors

Hydroacoustic Monitoring Report

Date: **Project:** 3121020 PNSY Multi-Mission Dry Dock 1

Project Information

Project Name: P381 Multi-Mission Dry Dock #1
Location: Portsmouth Naval Shipyard, Kittery, Maine
Project/Contract Number: N40085-21-C-0011
Hydroacoustic Engineer - Lead: Theodore Hallett

Hydrologic and Geologic Information

Body of Water: Portsmouth – Lower Piscataqua River
Type: Estuarine
Hydrologic Unit: 01060003
Geology: Glacial Till, Phyllite, Quartzite, Diorite and/or Shale

Equipment Information

Hydrophone: Cetacean Research CR3
Recording Device: Spectra DAQ-200
Sampling Rate: 96kHz
Bit Depth: 24 Bit

Weather

Meteorological Conditions:
Cloud Cover: 00%
Air Temperature: 00°F
Humidity: 00%
Wind Speed: 00 mph
Wind Direction:
Beaufort Sea State:
Water Temperature: 00°F

Pile #

Pile Type: **Pile Name:**

Hammer Make: **Hammer Model:** **Noise Type:** Impact

Start Time: **Stop Time:** **Active Hammer Duration:** 00 seconds

Strike Rate: **Depth of Substrate to Penetrate:**

BLUE UNIT

Hydrophone Distance from Drill: 00 meters

Latitude: **Longitude:**

Water Column Depth: 00.00 meters **Hydrophone Deployed Depth:** 00.00 meters

GREEN UNIT

Hydrophone Distance from Drill: 00 meters

Latitude: **Longitude:**

Water Column Depth: 00.00 meters **Hydrophone Deployed Depth:** 00.00 meters

Notes:

RMS SPL, Peak SPL, SELss, and SELcum data included in **Table 0.**

One-third octave band spectra and Power Spectral Density included in **Figure 0-0.**

Data unweighted.

Pile #	Date	Pile Type	Pile Name	Hammer Make/Model	Noise Type	Start Time	Stop Time	Active Hammer Duartion (seconds)	Pulse Duration	Hammer Strike(s)	Distance From Pile (meters)	RMS unweighted (SPL dB re 1uPa)			Peak unweighted (SPL dB re 1uPa)			SELs-s unweighted (dB re 1uPa^2.s)			SELcum unweighted (dB re 1uPa^2.s)	SELcum Duration (seconds)
												Median	Mean (average)	Maximum	Median	Mean (average)	Maximum	Median	Mean (average)	Maximum		
		78" Casing		DTH Cluster Drill	Impulsive																	
		78" Casing		DTH Cluster Drill	Impulsive																	
		78" Casing		DTH Cluster Drill	Impulsive																	
		78" Casing		DTH Cluster Drill	Impulsive																	
		78" Casing		DTH Cluster Drill	Impulsive																	
		78" Casing		DTH Cluster Drill	Impulsive																	
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		78" Casing		DTH Cluster Drill	Impulsive																	
		78" Casing		DTH Cluster Drill	Impulsive																	
		78" Casing		DTH Cluster Drill	Impulsive																	
		78" Casing		DTH Cluster Drill	Impulsive																	
		78" Casing		DTH Cluster Drill	Impulsive																	

Table X. Data Summary of Piles Monitored (78" Casing)

Pile #	Date	Pile Type	Pile Name	Hammer Make/Model	Noise Type	Start Time	Stop Time	Active Hammer Duartion (seconds)	Pulse Duration	Hammer Strike(s)	Distance From Pile (meters)	RMS unweighted (SPL dB re 1uPa)			Peak unweighted (SPL dB re 1uPa)			SELs-s unweighted (dB re 1uPa^2.s)			SELcum unweighted (dB re 1uPa^2.s)	SELcum Duration (seconds)
												Median	Mean (average)	Maximum	Median	Mean (average)	Maximum	Median	Mean (average)	Maximum		
		42" Pipe Pile		DTH Mono-Hammer	Impulsive																	
		42" Pipe Pile		DTH Mono-Hammer	Impulsive																	
		42" Pipe Pile		DTH Mono-Hammer	Impulsive																	
		42" Pipe Pile		DTH Mono-Hammer	Impulsive																	
		42" Pipe Pile		DTH Mono-Hammer	Impulsive																	
		42" Pipe Pile		DTH Mono-Hammer	Impulsive																	
		42" Pipe Pile		DTH Mono-Hammer	Impulsive																	
		42" Pipe Pile		DTH Mono-Hammer	Impulsive																	
		42" Pipe Pile		DTH Mono-Hammer	Impulsive																	
		42" Pipe Pile		DTH Mono-Hammer	Impulsive																	
		42" Pipe Pile		DTH Mono-Hammer	Impulsive																	
		42" Pipe Pile		DTH Mono-Hammer	Impulsive																	

Table X. Data Summary of Piles Monitored (42” Pipe Pile)

Pile #	Date	Pile Type	Pile Name	Hammer Make/Model	Noise Type	Start Time	Stop Time	Active Hammer Duartion (seconds)	Pulse Duration	Hammer Strike(s)	Distance From Pile (meters)	RMS unweighted (SPL dB re 1uPa)			Peak unweighted (SPL dB re 1uPa)			SELs-s unweighted (dB re 1uPa^2.s)			SELcum unweighted (dB re 1uPa^2.s)	SELcum Duration (seconds)
												Median	Mean (average)	Maximum	Median	Mean (average)	Maximum	Median	Mean (average)	Maximum		
		9" Pipe Pile		DTH Mono-Hammer	Impulsive																	
		9" Pipe Pile		DTH Mono-Hammer	Impulsive																	
		9" Pipe Pile		DTH Mono-Hammer	Impulsive																	
		9" Pipe Pile		DTH Mono-Hammer	Impulsive																	
		9" Pipe Pile		DTH Mono-Hammer	Impulsive																	
		9" Pipe Pile		DTH Mono-Hammer	Impulsive																	
		9" Pipe Pile		DTH Mono-Hammer	Impulsive																	
		9" Pipe Pile		DTH Mono-Hammer	Impulsive																	
		9" Pipe Pile		DTH Mono-Hammer	Impulsive																	
		9" Pipe Pile		DTH Mono-Hammer	Impulsive																	
		9" Pipe Pile		DTH Mono-Hammer	Impulsive																	
		9" Pipe Pile		DTH Mono-Hammer	Impulsive																	

Table X. Data Summary of Piles Monitored (9” Pipe Pile/Rock Anchors)

Pile #	Date	Pile Type	Pile Name	Hammer Make/Model	Noise Type	Start Time	Stop Time	Active Hammer Duartion (seconds)	Pulse Duration	Hammer Strike(s)	Distance From Pile (meters)	RMS unweighted (SPL dB re 1uPa)			Peak unweighted (SPL dB re 1uPa)			SELs-s unweighted (dB re 1uPa^2.s)			SELcum unweighted (dB re 1uPa^2.s)	SELcum Duration (seconds)
												Median	Mean (average)	Maximum	Median	Mean (average)	Maximum	Median	Mean (average)	Maximum		
		4"-6" Pipe Pile		DTH Mono-Hammer	Impulsive																	
		4"-6" Pipe Pile		DTH Mono-Hammer	Impulsive																	
		4"-6" Pipe Pile		DTH Mono-Hammer	Impulsive																	
		4"-6" Pipe Pile		DTH Mono-Hammer	Impulsive																	
		4"-6" Pipe Pile		DTH Mono-Hammer	Impulsive																	
		4"-6" Pipe Pile		DTH Mono-Hammer	Impulsive																	
		4"-6" Pipe Pile		DTH Mono-Hammer	Impulsive																	
		4"-6" Pipe Pile		DTH Mono-Hammer	Impulsive																	
		4"-6" Pipe Pile		DTH Mono-Hammer	Impulsive																	
		4"-6" Pipe Pile		DTH Mono-Hammer	Impulsive																	
		4"-6" Pipe Pile		DTH Mono-Hammer	Impulsive																	
		4"-6" Pipe Pile		DTH Mono-Hammer	Impulsive																	

Table X. Data Summary of Piles Monitored (4-6” Pipe Pile)

Pile #	Date	Pile Name	Hammer Make/Model	Noise Type	Start Time	Stop Time	Active Hammer Duartion (seconds)	Pulse Duration	Hammer Strike(s)	Distance From Pile (meters)	RMS unweighted (SPL dB re 1uPa)			Peak unweighted (SPL dB re 1uPa)			SEL unweighted (dB re 1uPa^2.s)			SELcum unweighted (dB re 1uPa^2.s)	SELcum Duration (seconds)
											Median	Mean (average)	Maximum	Median	Mean (average)	Maximum	Median	Mean (average)	Maximum		
			Rock Hammer	Continuous/ Impulsive																	
			Rock Hammer	Continuous/ Impulsive																	
			Rock Hammer	Continuous/ Impulsive																	
			Rock Hammer	Continuous/ Impulsive																	
			Rock Hammer	Continuous/ Impulsive																	
			Rock Hammer	Continuous/ Impulsive																	
			Rock Hammer	Continuous/ Impulsive																	
			Rock Hammer	Continuous/ Impulsive																	
			Rock Hammer	Continuous/ Impulsive																	
			Rock Hammer	Continuous/ Impulsive																	
			Rock Hammer	Continuous/ Impulsive																	
			Rock Hammer	Continuous/ Impulsive																	

Table X. Data Summary of Piles Monitored (Rock Hammer)

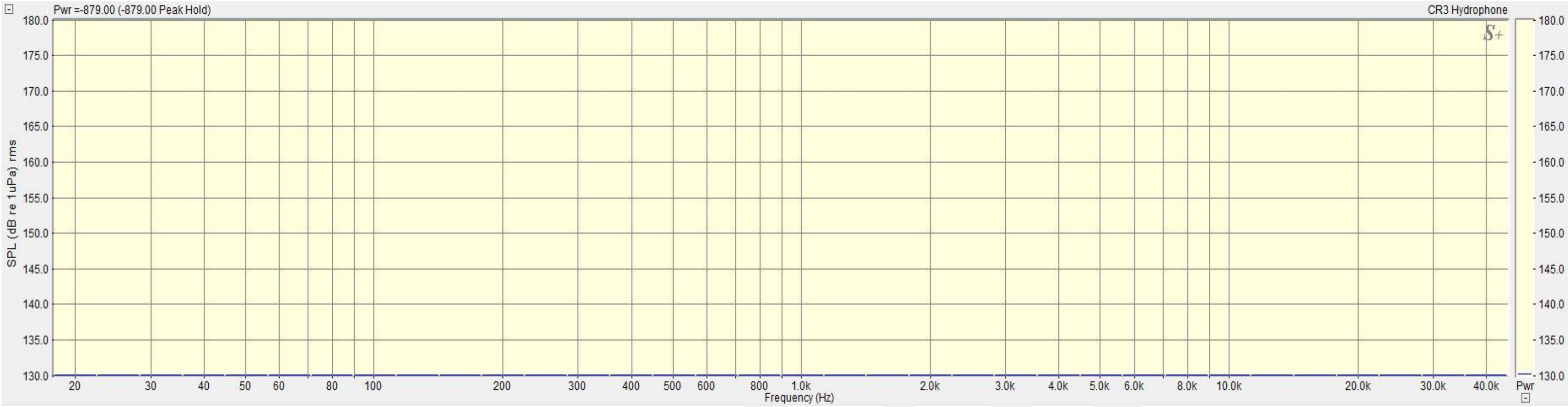

Figure X. 1/3 Octave Band Spectra from X meters for Sheet X installed MONTH DAY, YEAR at TIME

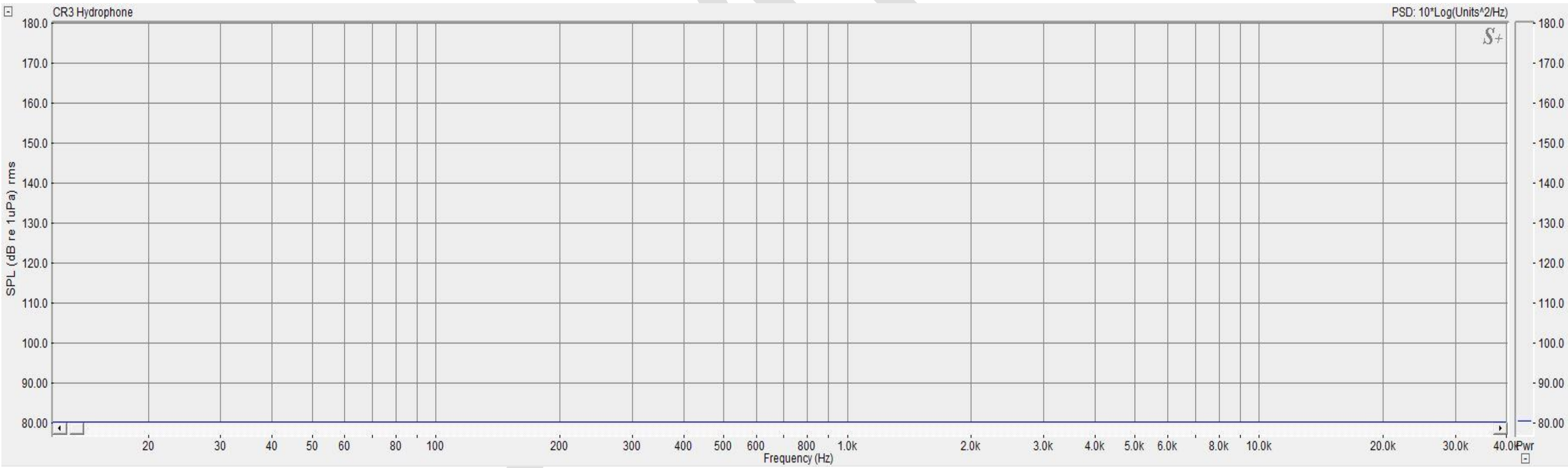

Figure X. Power Spectral Density from X meters for Sheet X installed MONTH DAY, YEAR at TIME

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Appendix D – Hydroacoustic Monitoring Report: Vibratory Sample

P381 Constructors

Hydroacoustic Monitoring Report

Date: **Project:** 3121020 PNSY Multi-Mission Dry Dock 1

Project Information

Project Name: P381 Multi-Mission Dry Dock #1
Location: Portsmouth Naval Shipyard, Kittery, Maine
Project/Contract Number: N40085-21-C-0011
Hydroacoustic Engineer - Lead: Theodore Hallett

Hydrologic and Geologic Information

Body of Water: Portsmouth – Lower Piscataqua River
Type: Estuarine
Hydrologic Unit: 01060003
Geology: Glacial Till, Phyllite, Quartzite, Diorite and/or Shale

Equipment Information

Hydrophone: Cetacean Research CR3
Recording Device: Spectra DAQ-200
Sampling Rate: 96kHz
Bit Depth: 24 Bit

Weather

Meteorological Conditions:
Cloud Cover: 00%
Air Temperature: 00°F
Humidity: 00%
Wind Speed: 00 mph
Wind Direction:
Beaufort Sea State:
Water Temperature: 00°F

Pile #

Pile Type: **Pile Name:**

Hammer Make: **Hammer Model:** **Noise Type:** Continuous/Vibratory

Start Time: **Stop Time:** **Active Hammer Duration:** 00 seconds

BLUE UNIT

Hydrophone Distance from Pile: 00 meters

Latitude: **Longitude:**

Water Column Depth: 00.00 meters **Hydrophone Deployed Depth:** 00.00 meters

GREEN UNIT

Hydrophone Distance from Pile: 00 meters

Latitude: **Longitude:**

Water Column Depth: 00.00 meters **Hydrophone Deployed Depth:** 00.00 meters

Notes:

RMS SPL and SELcum data included in **Table 0.**

One-third octave band spectra and Power Spectral Density included in **Figure 0-0.**

Data unweighted.

Pile #	Date	Pile Type	Pile Name	Hammer Make/Model	Noise Type	Start Time	Stop Time	Active Hammer Duartion (seconds)	Distance From Pile (meters)	RMS unweighted (SPL dB re 1uPa)			SELcum unweighted (dB re 1uPa^2.s)	SELcum Duration (seconds)
										Median	Mean (average)	Maximum		
		102" Casing		Rotary Drill	Continuous / Vibratory									
		102" Casing		Rotary Drill	Continuous / Vibratory									
		102" Casing		Rotary Drill	Continuous / Vibratory									
		102" Casing		Rotary Drill	Continuous / Vibratory									
		102" Casing		Rotary Drill	Continuous / Vibratory									
		102" Casing		Rotary Drill	Continuous / Vibratory									
		102" Casing		Rotary Drill	Continuous / Vibratory									
		102" Casing		Rotary Drill	Continuous / Vibratory									
		102" Casing		Rotary Drill	Continuous / Vibratory									
		102" Casing		Rotary Drill	Continuous / Vibratory									
		102" Casing		Rotary Drill	Continuous / Vibratory									
		102" Casing		Rotary Drill	Continuous / Vibratory									

Table X. Data Summary of Piles Monitored (102” Casing)

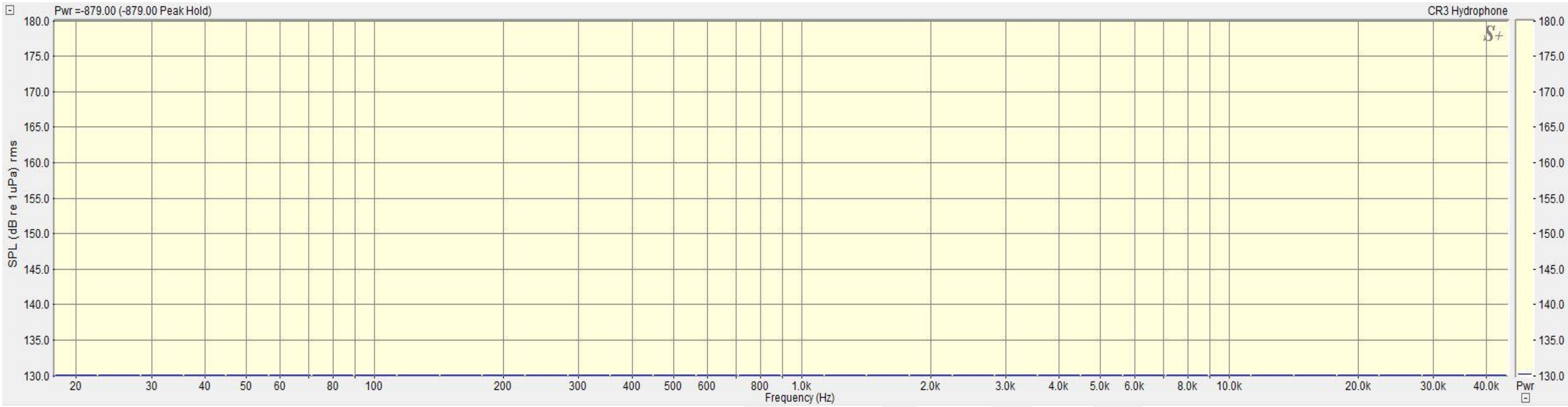

Figure X. 1/3 Octave Band Spectra from X meters for Sheet X installed MONTH DAY, YEAR at TIME

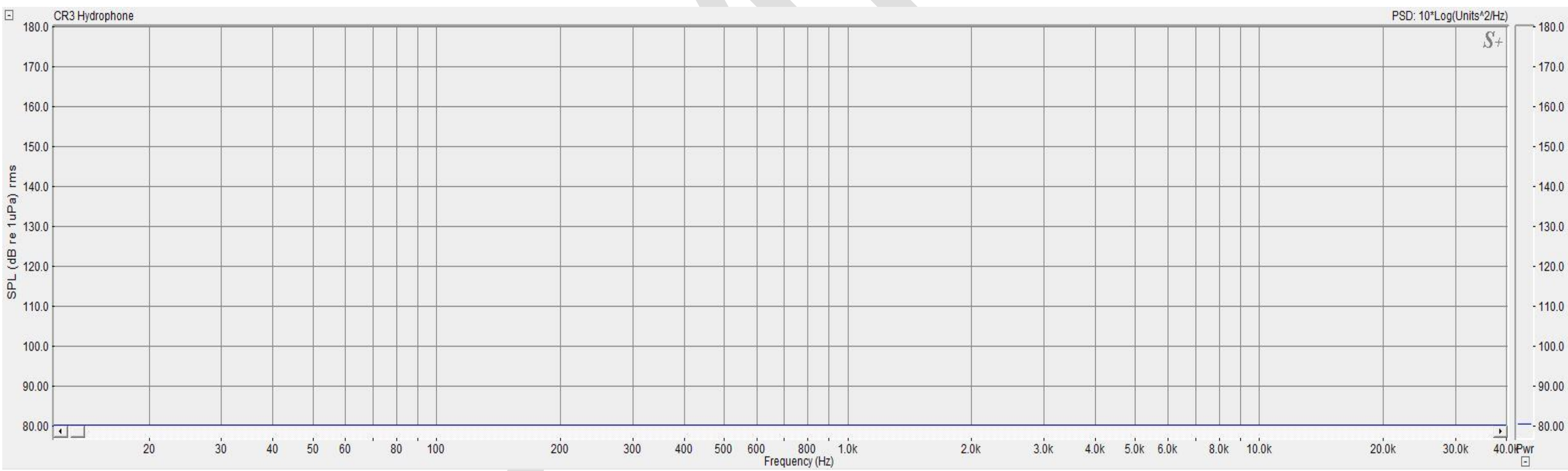

Figure X. Power Spectral Density from X meters for Sheet X installed MONTH DAY, YEAR at TIME

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Appendix D
Final Hydroacoustic Monitoring Reports for P-381 Year One IHA Period

INTRODUCTION

Multifunctional Expansion of Dry Dock 1 (P-381) is one of three projects that support the overall expansion and modification of Dry Dock 1. The P-381 project will be constructed within the same footprint of the super flood basin over an approximated 7-year period. In-water activities are expected to occur within the first 5 years, between March 2022 and March 2027.

An IHA application for in-water year 1 work for the P-381 project was submitted in December of 2021 while the construction of the super flood basin (P-310) and extension of portal crane rail and utilities (P-1074) was in the final phases of construction. The application was accepted and valid from April 1, 2022 through March 31, 2023. The IHA for P-381 year 1 in-water construction included pile driving, rock hammering, and drilling activities that were anticipated during April 1, 2022 through March 31, 2023.

Year 1 construction activities focused on the preparation of the walls and floors of the super flood basin to support the placement of monoliths and the construction of the two dry dock positions. The primary work needed to prepare the super flood basin involves structural reinforcement of the existing berths and floor within the super flood basin, bedrock removal, and demolition of portions of the super flood basin walls. Most of the preparatory work will occur behind the existing super flood basin walls that would act as a barrier to sound and would contain underwater noise to within a small portion of the Piscataqua River.

Assumptions relating to the project schedule and the projection of noise associated with in-water construction was presented as conservative assumptions. In order to maintain project schedules, it was assumed that multiple pieces of equipment would operate at the same time within the basin. An emphasis was put on capturing isolated noise-generating data. Unforeseen conditions such as inclement weather, equipment malfunctions, and design changes lead to the delay of execution of work.

EQUIPMENT AND METHODS

Equipment

Live measurements for each noise type were made at various locations depending on the safety and accessibility. Hydrophones were deployed at depths ranging from 3 to 7 meters. Far-field measurements were taken from Berth 11C when accessible. These live measurements were made using Cetacean Research CR3 hydrophones. The CR3 hydrophones were connected to a SpectraDAQ-200 which fed directly into the SpectraPLUS-SC software. Wav files were saved directly onto multiple LaCie hard drives due to events occasionally lasting longer than an hour as well as redundancy.

All recordings were analyzed and processed with the SpectraPLUS-SC software.

Calibration

The measurement systems were calibrated every day prior to use in the field with a G.R.A.S. Type 42AP pistonphone and Cetacean Research PC-CR3 hydrophone coupler (K-factor = -2.7dB). With a hydrophone placed in the coupler of the pistonphone, the calibration level and frequency is nominally 114 dB re 20 µPa at 250 Hz or 140 dB re 1 µPa at 250 Hz. The actual sound pressure level, corrected for static ambient pressure, is shown on the display of the pistonphone. The system calibration status was checked at the end of every day as well.

<u>Driving, Drilling & Hammering Measurements</u>

42-inch diameter

Pile driving measurements were made for the center wall support which consisted of temporary launching piles and piles for a temporary access platform (Daily Report: *June 10, 2022*). Six, temporary launching piles were installed using a 42-inch DTH mono-hammer to excavate shafts for pile installation. A Mincon MP340 mono-hammer was used to install the 42-inch casings.

Measurements for the pile being installed were taken from two hydrophones deployed using two davit arms place on the Entrance Structure. One davit was placed on the inside of the basin (Super flood basin; unprotected by the bubble curtain). The other davit was placed on the outside of the basin (Piscataqua River; protected by the bubble curtain). These locations were chosen to capture data as well as ensure compliance with the bubble curtain system installed.

Once the piles were successfully installed, the center wall platform was assembled (June 2023 – August 2023)

Mechanical Rock Removal – Bedrock Removal (42-inch diameter)

During assembly of the center wall platform, mechanical bedrock removal began near the West Closure Wall (WCW) (Daily Report: *September 7, 2022; September 8, 2022; September 9, 2022*). This work was performed to support a platform that will be installed around the WCW to support the future Dry Dock 1 North Entrance Structure. The activity utilized a 42-inch DTH mono-hammer advancing rock borings to remove bedrock material.

Measurements for this activity were taken from the near-field via the barge performing the work. The hydrophone was deployed away from the airlifting hose to avoid interference with drilling noise. Far-field measurements were taken from the Berth 11C outside the basin (Piscataqua River; protected by the bubble curtain). Due to the boring locations (behind the WCW), no direct line of sight was available for the far-field hydrophone location (see Map figure in respective daily reports in Appendix A). This means that the hydrophone on Berth 11C would not have been capable of capturing the direct sound but captured reflections from the source.

Data collected from this activity was initially processed exclusively as impulsive data, however, after further research, data was processed as vibratory or impulsive depending on whether or not the piston in the DTH mono-hammer was active or not. Supplemental Report provided in Appendix C.

102-inch Casing

After the completion of the center wall platform, installation of 102-inch casings began (Daily Report: *November 28, 2022; December 2, 2022*) The casing are being installed along the center-wall area, splitting the future Dry Dock 1 North and Dry Dock 1 West. A Bauer BG45 Rotary Drilling Rig (Base Carrier BS95) was used to install 102-inch casings from the center wall platform (CWP).

Measurements for this activity were taken from the CWP. The near-field hydrophone was deployed from the lower level of the platform. This location allowed safe and easy access to the near-field hydrophone to change depths depending on tide and monitor data in real-time. The changing of depths was necessary as drilling could last multiple hours. No far-field location was accessible due to multiple dredge material barges, drill barge, fuel barge, and boat crew barges tied up along Berth 11B and Berth 11C. Further data was extrapolated from captured data using the practical spreading loss model.

Mechanical Rock Removal – Hydraulic Rock Hammer

After the installation of a set of 102-inch casings from the CWP, the platform moves along tracks to reposition itself for the next set of 102-inch casings. While the platform began its reposition, mechanical rock removal to the Berth 11A face began (Daily Report: *December 13, 2022; December 20, 2022; December 21, 2022; January 12, 2023*). This demolition work was removing existing concrete shutter panels making up the face of Berth 11A. This additional area in the super flood basin is needed to fit the Dry Dock 1 North monoliths. The activity utilized a NPK GH50 hydraulic hammer attachment on Komatsu PC1250 excavator. The operation had a significant amount of starts and stops due to the operator and foreman not being able to see the profile the rock hammer inflicts on the wall.

Near-field data was collected from various locations due to the fact the super flood basin became saturated with barges and material for concurrent activities including support for the center wall platform, dredging, material barges, fuel barges, etc. Most of the data collected from a farther location (e.g. 70 meters on December 13, 2022) collected interference from boats moving barges in and out of the super flood basin. This lead to most of the data collected being saturated with non-hydraulic rock hammer noise. Due to the work being a demolition on Berth 11A, there was no safe place along Berth 11A to deploy the hydrophone within 10 meters. Further data was extrapolated from captured data using the practical spreading loss model.

Once the CWP was moved into its new position, bridge access was regained. The near-field hydrophone on January 12, 2023 was deployed from the CWP, approximately 30 meters-40 meters from the rock hammer activity. The distance was not consistent as the location of the Komatsu excavator/hydraulic rock hammer was sporadic and was often repositioned along Berth 11A. This data was the most consistent as it was the closest to the work being performed and away from the boats moving barges in and out of the super flood basin through the entrance structure. No far-field location was accessible due to multiple dredge material barges, drill barge, fuel barge, and boat crew barges tied up along Berth 11B and Berth 11C.

9-inch diameter holes – tie downs

Possibly not during the 2022-2023 IHA. Not anticipated until March of 2023

4 to 6-inch diameter – relief holes

Possibly not during the 2022-2023 IHA. Not anticipated until March of 2023

Measurement Results

Noise-generating activities were monitored live and recorded for further processing. RMS, Peak, SELss, SELcum (per pile), 1/3rd octave band spectra, and Power Spectral Density (PSD) are included in Appendix A – Daily Reports. All data presented is unweighted.

SELcum (24 hour) is included in Appendix B – Supplemental Data. SELcum (24 hour) is determined by adding up the sound energy associated with all pile strikes that occur over a given day. If the single strikes SEL and the number of daily strikes is known, the cumulative SEL can be calculated with the following equation:

$$SEL_{cumulative} = SEL_{ss} + 10\log(\text{number of strikes}) \quad \text{eq. 1}$$

Extrapolated data is included in Appendix B – Supplemental Data. Extrapolated data used the practical spreading loss model in which transmission loss (TL) in dB units can be defined by:

$$TL = 15\log(R_2/R_1) \quad \text{eq. 2}$$

Where: R_1 is the distance of a known or measured sound level

R_2 is the estimated distance that is required for sound to attenuate to a prescribed acoustic threshold.

Sound is assumed to diminish at a rate of 4.5 dB per doubling of distance (F=15). This is generally a conservative approach and should be used unless there is site-specific information indicating that a different attenuation rate is appropriate (i.e. bubble curtain). In practice, equation 2 can be rearranged as the following equation:

$$dB_2 = dB_1 - F*\log(D_2/D_1) \quad \text{eq. 3}$$

Where: dB_1 is the sound level at a distance of D_1 from the pile

dB_2 is the sound level at a distance of D_2 from the pile

APPENDIX A – DAILY REPORTS

P381 Constructors

Hydroacoustic Monitoring Daily Report

Date: June 10, 2022 **Project:** 3121020 PNSY Multi-Mission Dry Dock 1

Project Information

Project Name: P381 Multi-Mission Dry Dock #1
Location: Portsmouth Naval Shipyard, Kittery, Maine
Project/Contract Number: N40085-21-C-0011
Hydroacoustic Engineer - Lead: Theodore Hallett

Hydrologic and Geologic Information

Body of Water: Portsmouth – Lower Piscataqua River
Type: Estuarine
Hydrologic Unit: 01060003
Geology: Glacial Till, Phyllite, Quartzite, Diorite and/or Shale

Equipment Information

Hydrophone: Cetacean Research CR3
Recording Device: Spectra DAQ-200
Sampling Rate: 96kHz
Bit Depth: 24 Bit

Weather

Meteorological Conditions: Mostly Sunny
Cloud Cover: 30%
Air Temperature: 75°F
Humidity: 75%
Wind Speed: 7 mph
Wind Direction: South-West
Beaufort Sea State: 2
Water Temperature: 58°F

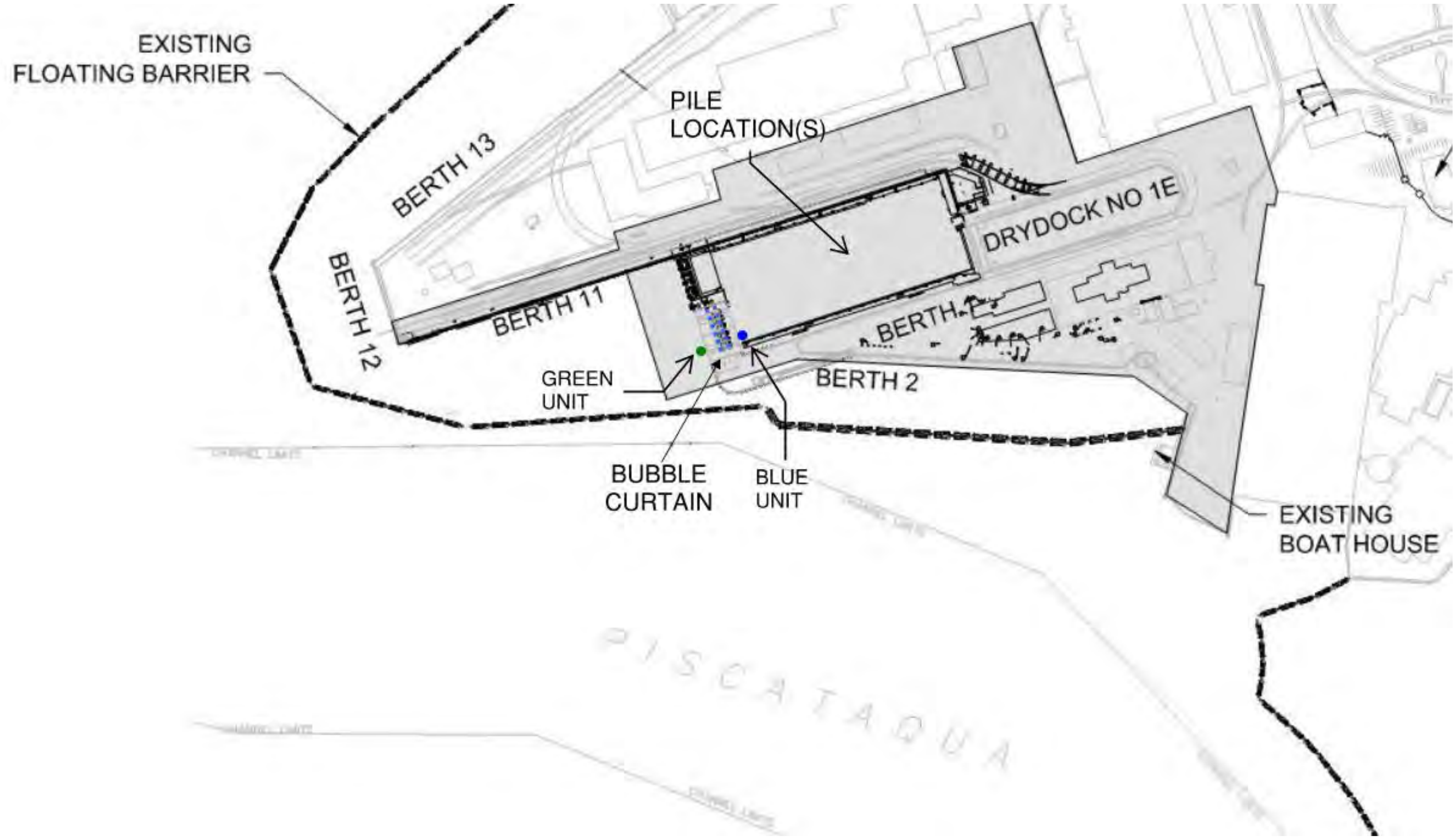

Figure 1. Location of Hydrophone Deployment

Event/Pile

Pile Type: 42” Casing **Activity:** DTH Mono-Hammer **IHA Count:** 1 of 10

Drill Make: Mincon **Drill Model:** MP340 **Noise Type:** Impulsive

Start Time: 10:22 **Stop Time:** 10:28 **Active Hammer Duration:** 358 seconds

<u>BLUE UNIT</u>

Hydrophone Distance from Drill: 65 meters

Latitude: 43°04’49.87”N **Longitude:** 70°44’39.98”W

Water Column Depth: 06.00 meters **Hydrophone Deployed Depth:** 03.00 meters

<u>GREEN UNIT</u>

Hydrophone Distance from Drill: N/A

Latitude: N/A **Longitude:** N/A

Water Column Depth: N/A **Hydrophone Deployed Depth:** N/A

Notes:

Mincon MP340 mono-hammer used to install 42” casings. Blue hydrophone was deployed on unprotected side of bubble curtain (inside basin). Green hydrophone was not deployed due to boat crew moving barge from inside basin through entrance structure to outside the basin.

Post-process analyses indicate pulse durations were about 55 milliseconds (ms).

RMS SPL, Peak SPL, SEL, and SELcum data included in **Table 1.**

One-third octave band spectra and Power Spectral Density included in **Figure 2-3.**

Data unweighted.

Event/Pile

Pile Type: 42" Casing **Activity:** DTH Mono-Hammer **IHA Count:** 2 of 10

Drill Make: Mincon **Drill Model:** MP340 **Noise Type:** Impulsive

Start Time: 10:28 **Stop Time:** 10:32 **Active Hammer Duration:** 195 seconds

<u>BLUE UNIT</u>

Hydrophone Distance from Drill: 65 meters

Latitude: 43°04'49.87"N **Longitude:** 70°44'39.98"W

Water Column Depth: 06.00 meters **Hydrophone Deployed Depth:** 03.00 meters

<u>GREEN UNIT</u>

Hydrophone Distance from Drill: 84 meters

Latitude: 43°04'49.87"N **Longitude:** 70°44'40"W

Water Column Depth: 07.00 meters **Hydrophone Deployed Depth:** 03.50 meters

Notes:

Mincon MP340 mono-hammer used to install 42" casings. Blue hydrophone was deployed on unprotected side of bubble curtain (inside basin). Green hydrophone was deployed on protected side of bubble curtain (outside basin). Bubble curtain was turned on during drilling activities.

Post-process analyses indicate pulse durations were about 56 milliseconds (ms).

RMS SPL, Peak SPL, SEL, and SELcum data included in **Table 1.**

One-third octave band spectra and Power Spectral Density included in **Figure 4-7.**

Data unweighted.

Event/Pile

Pile Type: 42” Casing **Activity:** DTH Mono-Hammer **IHA Count:** 3 of 10

Drill Make: Mincon **Drill Model:** MP340 **Noise Type:** Impulsive

Start Time: 10:59 **Stop Time:** 11:14 **Active Hammer Duration:** 901 seconds

BLUE UNIT

Hydrophone Distance from Drill: 65 meters

Latitude: 43º04’49.87”N **Longitude:** 70°44’39.98”W

Water Column Depth: 06.00 meters **Hydrophone Deployed Depth:** 03.00 meters

GREEN UNIT

Hydrophone Distance from Drill: 84 meters

Latitude: 43º04’49.87”N **Longitude:** 70°44’40”W

Water Column Depth: 07.00 meters **Hydrophone Deployed Depth:** 03.50 meters

Notes:

Mincon MP340 mono-hammer used to install 42” casings. Blue hydrophone was deployed on unprotected side of bubble curtain (inside basin). Green hydrophone was deployed on protected side of bubble curtain (outside basin). Bubble curtain was turned on during drilling activities.

Post-process analyses indicate pulse durations were about 56 milliseconds (ms).

RMS SPL, Peak SPL, SEL, and SELcum data included in **Table 1.**

One-third octave band spectra and Power Spectral Density included in **Figure 8-11.**

Data unweighted.

Event/Pile

Pile Type: 42” Casing **Activity:** DTH Mono-Hammer **IHA Count:** 4 of 10

Drill Make: Mincon **Drill Model:** MP340 **Noise Type:** Impulsive

Start Time: 11:33 **Stop Time:** 11:55 **Active Hammer Duration**: 1328 seconds

BLUE UNIT

Hydrophone Distance from Drill: 65 meters

Latitude: 43º04’49.87”N **Longitude:** 70°44’39.98”W

Water Column Depth: 06.00 meters **Hydrophone Deployed Depth:** 03.00 meters

GREEN UNIT

Hydrophone Distance from Drill: 84 meters

Latitude: 43º04’49.87”N **Longitude:** 70°44’40”W

Water Column Depth: 07.00 meters **Hydrophone Deployed Depth:** 03.50 meters

Notes:

Mincon MP340 mono-hammer used to install 42” casings. Blue hydrophone was deployed on unprotected side of bubble curtain (inside basin). Green hydrophone was deployed on protected side of bubble curtain (outside basin). Bubble curtain was turned on during drilling activities.

Post-process analyses indicate pulse durations were about 60 milliseconds (ms).

RMS SPL, Peak SPL, SEL, and SELcum data included in **Table 1.**

One-third octave band spectra and Power Spectral Density included in **Figure 12-15.**

Data unweighted.

Date	Pile Type	Hammer Make/Model	Noise Type	Start Time	Stop Time	Active Hammer Duration (seconds)	Hammer Strikes	Pulse Duration (seconds)	Distance From Pile (meters)	RMS unweighted (SPL dB re 1uPa)			Peak unweighted (SPL dB re 1uPa)			SELss unweighted (dB re 1uPa^2.s)			SELcum unweighted (dB re 1uPa^2.s)
										Median	Average	Range	Median	Average	Range	Median	Average	Range	
6/10/2022	42" Pipe Pile	Mincon MP340	Impulsive	10:22	10:28	358	2,864	0.055	65	155.68	155.81	150.07 - 161.57	168.19	168.79	151.22 - 175.96	146.65	146.77	141.04 - 152.54	181.22
									ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
6/10/2022	42" Pipe Pile	Mincon MP340	Impulsive	10:28	10:32	195	1,755	0.056	65	155.47	156.09	130.51 - 162.84	169.90	170.55	138.39 - 176.90	146.44	147.06	121.48 - 153.81	178.88
									84	137.49	137.21	125.09 - 149.28	148.06	148.16	131.51 - 166.94	128.46	128.18	116.06 - 140.25	160.90
6/10/2022	42" Pipe Pile	Mincon MP340	Impulsive	10:59	11:14	901	8,109	0.056	65	156.04	156.24	124.25 - 165.08	170.08	170.65	136.49 - 182.22	147.01	147.21	115.22 - 156.05	186.09
									84	137.21	137.21	120.68 - 141.99	148.85	148.83	130.77 - 153.94	128.18	128.18	111.65 - 132.96	167.27
6/10/2022	42" Pipe Pile	Mincon MP340	Impulsive	11:33	11:55	1,328	13,280	0.060	65	157.54	159.45	121.42 - 176.05	171.69	173.34	132.55 - 189.95	147.54	149.45	111.42 - 166.05	188.78
									84	138.04	139.63	121.64 - 160.37	149.80	151.11	129.51 - 176.28	129.01	130.59	110.92 - 145.61	170.24

Table 1. Data Summary of Piles Monitored

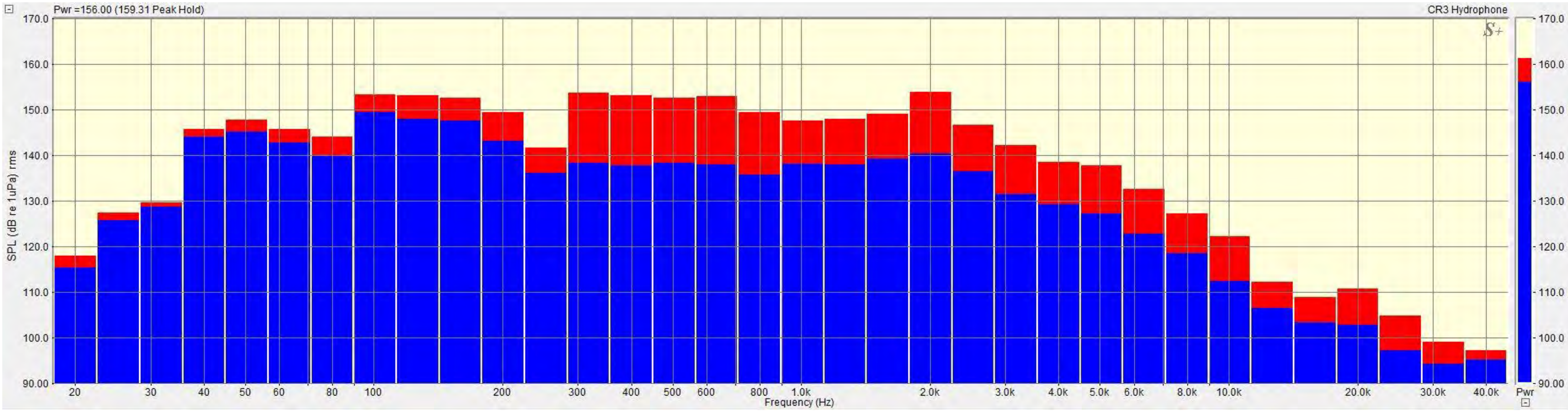

Figure 2. 1/3 Octave Band Spectra from 65 meters for Pile 1 installed June 10, 2021 at 10:22

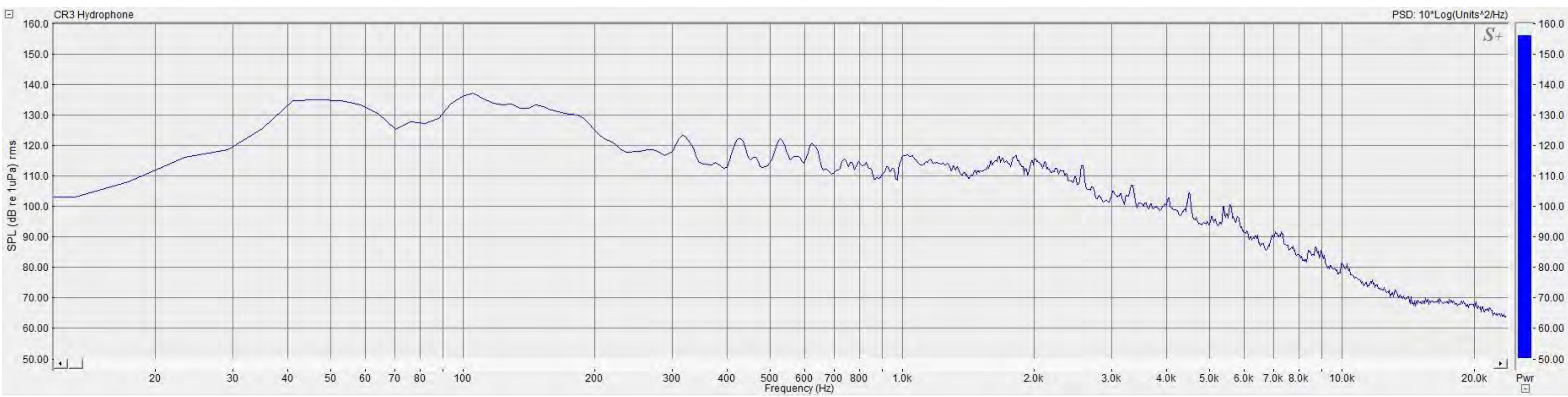

Figure 3. Power Spectral Density Plot from 65 meters for Pile 1 installed June 10, 2021 at 10:22

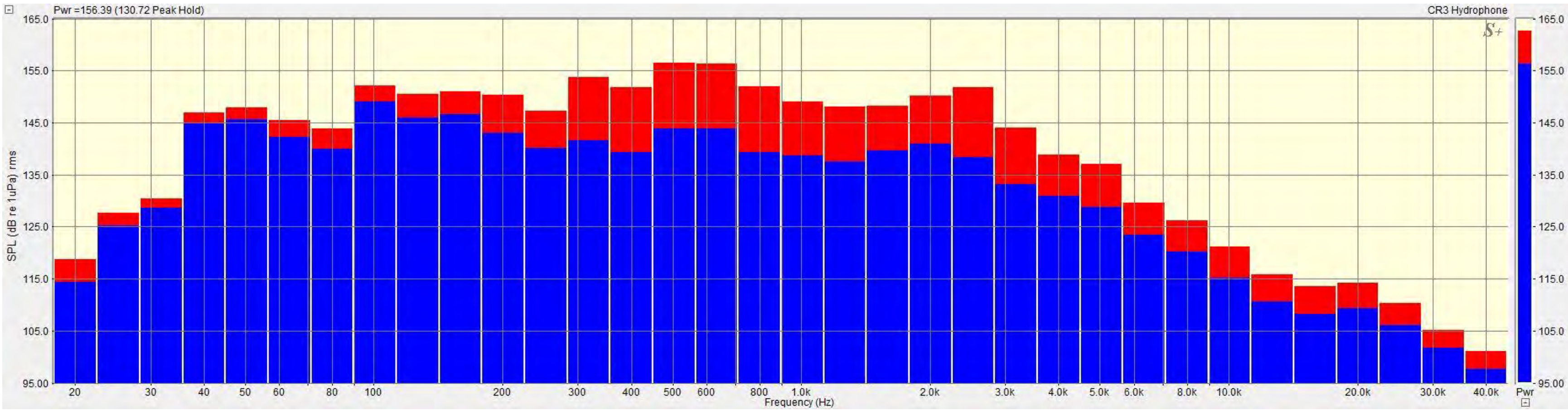

Figure 4. 1/3 Octave Band Spectra from 65 meters for Pile 2 installed June 10, 2021 at 10:28

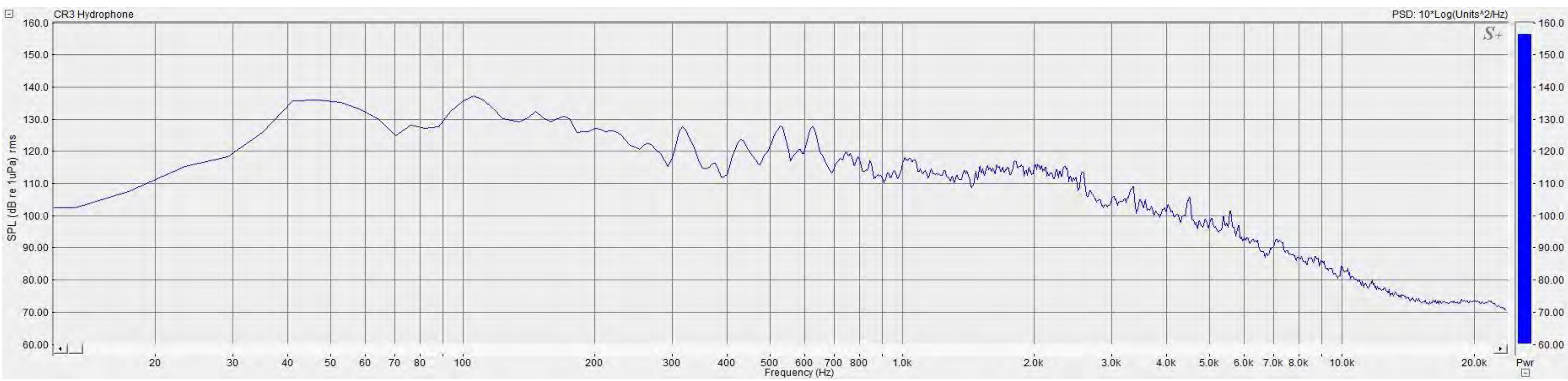

Figure 5. Power Spectral Density Plot from 65 meters for Pile 2 installed June 10, 2021 at 10:28

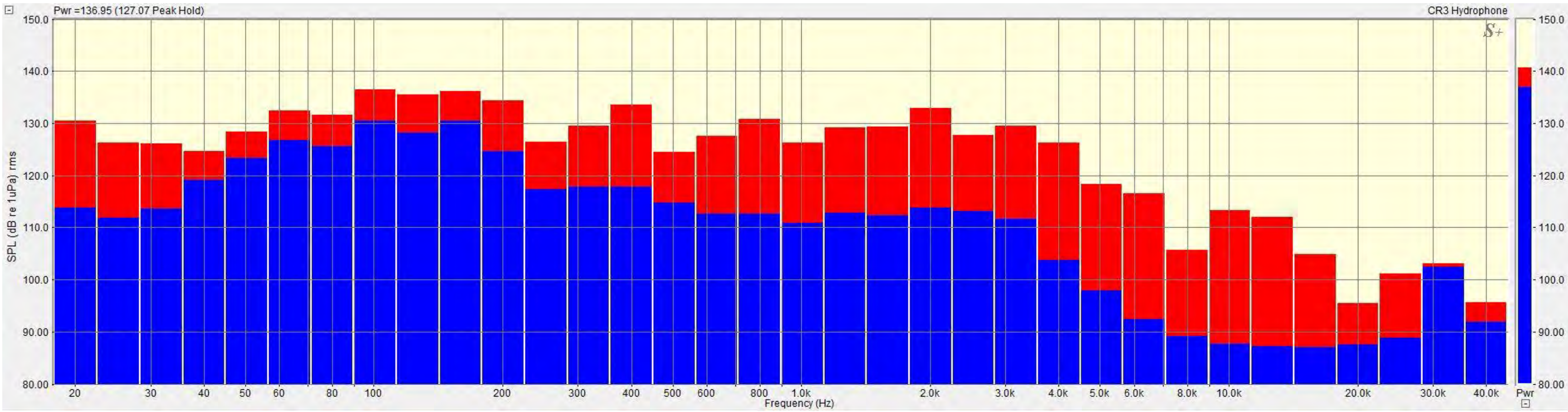

Figure 6. 1/3 Octave Band Spectra from 84 meters for Pile 2 installed June 10, 2021 at 10:28

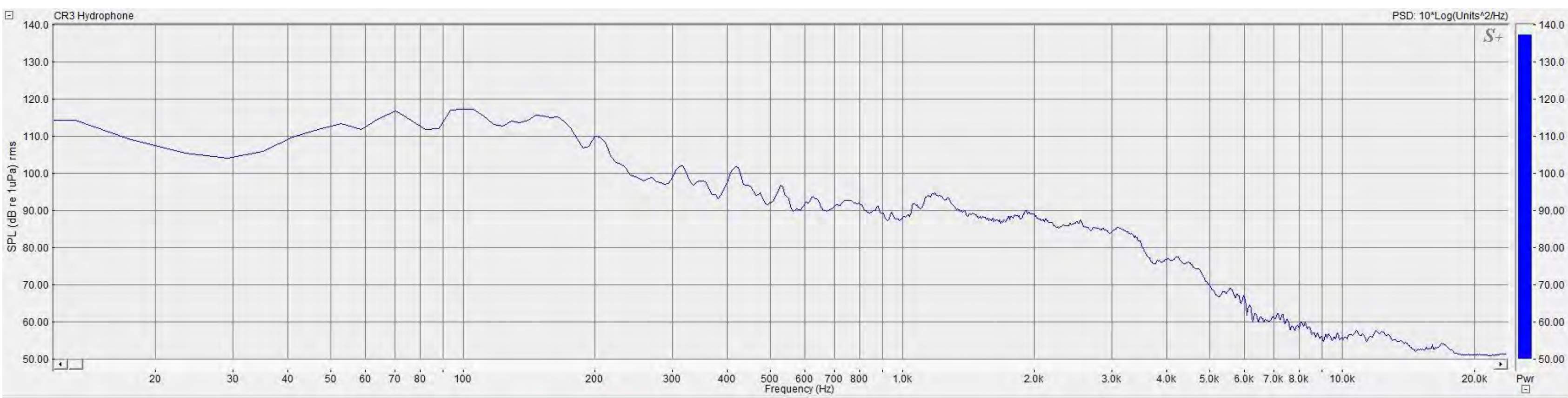

Figure 7. Power Spectral Density Plot from 84 meters for Pile 2 installed June 10, 2021 at 10:28

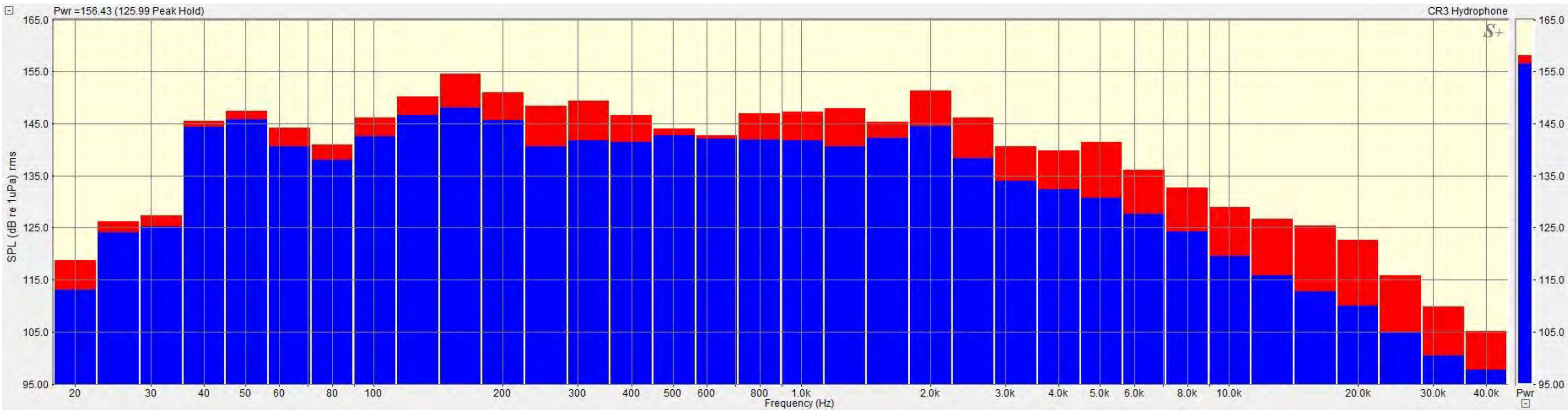

Figure 8. 1/3 Octave Band Spectra from 65 meters for Pile 3 installed June 10, 2021 at 10:59

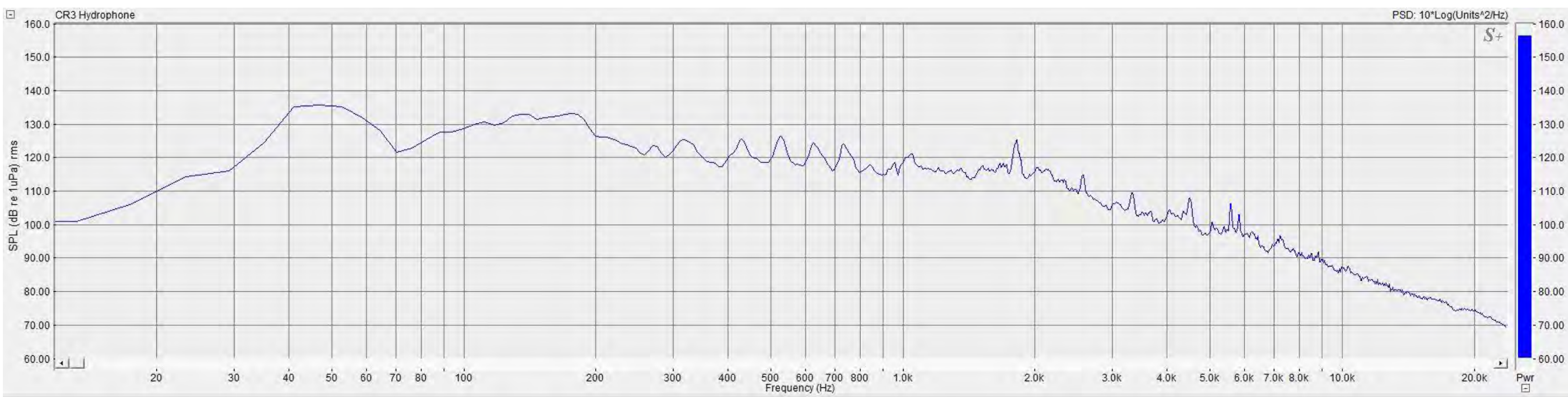

Figure 9. Power Spectral Density Plot from 65 meters for Pile 3 installed June 10, 2021 at 10:59

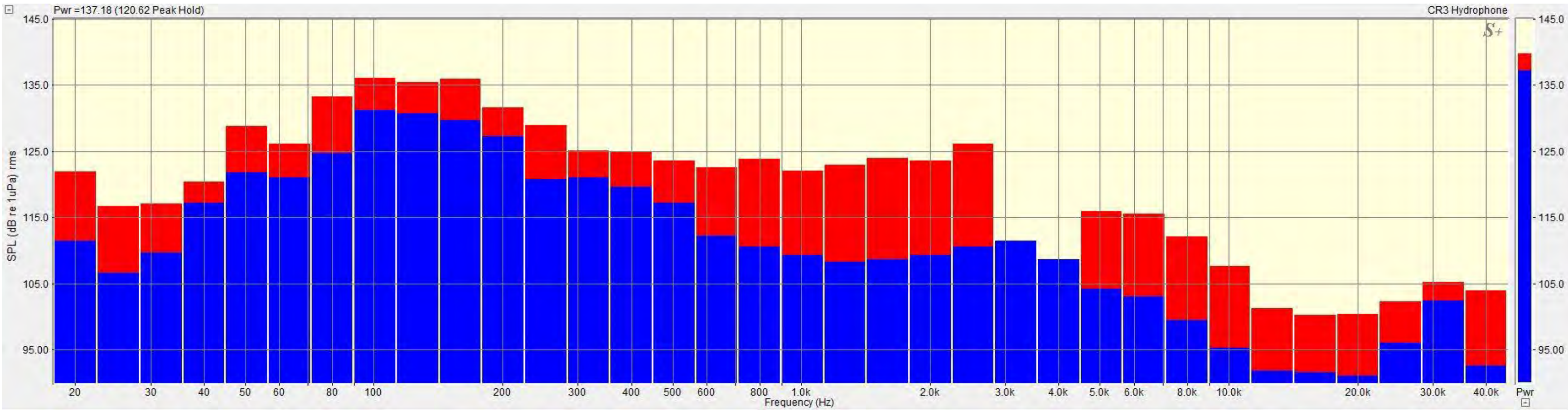

Figure 10. 1/3 Octave Band Spectra from 84 meters for Pile 3 installed June 10, 2021 at 10:59

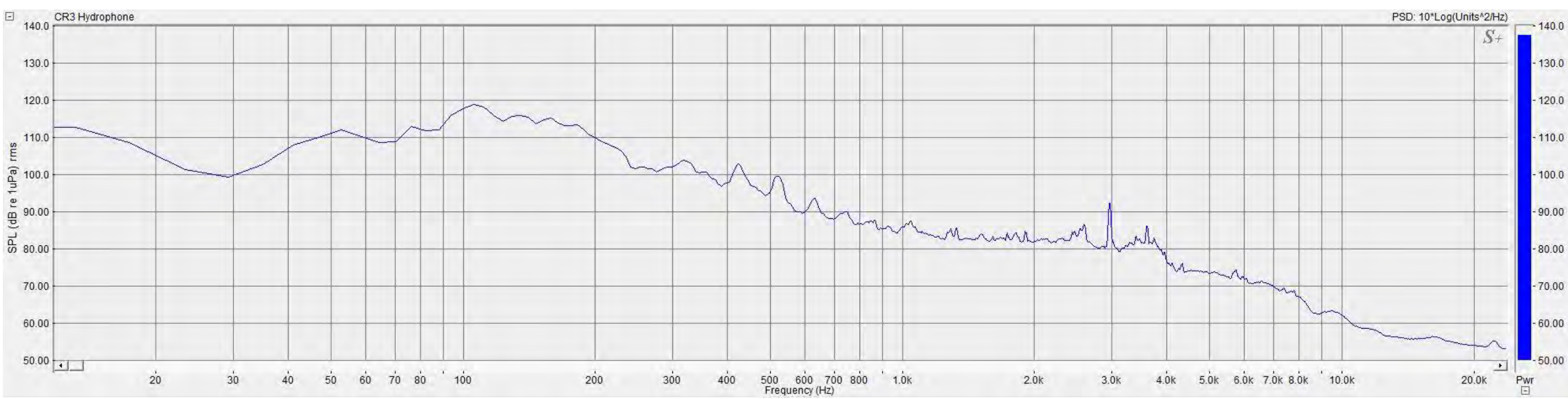

Figure 11. Power Spectral Density Plot from 84 meters for Pile 3 installed June 10, 2021 at 10:59

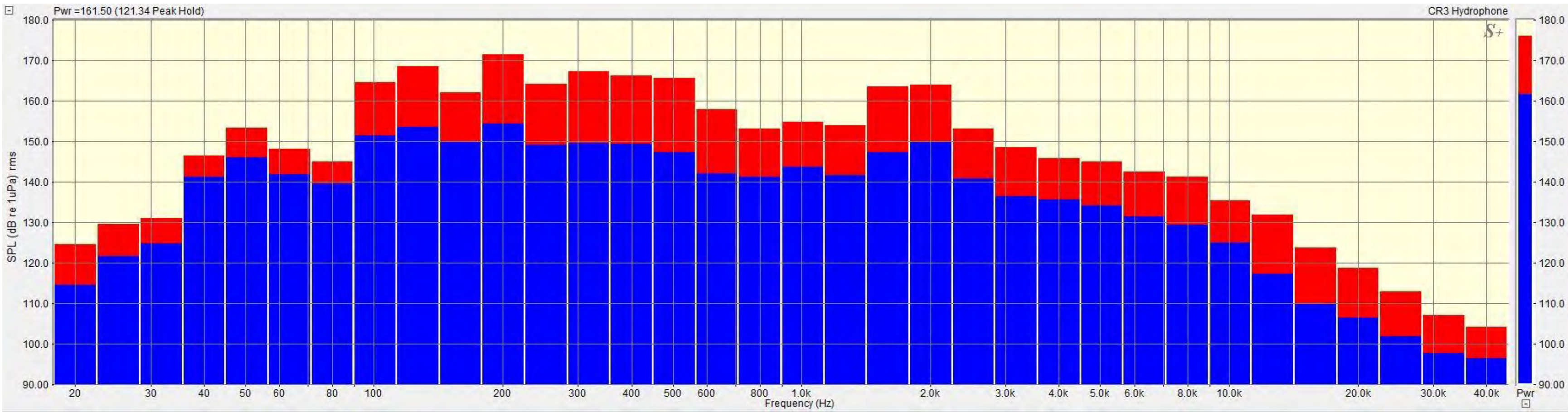

Figure 12. 1/3 Octave Band Spectra from 65 meters for Pile 4 installed June 10, 2021 at 11:33

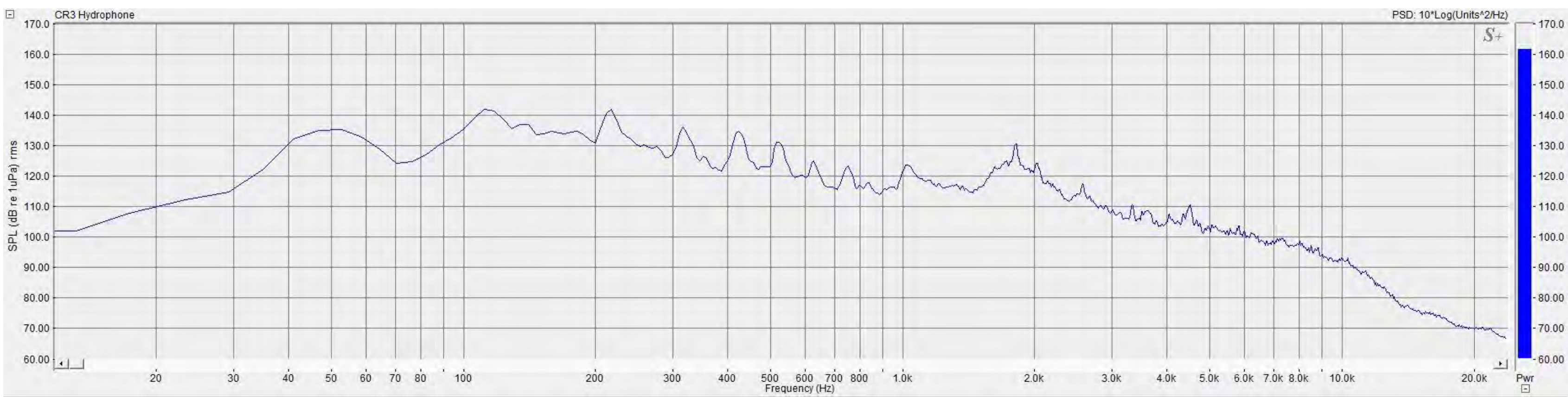

Figure 13. Power Spectral Density Plot from 65 meters for Pile 4 installed June 10, 2021 at 11:33

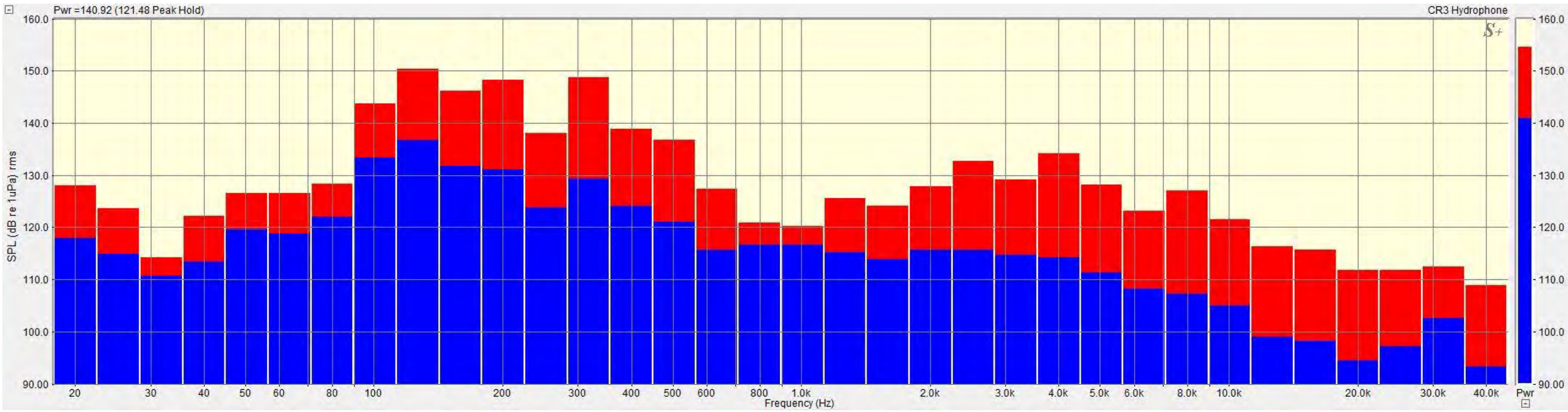

Figure 14. 1/3 Octave Band Spectra from 84 meters for Pile 4 installed June 10, 2021 at 11:33

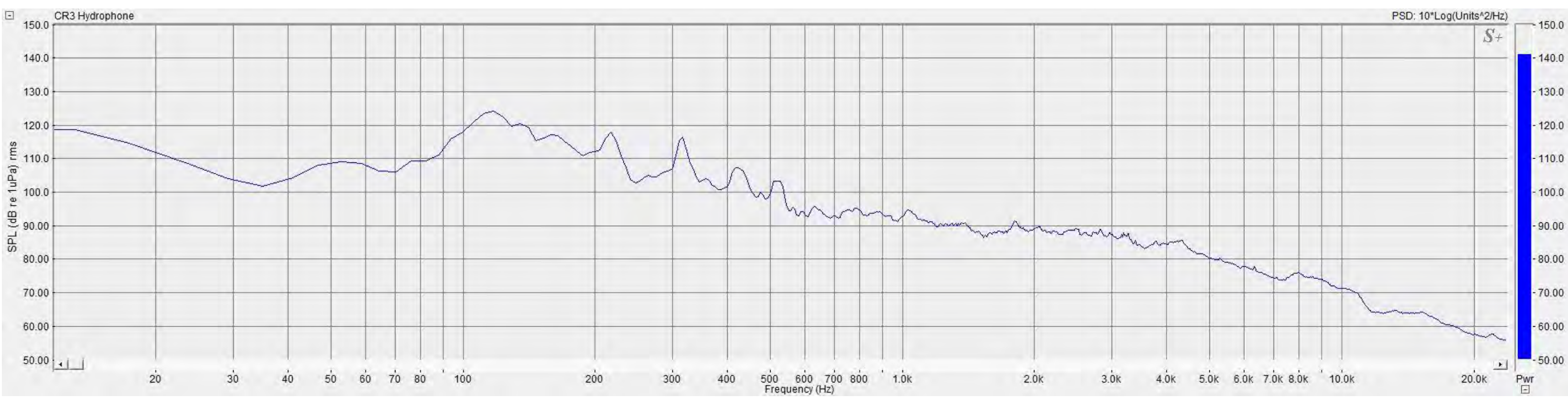

Figure 15. Power Spectral Density Plot from 84 meters for Pile 4 installed June 10, 2021 at 11:33

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P381 Constructors

Hydroacoustic Monitoring Daily Report

Date: September 7, 2022 **Project:** 3121020 PNSY Multi-Mission Dry Dock 1

Project Information

Project Name: P381 Multi-Mission Dry Dock #1
Location: Portsmouth Naval Shipyard, Kittery, Maine
Project/Contract Number: N40085-21-C-0011
Hydroacoustic Engineer - Lead: Theodore Hallett

Hydrologic and Geologic Information

Body of Water: Portsmouth – Lower Piscataqua River
Type: Estuarine
Hydrologic Unit: 01060003
Geology: Glacial Till, Phyllite, Quartzite, Diorite and/or Shale

Equipment Information

Hydrophone: Cetacean Research CR3
Recording Device: Spectra DAQ-200
Sampling Rate: 96kHz
Bit Depth: 24 Bit

Weather

Meteorological Conditions: Overcast
Cloud Cover: 10%
Air Temperature: 68°F
Humidity: 73%
Wind Speed: 6 mph
Wind Direction: South-West
Beaufort Sea State: 2
Water Temperature: 62°F

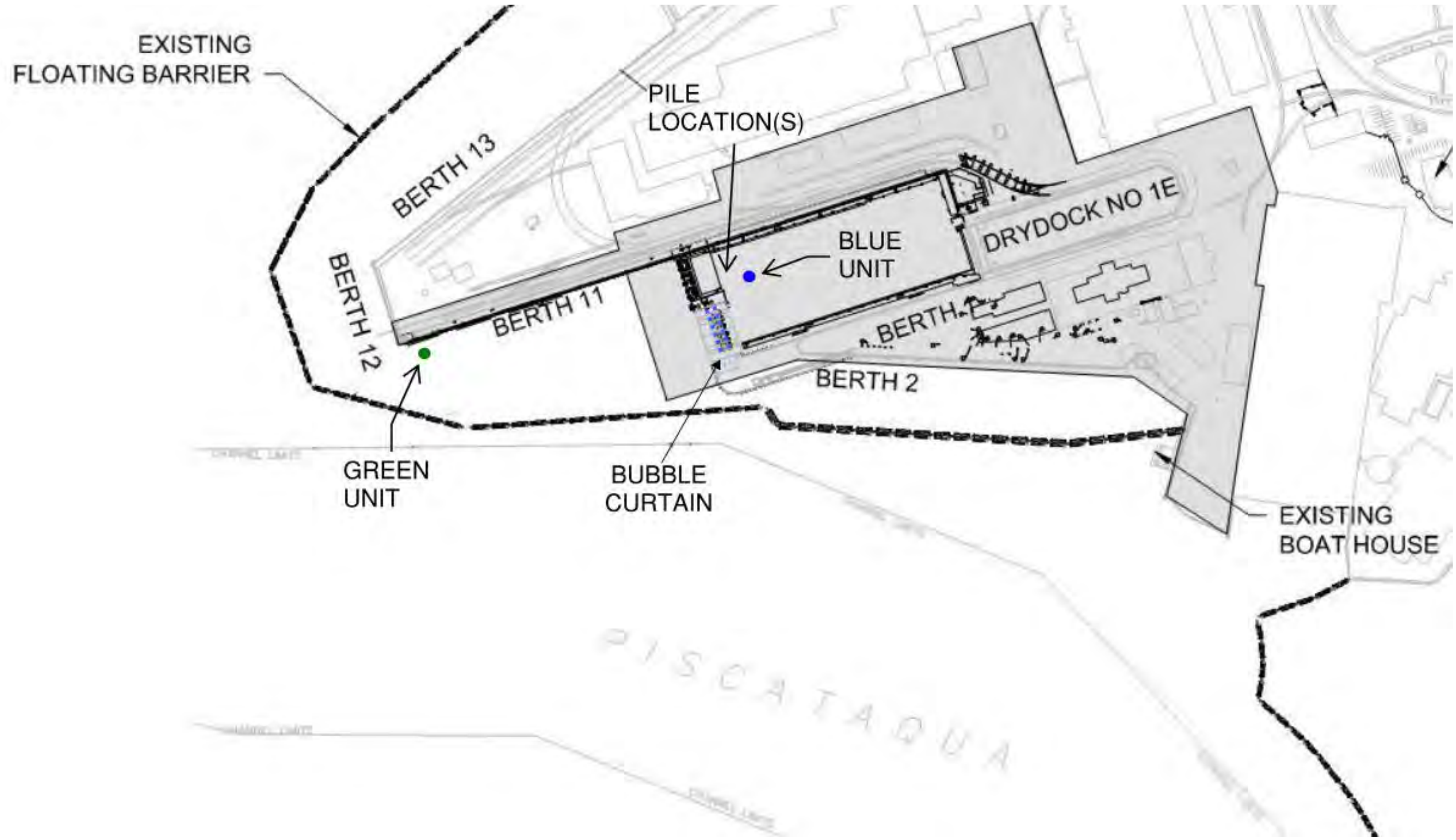

Figure 1. Location of Hydrophone Deployment

Event/Pile

Pile Type: 42” Casing
Activity: DTH Mono-Hammer
IHA Count: 5 of 10

Hammer Make: Mincon
Hammer Model: MP340
Noise Type: Impulsive

Start Time: 10:42
Stop Time: 11:07
Active Hammer Duration: 1,543 seconds

BLUE UNIT

Hydrophone Distance from Pile: 10 meters

Latitude: 43°04’50”N
Longitude: 70°44’39”W
Water Column Depth: 10.50 meters
Hydrophone Deployed Depth: 5.25 meters

GREEN UNIT

Hydrophone Distance from Pile: 186 meters

Latitude: 43°04’50”N
Longitude: 70°44’48”W
Water Column Depth: 12.8 meters
Hydrophone Deployed Depth: 6.4 meters

Notes:

Mincon MP340 mono-hammer used to install 42” casings near West Closure Wall. Blue unit was deployed from drill barge on unprotected side of bubble curtain (inside basin). Hydrophone was placed away from airlifting hose to avoid interference with drilling noise. Green unit was deployed from Berth 11C from davit arm on protected side of bubble curtain (outside basin). Bubble curtain was on and operational during drilling activities.

Post-process analyses indicate pulse durations were approximately 0.054 – 0.058 seconds or 54 – 58 milliseconds (ms).

RMS SPL, Peak SPL, SEL, and SELcum data included in **Table 1.**

One-third octave band spectra and Power Spectral Density (PSD) included in **Figures 2-3**.

Data unweighted.

Event/Pile

Pile Type: 42” Casing
Activity: DTH Mono-Hammer
IHA Count: 6 of 10

Hammer Make: Mincon
Hammer Model: MP340
Noise Type: Continuous

Start Time: 14:43
Stop Time: 15:49
Active Hammer Duration: 3,866 seconds

BLUE UNIT

Hydrophone Distance from Pile: 10 meters

Latitude: 43º04’50”N
Longitude: 70°44’39”W
Water Column Depth: 10.00 meters
Hydrophone Deployed Depth: 5.00 meters

GREEN UNIT

Hydrophone Distance from Pile: 186 meters

Latitude: 43º04’50”N
Longitude: 70°44’48”W
Water Column Depth: 12 meters
Hydrophone Deployed Depth: 6 meters

Notes:

Mincon MP340 mono-hammer used to install 42” casings near West Closure Wall. Blue unit was deployed from drill barge on unprotected side of bubble curtain (inside basin). Hydrophone was placed away from airlifting hose to avoid interference with drilling noise. Green unit was deployed from Berth 11C from davit arm on protected side of bubble curtain (outside basin). Bubble curtain was on and operational during drilling activities.

The active duration of the DTH mono-hammer advancing through soft substrate (coarse gravel material) was processed utilizing continuous metrics due to the piston not being active.

RMS SPL and SELcum data included in **Table 1.**

One-third octave band spectra and Power Spectral Density (PSD) included in **Figures 4-7** .

Data unweighted.

Event/Pile

Pile Type: 42" Casing **Activity:** DTH Mono-Hammer **IHA Count:** 6 of 10

Hammer Make: Mincon **Hammer Model:** MP340 **Noise Type:** Impulsive

Start Time: 15:49 **Stop Time:** 15:57 **Active Hammer Duration:** 475 seconds

BLUE UNIT

Hydrophone Distance from Pile: 10 meters

Latitude: 43º04'50"N **Longitude:** 70°44'39"W

Water Column Depth: 10.00 meters **Hydrophone Deployed Depth:** 5.00 meters

GREEN UNIT

Hydrophone Distance from Pile: 186 meters

Latitude: 43º04'50"N **Longitude:** 70°44'48"W

Water Column Depth: 12 meters **Hydrophone Deployed Depth:** 6 meters

Notes:

Mincon MP340 mono-hammer used to install 42" casings near West Closure Wall. Blue unit was deployed from drill barge on unprotected side of bubble curtain (inside basin). Hydrophone was placed away from airlifting hose to avoid interference with drilling noise. Green unit was deployed from Berth 11C from davit arm on protected side of bubble curtain (outside basin). Bubble curtain was on and operational during drilling activities.

The active duration of the DTH mono-hammer advancing through hard competent rock was processed utilizing impulsive metrics due to the piston being active.

Post-process analyses indicate pulse durations were approximately 0.054 – 0.058 seconds or 54 – 58 milliseconds (ms).

RMS SPL, Peak SPL, SEL, and SELcum data included in **Table 1.**

One-third octave band spectra and Power Spectral Density (PSD) included in **Figures 8-11**.

Data unweighted.

Pile #	Date	Pile Type	Hammer Make/Model	Noise Type	Start Time	Stop Time	Active Hammer Duration (seconds)	Hammer Strikes	Pulse Duration (seconds)	Distance From Pile (meters)	RMS unweighted (SPL dB re 1uPa)			Peak unweighted (SPL dB re 1uPa)			SELss unweighted (dB re 1uPa^2.s)			SELcum unweighted (dB re 1uPa^2.s)
											Median	Average	Range	Median	Average	Range	Median	Average	Range	
1	9/7/2022	42" Pipe Pile	Mincon MP340	Impulsive	10:42	11:07	1,543	13,887	0.054	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
										186	133.55	133.22	117.74 - 143.95	146.22	147.1	133.73 - 160.89	124.52	122.12	108.71 - 134.91	165.94
2	9/7/2022	42" Pipe Pile	Mincon MP340	Continuous	14:43	15:49	3,866	N/A	N/A	10	138.78	143.30	127.30 - 155.72	N/A	N/A	N/A	N/A	N/A	N/A	181.05
										186	109.67	110.73	103.61 - 121.10	N/A	N/A	N/A	N/A	N/A	N/A	147.75
2	9/7/2022	42" Pipe Pile	Mincon MP340	Impulsive	15:49	15:57	475	4,275	0.058	10	167.22	167.52	130.56 - 180.31	183.83	184.19	139.25 - 194.57	158.42	164.53	121.53 - 167.52	194.73
										186	119.90	120.45	104.84 - 132.76	134.56	135.04	120.39 - 144.81	110.87	111.42	95.81 - 123.73	147.18

Table 1. Data Summary of Piles Monitored

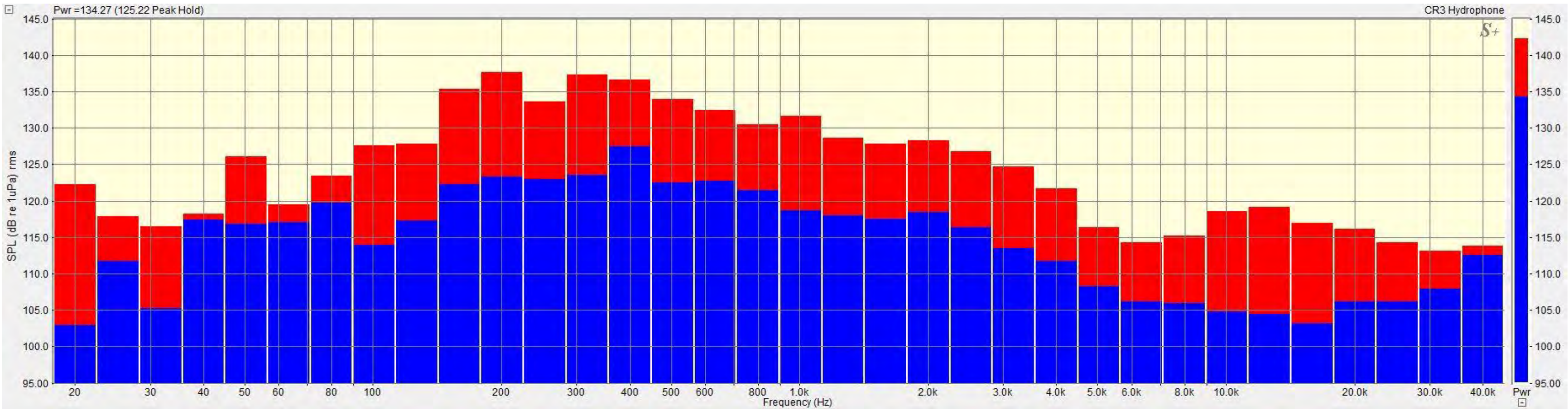

Figure 2. 1/3 Octave Band Spectra from 186 meters for Pile 1 installed September 7, 2022 at 10:42

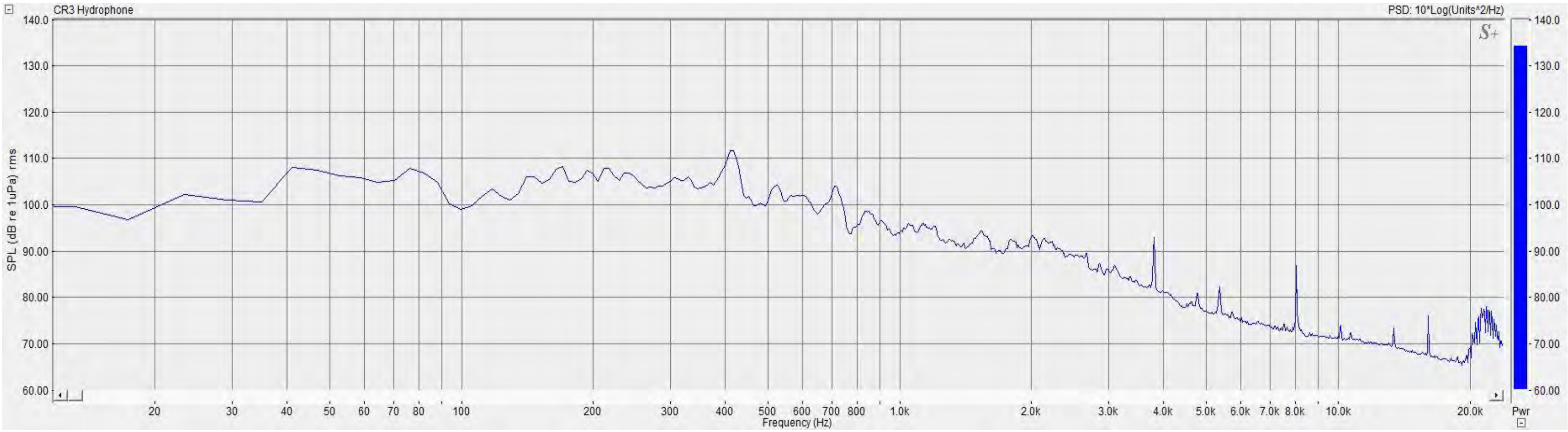

Figure 3. Power Spectral Density Plot from 186 meters for Pile 1 installed September 7, 2022 at 10:42

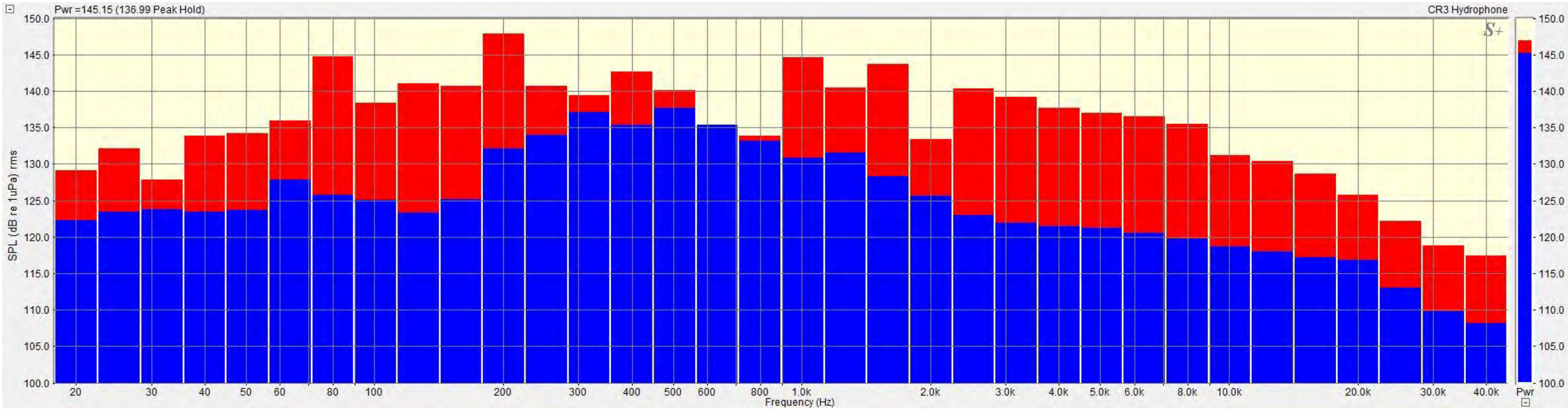

Figure 4. 1/3 Octave Band Spectra from 10 meters for Pile 2 (Continuous) installed September 7, 2022 at 14:43

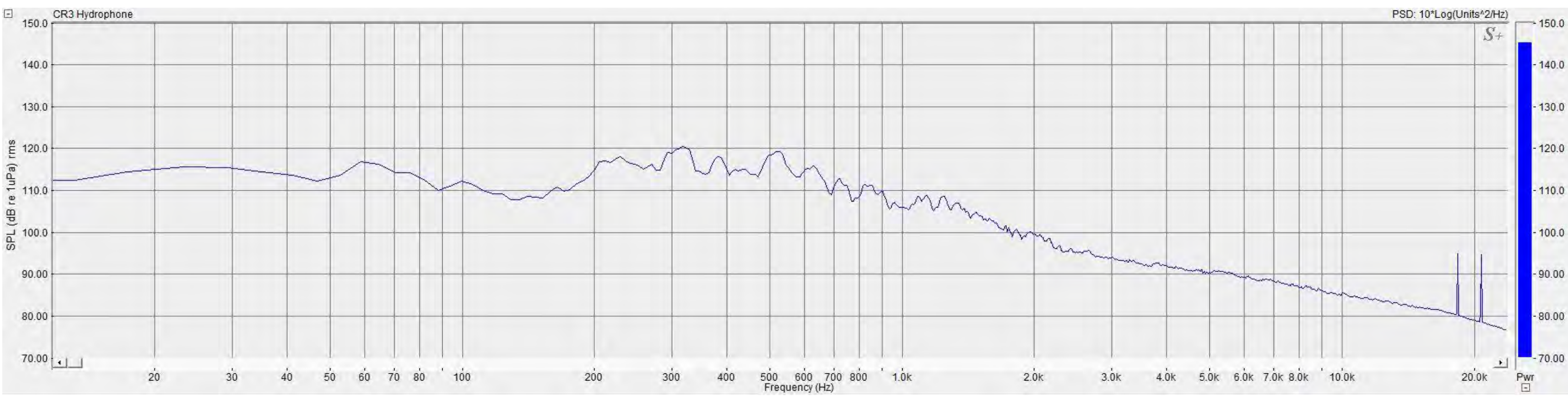

Figure 5. Power Spectral Density Plot from 10 meters for Pile 2 (Continuous) installed September 7, 2022 at 14:43

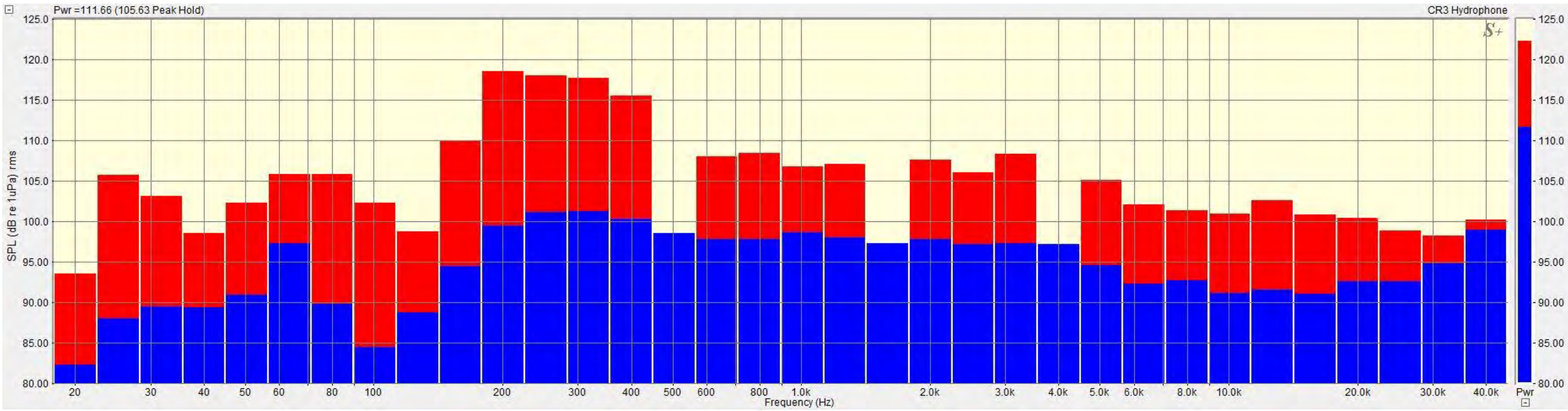

Figure 6. 1/3 Octave Band Spectra from 186 meters for Pile 2 (Continuous) installed September 7, 2022 at 14:43

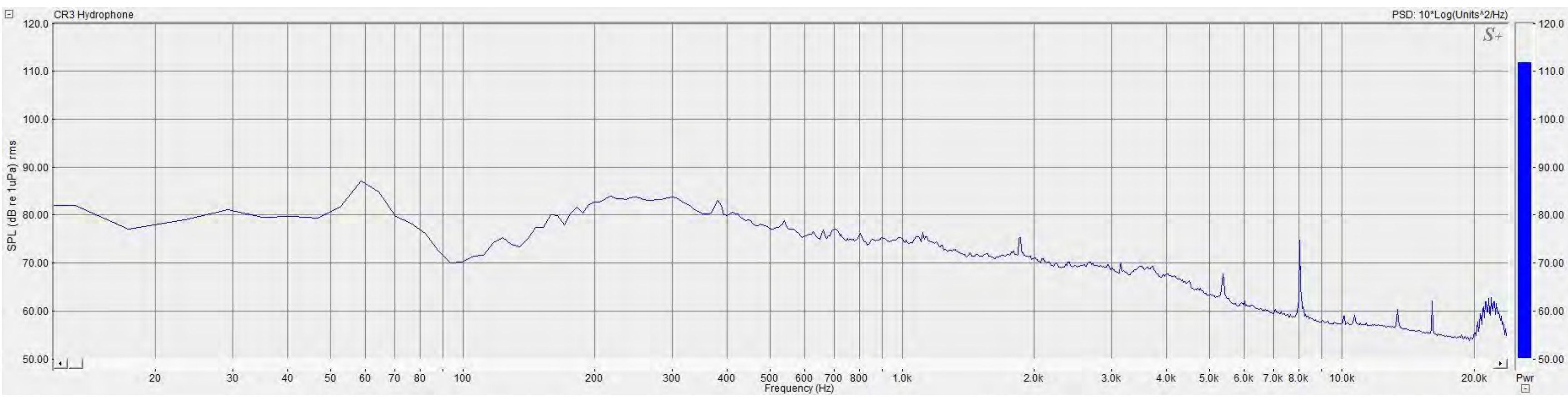

Figure 7. Power Spectral Density Plot from 186 meters for Pile 2 (Continuous) installed September 7, 2022 at 14:43

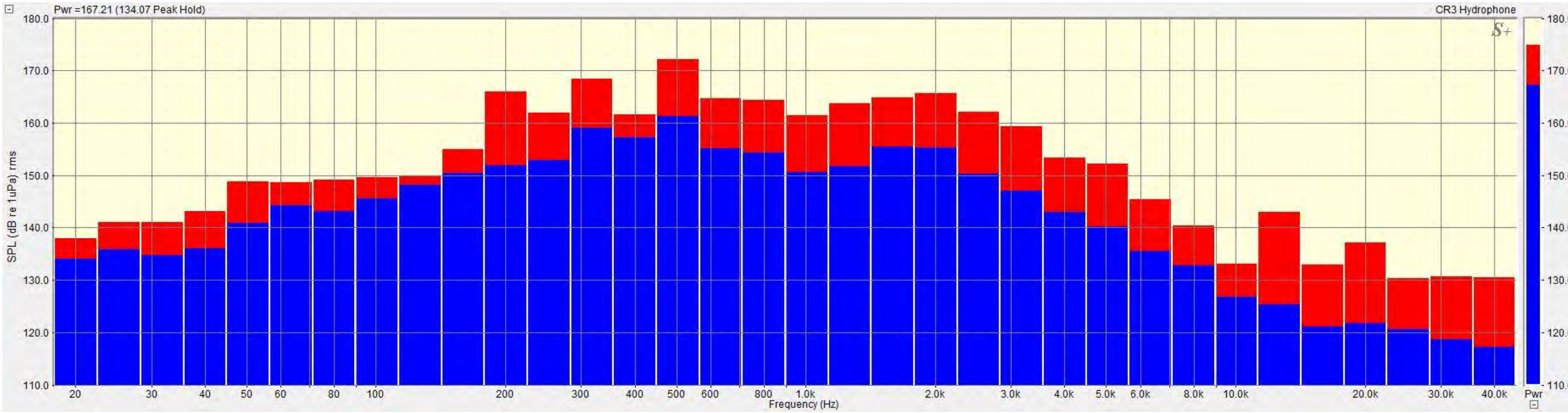

Figure 8. 1/3 Octave Band Spectra from 10 meters for Pile 2 (Impulsive) installed September 7, 2022 at 14:43

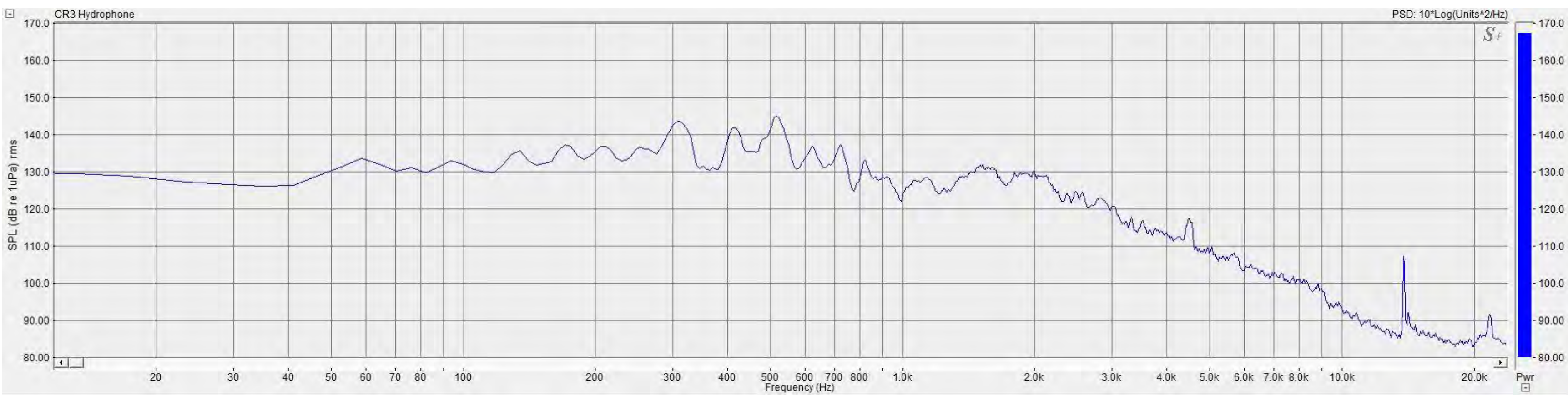

Figure 9. Power Spectral Density Plot from 10 meters for Pile 2 (Impulsive) installed September 7, 2022 at 14:43

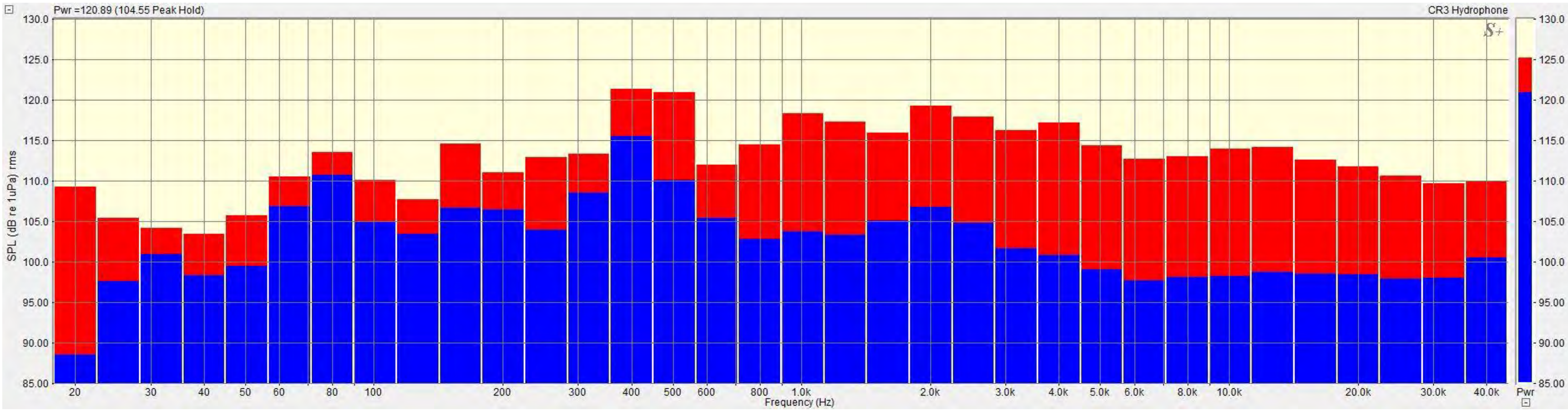

Figure 10. 1/3 Octave Band Spectra from 186 meters for Pile 2 (Impulsive) installed September 7, 2022 at 14:43

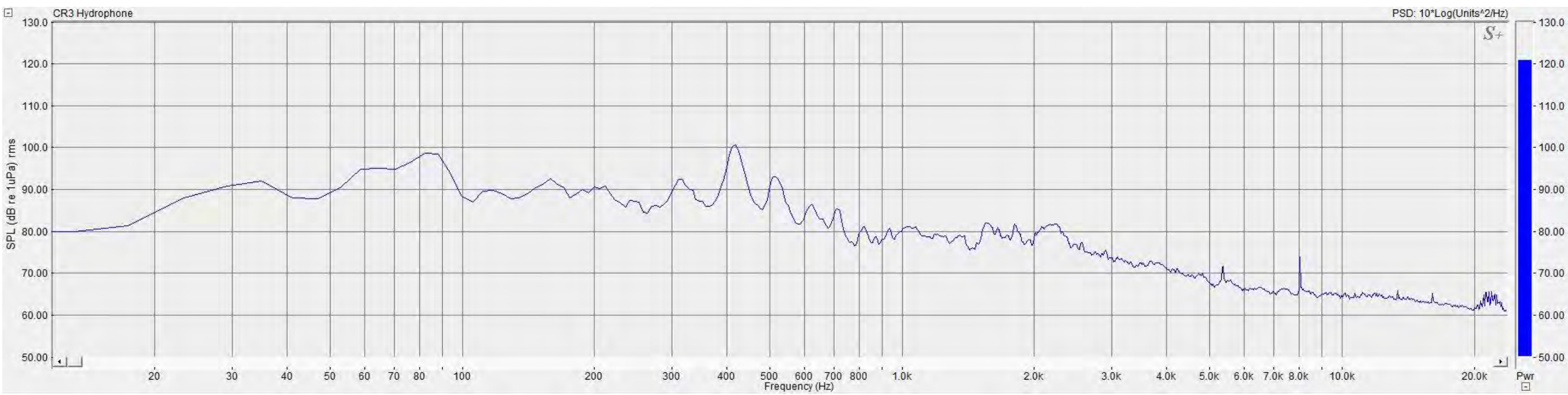

Figure 11. Power Spectral Density Plot from 186 meters for Pile 2 (Impulsive) installed September 7, 2022 at 14:43

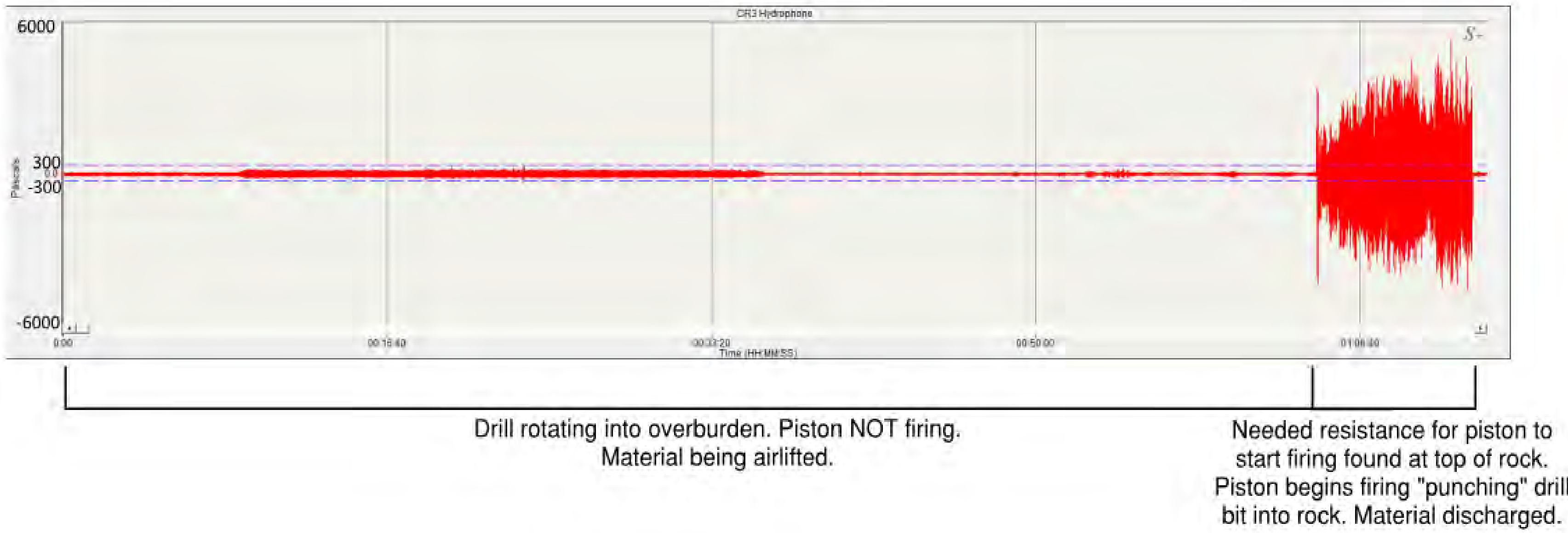

Figure 12. Time Series 10 meters away from Pile 2 on September 7, 2022

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P381 Constructors

Hydroacoustic Monitoring Daily Report

Date: September 8, 2022 **Project:** 3121020 PNSY Multi-Mission Dry Dock 1

Project Information

Project Name: P381 Multi-Mission Dry Dock #1
Location: Portsmouth Naval Shipyard, Kittery, Maine
Project/Contract Number: N40085-21-C-0011
Hydroacoustic Engineer - Lead: Theodore Hallett

Hydrologic and Geologic Information

Body of Water: Portsmouth – Lower Piscataqua River
Type: Estuarine
Hydrologic Unit: 01060003
Geology: Glacial Till, Phyllite, Quartzite, Diorite and/or Shale

Equipment Information

Hydrophone: Cetacean Research CR3
Recording Device: Spectra DAQ-200
Sampling Rate: 96kHz
Bit Depth: 24 Bit

Weather

Meteorological Conditions: Sunny
Cloud Cover: 10%
Air Temperature: 68°F
Humidity: 61%
Wind Speed: 8 mph
Wind Direction: West
Beaufort Sea State: 2
Water Temperature: 65°F

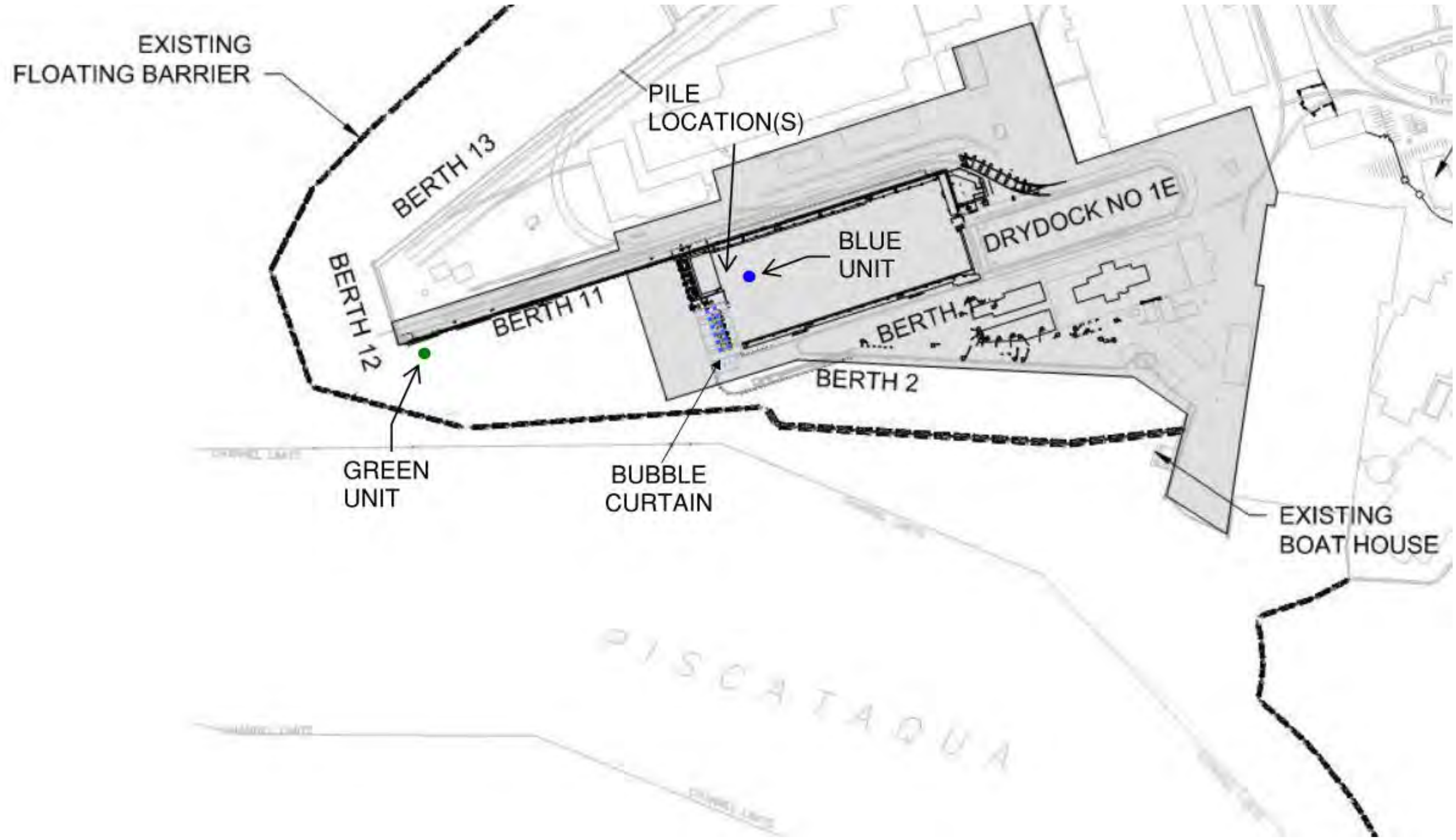

Figure 1. Location of Hydrophone Deployment

Event/Pile

Pile Type: 42” Casing **Activity:** DTH Mono-Hammer **IHA Count:** 7 of 10

Hammer Make: Mincon **Hammer Model:** MP340 **Noise Type:** Continuous

Start Time: 11:03 **Stop Time:** 11:25 **Active Hammer Duration:** 1,330 seconds

BLUE UNIT

Hydrophone Distance from Pile: 10 meters

Latitude: 43°04’50”N **Longitude:** 70°44’40”W

Water Column Depth: 10.40 meters **Hydrophone Deployed Depth:** 5.20 meters

GREEN UNIT

Hydrophone Distance from Pile: 188 meters

Latitude: 43°04’50”N **Longitude:** 70°44’48”W

Water Column Depth: 12.10 meters **Hydrophone Deployed Depth:** 6.05 meters

Notes:

Mincon MP340 mono-hammer used to install 42” casings near West Closure Wall. Blue unit was deployed from drill barge on unprotected side of bubble curtain (inside basin). Hydrophone was placed away from airlifting hose to avoid interference with drilling noise. Green unit was deployed from Berth 11C from davit arm on protected side of bubble curtain (outside basin). Bubble curtain was on and operational during drilling activities.

The active duration of the DTH mono-hammer advancing through soft substrate (coarse gravel material) was processed utilizing continuous metrics due to the piston not being active.

RMS SPL and SELcum data included in **Table 1.**

One-third octave band spectra and Power Spectral Density (PSD) included in **Figures 2-3**.

Data unweighted.

Event/Pile

Pile Type: 42” Casing **Activity:** DTH Mono-Hammer **IHA Count:** 8 of 10

Hammer Make: Mincon **Hammer Model:** MP340 **Noise Type:** Continuous

Start Time: 11:26 **Stop Time:** 11:54 **Active Hammer Duration:** 1,829 seconds

BLUE UNIT

Hydrophone Distance from Pile: 10 meters

Latitude: 43°04’50”N **Longitude:** 70°44’40”W

Water Column Depth: 9.80 meters **Hydrophone Deployed Depth:** 4.90 meters

GREEN UNIT

Hydrophone Distance from Pile: 188 meters

Latitude: 43°04’50”N **Longitude:** 70°44’48”W

Water Column Depth: 11.50 meters **Hydrophone Deployed Depth:** 5.75 meters

Notes:

Mincon MP340 mono-hammer used to install 42” casings near West Closure Wall. Blue unit was deployed from drill barge on unprotected side of bubble curtain (inside basin). Hydrophone was placed away from airlifting hose to avoid interference with drilling noise. Green unit was deployed from Berth 11C from davit arm on protected side of bubble curtain (outside basin). Bubble curtain was on and operational during drilling activities.

The active duration of the DTH mono-hammer advancing through soft substrate (coarse gravel material) was processed utilizing continuous metrics due to the piston not being active.

RMS SPL and SELcum data included in **Table 1.**

One-third octave band spectra and Power Spectral Density (PSD) included in **Figures 4-7**.

Data unweighted.

Event/Pile

Pile Type: 42” Casing **Activity:** DTH Mono-Hammer **IHA Count:** 8 of 10

Hammer Make: Mincon **Hammer Model:** MP340 **Noise Type:** Impulsive

Start Time: 11:54 **Stop Time:** 12:25 **Active Hammer Duration:** 1,711 seconds

BLUE UNIT

Hydrophone Distance from Pile: 10 meters

Latitude: 43º04’50”N **Longitude:** 70°44’40”W

Water Column Depth: 9.80 meters **Hydrophone Deployed Depth:** 4.90 meters

GREEN UNIT

Hydrophone Distance from Pile: 188 meters

Latitude: 43º04’50”N **Longitude:** 70°44’48”W

Water Column Depth: 11.50 meters **Hydrophone Deployed Depth:** 5.75 meters

Notes:

Mincon MP340 mono-hammer used to install 42” casings near West Closure Wall. Blue unit was deployed from drill barge on unprotected side of bubble curtain (inside basin). Hydrophone was placed away from airlifting hose to avoid interference with drilling noise. Green unit was deployed from Berth 11C from davit arm on protected side of bubble curtain (outside basin). Bubble curtain was on and operational during drilling activities.

The active duration of the DTH mono-hammer advancing through hard competent rock was processed utilizing impulsive metrics due to the piston being active.

Post-process analyses indicate pulse durations were approximately 0.059 seconds or 59 milliseconds (ms).

RMS SPL, Peak SPL, SEL, and SELcum data included in **Table 1.**

One-third octave band spectra and Power Spectral Density (PSD) included in **Figures 8-11**.

Data unweighted.

Pile #	Date	Pile Type	Hammer Make/Model	Noise Type	Start Time	Stop Time	Active Hammer Duration (seconds)	Hammer Strikes	Pulse Duration (seconds)	Distance From Pile (meters)	RMS unweighted (SPL dB re 1uPa)			Peak unweighted (SPL dB re 1uPa)			SELss unweighted (dB re 1uPa^2.s)			SELcum unweighted (dB re 1uPa^2.s)
											Median	Average	Range	Median	Average	Range	Median	Average	Range	
1	9/8/2022	42" Pipe Pile	Mincon MP340	Continuous	11:03	11:25	1,330	N/A	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
										188	127.74	128.64	123.80 - 136.20	N/A	N/A	N/A	N/A	N/A	N/A	161.20
2	9/8/2022	42" Pipe Pile	Mincon MP340	Continuous	11:26	11:54	1,829	N/A	N/A	10	135.18	135.72	129.64 - 143.55	N/A	N/A	N/A	N/A	N/A	N/A	169.19
										188	128.66	130.03	118.27 - 143.34	N/A	N/A	N/A	N/A	N/A	N/A	164.32
2	9/8/2022	42" Pipe Pile	Mincon MP340	Impulsive	11:54	12:25	1,711	17,110	0.059	10	165.57	168.32	132.61 - 184.79	182.09	184.80	142.02 - 199.26	155.39	157.14	122.61 - 170.21	197.72
										188	135.76	135.85	126.44 - 144.17	147.41	147.61	138.03 - 158.96	125.76	125.85	116.45 - 134.17	167.13

Table 1. Data Summary of Piles Monitored

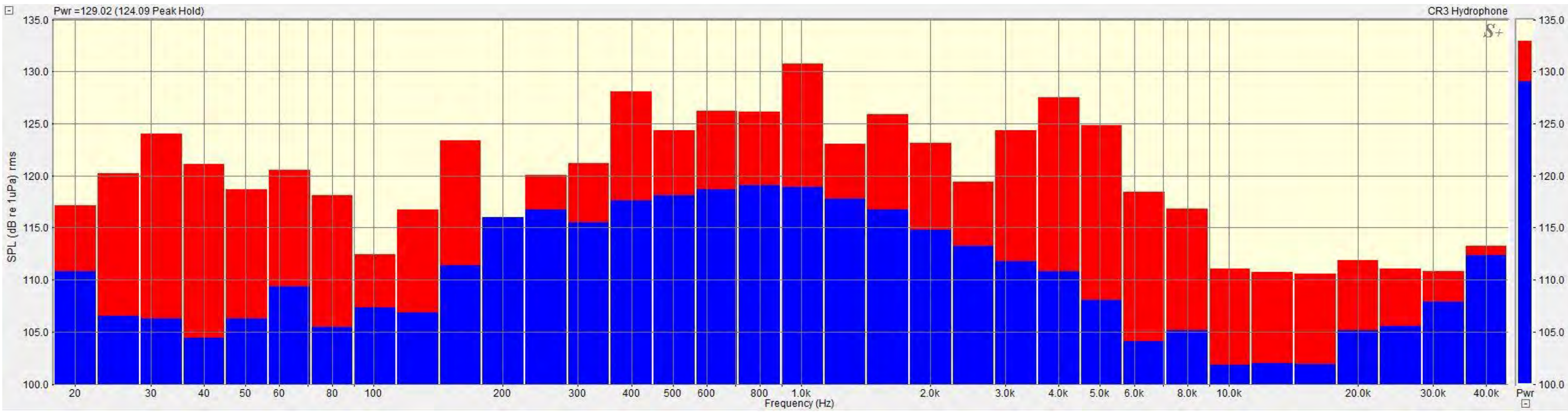

Figure 2. 1/3 Octave Band Spectra from 188 meters for Pile 1 installed September 8, 2022 at 11:03

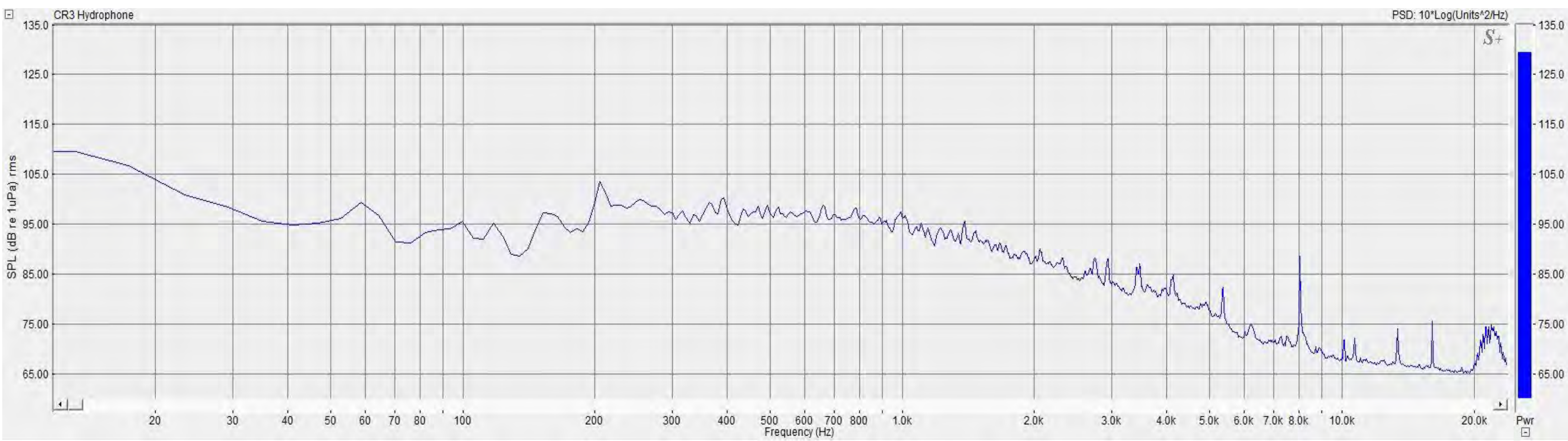

Figure 3. Power Spectral Density Plot from 188 meters for Pile 1 installed September 8, 2022 at 11:03

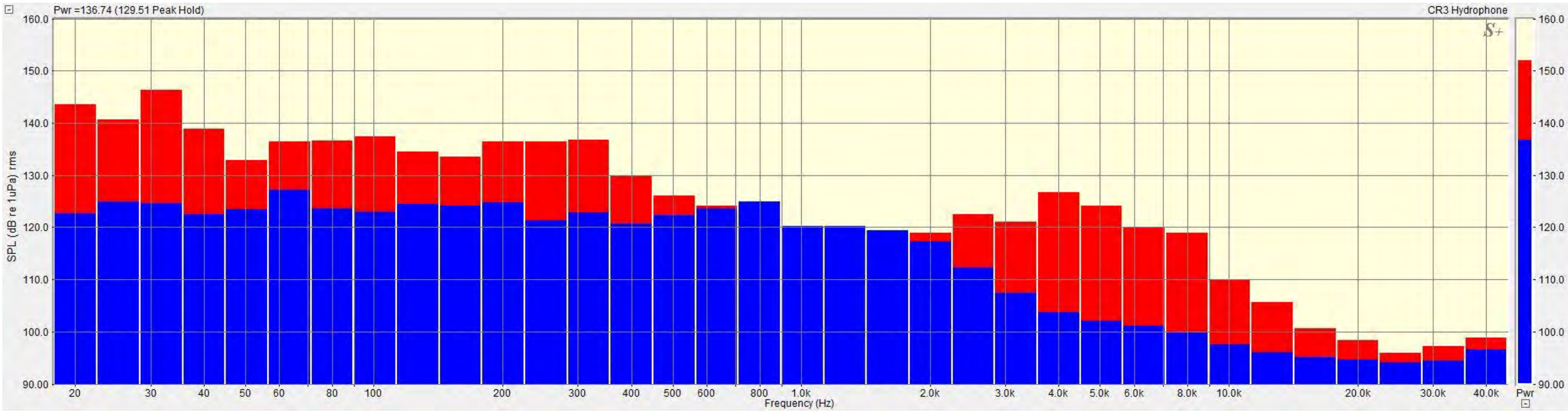

Figure 4. 1/3 Octave Band Spectra from 10 meters for Pile 2 (Continuous) installed September 8, 2022 at 11:26

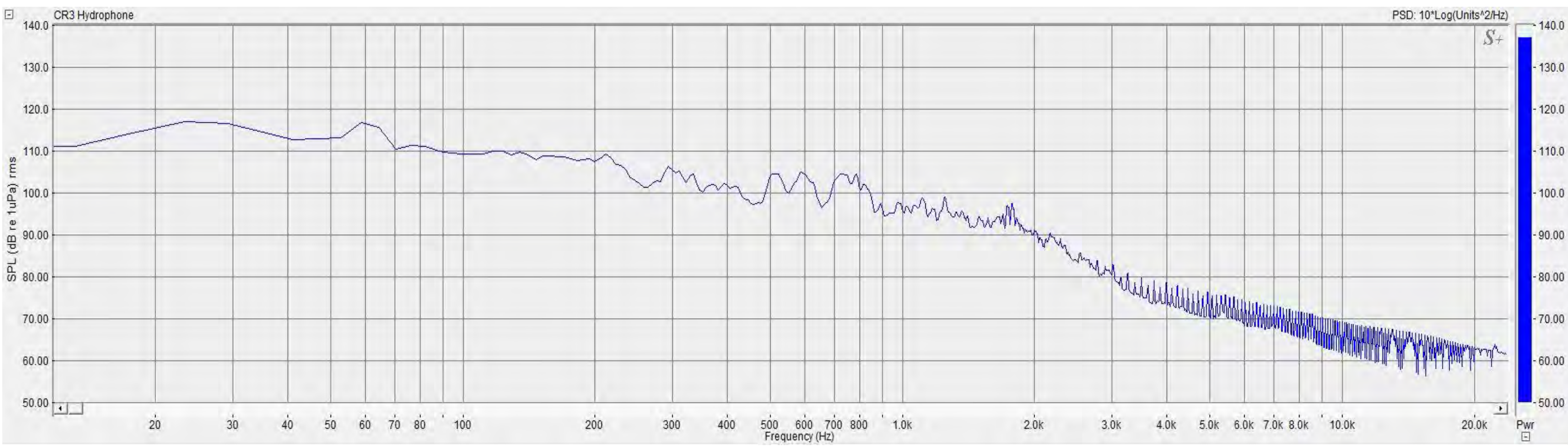

Figure 5. Power Spectral Density Plot from 10 meters for Pile 2 (Continuous) installed September 8, 2022 at 11:26

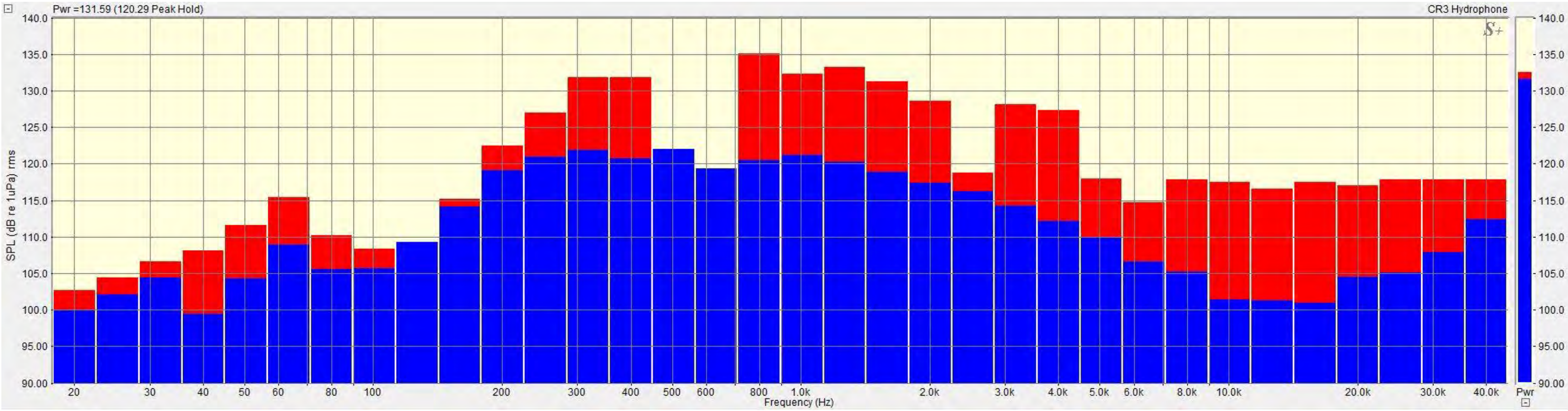

Figure 6. 1/3 Octave Band Spectra from 188 meters for Pile 2 (Continuous) installed September 8, 2022 at 11:26

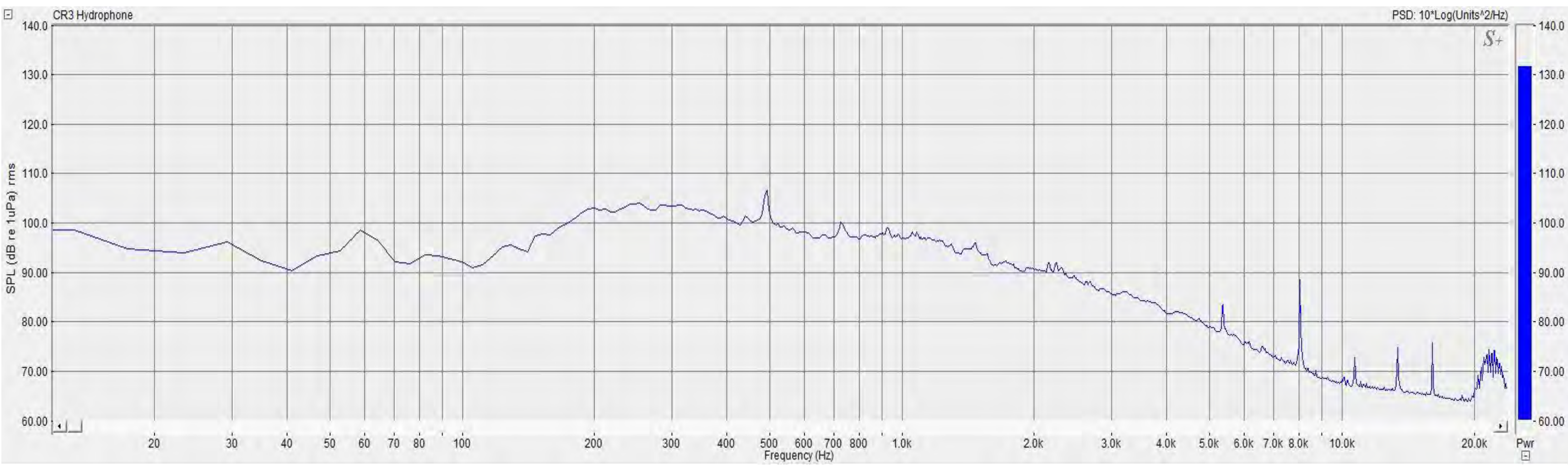

Figure 7. Power Spectral Density Plot from 188 meters for Pile 2 (Continuous) installed September 8, 2022 at 11:26

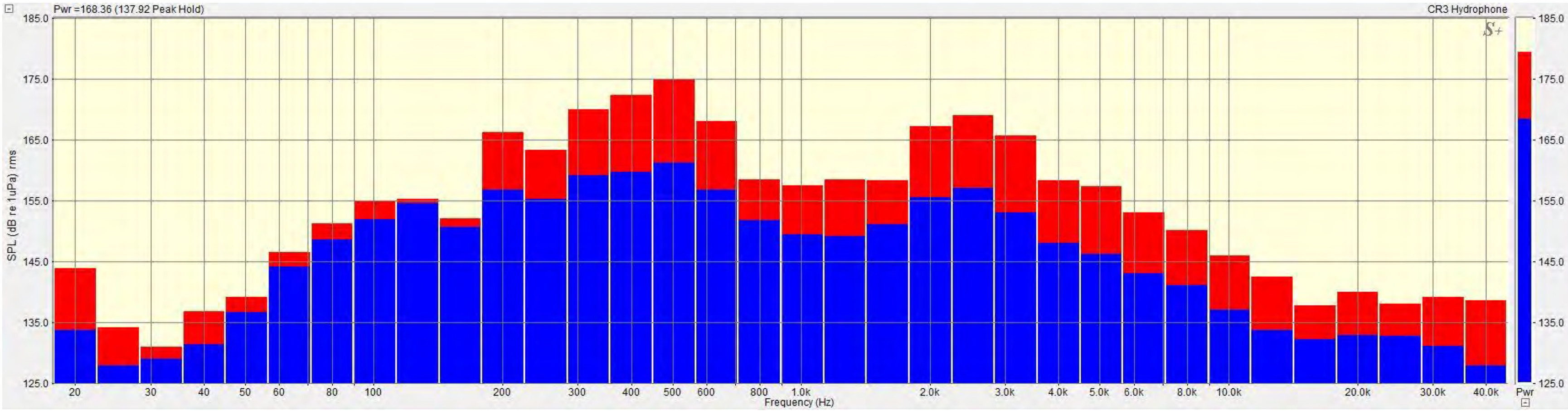

Figure 8. 1/3 Octave Band Spectra from 10 meters for Pile 2 (Impulsive) installed September 8, 2022 at 11:26

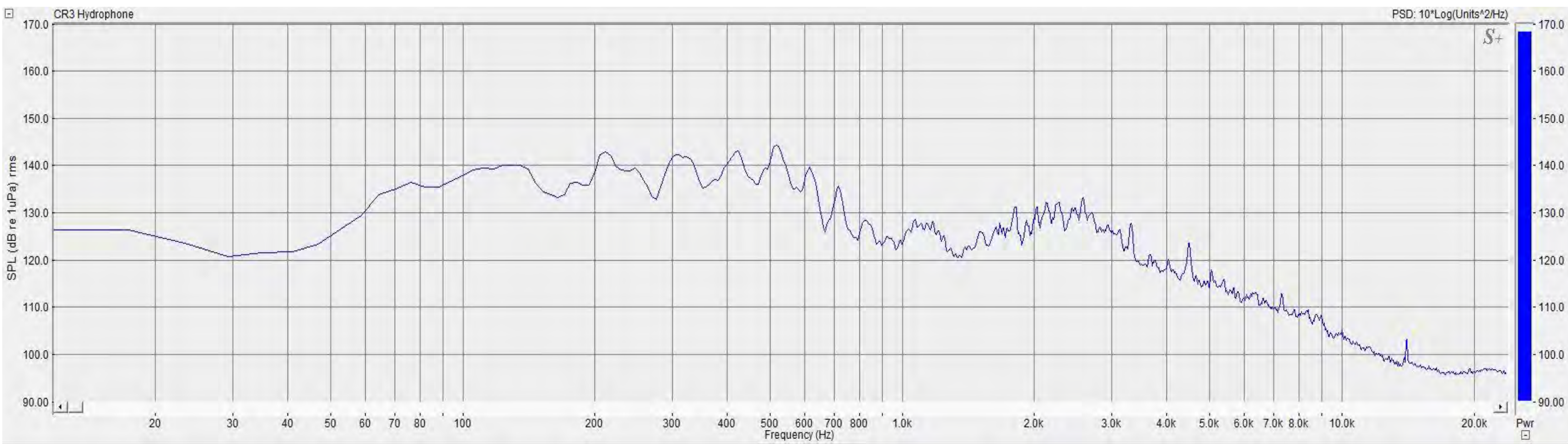

Figure 9. Power Spectral Density Plot from 10 meters for Pile 2 (Impulsive) installed September 8, 2022 at 11:26

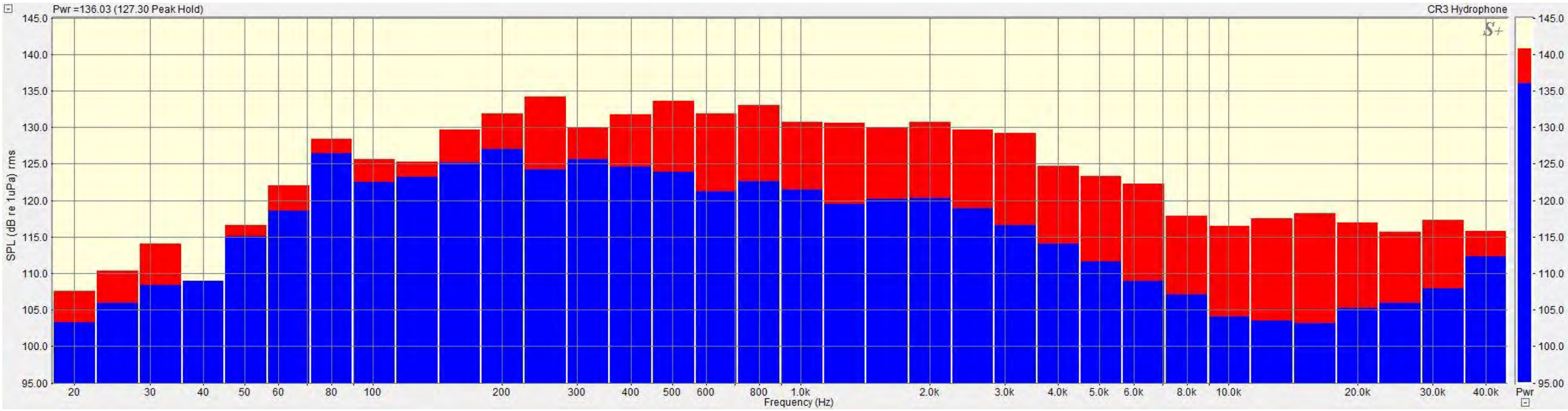

Figure 10. 1/3 Octave Band Spectra from 188 meters for Pile 2 (Impulsive) installed September 8, 2022 at 11:26

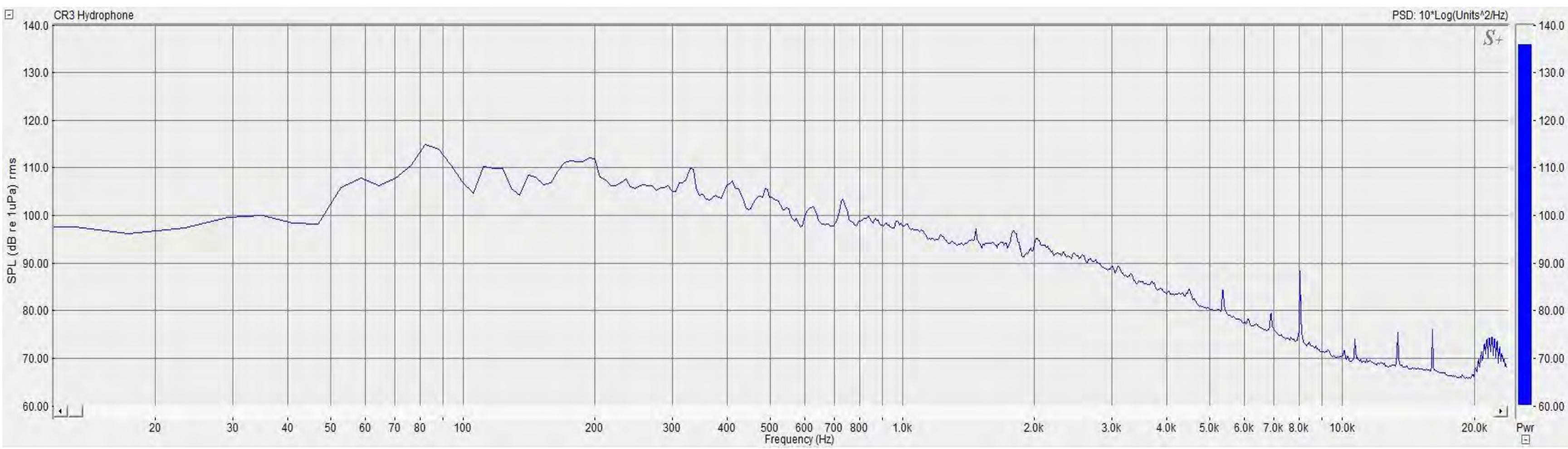

Figure 11. Power Spectral Density Plot from 188 meters for Pile 2 (Impulsive) installed September 8, 2022 at 11:26

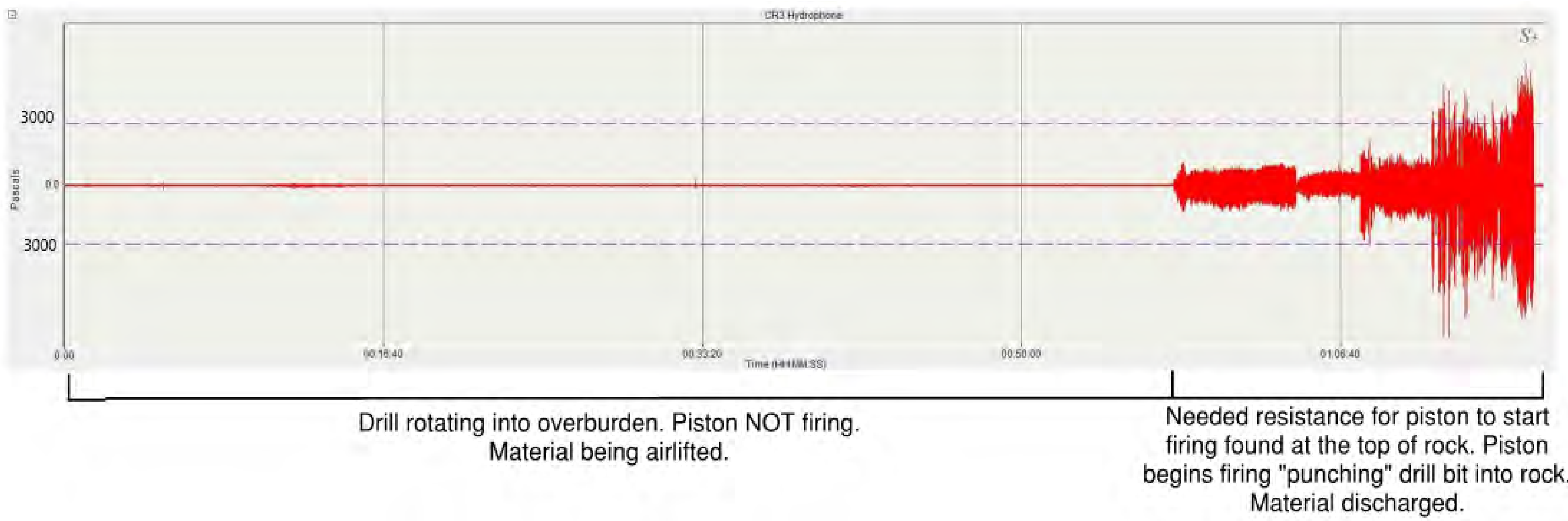

Figure 12. Time Series 10 meters away from Pile 2 on September 8, 2022

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P381 Constructors

Hydroacoustic Monitoring Daily Report

Date: September 9, 2022 **Project:** 3121020 PNSY Multi-Mission Dry Dock 1

Project Information

Project Name: P381 Multi-Mission Dry Dock #1
Location: Portsmouth Naval Shipyard, Kittery, Maine
Project/Contract Number: N40085-21-C-0011
Hydroacoustic Engineer - Lead: Theodore Hallett

Hydrologic and Geologic Information

Body of Water: Portsmouth – Lower Piscataqua River
Type: Estuarine
Hydrologic Unit: 01060003
Geology: Glacial Till, Phyllite, Quartzite, Diorite and/or Shale

Equipment Information

Hydrophone: Cetacean Research CR3
Recording Device: Spectra DAQ-200
Sampling Rate: 96kHz
Bit Depth: 24 Bit

Weather

Meteorological Conditions: Sunny
Cloud Cover: 10%
Air Temperature: 72°F
Humidity: 88%
Wind Speed: 7 mph
Wind Direction: North-West
Beaufort Sea State: 2
Water Temperature: 64°F

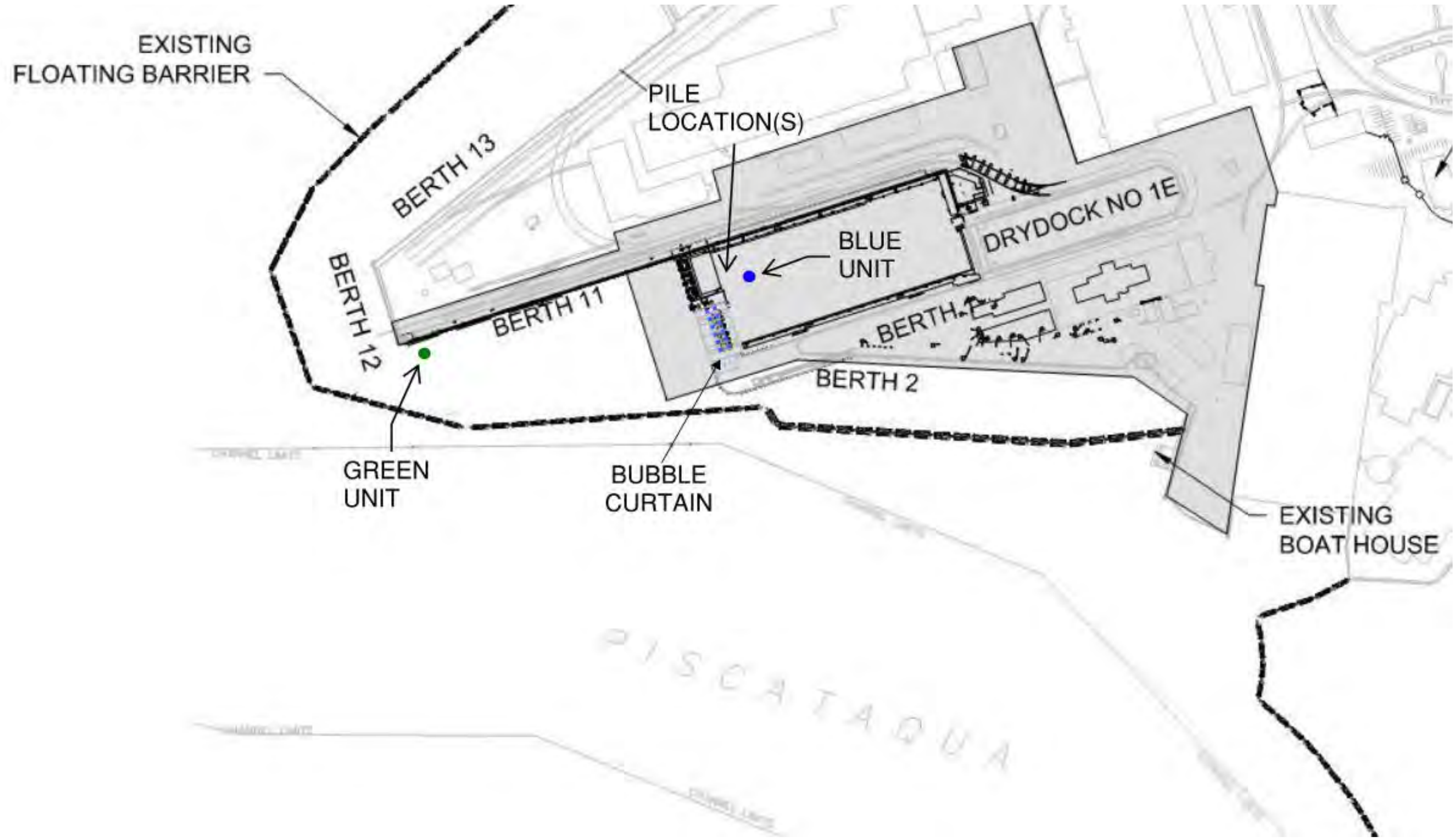

Figure 1. Location of Hydrophone Deployment

Event/Pile

Pile Type: 42” Casing **Activity:** DTH Mono-Hammer **IHA Count:** 9 of 10

Hammer Make: Mincon **Hammer Model:** MP340 **Noise Type:** Continuous

Start Time: 9:33 **Stop Time:** 10:45 **Active Hammer Duration:** 4,490 seconds

BLUE UNIT

Hydrophone Distance from Pile: 10 meters

Latitude: 43°04’50”N **Longitude:** 70°44’40”W

Water Column Depth: 13.71 meters **Hydrophone Deployed Depth:** 6.75 meters

GREEN UNIT

Hydrophone Distance from Pile: 188 meters

Latitude: 43°04’50”N **Longitude:** 70°44’48”W

Water Column Depth: 15.25 meters **Hydrophone Deployed Depth:** 7.75 meters

Notes:

Mincon MP340 mono-hammer used to install 42” casings near West Closure Wall. Blue unit was deployed from drill barge on unprotected side of bubble curtain (inside basin). Hydrophone was placed away from airlifting hose to avoid interference with drilling noise. Green unit was deployed from Berth 11C from davit arm on protected side of bubble curtain (outside basin). Bubble curtain was on and operational during drilling activities.

The active duration of the DTH mono-hammer advancing through soft substrate (coarse gravel material) was processed utilizing continuous metrics due to the piston not being active.

RMS SPL and SELcum data included in **Table 1.**

One-third octave band spectra and Power Spectral Density (PSD) included in **Figures 2-5**.

Data unweighted.

Event/Pile

Pile Type: 42” Casing **Activity:** DTH Mono-Hammer **IHA Count:** 9 of 10

Hammer Make: Mincon **Hammer Model:** MP340 **Noise Type:** Impulsive

Start Time: 10:45 **Stop Time:** 11:03 **Active Hammer Duration:** 837 seconds

BLUE UNIT

Hydrophone Distance from Pile: 10 meters

Latitude: 43º04’50”N **Longitude:** 70°44’40”W

Water Column Depth: 13.71 meters **Hydrophone Deployed Depth:** 6.75 meters

GREEN UNIT

Hydrophone Distance from Pile: 188 meters

Latitude: 43º04’50”N **Longitude:** 70°44’48”W

Water Column Depth: 15.25 meters **Hydrophone Deployed Depth:** 7.75 meters

Notes:

Mincon MP340 mono-hammer used to install 42” casings near West Closure Wall. Blue unit was deployed from drill barge on unprotected side of bubble curtain (inside basin). Hydrophone was placed away from airlifting hose to avoid interference with drilling noise. Green unit was deployed from Berth 11C from davit arm on protected side of bubble curtain (outside basin). Bubble curtain was on and operational during drilling activities.

The active duration of the DTH mono-hammer advancing through hard competent rock was processed utilizing impulsive metrics due to the piston being active.

Post-process analyses indicate pulse durations were approximately 0.058 seconds or 58 milliseconds (ms).

RMS SPL, Peak SPL, SEL, and SELcum data included in **Table 1.**

One-third octave band spectra and Power Spectral Density (PSD) included in **Figures 6-9**.

Data unweighted.

Event/Pile

Pile Type: 42" Casing **Activity:** DTH Mono-Hammer **IHA Count:** 10 of 10

Hammer Make: Mincon **Hammer Model:** MP340 **Noise Type:** Continuous

Start Time: 11:23 **Stop Time:** 12:22 **Active Hammer Duration:** 3,972 seconds

BLUE UNIT

Hydrophone Distance from Pile: 10 meters

Latitude: 43º04'50"N **Longitude:** 70°44'40"W

Water Column Depth: 12.80 meters **Hydrophone Deployed Depth:** 6.40 meters

GREEN UNIT

Hydrophone Distance from Pile: 188 meters

Latitude: 43º04'50"N **Longitude:** 70°44'48"W

Water Column Depth: 14.60 meters **Hydrophone Deployed Depth:** 7.30 meters

Notes:

Mincon MP340 mono-hammer used to install 42" casings near West Closure Wall. Blue unit was deployed from drill barge on unprotected side of bubble curtain (inside basin). Hydrophone was placed away from airlifting hose to avoid interference with drilling noise. Green unit was deployed from Berth 11C from davit arm on protected side of bubble curtain (outside basin). Bubble curtain was on and operational during drilling activities.

The active duration of the DTH mono-hammer advancing through soft substrate (coarse gravel material) was processed utilizing continuous metrics due to the piston not being active.

RMS SPL and SELcum data included in **Table 1.**

One-third octave band spectra and Power Spectral Density (PSD) included in **Figures 10-13**.

Data unweighted.

Event/Pile

Pile Type: 42" Casing **Activity:** DTH Mono-Hammer **IHA Count:** 10 of 10

Hammer Make: Mincon **Hammer Model:** MP340 **Noise Type:** Impulsive

Start Time: 12:22 **Stop Time:** 12:48 **Active Hammer Duration:** 1,127 seconds

BLUE UNIT

Hydrophone Distance from Pile: 10 meters

Latitude: 43°04'50"N **Longitude:** 70°44'40"W

Water Column Depth: 12.80 meters **Hydrophone Deployed Depth:** 6.40 meters

GREEN UNIT

Hydrophone Distance from Pile: 188 meters

Latitude: 43°04'50"N **Longitude:** 70°44'48"W

Water Column Depth: 14.60 meters **Hydrophone Deployed Depth:** 7.30 meters

Notes:

Mincon MP340 mono-hammer used to install 42" casings near West Closure Wall. Blue unit was deployed from drill barge on unprotected side of bubble curtain (inside basin). Hydrophone was placed away from airlifting hose to avoid interference with drilling noise. Green unit was deployed from Berth 11C from davit arm on protected side of bubble curtain (outside basin). Bubble curtain was on and operational during drilling activities.

The active duration of the DTH mono-hammer advancing through hard competent rock was processed utilizing impulsive metrics due to the piston being active.

Post-process analyses indicate pulse durations were approximately 0.058 seconds or 58 milliseconds (ms).

RMS SPL, Peak SPL, SEL, and SELcum data included in **Table 1.**

One-third octave band spectra and Power Spectral Density (PSD) included in **Figures 14-17**.

Data unweighted.

Pile #	Date	Pile Type	Hammer Make/Model	Noise Type	Start Time	Stop Time	Active Hammer Duration (seconds)	Hammer Strikes	Pulse Duration (seconds)	Distance From Pile (meters)	RMS unweighted (SPL dB re 1uPa)			Peak unweighted (SPL dB re 1uPa)			SELss unweighted (dB re 1uPa^2.s)			SELcum unweighted (dB re 1uPa^2.s)
											Median	Average	Range	Median	Average	Range	Median	Average	Range	
1	9/9/2022	42" Pipe Pile	Mincon MP340	Continuous	9:33	10:45	4,490	N/A	N/A	10	134.69	135.55	125.17 - 153.71	N/A	N/A	N/A	N/A	N/A	N/A	163.56
										188	136.50	136.62	121.75 - 147.05	N/A	N/A	N/A	N/A	N/A	N/A	176.80
1	9/9/2022	42" Pipe Pile	Mincon MP340	Impulsive	10:45	11:03	837	7,533	0.057	10	162.28	162.57	127.99 - 177.07	177.83	178.08	137.28 - 192.25	152.24	146.51	117.99 - 166.25	191.01
										188	136.99	137.60	124.09 - 147.01	147.16	147.54	137.31 - 156.15	127.96	128.57	115.06 - 137.98	170.29
2	9/9/2022	42" Pipe Pile	Mincon MP340	Continuous	11:23	12:22	3,972	N/A	N/A	10	134.98	135.74	127.61 - 146.17	N/A	N/A	N/A	N/A	N/A	N/A	171.94
										188	127.67	129.76	118.98 - 144.87	N/A	N/A	N/A	N/A	N/A	N/A	169.32
2	9/9/2022	42" Pipe Pile	Mincon MP340	Impulsive	12:22	12:48	1,127	11,270	0.058	10	163.95	165.94	131.76 - 183.04	178.41	180.94	141.42 - 197.38	153.89	155.17	121.76 - 169.52	194.41
										188	132.99	132.59	118.74 - 142.77	144.76	146.14	135.40 - 159.70	123.96	123.56	109.71 - 133.74	164.48

Table 1. Data Summary of Piles Monitored

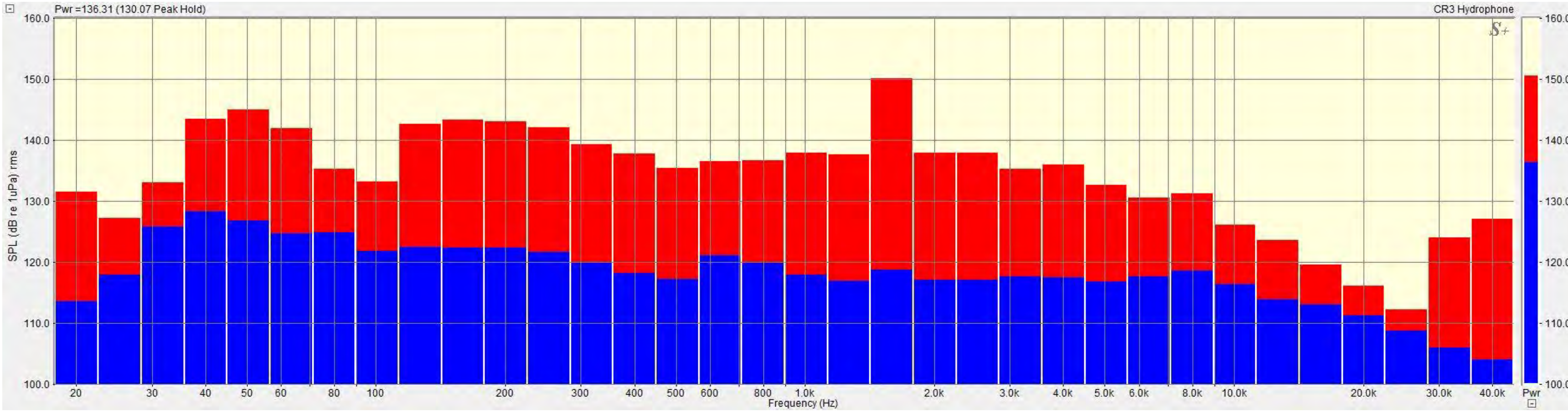

Figure 2. 1/3 Octave Band Spectra from 10 meters for Pile 1 (Continuous) installed September 9, 2022 at 9:33

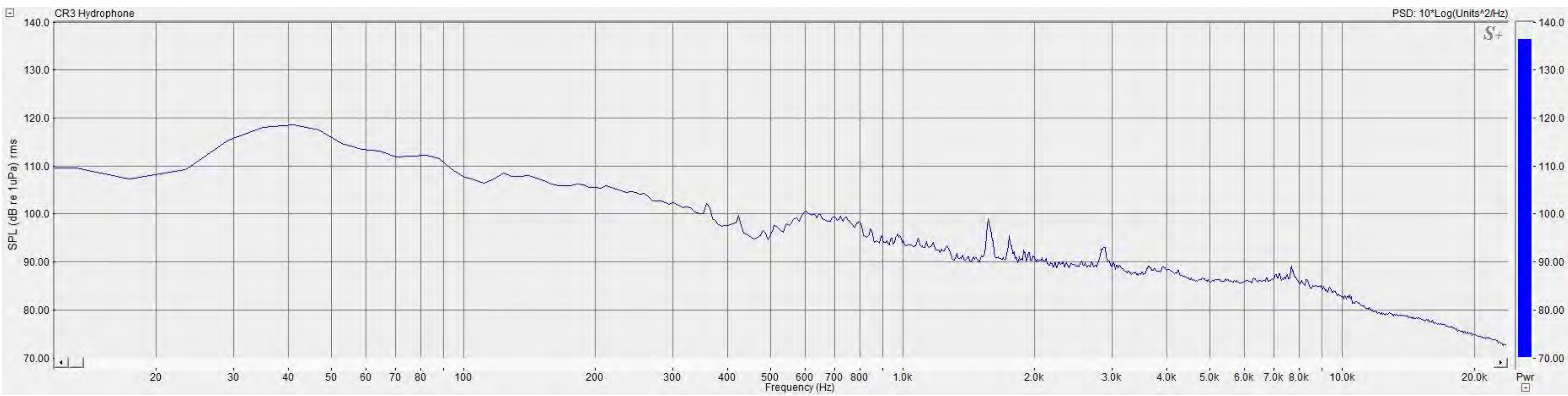

Figure 3. Power Spectral Density Plot from 10 meters for Pile 1 (Continuous) installed September 9, 2022 at 9:33

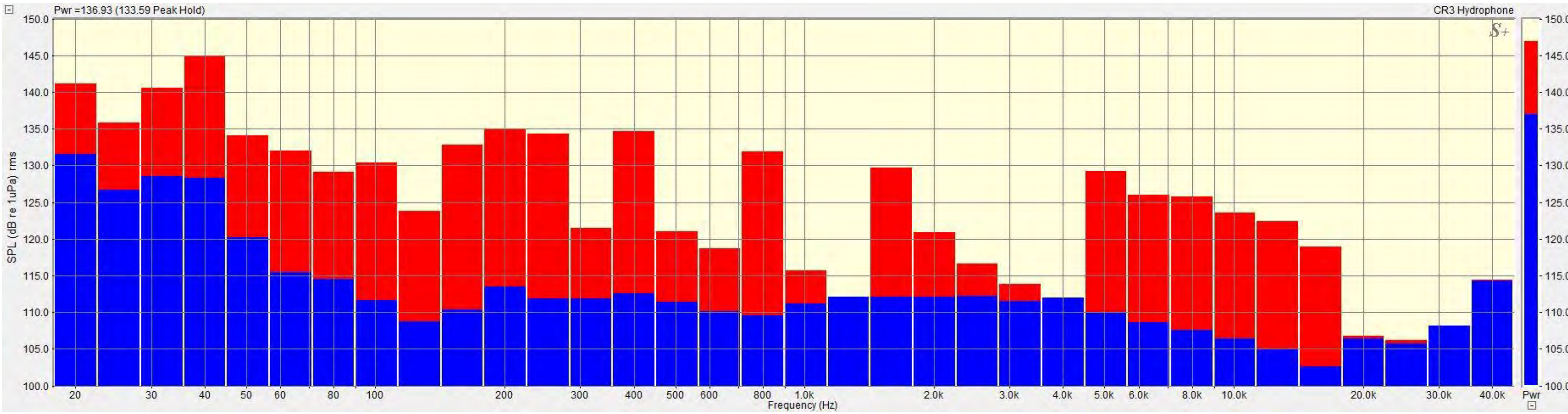

Figure 4. 1/3 Octave Band Spectra from 188 meters for Pile 1 (Continuous) installed September 9, 2022 at 9:33

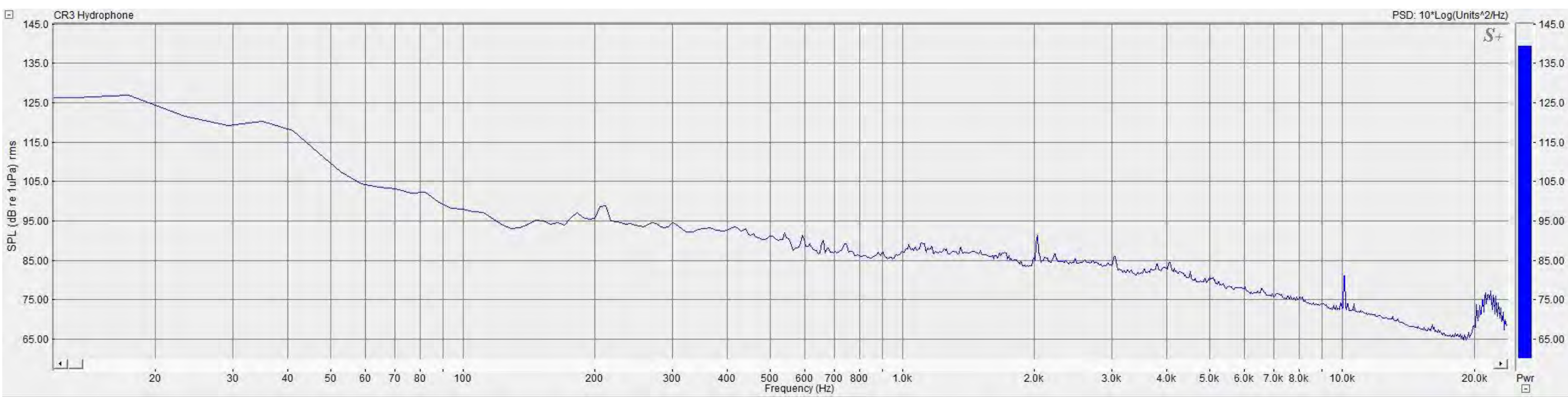

Figure 5. Power Spectral Density Plot from 188 meters for Pile 1 (Continuous) installed September 9, 2022 at 9:33

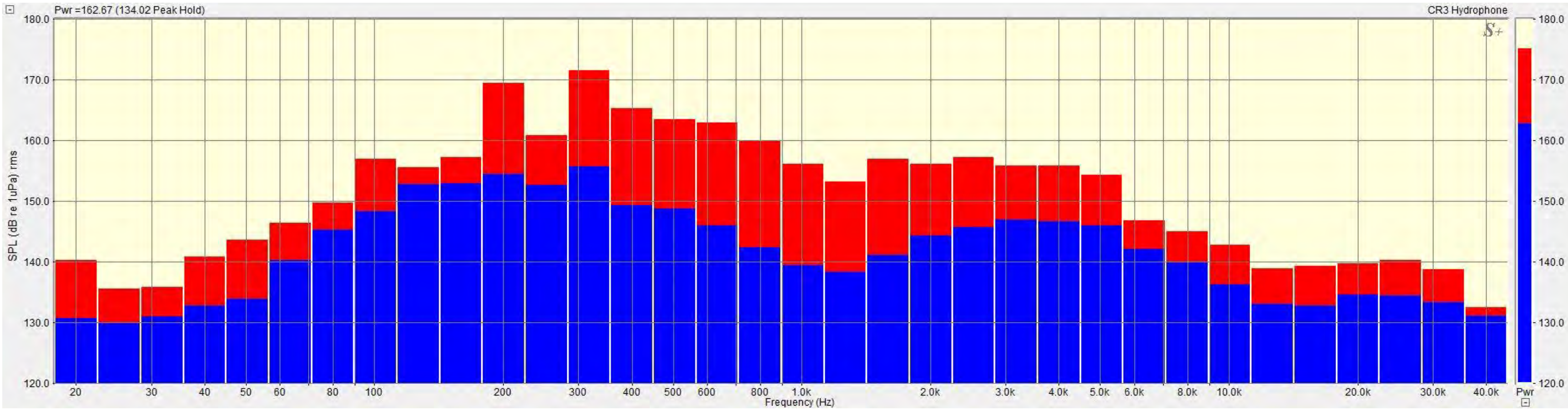

Figure 6. 1/3 Octave Band Spectra from 10 meters for Pile 1 (Impulsive) installed September 9, 2022 at 9:33

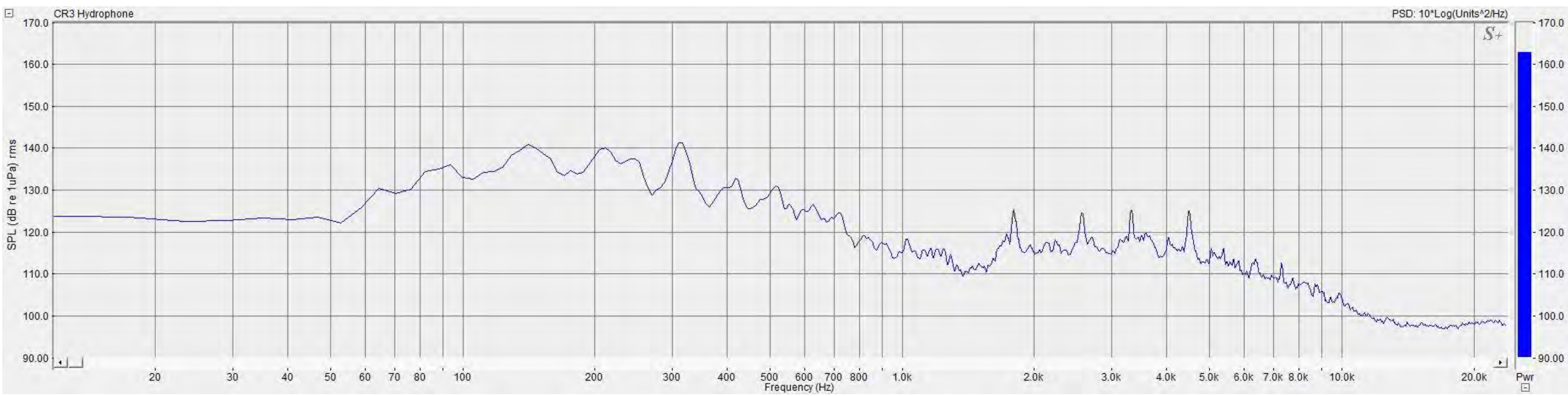

Figure 7. Power Spectral Density Plot from 10 meters for Pile 1 (Impulsive) installed September 9, 2022 at 9:33

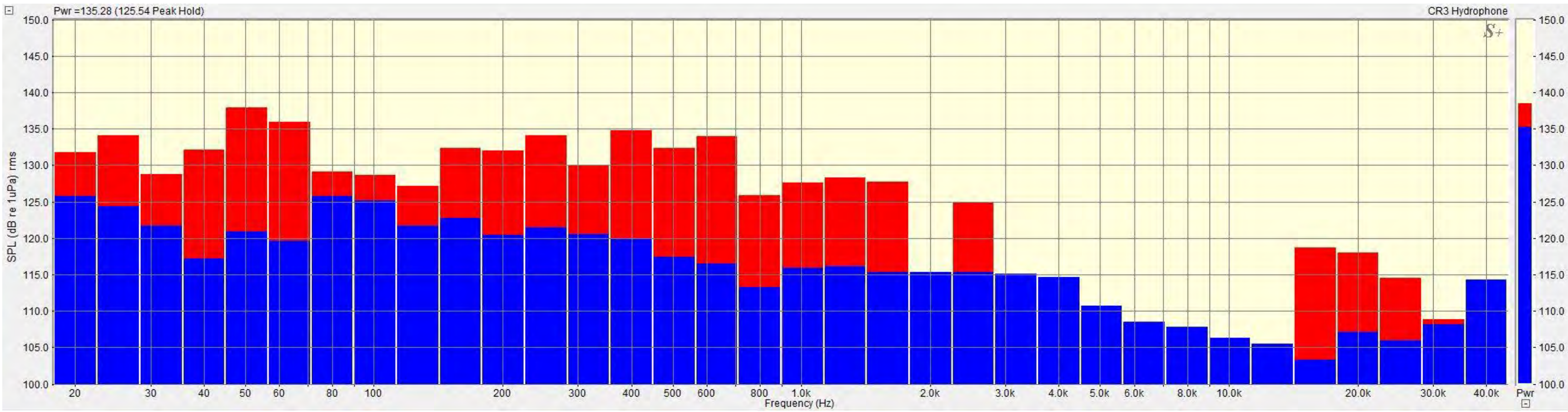

Figure 8. 1/3 Octave Band Spectra from 188 meters for Pile 1 (Impulsive) installed September 9, 2022 at 9:33

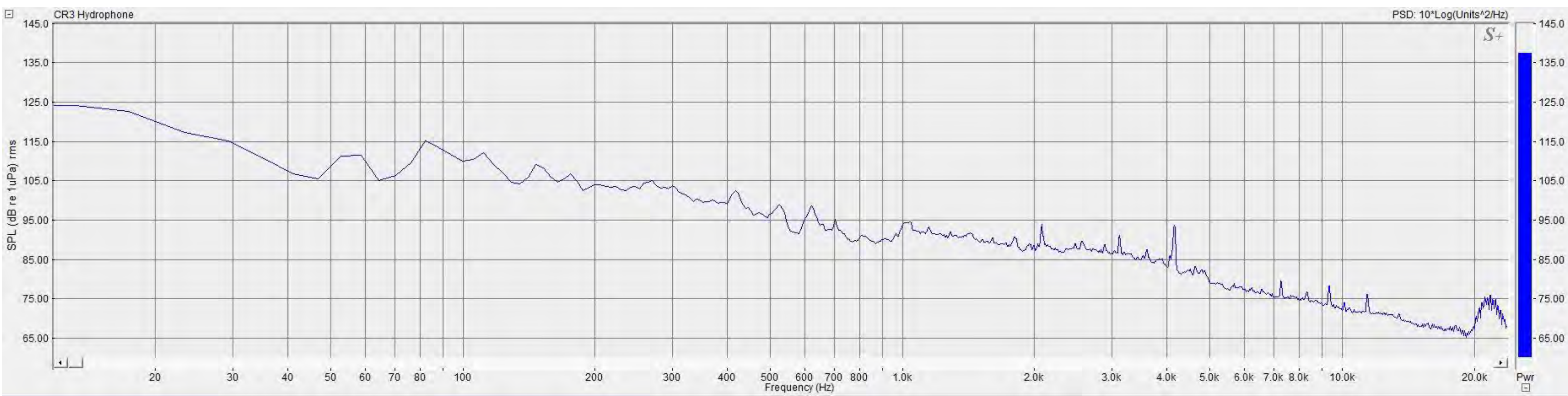

Figure 9. Power Spectral Density Plot from 188 meters for Pile 1 (Impulsive) installed September 9, 2022 at 9:33

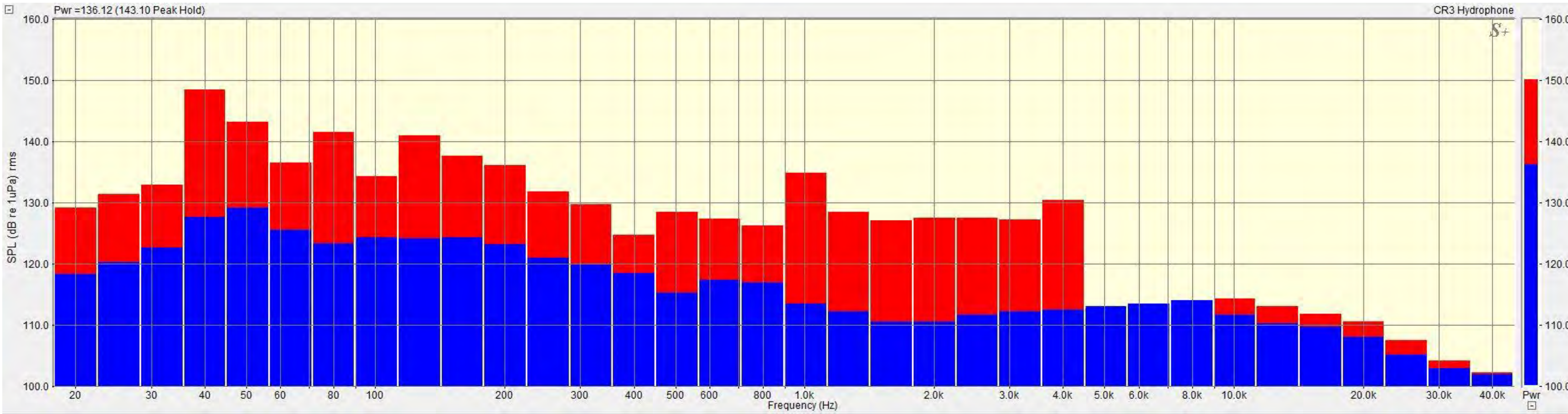

Figure 10. 1/3 Octave Band Spectra from 10 meters for Pile 2 (Continuous) installed September 9, 2022 at 11:23

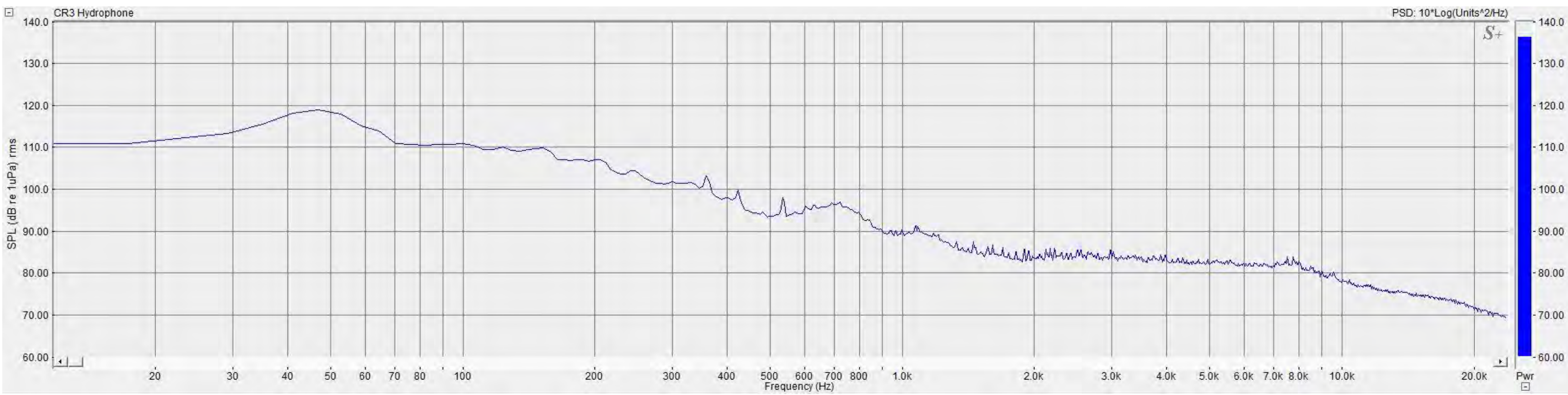

Figure 11. Power Spectral Density Plot from 10 meters for Pile 2 (Continuous) installed September 9, 2022 at 11:23

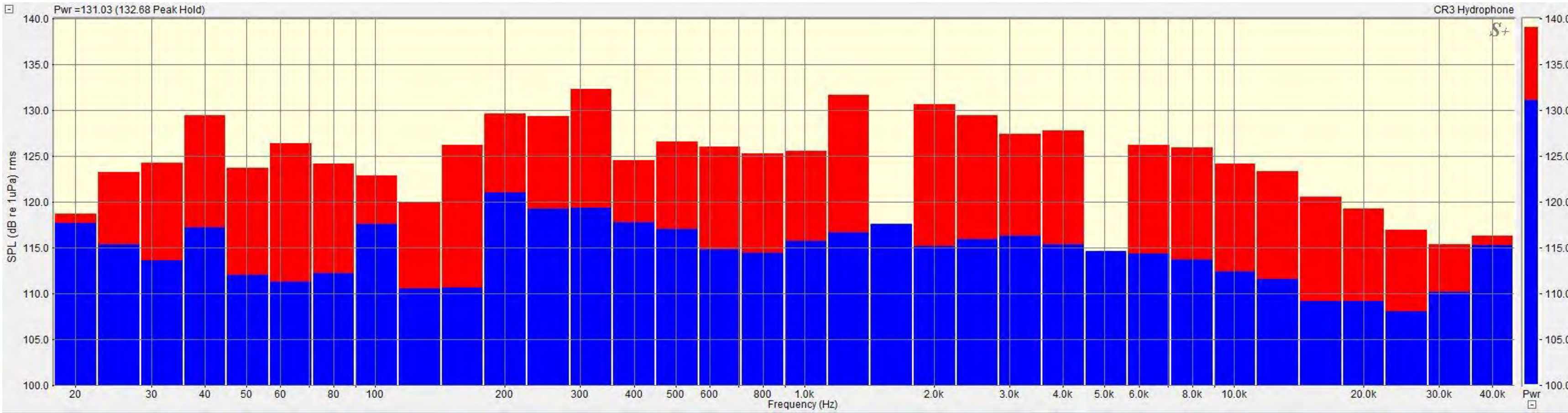

Figure 12. 1/3 Octave Band Spectra from 188 meters for Pile 2 (Continuous) installed September 9, 2022 at 11:23

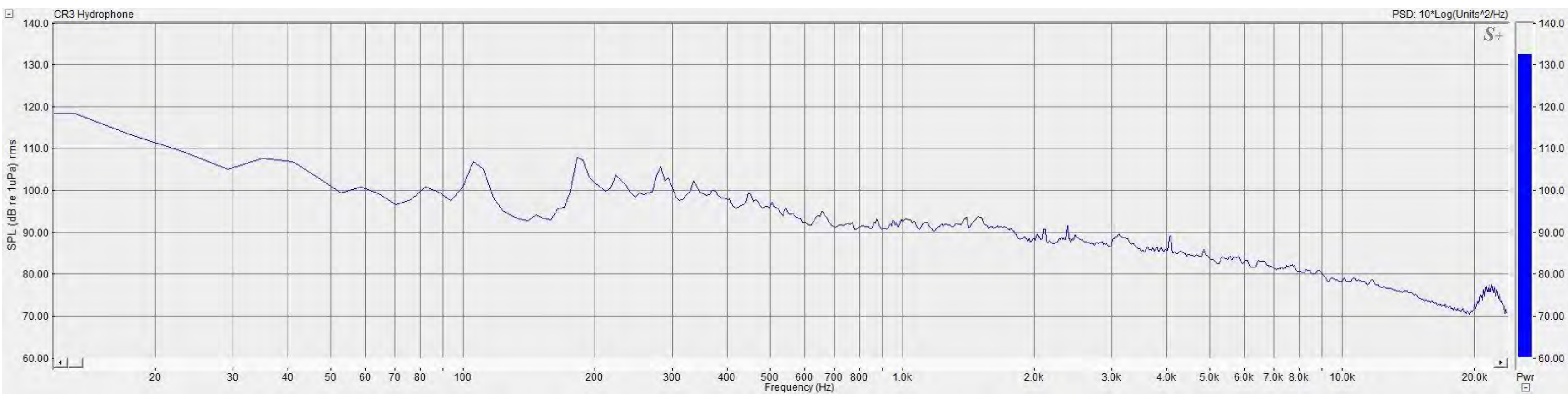

Figure 13. Power Spectral Density Plot from 188 meters for Pile 2 (Continuous) installed September 9, 2022 at 11:23

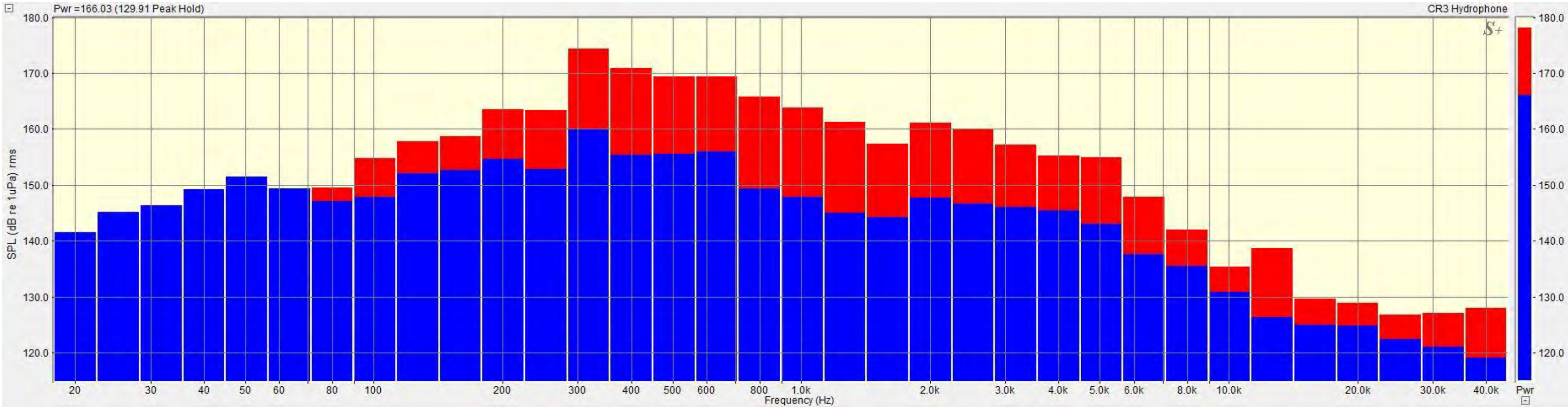

Figure 14. 1/3 Octave Band Spectra from 10 meters for Pile 2 (Impulsive) installed September 9, 2022 at 11:23

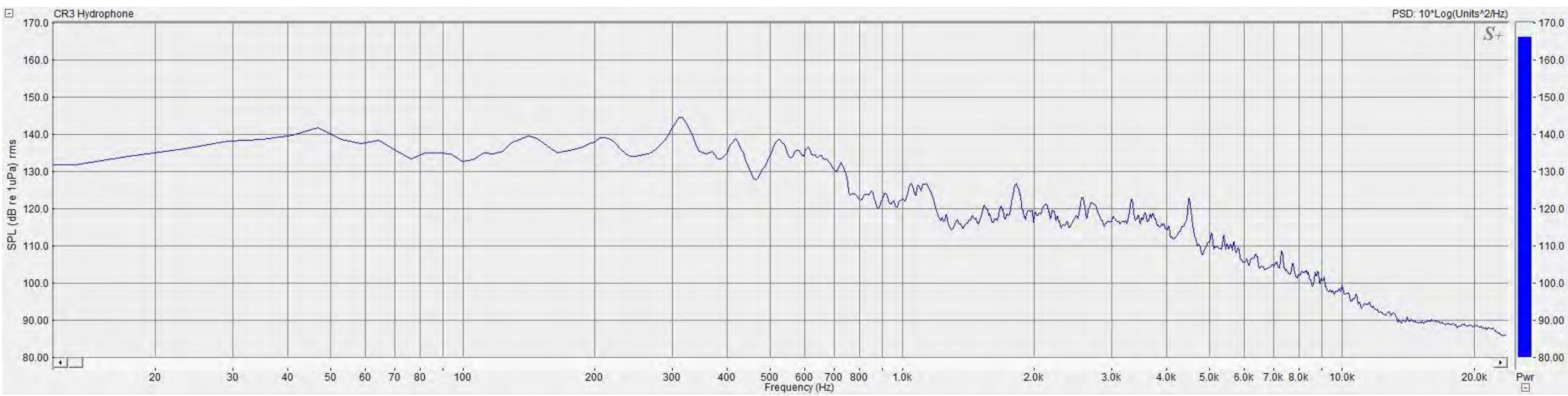

Figure 15. Power Spectral Density Plot from 10 meters for Pile 2 (Impulsive) installed September 9, 2022 at 11:23

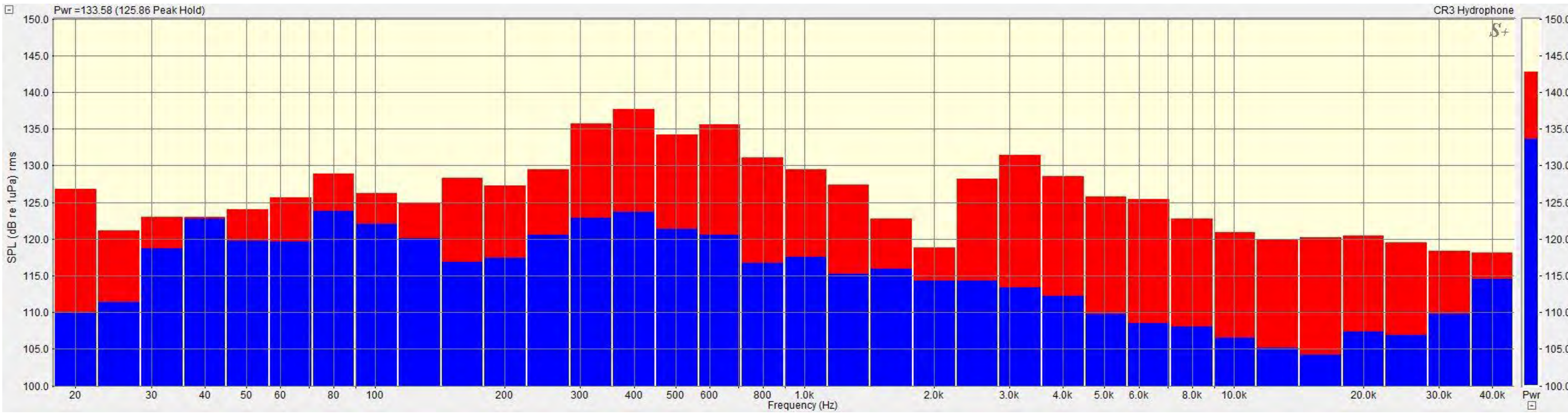

Figure 16. 1/3 Octave Band Spectra from 188 meters for Pile 2 (Impulsive) installed September 9, 2022 at 11:23

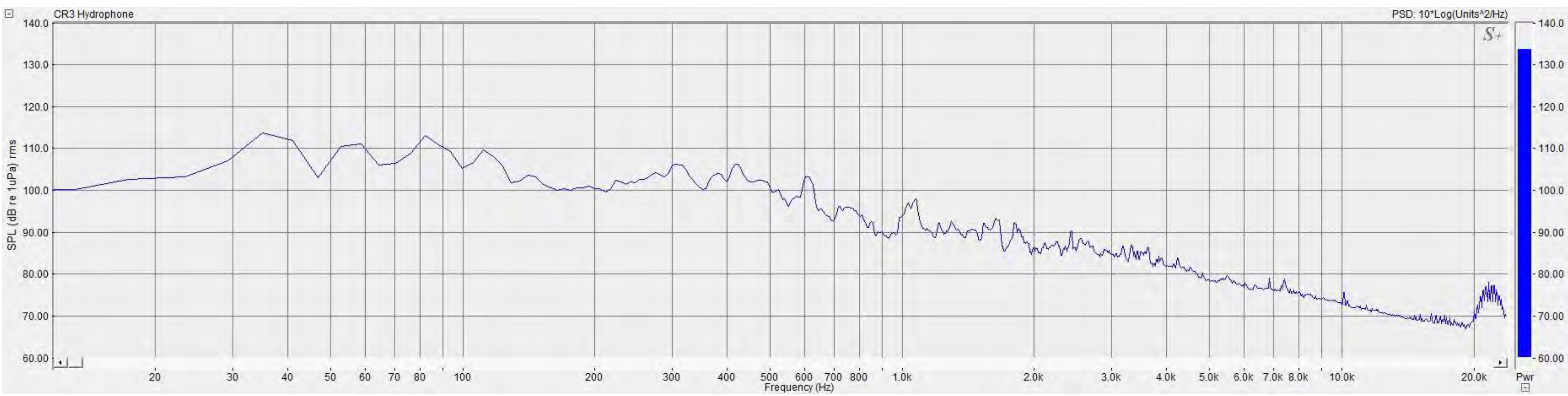

Figure 17. Power Spectral Density Plot from 188 meters for Pile 2 (Impulsive) installed September 9, 2022 at 11:23

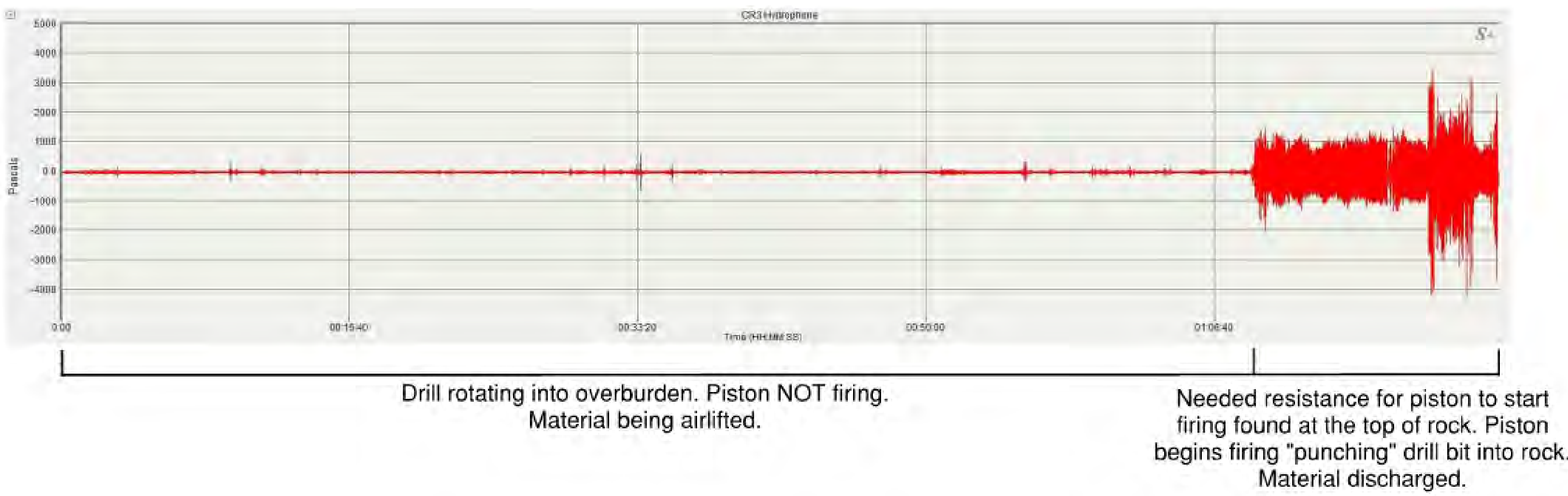

Figure 18. Time Series 10 meters away from Pile 1 on September 9, 2022

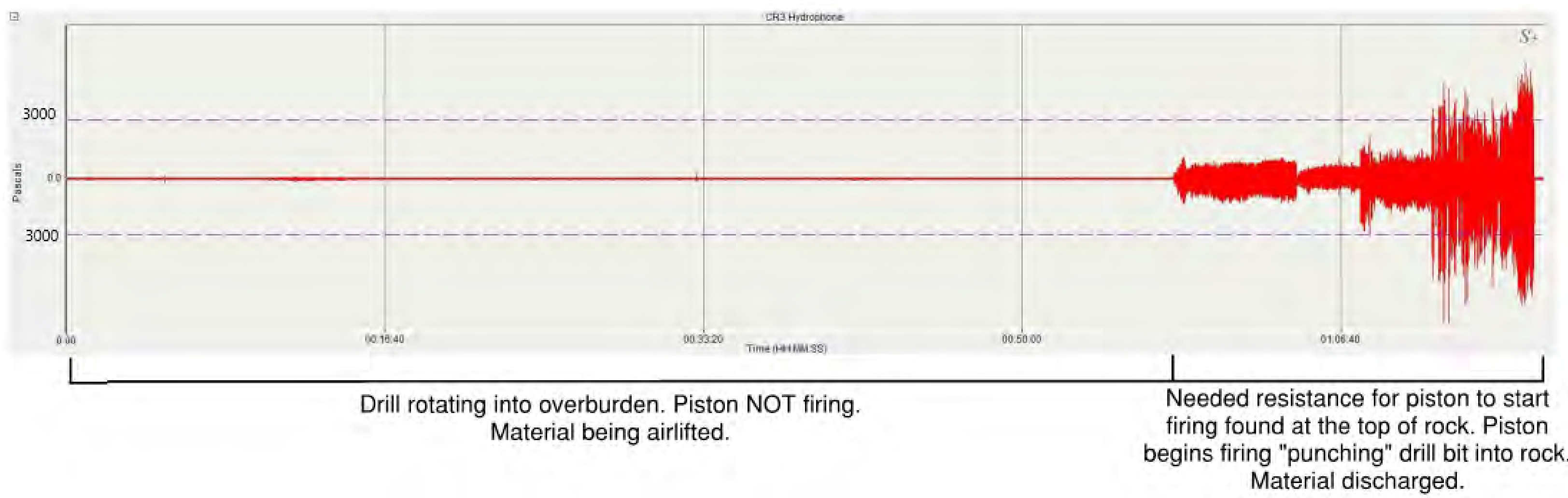

Figure 19. Time Series 10 meters away from Pile 2 on September 9, 2022

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P381 Constructors

Hydroacoustic Monitoring Daily Report

Date: November 28, 2022 **Project:** 3121020 PNSY Multi-Mission Dry Dock 1

Project Information

Project Name: P381 Multi-Mission Dry Dock #1
Location: Portsmouth Naval Shipyard, Kittery, Maine
Project/Contract Number: N40085-21-C-0011
Hydroacoustic Engineer - Lead: Theodore Hallett

Hydrologic and Geologic Information

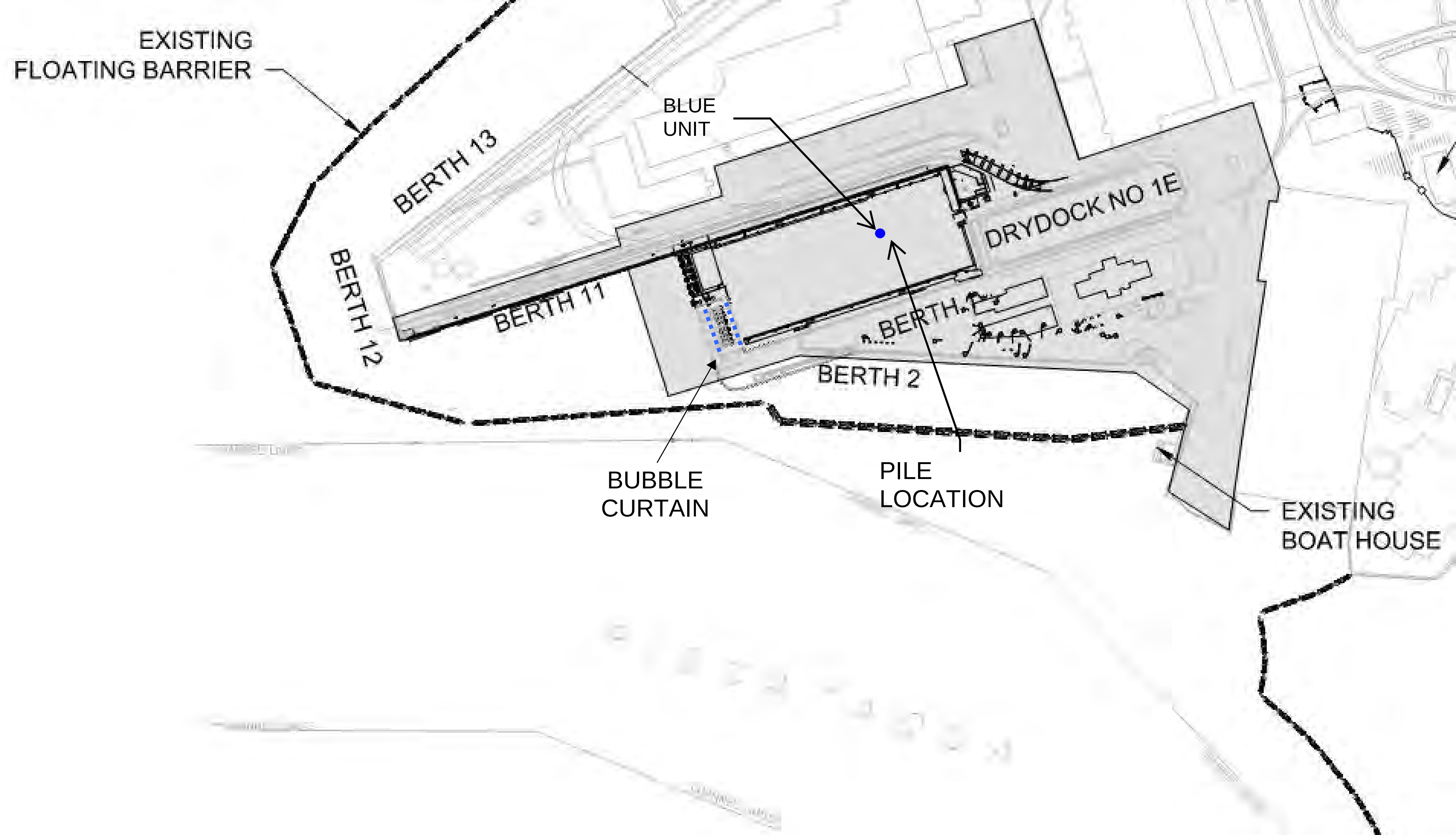
Body of Water: Portsmouth – Lower Piscataqua River
Type: Estuarine
Hydrologic Unit: 01060003
Geology: Glacial Till, Phyllite, Quartzite, Diorite and/or Shale

Equipment Information

Hydrophone: Cetacean Research CR3
Recording Device: Spectra DAQ-200
Sampling Rate: 96kHz
Bit Depth: 24 Bit

Weather

Meteorological Conditions: Sunny
Cloud Cover: 10%
Air Temperature: 48°F
Humidity: 80%
Wind Speed: 7 mph
Wind Direction: East
Beaufort Sea State: 2
Water Temperature: 46°F


EXISTING
FLOATING BARRIER
BERTH 13
BERTH 12
BERTH 11
BLUE
UNIT
DRYDOCK NO 1E
BERTH 1
BERTH 2
BUBBLE
CURTAIN
PILE
LOCATION
EXISTING
BOAT HOUSE

Event/Pile

Pile Type: 102" Casing **Activity:** Rotary Drill **IHA Count:** 1 of 10

Hammer Make: Bauer **Hammer Model:** BG 45 **Noise Type:** Continuous

Start Time: 9:17 **Stop Time:** 9:49 **Active Drill Duration:** 1,901 seconds

BLUE UNIT

Hydrophone Distance from Pile: 10 meters

Latitude: 43°04'51"N **Longitude:** 70°44'36"W

Water Column Depth: 11 meters **Hydrophone Deployed Depth:** 5.5 meters

GREEN UNIT

Hydrophone Distance from Pile: N/A

Latitude: N/A **Longitude:** N/A

Water Column Depth: N/A **Hydrophone Deployed Depth:** N/A

Notes:

Bauer BG 45 Rotary Drilling Rig (Base Carrier BS95) used to install 102" casings from center wall platform (CWP). Blue unit was deployed from CWP on unprotected side of bubble curtain (inside basin). Green unit was not deployed from Berth 11C davit arm due to multiple dredge material barges tied up along the Berth blocking the davit arm deployment location. No available location outside the bubble curtain to capture far field data. Bubble curtain was on and operational during drilling activities.

RMS SPL and SELcum data included in **Table 1.**

One-third octave band spectra and Power Spectral Density (PSD) included in **Figures 2-3**.

Data unweighted.

Event/Pile

Pile Type: 102" Casing **Activity:** Rotary Drill **IHA Count:** 2 of 10

Hammer Make: Bauer **Hammer Model:** BG 45 **Noise Type:** Continuous

Start Time: 10:15 **Stop Time:** 10:40 **Active Drill Duration:** 1,484 seconds

BLUE UNIT

Hydrophone Distance from Pile: 10 meters

Latitude: 43°04'51"N **Longitude:** 70°44'36"W

Water Column Depth: 11 meters **Hydrophone Deployed Depth:** 5.5 meters

GREEN UNIT

Hydrophone Distance from Pile: N/A

Latitude: N/A **Longitude:** N/A

Water Column Depth: N/A **Hydrophone Deployed Depth:** N/A

Notes:

Bauer BG 45 Rotary Drilling Rig (Base Carrier BS95) used to install 102" casings from center wall platform (CWP). Blue unit was deployed from CWP on unprotected side of bubble curtain (inside basin). Green unit was not deployed from Berth 11C davit arm due to multiple dredge material barges tied up along the Berth blocking the davit arm deployment location. No available location outside the bubble curtain to capture far field data. Bubble curtain was on and operational during drilling activities.

RMS SPL and SELcum data included in **Table 1.**

One-third octave band spectra and Power Spectral Density (PSD) included in **Figures 4-5**.

Data unweighted.

Event/Pile

Pile Type: 102" Casing **Activity:** Rotary Drill **IHA Count:** 3 of 10

Hammer Make: Bauer **Hammer Model:** BG 45 **Noise Type:** Continuous

Start Time: 10:44 **Stop Time:** 11:08 **Active Drill Duration:** 1,482 seconds

BLUE UNIT

Hydrophone Distance from Pile: 10 meters

Latitude: 43º04'51"N **Longitude:** 70°44'36"W

Water Column Depth: 11 meters **Hydrophone Deployed Depth:** 5.5 meters

GREEN UNIT

Hydrophone Distance from Pile: N/A

Latitude: N/A **Longitude:** N/A

Water Column Depth: N/A **Hydrophone Deployed Depth:** N/A

Notes:

Bauer BG 45 Rotary Drilling Rig (Base Carrier BS95) used to install 102" casings from center wall platform (CWP). Blue unit was deployed from CWP on unprotected side of bubble curtain (inside basin). Green unit was not deployed from Berth 11C davit arm due to multiple dredge material barges tied up along the Berth blocking the davit arm deployment location. No available location outside the bubble curtain to capture far field data. Bubble curtain was on and operational during drilling activities.

RMS SPL and SELcum data included in **Table 1.**

One-third octave band spectra and Power Spectral Density (PSD) included in **Figures 6-7**.

Data unweighted.

Event/Pile

Pile Type: 102" Casing **Activity:** Rotary Drill **IHA Count:** 4 of 10

Hammer Make: Bauer **Hammer Model:** BG 45 **Noise Type:** Continuous

Start Time: 11:21 **Stop Time:** 11:38 **Active Drill Duration:** 1,031 seconds

BLUE UNIT

Hydrophone Distance from Pile: 10 meters

Latitude: 43°04'51"N **Longitude:** 70°44'36"W

Water Column Depth: 12 meters **Hydrophone Deployed Depth:** 6 meters

GREEN UNIT

Hydrophone Distance from Pile: N/A

Latitude: N/A **Longitude:** N/A

Water Column Depth: N/A **Hydrophone Deployed Depth:** N/A

Notes:

Bauer BG 45 Rotary Drilling Rig (Base Carrier BS95) used to install 102" casings from center wall platform (CWP). Blue unit was deployed from CWP on unprotected side of bubble curtain (inside basin). Green unit was not deployed from Berth 11C davit arm due to multiple dredge material barges tied up along the Berth blocking the davit arm deployment location. No available location outside the bubble curtain to capture far field data. Bubble curtain was on and operational during drilling activities.

RMS SPL and SELcum data included in **Table 1.**

One-third octave band spectra and Power Spectral Density (PSD) included in **Figures 8-9**.

Data unweighted.

Event/Pile

Pile Type: 102” Casing **Activity:** Rotary Drill **IHA Count:** 5 of 10

Hammer Make: Bauer **Hammer Model:** BG 45 **Noise Type:** Continuous

Start Time: 12:16 **Stop Time:** 13:09 **Active Drill Duration:** 3,199 seconds

BLUE UNIT

Hydrophone Distance from Pile: 10 meters

Latitude: 43º04’51”N **Longitude:** 70°44’36”W

Water Column Depth: 12 meters **Hydrophone Deployed Depth:** 6 meters

GREEN UNIT

Hydrophone Distance from Pile: N/A

Latitude: N/A **Longitude:** N/A

Water Column Depth: N/A **Hydrophone Deployed Depth:** N/A

Notes:

Bauer BG 45 Rotary Drilling Rig (Base Carrier BS95) used to install 102” casings from center wall platform (CWP). Blue unit was deployed from CWP on unprotected side of bubble curtain (inside basin). Green unit was not deployed from Berth 11C davit arm due to multiple dredge material barges tied up along the Berth blocking the davit arm deployment location. No available location outside the bubble curtain to capture far field data. Bubble curtain was on and operational during drilling activities.

RMS SPL and SELcum data included in **Table 1.**

One-third octave band spectra and Power Spectral Density (PSD) included in **Figures 10-11**.

Data unweighted.

Event/Pile

Pile Type: 102” Casing **Activity:** Rotary Drill **IHA Count:** 6 of 10

Hammer Make: Bauer **Hammer Model:** BG 45 **Noise Type:** Continuous

Start Time: 13:23 **Stop Time:** 13:47 **Active Drill Duration:** 857 seconds

BLUE UNIT

Hydrophone Distance from Pile: 10 meters

Latitude: 43º04’51”N **Longitude:** 70°44’36”W

Water Column Depth: 12.5 meters **Hydrophone Deployed Depth:** 6.25 meters

GREEN UNIT

Hydrophone Distance from Pile: N/A

Latitude: N/A **Longitude:** N/A

Water Column Depth: N/A **Hydrophone Deployed Depth:** N/A

Notes:

Bauer BG 45 Rotary Drilling Rig (Base Carrier BS95) used to install 102” casings from center wall platform (CWP). Blue unit was deployed from CWP on unprotected side of bubble curtain (inside basin). Green unit was not deployed from Berth 11C davit arm due to multiple dredge material barges tied up along the Berth blocking the davit arm deployment location. No available location outside the bubble curtain to capture far field data. Bubble curtain was on and operational during drilling activities.

RMS SPL and SELcum data included in **Table 1.**

One-third octave band spectra and Power Spectral Density (PSD) included in **Figures 12-13**.

Data unweighted.

Date	Pile Type	Hammer Make/Model	Noise Type	Start Time	Stop Time	Active Hammer Duration (seconds)	Distance From Pile (meters)	RMS unweighted (SPL dB re 1uPa)			SELcum unweighted (dB re 1uPa^2.s)	SELcum Duration (seconds)
								Median	Mean (average)	Maximum		
11/28/2022	102" Casing	Rotary Drill	Continuous / Vibratory	9:17	9:49	1901	10	155.28	155.44	159.58	188.36	1901
							-	-	-	-	-	
11/28/2022	102" Casing	Rotary Drill	Continuous / Vibratory	10:15	10:40	1484	10	156.89	157.02	161.81	188.75	1484
							-	-	-	-	-	
11/28/2022	102" Casing	Rotary Drill	Continuous / Vibratory	10:44	11:08	1482	10	156.86	157.12	161.57	189.02	1482
							-	-	-	-	-	
11/28/2022	102" Casing	Rotary Drill	Continuous / Vibratory	11:21	11:38	1031	10	143.93	142.13	148.74	175.09	1031
							-	-	-	-	-	
11/28/2022	102" Casing	Rotary Drill	Continuous / Vibratory	12:16	13:09	3199	10	142.59	142.68	148.45	175.01	3199
							-	-	-	-	-	
11/28/2022	102" Casing	Rotary Drill	Continuous / Vibratory	13:23	13:47	857	10	142.02	141.92	145.20	173.70	857
							-	-	-	-	-	

Table 1. Data Summary of Piles Monitored

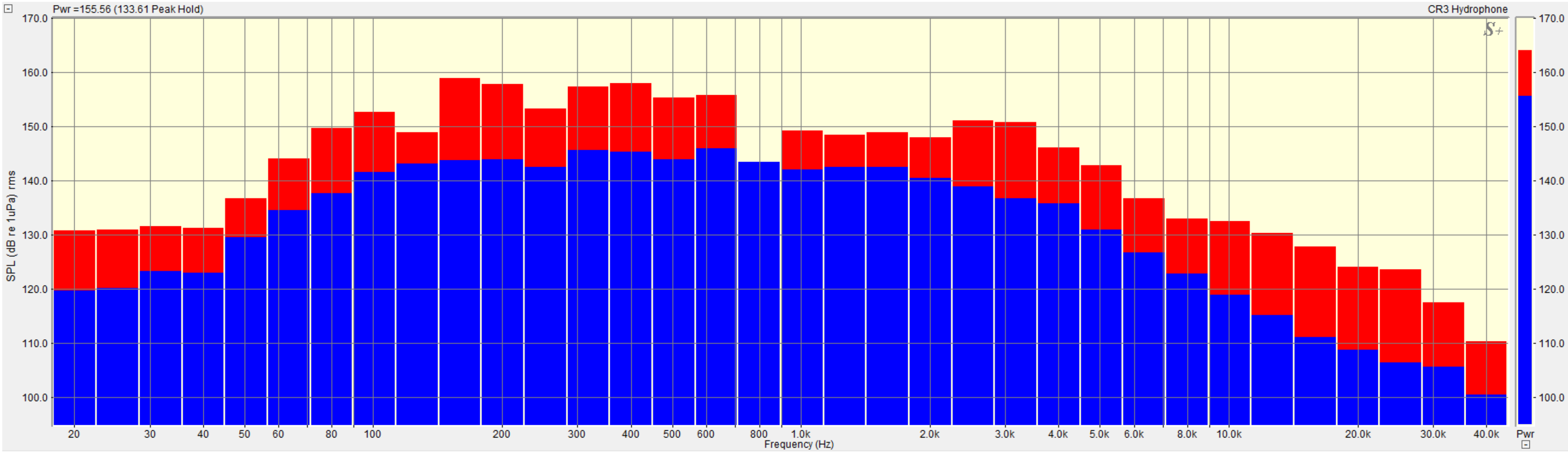


Figure 2. 1/3 Octave Band Spectra from 10 meters for Event 1 installed November 28, 2022 at 9:17

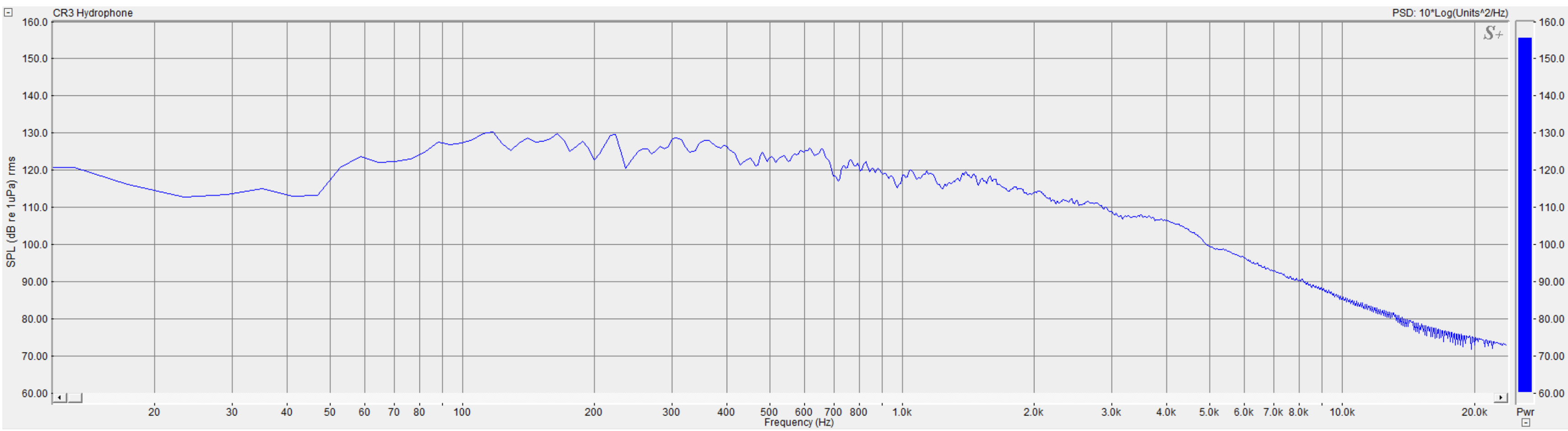


Figure 3. Power Spectral Density Plot from 10 meters for Event 1 installed November 28, 2022 at 9:17

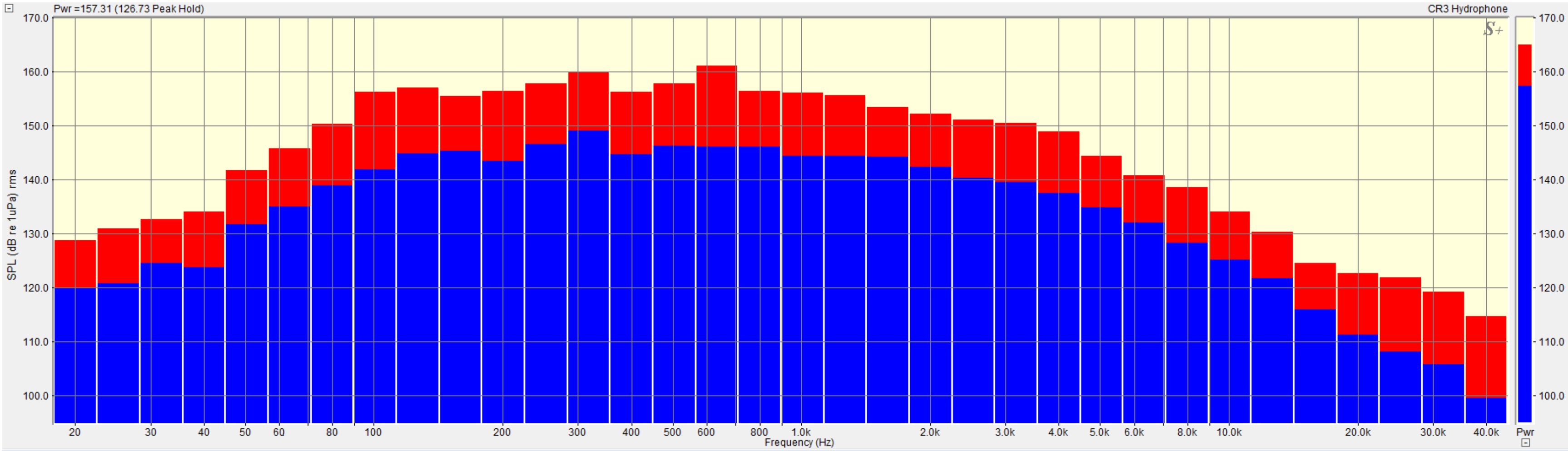


Figure 4. 1/3 Octave Band Spectra from 10 meters for Event 2 installed November 28, 2022 at 10:15

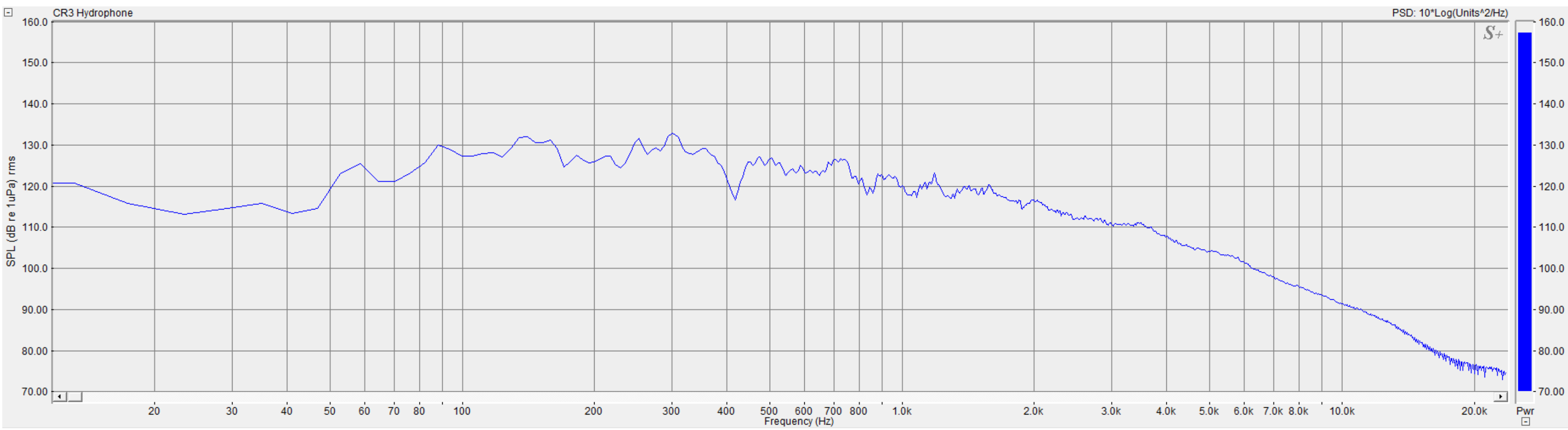


Figure 5. Power Spectral Density Plot from 10 meters for Event 2 installed November 28, 2022 at 10:15

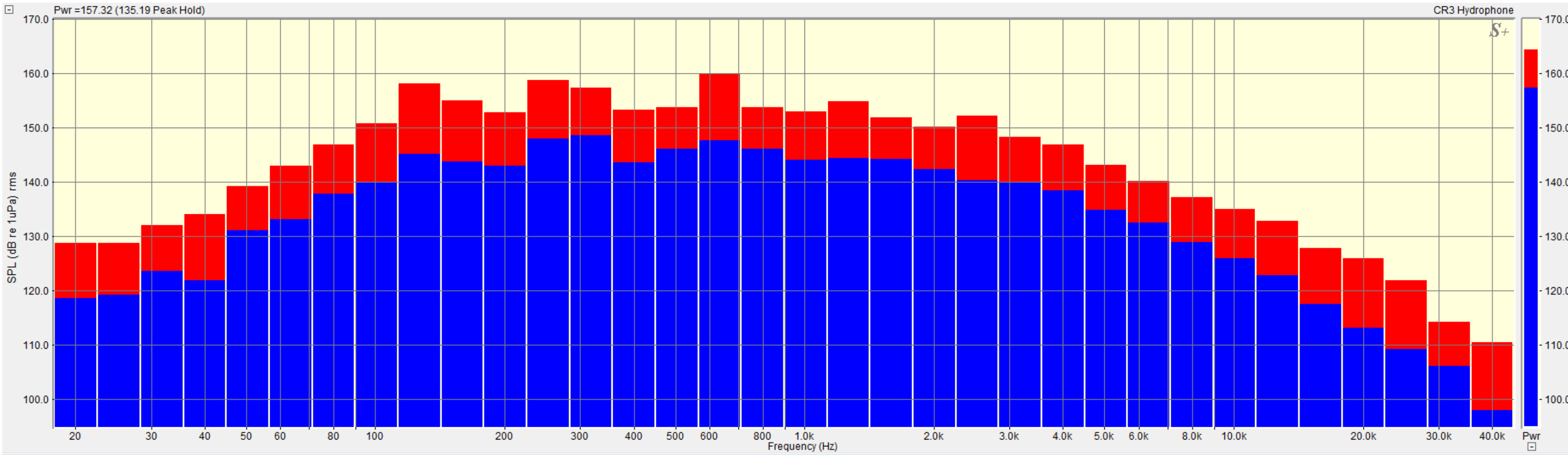


Figure 6. 1/3 Octave Band Spectra from 10 meters for Event 3 installed November 28, 2022 at 10:44

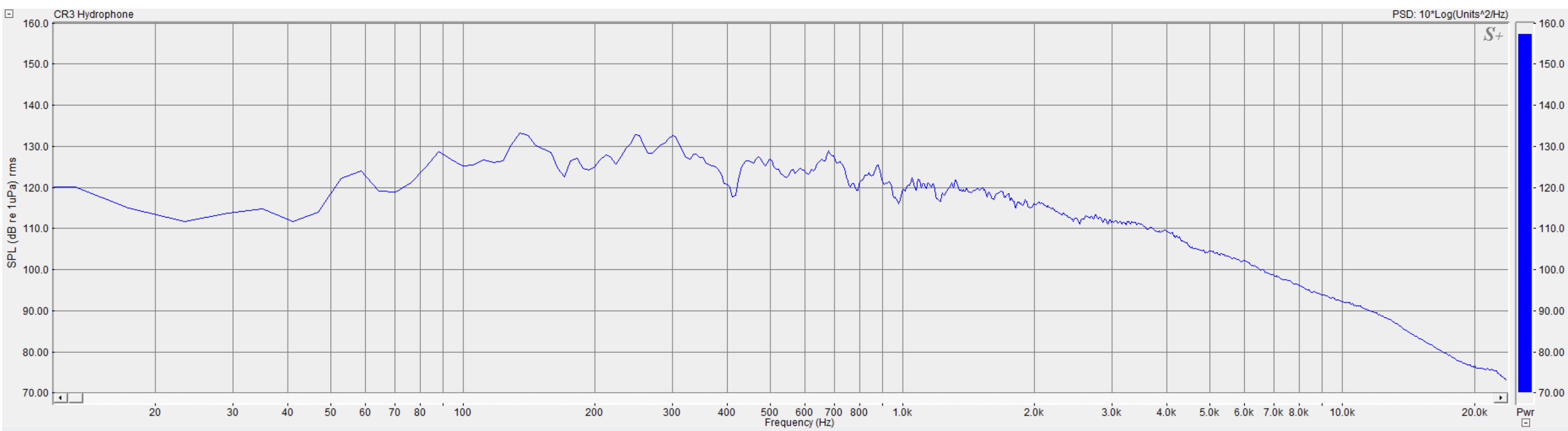


Figure 7. Power Spectral Density Plot from 10 meters for Event 3 installed November 28, 2022 at 10:44

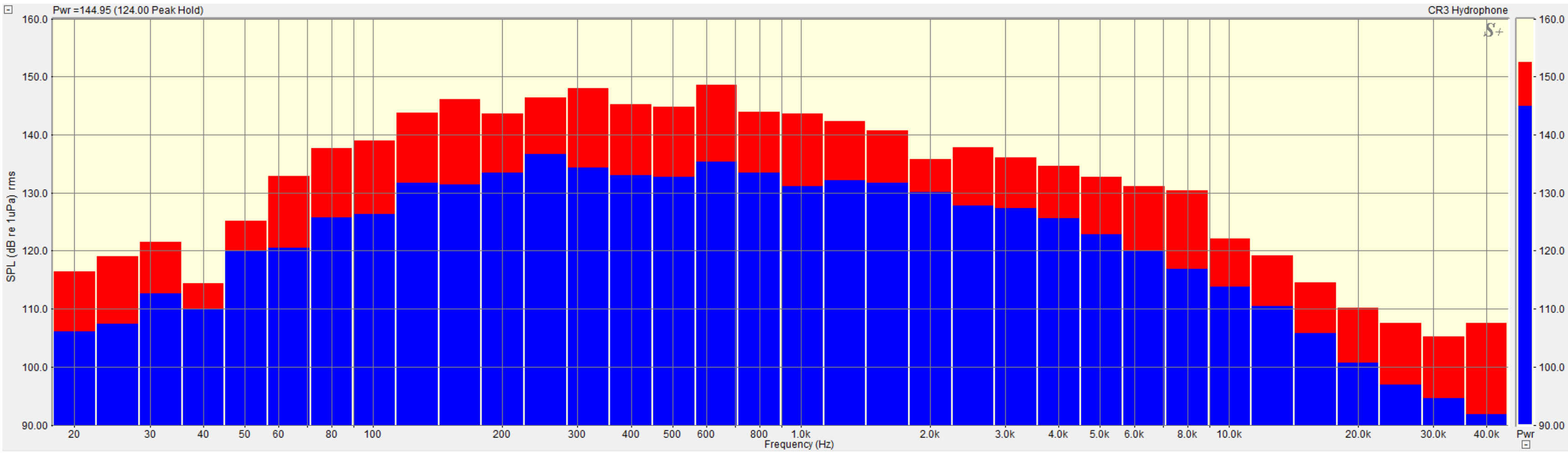


Figure 8. 1/3 Octave Band Spectra from 10 meters for Event 4 installed November 28, 2022 at 11:21

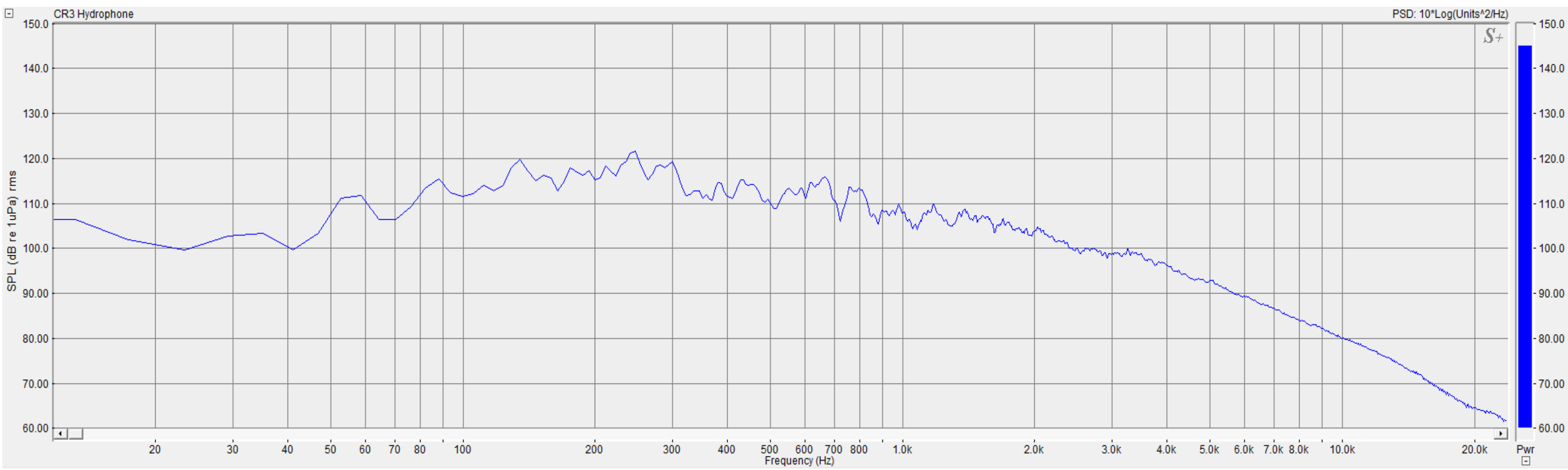


Figure 9. Power Spectral Density Plot from 10 meters for Event 4 installed November 28, 2022 at 11:21

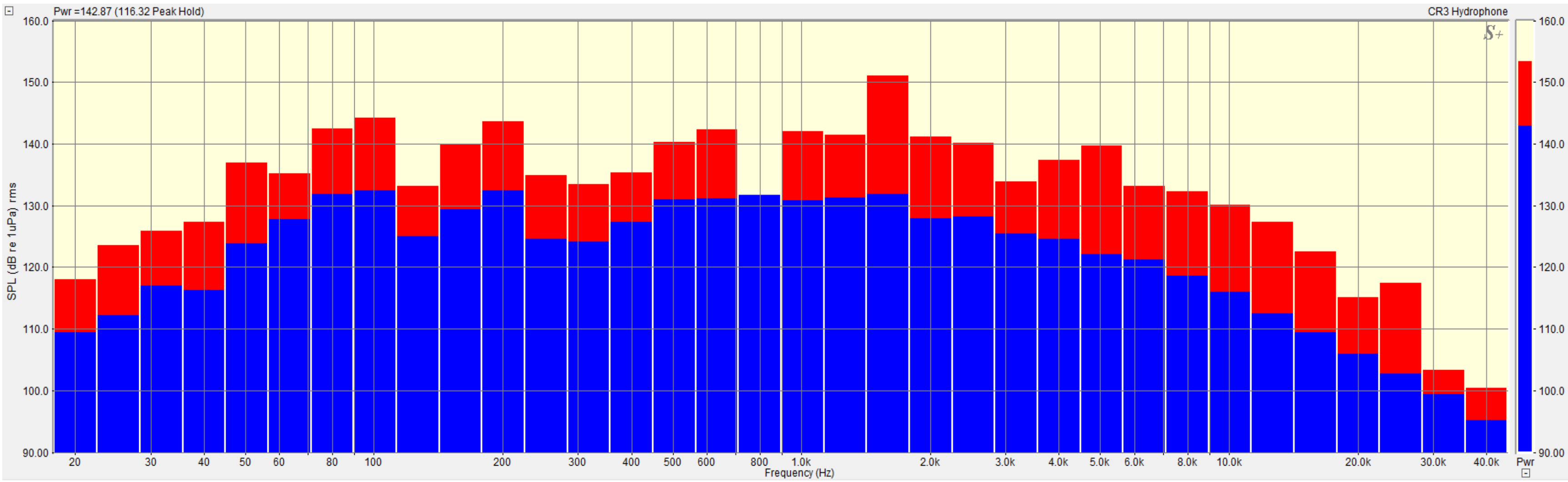


Figure 10. 1/3 Octave Band Spectra from 10 meters for Event 5 installed November 28, 2022 at 12:16

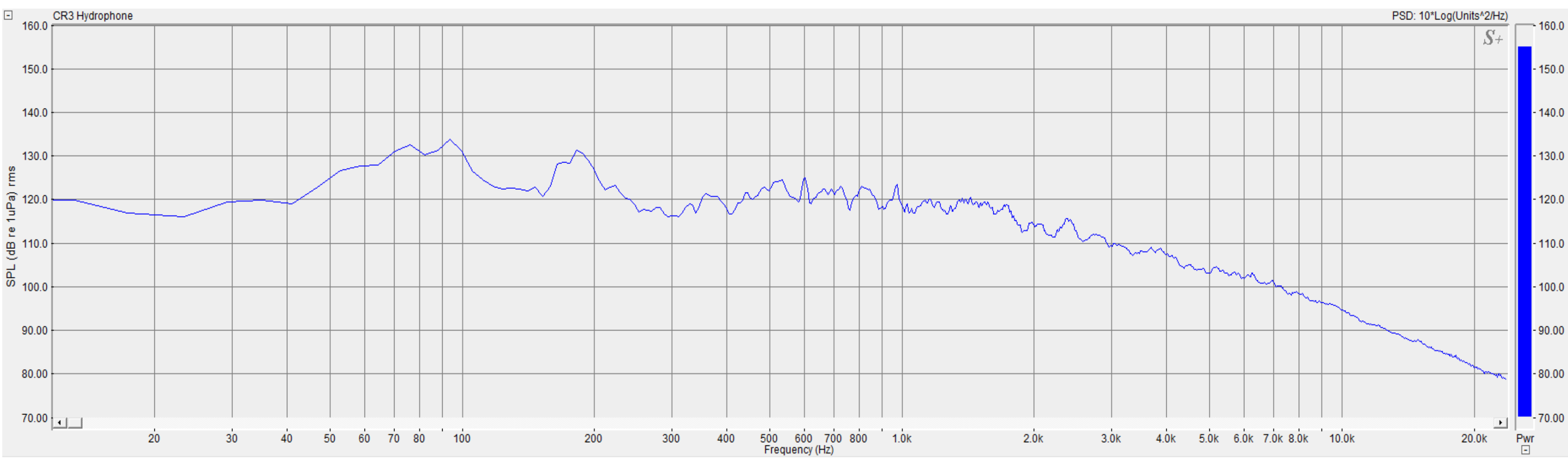


Figure 11. Power Spectral Density Plot from 10 meters for Event 5 installed November 28, 2022 at 12:16

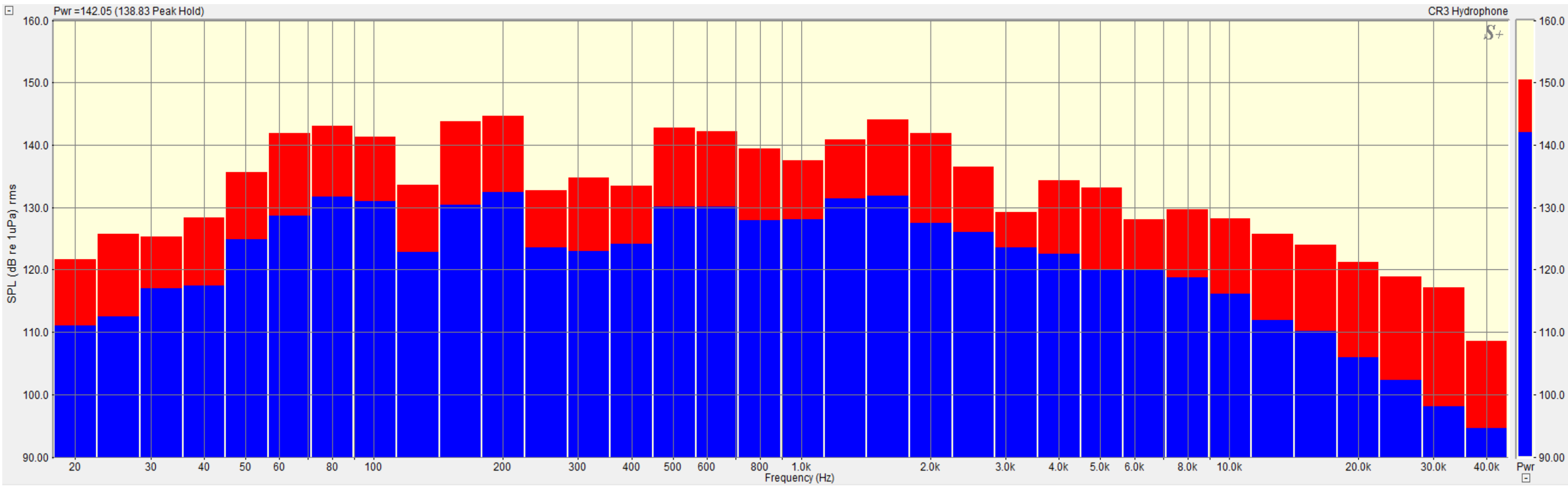


Figure 12. 1/3 Octave Band Spectra from 10 meters for Event 6 installed November 28, 2022 at 13:23

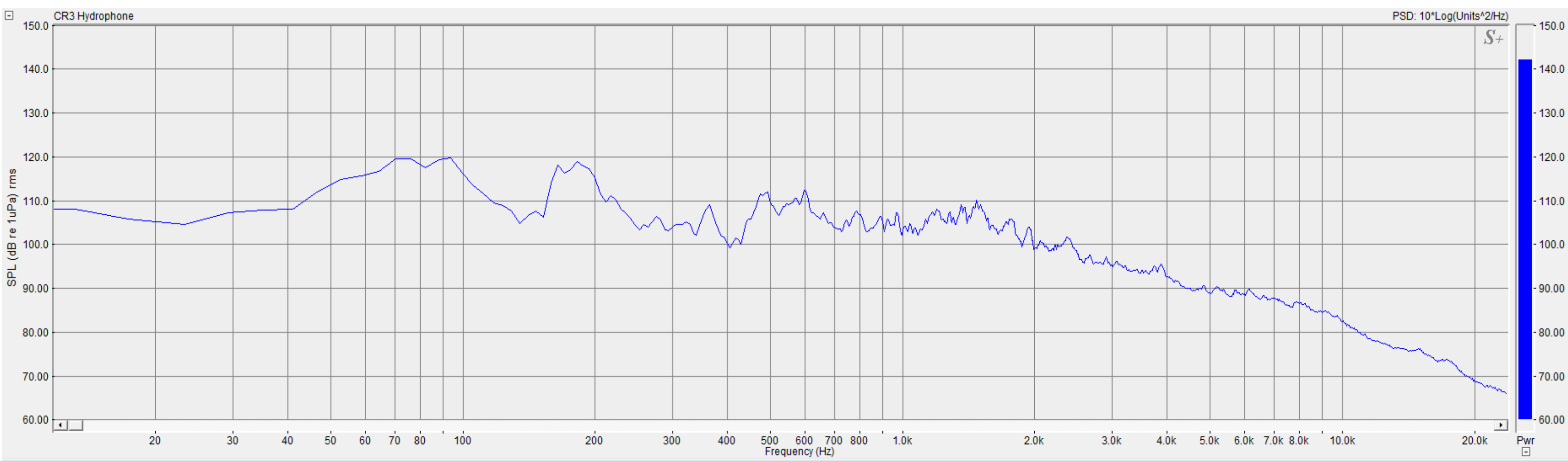


Figure 13. Power Spectral Density Plot from 10 meters for Event 6 installed November 28, 2022 at 13:23

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P381 Constructors

Hydroacoustic Monitoring Daily Report

Date: December 2, 2022 **Project:** 3121020 PNSY Multi-Mission Dry Dock 1

Project Information

Project Name: P381 Multi-Mission Dry Dock #1
Location: Portsmouth Naval Shipyard, Kittery, Maine
Project/Contract Number: N40085-21-C-0011
Hydroacoustic Engineer - Lead: Theodore Hallett

Hydrologic and Geologic Information

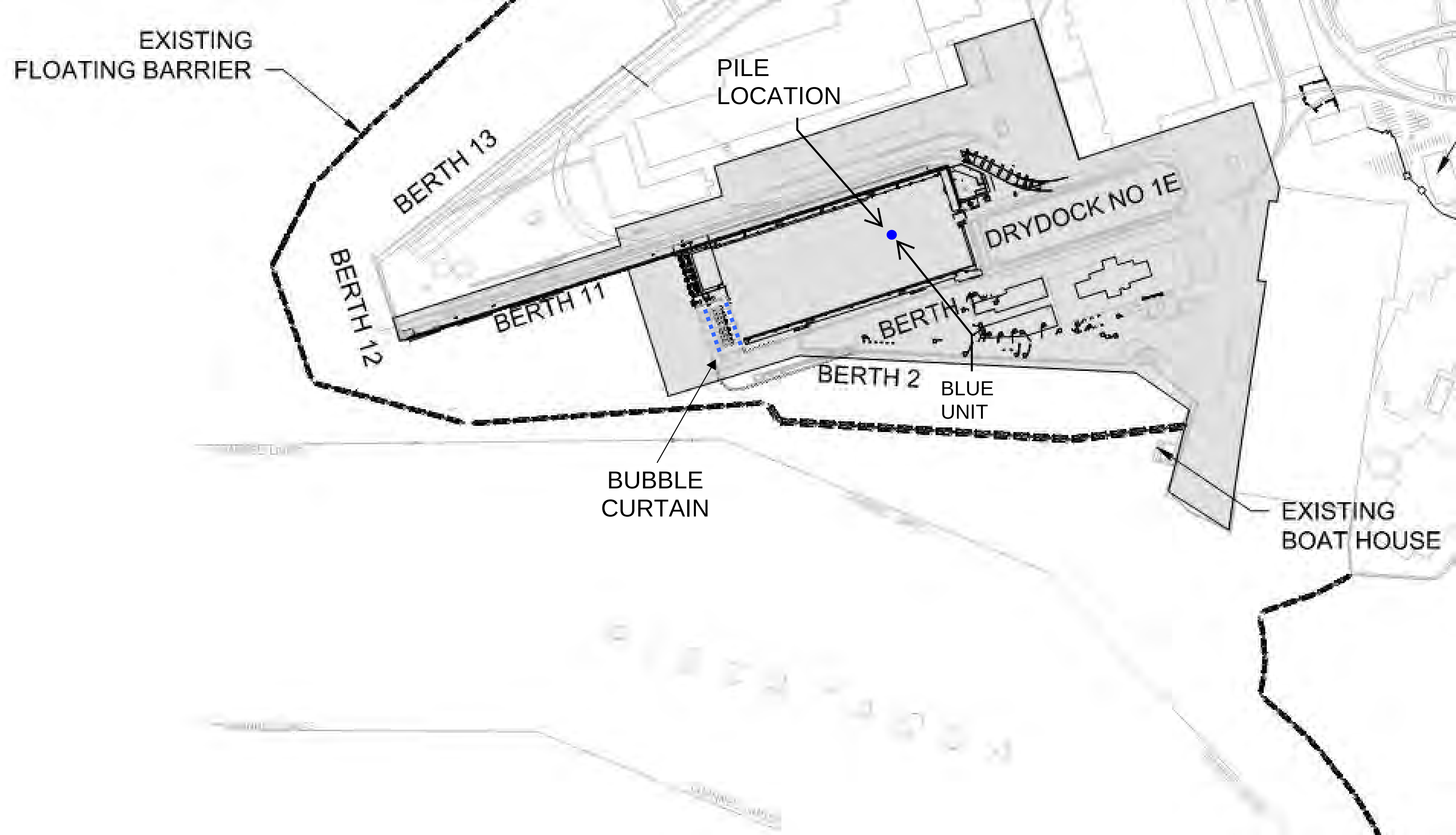
Body of Water: Portsmouth – Lower Piscataqua River
Type: Estuarine
Hydrologic Unit: 01060003
Geology: Glacial Till, Phyllite, Quartzite, Diorite and/or Shale

Equipment Information

Hydrophone: Cetacean Research CR3
Recording Device: Spectra DAQ-200
Sampling Rate: 96kHz
Bit Depth: 24 Bit

Weather

Meteorological Conditions: Sunny
Cloud Cover: 10%
Air Temperature: 39°F
Humidity: 55%
Wind Speed: 6 mph
Wind Direction: East
Beaufort Sea State: 2
Water Temperature: 47°F



EXISTING
FLOATING BARRIER
BERTH 13
BERTH 12
BERTH 11
PILE
LOCATION
DRYDOCK NO 1E
BERTH
BERTH 2
BLUE
UNIT
BUBBLE
CURTAIN
EXISTING
BOAT HOUSE

Event/Pile

Pile Type: 102” Casing **Activity:** Rotary Drill **IHA Count:** 7 of 10

Hammer Make: Bauer **Hammer Model:** BG 45 **Noise Type:** Continuous

Start Time: 11:15 **Stop Time:** 11:21 **Active Drill Duration:** 399 seconds

BLUE UNIT

Hydrophone Distance from Pile: 10 meters

Latitude: 43º04’51”N **Longitude:** 70°44’36”W

Water Column Depth: 13.2 meters **Hydrophone Deployed Depth:** 6.6 meters

GREEN UNIT

Hydrophone Distance from Pile: N/A

Latitude: N/A **Longitude:** N/A

Water Column Depth: N/A **Hydrophone Deployed Depth:** N/A

Notes:

Bauer BG 45 Rotary Drilling Rig (Base Carrier BS95) used to install 102” casings from center wall platform (CWP). Blue unit was deployed from CWP on unprotected side of bubble curtain (inside basin). Green unit was not deployed from Berth 11C davit arm due to multiple dredge material barges tied up along the Berth blocking the davit arm deployment location. No available location outside the bubble curtain to capture far field data. Bubble curtain was on and operational during drilling activities.

RMS SPL and SELcum data included in **Table 1.**

One-third octave band spectra and Power Spectral Density (PSD) included in **Figures 2-3**.

Data unweighted.

Event/Pile

Pile Type: 102” Casing **Activity:** Rotary Drill **IHA Count:** 8 of 10

Hammer Make: Bauer **Hammer Model:** BG 45 **Noise Type:** Continuous

Start Time: 11:29 **Stop Time:** 11:42 **Active Drill Duration:** 753 seconds

BLUE UNIT

Hydrophone Distance from Pile: 10 meters

Latitude: 43°04’51”N **Longitude:** 70°44’36”W

Water Column Depth: 13.2 meters **Hydrophone Deployed Depth:** 6.6 meters

GREEN UNIT

Hydrophone Distance from Pile: N/A

Latitude: N/A **Longitude:** N/A

Water Column Depth: N/A **Hydrophone Deployed Depth:** N/A

Notes:

Bauer BG 45 Rotary Drilling Rig (Base Carrier BS95) used to install 102” casings from center wall platform (CWP). Blue unit was deployed from CWP on unprotected side of bubble curtain (inside basin). Green unit was not deployed from Berth 11C davit arm due to multiple dredge material barges tied up along the Berth blocking the davit arm deployment location. No available location outside the bubble curtain to capture far field data. Bubble curtain was on and operational during drilling activities.

RMS SPL and SELcum data included in **Table 1.**

One-third octave band spectra and Power Spectral Density (PSD) included in **Figures 4-5**.

Data unweighted.

Event/Pile

Pile Type: 102" Casing

Activity: Rotary Drill

IHA Count: 9 of 10

Hammer Make: Bauer

Hammer Model: BG 45

Noise Type: Continuous

Start Time: 12:17

Stop Time: 12:20

Active Drill Duration: 180 seconds

BLUE UNIT

Hydrophone Distance from Pile: 10 meters

Latitude: 43º04'51"N

Longitude: 70°44'36"W

Water Column Depth: 13 meters

Hydrophone Deployed Depth: 6.5 meters

GREEN UNIT

Hydrophone Distance from Pile: N/A

Latitude: N/A

Longitude: N/A

Water Column Depth: N/A

Hydrophone Deployed Depth: N/A

Notes:

Bauer BG 45 Rotary Drilling Rig (Base Carrier BS95) used to install 102" casings from center wall platform (CWP). Blue unit was deployed from CWP on unprotected side of bubble curtain (inside basin). Green unit was not deployed from Berth 11C davit arm due to multiple dredge material barges tied up along the Berth blocking the davit arm deployment location. No available location outside the bubble curtain to capture far field data. Bubble curtain was on and operational during drilling activities.

RMS SPL and SELcum data included in **Table 1.**

One-third octave band spectra and Power Spectral Density (PSD) included in **Figures 6-7**.

Data unweighted.

Event/Pile

Pile Type: 102” Casing **Activity:** Rotary Drill **IHA Count:** 10 of 10

Hammer Make: Bauer **Hammer Model:** BG 45 **Noise Type:** Continuous

Start Time: 12:32 **Stop Time:** 12:39 **Active Drill Duration:** 412 seconds

BLUE UNIT

Hydrophone Distance from Pile: 10 meters

Latitude: 43°04’51”N **Longitude:** 70°44’36”W

Water Column Depth: 13 meters **Hydrophone Deployed Depth:** 6.5 meters

GREEN UNIT

Hydrophone Distance from Pile: N/A

Latitude: N/A **Longitude:** N/A

Water Column Depth: N/A **Hydrophone Deployed Depth:** N/A

Notes:

Bauer BG 45 Rotary Drilling Rig (Base Carrier BS95) used to install 102” casings from center wall platform (CWP). Blue unit was deployed from CWP on unprotected side of bubble curtain (inside basin). Green unit was not deployed from Berth 11C davit arm due to multiple dredge material barges tied up along the Berth blocking the davit arm deployment location. No available location outside the bubble curtain to capture far field data. Bubble curtain was on and operational during drilling activities.

RMS SPL and SELcum data included in **Table 1.**

One-third octave band spectra and Power Spectral Density (PSD) included in **Figures 8-9**.

Data unweighted.

Event/Pile

Pile Type: 102” Casing **Activity:** Rotary Drill **IHA Count:** 11 of 10

Hammer Make: Bauer **Hammer Model:** BG 45 **Noise Type:** Continuous

Start Time: 13:04 **Stop Time:** 13:08 **Active Drill Duration:** 222 seconds

<u>BLUE UNIT</u>

Hydrophone Distance from Pile: 10 meters

Latitude: 43º04’51”N **Longitude:** 70°44’36”W

Water Column Depth: 13 meters **Hydrophone Deployed Depth:** 6.5 meters

<u>GREEN UNIT</u>

Hydrophone Distance from Pile: N/A

Latitude: N/A **Longitude:** N/A

Water Column Depth: N/A **Hydrophone Deployed Depth:** N/A

Notes:

Bauer BG 45 Rotary Drilling Rig (Base Carrier BS95) used to install 102” casings from center wall platform (CWP). Blue unit was deployed from CWP on unprotected side of bubble curtain (inside basin). Green unit was not deployed from Berth 11C davit arm due to multiple dredge material barges tied up along the Berth blocking the davit arm deployment location. No available location outside the bubble curtain to capture far field data. Bubble curtain was on and operational during drilling activities.

RMS SPL and SELcum data included in **Table 1.**

One-third octave band spectra and Power Spectral Density (PSD) included in **Figures 10-11**.

Data unweighted.

Event/Pile

Pile Type: 102" Casing **Activity:** Rotary Drill **IHA Count:** 12 of 10

Hammer Make: Bauer **Hammer Model:** BG 45 **Noise Type:** Continuous

Start Time: 13:30 **Stop Time:** 13:56 **Active Drill Duration:** 1,584 seconds

BLUE UNIT

Hydrophone Distance from Pile: 10 meters

Latitude: 43°04'51"N **Longitude:** 70°44'36"W

Water Column Depth: 12.9 meters **Hydrophone Deployed Depth:** 6.5 meters

GREEN UNIT

Hydrophone Distance from Pile: N/A

Latitude: N/A **Longitude:** N/A

Water Column Depth: N/A **Hydrophone Deployed Depth:** N/A

Notes:

Bauer BG 45 Rotary Drilling Rig (Base Carrier BS95) used to install 102" casings from center wall platform (CWP). Blue unit was deployed from CWP on unprotected side of bubble curtain (inside basin). Green unit was not deployed from Berth 11C davit arm due to multiple dredge material barges tied up along the Berth blocking the davit arm deployment location. No available location outside the bubble curtain to capture far field data. Bubble curtain was on and operational during drilling activities.

RMS SPL and SELcum data included in **Table 1.**

One-third octave band spectra and Power Spectral Density (PSD) included in **Figures 12-13**.

Data unweighted.

Event/Pile

Pile Type: 102" Casing **Activity:** Rotary Drill **IHA Count:** 13 of 10

Hammer Make: Bauer **Hammer Model:** BG 45 **Noise Type:** Continuous

Start Time: 14:11 **Stop Time:** 14:24 **Active Drill Duration:** 778 seconds

BLUE UNIT

Hydrophone Distance from Pile: 10 meters

Latitude: 43º04'51"N **Longitude:** 70°44'36"W

Water Column Depth: 12.8 meters **Hydrophone Deployed Depth:** 6.5 meters

GREEN UNIT

Hydrophone Distance from Pile: N/A

Latitude: N/A **Longitude:** N/A

Water Column Depth: N/A **Hydrophone Deployed Depth:** N/A

Notes:

Bauer BG 45 Rotary Drilling Rig (Base Carrier BS95) used to install 102" casings from center wall platform (CWP). Blue unit was deployed from CWP on unprotected side of bubble curtain (inside basin). Green unit was not deployed from Berth 11C davit arm due to multiple dredge material barges tied up along the Berth blocking the davit arm deployment location. No available location outside the bubble curtain to capture far field data. Bubble curtain was on and operational during drilling activities.

RMS SPL and SELcum data included in **Table 1.**

One-third octave band spectra and Power Spectral Density (PSD) included in **Figures 14-15**.

Data unweighted.

Event/Pile

Pile Type: 102” Casing **Activity:** Rotary Drill **IHA Count:** 14 of 10

Hammer Make: Bauer **Hammer Model:** BG 45 **Noise Type:** Continuous

Start Time: 14:32 **Stop Time:** 15:11 **Active Drill Duration:** 2,368 seconds

BLUE UNIT

Hydrophone Distance from Pile: 10 meters

Latitude: 43°04’51”N **Longitude:** 70°44’36”W

Water Column Depth: 12.8 meters **Hydrophone Deployed Depth:** 6.5 meters

GREEN UNIT

Hydrophone Distance from Pile: N/A

Latitude: N/A **Longitude:** N/A

Water Column Depth: N/A **Hydrophone Deployed Depth:** N/A

Notes:

Bauer BG 45 Rotary Drilling Rig (Base Carrier BS95) used to install 102” casings from center wall platform (CWP). Blue unit was deployed from CWP on unprotected side of bubble curtain (inside basin). Green unit was not deployed from Berth 11C davit arm due to multiple dredge material barges tied up along the Berth blocking the davit arm deployment location. No available location outside the bubble curtain to capture far field data. Bubble curtain was on and operational during drilling activities.

RMS SPL and SELcum data included in **Table 1.**

One-third octave band spectra and Power Spectral Density (PSD) included in **Figures 16-17**.

Data unweighted.

Date	Pile Type	Hammer Make/Model	Noise Type	Start Time	Stop Time	Active Hammer Duration (seconds)	Distance From Pile (meters)	RMS unweighted (SPL dB re 1uPa)			SELcum unweighted (dB re 1uPa^2.s)	SELcum Duration (seconds)
								Median	Mean (average)	Maximum		
12/2/2022	102" Casing	Rotary Drill	Continuous / Vibratory	11:15	11:21	399	10	156.35	156.31	167.07	183.79	399
							-	-	-	-	-	
12/2/2022	102" Casing	Rotary Drill	Continuous / Vibratory	11:29	11:42	753	10	152.55	152.33	162.59	182.76	753
							-	-	-	-	-	
12/2/2022	102" Casing	Rotary Drill	Continuous / Vibratory	12:17	12:20	180	10	142.84	141.98	149.01	165.94	180
							-	-	-	-	-	
12/2/2022	102" Casing	Rotary Drill	Continuous / Vibratory	12:32	12:39	412	10	135.67	134.80	145.36	162.14	412
							-	-	-	-	-	
12/2/2022	102" Casing	Rotary Drill	Continuous / Vibratory	13:04	13:08	222	10	142.95	143.55	159.05	168.85	222
							-	-	-	-	-	
12/2/2022	102" Casing	Rotary Drill	Continuous / Vibratory	13:30	13:56	1584	10	135.51	137.47	151.79	171.03	1584
							-	-	-	-	-	
12/2/2022	102" Casing	Rotary Drill	Continuous / Vibratory	14:11	14:24	778	10	132.67	133.97	147.02	164.73	778
							-	-	-	-	-	
12/2/2022	102" Casing	Rotary Drill	Continuous / Vibratory	14:32	15:11	2368	10	139.2	139.04	155.48	174.23	2368
							-	-	-	-	-	

Table 1. Data Summary of Piles Monitored

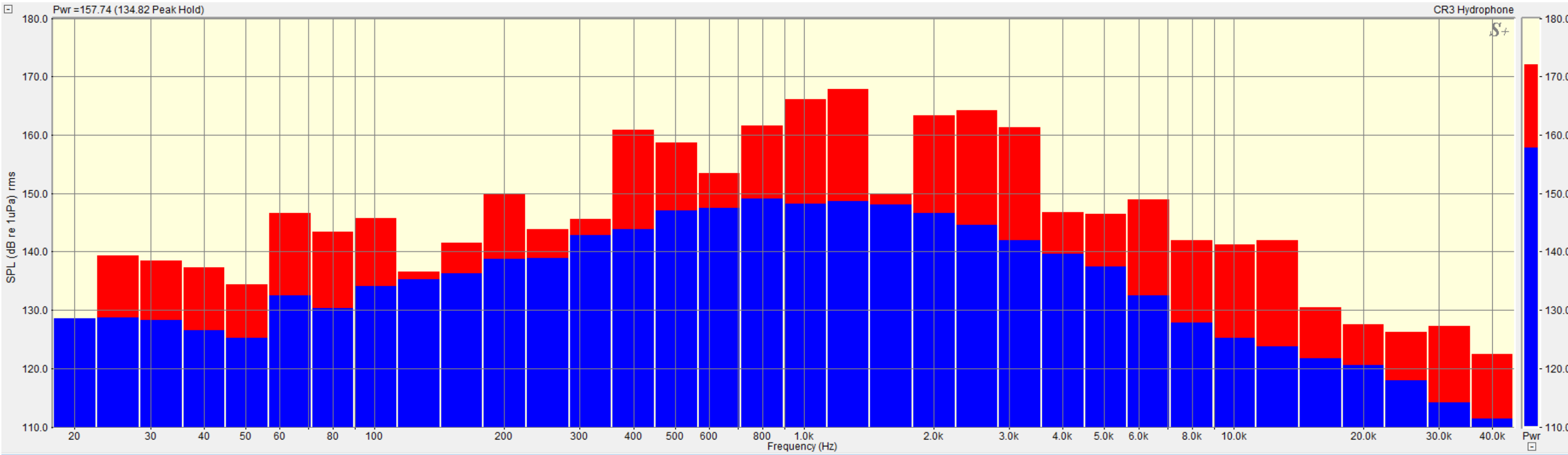


Figure 2. 1/3 Octave Band Spectra from 10 meters for Event 1 installed December 2, 2022 at 11:15

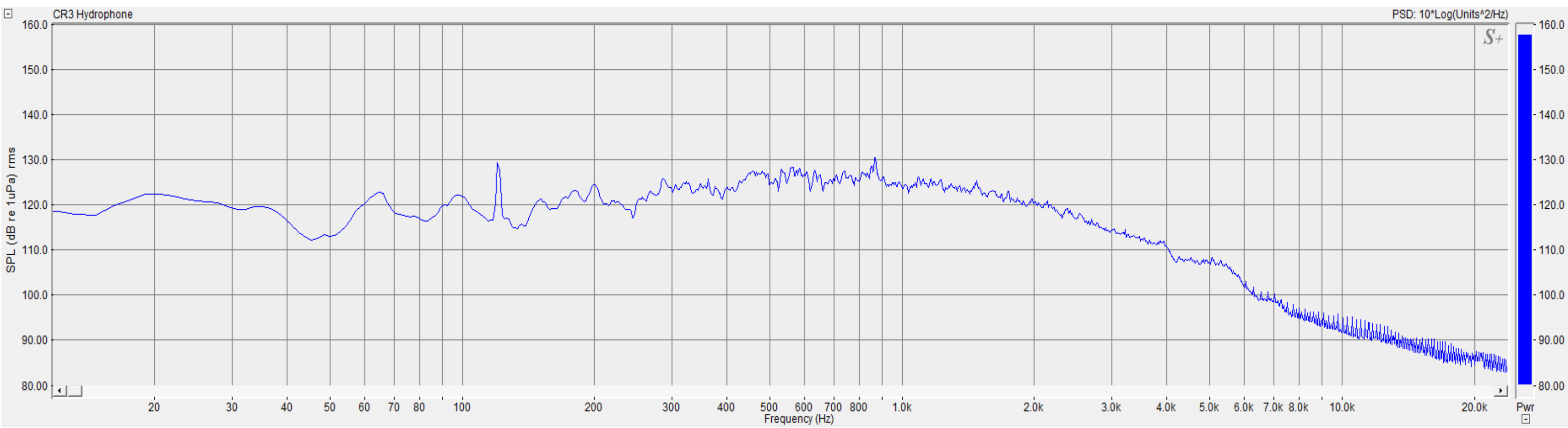


Figure 3. Power Spectral Density Plot from 10 meters for Event 1 installed December 2, 2022 at 11:15

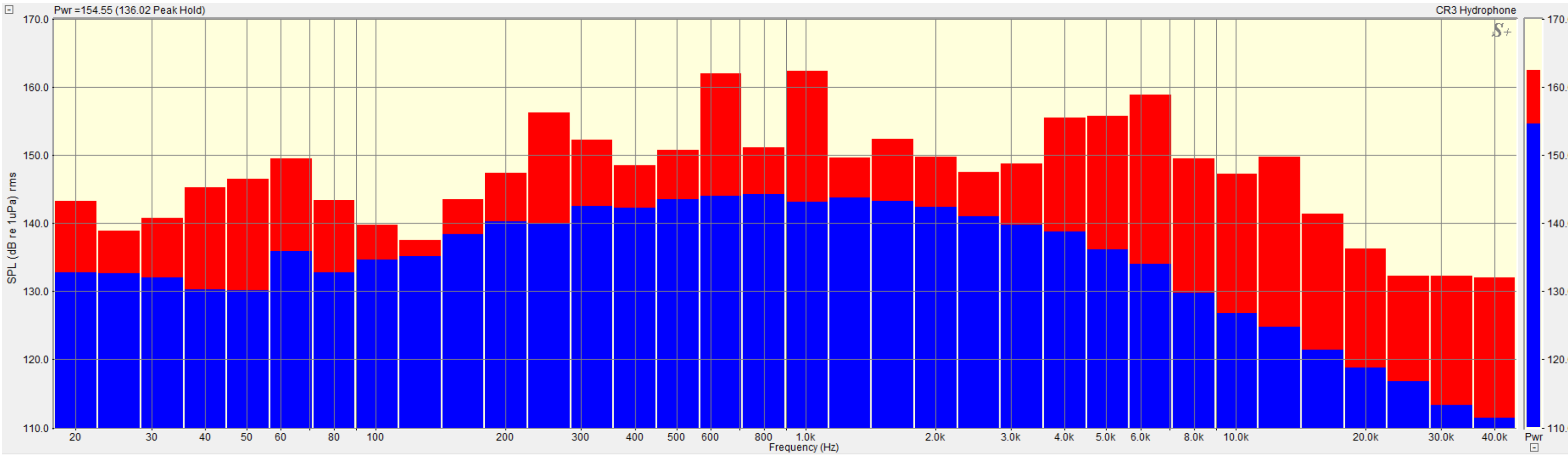


Figure 4. 1/3 Octave Band Spectra from 10 meters for Event 2 installed December 2, 2022 at 11:29

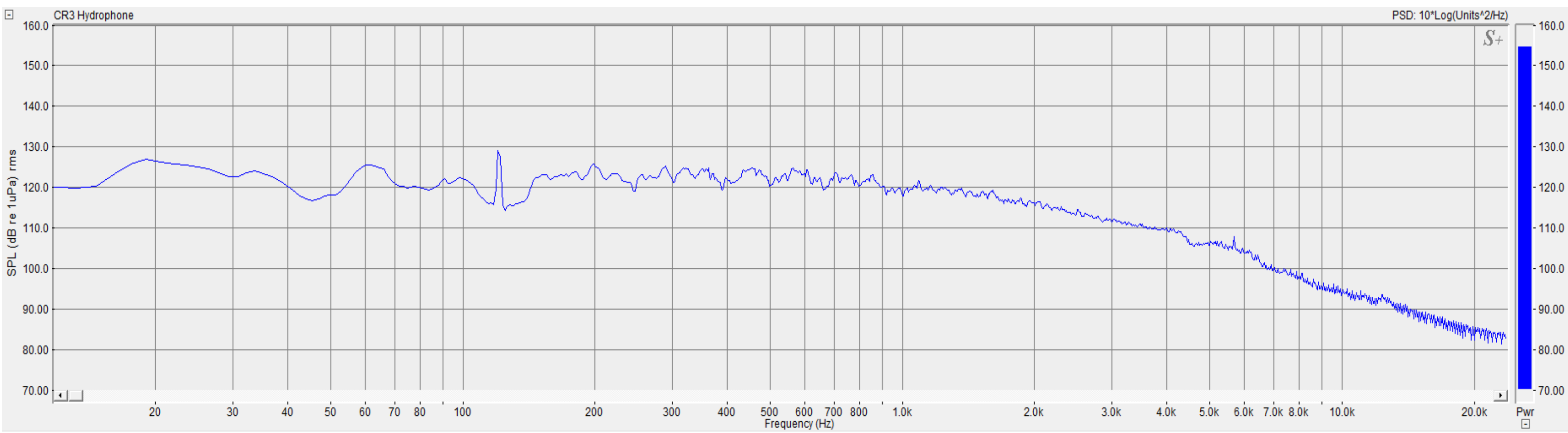


Figure 5. Power Spectral Density Plot from 10 meters for Event 2 installed December 2, 2022 at 11:29

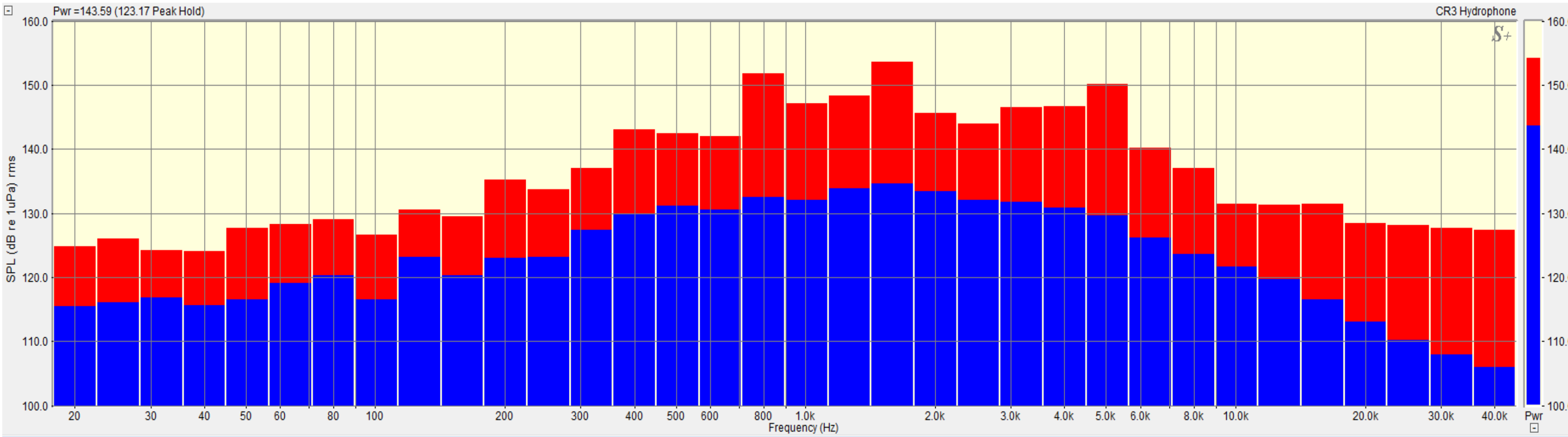


Figure 6. 1/3 Octave Band Spectra from 10 meters for Event 3 installed December 2, 2022 at 12:17

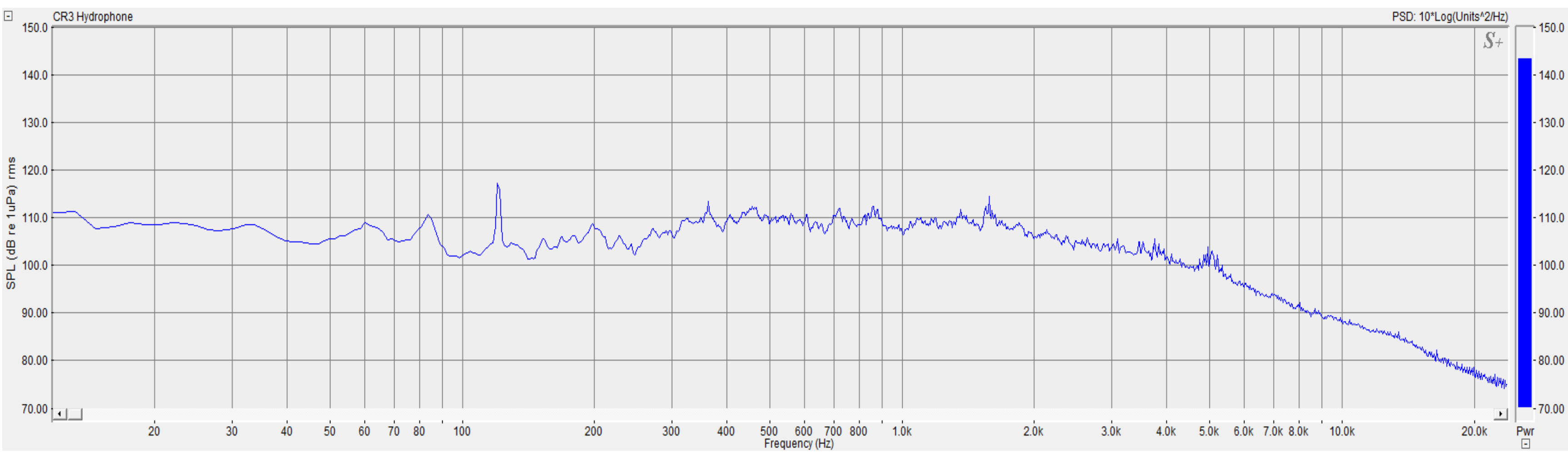


Figure 7. Power Spectral Density Plot from 10 meters for Event 3 installed December 2, 2022 at 12:17

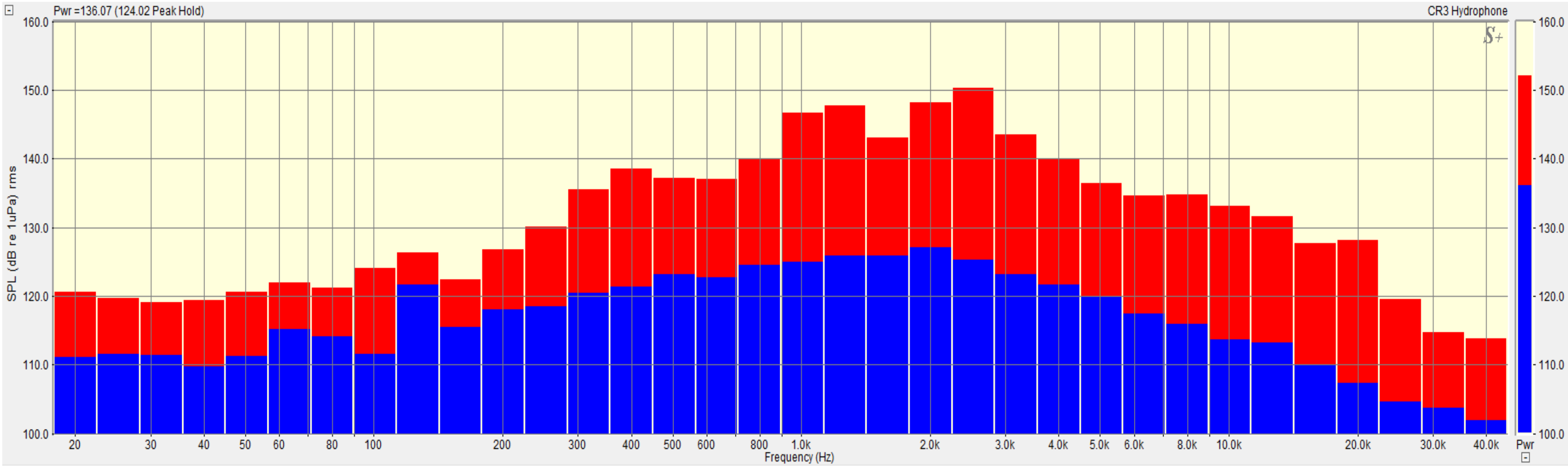


Figure 8. 1/3 Octave Band Spectra from 10 meters for Event 4 installed December 2, 2022 at 12:32

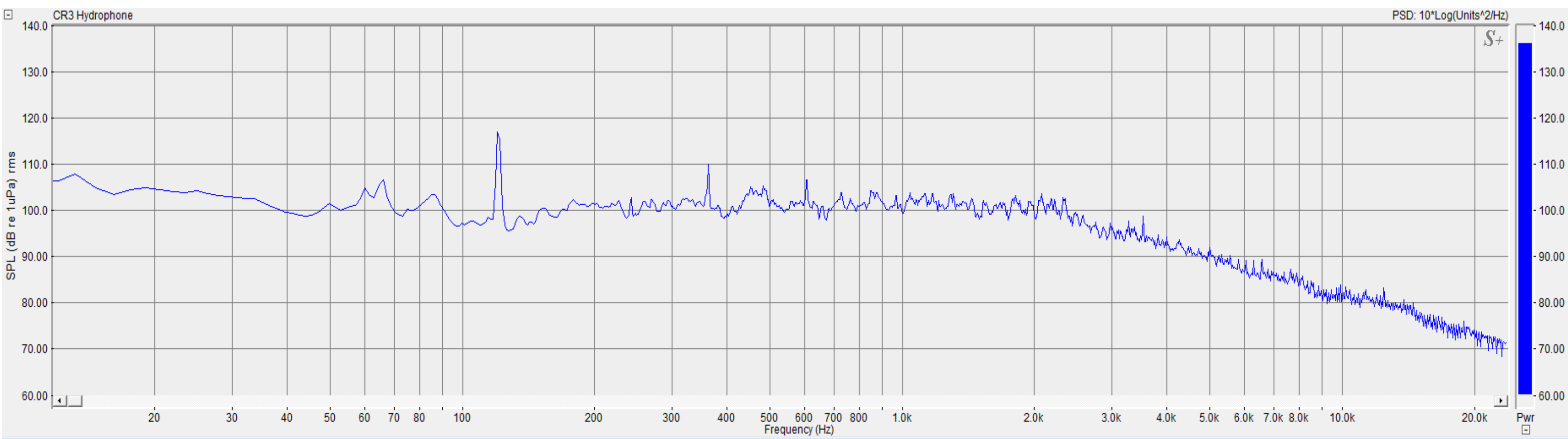


Figure 9. Power Spectral Density Plot from 10 meters for Event 4 installed December 2, 2022 at 12:32

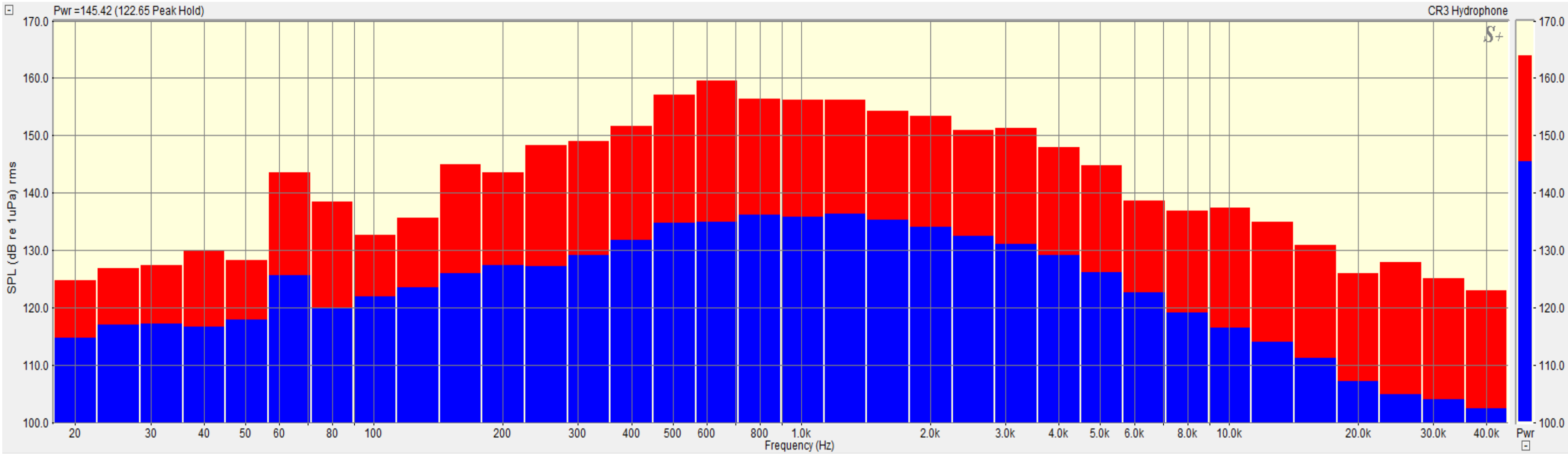


Figure 10. 1/3 Octave Band Spectra from 10 meters for Event 5 installed December 2, 2022 at 13:04

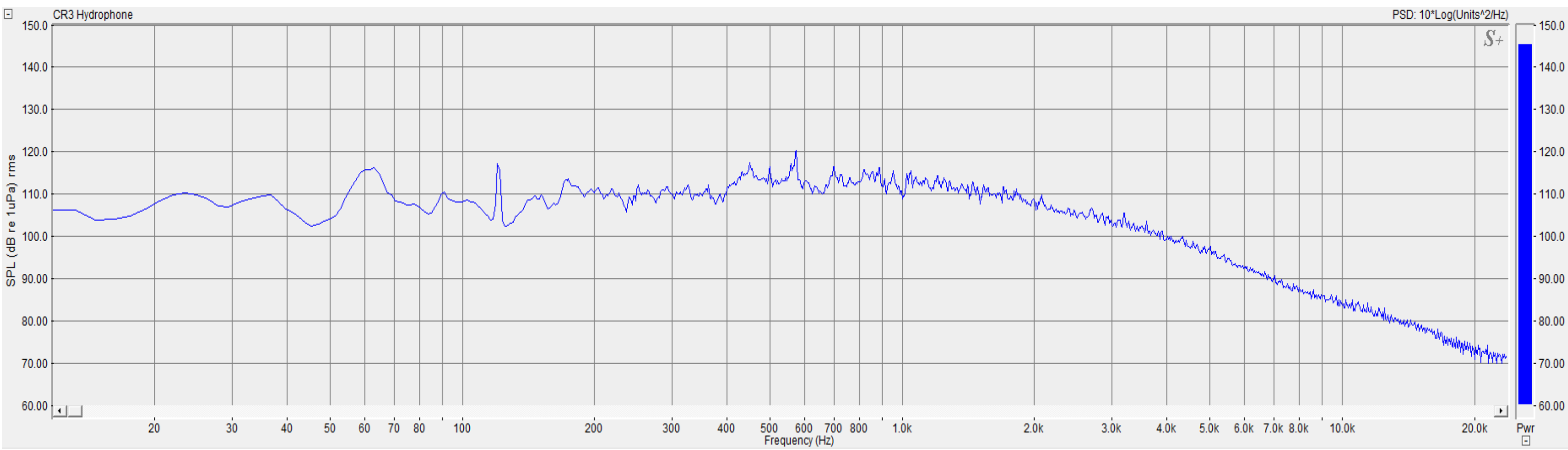


Figure 11. Power Spectral Density Plot from 10 meters for Event 5 installed December 2, 2022 at 13:04

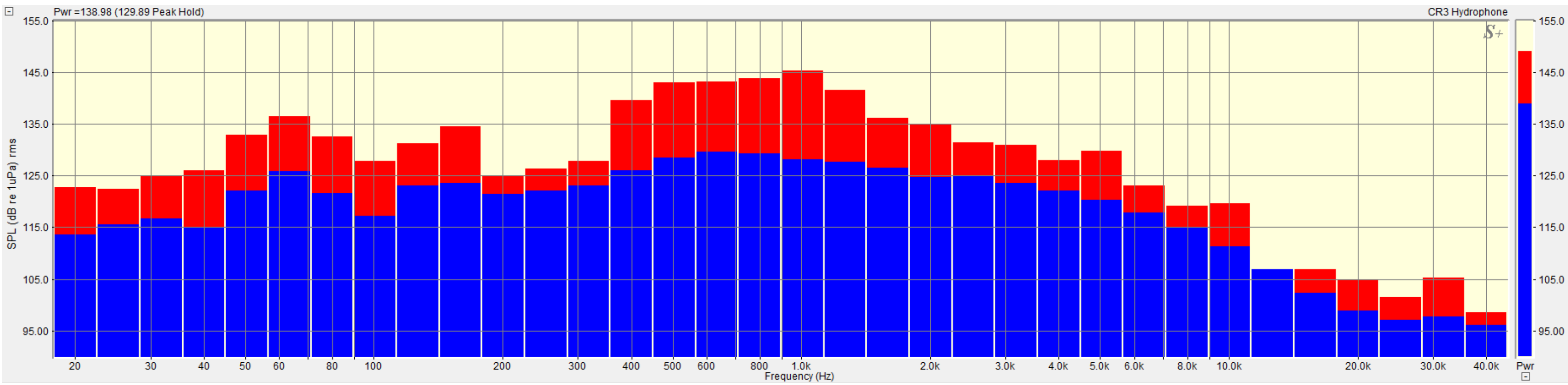


Figure 12. 1/3 Octave Band Spectra from 10 meters for Event 6 installed December 2, 2022 at 13:30

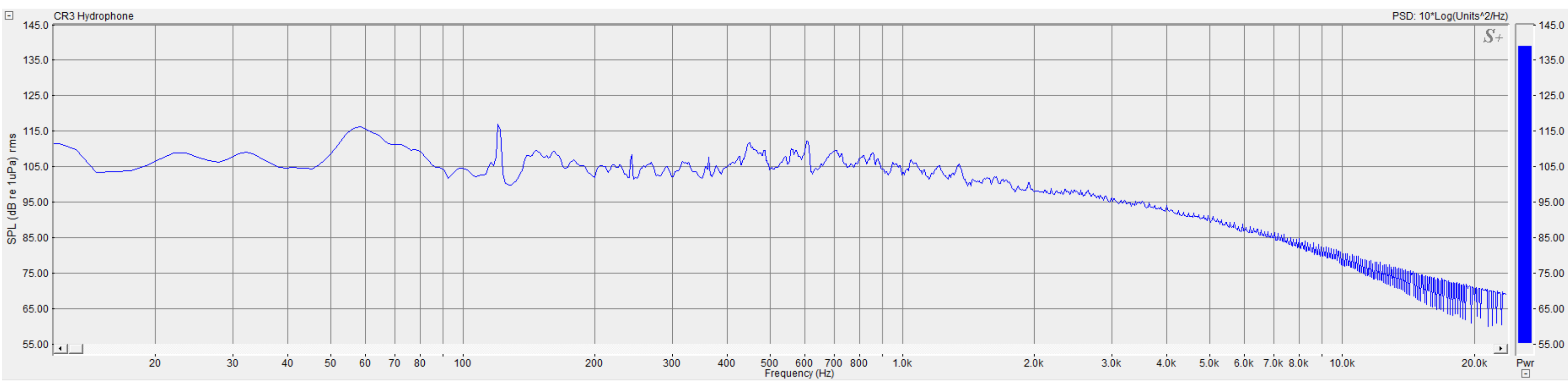


Figure 13. Power Spectral Density Plot from 10 meters for Event 6 installed December 2, 2022 at 13:30

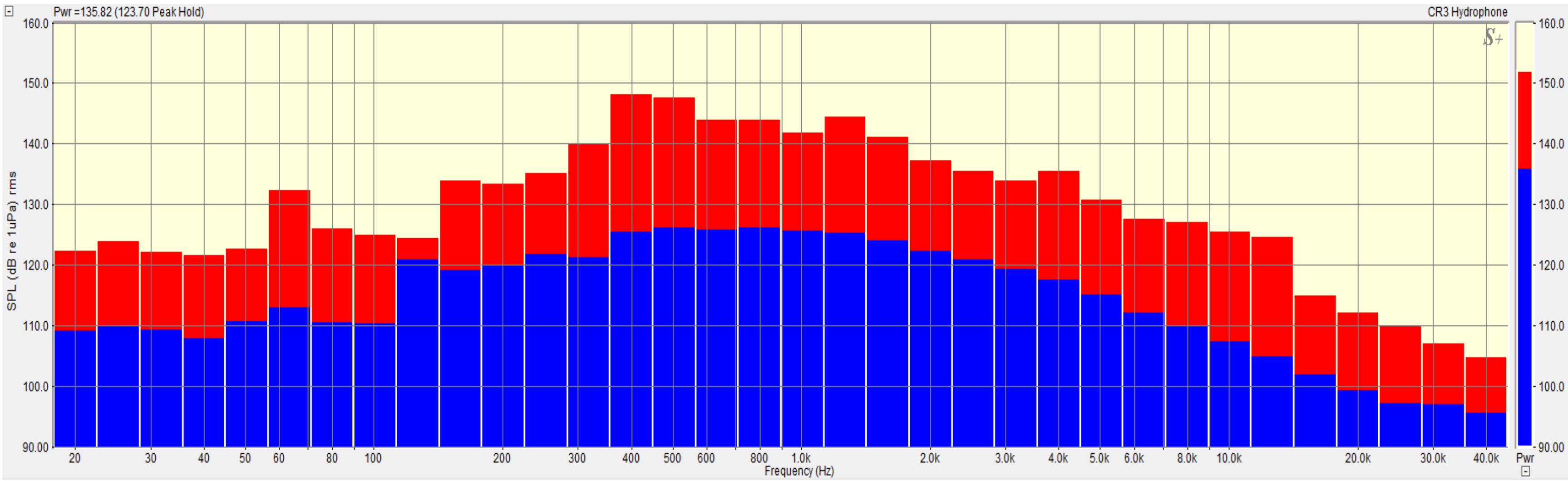


Figure 14. 1/3 Octave Band Spectra from 10 meters for Event 7 installed December 2, 2022 at 14:11

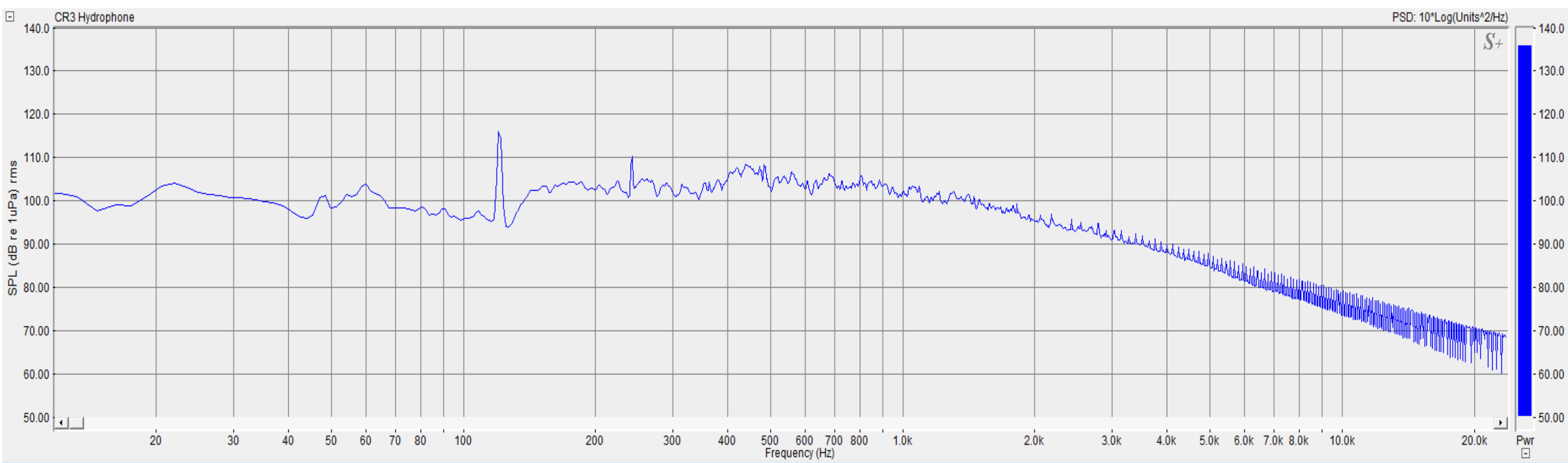


Figure 15. Power Spectral Density Plot from 10 meters for Event 7 installed December 2, 2022 at 14:11

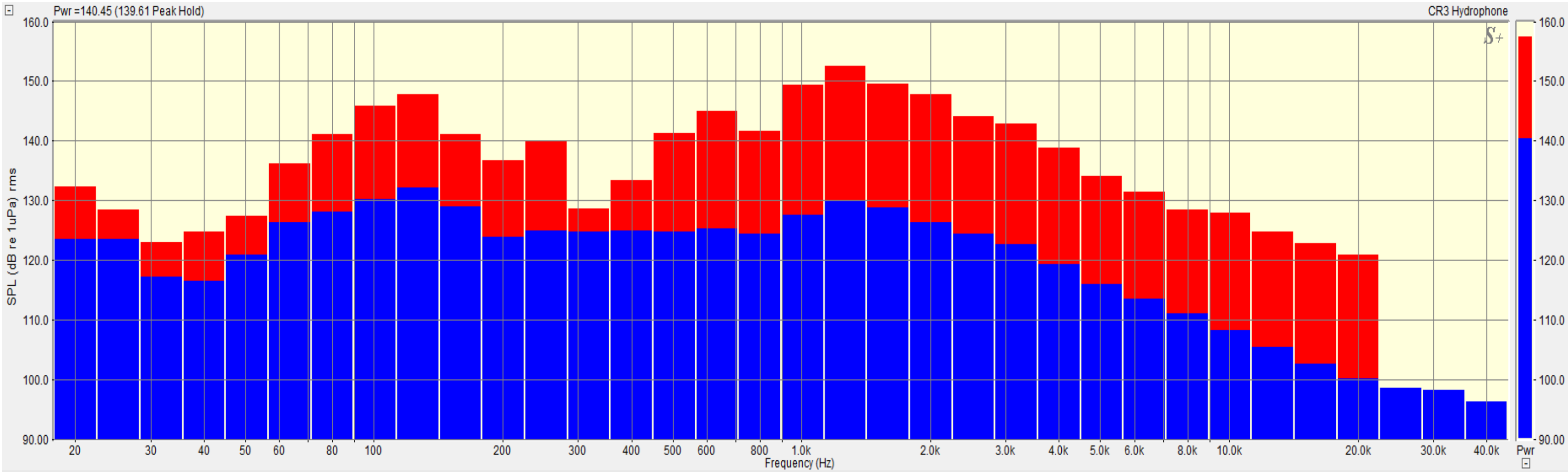


Figure 16. 1/3 Octave Band Spectra from 10 meters for Event 8 installed December 2, 2022 at 14:32

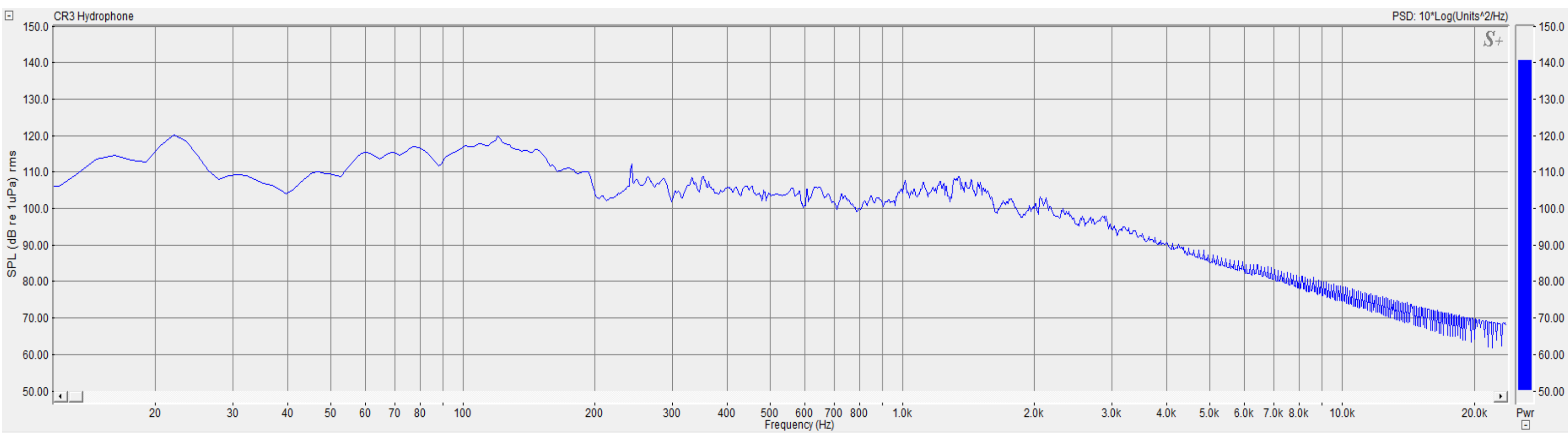


Figure 17. Power Spectral Density Plot from 10 meters for Event 8 installed December 2, 2022 at 14:32

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P381 Constructors

Hydroacoustic Monitoring Daily Report

Date: December 13, 2022 **Project:** 3121020 PNSY Multi-Mission Dry Dock 1

Project Information

Project Name: P381 Multi-Mission Dry Dock #1
Location: Portsmouth Naval Shipyard, Kittery, Maine
Project/Contract Number: N40085-21-C-0011
Hydroacoustic Engineer - Lead: Theodore Hallett

Hydrologic and Geologic Information

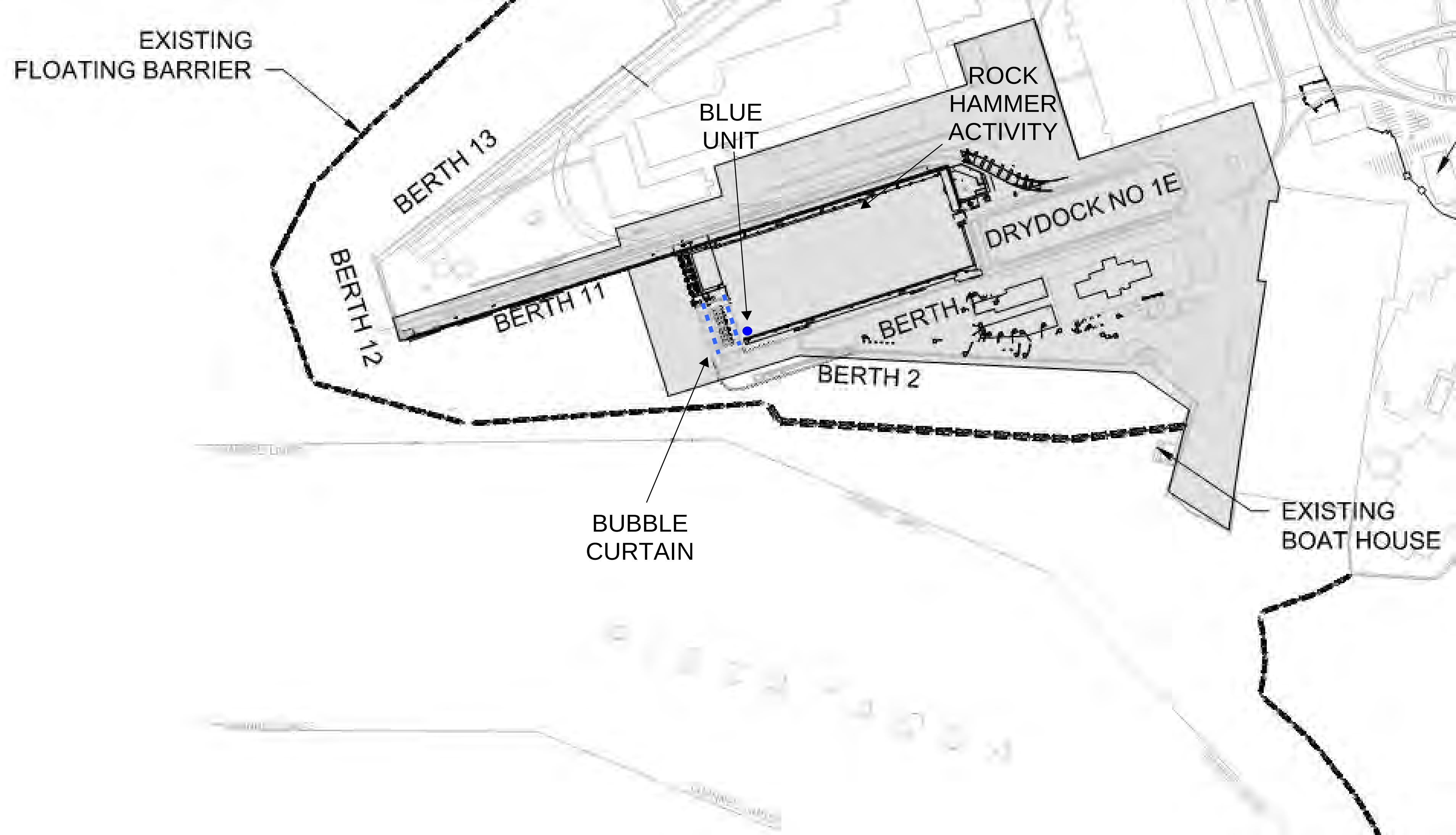
Body of Water: Portsmouth – Lower Piscataqua River
Type: Estuarine
Hydrologic Unit: 01060003
Geology: Glacial Till, Phyllite, Quartzite, Diorite and/or Shale

Equipment Information

Hydrophone: Cetacean Research CR3
Recording Device: Spectra DAQ-200
Sampling Rate: 96kHz
Bit Depth: 24 Bit

Weather

Meteorological Conditions: Partly Cloudy
Cloud Cover: 50%
Air Temperature: 30°F
Humidity: 55%
Wind Speed: 10 mph
Wind Direction: North-West
Beaufort Sea State: 2
Water Temperature: 44°F



EXISTING FLOATING BARRIER
BERTH 13
BERTH 12
BERTH 11
BLUE UNIT
ROCK HAMMER ACTIVITY
DRYDOCK NO 1E
BERTH
BERTH 2
BUBBLE CURTAIN
EXISTING BOAT HOUSE

Event/Pile

Pile Type: N/A **Activity:** Rock Hammering **IHA Count:** 1 of 10

Hammer Make: NPK **Hammer Model:** GH50 **Noise Type:** Impulsive

Start Time: 13:57 **Stop Time:** 14:08 **Active Hammer Duration:** 250 seconds

BLUE UNIT

Hydrophone Distance from Pile: 70 meters

Latitude: 43°04’50”N **Longitude:** 70°44’40”W

Water Column Depth: 12 meters **Hydrophone Deployed Depth:** 6 meters

GREEN UNIT

Hydrophone Distance from Pile: N/A

Latitude: N/A **Longitude:** N/A

Water Column Depth: N/A **Hydrophone Deployed Depth:** N/A

Notes:

NPK GH50 hydraulic hammer attachment on Komatsu PC1250 excavator used for demolition of Berth 11 shutter panel wall. Blue unit was deployed from South Closure Wall (SCW) / Entrance Structure on unprotected side of bubble curtain (inside basin). No available 10 meter position for hydrophone deployment from Berth 11. Green unit was not deployed from Berth 11C davit arm due to multiple dredge material barges tied up along the Berth blocking the davit arm deployment location. No available location outside the bubble curtain to capture far field data. Bubble curtain was on and operational during drilling activities.

RMS SPL and SELcum data included in **Table 1.**

One-third octave band spectra and Power Spectral Density (PSD) included in **Figures 2-3**.

Data unweighted.

Date	Hammer Make/Model	Noise Type	Start Time	Stop Time	Active Hammer Duration (seconds)	Hammer Strike(s)	Pulse Duration (seconds)	Distance From Pile (meters)	RMS unweighted (SPL dB re 1uPa)			Peak unweighted (SPL dB re 1uPa)			SEL unweighted (dB re 1uPa^2.s)			SELcum unweighted (dB re 1uPa^2.s)
									Median	Mean (average)	Maximum	Median	Mean (average)	Maximum	Median	Mean (average)	Maximum	
12/13/2022	Rock Hammer	Impulsive	13:57	14:08	250	673	0.061	-	-	-	-	-	-	-	-	-	-	-
								70	159.22	159.85	172.69	176.20	176.86	184.47	153.04	153.48	159.95	181.32

Table 1. Data Summary of Piles Monitored

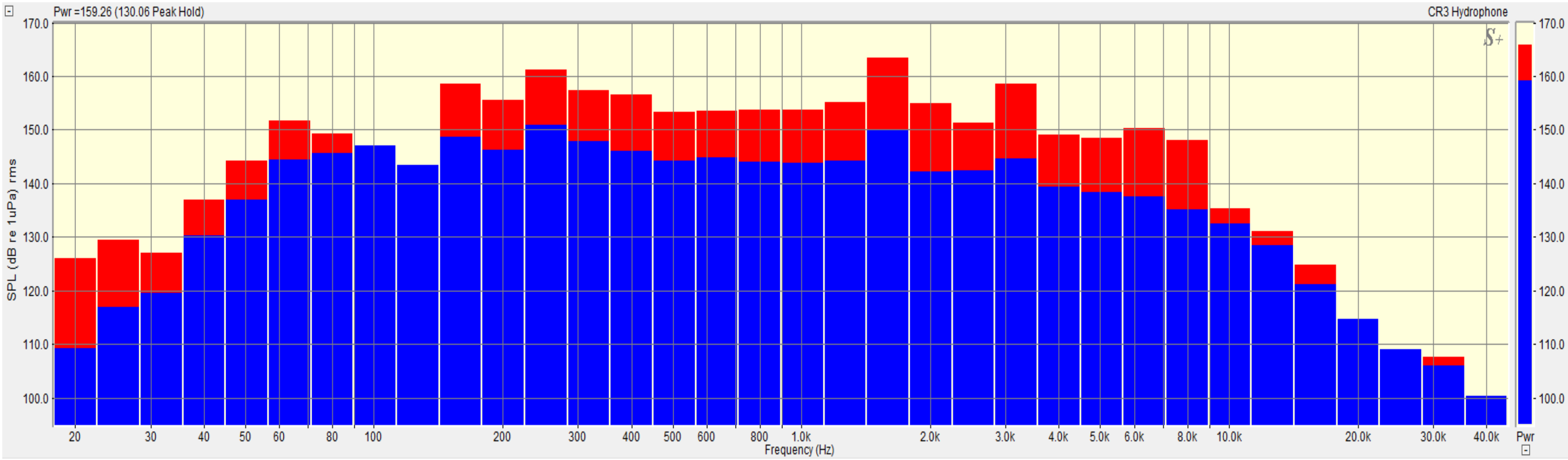


Figure 2. 1/3 Octave Band Spectra from 70 meters for Event 1 installed December 13, 2022 at 13:57

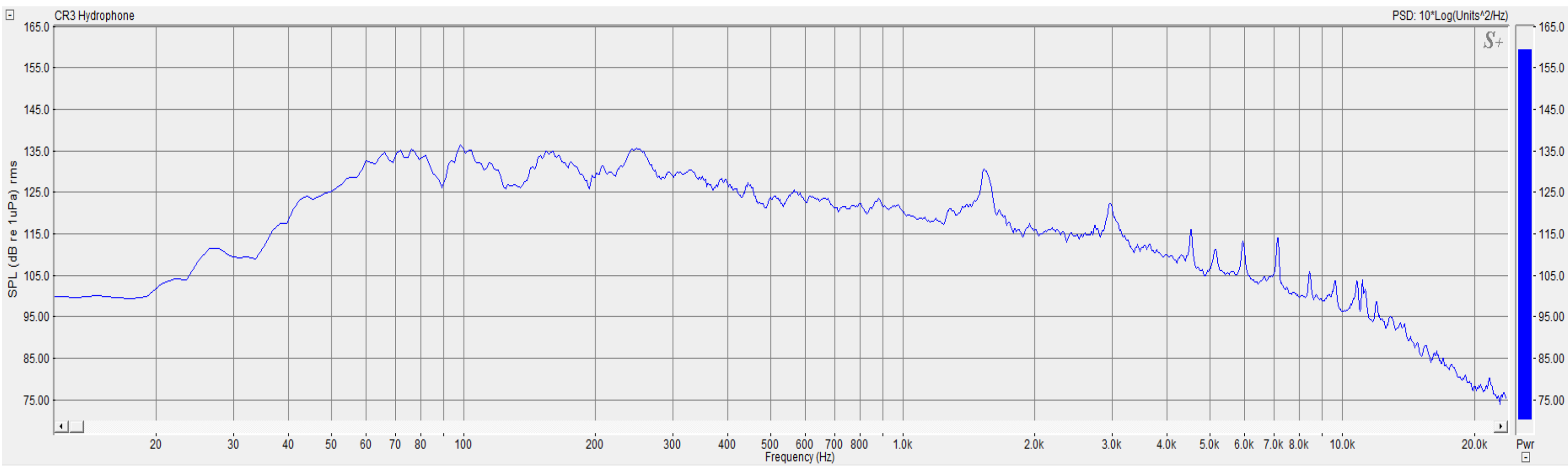


Figure 3. Power Spectral Density Plot from 70 meters for Event 1 installed December 13, 2022 at 13:57

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P381 Constructors

Hydroacoustic Monitoring Daily Report

Date: December 20, 2022 **Project:** 3121020 PNSY Multi-Mission Dry Dock 1

Project Information

Project Name: P381 Multi-Mission Dry Dock #1
Location: Portsmouth Naval Shipyard, Kittery, Maine
Project/Contract Number: N40085-21-C-0011
Hydroacoustic Engineer - Lead: Theodore Hallett

Hydrologic and Geologic Information

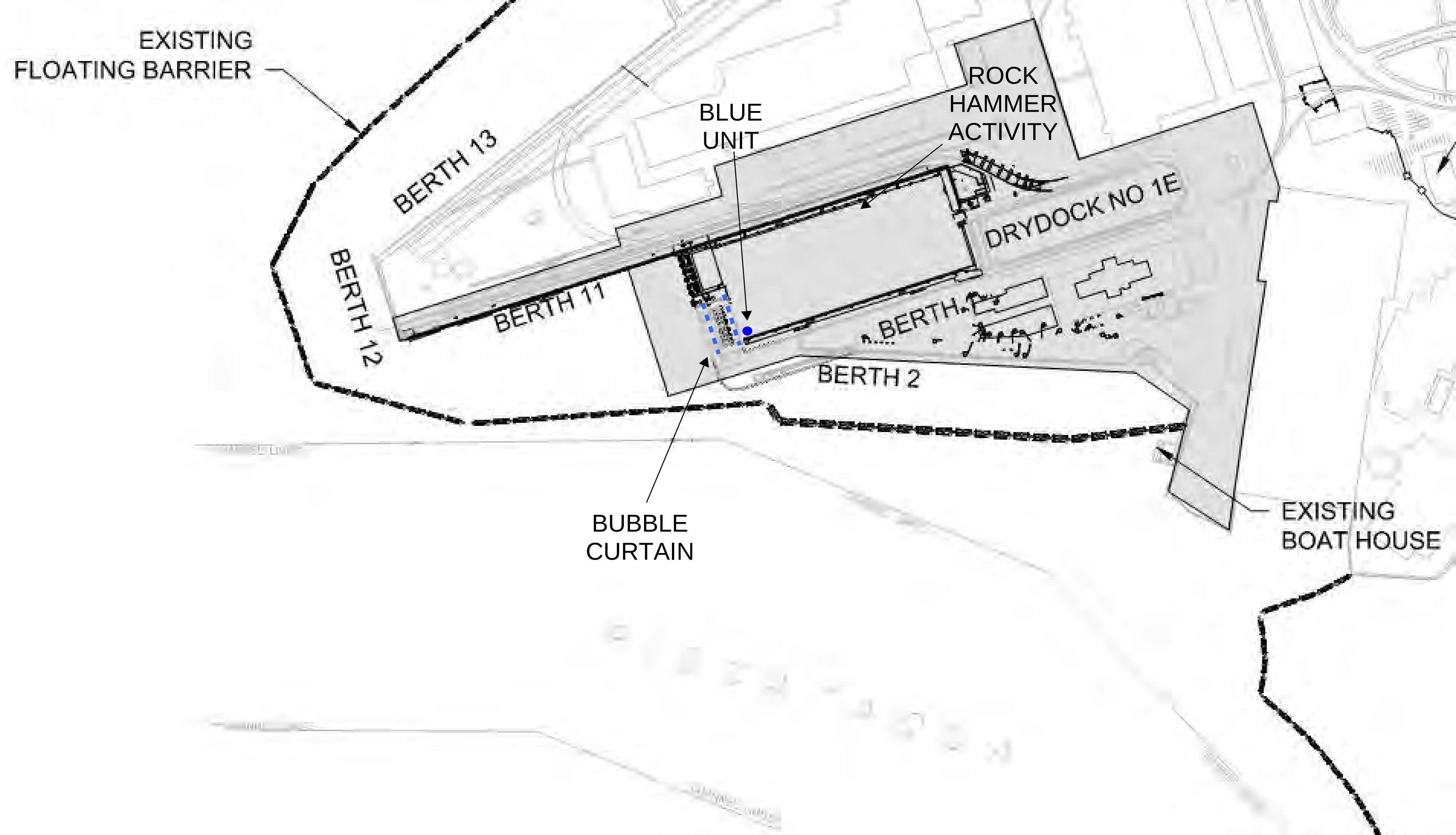
Body of Water: Portsmouth – Lower Piscataqua River
Type: Estuarine
Hydrologic Unit: 01060003
Geology: Glacial Till, Phyllite, Quartzite, Diorite and/or Shale

Equipment Information

Hydrophone: Cetacean Research CR3
Recording Device: Spectra DAQ-200
Sampling Rate: 96kHz
Bit Depth: 24 Bit

Weather

Meteorological Conditions: Sunny
Cloud Cover: 10%
Air Temperature: 34°F
Humidity: 60%
Wind Speed: 12 mph
Wind Direction: South-East
Beaufort Sea State: 1
Water Temperature: 45°F


EXISTING
FLOATING BARRIER
BERTH 13
BERTH 12
BERTH 11
BLUE
UNIT
ROCK
HAMMER
ACTIVITY
DRYDOCK NO 1E
BERTH
BERTH 2
BUBBLE
CURTAIN
EXISTING
BOAT HOUSE

Event/Pile

Pile Type: N/A **Activity:** Rock Hammering **IHA Count:** 2 of 10

Hammer Make: NPK **Hammer Model:** GH50 **Noise Type:** Impulsive

Start Time: 11:48 **Stop Time:** 12:08 **Active Hammer Duration:** 750 seconds

BLUE UNIT

Hydrophone Distance from Pile: 70 meters

Latitude: 43°04’50”N **Longitude:** 70°44’40”W

Water Column Depth: 13.6 meters **Hydrophone Deployed Depth:** 6.8 meters

GREEN UNIT

Hydrophone Distance from Pile: N/A

Latitude: N/A **Longitude:** N/A

Water Column Depth: N/A **Hydrophone Deployed Depth:** N/A

Notes:

NPK GH50 hydraulic hammer attachment on Komatsu PC1250 excavator used for demolition of Berth 11 shutter panel wall. Blue unit was deployed from South Closure Wall (SCW) / Entrance Structure on unprotected side of bubble curtain (inside basin). No available 10 meter position for hydrophone deployment from Berth 11. Green unit was not deployed from Berth 11C davit arm due to multiple dredge material barges tied up along the Berth blocking the davit arm deployment location. No available location outside the bubble curtain to capture far field data. Bubble curtain was on and operational during drilling activities.

RMS SPL and SELcum data included in **Table 1.**

One-third octave band spectra and Power Spectral Density (PSD) included in **Figures 2-3**.

Data unweighted.

Event/Pile

Pile Type: N/A **Activity:** Rock Hammering **IHA Count:** 3 of 10

Hammer Make: NPK **Hammer Model:** GH50 **Noise Type:** Impulsive

Start Time: 12:11 **Stop Time:** 12:20 **Active Hammer Duration:** 389 seconds

BLUE UNIT

Hydrophone Distance from Pile: 70 meters

Latitude: 43º04'50"N **Longitude:** 70°44'40"W

Water Column Depth: 13.6 meters **Hydrophone Deployed Depth:** 6.8 meters

GREEN UNIT

Hydrophone Distance from Pile: N/A

Latitude: N/A **Longitude:** N/A

Water Column Depth: N/A **Hydrophone Deployed Depth:** N/A

Notes:

NPK GH50 hydraulic hammer attachment on Komatsu PC1250 excavator used for demolition of Berth 11 shutter panel wall. Blue unit was deployed from South Closure Wall (SCW) / Entrance Structure on unprotected side of bubble curtain (inside basin). No available 10 meter position for hydrophone deployment from Berth 11. Green unit was not deployed from Berth 11C davit arm due to multiple dredge material barges tied up along the Berth blocking the davit arm deployment location. No available location outside the bubble curtain to capture far field data. Bubble curtain was on and operational during drilling activities.

RMS SPL and SELcum data included in **Table 1.**

One-third octave band spectra and Power Spectral Density (PSD) included in **Figures 2-3**.

Data unweighted.

Event/Pile

Pile Type: N/A **Activity:** Rock Hammering **IHA Count:** 4 of 10

Hammer Make: NPK **Hammer Model:** GH50 **Noise Type:** Impulsive

Start Time: 12:56 **Stop Time:** 13:03 **Active Hammer Duration:** 183 seconds

BLUE UNIT

Hydrophone Distance from Pile: 70 meters

Latitude: 43°04’50”N **Longitude:** 70°44’40”W

Water Column Depth: 13.6 meters **Hydrophone Deployed Depth:** 6.8 meters

GREEN UNIT

Hydrophone Distance from Pile: N/A

Latitude: N/A **Longitude:** N/A

Water Column Depth: N/A **Hydrophone Deployed Depth:** N/A

Notes:

NPK GH50 hydraulic hammer attachment on Komatsu PC1250 excavator used for demolition of Berth 11 shutter panel wall. Blue unit was deployed from South Closure Wall (SCW) / Entrance Structure on unprotected side of bubble curtain (inside basin). No available 10 meter position for hydrophone deployment from Berth 11. Green unit was not deployed from Berth 11C davit arm due to multiple dredge material barges tied up along the Berth blocking the davit arm deployment location. No available location outside the bubble curtain to capture far field data. Bubble curtain was on and operational during drilling activities.

RMS SPL and SELcum data included in **Table 1.**

One-third octave band spectra and Power Spectral Density (PSD) included in **Figures 2-3**.

Data unweighted.

Event/Pile

Pile Type: N/A **Activity:** Rock Hammering **IHA Count:** 5 of 10

Hammer Make: NPK **Hammer Model:** GH50 **Noise Type:** Impulsive

Start Time: 13:04 **Stop Time:** 13:15 **Active Hammer Duration:** 277 seconds

BLUE UNIT

Hydrophone Distance from Pile: 70 meters

Latitude: 43º04'50"N **Longitude:** 70°44'40"W

Water Column Depth: 13.6 meters **Hydrophone Deployed Depth:** 6.8 meters

GREEN UNIT

Hydrophone Distance from Pile: N/A

Latitude: N/A **Longitude:** N/A

Water Column Depth: N/A **Hydrophone Deployed Depth:** N/A

Notes:

NPK GH50 hydraulic hammer attachment on Komatsu PC1250 excavator used for demolition of Berth 11 shutter panel wall. Blue unit was deployed from South Closure Wall (SCW) / Entrance Structure on unprotected side of bubble curtain (inside basin). No available 10 meter position for hydrophone deployment from Berth 11. Green unit was not deployed from Berth 11C davit arm due to multiple dredge material barges tied up along the Berth blocking the davit arm deployment location. No available location outside the bubble curtain to capture far field data. Bubble curtain was on and operational during drilling activities.

RMS SPL and SELcum data included in **Table 1.**

One-third octave band spectra and Power Spectral Density (PSD) included in **Figures 2-3**.

Data unweighted.

Event/Pile

Pile Type: N/A
Activity: Rock Hammering
IHA Count: 6 of 10
Hammer Make: NPK
Hammer Model: GH50
Noise Type: Impulsive
Start Time: 14:06
Stop Time: 14:18
Active Hammer Duration: 414 seconds

BLUE UNIT

Hydrophone Distance from Pile: 70 meters
Latitude: 43°04'50"N
Longitude: 70°44'40"W
Water Column Depth: 13.4 meters
Hydrophone Deployed Depth: 6.2 meters

GREEN UNIT

Hydrophone Distance from Pile: N/A
Latitude: N/A
Longitude: N/A
Water Column Depth: N/A
Hydrophone Deployed Depth: N/A

Notes:

NPK GH50 hydraulic hammer attachment on Komatsu PC1250 excavator used for demolition of Berth 11 shutter panel wall. Blue unit was deployed from South Closure Wall (SCW) / Entrance Structure on unprotected side of bubble curtain (inside basin). No available 10 meter position for hydrophone deployment from Berth 11. Green unit was not deployed from Berth 11C davit arm due to multiple dredge material barges tied up along the Berth blocking the davit arm deployment location. No available location outside the bubble curtain to capture far field data. Bubble curtain was on and operational during drilling activities.

RMS SPL and SELcum data included in **Table 1.**

One-third octave band spectra and Power Spectral Density (PSD) included in **Figures 2-3**.

Data unweighted.

Date	Hammer Make/Model	Noise Type	Start Time	Stop Time	Active Hammer Duration (seconds)	Hammer Strike(s)	Pulse Duration (seconds)	Distance From Pile (meters)	RMS unweighted (SPL dB re 1uPa)			Peak unweighted (SPL dB re 1uPa)			SEL unweighted (dB re 1uPa^2.s)			SELcum unweighted (dB re 1uPa^2.s)
									Median	Mean (average)	Maximum	Median	Mean (average)	Maximum	Median	Mean (average)	Maximum	
12/20/2022	Rock Hammer	Impulsive	11:48	12:08	750	1815	0.045	-	-	-	-	-	-	-	-	-	-	-
								71	156.85	157.84	172.95	173.95	174.80	187.33	150.47	151.16	163.2	183.06
12/20/2022	Rock Hammer	Impulsive	12:11	12:20	389	999	0.052	-	-	-	-	-	-	-	-	-	-	-
								71	157.75	158.11	170.23	176.63	176.65	183.69	151.58	151.83	158.68	181.57
12/20/2022	Rock Hammer	Impulsive	12:56	13:03	183	513	0.049	-	-	-	-	-	-	-	-	-	-	-
								88	154.54	155.32	189.04	171.31	170.39	180.44	147.80	147.95	183.02	174.90
12/20/2022	Rock Hammer	Impulsive	13:04	13:15	277	723	0.055	-	-	-	-	-	-	-	-	-	-	-
								88	155.54	156.39	169.95	171.58	171.81	182.01	148.26	148.85	158.74	176.85
12/20/2022	Rock Hammer	Impulsive	14:06	14:18	414	1081	0.053	-	-	-	-	-	-	-	-	-	-	-
								88	157.80	158.18	170.55	173.94	173.91	181.60	151.19	151.30	158.37	181.52

Table 1. Data Summary of Piles Monitored

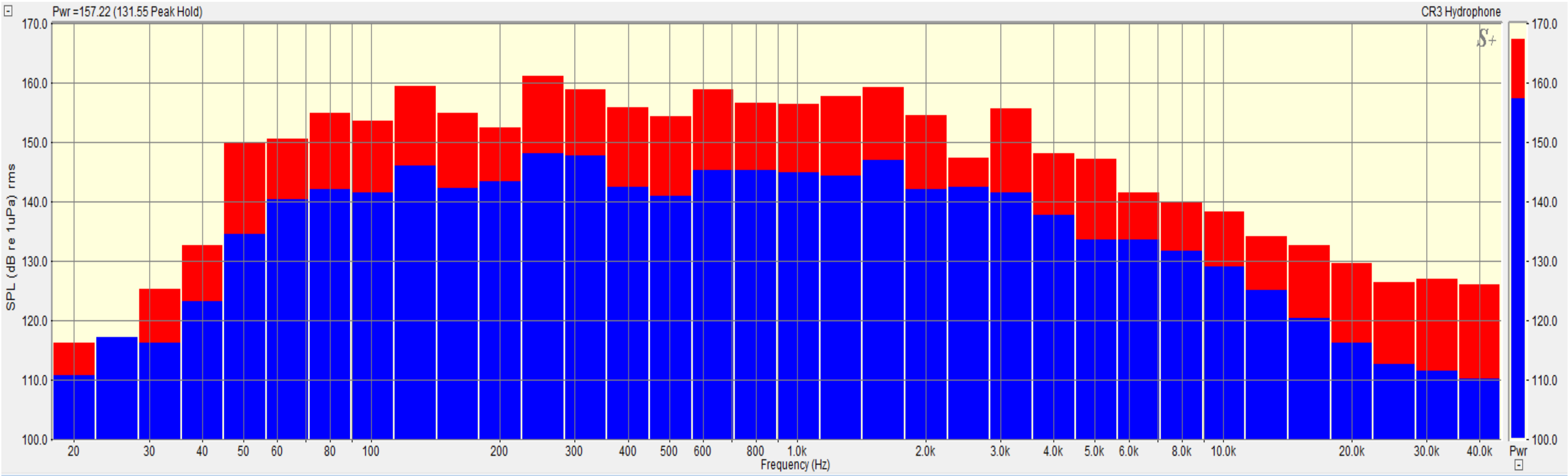


Figure 2. 1/3 Octave Band Spectra from 71 meters for Event 1 installed December 20, 2022 at 11:48

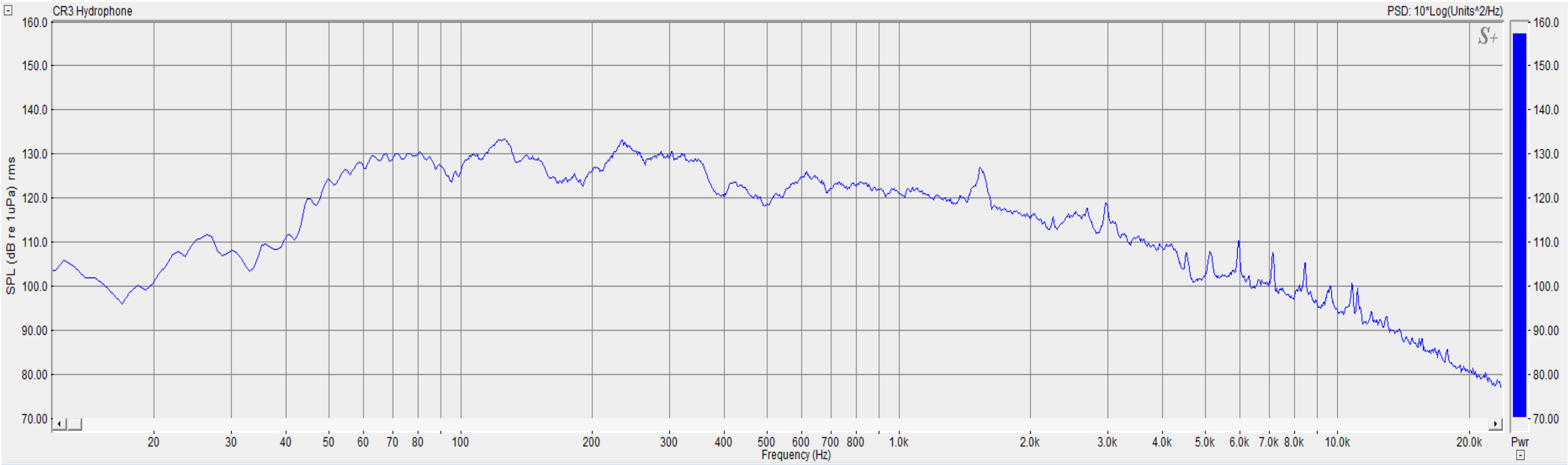


Figure 3. Power Spectral Density Plot from 71 meters for Event 1 installed December 20, 2022 at 11:48

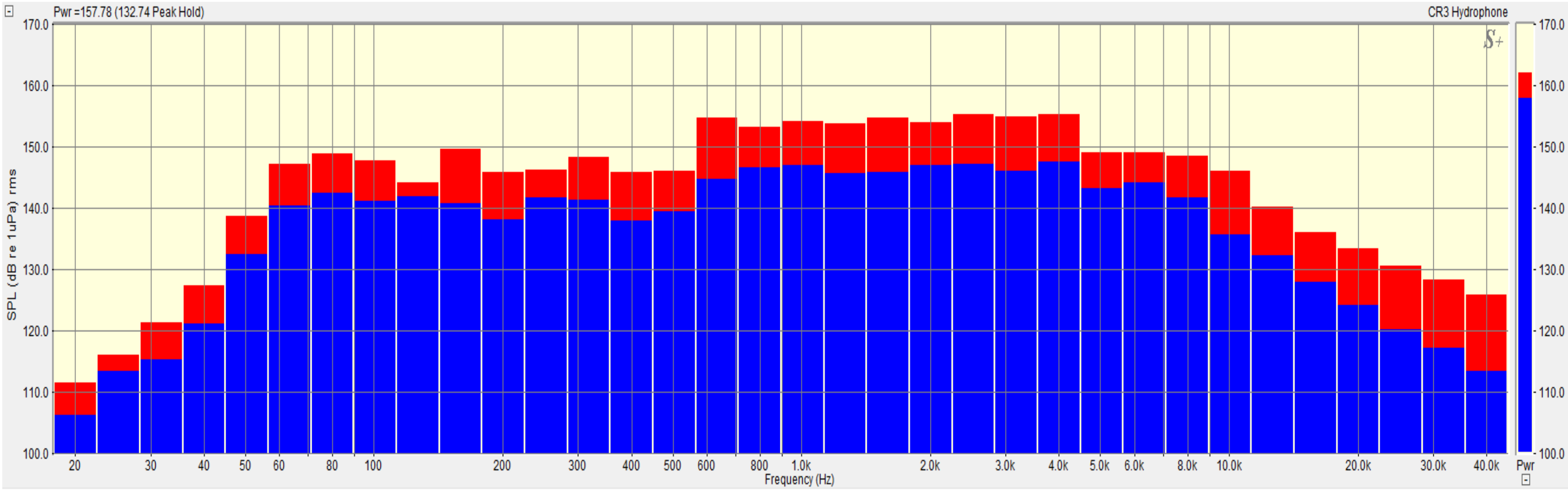


Figure 4. 1/3 Octave Band Spectra from 71 meters for Event 2 installed December 20, 2022 at 12:11

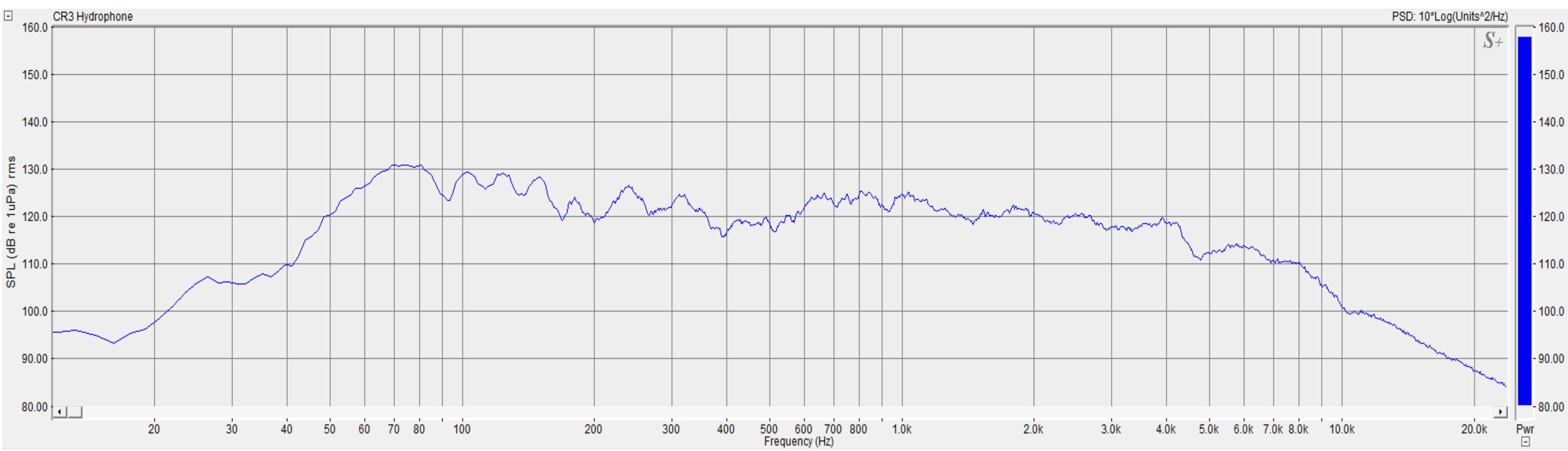


Figure 5. Power Spectral Density Plot from 71 meters for Event 2 installed December 20, 2022 at 12:11

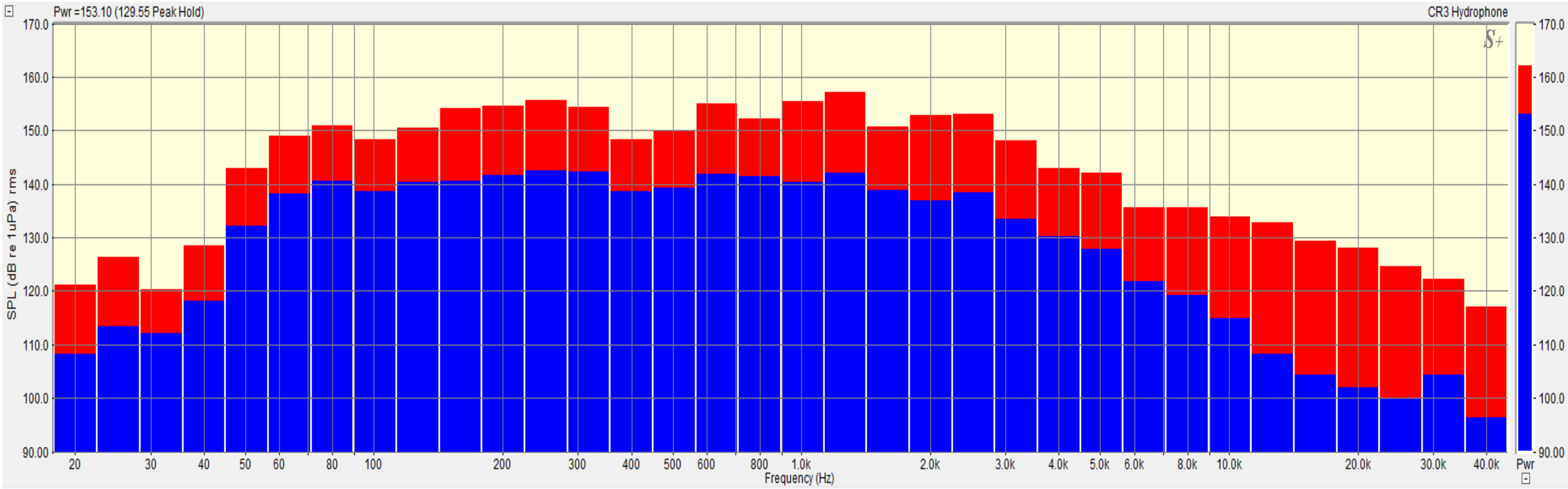


Figure 6. 1/3 Octave Band Spectra from 88 meters for Event 3 installed December 20, 2022 at 12:56

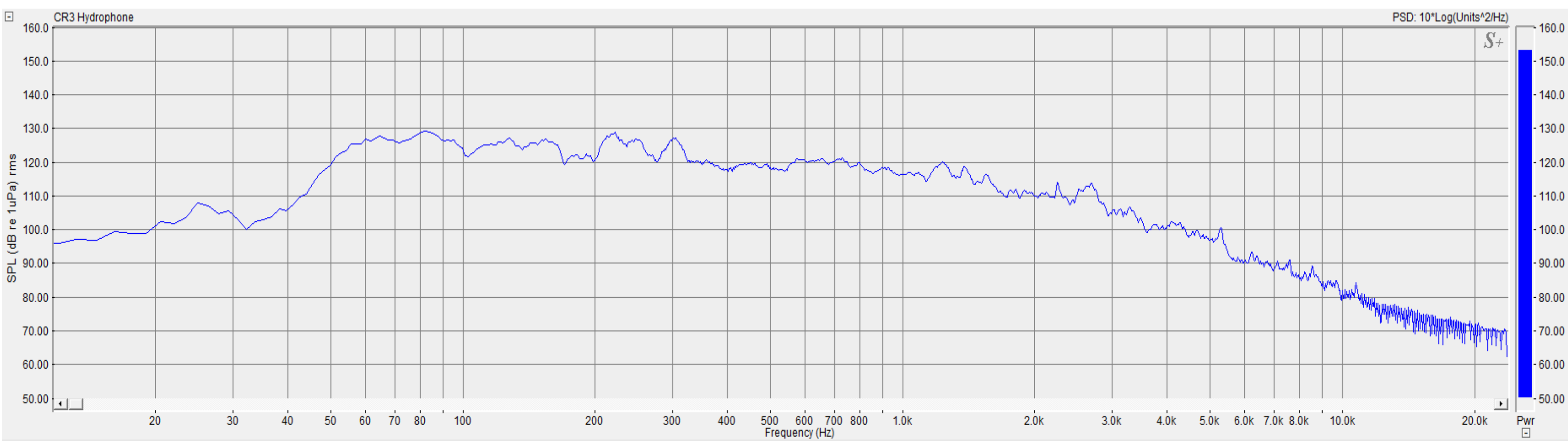


Figure 7. Power Spectral Density Plot from 88 meters for Event 3 installed December 20, 2022 at 13:04

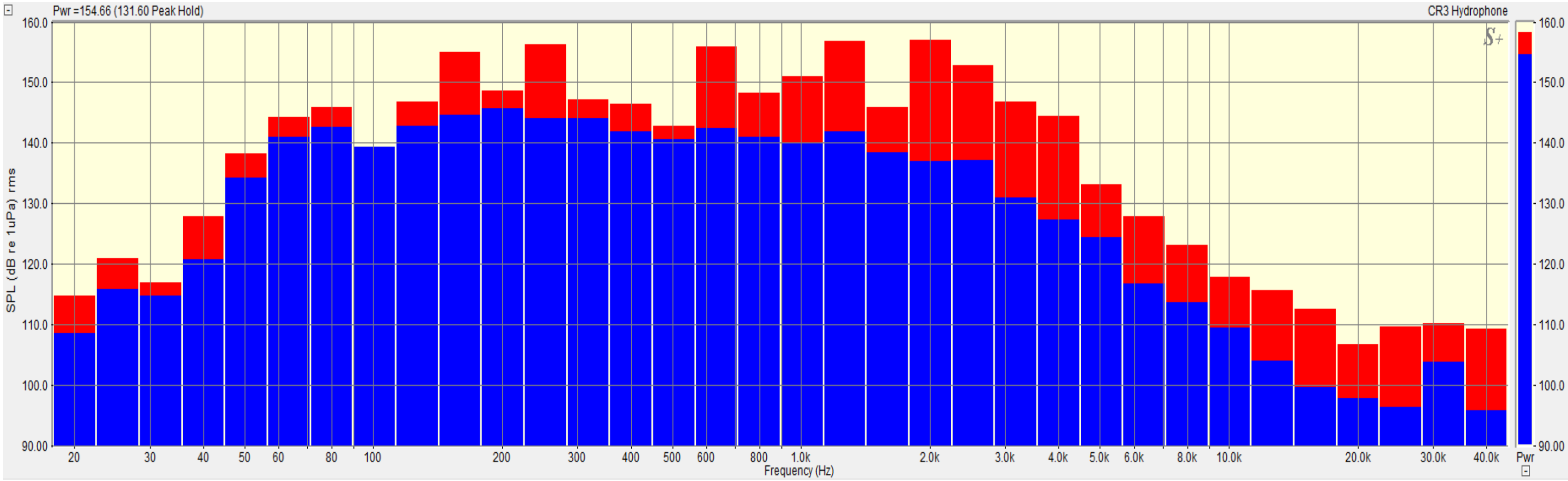


Figure 8. 1/3 Octave Band Spectra from 88 meters for Event 4 installed December 20, 2022 at 13:04

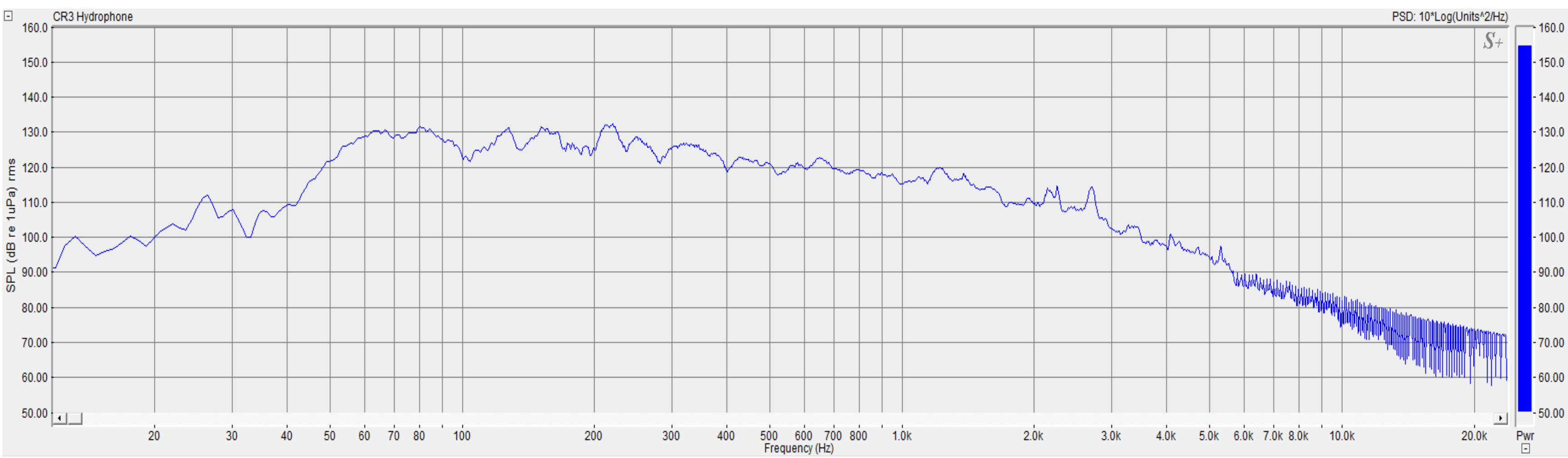


Figure 9. Power Spectral Density Plot from 88 meters for Event 4 installed December 20, 2022 at 13:04

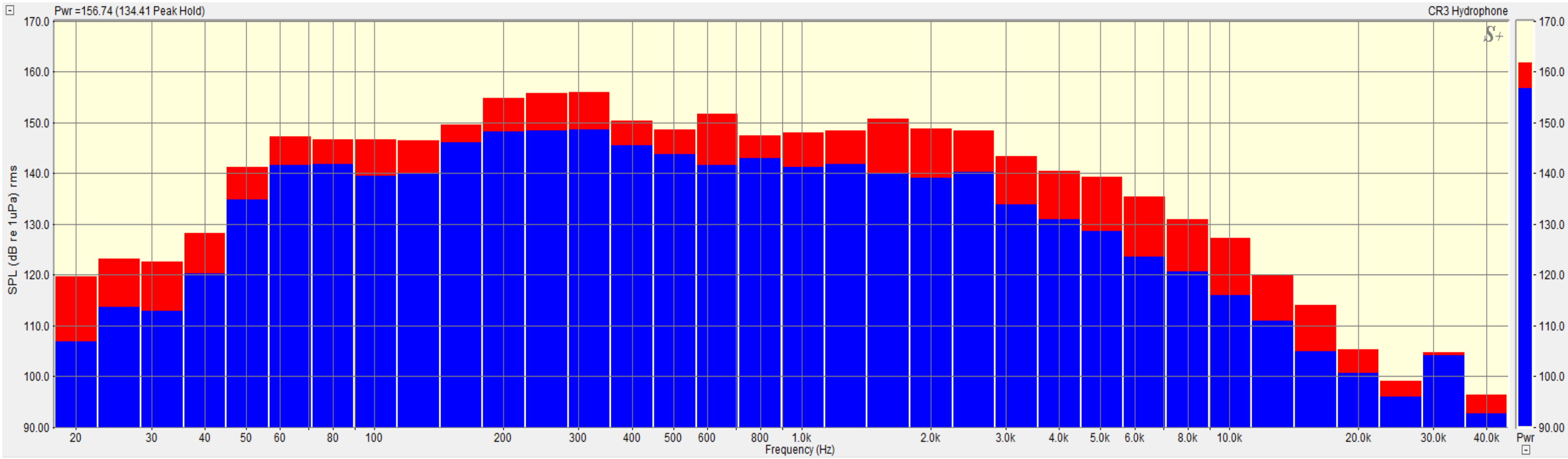


Figure 10. 1/3 Octave Band Spectra from 88 meters for Event 5 installed December 20, 2022 at 14:06

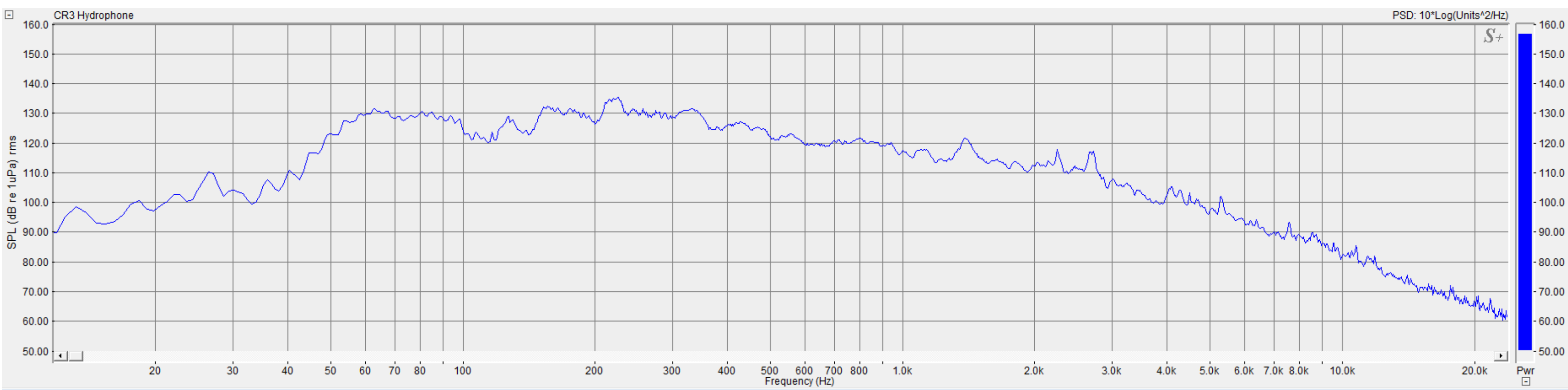


Figure 11. Power Spectral Density Plot from 88 meters for Event 5 installed December 20, 2022 at 14:06

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P381 Constructors

Hydroacoustic Monitoring Daily Report

Date: December 21, 2022 **Project:** 3121020 PNSY Multi-Mission Dry Dock 1

Project Information

Project Name: P381 Multi-Mission Dry Dock #1
Location: Portsmouth Naval Shipyard, Kittery, Maine
Project/Contract Number: N40085-21-C-0011
Hydroacoustic Engineer - Lead: Theodore Hallett

Hydrologic and Geologic Information

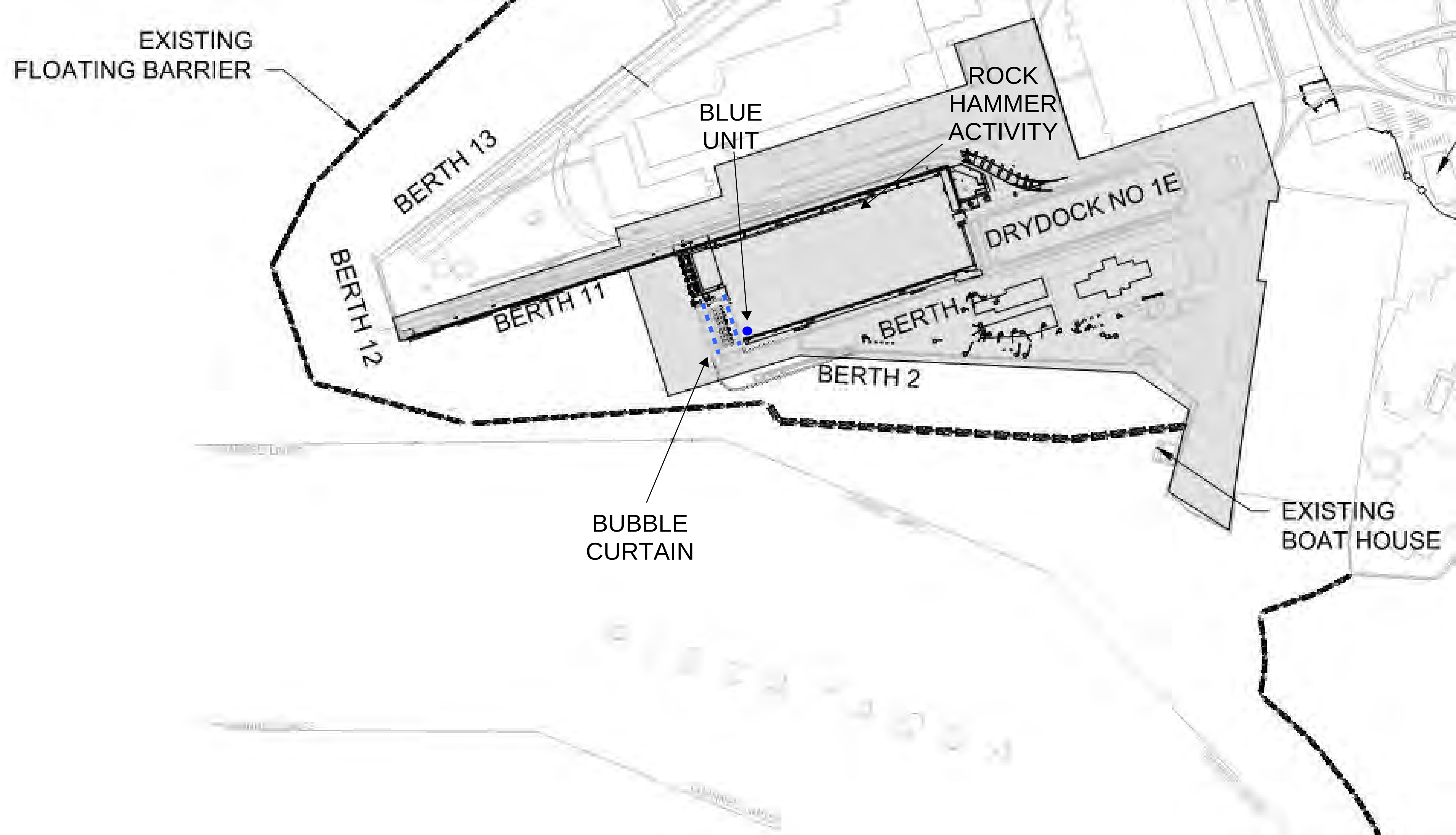
Body of Water: Portsmouth – Lower Piscataqua River
Type: Estuarine
Hydrologic Unit: 01060003
Geology: Glacial Till, Phyllite, Quartzite, Diorite and/or Shale

Equipment Information

Hydrophone: Cetacean Research CR3
Recording Device: Spectra DAQ-200
Sampling Rate: 96kHz
Bit Depth: 24 Bit

Weather

Meteorological Conditions: Partly Cloudy
Cloud Cover: 45%
Air Temperature: 33°F
Humidity: 50%
Wind Speed: 5 mph
Wind Direction: North-West
Beaufort Sea State: 1
Water Temperature: 45°F


EXISTING
FLOATING BARRIER
BERTH 13
BERTH 12
BERTH 11
BLUE
UNIT
ROCK
HAMMER
ACTIVITY
DRYDOCK NO 1E
BERTH
BERTH 2
BUBBLE
CURTAIN
EXISTING
BOAT HOUSE

Event/Pile

Pile Type: N/A
Activity: Rock Hammering
IHA Count: 7 of 10
Hammer Make: NPK
Hammer Model: GH50
Noise Type: Impulsive
Start Time: 9:52
Stop Time: 10:36
Active Hammer Duration: 1,307 seconds

BLUE UNIT

Hydrophone Distance from Pile: 80 meters
Latitude: 43°04'50"N
Longitude: 70°44'40"W
Water Column Depth: 12.4 meters
Hydrophone Deployed Depth: 6.2 meters

GREEN UNIT

Hydrophone Distance from Pile: N/A
Latitude: N/A
Longitude: N/A
Water Column Depth: N/A
Hydrophone Deployed Depth: N/A

Notes:

NPK GH50 hydraulic hammer attachment on Komatsu PC1250 excavator used for demolition of Berth 11 shutter panel wall. Blue unit was deployed from South Closure Wall (SCW) / Entrance Structure on unprotected side of bubble curtain (inside basin). No available 10 meter position for hydrophone deployment from Berth 11. Green unit was not deployed from Berth 11C davit arm due to multiple dredge material barges tied up along the Berth blocking the davit arm deployment location. No available location outside the bubble curtain to capture far field data. Bubble curtain was on and operational during drilling activities.

RMS SPL and SELcum data included in **Table 1.**

One-third octave band spectra and Power Spectral Density (PSD) included in **Figures 2-3**.

Data unweighted.

Date	Hammer Make/Model	Noise Type	Start Time	Stop Time	Active Hammer Duration (seconds)	Hammer Strike(s)	Pulse Duration (seconds)	Distance From Pile (meters)	RMS unweighted (SPL dB re 1uPa)			Peak unweighted (SPL dB re 1uPa)			SEL unweighted (dB re 1uPa^2.s)			SELcum unweighted (dB re 1uPa^2.s)
									Median	Mean (average)	Maximum	Median	Mean (average)	Maximum	Median	Mean (average)	Maximum	
12/21/2022	Rock Hammer	Impulsive	9:52	10:36	1307	3361	0.055	-	-	-	-	-	-	-	-	-	-	-
								80	155.36	156.15	166.76	170	170.31	179.95	149.01	149.73	159.08	184.28

Table 1. Data Summary of Piles Monitored

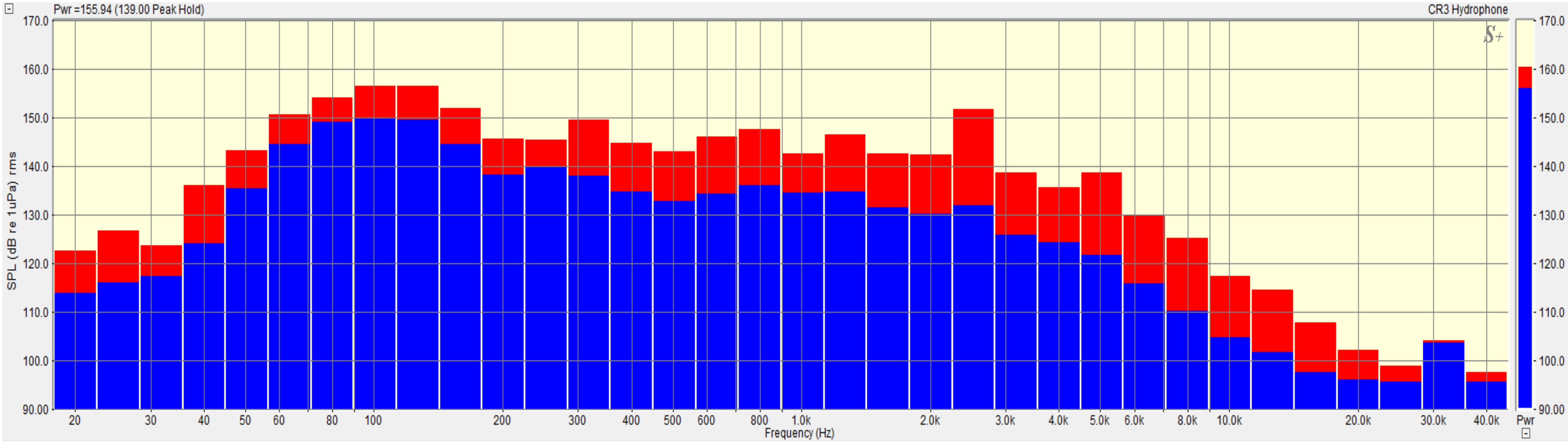


Figure 2. 1/3 Octave Band Spectra from 70 meters for Event 1 installed December 13, 2022 at 13:57

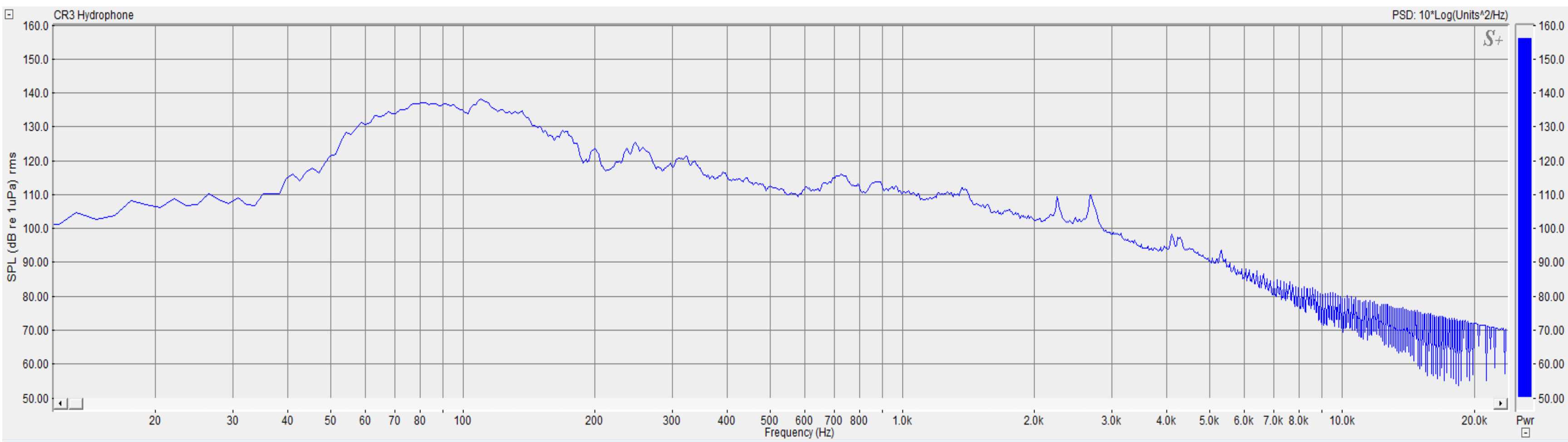


Figure 3. Power Spectral Density Plot from 70 meters for Event 1 installed December 13, 2022 at 13:57

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P381 Constructors

Hydroacoustic Monitoring Daily Report

Date: January 12, 2023 **Project:** 3121020 PNSY Multi-Mission Dry Dock 1

Project Information

Project Name: P381 Multi-Mission Dry Dock #1
Location: Portsmouth Naval Shipyard, Kittery, Maine
Project/Contract Number: N40085-21-C-0011
Hydroacoustic Engineer - Lead: Theodore Hallett

Hydrologic and Geologic Information

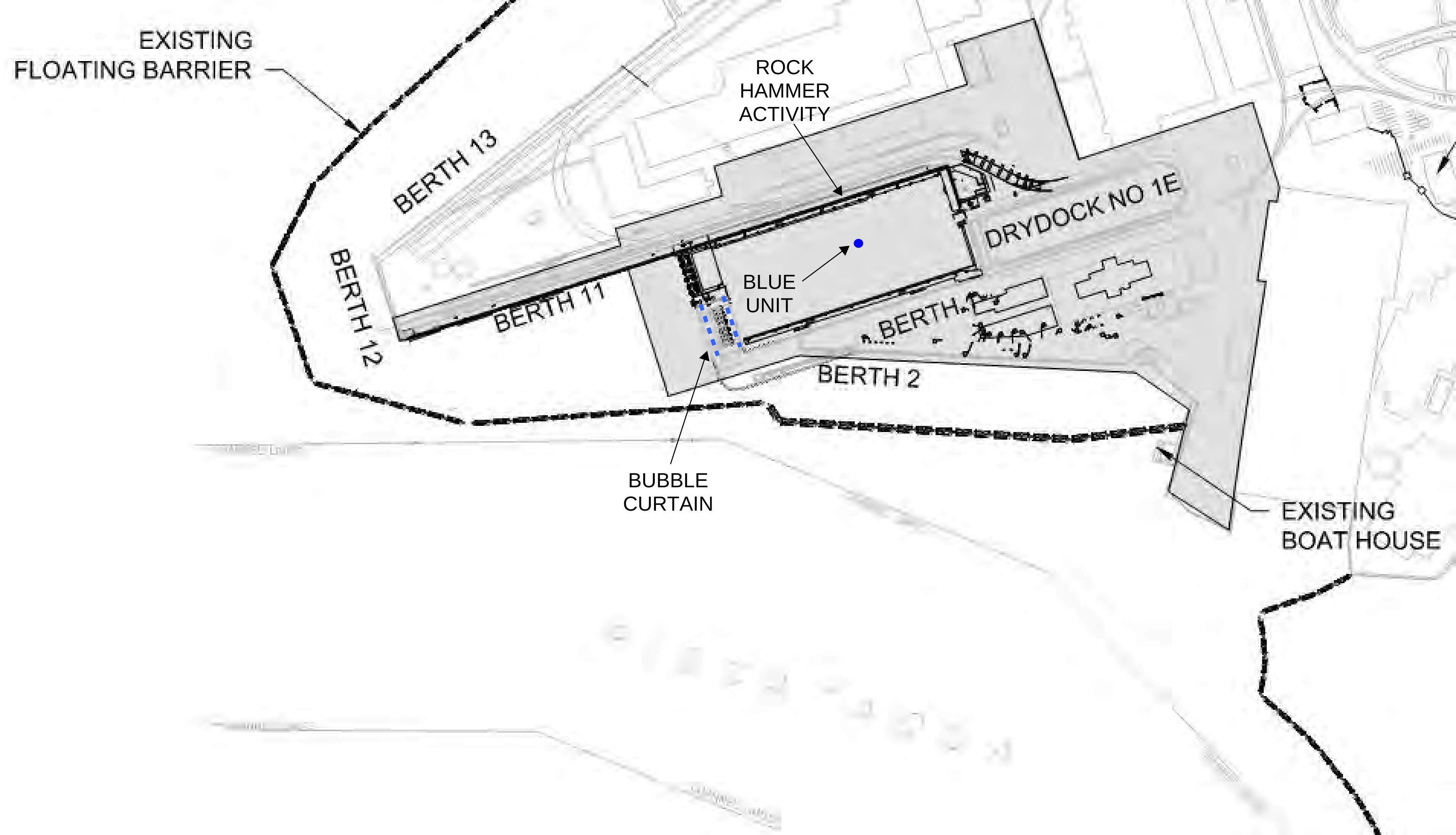
Body of Water: Portsmouth – Lower Piscataqua River
Type: Estuarine
Hydrologic Unit: 01060003
Geology: Glacial Till, Phyllite, Quartzite, Diorite and/or Shale

Equipment Information

Hydrophone: Cetacean Research CR3
Recording Device: Spectra DAQ-200
Sampling Rate: 96kHz
Bit Depth: 24 Bit

Weather

Meteorological Conditions: Cloudy
Cloud Cover: 100%
Air Temperature: 53°F
Humidity: 90%
Wind Speed: 13 mph
Wind Direction: North
Beaufort Sea State: 2
Water Temperature: 39°F


EXISTING
FLOATING BARRIER
ROCK
HAMMER
ACTIVITY
BERTH 13
BERTH 12
BERTH 11
DRYDOCK NO 1E
BLUE
UNIT
BERTH
BERTH 2
BUBBLE
CURTAIN
EXISTING
BOAT HOUSE

Event 1

Pile Type: N/A **Activity:** Rock Hammering **IHA Count:** 8 of 10

Hammer Make: NPK **Hammer Model:** GH50 **Noise Type:** Impulsive

Start Time: 8:48 **Stop Time:** 9:05 **Active Hammer Duration:** 704 seconds

BLUE UNIT

Hydrophone Distance from Pile: 40 meters

Latitude: 43º04'51"N **Longitude:** 70°44'36"W

Water Column Depth: 15.2 meters **Hydrophone Deployed Depth:** 7.6 meters

GREEN UNIT

Hydrophone Distance from Pile: N/A

Latitude: N/A **Longitude:** N/A

Water Column Depth: N/A **Hydrophone Deployed Depth:** N/A

Notes:

NPK GH50 hydraulic hammer attachment on Komatsu PC1250 excavator used for demolition of Berth 11 shutter panel wall. Blue unit was deployed from the center wall platform on the unprotected side of bubble curtain (inside basin). No available 10 meter position for hydrophone deployment from Berth 11. Green unit was not deployed from Berth 11C davit arm due to multiple dredge material barges tied up along the Berth blocking the davit arm deployment location. No available location outside the bubble curtain to capture far field data. Bubble curtain was on and operational during drilling activities.

RMS SPL and SELcum data included in **Table 1.**

One-third octave band spectra and Power Spectral Density (PSD) included in **Figures 2-3**.

Data unweighted.

Event 2

Pile Type: N/A
Activity: Rock Hammering
IHA Count: 9 of 10
Hammer Make: NPK
Hammer Model: GH50
Noise Type: Impulsive
Start Time: 9:07
Stop Time: 9:44
Active Hammer Duration: 1,451 seconds

BLUE UNIT

Hydrophone Distance from Pile: 40 meters
Latitude: 43º04'51"N
Longitude: 70°44'36"W
Water Column Depth: 15.2 meters
Hydrophone Deployed Depth: 7.6 meters

GREEN UNIT

Hydrophone Distance from Pile: N/A
Latitude: N/A
Longitude: N/A
Water Column Depth: N/A
Hydrophone Deployed Depth: N/A

Notes:

NPK GH50 hydraulic hammer attachment on Komatsu PC1250 excavator used for demolition of Berth 11 shutter panel wall. Blue unit was deployed from the center wall platform on the unprotected side of bubble curtain (inside basin). No available 10 meter position for hydrophone deployment from Berth 11. Green unit was not deployed from Berth 11C davit arm due to multiple dredge material barges tied up along the Berth blocking the davit arm deployment location. No available location outside the bubble curtain to capture far field data. Bubble curtain was on and operational during drilling activities.

RMS SPL and SELcum data included in **Table 1.**

One-third octave band spectra and Power Spectral Density (PSD) included in **Figures 2-3**.

Data unweighted.

Event 3

Pile Type: N/A **Activity:** Rock Hammering **IHA Count:** 10 of 10

Hammer Make: NPK **Hammer Model:** GH50 **Noise Type:** Impulsive

Start Time: 10:55 **Stop Time:** 11:03 **Active Hammer Duration:** 291 seconds

<u>BLUE UNIT</u>

Hydrophone Distance from Pile: 30 meters

Latitude: 43º04’51”N **Longitude:** 70°44’36”W

Water Column Depth: 14.3 meters **Hydrophone Deployed Depth:** 7.1 meters

<u>GREEN UNIT</u>

Hydrophone Distance from Pile: N/A

Latitude: N/A **Longitude:** N/A

Water Column Depth: N/A **Hydrophone Deployed Depth:** N/A

Notes:

NPK GH50 hydraulic hammer attachment on Komatsu PC1250 excavator used for demolition of Berth 11 shutter panel wall. Blue unit was deployed from the center wall platform on the unprotected side of bubble curtain (inside basin). No available 10 meter position for hydrophone deployment from Berth 11. Green unit was not deployed from Berth 11C davit arm due to multiple dredge material barges tied up along the Berth blocking the davit arm deployment location. No available location outside the bubble curtain to capture far field data. Bubble curtain was on and operational during drilling activities.

RMS SPL and SELcum data included in **Table 1.**

One-third octave band spectra and Power Spectral Density (PSD) included in **Figures 2-3**.

Data unweighted.

Event 4

Pile Type: N/A
Activity: Rock Hammering
IHA Count: 11 of 10
Hammer Make: NPK
Hammer Model: GH50
Noise Type: Impulsive
Start Time: 11:07
Stop Time: 11:28
Active Hammer Duration: 735 seconds

BLUE UNIT

Hydrophone Distance from Pile: 30 meters
Latitude: 43º04'51"N
Longitude: 70°44'36"W
Water Column Depth: 14.3 meters
Hydrophone Deployed Depth: 7.1 meters

GREEN UNIT

Hydrophone Distance from Pile: N/A
Latitude: N/A
Longitude: N/A
Water Column Depth: N/A
Hydrophone Deployed Depth: N/A

Notes:

NPK GH50 hydraulic hammer attachment on Komatsu PC1250 excavator used for demolition of Berth 11 shutter panel wall. Blue unit was deployed from the center wall platform on the unprotected side of bubble curtain (inside basin). No available 10 meter position for hydrophone deployment from Berth 11. Green unit was not deployed from Berth 11C davit arm due to multiple dredge material barges tied up along the Berth blocking the davit arm deployment location. No available location outside the bubble curtain to capture far field data. Bubble curtain was on and operational during drilling activities.

RMS SPL and SELcum data included in **Table 1.**

One-third octave band spectra and Power Spectral Density (PSD) included in **Figures 2-3**.

Data unweighted.

Event 5

Pile Type: N/A **Activity:** Rock Hammering **IHA Count:** 12 of 10

Hammer Make: NPK **Hammer Model:** GH50 **Noise Type:** Impulsive

Start Time: 11:41 **Stop Time:** 11:47 **Active Hammer Duration:** 279 seconds

BLUE UNIT

Hydrophone Distance from Pile: 35 meters

Latitude: 43º04’51”N **Longitude:** 70°44’36”W

Water Column Depth: 13.5 meters **Hydrophone Deployed Depth:** 6.8 meters

GREEN UNIT

Hydrophone Distance from Pile: N/A

Latitude: N/A **Longitude:** N/A

Water Column Depth: N/A **Hydrophone Deployed Depth:** N/A

Notes:

NPK GH50 hydraulic hammer attachment on Komatsu PC1250 excavator used for demolition of Berth 11 shutter panel wall. Blue unit was deployed from the center wall platform on the unprotected side of bubble curtain (inside basin). No available 10 meter position for hydrophone deployment from Berth 11. Green unit was not deployed from Berth 11C davit arm due to multiple dredge material barges tied up along the Berth blocking the davit arm deployment location. No available location outside the bubble curtain to capture far field data. Bubble curtain was on and operational during drilling activities.

RMS SPL and SELcum data included in **Table 1.**

One-third octave band spectra and Power Spectral Density (PSD) included in **Figures 2-3**.

Data unweighted.

Date	Hammer Make/Model	Noise Type	Start Time	Stop Time	Active Hammer Duration (seconds)	Hammer Strike(s)	Pulse Duration (seconds)	Distance From Pile (meters)	RMS unweighted (SPL dB re 1uPa)			Peak unweighted (SPL dB re 1uPa)			SEL unweighted (dB re 1uPa^2.s)			SELcum unweighted (dB re 1uPa^2.s)
									Median	Mean (average)	Maximum	Median	Mean (average)	Maximum	Median	Mean (average)	Maximum	
1/12/2023	Rock Hammer	Impulsive	8:48	9:05	704	2721	0.046	-	-	-	-	-	-	-	-	-	-	-
								40	149.75	151.94	166.41	165.85	169.87	183.41	143.00	145.74	158.33	177.31
1/12/2023	Rock Hammer	Impulsive	9:07	9:44	1451	5829	0.047	-	-	-	-	-	-	-	-	-	-	-
								40	153.11	153.84	170.14	170.28	172.01	187.06	146.63	147.72	160.76	184.28
1/12/2023	Rock Hammer	Impulsive	10:55	11:03	291	1013	0.038	-	-	-	-	-	-	-	-	-	-	-
								30	167.39	166.60	185.30	187.42	186.16	199.84	161.20	160.17	170.63	191.25
1/12/2023	Rock Hammer	Impulsive	11:07	11:28	735	2833	0.042	-	-	-	-	-	-	-	-	-	-	-
								30	164.22	165.08	184.31	182.94	184.16	198.13	157.78	158.69	171.14	192.30
1/12/2023	Rock Hammer	Impulsive	11:41	11:47	279	940	0.050	-	-	-	-	-	-	-	-	-	-	-
								35	159.05	158.61	170.21	177.31	176.30	186.6	152.36	152.26	164.19	182.10

Table 1. Data Summary of Piles Monitored

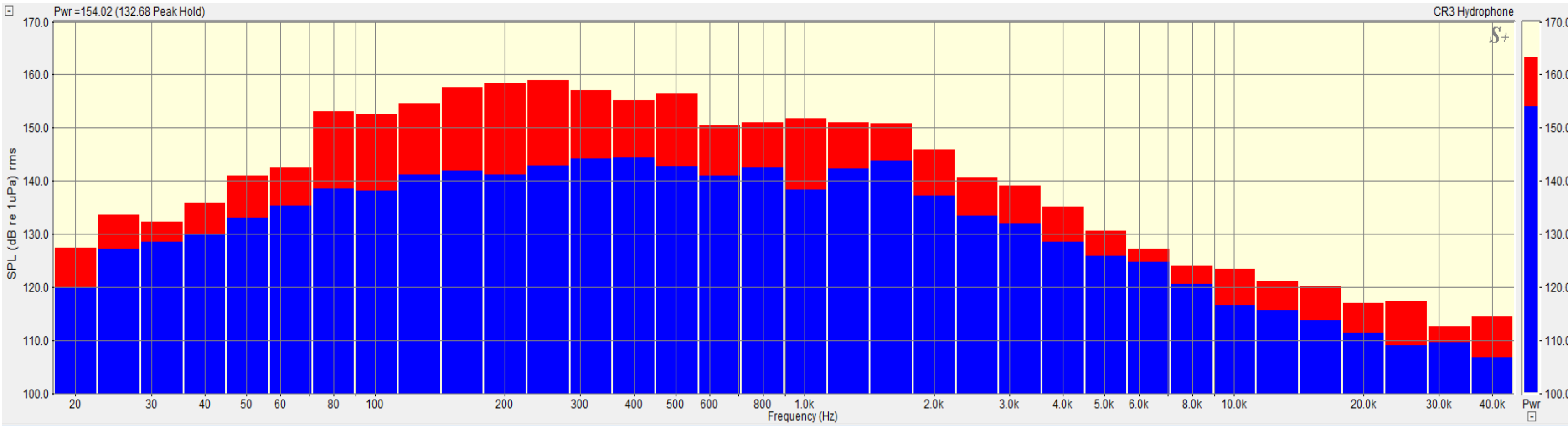


Figure 2. 1/3 Octave Band Spectra from 40 meters for Event 1 on January 12, 2023 at 8:48

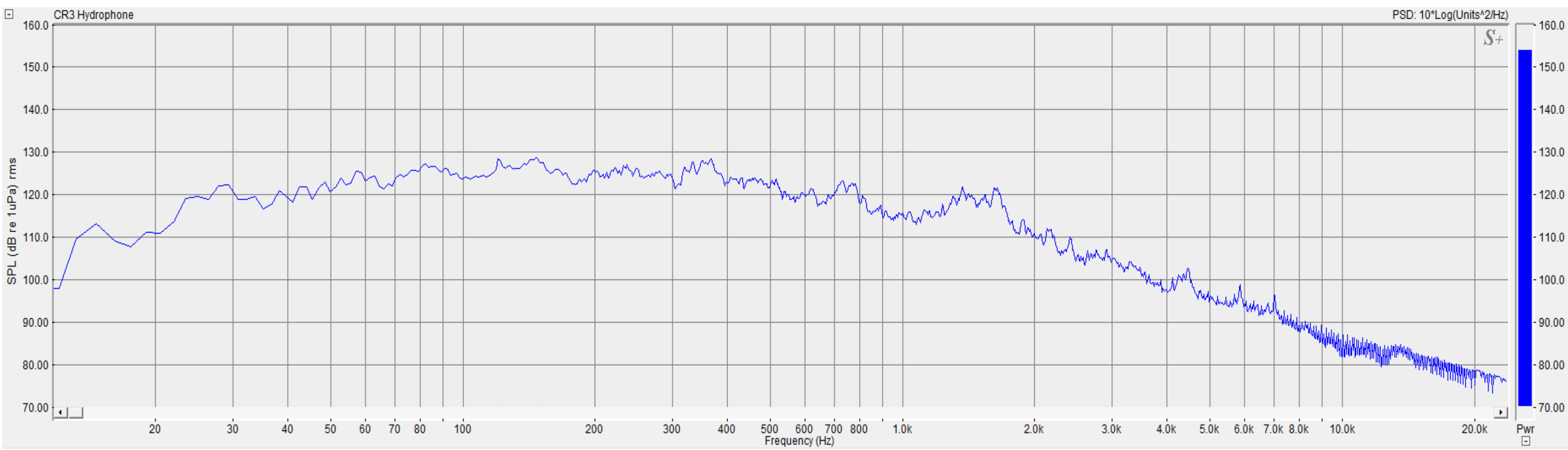


Figure 3. Power Spectral Density Plot from 40 meters for Event 1 on January 12, 2023 at 8:48

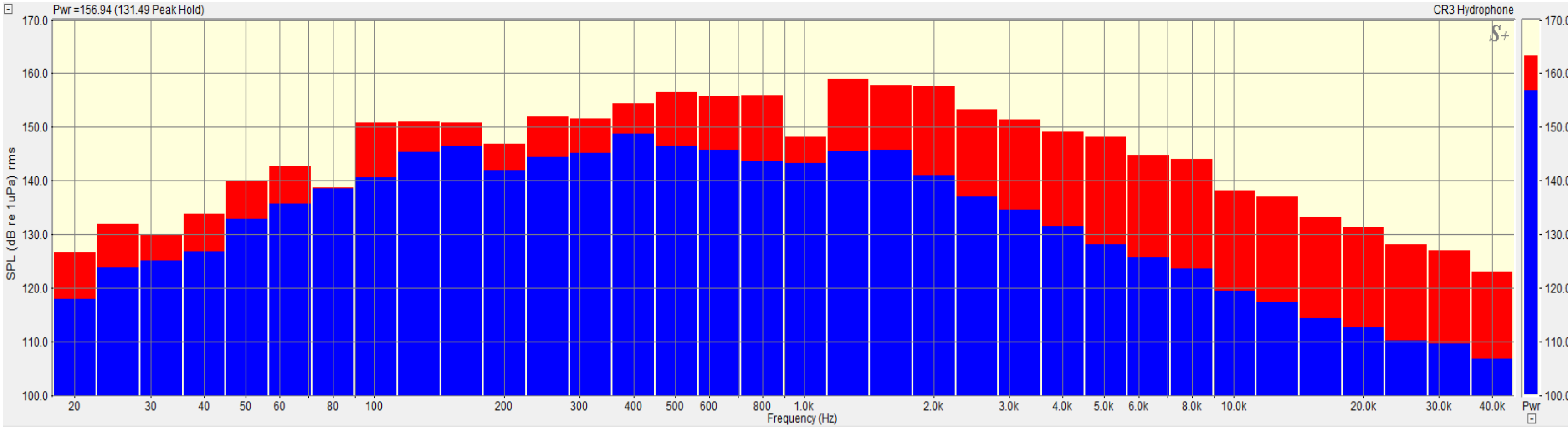


Figure 4. 1/3 Octave Band Spectra from 40 meters for Event 2 on January 12, 2023 at 9:07

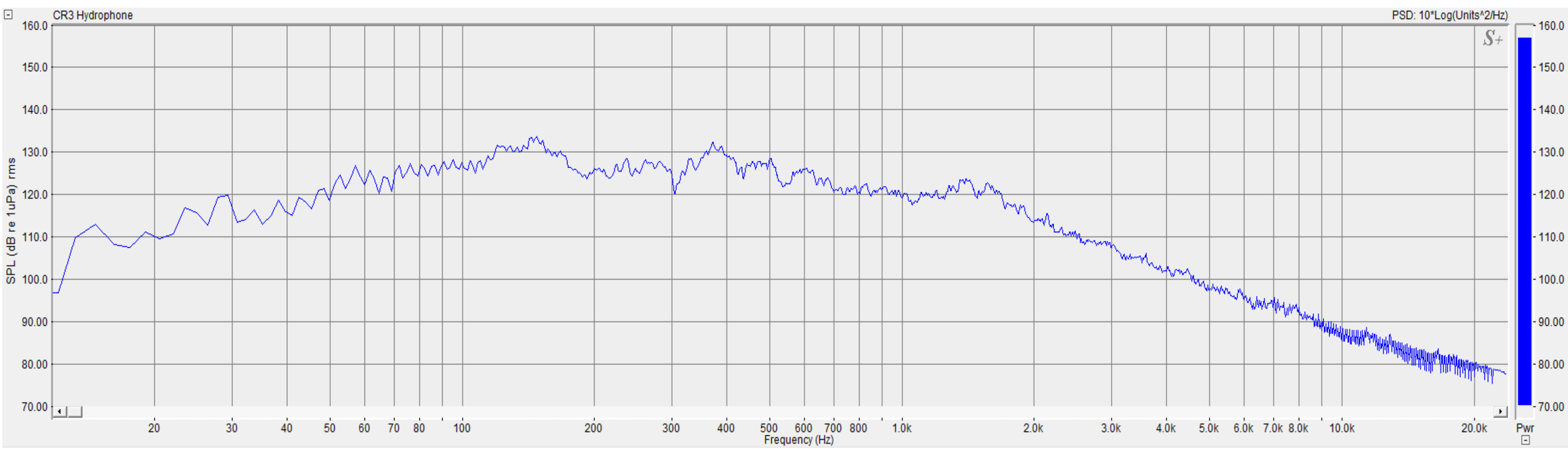


Figure 5. Power Spectral Density Plot from 40 meters for Event 2 on January 12, 2023 at 9:07

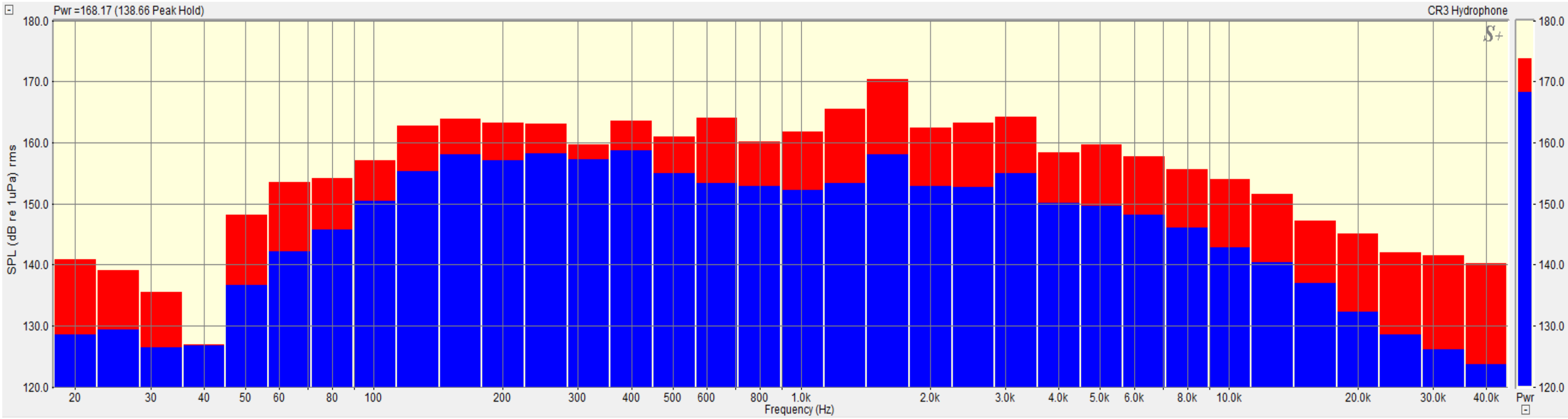


Figure 6. 1/3 Octave Band Spectra from 30 meters for Event 3 on January 12, 2023 at 10:55

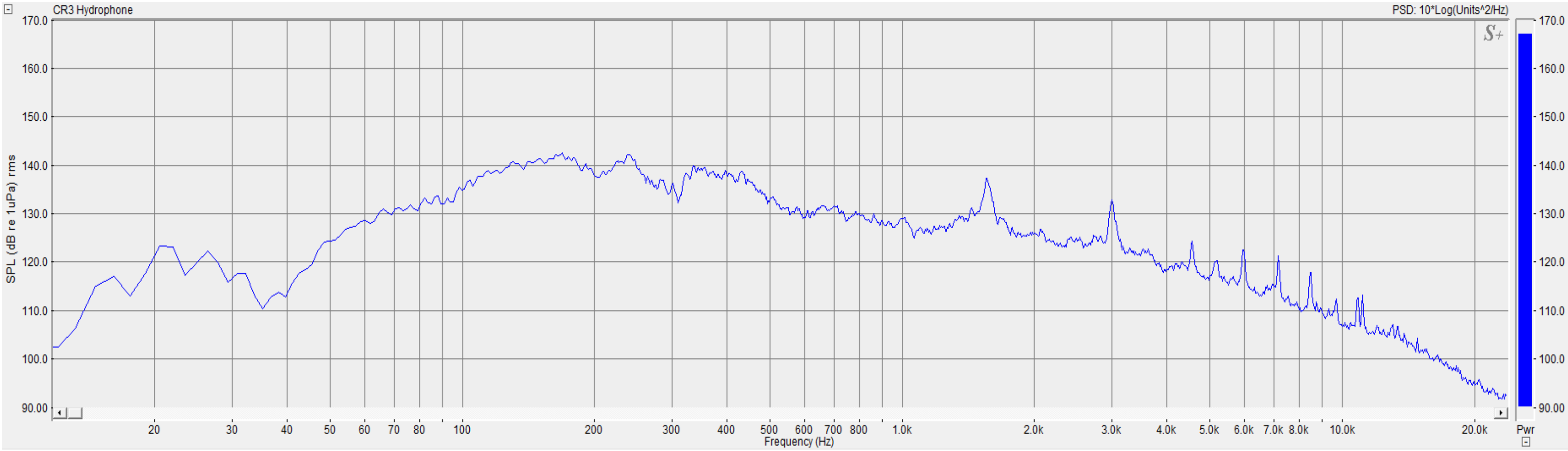


Figure 7. Power Spectral Density Plot from 30 meters for Event 3 on January 12, 2023 at 10:55

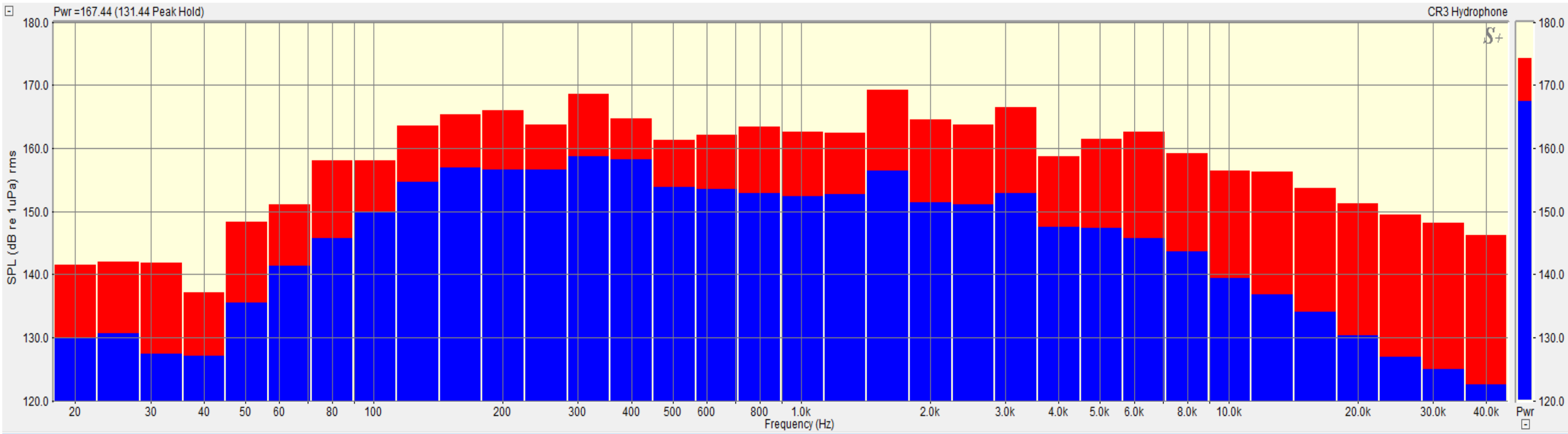


Figure 8. 1/3 Octave Band Spectra from 30 meters for Event 4 on January 12, 2023 at 11:07

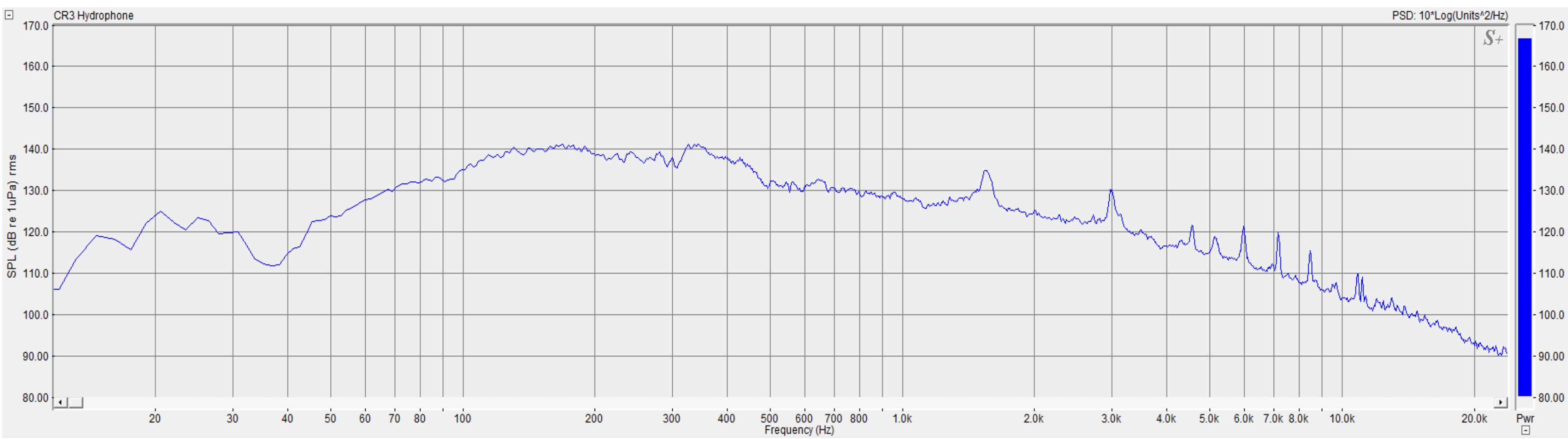


Figure 9. Power Spectral Density Plot from 30 meters for Event 4 on January 12, 2023 at 11:07

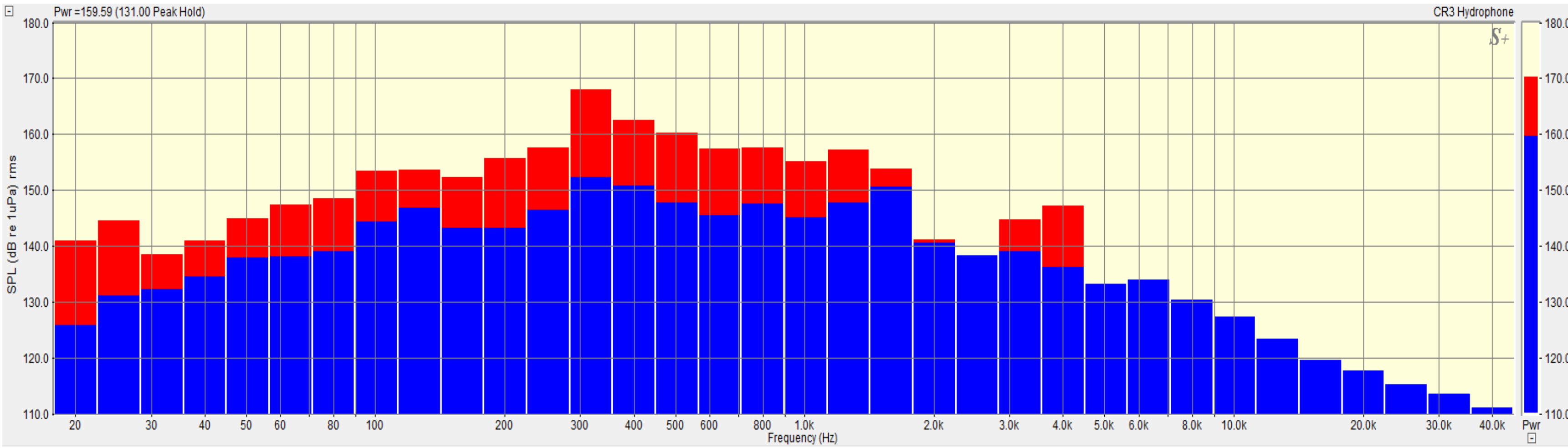


Figure 10. 1/3 Octave Band Spectra from 35 meters for Event 5 on January 12, 2023 at 11:41

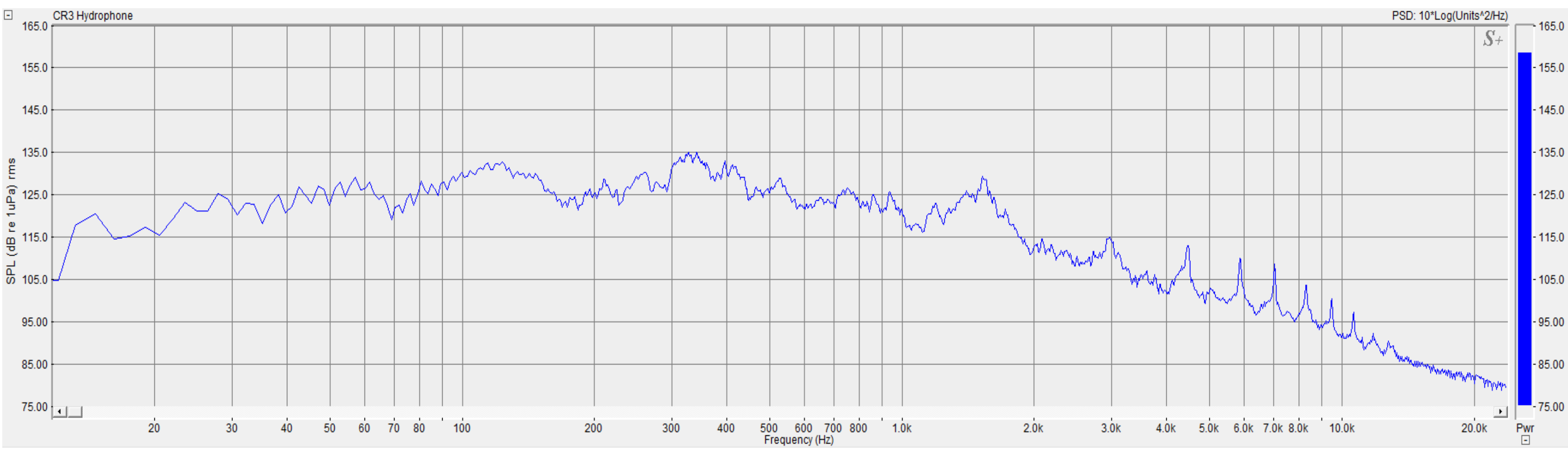


Figure 11. Power Spectral Density Plot from 35 meters for Event 5 on January 12, 2023 at 11:41

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APPENDIX B – SUPPLEMENTAL DATA

Date	Pile Type	Drill/Hammer Make/Model	Active Duration (seconds)	Hammer Strikes	Distance From Pile (meters)	SELcum 24h unweighted (dB re 1uPa^2.s)
6/10/2022	42" Pipe Pile	Mincon MP340	2,782	26,008	10	203.17
9/7/2022	42" Pipe Pile	Mincon MP340	5,884	18,162	10	192.03
9/8/2022	42" Pipe Pile	Mincon MP340	4,870	17,110	10	188.35
9/9/2022	42" Pipe Pile	Mincon MP340	10,426	18,803	10	187.97
11/28/2022	102" Casing	Rotary Drill	9,954	N/A	10	193.67
12/2/2022	102" Casing	Rotary Drill	6,696	N/A	10	186.78
12/13/2022	N/A	Rock Hammer	250	673	10	200.18
12/20/2022	N/A	Rock Hammer	2,013	5,131	10	206.81
12/21/2022	N/A	Rock Hammer	1,307	3,361	10	204.17
1/12/2023	N/A	Rock Hammer	3,460	13,336	10	201.77

24 hour SELcum Data

Pile #	Date	Pile Type	Drill Make/Model	Noise Type	Start Time	Stop Time	Active Drill Duration (seconds)	Distance From Pile (meters)	Protected by Bubble Curtain	RMS unweighted (SPL dB re 1uPa)			SELcum per pile unweighted (dB re 1uPa^2.s)
										Median	Mean (average)	Maximum	
1	11/28/2022	102" Casing	Rotary Drill	Continuous / Vibratory	9:17	9:49	1901	10	No	155.28	155.44	159.58	188.36
								300[a]	No	133.12	133.28	137.42	166.20
								300[b]	Yes	125.74	125.90	130.04	158.82
2	11/28/2022	102" Casing	Rotary Drill	Continuous / Vibratory	10:15	10:40	1484	10	No	156.89	157.02	161.81	188.75
								300[a]	No	134.73	134.86	139.65	166.59
								300[b]	Yes	127.35	127.48	132.27	159.21
3	11/28/2022	102" Casing	Rotary Drill	Continuous / Vibratory	10:44	11:08	1482	10	No	156.86	157.12	161.57	189.02
								300[a]	No	134.70	134.96	139.41	166.86
								300[b]	Yes	127.32	127.58	132.03	159.48
4	11/28/2022	102" Casing	Rotary Drill	Continuous / Vibratory	11:21	11:38	1031	10	No	143.93	142.13	148.74	175.09
								300[a]	No	121.77	119.97	126.58	152.93
								300[b]	Yes	114.39	112.59	119.20	145.55
5	11/28/2022	102" Casing	Rotary Drill	Continuous / Vibratory	12:16	13:09	3199	10	No	142.59	142.68	148.45	175.01
								300[a]	No	120.43	120.52	126.29	152.85
								300[b]	Yes	113.05	113.14	118.91	145.47
6	11/28/2022	102" Casing	Rotary Drill	Continuous / Vibratory	13:23	13:47	857	10	No	142.02	141.92	145.20	173.70
								300[a]	No	119.86	119.76	123.04	151.54
								300[b]	Yes	112.48	112.38	115.66	144.16
7	12/2/2022	102" Casing	Rotary Drill	Continuous / Vibratory	11:15	11:21	399	10	No	156.35	156.31	167.07	183.79
								300[a]	No	134.19	134.15	144.91	161.63
								300[b]	Yes	126.81	126.77	137.53	154.25
8	12/2/2022	102" Casing	Rotary Drill	Continuous / Vibratory	11:29	11:42	753	10	No	152.55	152.33	162.59	182.76
								300[a]	No	130.39	130.17	140.43	160.60
								300[b]	Yes	123.01	122.79	133.05	153.22
9	12/2/2022	102" Casing	Rotary Drill	Continuous / Vibratory	12:17	12:20	180	10	No	142.84	141.98	149.01	165.94
								300[a]	No	120.68	119.82	126.85	143.78
								300[b]	Yes	113.30	112.44	119.47	136.40
10	12/2/2022	102" Casing	Rotary Drill	Continuous / Vibratory	12:32	12:39	412	10	No	135.67	134.80	145.36	162.14
								300[a]	No	113.51	112.64	123.20	139.98
								300[b]	Yes	106.13	105.26	115.82	132.60
11	12/2/2022	102" Casing	Rotary Drill	Continuous / Vibratory	13:04	13:08	222	10	No	142.95	143.55	159.05	168.85
								300[a]	No	120.79	121.39	136.89	146.69
								300[b]	Yes	113.41	114.01	129.51	139.31
12	12/2/2022	102" Casing	Rotary Drill	Continuous / Vibratory	13:30	13:56	1584	10	No	135.51	137.47	151.79	171.03
								300[a]	No	113.35	115.31	129.89	148.87
								300[b]	Yes	105.97	107.93	122.25	141.49
13	12/2/2022	102" Casing	Rotary Drill	Continuous / Vibratory	14:11	14:24	778	10	No	132.67	133.97	147.02	164.73
								300[a]	No	110.51	111.81	124.86	142.57
								300[b]	Yes	103.13	104.43	117.48	135.19
14	12/2/2022	102" Casing	Rotary Drill	Continuous / Vibratory	14:32	15:11	2368	10	No	139.20	139.04	155.48	174.23
								300[a]	No	117.04	116.88	133.32	152.07
								300[b]	Yes	109.66	109.50	125.94	144.69

[a] data extrapolated from captured data; F value = 15 — *This data is included to help understand transmission loss of rotary drilling for future projects that may not utilize a bubble curtain*

[b] data extrapolated from captured data; F value = 20 — *This data is included to show assumed levels at Berth 11C. Noise levels of rotary drilling did not increase above ambient at 300m*

Bubble curtain gives increased attenuation rate

102-inch Rotary Drill Extrapolated Data - Revised per 02/16/2023 NOAA Correspondence

Pile #	Date	Pile Type	Hammer Make/Model	Noise Type	Start Time	Stop Time	Active Hammer Duration (seconds)	Hammer Strikes	Pulse Duration (seconds)	Distance From Pile (meters)	Protected by Bubble Curtain	RMS unweighted (SPL dB re 1uPa)				Peak unweighted (SPL dB re 1uPa)				SELss unweighted (dB re 1uPa^2.s)				SELcum unweighted (dB re 1uPa^2.s)
												Median	Average	Range Minimum	Range Maximum	Median	Average	Range Minimum	Range Maximum	Median	Average	Range Minimum	Range Maximum	
1	6/10/2022	42" Pipe Pile	Mincon MP340	Impulsive	10:22	10:28	358	2,864	0.055	10[a]	No	167.87	168.00	162.26	173.76	180.38	180.98	163.41	188.15	158.84	158.96	153.23	164.73	193.41
										65	No	155.68	155.81	150.07	161.57	168.19	168.79	151.22	175.96	146.65	146.77	141.04	152.54	181.22
										84[a]	Yes	154.01	154.14	148.40	159.90	166.52	167.12	149.55	174.29	144.98	145.10	139.37	150.87	179.55
										258[a]	Yes	146.70	146.83	141.09	152.59	159.21	159.81	142.24	166.98	137.67	137.79	132.06	143.56	172.24
2	6/10/2022	42" Pipe Pile	Mincon MP340	Impulsive	10:28	10:32	195	1,755	0.056	10[a]	No	167.66	168.28	142.70	175.03	182.09	182.74	150.58	189.09	158.63	159.25	133.67	166.00	191.08
										65	No	155.47	156.09	130.51	162.84	169.90	170.55	138.39	176.90	146.44	147.06	121.48	153.81	178.88
										84	Yes	137.49	137.21	125.09	149.28	148.06	148.16	131.51	166.94	128.46	128.18	116.06	140.25	160.90
										258[a]	Yes	130.18	129.90	117.78	141.97	140.75	140.85	124.20	159.63	121.15	120.87	108.75	132.94	153.59
3	6/10/2022	42" Pipe Pile	Mincon MP340	Impulsive	10:59	11:14	901	8,109	0.056	10[a]	No	168.23	168.43	136.44	177.27	182.27	182.84	148.68	194.41	159.20	159.40	127.41	168.24	198.29
										65	No	156.04	156.24	124.25	165.08	170.08	170.65	136.49	182.22	147.01	147.21	115.22	156.05	186.09
										84	Yes	137.21	137.21	120.68	141.99	148.85	148.83	130.77	153.94	128.18	128.18	111.65	132.96	167.27
										258[a]	Yes	129.90	132.03	115.50	136.81	143.67	143.65	125.59	148.76	123.00	123.00	106.47	127.78	162.09
4	6/10/2022	42" Pipe Pile	Mincon MP340	Impulsive	11:33	11:55	1,328	13,280	0.060	10[a]	No	169.73	171.64	133.61	188.24	183.88	185.53	144.74	202.14	159.73	161.64	123.61	178.24	200.97
										65	No	157.54	159.45	121.42	176.05	171.69	173.34	132.55	189.95	147.54	149.45	111.42	166.05	188.78
										84	Yes	138.04	139.63	121.64	160.37	149.80	151.11	129.51	176.28	129.01	130.59	110.92	145.61	170.24
										258[a]	Yes	130.73	132.32	114.33	153.06	142.49	143.80	122.20	168.97	121.70	123.28	103.61	138.30	162.93
5	9/7/2022	42" Pipe Pile	Mincon MP340	Impulsive	10:42	11:07	1,543	13,887	0.054	10[b]	No	158.94	158.61	143.13	169.34	171.61	172.49	159.12	186.28	149.91	147.51	134.10	160.30	191.34
										65[b]	No	142.68	142.35	126.87	153.08	155.35	156.23	142.86	170.02	133.65	131.25	117.84	144.04	175.08
										84[a]	Yes	138.73	138.40	122.92	149.13	151.40	152.28	138.91	166.07	129.70	127.30	113.89	140.09	171.12
										186	Yes	133.55	133.22	117.74	143.95	146.22	147.1	133.73	160.89	124.52	122.12	108.71	134.91	165.94
6	9/7/2022	42" Pipe Pile	Mincon MP340	Continuous	14:43	15:49	3,866	N/A	N/A	10	No	138.78	143.30	127.30	155.72	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	181.05
										186	Yes	109.67	110.73	103.61	121.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	147.75
6	9/7/2022	42" Pipe Pile	Mincon MP340	Impulsive	15:49	15:57	475	4,275	0.058	10	No	167.22	167.52	130.56	180.31	183.83	184.19	139.25	194.57	158.42	164.53	121.53	167.52	194.73
										186	Yes	119.90	120.45	104.84	132.76	134.56	135.04	120.39	144.81	110.87	111.42	95.81	123.73	147.18
7	9/8/2022	42" Pipe Pile	Mincon MP340	Continuous	11:03	11:25	1,330	N/A	N/A	10[a]	No	146.85	147.75	142.91	155.31	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	180.31
										188	Yes	127.74	128.64	123.80	136.20	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	161.20
8	9/8/2022	42" Pipe Pile	Mincon MP340	Continuous	11:26	11:54	1,829	N/A	N/A	10	No	135.18	135.72	129.64	143.55	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	169.19
										188	Yes	128.66	130.03	118.27	143.34	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	164.32
8	9/8/2022	42" Pipe Pile	Mincon MP340	Impulsive	11:54	12:25	1,711	17,110	0.059	10	No	165.57	168.32	132.61	184.79	182.09	184.80	142.02	199.26	155.39	157.14	122.61	170.21	197.72
										188	Yes	135.76	135.85	126.44	144.17	147.41	147.61	138.03	158.96	125.76	125.85	116.45	134.17	167.13
9	9/9/2022	42" Pipe Pile	Mincon MP340	Continuous	9:33	10:45	4,490	N/A	N/A	10	No	134.69	135.55	125.17	153.71	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	163.56
										188	Yes	136.50	136.62	121.75	147.05	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	176.80
9	9/9/2022	42" Pipe Pile	Mincon MP340	Impulsive	10:45	11:03	837	7,533	0.057	10	No	162.28	162.57	127.99	177.07	177.83	178.08	137.28	192.25	152.24	146.51	117.99	166.25	191.01
										188	Yes	136.99	137.60	124.09	147.01	147.16	147.54	137.31	156.15	127.96	128.57	115.06	137.98	170.29
10	9/9/2022	42" Pipe Pile	Mincon MP340	Continuous	11:23	12:22	3,972	N/A	N/A	10	No	134.98	135.74	127.61	146.17	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	171.94
										188	Yes	127.67	129.76	118.98	144.87	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	169.32
10	9/9/2022	42" Pipe Pile	Mincon MP340	Impulsive	12:22	12:48	1,127	11,270	0.058	10	No	163.95	165.94	131.76	183.04	178.41	180.94	141.42	197.38	153.89	155.17	121.76	169.52	194.41
										188	Yes	132.99	132.59	118.74	142.77	144.76	146.14	135.4	159.7	123.96	123.56	109.71	133.74	164.48

[a] data extrapolated from captured data; F value = 15

[b] data extrapolated from captured data; F value = 20

Bubble curtain gives increased attenuation rate

42-inch DTH Mono-Hammer Extrapolated Data - Revised per 02/16/2023 NOAA Correspondence

Date	Hammer Make/Model	Noise Type	Start Time	Stop Time	Active Hammer Duration (seconds)	Hammer Strike(s)	Pulse Duration (seconds)	Distance From Pile (meters)	Protected by Bubble Curtain	RMS unweighted (SPL dB re 1uPa)			Peak unweighted (SPL dB re 1uPa)			SEL unweighted (dB re 1uPa^2.s)			SELcum unweighted (dB re 1uPa^2.s)
										Median	Mean (average)	Maximum	Median	Mean (average)	Maximum	Median	Mean (average)	Maximum	
12/13/2022	Rock Hammer	Impulsive	13:57	14:08	250	673	0.061	10[a]	No	171.90	172.53	185.37	188.88	189.54	197.15	165.72	166.16	172.63	190.00
								70	No	159.22	159.85	172.69	176.20	176.86	184.47	153.04	153.48	159.95	181.32
								247[b]	Yes	148.27	148.90	161.74	165.25	165.91	173.52	142.09	142.53	149.00	170.37
12/20/2022	Rock Hammer	Impulsive	11:48	12:08	750	1815	0.045	10[a]	No	169.62	170.61	185.72	186.72	187.57	200.10	163.24	163.93	175.97	195.83
								71	No	156.85	157.84	172.95	173.95	174.80	187.33	150.47	151.16	163.20	183.06
								248[b]	Yes	145.99	146.98	162.09	163.09	163.94	176.47	139.61	140.30	152.34	172.19
12/20/2022	Rock Hammer	Impulsive	12:11	12:20	389	999	0.052	10[a]	No	170.52	170.88	183.00	189.40	189.42	196.46	164.35	164.60	171.45	194.34
								71	No	157.75	158.11	170.23	176.63	176.65	183.69	151.58	151.83	158.68	181.57
								248[b]	Yes	146.89	147.25	159.37	165.77	165.79	172.83	140.72	140.97	147.82	170.71
12/20/2022	Rock Hammer	Impulsive	12:56	13:03	183	513	0.049	10[a]	No	168.71	169.49	203.21	185.48	184.56	194.61	161.97	162.12	197.19	189.07
								88	No	154.54	155.32	189.04	171.31	170.39	180.44	147.80	147.95	183.02	174.90
								265[b]	Yes	144.96	145.74	179.46	161.73	160.81	170.86	138.22	138.37	173.44	165.33
12/20/2022	Rock Hammer	Impulsive	13:04	13:15	277	723	0.055	10[a]	No	169.71	170.56	184.12	185.75	185.98	196.18	162.43	163.02	172.91	191.02
								88	No	155.54	156.39	169.95	171.58	171.81	182.01	148.26	148.85	158.74	176.85
								265[b]	Yes	145.96	146.81	160.37	162.00	163.23	172.43	138.68	139.27	149.16	167.28
12/20/2022	Rock Hammer	Impulsive	14:06	14:18	414	1081	0.053	10[a]	No	171.97	172.35	184.72	188.11	188.08	195.77	165.36	165.47	172.54	195.70
								88	No	157.80	158.18	170.55	173.94	173.91	181.60	151.19	151.30	158.37	181.52
								265[b]	Yes	148.22	148.60	160.97	164.36	164.33	172.02	141.61	141.72	148.79	171.95
12/21/2022	Rock Hammer	Impulsive	9:52	10:36	1307	3361	0.055	10[a]	No	168.91	169.70	180.31	183.55	183.86	193.50	162.56	163.28	172.63	197.82
								80	No	155.36	156.15	166.76	170.00	170.31	179.95	149.01	149.73	159.08	184.28
								257[b]	Yes	145.22	146.01	156.62	159.86	160.17	169.81	138.87	139.59	148.94	174.14
1/12/2023	Rock Hammer	Impulsive	8:48	9:05	704	2721	0.046	10[a]	No	157.78	160.97	175.44	174.88	178.90	192.44	152.03	154.77	167.36	186.34
								40	No	149.75	151.94	166.41	165.85	169.87	183.41	143.00	145.74	158.33	177.31
								270[b]	Yes	133.16	135.35	149.82	149.26	153.28	166.82	126.41	129.15	141.71	160.72
1/12/2023	Rock Hammer	Impulsive	9:07	9:44	1451	5829	0.047	10[a]	No	162.14	162.87	179.17	179.31	181.04	196.09	155.66	156.75	169.79	193.31
								40	No	153.11	153.84	170.14	170.28	172.01	187.06	146.63	147.72	160.76	184.28
								270[b]	Yes	136.52	137.25	153.55	153.69	155.42	170.47	130.04	131.13	144.17	167.69
1/12/2023	Rock Hammer	Impulsive	10:55	11:03	291	1013	0.039	10[a]	No	174.55	173.76	192.46	194.58	193.32	207.00	168.36	167.33	177.79	198.41
								30	No	167.39	166.60	185.30	187.42	186.16	199.84	161.20	160.17	170.63	191.25
								260[b]	Yes	148.63	147.84	166.54	168.66	167.40	181.08	142.44	141.41	151.87	172.49
1/12/2023	Rock Hammer	Impulsive	11:07	11:28	735	2833	0.042	10[a]	No	171.38	172.24	191.47	190.10	191.32	205.29	164.94	165.85	178.30	199.46
								30	No	164.22	165.08	184.31	182.94	184.16	198.13	157.78	158.69	171.14	192.30
								260[b]	Yes	145.46	146.32	165.55	164.18	165.40	179.37	139.02	139.93	152.38	173.54
1/12/2023	Rock Hammer	Impulsive	11:41	11:47	279	940	0.050	10[a]	No	167.21	166.77	178.37	185.47	184.46	194.76	160.52	160.42	172.35	190.26
								35	No	159.05	158.61	170.21	177.31	176.30	186.60	152.36	152.26	164.19	182.10
								255[b]	Yes	141.80	141.36	152.96	160.06	159.05	169.35	135.11	135.01	146.94	164.85

[a]data extrapolated from captured data; F value = 15

[b]data extrapolated from captured data; F value = 20

Bubble curtain increases F value

Rock Hammer Extrapolated Data - Revised per 02/16/2023 NOAA Correspondence

APPENDIX C – SUPPLEMENTAL REPORT

Review of Down-the-Hole Drilling Acoustic Data

Review of Down-the-Hole Drilling Acoustic Data Measured for P381

381 Constructors measured sound levels associated with the installation of 42-inch diameter steel piles while utilizing a Mincon MP340 DTH mono-hammer. Based off previous DTH mono-hammer knowledge, it was assumed the DTH mono-hammer would produce impulsive sounds over the entire activity duration. This approach was crafted to capture impulsive sounds over the entire active duration.

Previous projects (White Pass & Yukon Route) that used 42-inch diameter steel piles for permanent installation began installation of the pile by first setting the pile into soft substrate by means of vibratory and/or impact hammers before utilizing a DTH mono-hammer to advance the pile into hard competent rock. 381 Constructors are utilizing a DTH mono-hammer as a means of mechanical rock removal along the West Closure Wall footprint. This involves removal of both soft substrate and hard competent rock. The 42-inch diameter steel guide pile is used as a temporary boring guide for rock removal rather than permanent installation. This method uses one 42-inch diameter steel pile multiple times as a guide rather than installing and removing multiple 42-inch diameter steel piles.

In DTH excavation, rotary drilling in conjunction with percussive hammering (approximately 8-13 strikes per second) is used to remove softer overburden material, along with fracturing and removing rock. The material is removed with an airlifting process as the drill tool is utilized. When the DTH mono-hammer is rotating (drilling/air lifting) through soft substrate, the piston is not engaged. When the hammer approaches resistance consistent with encountering hard rock, the air actuated piston is activated, forcing the drill bit into the rock repeatedly causing impulsive sound characteristics.

The mechanical bedrock removal (rock kerf) cutting adjacent to the West Closure Wall consist of drilling through a coarse gravel material prior to meeting harder material and eventually rock ledge. In review of the collected data, we will show resulting actions of the mono-hammer functions as they relate to moving through different material.

Data Captured

381 Constructors has captured data on 10 instances of mechanical rock excavation being performed by a DTH mono-hammer utilizing a 42-inch diameter steel guide pile.

On September 7, 2022, two instances of the 42-inch diameter steel pile being utilized to support West Closure Wall – Mechanical Rock Excavation were captured. The data collected from the first instance (far field hydrophone only) between 10:42 and 11:07 was not the entire duration of mechanical rock excavation. The data collected from the second instance (near field and far field hydrophone) between 14:43 and 15:57 was the entire duration of the mechanical rock excavation. In reference to Figure 3, it should be noted that the active duration of the piston firing was approximately 475 seconds out of the total mechanical rock excavation of 4,436 seconds.

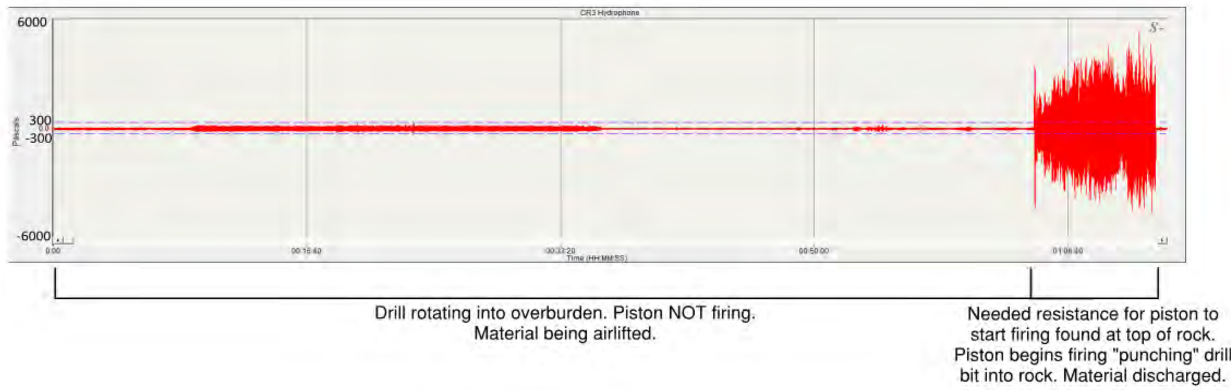


Figure 3. Time Series 10 meters away from Pile 2 on September 7, 2022

It was assumed in the IHA application that the DTH mono-hammer would produce approximately 13 strikes per second while active. In reference to Figure 4, it should be noted that when the piston was firing, the DTH mono-hammer was producing approximately 9 strikes per second.

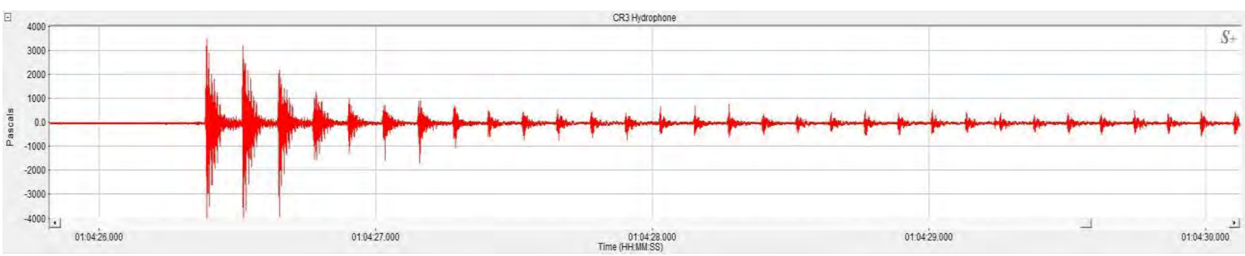


Figure 4. Snippet of Time Series 10 meters away from Pile 2 on September 7, 2022

Table 1. Data Reported for Pile 2 at 10 meters on September 7, 2022

Date	Start Time	Stop Time	Active Hammer Duration (seconds)	Hammer Strikes	Distance from Pile (meters)	Mean SELss unweighted (dB re 1uPa^2.s)	SELcum unweighted (dB re 1uPa^2.s)
9/7/2022	14:43	15:57	4,436	35,488	10	147.21	192.71

Table 2. Reanalysis of Pile 2 at 10 meters on September 7, 2022

Date	Start Time	Stop Time	Active Hammer Duration (seconds)	Hammer Strikes	Distance from Pile (meters)	Mean SELss unweighted (dB re 1uPa^2.s)	SELcum unweighted (dB re 1uPa^2.s)
9/7/2022	14:43	15:57	4,436	4,275	10	158.42	194.73

On September 8, 2022, two instances of the 42-inch diameter steel pile being utilized to support West Closure Wall – Mechanical Rock Excavation were captured. The data collected from the first instance (far field hydrophone only) between 11:03 and 11:25 was not the entire duration of the mechanical rock excavation. Once the far field hydrophone was deployed, the hydroacoustic engineer began recording. Between 11:03 and 11:25, the hydroacoustic engineer brought the blue unit (near field) out to a barge to deploy the hydrophone 10 meters from the pile. Recording of driving began at 11:25. Data from the same pile was split into two separate instances to accurately sync collected near field and far field data. In reference to Figure 6, it should be noted that the active duration of the piston firing was approximately 1,711 seconds out of the mechanical rock excavation of 3,540 seconds.

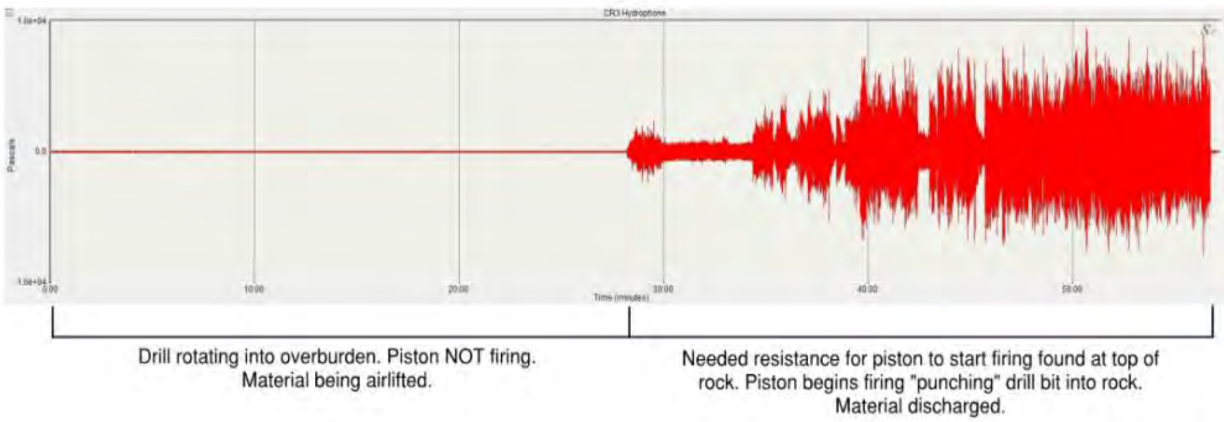


Figure 5. Time Series 10 meters away from Pile 2 on September 8, 2022

In reference to Figure 6, it should be noted that when the piston was firing, the DTH mono-hammer was producing approximately 10 strikes per second.

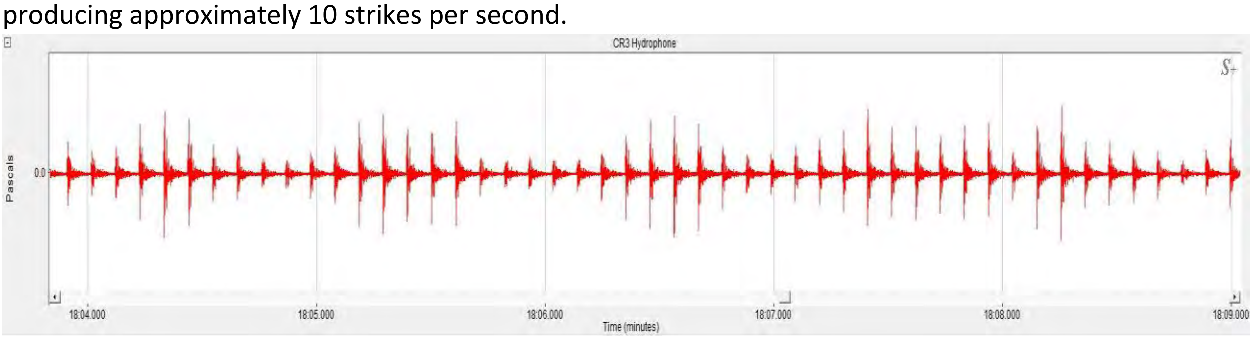


Figure 6. Snippet of Time Series 10 meters away from Pile 2 on September 8, 2022

Table 3. Data Reported for Pile 2 at 10 meters on September 8, 2022

Date	Start Time	Stop Time	Active Hammer Duration (seconds)	Hammer Strikes	Distance from Pile (meters)	Mean SELss unweighted (dB re 1uPa^2.s)	SELcum unweighted (dB re 1uPa^2.s)
9/8/2022	11:26	12:25	3,540	35,400	10	157.59	203.08

Table 4. Reanalysis of Pile 2 at 10 meters on September 8, 2022

Date	Start Time	Stop Time	Active Hammer Duration (seconds)	Hammer Strikes	Distance from Pile (meters)	Mean SELss unweighted (dB re 1uPa^2.s)	SELcum unweighted (dB re 1uPa^2.s)
9/8/2022	11:26	12:25	3,540	17,110	10	155.39	197.72

On September 9, 2022, two instances of the 42-inch diameter steel pile being utilized to support West Closure Wall – Mechanical Rock Excavation were captured. The data collected from both instances is the entire duration of the mechanical rock excavation. In reference to Figure 7, it should be noted that the active duration of the piston firing for Pile 1 was approximately 837 seconds out of the total mechanical rock excavation of 5,327 seconds.

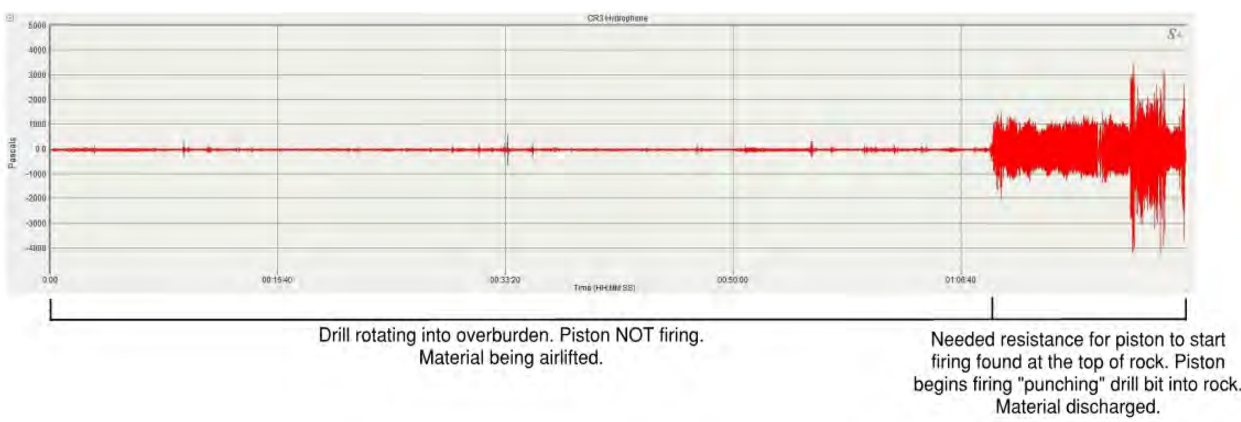


Figure 7. Time Series 10 meters away from Pile 1 on September 9, 2022

In reference to Figure 8, it should be noted that when the piston was firing, the DTH mono-hammer was producing approximately 9 strikes per second.

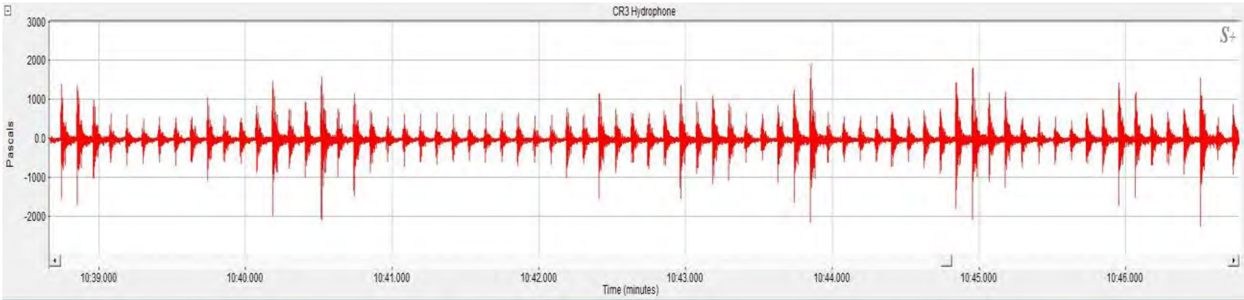


Figure 8. Snippet of Time Series 10 meters away from Pile 1 on September 9, 2022

Table 5. Data Reported for Pile 1 at 10 meters on September 9, 2022

Date	Start Time	Stop Time	Active Hammer Duration (seconds)	Hammer Strikes	Distance from Pile (meters)	Mean SELss unweighted (dB re 1uPa^2.s)	SELcum unweighted (dB re 1uPa^2.s)
9/9/2022	9:33	11:03	5,327	47,943	10	144.63	191.44

Table 6. Reanalysis of Pile 1 at 10 meters on September 9, 2022

Date	Start Time	Stop Time	Active Hammer Duration (seconds)	Hammer Strikes	Distance from Pile (meters)	Mean SELss unweighted (dB re 1uPa^2.s)	SELcum unweighted (dB re 1uPa^2.s)
9/9/2022	9:33	11:03	5,327	7,533	10	153.89	191.01

In reference to Figure 9, it should be noted that the active duration of the piston firing for Pile 2 was approximately 1,127 seconds out of the total mechanical rock excavation of 5,099 seconds.

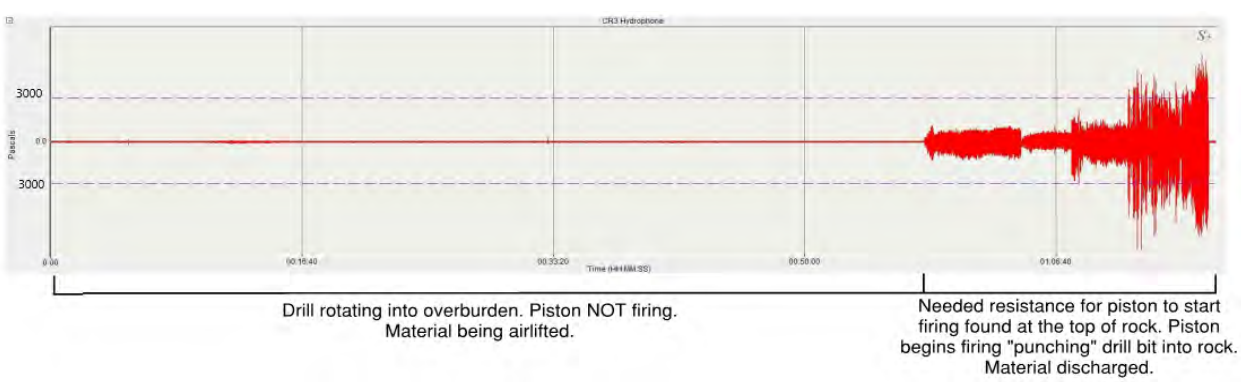


Figure 9. Time Series 10 meters away from Pile 2 on September 9, 2022

In reference to Figure 10, it should be noted that when the piston was firing, the DTH mono-hammer was producing approximately 10 strikes per second.

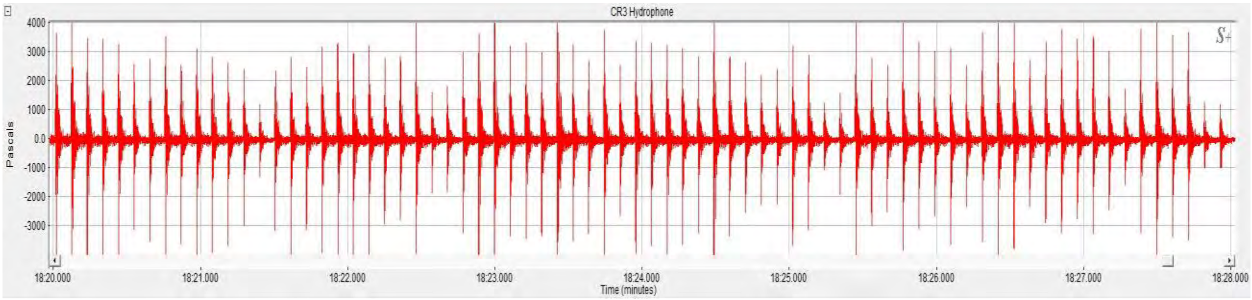


Figure 10. Snippet of Time Series 10 meters away from Pile 2 on September 9, 2022

Table 7. Data Reported for Pile 2 at 10 meters on September 9, 2022

Date	Start Time	Stop Time	Active Hammer Duration (seconds)	Hammer Strikes	Distance from Pile (meters)	Mean SELss unweighted (dB re 1uPa^2.s)	SELcum unweighted (dB re 1uPa^2.s)
9/9/2022	11:23	12:48	5,099	50,990	10	149.32	196.39

Table 8. Reanalysis of Pile 2 at 10 meters on September 9, 2022

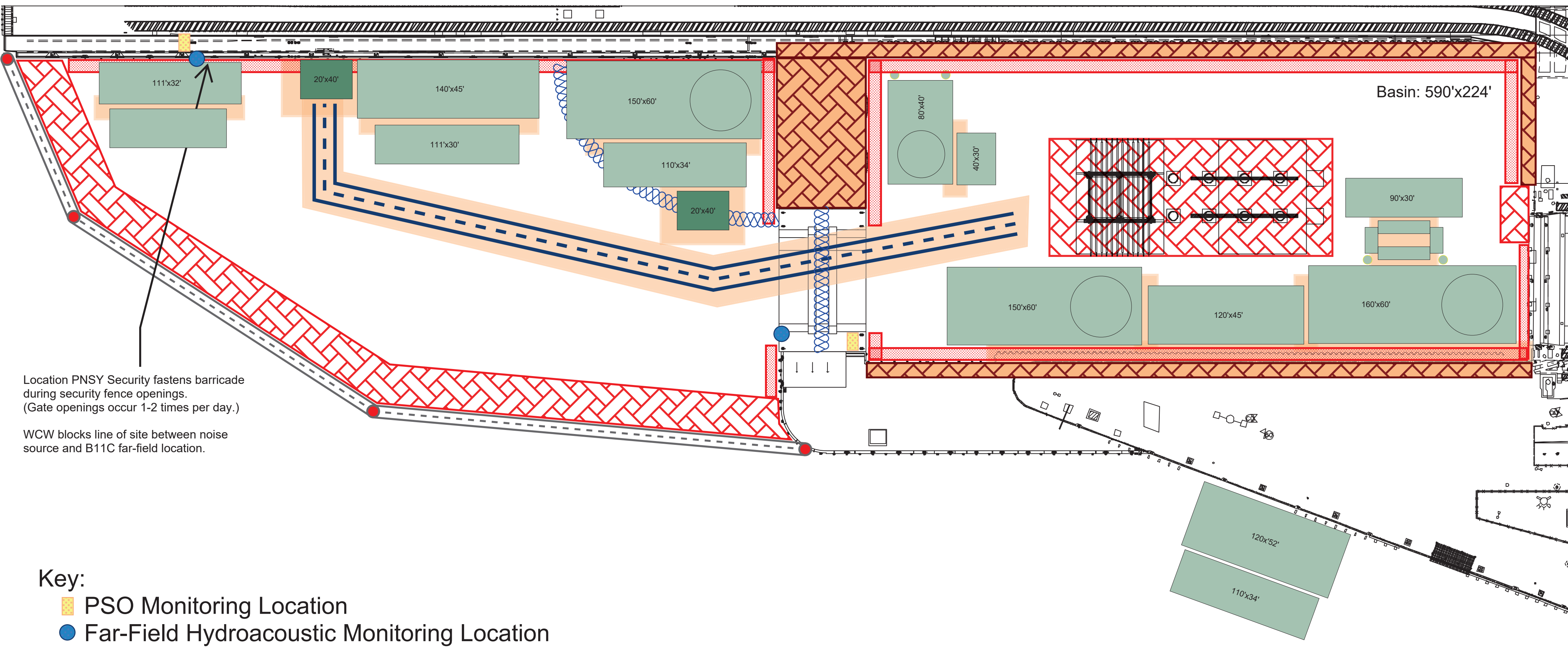
Date	Start Time	Stop Time	Active Hammer Duration (seconds)	Hammer Strikes	Distance from Pile (meters)	Mean SELss unweighted (dB re 1uPa^2.s)	SELcum unweighted (dB re 1uPa^2.s)
9/9/2022	11:23	12:48	5,099	11,270	10	153.89	194.41

EVALUATING RESULTS

381 Constructors have been analyzing measured sound levels associated with the use of 42-inch diameter steel pipe piles utilizing a Mincon MP340 DTH mono-hammer as impulsive. After the complete review of the data captured for this activity type, we recommend the 42-inch DTH mono-hammer data for the mechanical rock excavation activity be reprocessed, and future data be reviewed, processed and presented as separate continuous and impulsive results if applicable. We propose the captured hammer data over the duration while the drill is rotating and the piston is not firing be analyzed as continuous, and captured hammer data over the duration while the drill head is rotating and the piston is firing be analyzed separately as impulsive.

Appendix E
Barge Congestion Figure

Hydroacoustic Safety Buffers



Key:
- PSO Monitoring Location
- Far-Field Hydroacoustic Monitoring Location
- Bubble Curtain (No monitoring can occur over the bubble curtain)
- In Water Security Fence (Fence opens daily to allow boat traffic in and out of the basin)
- Hydrophone Restricted Areas
- Sources of Interference
- Barge Access Route (High Boat Traffic)
- Access Demolished
- Area of High Sound Reflection
- Shugart Barge (Pinned Floats - Cause Interference)
- Other Barge

Scale 50'-0" 100'-0"

Appendix F
NOAA Fisheries Comment Matrix and Project Responses

Report PDF Page #	NMFS Comment (02/16/2023 Email Correspondence)	381C/Stantec Response
11	Can you identify which measurements are within versus outside the bubble curtain in tables 12, 13, and 14. It is not very clear in those tables.	Yes. See response to Comment on Line 7 below. A column indicating whether a measurement was inside or outside the bubble curtain was added to ease explanation (see supplemental data sheet).
11	Is this equivalent to a transmission loss coefficient?	Correct. Sound levels diminish over distance (in water) as a result of many factors such as salinity, temperature, pressure, and pH. It is generally assumed that the sound (in water) will diminish at a rate of -4.5 dB per doubling of distance (following the inverse-square law). This is a conservative approach unless there is site-specific features that would indicate a different attenuation rate is appropriate (e.g. bubble curtain). F = 15 Eq. 1 15*log(0.5) = -4.5 dB per doubling of distance F = 20 Eq. 2 20*log(0.5) = -6 dB per doubling of distance
11	Does this mean in other words, for all measurements inside the bubble curtain?	Correct. If the noise would have traveled through the bubble curtain to the location that was extrapolated, an F value of 20 was selected as the bubble curtain would have added additional attenuation. If the noise would not have traveled through the bubble curtain to the location that was extrapolated, an F value of 15 was selected as the bubble curtain would not have affected the noise.
11	why was 20 selected for these distances instead of 15? Can you please explain further why two different F values were used?	If the noise would have traveled through the bubble curtain to the location that was extrapolated, an F value of 20 was selected as the bubble curtain would have added additional attenuation. If the noise would not have traveled through the bubble curtain to the location that was extrapolated, an F value of 15 was selected as the bubble curtain would not have affected the noise.
12	I am not sure we have this data. The only excel sheet I see is: "2022_drydock1_iha_report_dataset.xls"	It is located on the second tab of the Excel data spreadsheet provided with the monitoring report
24	Where was the bubble curtain in relation to the measurements? Were some of these measurements possibly reduced by the curtain? If so, which ones? Could you add a column that indicates whether a measurement was inside or outside the bubble curtain to ease review of these data?	The maps included in the daily reports found in Appendix D of the yearly report are the best way to understand distance from bubble curtain to each respective activity. An additional column will be added in the future reporting "Distance to Bubble Curtain". DTH Mono-Hammer activities captured were for two separate activities. June 10, 2022 consisted of installing temporary launching piles (support pile) for the Center Wall Platform while the September 7, 8, and 9 consisted of utilizing a 42" pipe pile as a guide for rock excavation near the West Closure Wall. The "guide" pile was not installed. Yes some measurements were reduced by the bubble curtain. A column was added by 381C that indicates which measurements to ease explanation (see supplemental excel sheet). Data from distances outside the bubble curtain still would be affected (extrapolated or not) by the bubble curtain had they been captured or reached levels high enough to be captured.
24	It would be appreciated if instead of including range, there were separate columns for the minimum and maximum values (for all levels). Alternatively, if you are willing to send us these data in spreadsheet form that would be ideal.	The smaller number in the "range" is the minimum and the larger number in the "range" is the maximum. Moving forward, 381C will not use one column titled "range" and instead will use two columns titled "minimum" and maximum" . Please see sheel titled Supplemental Bubble Curtain Data for NMFS for requested spreadsheet data. *Note: Supplemental Bubble Curtain Data not contained in this matrix but is provided in April 14, 2023 revision to the IHA report.*
24	Since there is no footnote for extrapolation here, does that mean that you had hydrophones both at 65 m and 84 m for this activity (i.e., 2 hydrophones)?	Correct
24	Confirming in this instance that you were able to put a hydrophone 10 m from the source (and did not have to extrapolate this value)? Then you had an additional hydrophone placed at 186 m?	Correct
24	How did you determine whether it was impulsive versus continuous? It makes sense why you might be seeing different characteristics with DTH in terms of whether the piston is firing (impulsive) or not (non-impulsive). However, can you predict ahead of time when the firing will occur or for what proportion of the time? Or is this all considered post-analysis. Is there a consistent depth that the piston was activated at, and can that be used to to predict the proportion of DTH with impulsive noise? Also, it would be helpful for us to get an average of the monitored piles for % continuous vs % impulsive. From our, standpoint, we believe we still need to make the conservative assumption that the source is impulsive (in terms of Level A). If you disagree, can you explain why? Thanks	Determination was made during post processing. It was decided that while the piston was not firing, the activity was similar to drilling. DTH Mono-Hammer data was first processed and submitted entirely as impulsive. However, after a further review of the data (see report: Review of Down-the-Hole Drilling Acoustic Data Measured for P381 submitted to Navy on 10/11/22) it is strongly believed that during the duration of rock excavation in support of the West Closure Wall, the data should be separated as continuous and impulsive depending upon whether the piston was firing or not. Predictions could be made if definitive substrate information was known, i.e.: 1-the amount of soft substrate to be removed was known 2-the depth of hard, competent rock was known 3-the boring rate that the DTH Mono-Hammer was advancing through soft substrate was known. At that time you could make a fairly educated guess how long it might take for the DTH Mono-Hammer to advance through the soft substrate until it reaches hard, competent rock. Geotechnical analysis was completed during the planning phase but was not done for every location a bore hole was drilled. There was no consistent depth at which the piston was activated. The trench that was being excavated utilizing the DTH Mono-Hammer consisted of differing depths of soft substrate. The depth of soft substrate seemed to constantly change for a number of factors including in-water work in close proximity stirring up bottom material. While standing on the barge with the 10 meter unit, it was extremely obvious when the piston began firing as the noise level of the DTH Mono-Hammer (in air) increased substantially to the point double hearing protection was needed just to remain on the barge. In terms of protection of mammals and marine life, we agree that the conservative assumption that the source is impulsive should be taken in terms of Level A. In terms of processing the hydroacoustic data, I believe further research and careful review should be done by the hydroacoustic engineer to ensure data accuracy. I personally do not believe DTH Mono-Hammer data should be processed as impulsive if the piston is not firing.
25	No bubble curtain was used during rotary drilling correct? Can you confirm all measurements do not consider reduction from a bubble curtain?	Incorrect. A bubble curtain was used during rotary drilling activity captured in this report as other in-water work requiring its use was occurring intermittently. An updated spreadsheet containing both F values of 15 (to give an estimation for assisting future projects about transmission loss without a bubble curtain) and 20 (what the P381 project estimated with the use of a bubble curtain system) is provided in the adjacennt cell and as a separate excel file and should be considered in place of Table 13 in the Annual Report. Extrapolated measurements within the confines of the basin wouldn't have considered an additonal attenuation from the bubble curtain. Extrapolated measurements that would take "near-field" data (e.g. 10 meters) and extrapolate to a location such as Berth 11C would consider the bubble curtain as the noise would have to travel through the bubble curtain. *Note: Revised Table 13 not contained in this comment matrix but is provided in April 14, 2023 revision to the IHA report.*
26	Where was the bubble curtain in relation to the measurements? Were some of these measurements possibly reduced by the curtain? If so, which ones?	Maps included in the daily reports found in Appendix D of the annual report would be the best way to understand distance from bubble curtain to activity. It does not give an actual metered distance but does show where the activity happened in relation to the bubble curtain system (Entrance Structure). Similar to the response to comment on Line 7, some measurements were reduced by the bubble curtain. Additional data will be given with these responses to indicate which measurements were reduced by the bubble curtain (see supplemental excel sheet).

34	We don't understand Appendix E - is it supposed to show barge congestion and why the hydrophone locations varied? If so, we don't see that. Perhaps a scale bar or a safety buffer around each pictured barge would get the point across?	The hydrophone locations varied due to the fact that each respective activity happened in a variety of locations within the basin. In the Hydroacoustic Plan, 381C stated the far-field would remain at a static location on Berth 11C. This location was chosen as it was supposed to assist with multiple problems that had arose in the past such as avoiding vessel disturbance/interference, decrease the likelihood of electrical noise in close proximity, and eliminate potential for measured data being contaminated8 from noise originating from platforms/barges. However, it proved difficult with accurate data collection because the ability to obtain a direct line of site to construction activity being monitored in the basin was limited, as illustrated in the figure. Choosing one far-field location for multiple different sources (i.e. rotary drill, cluster drill, DTH Mono-Hammer) proved ineffective against being able to have a field response to the complex dynamics of each respective source. Attenuation rates were greater than originally anticipated in Year 1 due to an effective bubble curtain system (multiple hoses laid in the Entrance Structure caisson crevices) as well as the Entrance Structure (solid concrete) and West Closure Wall (cofferdams filled with gravel material) acting as barriers to further provide protection from noise propagating into the Piscataqua River. Due to source sound levels not reaching the hydrophone deployed on Berth 11C due to attenuation, all that could be captured at this location was ambient noise/barges hitting together from waves. Far-field data collection under the LOA will be a fluid location that will depend on the location of the respective in-water activity to ensure collection of accurate data+C20 *Note: Scale bar and safety buffers have been added to the figure* for April 14 ,2023 revision of IHA Report
APPENDIX D		
2	Does this report supersede the preliminary report NMFS received in October?	Yes, The data provided in the fall of 2022 is also presented in this final report.
144	We are unclear why some data are extrapolated using an F value of 15, while others are using an F value of 20. We are not sure we fully understand how the extrapolations are being done. Can you please explain further?	June 10th was the first day the bubble curtain was put to use. The bubble curtain consist of two hoses. The two hoses were laid in the caisson seat of the Entrance Structure. On June 10th, 381C deployed two hydrophones. One hydrophone was deployed from a davit arm (on the entrance structure), inside the basin, 65 meters from the activity (DTH Mono-Hammer). A second hydrophone was deployed from a different davit arm (also on the entrance structure) outside the basin, 84 meters from the activity. Both hydrophones were deployed from the entrance structure and from different davit arms. Data collected at 65 meters (inside the basin, no bubble curtain) was used to extrapolate what sound levels would have approximately been at 10 meters. Therefore, an F value of 15 was used. Data collected at 84 meters (outside the basin, bubble curtain) was used to extrapolate what sound levels would have approximately been at 258 meters. Because the data collected at 84 meters has already been influenced by the bubble curtain, to estimate the levels at 258 meters, an F value of 15 was used as to not account for the bubble curtain twice.
148	We are confused what "Reanalysis" means in this appendix (e.g., Tables 2, 4, 6, 8). Does it mean that the drilling only sounds were removed? Can you please provide further explanation?	Drilling only sounds were not removed as they still would affect marine mammals. It was orignally assumed that the DTH mono-hammer would be strictly impulsive and produce approximately 13 strikes per second. Table 1, 3, 5, and 7 "Hammer Strikes" and "Mean SELss" are showing that even after finding the strike rate during that particular event and multiplying it by the active hammer duration, it would lead to an incorrect strike rate and SELss that throws off the mean SELss. Both numbers directly correlate to the SELcum. Tables 2, 4, 6, and 8 are showing that if you break the event into continuous and impulsive based on when the piston is firing, it will give a more accurate depiction of the number of pulses, which provides a correct SELcum. The reanalysis means that post-processing was done again so that the processing program code will know what data to process with continuous metrics as well as what data to process with impulsive metrics.

Comment # from 03/27/2023 Email	NMFS Comment	381C/Stantec Response
1	In Table 12 (Hydroacoustic Monitoring Results for Mono-Hammer DTH Activities; also tab 2 in the supplementary bubble curtain data): what do the NA values represent? Were these instances where the data were clipped or masked?	SELss was not applicable to the DTH mono-hammer when the piston was not firing as there was no strikes evident. Peak data was also not reported (381C does have this data available as it was processed and documented) as it was assumed the SELcum would result in a larger isopleth compared to the peak threshold. *Note: Table 12 updated in April 14, 2023 revision of IHA Report to include footnote on N/A values and this revision also includes the revised Table 13 with supplementary bubble curtain data*
2	Does your team have any opinions on why the 10 m unweighted RMS values seem to bounce between ~160 dBs to ~130 dBs? It seems generally like the data that were collected at 10 m are in the 130 dBs (except for two instances), but the data that is extrapolated to 10 m is higher. Were there situational factors that may have contributed to this, or is it possibly more related to the extrapolation to 10m?	Viewing the data for the 42" pipe pile, pile #1-4 were from monitoring the temporary launching piles in support of the center wall platform. During this time, the 42" pipe piles were installed in the center of the basin (area that had been previously blasted on 310). These four piles were installed into rock and did not go through much (if any) soft substrate. Therefore, the piston was firing for the entire duration of the pile installation. The 10m unweighted RMS values seem to be ~167-169 dB when the piston is firing on June 10th, 2022. It should be noted that hydrophone placement of 65m and 84m was chosen as this was the first day utilizing the bubble curtain system. Priority was ensuring the system was functional and adequate to specs. Pile #5-10 were from monitoring the west closure wall trench excavation. During this time, a single 42" pipe pile was placed into a template that was installed along the west closure wall. Using Pile #6 as an example, the DTH mono-hammer began advancing through soft substrate from 14:43 and reached hard, competent rock at 15:49. In the time between 14:43-15:49 (while the piston was not firing), the median 10m unweighted RMS values was ~138 dB. Once the DTH mono-hammer reached the rock at 15:49, it continued advancing until 15:57. In the time between 15:49-15:57 (while the piston was firing), the median 10m unweighted RMS values was ~167 dB. Once the adequate depth was reached, the 42" pipe was removed from it's respective template position and into another one. The median 10m unweighted RMS values from 6/10, 9/7, 9/8, 9/9 (while the piston is firing) are in the range of ~158 dB-169dB. The difference in range could possibly be from differing rock material as well as differing pressure the drill rig is applying to the bit while advancing (harder rock would possibly need additional pressure/time to advance). The applicable 10m unweighted RMS values (while the piston is not firing) are in the range of ~134 dB-138 dB (with the extrapolated pile #7 being an outlier of 146 dB). The opinion of 381C regarding the bounce between 160dB and 130dB would be dependent on if the piston was firing or not.
3	Further, one of our analysts was unable to review the initial report, but looked at the final, and wanted to share a comment regarding the choice to use 15Logr for extrapolating from outside the curtain and 20logr for extrapolating from inside the curtain. While this does capture to some extent the fact that the bubble curtain is attenuating, they believe that it would make more sense to use one F value and then add/subtract a fixed attenuation level when crossing the bubble curtain (5-10 dB?). For example: 15logr to the bubble curtain, then subtract 5 dB or so, and then 15logr to the final point.	Agree that it would make more sense to use one F value and then add/subtract a fixed attenuation level when crossing the bubble curtain. Absolutely correct the bubble curtain does not increase propagation loss as a function of range. If data is extrapolated in the future, this method will be used.