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Protected Species Mitigation and Monitoring Plan (PSMMP): Sea Turtles and ESA-Listed Fish Species

Revolution Wind, LLC

Revolution Wind | Powered by Ørsted & Eversource

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µPa	microPascal(s)
re 1 µPa	referenced to a pressure of 1 microPascal
BBC	big bubble curtain
BOEM	Bureau of Ocean Energy Management
CFR	Code of Federal Regulations
COP	Construction and Operations Plan
dB	decibel(s)
dBBC	double big bubble curtain
DPS	Distinct Population Segment
ECR	Export Cable Route(s)
ESA	Endangered Species Act
FR	*Federal Register*
ft	foot/feet
g	gram(s)
HRG	high-resolution geophysical
IAC	Inter-Array Cable
IR	infrared
ISO	International Organization for Standardization
ITR	Incidental Take Regulations
JASMINE	JASCO Animal Simulation Model Including Noise Exposure
km	kilometer(s)
Lease Area	BOEM-designated Renewable Energy Lease Area OCS-A 0486
$L_{E,24h}$	sound exposure level, cumulative 24 hours
L_p	root mean square sound pressure
L_{pk}	peak sound pressure level
m	meter(s)
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NMS	Noise Mitigation System
NVD	night-vision device
O&M	operations and maintenance
OCS	Outer Continental Shelf
Orsted	Orsted Wind Power North America LLC
OSS	offshore substation
PAM	passive acoustic monitoring
PK	peak sound pressure level
Project	Revolution Wind Farm Project
PSMMP, or Plan	Protected Species Mitigation and Monitoring Plan
PSO	Protected Species Observer(s)
PTS	permanent threshold shift
SEL	sound exposure level
SPL	sound pressure level
SZ	shutdown zone
TTS	temporary threshold shift
U.S.	United States
UXO	Unexploded Ordinance
WEA	Wind Energy Area
WTG	wind turbine generator

Glossary

Acoustic range	Range to acoustic thresholds calculated using acoustic modeling which assumes a stationary receiver and only considers sound propagation.
Clearance Zone or Visual Clearance Zone	The area that must be observable by PSOs, including with the use of monitoring technologies such as infrared or night vision systems, and clear of protected species prior to starting an activity. that must be visually clear of protected species prior to starting an activity that produces sound at frequencies and amplitudes that could result in Level A or Level B exposures (e.g., HRG sources with operating frequencies <200 kHz; impact and vibratory pile driving).
Construction and Operations Plan (COP)	Plan submitted to BOEM by developers as required by 30 CFR part 585 to describe all planned facilities proposed for construction and use for the Project, along with all proposed activities including the proposed construction activities, commercial operations, and conceptual decommissioning plans for all planned facilities, including onshore and support facilities.
Exposure range	Ranges to acoustic thresholds calculated using acoustic and animal movement and behavior modelling.
Incidental Take Authorization (ITA)	Authorization from NMFS per the MMPA for the "taking" of small numbers of marine mammals resulting from specified activities in a specified geographic region.
Level A Harassment Zone	The distances within which Level A harassment, defined as the potential to injure a marine mammal, may occur. This includes, but is not limited to, the area ensonified by a sound source to an acoustic isopleth defined as a threshold at which onset of a permanent threshold shift (PTS) in hearing, and/or non-auditory injury (e.g., lung, GI track), can occur.
Level B Harassment Zone	The distances within which Level B harassment, defined as the potential to disturb (but not injure) a marine mammal. This includes the area ensonified by a sound source to an acoustic isopleth defined as a threshold at which onset of a behavioural disturbance and/or TTS can occur.
Mitigation	The set of personnel, equipment and protocols that are in place to minimize the impacts of the specified activities on protected species.
Mitigation Monitoring	Monitoring conducted during Project activities with the goal of implementing mitigation measures that reduce impacts to protected species.
Monitoring Zone	The body of water around an activity that is visually and/or acoustically monitored for the presence of marine protected species.
Noise Attenuation System	Any device or suite of devices that reduces sound levels that are transmitted through the water. Primary systems reduce the sound levels being produced by the pile and secondary system reduce sound levels as they propagate away from the source.
Offshore Substation (OSS)	Station that collects the electricity generated by the WTGs, converts it from AC to DC, and exports it to shore, to be installed on monopile foundation within the Revolution Wind Lease Area.
Passive acoustic monitoring (PAM)	Monitoring for the presence of marine mammal vocalizations, and other underwater sounds of interest, during and/in conjunction with Project activities, via the use of hydrophones.
PAM Monitoring Zone	The distance within which the PAM system will be capable of detecting marine mammal calls.
PAM Clearance Zone	The distance within which a located marine mammal call will result in a delay to the start of the planned activity.

PAM Operator	NMFS-approved acoustic technicians trained in detecting and identifying marine mammal vocalizations using hydrophones and acoustic processing software.
Project Area	Revolution Wind Lease Area (OCS-A 0486) and associated export cable routes and transit routes to/from designated ports.
Protected species observer (PSO)	NMFS-approved visual observers trained to monitor the area around a vessel or platform during Project activities for the presence of protected species and implement appropriate mitigation as necessary.
Shutdown Zone (SZ)	The area in which equipment shut down or power down must be applied once a source is active if a protected species is sighted inside the corresponding zone.
Sound Field Verification (SFV)	Acoustic measurements taken in the field of specific Project activities used to identify the sound fields produced by the activity, verify modeling results used in environmental reviews where appropriate and confirm the monitoring and mitigation methods implemented for the Project are appropriate.
Unexploded Ordinance (UXO)	Any sort of military ammunition or explosive ordnance which has failed to function as intended and may still pose a risk of detonation.
Wind Farm Area	Maximum work area, excluding cable routes to shore, surrounding the Lease Area (BOEM Lease OCS-A 0486).
Wind turbine generator (WTG)	A device that converts wind energy into electricity, to be installed on monopile foundations within the RWF Lease Area.

1 Introduction

This Protected Species Mitigation and Monitoring Plan (PSMMP, or Plan) for sea turtles and ESA-listed fish species is in place for high-resolution geophysical (HRG) survey, construction, and operations and maintenance (O&M) activities planned for the Revolution Wind, LLC (Revolution Wind) (formerly DWW Rev I, LLC), a 50/50 joint venture between Orsted North America Inc. and Eversource Investment, LLC, Revolution Wind Farm Project (Project) located in the Bureau of Ocean Energy Management (BOEM) Renewable Energy Lease Area OCS-A 0486 (Lease Area) and associated Export Cable Routes (ECRs), referred to in this PSMMP as the Project Area.

The purpose of this PSMMP is to describe the mitigation and monitoring that will be carried out to reduce the potential impacts on federally protected species including sea turtles and Atlantic sturgeon [*Acipenser oxyrinchus oxyrinchus*].

1.1 PSMMP Format

Protected species likely to occur in the Project Area, and Project-specific activities, are presented in Section 2 and Section 3 of this Plan. General Project standard conditions will follow those described in BOEM's Lease for the Project. Note, on February 23, 2022, Revolution Wind submitted to the National Marine Fisheries Service (NMFS), and copied BOEM, the marine mammal PSMMP, which was appended to the Incidental Take Regulations (ITR) application and was deemed adequate and complete by NMFS on February 28, 2022. The Project-specific sections consider the range of activities and potential impacts and permit conditions under which the work is being performed.

The protocols described in this Plan are designed to minimize impacts on protected species resulting from Project activities and document the occurrence of protected species in proximity to the Project Area. The content of the Plan was developed from various resources including agreed-upon mitigation measures and monitoring protocols (Baker et al. 2013; Shell-Gulf-of-Mexico 2014) as well as previous survey plans, ongoing agency reviews and coordination, and regulatory standard requirements where applicable.

The monitoring and mitigation methods described in each section of the Plan focus on minimizing potential "take" of sea turtles and Atlantic sturgeon protected under the Endangered Species Act (ESA) from underwater sound and other potential Project-related disturbances. Subsequent sections of the Plan provide activity-specific details regarding the protocols that will be implemented during each activity.

Each activity section is designed to be used as a reference to the required measures that will be implemented during the corresponding activity including:

- designating mitigation and monitoring zones,
- defining measures related to sound impacts, and
- vessel strike avoidance measures as applicable for each activity.

Users should reference this Plan to confirm that all agreed upon and regulatory measures are being implemented using the accepted methods and practices.

In this Plan, the units of measure reported for construction activities are United States (U.S.) customary units, which are typically used in construction. Units of measure for scientific information, including acoustics, are metric. When appropriate, units are reported as both U.S. customary and metric.

1.2 Revolution Wind Project Area

1.2.1 Applicable Project Area

For the purposes of this Plan, the Project Area is defined as the Revolution Wind Farm (RWF) and the Revolution Wind Farm Export Cable (RWEC) (collectively, the Revolution Wind Farm Project or Project). The wind farm portion of the Project (referred to as the Revolution Wind Farm [RWF]) will be located in state and federal waters of the BOEM Lease Area (OCS-A-0486), which is a portion of Rhode Island/Massachusetts Wind Energy Area (RI-MA WEA), and along the Inshore and Offshore ECR corridors associated with the Project leading to Quonset Point (Figure 1). Project activities include HRG surveys, construction, and O&M.

The boundaries of the Project Area are depicted in Figure 1 and consist of the following:

- Revolution Wind Farm (RWF): area where the turbines (WTGs), inter-array cables (IACs), offshore substation(s) (OSS), OSS inter-array cables (IAC), and portions of the offshore export cables are located;
- Revolution Wind Export Cable (RWEC): area in which the offshore export cable systems will be installed and the cable landfall installation.

The key components of the Project for offshore infrastructure are as follows:

- Up to 100 WTGs connected by a network of IACs;
- Up to two OSSs connected by OSS-link cable;
- Up to two export cables.

The RWF is located within federal waters, in both the RI-MA WEA and the MA-WEA. The RWEC will traverse both federal and state territorial waters of Rhode Island, extending up to approximately 50 mi (80 km) from the RWF to the Landfall Work Area at Quonset Point in North Kingstown, Rhode Island.

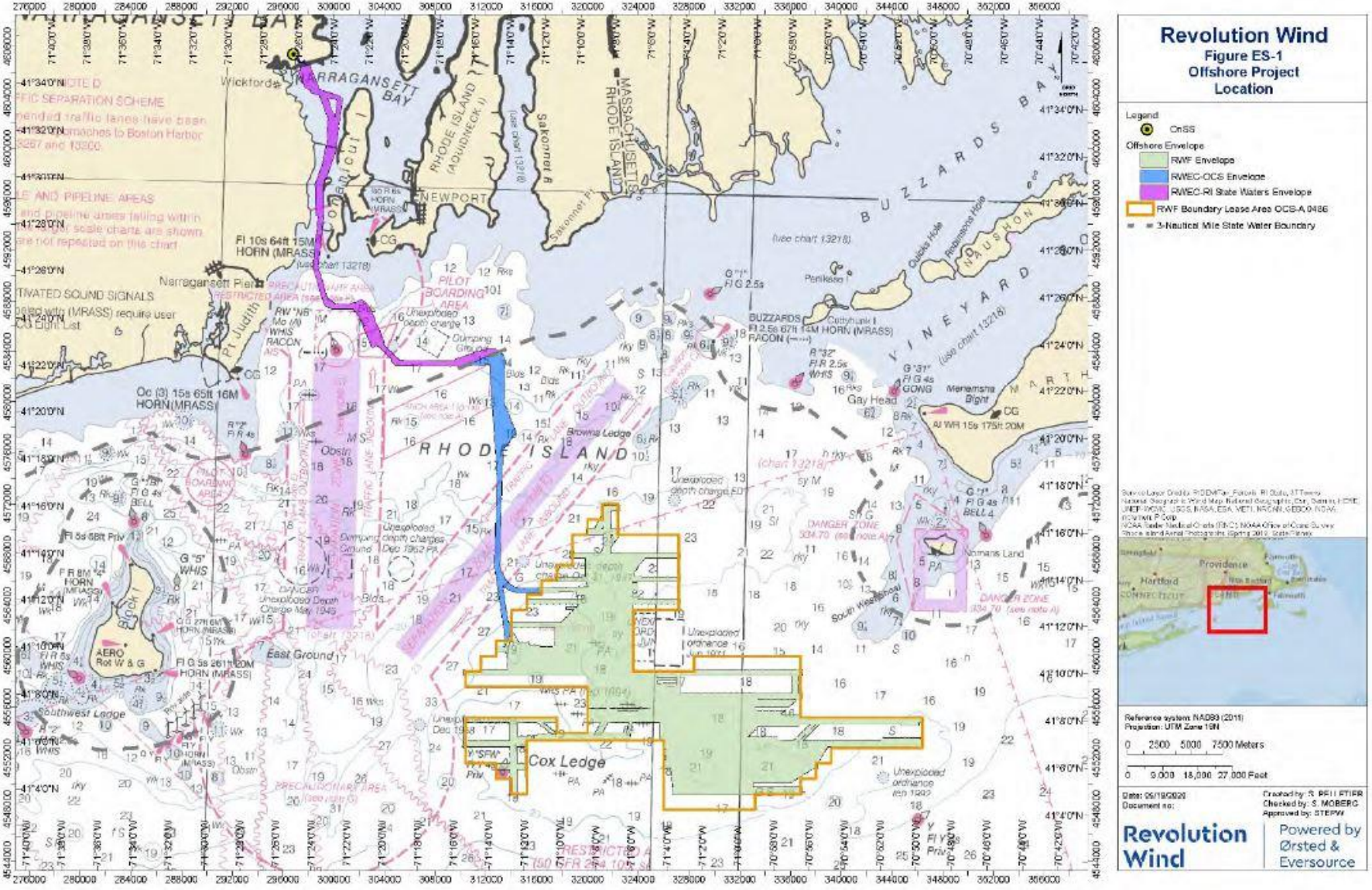


Figure 1: Location of the RWF within Lease Area OCS-A 0486 and the RWEC.

2 Sea Turtles

2.1 Species Likely to Occur in the Project Area

Four sea turtle species may occur or transit near the Project Area (Table 1). Two sea turtle species occurring in or near the Project Area are listed as endangered under the ESA and the other two are listed as threatened (NMFS 1970b, a, 2011, 2016) (Table 1).

Table 1: Sea Turtle species potentially occurring within the regional waters of the Western North Atlantic Outer Continental Shelf (OCS) and Project Area.

Species	Current Listing Status	Relative Occurrence in RWF	Relative Occurrence in the RWEC- OCS	Relative Occurrence in the RWEC-RI
Leatherback sea turtle (*Dermochelys coriacea*)	ESA Endangered; RI State Endangered	Common	Common	Common
Loggerhead sea turtle (*Caretta caretta*)	ESA Threatened; RI State Endangered	Common	Common	Common
Kemp's ridley sea turtle (*Lepidochelys kempii*)	ESA Endangered; RI State Endangered	Uncommon	Regular	Regular
Green sea turtle (*Chelonia mydas*)	ESA Threatened; RI State Endangered	Uncommon	Uncommon	Uncommon

ESA = Endangered Species Act; RWF = Revolution Wind Farm; RWEC-OCS = Revolution Wind Export Cable Corridor Outer Continental Shelf; RWEC-RI = Revolution Wind Export Cable Rhode Island State.

2.2 Acoustic Impact Thresholds

Thresholds for potential injury, impairment, and behavioral impacts from underwater sounds for sea turtles were developed for use by the U.S. Navy (U.S. Dept. of the Navy 2017) based on exposure studies (McCauley et al. 2000). Dual criteria (PK and SEL) have been suggested for permanent threshold shift (PTS) and temporary threshold shift (TTS), along with auditory weighting functions published by the U.S. Navy (2017). The behavioral threshold recommended in the NMFS Greater Atlantic Regional Fisheries Office (GARFO) acoustic tool (NMFS-GARFO 2020) is a root-mean-square (RMS) sound pressure level (SPL) of 175 dB re 1 µPa (McCauley et al. 2000; U.S. Dept. of the Navy 2017) (Table 2).

Table 2: Acoustic metrics and thresholds for sea turtles currently used by NMFS GARFO and BOEM for impact pile driving.

	Injury		Impairment		
	PTS		TTS		Behaviour
Faunal group	L_{pk}	$L_{E,\ 24hr}$	L_{pk}	$L_{E,\ 24hr}$	L_p
Sea turtles	232	204	226	189	175

L_{pk} – peak sound pressure (dB re 1 µPa), $L_{E,\ 24hr}$ – sound exposure level, cumulative 24h (dB re 1 µPa2·s), L_p – root mean square sound pressure (dB re 1 µPa).

PTS = permanent threshold shift; TTS = temporary threshold shift, which are recoverable hearing effects.

2.3 Standard Monitoring and Mitigation During all Project Phases

The monitoring and mitigation measures included in this section are applicable during all offshore activities conducted as part of the Project.

2.3.1 Vessel Strike Avoidance

Along with PSOs, all vessel operators and crew members will maintain a vigilant watch for sea turtles and slow down or stop their vessel to avoid striking an animal. All vessels will maintain a separation distance of 164 ft (50 m) or greater from any sighting of a sea turtle.

2.3.2 Reporting

Revolution Wind will adhere to all NMFS and BOEM reporting requirements in the event of a vessel strike or sighting of a dead or injured sea turtle. If the project nears a take number threshold of having 80% of the allowable ESA takes, Revolution Wind will alert the appropriate agencies. Revolution Wind will compile and submit monthly reports that include a summary of all Project activities carried out in the previous month, including vessel transits and piles installed, and all observations of sea turtles. Revolution Wind will also contribute all recorded sea turtle sightings, as reported, to an agency-approved centralized database in coordination with the monthly reports.

BOEM and NMFS will be notified within 24 hours if any evidence of a fish kill is observed related to Project activities.

2.4 Pile Driving

2.4.1 Pile Driving Monitoring and Mitigation Zones

Monitoring and mitigation zones for sea turtles during impact pile driving of WTG and OSS foundations as well as casing pipe installation are provided in Table 3 and Table 4 and displayed in Figure 2. The ranges used to define the zones were calculated using the JASCO Animal Simulation Model Including Noise Exposure (JASMINE) model which is based on the open-source marine mammal movement and behavior model (Houser 2006). The computer modelling predicts the exposure of animats (virtual sea turtles) to sound arising from sound sources in simulated environments (see COP Appendix P2). Animats are programmed to behave like the marine animals likely to be present in the Survey Area. The parameters used for forecasting realistic behaviors (e.g., diving, foraging, aversion, surface times) are

determined and interpreted from marine species studies (e.g., tagging studies) where available, or reasonably extrapolated from related species. An individual animat's modeled sound exposure levels are summed over the total simulation duration, such as 24 hours or the entire simulation, to determine its total received energy, and then compared to the threshold criteria to determine the ranges at which thresholds are exceeded (COP Appendix P2).

The ranges are calculated separately for two scenarios of monopile installations (see COP Appendix P2, Tables 20 and 21) and assume 10 dB broadband noise attenuation. Mitigation and monitoring zones established for sea turtles will be applied during all months of the year in which installations are performed. Mitigation and monitoring zones implemented during the Project may be modified, with NMFS approval, based on measurements of the received sound levels during piling operations. The sound field measurement plan is described in detail in Attachment 7 of the PSMMP for marine mammals (Appendix C of the Revolution Wind ITR application).

Noise modeling was conducted assuming one, two, or three WTG monopiles driven per day, and either one or two OSS monopiles driven per day (COP Appendix P2). Mitigation and monitoring zones shown in Table 3 and Figure 2 are based on the largest modeled zones for both of these scenarios to ensure conservatism and rounded up for PSO clarity.

Sea turtle exposure ranges were not modeled for vibratory piling or casing pipe pneumatic hammer pile driving at Revolution Wind's landfall location. To estimate distances to behavioral and injury thresholds, acoustic modelling was performed for the Sunrise Wind project at the project's anticipated HDD exit pit location approximately 0.5 mi (800 m) offshore of Long Island, New York near Smith Point. This location has similar substrate conditions as found at the landfall location in Narragansett Bay, so the modelling results are expected to be applicable to the Revolution Wind Project. Acoustic ranges for casing pipe impact pile driving were calculated by propagating the source spectra using average winter sound speed conditions. Casing pipe impact pile driving modelling assumed the use of a Grundoram Taurus pneumatic hammer using a hammer energy of 18 kJ. Mitigation and monitoring protocols for sea turtles during vibratory piling are described in Section 2.4.2.

Acoustic modelling at the Sunrise Wind HDD exit pit location was also performed to determine threshold distances for installation of sheet piles to create the casing pipe support "goal posts" and support the construction barge. Modeling was conducted by JASCO using their MONM. The modeling assumed the use of an APE model 300 vibratory hammer to drive the sheet piles.

Mitigation and monitoring zones shown in Table 3, Table 4, and Table 5 are based on the largest modeled zones in all four of these scenarios for conservatism and rounded up for PSO clarity.

Table 3: Sea Turtle threshold ranges and mitigation and monitoring zones (in meters) associated with WTG (7/12 m) (Scenario 1) and OSS (7/15 m) (Scenario 2) monopile impact pile driving, assuming 10 dB mitigation.

Pile Driving Scenario	Maximum Behavioral Threshold Distance (m)	Behavioural Monitoring Zone (m)	Maximum Injury Threshold Distance (m)	Pre-start Clearance Zone (m)	Shutdown Zone (m)	Vessel Separation Distance (m)
1	890	900	210	250	250	50
2	890	900	360	400	400	50

Table 4: Sea turtle threshold ranges and mitigation and monitoring zones (in meters) associated with casing pipe impact pile driving for average winter sound speed conditions.

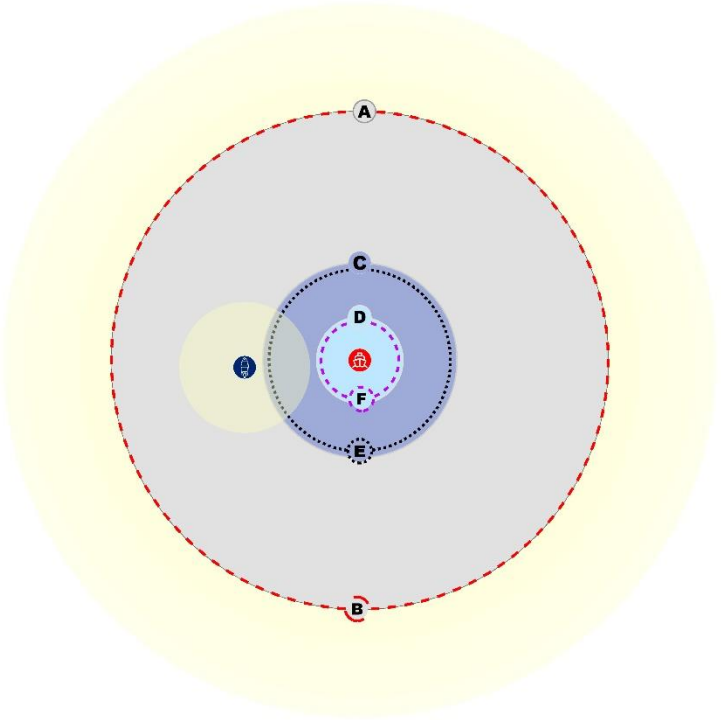
	Maximum Behavioral Threshold Distance (m)	Behavioural Monitoring Zone (m)	Maximum Injury Threshold Distance (m)	Pre-start Clearance Zone (m)	Shutdown Zone (m)	Vessel Separation Distance (m)
Impact Pile Driving	420	500	290	300	300	50

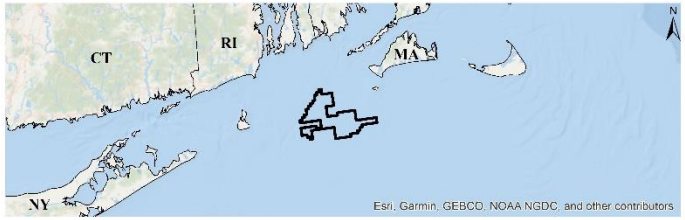
Table 5: Sea turtle threshold ranges and mitigation and monitoring zones (in meters) associated with vibratory pile driving for average winter sound speed conditions.

	Maximum Behavioral Threshold Distance (m)	Behavioural Monitoring Zone (m)	Maximum Injury Threshold Distance (m)	Pre-start Clearance Zone (m)	Shutdown Zone (m)	Vessel Separation Distance (m)
Vibratory Pile Driving	2,200	2,200	1,750	1,800	1,800	50

Revolution Wind Mitigation and Monitoring Zones

for WTG Impact Pile Driving 7/12 m Monopile and OSS Impact Pile Driving 7/15 m Monopile with 10 dB Attenuation in Summer





Monitoring Platforms

Pile/Construction Vessel	
Secondary Vessel	

Mitigation and Monitoring Zones

A	North Atlantic Right Whale Maximum Visibility Zones	2,300 m
B	Large Whale Shutdown Zone	2,300 m
C	Behavioural Monitoring Zone for Sea Turtles	900 m
D	Shutdown Zone for Sea Turtles	400 m

Monitoring Zones and Reporting

E	Maximum Behavioural Threshold Distance for Sea Turtles	890 m
F	Maximum Injury Threshold Distance for Sea Turtles	360 m

	DAYTIME MONITORING							NIGHTTIME MONITORING					
	PERSONNEL		EQUIPMENT					PERSONNEL	EQUIPMENT				
	PSOs on watch	PAM operators on duty	Reticle binoculars	Mounted "big-eye" binocular	Mounted thermal/IR camera system	Monitoring station for real time PAM system	Mysticetus data software	PSOs on handheld NVD/IR	PAM operators on duty	Handheld NVD/IR	Mounted thermal camera system	Monitoring station for real time PAM system	Mysticetus data software
# on Construction Vessel	2	1	2	1	1	1	1	2	1	2	1	1	1
# on Secondary Vessel	2	1	2	1	1	1	1	2	1	2	1	1	1

Figure 2: Sea Turtle mitigation and monitoring zones during impact pile driving. North Atlantic right whale zones are also shown for reference.

2.4.2 Pile Driving Monitoring and Mitigation Protocols

Protocols for sea turtle monitoring during impact and vibratory pile driving, including daytime and nighttime visual monitoring, will follow those outlined in the PSMMP for marine mammals **(**Appendix C of the Revolution Wind ITR application). Mitigation measures that will be implemented during a piling event include:

- Pre-start clearance;
- Ramp-up or soft-start of pile strikes;
- Shutdown;
- Pauses and silent periods.

For sea turtles, a pre-clearance and shutdown zone of 1,312 ft (400 m[1]) will be established and monitored during foundation impact pile driving, 300 m during casing pipe impact pile driving, and 1,800 m during vibratory pile driving (Table 3, Table 4, Table 5). If a sea turtle is detected within the respective zone, the PSO will call for a delay to the start of piling or a shutdown of pile-driving activities (as long as technically feasible and the cessation of equipment would not be a danger to human safety or a concern for structural failure) until the PSO verifies that the animal(s) has left the zone, or 30 minutes have elapsed without a resighting of the animal by the PSO. If the active pile-driving sound source is ceased for a period of greater than 20 minutes for any reason other than encroachment of a sea turtle into the shutdown zone, the zone will be cleared by the PSO team for at least 30 minutes before active pile-driving can resume with a ramp-up or soft-start.

During nighttime impact pile-driving operations, PSOs will be equipped with night-vision equipment to monitor for protected marine species (see Attachment 3 of the PSMMP for marine mammals (Appendix C of the Revolution Wind ITR application)). No pile driving at the landfall site will occur at night (vibratory pile driving or casing pipe impact pile driving). For sea turtles in particular, PSOs will utilize infrared (IR) and night-vision device (NVD) technology, as PAM is not suitable for monitoring of sea turtles, due to turtles being largely non-vocal. As described in the PSMMP for marine mammals (Appendix C of the Revolution Wind ITR application), IR imaging uses the radiance difference between an animal's cue at or above the water's surface and the ocean background. Although sea turtles are ectothermic, meaning that their body temperature is dependent on that of the surrounding environment, they do have some capacity to retain heat, and are able to maintain body temperatures that are slightly higher than the surrounding environment (Standora et al. 1982; Bostrom and Jones 2007; Sato 2014). Therefore, thermal imaging is in fact capable of detecting sea turtles (Snyder 2017). See Attachment 3 of the PSMMP for marine mammals (Appendix C of the Revolution Wind ITR application) for more details on nighttime monitoring devices.

NVDs work on a different principle than IR thermal cameras. They enhance available light to provide an image of the surrounding environment that resembles viewing during higher light conditions. NVDs are not dependent on temperature differentials necessary for the IR thermal camera systems but have narrow fields of view and short effective ranges. Although sea turtles are ectothermic, meaning that their body temperature is dependent on that of the surrounding environment, they do have some capacity to retain heat, and are able to maintain body temperatures that are slightly higher than the surrounding

[1] The 400-m monitoring zone will be reduced to 100-m during any required HRG surveys.

environment (Standora et al. 1982; Bostrom and Jones 2007; Sato 2014). Therefore, thermal imaging is in fact capable of detecting sea turtles (Snyder 2017). See Attachment 3 of the PSMMP for marine mammals (Appendix C of the Revolution Wind ITR application) for more details on nighttime monitoring devices.

2.4.2.1 Noise Attenuation

The Project will employ a Noise Attenuation System (NAS) during foundation installation impact pile driving events and is committed to achieving the modeled ranges associated with at least 10 dB of noise attenuation. NAS will not be utilized during casing pipe/sheet pile installation at the landfall location. NAS are employed during pile driving activities to reduce the SPLs that are transmitted through the water in an effort to reduce distances to acoustic thresholds and minimize the acoustic impacts of pile driving.

There are two categories of NAS, primary and secondary. A primary NAS is used to reduce the level of noise produced by the pile driving activities at the source, typically by adjusting parameters related to the pile driving methods or the impulse produced by a hammer strike. Primary NAS are still evolving and will be considered for mitigation when mature with demonstrated efficacy in commercial projects. However, primary NAS are not fully effective at eliminating all potentially harmful noise levels that can propagate from construction activities, so a secondary NAS is typically employed to further mitigate pile driving noise. A secondary NAS is a device or devices employed to reduce the noise as it is transmitted through the water from the pile. The noise is typically reduced by some sort of physical barrier that either reflects or absorbs sounds waves and therefore deceases the distance over which higher energy sound is propagated through the water column.

During impact pile driving, the Project will employ either a double big bubble curtain (dBBC) or a single big bubble curtain (BBC) in combination with a hydrodamper to achieve a minimum of 10 dB noise reduction. A bubble curtain consists of a hose with nozzles, which is laid on the seabed to fully encompass the monopile foundation. During impact pile driving, the hose is connected to air compressors, causing air bubbles to leave the hose nozzles and rise to the water surface, thus forming a bubble curtain (Water Proof Marine Consultancy & Services BV 2020). The demonstrated effectiveness of these systems is described in Lucke et al. (2011); Rustemeier et al. (2012); Bellman (2014, 2019; 2020).

The configuration of any secondary NAS will optimize its efficacy based on the location, operations, and environmental and oceanographic parameters of the Project. For the context of this report, the ***standard*** NAS configuration is defined as one that has been professionally deployed and further optimized after initial deployment based on local conditions and in situ measurement results. As stated above, the Project is committed to achieving a minimum of 10 dB of noise attenuation using a standard NAS, which is equivalent to a 90 percent reduction in sound energy level.

2.4.2.2 Sound Measurements

Received sound measurements will be collected during driving of the first three monopiles installed over the course of the project using an NAS. The measurement plan is provided in Attachment 7 of the PSMMP for marine mammals (Appendix C of the Revolution Wind ITR application). The goals of the of field verification measurements using an NAS are to verify modeled ranges and provide sound measurement data collected using International Organization for Standardization (ISO)-standard methodology to inform future impact assessments and comparison among projects. Based on the sound field measurement results, the Project may request a modification of the pre-start clearance and shutdown

zones (see Attachment 7 of the PSMMP for marine mammals (Appendix C of the Revolution Wind ITR application)).

2.5 Munitions, Explosives of Concern/ Unexploded Ordnance (MEC/UXO)

For MEC/UXOs that are positively identified in proximity to planned activities on the seabed, several alternative strategies will be considered prior to detonating the MEC/UXO in place. These may include relocating the activity away from the MEC/UXO (avoidance), moving the MEC/UXO away from the activity (lift and shift), cutting the MEC/UXO open to apportion large ammunition or deactivate fused munitions, using shaped charges to reduce the net explosive yield of a MEC/UXO (low-order detonation), or using shaped charges to ignite the explosive materials and allow them to burn at a slow rate rather than detonate instantaneously (deflagration). Only after these alternatives are considered would a decision to detonate the MEC/UXO in place be made. If deflagration is conducted, mitigation and monitoring measures would be implemented as if it was a high order detonation based on MEC/UXO size. Decision on removal method will be made in consultation with a MEC/UXO specialist and in coordination with the agencies with regulatory oversite of MEC/UXO. For detonations that cannot be avoided due to safety considerations, a number of mitigation measures will be employed by Revolution Wind. No more than a single MEC/UXO will be detonated in a 24-hour period.

2.5.1 MEC/UXO Monitoring and Mitigation Zones

Mitigation zones for MEC/UXO detonation presented here are based on the results of underwater sound propagation modeling specific to this noise source (Hannay and Zykov 2021). For sea turtles, mitigation and monitoring zones assume the use of a NAS resulting in a 10 dB reduction of noise levels and these are shown for the five different MEC/UXO charge weight bins in Table 6. In the unlikely event that a NAS cannot be appropriately or safely deployed around a MEC/UXO that must be detonated, modeling without the assumed 10 dB reduction was also completed and the resulting distances are shown in Table 7.

Table 6: Sea Turtle Mitigation and Monitoring Zones Associated with In-Situ MEC/UXO Detonation of Binned Charge Weights, with a 10 dB Noise Attenuation System.

MEC/UXO Charge Weight[1]	Pre-Start Clearance Zone[2] (m)	Behavioral Harassment Zone[3] (m)
E4 (2.3 kg)	<50	210
E6 (9.1 kg)	<50	450
E8 (45.5 kg)	160	870
E10 (227 kg)	350	1,800
E12 (454 kg)	480	2,300

kg = kilograms; m = meters

[1] MEC/UXO charge weights are groups of similar munitions defined by the U.S. Navy and binned into five categories (E4-E12) by explosive charge weight (equivalent weight in TNT).

[2] Pre-start clearance zones were determined by selecting the largest distance to a threshold value (the larger of either the PK or SEL noise metric). The chosen values were the largest distance for each weight bin across the four modeled sites.

[3] Behavioral harassment zones were calculated by selecting the largest TTS threshold (the larger of either the PK or SEL noise metric). The chosen values were the largest distance for each weight bin across the four modeled sites.

Table 7: Sea Turtle Mitigation and Monitoring Zones Associated with In-Situ MEC/UXO Detonation of Binned Charge Weights without the 10 dB reduction from use of a Noise Attenuation System.

MEC/UXO Charge Weight[1]	Pre-Start Clearance Zone[2] (m)	Behavioral Harassment Zone[3] (m)
E4 (2.3 kg)	110	710
E6 (9.1 kg)	250	1,400
E8 (45.5 kg)	550	2,600
E10 (227 kg)	1,100	4,400
E12 (454 kg)	1,400	5,300

* = denotes species listed under the Endangered Species Act; kg = kilograms; m = meters; PK = peak pressure level; SEL = sound exposure level.
[1] MEC/UXO charge weights are groups of similar munitions defined by the U.S. Navy and binned into five categories (E4-E12) by explosive charge weight (equivalent weight in TNT).
[2] Pre-start clearance zones were determined by selecting the largest distance to a threshold value (the larger of either the PK or SEL noise metric). The chosen values were the largest distance for each weight bin across the four modeled sites.
[3] Behavioral harassment zones were calculated by selecting the largest TTS threshold (the larger of either the PK or SEL noise metric). The chosen values were the largest distance for each weight bin across the four modeled sites.

2.5.2 UXO Monitoring and Mitigation Protocols

Protocols for sea turtle monitoring during MEC/UXO detonation will follow those outlined in the PSMMP for marine mammals (Appendix C of the Revolution Wind ITR application). Mitigation measures that will be implemented during MEC/UXO detonation are primarily related to pre-start clearance.

For sea turtles, a pre-start clearance zone based on the charge size being detonated will be monitored prior to each detonation (Table 6). If a sea turtle is observed entering or within the relevant pre-start clearance zone prior to the initiation of detonation, the detonation will be delayed. The detonation may proceed when the sea turtle has been visually confirmed to have voluntarily left the pre-start clearance zone or 30 minutes have elapsed without a resighting of the animal. In addition, monitoring will continue for at least 30 minutes after each detonation.

2.5.2.1 Noise Attenuation

Revolution Wind will use a NAS (see Section 2.4.2.1 above) for all detonation events as feasible and is committed to achieving the modeled ranges associated with 10 dB of noise attenuation. Zones without 10 dB attenuation would be implemented if use of a BBC was not feasible due to location, depth, or safety related constraints (unmitigated distances to thresholds are in Table 7 above). If a NAS system is not feasible, Revolution Wind will implement mitigation measures for the larger unmitigated zone sizes with deployment of vessels adequate to cover the entire pre-start clearance zones.

2.5.2.2 Sound Measurements

Received sound measurements will be collected during detonation of the first MEC/UXO within each weight bin. Measurements will be taken using the same general methods described in Attachment 7 of the PSMMP for marine mammals (Appendix C of the Revolution Wind ITR application). The goals of

the field verification measurements are to verify modeled ranges and provide sound measurement data collected using ISO-standard methodology to inform future impact assessments and comparison among projects. Based on the sound field measurement results, the Project may request a modification of the pre-start clearance zones (see Attachment 7 of the PSMMP for marine mammals (Appendix C of the Revolution Wind ITR application)).

2.5.2.3 Seasonal Restriction

To mitigate potential impacts to marine mammals, no in-situ MEC/UXO detonations are planned between December and April. As part of the federal consistency review for the Project and work in Rhode Island state waters, it is expected that in-situ MEC/UXO disposal will also be subject to state specific seasonal restrictions.

2.6 HRG Surveys

HRG Surveys will take place at various times throughout the construction and operations phases of the Project. Related surveys using the same or similar types of survey equipment have been ongoing in the Project Area during the pre-construction phase. Monitoring and mitigation measures included in the BOEM project design criteria (PDCs) and best management practices (BMPs) will be used for HRG surveys during the Construction and O&M phases of the Project.

2.6.1 HRG Survey Monitoring and Mitigation Zones

Monitoring and mitigation zones for sea turtles during HRG surveys will include a 500 m shutdown zone in all directions. This zone will be monitored around all vessels operating boomer, sparkers, or bubble gun equipment.

2.6.2 HRG Survey Monitoring and Mitigation Protocols

Prior to commencement of HRG survey activity, the 500 m shutdown zone will be monitored for 30 minutes of pre-start clearance observation. If any sea turtle is observed within the respective zone during the 30-minute pre-start clearance period, the 30-minute clock will be paused. If the PSO confirms the animal has exited the one and headed away from the survey vessel, the 30-minute clock that was paused will resume. The pre-start clearance period will be reset to 30 minutes if a sea turtle if visual observation is lost.

Ramp-up of the boomer, sparker, or bubble gun survey will occur at the start or re-start of any HRG survey activity when technically feasible. A ramp-up will begin with the power for the geophysical survey ramped up half power for 5 minutes, followed by full power.

If HRG survey equipment is shutdown for any reason, ramp-up of the equipment will begin immediately only if the shutdown was less than 30 minutes, visual monitoring of the shutdown zone(s) continued throughout the shutdown, the sea turtle causing the shutdown was visually followed and confirmed by PSOs to be outside of the designated shutdown zone and heading away from the vessel, and the shutdown zone remains clear of all sea turtles. If all these conditions are not met, the 500 m pre-start clearance zone will be monitored for 30 minutes prior to the commencement of any noise producing HRG survey equipment.

2.7 Operations

It is expected that during the O&M phase of the Project regular maintenance will require routine vessel movements within the Project Area. To reduce the likelihood of ship strikes the monitoring and mitigation measures described in Section 2.3.1 will be implemented. In the event that more significant maintenance must occur (e.g., blade replacement or nacelle work), appropriate monitoring and mitigation measures will be implemented as warranted during operations, particularly if any of the specific maintenance activities have a noise-producing component.

3 ESA- Listed Fish

3.1 Species Likely to Occur in the Project Area

Only one fish species that is listed under the ESA occurs routinely in or near the Project Area, the Atlantic sturgeon (NMFS 2012) (Table 8). Atlantic sturgeon distribution varies by season, but they are primarily found in shallow coastal waters (bottom depth less than 20 m) during the summer months (May to September) and move to deeper waters (20-50 m) in winter and early spring (December to March) Most Atlantic sturgeon captured in sampling are caught in depths less than 66 ft (20 m) (Dunton et al. 2010). Therefore, due to the Project schedule and time of year restrictions, it is unlikely that Atlantic sturgeon will be in the Project Area during the pile installation phase of this Project.

The other two species of fish either listed or considered a candidate for listing under the ESA that could occur in the Project Area (Shortnose Sturgeon *Acipenser brevirostrum* and Giant Manta Ray *Manta birostris*) are considered rare and are not expected to occur in the Project Area (Table 8) and are therefore not addressed further in this document.

Hearing data for Atlantic sturgeon, in terms of hearing sensitivity and auditory structure, are lacking, but it is known that these fish rely primarily on particle motion to detect sounds (Lovell et al. 2005). The best available information indicates that Atlantic sturgeon are not capable of hearing noise in frequencies above 1,000 Hz (1 kHz) (Popper 2005), and therefore are categorized as hearing "generalists" or "non-specialists" (Popper 2005). Atlantic sturgeon also do not have an interconnection between the swim bladder and inner ear, but instead have a physostomous swim bladder, which is a connection between the bladder and the alimentary canal, or gut (Halvorsen et al. 2012). This means that these fish are not only less sensitive to sound, but they are expected to be less susceptible to injury from impulsive sounds like those generated from impact pile driving activities due to the ability to expel air through the mouth when the bladder is under tension (Halvorsen et al. 2012).

Table 8: ESA-listed fish species likely or known to occur in the Project Area.

Species	Where Listed	Current Listing Status	Relative Occurrence in the RWF	Relative Occurrence in the RWEC-OCS	Relative Occurrence in the RWEC-RI
Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*)	New York Bight DPS	Federal—Endangered NYS—High Priority Species of Greatest Need[a] RI—State Historical	Common	Common	Common
Giant Manta Ray (*Manta birostris*)	Throughout its range	Federal-Threatened NYS- Not Listed RI- Not Listed	Rare	Rare	Rare
Shortnose Sturgeon (*Acipenser brevirostrum*)	Throughout its range	Federal- Endangered NYS- Endangered RI- State Historical	Rare	Rare	Rare

DPS = Distinct Population Segment; ESA = Endangered Species Act; RWF = Revolution Wind Farm; RWEC-OCS = Revolution Wind Export Cable Outer Continental Shelf; RWEC-RI = Revolution Wind Rhode Island State Waters.

3.2 Acoustic Impact Thresholds

The current U.S. regulatory acoustic criteria for fish include potential auditory injury thresholds (PK and SEL) recommended by Popper et al. (2014) for fish without swim bladders, fish with swim bladders not involved in hearing, and fish with swim bladders involved in hearing. The current behavioral thresholds for fish were developed by the NOAA Fisheries GARFO (Andersson et al. 2007; Wysocki et al. 2007; Mueller-Blenkle et al. 2010; Purser and Radford 2011).

3.3 Pile Driving

3.3.1 Pile Driving Acoustic Ranges

For the calculation of acoustic distances where sound levels could exceed established fish regulatory thresholds, fish were considered to be static receivers (although some fish may move during pile driving) and were not modeled using simulated fish movement and behavior (animats) (COP Appendix P2). Instead, distances to thresholds were determined using a maximum-over-depth approach to find the distance that encompasses at least 95 percent of the horizontal area expected to be ensonified at or above the specific levels (using thresholds from NMFS GARFO (2020) and Popper et al. (2014)) with 10 dB of broadband attenuation. Table 9 – Table 12 show distances in meters to the most conservative acoustic thresholds based on modeling of WTG and OSS monopile foundations using a 4000 kJ hammer during both summer and winter conditions. More details along with additional tables with various construction scenarios and different levels of attenuation can be found in COP Appendix P2, Section 4.5, Tables 22 - 25. As mentioned above, acoustic modelling was not completed for casing pipe and sheet pile installation at the Revolution Wind landfall location. Therefore, acoustic ranges were used from the Sunrise Wind acoustic modelling report. Table 13 shows distances in meters to the most conservative acoustic thresholds based on modeling of vibratory pile driving of goal-post sheet piles using an APE Model 300 during winter. And Table 14 shows distances in meters to the most conservative acoustic thresholds based on impact pile driving of casing pipe using a Grundoram Taurus hammer during winter. More details along with additional tables with various scenarios and different levels of attenuation can be

found in the Sunrise Wind COP Appendix I1, Section 4.3.1.1 and Appendix G5 of the acoustic modelling report.

Table 9: Distances in meters to the acoustic behavioral and injury thresholds for five fish faunal groups, with 10 dB Attenuation for WTG (7/12 m) monopile impact pile installation in Summer.

		Distance Threshold (meters)		
		Mitigated 10 dB		
Faunal Group	**Metric**	**Threshold**	**Behavioral (TTS[a])**	**Injury or Potential Mortality (PTS[b])**
Fish equal to or greater than 2 g	$L_{E,24hr}$	187	N/A	4,968
	L_{pk}	206	N/A	99
	L_p	150	5,805	N/A
Fish less than 2 g	$L_{E,24hr}$	183	N/A	6,351
	L_{pk}	206	N/A	99
	L_p	150	5,805	N/A
Fish without swim bladder	$L_{E,24hr}$	219	N/A	82
	L_{pk}	213	N/A	18
Fish: swim bladder not involved in hearing	$L_{E,24hr}$	210	N/A	354
	L_{pk}	207	N/A	91
Fish: swim bladder involved in hearing	$L_{E,24hr}$	207	N/A	580
	L_{pk}	207	N/A	91

L_{pk} = unweighted peak sound pressure (dB re 1 µPa); $L_{E,}$ = unweighted sound exposure level (dB re 1 µPa2·s); L_p = unweighted sound pressure (dB re 1 µPa); g = grams; N/A = not applicable.

a TTS = Temporary Threshold Shift

b PTS = Permanent Threshold Shift

Source: (Blackstock et al. 2018; NMFS 2020)

Table 10: Distances in meters to the acoustic behavioral and injury thresholds for five fish faunal groups, with 10 dB Attenuation for WTG (7/12 m) monopile impact pile installation in Winter.

		Distance Threshold (meters)		
		Mitigated 10 dB		
Faunal Group	**Metric**	**Threshold**	**Behavioral (TTS[a])**	**Injury or Potential Mortality (PTS[b])**
Fish equal to or greater than 2 g	$L_{E,24hr}$	187	N/A	7,997
	L_{pk}	206	N/A	105
	L_p	150	9,758	N/A
Fish less than 2 g	$L_{E,24hr}$	183	N/A	11,190
	L_{pk}	206	N/A	105
	L_p	150	9,758	N/A
Fish without swim bladder	$L_{E,24hr}$	219	N/A	108
	L_{pk}	213	N/A	18
Fish: swim bladder not involved in hearing	$L_{E,24hr}$	210	N/A	512
	L_{pk}	207	N/A	97
Fish: swim bladder involved in hearing	$L_{E,24hr}$	207	N/A	838
	L_{pk}	207	N/A	97

L_{pk} = unweighted peak sound pressure (dB re 1 µPa); $L_{E,}$ = unweighted sound exposure level (dB re 1 µPa2·s); L_p = unweighted sound pressure (dB re 1 µPa); g = grams; N/A = not applicable.

a TTS = Temporary Threshold Shift

b PTS = Permanent Threshold Shift

Source:(Blackstock et al. 2018; NMFS 2020).

Table 11: Distances in meters to the acoustic behavioral and injury thresholds for five fish faunal groups, with 10 dB Attenuation OSS (7/15 m) monopile impact pile installation in Summer.

		Distance Threshold (meters)		
		Mitigated 10 dB		
Faunal Group	**Metric**	**Threshold**	**Behavioral (TTS[a])**	**Injury or Potential Mortality (PTS[b])**
Fish equal to or greater than 2 g	$L_{E,24hr}$	187	N/A	6,895
	L_{pk}	206	N/A	93
	L_p	150	6,921	N/A
Fish less than 2 g	$L_{E,24hr}$	183	N/A	8,542
	L_{pk}	206	N/A	93
	L_p	150	6,921	N/A
Fish without swim bladder	$L_{E,24hr}$	219	N/A	189
	L_{pk}	213	N/A	19
Fish: swim bladder not involved in hearing	$L_{E,24hr}$	210	N/A	860
	L_{pk}	207	N/A	87
Fish: swim bladder involved in hearing	$L_{E,24hr}$	207	N/A	1,243
	L_{pk}	207	N/A	87

L_{pk} = unweighted peak sound pressure (dB re 1 µPa); $L_{E,}$ = unweighted sound exposure level (dB re 1 µPa2·s); L_p = unweighted sound pressure (dB re 1 µPa); g = grams; N/A = not applicable.

a TTS = Temporary Threshold Shift

b PTS = Permanent Threshold Shift

Source: (Blackstock et al. 2018; NMFS 2020).

Table 12: Distances in meters to the acoustic behavioral and injury thresholds for five fish faunal groups, with 10 dB Attenuation for OSS (7/15 m) monopile impact pile installation in Winter.

		Distance Threshold (meters)		
		Mitigated 10 dB		
Faunal Group	**Metric**	**Threshold**	**Behavioral (TTS[a])**	**Injury or Potential Mortality (PTS[b])**
Fish equal to or greater than 2 g	$L_{E,24hr}$	187	N/A	10,940
	L_{pk}	206	N/A	99
	L_p	150	10,888	N/A
Fish less than 2 g	$L_{E,24hr}$	183	N/A	14,609
	L_{pk}	206	N/A	99
	L_p	150	10,888	N/A
Fish without swim bladder	$L_{E,24hr}$	219	N/A	243
	L_{pk}	213	N/A	19
Fish: swim bladder not involved in hearing	$L_{E,24hr}$	210	N/A	1,054
	L_{pk}	207	N/A	91
Fish: swim bladder involved in hearing	$L_{E,24hr}$	207	N/A	1,583
	L_{pk}	207	N/A	91

L_{pk} = unweighted peak sound pressure (dB re 1 µPa); $L_{E,}$ = unweighted sound exposure level (dB re 1 µPa2·s); L_p = unweighted sound pressure (dB re 1 µPa); g = grams; N/A = not applicable.

a TTS = Temporary Threshold Shift

b PTS = Permanent Threshold Shift

Source: (Blackstock et al. 2018; NMFS 2020).

Table 13: Distances in meters to the acoustic behavioral and injury thresholds for two fish faunal groups, for goal post sheet pile (600 mm width) vibratory pile driving installation in Winter.

		Distance Threshold (meters)		
		Unmitigated		
Faunal Group	**Metric**	**Threshold**	**Behavioral (TTS[a])**	**Injury or Potential mortality (PTS)**
Fish: swim bladder involved in hearing	L_p [a]	170	N/A	-
	L_p [a]	158	20	N/A
Fish equal to or greater than 2 g	L_p [a]	150	10	N/A

Dashes indicate that the acoustic threshold was not reached.

Lp = unweighted sound pressure level (dB re 1 µPa).

[a] (Popper et al. 2014).

Table 14: Distances in meters to the acoustic behavioral and injury thresholds for five fish faunal groups, with 10 dB Attenuation for casing pipe (1.2 m diameter) impact pile installation in Winter.

		Distance Threshold (meters)		
		Mitigated 10 dB		
Faunal Group	Metric	Threshold	Behavioral (TTS)	Injury or Potential Mortality (PTS)
Fish equal to or greater than 2 g	$L_{E,}$ [a]	186	N/A	2,820
	L_{pk} [a]	206	-	-
	L_p [b]	150	2,510	N/A
Fish less than 2 g	$L_{E,}$ [a]	183	N/A	4,120
	L_{pk} [a]	206	-	-
	L_p [b]	150	2,510	N/A
Fish without swim bladder	$L_{E,}$ [c]	216	N/A	160
	L_{pk} [c]	213	-	-
Fish: swim bladder not involved in hearing	L_E [c]	203	N/A	620
	L_{pk} [c]	207	-	-
Fish: swim bladder involved in hearing	$L_{E,}$ [c]	203	N/A	620
	L_{pk} [c]	207	-	-

Dashes indicate that the acoustic threshold was not reached.
L_E = sound exposure level (dB re 1 µPa^2·s); L_p = sound pressure level (dB re 1 µPa); L_p = peak sound pressure level (dB re 1 µPa).
[b] (Andersson et al. 2007; Wysocki et al. 2007; Mueller-Blenkle et al. 2010; Purser and Radford 2011)
[c] (Popper et al. 2014)

3.3.2 Pile Driving Mitigation and Monitoring Protocols

Both NAS and soft-start techniques will be employed during foundation installation impact pile driving to mitigate impacts to fish. NAS will not be utilized during casing pipe/sheet pile installation at the landfall location. However, no fish-specific monitoring or shutdowns will be implemented since effective monitoring tools for fish are not currently available.

NAS are employed during pile driving activities to reduce the SPLs that are transmitted through the water in an effort to reduce distances to acoustic thresholds and minimize the acoustic impacts of pile driving (see Section 2.4.2.1 above). Soft start during impact piling is a mitigation technique that involves the gradual increase of hammer blow energy to allow marine life to leave the area. Soft starts will be employed on the Project such that, prior to the commencement of any impact pile driving (and any time following a cessation of 30-min or more), soft-start techniques will be implemented and will include at least 20 minutes of 4–6 strikes per minute at between 10–20 percent of the maximum hammer energy.

3.3.2.1 Seasonal Restrictions

Time-of-year-in-water restrictions will be employed to the extent feasible to avoid or minimize direct impacts to species of concern such as Atlantic sturgeon, during Landfall HDD and RWEC-RI construction. If work is anticipated to occur outside of these time-of-year restriction periods, Revolution Wind will work with state (Rhode Island State) and federal agencies to develop construction monitoring and impact minimization plans or mitigation plans as appropriate.

3.4 MEC/UXO

3.4.1 MEC/UXO Mitigation and Monitoring Protocols

As noted in Section **Error! Reference source not found.**, acoustic modeling for potential MEC/UXO detonations in the Project Area was conducted by JASCO (COP Appendix G) based on previous underwater acoustic assessments by the U.S. Navy for permitting by NMFS. This modeling provided estimated distances to impact thresholds for fish. Use of a NAS will help to reduce sound levels beyond the perimeter of the NAS and thereby mitigate some potential impacts. However, effective monitoring tools for fish are not available so no fish-specific monitoring or shutdowns are planned.

3.4.1.1 Seasonal Restrictions

No in-situ MEC/UXO detonations are planned between December and April. As part of the federal consistency review for the Project and work in Rhode Island state waters, it is expected that in-situ MEC/UXO disposal will also be subject to state specific seasonal restrictions.

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Attachment 1: Examples of Observation Zones and PSO/PAM Team Configurations

Table 15: Example PSO and PAM operator schedules for monitoring during foundation installation pile driving.

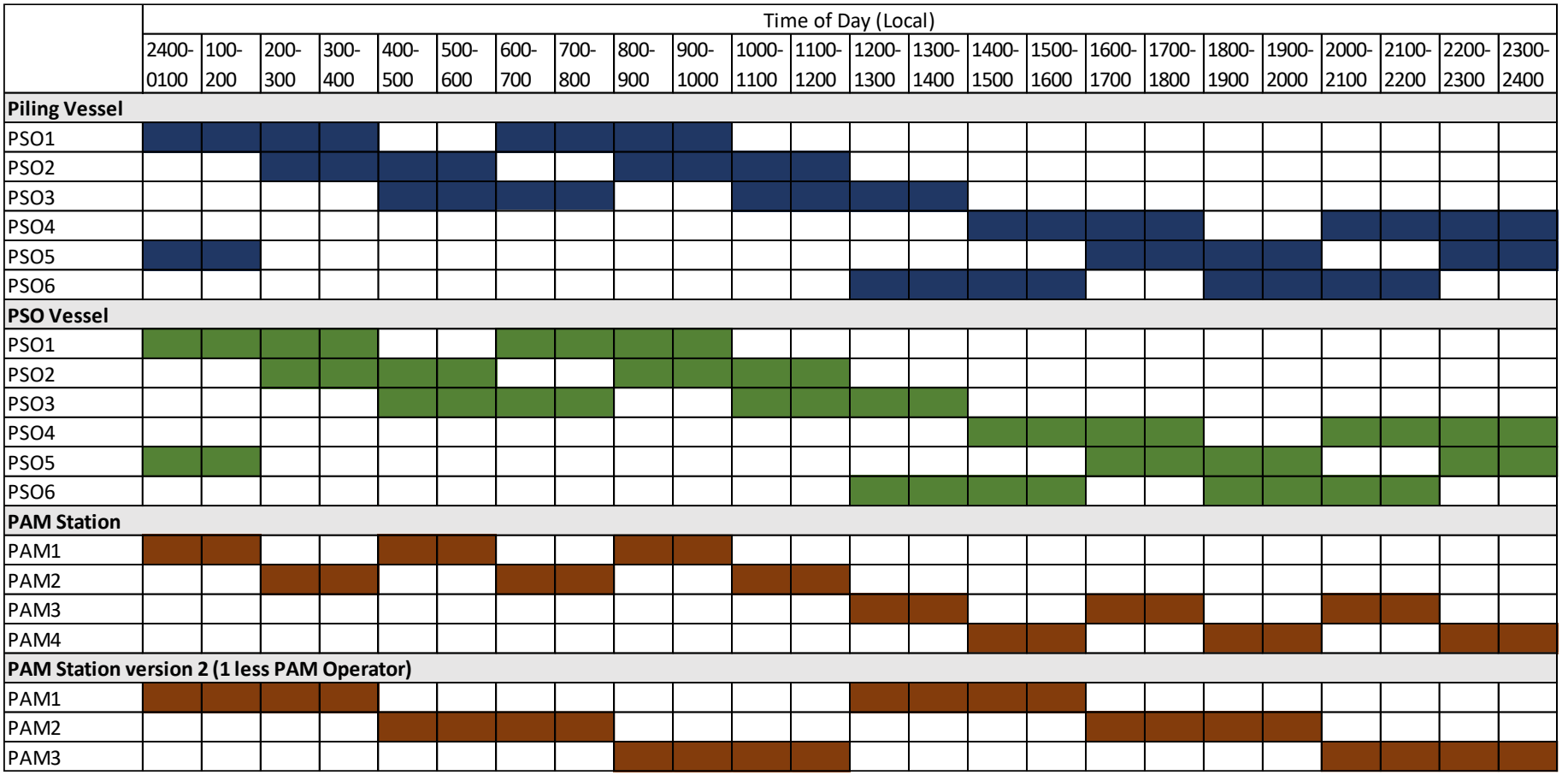

Table 16: Example PSO schedule for monitoring during HRG surveys.

	Time of Day (Local)																							
	2400-0100	100-200	200-300	300-400	400-500	500-600	600-700	700-800	800-900	900-1000	1000-1100	1100-1200	1200-1300	1300-1400	1400-1500	1500-1600	1600-1700	1700-1800	1800-1900	1900-2000	2000-2100	2100-2200	2200-2300	2300-2400
HRG Vessel																								
PSO1																								
PSO2																								
PSO3																								
PSO4																								
PSO5																								

Table 17: Example PSO schedule for monitoring during pile driving at the landfall construction site. PSO observations indicated by green cells would only be necessary if pile driving occurred on days with longer daylight periods.

	Time of Day (Local)																
	400-500	500-600	600-700	700-800	800-900	900-1000	1000-1100	1100-1200	1200-1300	1300-1400	1400-1500	1500-1600	1600-1700	1700-1800	1800-1900	1900-2000	2000-2100
Piling Vessel / PSO Vesel																	
PSO1																	
PSO2																	
PSO3																	
PSO4																	
PSO5																	

Attachment 2: Reporting Contact Information for the Project (Sea Turtles and Fish)

Introduction

The following tables provide a comprehensive schedule of reporting for various outputs of data collected for specified activities.

Table A2-1: Sea Turtle Reporting Plan

Report	Content	Frequency	Method	Applicable Activity
Immediate/Within 24–48 Hours				
Injured or Dead Sea Turtle (non-activity cause)	TBD	As soon as feasible; no longer than 24 hours	BOEM (renewable_reporting@boem.gov) BSEE (OSWSubmittals@bsee.gov) NMFS GARFO (nmfs.gar.incidentaltake@noaa.gov) NOAA stranding hotline (866-755-6622)	All
Injury/Death/Vessel Strike of Sea Turtles (caused by activity)	TBD	Immediate (and cease specified activity)	BOEM (renewable_reporting@boem.gov) BSEE (OSWSubmittals@bsee.gov) NMFS GARFO (nmfs.gar.incidentaltake@noaa.gov) NOAA stranding hotline (866-755-6622)	All
Weekly				
Weekly Marine Mammal and Sea Turtle Sighting Report	A summary of all detections of sea turtles, any mitigation actions (or if mitigation actions could not be taken, provide reasons why), and details on the noise attenuation system(s) used and its performance; vessel transits; and piles installed	Wednesday following a Sun-Sat week.	BOEM (renewable_reporting@boem.gov) BSEE (OSWSubmittals@bsee.gov) NMFS GARFO (nmfs.gar.incidentaltake@noaa.gov)	Construction Activity Only
Final /Annual Reports				
Annual: Annual (Draft) Marine Mammal and Sea Turtle Visual and Acoustic Monitoring Report	TBD; Summarized by activity type (e.g. piling, onshore installation works; Detonation and HRG)	April 1st of each year covering prior calendar year	BOEM (renewable_reporting@boem.gov) BSEE (OSWSubmittals@bsee.gov) NMFS GARFO (nmfs.gar.incidentaltake@noaa.gov)	All ITA Activity

Table A2-1: Administrative Reporting

Report	Frequency	Method	Applicable Activity
Required Training Documentation	Prior to initiation of project activities	TBD	All

Attachment 3: Reporting Contact Information for the Project (Sea Turtles and Fish)

Table A3-1: National Marine Fisheries Service Reporting Contact Information.

NMFS Contact	**Phone Number and email for Sea Turtle Sightings, or for Entangled, Stranded, Injured or Dead Sea Turtles and/or Sturgeon**	
Office of Protected Resources (OPR)	TBD by agency	TBD by agency
Greater Atlantic Regional Fisheries Office (GARFO)	TBD by agency	TBD by agency
Marine Mammal Stranding Program/Regional Stranding Coordinator (New England/Mid-Atlantic)	TBD by agency	TBD by agency

Table A3-2: BOEM Reporting Contact Information.

BOEM Contact	**Phone Number and email for Sea Turtle Sightings, or for Entangled, Stranded, Injured or Dead Sea Turtles and/or Sturgeon**	
BOEM Offshore Wind Division	TBD by agency	TBD by agency

Attachment 4: Sea Turtle Vessel Strike Avoidance Plan

To mitigate potential impacts of vessel strikes to sea turtles, Revolution Wind will adhere to the following Base Conditions.

Base Conditions:

- **Training**: All personnel **working** offshore will receive training on sea turtle awareness and vessel strike avoidance measures. This will include training to recognize the areas where sea turtles may be present such as near visible jellyfish aggregations or floating vegetation (e.g., sargassum lines or mats). Reference materials must be available aboard all Project vessels for identification of sea turtles.
- **Monitoring/Mitigation**: Vessel operators and crew will maintain a vigilant watch for sea turtles and slow down or maneuver their vessels as appropriate to avoid a potential intersection with a sea turtle.
- **Situational Awareness/Common Operating Picture**: Revolution Wind will establish a situational awareness network for sea turtle detections through the integration of sighting communication tools such as Mysticetus and the sea turtle hotline (seaturtlesightings.org). Sighting information will be made available to all project vessels through the established network. Revolution Wind Marine Coordination Center will serve to coordinate and maintain a Common Operating Picture.
- **Approach Constraints**: Vessels will avoid sea turtles as described below:
  - For all sea turtle observations, all vessels underway must not divert or alter course in order to approach.
  - When a sea turtle is sighted while a vessel is underway, the vessel must take action as necessary to avoid violating the separation distances.
  - All vessels must, to the maximum extent practicable, attempt to maintain a minimum separation distance of 100 m from all sea turtles. If a sea turtle is sighted within 100 m in the forward path of an underway vessel, that vessel must slow to 4 knots.
  - The vessel operator must then proceed away from the turtle at a speed of 4 knots or less until there is a separation distance of at least 328 feet (100 meters), at which time the vessel may resume normal operations.
  - If a sea turtle is sighted within 164 feet (50 meters) of the forward path of the operating vessel, the vessel operator must shift to neutral when safe to do so and then proceed away from the individual at a speed of 4 knots or less until there is a separation distance of at least 328 feet (100 meters), at which time normal vessel operations may be resumed.

Exceptions:

- Limitations on approach do not apply where compliance would create an imminent and serious threat to a person, vessel, or aircraft
- Limitations on approach do not apply when approaching to investigate an entanglement or injury, or to assist in the disentanglement or rescue of a sea turtle, provided that permission is received from NMFS or a NMFS designee prior to the approach
- Limitations on approach do not apply to the extent that a vessel is restricted in it's ability to maneuver, and because of the restriction, cannot comply with the limitation on approach.