

Sunrise Wind Pile Driving Monitoring Plan (OCS-DC Jacket Foundation)

Submitted To:

National Marine Fisheries Service

Office of Protected Resources

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List of Abbreviations and Acronyms

μPa	microPascal(s)
re 1 μPa	referenced to a pressure of 1 microPascal
AMAR	autonomous multichannel acoustic recorder
APC	American Power Conversion
ASL	above sea level
BA	Biological Assessment
BBC	big bubble curtain
DBBC	Double big bubble curtain
BiOp	Biological Opinion
BOEM	Bureau of Ocean Energy Management
BSEE	Bureau of Safety and Environmental Enforcement
COP	Construction and Operations Plan
CPA	closest point of approach
dB	decibel(s)
DMON	Acoustic digital monitor
DOI	Department of the Interior
ESA	Endangered Species Act
EST	Eastern Standard Time
FAD	free air delivery
FEIS	Final Environmental Impact Assessment
FFT	fast Fourier transform
FLT	flange lifting tool
FOV	Field of view
FR	Federal Register
GARFO	Greater Atlantic Regional Fisheries Office
GPS	global positioning system
HARP	high-frequency acoustic recording package
HSD	Hydro-sound Damper
HSE	Health, Safety and Environment
HTI	Hydroacoustic Technology Inc.
Hz	Hertz
ITR	Incidental Take Regulation
ITS	Incidental Take Statement
ID	identification number
IR	infrared
kHz	kilohertz
kJ	kilojoule(s)
km	kilometer(s)
Lease Area	BOEM-designated Renewable Energy Lease Area OCS-A 0487
LOA	letter of authorization
m	meter(s)
MA-WEA	Massachusetts Wind Energy Area
MARU	marine acoustic recording unit
MCPGF	motion compensated pile gripper frame
MF	mid-frequency
mm	millimeter(s)
min	minute
MMPA	Marine Mammal Protection Act

M/V	motor vessel
MW	megawatt
MWS	Marine Warranty Surveyor
NARW	North Atlantic right whale
NAS	noise abatement systems or noise attenuation systems
NCEI	National Centers for Environmental Information
NMFS	National Marine Fisheries Service
NTL	Notice to Lessees
OCM	Offshore Construction Manager
OCS	Outer Continental Shelf
OCS-DC	offshore converter station
OPR	Office of Protected Resources
Orsted	Orsted Wind Power North America LLC
PAM	passive acoustic monitoring
PDC	project design criteria
PDMP	Pile Driving Monitoring Plan
POC	point of contact
Project	Sunrise Wind Offshore Wind Farm Project
PSO	Protected Species Observer(s)
PTS	permanent threshold shift
Q2	second quarter
Q3	third quarter
QA	quality assurance
QC	quality control
RI-MA-WEA	Rhode Island/Massachusetts Wind Energy Area
rms	root mean square
ROC	Rehearsal of Concept
ROD	Record of Decision
RSA-ORCA	Multi-channel subsea acoustic recorder
RWSAS	Right Whale Sighting Advisory System
SAS	Sightings Advisory System
SEL _{cum}	cumulative sound exposure level
SFV	sound field verification
SNR	Signal to Noise Ratio
SPL	sound pressure level
SPL _{pk}	peak sound pressure level
SPL _{rms}	root-mean-square sound pressure level
SRWF	Sunrise Wind Farm
SZ	Shutdown Zone
TTS	temporary threshold shift
US	United States
USACE	United States Army Core of Engineers
USFWS	United States Fish and Wildlife Service
UTC	Coordinated Universal Time
UXO	unexploded ordnance
VHF	very high frequency
WEA	Wind Energy Area
WTG	wind turbine generator

1 Introduction

Sunrise Wind, LLC (Sunrise Wind) plans to construct and operate the Sunrise Wind Farm Project (SRWF) Project (hereinafter referred to as the Project). Sunrise Wind has developed this Pile Driving Monitoring Plan (PDMP or Plan) for impact pile driving of the OCS-DC jacket foundation pin piles at the SRWF, for review and concurrence by the Department of the Interior (DOI) and the National Marine Fisheries Service (NMFS) prior to commencing installation activities. This Plan is submitted pursuant to Condition 5.5.8 of the Approval of the Construction and Operations Plan (COP) for the Project, the issued Sunrise Wind Letter of Authorization (89 FR 53589, June 27, 2024), which is consistent with the final rulemaking (89 FR 45292) that was promulgated by the NMFS Office of Protected Resources (OPR) on 22 May 2024 as well as the Endangered Species Act (ESA) Section 7 Consultation Biological Opinion (BiOp) issued by NMFS-Greater Atlantic Fisheries Office (NMFS-GARFO) on 28 September 2023. Additional details on these conditions are included in Table 1. This Plan provides protocols and guidelines for mitigation and monitoring activities to minimize potential impacts on marine mammals and sea turtles.

Table 1. Relevant Conditions from COP Approval, Final ITR, LOA, and BiOp

Condition	Detail
COP Condition 5.5.8:	The Lessee must submit a Marine Mammal and Sea Turtle Monitoring Plan for Pile Driving and UXO Detonation to BOEM, BSEE, and NMFS GARFO-PRD at least 180 days before any pile driving or UXO detonation is planned. This may be a single plan or two separate plans. BOEM, BSEE, and NMFS GARFO – PRD will review the plan and provide comments within 45 days of receipt of the plan. The plan may not be implemented, and thus pile driving may not begin, until concurrence is reached by BOEM and BSEE. BOEM and BSEE will inform the Lessee if the plan is inconsistent with those requirements. The Lessee must resubmit a modified plan that addresses the identified issues within 30 days of the receipt of the comments but at least 15 days before the start of the associated activity.
COP Condition 5.5.8.1:	The Lessee must submit the Reduced Visibility Monitoring/Nighttime Pile Driving Monitoring Plan (or plans if separate plans are submitted) to BOEM, BSEE, and NMFS GARFO – PRD at least 180 days before impact pile driving is planned to begin unless a longer time period is identified in the MMPA Letter of Authorization. BOEM, BSEE, and NMFS GARFO-PRD will review the Reduced Visibility Monitoring Plan/Nighttime Pile Driving Monitoring Plan and provide comments within 45 days of receipt of the plan. The plan may not be implemented, and thus pile driving may not begin, until concurrence is reached by BOEM and BSEE. BOEM and BSEE will inform the Lessee if the plan is inconsistent with those requirements. The Lessee must resubmit a modified plan that addresses the identified issues within 30 days of the receipt of the comments and at least 15 days before the start of the associated activity.
LOA Condition 3(c)(16):	Sunrise Wind must submit a Foundation Installation Pile Driving Marine Mammal Monitoring Plan to NMFS Office of Protected Resources for review and approval at least 180 days prior to planned start of foundation pile driving and abide by the Plan if approved. Sunrise Wind must obtain both NMFS Office of Protected Resources and NMFS Greater Atlantic Regional Fisheries Office Protected Resources Division's concurrence with this Plan prior to the start of any pile driving. The plan must detail all

	plans and procedures for noise attenuation, including procedures for adjusting the noise attenuation system(s) and available contingency noise attenuation measures/systems if distances to modeled isopleths of concern are exceeded during SFV. The plan must include a description of all monitoring equipment and PAM operator and PSO protocols (including number and location of PSOs and PAM operators) for all foundation pile driving and an informal guide to aid personnel in identifying species if they are observed in the vicinity of the project area.
Final ITR § 217.314 (c)(16):	Sunrise Wind must submit a Foundation Installation Pile Driving Marine Mammal Monitoring Plan to NMFS Office of Protected Resources for review and approval at least 180 days prior to planned start of foundation pile driving and abide by the Plan if approved. Sunrise Wind must obtain both NMFS Office of Protected Resources and NMFS Greater Atlantic Regional Fisheries Office Protected Resources Division's concurrence with this Plan prior to the start of any pile driving. The Plan must detail all plans and procedures for sound attenuation, including procedures for adjusting the noise attenuation system(s) and available contingency noise attenuation measures/systems if distances to modeled isopleths of concern are exceeded during SFV. The Plan must include a description of all monitoring equipment and PAM operator and PSO protocols (including number and location of PSOs and PAM operators) for all foundation pile driving and an informal guide to aid personnel in identifying species if they are observe in the vicinity of the project area.
BiOp Terms and Condition (T&C) 11(b):	Marine Mammal and Sea Turtle Monitoring Plan – Pile Driving and UXO Detonation. BOEM, BSEE, and/or Sunrise Wind must submit this Plan to NMFS GARFO at least 180 calendar days before any pile driving for foundation installation is planned. BOEM, BSEE, and/or Sunrise Wind must obtain NMFS GARFO's concurrence with this Plan(s) prior to the start of any pile driving for foundation installation.
BiOp T&C 11(c):	Reduced Visibility Monitoring Plan/Nighttime Pile Driving Monitoring Plan. BOEM, BSEE, and/or Sunrise Wind must submit this Plan or Plans (if separate Daytime Reduced Visibility and Nighttime Monitoring Plans are prepared) to NMFS GARFO at least 180 calendar days before impact pile driving is planned to begin. BOEM, BSEE, and Sunrise must obtain NMFS GARFO's concurrence with this Plan(s) prior to the start of pile driving.

¹ The UXO/MEC detonation monitoring plan will be submitted separately from the OCS-DC PDMP given the separate anticipated commencement dates of each individual activity.

1.1 Permits and Agreements

Permits and agreements pertaining to the Project will define the mitigation and monitoring requirements through the various stages of the construction process. The permits and agreements in place for the Project are provided in Table 2. The requirements laid out in the most updated versions of all documents are reflected in the Plan. Any questions arising in the field regarding mitigation and monitoring should directly reference the applicable permits and agreements.

Table 2. Permits and agreements associated with protected species monitoring and mitigation within the Project Area.

Document Title	Issuing Organization	Issue/Revision Date	Acronym Used	Link (if available)
Final Incidental Take Rule (89 FR 45292)	NMFS- OPR	May 22, 2024	ITR	https://www.govinfo.gov/content/pkg/FR-2024-05-22/pdf/2024-09902.pdf
Letter of Authorization (89 FR 53589)	NMFS – OPR	June 27, 2024	LOA	https://www.fisheries.noaa.gov/action/incidental-take-authorization-sunrise-wind-llc-construction-and-operation-sunrise-wind
United States Department of Interior Fish and Wildlife Service Biological Opinion	USFWS	June 29, 2023	BiOp	Not available at this time
Endangered Species Act Section 7 Consultation Biological Opinion	NMFS- GARFO	September 28, 2023	BiOp	https://repository.library.noaa.gov/view/noaa/55726
Sunrise Wind Farm and Sunrise Wind Export Cable Final Environmental Impact Statement	BOEM	December 2023	FEIS	https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/Sunrise%20Wind%20Final%20Environmental%20Impact%20Statement%20Volume%201.pdf
Sunrise Wind Construction and Operations Plan and Appendices	Sunrise Wind	December 20, 2023	COP	https://www.boem.gov/renewable-energy/state-activities/sunrise-wind-construction-and-operation-plan
Sunrise Wind Farm and Sunrise Wind Export Cable – Development and Operation Biological Assessment	BOEM for USFWS	December 15, 2022	BA – USFWS	https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/Sunrise%20Wind%20BA%20for%20USFWS.pdf
Sunrise Wind Farm and Sunrise Wind Export Cable – Development and Operation Biological Assessment	BOEM for NMFS-GARFO	December 15, 2022	BA – NMFS	https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/Sunrise%20Wind%20Biological%20Assessment%2005JAN2023_508.pdf
Record of Decision	BOEM	March 26, 2024	ROD	https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/05579_Record%20of%20Decision_Sunrise%20Wind_OCS-A%200487.pdf
Sunrise Wind Farm and Sunrise Wind Export Cable– COP Approval	BOEM	June 21, 2024	COP Approval	https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/5774_App%20A_Sunrise%20Wind_Conditions%20of%20COP%20Approval_OCS-A%200487_FINAL.pdf
Offshore Wind Site Assessment Programmatic ESA Consultation	NMFS	June 29, 2021	PDC	https://media.fisheries.noaa.gov/2021-12/OSW-surveys-NLAA-programmatic-rev-1-2021-09-30-508-.pdf

1.2 Zone Definitions

Throughout this Plan, zones are described that identify either an impact range or areas within which mitigation and/or monitoring occurs. The size of the zones and the mitigation measures (if necessary) taken within each zone will be activity- and species-specific. Here, protected species includes marine mammals, sea turtles, and fish. The zones applicable during this Project are defined below.

- Potential Injury Zone** – For marine mammals, the potential injury zone is defined as the distances within which Level A Harassment¹ may occur. The PTS thresholds for marine mammals ((frequency-weighted cumulative sound exposure level (SEL_{cum}) and unweighted peak sound pressure level (SPL_{pk}))) are defined by NMFS (2018). Potential injury thresholds for sea turtles were developed by the US Navy using dual criteria (SEL_{cum} and SPL_{pk}) along with auditory weighting functions in conjunction with SEL thresholds as defined by Finneran et al. (2017). This includes, but is not limited to, the area ensonified by a sound source to an acoustic isopleth defined by the threshold at which onset of PTS in hearing may occur in marine mammals and sea turtles. For fish without swim bladders, fish with swim bladders, fish with swim bladders not involved in hearing, and fish with swim bladders involved in hearing, the physical injury thresholds (SPL_{pk} and SEL_{cum}) are recommended by Popper et al. (2014). For fish equal to or greater than 2 grams and fish less than 2 grams, the physical thresholds (SPL_{pk} and SEL_{cum}) are recommended by NMFS GARFO (2020). Marine mammals and ESA-listed species observed within the applicable potential injury zone(s) during impact pile driving may constitute a take².
- Behavioral Harassment Zone** – The behavioral harassment zone for marine mammals is defined as the distance within which Level B³ harassment may occur. For non-explosive, intermittent sources like impact pile driving, the Level B harassment threshold is defined by NMFS as the unweighted root-mean-square (rms) sound pressure level (SPL_{rms}) of 160 decibels (dB) referenced to (re) 1 microPascal (μPa) (NMFS 2022). The behavioral harassment threshold for sea turtles is defined by NMFS GARFO as a SPL_{rms} of 175 dB re 1 μPa from all non-explosive sound sources (McCauley et al. 2000; Finneran et al. 2017). The behavioral disturbance threshold for ESA-listed fishes was developed by the NMFS GARFO (Andersson et al. 2007; Wysocki et al. 2007; Mueller-Blenkle et al. 2010; Purser and Radford 2011) and set at a SPL_{rms} of ≥ 150 dB re 1 μPa from non-explosive, intermittent sources (Andersson et al. 2007; Wysocki et al. 2007; Mueller-Blenkle et al. 2010; Purser and Radford 2011). Marine mammals within the Behavioral Harassment Zone, or Level B harassment zone, during impact pile driving would constitute a take².
- Minimum Visibility Zone** – The area within which PSOs must be able to visual detect a marine mammal (the area must be free of visual obstructions such as fog) for a pre-

¹ Level A refers to marine mammal harassment as defined in the Marine Mammal Protection Act (MMPA) that could potentially cause permanent threshold shift (PTS) or auditory injury (marine mammals and sea turtles)/physical injury (fish).

² Take as defined under the ESA means “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct”. Take under the MMPA means to “harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal.

³ Level B refers to marine mammal harassment as defined in the MMPA that could potentially cause behavioral disturbance.

determined length of time immediately prior to the start of pile driving. The minimum visibility zone for marine mammals is defined as the ER95% distance for NARWs modeled under the applicable construction scenario. Clearance of the minimum visibility zone is intended to ensure that visibility conditions are sufficient enough for PSOs to effectively monitor the clearance zone prior to and during pile driving activity.

- **Clearance Zone** – The area that must be visually and/or acoustically clear of protected species prior to starting pile driving. Protected Species Observers (PSOs) and monitoring technologies such as passive acoustic monitoring (PAM) or infrared systems will be used to visually clear the clearance zone of protected species. Clearance zones may also be implemented prior to restarting the source after a shutdown of sound-producing activities. The size of the clearance zone is dependent on the activity and permit conditions. The clearance zone will be specific to species and/or faunal groups.
- **Shutdown Zone (SZ)** – The area within which a protected species sighting/detection will trigger an equipment shutdown, power down, or other active mitigation measures defined in the permit conditions once a source is active. The size of the shutdown zone is dependent on the activity and permit conditions. Shutdown zones will be specific to species and/or faunal groups.

2 OCS-DC Jacket Foundation Description and Pile-Driving Summary

2.1 OCS-DC Jacket Foundation Description

Sunrise Wind has proposed to construct and operate a 924 megawatts (MW) wind energy facility located on the Outer Continental Shelf (OCS) in the designated Bureau of Ocean Energy Management (BOEM) Renewable Energy Lease Area OCS-A 0487 (Lease Area). The SRWF will consist of installation of 84 wind turbine generators (WTGs) connected by a network of Inter-Array Cables and a single Offshore Converter Station (OCS-DC). The WTGs and OCS-DC will be sited in a uniform east-west/north-south grid with 1.15 mi (1 nm, 1.8 km) by 1.15 mi (1 nm, 1.8 km) spacing that aligns layouts proposed for other projects in the Rhode Island/Massachusetts Wind Energy Area (MA WEA). This Plan includes mitigation measures associated with the sequential installation of the OCS-DC jacket foundation (four pin piles/day), as well as concurrent installation (proximal assumptions⁴) of WTG MP foundations (one vessel installing two MPs/day)) and OCS-DC jacket foundation (one vessel installing four pin piles/day). Concurrent installation (distal assumptions⁵) of WTG MP foundations (one vessel installing two MPs/day) and the OCS-DC jacket foundation (one vessel installing four pin piles/day) may occur during the OCS-DC foundation installation campaign. However, the mitigation measures and associated zone sizes for concurrent installation of WTG MPs and the OCS-DC jacket foundation included in this Plan are based on the **proximal** assumptions which result in the most conservative ranges to auditory (marine mammal and sea turtles)/physical (fish) injury and behavioral thresholds.

⁴ The two vessels are assumed to be within the proximal separation distance of 3 nm with two foundation locations between the vessels.

⁵ The two vessels are assumed to be installing at opposite ends of the SRWF (distal separation).

The OCS-DC will be installed on a jacket foundation that will be driven into the seabed using a MHU3200 or MHU3000 impact hammer with a maximum hammer energy of 3,200 kJ. The underwater acoustic analysis and exposure modeling assumed a four-legged OCS-DC jacket foundation consisting of eight pin piles (two pin piles per jacket leg), each 4 m in diameter. The final engineering design of the OCS-DC jacket results in diameters of 2.44 m. Installation of a single jacket foundation is expected to require approximately 48 hours of pile driving per jacket (which includes up to 6 hours of pile driving per pin pile). The duration of pile driving will be determined by soil characteristics. The OCS-DC foundation installation is expected to occur at any point in late Q3 2025; however, the impact pile driving would likely occur within a 3-day period (72 hours) including waiting time between each pin pile installation for related installation activities (e.g. relocation of hammer/crane/vessel). A noise abatement system (NAS) consisting of a double big bubble curtain (DBBC) will be deployed during installation of the OCS-DC jacket foundation to reduce sounds propagated into the marine environment. Information on components of the noise abatement systems is provided in Appendix A.

2.1.1 OCS-DC Jacket Foundation

Figure 1 represents the four-legged jacket foundation being considered for the OCS-DC which will be designed to withstand the 1,000-year hurricane wind and wave conditions in accordance with the American Petroleum Institute (API) standards. A single OCS-DC jacket foundation will be constructed to support the OCS-DC. A jacket foundation is formed of a steel lattice construction (comprising tubular steel members and welded joints) secured to the seabed by means of hollow steel pin piles attached to the jacket. The ancillary components are fabricated as an integrated part of the jacket. Rock will be used to provide a level seafloor around the base of the jacket foundation.

The jacket foundation will include installation aids to allow safe installation. Installation aids are primarily related to the lifting and set down of the jacket foundation onto the seabed and upending of the piles to install into the pile sleeves. These predominantly consist of internal and external hydraulic lifting tools and lifting spreader bars fabricated specifically for the jacket lift.

OCS-DC jacket foundation pin piles will be installed to a target penetration depth of 71 m (233 ft). It is estimated that the pile driving for installation of the OCS-DC jacket foundation would occur within a 72-hour window (~3 days) including wait time between each pin pile installation for related installation activities (e.g. relocation of hammer/crane/vessel). This includes a one-hour Clearance period, soft-start procedure, up to six hours of piling, and a maximum of ~two hours between stabbed pin piles. After the first four pin piles have been driven to target penetration depth, a greater wait time of ~6-8 hours is required to upend and stab the final four pin piles before piling recommences. Given this greater wait period, up to four pin piles will be installed in a single day, rather than sequential installation of all eight pin piles in one day. This amounts to a total estimated installation time of 72 hours for all eight OCS-DC jacket foundation pin piles. Installation will include a soft-start at the beginning of each pile installation where lower hammer energy is used at the beginning of each pile segment during pile driving activity to provide additional protection to mobile species (e.g., whales, dolphins, porpoises) in the vicinity by allowing them to vacate the area prior to the commencement of pile driving activities.

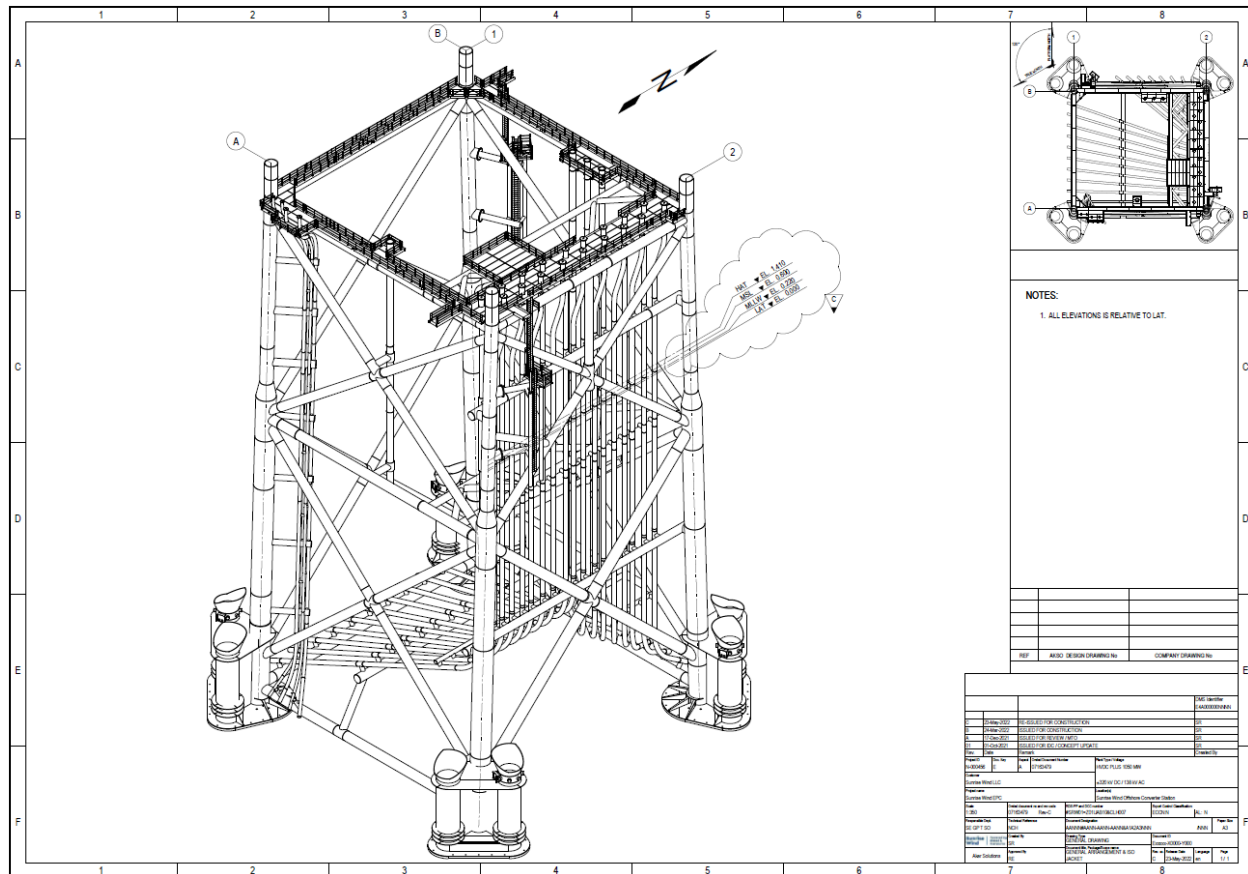


Figure 1. Example OCS-DC jacket foundation concept.

2.1.2 Sequence of Events for OCS-DC Pile Driving

The sequence of events from jacket foundation transport to foundation installation is summarized in Table 3. The jacket foundation and topside will be transported by the Heavy Transport Vessels (HTV) and associated pin piles will be transported by the Heavy Lift Vessel (HLV) Saipem 7000 (S7000). The pin piles will be sea-fastened and stored on grillage onboard the S7000 until ready to be installed.

Prior to any pile driving, the jacket foundation will first be lifted off the HTV and placed on the seabed. A go/no-go meeting will be held prior to the start of the lifting operation for the jacket foundation. This meeting will include the Offshore Construction Manager (OCM), Client representative, and Marine Warranty Surveyor (MWS) and will not include discussion of piling operations. Several factors will be considered during the lifting operations go/no-go meeting including environmental conditions such as wind speed, wave height, current velocity, and visibility. Once the lifting operation is determined safe to proceed, the jacket foundation will be lifted with the main cranes by a tandem lift and lowered to the seafloor. Once the jacket foundation lift and placement has been conducted safely, the HLV S7000 will disconnect from the jacket foundation concluding the lifting operation.

After some preliminary activities (checking of jacket inclination and position etc.) the installation sequence will shift to preparing for pile driving. Before any pile driving, the first four pin piles will be lifted and upended in turn and lowered into place through the jacket pile sleeves to self-penetration depth. Once self-weight penetration is achieved, the first four pin piles are expected to remain stable until piling

is initiated (unlike monopiles, which are typically considered unstable until at least partially driven). The bubble curtain vessel will deploy double bubble curtain rings before the HLV commences OCS-DC pin pile driving. At the same time PAM for marine mammals and sound field verification (SFV) acoustic measurement moorings will be deployed around the jacket foundation and subsequent recording and monitoring will begin. At this point, the hydraulic hammer will be rigged up and stabbed onto the first pin pile.

Before commencing pile driving, the Lead PSO will advise the OCM whether or not to proceed with the first hammer strike based on completion of clearance protocols, confirmation of DBBC operation, and assessment of all other operational and weather considerations. Pile driving activity will not commence if there are wind speeds exceeding 15 m/s (~30 knots), wave height greater than or equal to 2.0 m, or a current velocity greater than or equal to 0.75 m/s. Additionally, weather forecasts will be taken into account including forecasted visibility conditions (e.g., fog) and the likelihood of being able to clear the minimum Visibility Zone (Table 8) as stipulated in LOA Condition 3(c)(13) and COP Condition 5.10.5. Lastly, once pile driving is deemed safe to proceed, the on-duty Lead PSO will ensure that the entire relevant Minimum Visibility Zone (Table 8) is visually cleared for a full 30 minutes (including no visual or acoustic detections of NARW for 60 minutes) immediately prior to commencing OCS-DC pile driving activities. The hydraulic hammer will be lifted from the deck and each of the four pin piles will be driven in turn until the target embedment depth of 71 m (233 ft) is met. The pin piles will be driven into the seabed using a MHU3200 or MHU3000 impact hammer. Piling will begin with a soft-start which will involve initiating hammer operation at a reduced energy level (relative to full operating capacity) for a minimum of 10 minutes including single blow strokes at a maximum of 640 KJ (20% of maximum) hammer energy. The described soft-start procedure is subject to change and will be updated accordingly. Following the soft-start procedure, the pin piles will be driven to their final penetration depth using a maximum hammer energy of 3,200 kJ. During piling, monitoring will be undertaken to detect marine mammals and sea turtles and, if necessary, a shutdown will be initiated (see Section 3.5 for further details). After piling is completed, the monitoring systems and DBBC will shut down.

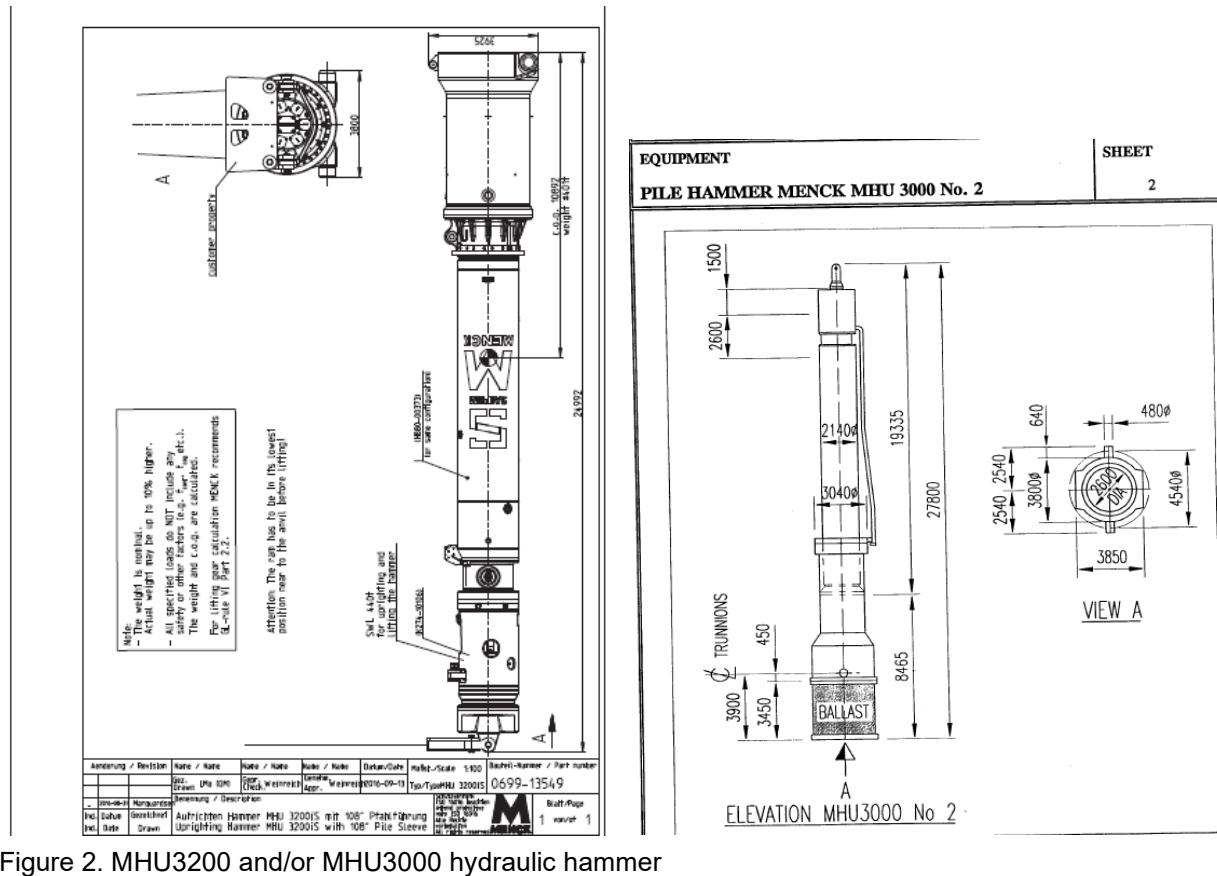


Figure 2. MHU3200 and/or MHU3000 hydraulic hammer

Table 3. Sequence of events for pin pile installation.

Status of Installation Activities Prior to Pile Driving:	
- S7000 set up at installation location - DBBC ready for use (as a base case, must occur before step 8) - S7000 moors to HTV starboard side - Go/no-go meeting for jacket foundation lift only: Offshore Construction Manager (OCM), Client Rep. and Marine Warranty Surveyor (MWS) must agree that it is considered safe to progress with the lifting process. MWS to issue a Certificate of Approval (CoA)	
	 Operational Hold Point
- Jacket lifted by S7000 from HTV - Jacket set down on pre-laid rock pad - Jacket is surveyed to ensure level to within 0.5°	
1	Piling Activities - Starting Points: - Sufficient weather window determined to be available⁶; - Crane ready for use - Hammer ready for use
2	Cut sea fastening from pin pile (~1 hour)
3	Lift pile into upending bay and rig up installation aids for upending (~1 hour)
4	Upend pin pile (1.5 hours)
5	Lower pin pile through jacket foundation onto seabed (~30 min)
6	Repeat steps 3 – 5 until first four pin piles are placed through the jacket foundation
7	Commence clearance monitoring procedures [in parallel with items 6, 8, 9] (~1 hour)
8	Start air compressors and airflow to DBBC [in parallel with items 6, 7, 9] (~15 min)
9	Lift hammer and place on top of first pin pile [in parallel with items 6, 7, 8] (~5 hours)
10	 Operational Hold Point Lead PSO to advise OCM that clearance period has been completed Confirm DBBC operation
11	Start hammer energy recording Commence pile driving with single blows with low energy until automatic setting can be engaged
12	Drive first pin pile to final penetration or refusal depth (~4.5 hours)
13	Move hammer to next pin pile (~30 mins)
14	Repeat steps 10 – 11 for the remaining three pin piles ⁵

⁶ The S7000 OCM will assess the conditions and discern if there is a suitable weather window (minimum of 10.5 hours of acceptable conditions) and conditions to drive the jacket pin pile. This will occur for each jacket pin pile individually.

-
- | | |
|----|--|
| 15 | Repeat steps 4 – 12 until the remaining four pin piles are driven to final penetration or refusal depth ⁷ |
| 16 | Discontinue DBBC operation and clearance monitoring procedures (~30 min) |
-

3 Mitigation and Monitoring

There are six primary mitigation and monitoring components associated with impact pile driving for OCS-DC foundations:

1. Vessel-based visual PSOs and associated visual monitoring tools stationed on the installation vessel and additional protected species observer (PSO) vessels;
2. Visual monitoring during daylight and reduced visibility conditions;
3. PAM monitoring;
4. Noise abatement systems (NAS);
5. Acoustic measurement data collection (SFV to validate the modeled ranges to the potential auditory (marine mammals and sea turtles)/physical (fish) injury and behavioral harassment isopleths) on which clearance and shutdown zones and take estimate, are based;
6. Data recording and reporting.

3.1 Mitigation and Monitoring Zones

The mitigation and monitoring zones are based on the results of the underwater sound propagation modeling of potential auditory (marine mammals and sea turtles)/physical (fish) injury and behavioral harassment ranges for modeled scenarios associated with OCS-DC foundation installation (NMFS 2018). The first scenario shown below involves sequential installation of the OCS-DC jacket foundation (4 pin piles/day) in summer and winter (Table 4 and Table 5, respectively). There is also the potential for concurrent installation of proximal WTG MPs (one vessel installing two MPs/day) and the OCS-DC jacket foundation (one vessel installing four pin piles/day) in summer and winter (Table 6 and Table 7, respectively). The zone sizes implemented will be dependent on the type of installation occurring (sequential or concurrent [proximal assumptions]). A further description on how these zone sizes were determined is explained within the Sunrise Wind Final Rule (89 FR 45292 2024) and the Sunrise Wind and Sunrise Wind Export Cable Development and Operation Biological Assessment (BOEM 2022).

⁷ The upending and driving sequence described is as a base case, S7000 OCM may vary according to operations, environmental conditions, or weather.

Table 4. Threshold ranges and mitigation and monitoring zones during sequential OCS-DC jacket foundation installation (4 pin piles/day) using impact pile driving in summer (May through November).

Species	Monitoring and Mitigation Zones (m)					Vessel Separation Distance (m)
	Level A Zone (m) (SEL _{cum})	Level A Zone (m) SPL _{pk}	Level B Harassment Zone ¹	Clearance and Shutdown Zone	Minimum Visibility Zone	
Low-frequency Cetaceans						
Fin whale*	5,550	≤10	6,470	5,600	3,700	500
Minke whale	2,880	≤10	6,470	5,600	3,700	100
Sei whale*	4,220	≤10	6,470	5,600	3,700	500
Humpback whale	5,130	≤10	6,470	5,600	3,700	100
North Atlantic right whale*	3,620	≤10	6,470	See Table 8	3,700	500
Blue whale*	5,550	≤10	6,470	5,600	3,700	100
Mid-frequency Cetaceans						
Sperm whale*	-	≤10	6,470	5,600	3,700	500
Atlantic spotted dolphin	-	≤10	6,470	NAS	3,700	50
Atlantic white-sided dolphin	-	≤10	6,470	NAS	3,700	50
Common dolphin	-	≤10	6,470	NAS	3,700	50
Risso's dolphin	-	≤10	6,470	NAS	3,700	50
Bottlenose dolphin	-	≤10	6,470	NAS	3,700	50
Long-finned pilot whale	-	≤10	6,470	NAS	3,700	50
High-frequency Cetaceans						
Harbor porpoise	810	220	6,470	900	3,700	50
Phocid Pinnipeds in Water						
Gray seal	1,720	≤10	6,470	1,800	3,700	50
Harbor seal	690	≤10	6,470	1,800	3,700	50
Sea Turtles						
Leatherback sea turtle*	2,150	-	1,160	500	500	100
Loggerhead sea turtle	300	-	1,160	500	500	100
Kemp's ridley sea turtle*	620	-	1,160	500	500	100
Green sea turtle*	920	-	1,160	500	500	100

* denotes species listed under the Endangered Species Act; dB = decibel; SEL_{cum} = cumulative sound exposure level
 SPL_{pk} = peak sound pressure level.

NAS (Noise Abatement System) means that the zone is small enough that it will be encompassed by the bubble curtain.

¹ Level B harassment zone values are based on the modeled single strike SPL acoustic range isopleths to 160 dB re 1 μPa and 175 dB re 1 μPa for behavioral disturbance of marine mammals and sea turtles respectively.

Table 5. Threshold ranges and mitigation and monitoring zones during sequential OCS-DC jacket foundation installation (4 pin piles/day) using impact pile driving in winter (December only).

Species	Monitoring and Mitigation Zones (m)					Vessel Separation Distance (m)
	Level A Zone (m) (SEL _{cum})	Level A Zone (m) (SPL _{pk})	Level B Harassment Zone ¹	Clearance and Shutdown Zone	Minimum Visibility Zone	
Low-frequency Cetaceans						
Fin whale*	6,420	≤10	6,630	6,500	4,100	500
Minke whale	3,200	≤10	6,630	6,500	4,100	100
Sei whale*	4,730	≤10	6,630	6,500	4,100	500
Humpback whale	6,030	≤10	6,630	6,500	4,100	100
North Atlantic right whale*	4,060	≤10	6,630	See Table 8	4,100	500
Blue whale*	6,420	≤10	6,630	6,500	4,100	100
Mid-frequency Cetaceans						
Sperm whale*	-	≤10	6,630	6,500	4,100	500
Atlantic spotted dolphin	-	≤10	6,630	NAS	4,100	50
Atlantic white-sided dolphin	-	≤10	6,630	NAS	4,100	50
Common dolphin	-	≤10	6,630	NAS	4,100	50
Risso's dolphin	-	≤10	6,630	NAS	4,100	50
Bottlenose dolphin	-	≤10	6,630	NAS	4,100	50
Long-finned pilot whale	-	≤10	6,630	NAS	4,100	50
High-frequency Cetaceans						
Harbor porpoise	590	180	6,630	600	4,100	50
Phocid Pinnipeds in Water						
Gray seal	1,730	≤10	6,630	1,800	4,100	50
Harbor seal	690	≤10	6,630	1,800	4,100	50
Sea Turtles						
Leatherback sea turtle*	2,160	-	1,160	500	500	100
Loggerhead sea turtle	290	-	1,160	500	500	100
Kemp's ridley sea turtle*	690	-	1,160	500	500	100
Green sea turtle*	930	-	1,160	500	500	100

* denotes species listed under the Endangered Species Act; dB = decibel; SEL_{cum} = cumulative sound exposure level
 SPL_{pk} = peak sound pressure level.

NAS (Noise Abatement System) means that the zone is small enough that it will be encompassed by the bubble curtain.

¹ Level B harassment zone values are based on the modeled single strike SPL acoustic range isopleths to 160 dB re 1 μPa and 175 dB re 1 μPa for behavioral disturbance of marine mammals and sea turtles respectively.

Table 6. Threshold ranges and mitigation and monitoring zones during proximal assumptions for concurrent piling of WTG monopiles (one vessel installing two MPs per day)) and the OCS-DC foundation (one vessel installing four pin piles per day) in Summer (May through November).

Species	Monitoring and Mitigation Zones (m)					Vessel Separation Distance (m)
	Level A Zone ¹ (SEL _{cum})	Level A Zone (m) (SPL _{pk})	Level B Harassment Zone ²	Clearance and Shutdown Zone	Minimum Visibility Zone	
Low-frequency Cetaceans						
Fin whale*	5,250	≤10	6,490	5,300	3,500	500
Minke whale	2,710	≤10	6,490	5,300	3,500	100
Sei whale*	3,970	≤10	6,490	5,300	3,500	500
Humpback whale	4,830	≤10	6,490	5,300	3,500	100
North Atlantic right whale*	3,490	≤10	6,490	See Table 8	3,500	500
Blue whale*	5,250	≤10	6,490	5,300	3,500	500
Mid-frequency Cetaceans						
Sperm whale*	-	≤10	6,490	5,300	3,500	500
Atlantic spotted dolphin	-	≤10	6,490	200	3,500	50
Atlantic white-sided dolphin	-	≤10	6,490	200	3,500	50
Common dolphin	-	≤10	6,490	200	3,500	50
Risso's dolphin	-	≤10	6,490	200	3,500	50
Bottlenose dolphin	-	≤10	6,490	200	3,500	50
Long-finned pilot whale	-	≤10	6,490	200	3,500	50
High-frequency Cetaceans						
Harbor porpoise	610	250	6,490	700	3,500	50
Phocid Pinnipeds in Water						
Gray seal	1,620	≤10	6,490	1,700	3,500	50
Harbor seal	750	≤10	6,490	1,700	3,500	50
Sea Turtles						
Leatherback sea turtle*	2,200	-	1,920	500	500	100
Loggerhead sea turtle*	260	-	1,920	500	500	100
Kemp's ridley sea turtle*	650	-	1,920	500	500	100
Green sea turtle*	1,020	-	1,920	500	500	100

* denotes species listed under the Endangered Species Act; dB = decibel; SEL_{cum} = cumulative sound exposure level SPL_{pk} = peak sound pressure level.

NAS (Noise Abatement System) means that the zone is small enough that it will be encompassed by the bubble curtain.

¹ Level A harassment ER95% exposure ranges for concurrent installation (proximal assumptions) of monopiles (one vessel installing two monopiles per day) and the OCS-DC foundation (one vessel installing four pin piles per day) (Scenario 5).

² Level B harassment zone values are based on the modeled single strike SPL acoustic range isopleths to 160 dB re 1 µPa and 175 dB re µPa for behavioral disturbance of marine mammals and sea turtles respectively.

Table 7. Threshold ranges and mitigation and monitoring zones during proximal assumptions for concurrent piling of WTG monopiles (one vessel installing two MPs per day)) and the OCS-DC foundation (one vessel installing four pin piles per day) in Winter (December only).

Species	Monitoring and Mitigation Zones (m)					Vessel Separation Distance (m)
	Level A Zone ¹ (SEL _{cum})	Level A Zone (m) (SPL _{pk})	Level B Harassment Zone ²	Clearance and Shutdown Zone	Minimum Visibility Zone	
Low-frequency Cetaceans						
Fin whale*	6,210	≤10	6,970	6,300	4,000	500
Minke whale	3,070	≤10	6,970	6,300	4,000	100
Sei whale*	4,650	≤10	6,970	6,300	4,000	500
Humpback whale	5,680	≤10	6,970	6,300	4,000	100
North Atlantic right whale*	3,850	≤10	6,970	See Table 8	4,000	500
Blue whale*	6,210	≤10	6,970	6,300	4,000	500
Mid-frequency Cetaceans						
Sperm whale*	-	≤10	6,970	6,300	4,000	500
Atlantic spotted dolphin	-	≤10	6,970	200	4,000	50
Atlantic white-sided dolphin	-	≤10	6,970	200	4,000	50
Common dolphin	-	≤10	6,970	200	4,000	50
Risso's dolphin	-	≤10	6,970	200	4,000	50
Bottlenose dolphin	-	≤10	6,970	200	4,000	50
Long-finned pilot whale	-	≤10	6,970	200	4,000	50
High-frequency Cetaceans						
Harbor porpoise	570	240	6,970	600	4,000	50
Phocid Pinnipeds in Water						
Gray seal	1,740	≤10	6,970	1,800	4,000	50
Harbor seal	780	≤10	6,970	1,800	4,000	50
Sea Turtles						
Leatherback sea turtle*	2,310	-	2,020	500	500	100
Loggerhead sea turtle*	260	-	2,020	500	500	100
Kemp's ridley sea turtle*	700	-	2,020	500	500	100
Green sea turtle*	1,140	-	2,020	500	500	100

* denotes species listed under the Endangered Species Act; dB = decibel; SEL_{cum} = cumulative sound exposure level SPL_{pk} = peak sound pressure level.

NAS (Noise Abatement System) means that the zone is small enough that it will be encompassed by the bubble curtain.

¹ Level A harassment ER95% exposure ranges for concurrent installation (proximal assumptions) of monopiles (one vessel installing two monopiles per day) and the OCS-DC foundation (one vessel installing four pin piles per day) (Scenario 5).

² Level B harassment zone values are based on the modeled single strike SPL acoustic range isopleths to 160 dB re 1 µPa and 175 dB re µPa for behavioral disturbance of marine mammals and sea turtles respectively.

Table 8. Relevant NARW Zones during OCS-DC Impact Piling (May through December).

Season	Minimum Visibility Zone (m)	Visual Clearance Delay and shutdown (m)	PAM Clearance/Shutdown Zone (km)	PAM Clearance and Shutdown Zone (m)
Sequential Summer OCS-DC	3,700	Any Distance	10	At any distance within the PAM Clearance/Shutdown Zone
Sequential Winter OCS-DC	4,100			
Concurrent Summer WTG	3,500			
Concurrent Winter WTG	4,000			

3.2 Personnel

Dedicated personnel will be required to carry out protected species monitoring and mitigation efforts onboard Project vessels. These roles are required to be filled by NMFS approved and BOEM-accepted PSOs and PAM operators. In addition, all project personnel in the field have a responsibility to support environmental compliance and will receive Environmental Awareness Training so that they are aware of the required monitoring, mitigation, and reporting.

3.2.1 Project Personnel Training

In accordance with LOA Condition 4(a) and 4(c)(1), ITR § 217.315 (a), § 217.315 (c)(1), and all COP Approval Conditions under Section 5.8, Sunrise Wind will ensure that all construction supervisors and crews, PSO and PAM teams, vessel operators and all relevant staff are trained prior to the start of activities. The Sunrise Wind Environmental Awareness Training will include offshore roles/responsibilities, communication procedures, summary of relevant permit conditions, protected species awareness and identification, marine trash and debris awareness training, and reporting procedures. As per LOA Condition 3(a)(2), a description of the training program will be provided to NMFS at least 60 days prior to the initial training before in-water activities commence. All project personnel will complete two separate sessions potentially occurring over the course of two days held with the PSO provider and Project compliance representative(s) prior to the start of in-water activities. Additionally, project briefings will be conducted by Sunrise Wind prior to construction and at each crew change to ensure that personnel have the most current Project-specific information and are aware of any changes that have occurred throughout the duration of the Project. This training will be repeated and reported to NMFS OPR for new personnel who join the work during the Project.

Additionally, an online training course provided and required by Sunrise Wind's PSO and PAM contractor for all vessel personnel prior to the start of in-water activities including training on how to use the required monitoring equipment (e.g., thermal cameras) specific to each PSO/PAM operator role. Similar equipment training will be reviewed and repeated during the required in-person training provided by the PSO and PAM contractors during vessel mobilization.

Marine trash and debris awareness training is required of all Sunrise Wind offshore personnel engaged in offshore activities pursuant to approved COP and BiOp Appendix A, BA Table 15, measure "Marine debris awareness and elimination" and must be completed annually. By January 31 of each year, Sunrise Wind will submit an annual report to BSEE describing the marine trash and debris awareness training that was followed and certificates for the previous calendar year. The training process will include the following elements:

1. Viewing a marine trash and debris training video or slide show;

2. Receiving an explanation from management personnel that emphasizes their commitment to the requirements;
3. Attendance measures (initial and annual).

Orsted is planning to conduct Rehearsal of Concept (ROC) drills with their construction, PSO, and PAM contractors well in advance of construction start. The ROC drills include a combination of senior PSOs, PAM operators, PSO/PAM program managers, pile driving operational leads/managers, and Sunrise Wind project leadership. Collaborative monitoring and mitigation drills for all stages of pile driving (including pre- and post-), with emphasis on compliance conditions, decision matrices, communication channels, etc., will take place.

In accordance with LOA Condition 4(c)(1); prior to initiation of Project activities, Sunrise Wind will demonstrate in a report submitted to NMFS-OPR at (pr.itp.monitoringreports@noaa.gov) that all required training for Sunrise Wind personnel, including the vessel crews, vessel captains, PSOs, and PAM operators has been completed. To facilitate this, a training log for all personnel will be maintained and reported to NMFS OPR within 30 days of completed training as per LOA Condition 3(a)(2). As per BiOp Appendix A, BA Table 15, measure “Vessel Crew and Visual Observer Training Requirements”, confirmation of the training and understanding of the requirements will be documented on a training course log sheet and provided to DOI upon request.

In addition to Environmental Awareness Training, and in accordance with LOA and BiOp conditions, additional training will be conducted for project personnel that have specific requirements for the role they will fulfill. All personnel involved with protected species mitigation and monitoring will complete Sunrise Wind training modules applicable to their role prior to deployment. The following list summarizes the training modules for personnel directly involved in protected species monitoring:

Trained Lookout (1 hour)

In accordance with LOA Condition 3(b)(1) and BiOp Appendix B PDC 4, BMP 1(b), the Trained Lookout will receive prior training on protected species detection and identification, detection and observation methods in both good and bad weather conditions, vessel strike minimization procedures, how and when to communicate with the vessel captain, and reporting requirements. The Trained Lookout will understand and undergo the training requirements included within the Sunrise Wind *Vessel Strike Avoidance Plan*.

Data Entry and Reporting (2 hours)

All PSO/PAM personnel will receive training in the operation of *Mysticetus* PSO data collection software or similar being used on the Project. Training will include data entry, metadata, Quality Assurance (QA) / Quality Control (QC), reporting, integration with other alternative monitoring technologies, if applicable (i.e., infrared or thermal cameras), detection sharing and situational awareness map, multi-platform data aggregation, and any special features applicable to the Project.

PSO and PAM Compliance (2 to 3 hours)

PSO and PAM operator training and qualifications must be met as defined in Sunrise Wind COP Condition of Approval 5.8.3, LOA condition 4(a), and BiOp Appendix B PDC 7. PSO and PAM operator training and qualification include:

The Lessee must use independent, dedicated, qualified PSOs provided by a third party. The PSOs sole Project-related duty must be to observe, collect and report data, and communicate with and instruct relevant vessel crew regarding the presence of protected species and mitigation requirements (including

brief alerts regarding maritime hazards). The Lessee must use NMFS-approved PSOs and PAM operators. The Lessee must provide training certificates for individual PSOs to BOEM or BSEE upon request. PSOs and PAM operators must be approved by NMFS before the start of construction activities. Qualifications to become a NMFS-approved PSO for construction activities are described in LOA Condition 4(a) and BiOp Appendix B PDC 7, BMP 4. PSOs and PAM operators must be on watch for no more than a maximum of 4 consecutive hours, followed by a break of at least 2 hours between watches. PSOs and PAM operations will not exceed a combined watch schedule of more than 12 hours in a 24-hour period. The NMFS-approved PSOs and PAM operators will receive additional Sunrise Wind and PAM compliance training that will include detailed permit and operational requirements. Contents will cover minimum visibility zone, clearance zone, clearance monitoring, soft-starts, shutdown zone monitoring, shutdown assessment by Lead Engineer, re-start/clearance protocols, PSO-PAM operations and communications, mitigation decision matrices, data collection and weekly/monthly reporting, incident reporting, situational reporting, and NARW reporting.

PAM Operator Training

In accordance with LOA Condition 4(a)(11), the PAM operator will demonstrate that they have prior experience with real-time acoustic detection systems and/or have completed specialized training for operating PAM systems, including experience with relevant Project acoustic software and equipment. Sunrise Wind PAM operators will complete the ThayerMahan PAM training which includes:

- Basic theory of Underwater Acoustics;
- Visual Representation of Sound;
- Sound in the Sea;
- Marine Mammals, Sound production & Hearing;
- Acoustic Monitoring;
- PAM Hardware;
- Hardware practical session;
- PAM Software;
- Software Practical session;
- Role as a PAM operator.

Whale Vocalization training (1-2 hours)

In accordance with LOA Condition 4(a)(11), PAM operators will complete specialized training for operating PAM systems and detecting and identifying Atlantic Ocean marine mammal sounds, including North Atlantic right whale (NARW) sounds, humpback whale sounds, and other co-occurring species' sounds in the area including sperm whales; must be able to distinguish between whether a marine mammal or other species sound is detected, possibly detected, or not detected. The PAM operator must be able to review and classify acoustic detections in real-time (prioritizing NARWs and noting detection of other cetaceans) during real-time monitoring periods. When localization of sounds or deriving bearings are possible, the PAM operators must demonstrate experience in using this technique. The course module will cover species-specific characteristics of their calls and how to identify them in spectrograms, including visual examples for each species and call type.

PAM Deployment and Recovery

In accordance with LOA Condition 4(a)(11), PAM operators will have the qualifications and relevant experience or training to safely deploy and retrieve equipment and program the software, as

necessary and test software and functionality prior to operation. PAM deployment and recovery training will be a mix of onshore and offshore modules that include:

- Mooring design;
- Mooring assembly;
- Antenna feedback/ introduction to software;
- Software troubleshooting;
- Grappling lines;
- Mooring deployment;
- Mooring recovery;
- Recording mooring deployments;
- Health, Safety and Environment (HSE) of mooring deployment;
- Data download;
- PAM recorder configuration;
- Telemetry configuration and testing.

3.2.2 Field Operations Personnel

The field operations team implementing the Plan comprise the visual PSOs, PAM operators, Sunrise Wind personnel, and construction contractors. As per LOA Condition 3(a)(4) and BiOp Appendix A, BA Table 15, measure “Vessel Speed Requirements” and Appendix B PDC 5, BMP 6, Sunrise Wind personnel and contractors will use available sources of information on NARW presence in or near the Project area including daily monitoring of the Right Whale Sighting Advisory System (RWSAS), and monitoring the USCG VHF Channel 16 throughout the day to receive notification of any sightings and/or information associated with any Slow Zones (i.e., Dynamic Management Areas (DMAs) and/or acoustically-triggered slow zones) to provide situational awareness for both vessel operators, PSOs, and PAM operators. These systems will be monitored no less than every 4 hours. The following is a description of the key personnel and their roles within the mitigation and monitoring framework covered under this Plan. Details of measures and communication among personnel are provided in other sections of this document.

Visual PSOs

Sunrise Wind will deploy PSOs with appropriate skills and sufficient numbers to meet all mitigation and monitoring requirements. Individual PSOs seeking NMFS- approval will submit a request via email to nmfs.psoreview@noaa.gov. This request will identify the activity and the role of which they are seeking approval on (PSO or Lead PSO), a resume, and training certificate documenting the requirements stipulated in the Sunrise Wind LOA. Resumes will include the applicant’s education, experience (academic, commercial, or government sponsored marine mammal surveys or PSO experience), and training, including dates, duration, location, and description of prior marine mammal monitoring experience, and, if applicable, a description of the project for which previous PSO work was conducted. PSOs and Lead PSOs will be chosen from the applicant pool of available and interested PSOs who have completed training and been granted NMFS-approval. PSOs must have at least 30 days of at-sea experience monitoring for marine mammals, including baleen whales, and recording observational data.

There are two categories of visual PSOs who will be deployed on the Project, PSO and Lead PSO. PSOs are responsible for the detection, identification, localization, and reporting of all protected species

observed during watch. PSOs will provide visual monitoring of all minimum visibility, clearance, and shutdown zones prior to, during, and after impact pile driving. Outside of the designated watch periods while present and available in-field during OCS-DC jacket foundation installation activities, PSOs will be responsible for general monitoring for situational awareness and vessel strike avoidance. PSOs (individuals and teams) will record marine species data into data collection software, submitting detection information when applicable, and communicating with the Lead PSO. Visual PSOs will remain in contact with the PAM operator on duty regarding any protected species detection that would be approaching or found within the applicable zones through the use of mobile phones using WhatsApp, or the Teams Application on a computer. WhatsApp and Teams messaging communications are instant. If these two methods of communication fail, PSOs will remain in contact with vessel-based operators using the vessel's radio or iridium satellite phone. All PSO detections will be relayed to the on-duty Lead PSO so that those detections are transmitted across the Project. If a protected species enters a clearance or shutdown zone, PSOs will immediately notify the on-duty Lead PSO so the appropriate mitigation actions can be implemented.

Lead PSOs carry the same duties as PSOs and also manage the activities associated with the PSO team, PAM team, and SFV field team. Lead PSOs will have a minimum of 90 days at-sea experience in monitoring for marine mammals, including baleen whales, with the conclusion of the most recent relevant experience no more than 18 months previous. Alongside the vessel operator, Lead PSOs will hold onboard briefings prior to the beginning of construction activity. Such briefings will be repeated whenever new relevant personnel join the pile driving activity before work commencement. Lead PSOs will also attend Project meetings, ensuring all PSO and noise monitoring protocols are followed, and conduct general correspondence with dedicated watches and the Client Representative. The on-duty Lead PSO will communicate directly with the Offshore Construction Manager (OCM) and will be responsible for communicating when clearances have been completed and pile driving can commence. Lead PSOs will make decisions regarding visibility and conduct final reviews on all PSO data and reporting. The on-duty Lead PSO will be the main point of contact (POC) for the entire mitigation team.

The PSO team will also have a PSO supervisor who will work ashore and provide additional support to the Lead PSOs and PSO team. The PSO supervisor will also facilitate communication between PSOs and other shoreside Project parties.

PAM Operators

Individual PAM and Lead PAM operators seeking NMFS- approval will submit a request via email to nmfs.psoreview@noaa.gov. This request will identify the activity and the role of which they are seeking approval on (PAM Operator or Lead PAM Operator), a resume, and training certificate documenting the requirements stipulated in the Sunrise Wind LOA. Resumes will include the applicant's education, experience (academic, commercial, or government sponsored marine mammal surveys or PSO experience), and training, including dates, duration, location, and description of prior marine mammal monitoring experience, and, if applicable, a description of the project for which previous PAM operator work was conducted. There are Lead and Standard PAM operators, and they function in relatively similar roles as PSOs but instead of visual monitoring they will conduct acoustic monitoring ashore in the ThayerMahan Operations Center. Standard PAM operators will have at least 30-days of experience in identifying and classifying marine mammal acoustic detections by species, including baleen whales, in real-time and demonstrate training or experience using Project-specific PAM hardware and software, including detection systems and localization methods (if applicable). Lead PAM operators will have a

minimum of 90 days of experience in identifying and classifying marine mammal acoustic detections by species, including baleen whales, in real-time and demonstrate training or experience using the Project-specific PAM hardware and software, including detection systems and localization methods (if applicable). The Lead PAM operator will also be able to troubleshoot the acoustic equipment and assist with making final decisions regarding species identifications, localization and other acoustic monitoring details that will be relayed to the on-duty Lead PSO. The Standard PAM operator will be able to access the expertise of the Lead PAM operator as needed.

PAM operators will be stationed in the shoreside ThayerMahan Command Center located in Groton, CT where they will classify and tag detection data using a hierarchy to create contact/detection reports to ensure potential call detections are not missed (as described in Section 1.3.1 of the *OCS-DC Passive Acoustic Monitoring [PAM] Plan*). Once detection reports are available, they will be entered or automatically pushed into the data collection software system (*Mysticetus* or similar system) cloud database which allows them to become visible to the vessel-based PSOs on a map display. If a call detection cannot be confirmed or have originated outside the clearance/shutdown zone, then a conservative approach will be taken and the shore-based PAM operator will request an immediate delay/shutdown of pile driving. If the shore-based PAM operator determines that the location of a call overlaps with an applicable mitigation zone (e.g., PAM clearance/shutdown zone for NARW or clearance/shutdown zone for non-NARW large whales) the PAM operator located in the ThayerMahan Command Center will initiate direct communications with the vessel-based on-duty Lead PSO on the installation vessel via Teams (primary line of communication) and the data collection software system (i.e., *Mysticetus* or similar system)). The on-duty Lead PSO will assess the information provided and will take the necessary mitigation actions. All communications regarding PAM detections will go directly to the on-duty Lead PSO. This same procedure of communications will occur if the area of uncertainty around a localized whale call overlaps a relevant mitigation zone even if the call itself is localized outside of the mitigation zone. In the unlikely circumstance that Teams and *Mysticetus* (or similar system) experiences a temporary disruption, all information will be communicated directly through other communication systems including cell phone voice communications, WhatsApp, or iridium satellite phone. The *Mysticetus* temporary disruption will be communicated by the PSO teams to all Project personnel to ensure use of other communication system(s) is consistent.

Acoustic Reporting Scientist

As part of the SFV team, the Acoustic Reporting Scientist will be responsible for confirming deployment, operation, and retrieval of all SFV equipment and relaying that information to the Lead PSOs. The Acoustic Reporting Scientist will also be responsible for immediate retrieval of acoustic data from the SFV recorders and ensuring its safe transmittal to the onshore acoustic analysts.

Acoustic Deployment Support Member

These are experienced field personnel who will assist the PAM and SFV deployment and recovery. These support personnel will not play a direct role in mitigation and monitoring but will assist in the deployment and recovery as well as troubleshooting or maintenance of all deployed acoustic buoys. Support members will be on the PSO vessel(s).

Offshore Construction Manager

The OCM will be the construction contractor representative on site that has the role of oversight across the entire Project. The contractor Project representatives on board the HLV will advise the OCM and will be the POCs for maintaining compliance with all regulations for the Project. The key role for the

OCM will be to maintain communication with the Lead PSOs such that the OCM is kept abreast of all clearance activities, detections, and mitigation activities. The OCM will initiate the shutdowns requested by the Lead PSOs, communicate with the hammer operator, and consult with engineers for risk of pile refusal in the case of any mitigation actions that require pile safety analysis.

3.2.3 PSO Standards and Overall Schedule

The following requirements and roles will be implemented for PSO and PAM personnel. As described in Section 3.2.1, PSOs and PAM operators will all receive project-specific training.

- All PSOs will be chosen from the applicant pool of available and interested PSOs who have been approved by NMFS-OPR prior to the start of the Project. PSOs will meet the qualifications outlined in LOA Condition 4(a) and BiOp Appendix B PDC 7, have completed a NMFS-approved PSO course, and will fulfill the physical/medical requirements, communication skills, and visa requirements.
- Prospective PSO and PAM operators not previously approved, or PSOs and PAM operators whose approval is not current will submit a request to nmfs.psoreview@noaa.gov identifying the activity and the role for which they are seeking approval at least 60 days prior to commencement of in-water construction activities requiring PSOs and PAM operators.
 - Resume's will include information related to their proposed role (i.e., PSO, Lead PSO, PAM operator, or Lead PAM operator), relevant education, training, and experience (academic, commercial, or government sponsored marine mammal surveys or PSO experience), including dates, duration, location and description of prior marine mammal monitoring experience and, if applicable, a description of the project for which previous PSO work was conducted. Resumes will also be accompanied by relevant documentation of successful completion of necessary training.
- For every shift, three visual PSOs per vessel will maintain active watch. The installation vessel will have at least two Lead PSOs onboard.
- ThayerMahan PAM operators will monitor one data stream per deployed system. Each data stream combines data from 32 hydrophones, which are beamformed into a single display that presents both broadband and spectrogram data. One ThayerMahan PAM operator is able to monitor data streams of up to six deployed systems. All systems will be monitored for the duration of the project, with priority analysis focused on the data streams from the three closest SeaPicket systems to the center of the OCS-DC platform. The PAM operators will be located at the ThayerMahan Command Center to review and analyze incoming data using a web-based interface. A single ThayerMahan PAM operator will monitor the data streams one hour before, during, and 30 minutes after OCS-DC foundation installation.
- Following established BOEM and NMFS standards, the PSO/PAM team(s) will work in designated shifts during protected species monitoring. For PSOs, shifts will be set up such that no individual will work more than 4 consecutive hours without a 2-hour break, or longer than 12 hours during any 24-hour period. The Project will provide each PSO with one 8-hour break per 24-hour period to sleep. An example rotation is provided in Figure 3. Actual rotations will be vessel-specific, and implemented rotations will be documented with the Project's final PSO report. New or inexperienced PSOs will be paired with an experienced PSO qualified to mentor new PSOs so that the quality of marine mammal observations and data recording is kept consistent.

- For PAM operators, shifts will be set up such that no individual will work more than 4 consecutive hours without a 2-hour break, or longer than 12 hours during any 24-hour period. Two NMFS-approved PAM operators will be assigned each day to cover the duration of pile-driving activities. In addition to the watch rotation requirements, ThayerMahan enhances operator efficiency with automated detection algorithms, which when paired with comfortable shore-based accommodations enable extended monitoring periods without inducing fatigue. Additionally, NMFS-approved PAM operators are available to provide coverage in the case of emergency or other short-term absence as necessary, ensuring seamless operations throughout the monitoring process.
- Before beginning active monitoring, PAM operators will conduct an archival review of the previous 24 hours of data. This review, completed prior to the active monitoring period, is not considered part of the monitoring process as it does not occur during pile-driving activities. Please refer to Section 1.5 of the *OCS-DC PAM Plan* for further details.
- The on-duty Lead PSO will communicate with each of the PSO vessels and will report directly to onshore project managers. The on-duty Lead PSO will be responsible for calling shutdowns or delays to impact pile driving activity and determining if visibility is adequate to commence or resume pile driving following a delay or shutdown.

An indicative crew rotation for the installation vessel and ThayerMahan Operations Center including shift lengths is shown below in Figure 3.

Figure 3. Indicative PSO and PAM Operator schedule onboard the installation vessel and ThayerMahan Operations Center.

Day/Night Period	Start Time	End Time	Lead PSO	Lead PSO	PSO	PSO	PSO	PSO	PAM (ashore)	PAM (ashore)
Day (based on example civil sunrise of 04:34 local time)	04:00	05:00	Visual		Visual	Visual			PAM	
	05:00	06:00	Visual		Visual	Visual			PAM	
	06:00	07:00	Visual		Visual	Visual			PAM	
	07:00	08:00	Visual		Visual	Visual			PAM	
	08:00	09:00		Visual			Visual	Visual		PAM
	09:00	10:00		Visual			Visual	Visual		PAM
	10:00	11:00		Visual			Visual	Visual		PAM
	11:00	12:00		Visual			Visual	Visual		PAM
	12:00	13:00	Visual		Visual	Visual			PAM	
	13:00	14:00	Visual		Visual	Visual			PAM	
	14:00	15:00	Visual		Visual	Visual			PAM	
	15:00	16:00	Visual		Visual	Visual			PAM	
	16:00	17:00		Visual			Visual	Visual		PAM
	17:00	18:00		Visual			Visual	Visual		PAM
	18:00	19:00	Visual		Visual	Visual			PAM	
	19:00	20:00	Visual		Visual	Visual			PAM	
Night (based on example civil sunset of 20:54 local time)	20:00	21:00		Visual			Visual	Visual		PAM
	21:00	22:00		Visual			Visual	Visual		PAM
	22:00	23:00		Visual			Visual	Visual		PAM
	23:00	00:00		Visual			Visual	Visual		PAM
	00:00	01:00								
	01:00	02:00								
	02:00	03:00								
	03:00	04:00								

3.3 Overall Monitoring Strategy

Visual and acoustic monitoring of the clearance and shutdown zones will be conducted by 3rd party PSOs and PAM operators. The PSOs will be located on the installation vessel as well as two additional PSO vessels (Figure 4). A team of six PSOs (including two Lead PSOs) will be on board the installation vessel and PSO vessels so that three PSOs can be on duty during all daylight hours. The number of PSOs per vessel may be reduced while still providing a sufficient number of PSOs per vessel such that three may be on duty during the required periods and with sufficient breaks as described in the LOA Condition 4(b)(4). Each day a team of two ThayerMahan PAM operators with experience using the SeaPicket systems will alternate operating and monitoring the incoming data at the shoreside ThayerMahan Command Center. All ThayerMahan PAM operators will be NMFS-approved and will work in accordance with the schedule shown in Figure 3. A detailed description of the PAM to be conducted to monitor and mitigate for marine mammals is presented in the separate *OCS-DC PAM Plan*.

The two dedicated PSO vessels will travel along a circular path around the installation vessel at or near the minimum visibility distance of 3,700 m (4,100 m in winter⁸) during sequential installation of OCS-DC jacket foundation installation and 3,500 m (4,000 in winter) during concurrent WTG MP and OCS-DC jacket foundation installation. This will ensure complete coverage of all 360° around the jacket foundation being installed. Each vessel will travel at a speed of 7–10 knots during clearance, piling, and post-piling monitoring.

PSOs on the installation vessel will use mounted high magnification (25x) binoculars, standard handheld (7x50) reticle binoculars, and the unaided eye to continuously search for protected species within all relevant clearance and shutdown zones. At least two PSOs on the installation vessel will be equipped with Big Eye binoculars (e.g., 25 x 150; 2.7 view angle; individual ocular focus; height control), which will be pedestal mounted on the port and starboard stern corners of the main deck (16m ASL). The three PSOs stationed on the PSO vessels will each be responsible for monitoring a 120-degree sector of the field of view (FOV) with unaided eye and reticle binoculars (and big eyes periodically) which will provide additional coverage inside the clearance zone towards the installation vessel as well as beyond the clearance zone away from the jacket foundation. The efficacy and effectiveness of monitoring methods described in this section will continue to be evaluated during and between seasons to ensure appropriate monitoring methods are used. PSOs will use the described monitoring equipment to confirm the relevant clearance and shutdown zones are clear of marine mammals and not impacted by fog or humidity. If a protected species is sighted during daylight conditions, the on-duty PSOs will radio the detection and location/bearing of the individual(s) to all Project vessels to ensure awareness of the protected species. The PSO that sighted the protected species will maintain visual contact with the species until they lose visibility, during which one of the other on-duty PSOs will record the sighting in *Mysticetus* or similar data collection tool, while the third on-duty PSO visually covers the remaining 240-degree sector of the FOV. Photographs and follow-up notes will be entered into the data collection tool once visual detection has ceased or at the end of the PSO watch.

All PAM and SFV deployment and associated pre- and post- watches for the Project will be conducted outside of pile driving activities allowing PSOs to fulfill the required duties on the PSO vessel without any deployment interruptions.

Table 9 provides a summary of equipment and personnel that will be deployed for the OCS-DC jacket foundation piling operations. Figure 4 shows indicative positions of the PSO vessels relative to the installation vessel as well as relevant monitoring and shutdown zones for summer OCS-DC foundation installation. Based on the acoustic modeling results, relevant monitoring and shutdown zones will be larger during winter foundation installation, should that be necessary and approved (not depicted in Figure 4). As per LOA Condition 3(c)(1), foundation installation must not be planned in December; however, it may only occur if necessary to complete the project within a given year with prior approval by NMFS. Sunrise Wind will notify NMFS in writing by September 1 of that year that pile driving cannot be avoided, and that circumstances are expected to require December piling. Should these circumstances arise, Sunrise Wind will also provide an amended *OCS-DC PDMP* that covers winter pile driving, including further detail surrounding the PSO vessel configuration to monitor the 4,100 m and 4,000 m clearance/shutdown zone for sequential and concurrent installation, respectively.

⁸ No impact pile driving is planned for the months of December through April; however, installation in December may occur, upon NMFS approval, in the case of unexpected delays.

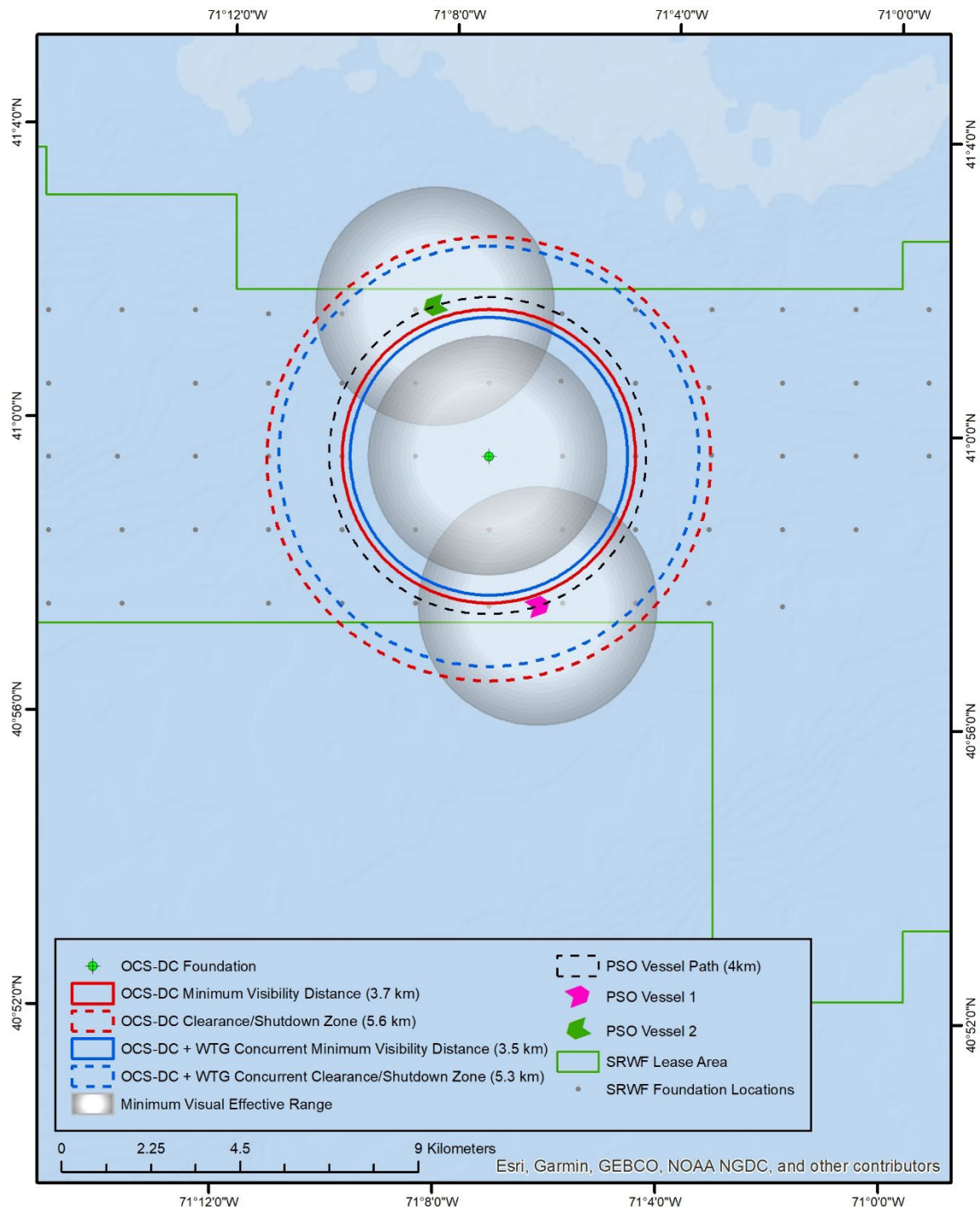


Figure 4. Indicative locations of personnel and equipment during OCS-DC jacket foundation pile driving occurring in summer.

Table 9. PSO and PAM personnel and equipment on installation, monitoring vessels, and ThayerMahan Operations Center.

Vessel Name		Installation Vessel	PSO Vessel #1	PSO Vessel #2	ThayerMahan Operations Center
Vessel Role		Pile Driving	PSO Monitoring	PSO Monitoring	PAM Monitoring
Personnel					
Visual PSOs		6	6	6	N/A
# PSOs on active watch		3	3	3	N/A
PAM Operators (ashore)		0	0	0	2
PAM Operators on duty ¹		0	0	0	1
Equipment	Model				
Binoculars (7x – 8x, reticle)	Varied	3	3	3	N/A
Big Eye Binoculars	Fujinon 25 x 150 MT-SX	2	0	0	N/A
Digital cameras ²	SLR camera with 300-mm lens	2	2	2	N/A
PSO dedicated VHF Radios	Varied	3	3	3	N/A
Mounted Thermal/IR Camera System	Current Scientific (Cooled – NN 3050)	2 - cooled	1 – cooled	1 – cooled	N/A
Night Vision Device (NVDs)	PVS-14 Gen 3 Autogated Pinnacle - White Phosphor - Night Vision ³	2	2	2	N/A
PAM System	SeaPicket	0	0	0	6
PAM Hydrophone Mooring	EOM Offshore 56"	0	0	0	6
Mysticetus Data Collection System	Mysticetus or similar	1	1	1	1

IR = infrared; NVD = night vision device; PSO = Protected Species observer; VHF=very high frequency.

¹ PAM operators will be stationed in the shoreside ThayerMahan Operations Center.

² There will be two digital cameras provided on each vessel for use by the three PSOs on duty. Each PSO team will share a single digital camera. This digital camera will be located on the bridge of the vessel to ensure easy

accessibility for any PSOs use. A second digital camera will be located on board as a backup (total of two digital cameras).

³ Model: PVS-14 Gen 3 Autogated Pinnacle - White Phosphor - Hand Select

- i. Generation : Gen 3
- ii. Image Tube Type : Elbit Gen 3 A Grade Autogated/Pinnacle Manual Gain
- Hand Select White Phosphor (Min SNR 24 or Higher, all units better than 1600 FOM)
- iii. Image Tube Data Sheet Included : Yes
- iv. Dimensions : 4.5 x 2.25 x 2 inches
- v. Weight Ounces : 13.8 ounces
- vi. FOV @1000 yards : 40° /2184ft
- vii. Magnification : 1x
- viii. Battery Type-Life : 1 x AA /40 hours
- ix. Lens Type : 26mm f1.12
- x. Resolution : 64 to 72 lp/mm
- xi. Range of Focus : "10" to infinity"
- xii. Ir Illuminator : Built In
- xiii. Environmental Rating : Waterproof to 66'
- xiv. Diopter Adjustment : +2 to -6
- xv. Detection Range : 1148ft (350m)
- xvi. Recognition Range : 984ft (300m)
- xvii. Operating Temperature : -60 to 125 ° F

3.4 Visual Monitoring Distances

Visual monitoring by PSOs will be conducted from the installation vessel and two dedicated PSO vessels. Daytime visual monitoring is defined by the period between nautical twilight rise and set for the region. The PSOs will conduct visual monitoring from the bridgewings located at a minimum height of 4.47 m ASL on the secondary PSO vessel(s) and from the main deck at a minimum height of 16 m on the installation vessel (Table 10). PSO on the installation vessel will monitor with the unaided eye, 7 x 50 magnification reticle binoculars, and a set of 25x magnification 'Bigeye' binoculars (one on the portside stern corner and one on the starboard stern corner). PSOs on the secondary PSO vessel(s) will monitor using the same equipment described for the installation vessel with the exception of no "Bigeye" binoculars mounted on the PSO vessels. PSO's eye height will be recorded on each vessel and input into the recording template prior to observations so more accurate height can be used during operations.

The longest distance able to be observed by PSOs, which is the distance to the horizon, can be calculated using the following equation: $3.6\sqrt{h}$, where "h" is eye height ASL. To calculate the minimum distance to the horizon observable by a PSOs based on this equation, the minimum eye height of a PSO can be used. Assuming the deck of the vessel is 4.47 m ASL and the minimum eye height of a PSO is 1.53 m (5 ft), then the minimum eye height ASL would be 6 m. Using the equation above, the minimum distance to the horizon visible by PSOs would be approximately 8.8 km (Table 10). The calculated visibility ranges for representative vessels are shown below in Table 10.

While the detection of large whales at or near the calculated visibility ranges (8–10 km) is possible, it is less likely for single individuals or small groups compared to larger groups, especially if larger groups are engaged in certain behaviors such as feeding or social activity. Depending on the environmental conditions and available detection cues of marine mammals, PSOs on a vessel have a minimum effective range of 2–3 km, meaning they can reliably detect individual large whales and/or small groups within that distance. To increase the probability of detecting whales within and beyond the 2–3 km effective range from the installation vessel, two dedicated PSO vessels will circle the installation

vessel as described in Section 3.3, providing additional coverage within the minimum visibility zone and effective coverage out to a distance of 4–6 km.

PSOs will routinely use available targets at known distances, primarily other project vessels, to quantify the distances at which they can reliably monitor for marine mammals and sea turtles. Each of the two dedicated PSO monitoring vessels will be located 4 km from the installation vessel at the edge of the 3,700 m or 3,500 m Minimum Visibility Zone(s) for sequential and concurrent foundation installation, respectively. Three-person PSO team teams aboard each monitoring vessel and the installation vessel will work collaboratively to monitor the entirety of the relevant Minimum Visibility Zone and adjacent waters beyond this zone. Other project vessels in the area will serve as additional reference points for PSOs to confirm effective monitoring distances and distances to potential sightings. If PSO teams conclude that the entirety of the Minimum Visibility Zone cannot be reliably monitored, a determination will be made by the on-duty Lead PSO on the installation vessel and pile driving will be delayed or shut down (as described in Section 3.5.4).

Table 10. PSO eye height above sea level in meters (m) for each vessel and the distance to horizon in kilometers (km), assuming the minimum PSO eye height is 1.53 m

	Installation Vessel	PSO Vessel #1	PSO Vessel #2
	Pile Driving	PSO Monitoring	PSO Monitoring
Average PSO eye height	1.53	1.53	1.53
Eye Height Above Sea Level (unaided eye, 7-10 x magnification binoculars, 25 x magnification binoculars)	17.53 (minimum)	6 (minimum)	6 (minimum)
Thermal cameras	16 (minimum)	8	8
Visible distance to horizon (km)	15.1	8.8	8.8

Note: A minimum anticipated deck is utilized in this case as the final PSO monitoring vessels are to be determined. Based on the anticipated size of vessel, 4.47m would be the minimum anticipated deck height for an estimated visible distance to horizon.

Using the below formula, and currently known obstructions aboard the installation and PSO monitoring vessels, we have estimated the available field of view (FOV) at each location as a percentage of a full 360° field of view around the vessel. The available field of view values represent how much of the full 360° around the installation site is available to a given person (PSO using binoculars) or visual monitoring equipment (IR cameras) based on where they are positioned or mounted on the installation vessel (Table 11) or PSO vessels (Table 12). These values do not represent the FOV being monitored instantaneously from these locations, but rather how much of the area around the vessel is available to be monitored from each observation location as PSOs using binoculars or the Current Corporation IR camera panning back and forth over that area.

$$(1) ((360^\circ - ^\circ\text{obscured}) / 360^\circ) \times 100\% = \text{Available Field of View (\%)}$$

Table 11. Available FOV by each PSO and/or visual monitoring equipment on the installation vessel.

	PSO (handheld binoculars)	25 x magnification binocular 1 – Port	25 x magnification binoculars 2 – Starboard	NN3050 Thermal Camera 1 – Starboard Stern	NN3050 Thermal Camera 2 – Portside Bow
Installation Vessel	80%	50%	50%	60%	60%

Note: Fields of view takes into account vessel-based obstructions at the anticipated position of equipment use. However, through collective monitoring across the piling and PSO vessels using the monitoring tools determined to be appropriate on a given day taking into account the environmental conditions during daytime, the full 100% field of view will be achieved with the available field of view.

Table 12. Available FOV by each PSO and/or visual monitoring equipment location on the PSO vessels.

	PSO Vessel #1	PSO Vessel #2
PSO (handheld binoculars)	40%	40%
NN3050 Thermal Camera	80%	80%

Note: Fields of view takes into account vessel-based obstructions at the anticipated position of equipment use. However, through collective monitoring across the piling and PSO vessels using the monitoring tools determined to be appropriate on a given day taking into account the environmental conditions during daytime, the full 100% field of view will be achieved with the available field of view.

3.5 Mitigation Measures

The monitoring and mitigation protocols that will be followed during daylight conditions are indicated below.

3.5.1 General Measures

- 1) A minimum of three PSOs on each PSO vessel will simultaneously monitor the relevant clearance/shutdown zones using standard handheld binoculars (7x), high magnification (25x) binoculars, and the unaided eye to search continuously for protected species.
- 2) PSOs stationed on the dedicated PSO vessel(s) will ensure the outer portion of the clearance/shutdown zones are visually monitored.
- 3) PSOs on all vessels will immediately communicate sightings within or near the clearance/shutdown zones to the on-duty Lead PSO aboard the installation vessel so that appropriate mitigation measures can be implemented.
 - a) PSOs and PAM operators will record all detections of marine mammals and sea turtles from periods of active watch, regardless of distance from the jacket foundation site or pile driving activity status.
 - b) All PSO and PAM detection data will be shared across PSO teams in real time to inform situational awareness and assessment of potential mitigation.

3.5.2 Clearance Protocols

- 1) Visual and acoustic monitoring will begin at least 60 minutes prior to the start of pile driving activity.

- 2) During the 60-minute clearance monitoring period, there must be no visual or acoustic detections of NARW for 60 minutes immediately prior to pile driving and no detections of other marine mammals or sea turtles in their applicable Clearance Zones for 30 minutes prior to pile driving.
- 3) At least one PAM operator will review data from at least 24 hours prior to pile driving as described in Section 1.5 of the *OCS-DC PAM Plan* as per LOA Condition 4(b)(6).
- 4) At least one PAM operator will review will actively monitor hydrophones for 60 minutes prior to pile driving, at all times during pile driving, and for 30-minutes after pile driving as per LOA Condition 3(c)(11).
- 5) PSOs will visually clear (i.e., confirm no observations of marine mammals), the entire minimum visibility zone (as shown in Table 8) for a full 60 minutes immediately prior to commencing OCS-DC jacket foundation pile driving activities.
- 6) In recognition of brief periods of reduced visibility, the on-duty Lead PSO will determine sufficient visibility conditions through communication between Project vessels. The configuration of PSOs and vessels will ensure that the area out to the relevant minimum visibility distance is visually monitored during the required monitoring periods; this includes the area comprising the sea turtle clearance/shutdown zone of 472 m (BiOp Table 3.17).
- 7) If PSOs cannot visually monitor the minimum visibility zone prior to impact pile driving, pile driving operations will not commence.
 - a) If the minimum visibility zone cannot be adequately monitored due to reduced visibility during daylight, an immediate delay to the commencement of pile driving will be called for. The clearance zone will only be declared clear when the entire Minimum Visibility Zone is visible for 60 minutes prior to the commencement of pile driving activity. Additional details are described in section 3.6.
- 8) Pile driving will not be initiated earlier than 1 hour after civil sunrise or 1.5 hours prior to civil sunset. Additionally, if pile driving has begun prior to/after the civil sunset/sunrise, pile driving may only continue after dark only when the minimum visibility zone for OCS-DC jacket foundation impact pile driving is fully visible and if stopping operations represents a risk to human health, safety, and/or risk of pile refusal.
 - a) If these circumstances arise, PSOs will utilize alternative technology (i.e., IR and/or Thermal camera) to monitor the clearance and shutdown zones (as shown above in measure 3) as approved by NMFS if impact pile driving continues past civil sunset.
- 9) The on-duty Lead PSOs will receive confirmation from the OCM that the bubble curtain is fully operational and configured correctly.
- 10) If a marine mammal (other than a NARW) or sea turtle is observed within the applicable clearance zone during the clearance period, impact pile driving will be delayed until the animal(s) has voluntarily left the specific clearance zone and has been visually or acoustically confirmed beyond that clearance zone, or when specific time period has elapsed with no further sightings: 15 minutes for odontocetes (excluding sperm whales) and pinnipeds, and 30 minutes for sperm and baleen whales and sea turtles.
 - a) Sea turtles observed within a clearance zone prior to the commencement of pile driving will be allowed to remain in the clearance zone (i.e., must leave on their own volition), and their behavior will be monitored and documented. If a sea turtle is observed entering or within the 500 m

- clearance zone after pile driving has begun, the PSO will request a temporary cessation of pile driving (as described in Section 3.5.4).
- b) In cases where these criteria are not met, pile driving may restart only if necessary to avoid pile refusal at which time Sunrise Wind will use the lowest hammer energy practicable to avoid risk of pile refusal.
- 11) In the event that any large whale is sighted or acoustically detected at any distance that cannot be confirmed as a non-NARW, it will be treated as if it were a NARW for purposes of mitigation.
- a) For NARW/unidentified large whale, any visual observation by PSOs at any distance or acoustic detection within the PAM clearance/shutdown zone for NARWs (10 km) will trigger a delay to the commencement of pile driving. The clearance zone will only be declared clear if no NARW visual detections at any distance or acoustic detections within the PAM clearance/shutdown zone for NARWs have occurred during the 60-minute clearance zone monitoring period of which 30 consecutive minutes will be determined to be clear of marine mammals (as per LOA Condition 3(c)(13)) directly prior to commencing these activities.
- 12) If a marine mammal vocalization is detected during pile driving and the detection is able to be localized or if the SeaPicket operator determines the location of a call to overlap with an applicable mitigation zone, the appropriate mitigation will be called for:
- a) Immediate shutdown and/or delay to pile driving commencement for any confirmed NARW/unidentified large whale localized at a distance within the 10 km PAM clearance/shutdown zone for NARW (as described in Section 3.5.4).
 - b) Immediate shutdown and/or delay to pile driving commencement for any confirmed non-NARW large whale localized within the 5,600 m (6,500 m in December) clearance/shutdown zone for sequential installation and 5,300 m (6,300 m in winter) clearance/shutdown zone for concurrent installation (as described in Section 3.5.4).
 - c) Continued pile driving if a NARW/unidentified large whale is localized **outside** the 10 km NARW PAM clearance/shutdown zone or if any identified non-NARW call is localized **outside** the 5,600 m (6,500 m in winter) or 5,300 m (6,300 m in winter) non-NARW large whale clearance/shutdown zone for sequential and concurrent installation, respectively.
- 13) If a marine mammal is detected; however, unable to be localized, and the animal is determined to potentially be within a mitigation zone, a conservative approach will be taken, and the PAM operator will request an immediate delay/shutdown of piling through communications with the vessel-based on-Duty PSO on the installation vessel. The delay/shutdown of piling will remain in effect until the animal is able to be localized and confirmed outside the clearance/shutdown zone or until a specific time period has elapsed with no further sighting or detection: 15 minutes for odontocetes (excluding sperm whales) and pinnipeds, and 30 minutes for sperm and baleen whales (other than NARW) and sea turtles. The PAM operator will use other available information, including the location of the pin pile being installed relative to the SeaPicket system(s) on which the call was detected and the call amplitude on the system(s), and their professional judgement to determine if the animal may be within a relevant mitigation zone.
- 14) If impact pile driving is delayed due to the presence of a NARW/unidentified large whale, impact pile driving will not begin until the NARW/unidentified large whale has neither been visually nor acoustically detected for 60 minutes.

3.5.3 Soft-start Protocols

- 1) Soft start of pile driving will not begin until the clearance zone has been determined clear including no NARW visual detections at any distance or PAM detections within the 10 km PAM clearance/shutdown zone for NARW for 60 minutes, no marine mammals or sea turtles in the applicable clearance zone for 30 minutes, and the entire Minimum Visibility Zone must be visible for 60 minutes as determined by the on-duty Lead PSO, visual PSOs and PAM operators.
- 2) Soft start is required at the start of all pile driving events and at any time following cessation of piling for 30 minutes or longer, unless not technically feasible to do so (As described below).
- 3) The pile driving soft-start will involve initiating hammer operation at a reduced energy level (relative to full operating capacity) for a minimum 10 minutes of single blow strokes at a maximum of 640KJ (20% of maximum) hammer energy. The described soft-start procedure is subject to change and will be updated accordingly.
- 4) If a marine mammal or sea turtle is observed within or about to enter the applicable clearance zone during the soft start period, impact pile driving will be stopped until the animal has been visually observed exiting the clearance zone or until a specific time period has elapsed with no further sightings: 15 minutes for odontocetes (excluding sperm whales) and pinnipeds, and 30 minutes for sperm and baleen whales (including the NARW), and sea turtles.
- 5) Upon re-starting pile driving on a pile that has been partially installed, soft start protocols will be followed unless not technically feasible to do so, in which case pile driving will restart using hammer energies no more than the minimum amount of hammer energy that Sunrise Wind determines necessary to advance the pile without causing damage to the hammer.

3.5.4 Shutdown Protocols

- 1) If a marine mammal or sea turtle is detected (visually or acoustically) entering or within the applicable shutdown zone after pile driving has begun, the PSO or PAM operator will call for a shutdown of pile driving and the vessel operator will stop pile driving immediately, unless shutdown is not practicable due to imminent risk of injury or loss of life to an individual or risk of damage to a vessel that creates risk of injury or loss of life for individuals, or the OCM determines there is risk of pile refusal.
- 2) The hammer energy selected to drive the pile will be the minimum effective hammer energy (no greater than the maximum 3,200 kJ hammer energy) necessary to effectively and safely install and achieve the necessary penetration to progress the pile installation without risk of pile refusal. The most efficient driving energy may not be equal to the minimum effective energy needed to drive the pin pile with correct penetration progress. Minimum effective energy may be an approximate maximum of 30-50 blows/0.25m with an absolute minimum of approximately 20% energy due to hydraulic restrictions. Any reduction greater than 20% hammer energy may risk excessive pile, pile follower, and hammer fatigue, and a trend toward pile refusal. These values are indicative given that the hammer operator can only give their best effort at adjusting hammer energy since pile progress is as much a function of soil strata as hammer energy. The difference between most efficient and minimum effective energy may be small; however, a difference would be recordable in the hammer logs. Therefore, if a shutdown is called for and the OCM determines that the pin pile is at risk of refusal and unable to be shutdown; mitigation will be requested and, if technically feasible, a lower

hammer energy (i.e., change from most efficient to minimum effective), if practicable, would be implemented⁹.

- a) If pile driving is not shutdown when a marine mammal has been detected within the applicable shutdown zone, the hammer energy will be reduced to the lowest level practicable and the reason(s) for not shutting down will be documented and reported to NMFS-OPR in the applicable monitoring reports (e.g., weekly, monthly) as described below in Section 5.7, 5.12, and 5.13.
- 3) Bubble curtain and compressor sensor monitoring will take place throughout the piling process. If bubble curtain sensors indicate that pressure or flow rates have changed and are not sufficient to maintain the 10 dB attenuation levels, the OCM will be notified and a shutdown in piling operations will be implemented, if it is safe to do so (see above). Pile driving will not restart until the bubble curtain or its compressor(s) are repaired and full functionality verified.
 - a) Bubble curtain performance will be monitored by confirming that the compressors are delivering the minimum required air flow rate of $0.5 \text{ m}^3/(\text{min} \cdot \text{m})$ at the compressors outlet. With this minimum air flow rate, the bubble curtain's noise attenuation capability of 10 dB will be achievable. This flow rate will be logged and included within a DBBC daily report.
- 4) After a shutdown, impact pile driving may restart when:
 - a) The animal (other than a NARW) has been observed voluntarily departing and outside the relevant clearance zone;
 - b) There have been no visual or acoustic detections for 15 minutes for odontocetes (excluding sperm whales) and pinnipeds, and 30 minutes for sperm and baleen whales (including the NARW), and sea turtles;
 - c) Visibility improves such that the relevant Clearance Zones are fully visible and clear of marine mammals and sea turtles for at least 60 minutes immediately prior to restart of impact pile driving.
- 5) If pile driving is shut down for less than 30 minutes and all visual and acoustic monitoring has been maintained continuously throughout the shut down period, pile driving may begin immediately without clearance watch and soft start procedures.
- 6) If pile driving is shut down for a period longer than 30 minutes, all clearance and soft start procedures will be followed, unless not technically feasible to do so.
 - a) If this is the case, pile driving will restart using hammer energies no more than the minimum amount of hammer energy than Sunrise Wind determines necessary to advance the pin pile without causing damage to the hammer.
- 7) As per LOA Condition 3(c)(4), initiation of a pile may occur no earlier than one hour after civil sunrise. However, if pile driving is shut down for darkness (nighttime), Sunrise Wind will assess the weather conditions for the rest of the night and the following daylight period. If weather conditions are forecast to worsen before daylight and cause an imminent or loss of life to an individual or risk of damage to a vessel that creates risk of injury or loss of life for individuals, or the OCM determines there is a risk of pile refusal, Sunrise Wind will initiate soft-start procedures and conduct pile

⁹ The hammer energy and strike rate are inversely related. By reducing the hammer energy, the strike rate will increase and to reduce the strike rate, the hammer energy will need to be increased. Therefore, by reducing the hammer energy the amount of blows per meter will increase thus resulting in an increase in the total exposure period.

installation overnight to maintain feasibility for complete pile installation. Monitoring during clearance and piling would be conducted as described in Section 3.6.

- 8) Any disagreements between the Lead PSO, PAM operator, and the activity operator regarding delays or shutdowns will only be discussed after the mitigative actions (as described above) have occurred.

3.5.5 Pauses and Silent Periods

- 1) The visual clearance and shutdown zones will be continuously monitored by PSOs and PAM operators during any pauses in pile driving in a given day. Monitoring will restart on any subsequent day of pile driving as described in Section 3.5.2.
- 2) If an animal is sighted within the applicable visual clearance zone or a NARW is visually sighted at any distance or acoustically detected on any PAM buoy within the 10 km PAM Clearance/Shutdown zone during a pause in piling, activities will be delayed until the animal(s) has moved outside the clearance zone (other than NARW) and no animals have been detected within their respective clearance zones for a period of 15 minutes for odontocetes (excluding sperm whales) and pinnipeds and 30 minutes for sperm and baleen whales (including NARW), and sea turtles.

3.5.6 Post-Piling Monitoring

- 1) PSOs will continue to monitor using visual and acoustic protocols throughout the pile installation and for a minimum of 30 minutes after piling has been completed.

3.6 Daytime Reduced Visibility Alternative Monitoring Plan

Pile driving may not be initiated at any time during daytime when the relevant minimum visibility zone is not fully visible (e.g., due to rain, fog etc.). As per LOA Condition 3(c)(4), initiation of a pile may occur no earlier than one hour after civil sunrise and no later than 1.5 hours before civil sunset. This Daytime Reduced Visibility Monitoring Plan is not intended to be used when the minimum visibility zone cannot be collectively cleared by PSOs for at least 60 minutes immediately prior to piling (e.g., at night). As per COP Condition 10.5.2, if daylight is insufficient, the on-duty Lead PSO will call for a delay in pile driving until the relevant minimum visibility distance can be monitored in all directions.

This Daytime Reduced Visibility Monitoring Plan will be used to monitor the relevant shutdown zone(s) in cases where piling has begun during suitable daytime visual conditions, soft start has been completed, but then visibility conditions become reduced to less than the minimum visibility distance and stopping operations represents a risk to human health, safety, and/or risk of pile refusal. Under such circumstances, all visual monitoring protocols described in Section 3.5 and PAM monitoring as described in the *OCS-DC PAM Plan* will be implemented with the additional utilization of alternative monitoring technology (e.g., infrared cameras [IR]) to monitor for marine mammals and sea turtles (described in the following paragraphs). A map showing the large whale (non-NARW) shutdown zone as well as the PSO vessels path at a representative OCS-DC location is shown in Figure 4. The visual effective range applicable during periods of reduced visibility will vary based on the environmental conditions as well as which tools the PSOs determine to be the most reliable for monitoring marine mammals and sea turtles in those conditions. Therefore, the effective range shown in Figure 4 may not be representative of the effective range during periods of reduced visibility. The shutdown zone distance for an OCS-DC jacket foundation installation in the summer is 5,600 m and 5,300 m assuming sequential and concurrent foundation installation, respectively (Table 4 and Table 6). Recording of marine mammal sightings and notifications to other PSOs during reduced visibility conditions will occur in the same manner as

described for daytime periods in Section 3.8 and Section 3.9. Any detections within or near the shutdown zone will be communicated directly to the on-duty PSOs on the installation vessel (through mobile phone via WhatsApp, Microsoft Teams/computer, or other immediate communication method) so that any necessary mitigation actions can be implemented in a timely manner.

During daylight pile driving operations, there will be a minimum of one vessel-mounted thermal camera on every vessel, supplied by Current Corporation. Two Current Corporation NN3050 cooled camera system(s) will be outfitted on the installation vessel, with 100% redundancy. The two PSO vessels will have a single mounted Current Corporation NN3050 cooled mounted system. The technical specifications of the cameras are provided in Table 13. Additional estimates on the available field of view (FOV) as a percentage of a full 360° FOV for the IR cameras on the installation vessel and other PSO vessels are provided in Table 11 and Table 12 respectively. The NN3050 Current Corporation camera was tested in the field during two separate trials in 2022. The field study results from ThayerMayhan (2023) present effective ranges for two camera systems included in shoreside testing where cameras were mounted 11 m ASL and for offshore testing from a vessel where the three IR cameras were mounted 13–14 m ASL. The results of these tests showed the thermal IR cameras to be capable of effective detection of large whale blows out to distances of 1–2 km at night in good visibility conditions (little to no fog, Beaufort Sea state less than 4) (ThayerMahan 2023). Based on comments received from agencies regarding the results in ThayerMahan (2023), the effectiveness of the cooled IR camera system was 1.5 km. The two dedicated PSO vessels will each travel along a circular path around the installation vessel at a distance of 2.5 km from the OCS-DC jacket foundation. The cooled camera systems will be able to detect out to 1.5 km towards the 3.7 km and 3.5 km minimum visibility zone for sequential and concurrent installation respectively. Through the combined use of the cooled camera systems located on the installation and PSO monitoring vessels, effective monitoring of the entire minimum visibility zone for summer piling installation assuming sequential and concurrent foundation installation respectively (3.7 km and 3.5 km) will be achieved. Therefore, Sunrise Wind expects coverage beyond the indicated 180° coverage given the overlap between the two IR cameras mounted on the installation vessel as well as the cameras onboard the PSO monitoring vessels.

Thermal IR cameras are not expected to be as effective in detecting whale blows at the same distances during moderate to dense fog or in high sea states. Therefore, the first priority during periods of moderate to dense fog or in high sea states will be to implement a shutdown of pile driving activities. However, in rare cases where pile driving must continue during reduced visibility conditions the Lead PSO on duty will determine whether or not the amount of fog or elevated sea states is affecting their ability to detect whale blows using the IR cameras. Should this determination be made, the on-duty Lead PSO will then decide which method (unaided eye or IR) provides the most effective observations under the current conditions and PSOs will use that method during continued periods of observation. The most effective monitoring method will continue to be evaluated as visibility conditions change.

As described in Section 3.3, no impact pile driving is planned for the month of December through April, however, installation in December may only occur upon NMFS approval, in the case of unexpected delays. If Sunrise Wind requests NMFS approval for OCS-DC jacket installation in December due to unexpected delays, Sunrise Wind will provide an amended OCS-DC PDMP that covers winter pile driving, including further detail surrounding the PSO vessel configuration to monitor the 4,100 m and 4,000 m minimum visibility zone assuming sequential and concurrent foundation installation, respectively.

Table 13. Specifications of the Current Corporation, Inc. thermal cameras.

Key factors	NN3050
Type of sensor	Cooled Mid Wave Infrared (MWIR), 3-5 μ m
Sensor Resolution	640x512 pixels, 30fps
Wavelength	3-5 μ m
Optics Field of View (FOV)	28° (wide) to 2° (narrow)
Zoom	30x optical zoom
360° visual scan	Yes
Testing standard	(Military standard) MIL-STD 810 & MIL-STD-461
Stabilization	3 axis gyro stabilization ² c./w. enhanced video stabilization

Each vessel will have a minimum of one NN3050 vessel mounted thermal camera monitored by a PSO should piling activity occur during daylight periods of reduced visibility. The NN3050 thermal camera will be mounted at approximately 8 m ASL on the two PSO vessels. The installation vessel will have two thermal NN3050 cameras installed on opposite corners of the main deck (port and starboard stern corners). Camera mounts will be at a minimum of 16m ASL. Having the two cameras mounted on opposite corners of the vessel provides optimized coverage in all directions, with minimal obstructions from the vessel structure or deck equipment. Each camera provides an estimated 220 degrees field of view (60% coverage) for a cumulative observation coverage of approximately 90%.

The standard monitoring procedure for the cameras on the installation vessel will be for the cooled cameras to be monitored by one PSO while the other two PSOs continue monitoring from the bridge wings. One of the bridge wing PSOs will use NVDs (PVS-14 Gen 3 Autogated Pinnacle - White Phosphor - Night Vision), handheld thermal monoculars (640 x 512 VOx Microbolometer), (or the unaided eye, as appropriate based on the amount of vessel lighting present) to monitor primarily for sea turtles since they are less likely to be detected by the IR camera while the other PSO will monitor using the unaided eye. However, when the on-duty Lead PSO determines that the bridge wing observers are no longer effective due to environmental conditions, one bridge wing PSO will move to a cooled thermal camera while the other continues to monitor for sea turtles using whichever monitoring method (NVD or TI) is determined to be the most effective under the current conditions. While it is unlikely that pile driving operations will continue into nighttime hours, that is the only time NVDs will be utilized based on the ambient light restrictions for this type of technology. In the unlikely event that pile driving commences prior to 1.5 hours prior to civil sunset and the circumstances warrant continued activity into nighttime hours NVDs would be used by the bridge wing PSO to supplement cooled thermal camera monitoring.

The standard monitoring procedure for the cooled camera on the PSO monitoring vessels will be for two PSOs to monitor from the bridge wings, one of which will use NVDs (PVS-14 Gen 3 Autogated Pinnacle - White Phosphor - Night Vision), handheld thermal monoculars (640 x 512 VOx Microbolometer), (or the unaided eye, as appropriate based on the amount of vessel lighting present) to

monitor primarily for sea turtles and the other will monitor using the unaided eye. The third PSO will monitor the cooled IR camera. If the on-duty Lead PSO determines that the bridge wing observers are no longer effective due to reduced visibility conditions, one PSO will continue monitoring for sea turtles using whichever monitoring method they determine to be most effective under the current conditions, while the other PSO assists in monitoring and/or data entry for the PSO monitoring the cooled camera system. While it is unlikely that pile driving operations will continue into nighttime hours, that is the only time NVDs will be utilized based on the ambient light restrictions for this type of technology. In the unlikely event that pile driving commences prior to the 1.5 hours prior to civil sunset and the circumstances warrant continued activity into nighttime hours NVDs would be used by the bridge wing PSO to supplement cooled thermal camera monitoring.

While using two cooled (NN3050) IR cameras on the installation vessel and a single cooled IR camera on the PSO monitoring vessels, the PSO monitoring each camera will control the pan rate such that it moves steadily back and forth across the 180° sector at a slow enough rate to avoid blurring the image. As described above, Sunrise Wind expects coverage beyond the indicated 180° FOV for each of the two cameras given the overlap between the two IR cameras on the installation vessel as well as the NN3050 on board each of the PSO monitoring vessels. This overlap will provide coverage of the 3.7 km and 3.5 km clearance zone(s) as described above. Additionally, the three PSOs stationed on the PSO vessels will each be responsible for monitoring a 120-degree sector of the FOV with unaided eye and reticle binoculars which will provide additional coverage inside the clearance zone towards the installation vessel as well as beyond the clearance zone away from the jacket foundation.

The pan rate of the IR cameras (NN3050) is designed at 30f panning speed to avoid motion blur (Table 13). The FOV is 63° to 2.3° for the NN3050 thermal camera (Table 13). The NN3050 cooled cameras will have a sensor resolution of 640x512 pixels (Table 13). Current Corporation IR camera data is collected in combination with H.264 Codec image compression software. This is a low-loss-high-resolution data compression package for monitoring of camera imagery by PSOs viewing a large HD monitor. Motion blur will be continually assessed by PSOs throughout periods of monitoring and the pan rate will be adjusted as necessary to maximize coverage based on environmental conditions at that time, location of additional PSO monitoring effort on other vessels, and any ongoing protected species detection events. Additionally, the camera systems (NN3050) include a mechanical stabilizing mechanism (Gyro stabilization) which increases the reliability of the footage in offshore conditions when movement is inevitable (helping to reduce motion blur).

If a potential detection is made the PSO will stop panning and, if possible, zoom in on the potential detection to improve detection and classification of the object. If the object is determined to be a protected species, all available methods will be used to determine the distance to the animal(s) and whether they are inside or outside of the relevant mitigation zone. If the PSO is unable to confirm the animal(s) are outside of the relevant mitigation zone, a conservative approach to calling for mitigation (delay or shutdown) will be used by the PSO. The PSO training emphasizes the importance of taking such a conservative approach to calling for mitigation (delay or shutdown) if an animal's estimated range is close to the mitigation boundary. Once the appropriate mitigation is called for, the PSO will then follow the same data recording and sighting communications protocols for daytime monitoring described in Sections 3.8 and 3.9. If the object is determined not to be a protected species, then the PSO will return the camera to the systematic panning method previously described. The planned IR cameras do not include automated detection software for highlighting potential objects of interest to PSOs so they will continuously monitor the video feed from their camera while on duty, except for brief periods of time required to record effort and

sighting data. If a PAM localization is made, PSOs conducting IR monitoring will use *Mysticetus* or similar data collection tool to determine in which sector the protected species may be located. The PSO responsible for monitoring that sector will focus their monitoring in the area indicated by the PAM localization. As the vessel continues the circular path around the installation site and the sector where the PAM localization was made the PSO will pass responsibility for monitoring in the area of the PAM localization to the next PSO responsible for that area via WhatsApp on a mobile phone or the Teams Application on a computer. WhatsApp and Teams messaging communications are instant. If these two methods of communication fail, PSOs will remain in contact with vessel-based operators using the vessel's radio.

For each detection made, Sunrise Wind will document the range to target, FOV, mounting height, environmental conditions including BSS, and degree of fog/humidity/inclement weather. Sunrise Wind will use all available data to summarize the distances of detections made using the IR cameras and, to the extent feasible based on the available sample size, will produce a detection function. The summary and analysis will be provided to NMFS within the annual report (as described in Section 5.13).

3.7 Nighttime Monitoring Plan

All OCS-DC jacket foundation pile driving is planned to occur during daytime. Therefore, the Sunrise Wind *Nighttime Monitoring Plan for Pile Driving* does not include any measures to be implemented during OCS-DC jacket foundation pile driving intentionally initiated during periods of darkness.

3.8 Data Collection

3.8.1 Visual PSOs

3.8.1.1 Monitoring Effort, Sightings, and Operations

For all visual monitoring efforts and protected species sightings, the following information will be collected by PSOs. A sequential identification number (ID) unique to each vessel will be assigned to each new marine mammal sighting with multiple sightings of the same animal or group given the same ID. The following information will be collected for each sighting as soon as possible:

- Date and time the monitored activity begins or ends;
- Construction activities occurring during each observation period;
- Watch status (i.e., sighting made by PSO on/off effort, opportunistic, crew, alternate vessel/platform);
- PSO who sighted the animal (last, first) and number of PSOs on watch;
- Date and Time of start and end of sighting (YYYY-MM-DD, hh:mm:ss (UTC)) and duration of observation;
- Weather parameters (e.g., wind speed (knots), wind direction, percent cloud cover, visibility (km), precipitation, glare);
- Water conditions (Beaufort Sea state, tidal state including swell height (m), swell height (meters), water depth (m));
- Identification of the animal(s) with degree of certainty (i.e., genus/species, lowest possible taxonomic level, or unidentified); also note the composition of the group if there is a mix of species;

- Pace of the animal(s);
- Estimated number of animals (minimum/maximum/high/low/best);
- Estimated number of animals by cohort (e.g., adults, yearlings, juveniles, calves, group composition);
- Description (i.e., as many distinguishing features as possible of each individual seen, including length, shape, color, pattern, scars or markings, shape and size of dorsal fin, shape of head, and blow characteristics);
- Whether or not there was a corresponding PAM detection;
- Description of behavior (e.g., such as feeding or traveling), including an assessment of behavioral responses thought to have resulted from the activity (e.g., no response or changes in behavioral state such as ceasing feeding, changing direction, or breaching). If the animal is bow-riding, record duration;
- Animal's closest distance (reticle distance in meters) from the pin pile being driven and estimated time spent (time entering and leaving (UTC HH:MM) and seconds duration) within the potential injury zone, behavioral harassment zone, and/or shutdown zone (specify radius in m) as well as closest distance from observation vessel if different (reticle distance in meters) and times when these closest approaches occurred (UTC HH:MM);
- Distance (meters) and bearing (relative to ship heading or "clock face") to each animal observed and the animal's direction of travel (relative to vessel as well as initial and final heading in degrees);
- Construction activity at time of sighting (i.e., impact pile driving), use of any NAS, and specific phase of activity (e.g., soft start, active pile driving, etc.). If observed during soft start, record first, closest and last distance as well as behavior at final detection;
- Use of any noise attenuation device(s);
- Specific phase of activity (soft-start for pile driving, active pile driving);
- Description of any mitigation-related actions implemented, or mitigation-related actions called for but not implemented, in response to the sighting (e.g., delay, shutdown, etc.) and time and location of the action;
- Location of observer (latitude and longitude in decimal degrees) and compass heading of vessel (degrees);
- Animal occurrence within potential injury or behavioral harassment zones;
- Other human activity in the area;
- Other applicable information as required in the LOA.

3.8.1.2 NARW Observations (visual and acoustic)

If a NARW is sighted with no visible injuries or entanglements by PSOs, the following information will be recorded (in addition to the information described in section 3.8.1.1) and the sighting will be reported immediately as described in Section 5.4:

- Time (UTC, EST), date (MM/DD/YYYY), and location (latitude/longitude in decimal degrees, coordinate system used) of the observation;
- Number of whales;
- Animal description/certainty of sighting (provide photos/video if taken);
- Lease Area/project name;
- PSO/personnel name who made the observation;
- PSO provider company (if applicable); and;

- Reporter's contact information;
- Confirmation the sighting was reported to the respective hotline;
- The vessel/platform from which the sighting was made;
- Activity the vessel/platform was engaged in at time of sighting;
- Project construction and/or survey activity at the time of sighting;
- Distance from vessel/platform to sighting at time of detection;
- Closest point of approach of whale to vessel/platform;
- Vessel speed; and,
- Any mitigation actions taken in response to the sighting.

If a NARW is acoustically detected, all NARW detections within a 24-hour period will be reported into a single spreadsheet (<https://www.fisheries.noaa.gov/resource/document/template-datasheet-real-time-north-atlantic-right-whale-acoustic-and-visual>) and reported to NMFS within 24-hours as described in Section 5.4.

3.8.1.3 Large Whale Detection during Vessel Transit

If an observation of a non-NARW large whale occurs during vessel transit, Sunrise Wind will collect and report the time, date, and location of the sighting through the WhaleAlert app as soon as possible but within 24 hours as described in 5.3.

3.8.1.4 Injured or Dead Protected Species

In the event that personnel involved in the Project discover a stranded, entangled, injured, or dead protected species, Sunrise Wind will collect the following data and report the sighting as described in Section 5.5:

- Contact (name, phone number, etc.);
- Time, date, and location (latitude/longitude in decimal degrees) of the first discovery (updated location information if known and applicable);
- Species identification (if known) or description of the animal(s) involved;
- Condition of the animal(s) (including carcass condition if the animal is dead);
- Observed behavior of the animal(s), if alive;
- If available, photographs or video footage of the animal(s); and,
- General circumstances under which the animal was discovered.

In the event that a protected species is injured (non-auditory injury) or killed as a result of Project activities, Sunrise Wind will collect the following information and report the event as described in Section 5.5:

- Time, date, and location (latitude/longitude in decimal degrees) of the incident;
- Species identification (if known) or description of the animal(s) involved;
- Vessel size and motor configuration (inboard, outboard, jet propulsion);
- Vessel's speed leading up to and during the incident;
- Vessel's course/heading and what operations were being conducted (if applicable);
- Status of all sound sources in use (if applicable);
- Description of avoidance measures/requirements that were in place at the time of the incident and what additional measures were taken, if any, to avoid the incident;
- Environmental conditions (e.g., wind speed and direction, Beaufort sea state, cloud cover, visibility) immediately preceding the incident;

- Estimate size and length of the animal that was injured or killed;
- Description of the behavior of the animal immediately preceding and following the strike;
- Estimated fate of the animal (e.g., dead, injured but alive, injured and moving, blood or tissue observed in the water, status unknown, disappeared); and,
- To the extent practicable, photographs or video footage of the animal(s).

3.8.1.5 Data Collection Software

Mysticetus or similar data collection software will be used by all PSO and PAM Operators aboard Project vessels to collect and share operational, monitoring effort, and species detection data. In addition to the data summarized above, the following project information will be captured:

- Project Name;
- Lease number;
- State coastal zones;
- PSO contractors;
- Vessel Names;
- Reporting dates (YYYY-MM-DD);
- Visual monitoring equipment used (e.g., bionics, magnification, IR cameras etc.);
- Distance finding method used;
- PSO names (Last, First) and training;
- Observation height above sea surface (m).

The following operational information will also be captured in *Mysticetus* or similar data collection tool:

- Date (YYYY-MM-DD);
- Hammer type used (make and model);
- Greatest hammer power used for each pile (kJ);
- Pile identified and pile number for the day (e.g., pile 2 and 3 for the day);
- Pile diameters (m);
- Pile length (m);
- Total number of strikes used to install each pile;
- Total hammer energy used to install each pile;
- Pile locations (latitude and longitude);
- Number of vessel transits;
- Types of vessels used;
- Vessel routes used.

The following monitoring effort information will also be captured:

- Date (YYYY-MM-DD);
- Noise source (ON = Hammer on; OFF = Hammer off);
- PSO name(s) (Last, first);
- If visual, how many PSOs on watch at one time;
- Time pre-clearance visual monitoring began and ended (UTC, HH:MM);
- Time pre-clearance PAM monitoring began and ended (UTC, HH:MM);
- Duration of clearance PAM and visual monitoring (MM:SS);

- Time power-up/ramp-up began and reached full power or ended (UTC, HH:MM);
- Duration of power-up/ramp-up (MM:SS);
- Time pile driving began (hammer on) and ended (hammer off) (UTC, HH:MM);
- Duration of hammer activity (MM:SS);
- Duration of visual detection;
- Wind speed (kts), from direction
- Environmental conditions such as: swell height (m), water depth (m), visibility (m), glare severity;
- Latitude (decimal degrees), longitude (decimal degrees);
- Compass heading of vessel (degrees);
- Beaufort scale;
- Precipitation;
- Cloud cover (%);
- Whether a shutdown or power-down occurred;
- Time shutdown was called for (UTC);
- Time equipment was shut down (UTC);
- Habitat or prey observations.

3.9 PSO Communication Plan

Communications are of utmost importance when conducting multi-vessel operations and monitoring. As such, Sunrise Wind will ensure communication channels between the PSOs, the OCM, and vessel masters on all applicable vessels are established and maintained prior to and during all vessel movements and pile driving events. Communication and decision tree flowcharts are provided below for specific protected species observations from any Project vessels (Figure 5), pile driving clearance (Figure 6), and during active pile driving (Figure 7).

The on-duty Lead PSO who will act as the main point of contact for the OCM, who will be situated on the bridge of the installation vessel. The Lead PSO(s) will be on the same vessel with the OCM and will have direct contact with the OCM throughout the piling process. PSOs will use mobile phones using WhatsApp, or the Teams Application on a computer for communication with the OCM. Additionally, all project personnel (e.g., PSOs, PAM operators, vessel captains, OCM) will have VHF radios and will use a dedicated channel outside the standard marine communications channels should communication via WhatsApp or the Teams Application fail. Additionally, all detections will be reported on *Mysticetus* or similar data collection tool and all PSO and non-PSO vessel with displays will receive the location of each detection. All PSO alerts, including visual and acoustic detections, will be transmitted via the radio channel for situational awareness and preparation for any mitigation activities.

For detections that trigger mitigation actions, only the on-duty Lead PSO will recommend to the OCM what mitigation action should be taken. The OCM will be responsible for deciding if a shutdown or delay in operations is safe and technically feasible. All PSOs/PAM Operators will communicate directly with the on-duty Lead PSO for discussion with the OCM. The OCM will verbally confirm and authorize the shutdown or delay and the on-duty Lead PSO will record the interaction.

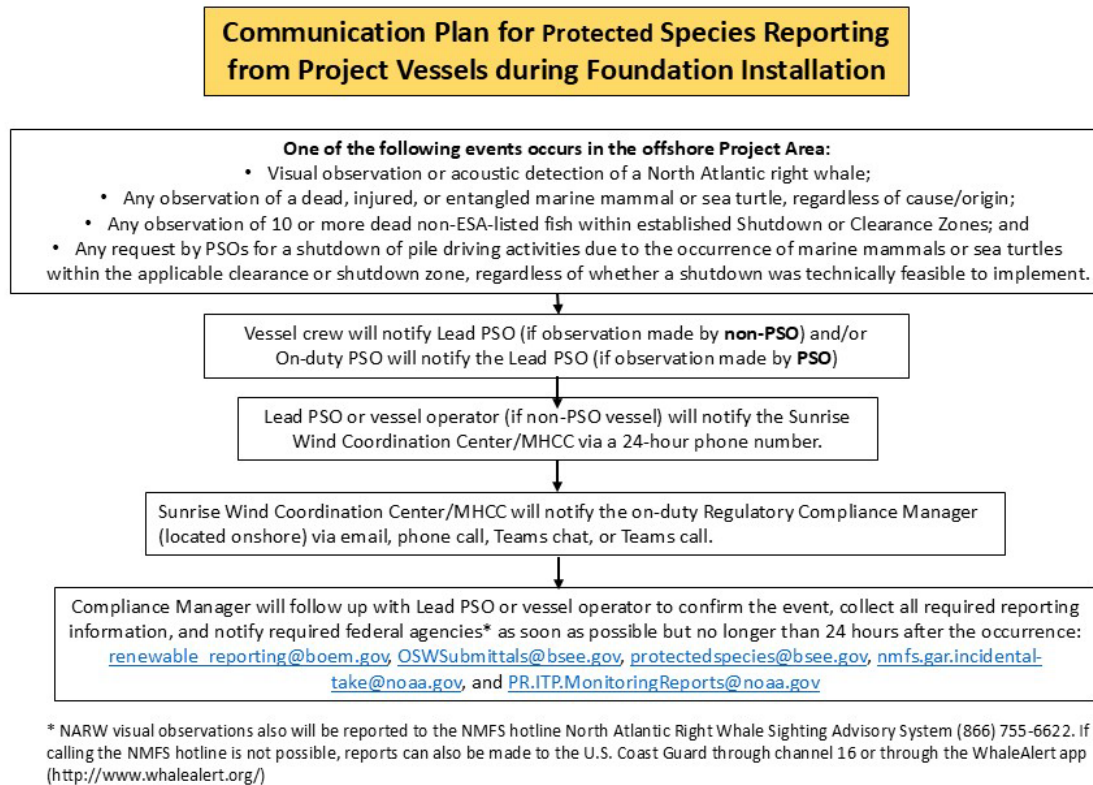


Figure 5. Communication flowchart for detection of certain protected species and mitigation events from Project vessels.

In the event that a shutdown is called for, the OCM must evaluate the penetration depth of the pile in relation to the known soil data and the pile's hammer/progress logs to determine risk of refusal and shutdown/reduction feasibility (as described in Section 3.5.4). If a mitigation action requested by the on-duty Lead PSO is not implemented due to safety or other allowable circumstances or a reduction in hammer energy is implemented, the general information will be relayed from the OCM to the on-duty Lead PSO who will note the information in their report. A separate report will be produced by the OCM and offshore construction staff detailing the reasoning behind the inability to shutdown (as described in 5.6).

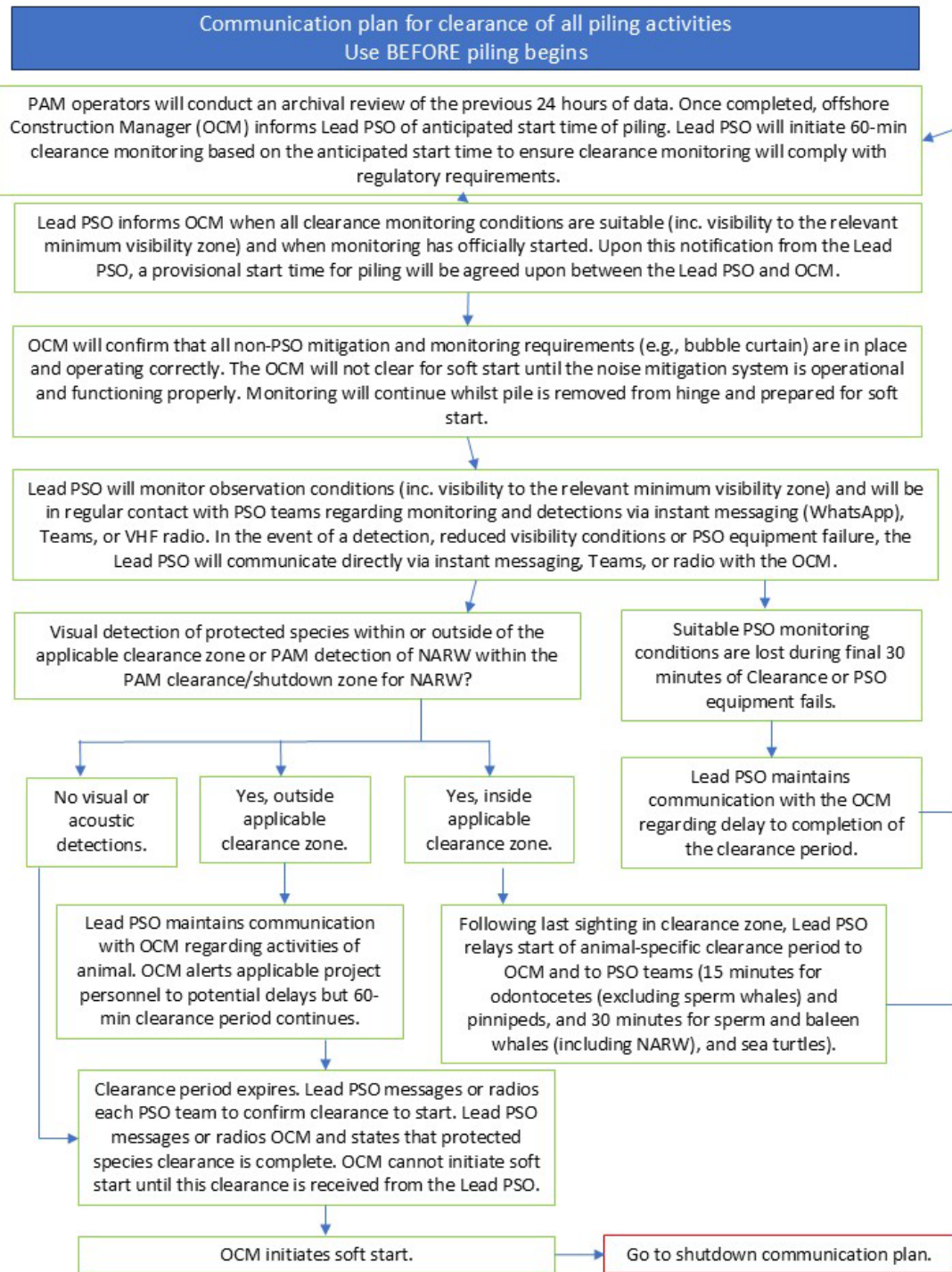
In the event that a reduced hammer energy is called for, the OCM must evaluate the penetration depth of the pile in relation to the known soil data and the pile's hammer/progress logs to determine risk of refusal and shutdown/reduction feasibility (as described in Section 3.5.4). If a mitigation action requested by the on-duty Lead PSO is not implemented due to safety or other allowable circumstances or a reduction in hammer energy is implemented, the general information will be relayed from the OCM to the on-duty Lead PSO who will note the information in their report. A separate report will be produced by the OCM and offshore construction staff detailing the reasoning behind the inability to reduce hammer energy (as described in 5.6).

Each PSO vessel will be outfitted with Starlink broadband internet with dedicated networks for the PSOs/PAM operators and acoustic reporters to provide reports efficiently. Additionally, each vessel will be provided a dedicated PSO laptop with access to a shared mailbox and Microsoft Teams channel. The PSOs and PAM operators will also be provided a VHF radio and iridium satellite phone for onshore and offshore connections should the internet go down. All sightings and mitigation data will also be input into *Mysticetus* or similar data collection tool by dedicated watch, PSOs and PAM Operators on all Project vessels. The PAM buoys will be on their own network therefore, they will not be reliant on any offshore internet availability.

Each SeaPicket system detects acoustic signals using a 32-channel linear acoustic array. The received signals undergo onboard processing with relevant data then transmitted every five minutes or less to the shoreside ThayerMahan Command Center via Starlink satellite communication. In the event Starlink communication fails a secondary broadband global area network (BGAN) antenna will transmit relevant data back to the operations center. The onboard processing will include classifiers specifically developed to identify the NARW upcall and humpback whale calls. Autodetection classifiers for other additional species are in development and will be used as they become available. Using a web-based interface, ThayerMahan PAM operator(s) will be on duty shoreside in the ThayerMahan Command Center to review and analyze incoming data. The SeaPicket operator(s) will classify and tag detection data using a hierarchy to create contact/detection reports and discuss any uncertainties with the on-duty PAM Operator to ensure potential call detects are not missed as described in Section 1.3.1 of the *OCS-DC PAM Plan*. As soon as a detection report for a marine mammal is available it will be entered or automatically pushed into the data collection software system (*Mysticetus* or similar software) cloud database. The vessel-based computers running *Mysticetus* or similar software automatically sync to the cloud resulting in the acoustic detections becoming visible to the vessel-based PSOs on a map display. The NMFS-approved PAM operator will review potential detections and conduct data recording, mitigation and monitoring decision making and direct communications to the on-duty Lead PSO (located on the installation vessel) required of PAM operators via Teams and the data collection software system (i.e., *Mysticetus* or similar system). The on-duty Lead PSO will assess the information provided and will take the necessary mitigation actions.

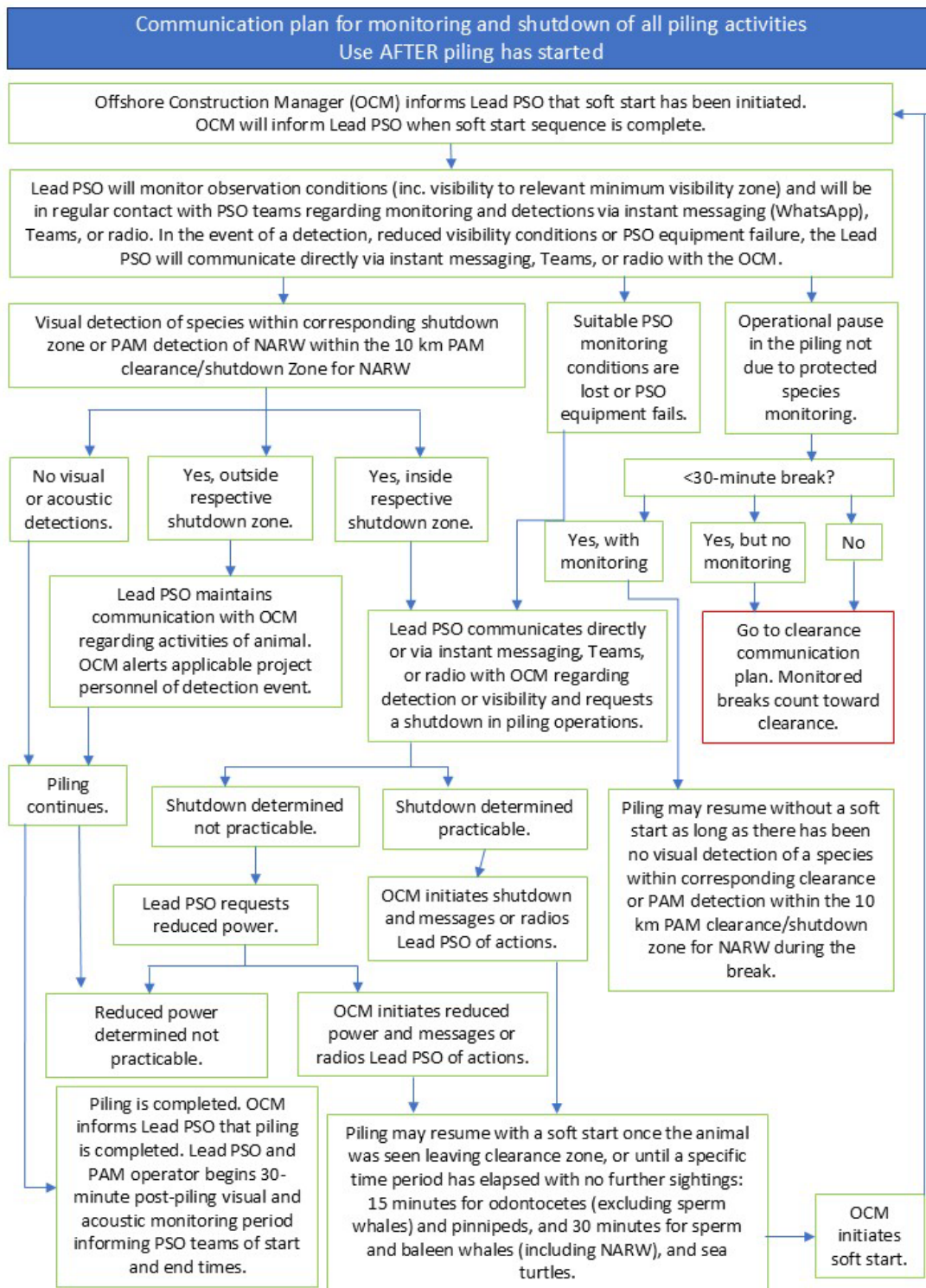
The duration of time from when a call is received by the SeaPicket system to when it can be reviewed by a PAM operator is less than 10 minutes and typically 4 – 7 minutes. Additional details describing the time required for potential marine mammal calls to be transmitted, reviewed, and communicated to the on-duty Lead PSO (via phone, Microsoft Teams, VHF radio, or iridium satellite

phone (as back-up)) are provided in Appendix D to the OCS-DC PAM Plan.



1. All detections will be relayed to the Lead PSO and to the OCM and throughout the project vessels
2. Last sighting refers to the most recent, or latest detection within the clearance zone which will initiate a restart of delay timing
3. Any mitigation measures requested by the Lead PSO will be followed up by communication from the OCM indicating compliance with the mitigation request or details regarding why a request could not be implemented. The PSO will record the event and if mitigation was not implemented. A follow up report will be provided by the OCM with specific details about the event and its conditions that lead to mitigation not being implemented.

Figure 6. Clearance communication flowchart and decision tree.



1. All detections will be relayed to the Lead PSO and to the OCM and throughout the project vessels
2. Any mitigation measures requested by the Lead PSO will be followed up by communication from the OCM indicating compliance with the mitigation request or details regarding why a request could not be implemented. The PSO will record the event if mitigation was not implemented. A follow up report will be provided by the OCM with specific details about the event and its conditions that lead to mitigation not being implemented.

Figure 7. Communication flowchart and decision tree during pile driving

4 Noise Abatement System (NAS)

As per LOA condition 3(c)(6), Sunrise Wind will deploy at a minimum, a double big bubble curtain that reduces noise levels to the modeled harassment isopleths, assuming 10 dB attenuation during all OCS-DC jacket foundation pile driving. A DBBC will be employed during the installation of the OCS-DC jacket foundation. The hoses will be flushed out prior to informing the installation vessel that the DBBC is operational.

The DBBC consists of 2 big bubble curtains (BBCs) comprising nozzle hoses with lengths of:

- BBC 1: 630 m (inner ring) set at 100 m from the jacket centroid, and
- BBC 2: 960 m (outer ring) set at 150 m from the jacket centroid.

The inner and outer BBCs will be deployed as a set at the OCS-DC location by the nozzle hose deployment vessel (NHDV) and will be supplied with compressed air to maintain a 2-layer bubble curtain around the OCS-DC jacket foundation. The DBBC will be pre-installed before jacket piling, the DBBC will be pressurized from the vessel at a level designed to reduce, to the maximum extent practicable, hammering noise that propagates through the water column. The Free Air Delivery (FAD) supplied on the DBBC during piling operations is greater than $0.5 \text{ m}^3/(\text{min} \times \text{m})$. Therefore, the total air supplied to the DBBC would be greater than $795 \text{ m}^3/\text{min}$ for the given hose lengths. If the DBBC is installed without use for 72 hours, the system will be fully pressurized. During this time the bubble rings will be monitored at the surface to verify correct layout and positions and to observe a uniform and constant flow. Should any gaps or irregularities be observed, the hoses will be retrieved, thoroughly inspected, and re-deployed. Similarly, if the DBBC is installed without use for 96 hours, the hose pressure test will be performed and if anomalies are noted in the DBBC, the hoses will be retrieved, thoroughly inspected, and re-deployed.

There will be one set of DBBC hoses (one set = inner and outer hose) onboard the noise mitigation vessel; this set will be operational. There will also be sufficient compressors onboard the noise mitigation vessel used to pressurize the combined DBBC including spares for redundancy. The water depth is 49m, therefore the pressure will be increased above 8 bars and the desired flow rate of $795 \text{ m}^3/\text{min}$.

A big bubble curtain is often described as 'far-field NAS' in the context of offshore impact pile driving and not necessarily from a strict acoustic propagation standpoint. The reason is it is placed at a distance from the source (foundation) that is often considered 'far field' in acoustics terminology. As stated in https://www.itap.de/media/experience_report_underwater_era-report.pdf page 30: 'The boundary between near and far field for underwater noise (hydro sound) is not exactly defined, but depends on the wavelength λ . In airborne sound, a value of $\geq 2\lambda$ is assumed. For underwater noise, values of up to $\geq 5\lambda$ can be found.' In accordance with LOA Condition 3(c)(6), construction contractors will train personnel to collect relevant data regarding the operation or maintenance of the deployed NAS (e.g., proper balancing of airflow to the bubble curtain ring, deployment accuracy of hose nozzles, maintenance record, etc.). Such data will be recorded by the Chief engineer on board the NAS deployment vessel. The Chief Engineer for the NAS will provide the works manager with verbal confirmation that the NAS is correctly operational so that the PSOs can begin watch. The reported data will be submitted to the OCM and the on-duty Lead PSO. The NAS report will be included in the daily construction report and will be included in the daily PSO reports. A full description of the NAS deployment, including equipment configurations that ensure connection to the seafloor, is provided in the Far Field Noise Mitigation Manual (Appendix A).

In accordance with LOA Condition 3(c)(6)(iv), the construction contractor will use a highly experienced NAS contractor with personnel who have deployed and managed NAS(s) on similar projects; all personnel from the NAS contractor will receive Sunrise Wind Environmental Awareness Training as required. The construction contractor will submit an inspection/performance report for approval by Sunrise Wind within 48 hours following an initial performance test conducted shortly after the NAS is fully operational and has been operating for at least 10 minutes; and any corrections to the NAS to meet the performance standards will occur prior to pile driving. The initial performance test will be performed once, before the Jacket IV positions itself for installation. The bubble curtain observations will indicate if there are any problems with the bubble curtain deployment. Sunrise Wind will provide NMFS-OPR, BOEM, and BSEE with a bubble curtain performance test and maintenance report to review within 48 hours after the installation of the entire OCS-DC jacket foundation using a bubble curtain is installed. Additionally, a full maintenance check (e.g., manually clearing holes) will occur prior to the OCS-DC jacket foundation being installed. Any corrections to the bubble ring(s) to meet the performance standards as described in LOA Condition (c)(6)(iv) will occur prior to impact pile driving of the OCS-DC jacket foundation. Any repairs or alterations will be included in the daily report and sent to NMFS-OPR, NMFS GARFO – PRD, BOEM and BSEE as described in Section 5.10. Prior to DBBC operations a number of quality checks will be performed to verify operational performance. This includes installation positions, air supply and pressure checks, and flushing out hoses. Additional details surrounding steps taken to ensure the DBBCs are operating at peak efficiency for each use are provided in Appendix A.

If any of the SFV measurements indicate distances to the isopleths corresponding to potential auditory (marine mammal and sea turtles)/physical (fish) injury and/or behavioral harassment thresholds are greater than the distances predicted by the modeling assuming 10 dB attenuation, Sunrise Wind will notify NMFS GARFO Protected Resources Division (NMFS GARFO – PRD), NMFS Office of Protected Resources (OPR), Bureau of Ocean and Energy Management (BOEM), and Bureau of Safety and Environmental Enforcement (BSEE) through TIMSWeb and at protectedspecies@bsee.gov via email.

5 Reporting

Sunrise Wind will use a standardized reporting system during the effective period of the Letter of Authorization (LOA). All data will be recorded using industry-standard software that is installed on field laptops and/or tablets (see Section 3.8). All reporting will comply with COP Approval, ITR, LOA and BiOp conditions. Sunrise Wind has the responsibility to meet all permit conditions. Contractor responsibilities are contractual commitments to Sunrise Wind that will allow compliance with permit conditions. Measures related to specific reporting circumstances are outlined in the following sub-sections below.

5.1 Training

5.1.1 Sunrise Wind Responsibilities

- Prior to initiation of OCS-DC jacket foundation installation, Sunrise Wind will demonstrate in a report submitted to NMFS-OPR (pr.itp.monitoringreports@noaa.gov) that all required training for Sunrise Wind personnel (including vessel crew, vessel captains, PSOs, and PAM operators) has been completed (ITR § 217.314 (c)(1) and LOA Condition 4(c)(1)).

5.1.2 Contractor Responsibilities

- The contractor will provide documentation of all personal training conducted by the contractor within 24 hours of training completion (Excel, word, or PDF format).
- Training certificates for the PSO and PAM personnel will be provided at least 90 days prior to the start of OCS-DC jacket foundation installation activity.
- Contractors will provide copies of PSO training documents to NMFS-OPR upon request.

5.2 Vessel Strike Reporting

Required reporting protocols surrounding vessel strike can be found within the stand-alone *Vessel Strike Avoidance Plan* originally submitted to NMFS-OPR for review on September 27, 2023 (revised August 20, 2024) and approved by NMFS OPR, NMFS GARFO – PRD, BOEM, and BSEE on September 10th, 2024.

5.3 Large Whale during Vessel Transit Reporting

If a non-NARW large whale is observed during vessel transit, the following reporting actions will be taken as described in LOA Condition (LOA Condition 4 (c)(17)(iii)).

5.3.1 Sunrise Wind Responsibilities

If a non-NARW large whale is observed during vessel transit, the following actions will be taken:

- Sunrise Wind will report the time, date, and location of the sighting through the WhaleAlert app (www.whalealert.org) as soon as possible but within 24 hours.

5.4 North Atlantic Right Whale Reporting

If a NARW is visually or acoustically detected by the PSOs or PAM operator on watch, the following reporting actions will be taken as described within LOA Condition 4(c)(17)(ii) and BiOp T&C 7 (b).

5.4.1 Sunrise Wind Responsibilities

If a NARW is sighted with no visible injuries or entanglement or is acoustically detected at any time by PSOs, PAM operators, or project personnel, the observation will be reported immediately (if not feasible, as soon as possible) and no longer than 24 hours after the initial sighting or acoustic detection. The visual sighting report will include the information described in Section 3.8.1.1 and 3.8.1.2. Reporting protocols will include the following steps:

- Download and complete the Real-Time North Atlantic Right Whale Reporting Template spreadsheet (<https://www.fisheries.noaa.gov/resource/document/template-datasheet-real-time-north-atlantic-right-whale-acoustic-and-visual>) for both visual sightings and acoustic detections. Save the spreadsheet as a .csv file and email it to NMFS NEFSC-PSD (ne.rw.survey@noaa.gov), NMFS GARFO-PRD (nmfs.gar.incidental-take@noaa.gov), and NMFS OPR (PR.ITPMonitoringReports@noaa.gov), BOEM (at renewable_reporting@BOEM.gov), BSEE (Submittal requirements to BSEE will follow reporting requirements under JOINT NTL 2023 -N01 Appendix B).
 - All NARW acoustic detections within a 24-hour period will be collated into one Real-Time North Atlantic Right Whale Reporting Template spreadsheet.

- If the sighting occurs within the Southeast (North Carolina through Florida) report via the Real-Time North Atlantic Right Whale Reporting Template and to the Southeast regional Hotline 877-WHALE-HELP (877-942-5343) with the information described in Sections 3.8.1.1 and 3.8.1.2
- If unable to report a sighting through the spreadsheet within 24 hours, call the relevant regional Hotline (Greater Atlantic Region [Maine through Virginia] Hotline (866-755-6622); Southeast Hotline (877-WHALE-HELP), with the observational information described in Section 3.8.1.1 and 3.8.1.2.
 - PAM detections are not reported to the Hotline.
- If unable to report via the template or the Regional NMFS Hotline, reports can be made through the WhaleAlert App (<http://www.whalealert.org/>). If this is not possible, reports can be made to the USCG through channel 16. The report to the USCG will include the same information as would be reported to the Hotline and described in Section 3.8.1.1 and 3.8.1.2.
 - PAM detections are not reported to WhaleAlert or the USCG.
- Sunrise Wind will submit a summary report to NMFS-OPR (PR.ITP.MonitoringReports@noaa.gov) and NMFS-GARFO (nmfs.gar.incidental-take@noaa.gov), and NMFS Northeast Fisheries Science Center (NEFSC) (ne.rw.survey@noaa.gov) within 24 hours including the data collection details described in Section 3.8.1.2

5.4.2 Contractor Responsibilities

- The Lead PSO will be notified of any visual or acoustic NARW detection(s);
 - Lead PSO will directly contact and notify the Sunrise Wind OCM (located on the same vessel as the Lead PSO) of the detection. As back up, the Lead PSO will contact the Sunrise Wind OCM using instant messaging, and/or a cell phone. If these methods fail, the Lead PSO will contact the Sunrise Wind OCM using the vessel's radio.
- The sighting information will be recorded as described in Section 3.8.1.1 as well as the following information recorded in *Mysticetus* or similar data collection tool:
 - Date, time (in ISO8601 units)
 - location in decimal degrees;
 - recording platform; and,
 - all required data (as shown in Section 3.8.1.5).
- The contractor will complete monthly NARW reporting using the NMFS Excel template (<https://www.ncei.noaa.gov/products/passive-acoustic-data> and <https://www.fisheries.noaa.gov/resource/document/passive-acoustic-reporting-system-templates>)
 - Monthly detection and reporting data for NARW on the NMFS NARW PAM reporting system website will be submitted to Sunrise Wind on the 12th of each month to allow review and submittal by Sunrise Wind by the 15th of each month (as required per LOA Condition 4(c)(7)).

5.5 Injured or Dead Protected Species Reporting

5.5.1 Sunrise Wind Responsibilities

- In the event that personnel involved in the Project discover a stranded, entangled, injured, or dead protected species (including sea turtle or sturgeon), the sighting will be reported immediately to the NMFS SAS hotline (marine mammals and sea turtles only). If in the Greater Atlantic Region (Maine through Virginia), call the NMFS Greater Atlantic Stranding Hotline (866-755-6622) and if in the Southeast Stranding Region (North Carolina through Florida) call the NMFS Southeast Stranding Hotline (877-WHALE-HELP (877-942-5343)). The stranding hotline may request the report be sent to the local stranding network response team. Or an alternative electronic reporting system as approved by NMFS stranding program, as well as the USCG. Staff responding to the hotline call will provide any instructions for handling or disposing of any injured or dead animals, which may include coordination of transport to shore, particularly for injured sea turtles.
 - Separately, Sunrise Wind will report the incident to NMFS-OPR (PR.ITP.MonitoringReports@noaa.gov) within 24 hours, and if in the Greater Atlantic Region (Maine – Virginia) to NMFS GARFO – PRD (nmfs.gar.incidental-take@noaa.gov) (by phone (marine mammals and sea turtles only) and email (marine mammals, sea turtle, and listed fish) (nmfs.gar.incidental-take@noaa.gov) or if in the Southeast Region (North Carolina through Florida) to the NMFS Southeast Regional Fisheries Office (SERO; secmammalreports@noaa.gov) as soon as feasible.
 - The report will include the information described in LOA Condition 4(c)(17)(iv) and Section 3.8.1.4 of this Plan.
 - BOEM (renewable_reporting@boem.gov), and BSEE (via TIMSWeb and notification email to protectedspecies@bsee.gov).
- If a protected species (including a sea turtle or sturgeon) is injured (non-auditory injury) or killed as a result of Project activities, the vessel captain or PSO on board will immediately report the incident to NMFS-OPR and GARFO, no later than within 24 hours.
 - If in the Greater Atlantic Region (Maine through Virginia), call the NMFS Greater Atlantic Stranding Hotline (866-755-6622), and if in the Southeast Region (North Carolina through Florida) call the NMFS Southeast Stranding Hotline (877-WHALE-HELP (877-942-5343)).
 - Separately, Sunrise Wind will report the incident to NMFS-OPR (PR.ITP.MonitoringReports@noaa.gov) within 24 hours, and if in the Greater Atlantic Region (Maine – Virginia) to NMFS GARFO – PRD (nmfs.gar.incidental-take@noaa.gov) (by phone (marine mammals and sea turtles only) and email (marine mammals, sea turtle, and listed fish) (nmfs.gar.incidental-take@noaa.gov) or if in the Southeast Region (North Carolina through Florida) to the NMFS Southeast Regional Fisheries Office (SERO; secmammalreports@noaa.gov) as soon as feasible.
 - The report will include the information described in LOA Condition 4(c)(17)(v) and Section 3.8.1.4 of this plan.
 - Activity operations will cease until NMFS-OPR is able to review the circumstances of the incident and determine what, if any, additional measures are appropriate before

continuing operations. Additional measures may be imposed by NMFS-OPR to minimize the likelihood of further prohibited take.

5.5.2 Contractor responsibilities

- The Lead PSO will be notified of any injured or dead protected species;
 - Lead PSO will directly contact and notify the Sunrise Wind OCM (located on the same vessel as the Lead PSO) of the detection. As back up, the Lead PSO will contact the Sunrise Wind OCM using instant messaging and/or a cell phone. If these methods fail, the Lead PSO will contact the Sunrise Wind OCM using the vessel's radio.
- Contractor will submit a report (within a word document) with the information/details described in LOA Condition 4(c)(17)(v) and Section 3.8.1.4 of this Plan.

5.6 Shutdown Reporting

5.6.1 Sunrise Wind Responsibilities

- Within 24 hours of detection resulting in a shutdown of piling activity, Sunrise Wind will report to BOEM (renewable_reporting@boem.gov) and BSEE (Submittal requirements to BSEE will follow reporting requirements under JOINT NTL 2023-N01 Appendix B) the sighting of any marine mammal or sea turtle in the relevant shutdown zone.
- Within 48 hours of any ESA-listed species observed within the identified shutdown zone during active pile driving, Sunrise Wind will report to NMFS GARFO – PRD (nmfs.gar.incidental-take@noaa.gov) and BSEE (protectedspecies@bsee.gov). The report will include the following:
 - During of pile driving prior to the detection of the animal(s);
 - Location of PSOs and any factors that impaired visibility or detection ability;
 - Time of first and last detection of the animal(s);
 - Distance of animal at first detection;
 - Closest point of approach of animal to pile;
 - Behavioral observations of the animal(s);
 - Time the PSO called for shutdown;
 - Hammer log (number of strikes, hammer energy);
 - Time the pile driving began and stopped;
 - Any measures implemented (e.g., reduced hammer energy) prior to shutdown;
 - If shutdown was determined not to be feasible, the report will include an explanation for that determination and measures that were implemented.

5.6.2 Contractor Responsibilities

- Within 12 hours of a detection resulting in a shutdown the contractor will provide the raw data collected in the field and daily report forms including:
 - Date;
 - Time (in ISO8601);

- Species (in standard species code);
 - Pile identification number;
 - Latitude and longitude in decimal degrees;
 - Time and distance (m) of the animal when sighted;
 - Time when the shutdown or power-down occurred;
 - Behavior of the animal;
 - Direction of travel in degrees;
 - Time the animal left the shutdown zone;
 - Time the piling restarted or powered back up;
 - Any photographs.
- Data will be recorded using Excel/*Mysticetus* or similar data collection tool (as shown in Section 3.8.1.5):/.FFT & .WAV files when protected species is acoustically detected.

5.7 Shutdown Refusal Reporting

5.7.1 Sunrise Wind Responsibilities

- Sunrise Wind will report any decision not to shut down pile-driving due to pile refusal to BOEM (renewable_reporting@boem.gov) and NMFS-OPR (PR.ITP.MonitoringReports@noaa.gov) within 24 hours of the decision.
 - Report will include an explanation of the safety risk presented by pile refusal and the animals potentially impacted.

5.7.2 Contractor Responsibilities

- Contractors will collect hammer/piling logs, summary of PSO-engineer conversations, engineering report (if applicable), and a debrief of events; and,
- All data will be collected in Word and copies of piling logs as needed.

5.8 Detected or Impacted Dead Non-ESA Listed Fish

5.8.1 Sunrise Wind Responsibilities

- An occurrence of at least 10 dead non-ESA-listed fish within any visual clearance or shutdown zone will be reported to BOEM (renewable_reporting@boem.gov) and BSEE (via TIMSWeb and notification to protectedspecies@bsee.gov) as soon as practicable (taking into account crew and vessel safety), but no later than 24 hours after the sighting. BOEM and BSEE will notify NMFS GARFO – PRD via NMFS.GAR.HESDoffshorewind@noaa.gov. Sunrise Wind will confirm the relevant POC prior to reporting and confirm the reporting was received.

5.8.2 Contractor Responsibilities

- The contractor will provide Sunrise Wind, a non-ESA listed fish impact report, within 12 hours of the occurrence. The report will identify the occurrence of 10 or more dead non-ESA listed fish species within any shutdown zone or anywhere within the areas being monitored by PSOs. All data will be recorded using *Mysticetus* or similar data collection tool (as shown in 3.8.1.5).
- The report will include:

- Time of occurrence (in ISO8601 units);
- Details surrounding the occurrence;
- Phase of pile driving and monitoring;
- Species or guild to the best estimate;
- Condition and number of fish observed.

5.9 Take Threshold Reporting

5.9.1 Sunrise Wind Responsibilities

- If the Project estimates that it has reached 80% of the allowable number of takes under the LOA for a given species across all Project activities, Sunrise Wind will alert NMFS-OPR (PR.ITP.MonitoringReports@noaa.gov), BSEE (Submittal requirements to BSEE will follow reporting requirements under JOINT NTL 2023 -N01 Appendix B), and BOEM (renewable_reporting@boem.gov).

5.10 Bubble Curtain Reporting

As per LOA Condition 3(c)(6)(iv) and BiOp T&C 2(d), Sunrise Wind will submit a NAS inspection/performance report as described below.

5.10.1 Sunrise Wind Responsibilities

- Construction contractors will submit a NAS inspection/performance report for approval by Sunrise Wind, which Sunrise Wind will then report to NMFF-OPR (PR.ITP.MonitoringReports@noaa.gov) and NMFS GARFO – PRD (nmfs.gar.incidental-take@noaa.gov), BOEM (renewable_reporting@boem.gov), and BSEE (Submittal requirements to BSEE will follow reporting requirements under JOINT NTL 2023 -N01 Appendix B) within 48 hours following the performance test, which will occur prior to the OCS-DC jacket installation. This report will be submitted as soon as possible as it is available and will be submitted with the SFV report as described in 5.11. This report will also be submitted with the SFV report as described in the *OCS-DC SFV Plan*. Performance reports for all subsequent piles will be submitted with the weekly pile driving report as described in Section 5.11.

5.10.2 Contractor Responsibilities

- The contractor will provide the results of a performance test within 48 hours following the test. All data will be recorded using Word and any additional necessary data files;
- Any maintenance or modifications made prior to pile driving will be included in this report.
- NAS contractor will be required to provide this report.

5.11 Weekly Reports

5.11.1 Sunrise Wind Responsibilities

- Sunrise Wind will compile and provide weekly PSO and PAM reports during foundation installation (including details on WTG monopiles and OCS-DC jacket foundation installation) to NMFS-OPR (PR.ITP.monitoringreports@noaa.gov) and NMFS-GARFO – PRD

(nmfs.gar.incidental-take@noaa.gov) as described in LOA Condition 4(c)(6) and BiOp T&C 7(e). Weekly reports will also be provided to BOEM (renewable_reporting@boem.gov) and (Submittal requirements to BSEE will follow reporting requirements under JOINT NTL 2023 - N01 Appendix B).

- Weekly reports will be due on Wednesday for activities occurring the previous week (Sunday – Saturday, local time)
- Once all foundation installation is completed in a given installation year, weekly reporting is no longer required.

5.11.2 Contractor Responsibilities

- Contractors will compile and submit weekly PSO and PAM reports to Sunrise Wind documenting the information described in LOA Condition 4(c)(6) and BiOp T&C 7(e);
- Weekly reports are due on Wednesday for the previous week (Sunday – Saturday);
- Weekly reports will include:
 - SFV results
 - Pile ID;
 - Type of pile;
 - Pile diameter;
 - Start and finish time of each pile driving event;
 - Hammer log (number of strikes, max hammer energy, duration of piling);
 - Any changes to NAS and/or hammer schedule;
 - The start and stop of associated observation periods by PSOs;
 - Details on the deployment of PSOs;
 - Vessel operations (including vessel name, port departures, number of vessels, type of vessel(s), and route
 - Record of all detections of marine mammals (acoustic and visual) as described in 3.8.1.1;
 - Sightings during pile driving activities (clearance, active pile driving, post-pile driving);
 - Any mitigation actions (or if mitigation actions could not be taken, why) including equipment shutdowns, delays etc.;
 - Details on the NAS(s) used and their performance;
 - Takes that may have occurred; and,
 - Identify which turbines become operational and when (a map will be provided).
- All reports will be compiled using *Mysticetus* or similar data collection tool (as shown in Section 3.8.1.5).

5.12 Monthly Reports

5.12.1 Sunrise Wind Responsibilities

- Sunrise Wind will compile and submit monthly reports to NMFS-OPR during foundation installation (including both WTG monopiles and the OCS-DC jacket foundation) on the 15th of

the month for the previous month via PR.ITP.monitoringreports@noaa.gov. Monthly reports will also be provided to BOEM (renewable_reporting@boem.gov), BSEE (Submittal requirements to BSEE will follow reporting requirements under JOINT NTL 2023 -N01 Appendix B), and NMFS GARFO – PRD (nmfs.gar.incidental-take@noaa.gov)

- Reports will be compiled using contract or weekly data to develop monthly reports for the agencies.
- The monthly report will include information described in described in LOA Condition 4(c)(7) and BiOp T&C 7(f).
- Sunrise Wind will also contribute all recorded sea turtle sightings, as reported, to an agency-approved centralized database in coordination with the monthly reports.
- Once all foundation installation is completed in a given installation year, monthly reporting is no longer required.

5.12.2 Contractor Responsibilities

- PSOs will collect data in accordance with standard reporting in standard forms, software tools, or electronic data forms authorized by BOEM for pile driving activity.
- As described in LOA Condition 4(c)(7) and BiOp T&C 7(f), monthly reports will include:
 - Project activities carried out in the previous month including dates and location of any fisheries surveys carried out;
 - Vessel transits (name, number of transits, type of vessel, vessel activity, Mobile Service Identity (MMSI) number, and route (this includes transits from all ports, foreign and domestic));
 - Number of piles installed and pile IDs;
 - All detections of marine mammals, sea turtles, and sturgeon as described in 3.8.1.1;
 - Species ID;
 - Time;
 - Date;
 - Initial detection distance
 - Vessel/platform name
 - Vessel activity
 - Vessel speed
 - Bearing to animal
 - Project activity
 - Any mitigative action taken or if mitigation actions could not be taken including the reasons why; and,
 - Identify which turbines become operational and when (a map will be provided).
- PSOs will collect data in accordance with standard reporting in standard forms, software tools, or electronic data forms authorized by BOEM for pile driving activity;

- PSOs will fill out report forms for each vessel with PSOs aboard. Unfilled cells will be left empty and must not contain “NA”. The reports will be compiled using *Mysticetus* or similar data collection tool (as shown in 3.8.1.5), Excel, and Word.
- A new entry will be created on the Effort form each time a pile segment changes, or weather conditions change, and at least once an hour as a minimum. Contractors will review and revise all forms for completeness and resolve incomplete data fields before submittal.
 - The file name will follow this format: Lease#_ProjectName_PSOData_YearMonthDay to YearMonthDay.xls.
 - Data fields will be reported in Excel format.
 - Data categories will include Project, Operations, Monitoring Effort, and Detection.
 - PSO data will be generated through software applications or otherwise recorded electronically by PSOs.
- Applications developed to record PSO data are encouraged, as long as the data fields listed below can be recorded and exported into Excel.

5.13 Draft Annual Marine Mammal Monitoring Report

5.13.1 Sunrise Wind Responsibilities

- Sunrise Wind will submit a draft annual marine mammal monitoring report on all visual and acoustic monitoring conducted under the LOA and COP Approval no later than March 31, annually. Sunrise Wind will submit a draft annual SFV report to NMFS no later than 90 days after SFV is completed for the year as per LOA Condition 4(c)(8) and BiOp T&C 7(g).
- The final annual report will be submitted within 30 calendar days following receipt of any comments received from NMFS on the draft report as per LOA Condition 4(c)(8).
- All draft and final monitoring reports will be submitted to NMFS-OPR (PR.ITP.MonitoringReports@noaa.gov), BOEM (renewable_reporting@boem.gov), and BSEE (Submittal requirements to BSEE will follow reporting requirements under JOINT NTL 2023 - N01 Appendix B) and NMFS-GARFO – PRD (nmfs.gar.incidental-take@noaa.gov)

5.13.2 Contractor Responsibilities

- The contractor will provide Sunrise Wind a final report (Word format) containing all information in the Orsted Reporting Template within 30 days of completion of all PSO activities (described in LOA Condition 4(c)(8) and BiOp T&C 7(g)).
- The draft and final report will include:
 - The total number of marine mammals of each species/stock detected and how many were within the designated potential injury and behavioral harassment zone(s) with comparison to authorized take of marine mammals associated with WTG monopile and OCS-DC jacket foundation installation;
 - The number of sea turtles exposed above the 175 dB harassment threshold and the number of marine mammals exposed above the Level A and Level B harassment thresholds will be determined based on the number actually observed within the relevant distances during pile driving. For comparison, alternative estimates of the number of individuals potentially exposed may be made based

on sightings recorded during periods without pile driving and/or by using availability bias corrections available in the literature.

- Marine mammal detections and behavioral observations before, during, and after each activity;
- What mitigation measures were implemented (i.e., number of shutdowns or clearance zone delays etc.) or, if no mitigative actions were taken, why not;
- Operational details (i.e., days and duration of impact pile driving, days and amount of HRG survey effort);
- HRG survey tracklines;
- Any PAM systems used;
- Results, effectiveness, and which NAS(s) were used during relevant activities;
- Summarized information related to situational reporting;
- Any other important information relevant to the Project;
- All raw data will be transferred in data packages following the Orsted data submittal folder structure
 - Raw data will be submitted as appropriate to the NCEI.

5.14 Draft Final 5-Year Report

5.14.1 Sunrise Wind Responsibilities

- Sunrise Wind will submit a draft final 5-year report on all visual and acoustic monitoring, including SFV, conducted within 90 days after completion of the specified activities as per LOA Condition 4(c)(9).
- Sunrise Wind will provide a final report within 30 days following receipt of any NMFS' comments on the draft report. If no comments are received from NMFS within 30 days of NMFS' receipt of the draft report, the report will be considered final.
- All draft and final 5-year reports will be submitted to NMFS-OPR (PR.ITP.MonitoringReports@noaa.gov), BOEM (renewable_reporting@boem.gov), and BSEE (Submittal requirements to BSEE will follow reporting requirements under JOINT NTL 2023 - N01 Appendix B) and NMFS-GARFO – PRD (nmfs.gar.incidental-take@noaa.gov)

5.14.2 Contractor Responsibilities

- The contractor will provide Sunrise Wind a final report (Word format) containing all information in the Orsted Reporting Template within 30 days of completion of all PSO activities (described in LOA Condition 4(c)(9) and BiOp T&C 7 (g)).
- The draft and final 5-year report will include:
 - The total number (annually and across all five years) of marine mammals of each species/stock detected and how many were within the designated potential injury and behavioral harassment zone(s) with comparison to authorized take of marine mammals for the associated activity;
 - The number of sea turtles exposed above the 175 dB harassment threshold and the number of marine mammals exposed above the Level A and Level B

harassment thresholds will be determined based on the number actually observed within the relevant distances during pile driving. For comparison, alternative estimates of the number of individuals potentially exposed may be made based on sightings recorded during periods without pile driving and/or by using availability bias corrections available in the literature.

- Summary table indicating the amount of each activity (e.g., pile installation, HRG) completed in each of the five years and total;
- GIS shapefiles(s) of the final location of all piles, cable routes, and other permanent structures including an indication of what year installed and began operation;
- GIS shapefile of all North Atlantic right whale sightings, including dates and group sizes;
- 5-year summary and evaluation of marine mammal detections and behavioral observations;
- 5-year summary and evaluation of mitigation and monitoring implementation and effectiveness;
- HRG survey tracklines;
- Five year summary and evaluation of all PAM and SFV data collected;
- List of recommendations to inform environmental compliance assessments for future offshore wind actions.

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Appendix A – Far Field Noise Mitigation Manual Offshore Control Station



Far Field Noise Mitigation Manual
Offshore Control Station

Executive Summary

The installation of offshore substation pin piles involves pile driving, which generates underwater noise that can potentially harm marine life. To mitigate this impact, the use of double big bubble curtains (DBBCs) is proposed as an effective noise mitigation measure for the Sunrise Wind offshore wind farm project. DBBCs are systems that create a barrier of air bubbles in the water column around the pile driving event during installation. This bubble curtain acts as a sound attenuator, reducing the transmission of noise from the pile driving activity.

The use of big bubble curtains is a proven and effective method for mitigating underwater noise during wind farm component installation. By implementing DBBCs at the Sunrise Wind project, the potential impact on marine life can be significantly reduced, ensuring the project's environmental sustainability and compliance with regulations.

1 INTRODUCTION

1.1 General Project Information

The wind farm portion of the Project (referred to as the Sunrise Wind Farm [SRWF]) will be located on the Outer Continental Shelf (OCS) in the designated Bureau of Ocean Energy Management (BOEM) Renewable Energy Lease Area OCS-A 0487 (Lease Area).¹ The Lease Area is approximately 18.9 statute miles (mi) (16.4 nautical miles [nm]), 30.4 kilometers [km]) south of Martha's Vineyard, Massachusetts, approximately 30.5 mi (26.5 nm, 48.1 km) east of Montauk, New York, and 16.7 mi (14.5 nm, 26.8 km) from Block Island, Rhode Island

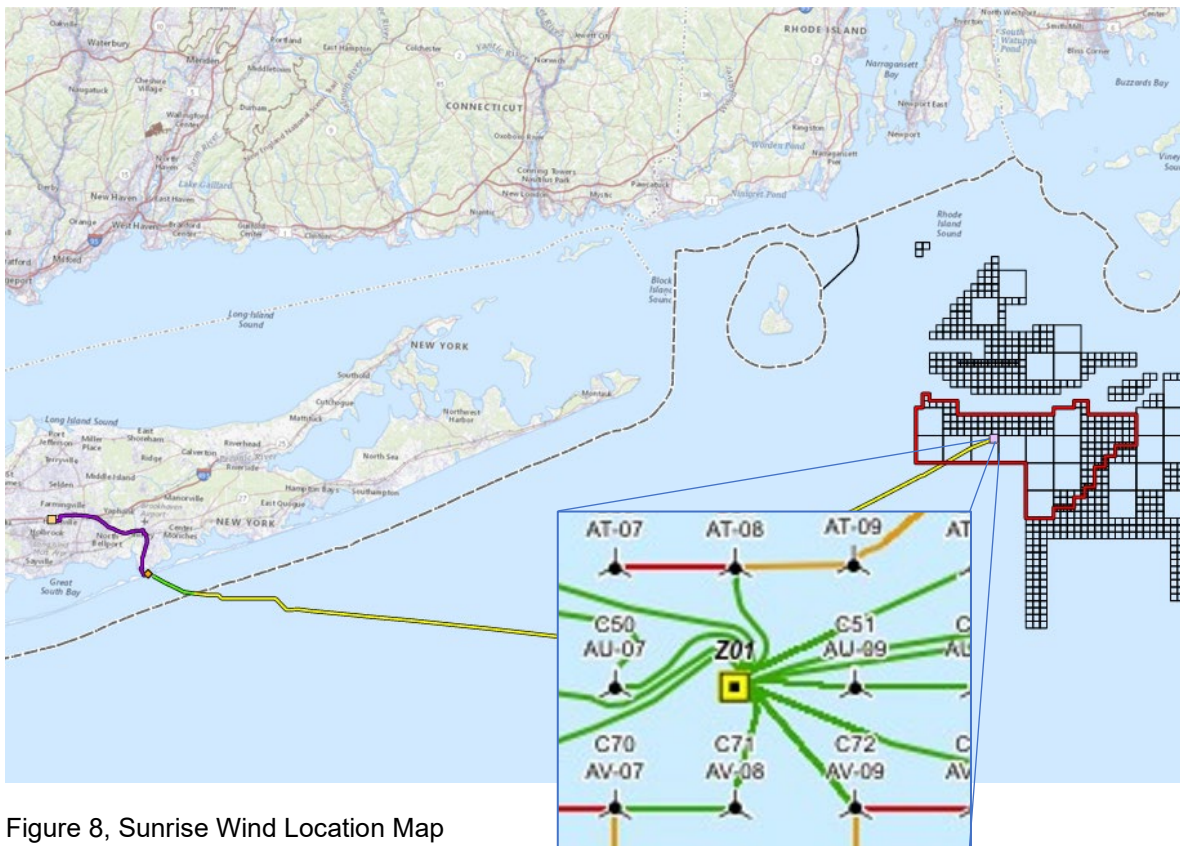


Figure 8, Sunrise Wind Location Map

The inner and outer BBCs will be deployed as a set on every installation location by the nozzle hose deployment vessel (NHDV) at OSS location and will be supplied with compressed air to maintain a 2-layer bubble curtain around the pin piles. The DBBC will be pre-installed before installation and during piling, the DBBC will be pressurized from the vessel at a level designed to reduce, to the maximum extent practicable, hammering noise that propagates through the water column. The Free Air Delivery (FAD) supplied on the DBBC during piling operations is greater than 0.5 m³/min/m).

2 DEFINITIONS and ABBREVIATIONS

2.1 Abbreviations

Abbreviation	Description
BBC	Big Bubble Curtain
BOEM	Bureau of Ocean Energy Management
COMP	Compressor
COP	Construction and Operations Plan
DBBC	Double Big Bubble Curtain
EU	European Union
FAD	Free Air Delivery
ITP	Installation Test Plan
Ha	Hectares
HLV	Heavy Lift Vessel
Hs	Significant Wave Height
SMC	Saipem Marine Construction
HTO	Hydrotechnik Offshore
MCPG	Motion Compensated Pile Gripper
MPLR	Monopile Location Report, BBC Data
MP/PP	Monopile/Pin Pile
NHDV	Nozzle Hose Deployment Vessel
OWF	Offshore Wind Farm
OSS	Offshore Substation
PAM	Passive Acoustic Monitoring

SUNRISE WIND
NOISE MITIGATION MANUAL

October 7, 2024

PLA	Project Labor Agreement
PSO	Protected Species Observers
SEL	Sound Exposure Level
SFV	Sound Field Verification
TIS	Technical Information Sheet
TM	ThayerMahan
TP	Transition Piece
US	United states
VHF	Very High Frequency

3 ROLES AND RESPONSIBILITY

The table below describes the DBBC specific roles:

Function	Function Description
Vessel Master	The Vessel Master is the first in command on board of the vessel and is responsible for the overall safety on board the DBBC vessel. He instructs the crew. He is responsible for carefully analyzing the weather forecasts prior to operations. He takes the lead in case of incidents and emergencies, such as oil pollution, fire on board, man overboard, collision, abandon ship, etc.
SMC Offshore Representative	The SAIPEM offshore representative manages the offshore operations on board of the Installation Vessel or DBBC vessel, including coordination with the DBBC subcontractor, in accordance with the method statements and in consultation with the Party Chief and Vessel Master. Any operation will only start when the Party Chief SAIPEM offshore representative and the vessel master agree that it's safe to do so.
ThayerMahan Party Chief	The DBBC subcontractor works manager is responsible for the operations of the DBBC subcontractor DBBC Team on board of the DBBC vessel, works with Vessel Master and SMC Offshore Representative for project coordination.
ThayerMahan DBBC Team operators	The DBBC subcontractor team is responsible for operation and maintenance of the DBBC spread, compressors and tools onboard.

3.1 Communications

The communication between the installation vessel and the Double Big Bubble Curtain (DBBC) vessel will be according to the below Figure 2, Offshore Organization Chart for DBBC and below Table 1, DBBC Project Notification Table (Example).

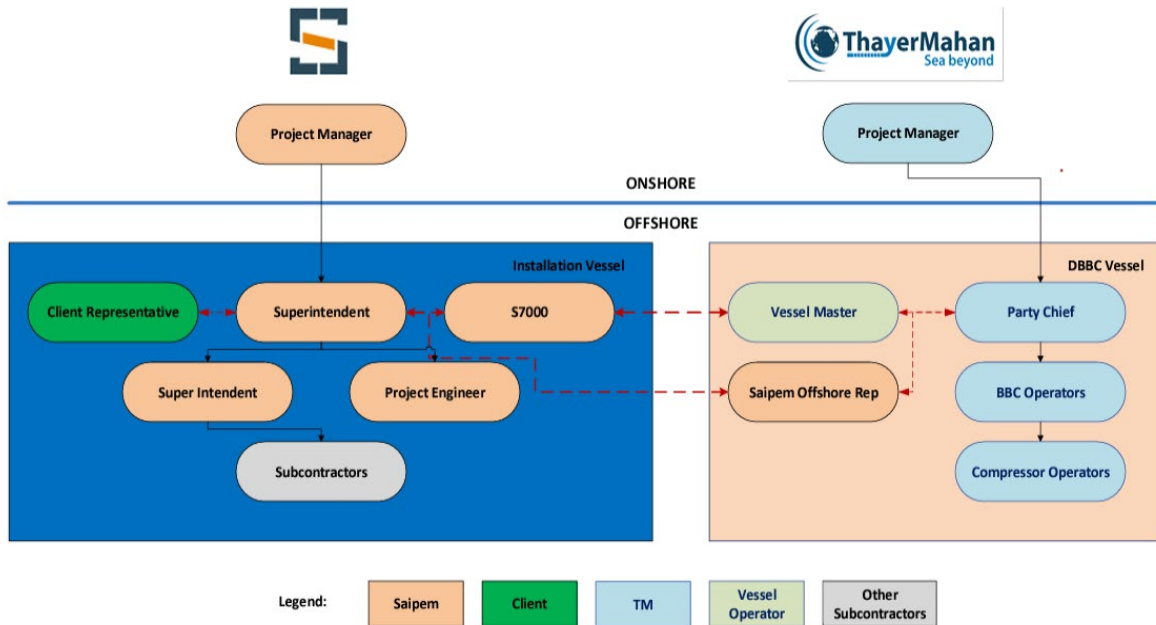


Figure 9, Offshore Organization Chart for DBBC

The installation vessel's (IV) captain communicates with the DBBC vessel captain about vessel maneuvers and simultaneous operations. The Installation vessel's Superintendent communicates with the DBBC SAIPEM Offshore representative on board in case present or the DBBC Party Chief about the start-up and readiness of the DBBC hoses and pile driving completion. When the SAIPEM representative is on board the DBBC vessel, he/she is involved in all communication with the aim to ensure a smooth execution.

An example of the notification times given for each piling event are provided in Table 1, DBBC Internal Notification Table (Example). A VHF radio channel to be agreed upon and checked at the start of the project operations.

Table 14, DBBC Project Notification Table (Example)

Direction of communication	Information	Window	Medium
IV → DBBC Vessel	Pile driving operation will start in 3 days	3 days before start pile driving	E-Mail Daily progress meeting
IV → DBBC Vessel	Pile driving operation will start in 24h	24h before start pile driving	E-Mail Daily progress Meeting
IV → DBBC Vessel	Pile driving operation will start in 12h	12h before start pile driving	E-Mail VHF Radio
IV → DBBC Vessel	Pile driving operation will start in 6h	6h before start pile driving	E-Mail VHF Radio
IV → DBBC Vessel	Pile driving operation will start in 3 h	3h before start pile driving	E-Mail VHF Radio
IV → DBBC Vessel	Pile driving operation will start in 1 h	1h before start pile driving	E-Mail VHF Radio
IV → DBBC Vessel	Pile driving operation will start in 15 minutes	15 min before start pile driving	VHF Radio
DBBC Vessel → IV	DBBC Operational (full pressure reached)	Immediately	VHF Radio
IV → DBBC Vessel	Pile driving Operation at location Finished	Immediately	VHF Radio
DBBC Vessel → SFV Contractor	DBBC performance summary (compressor log information)	Post piling	E-Mail
SFV contractor → DBBC vessel	Interim report	36h post piling	E-Mail

3.2 Intra Ship Communications

All intra ship project alignment communications shall be done through internet phone link. All near field instructions and operations shall be communicated through VHF radio channel #8 and #10 or as directed by IV Master.

3.3 Noise Abatement Reporting

Submit a NAS inspection/performance report for approval by Saipem/Sunrise Wind 12 hours following the performance test, which will occur at the first hose lay position, maybe at a location other than OSS for efficiencies, as well as any additional installations as required by Saipem/Sunrise Wind. Any modifications to attenuation device to meet the performance standards will occur before impact pile driving occurs and maintenance or modifications completed will be included in the report.

Performance reports for each bubble curtain deployed will include water depth, current speed and direction, wind speed and direction, bubble curtain deployment/retrieval date and time, bubble curtain hose length, bubble curtain radius (distance from pile), diameter of holes and hole spacing, air supply hose length, compressor type (including rated Cubic Feet per Minute (CFM) and model number), number of operational compressors, performance data from each compressor (including revolutions per minute

(RPM), pressure, start times, and stop times), free air delivery (m³/min), total hose air volume (m³/(min m)), schematic of GPS waypoints during hose laying, documentation of maintenance procedures performed (pressure tests, inspections, flushing, re-drilling, and any other hose or system maintenance) before and after installation, and the length of time the bubble curtain was on the seafloor prior to foundation installation.

3.4 Marine Mammal Observation

For the marine mammal observation procedure reference is made to the employer's Protected Species Mitigation Measures Plan. As part of the requirements, all vessels need to exercise strike avoidance surveillance with the protected species during transit and in-field. Daily reports will be sent to Saipem.

3.5 Weather forecast and limitations

A weather assessment (check of weather limitations and windows) will be performed prior operations. This weather assessment is done to identify if a suitable weather window is available to make the transition from one safe state to another. Operations can only be started when favorable conditions are forecasted for the duration of the operational reference period and when these conditions are not contradicted by live weather monitoring devices (i.e., anemometers on IV S7000 and wave buoys on site). This operational reference period is different for each of the operational phases described in this plan.

BBC Operational limitations

- Wind Speed (15m/s)
- Significant Wave Height ($\leq 2.0\text{m}$)
- Current Velocity ($\leq 0.75\text{m/s}$)

3.6 Daily Progress Reporting

Reporting is required on a daily basis for the period midnight to midnight (at worksite's local time). A web based DPR filling, and approval system will be used, which will contain the following information as a minimum:

- Date of report and report number;
- Current vessel operation and position;
- Current and forecasted weather;
- Personnel movements (quantity);
- Active marine spreads;
- Consumables;
- Mechanical breakdowns;
- HSE statistics;
- Breakdown of activities past 24 hours;
- Waiting on weather (time);
- As installed data of DBBC;
- Planned activities for next 24 hours.

4 Noise Abatement System (NAS)

For Sunrise Wind OCS installation piles ThayerMahan will deploy at a minimum, a double big bubble curtain that reduce noise levels on all pin pile driving activities.

The DBBC consists of 2 big bubble curtains (BBCs) comprising nozzle hoses with lengths of:

- BBC 1: 630 m (Inner ring) set at 100m from the pile, and
- BBC 2: 960 m (Outer ring) set at 150 m from the pile.

The inner and outer BBCs will be deployed as a set on the location by the nozzle hose deployment vessel (NHDV) per location and will be supplied with compressed air to maintain a 2-layer bubble curtain around the jacket. The DBBC will be pre-installed before pile installation and during piling, the DBBC will be pressurized from the vessel at a level designed to reduce, to the maximum extent practicable, hammering noise that propagates through the water column. The Free Air Delivery (FAD) supplied on the DBBC during piling operations is greater than $0.5 \text{ m}^3/(\text{min} \times \text{m})$. Therefore, the total air supplied to the DBBC would be greater than $795 \text{ m}^3/\text{min}$.

At least seven compressors on board the noise mitigation vessel will be used to pressurize the combined DBBC. There will also be two spare compressors on board the NHDV vessel. To account for varying water depths, the DBBC operating pressures will be modified to optimize performance at increasing water depths.

ThayerMahan teamed with Hydrotechnik Offshore the world's leader in Noise Abatement and Bubble curtain technologies. The teams highly experienced personnel have deployed and managed NAS(s) on similar projects; all personnel from the NAS contractor will receive Developer/Prime Environmental Awareness Training as required.

The TM/HTO teams are staffed with trained personnel that collect and interrupt relevant data regarding the operation or maintenance of the deployed NAS (e.g., proper balancing of airflow to the bubble curtain ring, deployment accuracy of hose nozzles, maintenance record, etc.). Such data will be recorded by the Chief engineer on board the NAS deployment vessel.

5 VESSEL AND MACHINERY

5.1 BBC VESSEL

DP2 vessel will be used for installation of the DBBC. This vessel will have a sufficient deck space to safely carry the necessary equipment for the safe operations of the DBBC Spread. The deck layout including the equipment described in this section is presented in Figure 3, Example DBBC Vessel Layout. A detailed deck layout of the vessel will be added in the plan once the vessel is selected and final position of the components are defined.

Positioning of the DP DBBC supporting vessel will be optimized for safe standoff and drift off regarding the PP/MP and the IV S7000. Positioning will be targeted to be as far away as possible from the TSFV and ASFV buoy locations, to minimize potential confounding factors

SUNRISE WIND
NOISE ABATEMENT SYSTEM PLAN

December 3, 2024

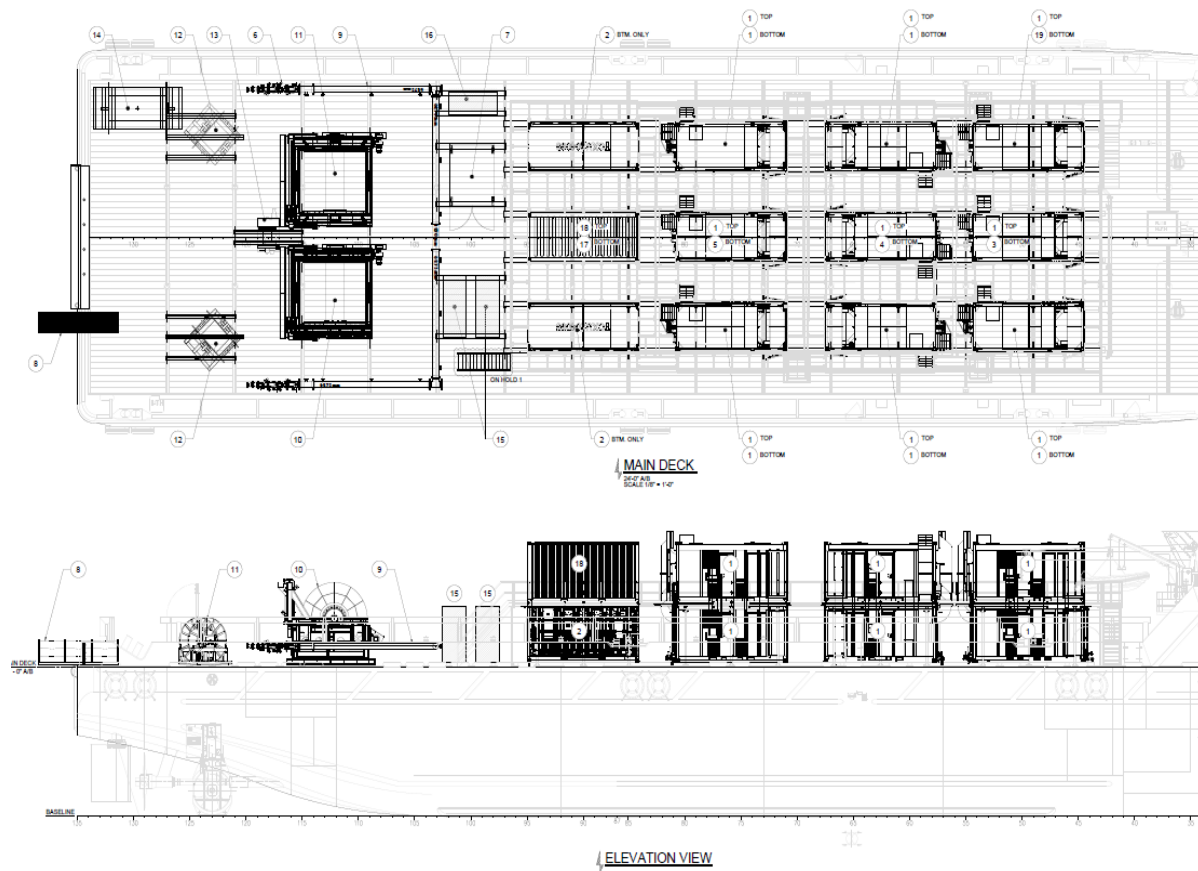


Figure 10, Example DBBC Vessel Layout

5.2 COMPRESSORS

The compressed air for the operations of the bubble curtain is generated by diesel driven compressors. These will be installed on board the DBBC vessel to supply the required air for 0.5 m³/m/min air volume requirement. In the event a single compressor malfunctions, there is sufficient redundancy for the offshore personnel operating the bubble curtains to start additional compressors as necessary to guarantee the air supply and operating pressure such that the maximum possible sound attenuation performance of the bubble curtains is achieved.

The compressed air will be piped through a conditioning/filter system that bundles the supplied air from the compressors and filters the air prior to delivery to manifold. The filtering system employed is a staged when combined with the running air compressors cleans and conditions the compressed air to a class 0 quality. Class 0 is defined as air quality that is better than Class 1 air quality. Filters and conditioners on board can filter and condition all machines running in parallel supplying compressed air with air quality meets ISO8573-1:2010 class zero in terms of total oil content.



Figure 12, Example ScanTech Compressor

T

Technical Information	
Model	ST3100
Delivered Flow @ 12 Bar	3100cfm / 87.5m ³ /min
Delivered Flow @ 14 Bar	2700cfm / 76.4m ³ /min
Stackable	Yes
Sound Level	Power (Lwa) >90dBA
Fuel Consumption	200 litres per hour
Fuel Tank Capacity	700 litres (designed for auto refuelling set up)
Compressed Air Outlet	4" ASA150 flange
Compressor Start Up	Battery Electric Start
Compressor Electrical Supply	360-440V @ 50HZ 440-480V @ 60 HZ Max current 7A (16A plug fitted)
Automatic Refuelling System Electrical Supply	380 – 480V @ 50/60Hz Max current 20A (32A plug fitted)
Ambient Operating Range	-10°C to + 45°C
Emission Compliance	EU Stage V & US EPA Tier 4 Final

Figure 11, ST3100 Technical Information

5.3 Nozzle Hoses

The BBC hose must comply with the following rules:

1. The bubble curtain(s) distribute air bubbles around 100 percent of the piling perimeter for the full depth of the water column.
2. Contact with the seafloor for the full circumference of the nozzle hose and the weights attached on the hose will ensure 100 percent seafloor contact.
3. No parts of the ring or other objects prevent full seafloor contact.

A bubble curtain system consists of 3 types of hoses, namely:

1. Supply hose: Supplies the compressed air from the vessel to the riser hoses. These are buoyant so they are situated on the water surface.
2. Riser hose: This hose connects the supply hose with the nozzle hose.
3. Nozzle hose: This is the hose that is laid out on the seabed and produces the bubble curtain by the holes inserted in them. These are non-buoyant and have steel parts to ensure a full circumferential contact with

the seabed. The DBBC hoses will be deployed before the installation vessel (IV) is in position. Two air hoses will be placed in a circular shape around the OSS jacket or template. DBBCs will be pre-deployed at foundation installation location, retrieved at the discretion of the IV project lead, and re-deployed as desired.

To guarantee the lowest bubble ring to be in contact with the seafloor for the full circumference of the nozzle hose is as follows. The total buoyancy of the hose is 5.5kg/m. The total weight, the rings plus the hoses weight is 17 kg/m out of the water, 12kg/m hose weight in the water and 5.5kg/m in water filled with air... Henceforth a negative buoyancy of 5.5 kg/m is achieved, ensuring 100-percent seafloor contact.



Specialpressurehose SDS 40

- A robust water and compressed air hose
- Flexible and easy to handle, with good kink resistance due to a special hose design.
- designed for applications where a heavy duty hose is necessary.



Temperature: -30°C / +80°C

Safetyfactor: 3 : 1

Tube: synthetic elastomer, black, smooth.

Reinforcement: plies of steel wire cord.

Cover: yellow, smooth, (wrapped finish) long lasting EPDM rubber, weathering and ozone resistant.

Figure 12, OEM Hose Specification Data

Hose					
Inner Diameter	102	mm	4	in	
Outer Diameter	122	mm	4.8	in	
Weight	6.2	kg/m	13.6	lb	
Weights					
Steel Ring	120	mm	4.8	in	
Inner Diameter	122	mm	5.5	in	
Outer Diameter	140	mm	6.8	in	
Weight	3.1	kg	6.8	lb	
Chain DIN766	10	mm			
Weight	2.3	kg/m	5	lb/m	
	Nozzle Hose (sea floor)		Riser Hose (vertical)		
Distance between the rings	380	mm	14.9	mm	1380 mm 54.3 in
Weight (air)	17	kg/m	37.5	lb/m	12 kg/m 26.5 lb
Weight (water)	12	kg/m	26.5	lb/m	
Weight (water air filled)	5.5	kg/m	12.1	lb/m	

Table 15, Hose and Weight Information

5.3.1 Hose Maintenance

Maintaining Double Big Bubble Curtain (DBBC) hoses is vital to ensure their effectiveness in attenuating noise during offshore construction activities.

Pre-Deployment Inspection - Visual Inspection:

Thoroughly examine hoses for any signs of damage, such as cuts, abrasions, punctures, or wear and tear. Pay close attention to areas near connectors and stress points.

Deployment and Operational Care:

Careful Handling: Handle hoses with care during deployment and retrieval to prevent damage from dragging, twisting, or sharp objects.

Proper Storage: When not in use, store hoses properly. Avoid kinking or crushing the hoses during storage.

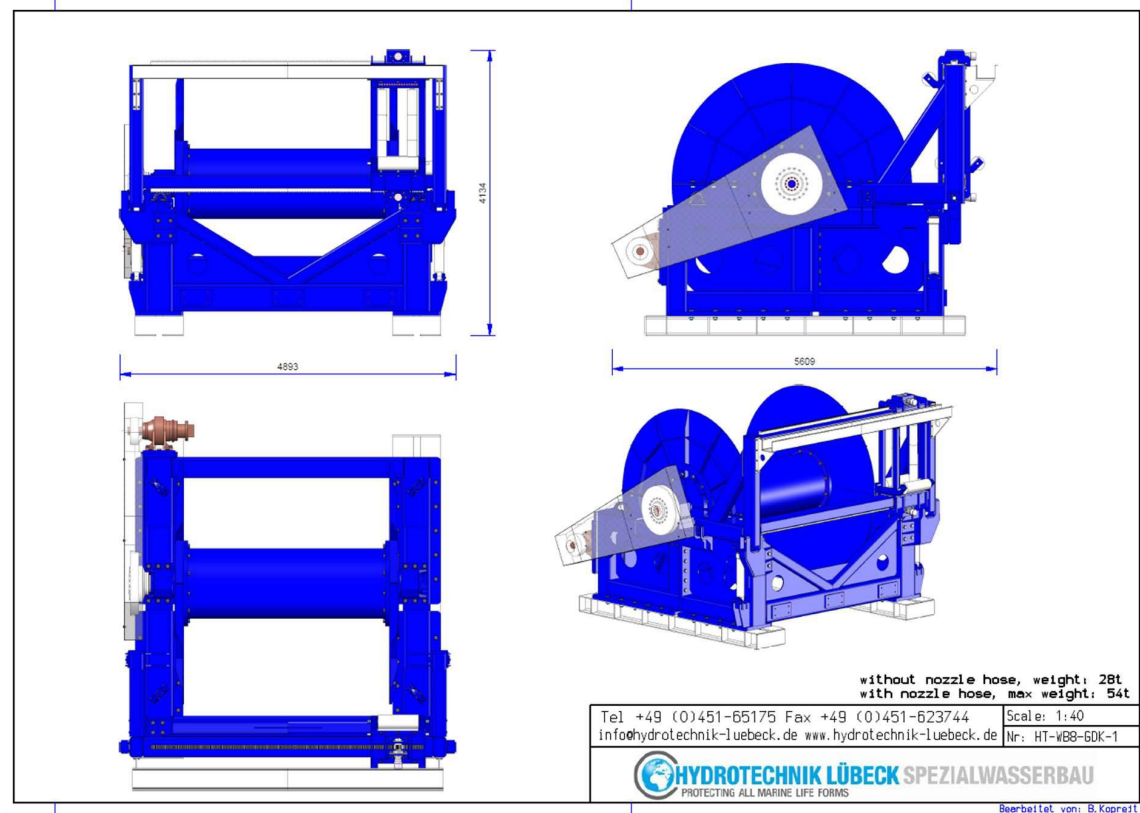
Regular Monitoring: During operation, monitor the hoses for any signs of uneven air distribution over the circumference of the nozzle hose. Inspect and perform maintenance on the hoses during retrieval after each use.

Retrieval Inspection and Maintenance: Inspect nozzles as the hose is retrieved and maintain as necessary to ensure holes are clear for air flow for full 360° circumference.

Repair: Repair any minor damage, small cuts or punctures, evidence of twists using replacement hose segments as needed.

5.4 Hose Reels

The BBC reel holds the nozzle hose and riser hose and rotates for deployment and retrieval of the hose laid on the seabed around the construction site. This hose reel has a live hub, allowing compressed air to be pushed through hose. This live hub allows the hose inspection during retrieval to ensure hose nozzles are free to release air evenly over the length of the hose.



Description	Variable	Value	Unit
Diameter of highest hose layer	L_h	3500	mm
Ratio	I	2,53	dimensionless
Chain tensile force normal	F_t	100,69	kN
Chain tensile force max.	F_t	201,37	kN
Reel traction normal	F_{Wn}	26,52	kN
	F_{Wn}	2,71	tons
Reel traction max	F_{Wmax}	53,04	kN
	F_{Wmax}	5,41	Tons
Nozzle hose weight with chain	W_{Hose}	17,1	Kg/m

Figure 13, BBC Deployment Hose Reel

6 Safe, Quality Operations

6.1 Deployment of the BBC

Nozzle hoses are laid and recovered when the HLV is not in position. An example layout of the hoses is shown below. The hoses are deployed by TM/HTO. In the scenario where the pile driving activities have been completed and the HLV remains on location for secondary works (retrieval of hoses on previous location, deployment hose on next location, bunkering, etc.).

Communication between bridge and deck will be done by radio. In case the HLV is already in position the 500 m procedure will apply. The below images are only as illustration from a previous project. May still change.

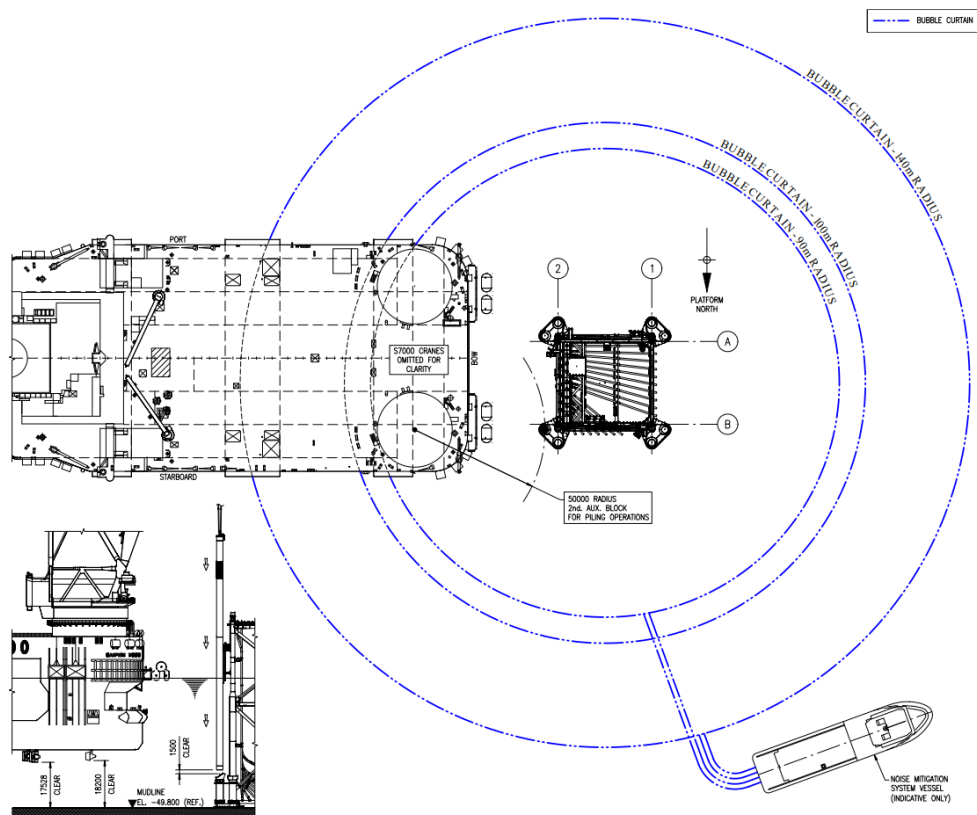
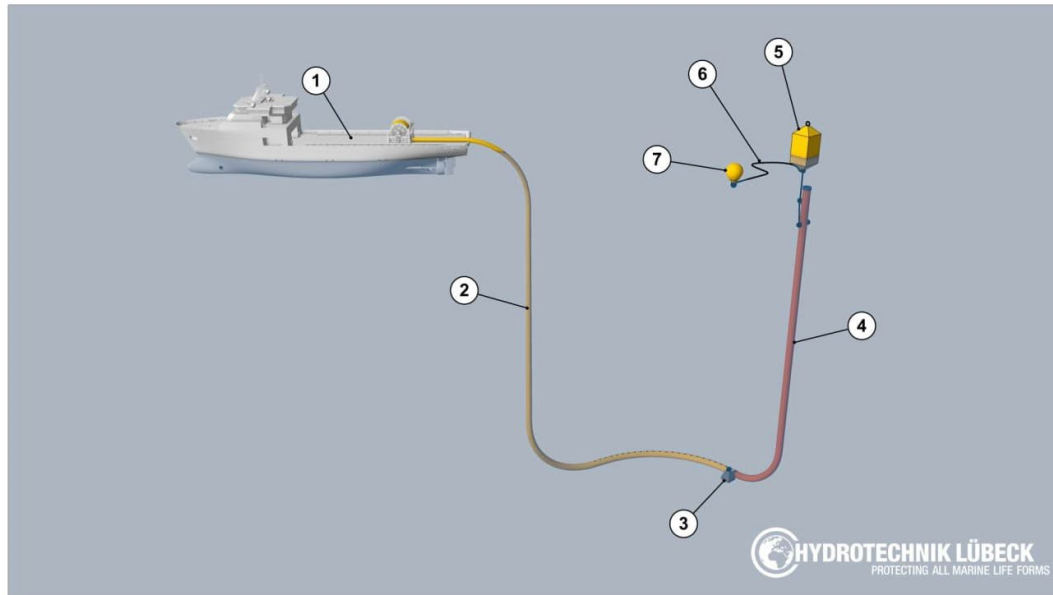


Figure 14, S7000, NHDV and Notional Bubble Curtain Hoses

6.2 Start position BBC hose

First riser is attached under heavy buoy and secured with an anchor weight on seabed.



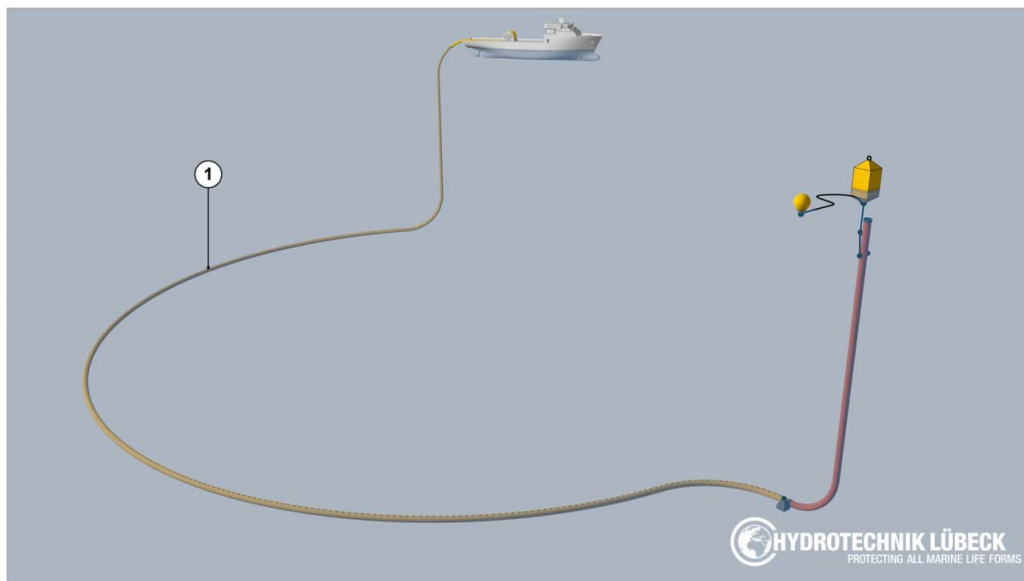
- 1 NHDV
- 2 Nozzle Hose
- 3 Anchor Weight

- 4 First Riser
- 5 Buoy 2000
- 6 Floating Rope

- 7 Buoy 600

6.3 Halfway BBC hose

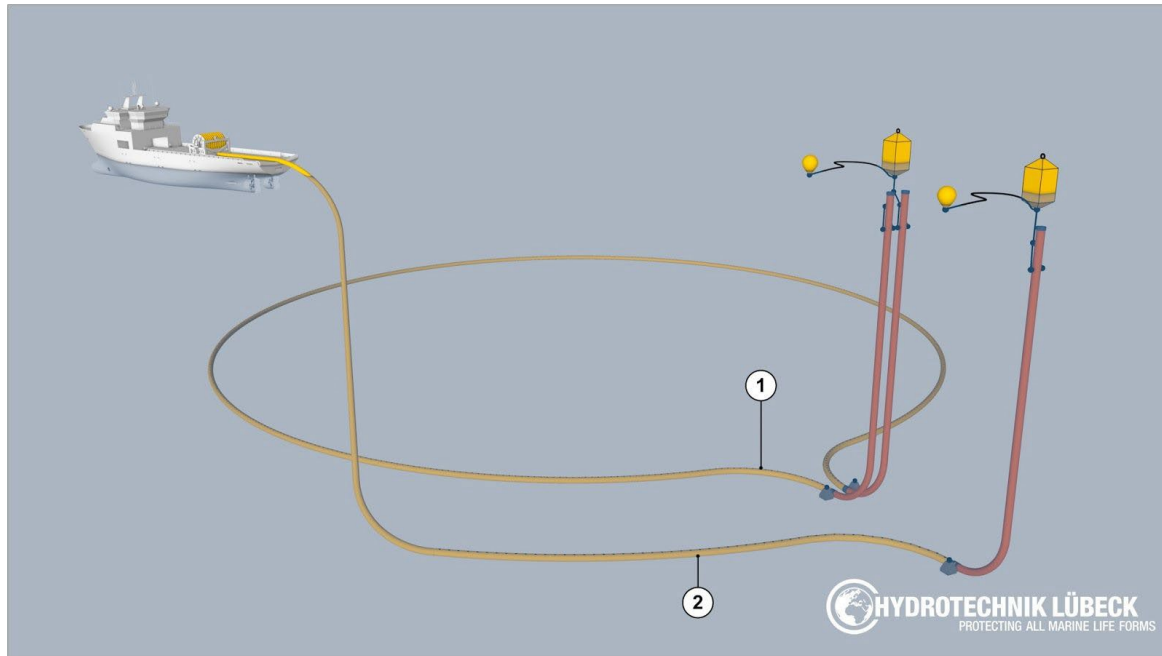
NHDV is deploying the first nozzle hose around the pile driving position.



- 1 Inner Nozzle Hose

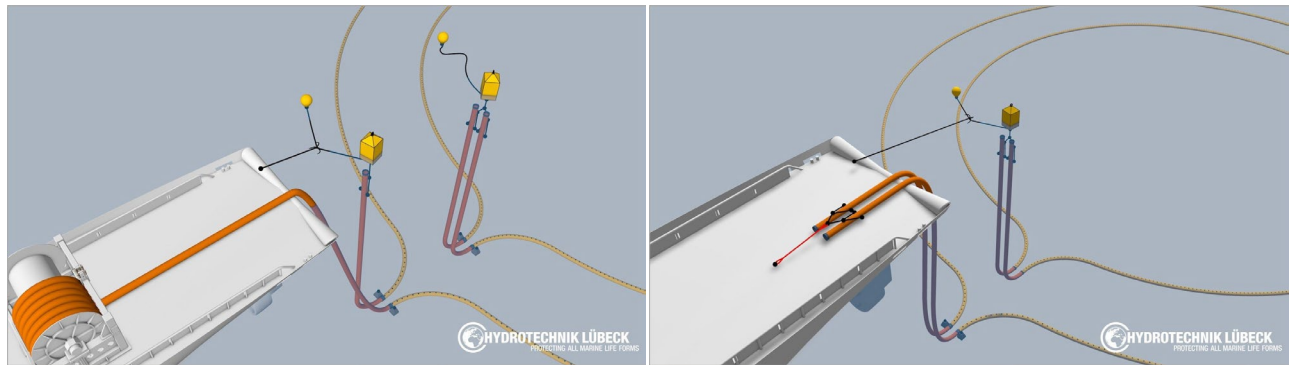
6.4 Halfway BBC hose

NHDV is deploying the first nozzle hose around the pile driving position.



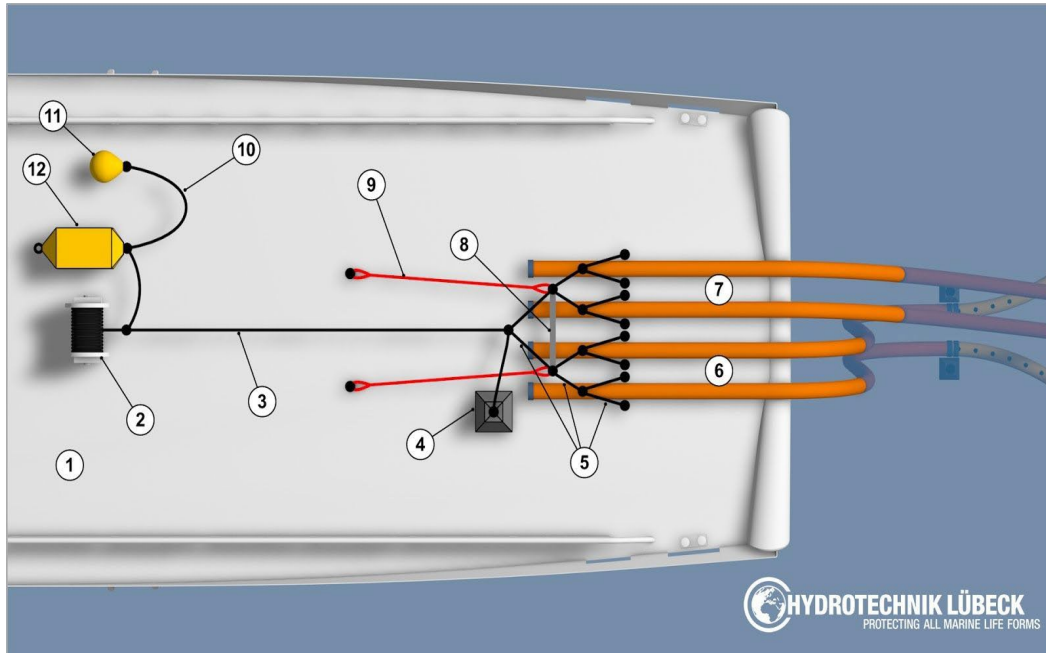
6.5 First riser back on board

After complete installation, first riser will be pulled back to deck using a grappling hook.



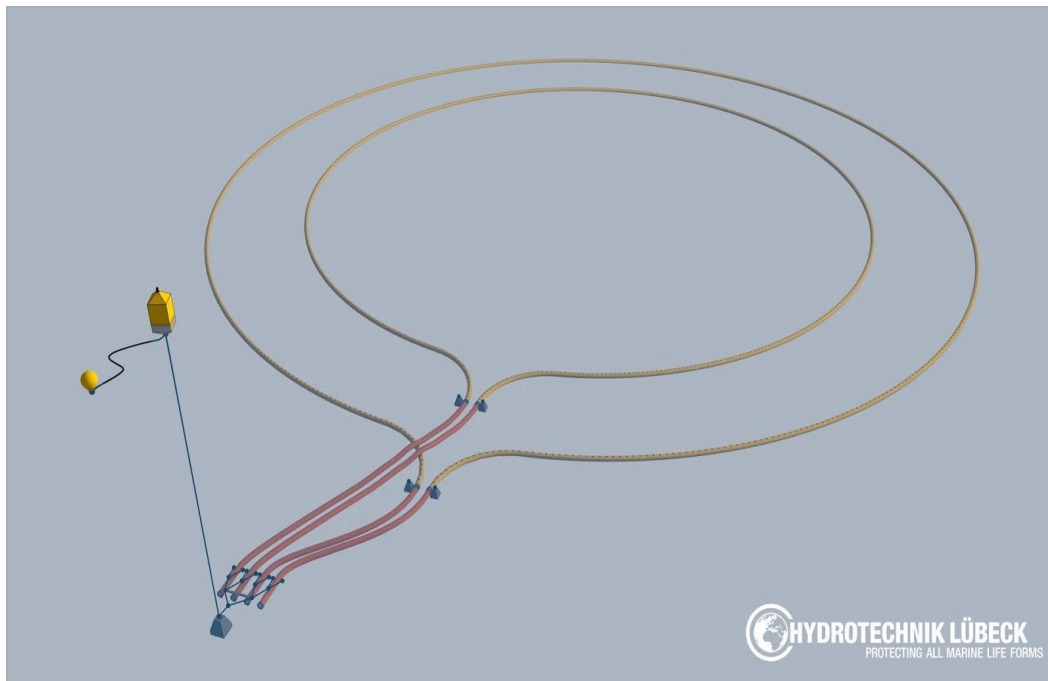
6.6 Connecting hose

Both risers of the BBC hose on deck of NHDV. They will be connected by a chain connection. During work, the hose system is secured at vessel with a strop securing.



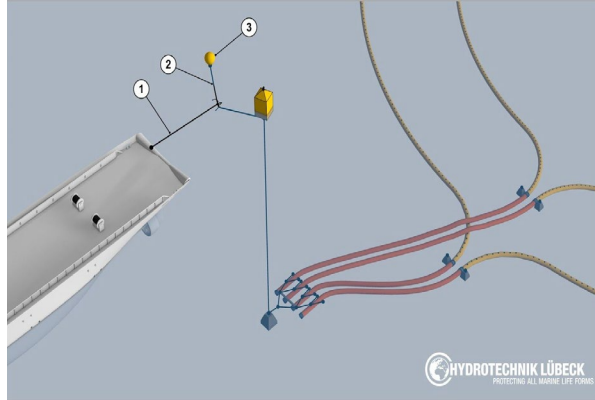
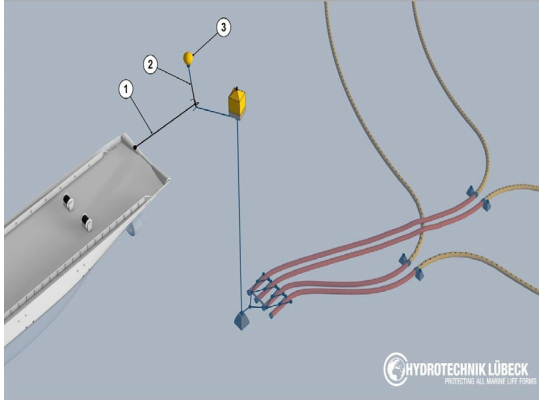
6.7 Nozzle hose installation completed

Hose connected under heavy buoy and secured with anchor weight on seabed.



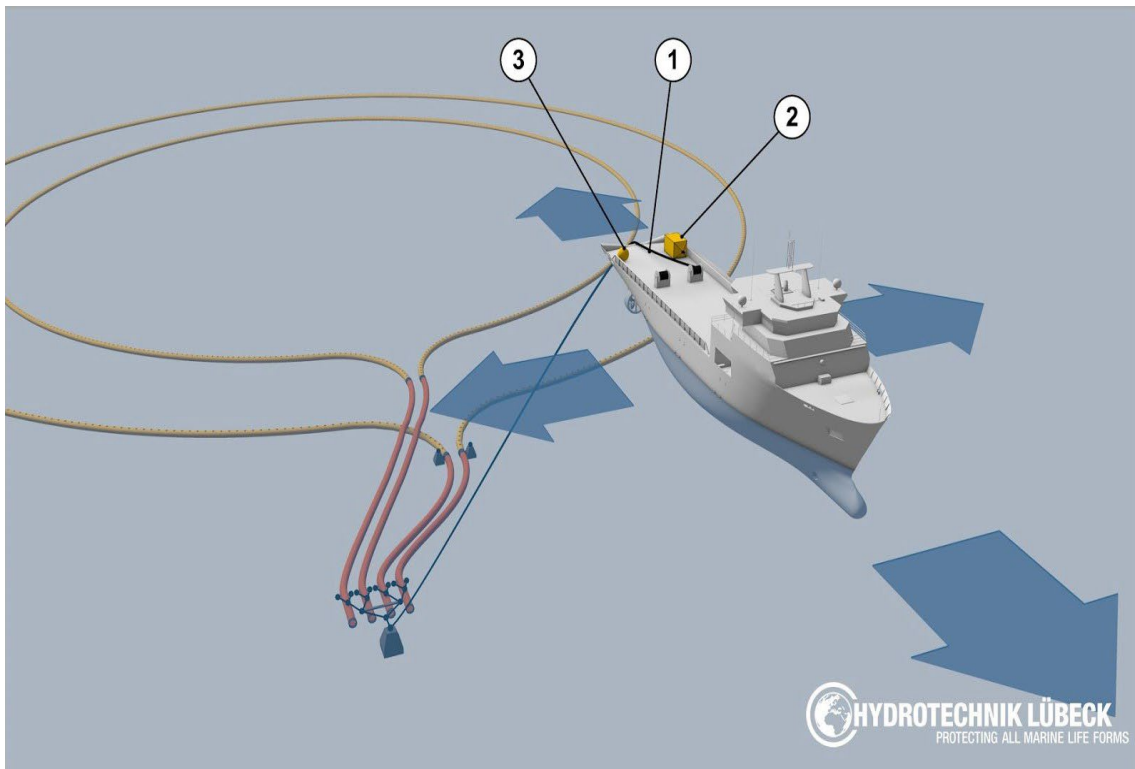
6.8 Getting back to the hose system

- Grappling hook is used to bring the floating rope of the hose system back on board.
- With the floating rope and a tugger winch the marker wire will be pulled on deck.



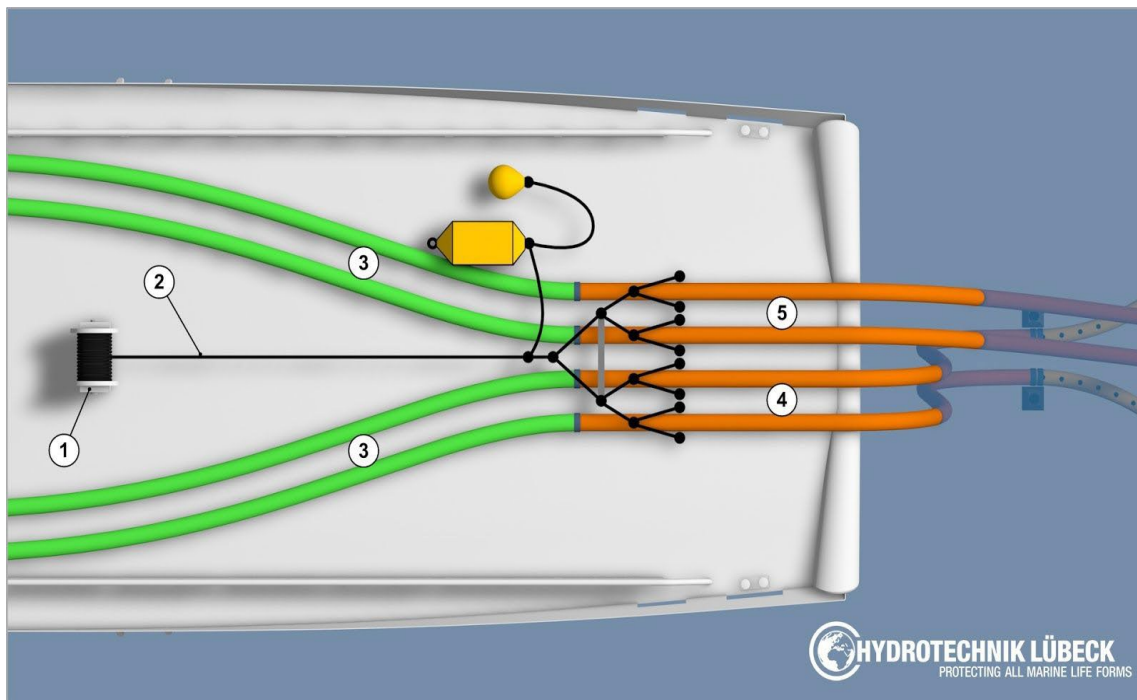
6.9 Approaching to DBBC

NHDV is going into final position for getting riser system on deck. Heavy buoy, light buoy and marker wire on deck.



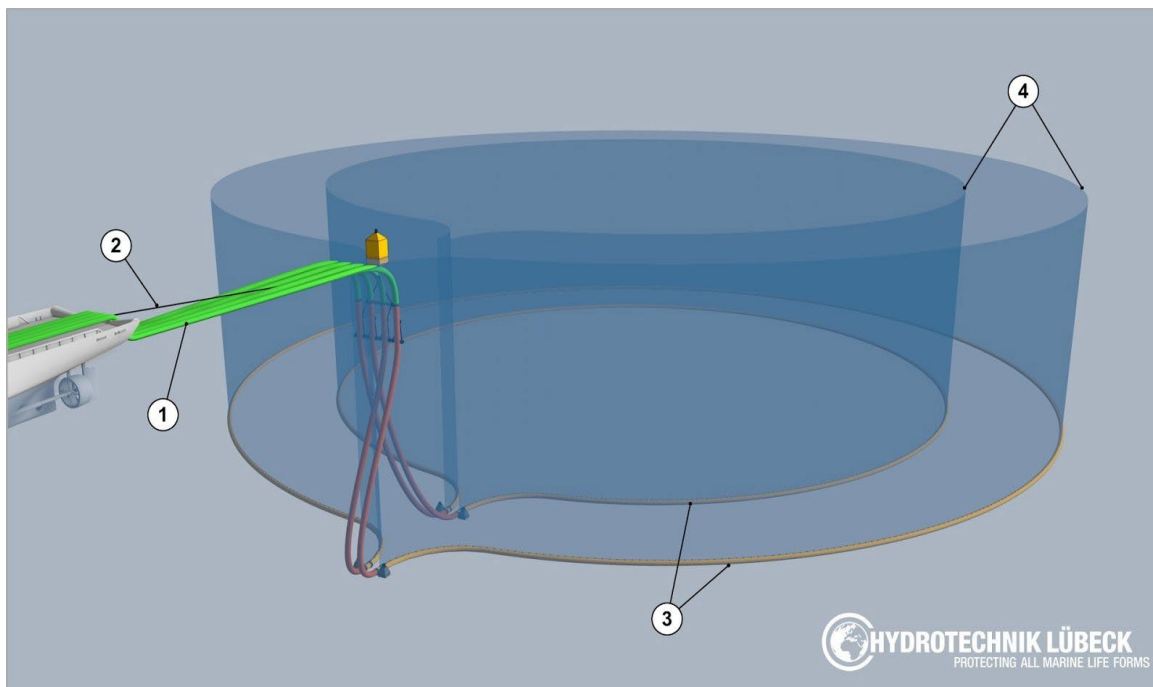
6.10 Connecting supply hoses

Supply hoses will be connected the risers.



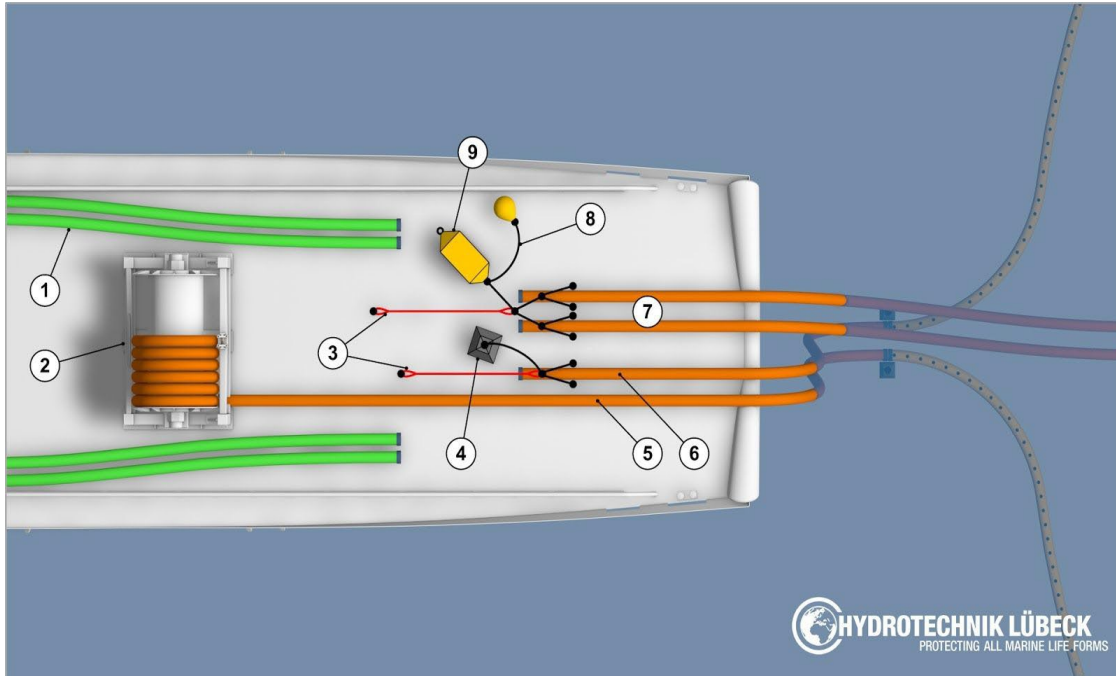
6.11 Operating DBBC

Nozzle hose system in position, NHDV at a safe distance, compressors are running under full power, bubble curtain is rising.



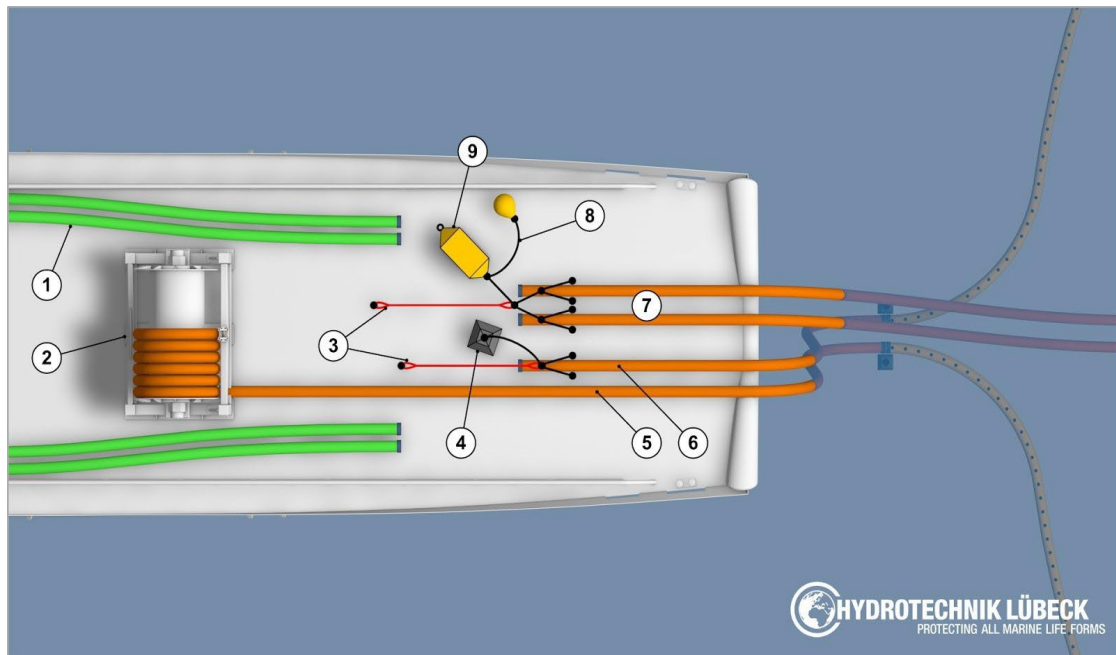
6.12 Disconnecting BBC from NHDV

This action is carried out when the hose system is not immediately taken on board but is deposited for later action on the seabed.



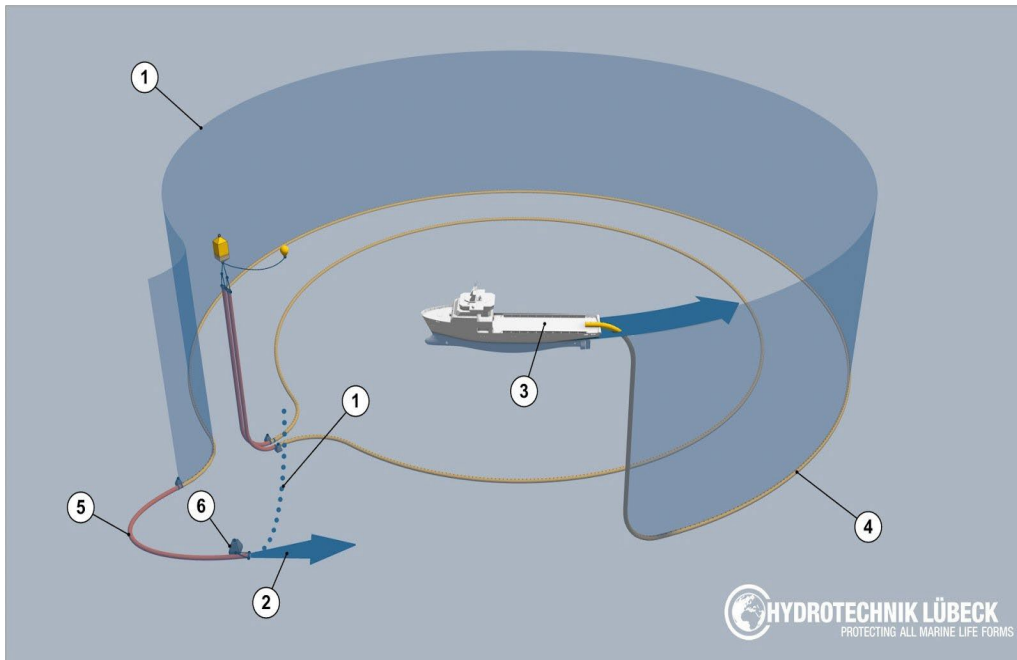
6.13 Disconnecting nozzle hose system

The nozzle hose system must be prepared for recovery of individual hoses.



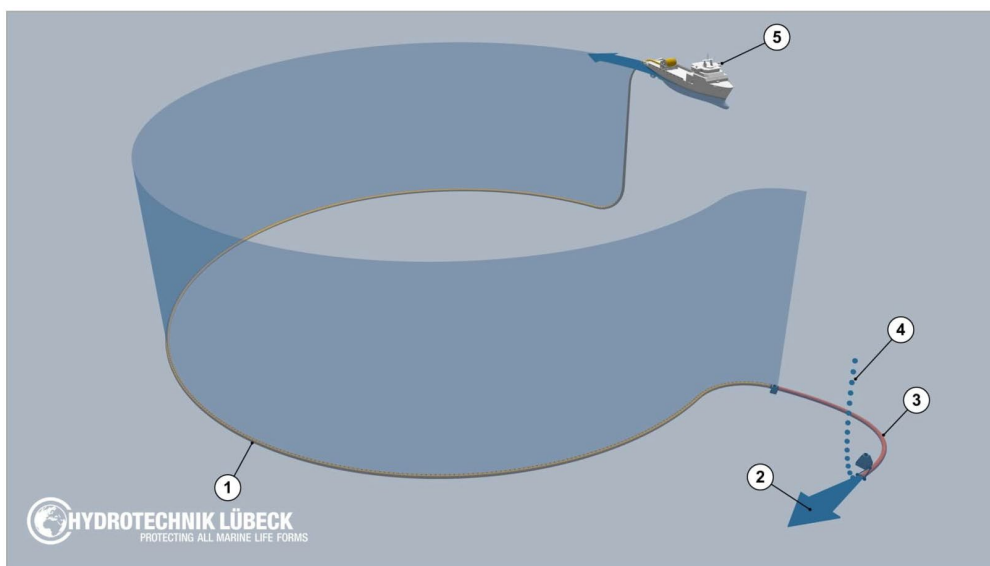
6.14 Start position recover outer nozzle hose

The hose is attached with one end on NHDV to the BBC reel, the second end with an anchor weight at seabed.



6.15 Recovery of the hose

During recovery process, the respective nozzle BBC hose laying on the seabed is under pressure.



- | | |
|---------------------|-------------------------------------|
| 1 Inner Nozzle Hose | 4 Ascending air from open Riser end |
| 2 Rinsed Sediment | 5 NHDV in reverse travel |
| 3 First Riser Hose | |

7 MOBILIZATION

The mobilization is planned to occur at JF Brennan / Senesco Marine Repair Yard, located at Quonset Point, RI. It involves the equipment owned by ThayerMahan and Hydrotechnik Lübeck GmbH, and the rental compressors from ScanTech.

The steelworks required for sea fastening will be performed by JF Brennan / Senesco Marine Repair Yard, which has been contracted by ThayerMahan. The HTL Party Chief and Mobilization Manager, is responsible for overseeing this mobilization. JF Brennan/Senesco will provide Welders, Fitters, Riggers, and Crane Operators for the operation.

For lifting operations across the entire deck, JF Brennan/Senesco Marine will supply a 140-ton crane barge and a 90-ton mobile crane. A lifting plan for the crane is available and can be shared as needed.

To ensure effective communication and safety, Toolbox Talks will be conducted every morning before work commences, involving all individuals participating in the deck works. The deck layouts of a notional vessel can be found in Figure below. All the equipment being mobilized can be found below.

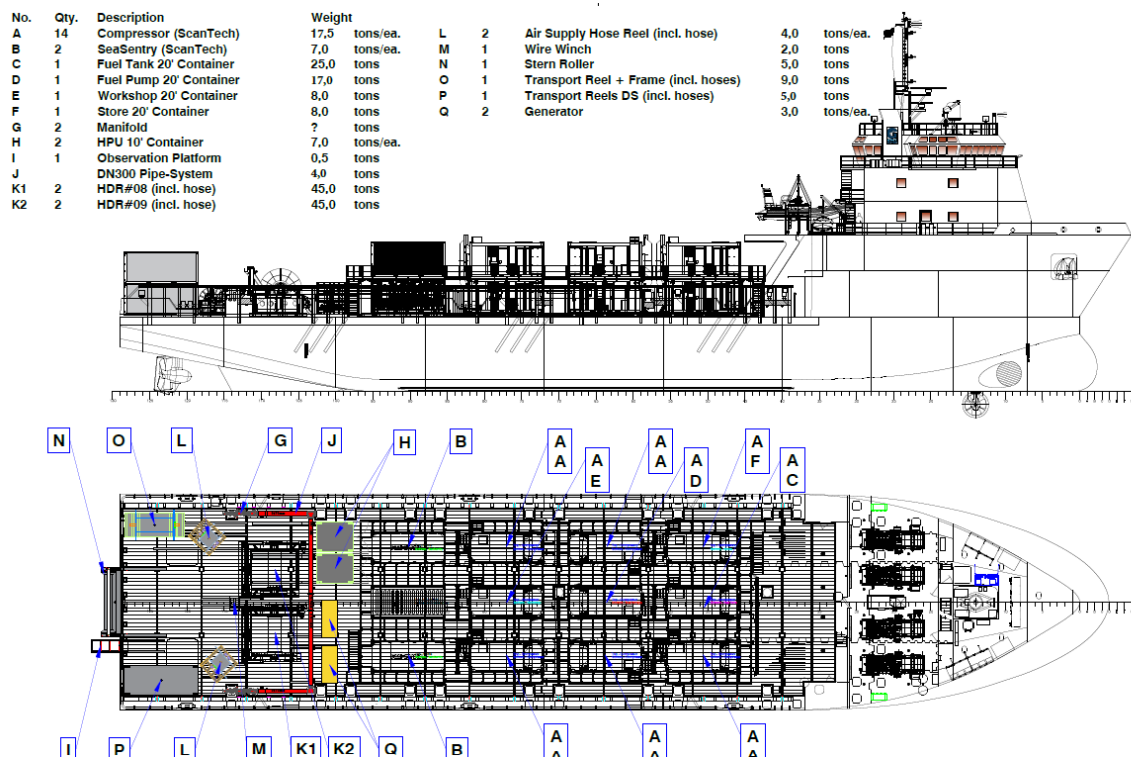


Figure 15, Sample NHDV Layout

8 INSPECTION AND TESTS

Inspections and tests will be done in accordance to following documents:

- ❑ Compressor Operational Log
- ❑ Compressor Maintenance procedure
- ❑ Air compressor check list
- ❑ ITP – Inspection and Test Plan

8.1 Acceptance Testing

Factory Acceptance Testing (FAT) will be done at the factory. Quayside acceptance testing (QAT) on shore will be done after mobilization at port prior to departure to wind development area. Each compressor will be checked individually. The BBC reels will be checked. The Site Acceptance Testing (SAT) is only possible to be done offshore when all nozzle hoses are deployed.

8.2 QAT ONSHORE (Quayside Testing)

This description explains how the acceptance test of the Compressors and Piping on the NHDV is done. Main parts of the equipment:

- ❑ Nozzle hoses
- ❑ Offshore reels
- ❑ Compressors
- ❑ ITP – Inspection and Test Plan

The compressors are delivering the compressed air into a collection system consisting of high-pressure hoses and a steel-pipe manifolds.

The first step of the QAT is done by filling the collection system with compressed air from one compressor until the highest pressure expected during the project is reached. This test is done to control if the collection system is free of any leakage. If there is a leakage it will be sealed by tightening fasteners and the test will be continued. The test is completed when no leakage is achieved.

The second step of the QAT is the test run of each compressor for approx. 20 min.

8.3 SAT OFFSHORE

To test the entire BBC (deployment, hoses under pressure and retrieval of hose), the nozzle hose will be deployed and connected to the compressor system and manifold. The compressors will be started and loaded in groups of four.

If the BBC crew identifies irregularities in the bubble curtain that may influence its noise-mitigation efficiency, the nozzle hose will be recovered and controlled thoroughly.

After the BBC-crew is sure that the nozzle hose is in good order it will be deployed again.

The visual inspection of the nozzle BBC hose is done during each recovery of the nozzle hose so that normally every change in performance will be discovered to remedy before BBC operations.

9 DEMOBILIZATION

The demobilization is planned to occur at Senesco Marine Repair Yard / Brennan Yard, located at Quonset Point, RI. It involves the equipment owned by ThayerMahan, Hydrotechnik Offshore, and the rental compressors from ScanTech.

The steelworks will be removed, and vessels returned to 'as delivered' condition. All sea fastening will be performed by JFBrennan Marine/ThayerMahan/Senesco Marine Repair, which has been contracted by ThayerMahan. The Party Chief is responsible for overseeing this demobilization.

JFBrennan/ThayerMahan will provide Pile Drivers, Riggers, and Crane Operators for the operation.

For lifting operations across the entire deck, JFBrennan Marine/Senesco Marine will supply a 140-ton crane barge and a 90-ton mobile crane. A lifting plan for the crane is available and can be shared as needed.

To ensure effective communication and safety, Toolbox Talks will be conducted every morning before work commences, involving all individuals participating in the deck works.