OCS Study
BOEM 2018-029

Field Observations During Wind Turbine Foundation Installation at the Block Island Wind Farm, Rhode Island

Appendix A: Field Plan

US Department of the Interior
Bureau of Ocean Energy Management
Office of Renewable Energy Programs

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Appendix A: Field Plan

May 2018

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U.S. Department of the Interior
Bureau of Ocean Energy Management
Office of Renewable Energy Programs

Deepwater Block Island Wind Farm Project

Field Data Collection Plan

Contract No. M15PC00002, Task Order No. M15PD00016

Prepared for:

BOEM
Bureau of Ocean Energy Management

Bureau of Ocean Energy Management
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June 2015

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This Field Data Collection Plan (Field Plan) describes the rationale, methods, and protocols for documenting real-time environmental observations during the construction of an offshore wind farm facility. Under this Plan, data on sediment disturbance and recovery and above- and underwater sound will be collected in parallel with construction activities that will be undertaken for the proposed Deepwater Block Island Wind Farm Project, Rhode Island. The utility of conducting ambient onshore air monitoring of criteria pollutants was also evaluated.

This data plan only covers construction activities that will be undertaken during the first construction phase that is scheduled to start on or around August 10, 2015.

This Plan was prepared for the Bureau of Ocean Energy Management's (BOEM) Office of Renewable Energy Programs under Contract No. M15PC00002, Task Order No. M15PD00016. The Plan will be implemented in the field under a separate Task Order.

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ACRONYMS AND ABBREVIATIONS

AC	alternating current
AWAC	Acoustic Wave and Current Meter
BIWF	Block Island Wind Farm
BITS	Block Island Transmission System
BOEM	Bureau of Ocean Energy Management
cm	centimeter(s)
CRMC	Coastal Resources Management Council
dB re 1 μPa	decibel(s) referenced to 1 micropascal
DWBI	Deepwater Wind Block Island
EA	Environmental Assessment
ft	foot/feet
GAP	General Activities Plan
HASP	Health and Safety Plan
Hz	hertz
kHz	kilohertz
kJ	kilojoule(s)
km	kilometer(s)
kV	kilovolt(s)
m	meter(s)
mi	mile(s)
MW	megawatt
MWh	megawatt-hour(s)
NEPA	National Environmental Policy Act
NM	nautical mile(s)
NMFS	National Marine Fisheries Service
O&M	Operation and Maintenance
OCS	Outer Continental Shelf
OFC	Onsite Field Coordinator
RIWINDS	Rhode Island Winds Program

rms	root mean square
RODEO	Real-Time Opportunity for Development of Environmental Observations
ROW	right-of-way
SDR	sediment disturbances and recovery
SHRU	several hydrophone receive unit
U.S.	United States
URI	University of Rhode Island
USACE	U.S. Army Corps of Engineers
WHOI	Woods Hole Oceanographic Institution
WTG	wind turbine generator

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1.0 INTRODUCTION

The United States (U.S.) Department of Interior's Bureau of Ocean Energy Management (BOEM) is responsible for managing the exploration and development of the nation's offshore energy resources. BOEM conducts environmental reviews, including National Environmental Policy Act (NEPA) analyses, for each major stage (leasing, site assessment, construction, operations, and decommissioning) of proposed offshore energy development projects. Through these reviews and analyses, BOEM evaluates potential environmental impacts from the proposed offshore activities on the human, coastal, and marine environments. The NEPA analysis is used to inform the decision-making process for whether and/or how to proceed with the approval of the offshore energy development.

To conduct the required analyses and effectively analyze the potential environmental impacts under NEPA, BOEM requires data on impact producing factors (stressors) and their effects on ecosystems and individual receptors. Development of offshore wind energy is new to the U.S. and therefore data necessary for assessment of environmental impacts are not readily available.
BOEM has therefore initiated the Real-Time Opportunity for Development Environmental Observations (RODEO) Program. The purpose of this Program is to make direct, real-time measurements of the nature, intensity, duration of potential stressors during the construction and/or initial operations of selected proposed offshore wind facilities. It also includes recording direct observations during the testing of different types of monitoring equipment that may be used during future offshore development to measure or monitor activities and their impact producing factors.

Data collected under the RODEO Program may be used as input to analyses or models that are used to evaluate effects or impacts from future offshore activities. This Program is not intended to duplicate or substitute for any monitoring that may otherwise be required to be conducted by the developers of the proposed projects. Also, RODEO Program monitoring will be coordinated with industry and shall not interfere with or result in delay of industry activities.

The first facility to be part of the RODEO Program monitoring is the proposed Block Island Wind Farm (BIWF) Project, which will be located off Rhode Island. This Field Data Collection Plan (Field Plan) describes the rationale, methods, and protocols for recording real-time environmental observations related to sediment disturbances and recovery (SDR) and ambient air noise and underwater sound propagation associated with BIWF construction activities that are scheduled to occur during the first of three construction phases.

1.1 Report Organization

- Section 1 contains an overview of the RODEO Program and describes its purpose.
- Section 2 provides a description of the proposed BIWF Project and its components.

- Section 3 describes the proposed BIWF RODEO Monitoring plan.
- Section 4 discusses an approach for implementation of the Field Plan.
- Section 5 contains an overview of the Health and Safety Plan (HASP).

A series of attachments contain additional information on specific topics.

2.0 BLOCK ISLAND WIND FARM (BIWF) PROJECT DESCRIPTION

The BIWF Project proposed by Deepwater Wind Block Island (DWBI), LLC is a 30-megawatt (MW) offshore wind farm to be located approximately 3 miles (mi) (4.8 kilometers [km]) southeast of Block Island, Rhode Island (about 16 mi [25.7 k]) south of the Rhode Island mainland) (**Figure 1**). The proposed BIWF will consist of five, 6-MW Alstom Haliade 150 wind turbine generators (WTGs), a submarine cable interconnecting the WTGs (hereafter referred to as Inter-Array Cable), and a 34.5-kilovolt (kV) transmission cable from the northernmost WTG to an interconnection point on Block Island (hereafter referred to as Export Cable). The proposed BIWF Project is located entirely within Rhode Island's state territorial waters. The BIWF WTGs, Inter-Array Cable, and a portion of the Export Cable are located within the Rhode Island Renewable Energy Zone established by the Rhode Island Coastal Resources Management Council (CRMC).

In parallel with the proposed BIWF Project, the Deepwater Wind Block Island Transmission, LLC[1], has proposed development of the Block Island Transmission System (BITS). The proposed BITS includes a 34.5-kilovolt (kV) alternating current (AC) bi-directional submarine transmission cable that will run approximately 21.8 mi from Block Island to the Rhode Island mainland (**Figure 1**). The proposed BITS will be capable of delivering power both to and from the Rhode Island mainland. The offshore BITS cable is located within the State of Rhode Island's territorial waters and in Federal waters. On January 22, 2015, the cable right of way was assigned to The Narragansett Electric Company who will install and maintain the cable.

The proposed BIWF Project supports the State of Rhode Island's expressed need for renewable energy established by the Rhode Island Winds Program (RIWINDS). The Project is expected to generate approximately 125,500 megawatt-hours (MWh) each year once it is fully operational, supplying enough energy to power approximately 17,200 Rhode Island households (DOE EIA 2010). The proposed BIWF Project will be capable of supplying the majority of Block Island's electricity needs and will provide an alternative energy source to the diesel-fired generators that are currently used to power Block Island. The BITS will export excess power from the BIWF to the Rhode Island mainland (DWBI 2012).

2.1 Regulatory Permitting

On September 4, 2014, the U.S. Army Corps of Engineers (USACE) published the Final Environmental Assessment (EA), a Finding of No Significant Impact, and issued Permit Number 2012-2724 for the BIWF Project.

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[1]The Deepwater Wind Block Island, LLC and the Deepwater Wind Block Island Transmission, LLC are wholly owned indirect subsidiaries of Deepwater Wind Holdings, LLC.

J:\2015\15-071_BOEM_Deepwater_Block_Island_Wind_Farm_(Khan)\Map_Docs\Draft\Report_Survey_Plan\15_071_Figure 2_BIWF and Block Island Transmission System Project Location_L.mxd | Last Updated: 05.21.2015

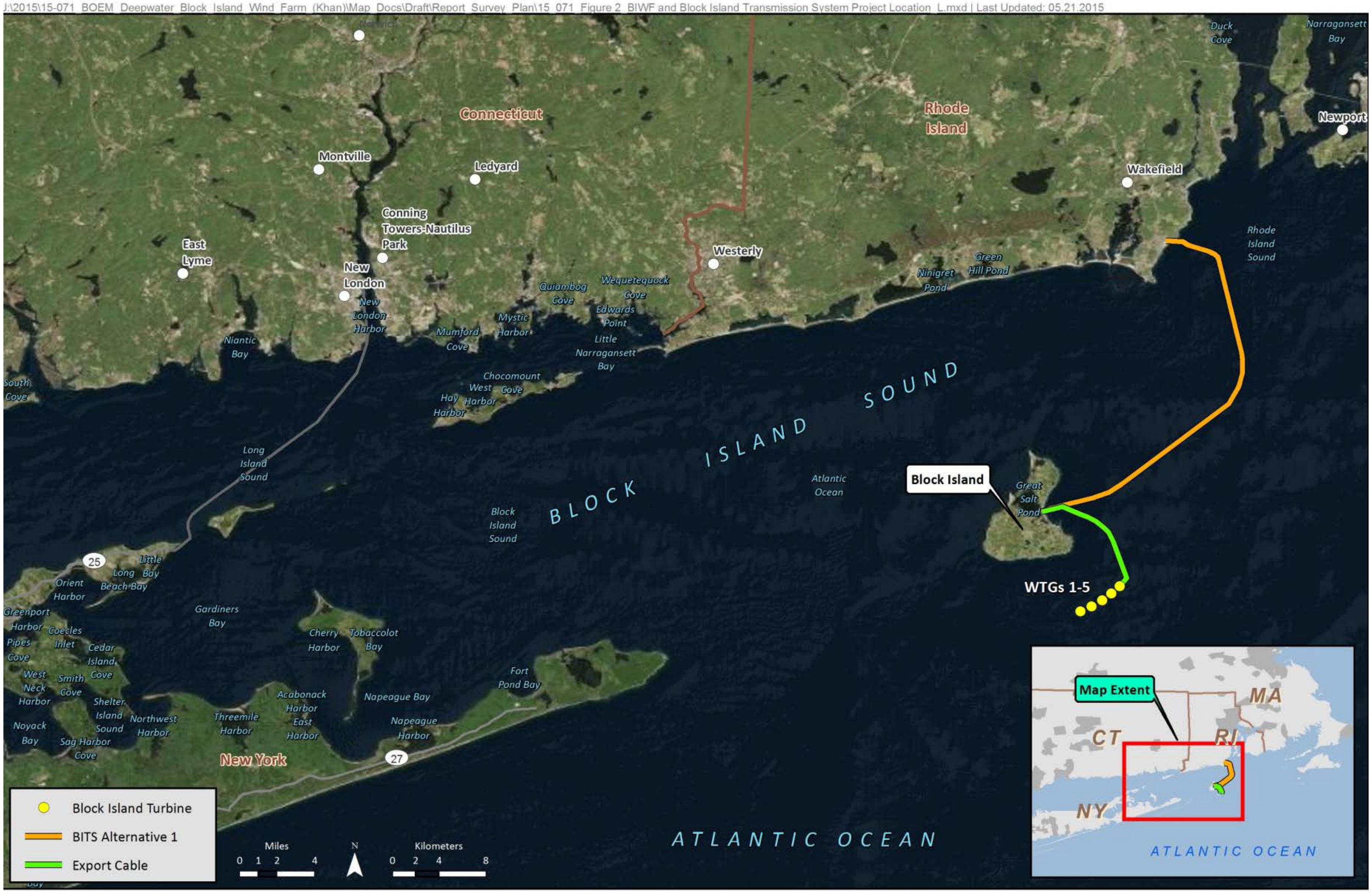

Figure 1: BIWF and BITS Project Location

BOEM participated in the preparation of the EA as a cooperating agency since it has jurisdiction for activities on the Outer Continental Shelf (OCS) and for the BIWF this would include an approximate 9-mi portion of the export cable which will be located in Federal waters. BOEM conducted an independent review of the USACE EA and determined that it complied with the Bureau's and the Council on Environmental Quality's regulations implementing NEPA. The Bureau therefore adopted the EA and issued a Finding of No Significant Impact to comply with its distinct requirements under NEPA to support issuance of a right-of-way (ROW) grant and approval of the General Activities Plan (GAP), with conditions.

A ROW grant was issued by BOEM to the Deepwater Wind Block Island Transmission on November 28, 2014, for the 200-foot (ft)-wide (60.9-meter [m]-wide) corridor in Federal waters. This is a portion of the total 25.1-mi (40.4-km) cable that connects Block Island to the Rhode Island mainland.

The BOEM-approved GAP includes eight standard operating conditions, which are considered to part of the proposed action. Most of these standard operating conditions are consistent with the USACE Special Conditions of Permit Number NAE-2012-2724, but they were modified to be specific to the proposed BITS.

Other permits received by the DWBI for the proposed BIWF Project include a Water Quality Certification under Section 401 of the Clean Water Act from the Rhode Island Department of Environmental Management.

2.2 Regional Bathymetry, Sea Floor Morphology, and Tidal Circulation

2.2.1 Large Regional Bathymetric Features

The BIWF and BITS are located on the continental shelf in Rhode Island Sound. The water depths and large bathymetric features in this area were created and shaped primarily as a result of glacial and inter-glacial processes during the Quaternary period (last 2.6 million years). Those large bathymetric features are believed to significantly influence circulation currents, sediment transport processes, and underwater acoustic noise propagation.

At least three major glacial events occurred in the area during the Quaternary. The most recent glacial maximum occurred approximately 18,000 to 20,000 years ago and the southern limit of that glacial advance is demarcated by a glacial moraine deposit that extends in an east-west direction across Long Island and Montauk Point, Block Island, Martha's Vineyard, and Nantucket Sound. The BIWF is located on this moraine. Moraine deposits are left in place at the edges of the advancing glaciers when they retreat during the interglacial melting. The moraines are typically comprised of sand, gravel, cobbles, and boulder deposits. Moraine deposits are illuminated on the regional bathymetric image shown in **Figure 2** as light brown colored water depths and 100-ft (30.5-m) contour near the BIWF.

Deeper water areas (e.g., dark blue areas in **Figure 2** where the water depths are greater than 125 and 200 ft [38.1 and 60.9 m]) are inferred to be areas where former glacial lakes or post-glacial drainages existed. One large north-south trending paleo-drainage delineated by the 150-ft (45.7-m) contour is located west of Block Island and had incised through the moraine. Another northeast-southwest trending paleo-drainage is located to the east of Block Island approximately where the 150-ft (45.7-m) contour is shown on **Figure 2**. A former glacial lake underlies the bathymetric low immediately east of Block Island where the Proposed Export Cable and BITS Alternative 1 intersect with the 100-ft (30.5-m) water depth contour.

2.2.2 Bathymetry and Seafloor Morphology

The BIWF will be constructed on the moraine feature or adjacent to it. Inference is that the moraine is comprised primarily of sand, gravel, cobbles and may contain boulders. **Figure 3** presents multibeam data rendering of the seafloor morphology in the area as reported in DWBI's Environmental Report. Wind turbine WTG-5 appears to be located on the main part of the moraine, wind turbines WTG-2, WTG-3, and WTG-4 appear to be the flank of the moraine, and wind turbine WTG-1 may be located adjacent to the moraine.

Figure 3 depicts complex seafloor morphology with varying sizes of sand waves and different crestline orientations. The variety of sizes and orientations of the sand waves reflect the complex bottom flow conditions at this site.

- Wind turbine WTG-1 position will be located in the deepest water (90 ft [27.4 m]) of the turbines and at a transition between a relatively flat seafloor with small ripples predominantly finer grained (silty) deposits and an area with moderate sized sand waves with long wavelengths, and east-west crestline.
- Wind turbines WTG-2, WTG-3, and WTG-4 will be located in water depths of 82 to 87 ft (25 to 26.5 m) and the seafloor sediment type is a mix of fine and medium sand. Sand waves are approximately 10 ft (3 m) tall with a wavelength of 1,500 to 2,000 ft (457 to 609.6 m).
- Wind turbine WTG-5 position will be located in the shallowest water depth (75 ft [22.9 m]) in an area with complex seafloor morphology near the axis of a northwest-southeast trending ridge. Superimposed on the ridge are northeast-southwest crestline oriented sand waves that are 4 to 6 ft (1.2 to 1.8 m) tall. Based on their orientation with respect to the tidal current axis, they may be maintained during ebb/flood tidal currents. The surficial deposits are primarily sand with interspersed gravel. The coarse moraine deposits are exposed at the seafloor and likely make the large ridge erosion resistant. The surficial sands superimposed on the ridge appear to be highly mobile.

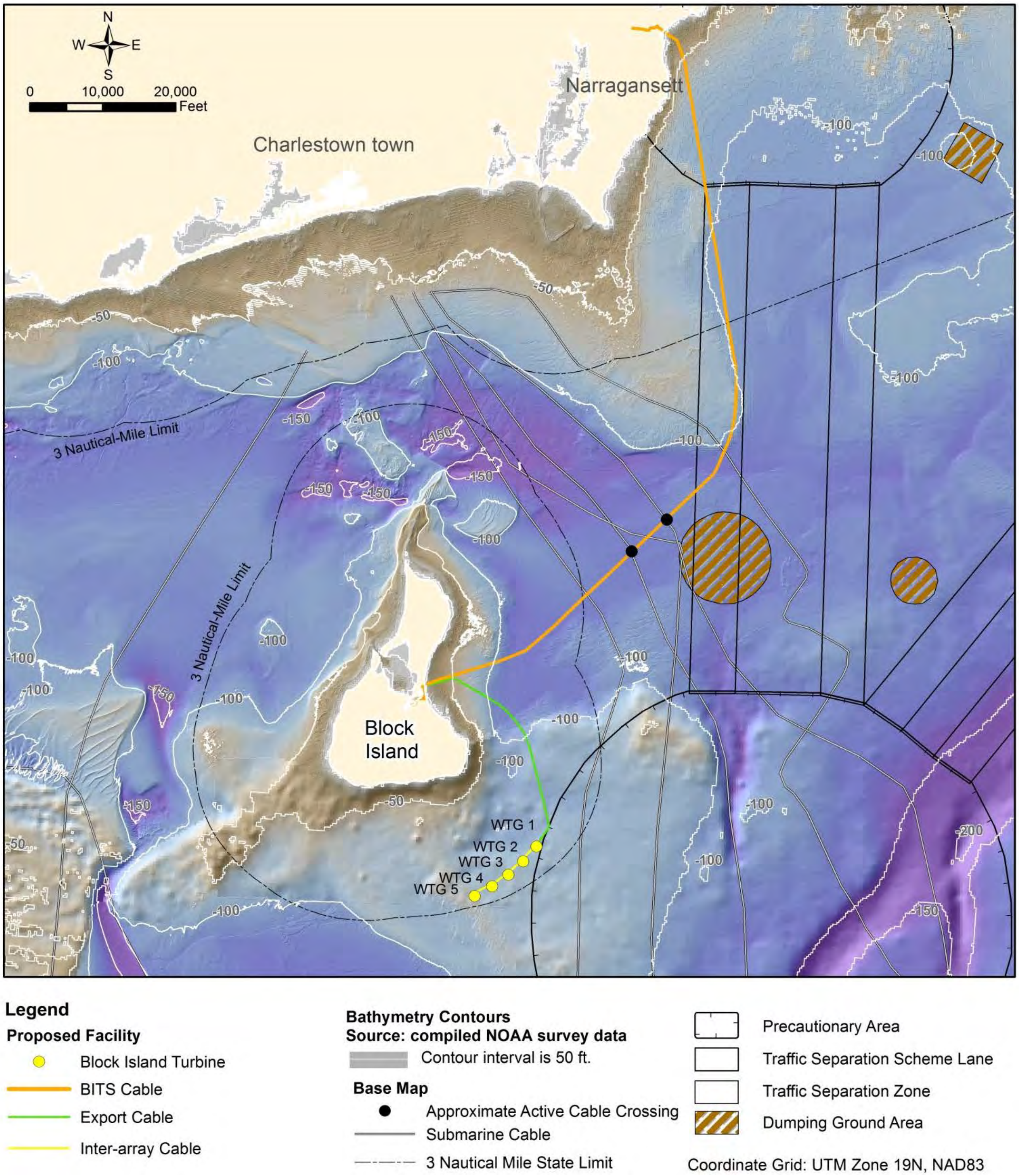

Figure 2: BIWF Project Area Regional Bathymetry

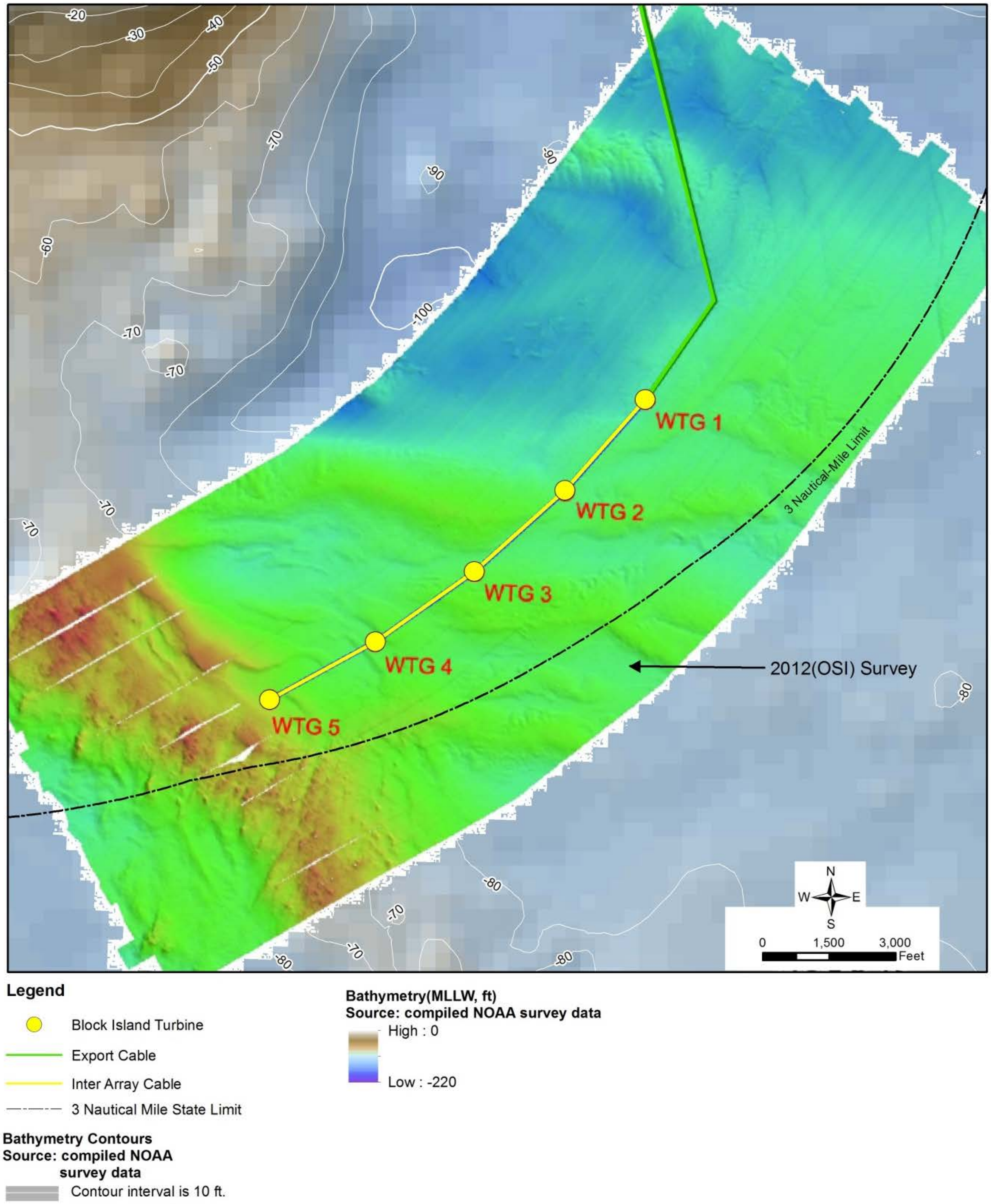

Figure 3: BIWF Project Area Seafloor Morphology

2.2.3 Regional Tidal Circulation Patterns

A tidal circulation model has been developed as part of the CRMC's Rhode Island Ocean Special Area Management Plan. The Rhode Island Ocean Special Area Management Plan analysis found that the M2 semi-diurnal (twice a day) tidal harmonic was the predominant tidal current frequency, also signifying that while the atmospheric conditions affect the magnitude or direction, the bulk of the energy in the system is due to tidal forcing. Flows are separated by Block Island and appear to be flood-dominated in the BIWF footprint. A northwest-southeast trending ridgeline at WTG-5 appears to be maintained by this flow.

2.3 BIWF Project Components

Key components of the proposed BIWF Project include the following:

- WTG
  - Five WTGs on jacket foundations
  - Collection System
- Submarine Inter-Array Cable
- Submarine and terrestrial Export Cable
- BIWF Generation Switchyard (part of the Block Island Substation).

Key components of the proposed BITS include the following:

- BITS Island Switchyard (part of the Block Island Substation)
- Submarine and terrestrial BITS Cable
- Narragansett Switchyard.

In addition, the proposed Project will be supported by construction of an Operation and Maintenance (O&M) facility in Rhode Island. Additional details on each individual component of the BIWF and BITS are presented in **Attachment A**.

2.4 BIWF Construction Activity Overview

The following overview of construction activities is based on information contained in the USACE permit application (Section 3.2.1.3). Each WTG will be supported by a 50-ft × 50-ft (15.24-m × 15.24-m) four-leg jacket foundation that is secured to the seafloor with four, through-the-leg foundation piles that are between 42 and 54 inches (106.7 and 137.2 centimeters [cm]) in diameter. Each member is joined together in a lattice structure which sits on the seabed supporting the WTG. Jacket foundations will be installed during 2015 at the locations shown in **Figure 1**.

Offshore installation of the jacket foundation will be carried out from 500-ft (152.4-m) derrick barges moored to the seabed by an 8-point mooring system consisting of 10-ton anchors with a maximum penetration depth of 10 ft (3 m).

The derrick barge will be anchored at the location of the first foundation, most likely the most northern WTG (WTG 1). Prior to commencing installation activities, the seabed will be checked for debris and levelness within a 100-ft (30.5-m) radius of the jacket installation location, and debris removed (e.g., via a grapnel) as necessary.

The jacket will be lifted from the material barge, placed onto the seafloor, leveled, and made ready for pilings. The piles will be inserted above the sea level into each corner of the jacket in two segments. First, the lead sections of the piles will be inserted into the jacket legs and then driven into the seafloor. The second length of piles will be places on the lead pile section and welded into place. The foundation piles will be driven into the seafloor to their final penetration design depth of 250 ft (76.2 m) or until refusal, whichever occurs first. Duration of pile driving is anticipated to be 4 days assumed daylight-only working conditions. Boat deck and landings will then be installed. Jacket foundations will be installed one at a time at each WTG location over a total of 5 weeks assuming no delays due to weather or other circumstances.

DWBI has conservatively estimated that the derrick barge may need to reposition and deploy anchors up to three times per foundation. Based on the depth of the water, it has been estimated that some anchor cables will be as long as 4,500 ft (1,371.6 m); this calculation was used to estimate the dimensions of the Area of Potential Effect. The weight of the anchor cable will cause it to drape through the water column and close to the anchors, so the cable may rest on the seafloor, potentially sweeping across the substrate in response to bottom currents. Where cable sweep occurs in soft substrate, the top few inches of the sediment may be temporarily disturbed and may potentially impact benthic infauna.

Installation of the WTGs themselves will be supported by two jack-up barges (i.e. the transportation barge and the installation barge) both held in place with spuds. The barges will remain in place at a separate location for each WTG and DWBI has assumed that each barge could be repositioned once at each WTG (a total of 10 anchor locations for each barge). Each spud will directly impact the substrate.

The proposed Construction and Operations Plan intends to avoid impacting hard bottom areas as much as possible. The Anchoring Plan is shown in **Figure 4**.

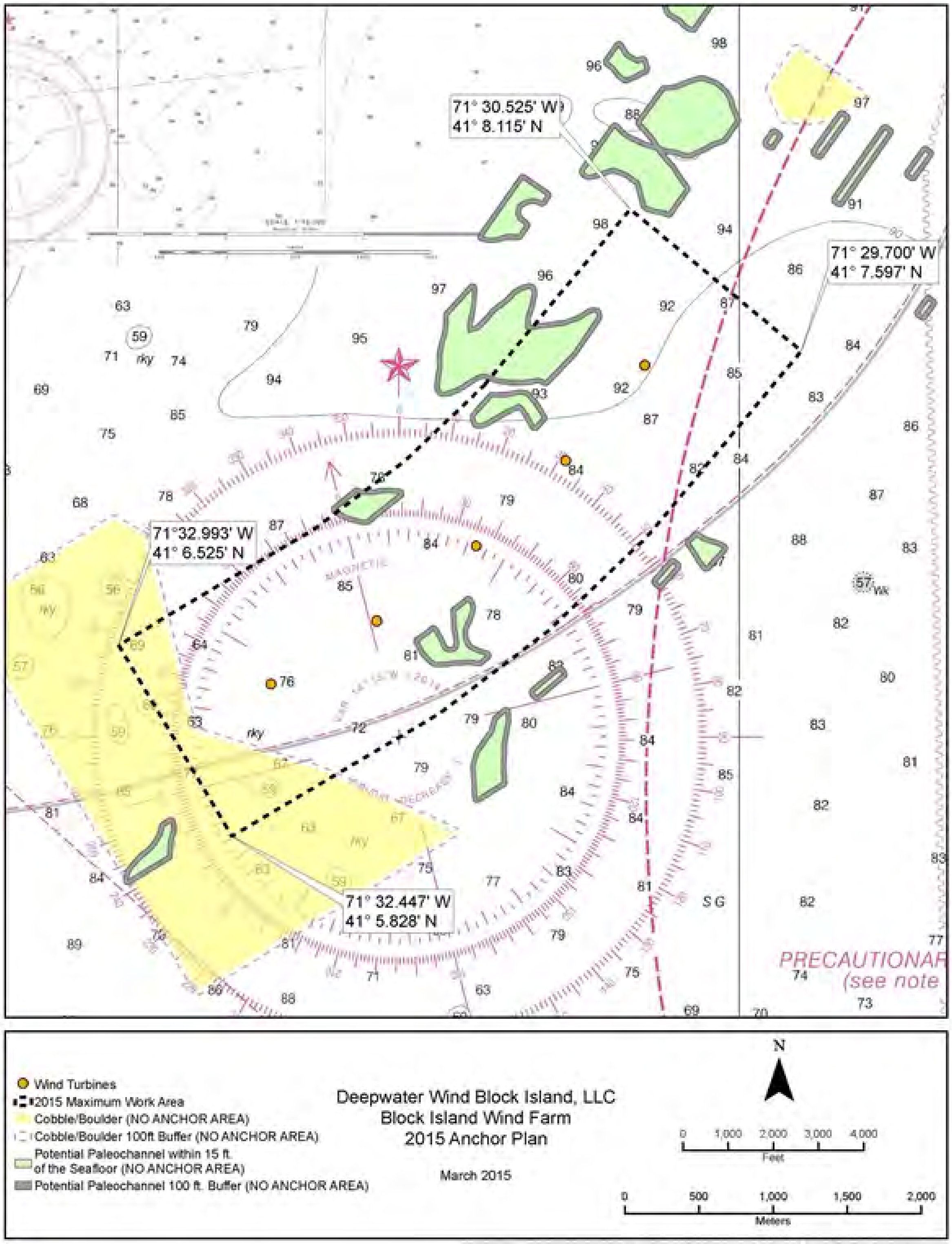

Figure 4: BIWF Anchoring Plan

2.4.1 Scour Considerations

When a structure is placed on a seabed, scour depressions may form around the foundation element (i.e., pile) at the seafloor as currents interact with the structure. The spatial extent, depth of scour and rate of development are primarily based on speed of the current, sediment type, and size and shape of the foundation element. In loose, sandy deposits, scour can develop and reach equilibrium in minutes or hours. In fine-grained, cohesive sediments, scour can take much longer to develop. Scour pits can change shape or infill in response to a change in bottom current flow direction during storm events, circulation pattern changes or change in a tidal cycle. Scour, if not planned for appropriately during design, can impact the safe operation of wind turbines and cables.

Since no wind turbines have been constructed previously on the Atlantic OCS, it is not well understood how scour will develop and how it may affect the safe operation of the wind turbine and cables. The proposed BIWF Project presents the first opportunity to observe an offshore wind turbine in Atlantic OCS waters and gain an understanding of the processes.

3.0 FIELD DATA COLLECTION PLAN

The Field Data Plan presented in this section describes the rationale, methods, and protocols for recording real-time measurements of the nature, intensity, propagation and duration of anthropogenic sound and sediment disturbance and recovery associated with the construction of the five BIWF WTG platforms. It is important to note that this Field Data Plan only covers construction activities that will be undertaken during the first construction phase that is scheduled to start on or around July 17, 2015.

Visual observations of construction activities from the shoreline and adjacent to the construction site will be also logged during the construction phase. The real-time data collected through the implementation of this Plan will provide additional information necessary for BOEM's evaluation of environmental effects of future facilities and generate data to improve the accuracy of models and analysis criteria employed to establish monitoring controls and mitigations.

3.1 Visual Documentation of Construction Activities

The following two tasks will be conducted:

1. Onshore visual observations
2. Offshore visual observations.

Specific activities conducted under each task are described below:

Task 1 – Onshore Visual Observations

During the construction of the foundations for WTG 2 and 3, a dedicated onshore observer will record the following from the Southeast Lighthouse on Block Island:

- Visibility of construction activities from shoreline,
- The types of lighting used at the construction site and what can be seen from the shoreline, and
- Meteorological conditions that affect visibility from shore including humidity.

Data will be recorded daily at sunrise, mid-day, sunset, and during significant changes in meteorological conditions (rain, fog, etc.) during each day that construction activity takes place. The observations will include a set of photos taken from a fixed point on the shoreline, at the same angle, and using a constant zoom setting on the camera. Video recordings will be made as necessary to document unusual sightings or infrequent occurrences.

Task 2 – Offshore Visual Observations

A second dedicated observer will be located offshore on a boat adjacent to the construction site. The offshore observer will record the following on a daily basis during the construction of the foundations for WTG 2 and 3 (a total of two weeks):

- Number, size, and type of construction vessels
- Size and location of deployed anchors
- Number and nature of lighting used at the site
- Type of construction activities being conducted and duration of each activity.

Where possible, the observer will also record relevant salient information including incidental observations on presence of marine species and other activities (fishing vessels, recreational vessels and etc.). The offshore observation location will be selected such that the observer vessel does not interfere with the construction activities or with transit of the construction vessels. Construction activity observations will be recorded using a field data log sheet and a photo log will be maintained. Video recordings will be made as necessary to document unusual sightings or infrequent occurrences.

The offshore observer will also serve as the Onsite Field Coordinator (OFC) during the Field Plan implementation. The OFC will be primarily responsible for ensuring coordination between DWBI construction contractors, DWBI environmental data monitoring team, the RODEO data collection teams, and the onshore observer.

The offshore observer will also serve as the onsite Health and Safety representative for the RODEO Team and will be responsible for ensuring that all field data collection is performed in accordance with the pre-approved site-specific Health and Safety Plan (see **Section 5**). Daily "tailgate" meetings will be held amongst all the RODEO Team. The OFC will attend DWBI safety meetings. The OFC will include information from the DWBI safety meetings that has applicability to the RODEO team in the daily "tailgate" meetings. A record of all health and safety meetings and acknowledgements will be maintained by the OFC.

The OFC will remain onsite for the entire proposed 5-week construction period. Onshore and offshore observations records will be maintained and backed up daily and will be summarized weekly and at the end of the construction phase. In the event there is a need to change out the OFC, a minimum of a 1-day overlap will occur with both OFC present for construction and monitoring activities.

3.2 Acoustic Monitoring

The purpose of the RODEO acoustic monitoring will be to measure and record real-time changes in the sound environment during the first phase of BIWF construction. Pile driving for the WTG foundations and vessel movements will be the main source of anthropogenic sound that will be targeted during this monitoring. Our proposed field data collection approach will provide BOEM with real-time data that can be used to evaluate environmental effects of future facilities and to validate the modeling that was conducted for the Environmental Assessment using the publicly available AcTUP modeling software to project impacts associated with construction noise. Acoustic data collected under this field plan will not substitute for or duplicate data that will be collected by DBWI (see Section 3.2.1).

3.2.1 DWBI Hydroacoustic Monitoring Plan Summary

The DWBI Hydroacoustic Monitoring Plan (TetraTech 2015) describes the sound data collection process that will be followed by the DWBI environmental monitoring team to ensure compliance with permits/authorizations issued by the National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS) under the Marine Mammal Protection Act and Endangered Species Act. Under this plan, vessel-based and static measurement of underwater sound pressure changes will be recorded. The measurements will be focused on identifying or validating ranges at which the impact criteria for the following selected key species are reached:

- 1,968.5 ft (600-m) 180-decibels referenced to 1 micropascal (dB re 1 μPa) root mean square (RMS) marine mammal Exclusion Zone associated with the 600-kilojoule (kJ) impact pile driver.
- 4.4 mi (7-km) 160-dB re 1 μPa RMS marine mammal Monitoring Zone associated with the 600 kJ impact pile driver.
- Distance to the 207-dB re1 1 μPa RMS sea turtle acoustic injury threshold.
- Distance to the 166-dB re1 1 μPa RMS sea turtle behavioral disturbance threshold.
- Distances to the Atlantic sturgeon 206 dB re1 1 μPa Peak and 187 dB re 1 μPa^2-s cumulative sound exposure level injury thresholds.
- Distances to the 150-dB re1 1 μPa RMS Atlantic sturgeon acoustic behavioral disturbance threshold.

Real-time measurements will be recorded during the installation of the first jacket foundations over 4 days. Monitoring will conducted at 656.2 ft (200 m) to 0.6 mi (1 km), and 2.2 mi (3.6 km) to 4.3 mi (7 km) from pile-driving activities at WTG1 on a vessel or vessels using two hydrophones at different depths. A temporary fixed monitor will be located at approximately

1.968.5 ft (600 m) and 32-day monitors will be located at 2.2 mi (3.6 km) and 4.4 mi (7 km) from the piling at WTG1 to the southeast.

3.2.2 RODEO Monitoring Plan

The proposed RODEO acoustic monitoring plan will focus on measuring changes in airborne and underwater sound pressure levels (in frequency range 10 Hertz [Hz] to up to 96 kilohertz [kHz]). Airborne sound levels will be recorded at both onshore and offshore locations. The RODEO monitoring is intended to collect additional and more detailed information, which goes beyond data required to be collected by DWBI. The following tasks will be conducted:

1. Airborne sound monitoring
2. Underwater sound monitoring
3. Gathering data for particle motion analyses
4. Deployment of a towed acoustic array
5. Data analyses and reporting
6. Advanced data evaluation (optional).

Specific activities that will be conducted under each of the six tasks are described below:

Task 1: Airborne Sound Monitoring

This task will include monitoring changes in airborne sound pressure levels at selected onshore (Subtask 1a) and offshore locations (Subtask 1b). At each location, monitoring will ideally be conducted prior to start of pile driving (to characterize the background sound environment [baseline conditions]) and during active pile driving.

Subtask 1a: Onshore Airborne Sound Monitoring

Airborne sound pressure levels will be simultaneously recorded onshore and over water at the following two onshore locations for one full foundation installation (either WTG 2 or 3):

- Mohegan Bluff s (Southeast Lights), on Block Island., and
- Point Judith on the Rhode Island mainland.

These locations have been selected based on geography, distance from the WTGs, and meteorological conditions (especially wind direction and speed) likely to prevail during the proposed construction period. During the spring and summer months, prevailing winds in the BIWF Project area are generally from the southwest at 5 to 10 knots. The southerly wind direction suggests that there may well be audibility in airborne noise at the three proposed locations. Should the wind direction during the monitoring period be substantially different from the normal southeasterly winds, the monitoring locations may be relocated to other more suitable areas.

It should be recognized that airborne sound propagation is influenced by a myriad of interacting natural and anthropogenic factors; wind speed and direction being one of most influential ones. Also, it is possible that the sound environment at other onshore locations (beyond the three location identified above) in the general vicinity of the BIWF Project may also be significantly influenced, especially on Block Island itself, depending on meteorological conditions.

At each of the two locations, the actual monitoring station will be located during the site reconnaissance visit. The team will not have access to private properties; therefore the monitoring stations will be located in public areas with relatively unhindered access. Areas with elevated anthropogenic background noise such as road or rail transportation hubs will be avoided.

At each monitoring station, data will be measured and recorded by a designated surveyor in general accordance with the basic principles of ISO 1996-1 (*Description, measurement and assessment of environmental noise – Part 1: Basic quantities and assessment procedures)* and ISO 1996-2 (*Description and measurement of environmental noise – Part 2: Determination of environmental noise levels*).

Monitoring equipment will include the following:

- Larson Davis 831 or other similar Type 1 sound level meter(s),
- Dedicated acoustic calibrator

As appropriate, L_{Amax}, L_{Aeq}, L_{A10}, and L_{A90} will be measured with a Type 1 integrating sound level meter. Octave and one-third octave band measurements will be acquired of all airborne noise samples in at least 63 Hz to 8,000 Hz bands. Relevant environmental conditions during measurements, such as wind speed and direction and temperature will be recorded.

Onshore airborne monitoring will be conducted into two separate phases:

Phase 1: Short-term Baseline Conditions – Onshore airborne sound measurements will be recorded at all three onshore monitoring stations simultaneously 1 to 2 days prior to the start of the BIWF pile driving activity. Measurements will be made over a 24-hour period including early morning and late evening, rush hours (if appropriate), and the middle of the day and night.

Phase 2: Construction Period – Onshore airborne sound data will be recorded during periods of active pile driving for one full foundation installation (either WTG 2 or 3). Airborne sound data will be simultaneously recorded at (depending upon wind direction) at Mohegan Bluffs on Block

Island and Point Judith on the mainland as well as offshore. At each onshore location, a designated surveyor will be responsible for measuring and recording the data..

Metrological data will be sampled at the measurement locations at the time of survey. Wind speed and direction, temperature and humidity will be recorded using hand held monitoring devices. Any precipitation or moisture on the ground will be noted. Ideally this will be supplemented by recorded data from a nearby-dedicated weather station if available.

Subtask 1b: Offshore Airborne Sound Monitoring

The rationale and approach for offshore airborne monitoring will generally be the same as that described above for onshore airborne monitoring. Offshore airborne sound measurements will be made using a microphone with a suitable high performance windscreen that is attached to the vessel framework above the wheelhouse and connected to a sound level meter. The vessel engines will be shut down when making recording these measurements to minimize background noise. This monitoring will also be conducted in two phases:

Phase 1: Short-term Baseline Conditions – Data will be recorded at least one to two days prior to the start of the BIWF pile driving activity. Measurements will be made over a 24-hour period including early morning and late evening, and the middle of the day and night.

Phase 2: Construction Period – Offshore airborne sound measurements will be recorded during periods of active pile driving for one full foundation installation (either WTG 2 or 3) simultaneously with onshore airborne sound monitoring and in parallel with underwater sound monitoring. The start and end times for daily pile driving activities will also be recorded as part of the offshore airborne monitoring.

Subtask 1c: Airborne Monitoring Data Reduction and Reporting

Following the completion of the airborne sound recording surveys, a series of time histories will be generated demonstrating key metrics including L_{eq}, L_{90} and octave/one-third octave band frequency data. The noise and/or vibration level at fixed distance (e.g. 10 meters) for each item of equipment sampled, and its propagation over land where available, will be calculated. If suitable long-term baseline data is available, measurements made during the surveys will be compared to the baseline to determine the change in the sound environment.

Survey data will be documented in a detailed report that will also describe the survey methodology, monitoring equipment, monitoring conditions, and recommendations for future monitoring.

Task 2: Underwater Sound Monitoring

This task will include monitoring changes in underwater sound pressure levels and seabed vibrations at selected locations around the BIWF Project area during WTG pile driving. This monitoring will start in parallel with initiation of construction activities for the WTG 1 foundation and will be continued on each WTG construction activity. The following types of equipment may be used for this purpose:

- Either Bruel and Kjaer type 8106, or Reson type TC4014 hydrophone for attended monitoring
- Ocean Sonics icListen HF hydrophone (most suitable for long-term baseline monitoring)
- Pistonphone calibrator
- Variable gain preamplifiers
- National Instruments USB-6216 Data Acquisition hardware
- Subacoustech's dedicated Survey software
- Cabling, anti-heave buoys etc.
- Underwater geophone (to be confirmed)

Additional equipment may be added to this list as a result on ongoing discussions with BOEM.

A fixed location hydrophone will be located at 750 m, or an alternative location deemed suitable, which could be a buoy or other existing fixed location already available near to the pile location (**Figure 5)**. This hydrophone will operate continuously over the day to capture the variation in piling noise output. At the end of a measurement day, the equipment will be collected, downloaded and refreshed, and reinstalled at the start of the next measurement day. In addition to the fixed noise monitors, vessel-based measurements will also be made on pre-determined transects around the piling rig.

Noise levels from each piled leg will be sampled on transects. Waterborne sound pressure at approximately mid-depth and one meter above the seafloor will be sampled. Seabed vibration (tri-axis) will also be sampled at each location, and on completion of the measurements the vessel will move out to the next position, where the measurements will be repeated. The standard offshore construction measurement procedure is as follows: On advance instruction that piling will commence shortly, the vessel will mobilize to the WTG installation site and install the fixed monitor. The vessel will then move to the closest authorized position to the pile and set up the sound pressure and seabed monitoring equipment with heights, depths and orientations noted.

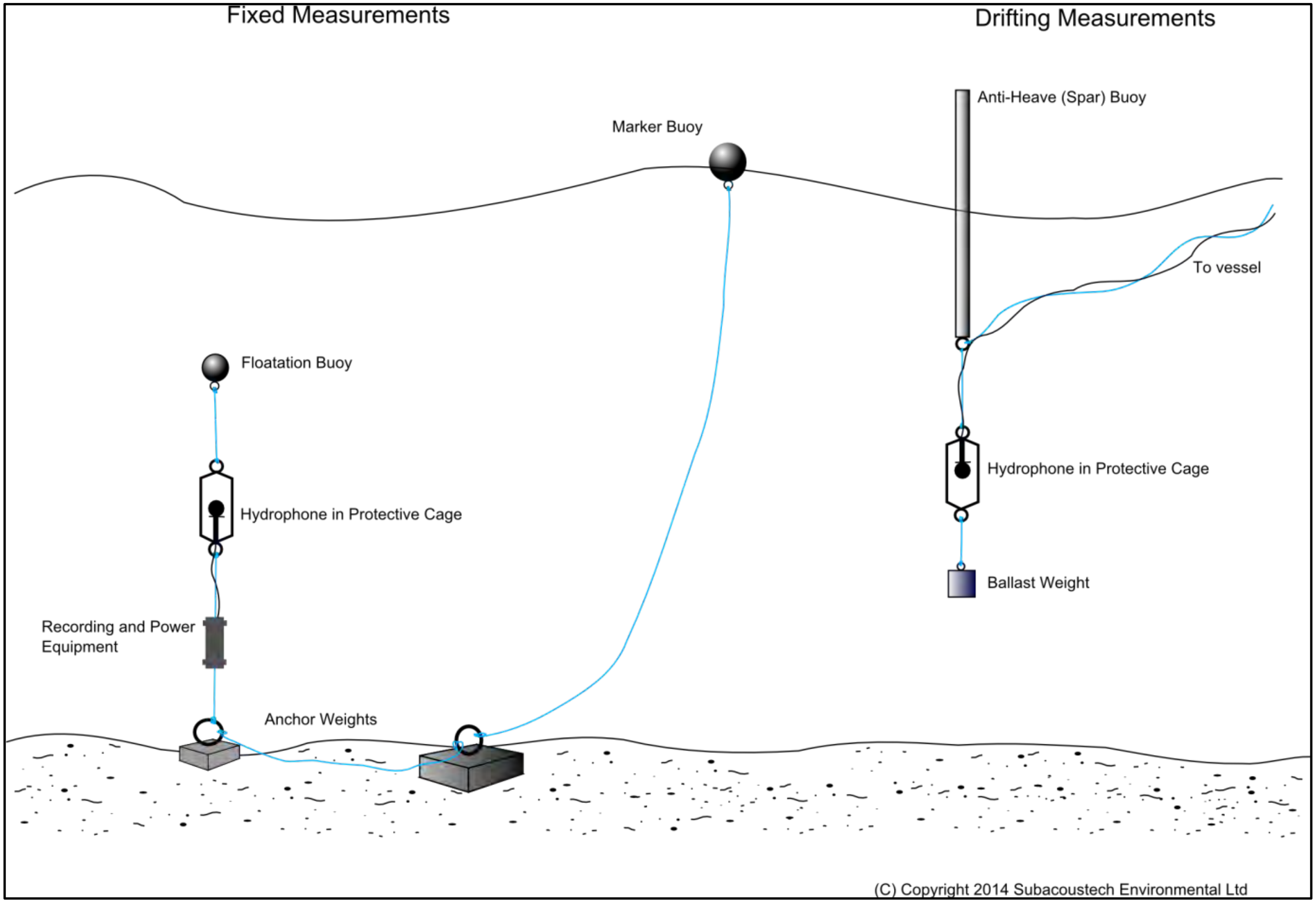

Figure 5: Configuration and Physical Setup of Underwater Sound Monitoring Equipment

On commencement of soft start, the vessel will shut down all noise producing machinery and equipment. Sampling will then start and measurements of sound pressure and vibration will be taken. The hydrophones will be manually deployed and allowed to drift with the current during recording to minimize flow noise. A surveyor wearing headphones will monitor the sound being sampled. Typically three 10-second samples are taken in each location.

On completion of measurements in the location all equipment is retrieved and the vessel restarts, moving to a position approximately double the distance from the piling of the last. A transect will be continued until the piling is completed, the piling noise is no longer audible or a level of under 120 dB re 1 μPa is reached.

On completion of each transect, another transect direction will be selected. Transects will be selected based primarily on variation in depth, although three to four transects are anticipated: northwest towards Block Island, north towards Point Judith, east and south (or southeast) into deep water.

The range out to which the measurements can be taken depends on how long each leg section takes to drive. It is normally preferable to obtain measurements over a continuous, unbroken transect. Currently it is unknown how long each piling duration will be, but if they are short, say 1 to 2 hours or less, it will be preferable to avoid duplication of work being undertaken by DWBI and to focus on measurement locations where greatest modeling uncertainty lies: at positions in the shallow water approaching Block Island, at long ranges of 6.2 mi (10 km) from the piling and beyond and at close ranges (less than 0.6 mi [1 km]) for seabed vibration.

Measurements will be taken during each of the piling events, and where durations are short, attempts will be made to capture as many of the situations above as possible during subsequent events, and then to repeat situations to ensure robust datasets are acquired. Where piling events are very short then it may be necessary to undertake sampling for one dataset at a time, e.g., noise or vibration.

In the absence of noise from piling activities, noise from vessels associated with the project will be sampled in such a way as to identify a reasonable source noise level from them. It will not be possible to follow the methodology defined in ANSI S12.64-2009 “Quantities and Procedures for Description and Measurement of Underwater Sound from Ships” due to the depths around Block Island and prescriptive requirements for source vessel transits. Vessel-based sound pressure measurements will be taken at ranges from approximately one source vessel-length out to the point where the noise reaches ambient background noise levels on transects to the bow, stern, port and starboard of key vessels where time allows.

Offshore environmental conditions will be sampled on a daily basis and repeated in key locations. Conductivity, depth, and temperature measurements will be taken to calculate a sound velocity profile in the water, and weather conditions (wind speed, direction, wave heights, cloud cover, air temperature) will be noted. The presence of any noise sources in the vicinity will be noted, and during vessel-based monitoring the underwater sound will be listened to in real- time to detect any unexpected noise sources.

No direct monitoring will be conducted for the 207-dB thresholds as this would require field crew to get very close to the construction site, which may not be permitted due to safety reasons. The HDR Team will evaluate feasibility of monitoring for the 150-dB thresholds. Our initial target for ending a transect is background noise or a level of under 120 dB re 1 μPa, whichever comes first.

As appropriate, GPS coordinates will be recorded for each location where the measurements are made. Parameters, such as time, depth, bottom type, ambient temperature, etc. may be recorded, where applicable.

An overview of the proposed RODEO acoustic monitoring locations is shown in **Figure 6**.

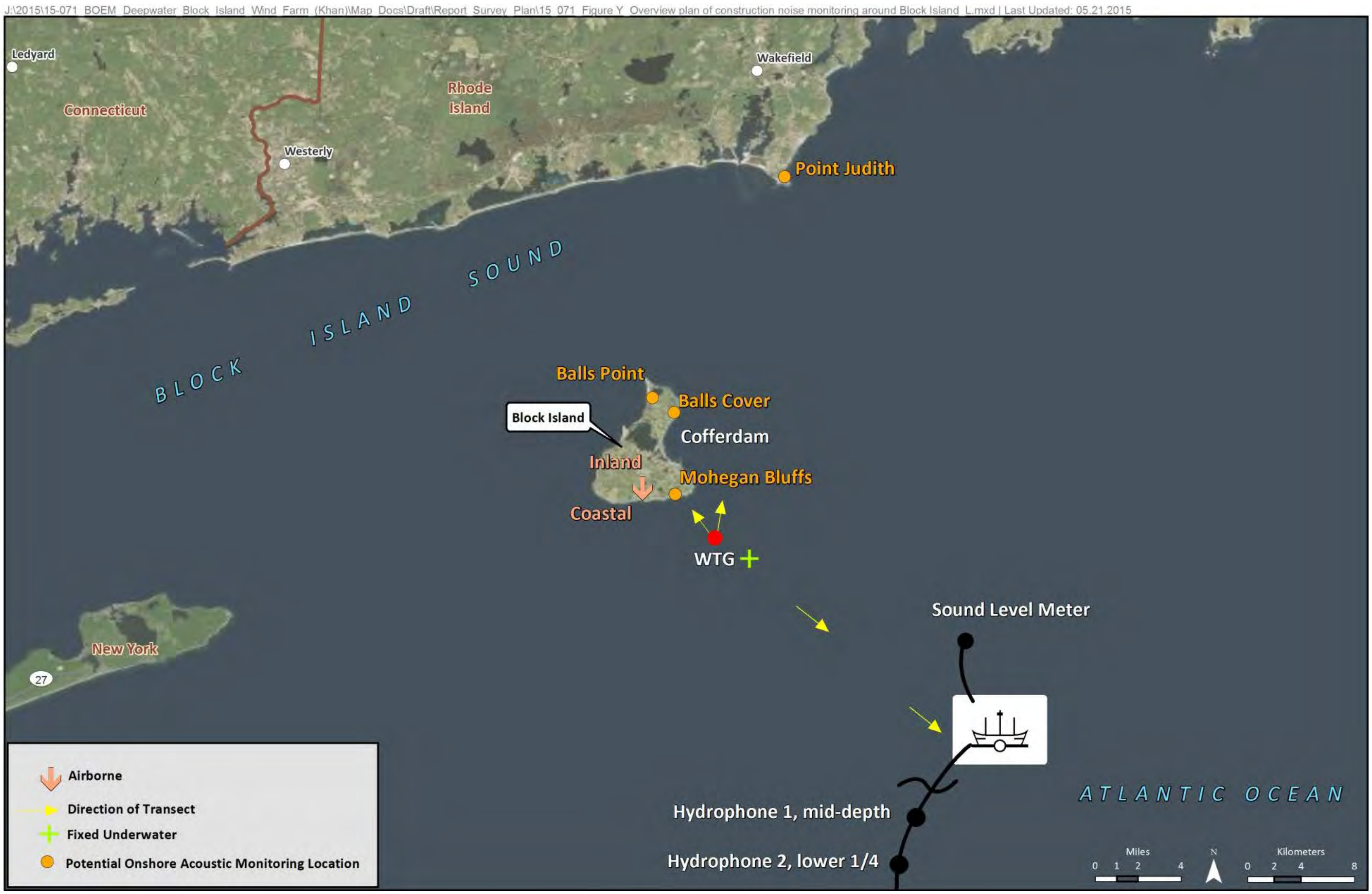

Figure 6: Overview plan of construction noise monitoring around Block Island

Task 3: Gathering Data for Particle Motion Analyses

This task will include measuring the radiated underwater acoustic sound pressure and particle motion from the impact pile driving at a number of fixed locations using moored passive acoustic and geophone systems. Data collected from geophone deployment will provide unique measurements of the particle motion signals from sound energy that has carried through the substrate and which can have a potential impact for benthic species such as flounder and lobster. Concurrently, data from sets of paired pressure hydrophones, placed in the water column above the geophones, will provide data on the particle motion in the water column (mid-water) that may affect many fish species. Data for particle motion analyses will be collected in association with construction activities related to foundations for WTG 2 and 3 only and activities (e.g. placement and retrieval of sensors) requiring entry into the hazard area will be accomplished before construction commences and after construction ceases in coordination with DWBI.

Background

The “sound” detection system of fishes, the inner ear, is an accelerometer-like structure that contains a dense stone (the otolith) and a sensory surface that detects relative motion between the fish body and the otolith (Popper et al. 2003). Thus, as an accelerometer, the fish ear responds to the particle motion component of the sound field.

Many fishes also have ancillary structures, such as the air-filled swim bladder, that responds to the pressure component of the sound field. In some species, this energy may be re-radiated from the swim bladder to the inner ear in the form of particle motion as well (see Popper et al. 2003 for a review). The critical issue is that all fishes (and sharks) detect particle motion (which can also be expressed as particle acceleration or velocity), and many species, including a large number in the marine environment, primarily use particle motion for hearing (e.g., Chapman and Sand 1974; Hawkins and Johnstone 1978; Fay and Popper 2012; Radford et al. 2012). Moreover, particle motion detection is the basis by which fishes determine the direction of a sound (sound source localization), one of the most important functions of fish (and all vertebrate) hearing, with the mechanism involving weighing of vectors between receptors oriented in different directions (e.g., Schuijf and Buwalda 1980; Fay 2005).

Since all fishes use particle motion for hearing, it is important to understand how well they detect the signal and how man-made sounds can impact this ability (e.g., masking of the biologically relevant signal). Moreover, in determining what fishes hear, and how man-made sound might impact fishes, it is critical that the particle motion component of the impinging sound field be carefully measured and calibrated (Hawkins and Popper, 2014; Popper et al., 2014).

Thus, in order to fully understand what sounds fishes detect, and the potential impact of man-made (or any other) sounds on fishes, it is important to know the level of the particle motion signals in the fish's environment as well as the sensitivity of fishes to particle motion (Chapman and Sand 1974; Hawkins et al. 2014).

Measurement of Particle Motion

While we know that it is important to measure particle motion, actual measurement has been far more difficult than measuring sound pressure (Sigray and Andersson 2011; Sigray and Andersson 2012; Martin et al. 2015; Rogers et al. 2015). This is because appropriate particle motion sensors have generally not been available, and when available they have been hard to use correctly, lacked proper calibration, and expensive to acquire. In addition, when considering particle motion from pile driving or other sound source, it is important to not only measure the motion carried directly through the water, but to also the motions of the substrate and the particle motion energy that enters the water from the substrate (e.g., signals that have propagated through the substrate) (Hazelwood 2012; Dosso 2014; Dahl et al. 2015; Hazelwood and Macey 2015). In addition, it is important to understand that particle motion (unlike sound pressure) has direction, and so measures must be made in three planes in order to fully understand and calibrate a sound field (Sigray and Andersson 2011).

There is no one preferred or even well documented methodology for measuring particle motion (Martin et al. 2015). One approach has been to measure the pressure gradient between pairs of hydrophones in three orthogonal directions and then calculate the particle motion in three planes (MacGillivray et al. 2004; Popper et al. 2005). At the same time, because the pressure differences between the hydrophones will be very small in relation to the overall sound pressure it is important that the hydrophones are evenly matched as well as calibrated. Another approach is to use a specially designed near-neutrally buoyant sensor that directly measures particle motion using accelerometers (Sigray and Andersson 2011; Sigray and Andersson 2012).

Either device measures particle motion in the water. However, they do not measure the motions of the substrate. Consequently a second device, which uses geophones, can be coupled to the bottom to measure substrate motion. Three geophones would be mounted together in orthogonal directions to give information on movement in three planes (Dosso 2014). Such a device also requires an electronic compass to provide reference information for the direction of the sound.

Measuring Particle Motion in the Field

Several approaches could potentially be used to measure particle motion. In each case, there needs to be a combination of a device to measure particle motion in the water column, preferably moored to the bottom so as not to be subject to water motion at the surface, and geophones in the substrate to measure vibration (especially from pile driving that have been transmitted through the substrate).

The general approach to map the particle motion field would be similar to that used for measuring pressure fields. Moreover, if a pressure gradient system is used to measure particle motion, the output from the hydrophones could potentially give sound pressure information as well.

Since there has been so little work measuring particle motion it is hard to recommend a specific device to use for the proper measures. One possible instrument is the Geospectrum M20 hydrophone along with geophones. The Geospectrum M20 includes a gyro-stabilized three-dimensional orientation sensor, three dipole sensors, and one omnidirectional acoustic pressure sensor (see: http://geospectrum.ca/m20-bottom-mount-system/).

An alternative, keying on a newly developed acoustic configuration, might be the "snow flake" system in development by Loggerhead Instruments (www.loggerhead.com). This is a combination of six hydrophones organized into pairs on three orthogonal planes along with a recorder. This system, according to the developer Dr. David Mann, can be adapted for different environments and different locations relative to the source.

The HDR RODEO Team recommends measuring sound pressure at different fixed locations from impact pile driving as well as measuring mid-water and bottom particle motion (both in three dimensions). Measures in all cases would be with moored passive devices. Bottom particle motion would be measured with a tri-axial geophone coupled with an electronic compass for orientation purposes. The mid-water particle motion would be measured above the geophones and be done by measure pressure gradients using three pairs of orthogonally placed hydrophones and a recorder. Pressure gradient would be done using the 'snow flake' system developed by Dr. David Mann of Loggerhead Instruments.

Technical specialists from HDR RODEO Team Subcontractor University of Rhode Island (URI) will deploy three fixed acoustic moorings instrumented with geophones, low-sensitivity hydrophones and standard hydrophones at locations to be determined based on safety, construction zones, measurements planned to be conducted by DWBI, and science goals. The instrumentation will consist of a multiple hydrophone receiver unit (SHRU) built by Woods Hole Oceanographic Institution (WHOI). The geophones available are Geospace GS-32 Vertical Axis Gimbaled Geophones including a low sensitivity hydrophone and Geospace Sea Array three-axis Gimbaled Geophones.

In addition, the HDR RODEO Team will deploy "Snow Flake" or alternative emerging technology for particle motion measurement at each location that has a geophone. The location of the particle motion systems will be determined during site reconnaissance with design assistance from HDR RODEO Team members Arthur Popper and Tony Hawkins and potentially from developmental experts based on emerging technology available at the time. Data for particle motion analyses will be collected in association with construction activities related to foundations for WTG 2 and 3 only. Alternative technology approaches may be presented to BOEM by HDR for consideration as options to the core tasks depending on availability of resources.

Task 4: Deployment of a Towed Array

This task will be performed by technical specialists subcontracted to the HDR RODEO Team from URI. Under this task, a passive towed hydrophone array will be used to independently measure the radiated underwater acoustic noise from the impact pile along a number of radials centered on the pile driving out to a range of 12.4 to 18.6 mi (20 to 30 km). This measurement will provide a unique and novel estimate of the transition in range from pulsed, fast rise time signals to non-pulsed signals. This information is of particular interest to federal regulators and bioacousticians for understanding impacts on hearing of marine mammals, sea turtles and fish (Southall et al. 2007).

The Team will deploy three fixed acoustic moorings instrumented with geophones, low-sensitivity hydrophones and standard hydrophone at locations to be determined based on non-interference with hydrophones placed and transects conducted under Task 2 (Underwater Sound Monitoring), safety, construction zones, already planned measurements by DWBI, and science goals.

The instrumentation consists of a SHRU built by WHOI. Available geophones include Geospace GS-32 Vertical Axis Gimbaled Geophones including a low sensitivity hydrophone, Geospace Sea Array 3–axis Gimbaled Geophones. In addition, a HTI-94-SSQ hydrophones compatible with the SHRUs is also available for deployment. Storage and battery capabilities allow the SHRUs to be deployed for many weeks without attendance.

The towed array will be an eight-hydrophone analog array built by Hydroscience Technologies, Inc. It is been previously been successfully used for similar research studies (e.g., Frankel et al. 2014). The hydrophones are irregularly spaced for beamforming at multiple frequencies and are low sensitivity to capture intense signals.

The array will be towed by a vessel at low speeds collecting data at a 64-kHz sampling rate to capture the rise time of the pile driving impulse signals. Measurements will be conducted at various azimuths from the pile driving operation on multiple days to understand the impact of bathymetry on signal propagation. Air measurements will be taken with a Bruel and Kjaer Sound

Analyzer Type 2250L. Table 1 summarizes the list of instruments likely to be used during Task 4 implementation.

Table 1: Measurement Instruments

Measurement Description	Instrument	Location(s)	Comments
Three-axis particle velocity and pressure at the sea floor	OYO Geospace Sea Array Gimbaled Geophone with WHOI SHRU Data Acquisition System	200 m from pile driving locations	Move the system to a location 200 m from each pile driving location.
Vertical particle velocity and pressure at the seafloor	OYO Geospace GS-PV-1 Gimbaled Geophones with WHOI SHRU Data Acquisition System	400 m from pile driving locations	Move the system to a location 400 m from each pile driving location.
Acoustic signals	HTI-94-SSQ Hydrophone vertical array (4)	10 km from WTG 3	Fixed site for the entire construction phase.
Acoustic signals	Hydroscience 8 hydrophone towed array	Three transects for three WTG 1, 3 and 5 from 200 m range out to 20 km.	One day per transect for a total of 9 days.

Based upon a 20-day pile driving schedule, it is proposed that three, 3-day cruises with a gap of at least 3 days between any two cruises be undertaken to compare measurements with different oceanographic conditions. This proposed schedule will be adapted to weather conditions prevailing at the site during the construction phase.

Oceanographic conditions will be measured using a RBR CTD, owned by URI Ocean Engineering. Sediment characterization data will be collected and evaluated in coordination with the activities proposed to be performed under the RODEO SDR monitoring (See Section 3.3). Sediment core measurements were taken during the pilot study as part of the licensing process and this data is available for use. An existing USACE buoy just south of Block Island will monitor sea surface conditions.

Two graduate students (MS level) and two undergraduate ocean engineering interns will assist in the data collection, perform the data analysis, and support the dissemination and publication of the results.

Task 5: Data Processing and Reporting

Acoustical data collected through the RODEO acoustics monitoring program under Tasks 1 to 4 will be processed and reported in a manner that facilitates easy input for subsequent advanced data analyses and modeling. The HDR RODEO team members from URI will provided additional analysis of the above and underwater data to produce standard metrics such as peak levels, SPL rms levels, rise time, SEL levels, particle velocity (from the geophones) and others as a function of range from the pile driving (using both the fixed sites and the towed array). These analyses may also include using a three-dimensional sound propagation model to predict the underwater sound field produced by the pile driving activity and compare it with the observed field as determined by real-time data.

A draft report for each task will be submitted to BOEM for review and comments. All raw data alongside metadata defining basic measurement parameters (e.g., time and duration of measurements, water depth, and meteorological data) will be provided to BOEM, suitable for external analysis by third parties. Each draft reports will be finalized by responding to comments provided by BOEM.

Optional Task 6: Advanced Data Evaluation

Each dataset will undergo detailed analysis to ascertain noise and vibration transmission characteristics. Analysis will be made of the noise or vibration source, its characteristics and the environment in which it is propagating. Trends will be made to identify the effects of changing parameters, such as bathymetry or sediment type, or airborne noise transmission over water and airborne noise transmission over land. All results will be compared to baseline data where available.

The results of measurements will be compared to data in published literature and other measurements undertaken by the HDR RODEO Team in different international environments and conditions but with otherwise similar parameters (e.g., pile sizes and hammer energies).

Comparisons between datasets will also be made where parameters are related, such as airborne noise transmission over land and over water, calculation of source noise levels in water and in air, transmission in shallow water, deep water and at long ranges distances using the towed array, and the propagation of sound pressure and particle motion, where appropriate measurements are taken.

A detailed report will be produced providing the survey method, equipment sampled, conditions under which measurements were taken, the results, analysis and discussion. Recommendations for future measurements and observations, which can be the subject of future task orders, will be made.

3.3 Sediment Disturbance and Recovery (SDR) Monitoring

The seafloor can be disturbed by various activities during the construction and operations phases of a wind farm development. During construction, vessel anchoring activities, and spudcan penetrations may result in depressions in the seafloor. While a lift boat is positioned on site, scour can develop around the legs that penetrate the seafloor. Evidence of those impacts on the environment can disappear as sediment is reworked and transported due to natural processes after construction equipment detaches from the seafloor.

The HDR RODEO Team SDR monitoring will focus on:

1. Sediment disturbances that may result from construction vessel anchoring; disturbed locations on the seafloor will be mapped using high resolution multibeam and side scan sonar. The depth and spatial extent of the each disturbed locations also will be determined.

2. Seafloor recovery rates will be monitored by conducting multibeam- and side-scan- sonar surveys after construction is completed. Rates of recovery primarily depend on the seafloor sediment type; duration and strength of bottom currents; and size of the depressions.

3. Scour development at the wind turbine locations. A Scour Monitoring System will be used to continuously monitor scour development at one of the WTGs. One of the unique facets of this system is that will be able to monitor changes during a single storm event. Prior to development of this monitoring system, most wind farm developers would conduct bathymetric surveys periodically (i.e., once a year) or after a significant storm event to assess scour development. This approach would not capture scour development when the currents were strongest during the storm it would be unknown how much of the scour pit had infilled after the storm subsided.

   A metocean measurement program will be conducted in parallel to the Scour Monitoring System. An Acoustic Doppler Current Profiler will be installed near the Scour Monitoring System to measure current and wave data.

The proposed monitoring will focus solely on collection of data for the characterization of seafloor disturbances. These data may have limited applicability for interpreting potential impacts to benthic habitats and their recovery.

3.3.1 SDR Data Application

The SDR monitoring data may be used to assess environmental impacts resulting from construction activity and recovery rates of the seafloor. The multibeam surveys will also cover the turbine foundation. Therefore, those data could also be used to assess scour development at the wind turbine foundations.

Scour monitoring data will provide valuable information used that could be used to gain an understanding of how scour will develop over time, during a discrete storm event, in response to seasonal flow regime changes, or in response to other changes in the flow regime. The metocean data will be used to interpret data obtained from the Scour Monitoring System.

This Scour Monitoring System program will provide a valuable data set for the first offshore wind turbines to be constructed in the United States and may demonstrate that this technology can be an effective monitoring system for future wind farm development to ensure they can safely operate.

3.3.2 DWBI SDR Monitoring

Information on seafloor disturbance and scour monitoring data to be collected by DWBI during the BIWF construction phase is based on review of relevant documents (GAP, BIWF and BITS Environmental Report, and USACE Permit) and discussions with DWBI staff that occurred on May 1, 2015. DWBI plans to conduct the following activities related to SDR and bathymetry monitoring:

- **Pre-installation Seafloor Inspection of Foundation Footprint** – Prior to installing the foundation, DWBI will conduct an inspection of the area within 100 ft of the foundation footprint to look for obstructions and to level the seafloor. It is unclear if the inspection will include conducting a multibeam survey that could be used to document pre-construction bathymetric conditions.
- **DWBI Construction Environmental Compliance Plan** – As described in the GAP, prior to start of construction DWBI will prepare an Environmental Compliance Plan that will describe all of the environmental and permitting commitments to be carried out during construction. However, during our review of project documents (e.g., USACE Permit, GAP, etc.) we did not identify any requirements for DWBI to: (1) document and monitor seafloor disturbance resulting from anchoring and seafloor recovery rates, or (2) monitor scour conditions at the wind turbine foundations. Therefore, it is anticipated that such monitoring will NOT be included in the Environmental Compliance Plan.
- **Post-construction Cable Surveys** – DWBI will conduct a post-lay survey of the export cables using multibeam and Chirp sub-bottom profiler systems. The surveys will be performed to inspect the burial depth of the cable. Per the GAP, Chirp sub-bottom profiler surveys will be conducted at least once every 5 years to inspect the cable burial depth. The GAP does not indicate a plan to conduct multibeam surveys to conduct scour monitoring at the wind turbine locations.

- **Wind Turbine Foundation Inspections (excerpted from the Biological Opinion)** – For the foundation, an annual inspection program will be developed to ensure all nodes of the foundations are inspected within a 5-year time frame. Underwater inspection will include visuals and eddy current tests with divers and/or remotely operated vehicles. Any damage or cracks will be analyzed and repaired accordingly. This inspection description does not indicate that multibeam surveys or diver-based measurements will be conducted to monitor scour conditions at the turbines.

3.3.3 RODEO SDR Monitoring

The purpose of the RODEO SDR monitoring will be to measure and record real-time changes in the sediment disturbance and recovery as a result of the BIWF construction activities. The proposed field data collection approach will provide BOEM with real-time data that can be used to evaluate environmental effects of future facilities. Data from the testing of the scour monitoring devices will provide a valuable data set for the first offshore wind turbines to be constructed in the U.S. and may demonstrate that this technology can be an effective monitoring system for future wind farm development to ensure they can safely operate. The proposed RODEO data collection will not duplicate data collection that will be performed by DWBI (as described in **Section 3.2.2**) nor will it substitute for data that is required to by DWBI to comply with USACE permit conditions.

The following four tasks will be conducted:

1. Seafloor Disturbance and Recovery Monitoring
2. Wind Turbine Scour Monitoring
3. Wind Turbine Scour Assessment
4. Metocean Measurements.

Specific activities that will be conducted under each of the four tasks are described below:

Task 1: Seafloor Disturbance and Recovery Monitoring

Task 1a – Field Data Collection: High resolution multibeam surveys will be conducted using an R2Sonic 2022, Konsberg, or a Reson Seabat 7125. These three systems are capable of mapping seafloor disturbances from spudcans and anchoring. The HDR RODEO Team will likely use the R2Sonic 2022 or Reson 7125.

<u>R2 Sonic 2022 Echosounder</u>

- Selectable frequencies 200 to 400 kHz
- Selectable swath sector 10 to 160 degrees

- Focused 1 degree beamwidth
- 256 beams.

<u>SeaBat 7125 Echosounder</u>

- Frequencies 200 and 400 kHz
- Swath width 165 degrees
- Focused 1 degree beamwidth
- Up to 512 beams

Additional specifications on the R2 Sonic 2022 and the SeaBat 7125 Echosounders are contained in **Attachment B**.

Surveys will be conducted at the following intervals:

- Post-construction (as close to completion of construction as possible)
- 3 months, 6 months, and 12 months after construction.

If a storm event occurs after the post-construction survey is completed, then a survey will be conducted as soon as it is practical do so after the storm. This post-storm survey will replace one of the scheduled 3-, 6-, or 12-month post-construction surveys. If full sediment bed recovery is observed during the post-storm survey, then subsequent schedule surveys (3-, 6-, or 12-month) post-construction surveys will not be conducted.

The post-construction will be the first survey conducted and will cover the “Defined 2015 Work Area” delineated by the black dashed line on the anchoring plan shown in **Figure 4**. Subsequent surveys will cover all noted seafloor disturbance zones to monitor the seafloor recovery rates.

A Fugro-owned vessel in the 35 to 75-ft (10.6 to 22.9-m) class range if one is available in the area will be used for the survey. Otherwise we will use a local vessel of opportunity that meets BOEM and the HDR RODEO Team’s safety and maintenance requirements. Specialists anticipate needing one multibeam operator and navigation surveyor and the survey will take 2 days to complete (exclusive of the mobilization).

Task 1b – Data Reduction and Reporting: The multibeam data will be processed and referenced to mean lower low water. Raw data will be evaluated to interpret and map seafloor disturbance features, their depth, and sizes. Assuming information is available from DWBI on locations of the installation vessels, anchor contact points with the seafloor, and duration that the anchors/spudcans were in contact with the seafloor, an attempt will be made to correlate the disturbance features to the installation vessel positioning.

Raw data will be compiled into a Geographic Information System (GIS) database to facilitate data management. At a minimum, this database will include the following:

- Bathymetric XYZ data
- Bathymetric grid and hillshade
- Interpreted extents of seafloor disturbance features
- Metadata.

A short summary report will be prepared and submitted to BOEM within 2 to 4 weeks of completion of each survey. This report will include maps showing locations, patterns, and extent of the seafloor disturbances. The 3-, 6-, and 12-month summary reports will also include an assessment of seafloor recovery.

Task 1c – Post-storm SDR Surveys (Optional): Upon request from BOEM, additional high-resolution multibeam surveys will be conducted within the survey area after specific storm events. This additional data will enable assessment of the effects of a given storm on seafloor recovery rates and/or scour development. With adequate advance notice, this monitoring could be undertaken within days following a storm event.

Note that if a post-storm survey is conducted it will replace one of the scheduled 3-, 6-, or 12-month post-construction surveys. A separate summary report will be prepared and submitted to BOEM within 2 to 4 weeks of completion of each additional storm-event related survey.

Task 2: Wind Turbine Scour Monitoring

Task 2a – Field Data Collection: Two Fugro scour monitoring devices will be installed on the WTG 3 Platform. These monitors have been developed by Fugro in conjunction with Nortek AS and it is the world's only self-contained system capable of monitoring scour for extended periods. The device uses 4 acoustic beams offset from the vertical at different angles to monitor the seabed over prolonged periods. Information collected with the scour monitoring devices will provide a valuable data set for the first offshore wind turbines to be constructed in the U.S. and may demonstrate that this technology can be an effective monitoring system for future wind farm development to ensure they can safely operate. **Figure 7** shows a schematic vie of the scour monitors in operation.

The two monitors will be installed such that they are oriented parallel to the principal tidal axis. Within the BIWF Project area, DWBI Sediment Transport Modeling has shown that the principal tidal axes are roughly aligned north and south (**Figures 8** and **9)**. The jackets will be oriented in a north-south, east-west orientation. Therefore, one monitor will be installed "looking north" on the northeast leg of the WTG 3 Platform and the second monitor will be installed "looking south" on the southeast leg of the WTG 3 Platform (**Figure 10**).

Scour around marine and riverine structures is a significant issue that can lead to expensive, unnecessary interventions or worse insufficient intervention. The Fugro Scour monitor is the world's only low power, self-contained scour monitoring systems.

Limited

Fugro Scour Monitor

Fugro EMU Limited are proud to announce the new Fugro Scour Monitoring system, this unique system developed in conjunction with Nortek AS is the world's only self-contained system capable of monitoring scour for extended periods. The system uses 4 acoustic beamsoffset from the vertical at different angles to monitor the seabed level over prolonged periods.

Offshore structures such as wind turbines, rigs, and pilings can be weakened by scour around their base. Scour holes are generated by storms or strong currents and will often appear and disappear on short notice. As a result, storm-driven scour may not leave a detectable signature in a post-storm survey. As such, it can only be properly characterized if monitored continuously.

To capture these transient events, Fugro developed the acoustic scour monitor, which allows continuous data collection during scour events, either as real time monitoring system or in an autonomous mode. The Scour Monitor uses four narrow acoustic beams to detect the along-beam distance from the sensor to the seabed at four points away from the structure (see illustration).

The instrument collects data at a user-specified sampling rate and outputs the acoustic scattering profile along the beam, which provides information about the changing location of the seabed and the nature of the suspended sediments.

By monitoring scour events, operators can determine the requirement for protective measures such as rock dumping. If combined with vibration sensors it can also relate possible changes in the natural resonance frequency of the structure to changes in the position of the seabed.

In parallel with other services, metocean, structural monitoring and hydrographic survey, Fugro can offer a comprehensive scour detection and monitoring program, including live feed data, long term assessment and engineering consultancy on prevention and cost effective mitigation measures.

Stability of marine structures can be compromised by scour

Idealised image of scour pit formation around a monopile foundation

Figure 7: Scour Monitoring Device Installation Conceptual Plan

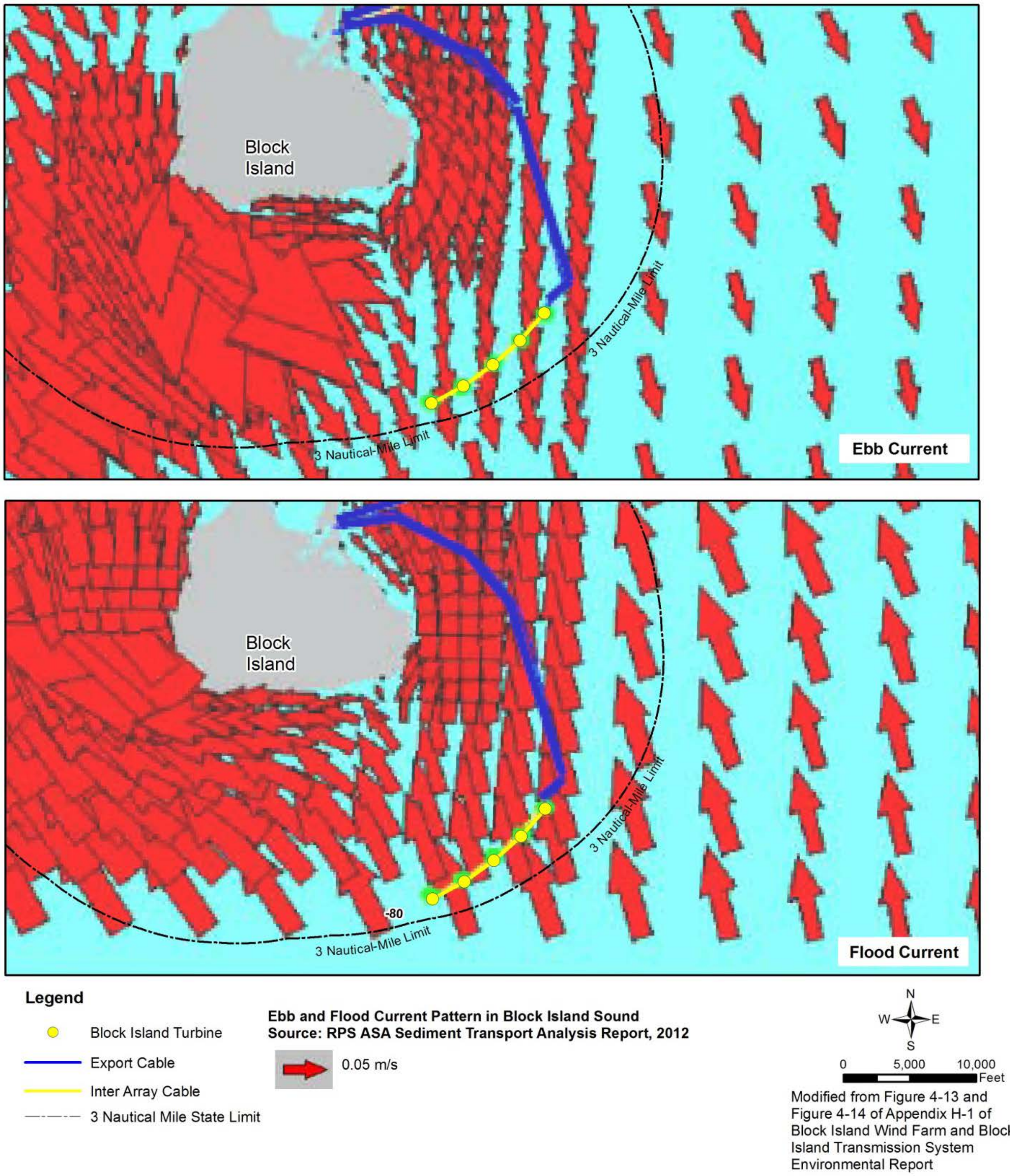

Figure 8: BIWF Tidal Current Simulation

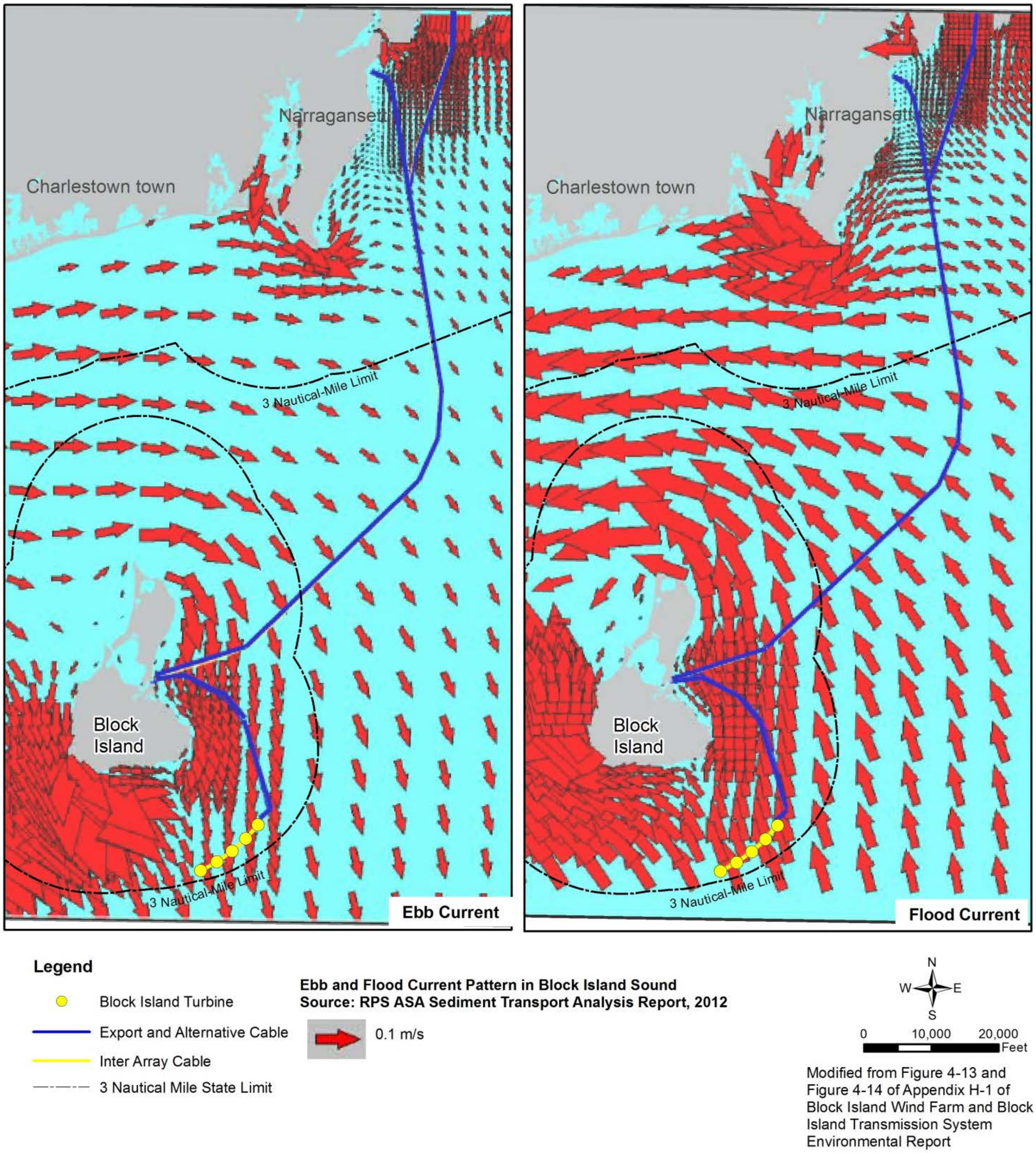

Figure 9: BITS Tidal Current Simulation

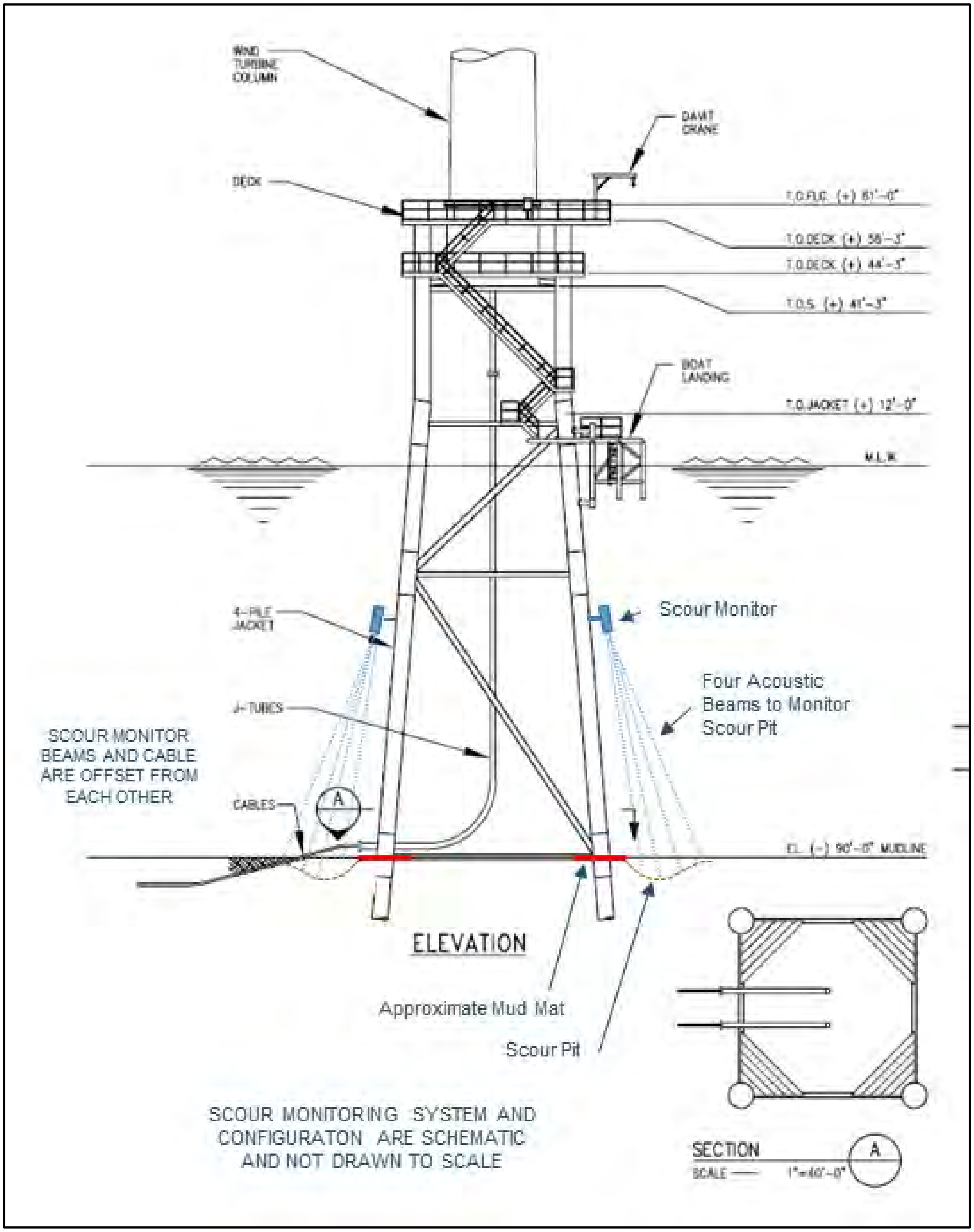

Figure 10: Schematic Scour Monitor Configuration (Modified from DWBI Typical Construction Drawing)

It is our understanding that the jacket legs are slightly inclined and include mud mats that extend a short distance outward from the leg at the seafloor. The monitors will be set at a height such that the inner beam does not encounter the mud mat but is as close to the seafloor as possible to increase accuracy. Based on preliminary calculations, the monitors will be mounted approximately 66 ft (20 m) above the seabed. This height is the best compromise between data quality and horizontal range from the foundation and avoiding the mud mats as far as possible. At 66 ft (20 m) above the seabed, the monitors will be approximately 26.2 ft (8 m) below mean lower low water thus making diver access easier without compromising high quality data collection.

Installation of the monitors will involve welding an arm and flange to the leg during jacket during fabrication. Discussions are currently ongoing to agree upon a suitable flange design. The flange will be fabricated and welded onto the legs before the jackets arrive on site at Block Island. Welding will be conducted by the party responsible for fabricating the jacket. After the jacket has been installed on site at the proposed BIWF Project, a diver will be used to install the monitors to the pre-fabricated flanges.

The scour monitoring device dimensions are as follows:

- Weight in air: 1.7 kilogram
- Length: 23.2 inches (59 cm)
- Diameter: 3 inches (7.5 cm)

The monitors will be encased in a stainless steel tube that will provide security and an attachment point. It is anticipated that the stainless steel tube covering will not be significantly larger than the dimensions of the monitor itself.

The monitors are self-contained (store data internally and have internal power supply) and can be continuously deployed for up to 3 months. Every 3 months, the monitors will be retrieved with the help of divers to download the data and replace the batteries followed by redeployment.

Task 2b – Data Reduction and Reporting: Data downloaded form the monitor at each 3-month interval will be reviewed and checked for quality. The data from the monitors will be interpreted along with the metocean data collected under Task 4 to develop a scour profile for each location for up to two storms.

Task 3: Wind Turbine Scour Assessment

Multibeam survey data collected under Task 1 will be used to assess scour patterns associated with each turbine. Based on a review of available seafloor morphology data from the wind farm area (**Figure 4**) and sediment transport modeling report, it is anticipated that the scour development will vary at the wind turbine locations. The hillshaded bathymetric relief model output shown in **Figure 4** shows that each of the five WTGs is located in different flow regime and geologic environment. The multibeam surveys will allow the scour development to be monitored across the wind farm area and support the interpretation of the data collection by the scour monitoring devices (as described under Task 2a).

Task 4: Metocean Measurements

Task 4a – Metocean Field Data Collection: An Acoustic Wave and Current Meter (AWAC) will be deployed in the vicinity of the WTG 3 Platform jacket to monitor waves and currents. Data from the scour monitors and the AWAC would be downloaded at the same frequency (every 3 months) and will be interpreted collectively.

Task 4b – Metocean Data Reduction and Reporting: The AWAC data will be analyzed and summarized to show current profile and wave conditions. It will be reported along with the scour monitoring data summary. The AWAC data will support interpretation of the scour monitoring data.

3.4 Air Quality Monitoring

Air quality monitoring data presented in the BOEM document entitled "*Visualization Simulations for Offshore Massachusetts and Rhode Island Wind Energy Area - Meteorological Report*" (January 15, 2014) were evaluated to determine if the onshore monitoring at Block Island, Newport, Martha's Vineyard, and/or Nantucket Island could provide meaningful insights into the potential air quality impacts from construction activities associated with the laying of the wind turbine foundation.

The factors considered in this evaluation included distances of the potential monitoring locations from the proposed BIWF Project area, prevailing winds at each onshore location, and relative magnitude of emissions from the wind farm construction activities and other sources of air emissions in the region, including commercial shipping, ferry and recreational boat traffic, and stationary emission sources in proximity of proposed onshore monitoring locations. The approximate distances and compass bearings from the proposed BIWF Project area to the four proposed onshore monitoring locations are as follows:

- Block Island 3.1 mi at 316 degrees
- Newport 26 mi at 25 degrees
- Martha's Vineyard 42 mi at 69 degrees
- Nantucket Island 71.5 mi at 82 degrees.

Assuming that the marine and auxiliary diesel engines deployed to support construction of the WTG foundations will have a total capacity in the range of from 5,000 to 8,000 horsepower, with exhaust stacks no more than 50 ft (15.2 m) above the water, it is not expected that significant ambient impacts from diesel emissions from these sources would extend beyond a range of approximately 6.21 mi (10 km) from the BIWF site.

Martha's Vineyard and Nantucket are east-southeast of the BIWF site and during the proposed construction period (July and August) prevailing winds at Martha's Vineyard and Nantucket Island are from the southwest and south-southwest respectively. Given the distance between the proposed BIWF Project area and Martha's Vineyard and Nantucket Island, and the contribution of commercial ship traffic and August ferry and recreational boat traffic to regional air emissions, it is doubtful that onshore ambient monitoring at either location could provide discernible information about air emission impacts from the wind farm construction activities.

Newport is north-northeast of the proposed BIWF Project area and in July and August prevailing winds at Newport are from the south-southwest. Again, given the distance between the wind farm site and Newport, the contribution of commercial ship traffic and August ferry and recreational boat traffic to regional emissions, and the contribution of stationary and mobile source emissions onshore in proximity to Newport, it is doubtful that onshore ambient monitoring at Newport could provide discernible information about air emission impacts from the proposed wind farm construction activities.

Although Block Island is only approximately 3.1 mi (5 km) from the proposed BIWF Project area, it is northwest of the site and the July and August prevailing winds at Block Island are from the west-southwest. Since the wind is blowing from the wind farm site toward Block Island less than 5 percent of the time in July and August, and it is likely that there will be a significant contribution to regional air emissions from commercial ship traffic and ferry and recreational boat traffic, as well as from the 8-MW diesel power plant on Block Island, it is doubtful that onshore ambient air monitoring at Block Island could provide discernible information about air emission impacts from the wind farm construction.

It was, therefore, concluded that ambient onshore air monitoring of criteria pollutants at Nantucket Island, Martha's Vineyard, Newport or Block Island during the July and August timeframe will not provide meaningful data for characterizing air emission impacts from the proposed BIWF Project construction activities. Therefore, no air quality monitoring protocols are presented in this Field Plan.

4.0 FIELD PLAN IMPLEMENTATION

The proposed BIWF Project construction is planned to occur in three separate phases:

- The first phase is expected to start in summer 2015, and it will involve laying the foundations for the five WTG platforms.
- The second phase is tentatively schedule to occur in spring 2016 and it will include installation of the turbines on the foundations.
- The export and BITS cables will be installed in the third phase, which is tentatively scheduled for summer 2016.

This Field Plan only covers construction that will be undertaken during the first construction phase.

4.1 Schedule

The first construction phase is tentatively scheduled to start on or around August 10, 2015. Construction activities are expected to last over 5 weeks. **<u>A detailed schedule of the proposed RODEO monitoring activities will be developed after additional construction scheduling information is received from DWBI.</u>**

4.2 Site Reconnaissance Visit

A site reconnaissance visit will be conducted at least 2 to 4 weeks prior to the proposed construction start date by 6 key resource and logistics staff to finalize logistical details related to acquisition of monitoring vessels, survey equipment, ground transportation, living quarters, etc.

4.3 Coordination with DWBI Team

During the RODEO monitoring, close coordination will be required with the DWBI construction contractor and DWBI environmental monitoring team. The HDR RODEO Team OFC will be responsible for ensuring this coordination. The OFC will check in every morning with a designated person on the DWBI construction contractors to get an update on the activities planned for the day and their nature and duration. The OFC will share this information with all members of the HDR RODEO Team monitoring personnel to ensure that data collection is conducted in real-time when the construction activities are actually in progress.

5.0 HEALTH AND SAFETY PLAN

All field activities for the BIWF RODEO Monitoring Program will be conducted in accordance with the guidance contained in the HASP (**Attachment C**). The objective of the HASP is to define the requirements and designate protocols to be followed during the field data collection. Applicability extends to HDR RODEO Team personnel and visitors, inclusive of client personnel and representatives. Work performed by the HDR Rodeo Team and subcontractors will comply with applicable Occupational Safety and Health Administration laws and regulations. Through careful planning and implementation of corporate and site-specific health and safety protocols, HDR will strive for zero accidents and incidents on the project.

The HDR RODEO Team Program Management Staff is committed to the health and safety of each employee that participates in the field data collection effort. It is essential that all Task Managers and Field Supervisors insist on the maximum safety performance and awareness of all employees under their direction, by enthusiastically and consistently administering all health and safety rules and regulations.

6.0 PERMITTING

Any additional permitting requirements for monitoring will be investigated and pursued by the HDR RODEO team. HDR will provide BOEM notification of the permit requirements and the scope associated with acquisition and a request for a modification to the scope of work to address the necessary resources.

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ATTACHMENTS

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Attachment A

BIWF and BITS Project Components

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Attachment A
BIWF and BITS Project Components

1.0 Overview

The Deepwater Wind Environmental Report collectively refers to the development of the Block Island Wind Farm (BIWF) and development of the Block Island Transmission System (BITS) as "the Project" (DWBI, 2012). The Project will consist of:

- A WTG Array that consists of five 6-MW WTGs spaced approximately 0.5 miles (0.8 km) apart.
- A 34.5-kV, 2-mile (3.2 km) submarine cable system connecting the WTGs (Inter-Array Cable).
- A 34.5-kV, 6.2-mile (10-km) Export Cable that connects the WTG Array to the BIWF Generation Switchyard located within a new substation on Block Island (Block Island Substation).
- A 34.5-kV, 21.8-mile (35.1-km) BITS Cable to provide power to the Rhode Island mainland by interconnecting with TNEC's 34.5-kV distribution system in Narragansett, and two switchyards at either end of the BITS: one on the Block Island Power Company (BIPCO) property on Block Island (BITS Island Switchyard within the new Block Island Substation) and one in Narragansett (the Narragansett Switchyard).
- An O&M facility proposed to be located in the Point Judith area of Narragansett.

The Project will include construction of one new substation at the site of an existing power generation facility on BIPCO property (Block Island Substation). The Block Island Substation will provide a point of interconnection for the power from the BIWF and will be the point of interconnection for BITS on Block Island. The Block Island Substation will consist of two adjoining switchyards: one dedicated to the BIWF (BIWF Generation Switchyard) and the other dedicated to the BITS (BITS Island Switchyard).

The BITS will include upgrades to the existing substation on the BIPCO property. The BITS will connect to the existing distribution system on the Rhode Island mainland that is operated by The Narragansett Electric Company (TNEC) at the existing Wakefield Substation in South Kingstown, Rhode Island, via a new switchyard located on Rhode Island Department of Transportation (RIDOT) property in the Town of Narragansett, Rhode Island (Dillon's Corner Switchyard).

The BIWF is located entirely within Rhode Island state territorial waters. The BIWF WTGs, Inter-Array Cable, and a portion of the Export Cable are located within the Rhode Island Renewable Energy Zone established by the Rhode Island CRMC. The offshore BITS cable is located within Rhode Island state territorial waters and in Federal waters.

Construction staging and laydown for the Project will occur within designated onshore construction areas and ROWs and at the Quonset Point port facility in North Kingstown, Rhode Island. No upgrades or alterations will be required at the Quonset Point port facility to support the Project. DDW will lease existing office space and a storage yard close to a dock in the Point Judith area of Narragansett, Rhode Island for the proposed Project's O&M facility.

2.0 BIWF Project Components

A detailed description of the specific components for the BIWF as presented in the DWBI Environmental Report (DWBI, 2012) and is summarized below:

2.1 Wind Turbine Generators (WTGs)

As noted earlier, the BIWF will consist of five 6-MW WTGs. The following is a description of the components of a WTG.

2.1.1 Tower

The tower will be a tapered, hollow, steel tubular structure that will be manufactured in three segments. The tower will have a diameter of approximately 22 ft (6.8 m) at the base and 15 ft (4.5 m) at the top.

2.1.2 Nacelle

The nacelle will be approximately 62 ft (18.9 m) long, 20.5 ft (6.2 m) tall, and 20 ft (6.1 m) wide. The weather screen and housing canopy around the machinery in the nacelle is made of fiberglass-reinforced laminated panels with multiple fire-protecting properties. A hollow, fixed man shaft provides internal access from the canopy to the hub. A transformer to step up the generator voltage will be located in a ventilated room in the nacelle. For cooling purposes, the transformer will be filled with mineral or comparable insulating oil that will be monitored for temperature, fluid level, and pressure.

2.1.3 Rotor

The WTG rotor is a three-bladed cantilevered construction, mounted upwind of the tower. The power output is controlled by pitch regulation. The WTG will operate between a cut-in wind speed of 4.5 miles per hour (mph) (2 meters per second [m/s]) and a cut-out wind speed of 67 mph (30 m/s). The WTG will have a rotor speed from 5 to 11 rotations per minute (rpm).

2.1.4 Blades

The blades will be made of fiberglass-reinforced epoxy resin manufactured in a single operation. The blades will be mounted on pitch bearings and can be feathered 80 degrees for shutdown purposes. Each blade will have its own independent fail-safe pitching mechanism capable of feathering the blade under any operating condition, and allowing fine tuning to maximize power output. The blade will have a length of approximately 253 to 271 ft (77 and 83 m, respectively) and a maximum chord (i.e., cross section diameter) of approximately 16 ft (5 m).

2.1.5 WTG Control Systems

The WTG controller will be a self-diagnosing, microprocessor-based industrial controller that has a keyboard and display for easy readout of status and adjustment of settings. The controller is complete with switchgear and protection devices. The WTGs will be equipped with a Supervisory Control and Data Acquisition (SCADA) system providing remote control and monitoring of the WTGs from an operations center onshore. The system provides real time information on electrical and mechanical data, operation and fault status, meteorological data, and grid station data. In addition to the SCADA system, the WTGs will be equipped with a condition monitoring system that monitors the vibration level of the main WTG components.

2.1.6 Lighting

The WTGs will be lit and marked in accordance with Federal Aviation Administration (FAA) and U.S. Coast Guard (USCG) requirements for aviation and navigation obstruction lighting.

2.2 Foundations

Each WTG will be attached to the seafloor using a four-leg jacket foundation secured with four through the-leg foundation piles. The jackets consist of hollow steel tubular members joined together in a lattice structure, which sit on the seabed supporting the WTG. The diameter of each pile is expected to be between 42 and 54 inches (in) (107 and 137 centimeters [cm], respectively), with a maximum wall thickness of 1.5 in (3.8 cm). The foundation piles will be inserted into the legs and driven to a depth of 250 ft (76.2 m) below the mud line. The piles will then be cut off at the top of the jacket and welded to the jacket structure.

2.3 BIWF Collection System

The BIWF collection system comprises the following components:

- Submarine Inter-Array Cable
- Submarine and terrestrial Export Cable
- BIWF Generation Switchyard (part of the Block Island Substation)

2.3.1 Inter-Array Cable

The WTGs will be interconnected via a 34.5-kV submarine cable system connecting the WTGs in a radial inter-turbine configuration (Inter-Array Cable). The WTGs will be connected in series. The Inter-Array Cable will comprise a single, three-core submarine cable that will carry 3-phase AC power. One or more fiber optic cables will be included in the interstitial space between the three conductors and will be used to transmit data from each WTG or the BIWF Generation Switchyard as part of the SCADA system. The bundled cable will be approximately 6 to 10 in (15.2 to 25.4 cm) in diameter, depending on the manufacturer.

2.3.2. Export Cable

A 34.5-kV AC cable will connect the WTG Array to the BIWF Generation Switchyard via WTG 5. The submarine portion of the Export Cable will be the same type of cable as described for the Inter-Array Cable, and will be installed using the same jet plow technique, buried to the same target depth and will require the same additional protective armoring installed by an anchored vessel in those areas where less than 4 ft (1.2 m) of burial is achieved.

The submarine portion of the Export Cable will make landfall on Block Island at a manhole located in the Crescent Beach parking lot. From this manhole, the Export Cable will be collocated in the same trench as the BITS and will follow the same route along existing public road rights-of-way to the newly proposed Block Island Substation on the BIPCO property. The underground portion of the Export Cable will be installed in a concrete-encased duct bank consisting of three single-core insulated aluminum or copper conductors in a protective jacket. The cable will be between approximately 2.5 to 3.5 in (6.4 to 8.9 cm) in diameter, depending on the manufacturer. In order to cross the bridge between Trims Pond and Harbor Pond, the cable will be installed in a conduit under the bridge in bays below the sidewalk and road surface

Installation of the Export Cable will require a 40-ft (12.2-m) wide temporary construction right-of-way that coincides with the public road ROW. DDW will keep one lane of traffic open during construction of the Export Cable on Block Island. DDW will obtain a permanent easement from the Town of New Shoreham for the terrestrial portion of the Export Cable. No routine maintenance or vegetation clearing will be required during operation. The Export Cable will transition to an overhead cable for a short length (approximately 0.2 miles [0.3 km]) on the BIPCO property. The fiber optic cable associated with the Project also will transition to overhead along this portion of the terrestrial route, and be carried on these same new overhead poles.

2.3.3 BIWF Generation Switchyard

The new BIWF Generation Switchyard will consist of a switchgear building, an isolation transformer, and a separate O&M building, all of which will be located inside the 0.5 acre (0.2 hectare) Block Island Substation area. This area will be fenced in and covered with crushed stone surface material.

3.0 BITS Project Components

The BITS will consist of the BITS Island Switchyard (part of the Block Island Substation), an expansion of the existing BIPCO Substation, a terrestrial and submarine transmission cable, and the Narragansett Switchyard. A summary from the DWBI Environmental Report (DWBI, 2012) is presented below:

3.1 BITS Island Switchyard

The BITS Island Switchyard will include switchgear building, two shunt reactors, and one 34.5- to 5-kV distribution transformer that will be installed within the 0.5 acre (0.2 hectare) Block Island Substation. The shunt reactors and distribution transformer will be separated by a concrete fire wall. The construction and operation footprints of the BITS Island Switchyard are part of the footprint of the Block Island Substation.

3.2 Expansion of the Existing BIPCO Substation

The existing BIPCO Substation will be expanded to allow for the transmission of electricity from the BITS into the existing Block Island grid. The expansion will consist of an open-air 3-phase, 5-kV-class electrical bus and open air disconnect switches supported by steel structures. The BIPCO Substation expansion will require development of up to 0.05 acre (0.02 hectare) on the BIPCO property.

3.3 Narragansett Switchyard

The Narragansett Switchyard will be constructed at a location adjacent to a Town of Narragansett Department of Public Works building. The Narragansett Switchyard will consist of an approximately 0.6 acre (0.2 hectare) area that will contain a 34.5-kV metal clad switchgear and two shunt reactors that will be installed in a walled area that is covered with crushed, stone-surface material.

4.0 Proposed Construction Methods

4.1 Construction of the Offshore Wind Turbine Generator Array

The study plans included with this document are focused on collecting data related to DWBI's effort to install 5 foundations for the WTG in summer 2015. As such a description the proposed construction methods are provided that relate to only the BIWF (not BITS) aspect of the overall project. The approach for construction presented below is from the Biological Opinion issued by the National Oceanic and Atmospheric Administration Fisheries on January 30, 2014.

Construction will be completed according to the following sequence:

- Transportation of the foundations to the WTG installation site;
- Mobilization of equipment;
- Installation of the foundations;
- Installation of the cable systems; and
- Installation of the WTGs.

Details of each phase of construction are described in the following sections.

4.1.1 Foundation Transportation

The foundations of the WTGs, including piles, jackets, and transition decks will be fabricated in the U.S. Gulf of Mexico region, most likely in Texas or Louisiana. Once foundation components have been fabricated, the fabrication contractor will load out and tie down the structures for transportation on barges to Rhode Island. The jacket, deck, piles, and all other platform components and appurtenances will then be towed by ocean-going tugs to either the WTG installation sites (in Rhode Island Sound), where the installation vessels will be mobilized, or to one of the designated offshore support areas in Block Island Sound.

4.1.2 Mobilization of Equipment

The WTGs and smaller secondary equipment will be transported to the staging facility on Quonset Point, Rhode Island, prior to construction. During construction, transportation barges, material barges, and other support vessels will transport the project components and equipment to the offshore construction sites.

4.1.3 Foundation Installation

Each WTG will be supported by a 50-ft x 50-ft four-leg jacket foundation that is secured to the sea floor with four, through the leg foundation piles that are between 42 and 54 inches in diameter. Each jacket member is joined together in a lattice structure, which sits on the seabed supporting the WTG.

Offshore installation of the jacket foundations will be carried out from 500-ft derrick barges moored to the seabed by an 8-point mooring system consisting of 10-ton anchors with a maximum penetration depth of 10 ft. Alternatively, the installation may be executed from the same jack-up vessel that will be used for WTG installation. The derrick barge will be anchored at the location of the first foundation, most likely the most northern WTG. Prior to commencing installation activities, the seabed will be checked for debris and levelness within a 100-ft radius of the jacket installation location, and debris will be removed (e.g., via a grapnel) as necessary.

Each jacket will be lifted from the material barge, placed onto the seafloor, leveled, and made ready for pilings. The piles will then be inserted above sea level into each corner of the jacket in two segments. First, the lead sections of the piles will be inserted into the jacket legs and then driven into the seafloor. The second length of the piles will be placed on the lead pile section and welded into place. The foundation piles will then be driven into the seafloor to their final penetration design depth of 250 ft or until refusal, whichever occurs first.

All piles will initially be driven with a 200 kilojoule (kJ) rated hydraulic hammer, followed by a 600-kJ rated hammer to reach final design penetration. Duration of pile driving is anticipated to be 4 days per jacket foundation (i.e., one pile per day; approximately 8 hours to install one pile), with all pile driving activities occurring only during daylight hours (i.e., starting approximately 30 min after dawn and ending 30 min prior to dusk unless a situation arises where ceasing the pile driving activity would compromise safety (both human health and environmental) and/or the integrity of the proposed Project).

Once the pile driving is complete, the top of the piles will be welded to the jacket legs using shear plates and cut to allow for horizontal placement of the transition deck. Boat landing and transition decks will also be welded into place, and bags of sand and/or cement will be placed on the seafloor at the base of the jacket foundation to secure the inter-array cable between the J-tube exit point and subsea burial point at each WTG. In total, each four-leg jacket foundation will require approximately 7 days to complete installation. Jacket foundations will be installed one at a time at each WTG location for a total of 5 weeks assuming no delays due to weather or other circumstances.

Throughout all phases of foundation installation, mats consisting of structured steel, steel plate, and/or wood beams and plates, will be attached to the jacket foundation to provide stability during pile installation. The foundation components (i.e., four circular legs, four linear braces between the legs, four triangular mud mats, and cable cement/sand bag armoring) will create a total footprint of approximately 0.07 acres on the seafloor per WTG (for a total of 0.35 acres).

4.1.4 Cable System Installation

4.1.4.1 Inter-Array Cable

The inter-array cable will be installed with a jet plow, which, via umbilical cords, will be connected to and operated from a dynamically-positioned (DP) cable installation barge. The jet plow will likely be a rubber-tired or skid-mounted plow that will be pulled along the seafloor behind the cable-laying barge with assistance of material barges. High pressure water from vessel-mounted pumps will be injected into the sediments through nozzles situated along the plow, causing the sediments to temporarily fluidize and create a liquefied temporary trench approximately 5 ft in width.

As the plow is pulled along the route behind the barge, the cable will be laid into the temporary, liquefied trench through the back of the plow, with the trench being backfilled by the water current and the natural settlement of the suspended material as the plow moves along. The target depth for cable burial is 6 ft below the sea floor, although actual burial depth may vary between 4 to 8 ft depending on substrate encountered along the cable installation route. If less than 4 ft of burial is achieved, additional protection, such as concrete matting or rock piles, will be placed atop the buried cable. If the latter is necessary, anchored vessels will be used to install additional cable protection.

At each of the WTG foundation locations, the Inter-Array Cable will be pulled into the jacket foundation through J-tubes installed on the sides of the jacket foundation. At the submarine cable transition point at the J-tubes, additional cable armoring, such as rock piles, sandbags, and/or concrete mats, will be placed to protect the inter-array cable, especially those portions not completely buried at the junction point with the J-tube.

4.1.4.2 Submarine Export Cable

Prior to the installation of the submarine portion of export cable, the terrestrial (underground) portion of the export cable will be installed. The terrestrial portion of the export cable will run from the BIWF Generation Switchyard to Block Island's Crescent Beach, where it will eventually interconnect with the submarine portion of the export cable via a "landfall" location (i.e., manhole) that will be constructed at Crescent Beach. During landfall construction, a manhole will be established in the parking lot of Crescent Beach, and a temporarily trench (approximately 6 ft x 10 ft wide, 12 ft deep, and 60 ft long), that begins at the mean high water mark of Crescent Beach, will be excavated.

Via a horizontal directional drill (HDD), a cable conduit will be created that will enable to the two cables to be pulled through the conduit, anchored, and splice together. Prior to HDD operations, steel sheet piling will be installed above the mean high water mark of Crescent Beach, via a vibratory hammer, to stabilize the excavated trench and support the HDD. Once the sheet piles are installed, the HDD will enter through the shore side of the excavated trench and the cable conduit will be installed between the trench and the manhole. Following the completion of HDD and cable conduit installation, the cable lay barge and its jet plow will transit to the shoreline of Crescent Beach.

The end of the submarine cable will be pulled through the conduits and anchored and spliced with the terrestrial cable. Once the end of the submarine export cable is spliced with the terrestrial cable, the jet plow will then be launched from the excavated trench on the shoreline, and installation of the submarine cables, below the seabed, will begin. The installation of the submarine portion of the export cable will use the same jet plow/DP cable installation barge technique as described above for the inter-array cable installation. The target burial depth is the same as described above for the inter-array cable. As with the installation of the inter-array cable, in those areas where the target burial depth is 4 ft or less, protective armoring (e.g., concrete matting) will be installed, via the use of anchored vessels, over the buried cable.

All equipment and materials necessary for both the Inter-Array and Export cable installation will be loaded aboard the cable laying barge and material barges at the staging area in Quonset Point, Rhode Island. Once loaded, these vessels will leave Quonset Point, transit through the waters of Narragansett Bay and Rhode Island Sound to reach the area where the WTGs are to be installed (i.e., approximately 3 miles southeast of the Block Island shoreline). Depending on bottom conditions, weather, and other factors, installation of the inter-array cable is expected to take 2 to 4 weeks. This schedule assumes a 24-hour work window, with no delays due to weather or other circumstances.

4.1.5 WTG Installation

The WTGs will be installed upon completion of the jacket foundations and the pull-in of the Inter-Array Cable. The WTGs will be transported to the offshore installation site from the storage facility at Quonset Point, Rhode Island using jack-up material transportation barges. These transportation barges will set up at the installation site adjacent to the jack-up lift barges. The jack-up barge legs will be lowered to the seafloor to provide a level work surface and begin the WTG installation.

The WTGs will be installed in sections with the lower tower section lifted onto the transition deck followed by the upper tower section. The nacelle and each blade will then be lifted and connected to the tower. Pending final engineering, the tower sections and the full rotor might be pre-assembled at Quonset Point. Installation of each turbine will require 2 days to complete assuming a 24-hour work window and no delays due to weather or other circumstances. Occasional crew changes will be provided by the crew boat and/or helicopters. A derrick barge, moored to the seafloor by an 8-point mooring system consisting of 10-ton anchors, may also be used to install the WTGs.

Attachment B

R2 Sonic 2022 and the SeaBat 7125 Echosounder Specifications

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Teledyne RESON

PLD13777-12

SeaBat® 7125

Ultra high Resolution Multibeam Echosounder

The new generation SeaBat 7125 builds on the field experience and feedback from many users around the world and brings unparalleled resolution and installation flexibility. The system is available in three separate configurations; one designed specifically for installation on survey vessels and 6000m depth rated systems for either ROV or AUV.

Each of these configurations provides superlative data quality and ease of use over depths from 0.5m to 500m. Enhanced features such as X-Range and Full Rate Dual Head bring unsurpassed performance levels to the SeaBat 7125.

Special emphasis has been put on maximizing operational efficiency and features such as variable swath width and roll stabilisation combined with a high ping rate and excellent data quality.

Surface Vessel Installation – SV2

The new SeaBat 7125-SV2 is a highly integrated single or dual frequency system designed with ease of installation and operation as a high priority. The system consists of a surface transceiver with integrated multiport card and a standard 25m cable run to the transducers. The transceiver hardware is suitable for running data acquisition software and is available with Teledyne RESON PDS2000 software pre-installed and configured.

ROV2

For deep-water use, the ROV version of the SeaBat 7125 is depth rated to 6000m and includes a titanium interface bottle. System performance is identical to other members of the SeaBat 7125 family and with optional features such as FlexMode and Full Rate Dual Head, the system provides state-of-the-art pipeline and umbilical profiling capability.

AUV

The AUV version of the 7125 provides on-board data processing and logging as well as interface to third party sensors. The electronics are supplied mounted on an aluminium frame for ease of integration and an optional 6000m depth-rated titanium electronics housing is available. The 7125-AUV provides high quality data and performance commensurate with the other versions of the 7125.

FEATURES

BEAM DENSITY
Up to 512 beams in selectable modes optimises operations for any survey type

DEPTH
Dual frequency provides seamless coverage from 0.5 to 500m depth

HIGH SPEED
High ping rate allows highspeed operations without compromising data density

ROLL STABILIZATION
Real-time roll stabilization maximizing usable swath

IHO
Compliance with IHO SP44Ed5 over entire depth range

DIAGNOSTICS
Advanced diagnostics

WATER COLUMN DATA
Allows collection of high density water column data for advanced processing

TELEDYNE RESON
Everywhereyoulook™

SeaBat® 7125

SEABAT 7125 SYSTEM SPECIFICATIONS

	7125 SV2	7125 ROV2	7125 AUV
Power requirement	Typical: 110-220 VAC, 50/60 Hz, 250 W. Max: 110-220 VAC, 50/60 Hz, 700 W.	Processor Typical: 110-220 VAC, 50/60 Hz, 110 W. Processor Max: 110-220 VAC, 50/60 Hz, 400 W. Wet end Typical: 48 VDC (+/- 10%), 115 W. Wet end Max: 48 VDC (+/- 10%) 250 W. Power requirements when Wet-ends are powered from sonar processor: 110-220 VAC, 50/60 Hz, 700 W.	48V DC (± 10%)
Transducer cable length	25m standard	3m standard 10m optional	3m standard 10m optional
LCU to processor cable length	N/A	25m (st), 3 m	N/A
System depth rating	25m	6000m	6000m optional

Frequency	200kHz or 400kHz (dual frequency available)
Along-track transmit beamwidth	2° at 200kHz & 1° at 400kHz
Across-track receive beamwidth	1° at 200kHz & 0.5° at 400kHz
Max ping rate	50Hz (±1Hz)
Pulse length	30µs – 300µs Continuous Wave; 300µs – 20ms Frequency Modulated (X-Range)
Number of beams	512EA/ED at 400kHz, 256EA/ED at 200kHz
Max swath angle	140° in Equi-Distant Mode; 165° in Equi-Angle Mode
Typical depth [2])	0.5m to 150m at 400kHz, 0.5m to 400m at 200kHz
Max depth [3])	>175m at 400kHz; 450m at 200kHz
Depth resolution	6mm
Data output	Bathmetry, sidescan and snippets 7K data format
Temperature:	-2° to +35°C
Flexmode:	Optional
Full Rate Dual Head	400 KHz for ROV/ AUV

For relevant tolerances for dimensions above and detailed outlined drawings see Product Description
1 All beam widths measured at -3dB, unsteered with a sound velocity of 1480m/s.
2 This is a depth range within which the system is normally operated, from the minimum depth to a depth value corresponding to the max. swath -50%.
3 This is the single value corresponding to the depth at which the swath is reduced to 10% of its max. value. For actual swath performance refer to Product Description.

TELEDYNE RESON
Everywhereyoulook™

SeaBat® 7125

SEABAT 7125 SYSTEM SPECIFICATIONS

Component	7125 SV2	7125 ROV2	7125 AUV
EM 7216 receiver	✓	✓	✓
TC 2181 dual frequency 200/ 400 khz projector	✓		
TC 2160 400khz projector		✓	✓
TC 2163 200khz projector (optional)		✓	✓
7-link control unit		✓	
Sonar processor unit with monitor, keyboard and pointer device		✓	
SV transceiver with monitor, keyboard and pointer device	✓		
7-i integrated control and processor unit			✓

Meassurements	Height [mm]	Width [mm]	Depth [mm]	Weight [kg/air]	Weight [kg/water]
TC 2181 df 200/ 400 khz projector	87	93	280	4.5	3.4
TC 2160 400 khz projector	77	62	285	2.7	1.7
TC 2163 200khz projector	115	100	280	7.5	5
EM 7216 200/400 khz receiver	137	496	102	10.7	5.7
Surface transceiver	5U	19”	557	20	N/A
LCU bottle	530	Ø174	N/A	23.5	12.0
ICPU frame	172	166	497	10	N/A
Sonar processor	5U	19”	630	30	N/A

OPTIONS:
- Mounting Bracket with Fairing
- SVP-70 sound velocity probe with 25m cable
- Standard Service Level Agreements (SLA)
- Fiber-optic conversion for ROV installations

SeaBat® 7125

Ultra high Resolution Multibeam Echosounder

SeaBat 7125- SV2

SeaBat 7125-ROV2

WHY CHOOSE A SEABAT 7125 SYSTEM?

- Maximum productivity during data collection
  - Up to165° swath
  - Roll Stabilization
  - Up to 512 beams in operator selectable modes

- Uncompromised clean data sets
  - Quality Filters/flags
  - Interactive, Comprehensive GUI
  - Industry leading bottom detect methods

- Ease of Installation and Use
  - Fully automatic operation
  - Single highly integrated topside transceiver
  - Integrated Multibeam acquisition and processing software
  - Extremely portable wet-end

- Maximum Operational Flexibility
  - 400 and 200kHz operation for seamless data collection from 0.5m to 500m
  - Advanced beam-forming with variable and steerable swath
  - Simultaneous output of bathymetry, Sidescan, Snippets backscatter, and raw water column data
  - Optional X-Range for increased range performance, ultra-high resolution and resistance to external noise
  - Optional Full Rate Dual Head

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TELEDYNE RESON
Everywhereyoulook™

High Resolution Multibeam Systems for:

Hydrography

Offshore

Dredging

Defense

Research

SONIC 2022

Multibeam Echo Sounder

Features:

- Ultra Compact
- Ideal for integration to small AUV, ROV or small boat operations
- Selectable frequencies 200-400kHz
- Selectable swath sector 10º to 160°
- Focused 1° beamwidth
- 1-500m range
- Embedded processor/controller
- Low weight, volume and power consumption

Applications:

- Hydrographic Survey
- Offshore Site Survey
- Pre & Post Dredge Survey
- Defense & Security
- Marine Research

System Description:

The Sonic 2022 is a compact wideband shallow water multibeam echo sounder, suitable for a wide variety of general mapping applications.

As with the higher resolution Sonic 2024 system, the Sonic 2022 provides over 20x selectable operating frequencies to chose from 200 to 400 kHz, with unparalleled flexibility to trade off resolution and range and controlling interference from other active acoustic systems.

In addition to selectable operating frequencies, the Sonic 2022 provides variable swath coverage selections from 10° to 160°.

Both the frequency and swath coverage may be selected 'on the fly', in real-time during survey operations.

The Sonar consists of the outboard projector and receiver modules, and the inboard Sonar Interface Module (SIM). Third party auxiliary sensors (GPS, and SVP) are connected to the Sonar Interface Module. The sonar data is tagged with GPS time.

The sonar operation is controlled from a graphical user interface on a PC or laptop which is typically equipped with navigation, data collection and storage applications software.

The operator sets the sonar parameters in the sonar control window, while depth, imagery and other sensor data are captured and displayed by the applications software.

Commands are transmitted through an Ethernet interface to the Sonar Interface Module. The Sonar Interface Module supplies power to the sonar heads, synchronizes multiple heads, time tags sensor data, and relays data to the applications workstation and commands to the sonar head.

The receiver head decodes the sonar commands, triggers the transmit pulse, receives, amplifies, beamforms, bottom detects, packages and transmits the data through the Sonar Interface Module via Ethernet to the control PC.

The compact size, low weight, low power consumption <35W and elimination of separate topside processors also make Sonic 2022 *very well suited* for small survey vessel, ROV or AUV operations.

The standard data output format is compatible with SeaBat™ 81xx for ease of interface to existing systems. An expanded format will be released as part of a planned firmware update, to incorporate additional features.

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1503-A Cook Pl.
Santa Barbara
California, USA
93117

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Sonic 2022 Multi Beam Echo Sounder

Systems Specification:

Frequency	200kHz-400kHz
Beamwidth, across track	1.0°
Beamwidth, along track	1.0°
Number of beams	256
Swath sector	Up to 160°
Max Range setting	500m
Pulse Length	10µs-1ms
Pulse Type	Shaped CW
Depth rating	100m
Operating Temperature	0℃ to 50℃
Storage Temperature	-30℃ to 55℃

Electrical Interface

Mains	90-260 VAC, 45-65Hz
Power consumption	<35W
Uplink/Downlink:	10/100/1000Base-T Ethernet
Data interface	10/100/1000Base-T Ethernet
Sync In, Sync out	TTL
GPS	1PPS, RS-232
Auxiliary Sensors	RS-232
Deck cable length	15m

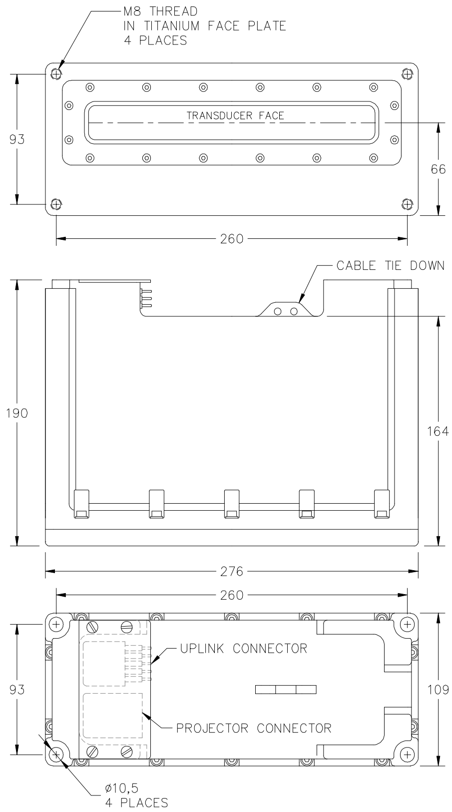
Mechanical:

Receiver Dim (LWD)	276 x 109 x 190 mm
Receiver Mass	7 kg
Projector Dim (LWD)	273 x 108 x 86 mm
Projector Mass	3.3 kg
Sonar Interface Module Dim (LWH)	280 x 170 x 60 mm
Sonar Interface Module Mass	2.4 kg

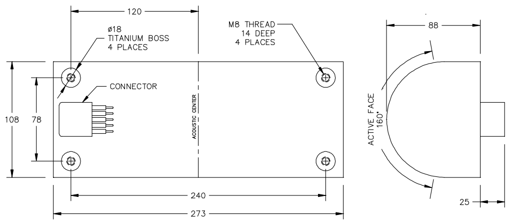
Sonar Options:

Snippets Imagery Output
Switchable Forward Looking Sonar Output
Mounting Frame & Hardware
Over-the-side Pole Mount
Sound Velocity Probe & Profiler
Extended Sonar Deck Cable, 25m or 50m
3000m Depth Immersion Depth

Sonar Interface Module



Sonic 2022 Receiver



Sonic 2022 Projector

High Resolution Multibeam Systems for:

Hydrography

Offshore

Dredging

Defense

Research

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the next generation, literally

Attachment C
Draft BIWF Project Health & Safety Plan

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Health and Safety Plan

Deepwater Block Island Wind Farm Project

Rhode Island

May 2015

**2600 Park Tower Drive,
Suite 100
Vienna, VA 22180**

SIGNATURE PAGE

Deepwater Block Island Wind Farm Project
Rhode Island

HEALTH AND SAFETY PLAN

		Phone No.
Project Manager:	Anwar Khan	954-494-2084
Health and Safety Director:	Danny Sciarro	720.236.5104
Preparation Date:	May 2015	
Expiration Date:	May 2016	

APPROVALS

Bruce Stewart July 2015

Anwar Khan July 2015

Prepared by:
HDR
2600 Park Tower Drive,
Suite 100
Vienna, VA 22180

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Table of Contents

Tables

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Attachments

ACRONYMS AND ABBREVIATIONS

CIH	Certified Industrial Hygienist
dB	decibel
EMS	Emergency Medical Services
HASP	Health and Safety Plan
HSD	Health and Safety Director
Kv	Kilovolts
MOB	Man Over Board
OSHA	Occupational Safety and Health Administration
PE	Professional Engineer
PEL	Permissible Exposure Limit
PFD	Personal Flotation Device
PM	Project Manager
POC	Point of Contact
PPE	personal protective equipment
RH	relative humidity
SHPO	State Historic Preservation Office
SOP	Standard Operating Procedure
SSHO	Site Safety and Health Officer
TO	Task Order
USCG	United States Coast Guard
VHF	Very High Frequency
VSD	Vessel Safety Director
ºF	degrees Fahrenheit

1 INTRODUCTION

HDR has prepared this Health and Safety Plan (HASP) that covers the general health and safety requirements for the Block Island Windfarm Project. Attachment B will be modified for each Task Order (TO) by adding health and safety provisions that cover specific field acitivities as required by the scope of work for that TO.

This plan will be a “living” document and will be administrated by the HDR Program management team. This document is applicable to activities and services performed and/or provided by HDR during all HDR monitored tasks.

1.1 Plan Objective

The objective of this HASP is to define the requirements and designate protocols to be followed during the field data collection. Applicability extends to HDR personnel and visitors, inclusive of client personnel and representatives. Work performed by HDR and subcontractors will comply with applicable Federal Occupational Safety and Health Administration (OSHA) laws and regulations. Through careful planning and implementation of corporate and site-specific health and safety protocols, HDR will strive for zero accidents and incidents on the project.

1.2 Health and Safety Policy Statement

The HDR management is committed to the health and safety of each employee. It is essential that all Managers and Supervisors insist on the maximum safety performance and awareness of all employees under their direction, by enthusiastically and consistently administering all health and safety rules and regulations. It is HDR’s policy to take the necessary actions, in engineering, planning, designing, assigning and supervising work operations, to create a safe work-site. HDR will:

- To the extent possible, maintain safe and healthful working conditions.
- Provide and assure the use of all necessary personal protective equipment (PPE) to minimize exposure to unsafe conditions.
- Require that site work be planned to provide a range of protection based on the degree of hazards encountered under actual working conditions.
- Provide site workers with the information and training required to make them fully aware of known and suspected hazards that may be encountered and of the appropriate methods for protecting themselves, their co-workers and the public at large.

1.3 Project Health and Safety Expectations

The health and safety of workers, client, the public, and the protection of the environment are a fundamental responsibility assumed by HDR under this contract. HDR will:

- Promote project health and safety with an objective of zero accidents.
- Manage activities in a proactive way that effectively increases the protection of HDR site workers, the public and the environment.
- Reduce health and safety risk by identifying and eliminating hazards from site activities.
- Carry out site activities in a manner that complies with all applicable safety, health and environmental laws and regulations.

The success of our health and safety program is ensured by our ability to seamlessly integrate our health and safety procedures into a site-specific document that establishes safe and healthy work conditions for on-site operations.

1.4 Project Health and Safety Compliance Program

Compliance with the requirements of applicable Federal and state laws will be accomplished through a combination of written programs, employee training, workplace monitoring, and system enforcement. HDR, thorough regular inspections by supervisors and health and safety personnel, as well as the culture of ownership and total involvement in the health and safety program, will produce an atmosphere of voluntary compliance. However, disciplinary action for violations of project requirements will be taken when necessary.

The safe and efficient work practices of this company require a spirit of teamwork and cooperation from all employees. Also required are uniform standards of expected behavior. Employees who refuse or fail to follow the standard set forth by this plan, the HDR Corporate Health and Safety Program and/or Regulatory standards; will subject themselves to disciplinary action up to, and including, discharge. In cases not specifically mentioned, employees are expected to use good judgment and refer any questions to their supervisors.

1.5 Scope of Work

The U.S. Department of Interior's Bureau of Ocean Energy Management (BOEM) is responsible for managing the exploration and development of the nation's offshore energy resources. It conducts environmental reviews, including National Environmental Policy Act analyses, for each major stage (leasing, site assessment, construction, operations, and decommissioning) of proposed offshore energy development projects. Through these reviews and analyses, BOEM evaluates potential environmental impacts from the proposed offshore activities on the human, coastal, and marine environments.

The analyses conducted by BOEM require data on impact producing factors (stressors) and their effects on ecosystems and individual receptors. The Bureau has therefore initiated the "Real-Time Opportunity for Development of Environmental Observations (RODEO)" Program. The primary objective of this program is to make direct, real-time measurements of the nature, intensity, duration of potential stressors during the construction and/or initial operations of selected proposed offshore wind facilities. The RODEO Program also include recording direct observations during the testing of different types of monitoring equipment that may be used by future offshore development to measure or monitor activities and their impact producing factors.

The first facility to be subjected to RODEO monitoring is the proposed Block Island Wind Farm (BIWF) Project, which will be located off the Rhode Island shoreline.

1.6 Health and Safety Plan Revisions

The development and preparation of this HASP is based on site-specific information provided to HDR. Should any unforeseen hazard become evident during the performance of the work, the Project Manager (PM) shall bring such hazard to the attention of the HDR Health and Safety Director (HSD) both verbally and in writing for resolution as soon as possible. In the interim, HDR will take necessary actions to maintain safe working conditions in order to safeguard on-site personnel, visitors, the public, and the environment. No changes to the HASP will be allowed until the item has been reviewed and an addendum prepared and approved by the HSD. Changes to the HASP will be documented and approved by the PM and the HSD. The approval will be accompanied by a formal addendum to the HASP.

2 ORGANIZATION AND RESPONSIBILITIES

While the HDR Safety and Health Department directs and supervises the overall Safety, Health and Environmental Program, the responsibility for Safety and Health extends throughout our organization from top management to every employee. For this reason, it is each person's duty to notify management personnel if a hazardous condition is identified and to make a "stop work" call if the condition represents an immediate danger to life or health, until the PM can make a further determination. The following are the HDR project personnel positions and responsibilities for this project.

Project Manager:	Anwar Khan
Field Director/Site Safety and Health Officer:	Michael Richlin (or alternate)
Health and Safety Director:	Bruce Stewart

2.1 Project Manager

The PM directs and manages all aspects of the project in compliance with all contract and technical requirements. The PM retains responsibility for serving as the primary liaison with the HSD.

The PM may request assistance from the HSD at any time. The PM is specifically responsible for ensuring that the following are completed:

- Implement health and safety training requirements at the site for HDR personnel. This includes weekly safety meetings and all applicable formal health and safety training.
- Immediately report to the HSD and the client, any incident that results in serious injury, illness or death.

2.2 Health and Safety Director

The HSD will:

- Be responsible for the development and oversight of the HASP.
- Be available for consultation 24/7 for the duration of the project.
- Provide consultation as needed to ensure the full implementation of the HASP.
- Coordinate any modifications to the HASP with the PM.
- Provide HDR personnel with support for upgrading/downgrading of the level of personal protection.
- Be responsible for recommending changes to engineering controls, work practices, and PPE.
- Conduct accident investigations.
- Review the daily and weekly safety meeting reports.

2.3 Field Director/Site Safety and Health Officer

The Site Safety and Health Officer (SSHO) shall be responsible for the implementation of this HASP and to ensure that the planned work objectives reflect adequate health and safety considerations. SSHO will perform site-specific training and briefing sessions for employee(s), prior to the start of field activities at the site and a briefing session each day before starting work. He/she will ensure the availability, proper use and maintenance of specified personal protective equipment, decontamination, and other safety and health equipment. He will maintain a high level of health and safety awareness among team members and communicate pertinent matters to them promptly. SSHO will:

- Have the authority to ensure site compliance with specified health and safety requirements, Federal OSHA regulations and all aspects of the HASP. This includes, but is not limited to: use of PPE, decontamination, site control; standard operating procedures (SOP) used to minimize hazards; safe use of engineering controls; the emergency response plan; spill containment; and preparation of records.
- Stop HDR work activities if unacceptable health or safety conditions exist. Immediately notify the PM or the HSD to discuss the safety concern. HDR work will not resume until the safety concern has been addressed.
- Consult and coordinate any modifications to the HASP with the HSD and the PM.
- Prepare preliminary accident reports.

2.4 Captain

The captain is ultimately responsible to ensure that the survey is safely conducted. The captain shall ensure that elements of the HDR safety program are adhered to during all operations. The primary Float Plan Point of Contact (POC) on shore within the safety program will be Michael Richlin. HDR acknowledges that there are times when a person within their company may not be an appropriate contact, and the captain shall have access to the HSD at any time. He may bring concerns anonymously if he chooses, and must have confidence that their chosen anonymity will be honored by the VSD and any other person who receives safety-related concerns from the captain.

2.5 Monitoring Team

The monitoring team will bear equal responsibility with the contractor's vessel operations to ensure that the policies and procedures of the HDR safety program are being adhered to during all operations. While their primary POC within the program will be the HSD, there are situations where they may feel that it is in the best interest of the program to address concerns initially with the captain. The observers will be familiar with the HDR safety program, and will have a working knowledge of the requirements of the equipment used on surveys. The observers must immediately report any violations of the program or any of its requirements to the VSD.

3 OPERATIONAL POLICIES & VESSEL SAFETY

This section provides basic procedures for field work and safe operation on the vessel.

3.1 Definitions

PFD – Equipment designed to prevent drowning. The U.S. Coast Guard (USCG) is the approving agency and divides all PFDs into 5 current classifications. Three classes are approved for HDR use – Class III, IV and V. Types III and V are designed to be worn as apparel around the body during all times of exposure, and are commonly referred to as "life vests, life preservers, float coats, or float suits." Type IV are circular life rings designed to be thrown to personnel who are in the water, as a rescue measure.

All vessel personnel are required to wear a Mustang type automatic PFD (provided) at all times while on the boat. Any personnel who are required to board the vessel for short periods of time and do not have Mustang type automatic PFD will be provided a Class III or V PFD by the vessel's captain.

Ring Buoy – Type IV life ring, with a retrieval rope attached.

NOTE: For cold weather work on boats, or on floating docks where the risk of falling into the water is present, if the water plus air temperature is less than 43.3 degrees Celsius (°C; 110 degrees Fahrenheit [°F]), a float coat or a float suit must be worn in lieu of a vest-type PFD.

Simply stated: Water temperature + air temperature < 43.3°C (< 110°F) = float coat or suit required. If this is contradictory to the heat stress brought on by wearing float coats or suits, then float coats or suits will not be worn. However, lifejackets will continue to be worn at all times.

3.2 Operational Risk Assessment

Prior to the start of any vessel-based monitoring, the PjM, the VSD, and all flight crewmembers and aerial observers shall have an Operational Risk Assessment meeting. This meeting should address safety concerns, both general, and specific to that project. These should include local weather environments, local seasonal considerations, other vessel traffic that could affect the safety of the launch and work area, vessel ingress/egress procedures, location of the project, and any other concern that any involved party may have.

All concerns addressed in the Operational Risk Assessment meeting shall be resolved or appropriately mitigated to the comfort of the PjM, the VSD and the crewmembers prior to any survey operations taking place. The concerns and resolution or mitigation strategies shall be noted and recorded by the VSD for reference for future surveys, and they shall be made available to all other operators and personnel involved in vessel survey operations.

3.3 Float Plan Following

All surveys will be followed in real-time via telephone (voice or text) by the designated HDR Float Plan POC. The following procedure will be as follows:

- The monitoring crew shall check in with the Float Plan POC as near to departure time as practical to arrange the vessel following. Immediate voice or text reply is required. The Flight

Follower is required to have their phone on their body during the entire duration the vessel is on the water.

- At the completion of the day, when the vessel is on the ground, the flight crew will call the Flight Follower to terminate flight following. Immediate voice or text reply is required. The Flight Follower is required to have their body during the entire duration of the survey.

3.4 Marine Radio

Marine radios transmit along VHF/FM frequencies and are much more reliable than Citizen's Band radios. In addition to this more advanced technology, marine radios have designated channels that are monitored 24 hours per day, 7 days per week. Channel 16 is the international channel for all distress calls.

3.5 Emergency Procedures

In the event that any member of the HDR organization becomes aware of an emergency or potential emergency situation, immediate action will be taken. The actions to be taken will be dependent upon the nature of the situation. In the event that there is uncertainty as to whether emergency action protocols or potential emergency protocols need to be taken, the situation will be treated as an actual emergency until such time as information dictates that it is a less dire event.

3.6 Potential Emergency Situation Protocols

In the event of an inability to contact the vessel crew, the situation will be treated as a potential emergency. The following action will be taken immediately.

- The VSD will be advised of the existing situation.
- The VSD will establish contact with the Program Manager and advise him of the situation.
- The VSD will establish contact with the owner from the vessel operator's company, advise them of the situation, and find out if they have additional information.
- In the event that no contact is established, the Float Plan POC will contact the U.S. Coast Guard.
- If reportable injury or death occurs to a member of the team, or in the event of significant equipment damage (such as to the vessel) during the course of the project, a Public Relations Plan should be placed in action. Typically, initial emergency measures are activated if the vessel crew misses a check-in or return time by 30 minutes. Depending on outcome, media interest may be generated. Typically, a single POC within the responsible agency would interface with the media. All media requests should be referred to the cognizant Public Affairs Office. No one except the cognizant Public Affairs Office should be authorized to release information to the media.

Call for Help:

- Make sure your radio is transmitting on Channel 16.

If you are in distress:

- Call "MAYDAY, MAYDAY, MAYDAY".

If you are not in distress:

- Call “Coast Guard”.

Tell the USCG:

- Your location or position
- Exact nature of the problem or emergency
- Number of people on board
- Your boat’s name, registration, description, and safety equipment on board.

Call Back When:

- A medical emergency develops
- A storm approaches
- Your boat begins to take on water
- Your last reported position changes.

The following are some useful channels to know, the most important of which is:

CHANNEL 16 VHF/Frequency Modulated 2182 kilohertz high frequency/SSB for international distress, safety and calling.

Channel Number	Ship Transmit Megahertz	Ship Receive Megahertz	Use
6	156.300	156.300	Intership Safety
07A	156.350	156.350	Commercial
9	156.450	156.450	Boater Calling. Commercial and Non-Commercial.
10	156.500	156.500	Commercial
13	156.650	156.650	Intership Navigation Safety (Bridge-to-bridge). Ships >20m length maintain a listening watch on this channel in US waters.
16	156.800	156.800	International Distress, Safety and Calling. Ships required to carry radio, USCG, and most coast stations maintain a listening watch on this channel.
21A	157.050	157.050	USCG only.
22A	157.100	157.100	USCG Liaison and Maritime Safety Information Broadcasts. Broadcasts announced on channel 16.

3.7 MEDICAL SUPPORT

Emergency contingency information including on-site emergency contacts and offsite medical arrangements are summarized on the Emergency Contacts page of this HASP. If an injured individual is ambulatory, they should be transported to the nearest launch point where medical services can obtain access.

4 COLD STRESS

Cold stress will be a factor to be considered while working on this project. The guidelines will be followed by HDR personnel.

4.1 Hypothermia

When exposed to cold temperatures, your body begins to lose heat faster than it can be produced. Prolonged exposure to cold will eventually use up your body's stored energy. The result is hypothermia, or abnormally low body temperature. A body temperature that is too low affects the brain, making the victim unable to think clearly or move well. This makes hypothermia particularly dangerous because a person may not know it is happening and will not be able to do anything about it.

4.2 Symptoms

Symptoms of hypothermia can vary depending on how long you have been exposed to the cold temperatures.

4.2.1 Early Symptoms

- Shivering
- Fatigue
- Loss of coordination
- Confusion and disorientation

4.2.2 Late Symptoms

- No shivering
- Blue skin
- Dilated pupils
- Slowed pulse and breathing
- Loss of consciousness

4.2.3 First Aid

Take the following steps to treat a worker with hypothermia:

- Alert the Field Team Leader and request medical assistance.
- Move the victim into a warm room or shelter.
- Remove their wet clothing.
- Warm the center of their body first-chest, neck, head, and groin-using a blanket or other available items; or use skin-to-skin contact under loose, dry layers of blankets, clothing, towels, or sheets.
- Warm beverages may help increase the body temperature, but do not give alcoholic beverages. Do not try to give beverages to an unconscious person.
- After their body temperature has increased, keep the victim dry and wrapped in a warm blanket, including the head and neck.

- If victim has no pulse, begin CPR.

4.3 Cold Water Immersion

Cold water immersion creates a specific condition known as immersion hypothermia. It develops much more quickly than standard hypothermia because water conducts heat away from the body 25 times faster than air. Typically people in temperate climates don't consider themselves at risk from hypothermia in the water, but hypothermia can occur in any water temperature below 70 degrees Fahrenheit (°F). Survival times can be lengthened by wearing proper clothing (wool and synthetics and not cotton), using a personal flotation device (life vest, immersion suit, dry suit), and having a means of both signaling rescuers (strobe lights, personal locator beacon, whistles, flares, waterproof radio) and having a means of being retrieved from the water..

4.4 Frostbite

Frostbite is an injury to the body that is caused by freezing. Frostbite causes a loss of feeling and color in the affected areas. It most often affects the nose, ears, cheeks, chin, fingers, or toes. Frostbite can permanently damage body tissues, and severe cases can lead to amputation. In extremely cold temperatures, the risk of frostbite is increased in workers with reduced blood circulation and among workers who are not dressed properly.

4.4.1 Symptoms

Symptoms of frostbite include:

- Reduced blood flow to hands and feet (fingers or toes can freeze)
- Numbness
- Tingling or stinging
- Aching
- Bluish or pail, waxy skin

4.4.2 First Aid

Workers suffering from frostbite should:

- Get into a warm area as soon as possible.
- Unless absolutely necessary, do not walk on frostbitten feet or toes-this increases the damage.
- Immerse the affected area in warm-not hot-water (the temperature should be comfortable to the touch for unaffected parts of the body).
- Warm the affected area using body heat; for example, the heat of an armpit can be used to warm frostbitten fingers.
- Do not rub or massage the frostbitten area; doing so may cause more damage.
- Do not use a heating pad, heat lamp, or the heat of a stove, fireplace, or radiator for warming. Affected areas are numb and can be easily burned.

4.5 Trench Foot

Trench foot, also known as immersion foot, is an injury of the feet resulting from prolonged exposure to wet and cold conditions. Trench foot can occur at temperatures as high as 60 ºF if the feet are constantly wet. Injury occurs because wet feet lose heat 25-times faster than dry feet. Therefore, to prevent heat loss, the body constricts blood vessels to shut down circulation in the feet. Skin tissue begins to die because of lack of oxygen and nutrients and due to the buildup of toxic products.

4.5.1 Symptoms

Symptoms of trench foot include:

- Reddening of the skin
- Numbness
- Leg cramps
- Swelling
- Tingling pain
- Blisters or ulcers
- Bleeding under the skin
- Gangrene (the foot may turn dark purple, blue, or gray)

4.5.2 First Aid

Workers suffering from trench foot should:

- Remove shoes/boots and wet socks.
- Dry their feet.
- Place gauze or other cloth between the toes.
- Avoid walking on feet, as this may cause tissue damage.

4.6 Chilblains

Chilblains are caused by the repeated exposure of skin to temperatures just above freezing to as high as 60 ºF. The cold exposure causes damage to the capillary beds (groups of small blood vessels) in the skin. This damage is permanent and the redness and itching will return with additional exposure. The redness and itching typically occurs on cheeks, ears, fingers, and toes.

4.6.1 Symptoms

Symptoms of chilblains include:

- Redness
- Itching
- Possible blistering
- Inflammation
- Possible ulceration in severe cases

4.6.2 First Aid

Workers suffering from chilblains should:

- Avoid scratching
- Slowly warm the skin

- Use corticosteroid creams to relieve itching and swelling
- Keep blisters and ulcers clean and covered

4.7 Equivalent Chill Temperature

Equivalent Chill Temperature – The Equivalent chill temperature is the temperature that it feels like outside to people and animals. Equivalent chill temperature is based on the rate of heat loss from exposed skin caused by combined effects of wind and cold. As the wind increases, heat is carried away from the body at an accelerated rate, driving down the both the skin temperature and eventually the internal body temperature. Therefore, the wind makes it feel much colder. If the temperature is 0°F and the wind is blowing at 15 miles per hour (mph), the wind chill is -19°F. At this equivalent chill temperature, exposed skin can freeze in 30 minutes.

The Equivalent Temperature Table, presented in **Table 1**, should be reviewed along with local temperature and wind speed data prior to extended work in the cold, and preventative work restrictions and preventions, presented herein, should be followed.

Table 1. Cooling Power of Wind on Exposed Flesh Expressed as Equivalent Temperature (under calm conditions)

Estimated Wind Speed (in mph)	Actual Temperature Reading (°F)											
	50	**40**	**30**	**20**	**10**	**0**	**-10**	**-20**	**-30**	**-40**	**-50**	**-60**
	Equivalent Chill Temperature (ºF)											
Calm	50	40	**30**	**20**	**10**	**0**	**-10**	**-20**	**-30**	**-40**	**-50**	**-60**
5	48	**37**	**27**	**16**	**6**	**-5**	**-15**	**-26**	**-36**	**-47**	**-57**	**-68**
10	40	**28**	**16**	**4**	**-9**	**-24**	**-33**	**-46**	**-58**	**-70**	**-83**	**-95**
15	**36**	**22**	**9**	**-5**	**-18**	**-32**	**-45**	**-58**	**-72**	**-85**	**-99**	**-112**
20	**32**	**18**	**4**	**-10**	**-25**	**-39**	**-53**	**-67**	**-82**	**-96**	**-110**	**-121**
25	**30**	**16**	**0**	**-15**	**-29**	**-44**	**-59**	**-74**	**-88**	**-104**	**-118**	**-133**
30	**28**	**13**	**-2**	**-18**	**-33**	**-48**	**-63**	**-79**	**-94**	**-109**	**-125**	**-140**
35	**27**	**11**	**-4**	**-20**	**-35**	**-51**	**-67**	**-82**	**-98**	**-113**	**-129**	**-145**
40	**26**	**10**	**-6**	**-21**	**-37**	**-53**	**-69**	**-85**	**-100**	**-116**	**-132**	**-148**
Wind speeds greater than 40 mph have little additional effect.	LITTLE DANGER In < hr with dry skin. Maximum danger of false sense of security.				INCREASING DANGER Danger from freezing of exposed flesh within one minute.			GREAT DANGER Flesh may freeze within 30 seconds.				
	Trench foot and immersion foot may occur at any point on this chart											

Equivalent chill temperature requiring dry clothing to maintain core body temperature above 36 Celsius (°C; 98.6 ºF) per cold stress threshold limit value (TLV).

* Developed by the U.S. Army Research Institute of Environmental Medicine, Natick, MA.

5 HEAT STRESS

Heat stress during this project may be a concern. This significantly increases the heat load on the body. Adherence to this procedure will be extremely important to prevent heat stress illnesses from occurring.

5.1 Heat-Related Illnesses

There are four typical types of heat-related illnesses (result of heat strain) resulting from prolonged exposure to high thermal environments (stressor which causes the strain). These are described in the sections below.

5.1.1 Heat Rash (Prickly Heat)

Heat rash is a painful temporary condition caused by clogged sweat pores. Heat rash is caused by the plugging of sweat ducts due to the swelling of the moist keratin layer of the skin which leads to inflammation of the sweat glands. Heat rash appears as tiny red bumps on the skin and can impair sweating, resulting in diminished heat tolerance. Signs and symptoms include:

- Tiny raised blustered red blisters or small pimples
- Pricking sensations, or itching during heat exposure
- Most likely to occur on the neck and upper chest, in the groin, under the breasts, and in elbow creases

Heat rash is usually a mild, temporary condition, although it decreases the body's ability to tolerate heat, as well as being a nuisance.

Treatment: Heat rash can usually be cured by providing cool areas; body powder may also help absorb moisture.

5.1.2 Heat Cramps

Heat cramps are characterized by painful intermittent spasms of the voluntary muscles following hard physical work in a hot environment. Heat cramps usually occur after heavy sweating, and often begin at the end of the workday. The cramps are caused by a loss of electrolytes, principally salt. This results in fluids leaving the blood and collecting in muscle tissue, resulting in painful spasms. Symptoms include muscle pain or spasms in the abdomen, arms, or legs.

Heat syncope is a condition caused by pooling of the blood in the extremities, usually related to activities where the person stands without moving for a period of time or sudden rising from a sitting or lying position. Factors that may contribute to heat syncope include dehydration and lack of acclimatization. The reduced blood volume to the head can cause fainting, which may in turn cause injuries. Symptoms include:

- Light-headedness
- Dizziness
- Fainting.

Treatment: Increase water ingestion. Eat normally throughout the day to replace electrolytes.

5.1.3 Heat Exhaustion

Heat exhaustion occurs when the bodies thermoregulatory system is not functioning efficiently. Symptoms of heat exhaustion include:

- Heavy sweating
- Extreme weakness or fatigue
- Low blood pressure
- Rapid pulse
- Dizziness, confusion
- Nausea
- Clammy, moist skin
- Pale or flushed complexion
- Muscle cramps
- Normal or slightly depressed body temperature
- Fast and shallow breathing

This is the most common form of serious heat illness encountered during employment activities. Any worker who is a victim of heat exhaustion may not be exposed to a hot working environment for an absolute minimum of 24 hours and, if fainting has occurred, the victim should not return to work until authorized by a physician.

Treatment: Move victim to a cool area, loosen clothing, and place in a head-low (shock prevention) position, and provide rest and plenty of fluids. Do not give coffee, tea or alcoholic beverages.

5.1.4 Heat Stroke

This is the most serious heat disorder and is life-threatening. Heat stroke is a true medical emergency. This results when the body's heat-dissipating system is overwhelmed and shuts down (thermoregulatory failure). Heat stroke results in a continual rise in the victim's deep core body temperature, which is fatal if not checked. Symptoms may include:

- Hot, dry skin; no perspiration
- Hallucinations
- Chills
- Throbbing headache
- High body temperature
- Confusion and/or dizziness
- Slurred speech
- Unconsciousness may occur.

Treatment: Call 911. First aid consists of immediately moving victim to a cool area; cool the body slowly by immersion in tepid (slightly warm) water or sponging the body with tepid water; treat for shock and obtain immediate medical assistance. Treatment response time is critical when assisting a victim of heat stroke! Do not give coffee, tea or alcoholic beverages.

5.2 General Heat Stress First Aid

First aid for heat stress conditions consists of proper evaluation of their condition, cooling the victim down, and rehydration. Specific actions which should be taken include:

- First-aid trained persons should be summoned to assist in evaluation of the victim's condition.
- If heat stroke is suspected, outside medical responders should be immediately contacted, as this condition should be considered immediately life-threatening. **Call 911** immediately.
- Impermeable clothing should be removed as soon as possible following the required decontamination steps, unless the delay could compromise the victim's health.
- The victim's clothing should be loosened to aid air circulation.
- The victim should be moved to a shaded, cooler location, preferably air-conditioned.
- The victim should sit, or lie down if they are dizzy or at risk of losing consciousness.
- The victim should be encouraged to drink cool water if they are not nauseous or losing consciousness.
- The victim may be cooled down further by:
    - Moistening the head, neck, torso and clothing with tepid water;
    - Spraying, sponging, or showering them with tepid water; and
    - Fanning their body, gently.
- To minimize the risk of shock, do not drench them with cold water, use tepid water, unless advised to do so by medical personnel.

5.3 Prevention of Heat Disorders

It is interesting to note that if a person works continually, for about a week, in a hot environment, he/she tolerates much hotter conditions than initially. This process of adjustment is termed "acclimatization". Acclimatization is essential if work is to be frequently performed in hot environments. Essentially, in acclimatized workers, their core body temperatures and heart rates are slower than non-acclimatized workers, and they sweat more but with less salt loss. Acclimatization to heat can, however, be lost almost as rapidly as it is acquired, if the worker is removed from the hot environment for a few days.

In order to prevent the onset of heat-related disorders, HDR employees should rely on the physiological monitoring methods described above, and practice the following good health measures.

5.3.1 Provision of Water (or other drinking fluids)

Fluids are a key preventative measure to minimize the risk of heat related illnesses. Each employee should have at least one quart per employee per hour for the entire shift. Each vehicle will carry at least 5 gallons of drinking water. This must be replenished at the beginning of each day. In addition, each employee is responsible for having a container (such as a Camelback or other means) so they can carry water with them throughout the day.

Coffee, tea and other warm and caffeinated beverages must be avoided. In addition, sport drinks and electrolyte replacement drinks are to be consumed in very limited quantities (one per day) as these contain sugar, which utilizes the bodies' water reserves to digest, thus dehydrating the individual.

Employees are encouraged to maximize water intake and realize that thirst is not an adequate indicator of sweat loss. Water should be consumed at a target rate of one cup every 20 minutes at a minimum.

If water containers are being shared by employees disposable/single use drinking cups need to be provided, or employees may use their own cup. In addition, a supervisor or designated employee shall be assigned to monitor the quantity and condition of the water. When water levels within a container drop below 50%, the water needs to be replenished.

5.3.2 Access to Shade (Rest Area)

Access to rest and shade or other cooling measures are important preventative steps to minimize the risk of heat related illnesses. Employees suffering from (or exhibiting symptoms of) heat illness or believing a preventative recovery period is needed, will be provided access to an area with shade that is either open to the air or provided with ventilation or cooling for a period of no less than five minutes. Such access to shade shall be permitted at all times.

The rest area should be shaded from the sun. Air-conditioned construction offices, trailers and work vehicles make good rest areas. When possible, rest areas should be readily accessible and near supplies of drinking fluids.

5.3.3 Additional Health Measures

To help prevent the onset of heat-related disorders, HDR employees should practice additional good health measures, such as:

- The workers should be as physically fit as possible. This is especially important concerning hot work. Obesity predisposes individuals to heat disorders;
- Older workers are at a disadvantage in hot work because the aging process results in a sluggish response of sweat glands, resulting in a less effective control of body temperature;
- A victim of a heat-related disorder is permanently predisposed to suffering a recurrence;
- Every worker is unique in his/her ability to handle heat. Work/rest periods should be based on the individual's capacity to safely handle the heat, not on a predetermined or inflexible time length;
- Alcohol has been commonly associated with the occurrence of heat-related disorders. Alcohol reduces heat tolerance;
- Inform female workers of the possible adverse consequences of hot work while pregnant, due to elevated core body temperatures.

5.4 Emergency Assistance Procedure

Employees are directed to immediately report to their SSHO, symptoms or signs of heat illness in themselves, or in co-workers. Employees should not delay in reporting these observations.

To help ensure proper medical care is provided with minimal delay, SSHO shall take the following steps:

- Providing First Aid: Should an HDR employee exhibit signs of possible heat illness, the treatment procedures described above should be implemented.
- Contacting EMS: If emergency medical service (EMS) is required, the HDR field supervisor (or a designee) shall contact EMS using the procedures presented in Table 1. Once contact is established, stay on the phone with EMS to provide clear and precise directions to the work site.

6 MATERIAL HANDLING

Various materials and equipment may be handled manually during project operations.

Employees working alone should not attempt to lift or move a load that is too heavy for one person - get help! If necessary, wear protective gloves and clothing (i.e., aprons) when handling loads with sharp or rough edges or when there is the potential for chemical exposure. Workers should be properly positioned when pulling or prying objects.

Care should be taken when lifting and handling heavy or bulky items to avoid back injuries. The following fundamentals address the proper lifting techniques that are essential in preventing back injuries:

- The size, shape, and weight of the object to be lifted must first be considered.
- The anticipated path to be taken by the lifter should be considered for the presence of slip, trip, and fall hazards.
- Those who have not been trained in proper lifting techniques shall not lift heavy objects.
- If an object is large or not easily carried by one person, two (or more) properly trained people shall be utilized to lift the object.
- Face the load squarely, get a firm footing and spread your feet 12-14 inches apart and, if possible, place one foot alongside the object being lifted.
- Bend your knees and get a good grip on the object. Keep your back straight, vertical, and lift by straightening your legs.
- Keep the load close to your body throughout the entire lifting process.
- If it is necessary to turn, change your foot position, DO NOT TWIST YOUR BODY.
- When the load is heavy or awkward, use teamwork. Lift slowly and evenly together.
- When two or more workers are required to handle the same object, workers shall coordinate the effort so that the load is lifted uniformly and that the weight is equally divided between the individuals carrying the load. When carrying the object, each worker, if possible, shall face the direction in which the object is being carried.
- When placing an object down, the stance and position are identical to that for lifting. The legs are bent at the knees and the object lowered.

7 OTHER PHYSICAL HAZARDS

7.1 Over-Water Safety Requirements

Whenever work is conducted from the barge or monitoring vessels, there is an inherent risk of falling off and being immersed in water, with a risk of drowning or hypothermia. To minimize the risk of drowning hazards, the following will be performed:

- All HDR personnel on a boat, barge, or on the pier will be required to wear a Personal Flotation Device (Type III or V).
- The pier and boats will have tools and equipment organized in a manner to minimize trip/fall hazards.

7.2 Sinking/Flooding

In the unlikely event a hull is compromised, personnel will immediately evacuate the barge or boat and go to shore. All personnel are required to wear personal flotation devices when on the boat. Under no circumstances will personnel endanger one's own life to attempt to save another.

7.3 Man Overboard

All personnel are required to wear personal flotation devices when on the boat. In the unlikely event a person falls overboard, personnel will immediately assist using the following directions. Under no circumstances will personnel endanger one's own life to attempt to save another.

- Immediately throw a lifebuoy and attachment overboard. Immediately throw any other items that float over to assist in marking the spot.
- Raise the alarm by shouting: "Man Overboard" (MOB). Even if you are the only one left aboard, shouting "man overboard" may provide reassurance to the person in the water. If there are others on board, instruct a crew member to watch the person in the water and point continuously.
- Start your recovery maneuver. If possible note your position – most GPS units have a MOB function - it may prove vital if contact is lost with the person in the water. Remember the MOB function records where the person fell overboard - he/she will drift away with the tide.
- If you are the only person remaining on board, do not leave the deck as you may become disorientated and loose sight of the person in the water.
- If you cannot see the person in the water or have any doubt about your ability to recover him/her, send a mayday call on your VHF radio.

7.4 Electrical Equipment Hazards

- Field staff should assume all electrical equipment is live with current and caution should be taken to avoid any contact with electrical equipment. Electrical dangers can include short-circuit arcing faults and shock or electrocution.
- It is important that safe work practices be employed to prevent electric shock or other injuries resulting from either direct or indirect electrical contacts when work is performed near equipment or circuits which are or may be energized. While any employee is exposed to electric equipment

or circuits that have been de-energized, the circuits energizing the parts shall be locked out, or tagged, or both.

- If work is being performed in an elevated position near overhead lines, the location shall be such that the person and the longest conductive object he or she may contact cannot come closer than 10 feet to any unguarded, energized overhead line for voltages to ground 50 kilovolts (kV) or below and 4 inches for every 10kV over 50kV. These distances are also applicable to vehicles or equipment that are elevated near overhead lines.

7.5 Crane Work

- Lifting operations by a hydraulic wire/rope crane may occur on the fieldwork site associated with construction activities and movement of materials and equipment. Ground-based field staff will be instructed in the hazards associated with working around cranes such as pinching, crushing and rigging (see sections below). Field staff will keep clear of any lifted or suspended loads. Under no circumstances should field staff be directly below a suspended load.

8 PERSONAL PROTECTIVE EQUIPMENT

Selection of the appropriate PPE is a complex process, which takes into consideration a variety of factors. Key factors involved in this process are identification of the hazards, or suspected hazards, routes of potential exposure to employees (inhalation, skin absorption, ingestion, and eye or skin contact); and the performance of the PPE materials (and clothing seams) in providing a barrier to these hazards. The amount of protection provided by PPE is material-hazard specific. That is, protective equipment materials will protect well against some hazardous substances and poorly, or not at all, against others.

Other factors in this selection process to be considered are matching the PPE to the employee's work requirements and task-specific conditions. The durability of PPE materials, such as tear strength and seam strength, is considered in relation to the employee's tasks. The effects of PPE in relation to heat stress and task duration are a factor in selecting and using PPE.

Each observer will be provided with a PFD in case of emergency. Furthermore, other specific gear (e.g., survival suit, UV protective clothing, hats, sunglasses or safety glasses, hearing protection) may be required dependent on conditions. Monitoring team members should dress according to the weather conditions at the time to prevent heat loss in cooler conditions or overheating in warmer conditions. Monitoring team members are required to wear closed-toe shoes aboard the vessel to avoid possible entanglement that may arise from flip-flops or sandals.

The standard personal protective equipment for this project is:

- Long pants
- Shirt with long sleeves
- Work gloves, if needed
- Safety glasses with side-shields; as needed
- Closed toed shoes
- Class II High visibility vest
- Personal flotation device

Each of the items listed above will be made available to each employee.

Wet Weather

Employees must have appropriate wet weather gear at all times while working on this project. This includes:

- Rain jacket
- Rain pants
- Water resistant boots.

A change of clothes should be kept in the vehicle so staff could change if their clothing becomes wet.

Maintenance of PPE

All PPE will be inspected when received from the distributor, prior to use, and whenever questions arise as to the proper functioning of the equipment. PPE will be inspected for:

- General cleanliness
- Material degradation
- Proper functioning of adjustable, moving, or mechanical parts

Protective equipment must be stored properly to prevent damage or malfunction due to exposure to moisture, sunlight, damaging chemicals, extreme temperatures, and impact. Many equipment failures can be directly attributed to improper storage.

All PPE must be cleaned by employees prior to storage, according to the manufacturer's recommendations. PPE will not be stored in a wet condition. PPE hung up to dry will be located in an area free from contamination.

Improperly functioning equipment must be immediately taken out of service, "red-tagged", and stored in a secured location to prevent use by uninformed individuals. Maintenance on PPE will be performed only by authorized service representatives for the specific equipment, or by individuals within the company who are trained and authorized to perform the repairs. Records of inspections and repairs will be kept with the Health and Safety records. These records will be reviewed according to the records review schedule to note any recurring problems.

8.1 Noise

Field staff working in high-noise areas will wear appropriate hearing protection. Ear muffs or ear plugs with a noise reduction rating of at least 25 decibels will be used by individuals working near an active pile-driving/vibratory rig or other high-noise generating equipment.

The Table 2 illustrates the distances and corresponding hearing protection required to reduce noise exposures to levels that do not exceed the OSHA PEL Exposure Limits.

Table 2. Protection Requirements for Assignments Near Pile Driving

Distance from Pile Noise Source	Enrollment in Hearing Conservation Program	Dual Hearing Protection [1]	Noise Canceling Earmuffs	Earplugs with minimum 32 dB NRR
0 – 10 feet (0 – 3 meters)	Exclusion Zone – HDR employees are not allowed this close.			
10 – 25 feet (3 – 8 meters)	√	√	√	√
25 – 45 feet (8 – 14 meters)	√		√	
45 – 80 feet (14 – 24 meters)	√			√
80 – 120 feet (24 – 37 meters)				√

[1] Dual hearing protection requires noise canceling earmuffs worn in tandem with earplugs with a minimum NRR of 32 dB.

9 SLIP/TRIP/HIT/FALL

Slip/trip/hit/fall injuries are the most frequent of all injuries to workers. Shovel test pits and test units will be conducted on this project. Remain aware of this trip and fall hazards and keeps others out of the general area if they do not have work near these excavations.

All injuries can be prevented by the following prudent practices:

- Spot-check the work area to identify hazards.
- Establish and utilize a pathway, which is most free of slip and trip hazards.
- Beware of trip hazards such as uneven surfaces or terrain, set surfaces, slopes.
- Carry only loads that you can see over and around.
- Communicate hazards to on-site personnel.
- Report and/or remove hazards.

Slips, trips and falls may occur especially around the shovel test pits. Extra caution should be taken when walking around this area and to ensure hand tools are placed in safe locations.

Housekeeping

Responsibility for good housekeeping rests with each employee and shall be enforced by the Project Coordinator. Keep all work areas clear. Supplies and material to be used, salvaged, or scrapped shall be stacked out of the way. Clean up all spills immediately to prevent slipping.

When using hoses, cables, or electrical extension cords, which must extend across decks, walkways, or stairs, position them in such a manner as to offer the least interference to people passing. Provide protection such as barricades or an inverted “V” device to prevent damage to the hose, cable, or electrical extension cord.

10 ACCIDENTS AND INJURY REPORTING

Any Accident (serious or minor), Catastrophe, Near-Miss Incident or Illness will be reported using the following procedures:

- If the illness or injury is life-threatening, call 911;
- All injuries, if not life-threatening, and after a 911 call, will be reported to the Incident Intervention Care Team at: **(888) 449-7787**
- Following initial treatment through the Incident Intervention Care Team or emergency responders, report the incident to the HDR HSD, Danny Sciarro at 720.236.5104.

Within 24 hours, the injured employee or their supervisor will complete the accident report form located in **Attachment A** and submit this via email to the HDR HSD.

10.1 Accident Investigation

Following notification that an accident or injury has occurred, Danny Sciarro will initiate a formal accident investigation. Those onsite, including the SSHO and witnesses will be interviewed and may be asked to assist in the investigation. A formal accident report will be provided to the PM upon completion of the investigation.

11 COMMUNICATION

The following means of communication will be available to employees, depending upon the service available.

- Company-provided mobile phones

12 EMERGENCY RESPONSE PLAN

This section describes the emergency response plan that shall be implemented by HDR employees to handle emergencies. Procedures will be implemented to minimize the possibility of an emergency situation. The procedures outlined below are designed to ensure that the workforce reacts quickly and appropriately to emergency situations, thereby protecting the health and well being of the individual workers.

12.1 First Aid/CPR

At least one person will be trained in first aid and CPR.

12.2 Medical Emergency

- Always leave the area immediately if it is unsafe.
- Call the emergency number for assistance, see **Table 3 (Attachment B)**.
- Remain calm and follow any instructions provided by emergency dispatch personnel.
- Secure the area and the mechanism of injury (shut down equipment, secure unstable structures).
- Render first aid to the extent of your training, experience and equipment. A trauma kit is available in each vehicle for use by those with First Aid training.
    - For contact with chemicals, immediately take victim to eyewash or emergency shower, and have person wash area until outside responders arrive, or a minimum of 15 minutes. Alternatively, use clean drinking water for flushing the affected area.
    - For inhalation exposures, remove to fresh air.
    - Identify the type and amount of hazardous material released if possible.
- Arrange for transport of victim to the nearest medical facility. If the victim's condition is life-threatening, or has the possibility of change during transport, EMS services must be notified.

12.3 Fire

- Notify team members to clear the area.
- Call 911.
- Assure that the emergency number has been called as listed in **Table 3**.

12.4 Severe Storm

- Secure your area.
- Move to a safe location.
- Tune radio to weather station for local conditions.
- Be prepared to evacuate the area. Take only necessary items.

12.5 Lightning

Lightning is a very dangerous yet somewhat avoidable hazard of working outdoors. Lightning is an electrical phenomenon which occurs in conjunction with a thunderstorm. Strong updrafts and downdrafts associated with thunderstorms create an intense electrical field. The upper section of the storm builds up a strong positive charge, while the lower section develops a negative charge. Whereas the ground is normally negatively charged, the strong negative charge of the storm induces a positive charge on the ground as the storm passes overhead. Electrical current begins to flow up buildings, trees and other tall objects as the opposite charges attract each other. When the difference between the charges is great enough, the insulating atmosphere between the cloud and ground is insufficient and an electrical connection is made resulting in a lightning strike.

The current in a bolt of lightning averages 30,000 amperes. Due to this imposing power, a direct lightning strike is usually fatal. In addition to being struck by lightning, danger exists from being in the path of ground currents as the electrons flow to the location of a nearby strike. Ground currents, or "indirect strikes", can also be fatal (though not always) and require more knowledge to understand avoidance. When lightning occurs, the intense electrical charge (100 billion electrons) is drawn quickly from many directions. As it travels across the ground, the charge passes through any conductive object in its path, including a human body. The human body is an excellent conductor of electricity - better than natural substances such as rocks, trees and soil. If the ground current flows through a human body, it will flow in the same way an electrical charge passes through a wire - in through an entry point and out through an exit point. When these points of entry and exit are at opposite extremes (e.g. entry at a hand and exit at a foot) the vital organs of the midsection are subject to extreme electrical shock. If however, the current passes from one foot to another, the organs are usually not as prone to damage. In either case, severe third degree burns at the entry and exit points or fourth degree burns of the intermediate muscles and bones can result, depending on the victim's proximity to the strike.

The key to safety during a potential thunderstorm is to know the most likely point where lightning might strike and to anticipate the path of travel of the charge that is drawn from it. Anticipate the hill on which you are standing will sustain a strike and work to avoid places on that hill which the lightning will likely strike. Use the following information to avoid lightning strikes:

- Stay away from the isolated or large trees. If the tree is isolated, stay farther from isolated trees than the height of the tree.
- When on an exposed talus or scree (field rock fields with no tree protection) stay nearer the smaller rocks.
- In open areas, seek a low place such as a ravine or valley, but be alert for flash floods.
- In all cases, stay away from sources of water (e.g. streams, lakes, puddles or even small pools of water collected on rocks). Water is an excellent conductor of electricity.
- The optimal location would be sheltered by small trees in a ravine, away from water and rock overhangs. As an electrical charge traveling along the ground reaches an overhang, it will very likely arc across to your body and travel through it rather than along the rock.
- If your team is a large group of people, spread out as much as possible to reduce the risk of multiple casualties.
- If you take shelter in a cave, stay away from the entrance. As the lightning passes through the ground, it will travel near the opening of the cave and will use a body as a bridge to pass from one side of the entrance to the other.
- Avoid body positions that would allow the charge to pass through the body. Whenever possible, drop to your knees and bend forward putting your hands on your knees. Try not to place your

hands on the ground, as this would increase the chance of entry and exit points resulting at opposite extremes. NEVER lie flat on the ground. Occupy the smallest area possible.

- At all times, wear shoes and stay on something insulated such as dry clothing, packs, ropes or tree branches. When there is a hazard of lightning, remove all exposed metal objects from your clothes. These objects become hazardous not only because they present a possible target for a direct strike but also because they will heat up significantly and fuse clothing or flesh as the current passes through the body on an indirect strike.
- When you see a bolt of lightning, count how long it takes for you to hear the thunder and divide by 5. The result is your distance, in miles, from the lightning.

13 SITE INSPECTIONS AND RECORDKEEPING

13.1 Audit Protocol

13.1.1 Daily Safety and Inspection Log

Each employee shall insure that they comply with all aspects of the HASP on a daily basis. Only one warning shall be given to individuals not complying with the HASP.

Any health and safety related issues must be noted on a daily basis in the employee's daily field notes. If deficiencies in health and safety are noted, they will be recorded in the daily field notes and will be corrected immediately. The employee remains responsible for notifying the SSHO of any deficiencies noted. Employees will ensure they record the date the safety deficiency was noted, a description of the deficiency, the name of the person responsible for correcting the deficiency, a projected resolution date and ultimately, a final resolution date.

Excavation permits will be retained in the project files. Copies will be provided to the HSM on a weekly basis.

13.2 OSHA Inspection Procedures

When an OSHA inspector arrives at a workplace, he or she must display official credentials and ask to see the employer or safety director. Employers should always insist upon seeing the compliance officer's U.S. Department of Labor or respective State government credentials bearing their photos and serial numbers which can be verified by the nearest OSHA office.

Once the OSHA inspector displays their credentials, inform them that you must notify the HSD prior to the start of the inspection. Immediately call:

***** Bruce Stewart at 808-551-9129 *****

Mr. Sciarro will participate in the Opening Conference and inspection via telephone. Mr. Scario is available 24/7 throughout the duration of this project. However, if Mr. Scario is unavailable, proceed with the opening conference.

During the opening conference, the compliance officer will explain the nature of the visit, the scope of the inspection and the applicable standards. Information on how to obtain copies of the OSHA regulations will be furnished. A copy of any employee complaint (edited, if requested, to conceal the employee's identity) will be provided. The employer will be asked to select an employer representative to accompany the compliance officer during the inspection. An authorized representative of the employees, if any, has the right to go along. The compliance officer will consult with a reasonable number of employees.

After the opening conference, the compliance officer and the company representatives perform a walk around inspection for workplace hazards. All employees are encouraged to cooperate fully with the OSHA inspection. The inspector may ask for documentation, provide what you can, make a list of the requested information that is not on site, request a business card and inform the OSHA inspector that the documentation will be forwarded via email.

During the closing conference, the compliance officer reviews any apparent violations with the employer and discusses possible methods and time periods necessary for their correction. The compliance officer explains that these violations may result in a citation and a proposed financial penalty, describes the employer's rights and responsibilities, and answers all questions.

14 TRAINING REQUIREMENTS

All site personnel will be required to be trained in accordance with the OSHA standards.

14.1 Training

The following classes will be completed by all project staff via HDR University;

- General Safety Awareness;
- Disaster Communication;
- Defensive/Safe Driving;
- Water and Boating Safety
- First Aid/CPR

14.2 Weekly Safety Meetings

As part of HDR's Corporate Safety and Health Program, a weekly Safety Meeting is conducted. This safety meeting discusses job-specific issues. The PM will ensure these meetings are conducted. The staff will be provided the opportunity to discuss specific health and safety issues that have surfaced during the past week. The PM or their designee will ensure that all health and safety issues noted during the meeting are adequately addressed. Coordination with the HSD is encouraged. Notes will be retained in the project file.

14.3 Daily Tailgate Safety Meetings

Daily tailgate meetings are held with the field staff. These meetings are held to discuss any safety issues that may have arisen the previous day. These meetings are documented on the Daily Tailgate Safety Meeting form provided in **Attachment A.**

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Attachment A

Health and Safety Forms

- Accident/Incident Report
- H&S Plan Sign Off
- Daily Safety Meeting Form
- Safety Kick-off Meeting Form

Attachment B

Emergency Contact Information

(To be modified for each Task Order or project location)

Table 3. Emergency Reference List

Department	Telephone Numbers	
Incident Intervention Care Team **WorkCare 24-hour Medical Assistance**		(888) 449-7787
Hospital: TBD		TBD
Police/fire/ambulance:		911
HDR Project Manager:	Anwar Khan Email	954-494-2084 Anwar.khan@hdrinc.com
HDR Field Director/SSHO	TBD	TBD (cell)
Safety Director	Bruce Stewart Email	808-551-9129 (office/cell) Bruce.stewart@hdrinc.com
Vessel Safety Director/Captain	Michael Richlen	808-591-5576 Michael.richlen@hdrinc.com
Contracting Officer's Representative U.S. Department of the Interior Bureau of Ocean Energy Management Office of Renewable Energy Programs 381 Elden Street, MS HM 1328 Herndon, VA 20170-4817	Mary Boatman, PhD Email	703-787-1662 mm.boatman@boem.gov
Contracting Officer **U.S. Department of the Interior** **Bureau of Safety and Environmental Enforcement** **Acquisition Operations Branch** **381 Elden Street, MS HE 2306** **Herndon, Virginia 20170-5817**	Lisa Algarin Email	703-787-1120 Lisa.algarin@bsee.gov
Chief, Division of Environmental Science **U.S. Department of the Interior** **Bureau of Ocean Energy Management** **Divisino of Environmental Sciences** **381 Elden Street** **Herndon, VA 20170-4817**		
Poison Control Center		800-424-9300
Chemical Transportation Emergency Center		800-424-9300
National Response Center		800-424-8802
CHEMTREC		800-424-9300

Diagram of project location and map of the nearest hospital will be included here for each Task Order or project location