

HIGH RESOLUTION GEOPHYSICAL SURVEY PLAN

for

Kitty Hawk Offshore Wind Project

Prepared for:



Avangrid Renewables, LLC

Prepared by:



Tetra Tech, Inc.

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ACRONYMS AND ABBREVIATIONS

Avangrid Renewables	Avangrid Renewables, LLC
AWOIS	Automated Wreck and Obstruction Information System
BOEM	Bureau of Ocean Energy Management
CFR	Code of Federal Regulations
COP	Construction and Operations Plan
ESA	Endangered Species Act
ft	foot
G&G	geological and geotechnical
GIS	geographic information system
GPS	global positioning system
HRG	high-resolution geophysical
IHA	Incidental Harassment Authorization
IR	infrared, thermal imaging systems
kHz	kilohertz
km	kilometer
km/hr	kilometers per hour
Lease Area	The OCS-A 0508 Lease, located approximately 44 km (24 nm) offshore of Corolla, North Carolina and containing approximately 21.5 OCS blocks or 495 km ² (122,317 acres).
m	meter
mi	mile
NASA	National Aeronautics and Space Administration
nm	nautical miles
NOAA	National Oceanic and Atmospheric Administration
NOAA Fisheries	NOAA National Marine Fisheries Service, NMFS
NTL	Notice to Lessees
OCS	Outer Continental Shelf
OCS-A 0508	Commercial Lease of Submerged Lands for Renewable Energy Development on the Outer Continental Shelf
Project	Kitty Hawk Offshore Wind Project
PSO	Protected Species Observer
QMA	Qualified Marine Archaeologist
SAP	Site Assessment Plan
SMA	seasonal management area
Survey Area	The Lease Area, an additional area 2 km west of the Lease Area, and two corridors of federal and state waters through which the export cable is expected to run
Tetra Tech	Tetra Tech, Inc.
UXO	Unexploded Ordinance

WEA

wind energy area

1.0 INTRODUCTION

Avangrid Renewables, LLC (Avangrid Renewables) submits this High Resolution Geophysical (HRG) Survey Plan to advance the development of the Kitty Hawk Offshore Wind Project (the Project), under Commercial Lease of Submerged Lands for Renewable Energy Development on the Outer Continental Shelf (OCS-A 0508). The Lease Area is located approximately 44 kilometers (km, 24 nautical miles [nm]) offshore of Corolla, North Carolina and extends approximately 47.6 km (25.7 nm) in a general southeasterly direction at its widest point. Its seaward extent ranges from 25 km (13.5 nm) in the north to 1.1 km (0.6 nm) in the south. It contains approximately 21.5 Outer Continental Shelf (OCS) blocks or 495 km² (122,317 acres). Water depths across OCS-A 0508 range from approximately 20 to 50 meters (m, 66 to 164 feet [ft]).

Avangrid Renewables intends to deploy metoceanic data collection devices in as many as three areas throughout OCS-A 0508 to support site assessment activities. The data collection devices will monitor the wind resource and metocean conditions in support of the Project. In order to satisfy the requirements of a Site Assessment Plan, Avangrid Renewables will conduct an HRG Survey at proposed deployment areas.

The deployment area HRG survey will be conducted and then followed by a reconnaissance level HRG survey of OCS-A 0508 and cable route corridors to obtain a baseline characterization assessment of seabed/sub-surface conditions to support siting of the proposed offshore wind farm. Cable route corridors will extend to shallow water areas near landfall locations to be identified within the cable route corridor indicated in Figure 1. The cable route corridor survey area is approximately 65 km long and 3 km wide. An additional survey area that extends 2 km to the west of the Lease Area will be investigated to provide information that may support cable routing (Figure 1). These survey areas collectively make up the Survey Area.

As required by Addendum C, Lease Stipulation 2.1.1, Avangrid Renewables must submit a Survey Plan to the Bureau of Ocean Energy Management (BOEM) prior to conducting surveys for agency review and comment in support of the Site Assessment Plan (SAP). This Survey Plan describes survey activities required to meet the relevant information requirements of 30 Code of Federal Regulations (CFR) § 585.610(b). Section 2 of this plan describes the existing conditions in OCS-A 0508 and cable route corridors; Section 3 describes the surveys proposed; Section 4 presents the Marine Mammal Mitigation Plan; Section 5 summarizes Avangrid Renewables' compliance with the relevant requirements in the Lease, BOEM Guidelines and BOEM regulations; and Section 6 presents a schedule of activities as directed by the Lease.

In addition, to support survey operations, Avangrid Renewables requested an Incidental Harassment Authorization (IHA) from National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Services (NOAA Fisheries) on October 4, 2018. A copy of the IHA, once received, will be provided to BOEM.

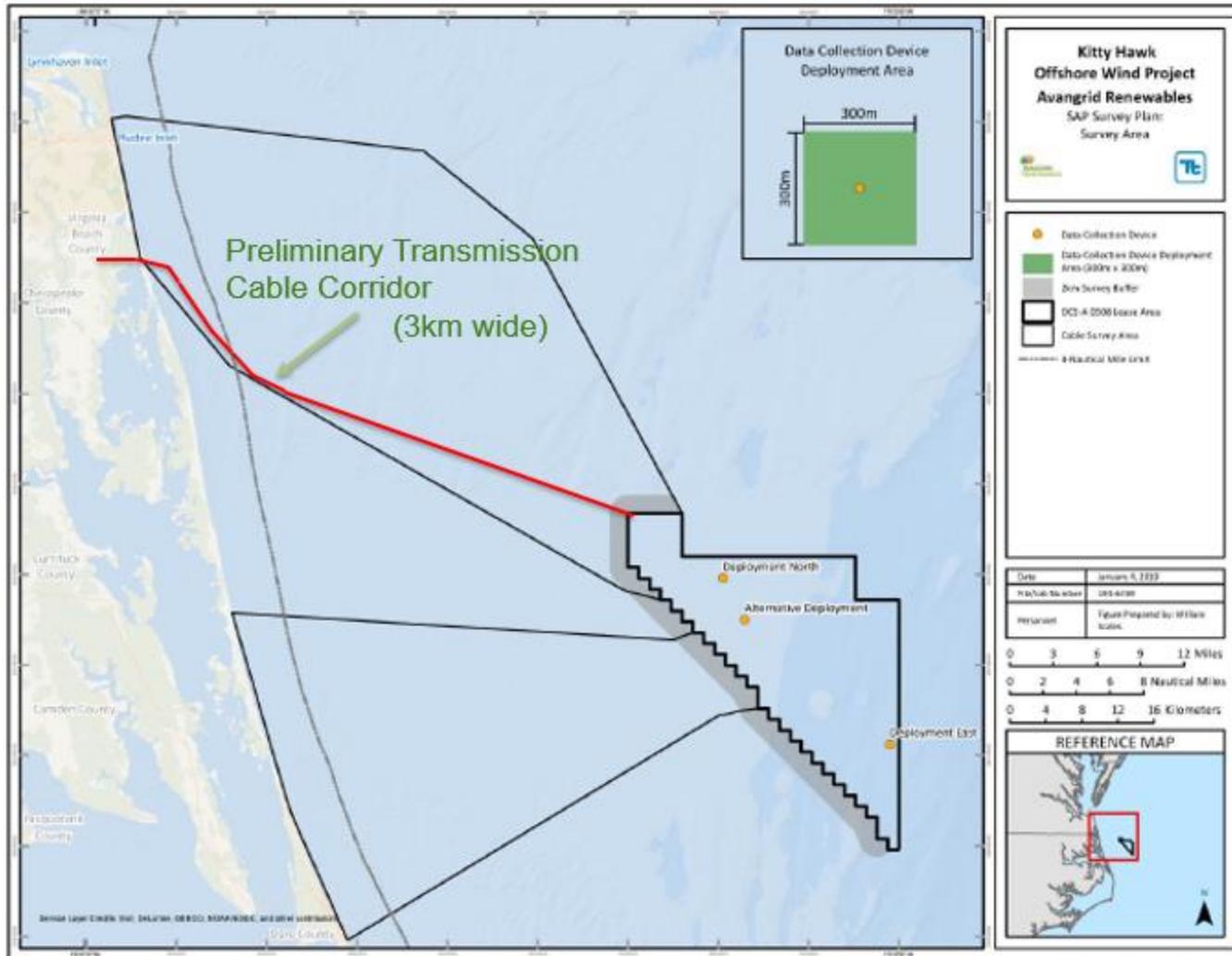


Figure 1. Kitty Hawk Offshore Wind Project OCS-A 0508 and proposed survey areas

1.1 Survey Team

Survey Contractor

Avangrid Renewables has contracted with TerraSond to perform the proposed survey activities. TerraSond is a leading provider of offshore wind geophysical and geotechnical services. Offering innovative solutions and comprised of Professional Surveyors, Hydrographers, Geophysicists, Marine Archaeologists, Geologists, and Engineers. TerraSond specializes in shallow hazards, site investigation, cable route, submerged boulder detection, unexploded ordinance (UXO), and seabed mapping projects to provide the highest quality data to meet BOEM specifications.

QMA

SEARCH will serve as the Qualified Marine Archaeologist (QMA) during execution of the Survey Plan, as provided in BOEM's *Guidelines for Providing Archaeological and Historic Property Information Pursuant to 30 CFR Part 585* (BOEM 2017). SEARCH is a leading nationwide and global provider of cultural resource services and has conducted over 3,000 projects across 38 U.S. states, all six U.S. territories, and 24 countries in Oceania, Asia, Africa, Europe, the Americas, and the West Indies. SEARCH has the largest team of professional archeologists in the United States, with the highest-capacity marine archaeology division. Per Addendum C, Lease Stipulation 2.1.2, the QMA will be available to attend the pre-survey meeting with BOEM to discuss the proposed activity and any issues related to submerged archaeological resources that may require evaluation during the survey.

Environmental Consultant

Tetra Tech, Inc. (Tetra Tech) is a leading provider of consulting, engineering, program management, construction, and technical services addressing the resource management and infrastructure markets. Tetra Tech is supporting Avangrid Renewables with this survey plan to ensure full compliance with applicable lease conditions and reporting requirements. Additionally, Tetra Tech's benthic habitat assessment team will support the selection of benthic sampling locations, based on review of the HRG data and will work with Avangrid Renewables to ensure that no sensitive benthic habitat is disturbed during execution of the proposed survey plan or the upcoming proposed data collection device deployment activities.

2.0 EXISTING CONDITIONS

The following section presents an overview of the existing conditions relevant to the proposed survey activity, which is understood to characterize OCS-A 0508 and cable route corridors. These conditions form a baseline upon which the site characterization survey program was designed.

This information provided below was collected from various sources including publicly available Geographic Information System (GIS) environmental data obtained from NOAA's ArcIMS Web Feature Services, U.S. Geological Survey (USGS), GEODAS Design-a-Grid (Bathymetry), BOEM's/NOAA's Marine Cadastre, and Esri 9.3 data.

2.1 Geological and Shallow Hazard

The Survey Area lies on the shallow shelf of the Atlantic continental margin. The shelf represents the seaward portion of the coastal plain geological province of North Carolina. Thick, gently seaward-dipping units of sediments have been deposited on the Atlantic Margin over the past 175 million

years. Variations in global sea-level and localized subsidence and uplift of the Earth's crust have created a complex series of sea-level transgressions and regressions. These changes have caused the coastline of North Carolina to migrate—varying from low stands where the shoreline was at the continental shelf break, approximately 90 km (56 miles) farther offshore than the modern coastline—to extreme highs where the coastline pushed many miles inland.

The physiographic setting of the Survey Area is the middle portion of the North Carolina continental shelf, north of Cape Hatteras and south of the Chesapeake Bay. The shelf in this area thins to the south with distances from the shoreline to the shelf break from approximately 110 km (68 miles) in the northern part of the Survey Area to approximately 80 km (50 miles) in the southern portion of the Survey Area. The shelf slopes seaward very gradually with an overall gradient of approximately 0.05 degrees before dropping off more abruptly at the shelf break, which occurs at 100 m (328 ft) water depth. A complex sea-level history on this passive continental margin has deposited and eroded sequences of sediments since the late Cretaceous (~65 million years ago) period. Alternating sequences of alluvial (river-deposited terrestrial sediments) and marine sediments occur across the area, including the development and migration of barrier islands, inlets, and estuaries. Older, harder Cretaceous Coastal Plain deposits outcrop or shallowly subcrop the much younger Quaternary Period marine muds, sands, and gravels comprising most of the surficial sediments across the area. Large shoal complexes occur in the Survey Area and recent studies indicated that they are composed of both underlying, harder more indurated sediments and overlying reworked mobile sand bodies (Thieler et al, 2014).

Seabed Morphology

Although generally flat lying, the shallow shelf in the Survey Area contains sand ridges, filled valleys, shoal-retreat massifs, and paleoshorelines. Significant research and data collection have been conducted immediately to the south and nearer to shore than the Survey Area, but higher-resolution, publicly-available multibeam bathymetry and subbottom data have not been identified within OCS-A 0508. The general features observed in adjacent and analogous shelf environments informs likely features below the resolutions of presently available datasets.

Massifs and shelf valleys owe their origin to older geologic processes related to past sea-level changes, but also are modified, reworked, and often overlain by modern marine processes such as the formation and migration of sediment waves, shoals, or dunes, which create and alter the surficial seabed on a nearly continual basis. The Survey Area on the North Carolina shelf experiences sediment erosion, transport, and deposition driven by wave and current action punctuated by intense activity from storm events occurring several times per year.

Surficial Sediments

The Survey Area is characterized as sand with isolated patches of gravel-sand immediately offshore of OCS-A 0508 (CONMAP, 1985). The CONMAP dataset is a low-resolution dataset showing large-scale trends. Smaller, more discrete areas potentially representing gravelly sand patches are likely to be present. These areas may be the surficial expression of buried, harder seabed, or may be the result of scouring of finer-grained sediments, leaving coarser material.

2.2 Marine Archeological Resources

Shipwrecks and Historic Sites

The Automated Wreck and Obstruction Information System (AWOIS) contains information on several thousand submerged wrecks and obstructions throughout U.S. coastal waters (NOAA OCS 2018). Detailed information on each wreck or obstruction includes, but is not limited to, vessel name, location, depth, the year the vessel sank, and any related history. Two shipwrecks are documented within OCS-A 0508.

BOEM collaborated via an Interagency Agreement with NOAA's Office of Marine Sanctuaries to conduct a baseline archaeological survey near and within the Kitty Hawk Wind Energy Area. The results of this effort are published as *North Carolina Collaborative Archaeological Survey: Kitty Hawk Wind Energy Area* (Carrier et al. 2017). Reconnaissance-level side-scan sonar survey of approximately 56 percent of OCS-A 0508 was followed by diver investigations of selected targets to ground truth the findings. Fifteen sonar contacts were identified in the data and presented in the report, however, BOEM has indicated that the location accuracy of the data is marginal to poor (personal communication).

Pre-Contact OCS Archeological Site Potential

There exists the potential for preserved, intact archeological sites now submerged on the shallow OCS. Evaluating the potential for these sites requires an understanding of both where these sites may have occurred initially and the possibility of subsequent inundation with rising sea level and burial by marine sediments. BOEM's *Inventory and Analysis of Archeological Sites on the Atlantic OCS* (BOEM 2012) study examined the factors that determine "Archeological Sensitivity" for the Middle Atlantic study region of the OCS.

Due to the timing of potential paleo-habitation in relation to local sea level rise, areas between -70 and 0 m (-230 and 0 ft) elevation, relative to modern sea level, are anticipated to have a high potential sensitivity. Localized landforms would have made certain areas much more susceptible to both habitation and site preservation within these regions. BOEM (2012) notes that geophysical studies could support more refined characterization of the seabed and the paleo-landscape to suggest areas of enhanced archeological potential, such as paleochannels and relic terraces. The BOEM (2012) study notes that such areas would include the back sides of drowned barrier islands, relic streams, estuaries, and outcrops, along with areas of observed paleosols.

2.3 Benthic Resources

OCS-A 0508 is predominantly characterized as coarse sand with isolated patches of mud and sandy mud, especially in the northwest corner and in the center of OCS-A 0508; small areas of gravel were reported in the extreme southwest and northwest blocks (Guida et al. 2017). Existing bathymetric data collected in the 1930s indicate a relatively smooth, flat bottom in the western OCS-A 0508 and a series of longshore ridges in the eastern OCS-A 0508. In general, benthic habitat throughout OCS-A 0508 is expected to be comparable to other OCS areas of similar depth and distance from shore (Guida et al. 2017). Limited areas of live/hardbottom occur in the offshore and nearshore area between OCS-A 0508 and the coast (BOEM 2014). No hardbottom is known to exist in OCS-A 0508 (BOEM 2015).

3.0 SURVEY PLAN

Avangrid Renewables plans to conduct an HRG survey that will support the evaluation of:

- Shallow hazards and geological conditions (including seabed constraints such as boulders and debris);
- Marine archaeological resources; and
- Benthic Resources.

Development of the shallow hazard and geologic condition survey plan will be closely coordinated with the benthic and marine archaeological teams to ensure acquired data also meets the requirements for those investigations.

3.1 Basis of Survey Specifications

Avangrid Renewables has developed detailed survey specifications based on the following:

- Requirements set forth in the Lease (OCS-A 0508);
- BOEM's *Guidelines for Providing Geophysical, Geotechnical, and Geohazard Information Pursuant to 30 CFR Part 585* (BOEM 2015);
- BOEM's *Guidelines for Providing Archaeological and Historic Property Information Pursuant to 30 CFR Part 585* (BOEM 2017);
- BOEM's *Guidelines for Providing Benthic Habitat Survey Information for Renewable Energy Development on the Atlantic Outer Continental Shelf Pursuant to 30 CFR Part 585* (BOEM 2013); and
- BOEM's *Guidelines for Submission of Spatial Data for Atlantic Offshore Renewable Energy Development Site Characterization* (BOEM 2013);
- Existing information on the surficial and subsurface geologic features, geologic processes, geohazards and submerged archaeological resources within OCS-A 0508 and surrounding waters; and
- Avangrid Renewables' standard operational procedures.

3.2 Data Collection Device Deployment Areas HRG Survey

To provide the data needed to evaluate and support deployment of the proposed data collection devices within OCS-A 0508, the following HRG survey and sampling activities will be conducted at each deployment area:

- Depth sounding (multibeam echosounder) to determine site bathymetry and elevations;
- Magnetic intensity measurements for detecting local variations in regional magnetic field from geological strata and potential ferrous objects on and below the bottom;
- Seafloor imaging (sidescan sonar survey) for seabed sediment classification purposes, to identify natural and man-made acoustic targets resting on the bottom as well as any anomalous features;
- Parametric Sub Bottom Profiler (or similar) to map the near surface stratigraphy (top 0 to 10 m [0 to 30 ft] of soils below seabed); and

- Three sediment grab samples and video imagery to support interpretation of geophysical data to characterize surficial sediment conditions and benthic habitat classification (according to Coastal and Marine Ecological Classifications Standard [CMECS]).

The HRG investigations will be conducted across three survey areas within the OCS-A 0508 (see Figure 1); each survey area is approximately 300 m by 300 m and will cover the seafloor impacted by the moorings for all proposed data collection devices. Per the BOEM *Guidelines for Providing Geophysical, Geotechnical, and Geohazard Information Pursuant to 30 CFR Part 585* and the *Guidelines for Providing Archaeological and Historic Property Information Pursuant to 30 CFR Part 585*, the survey trackline layout and seabed sampling plan will consist of the following:

- Multibeam bathymetry and sidescan sonar imagery acquired with full bottom coverage (100 percent and 200 percent, respectively);
- Magnetometer and shallow penetration sub-bottom profiler spaced 30 m (98 ft.) apart;
- Survey trackline shall consist of 20 primary track lines spaced at 30 m (98 ft.) apart and one Cross or “tie” line set (east-west oriented) perpendicular to the primary track lines passing through the intended deployment position; and
- A minimum of three grab samples and video imagery per deployment area. Additional grabs may be collected if survey data indicates variable bottom types with the data collection device deployment areas.

Seabed conditions within OCS-A 0508 appear to be relatively flat with no consistent orientation of terrain features. In the event that features are identified in the data collection device deployment areas that are suggestive of either potential cultural resources (e.g. shipwrecks), sensitive biological habitat, or other types of obstacles to the safe deployment of the data collection devices, the Survey Contractor would collect additional tracklines in order to identify a 300 m by 300 m area clear of obstructions. Additional tracklines will be offset by 30 meters in accordance with BOEM guidelines.

The potential for UXO risk in the buoy deployment area is currently being evaluated by Avangrid Renewables. If necessary, additional magnetometer only survey tracklines will be added to the program.

The HRG surveys are anticipated to begin no earlier than June 1, 2019. The survey equipment will be equivalent to the representative survey equipment identified in Table 1.

It is anticipated that the HRG survey will take approximately 7 to 10 days (depending on weather conditions). This survey schedule is based on 24-hour operations and includes estimated HRG survey equipment calibrations as well as estimated weather and survey down time.

Table 1. Proposed HRG Survey Equipment

Survey Equipment	Type
Subsea Positioning/USBL a/	Sonardyne Ranger 2 USBL
Sidescan Sonar	Edgetech 4125/ 4200
Shallow penetration sub-bottom profiler	Innomar parametric SES-2000 Medium
Medium penetration sub-bottom profiler	Applied Acoustics S-Boom triple plate boomer
Multibeam Echo Sounder	Reson T50
Surface sediment sampler	VanVeen, grab sampler. Sample volume should be no more than 0.25 m ³
Underwater digital video camera system.	1CamMk4 (1080HD) camera

Tables 6 through 8, set out in section 5 below, describe how Avangrid Renewables will comply with the requirements in the Lease while survey activities are conducted.

Site Characterization Report

A Site Characterization Report will be developed that presents the potential natural and man-made shallow hazards that are identified in the SAP Survey Area. The report would be developed based on BOEM's guidelines (*Guidelines for Providing Geophysical, Geotechnical, and Geohazard Information Pursuant to 30 CFR Part 585* and, to the extent appropriate, the *Guidelines for Providing Archaeological and Historic Property Information Pursuant to 30 CFR Part 585*).

QMA Reporting

An Archaeological Resource Assessment Report will be developed by the QMA. The Assessment Report will be developed in accordance with BOEM's *Guidelines for Providing Archaeological and Historic Property Information Pursuant to 30 CFR Part 585* (2017). Data will be processed and interpreted by the survey contractor and delivered to the QMA. The level of analysis and reporting will be sufficient to support BOEM with the final consultation requirements under Section 106 of the National Historic Preservation Act for the SAP.

Benthic Resource Reporting

At the conclusion of the HRG survey, the Environmental Consultant will review relevant HRG data, the sediment grabs and video imagery to evaluate the existing benthic habitat in the data collection devices deployment areas. A report will be prepared to present the findings of the data review and document the absence of any sensitive biological habitat in the data collection device deployment areas. The benthic habitat assessment report will be provided to BOEM in the SAP prior to initiating deployment of the data collection devices.

3.3 Reconnaissance HRG Survey

Avangrid Renewables proposes to conduct reconnaissance level HRG survey across the entire OCS-A 0508 and one submarine cable route corridor (Figure 1) to provide a baseline understanding of the seabed/sub-surface sediment conditions and support the siting of the proposed wind turbines. The survey trackline plan will consist of a defined grid of main transects formed by three north-south

oriented lines 90 m (295 ft) apart, and cross lines, east-west oriented, 2,500 m (8,202 ft) apart. The spacing between transects will be 900 m (2,953 ft) (see Figure 2).

Along the cable route corridor; a centerline and six wing-lines will be surveyed (three to either side of the centerline) offset 500 m (1,640 ft), for a total survey corridor width of 3,000 m. Cross lines along the cable corridor will be oriented perpendicular to the route and spaced 2,500 m apart.

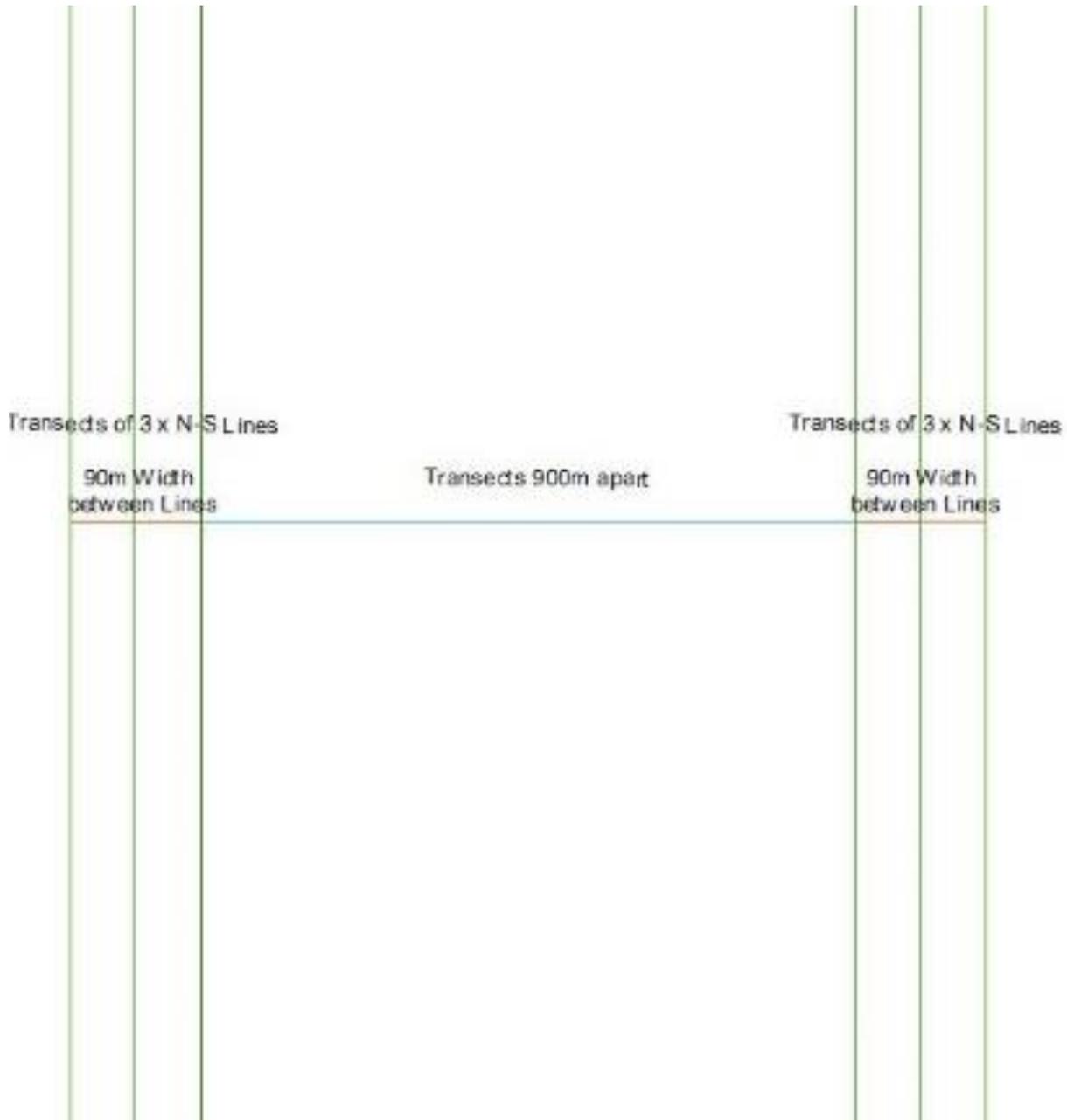


Figure 2. Schematic diagram of Reconnaissance Survey Trackline Plan across Lease Area

The following HRG survey and sampling activities are proposed:

- Depth sounding (multibeam echosounder) to determine site bathymetry and elevations across the entire Lease Area and cable corridor areas;
- Magnetic intensity measurements for detecting local variations in the regional magnetic field from geological strata and potential ferrous objects on and below the bottom;
- Seafloor imaging (sidescan sonar survey) for seabed sediment classification purposes, to identify natural and man-made acoustic targets on the seabed, as well as any anomalous features;
- Parametric Sub Bottom Profiler (or similar) to map the near surface stratigraphy (top 0 to 10 m [0 to 30 ft]); and
- Medium penetration sub-bottom profiler (top 0 m to 50 m [0 to 246 ft] penetration) – lease area only, and
- Up to 29 sediment grab samples and video imagery to support interpretation of geophysical data to characterize surficial sediment conditions and benthic habitat classification.

The same suite of instrumentation utilized for the data collection device deployment areas survey (Section 3.2) will be deployed for the reconnaissance HRG survey.

Equipment will meet the BOEM data quality guidelines for the HRG, archaeological, and benthic resources surveys.

The configuration and calibration activities described above for the data collection device deployment areas survey (Section 3.2) apply to the recon survey. Avangrid Renewables anticipates a seamless transition between the data collection device HRG survey and the reconnaissance level survey in terms of survey vessel and crew activities and that no port call will be required between the two scopes of work. The Survey Contractor will determine whether to conduct the data collection device deployment areas survey first, last, or concurrently with the reconnaissance level survey.

The reconnaissance HRG survey is anticipated to last approximately 5 months (including estimated weather down time). This survey schedule is based on 24-hour survey operations and includes estimated HRG survey equipment calibrations as well as estimated weather and survey down time.

Reconnaissance Survey Data Reporting

Reconnaissance data will be “preserved” for the future development of the Construction and Operations Plan (COP) Survey Plan and to the extent appropriate, the COP. Although BOEM does not have specific recommendations for conducting reconnaissance surveys, they do acknowledge that reconnaissance data may be collected as part of a phased project development approach.

3.4 Survey Vessels

The HRG survey activities will be supported by one smaller nearshore vessel, measuring approximately 11 m (36 ft) to 15 m (49 ft) in length, and up to two larger dynamically positioned offshore vessels, measuring approximately 52 m (171 ft) in length. See Appendix B for a summary of vessel specifications. Avangrid Renewables currently anticipates that survey vessels would be mobilized out of Norfolk, Virginia. All survey vessels will be capable of maintaining course and a

survey speed of approximately 7 kilometers per hour (km/hr, 4 nautical miles per hour [knots]) while transiting survey lines. The survey equipment will be configured aboard the survey vessels to optimize data quality, reduce ambient noise and cross talk. The survey equipment will be operated in accordance with manufacturer's recommendations. Industry standard protocols for data transformation and transfer and cultural resource needs will be followed to ensure the integrity of the original data set and the quality of post-processed data. Calibration will be performed daily, or as needed, to ensure proper equipment functionality and data quality. An Avangrid Renewables' representative will be onboard the survey vessel and responsible for ensuring the survey progresses as expected and that data quality is not compromised.

4.0 MARINE MAMMAL MITIGATION PLAN

4.1 Field Verification

Lease Stipulation 5.5.2 requires that Avangrid Renewables report the results of field verification for survey sound sources to verify the exclusion zones for all HRG survey equipment operating below 200 kilohertz (kHz), if no applicable data is available. Avangrid Renewables understands that HRG surveys have been conducted in all three Lease Areas off the coast of Massachusetts, the Lease Area off the coast of New York, and at least one of the Lease Areas off the coast of New Jersey, using similar survey equipment and vessels to the proposed for the Kitty Hawk HRG Survey. Each of these Lease Holders¹ conducted sound source verification and provide results to BOEM and National Marine Fisheries Service (NMFS). It is understood that field verification results are generally consistent and conclude that the exclusion zones proposed below in Section 4.6 are appropriately protective of acoustic harassment to marine mammals. As such, Avangrid Renewables respectfully requests that BOEM consider this existing data, along with other relevant published and unpublished data (e.g., Crocker and Fratantonio, 2016), in lieu of conducting field verification for the Kitty Hawk HRG surveys. This data was also considered in lieu of sound source verification for the surveys in the Lease Area off the coast of Virginia, which coincides with a portion of the Kitty Hawk HRG survey area.

Although sound source verification has not been conducted in Lease Area 0508, the parameters that affect underwater sound propagation; including temperature, salinity, seafloor sediment, and water depth are generally consistent across all BOEM lease areas from Massachusetts to North Carolina. . As a result, Avangrid Renewables believes that sound source verifications conducted on behalf of Equinor, Vineyard Wind, Ørsted, and Deepwater Wind can be applied to the Kitty Hawk Project and will demonstrate the appropriateness of the exclusion zones in proposed in Section 4.2.3 for avoiding Level A and B harassment.

The speed of sound in water is a function of density, which is controlled by seawater temperature and salinity. The speed of sound varies at given locations across different water depths and different times of the year. However, at any given time of year, the oceanographic conditions off the Coast of North Carolina are generally consistent with those off the coast of New Jersey or south of Massachusetts. Figure 3 illustrate the average summer sea surface temperature and salinity, respectively, for the mid-Atlantic and demonstrate a high degree of homogeneity. As a result, the

¹ Empire (OCS-A 0512), Vineyard (OCS-A 0501), Bay State (OSC-A 0500), Deepwater (OCS-A 0478/OSC-A 0486), US Wind NJ (OSC-A 0499), & Ocean Wind (OSC-A 0498)

attenuation of acoustic energy in the Kitty Hawk Project Area is expected to be consistent with sound source verifications conducted in other Lease Areas on the Atlantic OCS.

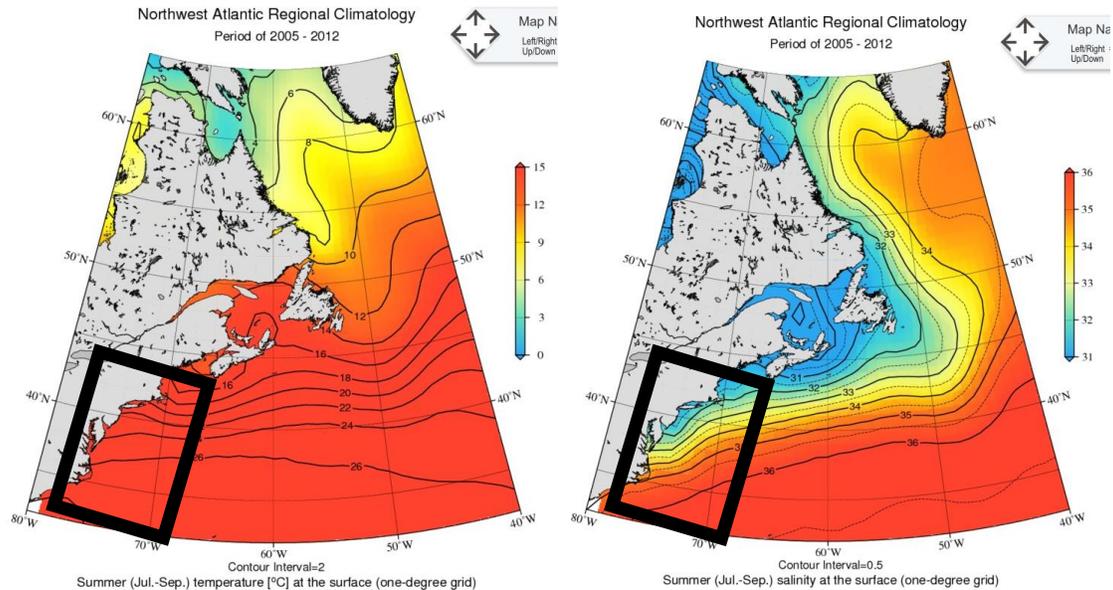


Figure 3: Sea surface temperature contour chart from the Northern and Mid-Atlantic is shown on the left. On the right, is a sea surface salinity contour chart. Black square illustrates the region where BOEM has issued renewable energy leases (NOAA National Centers for Environmental Information).

Figure 4 illustrates that the bathymetry is relatively flat in all Lease Areas. None of the sites are characterized by sudden drop offs in depth. In general, water depths are approximately 20 to 60 m with very minor gradients. Larger offshore bathymetric features are located at distances further from the coastline, and outside the Lease Areas.

The seafloor in all Lease Areas has a sandy bottom. This is based on information from the National Oceanic and Atmospheric Administration Office for Coastal Management and the United States Geological Survey gathered in 2005. The seafloor is consistent within all lease areas, so the response from the top layers of the seafloor would be similar in all locations. Figure 5 shows the similarity in sediment data from the Lease Areas.

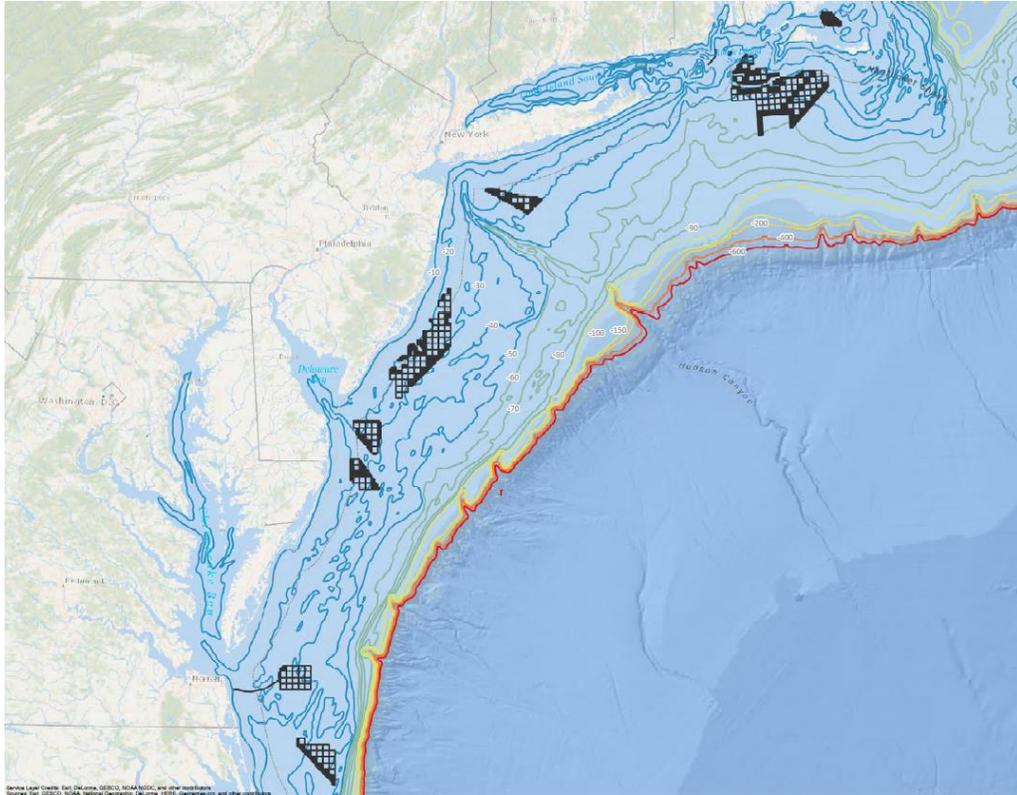


Figure 4: Bathymetry in the Northern and Mid-Atlantic

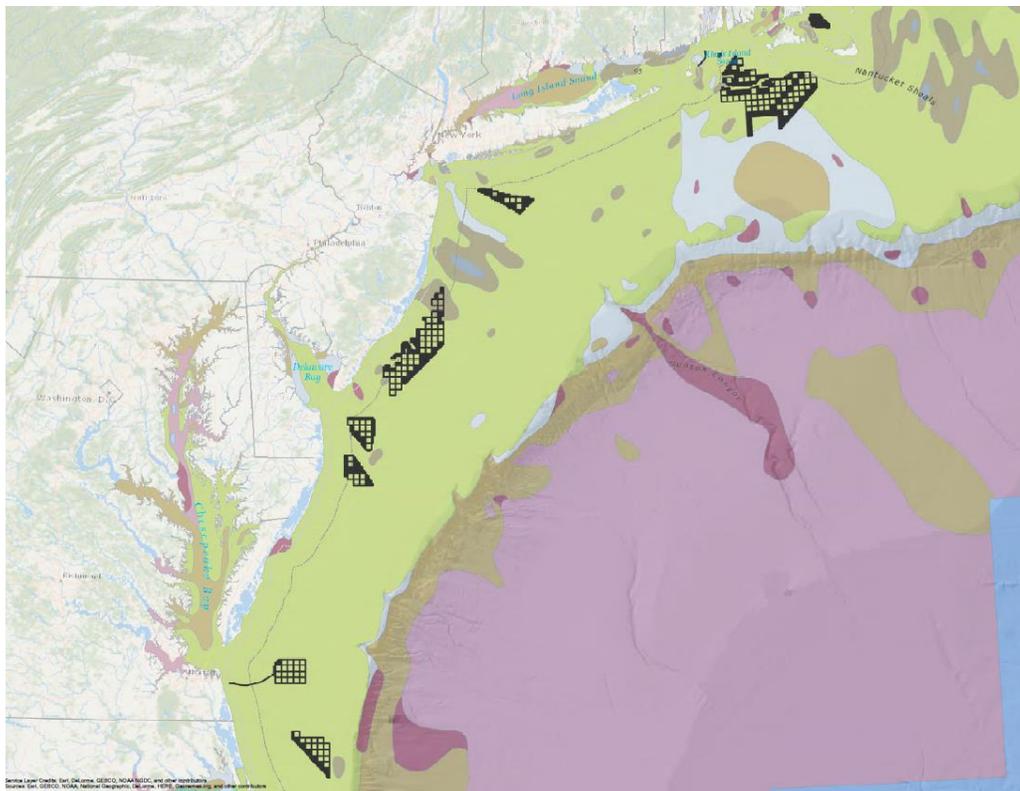


Figure 5: Benthic Sediment in the Northern and Mid-Atlantic

Avangrid Renewables prepared an application for Incidental Harassment Authorization, based on a recent technical report conducted by the Naval Undersea Warfare Center (NUWC), through support from BOEM and United States Geological Survey, which published measurement data from the sounds emitted during HRG surveys (Crocker and Fratantonio, 2016). The HRG test equipment were operated over a wide range of settings with different acoustic levels measured. As a conservative measure, the highest sound source levels and pulse duration for each piece of equipment were adopted for the IHA and are provided in Table 2 as representative of the equipment identified in Table 1, which TerraSond plans to deploy.

Table 2. Measured Source Levels of Representative Equipment

HRG System	Representative HRG Survey Equipment	Operating Frequencies	Peak Source Level	RMS Source Level	Pulse Duration (ms)	Beam Width (degree)	Signal Type
Subsea Positioning / USBL <u>a/</u>	Sonardyne Ranger 2 USBL	35-50 kHz	200 dB _{peak}	188 dB _{RMS}	16	180	FM Chirp
Shallow penetration sub-bottom profiler	Innomar parametric SES-2000 Standard	85 to 115 kHz	243 dB _{peak}	236 dB _{RMS}	0.07 to 2	1	FM Chirp
Medium penetration sub-bottom profiler	SIG ELC 820 Sparker	0.9 to 1.4 kHz	215 dB _{peak}	206 dB _{RMS}	0.8	30 <u>b/</u>	Impulse
<p><u>a/</u>: Equipment information not provided in Crocker and Fratantonio, 2016. Information provided is based on manufacturer specifications.</p> <p><u>b/</u>: A beamwidth of 30 degrees from horizontal is considered typical for electrode sparker technologies. Specific beamwidth information is not readily available from the equipment manufacturer.</p>							

BOEM and NOAA Fisheries have advised that the deployment of HRG survey equipment, including the use of sound-producing equipment operating below 200 kHz (e.g., sub-bottom profilers), has the potential to cause acoustic harassment to marine species, in particular marine mammals. Based on the frequency ranges of the equipment to be used in support of the HRG survey activities; the ultra-short baseline (USBL) positioning system and the sub-bottom profilers (shallow and medium penetration) operate within the established marine mammal hearing ranges and have the potential to result in Level A and B Harassment of marine mammals.

The noise levels of HRG survey equipment were evaluated against the criteria prescribed in the Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0) - Underwater Thresholds for Onset of Permanent and Temporary Threshold Shifts. Under this revised guidance document, Level A harassment is said to occur as a result of exposure to high noise levels and the onset of permanent hearing sensitivity loss, known as a permanent threshold shift (PTS), based on findings published by the Noise Criteria Group (Southall et al., 2007). The acoustic thresholds are presented using dual metrics of cumulative sound exposure level (SEL_{cum}) and peak sound level. The cumulative PTS criteria was applied to the formulaic spreadsheet provided by NMFS (See Table 3). This spreadsheet incorporates the different hearing abilities of marine mammal groups. The instantaneous peak criteria was calculated by applying a

practical spreading model to the peak source levels in Table 2. No marine mammal weighting correction is applied for evaluation of the peak criteria.

For sea turtles, NOAA Fisheries has considered injury onset beginning at 180 dB_{RMS} re 1 μPa to prevent mortalities, injuries, and most auditory impacts and behavioral response at 175 dB_{RMS} re 1 μPa, which has elicited specific avoidance behavior of sea turtles (Blackstock et al. 2017). There is limited information available on the effects of noise on sea turtles, and the hearing capabilities of sea turtles are still poorly understood. Some recent studies have indicated that sea turtles have fairly limited capacity to detect sound, although these results are based on a small number of individuals and must be interpreted cautiously (Popper et al. 2014). Research has shown that the upper limit of the hearing range of sea turtles is generally in the range of 1,000 to 1,200 Hz (Tech Environmental 2006). McCauley et al. (2000) noted that a minimum level of L_p 166 dB_{RMS} re 1 μPa were required before any behavioral reaction (e.g., increased swimming speed) was observed.

In a cooperative effort between federal and state agencies, interim criteria were developed to assess the potential for injury to fish exposed to pile driving sounds. These noise injury thresholds have been established by the Fisheries Hydroacoustic Working Group which was assembled by NOAA Fisheries with thresholds subsequently adopted by NOAA Fisheries. The NOAA Fisheries Greater Atlantic Regional Fisheries Office has applied these standards for assessing the potential effects of ESA-listed fish species exposed to elevated levels of underwater sound produced during pile driving (NOAA Fisheries GARFO 2016). These noise thresholds are based on sound levels that have the potential to produce injury or illicit a behavioral response to fisheries.

The Innomar SES-2000 is a specialized type of HGR low sub-bottom profiler that uses the principle of “parametric” or “nonlinear” acoustics to generate short narrow-beam sound pulses. Additionally, due to the short sound pulses and the highly directional sound pulse transmission of parametric sub-bottom profilers, the volume of area affected is much lower than using conventional (linear) acoustics devices such as sparker and chirp systems. The modeling analysis results presented in IHA Applications of Ocean Wind and Baystate Wind (NOAA 2017; NOAA 2018) indicate the water volume insonified by the Innomar sub-bottom profiler is rather small. Due to the narrow sound beams produced the distances to the Level B criteria were estimated to range from 120 to 135 meters for certain types of marine mammals with extended high frequency hearing ranges.

Table 3. Distances to Regulatory Level A SEL_{cum} Thresholds

Representative HRG Survey Equipment	Marine Species Group	PTS Onset	Lateral Distance (m)
USBL/GAPS Positioning Systems			
Sonardyne Ranger 2 USBL HPT 5/7000	LF cetaceans	199 dB SEL _{cum}	---
	MF cetaceans	198 dB SEL _{cum}	---
	HF cetaceans	173 dB SEL _{cum}	3
	Phocid pinnipeds	201 dB SEL _{cum}	---
	Fish	187 dB SEL _{cum}	---
Parametric Sub-bottom Profiler			
Innomar parametric SES-2000 Standard	LF cetaceans	199 dB SEL _{cum}	N/A
	MF cetaceans	198 dB SEL _{cum}	---

Table 3. Distances to Regulatory Level A SEL_{cum} Thresholds

Representative HRG Survey Equipment	Marine Species Group	PTS Onset	Lateral Distance (m)
	HF cetaceans	173 dB SEL _{cum}	< 5
	Phocid pinnipeds	201 dB SEL _{cum}	N/A
	Fish	187 dB SEL _{cum}	N/A
Medium Penetration Sub-bottom Profiler			
SIG ELC 820 Sparker	LF cetaceans	219 dBpeak	---
		183 dB SEL _{cum}	10
	MF cetaceans	230 dBpeak	---
		185 dB SEL _{cum}	---
	HF cetaceans	202 dBpeak	5
155 dB SEL _{cum}		4	
Phocid pinnipeds	218 dBpeak	---	
	185 dB SEL _{cum}	3	
Fish	206 dBpeak	<1	
	187 dB SEL _{cum}	---	
<p>Notes:</p> <p>The peak SPL criterion is unweighted (i.e., flat weighted), whereas the cumulative SEL criterion is weighted for the given marine mammal functional hearing group, except for fish species for which the SEL criterion is unweighted.</p> <p>The calculated sound levels and results are based on NMFS Technical Guidance's companion User Spreadsheet except as indicated in this IHA application.</p> <p>--- indicates that no injury was predicted for the given HRG equipment noise profile.</p> <p>N/A indicates not applicable as the HRG sound source operates outside the effective marine mammal hearing range.</p>			

Acoustic parameters were entered into the formulaic NMFS user spreadsheet with a vessel speed set at 2.05 meters per second (m/s). The USBL was defined by applying the following parameters: source level of 188 dB_{RMS}, pulse duration of 16 milliseconds (ms), repetition rate of 3 pulses per second and a primary operating frequency weighting of 26.5 kHz based on manufacturer specifications. The resultant distance to potential Level A Harassment for the USBL were 3 m for HF cetaceans. No potential for injury was predicted for the other marine mammal hearing groups. The medium penetration sub-bottom profiler was defined with the following parameters: source level at 206 dB_{RMS}, repetition rate 4 pulses per second, a pulse duration of 8 ms and a primary operating frequency of 1.4 kHz based on the technical information reported in the NUWC study document. The maximum distance was 10 m (32.8 ft) for LF cetaceans.

The distances for marine mammal, sea turtle, and fish species to regulatory criteria are presented in Table 44. The 200 m distance to the medium penetration sub-bottom profiler represents the largest distance for marine mammals and is likely a very conservative estimate based on sound source field verification assessments of similar sparker electrode equipment.

Table 4. Distances to Regulatory Level A and B Thresholds for Representative HRG Equipment

HRG System	Representative HRG Survey Equipment	Marine Mammal Level B Harassment 160 dB _{RMS90%} re 1 μPa (m)	Sea turtle Level A Harassment 180 dB _{RMS90%} re 1 μPa (m)	Sea turtle Level B Harassment 166 to 175 dB _{RMS90%} re 1 μPa (m)	Fish Species Level B Harassment 150 dB _{RMS90%} re 1 μPa (m)
Subsea Positioning / USBL	Sonardyne Ranger 2 USBL	25 to 75	3	5 to 13	80
Shallow penetration sub-bottom profiler	Innomar parametric SES-2000 Standard	120 to 135	N/A	N/A	N/A
Medium penetration sub-bottom profiler	SIG ELC 820 Sparker	200	20	35 to 100	635
N/A indicates not applicable as the HRG sound source operates outside the effective marine species hearing range.					

4.2 Alternative Monitoring Plan

Avangrid Renewables proposes to conduct surveys 24-hours per day over the proposed survey period. As authorized in Lease Stipulation 5.4.3, Avangrid Renewables proposes to implement an Alternative Monitoring Plan. The plan is designed to facilitate night-time operations and/or to support operations during periods when visual observations may be impaired (e.g., during bad weather, rough sea conditions, poor lighting conditions). This Alternative Monitoring Plan is specifically required to ensure the protection of marine mammals and sea turtles during survey activities under these conditions.

Recent studies have concluded that the use of IR (thermal) imaging technology allows for the detection of marine mammals at night as well as improve the detection during all periods through the use of automated detection algorithms (Weissenberger 2011). Studies have indicated that IR performance is independent of daylight and exhibits an almost uniform, omnidirectional detection probability within a radius of 5 km (3.1 mi). Results of studies demonstrate that thermal imaging can be used for reliable and continuous marine mammal protection (Zitterbart 2013). For this reason, Avangrid Renewables finds that use of an IR system for mitigation purposes warrants additional application in the field as both a standalone tool and in conjunction with other alternative monitoring methods (e.g., night vision binoculars and passive acoustic monitoring). For this survey effort, the IR system, passive acoustic monitoring (PAM), and night vision binoculars alternative monitoring methods will be used together and will ensure the protection of marine mammals during survey activities.

4.2.1 Vessel Strike Avoidance Procedures

Avangrid Renewables will ensure that vessel operators and crew maintain a vigilant watch for cetaceans and pinnipeds by slowing down or stopping their vessels to avoid striking these protected species. Survey vessel crew members responsible for navigation duties will receive site-specific training on marine mammal sighting/reporting and vessel strike avoidance measures. Vessel strike avoidance measures will include, but are not limited to, the following, except under extraordinary circumstances when complying with these requirements would put the safety of the vessel or crew at risk:

- All vessel operators and crew will maintain vigilant watch for marine mammals and sea turtles, and slow down or stop their vessel to avoid striking these protected species;
- All vessel operators will comply with 18.5 km/hr (10 knot) or less speed restrictions for vessels 19.8 m (65 ft) in length or greater. This applies to all vessels operating from November 1 through April 30;
- All vessel operators will comply with 18.5 km/hr (10 knot) or less speed restrictions when operating in any mid-Atlantic Seasonal Management Area (SMA) from November 1 through April 30;
- All vessel operators will comply with 18.5 km/hr (10 knot) or less speed restrictions when operating in any Dynamic Management Area (DMA);
- All vessel operators will monitor the North Atlantic right whale reporting systems (e.g. the Early Warning System, Sighting Advisory System, and Mandatory Ship Reporting System) from November 1 through July 31 for the presence of North Atlantic right whales during activities conducted in support of plan submittal;
- All survey vessels will maintain a separation distance of 500 m (1640 ft) or greater from any sighted North Atlantic right whale;
- If underway, vessels must steer a course away from any sighted North Atlantic right whale at 18.5 km/hr (10 knot) or less until the 500 m (1640 ft) minimum separation distance has been established. If a North Atlantic right whale is sighted in a vessel's path, or within 100 m (328 ft) to an underway vessel, the underway vessel must reduce speed and shift the engine to neutral. Engines will not be engaged until the North Atlantic right whale has moved outside of the vessel's path and beyond 100 m. If stationary, the vessel must not engage engines until the North Atlantic right whale has moved beyond 100 m;
- All vessels will maintain a separation distance of 100 m (328 ft) or greater from any sighted non-delphinid cetacean. If sighted, the vessel underway must reduce speed and shift the engine to neutral, and must not engage the engines until the non-delphinid cetacean has moved outside of the vessel's path and beyond 100 m. If a survey vessel is stationary, the vessel will not engage engines until the non-delphinid cetacean has moved out of the vessel's path and beyond 100 m;
- All vessel operators will comply with 18.5 km/hr (10 knot) or less speed restrictions when mother/calf pairs, pods, or large assemblages of non-delphinid cetaceans are observed near an underway vessel;
- All vessels will maintain a separation distance of 50 m (164 ft) or greater from any sighted delphinid cetacean and pinniped. Any vessel underway will remain parallel to a sighted delphinid cetacean or pinniped's course whenever possible and avoid excessive speed or

abrupt changes in direction. Any vessel underway reduces vessel speed to 18.5 km/hr (10 knot) or less when pods (including mother/calf pairs) or large assemblages of delphinid cetaceans are observed. Vessels may not adjust course and speed until the delphinid cetaceans have moved beyond 50 m and/or the abeam of the underway vessel;

- All vessels underway will not divert or alter course in order to approach any cetacean or pinniped. Any vessel underway will avoid excessive speed or abrupt changes in direction to avoid injury to the sighted cetacean or pinniped; and
- All vessels will maintain a separation distance of 50 m (164 ft) or greater from any sighted sea turtle.

Confirmation of the training and understanding of the requirements will be documented on a training course log sheet. Signing the log sheet will certify that the crew members understand and will comply with the necessary requirements throughout the survey event. An Avangrid Renewables' representative will ensure compliance with these requirements.

4.2.2 Seasonal Operating Requirements

Members of the monitoring team will consult NOAA Fisheries' North Atlantic right whale reporting systems for the presence of North Atlantic right whales throughout survey operations. All vessel operations will comply with the 18.5 km/hr (10 knot) or less speed restrictions when operating in any mid-Atlantic SMA from November 1 through April 30.

4.2.3 Exclusion Zone Implementation

Avangrid Renewables is requesting a modification to the exclusion zones to employ the following during all HRG survey activities involving equipment operating under 200 kHz, based on the issuance of an Incidental Harassment Authorization:

- 500 m North Atlantic right whale exclusion zone;
- 200 m ESA-listed large cetacean exclusion zone for Fin and Sei whales;
- 100 m non-delphinid and non-ESA-listed large cetacean exclusion zone; and
- 50 m exclusion zone for all other marine mammals and sea turtles.

4.2.4 Monitoring Program

Visual monitoring of the established exclusion zones will be performed by qualified and NOAA Fisheries-approved Protected Species Observers (PSOs). Protected Species Observer qualifications will include direct field experience on a marine mammal observation vessel and/or aerial surveys in the Atlantic Ocean/Gulf of Mexico. An observer team comprising a minimum of four NOAA Fisheries-approved PSOs, operating in shifts, will be stationed aboard either the survey vessel or a dedicated PSO vessel. Protected Species Observers will work in shifts such that no one monitor will work more than 4 consecutive hours without a 2-hour break or longer than 12 hours during any 24-hour period.

During daylight hours the PSOs will rotate in shifts of 1 on and 3 off, and while during nighttime operations PSOs will work in pairs. Each PSO will monitor 360 degrees of the field of vision. Avangrid Renewables will provide resumes of all proposed PSOs (including alternates) to BOEM for review and approval by NOAA Fisheries prior to the start of survey operations.

The PSOs will begin observation of the exclusion zones during all HRG survey operations. Observations of the zones will continue throughout the survey activity and/or while equipment operating below 200 kilohertz (kHz) are in use. Protected Species Observers will be responsible for visually monitoring and identifying marine mammals approaching or entering the established exclusion zones during survey activities. It will be the responsibility of the Lead PSO on duty to communicate the presence of marine mammals as well as to communicate and enforce the action(s) that are necessary to ensure mitigation and monitoring requirements are implemented as appropriate. A PSO mitigation and monitoring communications flow diagram has been included as Appendix A.

Protected Species Observers will be equipped with binoculars and have the ability to estimate distances to marine mammals located in proximity to their established zones using range finders. Reticulated binoculars will also be available to PSOs for use as appropriate based on conditions and visibility to support the siting and monitoring of marine species. Digital single-lens reflex camera equipment will be used to record sightings and verify species identification. During night operations, all PSOs will be supplied with several pieces of equipment to optimize night-time detection capabilities for all species expected in the region. The night vision devices proposed for this Project will be military specification high-performance PVS-7 Generation 3 Pinnacle night vision goggles (or similar). To further improve the performance of the night vision goggles, handheld infrared (IR) light-emitting diode (LED) spotlights will be provided to augment the performance of the night vision goggles.

Observations will take place from the highest available vantage point on the survey vessel. General 360-degree scanning will occur during the monitoring periods, and target scanning by the PSO will occur when alerted of a marine mammal presence.

Data on all PSO observations will be recorded based on standard PSO collection requirements (e.g. date, time, distance from vessel, type of animal, etc.). This will include dates and locations of construction operations; time of observation, location and weather; details of the sightings (e.g., species, age classification [if known], numbers, behavior); and details of any observed “taking” (behavioral disturbances or injury/mortality). The data sheet will be provided to both NOAA Fisheries and BOEM for review and approval prior to the start of survey activities. In addition, prior to initiation of survey work, all crew members will undergo environmental training, a component of which will focus on the procedures for sighting and protection of marine mammals. A briefing will also be conducted between the survey supervisors and crews, the PSOs, and Avangrid Renewables. The purpose of the briefing will be to establish responsibilities of each party, define the chains of command, discuss communication procedures, provide an overview of monitoring purposes, and review operational procedures.

The following watch schedule will be implemented on the offshore vessel operating 24-hours.

LEGEND	LOCAL TIME	A	B	C	D	E	F		LOCAL TIME	PAM	PSO	
Standard monitoring shifts	20:00	PAM		PSO			PSO		20:00	A	C	F
On call shifts for low visibility	21:00	PAM		PSO			PSO		21:00	A	C	F
	22:00		PAM	PSO		PSO			22:00	B	C	E
Night Time	23:00		PAM	PSO		PSO			23:00	B	C	E
Day Time	0:00		PAM		PSO	PSO		NIGHT	0:00	B	D	E
Daytime low visibility (fog)	1:00	PAM			PSO	PSO			1:00	A	D	E
	2:00	PAM		PSO	PSO				2:00	A	C	D
	3:00		PAM	PSO	PSO				3:00	B	C	D
	4:00	PSO	PAM			PSO			4:00	B	A	E
	5:00	PSO	PAM			PSO			5:00	B	A	E
	6:00		PSO		FAM				6:00	D		B
	7:00	FAM			PSO				7:00	A		D
	8:00	PSO				FAM			8:00	E		A
	9:00					PSO	FAM	PSO	9:00	E		E
	10:00				PSO	FAM			10:00	E		D
	11:00				PSO	FAM			11:00	E		D
	12:00				FAM		PSO	DAY	12:00	D		F
	13:00				FAM		PSO		13:00	D		F
	14:00			FAM			PSO		14:00	C		F
	15:00			FAM			PSO		15:00	C		F
	16:00		FAM	PSO					16:00	B		C
	17:00		FAM	PSO					17:00	B		C
	18:00		FAM				PSO		18:00	B		F
	19:00	FAM					PSO		19:00	A		F
Watch		7	7	8	7	7	8					
Sleep shift		10	13	12	12	12	14					
Watch- low vis		8	11	10	10	10	9					
Sleep shift		9	9	10	10	10	11					
										Lo-Vis		

Figure 6. PSO/PAM watch schedule

4.2.5 Passive Acoustic Monitoring

The Seiche PAM system is designed to give a flexible approach to the monitoring of marine noise from a vessel. The configuration consists of a hydrophone array and a depth gauge in a detachable or embedded array section that is towed astern of the vessel. A deck cable connects the array through to operator electronics inside the vessel. The acquired sound signals from each hydrophone are processed and displayed by PAMguard software running on a rack-mounted computer (PAMguard PC).

Two complete PAM systems will be provided to the survey vessel. Only one will be deployed and actively monitored. The second will act as a complete spare system should there be damages/failures to any component of the system in use.

The PAM system has been designed to monitor the cetacean species found in the Atlantic; covering a broad range of frequencies up to 200kHz. Two configurations of hydrophone arrays are available for deployment on this project, where the differences between the systems are outlined in Table 5. Both systems include an electronics unit which consists of a series of modules for processing the hydrophone signals. The unit splits the hydrophone signals into three groups, low frequencies (~0.01-30 kHz), ‘audible band’ (~2-24 kHz) and high frequencies (~30-200 kHz) and processes each in different ways to optimize the system performance. The low frequency signals are passed through the system without additional gain or filtering and can be selected for processing if ship noise permits. The audio band signals are amplified and filtered in the buffer unit and then connected to a multi-channel analogue-digital converter (ADC) which allows the signals to be distributed to the PAMguard software as well as to an audio output system for the operator to monitor using headphones. The high frequency band signals are amplified and filtered and passed to a high speed ADC, which passes the signals to Pamguard software for processing, on a separate rack-mounted computer.

To enable the operator to audibly monitor the hydrophones all the hydrophone outputs are sent to a mixer which combines the signals into a left/right pair, these signals are then fed through an analyser and filter to a radio headphone system.

The acoustic detection and analysis software, PAMGuard, will be pre-configured for optimal acoustic monitoring during survey operations as part of the acoustic monitoring equipment. PAMGuard is the industry standard for passive acoustic monitoring.

Table 5. Hydrophone array and specifications

General		
Manufacturer	Seiche Limited	Seiche Limited
Model	6 hydrophone array	4 hydrophone array
Hydrophone array section		
Length	20m array section	20m array section
Section diameter	14mm over cable 32mm over mouldings	14mm over cable 32mm over mouldings
Number of hydrophones	6	4
Hydrophone type	2 low frequency 2 ultra broadband 2 broadband	2 broadband 2 standard
Receive sensitivity (dB re 1 V/ μ Pa)	-166 (broadband channel sensitivity) -157 (standard channel sensitivity)	-166 (broadband and standard channel sensitivity)
Hydrophone separation	Hydrophone 1 and 2: 8m Hydrophone 2 and 3: 2m Hydrophone 3 and 4: 2m Hydrophone 4 and 5: 2m Hydrophone 5 and 6: 0.25m	Hydrophone 1 and 2: 2m Hydrophone 2 and 3: 13m Hydrophone 3 and 4: 0.25m
Preamplifiers	2 low frequency 2 ultra broadband 2 broadband	2 broadband 2 standard
Preamplifier type	Seiche low-noise	Seiche low-noise
Depth sensor manufacturer	Keller	Keller
Tow cable		
Length	230 m	230 m
Diameter	14mm	14mm
Termination	Seiche 36 pin connector (to array) ITT 19 pin connector (to deck cable)	Seiche 36 pin connector (to array) ITT 19 pin connector (to deck cable)
Deck cable		
Length	100 m	100 m
Diameter	14mm	14mm
Termination	ITT 19 pin connector	ITT 19 pin connector

Pre-Clearance of the Exclusion Zone

Avangrid Renewables will implement a clearance periods of the exclusion zone prior to the initiation of ramp-up. During this period the exclusion zones will be monitored by the PSOs, using the appropriate visual technology. Ramp-up may not be initiated if any marine mammal is observed within its respective exclusion zone. If a marine mammal is observed within an exclusion zone during the pre-clearance period, ramp-up may not begin until the animal(s) has been observed exiting its respective zone or until an additional time period has elapsed with no further sightings. The following clearance periods are proposed:

- Sea turtles – 60 mins
- Large cetaceans – 30 mins

- Small cetaceans and seals – 15 mins
- Small cetaceans and seals actively approaching the vessel when equipment is under full power – no requirement

This condition is a modification to Lease stipulation 5.4.7.4 and thus the Avangrid Renewables is requesting a waiver. Protected Species Observers would also continue to monitor the zone for 30 minutes after survey equipment is shut down or survey activity has concluded.

4.2.6 Ramp-Up Procedures

Where technically feasible, a ramp-up procedure will be used for HRG survey equipment capable of adjusting energy levels at the start or re-start of HRG survey activities. A ramp-up procedure will be used at the beginning of HRG survey activities in order to provide additional protection to marine mammals near the Survey Area by allowing them to vacate the area prior to the commencement of survey equipment use. Ramp-up is not required to re-initiate survey activities following a shut-down as described in Section 4.7. The ramp-up procedure will not be initiated during periods of inclement conditions if the exclusion zone cannot be adequately monitored by the PSOs using the appropriate visual technology (e.g., reticulated binoculars, night vision equipment). A ramp-up would begin with the power of the smallest acoustic equipment at its lowest practical power output appropriate for the survey. **When technically feasible** the power would then be gradually turned up. Ramp-up activities will be delayed if a marine mammal(s) enters an exclusion zone(s). Ramp-up will continue if the animal has been observed exiting the exclusion zone or until an additional time period has elapsed with no further sighting.

4.2.7 Shut-Down and Power-Down Procedures

The vessel operator must comply immediately with any call for shut down by the Lead PSO. The following outlines the shut-down procedures:

- If a non-delphinid cetacean is sighted at or within the established exclusion zone, an immediate shutdown of the survey equipment is required. Subsequent restart of the electromechanical survey equipment must use the ramp-up procedures described above and may only occur following clearance of the exclusion zone as described in Section 4.6.
- If a delphinid cetacean or pinniped, such as the Atlantic white-sided dolphin, bottlenose dolphin, Short beaked common dolphin, harbor porpoise, or harbor seal, is sighted at or within the exclusion zone, the HRG survey equipment (including the sub-bottom profiler) must be powered down to the lowest power output that is technically feasible. Subsequent power up of the survey equipment must use the ramp-up procedures described above and may occur after (1) the exclusion zone is clear of a delphinid cetacean and/or pinniped or (2) a determination by the PSO after a minimum of 10 minutes of observation that the delphinid cetacean or pinniped is approaching the vessel or towed equipment at a speed and vector that indicates voluntary approach to bow-ride or chase towed equipment.
- If the HRG sound source (including the sub-bottom profiler) shuts down for reasons other than encroachment into the exclusion zone by a non-delphinid cetacean, including but not limited to a mechanical or electronic failure, resulting in the cessation of sound source for a period greater than 20 minutes, a restart for the HRG survey equipment (including the sub-bottom profiler) is required using the full ramp-up procedures and clearance of the exclusion zone per Section 4.2.6. If the pause is fewer than 20 minutes, the equipment may be restarted

as soon as practicable at its operational level as long as visual surveys were continued diligently throughout the silent period and the exclusion zone remained clear of cetaceans, pinnipeds, and sea turtles. If the visual surveys were not continued diligently during the pause of 20 minutes or less, a restart for the HRG survey equipment (including the sub-bottom profiler) is required using the full ramp-up procedures and clearance of the exclusion zone per Section 4.2.6.

4.3 Reporting

Avangrid Renewables will provide the following reports as necessary during construction activities:

- Avangrid Renewables will contact BOEM and NOAA Fisheries within 24 hours of the commencement of survey activities described in this plan and again within 24 hours of the completion of the activity described in this plan;
- Any observed significant behavioral reactions (e.g., animals departing the area) or injury or mortality to any marine mammals must be reported to BOEM and NOAA Fisheries within 24 hours of observation. Dead or injured protected species (e.g., marine mammals, sea turtles or sturgeon) are reported to NOAA Fisheries 'Northeast Region's Stranding Hotline (800-900-3622) within 24 hours of sighting, regardless of whether the injury or death is caused by a vessel. In addition, if the injury or death was considered to be caused by a collision with a project-related vessel, Avangrid Renewables will ensure that BOEM and NOAA Fisheries are notified of the strike within 24 hours. Avangrid Renewables will use the form included as Appendix A to Addendum C of the Kitty Hawk Lease to report the sighting or incident. If Avangrid Renewables is proven to be responsible or the injury or death, the vessel will assist with any salvage effort as requested by NOAA Fisheries; and
- Within 90 days after completion of the marine site characterization survey activities, a final technical report will be provided to BOEM and NOAA Fisheries that fully documents the methods and monitoring protocols, summarizes the data recorded during monitoring, estimates the number of listed marine mammals and sea turtles that may have been taken during survey activities (based on NOAA Fisheries definition of Level A/B harassment [i.e. take]), and provides an interpretation of the results and effectiveness of all monitoring tasks as far as is reasonable practicable.

5.0 REGULATORY OVERVIEW

The Lease stipulates various pre-survey, survey, and post-survey requirements. Details regarding Avangrid Renewables' compliance with the Kitty Hawk Lease requirements are detailed in the following tables. Table 6 summarizes Avangrid Renewable's pre-survey compliance. Table 7 summarizes compliance with standard operating conditions during survey activities. Table 8 summarizes reporting requirements. All stipulations are summarized. See OCS-A 0508 for complete stipulations.

Table 6. Pre-Survey Conditions in the OCS-A 0508

Addendum "C" Stipulation	Lease Requirement	Compliance Statement
2.1.1 Survey Plan(s)	Survey Plan to be submitted if site assessment activities will be conducted, and at least 30 calendar days prior to the date of the pre-survey meeting with BOEM.	Survey Plan was submitted on January 4, 2019. The Pre-Survey Meeting occurred on April 9, 2019. See Section 6 of this Survey Plan.
2.1.2 Pre-Survey meeting(s) with the Lessor	Participate in a pre-survey meeting with BOEM at least 60 days prior to initiation of survey activities in support of the submission of a plan. A Qualified Marine Archaeologist (QMA) must be present.	The Pre-Survey Meeting occurred on April 9, 2019. The QMA was present at the meeting. See also the compliance statement for Lease Stipulation 4.3.3.
3.1 General Coordination with Command Headquarters	Establish and maintain early contact and coordination with the appropriate command headquarters to avoid or minimize conflicts with military operations.	Avangrid Renewables contacted the U.S. Department Navy Fleet Forces (N46) on June 3, 2019.
3.3.1 General	The United States reserves the right to temporarily suspend operations and/or require evacuation on this lease in the interest of national security.	Avangrid Renewables understands that the United States reserves the right to temporarily suspend operations and/or require evacuation on this lease in the interest of national security.
3.3.4 Lessee Point-of-Contact for Evacuation/Suspension Notifications	Provide BOEM with a Point of Contact for suspension or evacuation notifications.	Prior to the start of surveys, Avangrid Renewables will provide contact information for the on-site representative that will be aboard the survey vessel.
3.4 Electromagnetic Emissions	In any designated defense operating area, warning area, or water test area, coordinate the electromagnetic emissions associated with any survey activities with appropriate command headquarters. Ensure that all electromagnetic emissions associated with survey activities are controlled as directed by the commander of the appropriate command headquarters.	To be addressed for any relevant survey activities when coordinating with USNORTHCOM (see also the compliance statement for Lease Stipulation 3.1).
4.2 General Coordination with the National Aeronautics and Space Administration (NASA)	Establish and maintain early contact and coordination with NASA to avoid or minimize conflicts with NASA operations.	Avangrid Renewables contacted the NASA and discussed the upcoming survey activity on February 14, 2019

Addendum “C” Stipulation	Lease Requirement	Compliance Statement
4.3.1 General	The United States may temporarily suspend operations and/or require evacuation on this lease in the interest of fulfilling NASA missions.	Avangrid Renewables understands that the United States reserves the right to temporarily suspend operations and/or require evacuation on this lease in the interest of fulfilling NASA missions.
4.3.4 Lessee Point-of-Contact for Evacuation/Suspension Notifications	Provide BOEM with a Point of Contact for suspension or evacuation notifications.	Prior to the start of surveys, Avangrid Renewables will provide contact information for the on-site representative that will be aboard the survey vessel.
5.1.1 General Requirements	Prior to the start of operations, the Lessee must hold a briefing to establish responsibilities of each involved party, define the chains of command, discuss communication procedures, provide an overview of monitoring procedures, and review operational procedures. This briefing must include all relevant personnel, crew members and protected species observers (PSO). New personnel must be briefed as they join the work in progress.	All personnel participating in surveys will attend a pre-installation briefing. The pre-installation briefing will include the following topics: HSE; emergency response; responsibilities, chain of command, communication procedures, planned survey activities; protected species avoidance, marine trash and debris awareness; and oil spill response procedures.
5.1.2 General Requirements	The Lessee must ensure that all vessel operators and crew members, including PSOs, are familiar with, and understand, the requirements specified in Addendum C.	Vessel Operators, employees, and contractors will be briefed prior to boarding the vessel. See compliance statement for Stipulation 5.1.1 above.
5.1.3 General Requirements	The Lessee must ensure that a copy of Addendum C is made available on every project-related vessel.	Avangrid Renewables will ensure that a copy of Addendum C is available on every project-related vessel.

Addendum “C” Stipulation	Lease Requirement	Compliance Statement
5.1.4 Marine Trash and Debris Prevention	<p>The Lessee must ensure that vessel operators, employees, and contractors engaged in activities in support of plan submittal are briefed on marine trash and debris awareness and elimination, as described in the Bureau of Safety and Environmental Enforcement (BSEE) Notice to Lessees and Operators (NTL) No. 2015-G03 (“Marine Trash and Debris Awareness and Elimination”) or any NTL that supersedes this NTL, except that the Lessor will not require the Lessee, vessel operators, employees, and contractors to undergo formal training or post placards. The Lessee must ensure that these vessel operator employees and contractors are made aware of the environmental and socioeconomic impacts associated marine trash and debris and their responsibilities for ensuring that trash and debris are not intentionally or accidentally discharged into the marine environment. The above-referenced NTL provides information the Lessee may use for this awareness briefing.</p>	<p>Avangrid Renewables will comply with this stipulation and NTL 2015-G03 which has superseded NTL 2012-G01, except that formal training will not be conducted, and placards will not be posted. Vessel Operators, employees, and contractors will be briefed prior to boarding the vessel.</p>
5.3.4 Monitoring and Avoidance	<p>The Qualified Marine Archaeologist must be afforded the opportunity to be present during HRG surveys and bottom-disturbing activities to ensure avoidance of potential archeological resources. The Qualified Marine Archaeologist, upon request, should be provided the opportunity to inspect data quality.</p>	<p>The QMA will be afforded the opportunity to be present during HRG surveys and bottom-disturbing activities. The QMA will also be provided the opportunity to inspect data quality.</p>
5.3.5 No Impact Without Approval	<p>The Lessee must not knowingly impact a potential archaeological resource without the BOEM’s prior approval.</p>	<p>Avangrid Renewables will avoid conducting bottom disturbing activities in areas of known archaeological resources. The QMA will review any locations where bottom disturbing activities may occur and certify that the proposed activities will not impact potential archeological resources.</p>
5.4.6.2 Field Verification of HRG Survey Exclusion Zone	<p>The Lessee must submit to the Lessor the results of field verification to verify the exclusion zone for the HRG Survey equipment operating below 200 kHz. If no applicable data are available, the Lessee must conduct field verification of the exclusion zone for HRG Survey equipment operating below 200 kHz.</p>	<p>Applicable data is provided in Section 4.1, such that no field verification activity is proposed.</p>

Addendum “C” Stipulation	Lease Requirement	Compliance Statement
<p>5.4.6.3 Modification of HRG Survey Exclusion Zone Per Lessee Request</p>	<p>Results from the field verification may be used to modify the exclusion zone. Any new exclusion zone radius must be based on the most conservative measurement (i.e., the largest safety zone configuration) of the target Level A or Level B harassment acoustic threshold zone as defined by NOAA Fisheries. The Lessee must obtain approval from BOEM of any new exclusion zone before it may be implemented. See Lease for complete detail.</p>	<p>Avangrid Renewables is requesting a modification to the exclusion zones to employ the following during all HRG survey activities involving equipment operating under 200 kHz, based on the issuance of an Incidental Harassment Authorization:</p> <ul style="list-style-type: none"> • 500 m North Atlantic right whale exclusion zone; • 200 m ESA-listed large cetacean exclusion zone for Fin and Sei whales; • 100 m non-delphinid and non-ESA-listed large cetacean exclusion zone; and • 50 m exclusion zone for all other marine mammals and sea turtles.

Table 7. Standard Operating Conditions in the Lease Area

Addendum “C” Stipulation	Vessel Operations Conditions	Compliance Statement
5.2 Vessel Strike Avoidance Measures		
5.2.2	The Lessee must ensure that vessel operators and crews maintain a vigilant watch for marine mammals and sea turtles and slow down or stop their vessel to avoid striking protected species.	Survey vessel crew members responsible for navigation duties will receive site-specific training on marine mammal and sea turtle sighting/reporting and vessel strike avoidance measures, as detailed in the Lease. Confirmation of the training and understanding of the requirements will be documented on a training course log sheet onboard the vessel with individuals signing off to state that training has been received. Signing the log sheet will certify that the crew members understand and will comply with the necessary requirements throughout the survey event.
5.2.3	The Lessee must ensure that vessels 19.8 m (65 ft) in length or greater, operating from November 1 through April 30, operate at speeds of 18.5 km/hr (10 knot) or less.	
5.2.4	The Lessee must ensure that all vessels operating in any mid-Atlantic Seasonal Management Area (SMA) from November 1 through April 30 operate at speeds of 18.5 km/hr (10 knot) or less.	
5.2.5	The Lessee must ensure that all vessel operators comply with 18.5 km/hr (10 knot) speed restrictions in any Dynamic Management Area (DMA).	
5.2.6	The Lessee must ensure that vessel operators monitor the North Atlantic right whale reporting systems (e.g., the Early Warning System, Sighting Advisory System, and Mandatory Ship Reporting System) from November 1 through July 31 for the presence of North Atlantic right whales during activities conducted in support of plan submittal.	
5.2.7 North Atlantic right whales		
5.2.7.1	The Lessee must ensure all vessels maintain a separation distance of 500 meters (1,640 ft) or greater from any sighted North Atlantic right whale.	An observer team comprising a minimum of six Protected Species Observers (PSOs) operating in shifts, will be stationed aboard the survey vessel. It will be the responsibility of the Lead PSO on duty to communicate the presence of marine and/or sea turtle species as well as to communicate and enforce the action(s) that is necessary to ensure mitigation and monitoring requirements are implemented as appropriate. Details of 24-hour PSO and operator roles are detailed in Section 4.2 ‘Mitigation and Monitoring Communications’ is illustrated in Appendix A along with a description of the monitoring protocols.

Addendum “C” Stipulation	Vessel Operations Conditions	Compliance Statement
5.2.7.2.1	If underway, vessels must steer a course away from any sighted North Atlantic right whale at 18.5 km/h (10 knot) or less until the 500 meter (1,640 ft) minimum separation distance has been established, except as provided in 5.2.7.2.2.	See compliance statements for Lease Stipulations 5.2.6.1, 5.4.4 and 5.4.5.
5.2.7.2.2	If a North Atlantic right whale is sighted within 100 meters (328 ft) of an underway vessel, the vessel operator must immediately reduce speed and promptly shift the engine to neutral. The vessel operator must not engage engines until the North Atlantic right whale has moved outside the vessel’s path and beyond 100 meters (328 ft), at which point the Lessee must comply with 5.2.7.2.1.	
5.2.7.2.3	If a vessel is stationary, the vessel must not engage engines until the North Atlantic right whale has moved beyond 100 meters (328 ft), at which point the Lessee must comply with 5.2.7.2.1.	
5.2.8 Non-Delphinoid Cetaceans other than the North Atlantic Right Whale, 4.2.8 Delphinoid Cetaceans and Pinnipeds, and 4.2.9 Sea Turtles		
5.2.8.1	The Lessee must ensure all vessels maintain a separation distance of 100 meters (328 ft) or greater from any sighted non-delphinoid cetacean.	See compliance statements for Lease Stipulations 5.2.6.1, 5.4.4 and 5.4.5.
5.2.8.2	The Lessee must ensure that all vessel operators reduce vessel speed to 10 knots or less when mother/calf pairs, pods, or large assemblages of non-delphinoid cetaceans are observed near an underway vessel.	
5.2.8.3	If the vessel comes within 100 meters of any non-delphinoid cetacean is sighted, the vessel underway must reduce speed and shift the engine to neutral and must not engage the engines until the non-delphinoid cetacean has moved outside of the vessel’s path and beyond 100 m (328 ft.). If a vessel is stationary, the vessel must not engage engines until the sighted nondelphinoid cetacean has moved out of the vessel’s path and beyond 100 meters (328 ft).	
5.2.7.9.1	The Lessee must ensure that all vessels underway do not divert to approach any delphinoid cetacean and/or pinniped.	
5.2.9.2	The Lessee must ensure that all vessels maintain a separation distance of 50 meters (164 ft) or greater from any sighted delphinoid cetacean or pinniped, except if the delphinoid cetacean and/or pinniped approach the vessel, then refer to 5.2.9.3 below.	

Addendum “C” Stipulation	Vessel Operations Conditions	Compliance Statement
5.2.9.3	If a delphinoid cetacean and/or pinniped approaches any vessel underway, the vessel must avoid excessive speed or abrupt changes in direction to avoid injury to the delphinoid cetacean and/or pinniped.	
5.2.10.1	The Lessee must ensure all vessels maintain a separation distance of 50 meters (164 ft) or greater from any sighted sea turtle.	
5.1.2 General Requirements	The Lessee must ensure that all vessel operators and crew members, including PSOs, are familiar with, and understand, the requirements specified in Addendum C.	Survey vessel crew members responsible for navigation duties will receive site-specific training on marine mammal and sea turtle sighting/reporting and vessel strike avoidance measures as detailed in the Lease. Confirmation of the training and understanding of the requirements will be documented on a training course log sheet. Signing the log sheet will certify that the crew members understand and will comply with the necessary requirements throughout the survey event.
5.3.6 Post-Review Discovery Clauses	If while conducting bottom-disturbing site characterization activities an unanticipated potential archaeological resource or pre-contact archaeological site is discovered within the project area, bottom disturbing activities will be immediately halted; BOEM must be notified within 24 hours of discovery and notified in writing within 72 hours of discovery; the location will be kept confidential; any additional investigations may be conducted as directed by BOEM.	While conducting site characterization activities, Avangrid Renewables will follow the Post Discover Clauses, outlined in Stipulation 5.3.6.

Addendum “C” Stipulation	Vessel Operations Conditions	Compliance Statement
5.4 Geological and Geophysical (G&G) Survey Requirements		
5.4.1	The Lessee must ensure that all vessels conducting activity in support of a plan submittal comply with the G&G survey requirements specified in Sections 5.4, except under extraordinary circumstances when complying with these requirements would put the safety of the vessel or crew at risk.	See compliance statement for Lease Stipulation 5.1.2.
5.4.2 Visibility	The Lessee must not conduct G&G surveys in support of plan submittal at any time when lighting or weather conditions (e.g., darkness, rain, fog, sea state) prevent visual monitoring of the HRG Survey exclusion zone (per Section 5.4.6) or the Geotechnical Exploration exclusion zone (see 5.4.7), except as allowed under Section 5.4.3.	Section 4.2 of the Survey Plan and the compliance statement for Lease Stipulation 5.4.5 provide details on the visual observation equipment that will be available to the PSOs to support the monitoring of the exclusion zones 24-hours per day. As described in the compliance statement for Lease Stipulation 5.4.3, Avangrid Renewables has proposed the use of alternative monitoring methods for conducting survey operations at night that will include the use of night vision equipment, IR, and PAMs (see Section 4). In addition, as detailed in the compliance statement for Lease Stipulation 5.4.4, Avangrid Renewables will employ an observer team comprising a minimum of six role PSOs to support survey activities at night and/or during periods when visual observations may be impaired. It will be the responsibility of the Lead PSO on duty to communicate whether the conditions are suitable to effectively monitor the exclusion zone(s) throughout the survey day. HRG surveys may not commence until the Lead PSO on duty confirms visual suitability and the exclusion zone(s) has been clear of all marine mammals and sea turtles. If the exclusion zone(s) becomes obstructed once survey operations have commenced, the Lead PSO will call for a shutdown of survey operations until the zone(s) is once again visually clear.

Addendum “C” Stipulation	Vessel Operations Conditions	Compliance Statement
5.4.3 Modification of Visibility Requirement	<p>If the Lessee intends to conduct G&G survey operations in support of plan submittal at night or when visual observation is otherwise impaired, the Lessee must submit to the Lessor an alternative monitoring plan detailing the alternative monitoring methodology (e.g., active or passive acoustic monitoring technologies). The alternative monitoring plan must demonstrate the effectiveness of the methodology proposed to the Lessor's satisfaction. The Lessor may, after consultation with NOAA Fisheries, decide to allow the Lessee to conduct G&G surveys in support of plan submittal at night or when visual observation is otherwise impaired using the proposed alternative monitoring methodology.</p>	<p>Avangrid Renewables has proposed the use of alternative monitoring methods (See Section 4.1 and 4.5 of this Survey Plan) for conducting HRG surveys at night.</p>
5.4.4 Protected-Species Observer (PSO)	<p>The Lessee must ensure that the exclusion zone for all G&G surveys performed in support of plan submittal is monitored by NOAA Fisheries-approved PSOs around the sound source. The number of PSOs must be sufficient to effectively monitor the exclusion zone at all times. In order to ensure effective monitoring, PSOs must be on watch for no more than 4 consecutive hours, with at least a 2-hour break after a 4-hour watch, unless otherwise allowed by the Lessor. PSOs must not work for more than 12 hours in a 24-hour period. PSO reporting requirements are provided in Section 5.5. Prior to the scheduled start of the surveys to be performed in support of plan submittal, the Lessee must provide to the Lessor a list of proposed PSOs currently approved by NOAA Fisheries for G&G surveys. For proposed PSOs not currently approved by NOAA Fisheries, the Lessee must provide to the Lessor the PSO résumés no later than 45 calendar days prior to the scheduled start of such surveys. If additional PSO approvals are required after this time, the Lessee must provide the additional PSO résumés to the Lessor at least 15 calendar days prior to each PSO's start date. The Lessor will send the PSO résumés to NOAA Fisheries for approval.</p>	<p>Avangrid Renewables will employ an observation team of six NOAA Fisheries-approved PSOs capable of providing visual mitigation to provide alternating shifts during 24-hour survey operations. See Sections 4.1 and 4.5. Avangrid Renewables provided resumes of all proposed PSOs (including alternates) to BOEM for review and approval by NOAA Fisheries on April 17, 2019. Should additional staff need to be added to Avangrid Renewables' list of qualified PSOs once survey activities have commenced, Avangrid Renewables will submit the resume(s) of the new proposed personnel to BOEM for review and approval by NOAA Fisheries at least 15 days prior to the PSO's start date.</p>

Addendum “C” Stipulation	Vessel Operations Conditions	Compliance Statement
5.4.5 Observation Location and Optical Device Availability	The Lessee must ensure that monitoring occurs from the highest available vantage point on the associated operational platform, allowing for 360-degree scanning. The Lessee must ensure that each PSO has access to reticle binoculars and other suitable equipment to adequately perceive and monitor protected species within the exclusion zone during surveys conducted in support of plan submittal.	During daylight operations, PSOs will be equipped with binoculars with 8 x or 10 x magnification and have the ability to estimate distances to marine mammals and sea turtles located in proximity to the vessel and/or exclusion zone using rangefinder sticks. Reticulated binoculars will also be available to PSOs for use as appropriate based on conditions and visibility to support the siting and monitoring of marine species. Where possible, digital single-lens reflex camera equipment will be used to record sightings and verify species. During night operations, night vision and IR technologies will be used in conjunction with PAMs (see also Section 4 and Appendices A of this Survey Plan).
5.4.6.1 Establishment of Default HRG Survey Exclusion Zone	The Lessee must ensure that a NOAA Fisheries-approved PSO monitors a 200-meter radius exclusion zone for all marine mammals and sea turtles. In the case of the North Atlantic right whale, the Lessee must observe a minimum separation distance of 500 meters (1,640 ft), as required under Section 5.2.7.1. If the Lessor determines that the exclusion zone does not encompass the sound exposure threshold for ear injury to protected species (Level A harassment) calculated for the acoustic source having the highest source level, the Lessor will consult with NOAA Fisheries and may impose additional, relevant requirements on the Lessee, including, but not limited to, required expansion of this exclusion zone.	Avangrid Renewables will ensure the PSOs monitor out to the visible horizon during the HRG Survey. At all times the vessel operator will maintain a separation distance of 500-m from any sighted North Atlantic right whale. These stated requirements will be included in the site-specific training to be provided to the survey team.
5.4.6.4 Clearance of HRG Survey Exclusion Zone	The Lessee must ensure that active acoustic sound sources are not activated until the PSO has reported the exclusion zone clear of all marine mammals and sea turtles for at least 60 minutes.	See compliance statements for Lease Stipulations 5.4.2 and 5.4.4. Avangrid Renewables seeks a waiver from this lease condition in accordance with precedent and the anticipation of concurrence from NOAA Fisheries.

Addendum "C" Stipulation	Vessel Operations Conditions	Compliance Statement
5.4.6.5 HRG Survey Mid-Atlantic Seasonal Management Areas (SMAs) Right Whale	The Lessee must ensure that between November 1 and April 30, vessel operators monitor NOAA Fisheries' North Atlantic right whale reporting systems (e.g., the Early Warning System, Sighting Advisory System, and Mandatory Ship Reporting System) for the presence of North Atlantic right whales during HRG Survey operations.	Between watch shifts, members of the monitoring team will consult the identified NOAA Fisheries North Atlantic right whale reporting systems for the presence of North Atlantic right whale throughout survey operations. The proposed HRG survey activities will, however, occur outside of the SMA located off the coasts of Virginia and North Carolina.
5.4.6.6 Dynamic Management Area (DMA) HRG Survey Shutdown Requirement	The Lessee must ensure that vessels cease HRG Survey activities within 24 hours of NOAA Fisheries establishing a DMA in the Lessee's HRG Survey area. The Lessee may resume HRG Survey activities in the affected area as soon as the DMA has expired.	It will be the responsibility of the Lead PSO on duty to monitor the identified NOAA Fisheries North Atlantic right whale reporting systems for the establishment of a DMA. If NOAA Fisheries should establish a DMA within the HRG Survey area, the Lead PSO will notify Avangrid Renewables immediately so that survey operation can be shut down and/or altered to avoid the DMA within the stated 24-hour window.
5.4.6.7 Electromechanical Survey Equipment Ramp-Up	The Lessee must ensure that, when technically feasible, a ramp-up of the electromechanical survey equipment occurs at the start or re-start of HRG Survey activities. A ramp-up must begin with the power of the smallest acoustic equipment for the HRG Survey at its lowest power output. The power output must be radically increased, and other acoustic sources added in such a way that the source level would rise in steps not exceeding 6 dB per 5-minute period.	Avangrid Renewables confirms where technically feasible, a ramp-up procedure will be used for HRG survey equipment capable of adjusting energy levels at the start or re-start of HRG survey activities. It will be the responsibility of the Lead PSO on duty to authorize the ramp-up of HRG survey equipment.
5.4.6.8 Shutdown for Non-Delphinoid Cetaceans and Sea Turtles	Lessee must ensure that any time a non-delphinoid cetacean or sea turtle is observed within the exclusion zone, the PSO will immediately notify the Resident Engineer, or other authorized individual, and call for shutdown of the electromechanical survey equipment. The Lessee must ensure that the vessel operator immediately complies with such a call by the PSO. Any disagreement or discussion must occur only after shutdown. Subsequent restart of the electromechanical survey equipment must only occur following clearance of the exclusion zone, as described in Section 5.4.6.4, and implementation of ramp up procedures, as described in Section 5.4.6.7.	Avangrid Renewables will give the Lead PSO on duty the authority to communicate and enforce an equipment shutdown and subsequent ramp-up during HRG survey operations. A communications flow diagram is provided in Appendix A of this Survey Plan.

Addendum “C” Stipulation	Vessel Operations Conditions	Compliance Statement
5.4.6.9 Power Down for Delphinoid Cetaceans and Pinnipeds	<p>The Lessee must ensure that any time a delphinoid cetacean or pinniped is observed within the exclusion zone, the PSO will immediately notify the Resident Engineer, or other authorized individual, and call for a power down of the electromechanical survey equipment to the lowest power output that is technically feasible. The vessel operator must comply immediately with such a call by the PSO. Any disagreement or discussion must occur only after power down. Subsequent power up of the electromechanical survey equipment must use the ramp up provisions described in Section 5.4.6.7 and may occur after: (1) the exclusion zone is clear of delphinoid cetaceans and pinnipeds; or (2) a determination by the PSO after a minimum of 10 minutes of observation that the delphinoid cetacean or pinniped is approaching the vessel or towed equipment at a speed and vector that indicates voluntary approach to bow ride or chase towed equipment.</p>	<p>See compliance statement for Lease Stipulation 5.4.6.8.</p>
5.4.6.10 Pauses in Electromechanical Survey Sound Source	<p>If the electromechanical sound source pauses for reasons other than encroachment into the exclusion zone by a non-delphinoid cetacean or sea turtle, including, reasons such as, but not limited to, mechanical or electronic failure, resulting in the cessation of the sound source for a period greater than 20 minutes, the Lessee must ensure that restart of the electromechanical survey equipment commences only after clearance of the exclusion zone, as described in 5.4.6.4, and the implementation of ramp-up procedures, as described in 5.4.6.7. If the pause is less than 20 minutes, the equipment may be restarted as soon as practicable at its operational level as long as visual surveys were continued diligently throughout the silent period and the exclusion zone remained clear of all marine mammals and sea turtles. If visual surveys were not continued diligently during the pause of 20 minutes or less, the Lessee must clear the exclusion zone, as described in 5.4.6.4, and implement ramp-up procedures, as described in 5.4.6.7, prior to restarting the electromechanical survey equipment.</p>	<p>See compliance statement for Lease Stipulation 5.4.6.8.</p>

Table 8. Reporting Requirements in the Lease Area

Addendum “C” Stipulation	Lease Requirement	Compliance Statement
5.5.1 Field Verification Plan for HRG Survey Exclusion Zone	No later than 45 calendar days prior to the commencement of any required field verification activities, the Lessee must submit a plan to the Lessor for verifying the sound source levels of any G&G survey equipment operating at frequencies below 200 kHz. The plan must demonstrate how the field verification activities will comply with the requirements of 5.4.6.2. Prior to the commencement of the field verification activities, the Lessor may require the Lessee to modify the plan to address any comments the Lessor submits to the Lessee on the contents of the plan in a manner deemed satisfactory to the Lessor.	See the compliance statement for 5.4.6.2
5.5.2 Results of Field Verification of the Exclusion Zone for HRG Survey Equipment	Prior to the Lessee using HRG Survey equipment operating below 200 kHz during survey activities conducted in support of plan submittal, the Lessee must report the results of field verification of the survey sound sources to verify the distance of the exclusion zone to the Lessor (per 5.4.6.2). The results must accurately demonstrate the sufficiency of the exclusion zone to the Lessor’s satisfaction. The Lessee must include in its report a preliminary interpretation of the results for all sound sources, which will include details of the operating frequencies, SPLs (measured in Peak, SEL, and RMS), the distance to current ear injury and behavior thresholds, frequency bands measured, as well as associated latitude/longitude positions, ranges, depths and bearings between sound sources and receivers.	See Section 4.1
5.5.3 Reporting Injured or Dead Protected Species	The Lessee must ensure that sightings of any injured or dead protected species (e.g., marine mammals, sea turtles or sturgeon) are reported to the Lessor, NOAA Fisheries and the NOAA Fisheries Southeast Region’s Marine Mammal Stranding Hotline (877-433-8299) or the North Carolina Sea Turtle Stranding and Salvage Network hotline (252-241-7367) within 24 hours of sighting, regardless of whether the injury or death is caused by a vessel. In addition, if the injury or death was caused by a collision with a project-related vessel, the Lessee must notify the Lessor of the strike within 24 hours. The Lessee must use the form provided in Appendix A to ADDENDUM “C” to report the sighting or incident. If the Lessee’s activity is responsible for the injury or death, the Lessee must ensure that the vessel assists in any salvage effort as requested by NOAA Fisheries.	It will be the responsibility of the Lead PSO on duty to report the sightings of a dead and/or injured marine species to the Avangrid Renewables Project Manager, and to complete the required sightings/incident form. It will be the responsibility of the Avangrid Renewables Project Manager to make the appropriate notifications to NOAA Fisheries via the Region’s Stranding Hotline and, if necessary, to BOEM within 24-hours of the sighting/incident. If Avangrid Renewables is responsible for the injury or death, they will work with NOAA Fisheries to support the salvage effort, as necessary.

Addendum “C” Stipulation	Lease Requirement	Compliance Statement
5.5.4 Reporting Observed Impacts to Protected Species	The Lessee must report any observations concerning any impacts on Endangered Species Act-listed marine mammals, sea turtles or sturgeon to the Lessor and NOAA Fisheries Southeast Regional Stranding Coordinator within 48 hours (305-361-4586; blair.mase@noaa.gov).	It will be the responsibility of the Lead PSO on duty to report the any impacts to an ESA species to the Avangrid Renewables Project Manager, and to complete the required form as provided in Appendix A to Addendum C of the Lease. It will be the responsibility of the Avangrid Renewables Project Manager to make the appropriate notifications to NOAA Fisheries and BOEM within 48 hours of any observations concerning impacts to ESA listed species and within 24 hours of the take of any ESA listed species.
5.5.5 Protected Species Observer Reports	The Lessee must ensure that the PSO record all observations of protected species using standard marine mammal PSO data collection protocols. The list of required data elements for these reports is provided in Appendix B to ADDENDUM “C”.	Avangrid Renewables will provide the PSO team with a standardized data sheet that contains all of the data elements required by Appendix B to Addendum C. The PSO team will be instructed to record all of the required data in the field using the standardized form. The data sheet will be provided to both BOEM and NFMS for review and approval prior to the start of survey activities. Avangrid Renewables will review the data elements and sheet with the PSO team members during the site-specific training session.
5.5.6 Reports of G&G Survey Activities and Observations	The Lessee must provide the Lessor and NOAA Fisheries with reports every 90 calendar days following the commencement of HRG Survey and/or Geotechnical Exploration activities, and a final report at the conclusion of the HRG Survey and/or Geotechnical Exploration activities. Each report must include a summary of survey activities, all PSO and incident reports (See Appendices A and B), and an estimate of the number of listed marine mammals and sea turtles observed and/or taken during these survey activities. The final report must contain a detailed analysis and interpretation of the sound source verification data, if such data was collected by the Lessee.	Avangrid Renewables will work in coordination with the survey team and PSO team to develop a final report summarizing the HRG survey activities and all PSO reports. This report will be provided to both BOEM and NOAA Fisheries by Avangrid Renewables within 90 calendar days following the commencement of survey activities.

Addendum "C" Stipulation	Lease Requirement	Compliance Statement
5.5.7 Marine Mammal Protection Act Authorization(s)	If the Lessee is required to obtain an authorization pursuant to section 101(a)(5) of the Marine Mammal Protection Act prior to conducting survey activities in support of plan submittal, the Lessee must provide to the Lessor a copy of the authorization prior to commencing these activities.	A copy of the IHA was provided to BOEM upon issuance by NMFS on June 4, 2019.

6.0 SCHEDULE

Table 9. Anticipated Schedule of Activities

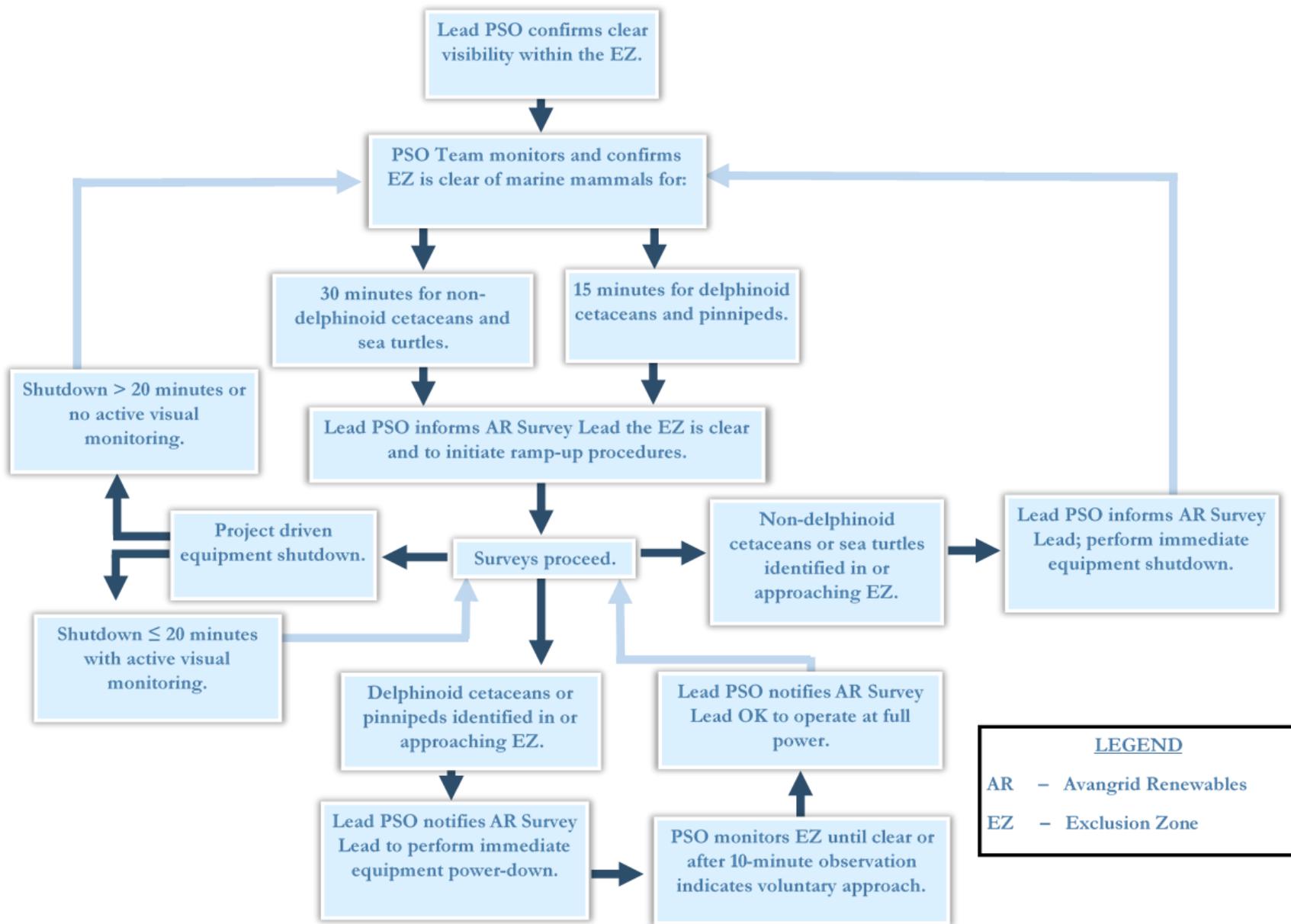
Submittal/Action/Milestone	Lease Stipulation	Date
Submit Survey Plan	2.1.1	January 4, 2019
Pre-Survey Meeting with BOEM	2.1.2	April 9, 2019
Start survey		No earlier than June 1, 2019

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APPENDIX A. MITIGATION AND MONITORING COMMUNICATIONS FLOW DIAGRAM



APPENDIX B. VESSEL SPECIFICATIONS



Gerry Bordelon Data Sheet

General Information

Owner/Manager	Bordelon Marine, LLC
Vessel Type	Offshore Supply Vessel
Year Built	2011
Flag State Authority	USA (Jones Act Compliant)
DP Classification	DP1
Classification	ABS / A1, USCG L&I
Official Number	1230075

Dimensions

Length	170 ft.	(51.82m)
Breadth	36 ft.	(10.97m)
Depth Molded	11.5 ft.	(3.50m)
Light Draft	8.5 ft.	(2.59m)
Loaded Draft	10 ft.	(3.04m)
Deadweight	570.2 LT	

Main Work Deck

Main Deck Area	3,300 ft.	(1072.90 m)
Main Deck Dimensions	30' x 110'	(9.75m x 33.52m)
Strength	540 lbs per sq ft.	
Tonnage	500 LT	

Capacities

Drill Water	1,520 BBLs	(63,864 USG)
Fuel	60,686 USG	
Liquid Mud	1,704 BBLs	(71,568 USG)

Accommodations

Total Berths	28
Crew	4
Passenger Berths	24

Navigation & Communication

DP	Yes
GPS	1
Radar	2-Furuno
Gyro Compass	2
Internet E-mail	VSAT System
Satellite Phone	VSAT System
VHF	3
Depth Recorder	1

Machinery

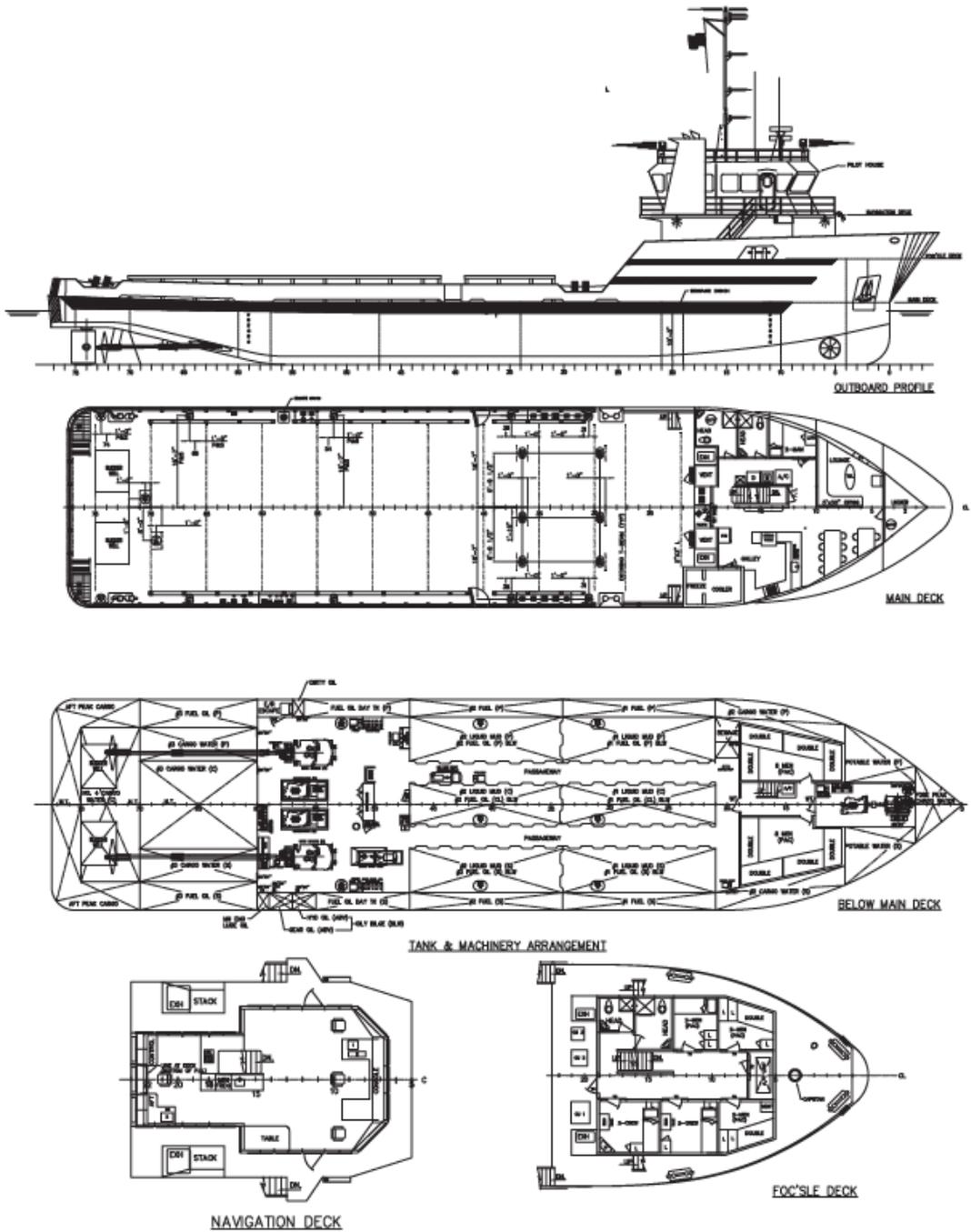
Main Engines	2-Cummins KTA 38MO
Brake Horsepower	850 HP
Generators	2-86KW
Bow Thrusters	450 HP

Performance

Maximum Speed	14 knots
Fuel Conservation Speed	12 knots
Maximum Fuel Consumption	80 USG/Hr
Fuel Conservation Fuel Consumption	65 USG/Hr

Discharge Rates

Drill Water	400 USG/min @80 ft
Potable Water	400 USG/min @80 ft
Fuel Oil	400 USG/min @80 ft
Liquid Mud at 22lbs Max	700 USG/min @150 ft



4/11/2019

Northstar 4, 50' Utility Work Boat – Northstar Marine



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› Northstar 4, 50' Utility Work Boat

(https://www.northstarmarineinc.com/wp-content/uploads/2011/04/Northstar_4.png)



(<https://www.northstarmarineinc.com/wp-content/gallery/work-boats/Northstar-4-1.jpg>)

SPECIFICATIONS

Vessel Type	Richard Squires Commercial Workboat
Documentation	560915
Tonnage	24 Gross Tons
Construction	Aluminum
Length, overall	49' 6"
Beam	14' 8"
Draft	3' 10"
Color	Black/White (2)
Engine	TAMD 102 Volvo Diesels 425 HP each
Cruising Speed	15 Knots
Fuel Capacity	1000 Gals.
Range	600 Miles
Accommodations	Sleeps 3, w/head.

<https://www.northstarmarineinc.com/portfolio/northstar-4-50-utility-work-boat/>

1/3

4/11/2019

Northstar 4, 50' Utility Work Boat – Northstar Marine

	shower and galley
	Heated & Air Conditioned
Aft A-frame – installed	3,000 lb. capacity w/ 16' head room.
Alt. Lifting Boom*	1,750 lb. capacity
optional add-on	Outboard or over transom.
Observation Platform	
Clear Deck Space	14' x 20'
Radar – 48 mile, Furuno FCV-585 Differential GPS and Chart Plotter- Furuno GP-1850 WD Receiver – Furuno LC-90 Auto Pilot – Robertson AP 35 Depth/Bottom recorder VHF Radios (2) EPIRB, 406 MHz Satellite Phone Hydraulic Power Hoisting Boom – 1,750 lb. Hydraulic Winch – 3,000 lb. Hydraulic Capstan – 2,000 lb. Generator – 12 kW Northern Lights 6 Man Life Raft USCG Required Safety Equipment Misc. Pumps, Blocks, Hardware Push Knee	

Northstar 4, 50' Utility Work Boat
 (<https://www.northstarmarineinc.com/portfolio/northstar-4-50-utility-work-boat/>)

 Categories

Work and Tug Boats
 (https://www.northstarmarineinc.com/portfolio_categories/work-and-tug-boats/)

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