Kitty Hawk Offshore Wind Project

Site Assessment Plan

Public

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Executive Summary

Avangrid Renewables LLC (the "Company") has prepared this Site Assessment Plan (SAP) in support of gaining approval from the Bureau of Ocean Energy Management (BOEM) to deploy and operate up to two Floating Light Detection and Ranging (FLiDAR) buoys and up to two metocean platforms (collectively referred to as Metocean Equipment) to be located within Official Protraction Diagram Currituck Sound NJ18-11 (see Figure 1-1). The Metocean Equipment is proposed to be deployed and operated in order to support development of the Lease Area[1]. The Metocean Equipment is designed to collect and analyze meteorological data, inclusive of wind speed and direction at multiple heights, and metocean conditions. The Company has selected AXYS Technologies Inc. to provide the FLiDAR and metocean platforms as the proposed meteorological and metocean data collection technologies, respectively. Installation, operation, and decommissioning of the Metocean Equipment is proposed to be staged out of Avalon, New Jersey. The Company anticipates collecting data for two years; installation, which will take approximately one week, is currently scheduled to occur no earlier than January 2020, but as soon as all authorizations are in place thereafter. Decommissioning of the Metocean Equipment is currently anticipated to occur in 2022.

The activities proposed in this SAP are consistent with the activities outlined in the *Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore North Carolina, Revised Environmental Assessment* (BOEM 2015), and demonstrate compliance with the requirements outlined in 30 Code of Federal Regulations § 585.606.

This SAP follows the Attachment C Template for Metocean Buoys included with the latest *Guidelines for Information Requirements for a Renewable Energy Site Assessment Plan* (SAP Guidelines, BOEM 2019).

[1] The Lease Area is defined by *Addendum A of BOEM Lease No. OCS-A 0508, Section II. Description of the Lease Area*. The total acreage of the Lease Area is approximately 122,405 acres. The Lease Area is depicted in its entirety on Figure 1-1 of this SAP.

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Abbreviations & Definitions

ADCP	Acoustic Doppler Current Profiler
AWAC	Acoustic Wave and Current Profiler
AXYS	AXYS Technology Inc.
BMPs	best management practices
BOEM	Bureau of Ocean Energy Management
Buoy Deployment Areas (BDAs)	Three areas where WindSentinel™ Buoys and TRBM Platforms may be deployed ranging from approximately 4.3 to 5.4 acres (1.7 to 2.2 hectares) each, located within each of the SAP Survey Areas that were assessed for physical and biological resources, during site-specific surveys
CFR	Code of Federal Regulations
CMECS	Coastal and Marine Ecological Classification Standard
CO	carbon monoxide
COP	Construction and Operations Plan
CVA	Certified Verification Agent
DoN	Department of Navy
DPS	Distinct Population Segments
EFH	essential fish habitat
EPA	United States Environmental Protection Agency
ESA	Endangered Species Act of 1973
FLiDAR	Floating Light Detection and Ranging
FONSI	Finding of No Significant Impact
ft	feet
Geophysical Survey Area	Three 1,312 ft by 1,312 ft (400 m by 400 m) areas (SAP Survey Areas plus a 328 ft [100 m] buffer) assessed for geophysical resources during site-specific surveys, to enable potential deployment of Metocean Equipment within Official Protraction Diagram Currituck Sound NJ18-11, Blocks 6666, 6719, and 6869
HAP	hazardous air pollutant
HRG	high resolution geophysical
HSE	health, safety, and environmental
in	inch
kg	kilogram
kHz	kilohertz
km	kilometer
knot	nautical miles per hour
lb	pound
Lease	Commercial Lease of Submerged Lands for Renewable Energy Development on the Outer Continental Shelf (OCS-A 0508)

LiDAR	Light Detection and Ranging
LNM	Local Notice to Mariners
LPTL	lowest practical taxonomic level
m	meter
MBES	multibeam echosounder
mm	millimeter
Metocean Equipment	up to two WindSentinel™ Buoys and up to two TRBM platforms
MLLW	mean lower low water
MMPA	Marine Mammal Protection Act of 1972
NC EA	*Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore North Carolina, Revised Environmental Assessment*
NCDEQ	North Carolina Department of Environmental Quality
NCWRC	North Carolina Wildlife Resources Commission
NHPA	National Historic Preservation Act of 1966
NMFS	National Oceanic and Atmospheric Administration, National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOx	nitrogen oxides
nT	nanotesla
NTL	Notice to Lessees and Operators
O_3	ozone
OCS	Outer Continental Shelf
PATON	Private Aids to Navigation
PM_{10}	particulate matter less than 10 microns in diameter
$PM_{2.5}$	particulate matter less than 2.5 microns in diameter
Project	Kitty Hawk Offshore Wind Project
PSO	Protected Species Observer
SAP	Site Assessment Plan
SAP Survey Areas	Three 984 ft by 984 ft (300 m by 300 m) areas assessed for physical and biological resources during site-specific surveys, to enable potential deployment of Metocean Equipment within Official Protraction Diagram Currituck Sound NJ18-11, Blocks 6666, 6719, and 6869
SBP	sub-bottom profiler
SEARCH	SEARCH, Inc.
SO_2	sulfur dioxide
SOC	Standard Operating Conditions
SSS	side scan sonar
Ton	US Ton (Short Ton)

TRBM	Trawl Resistant Bottom Mounted
TRBM Platforms	Trawl Resistant Bottom Mounted metocean data collection platform
U.S.C.	United States Code
USCG	United States Coast Guard
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UXO	unexploded ordnance
VDEQ	Virginia Department of Environmental Quality
VOC	volatile organic compound
WindSentinel™ Buoys	AXYS WindSentinel™ FLiDAR Buoys

1 Introduction

Avangrid Renewables LLC (the "Company") has prepared this Site Assessment Plan (SAP) in support of the installation and operation of up to two Floating Light Detection and Ranging (FLiDAR) buoys and up to two metocean platforms to be located within Official Protraction Diagram Currituck Sound NJ18-11 (Buoy Deployment Areas [BDAs]; see Figure 1-1). The Company has selected AXYS Technologies Inc. (AXYS) to provide up to two WindSentinel™ FLiDAR Buoys (WindSentinel™ Buoys) and up to two trawl resistant bottom mounted (TRBM) metocean data collection platforms (TRBM Platforms) (collectively referred to as Metocean Equipment) as the proposed meteorological and metocean data collection technologies, respectively.

The BDAs were identified following site-specific surveys and analysis that were conducted within three defined areas surveyed for potential deployment of Metocean Equipment within Official Protraction Diagram Currituck Sound NJ18-11, Blocks 6666, 6719, and 6869. The BDAs are contained within the Lease Area[2] as defined under the Commercial Lease of Submerged Lands for Renewable Energy Development on the Outer Continental Shelf (OCS-A 0508) (Lease). The Lease was issued with an Effective Date of November 1, 2017. On March 19, 2018, the Company requested a 12-month extension of the Preliminary Term of the Lease from the Bureau of Ocean Energy Management (BOEM), which was approved on May 17, 2018, extending the Preliminary Term from November 1, 2018 to November 1, 2019 (see Appendix A). This SAP has been prepared in accordance with the requirements under 30 Code of Federal Regulations (CFR) §§ 585.606, 610, and 611 (see Table 2-3), the *Guidelines for Information Requirements for a Renewable Energy SAP* issued by BOEM in June 2019, and in accordance with stipulations in the Lease (see Table 2-2).

The Metocean Equipment described in this SAP will collect wind resource and metocean data to support development of the Lease Area.

[2] The Lease Area is defined by *Addendum A of BOEM Lease No. OCS-A 0508, Section II. Description of the Lease Area*. The total acreage of the Lease Area is approximately 122,405 acres. The Lease Area is depicted in its entirety on Figure 1-1 of this SAP.

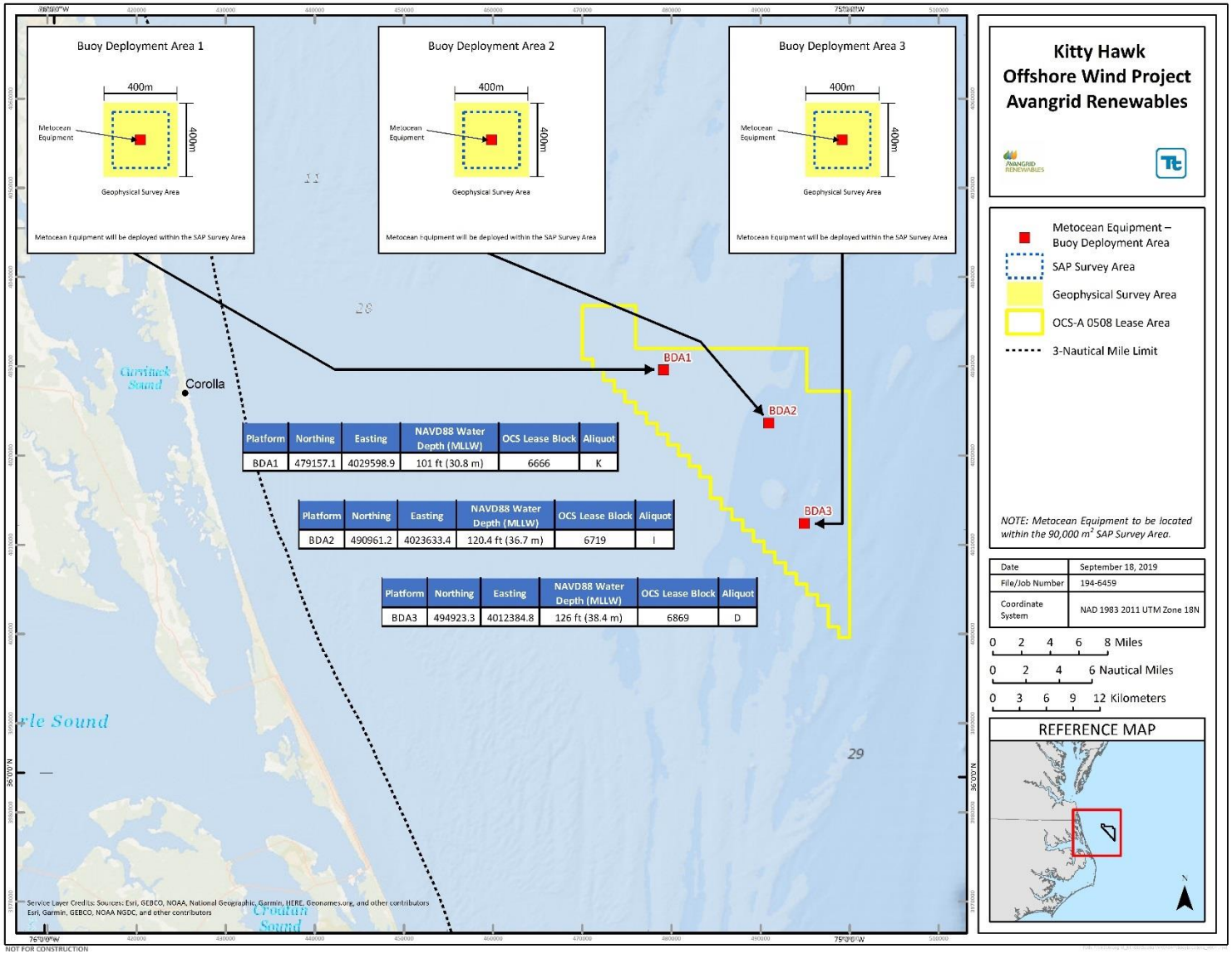

Figure 1-1 Survey Areas and Buoy Deployment Areas

1.1 Project Description and Objectives

The Company will collect and analyze meteorological data, inclusive of wind speed and direction at multiple heights, and metocean conditions within the Lease Area as part of site assessment activities. The Company proposes that the collection of this data will be performed using up to two WindSentinel™ Buoys and up to two TRBM Platforms. The proposed Metocean Equipment represents state-of-the-art equipment that incorporates the best available technologies, mooring components, and mooring designs, ensuring reliable, quality data collection; robust mooring integrity; safety; and minimal environmental impacts. The Metocean Equipment is commercially available technology that has been successfully deployed on many occasions in similar conditions by AXYS; the technology is not considered significant or complex. Design drawings of the technology proposed are provided in Appendix B.

The Company plans to deploy the Metocean Equipment no earlier than January 2020, but as soon as all authorizations are in place thereafter. The Company intends to deploy Metocean Equipment within BDA1 first (See Figure 1-1), and after one year of data collection, the company may elect to relocate the Metocean Equipment from the BDA1 Location or deploy a second set of Metocean Equipment to the BDA2 or BDA3 Locations. The collection of site-specific data via Metocean Equipment is standard practice within areas designated for offshore windfarm development, with data collected being used for a variety of purposes, including site characterization, project design, and wind resource assessment. The WindSentinel™ Buoys and TRBM Platforms are scheduled to be fully decommissioned at the end of the two-year site assessment period, but may be decommissioned and moved during the site assessment period as described in Section 4.2.

1.2 Authorized Representative and Designated Operator

As the Lease holder, the Company proposes to have AXYS serve as the designated operator for the Metocean Equipment. The contact information for the Company's Authorized Representative is as follows:

Name of Authorized Representative	Craig Poff
Title	Director of Development
Phone Number	610-230-0332
Email	Craig.Poff@Avangrid.com
Address	1125 NW Couch Street, Portland, OR 97209

1.3 Certified Verification Agent Waiver Request

Pursuant to 30 CFR § 585.610(a)(9), BOEM may require a Certified Verification Agent (CVA) to certify that the Metocean Equipment is designed to withstand the environmental and functional load conditions for the intended life of the Metocean Equipment within the BDAs.

The selected Metocean Equipment is a commercially available technology that has been successfully deployed on many occasions in similar conditions by AXYS. Therefore, the Company requests a waiver of the CVA requirement per 30 CFR § 585.705I. The Company has had measurement engineers from AXYS perform the duties similar to those of a CVA. The measurement engineers will also inspect the equipment prior to installation, witness the installation, and prepare an installation report as described in Section 3.1.

2 Conformance with Permits, the North Carolina EA, Commercial Lease, and Regulatory Requirements

The activities and equipment proposed in this SAP will be covered by the appropriate bond or other approved security, as required by 30 CFR §§ 585.515 and 585.516. This information will be provided to BOEM prior to the deployment of the Metocean Equipment.

Prior to installation of the Metocean Equipment, the Company will obtain all required permits and approvals from agencies identified in Table 2-1. The Company has included all available copies of the final agency authorizations as part of the SAP (see Appendix A). Copies of agency authorizations that are not available at the time of SAP submittal will be provided to BOEM prior to the initiation of SAP activities. All installation, operation, maintenance, and decommissioning activities will be conducted in compliance with any additional requirements stipulated in the final permits to be issued by other regulatory agencies.

Table 2-1 Permit Matrix

Permitting Agency	Applicable Permit or Approval	Statutory Basis	Regulations	Applicant Requirements
National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service (NMFS)	Endangered Species Act (ESA) Section 7 Consultation	16 United States Code (U.S.C.) § 1536	50 CFR § 402	BOEM conducted these consultations prior to the issuance of the Lease as part of the *Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore North Carolina, Revised Environmental Assessment* (NC EA, BOEM 2015). No action required by the Company.
	Magnuson-Stevens Fishery Conservation and Management Act Section 305(b) Consultation	16 U.S.C. § 1801	50 CFR § 600	BOEM conducted these consultations prior to the issuance of the Lease as part of the NC EA (BOEM 2015). No action required by the Company.
U.S. Army Corps of Engineers, Norfolk District	Nationwide Permit 5 – Scientific Measurement Devices	Clean Water Act 33 U.S.C. § 134	33 CFR §§ 320 *et seq*.	The Company has reviewed the terms of NWP 5 and the Wilmington District Regional Conditions and has determined that the proposed site assessment activity is consistent with the Conditions and is not anticipated to require additional review or authorization from USACE.
United States Coast Guard (USCG)	Approval for Private Aids to Navigation	14 U.S.C. § 81	33 CFR § 66	The Company will submit an application to the USCG for a Private Aids to Navigation (PATON). The Company will submit a copy of the approved PATON to BOEM prior to deployment of Metocean Equipment.
U.S. Department of Interior, BOEM	National Historic Preservation Act of 1966 (NHPA) Section 106 Consultation	NHPA 16 U.S.C. § 470	36 CFR § 60, Part 800	BOEM conducted these consultations prior to the issuance of the Lease as part of the NC EA (BOEM 2015). No action required by the Company.

Table 2-1 Permit Matrix

Permitting Agency	Applicable Permit or Approval	Statutory Basis	Regulations	Applicant Requirements
U.S. Fish and Wildlife Service (USFWS)	ESA Section 7 Consultation	16 U.S.C. § 1536	50 CFR § 402	BOEM conducted these consultations prior to the issuance of the Lease as part of the NC EA (BOEM 2015). No action required by the Company.
North Carolina Department of Environmental Quality, Division of Coastal Management; Virginia Department of Environmental Quality	Coastal Zone Management Act Consistency Determination	16 U.S.C. §§ 1451 *et seq.*	15 CFR § 930	BOEM conducted these consultations prior to the issuance of the Lease as part of the NC EA (BOEM 2015). As noted in the Virginia Coastal Zone Management Act Concurrence Letter (see Appendix A), no action is required by the Company.

On September 3, 2015, BOEM issued a Finding of No Significant Impact (FONSI) based on the *Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore North Carolina, Revised Environmental Assessment* (referred to herein as the "NC EA") (BOEM 2015). The NC EA analyzed the foreseeable consequences associated with issuing commercial leases within the North Carolina Wind Energy Area, which is inclusive of the Lease Area (Figure 1-1), as well as the site assessment activities, including the installation of Metocean Equipment. The Metocean Equipment proposed by the Company is consistent with the equipment that has been analyzed in the NC EA. BOEM identified several mitigation measures or Standard Operating Conditions (SOCs) in the NC EA for buoy installation, operation, and decommissioning. The SOCs were developed by BOEM in consultation with other federal and state agencies to reduce or eliminate the potential environmental risks to, or conflicts with, individual environmental and socioeconomic resources upon issuance of a commercial lease for site assessment and characterization activities. BOEM has issued the mitigation measures for the Company's Lease-specific site characterization activities and site assessment activities in the Lease based upon these SOCs. The Company will implement these measures as described in more detail in Table 2-2 and Section 6 of this SAP.

Table 2-2 provides an overview of Lease stipulations (see BOEM Lease OCS-A-0508) that are applicable to the SAP including a description of the requirement, how the Company proposes to comply, and where in the SAP the information is located. Table 2-3 outlines each regulatory requirement in 30 CFR § 585.610 and how the Company proposes to comply with those requirements.

Table 2-2 Conformance with the Commercial Renewable Energy Lease OCS-A 0508 Stipulations as Contained in ADDENDUM "C" to the Lease

Lease OCS-A 0508, ADDENDUM "C" Stipulation	Description	SAP Document
3 National Security and Military Operations		
3.2 General Coordination with Command Headquarters	The Lessee must establish and maintain contact and coordination with the appropriate command headquarters (see Contact Information for Reporting Requirements Sheet provided as an Enclosure to this Lease), in order to avoid or minimize the potential to conflict with, and minimize the potential effects of conflicts with, military operations.	The Company will comply with this stipulation.
3.3.4 Lessee Point-of-Contact for Evacuation/Suspension Notifications	The Lessee must inform the Lessor of the persons/offices to be notified to implement the terms of Lease stipulations 3.3.2 and 3.3.3.	Craig Poff Director of Development, Avangrid Renewables 610-230-0332 Craig.Poff@Avangrid.com 1125 NW Couch Street, Portland, OR 97209
3.4 Electromagnetic Emissions	Prior to entry into any designated defense operating area, warning area, or water test area for the purpose of commencing survey activities undertaken to support plan submittal, the Lessee must enter into an agreement with the commander of the appropriate command to coordinate the electromagnetic emissions associated with such survey activities. The Lessee must ensure that all electromagnetic emissions associated with such survey activities are controlled as directed by the commander of the appropriate command headquarters.	The Company will comply with this stipulation.
4 NASA Operations		
4.1 Hold and Save Harmless	The Lessee assumes all risks of damage or injury to persons or property that occurs in, on, or above the OCS, to any persons or to any property of any person or persons in connection with any activities being performed by the Lessee in, on, or above the OCS, if such injury or damage to such person or property occurs by reason of the activities of the National Aeronautics and Space Administration (hereinafter "NASA"), its contractors, or subcontractors, agreement partners (as defined in NASA Policy Directive (NPD) 1050.1 or any NPD that supersedes NPD 1050.1), or any of its officers, agents or employees, whether compensation for such damage or injury might be due under a theory of strict or absolute liability or otherwise. Notwithstanding any limitation of the Lessee's liability in Section 9 of the Lease, the Lessee assumes this risk whether such injury or damage is caused in whole or in part by any act or omission, regardless of negligence or fault, of the United States, its contractors or subcontractors, or any of its officers, agents, or	The Company will comply with this stipulation.

Table 2-2 Conformance with the Commercial Renewable Energy Lease OCS-A 0508 Stipulations as Contained in ADDENDUM "C" to the Lease

Lease OCS-A 0508, ADDENDUM "C" Stipulation	Description	SAP Document
	employees. The Lessee further agrees to indemnify and save harmless the United States against all claims for loss, damage, or injury in connection with the programs or activities of NASA, whether the same be caused in whole or in part by the negligence or fault of the United States, its contractors, agreement partners, or subcontractors, or any of its officers, agents, or employees and whether such claims might be sustained under a theory of strict or absolute liability or otherwise.	
4.2 General Coordination with NASA	The Lessee must establish and maintain contact and coordination with NASA (see Contract Information for Reporting Requirements Sheet provided as an Enclosure to this Lease), in order to avoid or minimize the potential to conflict with, and minimize the potential effects of conflicts with, NASA operations.	The Company will comply with this stipulation.
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.	The Company will comply with this stipulation.
4.3.2 Notification	Every effort will be made by NASA to provide as much advance notice as possible of the need to suspend operations and/or evacuate. Advance notice will normally be given before requiring a suspension or evacuation. Temporary suspension of operations may include but is not limited to the evacuation of personnel and appropriate sheltering of personnel not evacuated. "Appropriate sheltering" means the protection of all Lessee personnel for the entire duration of any NASA mission from flying or falling objects or substances, and will be implemented by an order (oral and/or written) from the BOEM Office of Renewable Energy Programs (OREP) Program Manager, after consultation with NASA. NASA will provide information to allow the Lessee to assess the degree of risk to, and provide sufficient protection for, the Lessee's personnel and property.	The Company will comply with this stipulation.
4.3.3 Duration	Suspensions or evacuations for NASA mission reasons will not generally exceed 72 hours; however, any such suspension may be extended by order of the OREP Program Manager. During such periods, equipment may remain in place, but all operations, if any, must cease for the duration of the temporary suspension if so, directed by the OREP Program Manager. Upon cessation of any temporary suspension, the OREP Program Manager will immediately notify the Lessee that such suspension has terminated and operations on the leased area can resume.	The Company will comply with this stipulation.

Table 2-2 Conformance with the Commercial Renewable Energy Lease OCS-A 0508 Stipulations as Contained in ADDENDUM "C" to the Lease

Lease OCS-A 0508, ADDENDUM "C" Stipulation	Description	SAP Document
4.3.4 Lessee Point-of-Contact for Evacuation/Suspension Notifications	The Lessee must inform the Lessor of the persons/offices to be notified to implement the terms of Lease stipulations 4.3.2 and 4.3.3.	Craig Poff Director of Development, Avangrid Renewables 610-230-0332 Craig.Poff@Avangrid.com 1125 NW Couch Street, Portland, OR 97209
5 Standard Operating Conditions		
5.1.1 Briefing	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 (PSOs). New personnel must be briefed as they join the work in progress.	The Company will comply with this stipulation. See Section 3.3, Pre-Installation Briefing.
5.1.2	The Lessee must ensure that all vessel operators and crew members, including PSO's, are familiar with, and understand, the requirements specified in ADDENDUM "C" of the Lease.	The Company will comply with this stipulation. See Section 3.3, Pre-Installation Briefing.
5.1.3	The Lessee must ensure that a copy ADDENDUM "C" is made available on every project-related vessel.	The Company will comply with this stipulation. See Section 3.3, Pre-Installation Briefing.
5.1.4 Marine Trash and Debris Prevention	The Lessee must ensure that vessel operators, employees and contractors actively engaged in activities in support of plan (i.e., SAP and/or Construction and Operations Plan [COP]) 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 vessel operator employees and contractors are made aware of the environmental and socioeconomic impacts associated with 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.	The Company will comply with this stipulation.
5.2.1 Vessel Strike Avoidance Measures	The Lessee must ensure that all vessels conducting activities in support of the plan submittal, including those transiting to and from local ports and the Lease	The Company will comply with this stipulation. See Section 3.4, Protected Species Avoidance

Table 2-2 Conformance with the Commercial Renewable Energy Lease OCS-A 0508 Stipulations as Contained in ADDENDUM "C" to the Lease

Lease OCS-A 0508, ADDENDUM "C" Stipulation	Description	SAP Document
	Area, comply with the vessel-strike avoidance measures specified in stipulations 5.2., except under extraordinary circumstances when complying with these requirements would put the safety of the vessel or crew at risk.	
5.3.5 No Impact without Approval	The Lessee must not knowingly impact a potential archaeological resource without the Lessor's prior approval.	The Company will comply with this stipulation.
5.3.6 Post-Review Discovery Clauses	If the Lessee, while conducting bottom-disturbing site characterization activities in support of a plan submittal (e.g. geotechnical exploration, anchoring), discovers an unanticipated potential archaeological resource, such as the presence of a shipwreck (e.g., a sonar image or visual confirmation of an iron, steel, or wooden hull, wooden timbers, anchors, concentrations of historic objects, piles of ballast rock) or pre-contact archaeological site (e.g., stone tools, pottery) within the Project Area, the Lessee must:	The Company will comply with this stipulation.
5.3.6.1	Immediately halt seafloor/bottom-disturbing activities within the area of discovery;	The Company will comply with this stipulation. See Appendix D, Marine Archaeological Resource Assessment Report.
5.3.6.2	Notify the Lessor within 24 hours of discovery;	The Company will comply with this stipulation. See Appendix D, Marine Archaeological Resource Assessment Report.
5.3.6.3	Notify the Lessor in writing via report to the Lessor within 72 hours of its discovery;	The Company will comply with this stipulation. See Appendix D, Marine Archaeological Resource Assessment Report.
5.3.6.4	Keep the location of the discovery confidential and take no action that may adversely affect the archaeological resource until the Lessor conducts an evaluation and instructs the applicant on how to proceed; and	The Company will comply with this stipulation. See Appendix D, Marine Archaeological Resource Assessment Report.
5.3.6.5	Conduct any additional investigations as directed by the Lessor to determine if the resource is eligible for listing in the National Register of Historic Places (30 CFR § 585.802(b)). The Lessor will direct the Lessee to conduct such investigations if: (1) the site has been impacted by the Lessee's project activities; or (2) impacts to the site or to the area of potential effect cannot be avoided. If investigations indicate that the resource is potentially eligible for listing in the National Register of Historic Places, the Lessor will tell the Lessee how to protect the resource or how to mitigate adverse effects to the site. If the Lessor incurs costs in protecting the resource, under Section 110(g) of the National Historic Preservation Act, the Lessor may	The Company will comply with this stipulation.

Table 2-2 Conformance with the Commercial Renewable Energy Lease OCS-A 0508 Stipulations as Contained in ADDENDUM "C" to the Lease

Lease OCS-A 0508, ADDENDUM "C" Stipulation	Description	SAP Document
	charge the Lessee reasonable costs for carrying out preservation responsibilities under the OCS Lands Act (30 CFR § 585.802(c-d)).	
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 NMFS and the NMFS Southeast Region's Marine Mammal Stranding Hotline (877-433-8299 or current) 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 assist in any salvage effort as requested by NMFS.	The Company will comply with this stipulation. See Section 3.5, Reporting.

Table 2-3 Site Assessment Plan Requirements for Commercial Leases Pursuant to §§ 585.610(a) and (b), and 611(a) and (b)

Requirement	Compliance Statement – Location within the SAP
§ 585.610(a)	
1) Contact Information	See Section 1.2.
2) Site assessment concept	Meteorological and metocean collection using WindSentinel™ Buoys and TRBM Platforms.
3) Designation of operator	See Section 1.2.
4) Commercial lease stipulations and compliance	See Table 2-2.
5) A location plat	See Figure 1-1.
6) General structural and project design, fabrication and installation information	See Sections 2, 3, 4, and 5.
7) Deployment activities	See Section 3.
8) Measures for avoiding, minimizing, reducing, eliminating, and monitoring environmental impacts	This SAP has been prepared in accordance with the NC EA and stipulations in the Lease. Specific efforts to avoid, minimize, reduce, eliminate, or monitor environmental impacts can be found in Sections 3 and 6. Conformance with the Lease is detailed in Section 2.
9) Certified Verification Agent nomination	See Section 1.3.
10) Reference information	See Section 7.
11) Decommissioning and Site Clearance Procedures	See Section 5.
12) Air quality information	See Section 6.8 and Appendix H.
13) A listing of all federal, state, and local authorizations or approvals required to conduct site assessment activities on your lease	See Table 2-1.

Table 2-3 Site Assessment Plan Requirements for Commercial Leases Pursuant to §§ 585.610(a) and (b), and 611(a) and (b)

Requirement	Compliance Statement – Location within the SAP
14) A list of agencies and persons with whom you have communicated, or with whom you will communicate, regarding potential impacts associated with your proposed activities	See Appendix A.
15) Financial assurance information	Activities and equipment proposed herein will be covered by an appropriate bond or other approved security.
§ 585.610(b)	
Geotechnical	
(i) A description of all relevant seabed and engineering data and information to allow for the design of the foundation for that facility	See Section 6.1, Appendix C.
Shallow Hazards	
(i) Shallow faults;	See Section 6.1.
(ii) Gas seeps or shallow gas;	See Section 6.1.
(iii) Slump blocks or slump sediments;	See Section 6.1.
(iv) Hydrates; or	See Section 6.1.
(v) Ice scour of seabed sediments.	See Section 6.1.
Archaeological Resources	
(i) A description of the results and data from the archaeological survey;	See Section 6.2, Appendix D.
(ii) A description of the historic and prehistoric archaeological resources, as required by the National Historic Preservation Act of 1966 (NHPA), as amended.	See Section 6.2, Appendix D.
Geological Survey.	
(i) Seismic activity at your proposed site;	See Section 6.1.
(ii) Fault zones;	See Section 6.1.
(iii) The possibility and effects of seabed subsidence; and	See Section 6.1.
(iv) The extent and geometry of faulting attenuation effects of geologic conditions near your site.	See Section 6.1.
Biological Survey	
(i) Live bottoms	See Sections 6.3 and 6.4.
(ii) Hard bottoms	See Sections 6.3 and 6.4.
(iii) Topographic features; and	See Sections 6.3 and 6.4.
(iv) Surveys of other marine resources such as fish populations (including migratory populations), marine mammals, sea turtles, and sea birds.	See Section 6.
§ 585.611(a) and (b) Requirements	
Hazard information	See Section 6.1.
Water quality	See Section 6.7.
Biological resources	
(i) Benthic communities	See Section 6.3.
(ii) Marine mammals	See Section 6.5.
(iii) Sea turtles	See Section 6.5.
(iv) Coastal and marine birds	See Section 6.6.
(v) Fish and shellfish	See Sections 6.3 and 6.4.
(vi) plankton and seagrasses, and	See Section 6.3.
(vii) plant life	See Section 6.3.
Threatened or endangered species	See Sections 6.5 and 6.6.

Table 2-3 Site Assessment Plan Requirements for Commercial Leases Pursuant to §§ 585.610(a) and (b), and 611(a) and (b)

Requirement	Compliance Statement – Location within the SAP
Sensitive biological resources or habitats	See Section 6.3.
Archaeological resources	See Section 6.2, Appendix D.
Socioeconomic resources	See Section 6.9
Coastal and marine uses	See Section 6.10
Consistency Certification	See Table 2-1.
Other Resources, conditions, and activities	None.

2.1 Project Equipment

This section describes the Metocean Equipment.

2.1.1 Equipment Proposed

WindSentinel™ Buoys

The WindSentinel™ Buoys will collect wind measurement data at multiple heights (range gates), which will be defined prior to deployment. The height of the middle range gate is typically equivalent to the hub height of the wind turbine generators that will be used for the Project. The remaining range gates collect wind measurement data from 33 feet (ft) (10 meter [m]) to 984 ft (300 m) above mean sea level. The WindSentinel™ Buoys will integrate both ZX 300M and WindCube™ Light Detection and Ranging (LiDARs) in a dual-LiDAR configuration. In the dual-LiDAR configuration, each LiDAR is supported by a fully redundant data management and device controller, independent access to the buoy's telemetry systems, and independent access to the system's power supply. Each LiDAR is capable of operating on a standalone basis, which reduces the risk of data loss if sensor failure were to occur. The WindSentinel ™ Buoys will include metocean sensors that record surface wind, barometric pressure, air temperature, relative humidity, wave conditions (significant wave height, maximum wave height, average direction, zero mean crossing period, peak period, and directional wave spectrum), ocean currents, and water temperature (Figure 2-1).

The WindSentinel™ Buoys will be housed in a Navy Oceanographic Meteorological Automatic Device (NOMAD). The NOMAD has a boat- shaped welded aluminum hull that measures 20 ft (6 m) long, 10.2 ft (3.1 m) wide, 29.5 ft (9 m) tall (15.7 ft [4.8 m] above the waterline and 13.8 ft [4.2 m] below the waterline) and weighs 17,857 pounds (lbs) (8,100 kilograms [kg]). The NOMAD hull was specifically developed as a metocean sensor platform and has been used extensively in this role. The NOMAD hull was originally designed in the 1940s for the U.S. Navy's offshore data collection program. The U.S. National Data Buoy Center later purchased surplus hulls, outfitted them with new payloads, and placed them in the U.S. network of permanent buoy stations with their 32.8 ft and 39.4 ft (10 m and 12 m) discus buoys. The hull ensures positive buoyancy through five individually pressure tested chambers: the four main system chambers and one at the bottom of the hull. The buoy is manufactured from marine grade aluminum, with corrosion protection measures such as cathodic protection using zincs.

The cabling for the WindSentinel™ Buoys is designed to an IP67 standard to provide protection from water ingress. The IP (Ingress Protection) rating system is a classification system showing the degree of protection from solid objects and fluids. The first number refers to protection against solids with values ranging from 0 (no protection) to 6 (total protection against dust). The second number refers to protection against immersion between 0.5 ft and 3.3 ft (0.15 m and 1 m) with values ranging from 0 (no protection) to 7 (protected against the effects of immersion). All external fasteners are manufactured from 316 grade stainless steel to prevent corrosion.

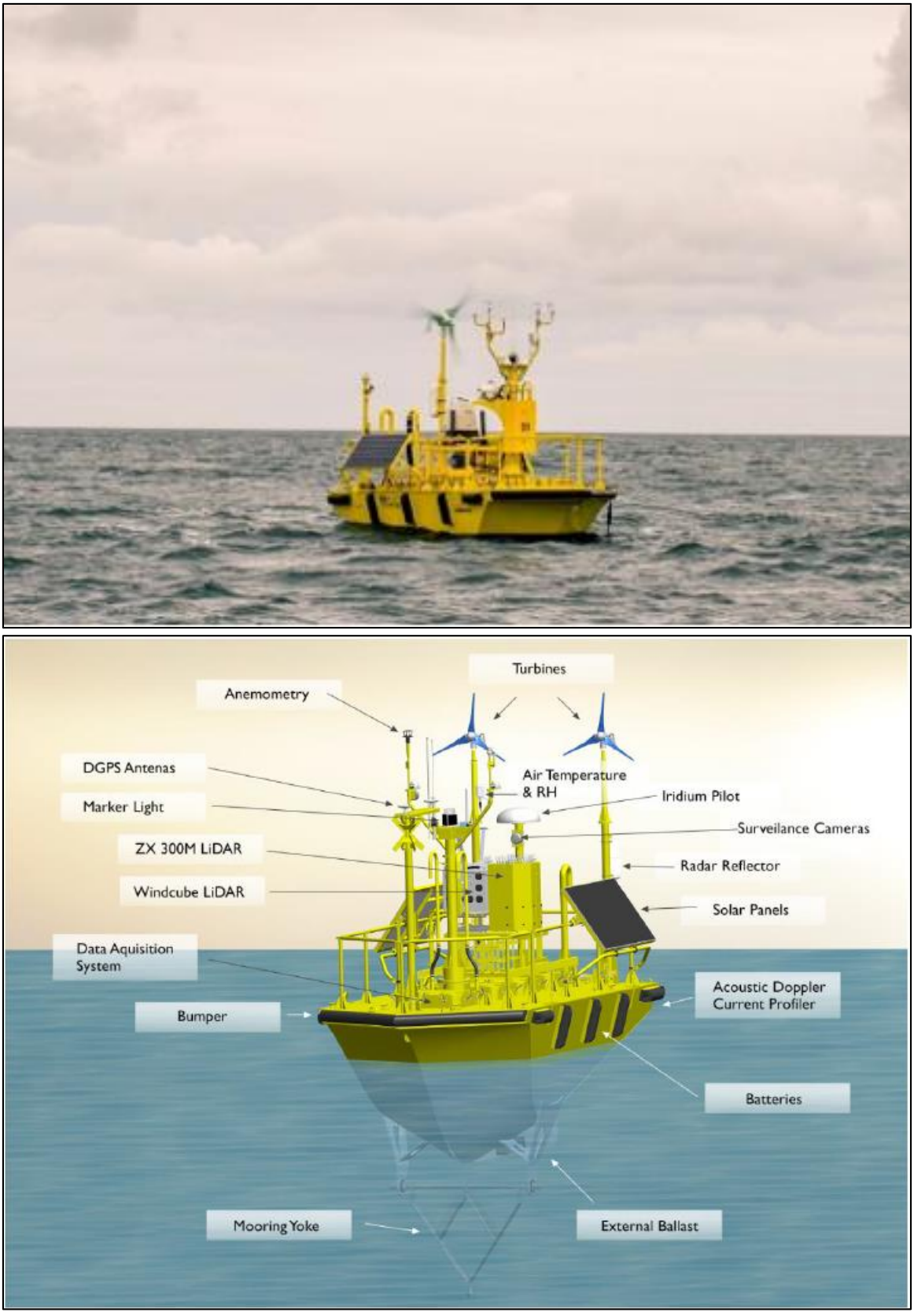

Figure 2-1 Typical AXYS WindSentinel™ Environmental Monitoring Buoy

TRBM Platforms

The TRBM Platforms will collect information on metocean conditions within the Lease Area via instrumentation housed within a Mooring Systems GP-TRBM frame. The Mooring Systems GP-TRBM frame is designed for the protection of oceanographic instrumentation and can support 661 lbs (300 kg), with an expected payload to be approximately 176 lbs (80 kg). The Mooring Systems GP-TRBM frame has a 1-inch (in) (25.4-millimeter [mm]) fiberglass base with a 3.8-inch (9.5-mm) urethane cover, an air weight of 132 lbs (60 kg), and an in-water weight of 50 lbs (23 kg). Oceanographic instrumentation, positioning equipment, and data collection and storage equipment housed within the Mooring Systems GP-TRBM frame will include:

- An EdgeTech PORT LF-ST Acoustic Transponder acoustic release;
- An EdgeTech PORT Pop-Up Recovery System;
- A JW Fisher SFP-1 extended housing acoustic locator;
- A NORTEK Signature 500 kHz acoustic Doppler current profiler; and
- A Wetlabs ECO-NTUS turbidity monitor.

Figure 2-2 TRBM Data Collection Platform

2.1.2 Mooring Design

WindSentinel™ Buoys

The WindSentinel™ Buoys will be moored to the seabed using a U-mooring design comprised of a series of studless open link chain connected with shackles attached to both a primary and secondary clump weight

anchor, as well as a marker buoy. The mooring has been designed to support a minimum of one year between service visits.

Moorings are constructed from compatible metals to ensure that no corrosion is caused by dissimilar materials. The chain mooring will be designed using mooring scopes of 1.7:1 for the marker buoy portion of the mooring and 3.5:1 for the WindSentinel™ Buoys (at 101 ft [30.8 m] water depth) (see Figure 2-3 below). Mooring scopes for BDAs 2 and 3 will be provided prior to deployment in those areas. The chain would be attached to the base of the hull via the steel mooring yoke. This system is designed to minimize the ability to loop, wrap, or be ingested by marine mammals or sea turtles.

AXYS, the manufacturer of the WindSentinel™ Buoys, has extensive experience in the mooring of NOMAD hulls, with over 20 hulls deployed over the last 25 years. AXYS moorings are designed and validated using a Woods Hole Oceanographic Institution cable and Proteus DS software. The modeling report is provided in Appendix B.

TRBM Platforms

The TRBM Platforms will rest on the seabed and be moored to a cast iron sinker and marker buoy using a series of open link chain connected with shackles. The mooring has been designed to support a minimum of one year between service visits.

Moorings are constructed from compatible metals to ensure that no corrosion is caused by dissimilar materials. The mooring will be designed using a 1.7:1 (at 101 ft [30.8 m] water depth) mooring scope. Mooring scopes for BDA2 and BDA3 will be provided prior to deployment in those areas. The mooring would be attached via a shackle connected to a bridle on the TRBM frames. This system is designed to minimize the ability to loop, wrap, or be ingested by marine mammals or sea turtles.

2.1.3 Bottom Disturbance

WindSentinel™ Buoys

Bottom disturbing activities associated with the FLiDAR buoys will come from the cast iron sinkers and chains associated with the U-mooring design. The two cast iron sinkers would weigh 2.8 tons (2,500.0 kg) and 5.5 tons (5,000.0 kg), and would rest on the seafloor for an area of 15.1 ft^2 (1.4 m^2) and 26.9 ft^2 (2.5 m^2), respectively. The anchor chain sweep areas associated with the operation of the WindSentinel™ Buoys in BDA1, BDA2, and BDA3, including chain sweep (which is inclusive of the sinker areas) and 1-inch (25-mm)-wide chain resting on the seafloor outside of sweep areas, is anticipated to be approximately 5.01 acres (2.03 hectares), 4.18 acres (1.69 hectares), and 3.95 acres (1.60 hectares), respectively (see Appendix B). Vertical penetration of the 2.8 ton (2,500 kg) and 5.5 ton (5,000 kg) cast iron sinkers into the seabed is anticipated to be approximately 3.3 to 6.6 ft (1 m to 2 m) and 6.6 ft to 9.9 ft (2 m to 3 m), respectively.

TRBM Platforms

Bottom disturbing activities associated with the TRBM Platforms include the TRBM frame, cast iron sinker and chains associated with marker buoy mooring design. The TRBM Platforms and cast iron sinker will weigh 0.2 tons (150 kg) and 1.7 tons (1,500 kg), respectively. The seafloor footprint associated with the operation of the TRBM Platforms in BDA1, BDA2, and BDA3, including chain sweep (which is inclusive of sinker area), 0.63-inch (16-mm)-wide chain 0.41 acres (0.17 hectares), 0.23 acres (0.09 hectares), and 0.19 acres (0.08 hectares), respectively (see Appendix B). Vertical penetration of each 0.2 ton (150 kg) TRBM Platforms and 1.7 ton (1500 kg) cast iron sinker into the seabed is anticipated to be approximately 0.5 ft to 1 ft (0.2 m to 0.3 m) and 1.6 ft to 3.3 ft (0.5 m to 1 m), respectively.

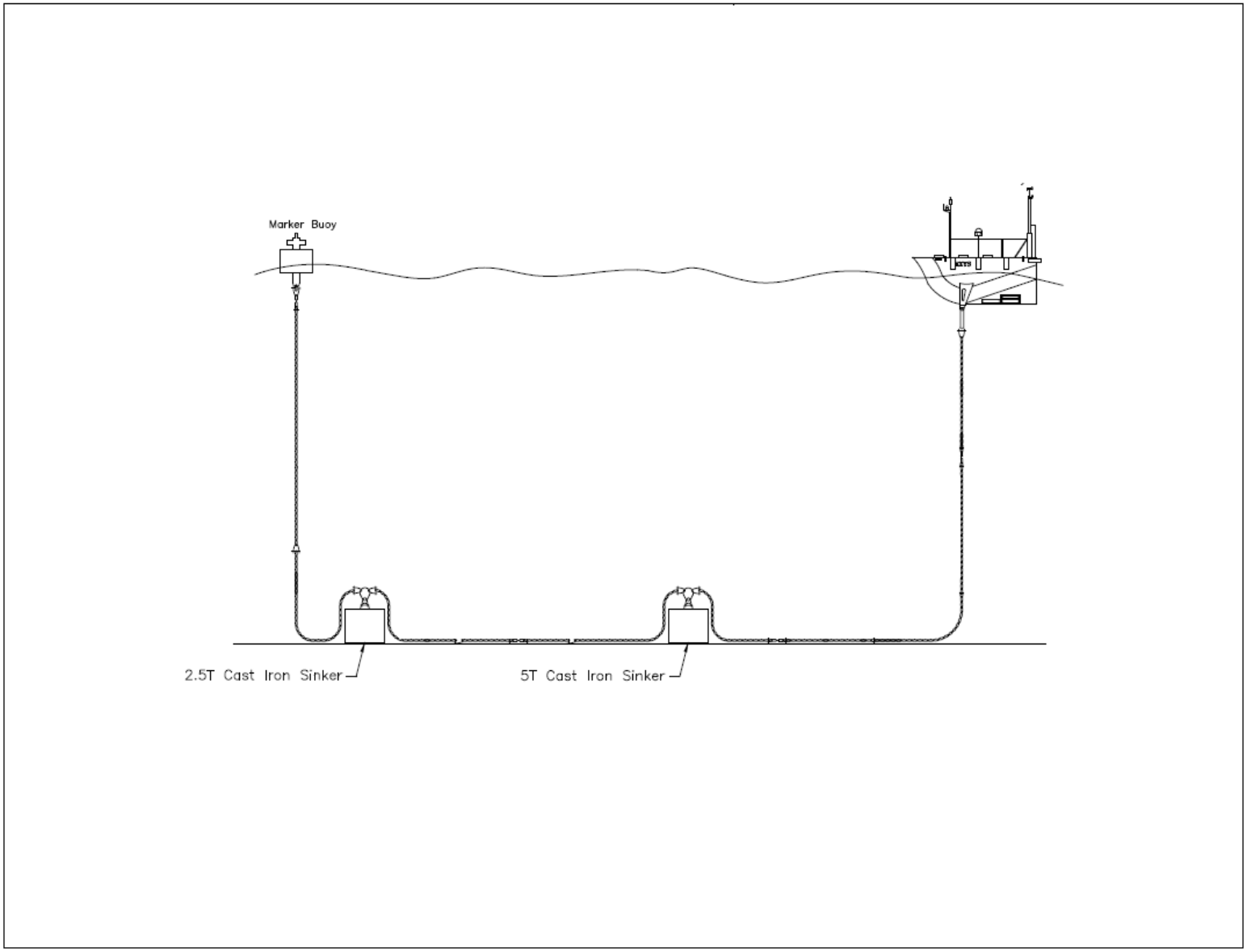

Figure 2-3 Typical FLiDAR WindSentinel™ Mooring Design

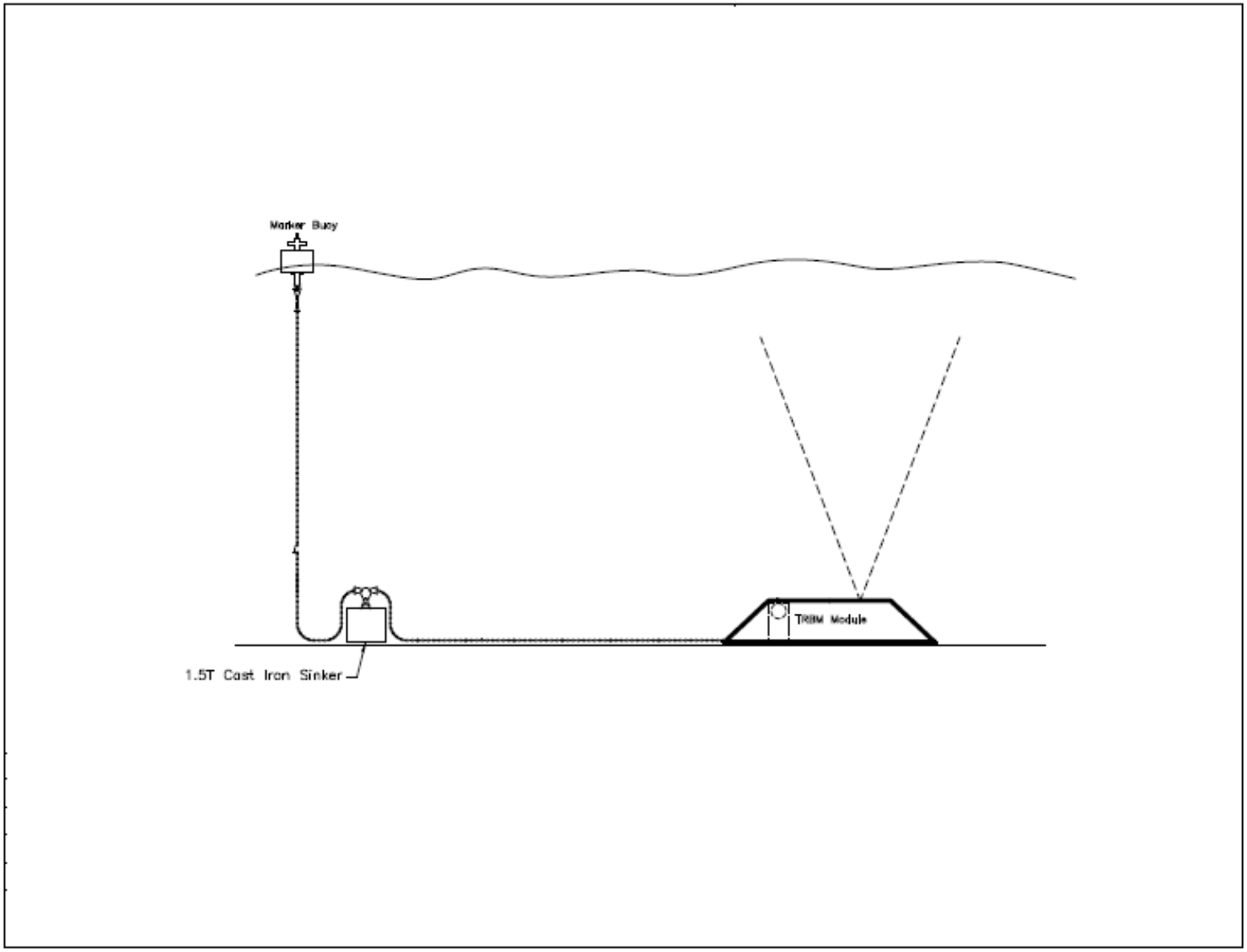

Figure 2-4 Typical TRBM Platform Design

2.2 Schedule

It is currently anticipated that the Metocean Equipment will be deployed no earlier than January 2020, but as soon as all authorizations are in place thereafter. The Company anticipates that the Metocean Equipment will remain in place for at least two years. The Company may request that the Metocean Equipment remain in place for an additional year if it is determined that additional data is necessary to inform development of the Lease Area. The Metocean Equipment will then be decommissioned as described in Section 5.

2.3 Site Location

Installation, operation, and decommissioning of the Metocean Equipment is proposed to be staged out of Avalon, New Jersey. Installation vessels will launch from the Avalon Marine Center in Avalon, New Jersey. The Metocean Equipment will be deployed within the targeted BDAs at the coordinates listed in Table 2-4. Each BDA has been given a unique identifier as shown in Table 2-4. The Company intends to deploy Metocean Equipment within BDA1 in January 2020. After one year of data collection, the company may elect to relocate the Metocean Equipment from the BDA1 Installation Location to the BDA2 or BDA3 Installation Locations. Site assessment surveys, benthic analysis (Section 6.3 and Appendix E), and marine archaeological assessments (Section 6.2 and Appendix D) were performed in all three installation locations. Air emissions calculations (Section 6.8 and Appendix H) were prepared to account for deploying Metocean Equipment in BDA1.

Table 2-4 Location of the Metocean Equipment

Platform	Northing	Easting	NAVD88 Water Depth (MLLW)	OCS Lease Block	Aliquot
WindSentinel™ Buoy (BDA1)	479157.05	4029598.92	101 ft (30.8 m)	6666	K
WindSentinel™ Buoy (BDA2)	490961.23	4023633.35	120.4 ft (36.7 m)	6719	I
WindSentinel™ Buoy (BDA3)	494923.29	4012384.80	126 ft (38.4 m)	6869	D

3 Deployment and Installation

3.1 Overview of Deployment and Installation Activities

The Company will notify BOEM, United States Fleet Forces N46, the United States Army Corps of Engineers, and the United States Coast Guard (USCG) prior to deploying the Metocean Equipment. Written notice via email will be provided to the appropriate point of contact at Fleet Forces Command prior to mobilization in order to avoid potential conflicts with military operations. The Company will update Fleet Forces Command on the installation schedule following approval of the SAP and detailed planning.

The Company will notify mariners, fishermen, and other users of the area by submitting a request to the USCG for publication of a Local Notice to Mariners (LNM) at least two weeks prior to the start of the in-water work. This notice will include the contact names for the installation vessel, local fisheries liaison officer, channels of communication, and the duration of the work. The LNM will be published to the USCG Navigation Center website by the USCG prior to and during planned installation work. Copies of all USCG communications will be provided to BOEM as required. Additionally, in accordance with standard maritime practices, the vessel captain(s) will broadcast via VHF radio on Marine Channel 16 notification of their position and limited mobility during installation activities. The broadcast will describe what their work plan will be as a courtesy to other mariners in the area (commercial fishermen, bulk shippers, tug and barge crews, military vessels, etc.). Any follow-up questions will be directed to a different, public frequency of the vessel captain's choice. In addition to the LNM, the Fisheries Liaison Officer will continue efforts to directly engage with the fishing communities before and during deployment and installation activities.

The Company will submit an application to the USCG for a Private Aids to Navigation (PATON) for the Metocean Equipment (see Table 2-1), which will be submitted to BOEM upon approval prior to buoy deployment.

Within 30 days of completing the installation of the Metocean Equipment, the Company will prepare an Installation Report for submission to BOEM to fulfil the requirements of 30 CFR § 585.615(a). This report will include a description of the equipment and the installation procedure, including final coordinates of the installation site, photo documentation of the equipment deployed, the results of all commissioning tests, the plans and schedule for upcoming inspections and maintenance, and any noted problems or issues to be addressed.

The Company will provide written notification to BOEM and the Department of Defense of any proposal to add new sensors to the Metocean Equipment. The Company will include the technical specifications (manufacturer, model, spectrum requirements, etc.) for any proposed new sensors in the notification. The notification will be provided to the contacts listed in the Lease, or updated contact information as provided by BOEM.

3.1.1 Metocean Equipment Deployment

Installation of each WindSentinel™ Buoy and TRBM Platform is anticipated to take approximately one week using a vessel deployed from Avalon, New Jersey. The WindSentinel™ Buoy and TRBM mooring system will be assembled flaked out on the work deck. The TRBM Platform will be fastened to the work deck and the WindSentinel™ Buoy will be towed behind the vessel for transport to BDA1 (see Figure 1-1). The WindSentinel™ Buoy mooring system will be deployed using an A-frame derrick, and a temporary buoy will hold the upper end of the mooring at the sea surface as it is prepared for connection to the WindSentinel™ Buoy. The WindSentinel™ Buoy will then be connected to the mooring system and the temporary buoy will be recovered.

Following deployment of the WindSentinel™ Buoy, an acoustic release will be connected to the bridle on the TRBM Platform, and the TRBM Platform and sinker will each be lowered to the seabed using an A-frame derrick. When the TRBM Platform and sinker are on the seabed, the acoustic release will release the winch wire and the wire and acoustic release will be recovered to deck. When there is approximately 10 ft (3 m) of the mooring chain left on deck, the marker buoy will be pushed over the stern of the vessel. No vessel anchoring will take place during installation. It is expected that installation of the WindSentinel™ Buoy and TRBM Platform can be accomplished in 7 days.

3.2 Vessels

The Company will employ AXYS to transport and deploy the Metocean Equipment. The deployment of the Metocean Equipment will require the support of a single offshore utility vessel. The vessel used will be the NorthStar 4 offshore utility vessel, or similar. The vessel will be approximately 49 ft (15 m) in length, with a 14 ft (4 m) beam and 3 ft (1 m) draft. See Appendix G for vessel specifications.

3.3 Pre-Installation Briefing

All personnel will attend a pre-installation briefing as required by Lease stipulation 5.1.1. The pre-installation briefing will be performed prior to departure from the AXYS office in Avalon, New Jersey, and again, on the vessel prior to the installation of the Metocean Equipment. The pre-installation briefing will include a Tool-Box Talk, health, safety, and environmental (HSE) and hazard identification presentations, commitments made in this SAP, as well as reporting requirements and Lease stipulations that are relevant to site assessment activities. The purpose of this briefing will be to review the HSE requirements and associated emergency response requirements for the proposed work, identify the responsibilities of each person, define the chain of command, discuss communication procedures, and provide an overview of planned

installation activities. Additional topics for the briefing will include protected species avoidance, marine trash and debris awareness, and oil spill response procedures.

The Company onsite representative will be aboard the offshore utility vessel during installation and deployment activities, and will have the authority to stop or delay any of the activities if deemed necessary. Examples of circumstances that would warrant the stop or delay of work include the sighting of a North Atlantic right whale within 1,640 ft (500 m) of the vessel (per Lease stipulations, as documented in Table 3-1), or unsafe work conditions (per Appendix F). If a change in personnel is required during installation activities, the new personnel will be briefed prior to joining the work in progress.

3.4 Protected Species Avoidance

All whales, dolphins, and porpoises in the Mid-Atlantic are federally protected by the Marine Mammal Protection Act of 1972 (MMPA). In addition, many large whales in the area, as well as sea turtles, are further protected under the Endangered Species Act of 1973 (ESA).

The Lease contains specific stipulations that must be followed to minimize risk to marine species. Installation of the Metocean Equipment will not require pile driving; accordingly, mitigations to reduce adverse impacts on protected species from pile driving do not apply to this installation. The Company will ensure the Lease stipulations summarized in Table 3-1 are adhered to during the installation, operation, maintenance, and decommissioning of the Metocean Equipment.

Table 3-1 Standard Operating Conditions in the Lease Area, as Contained in ADDENDUM "C" to the Lease

Lease OCS-A 0508, ADDENDUM "C" Stipulation	Vessel Operations Conditions
5.2 Vessel Strike Avoidance Measures	
5.2.1	The Lessee must ensure that vessels conducting activity in support of a plan submittal, including those transiting to and from local ports and the Lease Area, comply with the vessel-strike avoidance measures specified in stipulation 5.2, except under extraordinary circumstances where complying with these requirements would put the safety of the vessel or crew at risk.
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.
5.2.3	The Lessee must ensure that vessels 65 ft (19.8 m) in length or greater, operating from November 1 through April 30, operate at speeds of 10 nautical miles per hour (knots, 18.5 km/hr) or less.
5.2.4	The Lessee must ensure that vessels operating in any mid-Atlantic Seasonal Management Area from November 1 through April 30, operate at speeds of 10 knots (18.5 km/hr) or less.
5.2.5	The Lessee must ensure that all vessel operators comply with 10 knot (18.5 km/hr) speed restrictions in any Dynamic Management Area.
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 1,640 ft (500 m) or greater from any sighted North Atlantic right whale.
5.2.7.2	The Lessee must ensure that the following avoidance measures are taken if a vessel comes within 1,640 ft (500 m) of any North Atlantic right whale:

Table 3-1 Standard Operating Conditions in the Lease Area, as Contained in ADDENDUM "C" to the Lease

Lease OCS-A 0508, ADDENDUM "C" Stipulation	Vessel Operations Conditions
5.2.7.2.1	If underway, vessels must steer a course away from any sighted North Atlantic right whale at 10 knots (18.5 km/hr) or less until the 1,640 ft (500 m) minimum separation distance has been established, except as provided in stipulation 5.2.7.2.2).
5.2.7.2.2	If a North Atlantic right whale is sighted within 328 ft (100 m) 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 of the vessel's path and beyond 328 ft (100 m), 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 328 ft (100 m), at which point the Lessee must comply with 5.2.7.2.1.
5.2.8 Non-delphinoid cetaceans (whales) other than the North Atlantic Right Whale	
5.2.8.1	The Lessee must ensure all vessels maintain a separation distance of 328 ft (100 m) or greater from any sighted non-delphinoid cetacean.
5.2.8.2	The Lessee must ensure that all vessel operators reduce vessel speed to 10 knots (18.5 km/hr) or less when mother/calf pairs, pods, or large assemblages of non-delphinoid cetaceans are observed near an underway vessel.
5.2.8.3	The Lessee must ensure that the following avoidance measures are taken if a vessel comes within 328 ft (100 m) of any non-delphinoid cetacean:
5.2.8.3.1	If underway, the vessel 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 328 ft (100 m).
5.2.8.3.2	If a vessel is stationary, the vessel will not engage engines until the sighted non-delphinoid cetacean has moved out of the vessel's path and beyond 328 ft (100 m).
5.2.9 Delphinoid Cetaceans and Pinnipeds (dolphins, porpoises, and seals)	
5.2.9.1	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 164 ft (50 m) 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.
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 Sea Turtles	
5.2.10.1	The Lessee must ensure all vessels maintain a separation distance of 164 ft (50 m) or greater from any sighted sea turtle.

3.5 Reporting

During all phases of marine activities, sightings of any injured or dead protected species (sea turtles and marine mammals) will be reported within 24 hours, regardless of whether the injury or death was caused by a Project related vessel, as specified in Stipulation 5.5.3 of the Lease. All marine activities will be suspended immediately, and the circumstances reported if a dead or injured protected species is found in any of the BDAs as specified below. The Lease stipulations summarized in Table 3-2 will be adhered to by the Company.

Table 3-2 Protected Species Reporting Requirements in the Lease Area, as Contained in ADDENDUM "C" to the Lease

Lease OCS-A 0508, ADDENDUM "C" Stipulation	Lease Requirement
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, NMFS and the NMFS 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 NMFS.
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 NMFS Southeast Regional Stranding Coordinator within 48 hours (305-361-4586; blair.mase@noaa.gov).
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".

3.5.1 Avian and Bat Protection

The Company will provide an annual report to BOEM and the U.S. Fish and Wildlife Service (USFWS) using the contact information listed in the Lease, or updated contact information as provided by BOEM, by January 31 of each year that the Metocean Equipment is deployed. This report will document dead or injured birds or bats found on vessels and the Metocean Equipment during installation, operations, maintenance, and decommissioning. Each report will contain the following information: the name of species, date found, location, a picture to confirm species identity (if possible), and any other relevant information. In addition to submitting the annual report, the Company will report carcasses with Federal or research bands to the United States Geological Survey Bird Band Laboratory within 30 calendar days of discovery using the following website: https://www.pwrc.usgs.gov/bbl/, or updated contact information as provided by BOEM.

3.5.2 Marine Trash and Debris Awareness and Elimination

The Company will comply with, and ensure that all employees and contractors are briefed on, marine trash and debris awareness elimination, as required in ADDENDUM "C", Section 5.1.4 of the Lease and as described in the Bureau of Safety and Environmental Enforcement Notice to Lessees and Operators (NTL) No. 2015-G03 or any NTL that supersedes NTL 2015-G03.

3.5.3 Oil Spill Response

The WindSentinel™ Buoys will utilize an Oorja Direct Methanol Fuel Cell as its back up power source that does not contain oil; therefore, Oil Spill Response Measures are not required.

3.5.4 Health, Safety, and Environmental Management

AXYS will implement an HSE Plan (See Appendix F) to ensure the health and safety of all personnel involved in the installation, operation, maintenance, and decommissioning of the Metocean Equipment. The Project-specific plan will be prepared in accordance with standard corporate HSE policies and procedures. The HSE Plan will also address emergency response and reporting requirements.

4 Operations and Maintenance

4.1 Data Collection and Operations for Wind and Metocean Data

The WindSentinel™ Buoys include the WatchMan500™, which will transmit performance information to AXYS on a daily basis. Parameters to be monitored include battery levels, charging system output, and buoy position. Continuous evaluation of these indicators will allow the Company to immediately detect any system discrepancies so that a response may quickly be initiated.

The WindSentinel™ Buoys are equipped with a location warning system should the mooring fail. The onboard system uses buoy coordinates and the Global Positioning System receiver to determine whether the buoy is within a predefined area (watch circle). Should the WindSentinel™ Buoy drift out of the watch circle, a satellite transmitter is activated, and location messages are transmitted, enabling the tracking of the buoy until recovered.

Data collected by the TRBM Platforms will be stored by data loggers inside each instrument. Raw data files will be retrieved during quarterly maintenance intervals, and raw data and averaged data files will be stored onboard the maintenance vessel for transport back to shore.

4.2 Maintenance Activities

The WindSentinel™ Buoys will be brought to shore annually for maintenance. The buoy platform will be disconnected and towed to shore or a full service of the structure and systems. The mooring systems will remain in place and be marked with marker buoys during this brief hiatus. The service will include cleaning bio-fouling from the buoy and assessment of all mooring hardware, replacing shackles and other components as needed. Maintenance of the WindSentinel™ Buoys will be performed using the NorthStar 4 (or similar vessel) from Avalon, New Jersey (see Appendix G for specifications). In water maintenance of the WindSentinel™ and TRBM Platforms will be performed quarterly during retrieval of the data from the TRBM Platforms. The TRBM platform will be recovered to the vessel deck where the data will be downloaded, and any necessary repairs will be made before redeployment. Final selection of the vessel(s) will be dictated by weather, crew, and availability.

In the event that the Company elects to move the Metocean Equipment, or deploy a second set of Metocean Equipment, it will be deployed to one of the other approved alternative Buoy Deployment Areas (BDA2 or BDA3) following routine annual maintenance.

4.3 Reporting

Per Lease stipulation 2.2.1, the Company will continue to submit a semi-annual progress report to BOEM every six months for the duration of the site assessment term. The semi-annual progress report will provide a brief narrative of overall progress since the previous semi-annual progress report (or since the effective date for the first semi-annual progress report). The progress report will include updated survey plans to account for modifications in schedule, as necessary.

Pursuant to 30 CFR § 585, BOEM may require a Self-Inspection Report, an Annual Report, and a Certification of Compliance. The Company requests a departure from this request and proposes to submit a Site Assessment Activities Report which would include a combination of the Self-Inspection Report, an Annual Report, and a Certification of Compliance. The Company would submit the Site Assessment Activities Report to BOEM no later than November 1 of each year for the duration of the site assessment term. See Table 4-1 for a description of the contents of the Site Assessment Activities report and the associated regulatory citation.

Table 4-1 Reporting Requirements

Report Name	Content	Regulatory Citation
Self-Inspection Report	The Self-Inspection Report will be based on the comprehensive Self-Inspection Plan that The Company will develop pursuant to 30 CFR § 585.824(a).	30 CFR § 585.824(b)
Annual Report	The Annual Report will provide a summary of site assessment activities and the results of those activities.	30 CFR § 585.615(b)
Certification of Compliance	Together with the certification, the Company will submit: • Summary reports that demonstrate compliance with the terms and conditions that require certification; and • A statement identifying and describing any mitigation measures and monitoring methods that have been taken, as well as their effectiveness. If the Company identifies measures that are not effective, we will make recommendations for substitute mitigations measures and monitoring methods, and explain why we believe they would be effective.	30 CFR § 585.615l

5 Decommissioning and Site Clearance

BOEM requires decommissioning of facilities described in the SAP in accordance with 30 CFR § 585.901. The Company will submit a decommissioning application to BOEM as required by 30 CFR § 585.902(b) prior to decommissioning of the Metocean Equipment. Following BOEM approval of the decommissioning application, the Company will submit a decommissioning notice to BOEM at least 60 days prior to vessel deployment as required by 30 CFR § 585.90(a).

5.1 Overview of Decommissioning Activities

Upon completion of SAP activities, the Metocean Equipment will be decommissioned. The decommissioning process will be similar to the installation process but in reverse. A suitable vessel similar to that used for the installation of the Metocean Equipment would be used for decommissioning. The work vessel would position itself on-site, attach the chain to the crane or A-frame, and recover the mooring to the deck. The buoy would then be detached from the mooring, attached to the work vessel, and towed off site. The same process would be used if the Company elects to relocate the Metocean Equipment to a different BDA.

5.2 Site Clearance

The operation of the Metocean Equipment is not expected to result in any trash or bottom debris. However, the Company will ensure that the seafloor has been cleared of all obstructions created by activities in the BDAs as required in 30 CFR § 585.902(a)(2). This will be accomplished via photo documentation of all deployed and retrieved equipment. As stated in Section 3.1, the Company will provide an Installation Report that will contain the final coordinates and photo documentation of the equipment that was deployed. At the completion of decommissioning, similar documentation will be provided to BOEM with the Decommissioning Report to confirm that all equipment was retrieved from the site.

5.3 Reporting

As specified in the Lease, ADDENDUM "C", Section 2.2.1, the Company will continue to submit semi-annual progress reports to BOEM throughout the duration of the site assessment term. At the conclusion of the site assessment activities a Decommissioning Report will be prepared and provided to BOEM within 60

days of decommissioning in accordance with 30 CFR §§ 585.900-913. This report will include a description of the process and equipment used for decommissioning the Metocean Equipment and confirmation of site clearance.

6 Affected Environment, Potential Impacts, and Mitigation Measures

The following sections describe the affected environment, impacts and proposed mitigation measures for benthic resources, archaeological resources, and geophysical conditions which have been developed through site specific surveys and analysis that were conducted in July and August 2019 in support of the SAP. As part of this analysis, the Company reviewed currently available literature and data regarding resources in the Mid-Atlantic off the coast of North Carolina to determine consistency with the NC EA and FONSI. Site specific surveys and analysis followed a detailed SAP Survey Plan which included protocols, methods, and/or used data that represented industry techniques and knowledge at the time of the study. The SAP Survey Plan, detailing the SAP survey approach, timing, type of surveys, and reporting, was accepted by BOEM on June 4, 2019 (see Appendix A).

The analysis focuses on the maximum area of potential disturbance associated with the installation, operation, and decommissioning of the Metocean Equipment (site assessment activities): approximately 984 ft x 984 ft (300 m x 300 m) for each BDA (SAP Survey Area). The site-specific geophysical survey activities included the SAP Survey Area plus a 328 ft (100 m) buffer, resulting in an approximately 1,312 ft by 1,312 ft (400 m by 400 m) area for each BDA, identified as the Geophysical Survey Area.

As stated in Section 2.3, the three BDAs where the Metocean Equipment are proposed to be located have been given unique identifiers. The coordinates for these locations are provided in Table 2-4 and depicted on Figure 1-1.

6.1 Geological Conditions

The following section summarizes results of the high resolution geophysical (HRG) survey that was conducted in July and August 2019. The survey was conducted in accordance with the SAP Survey Plan, as approved by BOEM on June 4, 2019. The full site characterization report is provided as Appendix C.

The HRG survey and sampling program involved acquisition of the following data:

- **Multibeam echosounder bathymetry (MBES)** – acoustic swath mapping to determine water depths and topographic features on the seabed and initial review of surficial sediment;
- **Side scan sonar (SSS) imagery** – acoustic seabed imagery used to map surficial sediment distributions and bedforms, as well as detect possible natural and anthropogenic hazards on the seabed such as boulders, debris, and shipwrecks;
- **Sub-bottom profiler (SBP)** – acoustic reflection profiling subsurface investigation using a medium parametric sub-bottom profiler system to investigate shallow (up to 33 ft [10 m]) sediment stratigraphy at a high resolution;
- **Gradiometer** – magnetic field anomaly mapping to detect ferrous items on the seabed that could be potential hazards or cultural deposits, included debris and shipwrecks;
- **Sediment grab samples** – acquisition of physical samples of the surficial seabed to ground-truth interpretation of the geophysical data; and
- **Underwater imagery** – visual imagery of the seabed collected using a remotely operated camera to identify natural and human-caused obstructions, as well as aid in benthic habitat assessment.

Data from the HRG and sampling program, along with information from publicly-available databases, were compiled and reviewed to describe the surface and subsurface geologic conditions in the 1,312 ft by 1,312 ft (400 m by 400 m) Geophysical Survey Areas. Table 6-1 summarizes the seafloor and sub-seafloor hazards identified within these areas.

Table 6-1 Seafloor and Sub-Seafloor Hazards Identified within the Geophysical Survey Areas

Hazard	Definition	Identification and Description
Seafloor		
Scarp	An exposed face of soil above the head of a landslide.	None present in the bathymetry dataset.
Channels	The deepest portion of a body of water through which the main volume or current of water flows.	Shallow channel, oriented northeast to southwest, is located along the western side of approximately 1 m (3 ft) relief the ridge identified in Geophysical Survey Area 2. This is likely a relic feature related to sea level transgression across the area and flow constrained by the associated ridge, and not a channel experiencing any modern flow.
Ridges	A relatively narrow elevation which is prominent on account of steep angle at which it rises.	A minor (1-m [3-ft]) relief ridge of unconsolidated sediment is oriented northeast to southwest in Geophysical Survey Area 2.
Bedforms	Features that develop due to the movement of sediment by the interaction of flowing water; critical angle and forces required for movement are dependent upon many factors.	Minor bedforms (ripple-scale features, less them 5 m [16 ft] in wavelength and 1 m [3 ft] in height) are observed in Geophysical Survey Area 2 and Geophysical Survey Area 3 and are not anticipated to result in any impact to Metocean Equipment deployment, operations, or recovery.
Exposed Rocky Area	Surface expression of bedrock outcropping on seafloor.	No rocky areas are observed outcropping the seabed in Geophysical Survey Area 1, 2, or 3. Exposed underlying strata is observed in Geophysical Survey Area 2 and the minor seabed features in Geophysical Survey Area 3, but these layers are anticipated to be non-lithified, unconsolidated sediment, but may be more cohesive or slightly compacted leading to a slightly different seabed character in the bathymetry and

Table 6-1 Seafloor and Sub-Seafloor Hazards Identified within the Geophysical Survey Areas

Hazard	Definition	Identification and Description
		side-scan datasets. No impacts to Metocean Equipment deployment, operations, or recovery are anticipated.
Boulders	Glacial erratics (boulders) greater than 12 inches in diameter; outcropping coarse till/drift or lag deposit.	No boulders are identified within Geophysical Survey Areas 1, 2, and 3. Side-scan sonar contacts in Geophysical Survey Areas 1, 2, and 3 are classified as debris. Due to geographical location, these contacts are unlikely to be glacial erratics, but some may be geological in nature while others most likely represent man-made debris.
Buried Boulders	Glacial erratics (boulders) greater than 12 inches in diameter; subsurface coarse till/drift or lag deposits.	Some minor amplitude anomalies were observed in the sub-bottom profiler (SBP) data. However, these have not been interpreted as boulders. Due to geographical location, these contacts are unlikely to be glacial erratics,
Pock Marks / Depressions	Craters in the seabed caused by fluids (gas and liquids) erupting /streaming through the seabed sediments.	Multiple small seabed depressions (less than 0.2 m [0.7 ft] relief) are identified in the Geophysical Survey Areas 1, 2, and 3. Some depressions may be associated with scour related to debris of other objects on seabed in the presence of minor seabed currents. No evidence of fluid or gas flow were identified at these locations in the HRG datasets. Not anticipated to pose a risk to the Metocean Equipment deployment, operation, or recovery.
Seabed Scars / Ice Scour / Drag Marks	Incisions or cuts into the seafloor may be associated with glacial advances/retreats or bottom fishing activity.	Possible anthropogenic drag scar identified in Geophysical Survey Area 2. Potentially related to anchoring or fishing.
Buried Channels	Former fluvial drainage pathways during sea level low stands, usually only deepest portion of the waterway in-filled and preserved. Mark ancestral patterns of glacier meltwater runoff or river outflow.	Shallow partially-infilled channel, oriented northeast to southwest, located along the western side of the low-relief ridge in Geophysical Survey Area 2. Buried paleochannel in Geophysical Survey Area 2. Not anticipated to pose a risk to the Metocean Equipment

Table 6-1 Seafloor and Sub-Seafloor Hazards Identified within the Geophysical Survey Areas

Hazard	Definition	Identification and Description
		deployment, operation, or recovery.
Submarine Canyons	Steep-sided valley cut into the seafloor of the continental slope, sometimes extending well onto the continental shelf.	None present in the bathymetry data nor expected due to the location on the continental shelf.
River Channel	Outline of a path of relatively shallow and narrow body of fluid.	No evidence of these features was observed in the HRG datasets. The buried channel in the Geophysical Survey Area 2 is likely to have been related to tidal currents rather than river flow during a time of lower sea level.
Exposed Hardbottom Surfaces	Any semi-lithified to solid rock strata exposed at the seafloor; in this area, may include bedrock or a nearly continuous pavement of fragmented rock or boulders.	None present in the bathymetry, SSS, or SBP data. Slightly more cohesive strata may outcrop at the escarpment identified in Geophysical Survey Area 2 and throughout Geophysical Survey Area 3, but these strata are unconsolidated sediment and not rocky hardgrounds.
Shallow Gas	Subsurface concentration of material in gaseous form that has accumulated by the process of decomposition of carbon-based materials (former living organisms).	Potential of subsurface gas detection in Geophysical Survey Area 1 due to attenuated SBP amplitudes in strata 2-4 m (7-13 ft) or deeper below the seabed. Gas-containing sediment strata are not interpreted as high-pressure nor expansive. No risk to the Metocean Equipment deployment, operation, or recovery is anticipated.
Gas Hydrates	Subsurface gas deposits that were formed at or near the seafloor in association with hydrocarbon seeps.	None present in the SBP data as no bottom simulating reflectors nor significant amplitude anomalies were identified.
Gas/Fluid Expulsion Features	Upward movement of gas/fluid via low resistance pathways through sediments onto the seafloor; may be related to other hazards diapirs, faults, shallow water flows).	No evidence present in the SBP, SSS, or MBES data of fluid migration nor expulsion.
Diapiric Structure Expressions	The extrusion of more mobile and ductile-deformable material forced onto the seafloor from pressure below.	No diapiric structures present in the SBP, SSS, or MBES data.
Karst Areas	Landscape formed from the dissolution of soluble rocks.	Not applicable due to unsuitable regional geology for the development of karst features. No evidence of voids or dissolution identified in the HRG datasets.

Table 6-1 Seafloor and Sub-Seafloor Hazards Identified within the Geophysical Survey Areas

Hazard	Definition	Identification and Description
Faults, Faulting Expression, Fault Activity	Physiographic feature (surface expression) related to a fracture, fault, or fracture zone along which there has been displacement of the sides relative to one another.	No vertically displaced strata are evident in the SBP dataset. No surficial fault expressions were identified on the seabed in the MBES or SSS datasets. This is consistent with the passive margin environment of the sites.
Slumping, Sliding Seafloor Features	Large scale structures that result from the downslope movement of sediments due to instability and gravity. In the submarine environment these structures are often found in slope environments along coastal margins.	No evidence of scarps, slides, or slumps present in the SBP, SSS, or MBES data.
Steep/Unstable Seafloor Slopes	Large scale feature/stretch of ground forming a natural or artificial incline, with a slope that approaches the angle of repose (maximum angle at which the material remains stable).	None present in the SBP, SSS, or MBES data. Localized seafloor slopes are steepest (isolated maximum of less than 10°) at the 1-m (3-ft) ridge identified in Geophysical Survey Area 2, but no evidence of seabed movement is identified.
Scour/Erosion Features	Erosion of material due to water flow. Often associated with erosion adjacent to larger natural and man-made structures.	Minor depressions potentially related to scour at areas of steeper slopes (the 1-m [3-ft] ridge in Geophysical Survey Area 2) and individual larger seabed point features in the Geophysical Survey Areas 1, 2, and 3. This is indicative of minor seabed scour potentially related to minor or intermittent seabed currents. No risk to the Metocean Equipment deployment, operation, or recovery is anticipated.
Sensitive Benthic Habitats (chemosynthetic communities, submerged aquatic vegetation)	Shallow water habitats of submerged aquatic vegetation including macroalgae and sea grasses.	None identified in the bathymetry, SSS, or SBP datasets.
Manmade Features	Anthropogenic debris caused by offshore activities.	Several elongated (Geophysical Survey Areas 1, 2, and 3), rectangular (Geophysical Survey Areas 1, 2, and 3) and triangular (Geophysical Survey Area 2) debris that indicate possible manmade features. Most debris measured smaller than 1 m by 1 m (3 ft x 3 ft) in the sidescan, and no debris items were identified with significant height above the seabed (i.e., all were

Table 6-1 Seafloor and Sub-Seafloor Hazards Identified within the Geophysical Survey Areas

Hazard	Definition	Identification and Description
		between height of 0.00 m and 0.28 m [0.00 ft to 0.92 ft], with only four contacts over 0.10 m [0.33 ft]). Non-unexploded ordnance (UXO) debris is not anticipated to pose a risk to the Metocean Equipment deployment, operation, or recovery.

6.1.1 Geophysical Survey Area 1

Water depths within the 1,312 ft x 1,312 ft (400 m x 400 m) (0.16 km^2 [0.047 nm^2]) Geophysical Survey Area 1 boundary ranged from -120.70 ft (-36.79 m) in the northwest and -126.90 ft (-38.68 m) in the southeast. The area gently sloped deeper from the northwest to the southeast. The average slope of the Geophysical Survey Area was less than 1° (very gentle), with maximum slopes of 2.5° (gentle). Multiple depressions were scattered throughout the area. The depressions were predominantly irregular in shape. These depressions averaged 10.99 ft (3.35 m) in length, 8.56 ft (2.61 m) in width, and 0.12 ft (0.036 m) deep. There were 25 MBES contacts located within Geophysical Survey Area 1. One large contact was identified as a depression, measuring approximately 29.53 ft (9 m) long, 19.69 ft (6 m) wide, and 0.46 ft (0.14 m) deep, but was located along the eastern edge of the bathymetry dataset and outside of the Geophysical Survey Area boundaries. Bathymetric contours for Geophysical Survey Area 1 can be found in the chart in Appendix C.

Characterization of seabed in Geophysical Survey Area 1 is consistent with silty sand, and the area is generally featureless except for the scattered seabed depressions. There was a total of 149 SSS targets picked and measured, of which 72 were classified as debris. Although most of the debris were small, irregular features, approximately 22 debris contacts measured over 3.28 ft (1 m) in length or width, with Contact 0138 measuring 13.78 ft (4.2 m) x 7.54 ft (2.3 m). The remainder of the contacts were classified as depressions with varying shapes: irregular, elongated, oval, or circular. These seabed depressions may indicate some minor scouring around isolated point features, such as debris, on the seabed. The seabed currents or the resulting scour is not anticipated to be significant, given the presence of relatively fine-grained sediment at the seabed, which would be mobilized under more significant flows. As such, no risk to the planned seabed facilities is anticipated during deployment, operations, or recovery.

The side scan sonar mosaic showing the uniformity of the seabed sediments along with picked sonar contacts can be found in the chart in Appendix C.

The survey identified a total of 29 magnetic anomalies in Geophysical Survey Area 1, of which two were categorized as major anomalies (greater than 100 nanotesla [nT]) and another four as large anomalies (greater than 50 nT). While generally the anomalies were small and had limited areal extent, eight contacts had a significant area within the ±5 nT anomaly contour. A possible linear feature is observed outside of the northern boundary of Geophysical Survey Area 1 (Contact_012, Contact_014 and Contact_015). However, no significant magnetic values were seen between them suggesting these may be individual anomalies rather than a linear feature. None of the magnetic anomalies correspond to very large items of debris nor are otherwise considered to be a risk to the Metocean Equipment deployment, operation, or recovery. A chart with the picked magnetic anomalies and a chart with the contoured magnetic anomaly grid data can be found in Appendix C.

Sub-bottom profiling results indicate that the first six and a half to nine feet (two to three meters) below the seabed contains some continuous reflectors with medium amplitude in the southern portion of the

Geophysical Survey Area 1 to low amplitude reflectors in the northern portion of the area. This upper unit contains a total of 160 buried subbottom profiler contacts, which presented as parabolic high-amplitude anomalies, with none measuring larger than 9.84 ft (3 m) in lateral extent. While these were picked as potential contacts, none were interpreted as a specific geological hazard to the Metocean Equipment deployment. The base of these shallow sediments is interpreted as an erosional unconformity, possibly the base of the Holocene section. Below this unconformity, several areas of low reflection amplitudes were identified on the sub-bottom profiler (SBP) profiles, which may indicate the presence of shallow gas within or immediately above these sediments. However, any gas is buried at least several meters below the seabed, with no indications in the data of expansive extents nor significant or dangerous accumulations of gas. As such, no risk to the deployment, operations, or recovery of the facilities is anticipated. No paleochannels have been identified in the shallow subsurface of Geophysical Survey Area 1. An isopach chart of the Geophysical Survey Area 1 showing the thickness of the shallow surficial unit (likely Holocene) is included in Appendix C. The locations of the picked sub-bottom profiler contacts are drawn on the Geophysical Survey Area 1 Seabed Features chart in Appendix C.

6.1.2 Geophysical Survey Area 2

Water depths within the 1,312 ft x 1,312 ft (400 m x 400 m) (0.16 km^2 [0.047 nm^2]) Geophysical Survey Area 2 boundary ranged from -118.14 ft (-36.01 m) to -123.75 ft (-37.72 m), with the deepest area immediately west of an approximately 3.28 ft (1 m) high ridge running from the northeast to the southwest. The ridge lies east of the Geophysical Survey Area. The maximum slope of 9° (moderate) was found at the flank of the ridge, with the average slope of 2° (gentle) on either side. A single linear MBES contact was identified near the northern boundary of Geophysical Survey Area 2 and is interpreted to be a drag scar. Intermittent cohesive sediments were exposed predominantly in the southeastern side of the area lending a slightly different seabed character observable in the bathymetry dataset. Bathymetric contours for Geophysical Survey Area 2 can be found in the chart in Appendix C.

The seabed within Geophysical Survey Area 2 consists of mainly sand and reworked fluvial deposits. Ripples were present on either side of the ridge, with wavelengths and heights less than 16.40 ft (5 m) and 1.64 ft (0.5 m), respectively. There were 90 SSS targets picked and measured in this area: 44 classified as debris, 36 classified as individual depressions, and 10 classified as depression fields. The debris contacts ranged from 0.98 ft (0.29 m) to 4.92 ft (1.49 m) in both length and width, with no contacts over 0.92 ft (0.28 m) in height. Two contacts were described as elongated, one as rectangular, and one as triangular; the 2.76 ft x 2.46 ft (0.84 m x 0.75 m). These shapes could potentially indicate man-made objects or debris. The depressions were located predominantly along the western and southeastern boundaries of Geophysical Survey Area 2, with average depressions from 0.66 ft to 2.62 ft (0.20 m to 0.80 m) in width and 0.98 ft (0.30 m) to 3.28 ft (1 m) in length. None of these contacts indicate items that would pose a significant risk to the deployment, operation, or recovery of the proposed Metocean Equipment.

These seabed depressions and seabed ripples may indicate some minor scouring and seabed sediment mobility. The seabed currents or the resulting scour or ripple development is not anticipated to be significant, given the presence of relatively fine-grained sediment at the seabed, which would be mobilized under more significant flows. As such, no risk to the planned seabed equipment is anticipated during deployment, operations, or recovery from seabed currents, seabed mobility, or scour.

The side-scan sonar mosaic showing the relative uniformity of the seabed sediments along with picked sonar contacts can be found in the chart in Appendix C.

The survey identified a total of 55 magnetic anomalies, of which three were categorized as major anomalies (greater than 100 nT). A 966 nT contact (Contact_049) was observed at the northern boundary of Geophysical Survey Area 2. Most of the remaining anomalies had relatively small areal extents within the ±5 nT anomaly contour. No linear anomaly contacts were identified. None of the magnetic anomalies near Geophysical Survey Area 2 correspond to very large items of debris nor are otherwise considered to be a

risk to the Metocean Equipment deployment, operation, or recovery. A chart with the picked magnetic anomalies and a chart with the contoured magnetic anomaly grid data can be found in Appendix C.

The upper 9.84 ft (3 m) of the seabed in Geophysical Survey Area 2 represents a zone with low seismic amplitudes and poor reflectivity events. No coherent reflectors were interpreted across Geophysical Survey Area 2 within this unit, but most of the sub-bottom contacts were identified within this depth range. This upper unit contains a total of 111 buried subbottom profiler contacts, which presented as parabolic high-amplitude anomalies, with none measuring larger than 6.56 ft (2 m) in lateral extent. None of the contacts were interpreted as specific geologic hazards to the Metocean Equipment deployment, operation, or recovery.

Two erosional surfaces have been interpreted within the sub-bottom data across Geophysical Survey Area 2. The upper is an erosional inconformity which truncates some of the underlying strata and serves as a lower bound to the surficial sediments exhibiting poor reflectivity, likely representing the base of the Holocene section in this area. The second erosional surface underlies a unit exhibiting more coherent internal reflectors and sub-parallel deposition, and potentially represents a Pleistocene deposit.

The upper (potentially Holocene) section exhibits infilled paleochannels, which can be seen in the isopach maps of this unit. The second (potentially Pleistocene) unit also appears to infill incised lows and is not continuous across the entirety of Geophysical Survey Area 2, as it has been eroded in places. The buried paleochannels do not pose any risk to the Metocean Equipment deployment, operation, or recovery.

While the ridge identified in Geophysical Survey Area 2 appears to be a Holocene feature, there is no indication in the subbottom profiler records nor any of the other datasets that this feature is currently active and growing or migrating laterally. As such, it poses no risk of migrating across the Metocean Equipment mooring location and burying the anchor.

An isopach chart of Geophysical Survey Area 2 showing the thickness of the shallow surficial unit (likely Holocene) is included in Appendix C. The locations of the picked sub-bottom profiler contacts are drawn on the Geophysical Survey Area 2 Seabed Features chart in Appendix C.

6.1.3 Geophysical Survey Area 3

Water depths within the 1,312 ft x 1,312 ft (400 m x 400 m) (0.16 km^2 [0.047 nm^2]) Geophysical Survey Area 3 boundary ranged from -125.53 ft (-38.28 m) to -128.60 ft (-39.20 m). This area sloped gently (average 1.5°) to the south-southeast, with maximum slope of 3°. The seabed exhibits a very mildly hummocky appearance in the western extent of Geophysical Survey Area 3. This is possibly due to underlying slightly more cohesive sediment exposure near the surface and subject to slight seabed scour. No MBES contacts were identified in the area. Bathymetric contours for Geophysical Survey Area 3 can be found in the chart in Appendix C.

Geophysical Survey Area 3 is generally featureless from seabed to shallow subsurface, with the seabed comprised of unconsolidated sands. There was a total of 45 SSS targets picked and measured. Twenty-eight (28) of the contacts were classified as debris, primarily irregular with one rectangular and one elongated debris. All debris were smaller than 3.28 ft x 3.28 ft (1 m by 1 m). Seventeen (17) contacts were classified as depressions, ranging from 0.98 ft to 2.46 (0.3 m to 0.75 m) in width and 1.31 ft to 3.61 ft (0.4 m to 1.1 m) in length. Depression shape varied from irregular to oval, with no pattern to the distribution across the survey area. Small scale ripples (less than 3.28 ft [1 m] wavelength) were seen across the area, with crests oriented primarily north – northeast to south – southwest. These seabed depressions and seabed ripples may indicate some minor scouring and seabed sediment mobility. The seabed currents or the resulting scour or ripple development is not anticipated to be significant, given the presence of relatively fine-grained sediment at the seabed, which would be mobilized under more significant flows. As such, no risk to the planned seabed facilities is anticipated during the Metocean Equipment deployment, operations, or recovery from seabed currents, seabed mobility, or scour. The side-scan sonar mosaic showing the

relative uniformity of the seabed sediments along with picked sonar contacts can be found in the chart in Appendix C.

The survey identified a total of 26 magnetic anomalies, of which most were located in the southwest corner of Geophysical Survey Area 3. Only 3 contacts had a significant areal extent within the ±5 nT anomaly contour. None of the magnetic anomalies near Geophysical Survey Area 3correspond to very large items of debris nor are otherwise considered to be a risk to the Metocean Equipment deployment, operation, or recovery. A chart with the picked magnetic anomalies and a chart with the contoured magnetic anomaly grid data can be found in Appendix C.

The upper four meters of the seabed in Geophysical Survey Area 3 show inconsistent, low-coherency seismic reflectivity with poor continuity. This unit is interpreted as Holocene sands. The base of this unit is ambiguous but has been picked on the basis of reflection character and amplitude. This upper unit contains a total of 59 buried subbottom profiler contacts, which presented as parabolic high-amplitude anomalies, with none measuring larger than 9.84 ft (3 m) in lateral extent. None of the contacts were interpreted as specific geologic hazards to the Metocean Equipment deployment, operation, or recovery.

An isopach chart of Geophysical Survey Area 3 showing the thickness of the shallow surficial unit (likely Holocene) is included in Appendix C. The locations of the picked sub-bottom profiler contacts are drawn on the Geophysical Survey Area 3 Seabed Features chart in Appendix C.

6.1.4 Natural Seafloor and Sub-Seafloor Hazards

The HRG datasets were analyzed for seafloor and sub-seafloor hazards, which could pose a potential risk to the installation, operation, and maintenance of the Metocean Equipment. Installation of the Metocean Equipment has the potential to affect a small area as a result of the small vertical and horizontal region of geographic impact on the seafloor. The HRG surveys conducted at the Geophysical Survey Areas are an appropriate scale for the size of the proposed Metocean Equipment.

HRG datasets in the three Geophysical Survey Areas determined the presence of shallow seafloor units consisting of fine to course sandy unconsolidated sediments deposited during cycles of sea level fluctuations. The seafloor surface is primarily sand with varying amounts of gravel and fined-grained sediments, as confirmed by the benthic investigation grab samples.

Given the generally flat and featureless character of the Geophysical Survey Areas, small features such as decimeter-scale vertical depressions and the small SBP contacts have been individually identified and picked. In an area of more complex seabed, these may otherwise have gone unnoticed or described broadly across the entire area with no attention to individual features. As such, the tabulated and charted contacts presented in Appendix C may appear busier or more complex than the relatively simple and benign site geology would otherwise suggest.

The HRG datasets were used to determine the presence or absence of additional geological hazards (see Table 6-1).

To rule out the presence of other specific hazards as noted in 30 CFR § 585.610(b), the HRG, the side scan sonar, multibeam bathymetry, and sub-bottom profiler datasets were reviewed and do not indicate any evidence of seismic activity, such as extensive or regional faulting or slump and mass wasting features. No fault zones, nor any other faulting activity, are identified either from seabed data or from the sub-bottom profiler records, as would typically be indicated by offset sedimentary bedding planes in the sub-bottom profiles or linear fault-related features on the seabed. No faults or other sedimentary features indicative of differential compaction or localized seabed subsidence have been identified. These results are consistent with the expected nature of the passive continental margin off of North Carolina.

Other than the minor low-reflection amplitude areas underlying Geophysical Survey Area 1, no areas of acoustic whiteouts or other significant amplitude anomalies were observed in the sub-bottom profiler data, as would be anticipated for any significant accumulation of shallow gas. The sub-bottom profiler records do not contain any bottom simulating reflectors, which are a typical indication of the presence of hydrates. The interpretation of the side-scan sonar, multibeam bathymetry, and sub-bottom profile datasets provide no evidence of ice scour, such as seabed gouging by either icebergs or sea ice pressure ridges, which is consistent with the location and history of the area.

Based on the SAP Site Characterization Report (Appendix C), the site conditions are suitable for the installation of the proposed Metocean Equipment and associated moorings within the three Geophysical Survey Areas. No notable geological seabed or subsurface hazards are identified which would preclude installation at these locations. Small depressions and ripple-scale bedforms identified by the survey may indicate some currents acting on the seabed. The absence of larger-scale scour-related features, such as moats around seabed features, and the lack any larger migrating bedforms indicates that seabed currents are likely modest. As such, the risk of scour to the metocean mooring equipment is not anticipated to be an issue. The low relief seabed contacts, such as debris, exhibit heights of less than 0.91 ft (0.28 m) above the seabed do not represent a significant hazard to the installation, operation, maintenance, or recovery of the mooring systems. Similarly, the buried channel identified in Geophysical Survey Area 2, and the potential sediment with gas in Geophysical Survey Area 1, and the buried subbottom profiler contacts in all three Geophysical Survey Areas do not represent any hazard to the planned activities.

6.2 Archaeological Resources

The following section summarizes the analysis and findings described in the Marine Archaeological Resource Assessment Report (Appendix D). The Marine Archaeological Resource Assessment focused on the 984 ft by 984 ft (300 m by 300 m, or 22.2 acre [9 hectare]) SAP Survey Areas. This area is identified in Figure 1-1.

6.2.1 Affected Environment

Installation of the Metocean Equipment has the potential to affect submerged archaeological resources that may relate to the pre-contact and historic time periods. Documentary and field research show the submerged SAP Survey Areas to have potential for both pre-contact and historic submerged cultural resources. The potential for the existence of these sites is due to the historic maritime activity in the area and the prehistoric occupation on the once exposed continental shelf.

During the pre-contact era, habitation of the exposed coastal plain was possible beginning around 14,000 years ago. As such, there is potential for submerged pre-contact sites to exist within the SAP Survey Areas, although the preservation of such sites is variable based on environmental influences such as marine transgression and seafloor sedimentation. To date, no identified pre-contact archaeological sites have been documented in the SAP Survey Areas (SEARCH 2019). Historic period archaeological sites that could occur within offshore portions of the survey area are predominantly related to marine activity, such as historic shipwrecks from the 17th to 20th centuries (SEARCH 2019). Background research indicates that no shipwrecks or obstructions have been reported within 1 mile (1.6 km) of the proposed SAP Survey Areas or BDAs (see Appendix D).

In 2019, SEARCH, Inc. (SEARCH) conducted a desktop study and archaeological assessment of the 2019 HRG survey data acquired for the Company. SEARCH processed the data, utilizing methodologies that facilitate archaeological analysis and sound resource management decisions. SEARCH maritime archaeologists, submerged paleoarchaeologists, and historians created a prehistoric and historic context for the region, assembled a geologic and environmental background, reviewed previous archaeological investigations conducted in the vicinity, and identified submerged cultural resources reported in the vicinity of the Lease Area to supplement and guide data analysis.

The HRG survey and archaeological analyses were performed in accordance with the Kitty Hawk Offshore Wind Project Survey Plan, BOEM's guidelines, and associated SOCs for cultural resources as defined in both the Lease and the NC EA. The detailed Marine Archaeological Resources Assessment for the Kitty Hawk Commercial Offshore Wind Lease Area, Metocean Equipment SAP Survey Areas is provided in Appendix D.

The SAP Survey Areas consisted of a detailed review of three approximately 984 ft by 984 ft (300 m by 300 m, or 22.2 acre [9 hectare]) areas centered on each of the proposed BDAs. To achieve the required site characterization data, the HRG survey provided 100 percent coverage of the entire geographic area (horizontal and vertical extents) that could be physically disturbed by Project activities. The area of disturbance related to installation of the Metocean Equipment is limited to a small vertical and horizontal region of geographic impact on the seafloor for an area of approximately 5.4 acres (2.2 hectares). The extent of archaeological surveys conducted were limited to the proposed seafloor impacts associated with each buoy deployment, installation, and decommissioning, which is an appropriate scale for the size of the proposed Metocean Equipment.

The HRG survey utilized numerous remote sensing survey methods including: gradiometer, SSS, SBP, and MBES. Archaeological resource review of the data focused on areas of planned bottom-disturbing activities within the SAP Survey Areas that have the potential to impact submerged archaeological resources. SEARCH's review of remote sensing data identified no magnetic anomalies and no side scan sonar contacts within the SAP Survey Areas that may represent potential and submerged cultural resources. Sub-bottom profiler data was collected and analyzed to identify paleo-landscape features. This data indicated that no paleo-landforms are present that may preserve inundated archaeological sites.

6.2.2 SAP Survey Area 1

SEARCH identified 11 magnetic anomalies (meeting the 5-gamma threshold), 81 acoustic contacts, and no unique acoustic reflectors within SAP Survey Area 1. Of the 81 acoustic contacts identified in SAP Survey Area 1, 45 are categorized as depressions and are likely geologic, 33 are categorized as debris, and three are not categorized. None of the magnetic anomalies correlate with any acoustic contacts and/or acoustic reflectors. SEARCH assessed each magnetic anomaly based on a robust and well-tested protocol for determining if magnetic signatures indicate cultural resources. These targets do not exhibit characteristics of verified shipwrecks. No acoustic reflectors were observed in the sub-bottom data. No acoustic reflectors were observed in the sub-bottom data (see Appendix A-6). It was concluded that no significant submerged cultural resources are present in the archaeological survey area of SAP Survey Area 1 and that the deployment of the Metocean Equipment will not impact potentially eligible historic properties.

6.2.3 SAP Survey Area 2

SEARCH identified 19 magnetic anomalies (meeting the 5-gamma threshold), 38 acoustic contacts, and two unique acoustic reflectors within SAP Survey Area 2. Of the 38 acoustic contacts identified in SAP Survey Area 2, 13 are categorized as depressions and three categorized as depression fields, and are likely geologic, while 22 are categorized as debris. None of the 38 acoustic contacts appear to represent potential significant submerged cultural material. Two magnetic anomalies correlate with two acoustic contacts (S048 and M058; S027 and M047). These targets do not exhibit characteristics of potential submerged cultural resources. SEARCH assessed each magnetic anomaly based on a robust and well-tested protocol for determining if magnetic signatures indicate cultural resources. Two acoustic reflectors were observed in the sub-bottom data. The two reflectors are described as unknown surface reflectors, and do not exhibit characteristics of a submerged paleo-landscape that might indicate potential pre-contact habitation. It appears that the reflectors likely relate to modern debris and/or non-cultural geological features. Given that no remote-sensing targets exhibit characteristics of verified shipwrecks or paleo-landscapes, it was concluded that no significant submerged cultural resources are present in the

archaeological survey area in SAP Survey Area 2 and that the deployment of the Metocean Equipment will not impact potentially eligible historic properties.

6.2.4 SAP Survey Area 3

SEARCH identified 13 magnetic anomalies (meeting the 5-gamma threshold), 26 acoustic contacts, and one unique acoustic reflector within SAP Survey Area 3. Of the 26 acoustic contacts identified in SAP Survey Area 3, eight are categorized as depressions and are likely geologic and 18 are categorized as debris. None of the 26 acoustic contacts appear to represent potential significant submerged cultural material. None of the magnetic anomalies correlate with any acoustic contacts. These targets do not exhibit characteristics of submerged cultural resources. SEARCH assessed each magnetic anomaly based on a robust and well-tested protocol for determining if magnetic signatures indicate cultural resources. One acoustic reflector was observed in the sub-bottom data. The one reflector is described as an unknown surface reflector and does not exhibit characteristics of a submerged paleo-landscape that might indicate potential pre-contact habitation. The reflector likely relates to modern debris and/or non-cultural geological features. Given that no remote-sensing targets exhibit characteristics of verified shipwrecks or paleo-landscapes, it was concluded that no significant submerged cultural resources are present in the archaeological survey area in SAP Survey Area 3 and that the deployment of the Metocean Equipment will not impact potentially eligible historic properties.

6.2.5 Potential Impacts and Proposed Mitigation Measures

Based upon the results of the Marine Archaeological Resources Assessment, no potential submerged cultural or archaeological resources were identified within the SAP Survey Areas. As such, the installation, operation, maintenance, and decommissioning of the proposed Metocean Equipment would result in no impacts to marine archaeological resources. However, if a potential archaeological resource is discovered, the Company will comply with measures included in 30 CFR § 585.802 and Section 5.3 of the Lease.

The Company will employ communication and outreach practices in order to maintain coordination with BOEM, the North Carolina State Historic Preservation Office, Virginia State Historic Preservation Office, and any identified tribal interests throughout the installation, operation, maintenance, and decommissioning of the Metocean Equipment.

Based on the small size of the proposed Metocean Equipment and the distance from shore, there will be no visual impacts onshore associated with these site assessment activities.

6.3 Benthic Resources

The following section summarizes results of the benthic habitat assessment that was conducted in July and August 2019. The full benthic habitat assessment report is provided in Appendix E. The benthic habitat assessment focused on the Buoy Deployment Areas, which are three areas where WindSentinel™ Buoys and TRBM Platforms may be deployed ranging from approximately 4.3 to 5.4 acres (1.7 to 2.2 hectares) each, located within each of the SAP Survey Areas.

Three benthic grab samples were collected at each of the three BDAs (Figure 6-1, Figure 6-2, Figure 6-3, Figure 6-4), for a total of nine benthic samples, using a stainless-steel 0.1 m^2 Van Veen grab. In addition to sediment grabs, imagery was also taken at each location. Imagery was analyzed for visual classifications, and sediment samples were analyzed for their grain size composition, taxonomy, and concentration of total organic carbon present.

Results of sediment grain analysis indicate sandy with more than 80 percent fine and/or medium grain sand, slightly irregular relief, and trace shell hash. Organic carbon content was generally low or not detected in all samples. Imagery at all sample locations did not detect the presence of any unique benthic features, biological activity, submerged aquatic vegetation, fish, essential fish habitat (EFH), or anthropogenic debris.

The nine benthic grab samples collected in this survey yielded a total of 1,128 individual macrofaunal organisms from 10 unique phyla and 79 families. The phyla Annelida, Arthropoda, and Mollusca dominated the samples in both abundance and unique number of taxa, representing 84 percent of all organisms and 86 percent of all unique taxa. Taxonomic richness ranged from 7.78 at BDA3 to 12.71 at BDA1 with a mean richness of 10.13.

No evidence of protected or unique habitats was indicated by the seabed imagery or grab sampling in any of the BDAs. No hard bottom or sensitive benthic habitats or taxa were sampled. No benthic species listed under the ESA occur in the Lease Area. No protected fish species were observed during the survey.

6.3.1 BDA1

BDA1 was characterized as silty sand with medium to high compaction based on the side scan sonar imagery. This substrate was confirmed by the benthic grab sampling, which was dominated by fine sand (more than 96.5 percent) and silt (less than 3.5 percent) with occasional worm casings at all stations. Total organic carbon was low at all stations, ranging from below detection limits (N.D.) to 3,400 mg/kg (0.34 percent).

A total of 585 organisms were collected in BDA1, which belonged to 9 phyla and 60 different species or lowest practical taxonomic level (LPTL). Organisms collected at BDA1 primarily consisted of polychaete worms, amphipods, bivalves, and forams (amoeboid protists), which were only found within BDA1. Species of anthropogenic importance observed included Atlantic rock crab (*Cancer irroratus*), Atlantic jackknife clam (*Ensis leei*), scallops (*Pectinidae*), ocean quahog (*Arctica islandica*), and Atlantic surf clam (*Spisula solidissima*).

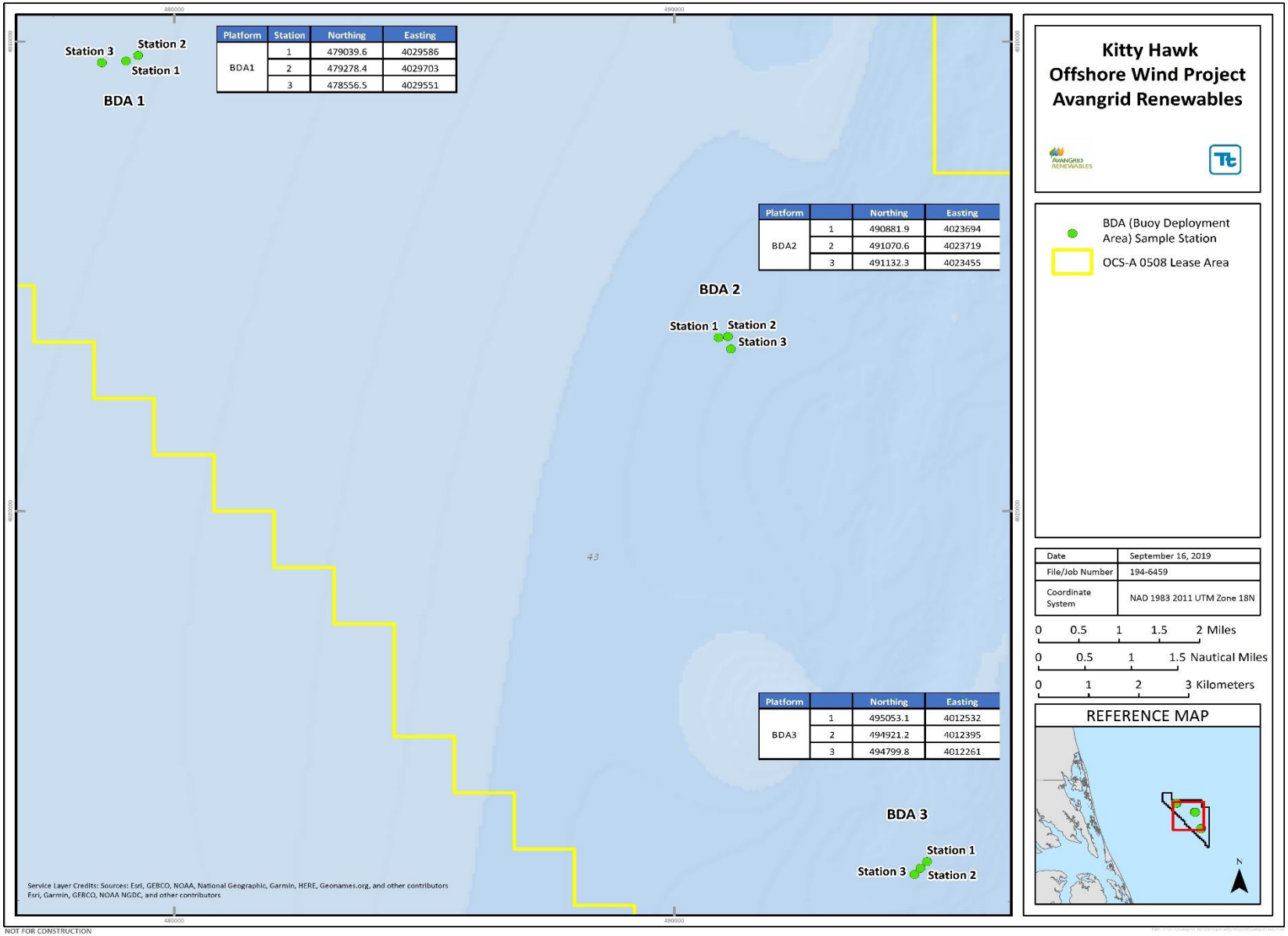

Figure 6-1 Grab Sample Locations

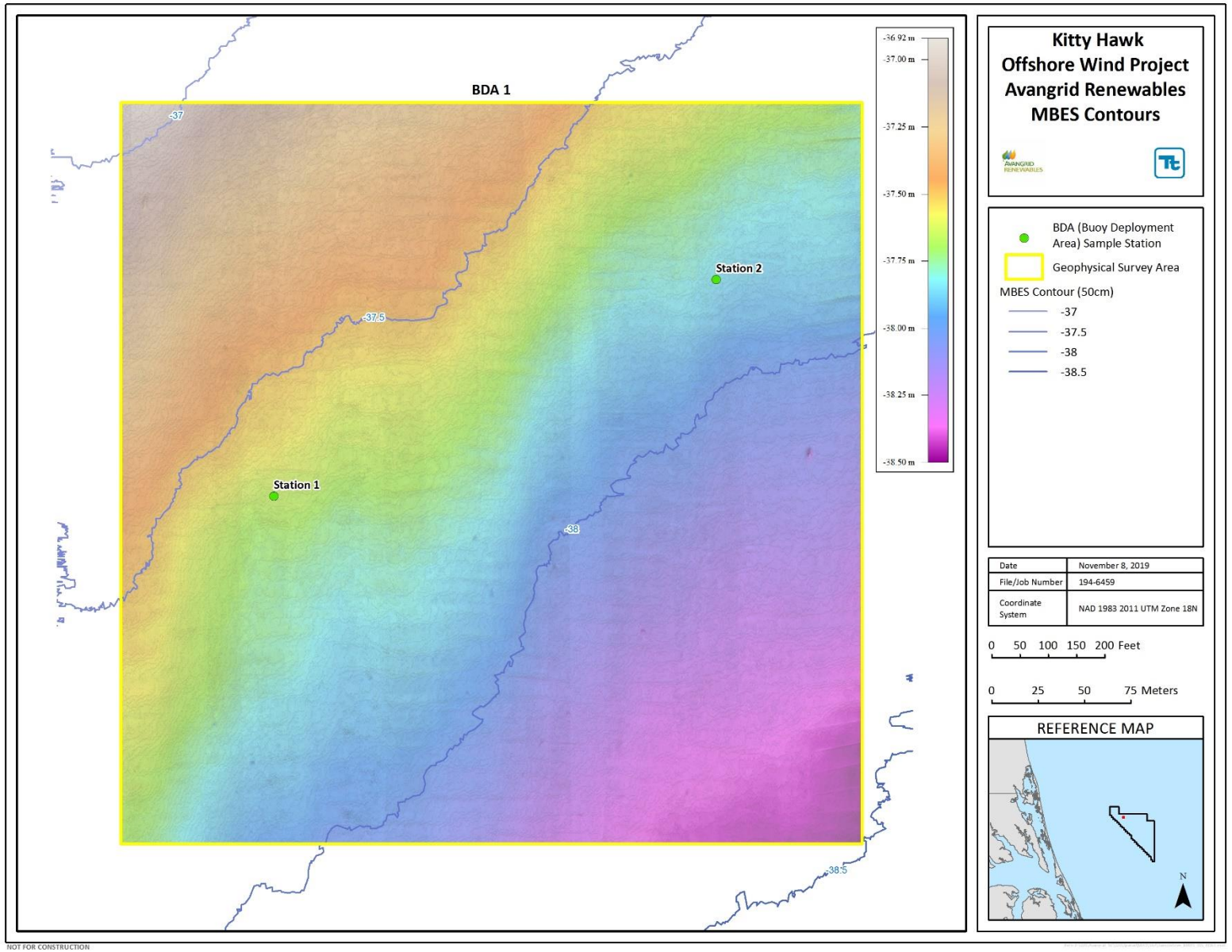

Figure 6-2 BDA 1 MBES/SSS Mosaic

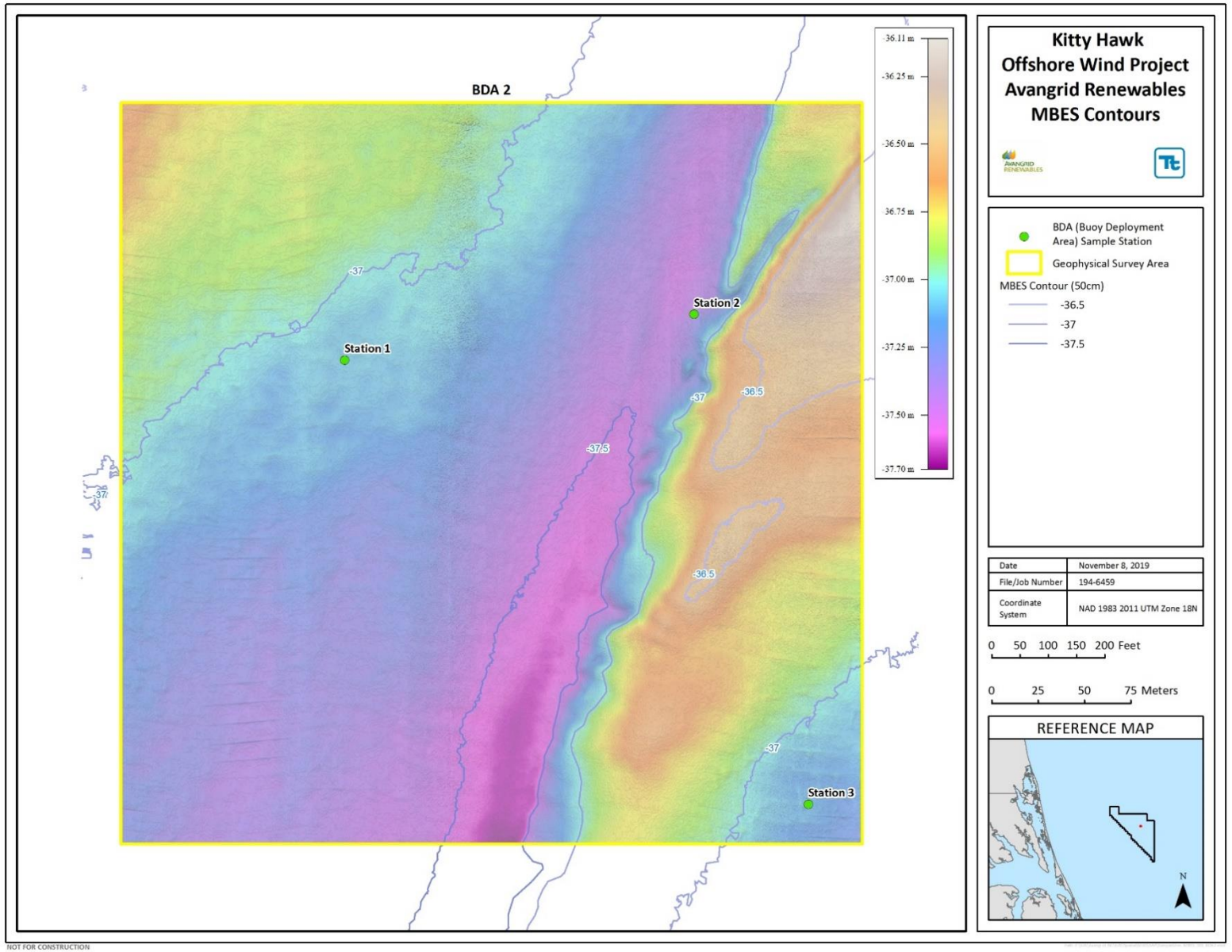

Figure 6-3 BDA 2 MBES/SSS Mosaic

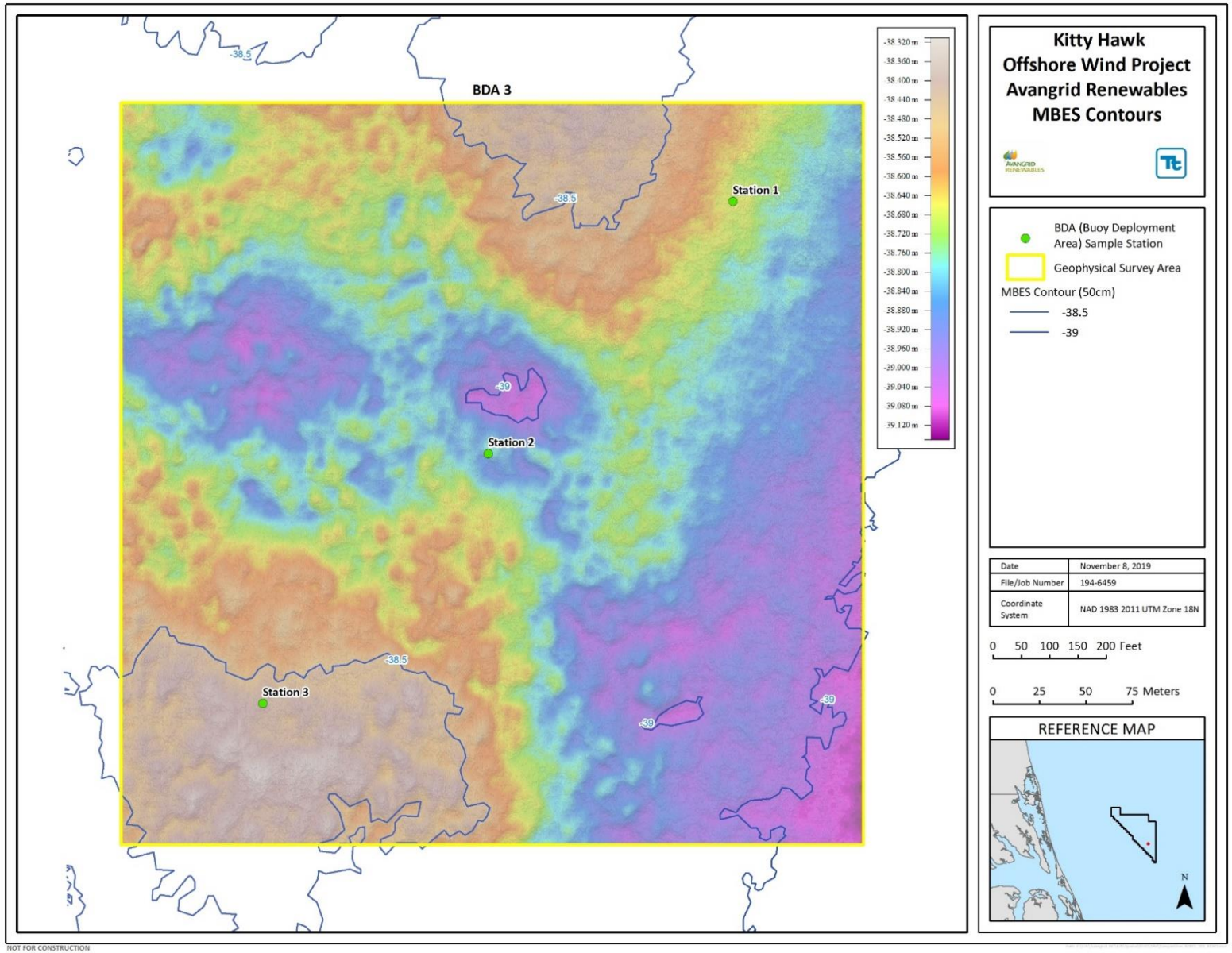

Figure 6-4 BDA 3 MBES/SSS Mosaic

Species distribution was patchy among the three stations, as shown by the Coastal and Marine Ecological Classification Standard (CMECS). All three stations of BDA1 were classified as fine sand with traces of clam or worm hash. Detailed size information on the organisms or high-resolution imagery of the structure of the surficial sediment layer were not available, so samples were classified to the level of Group, and then each sample was defined by the dominant taxa thereafter. All three stations were classified as Benthic Biota, Faunal Bed, or Soft Sediment Fauna; with all three stations of BDA1 dominated by Small Tube-Building Fauna (polychaete worms) at the Biotic Group CMECS level. The complete results of benthic samples are included in Appendix E (Benthic Assessment).

6.3.2 BDA2

BDA2 was characterized as mainly sand with fluvial deposits based on the side scan sonar imagery. This substrate was confirmed by the benthic grab sampling, which exhibited variability of unconsolidated sediments between stations; ranging from fine sand and trace amounts of shell hash (BDA2 Station 1) to gravelly sand and dense shell hash (BDA2 Station 2). Total organic carbon was low at all stations, ranging from below detection limits (N.D.) to 3,700 mg/kg (0.37 percent).

A total of 258 organisms was collected in BDA2, which belonged to 6 phyla and 56 different species or LPTL. Organisms collected at BDA2 primarily consisted of polychaete worms and amphipods. Species of anthropogenic importance observed included Atlantic rock crab (*Cancer irroratus*).

Species distribution was patchy among the three stations, as shown by the CMECS. Each of the three stations of BDA2 were classified as different sediment subgroups; BDA2 Station 1 was fine sand with traces of clam or worm hash, BDA2 Station 2 was gravelly sand with dense clam hash, and BDA2 Station 3 was slightly gravelly sand with trace clam hash. Detailed size information on the organisms or high-resolution imagery of the structure of the surficial sediment layer were not available, so samples were classified to the level of Group, and then each sample was defined by the dominant taxa thereafter. All three stations were classified as Benthic Biota, Faunal Bed, or Soft Sediment Fauna, with BDA2 Station 2 dominated by Small Tube-Building Fauna (polychaete worms) at the Biotic Group CMECS level. BDA2 Station 1 and BDA2 Station 3 were comprised of Small Surface-Burrowing Fauna (amphipod species). The complete results of benthic samples are included in Appendix E (Benthic Assessment).

6.3.3 BDA3

BDA3 was characterized as sands with poor compaction based on the side scan sonar imagery. This substrate was confirmed by the benthic grab sampling, which was dominated by slightly gravelly sand and fine sand with sparse to moderate shell hash at all stations. Total organic carbon was low at all stations, ranging from below detection limits (N.D.) to 6,300 mg/kg (0.63 percent).

A total of 285 organisms was collected in BDA3, which belonged to 6 phyla and 45 different species or LPTL. Organisms collected at SAP BDA3 contained a large number of organisms from the Arthropoda phylum, comprised primarily of the amphipod species *Rhepoxynius hudsoni*. The phylum Mollusca was also well represented at these stations, with 71 organisms from 16 unique taxa. The most abundant Mollusca taxa collected at these stations was the Pectinidae or scallop family. Other species of anthropogenic importance observed in the samples include Atlantic rock crab (*Cancer irroratus*).

Species distribution was patchy among the three stations, as shown by the CMECS. All three stations of BDA3 were classified as slightly gravelly sand with sparse (BDA3 Station 2) to moderate (BDA3 Station 1 and Station 3) clam hash. Detailed size information on the organisms or high-resolution imagery of the structure of the surficial sediment layer were not available, so samples were classified to the level of Group, and then each sample was defined by the dominant taxa thereafter. All three stations were classified as Benthic Biota, Faunal Bed, or Soft Sediment Fauna, with all three stations of BDA3 dominated by Small Surface-Burrowing Fauna (amphipod species) at the Biotic Group CMECS level. The complete results of benthic samples are included in Appendix E (Benthic Assessment).

6.4 Fisheries

As demonstrated in Section 3, the equipment and methodologies proposed herein by the Company are consistent with the activity considered by BOEM in the NC EA (BOEM 2015).

The Company has reviewed currently available literature and data regarding fisheries and EFH in and near the Lease Area and has determined that no substantive information has become available that warrants revision of the analysis in the NC EA (2015). While stock assessments for the North Carolina Atlantic fisheries resources are regularly updated, the description of species assemblages in the NC EA are considered representative of current conditions.

Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) is the only federally listed endangered fish that may occur in the Lease Area. NMFS is in the process of its five-year review for Atlantic sturgeon (NOAA 2018a). Requisite findings of this five-year review will be included in the recovery planning process under the ESA. Critical habitat for the Atlantic sturgeon was designated in August 2017, after the NC EA was released. However, no critical habitat was designated within the Lease Area (NOAA 2017). The nearest designated critical habitat includes the Roanoke River, Tar-Pamlico River, and the James River, which are located well inland from the Lease Area. BOEM's analysis is applicable and the determination that the proposed site assessment activity would not likely to adversely affect Atlantic sturgeon is appropriate.

The oceanic whitetip shark (*Carcharhinus longimanus*) (NOAA 2018b) and the giant manta ray (*Manta birostris*) (NOAA 2018c) were listed as threatened under the ESA after the NC EA was released. No designated critical habitat exists for these species. These large mobile elasmobranchs are assumed to be present in the Lease Area; they are expected to behave much like other more common sharks, skates, and rays by avoiding areas of human activity. Large slow-moving fishes such as giant manta rays may occur near the surface, making them more susceptible to vessel strikes (Couturier et al., 2012). However, unlike other large ray species, the giant manta ray is not typically found in large aggregations, and more commonly occurs in low numbers of individuals (Miller & Klimovich, 2017). Therefore, the likelihood of a vessel associated with the SAP activities encountering or striking a giant manta ray is expected to be low, particularly with implementation of vessel strike avoidance procedures. While interaction with fishing gear (e.g. gill nets, lines) has been observed for giant manta ray (Alfaro-Cordova et al. 2017), potential interaction with buoy anchor chains or moorings is not expected to result in entanglement, since anchor chains and moorings can be avoided. In addition, Best Management Practices (BMPs) implemented for other fish species, including Atlantic sturgeon, would be protective of the whitetip shark and giant manta ray. The proposed site assessment activity would not adversely affect these threatened species.

The Company will implement all applicable Lease conditions, which include implementing BMPs during installation, operation, maintenance, and decommissioning of the Metocean Equipment to minimize impacts on fisheries, including species protected under the ESA. The Company has developed a Fisheries Communications Plan which describes the strategies that the Company intends to use for communicating with commercial and recreational fisheries stakeholders prior to and during the development of the Project. Additionally, the Company has contracted with FathomEdge Limited to provide Fisheries Liaison Officer(s) for the Project. The lead Fisheries Liaison Officer for the Project is:

Rick Robins
FathomEdge Limited
rick@fathomedgelimited.com
(757) 876-3778

The Company is committed to developing a detailed understanding of the marine fisheries resources in the Lease Area and the commercial and recreational fisheries that have historically operated in, and transited through, the Lease Area. The Fisheries Communications Plan includes outreach to fishermen who transit and fish in the Lease Area. Fisheries outreach will promote awareness of offshore Project activities and will

invite feedback to promote a mutual and transparent understanding of fisheries uses, resources, concerns, and issues within the Lease Area. The Fisheries Liaison Officer will work to develop a comprehensive communications network in order to maintain proactive communications with marine fisheries participants who transit and fish in the Lease Area throughout the life cycle of the project. The Fisheries Communications Plan also includes engagements with the regional fishing community, BOEM, regional fisheries management councils and commissions, state fisheries managers, regional fisheries science centers and fisheries scientists. A copy of the Fisheries Communication Plan will be posted on the Project website at http://www.avangridrenewables.com/kittyhawk.

6.5 Marine Mammals and Sea Turtles

As demonstrated in Section 2, the equipment and methodologies proposed herein by the Company are consistent with the activity considered by BOEM in the NC EA (BOEM 2015) and in the Atlantic Outer Continental Shelf (OCS) *Programmatic Environmental Impact Statement for proposed Geological and Geophysical Activities* (BOEM 2014). Potential impacts on marine mammals and sea turtles from installation and operation of an environmental monitoring buoy were analyzed in the NC EA and BOEM Programmatic Environmental Impact Statement. BOEM's assessment was that the installation of environmental monitoring buoys is not anticipated to result in any significant or population-level effects to marine mammals or sea turtles.

There are up to 35 marine mammal species (cetaceans, pinnipeds, and manatee) known to be present (some year-round and some seasonally) in the Mid-Atlantic OCS region, all of which are protected by the MMPA and some are additionally protected under the ESA including 5 large whale species (right, blue, fin, sei, and sperm whale). There are five sea turtle species known to be found in the Lease Area, of which two are listed as threatened (Northwest Atlantic Ocean Distinct Population Segment Loggerhead, North Atlantic Distinct Population Segment Green) and three are listed as endangered (Kemp's ridley, Leatherback, and Hawksbill) under the ESA.

The Company has reviewed publicly available literature and published data. The offshore waters of Virginia and North Carolina, including the Lease Area, are used as both a migration corridor for several ESA-listed large whale species known to occur in these waters and serve as summer feeding grounds for cetacean species. The ESA-listed endangered large whale species which are considered mostly likely to be found in the area are the fin, sei, and right whale. However, among these three, the sei whale has the lowest likelihood of being collocated with Project activities since it is more typically found offshore and is not as common as the right whale and fin whale in this region. Similarly, the sperm whale and blue whale are typically found further offshore (Pabst et al. 2011; Read et al. 2014; NPS 2015; Sivle et al. 2015, 2016; Hodge et al. 2016; Costidis et al. 2017; Wensveen et al. 2017; Hayes et al. 2019; Aschettino et al. 2018; DoN 2019; Ormont Blumberg 2019; NOAA 2019; Southall et al. 2019). Fin whales and humpback whales may occur year-round in these waters. There has been an increase in sightings along the coastline of both Virginia and North Carolina, especially during the summer feeding season, for these species (DoN 2019). Additionally, there has been an increase in stranded dead whales along the North Carolina and Virginia coastlines within the last year (Wensveen et al. 2017; Hampton 2019; Price 2019).

The humpback whale is the commonly found large whale species in the area, but it was delisted from endangered status in 2015. In 2015, humpback whale species were divided into 14 Distinct Population Segments (DPS), and the DPS occurring in the SAP Survey Area was removed from the species-level listing. The humpback whale DPS in the SAP Survey Area is the West Indies DPS, and was delisted on October 11, 2016 (81 FR 62260; September 8, 2016). While the humpback whale DPS is no longer ESA-protected, it is protected under the MMPA and still subject to BOEM's project design constraints, which apply to all marine mammals regardless of their listing status under the ESA.

The endangered North Atlantic right whale can be found in these waters during seasonal movements north or south between its feeding and breeding grounds. As of January 26, 2016, NMFS expanded the North

Atlantic Right Whale Critical Habitat Southeastern U.S. Calving Area from Cape Fear, North Carolina, southward to 29°N latitude (approximately 43 miles north of Cape Canaveral, Florida). However, this expanded area is well south of the proposed Lease Area.

There is very low potential for the sperm whale and blue whale, (both of which are ESA-listed) as well as the Bryde's whale, *Kogia* spp., and beaked whales to occur, however, these species are typically found in deeper waters off the OCS and are therefore unlikely to occur in the Lease Area due to this habitat preference. Florida manatees are typically found in Florida waters; however, they also occur throughout the mid-Atlantic and can be found further offshore, especially when waters are warmer (Cummings et al. 2014; USFWS 2014). Manatees have been sighted in the waters of all mid-Atlantic states and as far north as Massachusetts in warmer months (USFWS 2014). Recently, in 2015 and 2016, annual sightings have ranged between 13 and 17 in Virginia, respectively (Costidis et al. 2017). The manatee is considered unlikely to occur in the Lease Area since they are primarily found in the warm coastal waters of Florida; however, presence would have the highest likelihood of occurring in the spring and summer months when waters are warmer (Costidis et al. 2017). Harbor and gray seals along the Mid-Atlantic coast south of New Jersey typically prefer colder, northern waters. However, researchers have documented a trend of increased haul-out numbers during the winter months in coastal Virginia and have posited a distribution expansion to the south for both these species (Jones et al. 2018). There is a documented correlation between water temperature and haul-out numbers, with a decrease in haul out numbers seen during the warmer summer months and an increase in numbers during the winter months (Parker 2017; DoN 2019).

All five species of sea turtles occur in the SAP Survey Area, but of these, the most commonly occurring is the loggerhead sea turtle. Loggerhead, green, and the leatherback sea turtles have nesting sites on North Carolina beaches. The hawksbill sea turtle is the least common in the SAP Survey Area; however, sightings have been documented (Epperly et al. 1995; Stevens 2019). Researchers in the Sea Turtle Project have documented an increase in numbers of cold-stunned sea turtles (specifically Kemp's Ridley, Loggerhead, and Green turtles) in recent years, as well as an increase in nesting sites along the southern Virginia Coastline (near Chesapeake Bay) (North Carolina Sea Turtle Project 2018).

Marine mammal species and sea turtle species impacts are mainly from collision from ships or entanglement events A vessel collision or an entanglement event would likely result in adverse, injurious, or mortality impacts to an individual animal If an animal is ESA-listed, this would be a population level impact.

With implementation of the vessel strike avoidance measures, there is a negligible risk of vessel strikes in the BDA. The vessel strike avoidance measures and best management practices (BMPs) utilized will mitigate ship strike impacts on marine mammals and sea turtles. The use of chain moorings and best available practices to reduce entanglement in the mooring design result in a negligible risk of entanglement for marine mammals or sea turtles. The proposed Metocean Equipment is designed with a U-mooring configuration that will only use heavy chain as the primary connection between the buoy and anchors. The primary FLiDAR mooring recovery method is to recover the U-mooring marker buoy to retrieve the entire mooring and anchors. There will be a secondary Dyneema pendant line connected from the FLiDAR buoy topside to the upper chain at 44.3 ft (13.5 m) below the buoy. This line is secured at 1.3 ft (0.4 m) increments to the buoy bull and chain with no excessive loops of line protruding that could be potential for marine mammal entanglement. The TRBM module has a similar U-mooring configuration with a surface buoy connected to a primary anchor by chain and to the TRBM by chain. The TRBM module will have a secondary acoustic pop-up cannister with Dyneema recovery line. This line is only exposed to the environment during the recovery operation when vessels/crew are on site. No synthetic line would be exposed during monitoring operations. Sea turtle feeding habits also result in them being less likely to be at risk from entanglement (Benjamins et al. 2014; Harnois et al. 2015).

The Company will implement all applicable Lease conditions, which include BMPs for the installation, operation, maintenance, and decommissioning of the Metocean Equipment, in order to further reduce the potential for interactions with or impacts on marine wildlife.

The Company will provide plans to minimize potential impacts to marine mammals and sea turtles in accordance with Lease stipulations, the NC EA, and other permit conditions. The installation, operation, maintenance, and decommissioning of the Metocean Equipment will not result in the harassment of marine mammals or sea turtles protected under the MMPA and ESA. Additionally, pile driving activity is not required for Metocean Equipment installation proposed in this SAP, and therefore there will be no acoustic harassment associated with installation, and mitigation measures are not applicable.

The approach to developing a baseline and an assessment of future potential impacts on marine mammal and sea turtle species from development of the Project within the Lease Area will need to satisfy the requirements of various regulations and agencies. As such, the Company is collaborating and coordinating with various agencies including BOEM, NMFS, USFWS, North Carolina Department of Environmental Quality (NCDEQ), North Carolina Wildlife Resources Commission (NCWRC), Virginia Marine Resources Commission, and Virginia Department of Game and Inland Fisheries throughout the development and planning process.

6.6 Avian and Bat Resources

As demonstrated in Section 2, the equipment and methodologies proposed herein by the Company are consistent with the activity considered by BOEM in the NC EA (BOEM 2015). Sections 4.4.2.1 and 4.2.2.2 of the NC EA provide details on the potential impacts to avian and bat resources that result from the proposed site assessment activity and are incorporated by reference and not repeated.

North Carolina is part of the Atlantic Flyway, which extends over the OCS where numerous bird species could potentially occur, fly over, or use the coastal and pelagic region of the OCS during parts of their annual cycle (eBird 2012, Buler and Rivera 2016, Veit et al. 2016, Winship et al. 2018, Goodale et. al 2019). According to recent studies, publicly available data, and information obtained from the Information for Planning Consultation tool, the Lease Area provides potential habitat for both coastal and pelagic species of the OCS for approximately 100 waterbird species, including sea ducks, loons, gulls, scoters, terns, alcids, gannets, shearwaters, petrels, shorebirds, as well as migrating passerines (eBird 2012, Buler and Rivera 2016, Kinlan et al. 2016, Veit et al. 2016).

Three federally listed species including the endangered roseate tern (*Sterna dougallii dougallii*) and the threatened piping plover (*Charadrius melodus*) and red knot (*Calidris canutus ssp. rufa*) may occur regionally surrounding the Lease Area (eBird 2012, Buler and Rivera 2016, Kinlan et al. 2016, Veit et al. 2016).

Roseate tern (also a state endangered species) are known to forage and/or migrate through coastal North Carolina and potentially the Lease Area (NCWRC 2017, Kinlan et al. 2016, USFWS 2019). More than 90 percent of the total population nest on three islands in eastern New York and Massachusetts (Burger et al. 2011).

Little is known about the migratory pathways and stopover sites of the federally-listed threatened piping plover (also a state endangered species). It has been assumed that piping plovers stay close to coastal margins during migration; however, a recent study showed that piping plover, fitted with radio transmitters, were tracked flying over open ocean (Loring et al. 2019). The species is also known to winter on islands in the Bahamas (USFWS 2015), demonstrating the species' ability to fly over open ocean. Therefore, piping plovers could potentially fly through the Lease Area; however, the NC EA determined that buoys did not pose a significant risk to birds.

The federally listed threatened red knot, (also a state threatened species) has been documented migrating along the North American Atlantic coastline using automated telemetry stations within a Study Area extending from Cape Cod, Massachusetts to Back Bay, Virginia (Loring et. al 2018). The study found eight percent of 388 tagged birds passed through one or more of the current offshore wind energy lease areas in the Atlantic during fall migration (mostly November). Red knot has not been documented migrating and/or foraging in the Lease Area.

In addition, Gull-billed tern (*Gelochelidon nilotica*, state threatened), Peregrine falcon (*Falco peregrinus*, state endangered), and Bald eagle (*Haliaeetus leucocephalus*, state threatened) may also occur along the coast of North Carolina and potentially the Lease Area. Lastly, Bermuda petrel (*Pterodroma cahow*, federally and internationally listed as endangered) are known to occur year-round in pelagic waters off the coast of Virginia and the Carolinas (eBird 2012) but breed in Bermuda.

Most bat species found in North Carolina prefer forested habitats, hibernate in existing caves and abandoned mines during the winter, and are mostly found in the western part of the state along the Appalachian Mountains (NCWRC 2015). Northern long-eared bats (*Myotis septentrionalis*, federally threatened), southeastern bats (*M. austroriparius*, Species of Concern), eastern small-footed bat (*M. leibii*, Species of Concern) and northern yellow bat (Lasiurus intermedius, Species of Concern) have ranges that overlap with the coastal barrier beaches of coastal North Carolina but are not known to venture offshore and are unlikely to occur in the Lease Area. Bats with the greatest potential to migrate through the Lease Area during the spring and fall are the three migratory tree species: eastern red bat (*Lasiurus borealis*), hoary bat (*Lasionycteris cinereus*), and silver-haired bat (*L. noctivagans*). All three migratory tree bats have been confirmed to occur offshore and appear to migrate and possibly forage offshore (Pelletier et al. 2013, Peterson 2016). While little is known about species-specific seasonal patterns, the density of bats detected offshore generally decreases the further the distance from onshore coastal sites and with most detections for migratory tree bats occurred during the late summer to fall seasons (July to October; Peterson 2016). While tree bats could potentially occur in the Lease Area, any potential impacts to tree bat species are expected to be minimal and not contribute to any population declines.

The Company has reviewed currently available literature and data regarding avian and bat resources in the Mid-Atlantic off the coast of North Carolina and has determined that there is no substantive new information that would change BOEM's analysis. The results of the NC EA and BOEM's analysis and conclusion that the proposed activity is not anticipated to result in any significant or population-level effects to avian and bat resources is applicable.

The Company will implement all applicable Lease conditions, which include BMPs for the installation, operation, maintenance, and decommissioning of the Metocean Equipment in order to further reduce the potential for impacts on avian and bat resources.

6.7 Water Quality

As demonstrated in Section 2, the equipment and methodologies proposed herein by the Company are consistent with the activity considered by BOEM in the NC EA (BOEM 2015). Section 4.4.1.2 of the NC EA provide details on the potential impacts to water quality that result from the proposed site assessment activity and are incorporated by reference and not repeated.

State coastal waters in the area include the Albemarle Sound and the shoreline. The NC EA and FONSI did not report any significant findings regarding water quality in coastal state waters, with the exception of historic nuisance algal blooms which are caused by agricultural run off or other nutrient rich sources (BOEM 2015). Water quality data are collected in state coastal waters by both NCDEQ and Virginia Department of Environmental Quality (VDEQ), and additional monitoring studies are occasionally conducted in the area, including studies by the U.S. Geological Survey (USGS).

NCDEQ maintains three water quality stations within the area that monitor salinity, Secchi depth, nutrients, and chlorophyll-a (NCDEQ 2019a). The data are available through 2018 and most parameters are collected multiple times a year (NCDEQ 2019a). No data are available in the area along the shoreline or in freshwater tributaries or wetlands. VDEQ collects water quality data near potential landing zones, including at the mouth of Chesapeake Bay and in streams and lakes throughout Virginia Beach County. Data collected varies by stations, but includes water temperature, dissolved oxygen, conductivity, nutrients, chlorophyll-a, and turbidity (VDEQ 2019).

The USGS conducted a large water quality study of the Albemarle Sound Watershed from 2012 through 2014, which included the area in Virginia that drains to the Sound and its associated shoreline (Moorman et al. 2016). The USGS collected dissolved oxygen, nutrient, sediment, and metal data at 34 sites and compared results to water quality standards or recommend water quality criteria. In the estuarine area, several stations exceeded standards or recommended concentrations for dissolved oxygen, pH, chlorophyll-a, filtered copper, filtered zinc, and cyanobacteria density (Moorman et al. 2016). Total nitrogen concentrations were highest in the Currituck Sound and Back Bay, while phosphorus concentrations were typically highest where freshwater streams enter estuarine areas (Moorman et al. 2016). Chlorophyll-a and cyanobacteria concentrations were elevated throughout the estuarine areas. Historic data showed that the Albemarle Sound had frequent nuisance and toxic blooms (BOEM 2015), and nuisance blooms occurred as recently as 2019 (NCDEQ 2019b).

The North Carolina coastal shorelines, bays, and estuaries listed as impaired in BOEM (2015) are still listed as impaired, and the Environmental Protection Agency (EPA) North Carolina assessment information cited represents the best available information on their website (BOEM 2015, EPA 2019). The coastal bays and estuaries in the area are all impaired for fish consumption due to mercury, and most of the waters are impaired for aquatic life (EPA 2019). Typical causes for the aquatic life impairment include algal growth, mercury, metals, enrichment/oxygen depletion, and pathogens. In Virginia, all of the coastal waters in the area with the exception of Back Bay are listed as impaired for aquatic life due to poor estuarine bioassessments and/or low dissolved oxygen (VDEQ 2018). Several coastal areas are also listed as impaired because they do not fully support recreation and shellfish harvesting due to elevated pathogens, and fish consumption due to PCBs (VDEQ 2018). Causes of impairments include atmospheric deposition, contaminated sediments, point source discharges, internal nutrient cycling, loss of riparian habitat, and stormwater (VDEQ 2018).

The Company has reviewed currently available literature and data regarding water quality in the Mid-Atlantic off the coast of North Carolina and has determined that there is no substantive new information that would change BOEM's analysis. The results of the NC EA and BOEM's analysis and conclusion that the proposed activity is not anticipated to result in any significant water quality effects is applicable.

6.7.1 Marine Waters

While the EPA National Coastal Condition Report IV rated North Carolina and Virginia shorelines as "fair" to "poor" for water quality and sediments, their offshore areas were rated as "good" to "fair" for water quality and sediments (EPA 2012, BOEM 2015). The offshore data shows better water quality than the coastline because the majority of pollutants to marine water quality originate onshore, and these pollutants disperse and dilute in the ocean waters (BOEM 2012, 2015). Onshore pollutants include wastewater treatment equipment, non-point sources such as stormwater runoff, and agricultural runoff (BOEM 2015). There are limited offshore pollutants, and these typically consists of vessel discharge bilge and ballast water (BOEM 2015).

The only water quality data for marine waters cited in the North Carolina EA was the EPA National Coastal Condition Report IV, likely because water quality data are rarely collected in the offshore area (BOEM 2015). Most data collected in the offshore area in recent years consists of satellite imagery, although some research agencies have collected infrequent water quality grab sample data. The NOAA CoastWatch uses

satellite imagery to predict primary production (radiation, chlorophyll-a concentration, and sea surface temperature) in the Lease Area and turbidity and sediment concentrations based on satellite imagery (NOAA 2018d, 2018e). The Southeast Coastal Ocean Observing Regional Association maintains water quality data collected by a variety of organizations, such as the Coastal Data Information Program, university study data, USGS, National Estuarine Research Reserve System, and NOAA buoy data (SECOORA 2019).

6.8 Air Quality

The closest point of land to the BDAs is located near Corolla, North Carolina, approximately 25.7 nautical miles (48 km) from BDA1.

The proposed site assessment activity has a *de minimis* potential to impact local air quality. Potential emission sources would include a single work boat, as well as a methanol-powered fuel cell installed on each of the WindSentinel™ Buoys. The vessels associated with these activities would emit criteria air pollutants (nitrogen oxides [NO_x], carbon monoxide [CO], sulfur dioxide [SO_2], particulate matter less than 10 microns in aerodynamic diameter [PM_{10}], particulate matter less than 2.5 microns in aerodynamic diameter [$PM_{2.5}$]), and volatile organic compounds [VOCs]), hazardous air pollutants (HAPs) and greenhouse gases. The vessels would emit pollutants both in state and federal waters while traveling to and from the BDAs throughout the installation and operational lifecycle of the proposed Metocean Equipment. The methanol fuel cells on the WindSentinel™ Buoy would have a very small amount of air emissions during intermittent periods of operation when necessary to supplement the wind turbines and solar panels that would be the primary electric power source on the buoy. Impacts from emissions associated with these activities would not be significant, and would be localized within the immediate vicinity of the site assessment activity.

Installation of the Metocean Equipment is anticipated to be completed over a period of approximately one week in 2020 and decommissioning of the Metocean Equipment is anticipated to be completed over a similar time period in 2022. During the operations phase, the Company has assumed one separate round trip every three months to the deployment site for a single work boat (plus up to two additional visits per year for unscheduled maintenance). The calculations are based on an assumed typical vessel representative of the type, configuration, and size that are anticipated to be employed during the construction and operation phases of the Metocean Equipment. While the vessel that is anticipated to be use is the NorthStar 4 offshore utility vessel or similar, the NorthStar Commander was used for this analysis in order to be more conservative, as it is a larger vessel and has larger engines. After accounting for the two-year operational life of the WindSentinel™ Buoys and the two-year operational life of the TRBM data collection platforms, this results in a total of 14 round trips during the operations phase.

Table 6-2 presents the potential emissions for each activity related to deployment, operation, maintenance, and decommissioning of the Metocean Equipment, along with the maximum calendar year emissions, and the total project lifetime emissions.

Table 6-2 Metocean Equipment Air Emissions Summary

Metocean Equipment Activity	VOC tons	NO_X tons	CO tons	PM/ PM_{10} tons	$PM_{2.5}$ tons	SO_2 tons	HAPs tons	GHG tons CO_{2e}
Metocean Equipment Deployment (start of year 1)	0.006	0.190	0.099	0.005	0.005	2.53E-05	1.07E-03	13.5
Quarterly Maintenance (year 1)	0.019	0.695	0.355	0.018	0.018	9.22E-05	3.94E-03	49.5
WindSentinel™ Buoy Fuel Cell (year 1)	0.095	0.105	0.025	0	0	0	1.31E-04	12.3

Table 6-2 Metocean Equipment Air Emissions Summary

Metocean Equipment Activity	VOC tons	NO_X tons	CO tons	PM/PM_{10} tons	$PM_{2.5}$ tons	SO_2 tons	HAPs tons	GHG tons CO_{2e}
Annual Maintenance Recovery (end of year 1)	0.006	0.203	0.108	0.006	0.006	2.71E-05	1.13E-03	14.7
Metocean Equipment Redeployment (start of year 2)	0.006	0.201	0.104	0.006	0.005	2.67E-05	1.13E-03	14.4
Quarterly Maintenance (year 2)	0.020	0.731	0.373	0.019	0.019	9.70E-05	4.14E-03	52.1
WindSentinel™ Buoy Fuel Cell (year 2)	0.095	0.105	0.025	0	0	0	1.31E-04	12.3
Metocean Equipment Decommissioning (end of year 2)	0.007	0.214	0.113	0.006	0.006	2.86E-05	1.20E-03	15.4
Maximum Annual Emissions (tons)	**0.127**	**1.250**	**0.615**	**0.031**	**0.030**	**1.52E-04**	**0.007**	**94.2**
Total Project Lifetime Emissions (tons)	**0.253**	**2.443**	**1.201**	**0.060**	**0.058**	**2.97E-04**	**0.013**	**184.2**

The Company consulted with the EPA and confirmed that an OCS air permit is not required because the buoy would be located more than 25 nautical miles (46.3 km) from the state seaward boundaries, and would not trigger the thresholds for any of the federal requirements listed in 40 CFR § 55.13, because total Project emissions would be well below the major source thresholds of 100 tons per year for criteria air pollutants, and 25 tons per year of total HAPs or 10 tons per year of any individual HAP.

6.9 Socioeconomic Resources

As demonstrated in Section 2, the equipment and methodologies proposed herein by the Company are consistent with the activity considered by BOEM in the NC EA (BOEM 2015). Section 4.4.4 of the NC EA provides details on the potential impacts to socioeconomic resources that could result from the proposed site assessment activity and is incorporated by reference and not repeated.

BOEM (2015) considered impacts to demographics and employment, environmental justice, recreation and tourism, commercial and recreational fishing, and visual resources. BOEM's analysis in the NC EA concluded that impacts would be negligible (visual resources) or negligible to minor (demographics and employment, recreation and tourism, and commercial and recreational fishing), and also concluded that the proposed action would have no disproportionately high and adverse human health or environmental effects on minority or low-income populations (i.e., environmental justice impacts) (BOEM 2015). The Company has reviewed currently available literature and data regarding socioeconomic resources in the Mid-Atlantic off the coast of North Carolina, including the following:

- BOEM's Analysis of the Socio-Economic Impact of Outer Continental Shelf Wind Energy Development on Fisheries in the U.S. Atlantic (Kirkpatrick, A. J., S. Benjamin, G.S. DePiper, T. Murphy, S. Steinback and C. Demarest 2017);
- National Ocean Economic Program market data (National Ocean Economic Program 2019);
- Northeast Ocean Council data (Northeast Ocean Council 2019);
- The U.S. Travel Association's Economic Impact of Tourism in North Carolina, Tourism Satellite Account Calendar (Tourism Economics 2017);
- U.S. Bureau of Labor Statistics data on civilian labor force and unemployment by metropolitan area, (U.S. Bureau of Labor Statistics data, 2019); and
- U.S. Census Bureau population data (U.S. Census Bureau 2019).

Based on this data, the Company has determined that there is no substantive new information that would change the results of BOEM's analysis. The results of the NC EA and BOEM's conclusion that the proposed activity is not anticipated to result in any significant impact to socioeconomic resources is applicable.

The Company will implement all applicable Lease conditions, which include BMPs for the installation, operation, and decommissioning of the Metocean Equipment in order to further reduce the potential for impacts on socioeconomic resources.

6.10 Coastal and Marine Uses

As demonstrated in Section 2, the equipment and methodologies proposed herein by the Company are consistent with the activity considered by BOEM in the NC EA (BOEM 2015). Sections 4.4.2, 4.4.3, and 4.4.4 of the NC EA provide details on the affected environment and potential impacts to coastal and marine uses that may result from the proposed site assessment activity.

The Company has reviewed currently available literature and data regarding coastal and marine uses off the coast of North Carolina and determined that there is no substantive new information that would change BOEM's analysis. The results of the NC EA and BOEM's analysis and conclusion that the proposed activity is not anticipated to result in any significant impact to coastal and marine uses is applicable.

The Company will implement all applicable Lease conditions, which include BMPs for the installation, operation, and decommissioning of the Metocean Equipment in order to further reduce the potential for impacts on coastal and marine uses.

6.11 Meteorological and Oceanographic Hazards

As demonstrated in Section 2, the equipment and methodologies proposed herein by the Company are consistent with the activity considered by BOEM in the NC EA (BOEM 2015). Sections 3.3.1, 4.3.2, and 4.4.1 of the NC EA directly discuss the details on the affected and environment and potential impacts to the oceanographic hazards that may result from the proposed site assessment activity, and is incorporated by reference and not repeated.

The Company has reviewed currently available literature and data regarding meteorological and oceanographic hazards off the coast of North Carolina and has determined that there is no substantive new information that would change BOEM's analysis. The results of the NC EA and BOEM's analysis and conclusion that the proposed activity is not anticipated to result in any significant impact to meteorological and oceanographic hazards is applicable.

The Company will implement all applicable Lease conditions, which include BMPs for the installation, operation, and decommissioning of the Metocean Equipment in order to further reduce the potential for impacts on meteorological and oceanographic hazards.

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Appendix A. Permits and Consultations

United States Department of the Interior

BUREAU OF OCEAN ENERGY MANAGEMENT
WASHINGTON, DC 20240-0001

MAY 17 2018

Mr. Craig Poff
Avangrid Renewables, LLC
Two Radnor Corporate Center, Suite 200
100 Matson Ford Road
Radnor, Pennsylvania 19087

Dear Mr. Poff:

The Bureau of Ocean Energy Management (BOEM) has received Avangrid Renewables, LLC (Avangrid) March 9, 2018, letter requesting a 12-month extension of the preliminary term for commercial lease OCS-A 0508, from November 1, 2018 to November 1, 2019, pursuant to 30 C.F.R. § 585.235(b). BOEM is approving your request for the reasons described below.

Your letter states that while Avangrid has worked diligently on the lease to establish a dedicated, internal project team and has engaged external consultants to evaluate how the project may be best supported with a view to effective, efficient, and cost effective delivery it is not in a position to complete a Site Assessment Plan (SAP) by November 1, 2018, as required by lease OCS-A 0508 in light of the following considerations:

1. Material constraints on the availability of equipment, vessels, and personnel to initiate the survey effort required for a SAP delivery in 2018.
2. Additional time will allow thoughtful and deliberate survey planning and procurement, as well as detailed discussion with BOEM.

Your letter indicates that Avangrid plans to conduct the following key activities to support the submission of a SAP during the preliminary term extension. These activities include:

1. Procure environmental and technical consultants to support the project.
2. Conduct a rigorous data gap analysis.
3. Commence survey planning and collaborate with BOEM Subject Matter Experts.
4. Procure equipment, vessels & personnel for surveys planned for 2019.
5. Identify cable routing options and conduct alternatives analysis.
6. Commence stakeholder identification and engagement planning.

BOEM has reviewed your request and has determined an extension of the preliminary term is justified. We base our decision on the fact that Avangrid has identified their previous and planned activities over the next year to support SAP submission and development of commercial lease OCS-A 0508. Specifically, Avangrid plans to conduct the necessary surveys to support a SAP in 2019.

Therefore, pursuant to 30 C.F.R. § 585.235(b) and in consideration of the information provided in your February 14, 2017, letter, your request to extend the preliminary term of commercial lease OCS-A 0508 to November 1, 2019, is approved.

If you have any questions please contact Mr. Will Waskes at 703-787-1287 or will.waskes@boem.gov.

Sincerely,

James F. Bennett
Program Manager
Office of Renewable Energy Programs

BENITO JR, BRIAN

From: Waskes, Will <will.waskes@boem.gov>
Sent: Friday, June 7, 2019 1:51 PM
To: Poff, Craig; BENITO JR, BRIAN
Cc: Brian Krevor; Culbertson, Jennifer; Kemiki, Motunrayo; David Macduffee; Michelle Morin
Subject: EXTERNAL: BOEM Review of Avangrid Renewables's Survey Plan for OCS-A 0508 - June 2019
Attachments: Review Matrix_Survey Plan_OCS-A 0508_6.4.2019_FINAL.pdf

Craig and Brian,

We are sending this message to your attention in response to Avangrid Renewables's (the Lessee, Company Number: 15059) (Avangrid) request for authorization to conduct surveys described in their survey plan, which the Lessee submitted to the Bureau of Ocean Energy Management (BOEM) (the Lessor) pursuant to stipulation 2.1.1 of Addendum C of commercial lease OCS-A 0508 on January 4, 2019, with subsequent revisions submitted on March 22, 2019, April 12, 2019, May 10, 2019 and June 4, 2019. BOEM has completed its review of the final version of the survey plan and determined that Avangrid has satisfactorily modified it to address the Lessor's comments. Attached is the final review matrix for the survey plan. BOEM makes the following specific determinations regarding Avangrid's survey plan.

Waiver Request of Lease Stipulation 2.1.2 of Addendum C

On March 27, 2019, Avangrid submitted a request for a waiver of the requirements in 2.1.2 of Addendum C of the lease that it hold the survey plan pre-meeting at least 60 days prior to the initiation of the survey activities.

The Office of Renewable Energy Program's Program Manager (as Lease Representative for Lessor) hereby approves Avandrid Wind's request for a waiver of the 60-day timing requirement included in stipulation 2.1.2 as Avangrid has fulfilled all the necessary compliance requirements. Avangrid may begin the commencement of their surveys prior to June 9, 2019.

Alternative Monitoring Plan (Lease Stipulation 5.4.3)

BOEM has completed its review of the final version of the Alternative Monitoring Plan (AMP), dated June 4, 2019, and has determined that it has demonstrated the effectiveness of the proposed methodology in compliance with stipulation 5.4.3. Avangrid may conduct survey activities in support of plan submittal at night or when visual observation is otherwise impaired, using the proposed alternative monitoring methodology.

Protected Species Observers (Lease Stipulation 5.4.4)

Avangrid submitted Protected Species Observer (PSO) résumés and approval letters from NMFS to BOEM on April 13, 2019, in accordance with stipulation 5.4.4 of Addendum C of the lease. These resumes have been reviewed and accepted by BOEM.

Use of Previously Submitted Field Verification Data to Field Verification of the HRG Survey Exclusion Zone (Lease Stipulation 5.4.6.2)

Avangrid submitted a request to utilize the results other Lessee's High Resolution Geophysical (HRG) survey equipment field verification efforts, in addition to third-party verification studies (published and unpublished), to meet the requirements of stipulations 5.4.6.2 of Addendum C of the lease. BOEM reviewed the relevant results and studies, and determined that the previously collected data and study results were applicable and acceptable.

Modification of HRG Exclusion Zone per Lessee Request (Lease Stipulation 5.4.6.3)

Pursuant to lease stipulation 5.4.6.3, Avangrid requests a modification of the exclusion zones required in lease stipulation 5.4.6.1 for HRG survey equipment based on the results of its sound source verification analysis, which it submitted to BOEM in accordance with stipulation 5.4.6.2. The proposed changes have been authorized for marine mammals by the National Marine Fisheries Service (NMFS) in the June 3, 2019, Incidental Harassment Authorization issued to Avangrid, and is consistent with the analysis of new information for sea turtles.

BOEM hereby approves Avangrid's request to modify the HRG exclusion zone described in stipulation 5.4.6.1 to 500 m for North Atlantic right whales, 200 m for sei and fin whales, 100 m for other large cetaceans (i.e., humpback whales, minke whale, pilot whale, Risso's dolphin), and 50 m for sea turtles for this survey.

Waiver of Lease Stipulation 5.4.6.4 of Addendum C

On April 17, 2019, Avangrid submitted a waiver request for lease stipulation 5.4.6.4 of Addendum C of lease OCS-A 0508 to depart from the requirement that any HRG sound sources are not activated until clearance of the exclusion zone for at least 60 minutes. BOEM has determined that once survey activities have begun, the species-specific modified clearance zone time periods requested by Avangrid satisfy the protective purposes of stipulations 5.4.6.8 and 5.4.6.9, while allowing Avangrid to more efficiently execute its surveys. The Lessor is approving this request because it is consistent with marine mammal and sea turtles dive periods of protected species. The 60 minute pre-clearance period was based on the longest dive period of sea turtles and applied to all protected species. The waiver provides for a marine-mammal specific clearance periods based on their dive periods.

The Office of Renewable Energy Program's Program Manager (as Lease Representative for Lessor) hereby approves Avangrid's waiver request that the start or restart of the electromechanical survey equipment described in stipulation 5.4.6.4 occur after the following clearance times for the exclusion zones 15 minutes for small cetaceans and seals; 30 minutes for large whales; and 60 minutes for turtles.

Waiver of Lease Stipulation 5.5.6 of Addendum C

On April 17, 2019, Avangrid submitted a waiver request for lease stipulation 5.5.6 of Addendum C of lease OCS-A 0508. Specifically, Avangrid requests to depart from the requirement to provide reports of G&G survey activities and PSO observations every 90 calendar days following the commencement of survey activities, as well a final report at the conclusion of the survey actives. Instead, Avangrid would submit a single survey activity and observation report at the conclusion of the survey that contains all the information required by stipulation 5.5.6.

The Office of Renewable Energy Program's Program Manager (as Lease Representative for Lessor) hereby approves Avangrid's waiver request to submit a single survey activity and observation report that contains the information described in least stipulation 5.5.6, to the Lessor and NMFS within 90 days after the conclusion of the survey activities authorized by this email.

If you have any questions or concerns, please feel free to contact Will Waskes at Will.Waskes@boem.gov or at 703-787-1287.

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U.S. Department of the Interior
Bureau of Ocean Energy Management

Coastal Zone Management Act, Consistency Determination (15 CFR 930.36(a))

Kitty Hawk Wind Energy Area Offshore the State of North Carolina

The purpose of this Consistency Determination (CD) is to determine whether issuing a commercial wind energy lease and approving site assessment activities (including the installation, operation, and decommissioning of a meteorological tower and/or buoys) within the Kitty Hawk Wind Energy Area (WEA) offshore North Carolina (*see* Figure 1) is consistent to the maximum extent practicable with the enforceable policies of the North Carolina and Virginia Coastal Management Programs (CMPs). This document is provided pursuant to the requirements of 15 CFR 930.39(a) of the Coastal Zone Management Act (CZMA) Federal consistency regulations.

Section 307(c)(1) of the CZMA, as amended, requires that Federal agency activities affecting any land or water use, or natural resource of the coastal zone shall be carried out in a manner which is consistent to the maximum extent practicable with the enforceable policies of federally-approved state management programs.

The State of North Carolina and the Commonwealth of Virginia share common coastal management issues and have similar enforceable policies as identified by their respective CMPs. Due to the proximity of the Kitty Hawk WEA to both states (*see* Figure 1), and their shared impacts on environmental and socioeconomic resources and uses, the Bureau of Ocean Energy Management (BOEM) has prepared a single CD for the Kitty Hawk WEA.

BOEM is proposing to issue a commercial wind energy lease within the Kitty Hawk WEA (as illustrated in Figure 1 and described below) and approve site assessment activities that would determine whether the lease is suitable for, and would support, commercial-scale wind energy production. The lease, by itself, would not authorize the lessee to construct or operate any wind energy project on the Outer Continental Shelf (OCS).

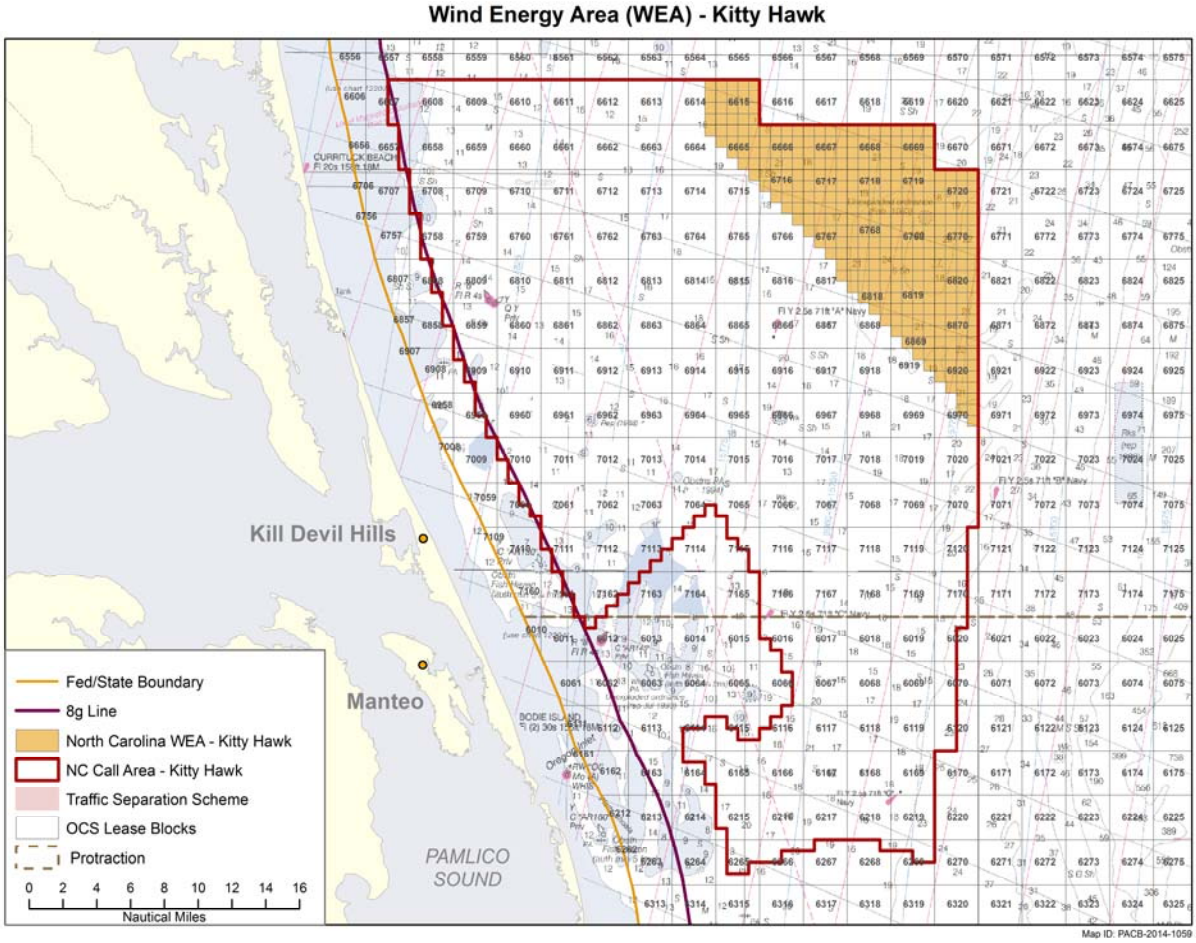

Figure 1: Kitty Hawk Wind Energy Area

In January 2011, BOEM established the North Carolina Intergovernmental Renewable Energy Task Force (Task Force). The Task Force began working to develop an area offshore of North Carolina to be considered for commercial wind energy leasing.

On December 13, 2012, BOEM published a Call for Information and Nominations (Call) in the Federal Register (under Docket ID: BOEM-2012-0088). The Call was open for public comments for 45 days. On February 5, 2013, BOEM reopened the comment period for the Call to allow for additional public input. The comment period for the Call closed on March 7, 2013. After considering public comments on the Call and working closely with stakeholders, BOEM announced on August 11, 2014, that it had identified WEAs offshore North Carolina. The Kitty Hawk area was refined to accommodate navigational safety concerns and avoid potential impacts to the Bodie Island Lighthouse. The Kitty Hawk WEA is shown in Figure 1 and described in Table 1 below.

Table 1: Kitty Hawk Wind Energy Area

Wind Energy Area (WEA)	Official Protraction Diagram	Size (sq nautical miles [nm^2])	Distance to Shore (nm)	Minimum Water Depth (feet [ft])	Maximum Water Depth (ft)
Kitty Hawk	Currituck Sound NJ18-11	145	24	88	134

Activities that may occur over the site assessment period of the lease (i.e., up to five years) include site characterization survey activities and site assessment activities involving the construction, operation, maintenance, and decommissioning of a meteorological tower and/or buoys. Site characterization surveys would inform a lessee about site specifics of a lease area in order to prepare for submission of a site assessment plan (SAP) and, potentially, a construction and operations plan (COP). The projected site characterization and site assessment activities within the WEA are discussed in detail in Section 2 and summarized in Table 2 (below).

Table 2: Projected Site Characterization & Assessment Activities in the WEA

Potential Leaseholds	Site Characterization Activities			Site Assessment Activities	
	High Resolution Geophysical (HRG) Surveys (Total Trips)	Sub-bottom Sampling (Total Trips)	Avian and Fish Surveys	Installation of Met Towers (max)	Installation of Met Buoys (max)
1	236	467	132-168	1	2

1. BACKGROUND

BOEM is authorized to issue leases on the OCS for the purposes of wind energy development pursuant to Section 388 of the Energy Policy Act of 2005. On April 22, 2009, BOEM promulgated regulations implementing this authority at 30 CFR Part 585. The regulations establish a program to grant leases, easements, and rights-of-way for orderly, safe, and environmentally responsible renewable energy development activities, such as the siting and construction of offshore wind facilities on the OCS, as well as other forms of renewable energy such as marine hydrokinetic (i.e., wave and current). The Minerals Management Service (MMS) prepared a programmatic environmental impact statement to evaluate the impact of establishing a comprehensive, nationwide MMS Alternative Energy Program on the OCS (*Programmatic Environmental Impact Statement for Alternative Energy Development and Production and Alternate Use of Facilities on the Outer Continental Shelf, Final Programmatic Environmental Impact Statement*, October 2007 (Programmatic EIS). The final rule and the Programmatic EIS can be reviewed for reference on the BOEM website at: http://www.boem.gov/Renewable-Energy-Program/Regulatory-Information/Index.aspx and http://www.boem.gov/Renewable-Energy-Program/Regulatory-Information/Guide-To-EIS.aspx. In addition, BOEM published the *Atlantic Geological and Geophysical Activities Programmatic Final Environmental Impact Statement* (G&G PEIS). The G&G PEIS can be viewed here: http://www.boem.gov/Atlantic-G-G-PEIS/.

On September 18, 2015, BOEM released the *Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore North Carolina Revised Environmental Assessment* (Revised EA), which is available online at: http://www.boem.gov/NC-EA-Camera-FONSI/. The Revised EA analyzes the reasonably foreseeable consequences associated with two distinct BOEM actions in the Kitty Hawk WEA:

(1) Lease issuance (including reasonably foreseeable consequences associated with shallow hazards, geological, geotechnical, archaeological resources, and biological surveys); and

(2) SAP approval (including reasonably foreseeable consequences associated with the installation of a meteorological tower and/or meteorological buoys).

BOEM does not issue permits for shallow hazards, geological, geotechnical, or archaeological resource surveys. However, since BOEM regulations require that a lessee include the results of these surveys in its application for SAP and COP approval, the Revised EA and this CD treats the environmental consequences of these surveys as reasonably foreseeable consequences of issuing a lease.

2. PROPOSED ACTION DESCRIPTION

Offshore Site Characterization Surveys

BOEM regulations require that a lessee provide the results of a number of surveys with both a SAP and a COP, including: a shallow hazards survey, a geological survey, biological surveys, a geotechnical survey, and an archaeological resource survey (30 CFR 585.626(a)(1) to (a)(5), respectively). BOEM refers to these surveys as "site characterization" activities. Site characterization activities (e.g., locating shallow hazards, cultural resources, and hard-bottom areas; evaluating installation feasibility; assisting in the selection of appropriate foundation system designs, and determining the variability of subsurface sediments) would necessitate using high-resolution geophysical (HRG) surveys and geotechnical exploration. The purpose of the HRG survey would be to acquire geophysical shallow hazards data and information pertaining to the presence or absence of archaeological resources and to conduct bathymetric charting. The purpose of geotechnical exploration would be to assess the suitability of shallow foundation soils for supporting a structure or transmission cable under any operational and environmental conditions that might be encountered (including extreme events), and to document soil characteristics necessary for the design and installation of all structures and cables. The results of geotechnical exploration allow for a thorough investigation of the stratigraphic and geo-engineering properties of the sediment that may affect the foundations or anchoring systems of a meteorological tower or buoy, which would be necessary for BOEM to consider in a SAP, or later a COP, for a given lease.

Site characterization activities would also necessitate vessel and/or aerial surveys to characterize three primary biological resource categories: (1) benthic habitats; (2) avian resources; and (3) marine fauna. BOEM does not anticipate a lessee needing to conduct separate surveys to characterize the benthic habitats which could be affected by their potential future leasehold activities, because the geological and geotechnical surveys would provide enough detailed information for BOEM to adequately assess potential impacts on benthic habitats in the area. For a lessee to describe the state of the avian and marine fauna resources, resource surveys

would generally involve simple visual observation, either from a vessel or aircraft. For avian and marine fauna surveys, multi-year assessment periods may be necessary to capture natural seasonal and inter-annual variability of marine fauna within the WEA and immediate surroundings if current data available is not sufficient to determine spatial and temporal distribution of species. It is generally envisioned that the fish, marine mammal, sea turtle, and bird aerial and shipboard surveys could be conducted simultaneously.

It is assumed that the site of a meteorological tower and/or buoys would be surveyed first to meet the similar data requirements for a lessee's SAP (30 CFR 585.610 and 585.611), and the site of a meteorological tower or buoy would not be resurveyed when the remainder of the leasehold is surveyed to meet the data requirements for a lessee's COP (30 CFR 585.626(a)). However, a lessee could conduct all of their surveys at the same time (to support both a SAP and a COP).

Meteorological Tower and Buoys

A typical meteorological tower consists of a mast mounted on a foundation anchored to the seafloor. The mast may be either a monopole or a lattice (similar to a radio tower). The mast and data collection devices would be mounted on a fixed or pile-supported platform (monopile, jackets, or gravity bases) or floating platform (spar, semi-submersible, or tension-leg). Once installed, the top of a meteorological tower would be 295 to 377 ft (90-115 meters [m]) above mean sea level. Total installation time for one meteorological tower would be eight days to 10 weeks, depending on the type of structure installed and the weather and ocean conditions. There are several types of foundation pile(s) for a fixed platform, and could include, for example, a single 10-foot (3 m) diameter monopile or a steel jacket with three to four 36-inch-diameter (91-cm-diameter) piles. The monopile or piles would be driven anywhere from 25 to 100 ft (8-30 m) into the seafloor. The area of ocean bottom affected by a meteorological tower would range from about 200 square feet (ft^2), if supported by a monopile, to 2,000 ft^2, if supported by a jacket foundation. The final foundation selection would be included in a detailed SAP submitted to BOEM for its review, along with the results of SAP-related site characterization surveys. See Section 3.2.2.1 of the Revised EA for more information on a meteorological tower.

While a meteorological tower has been the traditional device for characterizing wind conditions, several companies have expressed their interest in installing one or two meteorological buoys instead. Meteorological buoys can be used as an alternative to a meteorological tower for collecting wind, wave, and current data in the offshore environment. The Revised EA assumes that, should a lessee choose to employ buoys instead of meteorological towers, it would install a maximum of two buoys. These meteorological buoys would be anchored at fixed locations, and would regularly collect observations from many different atmospheric and oceanographic sensors. There are three primary types of buoys BOEM anticipates could be used for meteorological resource data collection on the lease: discus-shaped hull buoys; boat-shaped hull buoys; and spar-type buoys. Discus-shaped and boat-shaped buoys are typically towed or carried aboard a vessel to the installation location. A discus-type buoy would use a combination of chain, nylon and buoyant polypropylene materials, while a boat-shaped buoy would be moored using an all-chain mooring. Once at the location site, the buoy would be either lowered to the surface from the deck of the transport vessel or placed over the final location; then the mooring anchor is dropped. Transport and installation vessel anchoring would typically require one day

for these types of buoys. The total area of bottom disturbance for boat-shaped and discus-shaped buoys would be approximately 6 ft^2 (.55 square meters [m^2]) for the actual footprint, and 370,260 ft^2 (34,398 m^2) for the anchor sweep. A spar-type buoy would require two distinct phases for installation, with typically a total of 2 to 3 days to install. The total area of bottom disturbance associated with a spar-type buoy and installation vessel anchors would be roughly 785 ft^2 (73 m^2). See Section 3.2.2.2 of the Revised EA for more information on meteorological buoys and their anchor systems.

To obtain meteorological data, scientific measurement devices consisting of anemometers, vanes, barometers, and temperature transmitters would be mounted either directly on a tower and/or buoy, or on instrument support arms. A meteorological tower or buoy also could accommodate environmental monitoring equipment, such as avian monitoring equipment (e.g., radar units, thermal imaging cameras), acoustic monitoring for marine mammals, data-logging computers, power supplies, visibility sensors, water measurements (e.g., temperature, salinity), communications equipment, material hoist, and storage containers.

To measure the speed and direction of ocean currents, Acoustic Doppler Current Profilers (ADCPs) would likely be installed on or near a meteorological tower or buoy. The ADCP is a remote-sensing technology which transmits sound waves at a constant frequency and measures the ricochet of the sound wave off fine particles or zooplanktons suspended in the water column. The ADCPs may be mounted independently on the seafloor, to the legs of the platform, or attached to a buoy. A typical ADCP is about 1 to 2 ft tall (approximately 0.3-0.6 m) and 1 to 2 ft wide (approximately 0.3-0.6 m).

A SAP would describe the activities (e.g., installation of meteorological tower and/or buoys) a lessee plans to perform for the assessment of the wind resources and ocean conditions at its commercial lease (30 CFR 585.605). No site assessment activities may take place on a lease until BOEM has approved a lessee's SAP (30 CFR 585.600(a)). Once approved, the site assessment term for a commercial lease is five years from the date of SAP approval (30 CFR 585.235(a)(2)). It is assumed that the lessee would install a data-collection device (e.g., meteorological tower, buoy, or both) on its lease area to assess the wind resources and ocean conditions of the leasehold. This information would allow the lessee to determine whether the lease is suitable for wind energy development, where on the lease it would propose development, and what form of development to propose in a COP.

If a lessee submits a SAP, then after BOEM has deemed it complete and sufficient, BOEM must send the SAP, as well as all supporting information, to the North Carolina Department of Environmental Quality Division of Coastal Management (DCM). After providing the SAP to DCM and prior to approving the SAP, BOEM must hold a conference call with DCM and the North Carolina Division of Marine Fisheries in order to ensure adequate communication regarding precise construction location and timing for the proposed meteorological tower and/or buoys.

A lessee must submit a COP at least six months before the end of the site assessment term if the lessee intends to continue to the lease's operations term (30 CFR 585.601(c)). If the COP describes continued use of existing facilities, such as a meteorological tower and/or buoys

approved in the SAP, a lessee may keep such facilities in place on their lease during BOEM's review of the COP (30 CFR 585.618(a)), which may take up to two years. If, after the technical and environmental review of a submitted COP, BOEM determines that such facilities may not remain in place throughout the operations term, a lessee must initiate the decommissioning process (30 CFR 585.618(c)). BOEM anticipates that a meteorological tower could be present for up to five years before the agency decides whether to allow the tower to remain in place for the lease's operations term or whether the tower must be decommissioned immediately.

Coastal Activity

A lessee will likely determine specific ports used for site assessment and survey activities based primarily on proximity to the lease blocks, capacity to handle the proposed activities, and/or established business relationships between port facilities and the lessee. Existing ports or industrial areas in Virginia and North Carolina are adequate to support proposed action activities. Survey vessels would use existing ports and harbors for trip departures and returns and require a diesel refueling station. Vessels conducting HRG surveys and geotechnical exploration work can either depart from one of the two major ports or from one of the two smaller ports identified in the Revised EA and in the closest proximity to the Kitty Hawk WEA. Because the survey vessels used for HRG surveys and geotechnical exploration are smaller than most commercial ocean-going vessels and require a smaller navigation channel depth, they can use most existing commercial ports in the Virginia and North Carolina coastal area. Because anticipated offshore site characterization work is generally smaller in scale than other activities within existing ports, port infrastructure requirements are also likely to be smaller. Because of their proximity to the WEA, the majority of onshore activities would be divided among existing commercial and/or smaller ports in Virginia and North Carolina. BOEM, therefore, does not anticipate expansion of port facilities to meet lessee needs, and considers only existing facilities which can currently accommodate proposed site characterization and site assessment activities.

In order to survey all of the WEA, a lessee may have to use multiple vessels over several years. BOEM anticipates that 65 to 100 ft long vessels would be used, depending on availability, and that they could conduct several surveys simultaneously. Vessels must be able to accommodate a crew for several days and be large enough to mount enough cable to tow instruments.

Vessel Traffic

Approximately 880 to 1,340 total vessel round trips are anticipated to occur as a result of the proposed action over a five-year period (*see* Table 3). Approximately 836 to 872 of these vessel trips (round trips) would be associated with all site characterization surveys as a result of the proposed action over five years, from 2017 to 2022. The total vessel traffic estimated as a result of the installation, decommissioning, and routine maintenance of the meteorological towers and meteorological buoys that could be reasonably anticipated in connection with the proposed action would range from 44 to 468 round trips over a five-year period.

Table 3: Total Vessel Round Trips

HRG Surveys	Cable surveys	Geotechnical Sampling Surveys	Avian Surveys	Fish Surveys	Met Buoys	Met Tower	Total
236	1	467	72-108	60	44-128	100-340	880-1340

The total vessel traffic estimated as a result of the HRG surveys and geotechnical exploration work that could be reasonably anticipated in connection with the proposed action would be approximately 704 round trips over five years, and spread over existing and available port facilities, which would likely be located in Virginia and North Carolina. In addition, BOEM presumes 132 to 168 extra independent surveys conducted to characterize avian and fish resources under the proposed action.

Should the lessee decide to install a meteorological tower on its leasehold, a total of 40 round trips are estimated for construction (*see* Table 4). These vessel trips may be spread over multiple construction seasons as a result of weather and sea state conditions; the time to assess suitable site(s); the time to acquire the necessary permits; and the availability of vessels, workers, and tower components. Because the decommissioning process would basically be the reverse of construction, vessel usage during decommissioning would be similar to vessel usage during construction, so another 40 round trips are estimated for decommissioning of the tower. Meteorological buoys would typically take 1 to 2 days to install by one vessel, and 1 to 2 days to decommission by one vessel. Maintenance trips to each meteorological tower may occur weekly to quarterly, and monthly to quarterly for each buoy. However, to provide for a conservative scenario, total maintenance vessel trip calculations are based on weekly trips for a tower and monthly trips for buoys over the entire 5-year period (*see* Table 4).

Table 4: Vessel Traffic for Meteorological Buoy and Tower Construction, Maintenance, and Decommissioning

Activity	**Round Trips**	**Formula**
Meteorological Buoy Installation	2-4	1-2 round trips x 2 buoys
Meteorological Buoy Maintenance	40-120	4 quarters x 2 buoys x 5 years 12 months x 2 buoys x 5 years
Meteorological Buoy Decommissioning	2-4	1-2 round trips x 2 buoys
Total Meteorological Buoy Trips	**44-128**	
Meteorological Tower Construction	40	40 round trips x 1 tower
Meteorological Tower Maintenance	20-260	4 quarters x 1 tower x 5 years 52 weeks x 1 tower x 5 years
Meteorological Tower Decommissioning	40	40 round trips x 1 tower
Total Meteorological Tower Trips	**100-340**	

3. STATE ENFORCEABLE POLICIES

As part of this CD, BOEM has evaluated and documented in the enclosed table (*see* Table 5), policies identified by North Carolina and Virginia as enforceable, applicable to offshore and coastal resources or uses, and CZMA "reasonably foreseeable coastal effects" that might be expected for activities conducted under the proposed action. While reviewing and making these determinations on the policies the states have identified as enforceable in this CD, BOEM has considered the common enforceable policies identified by each of the two states as enforceable in their CMP as listed in Table 5.

4. CONSISTENCY DETERMINATION

BOEM has evaluated all applicable enforceable policies of North Carolina and Virginia and the potential activities resulting from the proposed action. This CD has examined whether the proposed action described in Section 1 is consistent to the maximum extent practicable with the policies and provisions identified as enforceable by the CMPs of North Carolina and Virginia (*see* Table 5). Based on the preceding information and analyses, and the incorporated-by-reference Programmatic EIS, G&G PEIS, and the Revised EA, BOEM has determined the proposed action will be consistent to the maximum extent practicable with the policies that North Carolina and Virginia have identified as enforceable.

Coastal Management
ENVIRONMENTAL QUALITY

PAT MCCRORY
Governor

DONALD R. VAN DER VAART
Secretary

BRAXTON DAVIS

October 10, 2016

James F. Bennett
Program Manager
Office of Renewable Energy Programs
Bureau of Ocean Energy Management
45600 Woodland Road
Sterling, Virginia 20166

SUBJECT: **CD16-032**– Consistency Determination concerning the Bureau of Ocean Energy Management proposed wind energy lease and approved site assessment activities (DCM#20160033)

Dear Mr. Bennett:

On August 11, 2016 the Division of Coastal Management (DCM) received the Bureau of Ocean Energy Management (BOEM) consistency determination regarding the proposal to issue a commercial wind energy lease within the Kitty Hawk Wind Energy Area (WEA). This proposed lease would allow approved site assessment activities including the placement of meteorological towers and buoys that would determine whether the lease is suitable for, and would support, commercial-scale wind energy production.

North Carolina's coastal zone management program consists of, but is not limited to, the Coastal Area Management Act, the State's Dredge and Fill Law, Chapter 7 of Title 15A of North Carolina's Administrative Code, and the land use plans of the coastal counties and municipalities that the proposed project may affect. It is the objective of the North Carolina Division of Coastal Management (DCM) to manage the State's coastal resources to ensure that proposed federal activities are compatible with safeguarding and perpetuating the biological, social, economic and aesthetic values of the State's coastal waters. We appreciate your diligence to include the enforceable policies of North Carolinas coastal zone management program in Table 5.

During this review process, DCM circulated the draft Consistency Determination to the North Carolina Division of Marine Fisheries (DMF). DMF expressed possible concerns for marine fisheries, specifically during the construction activities of meteorological towers. The proposed construction activities may impact local fish abundance by deterring foraging, refuge, and spawning activities, possibly affecting economically valuable commercial and recreational fisheries operations throughout the proposed WEA.

The State recognizes and appreciates BOEM's willingness to require the Site Assessment Plan (SAP) and all supporting documentation to be sent to DCM and for requiring a meeting with DCM and DMF prior to BOEM's approval of the SAP, as described in the submitted federal consistency determination. This coordination will allow the precise activity locations and timing to be reviewed and discussed to avoid, minimize, and mitigate any possible impacts or conflicts with marine resources and fishing activities.

In conclusion, DCM has reviewed the submitted information pursuant to the management objectives and enforceable policies of Subchapters 7H and 7M of Chapter 7 in Title 15A of the North Carolina Administrative Code and concurs that the proposed Federal activity by BOEM is consistent, to the maximum extent practicable, with North Carolina's federally-approved coastal management program. DCM's concurrence is contingent upon the fulfillment of BOEM's coordination requirement with DCM and DMF prior to the approval of any SAP.

Should the proposed action be modified, a revised consistency determination could be necessary. This might take the form of either a supplemental consistency determination pursuant to 15 CFR 930.46, or a new consistency determination pursuant to 15 CFR 930.36. Likewise, if further project assessments reveal environmental effects not previously considered by the proposed development, a supplemental consistency certification may be required. If you have any questions, please contact me at 252-808-2808 x233. Thank you for your consideration of the North Carolina Coastal Management Program.

Sincerely,

Daniel Govoni
Policy Analyst

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Office of Renewable Energy Programs

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY
Street address: 629 East Main Street, Richmond, Virginia 23219
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Molly Joseph Ward
Secretary of Natural Resources

David K. Paylor
Director

(804) 698-4000
1-800-592-5482

October 6, 2016

Mr. James F. Bennett
Bureau of Ocean Energy Management
Office of Renewable Energy Programs
45600 Woodland Road, VAM-OREP
Sterling, Virginia 20166

RE: Federal Consistency Determination for the Kitty Hawk Wind Energy Area, Offshore North Carolina, DEQ 16-178F.

Dear Mr. Bennett:

The Commonwealth of Virginia has completed its review of the Federal Consistency Determination (FCD) for the above-referenced project. The Department of Environmental Quality (DEQ) is responsible for coordinating Virginia's review of FCDs and responding to appropriate officials on behalf of the Commonwealth. This letter is in response to your submission dated August 11, 2016 (received on August 12, 2016) requesting concurrence with the FCD prepared by the Bureau of Ocean Energy Management. The following agencies participated in this review:

Department of Environmental Quality
Department of Conservation and Recreation
Virginia Marine Resources Commission
Virginia Institute of Marine Science

In addition, the Department of Game and Inland Fisheries, Department of Historic Resources, Hampton Roads Planning District Commission, and City of Virginia Beach were invited to participate in the review.

PROJECT DESCRIPTION

The Department of the Interior (DOI), Bureau of Ocean Energy Management (BOEM) is considering the issuance of a commercial wind energy lease and approving site assessment activities within the Kitty Hawk Wind Energy Area (WEA) offshore North Carolina. The State of North Carolina and the Commonwealth of Virginia share common coastal management issues and have similar enforceable policies as identified

by their respective Coastal Management Programs. Due to the proximity of the Kitty Hawk WEA to both states, and their shared impacts on environmental and socioeconomic resources and uses, BOEM has prepared a single Federal Consistency Determination for the Kitty Hawk WEA. BOEM is proposing to issue a commercial wind energy lease within the Kitty Hawk WEA and approve site assessment activities that would determine whether the lease is suitable for, and would support, commercial-scale wind energy production. The lease, by itself, would not authorize the lessee to construct or operate any wind energy project on the Outer Continental Shelf. Activities that may occur over the site assessment period of the lease (i.e., up to five years) include site characterization survey activities and site assessment activities involving the construction, operation, maintenance, and decommissioning of a meteorological tower and/or buoys. Site characterization surveys would inform a lessee about site specifics of a lease area in order to prepare for submission of a site assessment plan (SAP) and, potentially, a construction and operations plan (COP).

FEDERAL CONSISTENCY PUBLIC PARTICIPATION

In accordance with Title 15, Code of Federal Regulations (CFR), §930.2, the public was invited to participate in the review of the FCD. Public notice of this proposed action was published in OEIR's Program Newsletter and on the DEQ website from August 18, 2016 through September 9, 2016. No public comments were received in response to the notice.

FEDERAL CONSISTENCY UNDER THE COASTAL ZONE MANAGEMENT ACT

Pursuant to the Coastal Zone Management Act of 1972 (§ 1456(c)), as amended, and the federal consistency regulations implementing the CZMA (15 CFR Part 930, Subpart C, § 930.30 *et seq.*) federal actions that can have reasonably foreseeable effects on Virginia's coastal uses or resources must be conducted in a manner which is consistent, to the maximum extent practicable, with the Virginia Coastal Zone Management (CZM) Program. The Virginia CZM Program is comprised of a network of programs administered by several agencies. In order to be consistent with the Virginia CZM Program, the applicant must obtain all the applicable permits and approvals listed under the enforceable policies of the Program prior to commencing the project.

FEDERAL CONSISTENCY CONCURRENCE

Based on our review of the FCD and the comments submitted by agencies administering the enforceable policies of the Virginia CZM Program, DEQ concurs that the proposal is consistent with the Virginia CZM Program provided it complies with all the applicable permits, approvals, and conditions of the enforceable policies of the Virginia CZM Program (see detailed discussions below). In addition, the FCD considers potential project impacts on the advisory policies of the Virginia CZM Program.

Other state approvals which may apply to this project are not included in this consistency concurrence. Therefore, BOEM must ensure that this project is constructed

and operated in accordance with all applicable federal, state, and local laws and regulations.

FEDERAL CONSISTENCY ANALYSIS

According to information in the FCD, the proposed activity would have no effect on the following enforceable policies in Virginia: subaqueous lands management; wetlands management; dunes management; nonpoint source pollution control; shoreline sanitation; and coastal lands management. The resource agencies that are responsible for the administration of the enforceable policies of the Virginia CZM Program generally agree with BOEM's determination. BOEM must ensure that the proposed action is consistent with the aforementioned policies. The analysis which follows responds to BOEM's discussion of the enforceable policies of the Virginia CZM Program that apply to this project and review comments submitted by agencies that administer the enforceable policies.

1. Fisheries Management. According to the FCD (page 7), site characterization surveys associated with renewable energy have the potential to affect commercial and recreational fisheries through active acoustic sound sources, vessel traffic, seafloor disturbance, trash and debris, and accidental fuel spills. Site assessment activities would add noise from installation of piles to support the meteorological tower. Site assessment activities would also add vessel traffic. However, the level of additional traffic is small relative to current traffic levels in the affected area. Based on the relative importance of the analyzed WEA for local fisheries, BOEM concludes that the impacts would be negligible to minor for both North Carolina and Virginia.

1(a) Agency Jurisdictions. The fisheries management enforceable policy is administered by the Department of Game and Inland Fisheries (Virginia Code §§29.1-100 to 29.1-570) and Virginia Marine Resources Commission (Virginia Code §§28.2-200 to 28.2-713) which have management authority for the conservation and enhancement of finfish and shellfish resources in the Commonwealth.

1(b) Agency Findings.

(i) Department of Game and Inland Fisheries

The Department of Game and Inland Fisheries (DGIF) did not respond to the request for comments on the proposal.

(ii) Virginia Marine Resources Commission

According to the Virginia Marine Resources Commission (VMRC), the transmission of generated electricity from the offshore site to the shore station through a buried cable has the potential to impact fish moving north and south along the coastline; particularly with respect to the elasmobranches and Atlantic sturgeon. VMRC notes that this question was raised by fishermen at public meetings. An early study at Virginia

Commonwealth University (Dr. Greg Garman) suggests electrical transmission cause minimal impacts to sturgeon.

1(c) Conclusion. The proposal is consistent with the fisheries management enforceable policy of the Virginia CZM Program.

For further information, contact VMRC, Justin Worrell at (757) 247-8063 or DGIF, Amy Ewing at (804) 367-2211.

2. Subaqueous Lands Management. According to the document (page 6), the proposed action will not adversely affect any state-regulated submerged lands or any resources located therein. All bottom disturbing activities will occur in the WEA at least 24 nautical miles (nm) from shore.

2(a) Agency Jurisdiction. The management program for subaqueous lands establishes conditions for granting or denying permits to use state-owned bottomlands based on considerations of potential effects on marine and fisheries resources, tidal wetlands, adjacent or nearby properties, anticipated public and private benefits, and water quality standards established by the Department of Environmental Quality. The program is administered by the Virginia Marine Resources Commission (Virginia Code §28.2-1200 to §28.2-1213).

2(b) Agency Findings. VMRC did not indicate any concern that the proposal would impact state-owned subaqueous lands.

2(c) Conclusion. The project is consistent with the subaqueous lands management enforceable policy of the Virginia CZM Program.

For additional information, contact VMRC, Justin Worrell at (757) 247-8063.

3. Wetlands Management. According to the FCD (page 7), no direct impacts on wetlands or other coastal habitats would occur from routine activities in the WEA due to the distance of the WEA from shore.

3(a) Agency Jurisdiction. The wetlands management enforceable policy is administered by the Virginia Marine Resources Commission (tidal wetlands) (Virginia Code §28.2-1301 through 28.2-1320) and the Department of Environmental Quality through the Virginia Water Protection Permit program (tidal and non-tidal wetlands) (Virginia Code §62.1-44.15:20 and Water Quality Certification pursuant to Section 401 of the Clean Water Act).

3(b) Agency Findings.

(i) Department of Environmental Quality

The Virginia Water Protection (VWP) Permit program at the DEQ Tidewater Regional Office (NRO) did not indicate that wetlands under its jurisdiction would be impacted.

(ii) Virginia Marine Resources Commission

VMRC did not indicate that tidal wetlands would be impacted.

3(c) Conclusion. The project is consistent with the wetlands management enforceable policy of the Virginia CZM Program.

For additional information, contact DEQ-TRO, Bert Parolari at (757) 518-2166 and/or VMRC, Justin Worrell at (757) 247-8063.

4. Air Pollution Control. The FCD (page 11) states that the onshore area of Norfolk is classified as a maintenance area for ozone. Results from this analysis indicate negligible impacts on air quality. The document concludes that air pollutant concentrations due to emissions from the project would not be expected to lead to any violation of the National Ambient Air Quality Standards (NAAQS). Class I air quality areas are too distant to be affected by emissions from project activities.

4(a) Agency Jurisdiction. DEQ's Air Division implements the federal Clean Air Act to provide a legally enforceable State Implementation Plan for the attainment and maintenance of the National Ambient Air Quality Standards. This program is administered by the State Air Pollution Control Board (DEQ) (Virginia Code §10-1.1300 through §10.1-1320).

4(b) Agency Findings. According to the DEQ Air Division, the project is located in an ozone (O_3) attainment and emission control area for oxides of nitrogen (NO_x) and volatile organic compounds (VOCs).

4(c) Recommendation. The applicant is encouraged to take all reasonable precautions to limit emissions VOCs and NO_x, principally by controlling or limiting the burning of fossil fuels.

4(d) Conclusion. The project is consistent with the air pollution control enforceable policy of the Virginia CZM Program.

5. Coastal Lands Management. The FCD does not discuss potential project impacts to Chesapeake Bay Preservation Areas.

5(a) Agency Jurisdiction. The DEQ Office of Local Government Programs (OLGP) administers the coastal lands management enforceable policy through the Chesapeake

Bay Preservation Act (Bay Act) (Virginia Code §62.1-44.15 *et seq.*) and *Chesapeake Bay Preservation Area Designation and Management Regulations* (*Regulations*) (9 VAC 25-830-10 *et seq.*).

5(b) Agency Findings. DEQ-OLGP finds that there are no Bay Act requirements applicable to the proposal due to the distance of the WEA from locally designated Chesapeake Bay Preservation Areas.

5(c) Conclusion. The project is consistent with the coastal lands management enforceable policy of the Virginia CZM Program.

For additional information contact DEQ-OLGP, Shawn Smith at (804) 698-4082.

6. Point Source Pollution Control. According to the FCD (page 8), the routine activities associated with the proposed action which would impact coastal and marine water quality include vessel discharges (including bilge and ballast water and sanitary waste), drilling, coring, bottom sampling, and structure installation and removal. The potential impacts on water quality are not expected to be significant. Therefore, impacts on harbors, ports, coastal areas, and the WEA from point source pollution including vessel discharges, seabed disturbance, and potential spills associated with the proposed action would be minor.

6(a) Agency Jurisdiction. The point source program is administered by the State Water Control Board (DEQ) pursuant to Virginia Code §62.1-44.15. Point source pollution control is accomplished through the implementation of: (1) the National Pollutant Discharge Elimination System (NPDES) permit program established pursuant to Section 402 of the federal Clean Water Act and administered in Virginia as the Virginia Pollutant Discharge Elimination System (VPDES) permit program; and (2) the Virginia Water Protection (VWP) Permit program administered by DEQ (Virginia Code §62.1-44.15:20 et seq.) and Water Quality Certification pursuant to Section 401 of the Clean Water Act.

6(b) Agency Findings. Neither the VWP nor VPDES Programs at DEQ-TRO indicated that project activities would adversely impact water quality offshore Virginia.

6(c) Conclusion. The proposed action is consistent with the point source pollution control enforceable policy of the Virginia CZM Program.

For additional information, contact the DEQ-TRO VWP Program, Bert Parolari at (757) 518-2166 and/or the VPDES Program, Maria Nold at (757) 518-2173.

ADDITIONAL ENVIRONMENTAL CONSIDERATIONS

In addition to the enforceable policies of the Virginia CZM Program, comments were provided with respect to other applicable requirements and recommendations. The

applicant must ensure that this project is constructed and operated in accordance with all applicable federal, state, and local laws and regulations.

1. Natural Heritage Resources.

1(a) Agency Jurisdiction.

(i) The Virginia Department of Conservation and Recreation (DCR) Division of Natural Heritage (DNH)

DNH's mission is conserving Virginia's biodiversity through inventory, protection and stewardship. The Virginia Natural Area Preserves Act (Virginia Code §10.1-209 through 217) authorizes DCR to maintain a statewide database for conservation planning and project review, protect land for the conservation of biodiversity, and protect and ecologically manage the natural heritage resources of Virginia (the habitats of rare, threatened and endangered species, significant natural communities, geologic sites, and other natural features).

(ii) Virginia Department of Agriculture and Consumer Services (VDACS)

The Endangered Plant and Insect Species Act of 1979 (Virginia Code Chapter 39 §3.1-1020 through 1030) authorizes VDACS to conserve, protect and manage endangered and threatened species of plants and insects. Under a Memorandum of Agreement established between VDACS and the DCR, DCR represents VDACS in comments regarding potential impacts on state-listed threatened and endangered plant and insect species.

1(b) Agency Findings.

(i) Natural Heritage Resources

DCR-DNH finds that impacts to several state- and federally-listed species including marine mammals, sea turtles, and marine/coastal birds may occur due to the potential for an increase in ship traffic at Virginia ports.

(ii) Threatened and Endangered Plant and Insect Species

DCR finds that the current activity will not affect any documented state-listed plants or insects.

(iii) State Natural Area Preserves

DCR files do not indicate the presence of any State Natural Area Preserves under the agency's jurisdiction in the project vicinity.

1(c) Recommendations.

(i) Natural Heritage Resources

Contact DCR-DNH, Rene Hypes at (804) 371-2708, to secure updated information on natural heritage resources if the scope of the project changes or six months pass before the project is implemented, since new and updated information is continually added to the Biotics Data System.

In addition, DCR recommends coordination with the North Carolina Heritage Program for potential impacts to natural heritage resources in the project area.

(ii) Wildlife Resources and Protected Species

DCR-DNH recommends coordination with DGIF, the United States Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) to ensure compliance with protected species legislation.

DGIF maintains a database of wildlife locations, including threatened and endangered species, trout streams, and anadromous fish waters that may contain additional information relevant to the project. The DGIF database may be accessed at http://vafwis.org/fwis/ or contact DGIF, Ernie Aschenbach at (804) 367-2733 or ernie.aschenbach@dgif.virginia.gov.

Thank you for the opportunity to comment on the FCD for the Kitty Hawk Wind Energy Area Offshore the State of North Carolina. Detailed comments of reviewing agencies are attached for your review. Please contact me at (804) 698-4325 or John Fisher at (804) 698-4339 for clarification of these comments.

Sincerely,

Bettina Sullivan, Program Manager
Environmental Impact Review and Long-Range Priorities

Enclosures

Ec: Amy Ewing, DGIF
Robbie Rhur, DCR
Tony Watkinson, VMRC
Roger Kirchen, DHR
Pam Mason, VIMS
Clay Bernick, City of Virginia Beach
Ben McFarlane, Hampton Roads PDC
Brian Krevor, BOEM

DEPARTMENT OF ENVIRONMENTAL QUALITY
TIDEWATER REGIONAL OFFICE
ENVIRONMENTAL IMPACT REVIEW COMMENTS

October 6, 2016

PROJECT NUMBER: 16-178F

PROJECT TITLE: Kitty Hawk Wind Energy Area

As Requested, TRO staff has reviewed the supplied information and has the following comments:

Petroleum Storage Tank Cleanups:
No comments.

Petroleum Storage Tank Compliance/Inspections:
No comments.

Virginia Water Protection Permit Program (VWPP):
Provided that you do not impact surface waters in Virginia, we do not have comments on this project.

Air Permit Program :
No air permitting issues identified.

Water Permit Program :
No comments.

Waste Permit Program :
No comment. Contact Sean Priest at 757-518-2141 or jonathan.priest@deq.virginia.gov if you require additional information.

Storm Water Program:
No Comments

The staff from the Tidewater Regional Office thanks you for the opportunity to provide comments.

Sincerely,

Cindy Robinson

Cindy Robinson
Environmental Specialist II
5636 Southern Blvd.
VA Beach, VA 23462
(757) 518-2167

Fisher, John (DEQ)

From: Worrell, Justin (MRC)
Sent: Wednesday, September 07, 2016 4:22 PM
To: Fisher, John (DEQ)
Subject: VMRC comments

Document Type: Federal Consistency Determination
Project Sponsor: Bureau of Ocean Energy Management
Project Title: Kitty Hawk Wind Energy Area
Location: City of Virginia Beach
Project Number: DEQ #16-178F

John,

The following comments are from our Fisheries Management Division:
"The one issue we could come up with was the transmission of generated electricity from the offshore site to the shore station through a buried cable and potential impact to fish moving north and south along the coastline—with special consideration to the elasmobranches and Atlantic sturgeon. This question was raised from fishermen at public meetings (some NC guys). I'm sure some work has been done on this question for the VA and RI sites to be permitted. Greg Garman at VSU was funded through DEQ to explore the sturgeon question but his subject sturgeon were juveniles conditioned to freshwater. I believe his early results suggested minimal impacts."

Justin D. Worrell
Environmental Engineer, Sr.
Habitat Management Division
Virginia Marine Resources Commission
(757) 247-8063 telephone
(757) 247-8062 fax

Molly Joseph Ward
Secretary of Natural Resources

Clyde E. Cristman
Director

COMMONWEALTH of VIRGINIA

DEPARTMENT OF CONSERVATION AND RECREATION

Rochelle Altholz
Deputy Director of Administration and Finance

David C. Dowling
Deputy Director of Soil and Water Conservation and Dam Safety

Thomas L. Smith
Deputy Director of Operations

MEMORANDUM

DATE: September 12, 2016

TO: John Fisher, DEQ

FROM: Roberta Rhur, Environmental Impact Review Coordinator

SUBJECT: DEQ 16-178F- BOEM Kitty Hawk Wind Energy

Division of Natural Heritage

The Department of Conservation and Recreation's Division of Natural Heritage (DCR) has searched its Biotics Data System for occurrences of natural heritage resources from the area outlined on the submitted map. Natural heritage resources are defined as the habitat of rare, threatened, or endangered plant and animal species, unique or exemplary natural communities, and significant geologic formations.

Due to potential for an increase in ship traffic at Virginia ports related to this project, impacts to several state and federally-listed species including marine mammals, sea turtles, and marine/coastal birds may occur. Therefore DCR-DNH recommends coordination with the Virginia Department of Game and Inland Fisheries (VDGIF), the United States Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) to ensure compliance with protected species legislation. DCR also recommends coordination with the North Carolina Heritage Program for potential impacts to natural heritage resources in the project area.

There are no State Natural Area Preserves under DCR's jurisdiction in the project vicinity.

Under a Memorandum of Agreement established between the Virginia Department of Agriculture and Consumer Services (VDACS) and the DCR, DCR represents VDACS in comments regarding potential impacts on state-listed threatened and endangered plant and insect species. The current activity will not affect any documented state-listed plants or insects.

New and updated information is continually added to Biotics. Please re-submit project information and map for an update on this natural heritage information if six months has passed before it is utilized.

The Virginia Department of Game and Inland Fisheries (VDGIF) maintains a database of wildlife locations, including threatened and endangered species, trout streams, and anadromous fish waters that may contain information not documented in this letter. Their database may be accessed from http://vafwis.org/fwis/ or contact Gladys Cason (804-367-0909 or Gladys.Cason@dgif.virginia.gov).

Appendix B. Design Drawings

(Contains Privileged or Confidential Information)

Appendix C. Site Characterization Report

(Contains Privileged or Confidential Information)

Appendix D. Marine Archaeological Resources Assessment

(Contains Privileged or Confidential Information)

Appendix E. Benthic Assessment

(Contains Privileged or Confidential Information)

Appendix F. Health, Safety, and Environmental Plan

(Contains Privileged or Confidential Information)

Appendix G. Vessel Specifications

NORTHSTAR
ENVIRONMENTAL & MARINE SERVICES
Est. 1990

NORTHSTAR COMMANDER

The Northstar Commander is an ABS L.L multi-purpose offshore utility vessel (work-boat), capable of performing a wide variety of duties such as towing, salvage, marine construction, oil-spill response work, in-shore supply work and supporting a wide array of scientific and research projects.

SPECIFICATIONS

Vessel Type	OSV/ Tow Vessel/ Utility Vessel
Length, overall	92ft
Beam	26ft
Draft	8.5ft
Engine	Twin screw Volvo D125-E 450hp each (new 2011)
Accommodations	12 births in 3 cabins
Navigation	2x Furuno Radars, Furuno Nav Net Chart Plotter, AIS & DGPS, Raytheon Thermal Imaging Camera
Fuel Capacity	10,000 gallons
Water Capacity	2,900 gallons with additional options available for extended cruises
Other Equipment	35 ton Tow Winch
	Generators: 1x 65KW John Deere (new 2015) 1X 65KW Caterpillar (reconditioned 2010)
	3.75 ton Palfinger PK 18080MD-S25 Marine Knuckleboom Crane
	Push Knee, Towing Winch, Capstan & Windlass
	Heavy A-frame ready, 16ft A-frame available
	Deck Office Container available
	Auxiliary Hydraulics and additional Pull Master Winches available
	Full USGS safety requirements met

NORTHSTAR
ENVIRONMENTAL & MARINE SERVICES
Est. 1990

Northstar 4

EQUIPMENT DATA SHEET

Item	Description	Details	Remarks
1	**Vessel Type**	Richard Squires Commercial Workboat	
2	**Official No.**	560915	MMSI # 338019385
3	**Construction**	Aluminium	
4	**Length, Overall**	49’ 6”	
5	**Beam**	14’ 8”	
6	**Draft**	3’ 10”	
7	**Observation platform** **Clear deck space**	6’ x 8’ 14’ x 20’	W/H Deck Head
8	**Tonnage**	24 GRT	

9	**Color**	Black/White	
10	**Engines**	TMAD 102 Volvo 425 HP Diesel	
11	**Generator**	12 kW Northern Lights	
12	**Cruising Speed**	13 Knots	
13	**Fuel Capacity**	1000 gallons	
14	**Range/ Endurance**	600 miles	
15	**Nav Instruments**	Radar Differential GPS & Chart Plotter Receiver Depth Sounder Auto Pilot	48-mile, Furuno FCV-585 Furuno GP-1850WD Furuno LC-90 Robertson AP 35
16	**Lifting Equipment**	Aft A-frame Altn. Hoisting Boom Avail. Hydraulic Winch's (2) Hydraulic Capstan	3000-lb capacity w/ 16' head room 1,750-lb capacity 3,000-lb 2,000-lb
17	**Safety**	6 Man Life Raft USCG Safety Equipment EPIRB, 406 MHz VHF Radio (x2) Satellite Phone Flir IR Camera	 Call Sign: WAL 4973
18	**Accommodations**	Sleeps 3, w/ head, shower and galley. Heated and Air Conditioned	
19	**Other Features**	Push Knee Misc. pumps, block and hardware	

Appendix H. Detailed Air Emission Calculations and Assumptions

Table of Contents

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List of Attachments

Abbreviations & Definitions

AXYS	AXYS Technology Inc.
Buoy Deployment Areas	Three areas where WindSentinel™ Buoys and TRBM Platforms may be deployed located within each of the SAP Survey Areas that were cleared during site-specific surveys
CFR	Code of Federal Regulations
CH_4	methane
CO	carbon monoxide
CMV	commercial marine vessels
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalents
EPA	United States Environmental Protection Agency
FLiDAR	Floating Light Detection and Ranging
GHG	greenhouse gases
HAP	hazardous air pollutant
ICF	ICF International
kW	kilowatt
Metocean Equipment	up to two WindSentinel™ Buoys and up to two TRBM platforms
NOx	nitrogen oxides
N_2O	nitrous oxide
O_3	ozone
OCS	Outer Continental Shelf
OGV	ocean-going vessels
PM	particulate matter
PM_{10}	particulate matter less than 10 microns in diameter
$PM_{2.5}$	particulate matter less than 2.5 microns in diameter
ppmw	parts per million by weight
Project	Kitty Hawk Offshore Wind Project
SAP	Site Assessment Plan
SO_2	sulfur dioxide
TRBM	Trawl Resistant Bottom Mounted Platform
ULSD	ultra-low-sulfur distillate oil
VOC	volatile organic compounds
WindSentinel™ Buoy	AXYS WindSentinel™ FLiDAR Buoy

1 Introduction

Avangrid Renewables LLC (the "Company") plans to install and operate up to two floating light detection and ranging (FLiDAR) buoys and up to two metocean platforms to be located within Official Protraction Diagram Currituck Sound NJ18-11 (Buoy Deployment Areas [BDAs]). The Company has selected AXYS Technologies Inc. (AXYS) to provide up to two WindSentinel™ FLiDAR Buoys (WindSentinel™ Buoy) and up to two trawl resistant bottom mounted (TRBM) metocean data collection platforms (TRBM Platform) (collectively referred to as Metocean Equipment) as the proposed meteorological and metocean data collection technologies, respectively. The Company intends to deploy one set of Metocean Equipment within one BDA first, and after one year of data collection, the company may elect to relocate the Metocean Equipment from one BDA location to another location. This report summarizes the results of the emissions calculations for the deployment of one set of Metocean Equipment collecting data for two years.

This report describes the methodology applied to calculate the air emissions associated with the Kitty Hawk Offshore Wind Project (Project), as well as the results of the emissions calculations, which are detailed in Attachment A. There are two categories of sources for which emissions were calculated:

- Commercial marine vessel (CMV); and
- Fuel cell.

The specific air pollutants estimated from the above listed source categories consist of criteria air pollutants and greenhouse gases (GHGs). Specific pollutants in each group are as follows:

- Criteria Pollutants:
  - Nitrogen oxides (NO_X),
  - Volatile organic compounds (VOC),
  - Carbon monoxide (CO),
  - Total particulate matter (PM),
  - Particulate matter with aerodynamic diameter 10 micrometers or less (PM_{10}),
  - Particulate matter with aerodynamic diameter 2.5 micrometers or less ($PM_{2.5}$), and
  - Sulfur dioxide (SO_2).
- GHGs:
  - Carbon dioxide (CO_2),
  - Methane (CH_4), and
  - Nitrous oxide (N_2O).

Note: For the purposes of this analysis emissions of $PM_{2.5}$, PM_{10}, and PM are conservatively assumed to be the same.

2 Emission Calculation Methods

Methods for calculating criteria pollutant emissions for the respective emission source categories are summarized in Sections 2.1 through 2.2 below. Section 2.3 discusses the methodology for estimating the total GHG emissions for each of the source categories. GHG emissions are presented as "CO_2 equivalent" or (CO_2e), because the different GHG constituents have different heat absorption capacities.

2.1 Commercial Marine Vessel

The calculations presented in Attachment A are based on an assumed typical vessel representative of the type, configuration, and size that are anticipated to be employed during the construction and operation phases of the Metocean Equipment. Any vessel names included are presented for illustrative purposes only, with each representing a reasonable worst-case scenario with respect to the potential emissions of the identified vessel category. Actual vessels to be employed during construction and operation activities are subject to change. Vessel operating durations are based on anticipated schedules and may also be subject to change, but again have been selected to represent a reasonable worst-case scenario with respect to potential emissions.

2.1.1 Emission Factors

ICF International was contracted by the U.S. Environmental Protection Agency (EPA) to produce a guidance document for estimating CMV emissions, "Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories" (ICF International 2009), which categorizes most vessels, including tugboats, crew boats, etc. as "harbor craft," and which categorizes ships with larger engines as "ocean-going vessels" (OGVs). The ICF International factors that were selected for estimating emissions from harbor craft and OGVs are presented in Table 2-1.

Table 2-1 Summary of Harbor Craft and OGV Emission Factors

		Emission Factor (g/kW-hr)							
Minimum Power (kW)		NO_X	VOC	CO	$PM_{10}/PM_{2.5}$	SO_2	CO_2	CH_4	N_2O
Harbor Craft – Worst-Case Rate for Tier 1 and Tier 2 Engines									
Category 1	37-75 kW	9.8	0.27	5	0.77	0.0013	690	0.09	0.02
	75 – 130 kW	9.8	0.27	5	0.34	0.0013	690	0.09	0.02
	130 – 225 kW	9.8	0.27	5	0.34	0.0013	690	0.09	0.02
	225 – 450 kW	9.8	0.27	5	0.26	0.0013	690	0.09	0.02
	450 – 560 kW	9.8	0.27	5	0.26	0.0013	690	0.09	0.02
	560 – 1000 kW	9.8	0.27	5	0.26	0.0013	690	0.09	0.02
	1,000+ kW	9.8	0.27	5	0.26	0.0013	690	0.09	0.02
Category 2	All sizes	9.8	0.5	5	0.62	0.0013	690	0.09	0.02
Ocean-going Vessels									
Category 3	Main Engines	13.2	0.50	1.10	0.19	0.397	646.08	0.004	0.031
	Auxiliary Engines	13.9	0.40	1.10	0.18	0.424	690.71	0.004	0.031

Notes:

1. Category 1 engines are main or auxiliary engines rated at less than 1,000 kW, Category 2 engines are those rated at 1,000 kW or greater with a displacement less than 30 liters per cylinder, and Category 3 engines are those with a displacement equal to or greater than 30 liters per cylinder.

2. The PM_{10} and SO_2 emission factors presented above for Category 1 and 2 engines for SO_2 and PM_{10} have had an adjustment factor applied, as recommended in Section 3.4.2 of the ICF Report (ICF International 2009) and presented in Table 3-8 of the ICF report which are based on a fuel sulfur content of 1.5 percent. These factors were adjusted for the now-required 15 ppmw sulfur content in ultra-low sulfur diesel fuel (ULSD), by multiplying the emission factors by 0.001 and 0.86 for SO_2 and PM_{10}, respectively.

3. The emission factors for the Category 3 engines were based on a medium-speed diesel vessel using marine diesel oil fuel. The PM_{10} and SO_2 emission factors for Category 3 engines are based on the formulas provided in Section 2.6 of the ICF report, and assumed use of marine diesel oil (MDO) fuel with 0.1 percent sulfur content.

Vessel engines were classified as either Category 1, Category 2, or Category 3 engines based on the following size ranges:

- Category 1: Main or auxiliary engines rated at less than 1,000 kW;
- Category 2: Main or auxiliary engines rated at 1,000 kW or greater (but with a displacement of less than 30 liters per cylinder); and

- Category 3: Main or auxiliary engines with a displacement equal to or greater than 30 liters per cylinder.

The marine vessel to be used for all phases of the Project is assumed to be equipped with either Category 1 or Category 2 engines, and will qualify as a harbor craft. These categories of engines will use only ultra-low sulfur diesel (ULSD) fuel, which has a sulfur content of 15 parts per million by weight (ppmw). The harbor craft emission factors for SO_2 and PM_{10} originally presented in Table 3-8 of the ICF report are based on a fuel sulfur content of 1.5 percent. To adjust these emission factors to reflect the now-required use of ULSD fuel, they were multiplied by adjustment factors of 0.001 and 0.86 for SO_2 and $PM_{10,}$ respectively, as recommended in Table 3-9 of the ICF report. For other criteria pollutants, the emission factors for harbor vessels are based on EPA marine engine emissions standards (i.e., Tier 0 to Tier 3 based on cylinder displacement) and their respective EPA engine categories for CMV main propulsion engines and auxiliary engines. EPA established a tier structure for the emission standards based on age of the engine and cylinder displacement. Tier 0 (baseline), Tier 1, or Tier 2 apply to engines built prior to 2009. Stricter Tier 3 emission standards apply to engines built starting in 2009; however, for the purpose of estimating the CMV emissions for the Project during which harbor craft with older engines might be utilized, the worst-case Tier 1 or Tier 2 emission factors were used providing a conservative estimate.

Emissions of hazardous air pollutants (HAPs) for the marine vessel main engines and auxiliary generators were determined using the methodology identified by US EPA for the 2011 National Emissions Inventory (NEI), which provides emission factors for each HAP compound as a percentage of the PM_{10}, $PM_{2.5}$, or VOC emissions from CMVs.

Emissions of HAPs from the marine vessel auxiliary engine (used to provide hydraulic power for deck-mounted equipment such as an A-Frame and a winch) were determined using emission factors for small diesel engines from Section 3.3 of EPA's AP-42 publication.

2.1.2 Load Factors

For marine vessel activities, main engines were assigned an average load factor of 45 percent, and auxiliary engines were assigned an average load factor of 43 percent, based on Table 3-4 in the ICF report. The ICF report, in turn, based these load factors on the 2007 air emissions inventories prepared by Starcrest Consulting Group LLC, for the Port of Los Angeles[1] and the Port of Long Beach.[2] These load factors are based on a combination of: actual vessel engine load data for the Port of Los Angeles; the methodology used by the California Air Resources Board (CARB) for its commercial harbor craft emission inventories;[3] and EPA's NONROAD2005 model for estimating emissions from nonroad engines.

2.1.3 Calculation of Emissions

The basic equation used to estimate annual emissions from each CMV engine and activity is:

$$E = kW \times Act \times LF \times EF$$

Where:

E = emission, grams/year

[1] Starcrest Consulting Group, LLC. 2009. Port of Long Angeles Inventory of Air Emissions - 2007. December 2008. Available at: https://www.portoflosangeles.org/DOC/REPORT_Air_Emissions_Inventory_2007.pdf.
[2] Starcrest Consulting Group, LLC. 2009. Port of Long Beach Air Emissions Inventory - 2007. January 2009. Available at: http://www.polb.com/civica/filebank/blobdload.asp?BlobID=6029.
[3] California Air Resources Board (CARB). 2007. Technical Support Document: Initial Statement of Reasons for Proposed Rulemaking. Proposed Regulation for Commercial Harbor Craft, Appendix B: Emissions Estimation Methodology for Commercial Harbor Craft Operating in California. September 2007. Available at: https://www.arb.ca.gov/regact/2007/chc07/chc07.htm.

kW = kilowatts (engine rating)
Act = activity, hours/year
LF = engine load factor (for the activity)
EF = emission factor, g/kW-hr

The calculated emissions were converted to tons per year by dividing the emissions by the conversion factor from grams to pounds (453.6 g/lb) and by the conversion factor from pounds to tons (2,000 lb/ton).

The CO_2e (GHG) emissions for the CMVs were calculated based on the methodology presented in Section 2.3 below.

2.2 Fuel Cell

The WindSentinel™ Buoy will be equipped with a methanol-powered fuel cell rated at 1.2 kW electrical output, which will provide backup power to charge the WindSentinel™ Buoy batteries in the event that the wind turbine and solar panels installed on the WindSentinel™ Buoy do not provide enough power.

Although the fuel cell is not a combustion device, it will produce a very small quantity of air emissions, including emissions of NO_x, CO, methanol, formaldehyde, and CO_2. Emissions for these pollutants were based on hourly potential emission rates provided by the buoy manufacturer, and conservatively assumed continuous operation (8,760 hours per year). The fuel cell will likely only operate for brief periods of time.

2.3 Global Warming Potentials

The GHG emissions from the Project are a result of the combustion of diesel fuel that produces emissions of CO2, CH4, and N2O, as well as a small amount of CO2 from the methanol-powered fuel cell on the WindSentinel™ Buoy. GHGs (CO_2, CH_4, and N_2O), are typically presented in CO_2 equivalent or "CO_2e", which is based on their specific Global Warming Potential (GWP). Each GHG constituent has a different heat trapping capability; the corresponding GWP has been calculated by EPA to reflect how long the gas remains in the atmosphere, on average, and how strongly it absorbs energy compared to CO_2. Gases with a higher GWP absorb more energy, per pound, than gases with a lower GWP. Factors used to calculate CO_2e (GWP) and were taken from Table A-1 of 40 CFR 98, Subpart A. The GWPs are 1 for CO_2, 25 for CH_4, and 298 for N_2O. Therefore, the equation to calculate CO_2e for each of the sources is:

$$\mathrm{CO2e} = \left[\mathrm{CO2}\,\frac{\mathrm{tons}}{\mathrm{yr}}\ \mathrm{x\ CO2\ WP}\quad (1)\right] + \left[\mathrm{CH4}\,\frac{\mathrm{tons}}{\mathrm{yr}}\ \mathrm{x\ CH4\ WP}\quad (25)\right] + \left[\mathrm{N2O}\,\frac{\mathrm{tons}}{\mathrm{yr}}\ \mathrm{x\ N20\ WP}\quad (298)\right]$$

2.4 Summary of Emissions

Table 2-2 presents the potential emissions for each activity related to deployment, operation, maintenance, and decommissioning of the Metocean Equipment, along with the maximum calendar year emissions, and the total project lifetime emissions.

Table 2-2 Metocean Equipment Air Emissions Summary

Metocean Equipment Activity	VOC tons	NO_X tons	CO tons	PM/ PM_{10} tons	$PM_{2.5}$ tons	SO_2 tons	HAPs tons	GHG tons CO_2e
Metocean Equipment Deployment (start of year 1)	0.006	0.190	0.099	0.005	0.005	2.53E-05	1.07E-03	13.5
Quarterly Maintenance (year 1)	0.019	0.695	0.355	0.018	0.018	9.22E-05	3.94E-03	49.5
WindSentinel™ Buoy Fuel Cell (year 1)	0.095	0.105	0.025	0	0	0	1.31E-04	12.3
Annual Maintenance Recovery (end of year 1)	0.006	0.203	0.108	0.006	0.006	2.71E-05	1.13E-03	14.7
Metocean Equipment Redeployment (start of year 2)	0.006	0.201	0.104	0.006	0.005	2.67E-05	1.13E-03	14.4

Table 2-2 Metocean Equipment Air Emissions Summary

Metocean Equipment Activity	VOC tons	NO_X tons	CO tons	PM/ PM_{10} tons	$PM_{2.5}$ tons	SO_2 tons	HAPs tons	GHG tons CO_2e
Quarterly Maintenance (year 2)	0.020	0.731	0.373	0.019	0.019	9.70E-05	4.14E-03	52.1
WindSentinel™ Buoy Fuel Cell (year 2)	0.095	0.105	0.025	0	0	0	1.31E-04	12.3
Metocean Equipment Decommissioning (end of year 2)	0.007	0.214	0.113	0.006	0.006	2.86E-05	1.20E-03	15.4
Maximum Annual Emissions (tons)	**0.127**	**1.250**	**0.615**	**0.031**	**0.030**	**1.52E-04**	**0.007**	**94.2**
Total Project Lifetime Emissions (tons)	**0.253**	**2.443**	**1.201**	**0.060**	**0.058**	**2.97E-04**	**0.013**	**184.2**

3 References

EPA (U.S. Environmental Protection Agency). 1996. Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources, Section 3.3 Gasoline and Diesel Industrial Engines, AP-42, October 1996.

EPA. 2016. Direct Emissions from Mobile Combustion Sources, U.S. EPA Center for Corporate Leadership – Greenhouse Gas Inventory Guidance, EPA430-K-16-004, January 2016.

ICF International. 2009. Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories, prepared for the USEPA Office of Policy, Economics, and Innovation, Sector Strategies Program, April, 2009.

Attachment A. Emission Calculations

KITTY HAWK OFFSHORE WIND PROJECT
Air Emission Calculations
Emission Summary - Metocean Equipment Deployment

Potential Emissions by Project Activity

Metocean Equipment Activity	VOC tpy	NO_X tpy	CO tpy	PM/PM_{10} tpy	$PM_{2.5}$ tpy	SO_2 tpy	HAPs tpy	GHG tpy CO_2e
Metocean Equipment Deployment (start of year 1)	0.006	0.190	0.099	0.005	0.005	2.53E-05	1.07E-03	13.5
Quarterly Maintenance (year 1)	0.019	0.695	0.355	0.018	0.018	9.22E-05	3.94E-03	49.5
WindSentinel™ Buoy Fuel Cell (year 1)	0.095	0.105	0.025	0	0	0	1.31E-04	12.3
Annual Maintenance Recovery (end of year 1)	0.006	0.203	0.108	0.006	0.006	2.71E-05	1.13E-03	14.7
Metocean Equipment Redeployment (start of year 2)	0.006	0.201	0.104	0.006	0.005	2.67E-05	1.13E-03	14.4
Quarterly Maintenance (year 2)	0.020	0.731	0.373	0.019	0.019	9.70E-05	4.14E-03	52.1
WindSentinel™ Buoy Fuel Cell (year 2)	0.095	0.105	0.025	0	0	0	1.31E-04	12.3
Metocean Equipment Decommissioning (end of year 2)	0.007	0.214	0.113	0.006	0.006	2.86E-05	1.20E-03	15.4
Total Project Lifetime Emissions (tons)	**0.253**	**2.443**	**1.201**	**0.060**	**0.058**	**2.97E-04**	**0.013**	**184.2**

Estimated Emissions by Calendar Year and Project Lifetime Emissions

Period of Activity	VOC tpy	NO_X tpy	CO tpy	PM/PM_{10} tpy	$PM_{2.5}$ tpy	SO_2 tpy	HAPs tpy	GHG tpy CO_2e
Year 1	0.126	1.193	0.586	0.029	0.028	1.45E-04	0.006	90.0
Year 2	0.127	1.250	0.615	0.031	0.030	1.52E-04	0.007	94.2
Total Project Lifetime Emissions (tons)	**0.253**	**2.443**	**1.201**	**0.060**	**0.058**	**2.97E-04**	**0.013**	**184.2**

KITTY HAWK OFFSHORE WIND PROJECT - AIR EMISSION CALCULATIONS

WindSentinel™ Buoy Backup Fuel Cells (POTENTIAL TO EMIT)

Fuel Cell Data

Manufacturer	Oorja
Model	T-1
Engine Type	Methanol-powered fuel cell

Fuel Use Assumptions

Maximum fuel consumption rate	L/kWh	0.8
Maximum fuel consumption rate	L/hr	1.0
Calculated power output	kW	1.20
Heat input rate	MMBtu/hr (HHV)	0.0145
Number of fuel cells		1
Annual operating hours per generator	hr/yr	8,760
Annual fuel usage per generator	L/yr	8,410

Fuel Data

Fuel type	Methanol	
Fuel heat content	Btu/gal (HHV)	57,000
Fuel density (at 25 °C)	lb/gal	6.56

Fuel Cell Emission Factors

NOx	lb/hr	0.0239
CO	lb/hr	0.00563
Methanol	lb/hr	0.0216
Formaldehyde	lb/hr	0.00003
CO2	lb/hr	2.815

Fuel Cell Emission Estimates

NOx	lb/hr (per cell)	0.0239
CO	lb/hr (per cell)	0.00563
Methanol	lb/hr (per cell)	0.0216
Formaldehyde	lb/hr (per cell)	0.00003
CO2	lb/hr (per cell)	2.815

	Annual Emissions Per Cell (tons/yr)
NOx	0.105
CO	0.025
Methanol	0.0946
Formaldehyde	1.31E-04
CO2	12.33

Notes:

1. Fuel consumption rate provided by client via email (September 4, 2019).
2. Fuel heat content and density are based on typical values for pure methanol.
3. Annual emissions are conservatively based on continuous operation, but the fuel will likely only operate for brief periods of time.
4. Hourly emission rates for NOx, CO, methanol, formaldehyde, and CO2 provided by client via email (September 4, 2019).

KITTY HAWK OFFSHORE WIND PROJECT
Air Emission Calculations
Marine Vessel Emissions - Metocean Equipment Deployment

Vessels/Equipment	No. of Engines per vessel	Dimensions (ft) length x breadth x draft	Emission Factor Used (see EFs worksheet)	Activity	Engine Rating (hp)	Fuel Type	Trips	Hrs/trip	Operating Days	Operating Hours (hrs/day)	Total Vessel Operating Hours (hrs)	Average load (%)	Fuel Usage Gallons	Total Emissions: VOC tons	NO_X tons	CO tons	PM_{10} tons	$PM_{2.5}$ tons	SO_2 tons	HAPs tons	CO_2 tons	CH_4 tons	N_2O tons	CO_2e tons
Work boat (Northstar Commander or similar)		92' x 26' x 8.5'		Deploying FLIDAR at Site 1																				
- main engines	2		2	(start of year 1)	450	Diesel	1	49.5	1	3	53	45%	1,072.0	4.72E-03	0.17	0.09	4.51E-03	4.38E-03	2.27E-05	9.71E-04	12.06	1.57E-03	3.50E-04	12.21
- aux. generator	1		2		87	Diesel	1	49.5	1	3	53	43%	99.0	4.36E-04	1.58E-02	8.08E-03	4.17E-04	4.04E-04	2.10E-06	8.97E-05	1.11	1.45E-04	3.23E-05	1.13
- aux. engine	1		205		120	Diesel	0	0	1	3	3	100%	24.4	3.85E-04	2.72E-03	3.37E-03	2.96E-04	2.87E-04	4.44E-07	6.66E-06	0.28	1.13E-05	2.26E-06	0.28
Work boat (Northstar Commander or similar)		92' x 26' x 8.5'		Quarterly maintenance trips																				
- main engines	2		2	(plus two unscheduled visits)	450	Diesel	5	33	5	6	195	45%	3,981.5	1.75E-02	0.64	0.32	1.68E-02	1.63E-02	8.44E-05	3.61E-03	44.81	5.84E-03	1.30E-03	45.34
- aux. generator	1		2	(year 1)	87	Diesel	5	33	5	6	195	43%	367.8	1.62E-03	0.06	3.00E-02	1.55E-03	1.50E-03	7.80E-06	3.33E-04	4.14	5.40E-04	1.20E-04	4.19
- aux. engine	1		205		120	Diesel	0	0	0	0	0	100%	0.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00
Work boat (Northstar Commander or similar)		92' x 26' x 8.5'		Annual maintenance recovery																				
- main engines	2		2	(end of year 1)	450	Diesel	1	49.5	1	6	56	45%	1,133.2	4.99E-03	0.18	0.09	4.77E-03	4.63E-03	2.40E-05	1.03E-03	12.75	1.66E-03	3.70E-04	12.91
- aux. generator	1		2		87	Diesel	1	49.5	1	6	56	43%	104.7	4.61E-04	1.67E-02	8.54E-03	4.40E-04	4.27E-04	2.22E-06	9.48E-05	1.18	1.54E-04	3.41E-05	1.19
- aux. engine	1		205		120	Diesel	0	0	1	6	6	100%	48.9	7.70E-04	5.45E-03	6.75E-03	5.92E-04	5.74E-04	8.88E-07	1.33E-05	0.56	2.26E-05	4.53E-06	0.56
Work boat (Northstar Commander or similar)		92' x 26' x 8.5'		Redeploying FLIDAR at Site 2																				
- main engines	2		2	(start of year 1)	450	Diesel	1	52.5	1	3	56	45%	1,133.2	4.99E-03	0.18	0.09	4.77E-03	4.63E-03	2.40E-05	1.03E-03	12.75	1.66E-03	3.70E-04	12.91
- aux. generator	1		2		87	Diesel	1	52.5	1	3	56	43%	104.7	4.61E-04	1.67E-02	8.54E-03	4.40E-04	4.27E-04	2.22E-06	9.48E-05	1.18	1.54E-04	3.41E-05	1.19
- aux. engine	1		205		120	Diesel	0	0	1	3	3	100%	24.4	3.85E-04	2.72E-03	3.37E-03	2.96E-04	2.87E-04	4.44E-07	6.66E-06	0.28	1.13E-05	2.26E-06	0.28
Work boat (Northstar Commander or similar)		92' x 26' x 8.5'		Quarterly maintenance trips																				
- main engines	2		2	(plus two unscheduled visits)	450	Diesel	5	35	5	6	205	45%	4,185.7	1.84E-02	0.67	0.34	1.76E-02	1.71E-02	8.88E-05	3.79E-03	47.11	6.14E-03	1.37E-03	47.67
- aux. generator	1		2	(year 2)	87	Diesel	5	35	5	6	205	43%	386.6	1.70E-03	0.06	0.03	1.63E-03	1.58E-03	8.20E-06	3.50E-04	4.35	5.68E-04	1.26E-04	4.40
- aux. engine	1		205		120	Diesel	0	0	0	0	0	100%	0.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00	0.00E+00	0.00
Work boat (Northstar Commander or similar)		92' x 26' x 8.5'		Decommissioning FLIDAR																				
- main engines	2		2	(end of year 2)	450	Diesel	1	52.5	1	6	59	45%	1,194.5	5.26E-03	0.19	0.10	5.03E-03	4.88E-03	2.53E-05	1.08E-03	13.44	1.75E-03	3.90E-04	13.60
- aux. generator	1		2		87	Diesel	1	52.5	1	6	59	43%	110.3	4.86E-04	1.76E-02	9.00E-03	4.64E-04	4.50E-04	2.34E-06	9.99E-05	1.24	1.62E-04	3.60E-05	1.26
- aux. engine	1		205		120	Diesel	0	0	1	6	6	100%	48.9	7.70E-04	5.45E-03	6.75E-03	5.92E-04	5.74E-04	8.88E-07	1.33E-05	0.56	2.26E-05	4.53E-06	0.56
													14,019.8	**0.06**	**2.23**	**1.15**	**6.02E-02**	**5.84E-02**	**2.97E-04**	**1.26E-02**	**157.81**	**2.04E-02**	**4.54E-03**	**159.67**

Notes:
1. Projected maintenance and decommissioning activities are based on current project planning.
2. Trip time constitutes the round trip transit time to and from the project site. The number of hours per trip were estimated based on an assumed transit speed of 5 knots when towing a buoy, and 10 knots when not towing a buoy, plus additional time required for maneuvering and berthing. Round trip distances are estimated to be: 330 nm for deployment site 1; and 350 nm for deployment site 2.
3. Operating days/hours is the estimated time each vessel is at the deployment site performing its associated activities.
4. The auxiliary engine on the work boat powers the deck machinery (winches and A-frame), and will only operate in the immediate vicinity of each deployment site.
5. Emission calculations based on actual vessel trip durations from Avalon, NJ.
6. The engines utilized on each of the vessels are assumed to be Category 1 engines based on engine horsepower rating (<1,000 kW) and cylinder displacement (1-5 liters per cylinder).
7. Emission factors for marine vessel engines are from Table 3-8 in the ICF International report to the US EPA "Current Methodologies in Preparing Mobile Source Port-Related Emissions Inventories", April 2009. (See emission factors summary page) Assumed all engines to be used are certified to meet EPA Tier 1 engine standards; therefore, the Tier 1 emission factors in Table 3-8 from the ICF International report was used to provide conservative estimate.
8. HAP emission factors for commercial marine vessels were determined using the methodology identified by US EPA for the 2011 National Emissions Inventory (NEI); i.e., they are calculated as percentages of the PM_{10}, $PM_{2.5}$, or VOC emissions from the CMVs. The HAP emisson for nonroad engines were based on EPA's AP-42 Volume 1, Chapters 3.3 and 3.4 for small and large diesel engines. (see HAP emission factor summary pages)
9. Average load factors were estimated based on load factors presented in Table 3-4 of the ICF International report.
10. CO_2e emission rates use the following carbon equivalence factors: 25 for CH_4, and 298 for N_2O.

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PROJECT Emission Factor Summary

Commercial Marine Vessels (CMVs)

		Commercial Marine Vessel Emission Factors (g/hp-hr) /a									Fuel Cons.
	Engine Type	VOC	NO_x	CO	PM/ PM_{10} /b, /c	$PM_{2.5}$ /b	SO_2 /c	CO_2	CH_4	N_2O	(gal/hp-hr) /d
1	Category 2 engines	0.37	7.3	3.73	0.46	0.45	0.0010	515	0.067	0.015	0.050
2	Category 1 engines ≤ 1000 kW	0.20	7.3	3.73	0.19	0.19	0.0010	515	0.067	0.015	0.050
3	Category 3 engines (MSD using MDO) (>30L/cyl.)	0.37	9.8	0.82	0.14	0.13	0.296	482	0.003	0.023	0.046
4	All Categories aux. engines (MSD using MDO)	0.30	10.4	0.82	0.14	0.13	0.316	515	0.003	0.023	0.049

/a Emission factors for Category 1 and 2 engines are from Table 3-8 from ICF International report to the US EPA "Current Methodologies in Preparing Mobile Source Port-Related Emissions Inventories", April 2009 (converted from g/kW-hr to g/hp-hr by multiplying by 0.746 kW/hp). Assumed all Category 1 and 2 engines to be used are certified to meet EPA Tier 1 and 2 marine engine standards respectively (providing conservative estimate for Category 1 engines); therefore the Tier 1 and 2 emission factors in Table 3-8 from the ICF International report was used. Note, the CO emission factor for Category 1 Tier 2 engines is higher than what is provided for Tier 1 engines, thus the Tier 2 emission factor for CO was used to provide a conservative estimate.

/b All PM is assumed to less than 10 µm in diameter; therefore, PM emission factor is equivalent to PM_{10} emission factor. $PM_{2.5}$ is estimated to be 97 % of PM_{10} per EPA guidance in "Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression-Ignition," EPA420-R-10-018/NR-009d, July 2010.

/c Emission factors for Category 1 and 2 engines for SO_2 and PM_{10} presented in Table 3-8 of the ICF report (ICF International 2009) are based on a fuel sulfur content of 1.5 percent. These factors were adjusted for the 15 ppmw sulfur content in ultra-low sulfur diesel fuel, by multiplying the emission factors by 0.001 and 0.86 for SO_2 and PM_{10}, respectively, following the approach used in Section 3.4.2 of the ICF Report.

/d Fuel consuption rate for Category 1 and 2 marine engines was estimated based on CO_2 emission factor (g/hp-hr) and the emission factor for the mass of CO_2 generated per gallon of fuel (10.21 kg CO_2/gal fuel) as presented in the Table 13.1 of the "2014 Climate Registry Default Emission Factors." Fuel consumption for Category 3 marine engines was based on the BSFC (g/kW-hr) in the ICF International report.

Land-Based Stationary Diesel Engines, Excluding Fire Pumps (<= 2,237 kW and Displacement < 10 L/cylinder)

			Subpart IIII standards (g/kWh) /a				(g/kWh) /b	Other Emission Factors (lb/MMBtu) /c, /d				Fuel Cons.
	Stationary Source Category	Engine Size (kW)	VOC	NO_x	CO	PM/ PM_{10}	$PM_{2.5}$	SO_2	CO_2	CH_4	N_2O	(gal/hp-hr) /e
200	Non-Emergency Engines (pre-2007)	kW < 8	1.3	9.2	8.0	1.0	0.97	0.0015	163.1	0.007	0.001	0.050
201		8 <= kW < 19	1.18	8.32	6.6	0.80	0.78	0.0015	163.1	0.007	0.001	0.050
202		19 <= kW < 37	1.18	8.32	5.5	0.80	0.78	0.0015	163.1	0.007	0.001	0.050
203		37 <= kW < 56	1.3	9.2	11.4	1.0	0.97	0.0015	163.1	0.007	0.001	0.050
204		56 <= kW < 75	1.3	9.2	11.4	1.0	0.97	0.0015	163.1	0.007	0.001	0.050
205		75 <= kW < 130	1.3	9.2	11.4	1.0	0.97	0.0015	163.1	0.007	0.001	0.050
206		130 <= kW < 225	1.3	9.2	11.4	0.54	0.52	0.0015	163.1	0.007	0.001	0.050
207		225 <= kW < 450	1.3	9.2	11.4	0.54	0.52	0.0015	163.1	0.007	0.001	0.050
208		450 <= kW < 560	1.3	9.2	11.4	0.54	0.52	0.0015	163.1	0.007	0.001	0.050
209		kW > 560	1.3	9.2	11.4	0.54	0.52	0.0015	163.1	0.007	0.001	0.050

/a Values are from Table 1 to 40 CFR 60 Subpart IIII, except as follows:
For highlighted cells, either a combined standard was provided (NMHC+NOx) or no standard was provided (CO and PM, and VOC in three cases).
Values for NMHC+NOx were apportioned into NOx and VOC rates based on the ratio of Tier 1 limits (9.2 g/kWh NOx and 1.3 g/kWh HC).
Substitute values for CO and PM (and VOC, when only a NOx standard was provided) were based on the worst-case rate provided for non-emergency pre-2007 engines.

/b All PM is assumed to less than 10 µm in diameter; therefore, PM emission factor is equivalent to PM_{10} emission factor. $PM_{2.5}$ is estimated to be 97 % of PM_{10} per EPA guidance in "Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression-Ignition," EPA420-R-10-018/NR-009d, July 2010.

/c SO2 emission factor based on typical mass balance for 0.0015% by weight ULSD, assuming 100% conversion of fuel sulfur to SO2.

/d Emission factors used to calculate emission rates for CO2 (73.96 kg/MMBtu), CH4 (0.003 kg/MMBtu) and N2O (0.0006 kg/MMBtu) were based on Tables C-1 and C-2 of 40 CFR Part 98 - Mandatory Greenhouse Gas Reporting, Subpart C - General Stationary Fuel Combustion Sources.

/e Fuel consumption rate is on a higher heating value (HHV) basis per unit of engine output, assuming the AP-42 specific consumption rate of 7,000 Btu/hp-hr, and a fuel heat content of 140,000 Btu/gal.

KITTY HAWK OFFSHORE WIND PROJECT
EPA NEI HAP emission factors for Commercial Marine Vessels

HAP emission factors for commercial marine vessels were determined using the methodology identified by US EPA for the 2011 National Emissions Inventory (NEI); i.e., they are calculated as percentages of the PM10, PM2.5, or VOC emissions from the CMVs.

CMV fuel type			Diesel (distillate)		Residual			
Operating description			In Port	Underway	In Port		Underway	
SCC code			2280002100	2280002200	2280003100		2280003200	
Type			Maneuvering	Cruising	Manuevering	Hotelling	Cruising	Reduced Speed Zone
Type Code			M	C	M	H	C	Z
Pollutant	HAP?*	Fraction of						
Ammonia	No	PM10	0.01	0.02	0.00238	0.0108	0.00477	0.00477
Arsenic	Yes	PM10	0.0000175	0.00003	8.74126E-05	0.0004	0.000174825	0.000174825
Benzo[a]Pyrene	Yes	PM10	0.0000025	0.000005	4.37063E-07	0.000002	8.74126E-07	8.74126E-07
Benzo[b]Fluoranthene	Yes	PM10	0.000005	0.00001	8.74126E-07	0.000004	1.74825E-06	1.74825E-06
Benzo[k]Fluoranthene	Yes	PM10	0.0000025	0.000005	4.37063E-07	0.000002	8.74126E-07	8.74126E-07
Beryllium	Yes	PM10			0.000000546	0.000000546	0.000000546	0.000000546
Cadmium	Yes	PM10	0.00000283	0.00000515	0.0000226	0.0000059	0.0000226	0.0000226
Chromium (VI)	Yes	PM10	0.0000085	0.000017	0.00006528	0.000204	0.00006528	0.00006528
Chromium III	Yes	PM10	0.0000165	0.000033	0.00012672	0.000396	0.00012672	0.00012672
Cobalt	Yes	PM10			5.94406E-05	0.000292	0.000153846	0.000153846
Hexachlorobenzene	Yes	PM10	0.00000002	0.00000004	3.4965E-09	0.000000016	6.99301E-09	6.99301E-09
Indeno[1,2,3-c,d]Pyrene	Yes	PM10	0.000005	0.00001	8.74126E-07	0.000004	1.74825E-06	1.74825E-06
Lead	Yes	PM10	0.000075	0.00015	1.39642E-05	0.00006	0.0000262	0.0000262
Manganese	Yes	PM10	0.00000153	0.000001275	0.0000573	0.0000573	0.0000573	0.0000573
Mercury	Yes	PM10	0.000000025	0.00000005	2.7076E-07	0.0000014	5.24476E-07	5.24476E-07
Nickel	Yes	PM10	0.0005	0.001	0.003250219	0.0154	0.00589	0.00589
Phosphorus	Yes**	PM10			0.001787587	0.00438	0.005734266	0.005734266
Polychlorinated Biphenyls	Yes	PM10	0.00000025	0.0000005	4.37063E-08	0.0000002	8.74126E-08	8.74126E-08
Selenium	Yes	PM10	2.83E-08	5.15E-08	1.9125E-06	0.00000908	0.00000348	0.00000348
Total HAP (ratioed to PM10)			**0.0006**	**0.0013**	**0.0055**	**0.0212**	**0.0123**	**0.0123**
Acenaphthene	Yes	PM2.5	0.000018	0.000015	0.00000034	0.00000034	0.00000034	0.00000034
Acenaphthylene	Yes	PM2.5	0.00002775	0.000023125	0.000000525	0.000000525	0.000000525	0.000000525
Anthracene	Yes	PM2.5	0.00002775	0.000023125	0.000000525	0.000000525	0.000000525	0.000000525
Benz[a]Anthracene	Yes	PM2.5	0.00003	0.000025	0.000000567	0.000000567	0.000000567	0.000000567
Benzo[g,h,i,]Perylene	Yes	PM2.5	0.00000675	0.000005625	0.000000128	0.000000128	0.000000128	0.000000128
Chrysene	Yes	PM2.5	0.00000525	0.000004375	9.93E-08	9.93E-08	9.93E-08	9.93E-08
Fluoranthene	Yes	PM2.5	0.0000165	0.00001375	0.000000312	0.000000312	0.000000312	0.000000312
Fluorene	Yes	PM2.5	0.00003675	0.000030625	0.000000695	0.000000695	0.000000695	0.000000695
Naphthalene	Yes	PM2.5	0.00105075	0.000875625	0.0000199	0.0000199	0.0000199	0.0000199
Phenanthrene	Yes	PM2.5	0.000042	0.000035	0.000000794	0.000000794	0.000000794	0.000000794
Pyrene	Yes	PM2.5	0.00002925	0.000024375	0.000000553	0.000000553	0.000000553	0.000000553
Total HAP (ratioed to PM2.5)			**0.0013**	**0.0011**	**0.000024**	**0.000024**	**0.000024**	**0.000024**
2,2,4-Trimethylpentane	Yes	VOC	0.0003	0.00025	NA	NA	NA	NA
Acetaldehyde	Yes	VOC	0.0557235	0.04643625	0.000229	0.000229	0.000229	0.000229
Acrolein	Yes	VOC	0.002625	0.0021875	NA	NA	NA	NA
Benzene	Yes	VOC	0.015258	0.012715	0.0000098	0.0000098	0.0000098	0.0000098
Ethyl Benzene	Yes	VOC	0.0015	0.00125	NA	NA	NA	NA
Formaldehyde	Yes	VOC	0.1122	0.0935	0.00157	0.00157	0.00157	0.00157
Hexane	Yes	VOC	0.004125	0.0034375	NA	NA	NA	NA
Propionaldehyde	Yes	VOC	0.004575	0.0038125	NA	NA	NA	NA
Styrene	Yes	VOC	0.001575	0.0013125	NA	NA	NA	NA
Toluene	Yes	VOC	0.0024	0.002	NA	NA	NA	NA
Xylenes (Mixed Isomers)	Yes	VOC	0.0036	0.003	NA	NA	NA	NA
Total HAP (ratioed to VOC)			**0.2039**	**0.1699**	**0.0018**	**0.0018**	**0.0018**	**0.0018**

*For completeness, all of the pollutants in EPA's database are shown, but not all are HAP as defined in Section 112 of the Clean Air Act and as updated in 40 CFR 63 Subpart C.

**Only elemental phosphorus (CAS #7723140) is a HAP; phosphorus-containing compounds in general are not.

Reference: US EPA, "2011 National Emissions Inventory, version 1, Technical Support Document", draft, November 2013, available from http://www.epa.gov/ttn/chief/net/2011nei/2011_neiv1_tsd_draft.pdf; Table 104 on pp. 178-179 refers to the dataset "2011EPA_HAP-Augmentation" for HAP emissions, which is available from ftp://ftp.epa.gov/EmisInventory/2011/doc; the factors above are from that

KITTY HAWK OFFSHORE WIND
PROJECT HAP Emission Factor
Calculation Sheet Small Diesel Engines

Pollutant	Emission Factor (lb/MMBtu)[a]	Emission Factor Rating	Source (AP-42 Table)
Organic Compounds			
Benzene[b]	9.33E-04	E	3.3-2
Toluene[b]	4.09E-04	E	3.3-2
Xylene[b]	2.85E-04	E	3.3-2
1,3 Butadiene	< 3.91E-05	E	3.3-2
Propylene	2.58E-03	E	3.3-2
Formaldehyde[b]	1.18E-03	E	3.3-2
Acetaldehyde[b]	7.67E-04	E	3.3-2
Acrolein[b]	< 9.25E-05	E	3.3-2
PAH			
Naphthalene[b]	8.48E-05	E	3.3-2
Acenaphthylene[b]	< 5.06E-05	E	3.3-2
Acenaphthene[b]	< 1.42E-06	E	3.3-2
Fluorene[b]	2.92E-05	E	3.3-2
Phenanthrene[b]	2.94E-05	E	3.3-2
Anthracene[b]	1.87E-06	E	3.3-2
Fluoranthene[b]	7.61E-06	E	3.3-2
Pyrene[b]	4.78E-06	E	3.3-2
Benzo(a)anthracene[b]	1.68E-06	E	3.3-2
Chrysene[b]	3.53E-07	E	3.3-2
Benzo(b)fluoranthene[b]	< 9.91E-08	E	3.3-2
Benzo(k)fluoranthene[b]	< 1.55E-07	E	3.3-2
Benzo(a)pyrene[b]	< 1.88E-07	E	3.3-2
Indeno(1,2,3-cd)pyrene[b]	< 3.75E-07	E	3.3-2
Dibenz(a,h)anthracene[b]	< 5.83E-07	E	3.3-2
Benzo(g,h,i)perylene[b]	< 4.89E-07	E	3.3-2
TOTAL PAH	1.68E-04	E	3.3-2
Metals and inorganics[c]			
Arsenic[b]	4.62E-08		
Cadmium[b]	5.13E-09		
Chromium[b]	1.24E-05		
Chromium VI[b]	2.24E-06		
Lead[b]	7.69E-07		
Mercury[b]	1.03E-08		
Nickel[b]	1.48E-06		
Selenium[b]	2.56E-07		

Total for substances identified as HAP[e]	< 3.89E-03

[a] Values preceded by "<" are based on method detection limits.

[b] Specifically listed as a "Hazardous Air Pollutant" (HAP) in the Clean Air Act, or a component of Polycyclic Organic Matter, which is also listed as a HAP.

[c] Metal emissions are based on the paper *Survey of Ultra-Trace Metals in Gas Turbine Fuels,* 11th Annual International Petroleum Conference, Oct 12-15, 2004. Where trace metals were detected in any of 13 samples, the average result is used. Where no metals were detected in any of 13 samples, the detection limit is used.

[d] Hexavalent chrome was not detected in any fuel oil samples (in the note c reference study). However, to allow for potential hex chrome emissions formed during combustion, 18% of the total chrome emissions were assumed to be hex chrome (per EPA 453/R-98-004a)

[e] Total calculated using the TOTAL PAH emission factor instead of factors for individual PAH.