SITE ASSESSMENT PLAN
Virginia Commercial Offshore Wind

Prepared for:

Dominion

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ACRONYMS AND ABBREVIATIONS

AXYS	AXYS Technology, Inc.
BCE	Before Common Era
BOEM	Bureau of Ocean Energy Management
BSEE	Bureau of Safety and Environmental Enforcement
CFR	Code of Federal Regulations
CMV	commercial marine vessel
COP	Construction and Operations Plan
CVA	Certified Verification Agent
Dominion	Virginia Electric and Power Company
EA	Environmental Assessment
EFH	Essential Fish Habitat
ESA	Endangered Species Act
ft	feet
Fugro	Fugro Consultants, Inc.
GPS	Global Positioning System
HRG	high-resolution geophysical
Hz	hertz
IHA	Incidental Harassment Authorization
Installation Area	Official Protraction Diagram NJ18-11 Currituck Sound Block 6112, Aliquot I
IP	Ingress Protection
kg	kilogram
kHz	kilohertz
lbs	pounds
LiDAR	light detection and ranging
m	meter
Mag	magnetometer
Met Facility	metocean instrumentation platform
Mid-Atlantic EA	Environmental Assessment of Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore New Jersey, Delaware, Maryland and Virginia, BOEM, February 2012
MLLW	mean lower low water
MMPA	Marine Mammal Protection Act
NDBC	U.S. National Data Buoy Center
NERO	Northeast Regional Office
NHPA	National Historic Preservation Act
NOAA	National Oceanographic and Atmospheric Administration
NOAA Fisheries	NOAA National Marine Fisheries Service
NOMAD	Navy Oceanographic Meteorological Automatic Device
NTL	Notice to Lessees
OCS	Outer Continental Shelf
PATON	Private Aids to Navigation

Project	Virginia Commercial Offshore Wind
SAP	Site Assessment Plan
USACE	United States Army Corps of Engineers
U.S.C.	United States Code
USCG	United States Coast Guard
VACAPES	Virginia Capes naval operating area
VDEQ	Virginia Department of Environmental Quality
VHF	very high frequency
VOWTAP	Virginia Offshore Wind Technology Advancement Project
WatchMan	WatchMan™ 500 controller
WEA	Wind Energy Area
WHOI	Woods Hole Oceanographic Institution
WindSentinel buoy	AXYS WindSentinel™ Environmental Monitoring buoy

1 INTRODUCTION

Virginia Electric and Power Company, dba Dominion Virginia Power (Dominion), has prepared this updated Site Assessment Plan (SAP) in support of the installation and operation of a WindSentinel™ Environmental Monitoring buoy (Meteorological Facility [Met Facility]) to be located within Official Protraction Diagram NJ18-11 Currituck Sound Outer Continental Shelf (OCS) Block 6112, Aliquot I (Installation Area; Figure 1-1). The Installation Area is contained within the area of the Commercial Lease of Submerged Lands for Renewable Energy Development on the Outer Continental Shelf (OCS-A 0483; the Commercial Lease), issued October 22, 2013, with an Effective Date of November 1, 2013. This SAP has been prepared in accordance with the requirements under 30 Code of Federal Regulations (CFR) 585.606, 610, and 611 (see Table 1-1) and in accordance with stipulations in the Commercial Lease (see Table 2-1).

Prior to the deployment of the proposed Met Facility, Dominion will obtain other regulatory permits and approvals from various jurisdictional agencies as identified in Table 1-2. Dominion will include copies of all final agency authorizations as part of the SAP (see Appendix A) and copies will be provided to the Bureau of Ocean Energy Management (BOEM) prior to the initiation of SAP activities in 2019. All installation, operation, and decommissioning activities will be conducted in compliance with any additional requirements stipulated in the final permits to be issued by other regulatory agencies.

The instrumentation platform described in this SAP will monitor environmental conditions in support of development of Virginia Commercial Offshore Wind (the Project) within the Commercial Lease area.

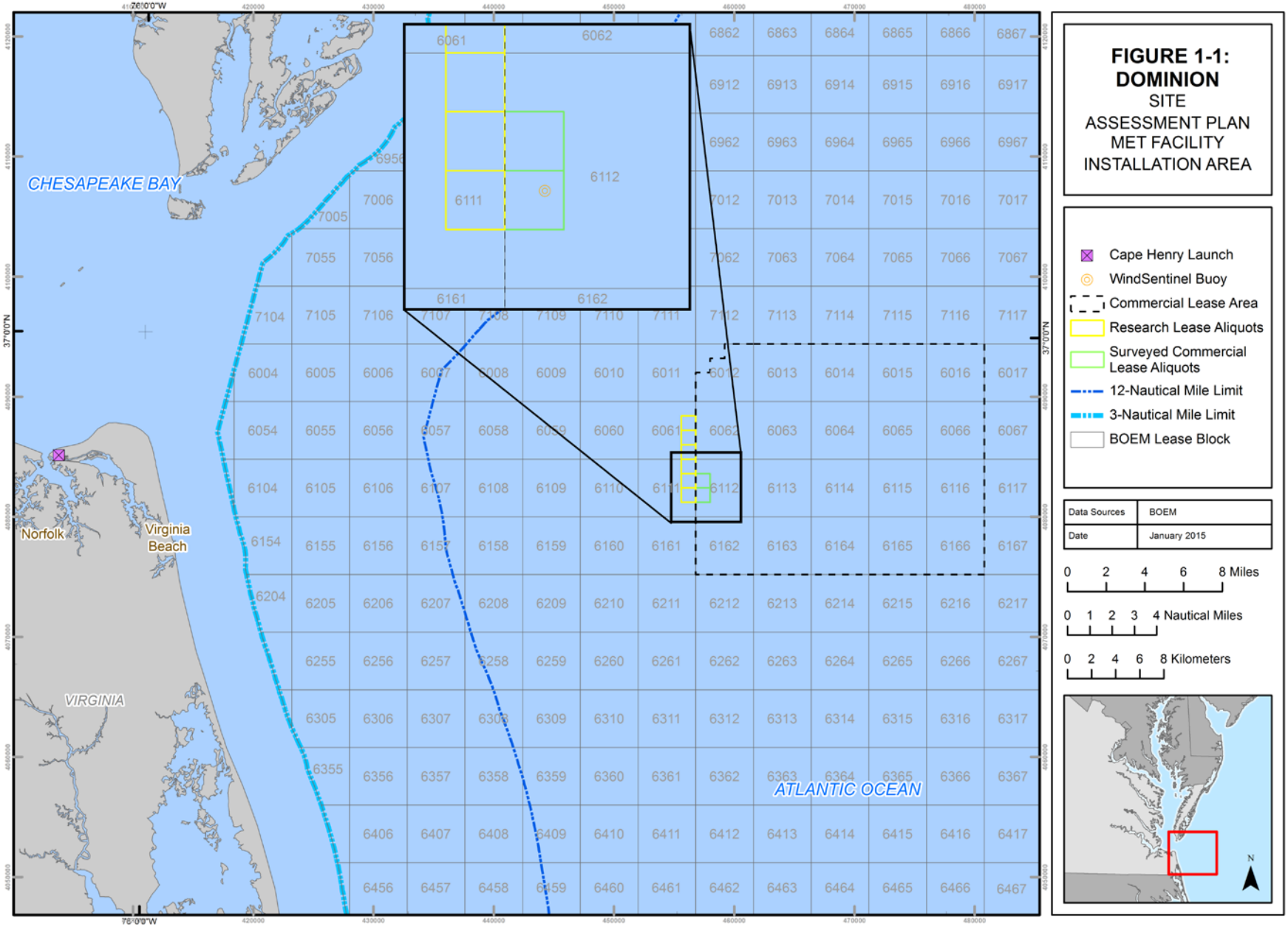

CHESAPEAKE BAY
Norfolk
Virginia Beach
VIRGINIA
ATLANTIC OCEAN
6061
6062
6111
6112
6161
6162
37°0'0"N
76°0'0"W
FIGURE 1-1:
DOMINION
SITE
ASSESSMENT PLAN
MET FACILITY
INSTALLATION AREA
Cape Henry Launch
WindSentinel Buoy
Commercial Lease Area
Research Lease Aliquots
Surveyed Commercial Lease Aliquots
12-Nautical Mile Limit
3-Nautical Mile Limit
BOEM Lease Block
Data Sources
BOEM
Date
January 2015
0 2 4 6 8 Miles
0 1 2 3 4 Nautical Miles
0 2 4 6 8 Kilometers
N

Table 1-1. Site Assessment Plan Requirements §585.105(a), 606(a), 610(a) and (b), and 611(a) and (b)

Requirement	Compliance Statement
§585.105(a)	
1) The design of the environmental monitoring buoys and conduct of planned activities ensures safety and will not cause undue harm or damage to natural resources and will take measures to prevent unauthorized discharge of pollutants into the offshore environment.	Dominion will comply with this requirement, as evidenced in this SAP.
§585.606(a)	
1) The Project will conform to all applicable laws, regulations, and lease provisions.	Dominion will comply with this requirement. See Table 1-2, Table 2-1, and Appendix A.
2) The Project will be safe.	Dominion will comply with this requirement. See Section 4.3. As stated in Section 4.3, SAP activities will be supported by a detailed Health and Safety Plan. This plan is included as Appendix B.
3) The Project will not unreasonably interfere with other uses of the OCS, including national security or defense.	Dominion will comply with this requirement. See Table 2-1 for specific activities to ensure compliance.
4) The Project will not cause undue harm or damage to natural resources; life; property; the marine, coastal, or human environment; or historical or archeological resources.	See Section 7 for an analysis of site characteristics and Sections 7 and 4.2.1 for avoidance and mitigation measures.
5) The Project will use best available and safest technology.	Dominion will comply with this requirement.
6) The Project will use best management practices.	Dominion will comply with this requirement. Best management practices are described in Table 1-3, Sections 4, 5, and 7. Dominion will use its standard internal project execution structure to manage activities described in the SAP.
7) The Project will use properly trained personnel.	Dominion will comply with this requirement.
§585.610(a)	
1) Contact Information	Scott Lawton 5000 Dominion Blvd, Glen Allen, VA 23060 Scott.Lawton@dom.com (804) 273-2600
2) Site assessment concept	Meteorological and metocean data collection using one stand-alone environmental monitoring buoy.
3) Designation of operator	Dominion as the leaseholder will own and operate the Met Facility.
4) Commercial lease stipulations and compliance	See Table 2-1
5) A location plan	See Section 3.3
6) General structural and project design, and installation information	See Sections 3, 4, and 5
7) Deployment activities	See Section 4
8) Measures for avoiding, minimizing, reducing, eliminating, and monitoring environmental impacts	This SAP has been prepared in accordance with the Mid-Atlantic Environmental Assessment (EA) and stipulations in the Commercial Lease (Table 2-1). Specific efforts to avoid, minimize, reduce, eliminate, or monitor environmental impacts can be found in Sections 7 and 4.2.1.
9) Certified Verification Agent nomination	See Section 1.2
10) Reference information	See Section 8
11) Decommissioning and site clearance procedures	See Section 6
12) Air quality information	See Section 7.3.1
13) A listing of all federal, state, and local authorizations or approvals required to conduct site assessment activities on your lease	See Table 1-2
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	To be provided by Dominion prior to initiation of deployment activities.

Table 1-1. Site Assessment Plan Requirements §585.105(a), 606(a), 610(a) and (b), and 611(a) and (b) (continued)

Requirement	Compliance Statement
§585.610(b)	
1) Geotechnical	
(i) A description of all relevant seabed and engineering data and information to allow for the design of the foundation for that facility…	Section 7.1
2) Shallow Hazards	
(i) Shallow faults;	Section 7.1.1
(ii) Gas seeps or shallow gas;	Section 7.1.1
(iii) Slump blocks or slump sediments;	Section 7.1.1
(iv) Hydrates; or	Section 7.1.1
(v) Ice scour of seabed sediments.	Section 7.1.1
3) Archaeological Resources	
(i) A description of the results and data from the archaeological survey;	Appendix I
(ii) A description of the historic and prehistoric archaeological resources, as required by the National Historic Preservation Act (NHPA) of 1966, as amended.	Appendix I
4) Geological Survey	
(i) Seismic activity at your proposed site;	Section 7.1.1
(ii) Fault zones;	Section 7.1.1
(iii) The possibility and effects of seabed subsidence; and	Section 7.1.1
(iv) The extent and geometry of faulting attenuation effects of geologic conditions near your site.	Section 7.1.1
5) Biological	
(i) Live bottoms	Section 7.2.1
(ii) Hard bottoms	Section 7.2.1
(iii) Topographic features; and	Section 7.2.1
(iv) Surveys of other marine resources such as fish populations (including migratory populations), marine mammals, sea turtles, and sea birds.	Section 7.2.1
§ 585.611(a) and (b) Requirements	
1) Hazard information	Section 7.1.2
2) Water quality	Section 7.3.1
3) Biological resources	
(i) Benthic communities	Section 7.2.1 and Appendix G
(ii) Marine mammals	Section 7.2.2
(iii) Sea turtles	Section 7.2.2
(iv) Coastal and marine birds	Section 7.2.3
(v) Fish and shellfish	Section 7.2.1
(vi) plankton and seagrasses, and	Section 7.2.1
(vii) plant life	Section 7.2.1
4) Threatened or endangered species	Sections 7.2.2 and 7.2.3
5) Sensitive biological resources or habitats	Section 7.2
6) Archaeological resources	Section 7.4, Appendix I
7) Social and economic resources	Section 7.3.2
8) Coastal and marine uses	Section 7.3.2

Table 1-2. Permit Matrix

Permitting Agency	Applicable Permit or Approval	Statutory Basis	Regulations	Applicant Requirements
U.S. Army Corps of Engineers (USACE)	Nationwide Permit No. 5 – Scientific Measuring Devices	Clean Water Act 33 United States Code (U.S.C.)134	33 CFR 320 et seq.	Dominion will file a letter with the USACE documenting conformance to Nationwide Permit No. 5 conditions.
Bureau of Ocean Energy Management	National Historic Preservation Act (NHPA) Section 106 Consultation	NHPA 16 U.S.C. 470	36 CFR Part 60, Part 800	Section 106 of the NHPA requires federal agencies to take into consideration the effects of their actions, including permit approvals, on cultural resources listed in, nominated to, and eligible for the National Register of Historic Places. It also requires federal agencies to consult with the State Historic Preservation Office of the state in which federal actions are to take place, as well as with other state, local, and tribal authorities. On May 21, 2012, BOEM made a Finding of No Historic Properties Affected for the issuance of a commercial offshore wind lease off Virginia and the subsequent approval of site assessment activities on the leasehold. In the finding, BOEM established a Programmatic Agreement with its consulting parties to continue Section 106 consultations throughout BOEM's approval processes, including the approval of any subsequent SAP(s).
	Abandoned Shipwreck Act/Consultation and Determination	Abandoned Shipwreck Act 43 U.S.C. 2101 et seq.		Appendix I includes a marine cultural resources report; that assessment along with this SAP indicates Met Facility deployment will have no impact on submerged pre- or post-contact period archaeological properties or archaeologically sensitive paleosols.
United States Coast Guard	Approval for Private Aids to Navigation	14 U.S.C. 81	33 CFR Part 66	Dominion will file Private Aids to Navigation applications prior to deployment of the Met Facility.
Virginia Department of Environmental Quality (VDEQ)	Coastal Zone Program consistency certification	Coastal Zone Management Act	15 CFR 930 Subpart C	Dominion provided a consistency certification with the SAP for BOEM to provide to VDEQ, in order to receive a final Consistency Determination. On August 11, 2011, the Commonwealth of Virginia concurred with the regional Consistency Determination that BOEM prepared with the Mid-Atlantic EA. The regional Consistency Determination considered all activities proposed in this SAP.
National Oceanic and Atmospheric Administration National Marine Fisheries Service (NOAA Fisheries)	Incidental Take Authorization (IHA)	Marine Mammal Protection Act (MMPA)	16 USC §§ 1361 *et seq.*	The low levels of sound associated with the small vessels for deployment, operation, maintenance, and decommissioning will not require an Incidental Harassment Authorization from NOAA Fisheries, and, as described in Sections 2 and 4.2.1, Dominion will comply with the vessel strike avoidance measures in the Commercial Lease

1.1 Authorized Representative and Designated Operator

Dominion will be the operator of the Met Facility. The contact information for the Authorized Representative is as follows:

Name of Authorized Representative	Mark D. Mitchell
Title	Vice President – Generation Construction
Phone Number	(804) 273-4543
Email	Mark.D.Mitchell@dom.com
Address	5000 Dominion Blvd, Glen Allen, VA 23060

1.2 Certified Verification Agent Waiver Request

Pursuant to 30 CFR 585.610(a)(9), BOEM may require a Certified Verification Agent (CVA) to certify to BOEM that the Met Facility is designed to withstand the environmental and functional load conditions for the intended life of the Met Facility in the Installation Area. Dominion requests a waiver of the CVA requirement per § 585.705(c) because the Met Facility is a commercially available technology that has been deployed in similar conditions. Dominion will have an Owner Engineer perform duties similar to those of a CVA. The Owner's Engineer will inspect the equipment prior to deployment and will prepare the *Installation Report* described in Section 4.1.

1.3 Best Management Practices

Best management practices are described in Sections 4, 5, and 7. Dominion will use its standard internal project execution structure to manage activities described in the SAP. As stated in Section 4.3, SAP activities will be supported by a detailed Health and Safety Plan, which is included as Appendix B.

In addition, Dominion will use many of the best management practices identified in the *Establishment of an OCS Alternative Energy and Alternate Use Program*, Record of Decision, December 2007. U.S. Department of the Interior, Bureau of Ocean Energy Management, Regulation and Enforcement, Washington, D.C. See Table 1-3 for a summary of these best management practices using the numbering as shown in the above referenced document.

Table 1-3. Best Management Practices

Best Management Practice	Location in SAP Document
7. Avoid known sensitive seafloor habitats	Section 7.1.1 and Appendix G
8. Avoid anchoring on sensitive seafloor habitats	Section 7.1.1 and Appendix G
9. Minimize seafloor disturbance during installation of the equipment	Section 7.1.1 and Section 4.1
11. Routine inspection of the facilities to monitor scouring and ensure structural integrity	Section 5.2
12. Avoid the use of explosives that may impact fish or benthic organisms	No explosives will be used for activities proposed in the SAP.
15, 16, 18, and 22 related to minimizing/avoiding vessel impacts to marine mammals and sea turtles.	Section 4.2.1
19. Use existing data to identify important, sensitive, and unique marine habitats in the vicinity of the project and design the deployment to avoid adverse impacts to these habitats	Section 7
20. Minimize construction activities in areas containing anadromous fish during migration periods	Section 7.2.1
21. Minimize seafloor disturbance during installation of the buoys	Section 4.1
26. Minimize perching opportunities	Section 7.2.3
29. Comply with United States Coast Guard (USCG) lighting and marking requirements while using lighting technology that minimizes impacts to avian species	Table 1-2 and Section 4.1

Table 1-3. Best Management Practices (continued)

Best Management Practice	Location in SAP Document
37. Avoid impacts to the commercial fishing industry by marking the buoy(s) with USCG-approved marking and lighting to ensure safe vessel operation	Table 1-2 and Section 4.1
39. Avoid hard-bottom habitats, including seagrass communities and kelp beds	Section 7.2.1 and Appendix G
54. Prepare an oil spill response plan	Dominion will comply with the documentation requirements identified by the Bureau of Safety and Environmental Enforcement (BSEE), unless otherwise directed (see Appendix A).

2 CONFORMANCE WITH THE COMMERCIAL LEASE AND MID-ATLANTIC ENVIRONMENTAL ASSESSMENT/FINDING OF NO SIGNIFICANT IMPACT

In February 2012, BOEM issued a Finding of No Significant Impact based on the final Environmental Assessment of Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore New Jersey, Delaware, Maryland and Virginia (Mid-Atlantic EA) (BOEM 2012). The Mid-Atlantic EA analyzed the foreseeable consequences associated with issuing commercial leases in the four identified Wind Energy Areas (WEAs), which are inclusive of the location of the Commercial Lease (Figure 1-1), as well as the site assessment activities including the installation of meteorological towers and monitoring buoys. The Met Facility includes the commercially available meteorological buoys analyzed in the Mid-Atlantic EA. BOEM identified several mitigation measures in the Mid-Atlantic EA for buoy installation, operation, and decommissioning. These mitigation measures were included as stipulations in the Commercial Lease. Dominion will implement these measures as described in more detail in Table 2-1 and Section 4 of this SAP.

Table 2-1. Conformance with the Commercial Lease Stipulations

Addendum C Stipulation	Description	SAP Document
3 National Security and Military Operations		
3.2.4 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 3.2.2 and 3.2.3	Mark Mitchell Vice President – Generation Construction See Section 1.1
3.2.5 Coordination with Command Headquarters	The Lessee must establish and maintain early contact and coordination with the appropriate command headquarters, in order to avoid or minimize the potential to conflict with and minimize the potential effects of conflicts with military operations.	Dominion established a point of contact at Fleet Forces Atlantic Exercise Coordination Center at Naval Air Station Oceana. Dominion will provide Mr. Jim Casey an email notification prior to mobilization and will update Fleet Forces Command with more detail about the deployment schedule following BOEM approval of the SAP.
3.3 Electromagnetic Emissions	The Lessee, prior to entry into any designated defense operating area, warning area, or water test area, must enter into an agreement with the commander of the appropriate command headquarters prior to commencing survey activities undertaken to support SAP or COP (Construction and Operations Plan) submittal, to coordinate the electromagnetic emissions associated with any 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.	Dominion will provide the frequencies the Met Facility will use to transmit data to confirm electromagnetic emissions from the SAP activities will not conflict with military operations.

Table 2-1. Conformance with the Commercial Lease Stipulations (continued)

Addendum C Stipulation	Description	SAP Document
4 Standard Operating Conditions		
4.1.1 Vessel Strike Avoidance Measures	The Lessee must ensure that all vessels associated with activities performed in support of plan (i.e., SAP and/or COP) submittal comply with the vessel-strike avoidance measures specified in stipulations 4.1.1.1 through 4.1.1.8, except under extraordinary circumstances when the safety of the vessel or crew is in doubt or the safety of life at sea is in question.	See Section 4.2.1, Protected Species Avoidance
4.1.2 Marine Trash and Debris Prevention	The Lessee must ensure that vessel operators, employees and contractors actively engaged in activity in support of plan (i.e., SAP and COP) submittal are briefed on marine trash and debris awareness and elimination, as described in the BSEE Notice to Lessees (NTL) No. 2012-G01 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 training.	Dominion will comply with this stipulation and NTL-2012-BSEE-G01, and as directed formal training will not be conducted and placards will not be posted. Vessel operators, employees, and contractors will be briefed prior to boarding the vessel.
4.4.1 Reporting Injured or Dead Protected Species	The Lessee must ensure that sightings of any injured or dead protected species (e.g., marine mammals or sea turtles) are reported to the National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NOAA Fisheries) Northeast Region's Stranding Hotline (800-900-3622 or current) 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 ensure that the Lessor is notified of the strike within 24 hours. The notification of such strike must include the date and location (latitude/longitude) of the strike, the name of the vessel involved, and the species identification or a description of the animal, if possible. 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 NOAA Fisheries.	See Section 4.2.1.

3 PROJECT DESCRIPTION AND OBJECTIVES

3.1 Project Description

Dominion will conduct meteorological evaluations as part of the site assessment activities of the Project within the Commercial Lease area. Dominion will collect and analyze meteorological data, inclusive of wind speed and direction at multiple heights, and information on other meteorological conditions and the marine environment. Collection of this data will be performed using a floating light detection and ranging (LiDAR) buoy. The Met Facility will be decommissioned from the nearby Virginia Offshore Wind Technology Advancement Project (VOWTAP) Research Lease Area and redeployed within the Commercial Lease area to the extent practicable. Decommissioning of the adjacent VOWTAP Met Facility coincides with the deployment of the metocean monitoring equipment to support the Project. Equipment from the VOWTAP area will be repaired or replaced as needed. This will provide an opportunity for substantial cost savings by repurposing the equipment where possible, as well as reducing deployment duration. For the purposes of this SAP, the proposed location of the Met Facility is referred to as the Installation Area. A detailed description of the site location is provided in Section 3.3.

The LiDAR platform will characterize the vertical profile of wind speed and direction from 98.4 feet (ft) (30 meters [m]) up to 656.2 ft (200 m) above sea level, with six range gates. The LiDAR platform will support two down-looking active acoustic sensors for redundant measurements of the underwater current speed and direction profile and still-water level. The LiDAR will be deployed on an AXYS Technology Inc. (AXYS) WindSentinel™ Environmental Monitoring buoy (WindSentinel buoy), which will include additional instruments to measure waves, ocean current direction and velocity, air pressure, water temperature, and water salinity (Figure 3-1). The WindSentinel buoy is housed in a Navy Oceanographic Meteorological Automatic Device (NOMAD). The NOMAD is a welded aluminum hull that measures 20.2 ft (6.2 m) long and 10.5 ft (3.2 m) wide and weighs 14,330 pounds (lbs) (6,500 kilograms [kg]). The WindSentinel buoy will be moored to the seabed using a catenary chain attached to a 4-ton concrete block anchor.

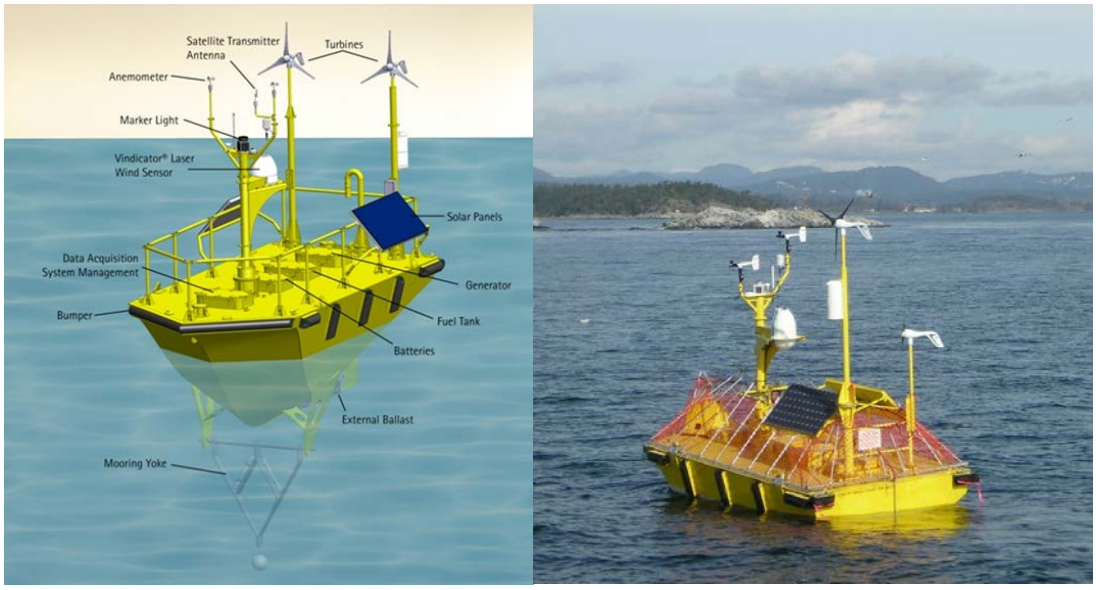


Figure 3-1. AXYS WindSentinel™ Environmental Monitoring Buoy

3.2 Schedule

It is currently anticipated that the WindSentinel buoy will be deployed in the second quarter of 2019. The Met Facility will remain in place through the end of the Site Assessment Term of the Commercial Lease. Dominion may request that the Met Facility remain in place to gather additional data as the Project is constructed or the monitoring system will then be decommissioned as described in Section 6.

3.3 Site Location

The Met Facility will be deployed at the coordinates listed in Table 3-1 (Installation Area) within the OCS Block 6112, Aliquot I (see Figure 1-1). The location of the monitoring system is designed to provide metocean and wind resource information as a supplement to data collected in support of VOWTAP.

Table 3-1. Installation Area

Platform Identification	Latitude (decimal degrees)	Longitude (decimal degrees)	Mean Lower Low Water Depth (m)
WindSentinel Buoy	36.882938	-75.475578	25.5

Siting of the Met Facility was influenced by two primary factors: the goal of leveraging the data from the VOWTAP campaigns, and ensuring that the monitoring equipment was well exposed to representative metocean conditions.

Dominion's participation in VOWTAP ensures that the data collected in the Research Lease Area will be utilized to establish a representative period of record for the adjacent Commercial Lease area. While the Project layout and design are being developed, the metocean data collected by VOWTAP will help establish baseline conditions for future modeling and analysis work to support the Project. Specifically, data collected from the seabed-mounted acoustic Doppler current profiler and wave buoy, as well as data from instrumentation deployed on the VOWTAP turbines and foundations to measure waves, currents, and loads, will inform development of the Project and the Construction and Operations Plan.

Once the VOWTAP turbines are operating, they will affect wind measurements in the immediate area. The position of the Met Facility was selected based upon the planned VOWTAP turbine locations, the expected wind rose, and the surveyed area available in the adjacent aliquots. The WindSentinel buoy was sited 3,280.8 ft (1,000 m) east of its planned location in the Research Lease Area. This proposed location is expected to be sufficiently close to the VOWTAP site to support use of the two data sets together in the Project's assessments. This site also provides a separation of approximately 4,921.3 ft (1,500 m) from the southernmost VOWTAP turbine location. This represents a span of approximately 10 rotor diameters based upon VOWTAP's turbine design, a distance typically sufficient for the turbine wake to dissipate in the infrequent cases when the LiDAR on the WindSentinel buoy is directly downstream of that system.

Dominion may consider alternate locations for the Met Facility prior to deployment. High-resolution geophysical (HRG) surveys will be conducted within a portion of the Commercial Lease area in accordance with the requirements of the Commercial Lease. Following completion of the HRG surveys, Dominion may identify other suitable locations for the Met Facility and submit a revised SAP to BOEM including the results of the HRG and other necessary surveys required under §§ 606, 610, and 611.

3.4 WindSentinel Buoy and Mooring Design

The selection of the Met Facility was based, in part, by a review of known metocean conditions (Fugro 2013a, 2013b) in the Installation Area.

The design of the WindSentinel buoy is based on the NOMAD boat-shaped hull, which has an overall length of 20.2 ft (6.2 m). 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 Centre (NDBC) 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- and 39.4-ft (10- 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 WindSentinel buoy would be moored to the seabed via a clump weight anchor. The anchor does not require drag embedment and would have a seabed scar area approximately 5.3 ft by 5.3 ft (1.6 m by 1.6 m). The clump weight anchor will be approximately 35 inches (0.89 m) in height and will have a vertical penetration into the seabed of approximately 17.5 inches (0.44 m). The mooring has been designed to support a minimum one year between service visits.

A catenary chain mooring system consisting of multiple chain segments will be connected from the clump weight anchor to the base of the buoy. Moorings are constructed from compatible metals to ensure that no corrosion is caused by dissimilar materials. The all-chain mooring will be designed using a 2.5:1 (at minimum water depth) mooring scope; therefore, at least a 210-ft (64-m) chain will be needed for the 83.6-ft (25.5-m) mean lower low water (MLLW) depth at the Installation Area. AXYS, the manufacturer of the WindSentinel buoy, has extensive experience in the mooring of NOMAD hulls, with over 20 hulls deployed over the last 25 years all using approximately a 2:1 scope. AXYS moorings are designed and validated using a Woods Hole Oceanographic Institution (WHOI) cable and Proteus DS software, and this process will be used as part of the final mooring design for this installation. Inputs and outputs from this modeling can be provided to BOEM upon request. WHOI mooring simulations for the adjacent VOWTAP NOMAD buoy location, as well as a statement from the mooring designer confirming the applicability of the design to the Installation Area, have been provided in Appendix C.

The cabling for the WindSentinel buoy is designed to 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 15 cm and 1 m with values ranging from 0 (no protection) to 7 (protected against the effects of immersion). All external fasteners are manufactured from stainless steel 316 to prevent corrosion.

Drawings of the mooring and the anchor are shown in Figures 3-2 and 3-3, respectively. Complete technical details of the WindSentinel buoy can be found in Appendix C and Appendix D.

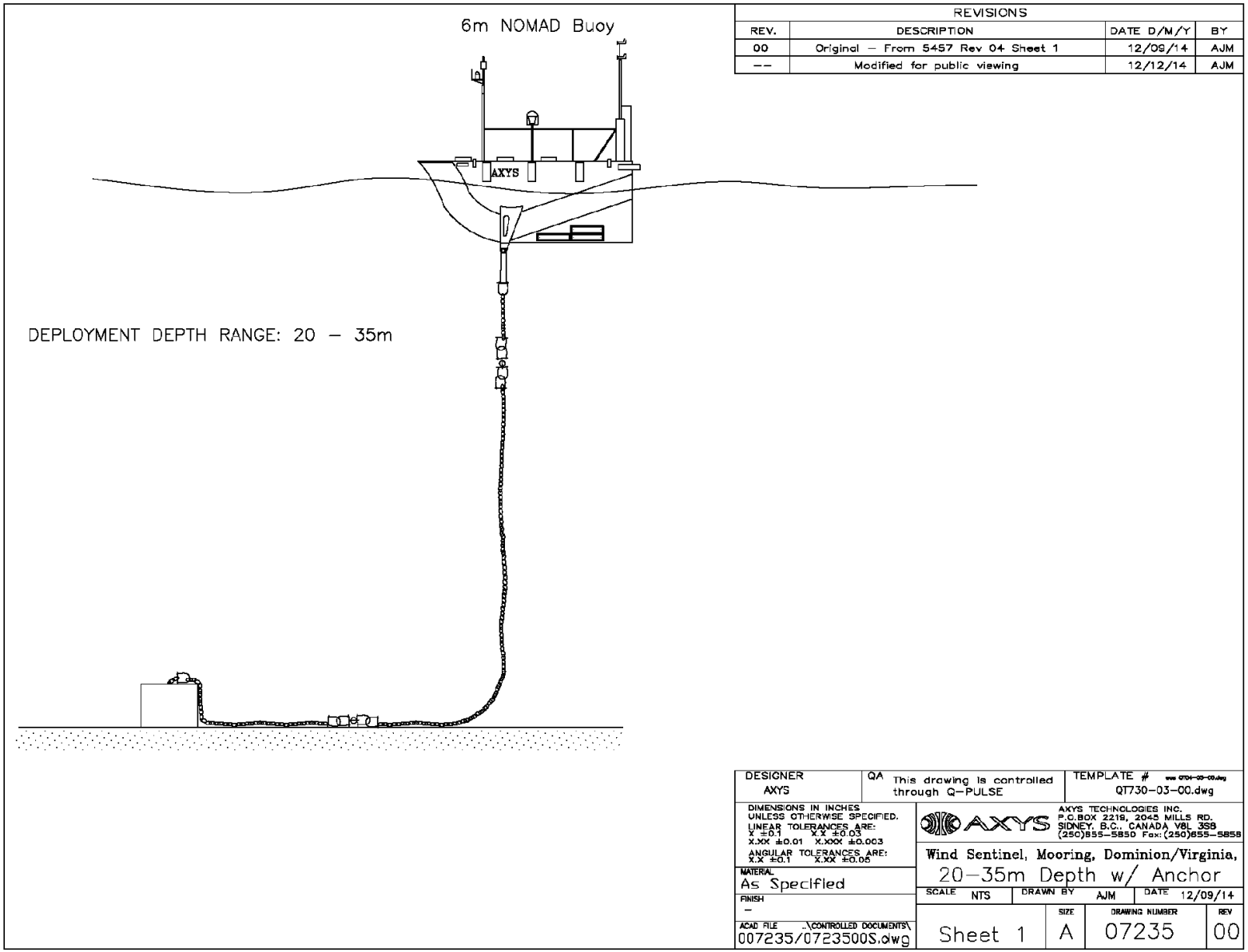


Figure 3-2. Drawing of All-Chain Mooring for a WindSentinel Buoy

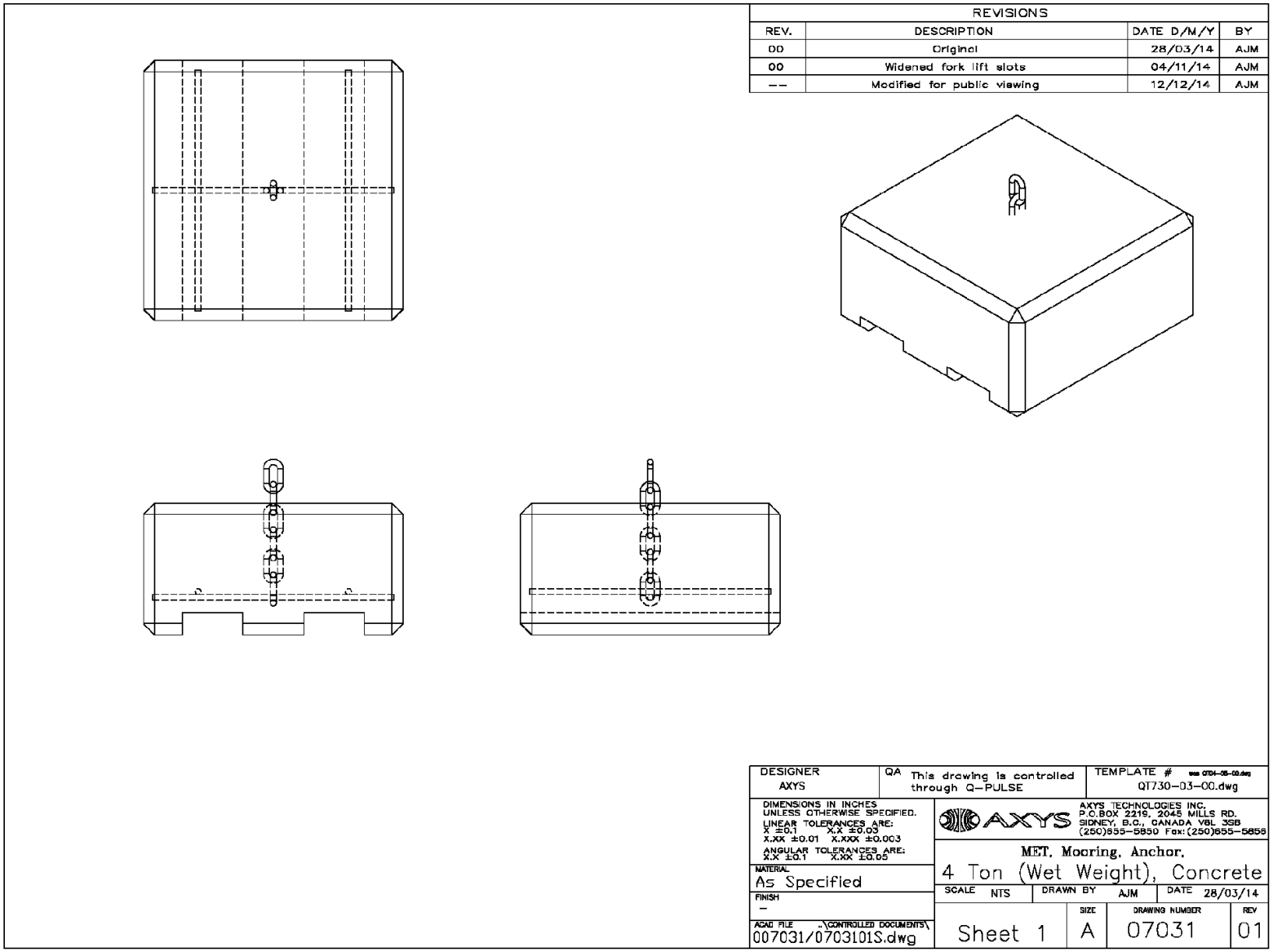


Figure 3-3. Drawing of Concrete Anchor for WindSentinel Buoy

3.5 Equipment Description

This section describes the power supplies of the WindSentinel buoy as well as wind and metocean instrumentation that will be part of the Met Facility.

3.5.1 Power Equipment

The WindSentinel buoy instrumentation is powered by lead-acid batteries, primarily charged by a hybrid wind-solar system, with a diesel generator as a secondary backup battery charging source. In the event of failure of the key power supply systems, the system would operate at full capacity on battery power alone for 7 days. Triple redundancy is provided through the use of a 3 by 20-watt solar panel array, which is mounted on the superstructure to avoid damage by waves, and is available for instances where both wind and diesel generators are offline. The solar panel system will allow the WindSentinel buoy to inform the operator that the main power systems are down and will continue to monitor and track the buoy. A regulator protects the batteries from being damaged by possible overcharging.

3.5.2 Instrumentation Equipment

A LiDAR and anemometer capable of measuring wind speeds and directions up to 656.2 ft (200 m) will be mounted atop the WindSentinel buoy. The buoy would also contain the following equipment:

- Downward looking 600 kilohertz (kHz) acoustic Doppler current profiler for wave and current measurements;
- Integrated motion sensors to provide information on the orientation, roll and pitch of the platform (to validate motion correction algorithms and troubleshoot as necessary);
- A 500 kHz acoustic altimeter (narrow-beam down-looking sonar) to measure still-water level changes due to tides and storm surges;
- A radiometer to provide a vertical profile of air temperature;
- A barometric pressure sensor to provide atmospheric pressure;
- A conductivity-temperature sensor to measure salinity and water temperature; and
- Integrated wireless communication systems to provide data download and system remote operation via general packet radio service, satellite, or wireless radio or mobile phone connection to shore.

The data acquisition system acquires and stores data using the WatchMan™ 500 controller (WatchMan). The WatchMan has an intelligent, configurable sensor input/output platform with two-way communication, designed for long-term operations in harsh marine environments. The WatchMan manages the operation of each sensor in the system and the power equipment, allows for remote adjustments to system performance, and transfers data using a combination of cell phone, Iridium, and Inmarsat D + (or iSAT data pro) telemetries for the WindSentinel buoy.

Using the maintenance plan described in Section 5.2, equipment on the WindSentinel buoy will have a minimum 5-year lifespan.

4 DEPLOYMENT / INSTALLATION

4.1 Overview of Installation and Deployment Activities

Installation of the WindSentinel buoy is anticipated to take place over 1 day using vessels deployed from Cape Henry Launch in Virginia Beach, Virginia. The Met Facility will be decommissioned from the VOWTAP Research Lease Area and redeployed in the Installation Area, to the extent practicable. Equipment from the VOWTAP area will be repaired or replaced as needed. Upon evaluation, Dominion may transport the equipment from the VOWTAP Research Lease Area to Cape Henry Launch for maintenance and calibration, and then redeploy the Met Facility using the following methodology.

Dominion will notify BOEM, Fleet Forces Atlantic Exercise Coordination Center at Naval Air Station Oceana, the United States Army Corps of Engineers, and the United States Coast Guard (USCG) prior to the installation mobilization supporting deployment of the Met Facility. Written notice will be provided to Mr. Jim Casey at Fleet Forces Command via email prior to mobilization in order to avoid potential conflicts with military operations. Dominion will update Fleet Forces Command on the installation schedule following approval of the SAP and detailed planning.

A Local Notice to Mariners advising of the installation of the WindSentinel buoy and mooring will be published and broadcast on Marine Channel 16 by the USCG prior to and during planned installation work. The USCG may choose to circulate the Private Aids to Navigation (PATONs) in a public forum as well. Additionally, the installation vessel will issue a very high frequency (VHF) broadcast on their short range radio describing, in brief, 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.). As is standard practice, this will be broadcast on the emergency band and Marine Channel 16, and any follow-up questions will be directed to a different, public frequency of the vessel captain's choice.

A tug and a small floating work barge of less than 79 ft (less than 24 m) total length will be used for installation activities. The mooring system will be assembled on the barge deck and the WindSentinel buoy will be towed behind the barge to the Installation Area (see Figure 1-1). The 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. No anchoring will take place during installation. It is expected that installation of the WindSentinel buoy can be accomplished in 1 day.

Following the installation, Dominion will prepare an *Installation Report* and provide a copy to BOEM. This report will include a description of the equipment and the deployment, including final coordinates of the installation site, the results of all commissioning tests, the plans and schedule for upcoming inspections and maintenance, and any noted problems or issues to be addressed.

4.2 Vessel Descriptions

Installation of the WindSentinel buoy and mooring will use a tug, barge, and small launch from Cape Henry Launch. Dominion will use the tug *Little Brutus* or a similar vessel. The *Little Brutus* is a twin-screw 1,000-horsepower model bow tug, 42 ft (12.8 m) long, with 4.5 to 1 reduction through 3.5-ft (1.1-m) propellers. The barge will comprise two equal sections rigidly connected through the centerline for total dimensions

of 79 ft by 28 ft by 6 ft (24.1 m by 8.5 m by 1.8 m). Each barge section will have a centerline longitudinal bulkhead for additional strength. A removable A-frame derrick with 25-ft (7.6-m) hook height and 30,000-lb (13,607.8-kg) lift capacity will be attached at the front of the barge.

See Appendix E for vessel specifications.

4.2.1 Protected Species Avoidance

All whales, dolphins, and porpoises in the mid-Atlantic and northeast regions are federally protected by the Marine Mammal Protection Act (MMPA) and most large whales in the area, as well as sea turtles, are further protected under the Endangered Species Act (ESA). Reasonable and prudent measures to minimize impacts to marine mammals and sea turtles have been developed and listed as stipulations under the Commercial Lease. These stipulations serve as mitigations for all Dominion activities. Deployment of the Met Facility will not require pile-driving; accordingly, mitigations to reduce adverse impacts on protected species from pile driving do not apply to this installation. Stipulation No. 4.1.1 of the Commercial Lease specifies that all vessels abide by vessel strike avoidance measures. Following the vessel strike avoidance measures can help protect both the construction vessel and the marine species of concern. These measures, as specified in the Commercial Lease, Addendum C, include the following:

- 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 marine mammals or sea turtles.
- Ensure that all vessel operators comply with 10 knot speed restrictions in any dynamic management area. In addition, ensure that all vessels operating from November 1 through April 30 operate at speeds of 10 knots or less.
- For North Atlantic right whales:
  - Ensure that all vessels maintain a separation distance of 1,640 ft (500 m) or greater from any sighted North Atlantic right whale.
  - Ensure that the following avoidance measures are taken if a vessel comes within 1,640 ft (500 m) of any North Atlantic right whale:
    - If underway, any vessel must steer a course away from the North Atlantic right whale at 10 knots or less until the 1,640 ft (500 m) minimum separation distance has been established.
    - If a North Atlantic right whale is sighted within 328.1 (100 m) to an underway vessel, the vessel operator must immediately reduce speed and promptly shift the engine to neutral. The vessel operator must not engage the engines until the North Atlantic right whale has moved beyond 328.1 (100 m).
    - If a vessel is stationary, the vessel must not engage the engines until the North Atlantic right whale has moved beyond 328.1 (100 m) before steering a course away from the North Atlantic right whale at 10 knots or less until the 1,640 ft (500 m) minimum separation distance has been established.

- For non-delphinoid cetaceans other than the North Atlantic right whale:
  - Ensure that all vessels maintain a separation distance of 328.1 (100 m) or greater from any sighted non-delphinoid cetacean.
  - Ensure that the following avoidance measures are taken if a vessel comes within 328.1 (100 m) of any non-delphinoid cetacean:
    - If any non-delphinoid cetacean is sighted, the vessel underway must reduce speed and shift the engine to neutral, and must not engage the engines until the non-delphinoid cetacean has moved beyond 328.1 (100 m).
    - If a vessel is stationary, the vessel must not engage engines until the non-delphinoid cetacean has moved beyond 328.1 (100 m).
- For delphinoid cetaceans:
  - Ensure that all vessels maintain a separation distance of 164 ft (50 m) or greater from any sighted delphinoid cetacean.
  - Ensure that the following avoidance measures are taken if a vessel comes within 164 ft (50 m) of any delphinoid cetacean:
    - Ensure that any vessel underway remain parallel to a sighted delphinoid cetacean's course whenever possible, and avoid excessive speed or abrupt changes in direction. Vessel may not adjust course and speed until the delphinoid cetacean has moved abeam of the underway vessel.
    - Ensure that any vessel underway reduces vessel speed to 10 knots or less when pods (including mother/calf pairs) or large assemblages of delphinoid cetaceans are observed. Vessel may not adjust course and speed until the delphinoid cetaceans have moved beyond 164 ft (50 m) or abeam of the underway vessel.
- For sea turtles and pinnipeds:
  - Ensure all vessels maintain a separation distance of 164 ft (50 m) or greater from any sighted sea turtle or pinniped.
- Ensure that all vessel operators are briefed to ensure they are familiar with the above requirements.
- Ensure that vessel operators, employees, and contractors actively engaged in activity in support of plan submittal are briefed on marine trash and debris awareness and elimination, as described in the Bureau of Safety and Environmental Enforcement (BSEE) Notice to Lessees (NTL) No. 2012-G01 ("Marine Trash and Debris Awareness and Elimination") or any NTL that supersedes this NTL, except that formal training or placard posting will not be required. Ensure that these vessel operators, 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. Vessel operators, employees, and contractors will be briefed prior to boarding the vessel. The above-referenced NTL provides information for use in this awareness training.

Reporting of Injured or Dead Protected Species

During all phases of marine activities, sightings of any injured or dead protected species (sea turtles and marine mammals) shall be reported within 24 hours, regardless of whether the injury or death was caused by Met Facility-related activities. All marine activities will be suspended immediately and the circumstances reported as specified below if a dead or injured right whale is found in the vicinity of the Installation Area. Sightings of injured or dead whales and sea turtles not associated with Met Facility-related activities will be reported to the USCG on VHF channel 16, and to the National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NOAA Fisheries) Stranding and Entanglement Hotline: (978) 281-9351. In addition, if the injury or death was caused by a Met Facility-related vessel or project-related equipment or material/activity (e.g., support vessel, entanglement, buoy, etc.), Dominion shall notify the NOAA Fisheries Director at the Northeast Regional Office (NERO): (978) 281-9300, the Director of the Office of Protected Resources at NOAA Fisheries: (301) 713-2332), NOAA Fisheries Endangered Species Act Interagency Cooperation Division of the Office of Protected Resources: incidental.take@noaa.gov and kellie.foster-taylor@noaa.gov, BOEM: renewable_reporting@boem.gov, and the USCG immediately, and shall provide a full report to NOAA Fisheries at NERO. The reports to NOAA Fisheries shall include the following information:

- The time, date, and location (latitude/longitude) of the incident;
- The name and type of the vessel involved or other equipment/material that caused the injury or death;
- The vessel's speed during the incident, if applicable;
- A description of the incident;
- Water depth;
- Environmental conditions (e.g., wind speed and direction, sea state, cloud cover and visibility);
- The species identification or description of the animal, if possible; and
- The fate of the animal.

BOEM has recently recommended that, in addition to recording the above-listed information, wind energy projects should report any obtainable information as indicated on the Incident Report published in Appendix A to Addendum C of the Commercial Lease (e.g., photographs, species, size, decomposition state, obvious injuries, etc.). Dominion will use the Incident Report as required in stipulation 4.4.1 of the Commercial Lease, a copy of which is included as Appendix F of this document. As required, should an incident occur, the Incident Report will be submitted to BOEM and NOAA Fisheries within 24 hours.

4.2.2 Oil Spill Response

The WindSentinel buoy will carry 240 gallons of diesel to provide back-up power to the wind and solar systems. BSEE has determined that deploying the WindSentinel buoy in support of VOWTAP requires the submittal of documentation of compliance with § 585.254 to BSEE (see Appendix A). Dominion intends to deploy the same or similar WindSentinel buoy in the Commercial Lease area and therefore intends to comply with this same requirement for the Met Facility.

4.3 Health and Safety

Dominion will implement a project-specific Health and Safety Plan to ensure the health and safety of all personnel involved in the deployment, operations and maintenance, and decommissioning of the Met Facility. This plan is included in Appendix B.

5 OPERATIONS AND MAINTENANCE

5.1 Data Collection and Operations

The WindSentinel buoy includes the WatchMan, which will transmit performance information to the Data Management Vendor on a daily basis. Parameters to be monitored include battery levels and charging system output and buoy positions. Continuous evaluation of these indicators will allow Dominion to immediately detect any system incongruities so that a response may quickly be initiated.

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

5.2 Maintenance Activities

The WindSentinel buoy will be subject to an offshore visual inspection approximately every 3 months and preventive maintenance will be performed on the system approximately every 6 months. Inspections will include monitoring for scour around the anchor. If monitoring reveals substantial scour around the buoy anchor, Dominion will consult with BOEM regarding the extent and type of scour protection to be deployed. The buoy platform will be disconnected and towed to shore once annually for a full service of the structure and systems. The mooring system will remain in place 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 buoy will be performed using the *Cape Crusader* or *Shawn Alan* (or similar vessel) from Cape Henry Launch (see Appendix E for specifications). Choices between these vessels would be dictated by weather, crew, and availability.

5.3 Reporting

A copy of the maintenance and inspection report will be provided to BOEM with Semi-Annual Progress Reports required by the Commercial Lease (Stipulation No. 2.2.1), or upon request.

6 DECOMMISSIONING

BOEM requires decommissioning of facilities described in the SAP in accordance with § 585.901. Dominion will submit a decommissioning application to BOEM as required by § 585.902(b) prior to removal of the WindSentinel buoy. Following BOEM approval of the decommissioning application, Dominion will notify BOEM at least 60 days prior to vessel deployment.

6.1 Overview of Decommissioning Activities

Dominion's decommissioning application will describe the specific activities to be conducted. In general, decommissioning will follow a similar process as installation. The WindSentinel buoy mooring would be recovered using a deck-mounted winch and davit and then the WindSentinel buoy and mooring would be towed to port.

6.2 Site Clearance Survey

Once the WindSentinel buoy and anchoring equipment has been removed from the site, Dominion will survey the Installation Area to ensure any obstructions related to the Met Facility are removed as required in § 585.902(a)(2). It is expected that any scour holes or draglines left by the anchor or mooring chain will quickly be covered through natural sediment transport processes.

6.3 Reporting

A Decommissioning Report will be prepared and provided to BOEM with the corresponding Semi-Annual Progress Report required by the Commercial Lease (Stipulation No. 2.2.1), or upon request. This report will include a description of the process and equipment used for decommissioning the WindSentinel buoy and the results of the site clearance survey.

7 AFFECTED ENVIRONMENT, POTENTIAL IMPACTS, AND MITIGATION MEASURES

A detailed understanding of the biological resources, archaeological resources, and geophysical and geotechnical conditions has been developed through site surveys and analyses that were conducted in June 2013 in support of the VOWTAP. The VOWTAP Team conducted the surveys and site investigations within the VOWTAP Research Lease Area and associated marine cable corridor. These surveys also included the portion of the Commercial Lease area proposed for the Installation Area. All investigations followed protocols, methods, and/or used data that represented the state of industries techniques/knowledge at the time of the study. All environmental studies were discussed with regulatory agencies and, as appropriate, reviewed and approved by the agencies with jurisdiction for the respective resources.

The study results include the Installation Area. The following analyses focus on the maximum area of potential disturbance associated with the Met Facility, 50,123 square feet (1.2 acres, 4,656.6 square meters), within the area of the Commercial Lease surveyed.

7.1 Geologic Conditions

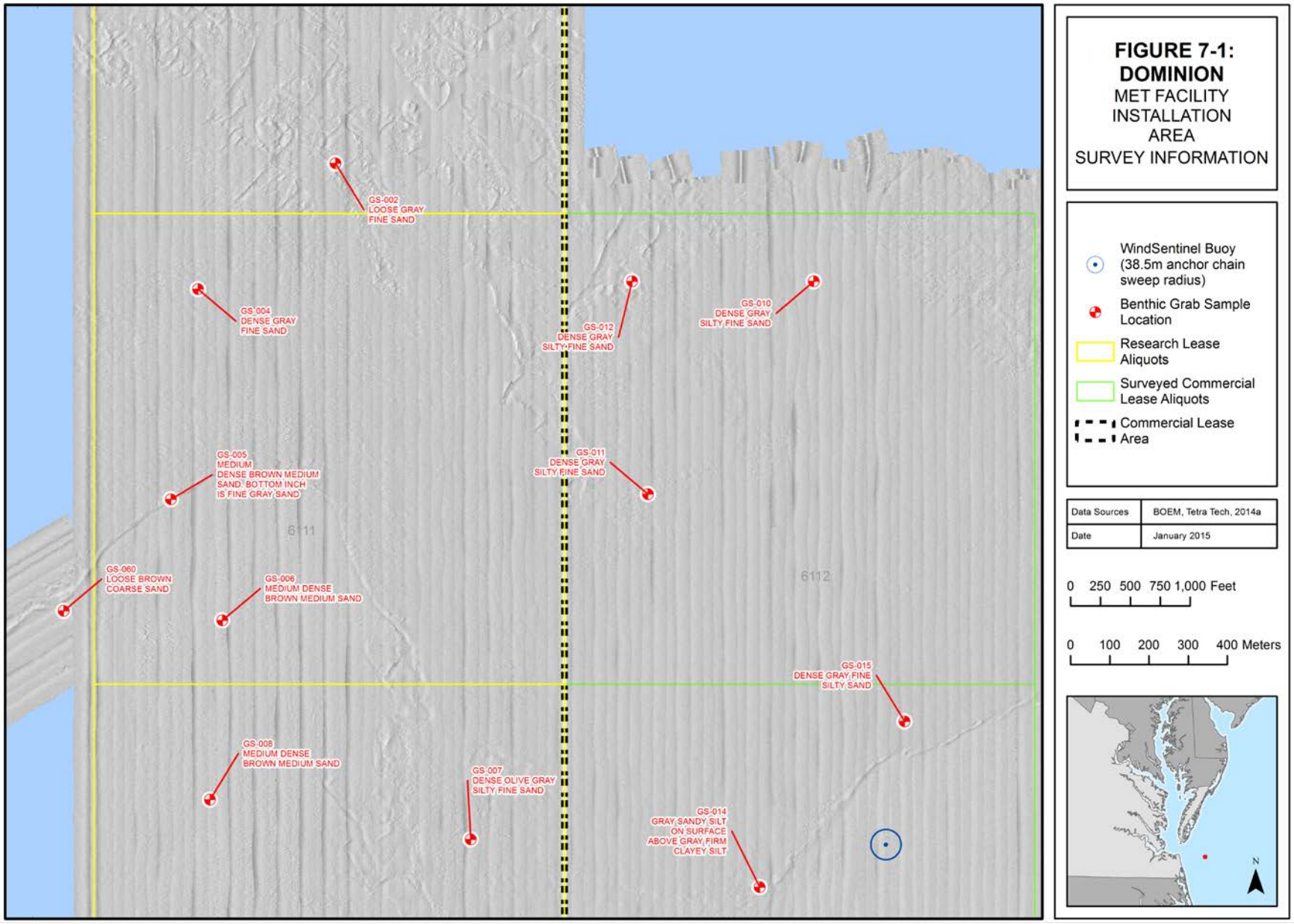
7.1.1 Affected Environment

The Commercial Lease area is situated on the shallow shelf of the Atlantic continental margin approximately 24 nm (45 km) off the coast of Virginia. The area was the subject of three NOAA charting expeditions in 2011-2012 that provided full coverage, high resolution water depths across the area (NOAA 2011, 2012a, 2012b). A reconnaissance bathymetric and geophysical survey was conducted by Fugro Consultants, Inc. (Fugro) in 2013 to provide information needed for planning the development of the Commercial Lease area (Fugro 2013c). Primary line spacing for the reconnaissance geophysical survey was 1.5 km. Fugro incorporated the 2011-2012 NOAA bathymetric data into their charts to show full coverage across the area. In addition, three aliquots of the Research Lease Area, located adjacent to the western border of the Commercial Lease area, and two additional aliquots located adjacent to the eastern boundary of the Research Lease Area, were surveyed to full BOEM specifications by Tetra Tech in 2013 as part of the VOWTAP (Tetra Tech 2014a). Data from these survey efforts, as well as a geoscience-focused Desktop Study performed by Fugro in 2013 for the Virginia Wind Energy Area (Fugro 2013b), were compiled and reviewed to describe the surface and subsurface geologic conditions in the area of the WindSentinel buoy and within the Installation Area.

The seabed in the WindSentinel buoy area comprises primarily sand and silty sand, with interbedded sands, silts, and clays in the subsurface. The geologic conditions present at the proposed buoy location, and its proximity to nearby mapped anomalies, are summarized in Table 7-1 and Figure 7-1.

Table 7-1. Geologic Conditions and Anthropogenic Hazards in the Installation Area

Platform Identification	Water Depth (m MLLW)	Surface Sediment Type	Maximum Potential Bottom Disturbance	Nearest Mapped Sidescan Sonar and Magnetometer Contacts
WindSentinel Buoy	25.5	Silty Sand with shells	Anchor Chain Sweep Area = 4.656.63 m^2 Radius = 38.5m	> 40 m – Magnetometer >100 m – Sidescan sonar


GS-002
LOOSE GRAY
FINE SAND
GS-004
DENSE GRAY
FINE SAND
GS-012
DENSE GRAY
SILTY FINE SAND
GS-010
DENSE GRAY
SILTY FINE SAND
GS-005
MEDIUM
DENSE BROWN MEDIUM
SAND BOTTOM INCH
IS FINE GRAY SAND
GS-011
DENSE GRAY
SILTY FINE SAND
6111
6112
GS-060
LOOSE BROWN
COARSE SAND
GS-006
MEDIUM DENSE
BROWN MEDIUM SAND
GS-015
DENSE GRAY FINE
SILTY SAND
GS-008
MEDIUM DENSE
BROWN MEDIUM SAND
GS-007
DENSE OLIVE GRAY
SILTY FINE SAND
GS-014
GRAY SANDY SILT
ON SURFACE
ABOVE GRAY FIRM
CLAYEY SILT
FIGURE 7-1:
DOMINION
MET FACILITY
INSTALLATION
AREA
SURVEY INFORMATION
WindSentinel Buoy
(38.5m anchor chain
sweep radius)
Benthic Grab Sample
Location
Research Lease
Aliquots
Surveyed Commercial
Lease Aliquots
Commercial Lease
Area
Data Sources
BOEM, Tetra Tech, 2014a
Date
January 2015
0 250 500 750 1,000 Feet
0 100 200 300 400 Meters
N

Bedforms present in the Installation Area and regional bottom shear stress studies (Dalyander et al. 2012) and sediment mobility studies (Woods Hole Group 2013), have indicated that bottom currents are capable of frequently mobilizing sediments in the Installation Area and, therefore, erosion and scour are a consideration for all offshore installations. Movement/migration of larger sand ridges observed in the Commercial Lease area is anticipated to be minimal and should not pose a risk to the planned buoy and anchor. The WindSentinel buoy is situated on a northeast-trending, low relief 3.3 to 6.6 ft (1 to 2 m) sandy shoal that traverses OCS Block 6112, Aliquot I. Some scour was indicated around the base of this shoal.

Natural Seafloor and Sub-Seafloor Hazards

The geophysical and geotechnical datasets were analyzed for seafloor and sub-seafloor hazards, which could pose a potential risk to the installation, operation, and maintenance of the Met Facility. The sidescan and multibeam bathymetry datasets were interpreted and found to contain no evidence of the surficial expression of shallow faults, and the subbottom profiler data showed no significant offsets of sedimentary bedding indicative of shallow faults. No areas of acoustic whiteouts or other amplitude anomalies were observed in the subbottom profiler data, as would be anticipated for any significant accumulation of shallow gas. The subbottom profiler records do not contain any bottom simulating reflectors (BSRs), which are a typical indication of the presence of hydrates. The generally low relief of the project area, along with the lack of observed buried failure planes, slump blocks, or other evidence of mass wasting in the subbottom profiler records indicate that slump blocks and slump sediment are not found within the study area. The interpretation of the sidescan sonar, multibeam bathymetry, and subbottom profile datasets provide no evidence of ice scour, such as seabed gouging by either icebergs or sea ice pressure ridges. Additionally, no craters or other seabed evidence of strudel scours were noted in any of the datasets.

The geophysical and geotechnical datasets were used to confirm additional geological hazards were not present. The sidescan sonar, multibeam bathymetry, and subbottom profiler datasets were reviewed and do not provide any evidence of seismic activity, such as extensive or regional faulting or slump and mass wasting features. Additionally, no fault zones, nor any other faulting activity, are identified either from seabed data or from the subbottom profiler records, as would typically be indicated by offset sedimentary bedding planes in the subbottom 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. As there has been no faulting identified, there has also been no evidence of faulting attenuation effects observed in the geophysical datasets. These results are consistent with the expected nature of the passive continental margin off of Virginia Beach containing the Installation Area.

The equipment location was selected to avoid known hazards, both natural and man-made. Shallow hazards will not impact deployment, maintenance, or decommissioning of the Met Facility. Table 7-2 summarizes major types of seafloor hazards and associated details observed during the survey and desktop review, as necessary.

Table 7-2. Seafloor and Sub-Seafloor Hazards

Hazard	Definition	Identification and description
Seafloor		
Steep seabed slopes	Steep seafloor gradients, posing a risk of unstable seabed and complications during installation	Not present.
Sediment failure / mass movement	Large-scale movement of the seabed due to gravity, such as slumps and slides	Not present.
Hard grounds	Rock or lithified sediments	Not present.
Diapiric structures	Structures caused by the movement and flow of ductile sediments due to pressure	Not present.
Bedforms and sand waves	Current controlled deposition of sediment, causing variable or wavy seabed. Large-scale sediment waves pose an issue for cable burial and subsea installations	Present throughout the surveyed area. A variety of bedforms were observed including sand ridges and sediment ripples. Movement/migration of sand ridges is anticipated to be minimal and does not pose a risk to the deployment, maintenance, or decommissioning of the Met Facility. Sediment ripples observed are sub-meter scale and do not pose a hazard to the deployment, maintenance, or decommissioning of the Met Facility.
Faulting	A feature caused by relative movement of adjacent portions of seafloor, due to deeper movements of the Earth's crust or by shallower differential compaction of soft sediments	Not present.
Fluid or gas expulsion	Movement of gas or fluid through the seabed and into the water column	Not present.
Water scour	Erosion of seabed due to tidal, storm-induced, or other currents along the seabed	Present throughout the surveyed area. Areas of scour were observed near the base of sand ridges and other bathymetric features. This natural scour appears to be minimal to moderate.
Hydrates	Naturally occurring solids comprised of water molecules forming a rigid lattice of cages with most of the cages, each containing a molecule of natural gas, mainly methane	Not expected to be present in the upper 300 ft (90 m) of the ocean in the Installation Area.
Ice scour	Gouges in seabed caused by the movement of pack ice	Not present.
Channels	Pathway taken by water and sediment flowing due to gravity	Not present in the Installation Area.
Sub-Seafloor		
Shallow faults	A feature caused by relative movement of adjacent portions of seafloor, due to deeper movements of the Earth's crust or by shallower differential compaction of soft sediments	Not evident.
Shallow gas	Buildup of gas due to biological or chemical processes and trapped by less permeable layers in the seabed	Not evident.
Shallow rock or hard ground	Rock or lithified sediments subcropping the seafloor	Not evident.
Diapiric structures	Structures caused by the movement and flow of ductile sediments due to pressure	Not evident.
Fluid or gas expulsion	Movement of gas or fluid through the seabed and into the water column	Not evident.
Degradation of permafrost	Instability and subsidence due to melting of permafrost layers in the subsurface	Not evident.
Channels	Former pathways of the transport of water and sediment due to gravity, partially or fully filled in by sedimentation	Not present in the Installation Area.

7.1.2 Potential Impacts and Mitigation Measures

Based on the 2013 site characterization surveys and report (Tetra Tech 2014a), site conditions are suitable for the installation of the Met Facility. Some scour around the WindSentinel buoy anchor may occur and will be monitored during regular maintenance (see Section 5.2). The WindSentinel buoy may be towed to shore prior to any forecasted major storm events. Additional maintenance surveys will be conducted, as needed, following major storm events to monitor sediment deposition and/or scour around the anchor.

7.2 Biological Resources

7.2.1 Fisheries and Benthic Resources

Affected Environment

Deployment of the Met Facility in the Installation Area is not expected to result in significant effects to fisheries resources or result in significant changes in local community assemblage and diversity, or the availability of habitat and forage items. As BOEM concluded in consultation with NOAA Fisheries, the limited spatial extent and duration of activities analyzed in the Virginia WEA, in the Mid-Atlantic Bight, are not likely to cause more than temporary impacts and will not substantially affect fish populations in the area (BOEM 2012).

A benthic survey conducted by Tetra Tech in 2013 (Appendix G) included the Installation Area and gathered information on the benthic infaunal organisms, sediment grain size, and total organic carbon of the benthic sediment. Grain size analysis performed revealed consistently fine sand with very low organic content dominating the samples followed by medium sand. Grab samples GS-014 and GS-015 (depicted on Figure 7-1) were collected from the Lease Area on June 17, 2013 (Table 7-3) and were used to evaluate the benthic habitat at and around the Installation Area.

Table 7-3. Sample Log and Description for Sites GS-014 and GS-015 within the Lease Area

Sample Number	UTC Date	UTC Time	Northing	Easting	Water Depth (MLLW) (m)	Complete Description
GS-014	6/17/2013	1:25	4081882.4	457298.5	28.11	Firm gray sandy silt on surface above firm dark gray clayey silt, clamshells, shell hash
GS-015	6/17/2013	2:33	4082304.9	457667.7	26.84	Dense grayish brown fine silty sand, worm tubes, shell hash

Samples at these locations determined the sediments within the area were comprised of sandy clay (GS-014) and gray fine sand with silt and shell (GS-015). Sediment size composition is included in Table 7-4 and shown graphically in Figure 7-2.

Table 7-4. Grain Size and Organic Content for Sites GS-014 and GS-015 within the Lease Area

Grab Sample	Organic Content (%)	Particle-Size Distribution (dry mass basis)						
		Specimen Mass (grams)	Maximum Particle Size (inch)	Gravel-Size (%)	Sand-Size (%)			Silt- & Clay-Size (%)
					Coarse	Medium	Fine	
GS-014	2.3	209.50	< 3/8	0.7	0.6	6.8	27.0	64.9
GS-015	0.4	125.26	< 3/16	0.1	0.1	0.6	92.5	6.7

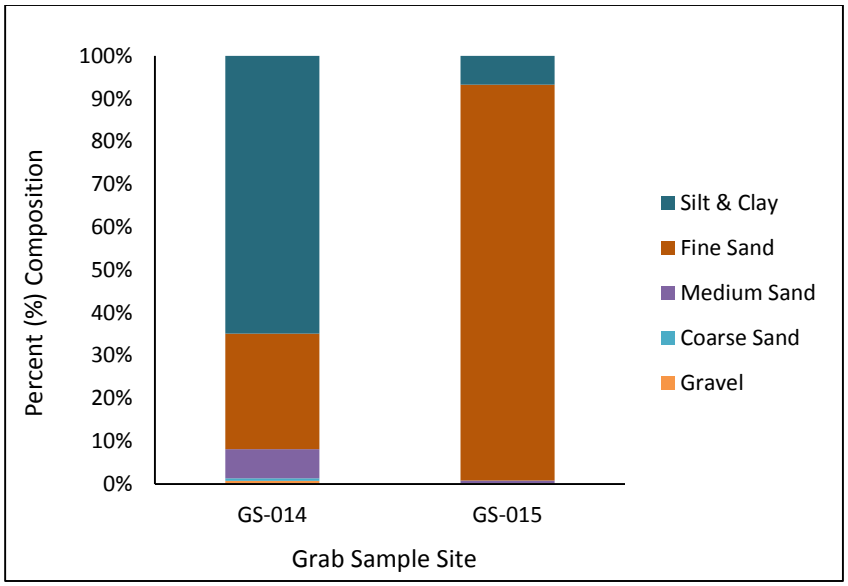
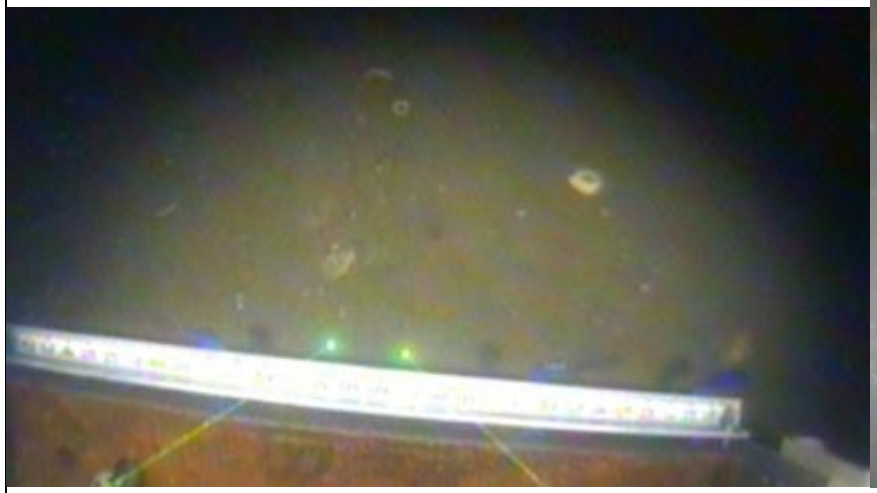


Figure 7-2. Percentage of Sediment Type for Sites GS-014 and GS-015 within the Lease Area

Underwater imagery taken during the benthic surveys, as well as photos of grabs GS-014 and GS-015 before processing are included in Figure 7-3 and Figure 7-4.

Camera Still	**Virginia Offshore Wind Technology Advancement Project**
Sample ID: GS-014	**Date: 17 June 2013 Time 01:25 UTC**



Sediment Description: Firm gray sandy SILT on surface above Firm dark gray clayey SILT, clamshells, shell hash			
NAD83, UTM Zone 18N, Meters	N: 4081882.4	E: 457298.5	Water Depth: 28.11m MLLW

Figure 7-3. Sample GS-014 Photo Log: Underwater and On-deck Imagery

Camera Still	**Virginia Offshore Wind Technology Advancement Project**
Sample ID: GS-015	**Date: 17 June 2013 Time 02:33 UTC**

Sediment Description: Dense grayish brown fine silty SAND, worm tubes, shell hash			
NAD83, UTM Zone 18N, Meters	N: 4082304.9	E: 457667.7	Water Depth: 26.84m MLLW

Figure 7-4. Sample GS-015 Photo Log: Underwater and On-deck Imagery

Sites GS-014 and GS-015 were analyzed to characterize the benthic infauna community within the Installation Area. At GS-014, 96 individuals were collected from 21 species, which resulted in a Shannon-Weiner diversity index (H') of 2.61 and a Pielou's evenness index (J') of 0.86. Site GS-015 had a total of 216 individuals, representing 19 species, which had a diversity index of 1.45 and an evenness index of 0.49. Site-specific information on benthic infauna species composition is presented in Table 7-5.

Table 7-5. Rank and Abundance of Organisms Present in GS-014 and GS-015 within the Lease Area

Major Taxon	Species	GS-014		GS-015	
		Total	% of Individuals	Total	% of Individuals
Mollusca-Gastropoda	*Nassarius trivittatus*	21	21.88%	13	6.02%
Annelida-Polychaeta	*Paraehlersia ferrugina*	13	13.54%	0	0.00%
Crustacea-Decapoda	*Pagurus politus*	8	8.33%	10	4.63%
Annelida-Polychaeta	*Scoletoma fragilis*	8	8.33%	3	1.39%
Annelida-Polychaeta	*Scalibregma inflatum*	6	6.25%	4	1.85%
Annelida-Polychaeta	*Abyssoninoe sp. 2 EcoA*	6	6.25%	0	0.00%
Annelida-Polychaeta	*Asabellides oculata*	5	5.21%	4	1.85%
Annelida-Polychaeta	*Ninoe nigripes*	5	5.21%	1	0.46%
Annelida-Polychaeta	*Clymenella torquata*	4	4.17%	0	0.00%
Mollusca-Bivalvia	*Pitar morrhuanus*	4	4.17%	0	0.00%
Crustacea-Amphipoda	*Unciola irrorata*	3	3.13%	1	0.46%
Mollusca-Bivalvia	*Abra longicallus*	3	3.13%	0	0.00%
Annelida-Polychaeta	*Monticellina cf. dorsobranchialis*	2	2.08%	0	0.00%
Annelida-Polychaeta	*Nephtys picta*	1	1.04%	1	0.46%
Annelida-Polychaeta	*Aricidea (Acmira) catherinae*	1	1.04%	0	0.00%
Annelida-Polychaeta	*Leitoscoloplos sp.*	1	1.04%	0	0.00%
Annelida-Polychaeta	*Spio filicornis*	1	1.04%	0	0.00%
Annelida-Polychaeta	*Spionidae* sp.	1	1.04%	0	0.00%
Mollusca-Bivalvia	*Nucula proxima*	1	1.04%	0	0.00%
Mollusca-Bivalvia	*Nucula* sp.	1	1.04%	0	0.00%
Mollusca-Bivalvia	*Tellina versicolor*	1	1.04%	0	0.00%
Annelida-Polychaeta	*Spiophanes bombyx*	0	0.00%	145	67.13%
Crustacea-Amphipoda	*Ampelisca verrilli*	0	0.00%	11	5.09%
Annelida-Polychaeta	*Phylo felix*	0	0.00%	8	3.70%
Mollusca-Gastropoda	*Turbonilla sp.*	0	0.00%	5	2.31%
Crustacea-Decapoda	*Brachyura sp.*	0	0.00%	3	1.39%
Mollusca-Bivalvia	*Lucinoma filosa*	0	0.00%	2	0.93%
Annelida-Polychaeta	*Clymenella mucosa*	0	0.00%	1	0.46%
Annelida-Polychaeta	*Leitoscoloplos robustus*	0	0.00%	1	0.46%
Annelida-Polychaeta	*Phyllodoce groenlandica*	0	0.00%	1	0.46%
Annelida-Polychaeta	*Polygordius jouinae*	0	0.00%	1	0.46%
Annelida-Polychaeta	*Sthenelais limicola*	0	0.00%	1	0.46%
TOTAL		96	100.00%	216	100.00%

The fine sand that was found to dominate the installation area during the field survey verifies the sediment type predicted by the Nature Conservancy's Benthic Habitat Model for this location (Greene et al. 2010), supporting the use of the model for the Installation Area. The sandy substrate associated with both the Installation Area as well as the larger Commercial Lease Area provides a uniform and non-complex habitat for benthic infaunal organisms typical of this region. Such softbottom environments provide habitat for infaunal polychaete annelids and mollusks, and do not support any seagrasses, hardbottom, livebottom, or

any other unique habitat features. Surveys indicated that annelids (specifically, polychaete worms) numerically dominated the benthic samples within the larger Commercial Lease area, followed by mollusks and crustaceans. However, mollusks had the highest overall biomass, followed by annelids and crustaceans (Appendix G). Additional desktop analysis using previous survey data and available online resources, has indicated a correlation in sediment type between the grab sample locations and the proposed mooring locations. Though sediment grain size may vary within the Installation Area, the proposed Met Facility location is dominated by fine sandy sediment (Figure 7-1; NOAA Fisheries 2014a, Northeast Ocean Data 2014).

Fish and invertebrate abundance and distribution within the Installation Area are influenced by benthic habitat and by physical and chemical characteristics of the water (e.g., depth, temperature, salinity, nutrient concentrations, and ocean currents) (Helfman et al. 2009; Levinton 2009). Other factors, including predator/prey relationships, water quality, and refuge (e.g., physical structure or vegetation cover), may affect fish distribution; however, these factors operate on more regional spatial scales (Helfman et al. 2009). As the Installation Area includes both northern (temperate) and southern (subtropical/tropical) fish populations, the overall fish population and diversity may further be influenced by seasonal spawning migrations (Olney and Bilkovic 1998). According to Briggs (1974), the Mid-Atlantic Bight is composed of at least 250 fish species, with over 75 percent having southern (warm water) affinities.

In 1996, the Magnuson-Stevens Fishery Conservation and Management Act was reauthorized and amended by the Sustainable Fisheries Act, which mandated numerous changes to the existing legislation designed to prevent overfishing, rebuild depleted fish stocks, minimize bycatch, enhance research, improve monitoring, and protect fish habitat (Public Law 104-267). These mandates additionally reauthorized the Essential Fish Habitat (EFH) provision, which provides the means to conserve fish habitat. EFH is defined as those waters and seafloor necessary (required to support a sustainable fishery and the managed species) to fish for spawning, breeding, feeding, or growth to maturity (i.e., full life cycle) (16 United States Code [U.S.C.] §1802 [10]). These waters include aquatic areas and their associated physical, chemical, and biological properties used by fish, and may additionally include areas historically used by fish. Benthic and water column habitats at the Installation Area include EFH for some federally-managed fish species.

The benthic environment refers to anything associated with or occurring on the bottom of a body of water. Species within this environment are adapted to live on the substrate, and may burrow into the ocean floor. The benthic macroinvertebrates associated with the waters off of the Virginia coast consist of a wide variety of species. Macrobenthic fauna generally comprise several species groups that show varying affinities to certain bottom types and the potential for seasonality within those habitats. Previous benthic surveys have determined silty fine sand substrate to be dominated by several species of ampeliscid amphipods and clams, while coarser sands are dominated by several other amphipod species and several polychaete species (Steimle 1982). These soft bottom substrates are likely well-oxygenated and may maintain a mix of organisms such as amphipods, bivalves, and polychaete worms. Harder substrate types that may additionally be found in the area (e.g., cobble and gravel) may be largely composed of macrobenthic invertebrate species.

A variety of benthic macroinvertebrates may also occur within the Installation Area. Of these species, only the long finned squid (*Loligo pealeii*) and the surf clam (*Spisula solidissima*) have designated EFH at the Installation Area, both in the juvenile stage (NOAA Fisheries 2014b).

Fish species that occur within the Installation Area can be divided into two groups based upon their habitat preferences: demersal and pelagic. The demersal zone refers to the bottom substrate within the continental shelf area. Fish within this grouping occupy waters adjacent to bottom areas, feed on benthic organisms, and have a strong relationship with benthic habitat complexity (e.g., hardbottom, reef), as complex habitats contain greater fish diversity (Malek et al. 2010). These species are widely distributed throughout the coastal Virginia waters, with many occurring year-round, although abundances may vary with both season and life stage. Of the demersal Mid-Atlantic Bight finfish species that have been identified as potentially occurring within the Installation Area, 10 have recognized EFH located within the Installation Area. These species are summarized in Table 7-6 (NOAA Fisheries 2014a, 2014b).

Table 7-6. Demersal Fish with Identified EFH within the Installation Area

Common Name	Scientific Name	Life Stage (s) Found at Location
Atlantic angel shark	*Squatina dumeril*	Juveniles, Adults
Black sea bass	*Centropristis striata*	Larvae, Juveniles, Adults
Clearnose skate	*Raja eglanteria*	Juveniles
Little skate	*Leucoraja erinacea*	Juveniles
Monkfish	*Lophius americanus*	Eggs, Larvae
Scup	*Stenotomus chrysops*	Juveniles, Adults
Spiny dogfish	*Squalus acanthias*	Juveniles, Adults
Summer flounder	*Paralichthys dentatus*	Eggs, Juveniles, Adults
Windowpane flounder	*Scophthalmus aquosus*	Eggs, Larvae, Juveniles, Adults
Witch flounder	*Pseudopleuronectes americanus*	Eggs, Larvae

The pelagic zone refers to the surface or mid-water depths within the continental shelf areas. Pelagic fish within the Installation Area can be classified primarily as temperate species, but also include subtropical-tropical and highly migratory species (Helfman et al. 2009). Highly migratory pelagic fish (e.g., billfish, swordfish, mackerel, tuna, and many shark species) are distributed from coastal waters seaward into the open ocean, and are capable of migrating great distances seasonally (Packer et al. 2003). Pelagic fish can be broadly categorized into horizontal and vertical distributions in the water column, with the highest number and diversity occurring where the habitat is most diverse, reflecting the structural complexity (habitat structure/relief, seamounts, Sargassum patches, etc.), and/or a variety of physical and chemical conditions (currents, upwelling, nutrients, dissolved oxygen, and temperature) in the Installation Area (Parin 1984; Moyle and Cech 1996; Helfman et al. 2009). Pelagic fish feed on organisms within the water column or on the water surface. Of the pelagic finfish species recognized as potentially occurring in the Installation Area, 23 have identified EFH within the Installation Area (Table 7-7; NOAA Fisheries 2014a, 2014b).

Table 7-7. Pelagic Finfish with Identified EFH within the Installation Area

Common Name	Scientific Name	Life Stage (s) Found at Location
Albacore tuna	*Thunnus alalunga*	Juveniles
Atlantic bluefin tuna	*Thunnus thynnus*	Juveniles
Atlantic butterfish	*Peprilus triacanthus*	Eggs
Atlantic herring	*Clupea harengus*	Adults
Atlantic sharpnose shark	*Rhizoprionodon terraenovae*	Adults
Bluefish	*Pomatomus saltatrix*	Juveniles
Cobia	*Rachycentron canadum*	Eggs, Larvae, Juveniles, Adults
Common thresher shark	*Alopias vulpinus*	Eggs, Neonates, Larvae, Juveniles, Adults
Dusky shark	*Carcharhinus obscurus*	Neonates, Larvae, Juveniles, Adults
Great hammerhead shark	*Sphyrna mokarran*	Eggs, Neonates, Larvae, Juveniles, Adults
King mackerel	*Scomberomorus cavalla*	Eggs, Larvae, Juveniles, Adults
Longbill spearfish	*Tetrapturus pfluegeri*	Juveniles, Adults
Red drum	*Sciaenops occelatus*	Eggs, Larvae, Juveniles, Adults
Sandbar shark	*Carcharhinus plumbeus*	Neonates, Larvae, Juveniles, Adults
Sand tiger shark	*Carcharias taurus*	Neonates, Larvae, Juveniles, Adults
Scalloped hammerhead shark	*Sphyrna lewini*	Juveniles, Adults
Shortfin mako shark	*Isurus oxyrinchus*	Eggs, Neonates, Larvae, Juveniles, Adults
Skipjack tuna	*Katsuwonus pelamis*	Juveniles, Adults
Smooth dogfish	*Mustelus canis*	Eggs, Neonates, Larvae, Juveniles, Adults
Spanish mackerel	*Scomberomorus maculatus*	Eggs, Larvae, Juveniles, Adults
Spinner shark	*Carcharhinus brevipinna*	Adults
Tiger shark	*Galeocerdo cuvier*	Larvae, Juveniles, Adults
Yellowfin tuna	*Thunnus albacares*	Juveniles

Potential Impacts and Mitigation Measures

Installation of the WindSentinel buoy, including placement of the mooring system, would result in the short-term loss of the seafloor habitat occupied by the footprint of the buoy anchor and potential disturbance of the seafloor in the area of chain sweep. It is anticipated that benthic fauna directly within the small footprint of the anchor will experience mortality. Common benthic fauna found within the Installation Area, including polychaetes and amphipods, may particularly be susceptible to harm or mortality if in the area of anchor chain sweep; however, it is unlikely that loss of benthos from this area during installation will affect the general population or productivity.

Noise levels associated with the installation of the Met Facility could additionally disturb normal fish behavior. Vessel noise and other noise associated with installation could affect fish foraging ability/behavior, migration behavior, predator avoidance, and overall avoidance of the area during the installation. However, pile driving is not required to install the Met Facility; therefore, there will be no impacts to fish populations from noise.

Installation of the Met Facility would introduce an artificial hard substrate and may positively influence biodiversity, providing an important habitat structure for invertebrates as well as pelagic and demersal fish species by functioning as an artificial reef (Langhamer et al. 2009). Growth on the buoy and mooring may stimulate invertebrate species community growth, allowing them to accumulate on the seafloor (Langhamer and Wilhelmsson 2009; Boehlert and Gill 2010). Placement of the WindSentinel buoy within sandy substrate areas, as found within the Installation Area, will likely result in greater invertebrate diversity (Inger et al. 2009; Boehlert and Gill 2010). This new habitat may additionally increase both the density and biomass of fish, when compared with surrounding soft bottom areas (Wilhelmsson et al. 1998; Wilhelmsson and Malm 2008; Inger et al. 2009). Previous research has indicated that fish populations within the vicinity

of floating devices and moorings associated with offshore energy developments are greater than in surrounding areas, as these devices function not only as a patch reef, but additionally as fish aggregation devices (Wilhelmsson et al. 2006a; Inger et al. 2009). This effect may particularly be seen in migratory pelagic fish, as they may use this area for rest, foraging, geographical references, and school recomposition (Castro et al. 2002).

After completion of site assessment activities, the Met Facility would be removed and transported by vessel to shore. When each instrument is removed, the areas disturbed by the Met Facility, if present, will fill in through natural processes and will ultimately be recolonized with native benthic species (Lundquist et al. 2010). The temporary and isolated disturbance of fish during Met Facility removal activities is expected to result in negligible impacts to fish (BOEM 2012).

7.2.2 Marine Mammals and Sea Turtles

Affected Environment

Based on occurrence records, 35 marine mammal species have been documented as occurring in the waters off the coast of Virginia (Table 7-8). Certain marine mammal species, such as the bottlenosed dolphin, spotted dolphin, striped dolphin, Risso's dolphin, long- and short-finned pilot whales, fin whale, and sei whale are resident to the Mid-Atlantic region. The remaining species tend to be more common during spring, summer, and fall, when prey is abundant, and otherwise are infrequent visitors. Data sources such as the Navy Operating Area Density Estimates and others used by NOAA Fisheries to update species Stock Assessment Reports also suggest that marine mammal density in the Mid-Atlantic region is patchy and seasonally variable (Department of the Navy 2007a). Six whale species and one Sirenia are listed as endangered under the ESA, including the North Atlantic right whale, humpback whale, sei whale, fin whale, blue whale, sperm whale, and the West Indian manatee.

As shown in Table 7-8, marine mammal and sea turtle presence can be year-round, and is typically highest during warmer seasons (spring, summer, fall) for many migratory species.

Table 7-8. Marine Mammal Occurrence in Coastal and Offshore Virginia

Common Name	Scientific Name	Seasonality	Status	Estimated Auditory Bandwidth[1]
Odontocetes (Toothed Whales)				
Phocoenidae				
Harbor Porpoise	*Phocoena phocoena*	Winter	MMPA[2]	200 Hz to 180 kHz
Delphinidae				
White-Sided Dolphin	*Lagenorhynchus acutus*	Winter/Spring	MMPA	150 Hz to 160 kHz
Short-beaked Common Dolphin	*Delphinus delphis*	Summer/Fall	MMPA	150 Hz to 160 kHz
Bottlenosed Dolphin	*Tursiops truncAtus*	Year-round	MMPA	150 Hz to 160 kHz
Clymene Dolphin	*Stenella clymene*	Infrequent Summer	MMPA	150 Hz to 160 kHz
Pan-Tropical Spotted Dolphin	*Stenella attenuata*	Infrequent Summer	MMPA	150 Hz to 160 kHz
Atlantic Spotted Dolphin	*Stenella frontalis*	Year-round	MMPA	150 Hz to 160 kHz
Striped Dolphin	*Stenella coeruleoalba*	Year-round	MMPA	150 Hz to 160 kHz
Risso's Dolphin	*Grampus griseus*	Year-round	MMPA	150 Hz to 160 kHz
Spinner Dolphin	*Stenella longirostris*	Occasional	MMPA	150 Hz to 160 kHz

Table 7-8. Marine Mammal Occurrence in Coastal and Offshore Virginia (Continued)

Common Name	Scientific Name	Seasonality	Status	Estimated Auditory Bandwidth[1]
Killer Whale	*Orcinus orca*	Infrequent/sporadic	Endangered-certain populations	150 Hz to 160 kHz
False Killer Whale	*Pseudorca crassidens*	Infrequent/sporadic	MMPA	150 Hz to 160 kHz
Melon-headed whale	*Peponocephala electra*	Infrequent/sporadic	MMPA	150 Hz to 160 kHz
Sperm Whale	*Physeter macrocephalus*	Infrequent/sporadic	Endangered	150 Hz to 160 kHz
Dwarf Sperm Whale	*Peponocephala electra*	Infrequent/sporadic	MMPA	150 Hz to 160 kHz
Pygmy Sperm Whale	*Kogia breviceps*	Infrequent/sporadic	MMPA	200 Hz to 180 kHz
Long-finned Pilot Whale	*Globicephala melas*	Year-round	MMPA	150 Hz to 160 kHz
Short-finned pilot whale	*Globicephala macrorhynchus*	Year-round	MMPA	150 Hz to 160 kHz
Ziphiidae				
Blainville's Beaked Whale	*Mesoplodon densirostris*	Infrequent Spring/Summer	MMPA	150 Hz to 160 kHz
True's Beaked Whale	*Mesoplodon mirus*	Infrequent Spring/Summer	MMPA	150 Hz to 160 kHz
Gervais' Beaked Whale	*Mesoplodon europaeus*	Infrequent Spring/Summer	MMPA	150 Hz to 160 kHz
Cuvier's Beaked Whale	*Ziphius cavirostris*	Infrequent/sporadic	MMPA	150 Hz to 160 kHz
Sowerby's Beaked Whale	*Mesoplodon bidens*	Infrequent Spring/Summer	MMPA	150 Hz to 160 kHz
Mysticetes (Baleen Whales)				
Balaenopteridae				
Humpback Whale	*Megaptera novaeangliae*	Fall/Winter/Spring	Endangered	7 Hz to 22 kHz
Fin Whale	*Balaenoptera physalus*	Year- round	Endangered	7 Hz to 22 kHz
Sei Whale	*Balaenoptera borealis*	Year- round	Endangered	7 Hz to 22 kHz
Minke Whale	*Balaenoptera acutorostrata*	Winter	MMPA	7 Hz to 22 kHz
Blue Whale	*Balaenoptera musculus*	Rare Summer/Fall	Endangered	7 Hz to 22 kHz
Bryde's Whale	*Balaenoptera edeni*	*Infrequent Summer/Fall*	MMPA	7 Hz to 22 kHz
Balaenidae				
North Atlantic Right Whale	*Eubalaena glacialis*	Winter/Spring	Endangered	7 Hz to 22 kHz[1]
Sirenia				
Trichechidae				
West Indian Manatee	*Trichechus manatus*	Infrequent/sporadic	Endangered	10 to 60 kHz
Pinnipeds				
Phocidae				
Harbor Seal	*Phoca vitulina*	Infrequent Fall/Winter/Spring	MMPA	75 Hz to 75 kHz
Gray Seal	*Halichoerus grypus*	Infrequent Fall/Winter/Spring	MMPA	75 Hz to 75 kHz
Harp Seal	*Pagophilus groenlandicus*	Rare January-May	MMPA	75 Hz to 75 kHz
Hooded Seal	*Cystophora cristata*	Rare Summer/Fall	MMPA	75 Hz to 75 kHz
Sea Turtles				
Atlantic hawksbill sea turtle	*Eretmochelys imbricate*	Rare Summer/Fall	Endangered	Unknown
Atlantic (Kemp's) ridley sea turtle	*Lepidochelys kempii*	*Common Year Round*	Endangered	100 to 500 Hz[3]
Green sea turtle	*Chelonia mydas*	*Infrequent Summer/Fall*	Endangered	100 to 500 Hz[3]
Loggerhead sea turtle	*Carretta caretta*	*Common Year Round*	Threatened	250 to 750 Hz[4]
Leatherback sea turtle	*Dermochelys coriacea*	*Common Year Round*	Endangered	Unknown

Hz – hertz; kHz – kilohertz; MMPA – Marine Mammal Protection Act
[1] Southall et al. (2007)
[2] Marine Mammal Protection Act
[3] Bartol and Ketten (2006)
[4] Bartol et al. (1999)

North Atlantic right whales are the marine mammal species of highest management concern in U.S. Atlantic waters, because of their critically endangered status and known human impacts—most notably mortality from ship collisions but also entanglement in commercial fishing gear (Waring et al. 2013). However, the relative abundance for North Atlantic right whales is low in the Installation Area (Department of the Navy 2007a). During spring and summer, the potential for interactions with North Atlantic right whales is low off the coast of Virginia, because abundance is highest for this species around feeding grounds found in the southern Gulf of Maine off Massachusetts (Department of the Navy 2007a, 2007b).

The leatherback (endangered), loggerhead (threatened), Atlantic (Kemp's) ridley (endangered), green (endangered), and hawksbill (endangered) are the five species of sea turtles listed as threatened or endangered under the ESA that historically have been reported to occur in the waters off the coast of Virginia (Table 7-8). The highest numbers of sea turtles in Virginia's coastal waters are typically from May to November. The lower Chesapeake Bay estuary and the Atlantic Coastline provide important developmental habitat for juvenile sea turtles because of submergent vegetation beds and a rich diversity of bottom-dwelling fauna that provide refuge and forage. The leatherback turtle is mainly pelagic, inhabiting the open ocean, and seldom approaches land except for nesting (Eckert 1992). Off the coast of Virginia, the leatherback is common enough to be observed every year, with 6 to 10 strandings every year (VIMS 2013). Adult Kemp's ridley turtles range from the Gulf of Mexico north to Long Island Sound, New England, and Nova Scotia. This species is one of the least abundant sea turtles in the world. Off the coast of Virginia, the Kemp's ridley sea turtle is the second most common turtle with approximately 200 to 300 individuals observed every year (VIMS 2013). The loggerhead turtle is found in the open seas as far as 500 miles from shore, but mainly over the continental shelf, and in bays, estuaries, lagoons, creeks, and mouths of rivers. Off the coast of Virginia, the loggerhead sea turtle is the most common turtle (VIMS 2013). Occasionally, adult females of this species nest along Virginia's ocean facing beaches from early June through August between False Cape State Park and Fort Story. Virginia is considered the northern limit of the loggerhead's nesting range in the United States and nesting sites on remote barrier islands along the seaward margin of the Delmarva Peninsula are very rare. The green sea turtle primarily utilizes shallow habitats such as lagoons, bays, inlets, shoals, estuaries, and other areas with an abundance of marine algae, seagrasses and other submerged aquatic vegetation, their principal food sources (Bartlett and Bartlett 1999). Off the coast of Virginia, the green sea turtle is infrequently observed during late summer and early fall (VIMS 2013). The hawksbill occurs in tropical and subtropical seas of the Atlantic, Pacific, and Indian Oceans (Witzell 1983). Off the coast of Virginia, the hawksbill turtle is extremely rare (VIMS 2013).

Potential Impacts and Mitigation Measures

Potential impacts to marine mammals and sea turtles from installation of buoys were analyzed in the Mid-Atlantic EA (BOEM 2012). Based on BOEM's assessment, the proposed deployment of environmental monitoring systems is not anticipated to result in any significant or population-level effects to marine mammals or sea turtles. The potential effects to marine mammals and sea turtles are expected to be localized and temporary resulting in minimal to negligible harassment. Activities associated with deployment of environmental monitoring systems that may affect marine mammals and sea turtles include: (1) deployment and retrieval (decommissioning) of the environmental monitoring buoys themselves; (2) vessel traffic; and (3) discharges of waste materials and accidental fuel releases.

Marine mammals and sea turtles may be affected by surface vessel noise during buoy deployment, retrieval, and any subsequent maintenance needs during operation. Vessel noise, as analyzed by BOEM, from vessels associated with these activities would generally produce low levels of noise, anticipated to be in the range of 150 to 170 decibels re 1 µPa-m,[1] at frequencies below 1,000 hertz (Hz), and would dissipate quickly with distance from the source. The low levels of sound associated with the small vessels for deployment, operation, maintenance, and decommissioning will not require an Incidental Harassment Authorization from NOAA Fisheries, and, as described in Sections 2 and 4.2.1, Dominion will comply with the vessel strike avoidance measures in the Commercial Lease. Exposure of marine mammals and sea turtles to individual vessels would be transient, and the noise intensity would vary depending upon the source and specific location. Reactions of marine mammals and sea turtles may include apparent indifference, cessation of vocalizations or feeding activity, and evasive behavior (e.g., turns, diving) to avoid approaching vessels (Richardson et al. 1995; Nowacek and Wells 2001). BOEM (2012) concluded that behavior would likely return to normal following passage of the vessel, and it is unlikely that such short-term effects would result in long-term population-level impacts for marine mammals or sea turtles. Thus, impacts from vessel noise would be negligible, if detectible, and short term. Additionally, the waters off the coast of Virginia, including approaches to the Chesapeake Bay, are some of the most heavily trafficked waters in the world for commercial shipping, the U.S. Navy, and the fishing industry. Therefore, the potential for impact would be exceedingly minor in light of the current potential for impact associated with vessels already occurring in the region.

For potential benthic habitat impacts that may affect marine mammals and sea turtles, BOEM concluded that re-suspension of bottom sediment and the ensuing sedimentation that would occur around a recently deployed buoy would have only minor temporary effects that could impact the habitat and food availability for marine mammals and sea turtles. The effects would be minor and temporary due to limited utilization of the benthic environment by these species and the limited impact to the benthos itself from buoy deployment, operation, and decommissioning. The installation of environmental monitoring buoys is not expected to result in any changes in local community assemblage and diversity or the availability of habitat and forage items for marine mammals and sea turtles.

Vessels associated with buoy deployment, operation (maintenance), and decommissioning could collide with marine mammals and sea turtles during transit. However, considering the existing regulatory measures in place, the limited spatial and temporal scale of buoy deployment/retrieval, and BOEM's vessel strike avoidance measures (see Section 4.2.1), no significant impacts due to vessel strikes are anticipated. Moreover, due to the nature and volume of existing and historic vessel traffic in the area, it is unlikely that the vessel traffic associated with the installation, operation, and decommissioning of the Met Facility would substantially increase the risk of vessel strike on marine mammals and sea turtles. Buoy deployment, operation, and retrieval would not lead to any substantial effects on the population of marine mammal species in these areas.

BOEM has concluded that the limited amount of vessel traffic associated with deployment/retrieval of environmental monitoring buoys would result in infrequent, if any, release of liquid wastes. Therefore,

[1] Micropascal at 1 meter from source, i.e., the theoretical sound pressure level within one meter of the source.

impacts to marine mammals and sea turtles from the discharge of waste materials or the accidental release of fuels are expected to be minor, if they occur at all.

Potential effects to marine mammals and sea turtles from installation, operation, and retrieval of environmental monitoring buoys were analyzed in the Mid-Atlantic EA. After consultation with NOAA Fisheries, BOEM developed stipulations in the Commercial Lease to minimize any potential effects. Table 2-1 and Section 4.2.1 describe the actions Dominion will take to comply with associated stipulations and avoid impacts to marine mammals and sea turtles, as directed by BOEM and NOAA Fisheries.

7.2.3 Avian and Bat Resources

Affected Environment

Results of field surveys and assessments of the Installation Area indicate that the area provides seasonal habitat for loons, grebes, sea ducks, gulls, terns, pelagic birds (e.g., shearwaters, storm-petrels, and allies), and alcids (e.g., dovekie [*Alle alle*], murre [*Alca* spp.]) (BOEM 2012; Tetra Tech 2014b; Williams 2013). Some avian species, such as peregrine falcons, shorebirds, and passerines, occur primarily on the mainland and on barrier islands, but may also occur in the Installation Area, primarily during migration. Approximately 166 species of birds have ranges that overlap the Installation Area, many of which may occur in the area either during migration or year-round.

The offshore waters and adjacent coastal areas of Virginia also provide habitat for avian species with special state and federal conservation status. Some avian species, such as the peregrine falcon (*Falco peregrinus*), shorebirds, and passerines occur primarily in terrestrial habitat on the mainland and on barrier islands, but may also occur in the Installation Area during migration. Federally listed and state listed avifauna may occur offshore during migration and non-breeding periods. Three species listed under the federal ESA, the roseate tern (*Sterna dougallii dougallii*),piping plover (*Charadrius melodus*), and Red knot (*Calidris cantus rufa*) are likely to occur in the Installation Area and along the adjacent Virginia coastline, although the frequency and distribution of their occurrence on the OCS are not well documented. Roseate terns, piping plovers, and red knots would only be expected to occur in the Installation Area during migration. A fourth federally listed species, Bermuda petrel (*Pterodroma cahow*), may occur in the Installation Area during the non-breeding period.

The proposed location of the Met Facility is within the area surveyed during 2013–2014 (Tetra Tech 2014b). Preliminary results from these surveys indicate that no ESA listed species occur in the area, and that the areas supports relatively low abundance and species richness compared to areas near shore, or over more productive benthic habitats (Tetra Tech 2014b).

Potential Impacts and Mitigation Measures

BOEM has previously concluded, and the United States Fish and Wildlife Service has concurred, that commercial lease issuances and site assessment activities in the Virginia WEA would pose no threat of significant impact to birds, including species protected under the Migratory Bird Treaty Act and the ESA (BOEM 2012). Similarly, BOEM concluded that site assessment activities are unlikely to adversely affect bats (BOEM 2012). As a site assessment activity, the deployment of the Met Facility within the Installation Area is unlikely to cause adverse effects to avifauna. However, Dominion has identified some minor

potential affects to birds from the proposed site assessment activities, and has agreed to the following avoidance and mitigation measures.

Lights on deployment vessels and the buoy could attract birds migrating at night, and potentially foraging or migrating bats. However, the increase in artificial lighting in the Installation Area from the deployment vessels and WindSentinel buoy would be negligible compared with other sources of light in the area, including lighting on commercial and military vessels. It is anticipated that deployment will occur during daylight hours and artificial lighting will not be necessary on the installation vessels. Any artificial lights, if needed, on installation vessels will be hooded and downward directed.

Birds may be attracted to perch on or forage near the WindSentinel buoy. If birds perch on the WindSentinel buoy, they may foul the instruments. Additionally, the perches could attract species such as cormorants (*Phalacrocorax* spp.) and gulls (*Larus* spp.) to the Installation Area, increasing bird abundance where the Met Facility will be deployed, and consequently increasing the possibility of adverse interactions with vessels and/or Met Facility. To reduce potential impacts on birds in the Installation Area, Dominion will install anti-perching devices on the WindSentinel buoy, to the extent practicable, to eliminate perching habitat. Anti-perching devices are an effective way of preventing perching on isolated structures, including remote sensing equipment (Avery and Genchi 2004). Anti-perching devices will be non-corrosive (either stainless steel or composite) to increase longevity, and reduce potential for corrosion at the attachment point. Anti-perching devices will not be installed on the railings along the perimeter of the hull because they would pose a safety hazard to personnel working on the WindSentinel buoy. However, the railings will be round and as such will function as an anti-perching device. Anti-perching devices to be installed on the WindSentinel buoy are shown in Figure 7-5.

As stated above, deployment and operation of the proposed Met Facility is unlikely to adversely affect or result in the mortality of federal- or state-listed avifauna. In addition, Dominion has committed to both lighting and anti-perching best management practices during installation and operation to mitigate any potential for effect. For these reasons, fatality monitoring and the acquisition of a salvage permit for migratory birds is not necessary. However, in the unlikely event Dominion identifies any federal- or state-listed avian fatalities during installation or operation of the Met Facility, they will be reported within 24 hours to both BOEM and the United States Fish and Wildlife Service. Dominion will also prepare an annual mortality report for submission to BOEM and the Fish and Wildlife Service that will include all identified listed and non-listed avian fatalities. The annual mortality report will include: name of species; date found; location; a picture to confirm species identity, if possible; and any other relevant information.

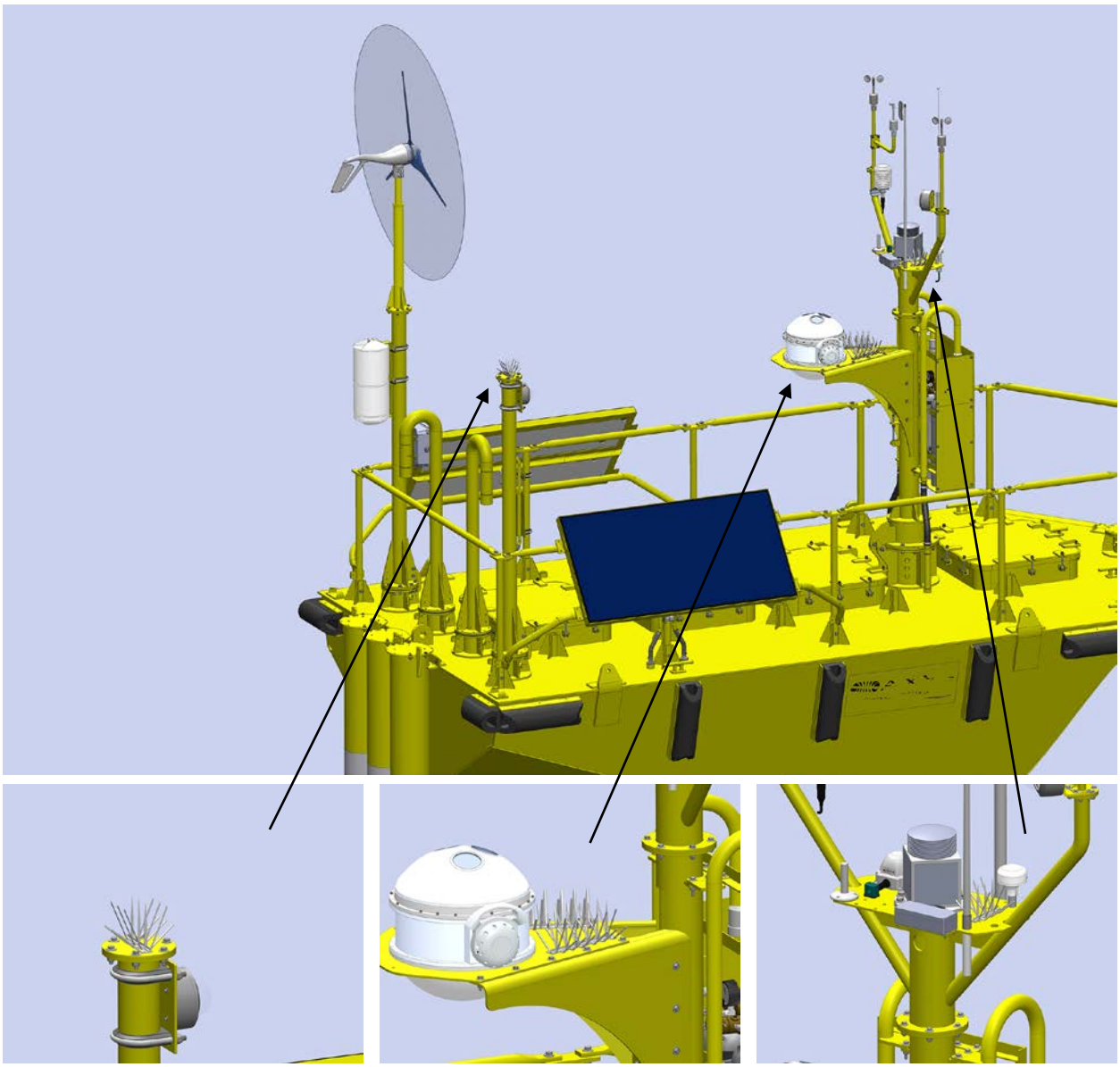


Figure 7-5. Anti-Perching Devices

7.3 Physical Resources

7.3.1 Water and Air Quality

Water Quality

The majority of pollutants and threats to marine waters originate on land and fewer identified threats to marine water quality originate from activities in the marine environment. Vessel discharges, including bilge and ballast water and sanitary waste, may affect water quality when vessels are traveling to and from the Installation Area. Dominion will comply with NTL 2012-G01 (see Table 2-1) regarding marine trash and debris prevention. In addition, Dominion will provide documentation of compliance with sections of § 585.254 based on direction Dominion has received in support of the VOWTAP (see Appendix A).

BOEM concluded in the Mid-Atlantic EA that any impacts to coastal and marine waters from vessel discharges associated with site characterization and assessment activities would be minimal, if detectable (BOEM 2012).

Air Quality

Vessels associated with the installation of the Met Facility are likely to emit pollutants at the associated port, in transit, and at the Installation Area. The majority of these emissions would occur within the Installation Area and would not affect local onshore ambient air quality.

Installation and maintenance vessels, as well as vessels involved with decommissioning, will use Cape Henry Launch (see Figure 1-1) as a port. Cape Henry Launch is located in Virginia Beach, which is not a nonattainment area for any criteria pollutants under the National Ambient Air Quality Standards.

Installation, maintenance, and decommissioning of the Met Facility will not require attaching any vessels to the seabed (see Sections 4, 5, and 6). Using current assumptions about the installation, maintenance, and decommissioning trips (see Table 7-9 below), the maximum number of vessel round trips from Cape Henry Launch to the Installation Area would consist of one for the installation activities, four round trips annually for maintenance activities, and one round trip for decommissioning of the Met Facility.

Table 7-9. Installation and Maintenance Trips

Vessel Type	Installation	Maintenance	Decommissioning
Tug and floating work barge	1 trip	n/a	1 trip
47-foot launch (or similar vessel)	n/a	4 trips/year	n/a

To determine the effects the installation, maintenance, and decommissioning of the Met Facility has on air quality, an estimate of the air emissions from the combustion of fuel from the commercial marine vessel (CMV) engines used to conduct these activities was performed. The estimated emissions from the CMVs utilized the methodologies presented in the ICF International (2009) report to the United States Environmental Protection Agency, *Current Methodologies in Preparing Mobile Source Port-Related Emissions Inventories*. A summary of the air emission estimates is presented in the Table 7-10, and the detailed emission calculations and assumptions are presented in Appendix H.

Table 7-10. Emission Summary – Met Facility Installation, Maintenance, and Decommissioning

Met Facility 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
Installation Activities	0.002	0.09	0.05	0.002	0.002	0.0001	0.001	6.5
Annual Maintenance Activities	0.004	0.15	0.08	0.004	0.004	0.0001	0.001	10.8
Decommissioning Activities	0.002	0.09	0.05	0.002	0.002	0.0001	0.001	6.5
Maximum Annual Emissions[1]	0.01	0.24	0.12	0.01	0.01	0.0002	0.001	17.3

[1] The maximum annual emissions assume that the annual maintenance activities and either the installation or decommissioning activities occur in the same year.
CO – carbon monoxide; CO_2e – carbon dioxide equivalent; GHG – greenhouse gas; HAP – hazardous air pollutant; NO_x – nitrogen oxide; $PM_{2.5}$ – particulate matter less than 2.5 microns; PM_{10} – particulate matter less than 10 microns; SO_2 – sulfur dioxide; VOC – volatile organic compound

As presented in Table 7-10, the air emissions associated with the installation, maintenance, or decommissioning activities of the Met Facility would be considered insignificant and would not have any adverse effect on air quality onshore or offshore. Furthermore, emissions within the port area would be negligible, if detectable, due to the low volume of vessel activity and time spent in port associated with the Met Facility installation, maintenance, operation, and decommissioning, particularly when compared to the high volume of historic, current, and anticipated future activity in and around these areas, which emit pollution (BOEM 2012).

7.3.2 Social and Economic Resources

Coastal and Marine Uses

The Commonwealth of Virginia has approximately 112 miles (180 kilometers) of shoreline along the Atlantic Ocean and 3,315 miles (5,335 kilometers) of shoreline within the Chesapeake Bay and its tributaries. A large majority of these coastal waters are used for U.S. Navy and commercial shipping, commercial and recreational fishing, and recreational boating. Virginia also has 47 beaches that are used for various kinds of recreational activities.

The Installation Area is located within the Virginia Capes naval operating area (VACAPES) where the Navy and Marine Corps conduct training exercises. Dominion will comply with stipulations in the Commercial Lease (see Table 2-1) and will therefore contact Mr. Jim Casey at Fleet Forces Command to establish a point of contact and discuss the Met Facility. Dominion will notify Fleet Forces Command in writing before the proposed installation of the Met Facility to avoid conflicts with any planned seaspace and airspace activities by the Navy in the VACAPES. Dominion will provide Fleet Forces Command with the operational frequencies for data transmission equipment on the WindSentinel buoy to avoid any potential conflicts due to electromagnetic emissions.

The coastal and offshore waters of Virginia are heavily utilized to support commercial fishing, recreational fishing, and aquaculture activities. The major commercial fishing ports in Virginia are Hampton Roads, Reedville, and Chincoteague Island, but many local ports also support commercial fishing operations in some form. Due to the distance from shore and the limited number of vessel trips associated with the installation, maintenance, and decommissioning of the Met Facility, few, if any, shore-based recreation resources would be impacted (BOEM 2012). Therefore, minority or low-income populations who depend upon existing coastal facilities would not be adversely disproportionately impacted, because the majority of the activities associated with the Met Facility would be located offshore.

Prominent commercially important species in Virginia waters include blue crab, menhaden, scallops, croaker, spot, striped bass, summer flounder, northern quahog, spiny dogfish, and oysters; fishing effort for these species is uniformly distributed off the coast of Virginia (BOEM 2012). Conch pot fishing is common in coastal areas within Virginia state waters. Recreational fishing activities are concentrated all along the Virginia coast. Recreational fishing activities include private and rental boats, party and charter boats, and shore, beach, and pier fishing.

BOEM examined the most popular commercial fishing areas and received input from some commercial anglers when establishing the Virginia WEA. The majority of commercial fishing effort, therefore, occurs outside of the Commercial Lease area. Specific to the Project, commercial and recreational fishing activities

and recreational boating occur at moderate to low levels in the Commercial Lease area. Moderate recreational fishing effort has been identified within and east of the Installation Area. It is likely that some commercial and recreational vessels will pass through this area while in transit to fishing grounds. However, it is very unlikely that activities associated with the Met Facility would affect commercial and recreational fishing or would unreasonably interfere with access to the active fisheries beyond the Commercial Lease area. Dominion will notify commercial and recreational fishermen, as well as other users of the OCS, via an NLM and broadcasts on Marine Channel 16 prior to installation and decommissioning activities, as described in Sections 4 and 6. Additionally, prior to deployment, Dominion will consult with the USCG for approval of the Met Facility as PATONs. The navigational lighting will notify vessels in the area of the buoy location so it can be safely avoided.

As discussed in Section 7.2.1, the presence of offshore wind farm foundations creates new physical habitat, providing a greater colonization opportunity for marine species, thus potentially increasing both the density and biomass of fish and invertebrates within the surrounding areas (Gill 2005; Inger et al. 2009). Offshore energy structures have been found to act as artificial reefs and fish aggregating devices for both fish and invertebrates, providing protection, food, spawning substrates, cleaning stations, and resting areas for fish species (Castro et al. 2002). Smaller fish attracted to these areas may, in turn, attract commercially important fish looking for prey (Wilhelmsson et al. 2006b). Research performed on fishing records has indicated an increase in yields post-construction, assumed to be a result of extensive invertebrate colonization attracting fish (Gill 2005). Deployment of the Met Facility is, therefore, unlikely to have any adverse effect on commercial or recreational fishing. Rather, the overall presence of the structures will positively influence the biodiversity and species density of the area, providing an important habitat structure for invertebrates, and pelagic and demersal fish species, thus potentially enhancing local fisheries (Gill 2005).

The installation of the Met Facility would result in minimal and temporary change to landscape conditions for viewers along the Virginia Beach coastline and associated with Camp Pendleton. During the installation, maintenance, and decommissioning of Met Facility, viewers onshore would be able to observe marine traffic associated with these activities. Based on the small volume of Met Facility-related vessel traffic relative to baseline marine traffic, it is not likely that many viewers would perceive a change. On a long-term basis, during Met Facility operation, viewers along the Virginia Beach coastline would not perceive a change in the viewshed due to the distance from shore and size of the Met Facility equipment.

7.4 Archaeological Resources

7.4.1 Affected Environment

The installation of the Met Facility has the potential to affect submerged archaeological resources that may relate to both pre-contact and historic time periods. Potential prehistoric archaeological resources would include archaeological sites from the area's earliest inhabitants located on flooded prehistoric landforms (paleolandscape features). Within the proposed Installation Area, this would include Paleo-Indian and Early to Middle Archaic occupations ranging from 15,000 to 8,000 Before Common Era (BCE) and 8,000 to 2,500 BCE (VDHR 2013). Such sites could possibly have been occupied prior to post-glacial inundation, when portions of the Continental Shelf were exposed upland. Historic period archaeological sites that could potentially occur within offshore portions of the area of potential effect are predominantly related to marine activity, such as historic shipwrecks.

In 2013 and updated in 2015 for the Met Facility, R. Christopher Goodwin & Associates conducted an archaeological assessment of the geophysical remote sensing survey and geotechnical investigations conducted in OCS Block 6112, Aliquot I of the Commercial Lease area (Appendix I). As reported in 2013, background research indicated the potential for the presence of submerged Paleo-Indian and Early to Middle Archaic prehistoric sites and historic shipwrecks within the offshore Commercial Wind Energy Area. The geophysical survey undertaken in 2013 used a multibeam echo sounder, magnetometer, side scan sonar, compressed high-intensity radar pulse sub-bottom profiler, and multi-channel and single-channel seismic reflection (Boomer) equipment to collect data along transects spaced at 98.4-ft (30-m) intervals with tie lines spaced at 492.1–ft (150-m) intervals. Survey activities adhered to the Survey Protocols for Marine Archaeological Assessment developed in accordance with BOEM's *Guidelines for Providing Geological and Geophysical, Hazards, and Archaeological Information Pursuant to 30 CFR Part 585*. R. Christopher Goodwin & Associates archaeological analysis of the geophysical survey data identified no potential submerged cultural resources within OCS Block 6112, Aliquot I. In addition, at the request of BOEM, R. Christopher Goodwin & Associates provided an assessment of the vertical area of potential effect associated with the WindSentinel clump weight anchor. Based upon a vertical penetration into the seabed of approximately 17.5 inches (0.44 m) there will be no marine archaeological resources affected.

7.4.2 Potential Impacts and Mitigation Measures

Based upon the results of the 2013 and 2015 marine archaeological investigations, installation and operation of the Met Facility would result in no impacts to marine archaeological resources.

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