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Construction and Operations Plan

Coastal Virginia Offshore Wind Commercial Project

Introduction, Project Siting and Design Development, Description of Proposed Activity

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1 INTRODUCTION

1.1 Project Overview

The Virginia Electric and Power Company, doing business as Dominion Energy Virginia (hereafter referred to as Dominion Energy), is proposing to construct, own, and operate the Coastal Virginia Offshore Wind (CVOW) Commercial Project (hereinafter referred to as the Project). The Project will be located in the Commercial Lease of Submerged Lands for Renewable Energy Development on the Outer Continental Shelf (OCS) Offshore Virginia (Lease No. OCS-A-0483) (Lease Area), which was awarded to Dominion Energy (Lessee) through the Bureau of Ocean Energy Management (BOEM) competitive renewable energy lease auction of the Wind Energy Area (WEA) offshore of Virginia in 2013. The Lease Area covers approximately 112,799 acres (ac; 45,658 hectares [ha]) and is approximately 27 statute miles (mi; 23.75 nautical miles [nm], 43.99 kilometers [km]) off the Virginia Beach coastline (Figure 1.1-1).

The purpose of this Project is to provide between 2,500 and 3,000 megawatts (MW) of clean, reliable offshore wind energy; to increase the amount and availability of renewable energy to Virginia and North Carolina consumers; to create the opportunity to displace electricity generated by fossil fuel-powered plants, and to offer substantial economic and environmental benefits to the Commonwealth of Virginia. This Project represents a viable and needed opportunity for Virginia to obtain clean renewable energy and realize its economic and environmental goals.

Dominion Energy has adopted a Project Design Envelope (PDE) approach to describe Project facilities and activities. A PDE is defined as "a reasonable range of project designs" associated with various components of the project (e.g., foundation and wind turbine generator (WTG) [or wind turbine] options) (BOEM 2018). The PDE is then used to assess the potential impacts on key environmental and human use resources (e.g., marine mammals, fish, benthic habitats, commercial fisheries, navigation, etc.) focusing on the design parameter (within the defined range) that represents the greatest potential impact (i.e., the "maximum design scenario") for each unique resource (Rowe et al. 2017). The primary goal of applying a design envelope is to allow for meaningful assessments by the jurisdictional agencies of the proposed project elements and activities while concurrently providing the Lessee reasonable flexibility to make prudent development and design decisions prior to construction. This conservative approach likely overstates the actual impact to environmental and human use resources from the ultimate Project following alternatives refinement and implementation of any selected avoidance, minimization, and mitigation measures.

This Construction and Operations Plan (COP) covers the entire Lease Area, Offshore Export Cable Route Corridor, and associated Onshore Project Components and therefore addresses the proposed Project elements and the means and methods used for constructing, installing and operating the facilities as well as the potential positive and adverse effects of the Project.

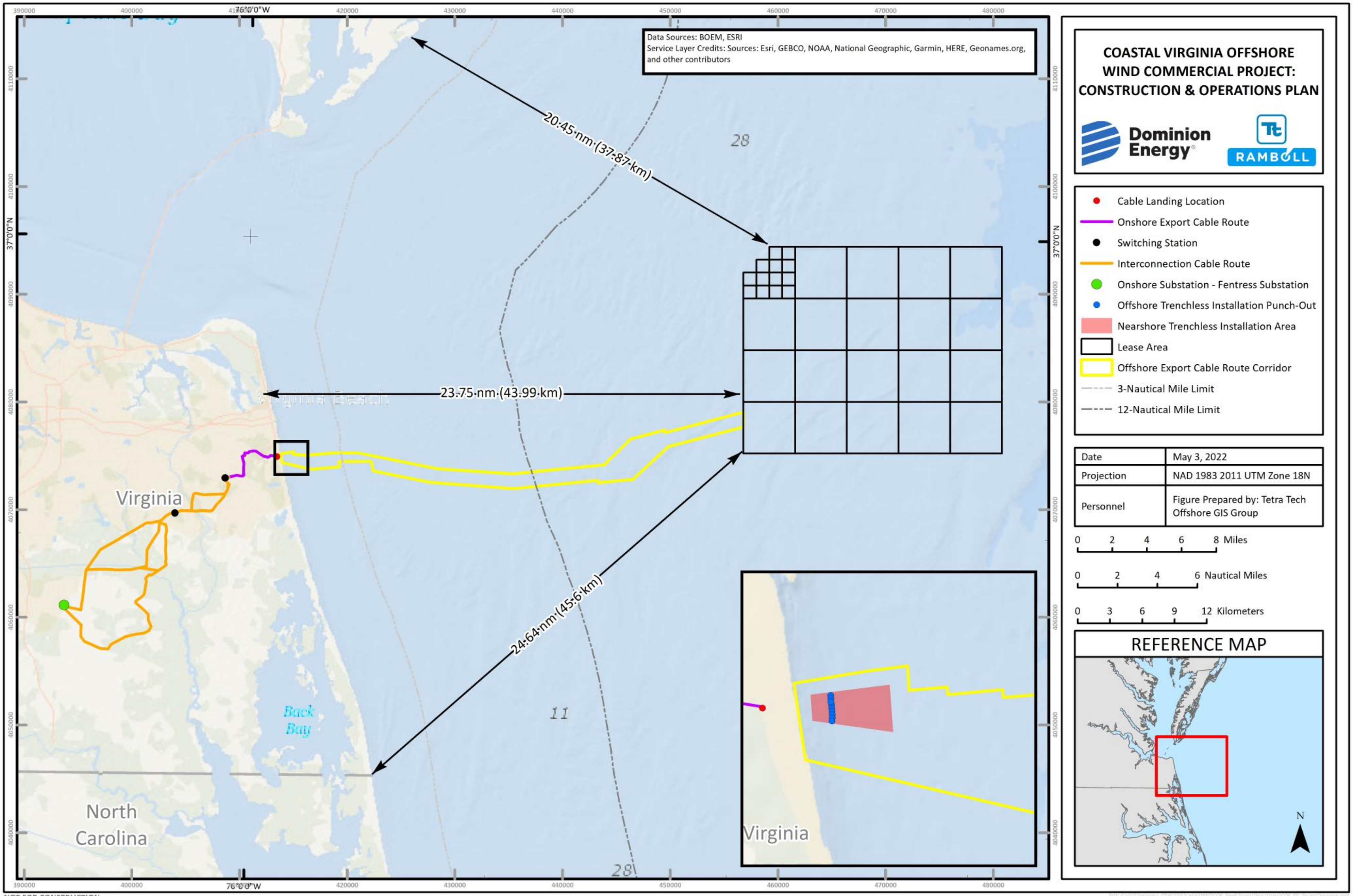


Figure 1.1-1. Project Overview

Offshore components of the Project will consist of the following, as further described in Section 3, Description of Proposed Activity:

- Up to 205 WTGs and associated WTG Monopile Foundations;
- Three Offshore Substations and associated Offshore Substation Jacket Foundations;
- Up to 300 mi (484 km) total length of Inter-Array Cables (average Inter-Array Cable length of 5,868 feet [ft; 1,789 meters [m]) between turbines; and
- Up to nine buried submarine high-voltage alternating-current (HVAC) Offshore Export Cables.

The Offshore Project Components, including the Offshore Substations, Inter-Array Cables, and WTGs, will be located in federal waters in the Lease Area, while the Offshore Export Cable Route Corridor will traverse both federal and state territorial waters of Virginia. The construction stage of the Project will include a temporary construction laydown area(s) and construction port(s). The operations and maintenance (O&M) stage of the Project will include an onshore O&M facility with an associated Operations and Maintenance Port.

Onshore components of the Project will consist of the following as further detailed in Section 3, Description of Proposed Activity:

- One Cable Landing Location;
- Up to 27 Onshore Export Cables along one route from the Cable Landing Location to a Common Location north of Harpers Road;
- A Switching Station to be located either north of Harpers Road (Preferred) or north of Princess Anne Road;
- Triple-circuit Interconnection Cables from the Switching Station to be located either north of Harpers Road (Preferred) or north of Princess Anne Road to the Onshore Substation; and
- An existing Onshore Substation that will require facility expansion/upgrades to accommodate the power generated by the Project.

The Onshore Substation is an existing substation currently owned by Dominion Energy called the Fentress Substation. Onshore Export Cables are anticipated to be constructed as underground transmission lines from the Cable Landing Location to a Common Location north of Harpers Road, while the Interconnection Cables are expected to be constructed as overhead transmission lines (Preferred) or as a combination of overhead and underground (hybrid) transmission lines from the Common Location north of Harpers Road to the Onshore Substation. The onshore components of the Project, including the Onshore Substation, Interconnection Cables, Switching Station, Onshore Export Cables, and the Cable Landing Location will be located in the area of Hampton Roads in Virginia.

The proposed facility locations for development of the Project have been selected based upon the preliminary environmental and engineering site characterization studies that have been completed to date. The location of Project facilities will be further refined by the final engineering design as well as ongoing and continuing discussions, agency reviews, public input, and the National Environmental Policy Act (NEPA) and National Historic Preservation Act (NHPA) review processes.

Construction and O&M of the Project will require federal, state, and local permits and environmental reviews. Dominion Energy prepared this COP in accordance with BOEM's renewable energy regulations

(30 Code of Federal Regulations [CFR] Part 585) (see Table 1.1-1). The COP is intended to support the environmental impact assessment under NEPA, as amended (42 United States Code [U.S.C.] §§ 4321 *et seq*.), as well as the environmental analysis required as part of other federal, state, and local approvals and consultations for the Project, which are discussed in Section 1.4, Regulatory Framework. Since the original COP submittal on December 17, 2020, Dominion Energy has submitted several supplemental filings for surveys and studies that had not been completed at the time of the original submission of this COP (See Table 1.1-2).

Table 1.1-1. BOEM Requirements

BOEM Requirement	Location in COP
30 CFR § 585.105(a)	
(1) Design your projects and conduct all activities in a manner that ensures safety and will not cause undue harm or damage to natural resources, including their physical, atmospheric, and biological components to the extent practicable; and take measures to prevent unauthorized discharge of pollutants including marine trash and debris into the offshore environment.	Section 4, Site Characterization and Assessment of Impact Producing Factors Appendix A, Safety Management System
30 CFR § 585.621(a-g)	
(a) The project will conform to all applicable laws, implementing regulations, lease provisions, and stipulations or conditions of the lease.	Section 1.4, Regulatory Framework
(b) The project will be safe.	Appendix A, Safety Management System
(c) The project will not unreasonably interfere with other uses of the OCS, including those involved with National security or defense.	Section 4.4.8, Department of Defense and Outer Continental Shelf National Security Maritime Uses,
(d) The project will not cause undue harm or damage to natural resources; life (including human and wildlife); property; the marine, coastal, or human environment; or sites, structures, or objects of historical or archaeological significance.	Section 4, Site Characterization and Assessment of Impact Producing Factors
(e) The project will use the best available and safest technology.	Section 1.10, Design Standards Section 3, Description of Proposed Activity Appendix B, Preliminary Hierarchy of Standards
(f) The project will use best management practices.	Section 4, Site Characterization and Assessment of Impact Producing Factors
(g) The project will use properly trained personnel.	Appendix A, Safety Management System
30 CFR § 585.626(a)	
(1) Shallow Hazards	
(1)(ii) Gas Seeps or shallow gas;	Section 4.1, Physical Resources Appendix C, Marine Site Investigation Report
(1)(iii) Slump blocks or slump sediments;	Section 4.1, Physical Resources Appendix C, Marine Site Investigation Report
(1)(iv) Hydrates;	Section 4.1, Physical Resources Appendix C, Marine Site Investigation Report
(1)(v) Ice Scour of seabed sediments;	Section 4.1, Physical Resources Appendix C, Marine Site Investigation Report

BOEM Requirement	Location in COP
(2) Geological survey relevant to the design and siting of facility	Section 4.1, Physical Resources Appendix C, Marine Site Investigation Report
(2)(i) Seismic activity at your proposed site;	Section 4.1, Physical Resources Appendix C, Marine Site Investigation Report
(2)(ii) Fault zones;	Section 4.1, Physical Resources Appendix C, Marine Site Investigation Report
(2)(iii) The possibility and effects of seabed subsidence; and	Section 4.1, Physical Resources Appendix C, Marine Site Investigation Report
(2)(iv) The extent and geometry of faulting attenuation effects of geological conditions near your site.	Section 4.1, Physical Resources Appendix C, Marine Site Investigation Report
(3) Biological	
(3)(i) A description of the results of biological surveys used to determine the presence of live bottoms, hard bottoms, and topographic features, and surveys of other marine resources such as fish populations (including migratory populations), marine mammals, sea turtles, and sea birds.	Section 4.2, Biological Resources Appendix D, Benthic Resource Characterization Report Appendix E, Essential Fish Habitat Assessment
(4) Geotechnical Survey	
(4)(i) The results of a testing program used to investigate the stratigraphic and engineering properties of the sediment that may affect the foundations or anchoring systems for your facility.	Section 4.1, Physical Resources Appendix C, Marine Site Investigation Report
(4)(ii) The results of adequate in situ testing, boring, and sampling at each foundation location, to examine all important sediment and rock strata to determine its strength classification, deformation properties, and dynamic characteristics.	Section 4.1, Physical Resources Appendix C, Marine Site Investigation Report [a]
(4)(iii) The results of a minimum of one deep boring (with soil sampling and testing) at each edge of the project area and within the project area as needed to determine the vertical and lateral variation in seabed conditions and to provide the relevant geotechnical data required for design.	Section 4.1, Physical Resources Appendix C, Marine Site Investigation Report [a]
(5) Archaeological Resources	
(5)(i) A description of the historic and prehistoric archaeological resources, as required by the National Historic Preservation Act of 1966 (NHPA) (16 U.S.C. §§ 470 *et seq.*), as amended.	Section 4.3, Cultural Resources Appendix F, Marine Archaeological Resource Assessment Appendix G, Terrestrial Archaeological Resource Assessment Appendix H, Historic Properties Assessment Appendix I, Visual Impact Assessment Appendix DD, Section 106 Phased Identification Plan
(6) Overall Site Investigation	
(6) (i) Scouring of the seabed;	Appendix C, Marine Site Investigation Report
(6) (ii) Hydraulic instability;	Appendix C, Marine Site Investigation Report
(6) (iii) The occurrence of sand waves;	Appendix C, Marine Site Investigation Report
(6) (iv) Instability of slopes at the facility location;	Appendix C, Marine Site Investigation Report
(6) (v) Liquefaction, or possible reduction of sediment strength due to increased pore pressures;	Appendix C, Marine Site Investigation Report Appendix J, Sediment Transport Analysis

BOEM Requirement	Location in COP
(6) (vi) Degradation of subsea permafrost layers;	Appendix C, Marine Site Investigation Report
(6) (vii) Cyclic loading;	Appendix C, Marine Site Investigation Report
(6) (viii) Lateral loading;	Appendix C, Marine Site Investigation Report
(6) (ix) Dynamic loading;	Appendix C, Marine Site Investigation Report
(6) (x) Settlements and displacements;	Appendix C, Marine Site Investigation Report Appendix J, Sediment Transport Analysis
(6) (xi) Plastic deformation and formation collapse mechanisms; and	Appendix C, Marine Site Investigation Report
(6) (xii) Sediment reactions on the facility foundations or anchoring systems.	Appendix J, Sediment Transport Analysis
30 CFR § 585.626(b)	
(1) Contact information	Section 1.7, Authorized Representative and Designated Operator
(2) Designation of operator, if applicable	Section 1.7, Authorized Representative and Designated Operator
(3) The construction and operation concept	Section 3, Description of Proposed Activity
(4) Commercial lease stipulations and compliance	Section 1.4, Regulatory Framework
(5) A location plat	Appendix K, Conceptual Project Design Drawings
(6) General structural and project design, fabrication, and installation	Section 3, Description of Proposed Activity Appendix K, Conceptual Project Design Drawings
(7) All cables and pipelines, including cables on project easements	Section 3, Description of Proposed Activity
(8) A description of the deployment activities	Section 3, Description of Proposed Activity
(9) A list of solid and liquid wastes generated	Section 3, Description of Proposed Activity
(10) A listing of chemical products used (if stored volume exceeds U.S. Environmental Protection Agency [EPA] Reportable Quantities)	Section 3, Description of Proposed Activity
(11) A description of any vessels, vehicles, and aircraft you will use to support your activities	Section 3, Description of Proposed Activity
(12)(i) A general description of the operating procedures and systems under normal conditions	Section 3, Description of Proposed Activity
(12)(ii) A general description of the operating procedures and systems in the case of accidents or emergencies, including those that are natural or manmade	Appendix A, Safety Management System
(13) Decommissioning and site clearance procedures	Section 3, Description of Proposed Activity
(14)(i) A listing of all Federal, State, and local authorizations, approvals, or permits that are required to conduct the proposed activities, including commercial operations. The U.S. Coast Guard (USCG), U.S. Army Corps of Engineers (USACE), and any other applicable authorizations, approvals, or permits, including any federal, state, or local authorizations pertaining to energy gathering, transmission or distribution (e.g., interconnection authorizations)	Section 1.4, Regulatory Framework
(14)(ii) A statement indicating whether you have applied for or obtained such authorization, approval, or permit	Section 1.4, Regulatory Framework

BOEM Requirement	Location in COP
(15) Your proposed measures for avoiding, minimizing, reducing, eliminating, and monitoring environmental impacts	Section 4, Site Characterization and Assessment of Impact Producing Factors
(16) Information you incorporate by reference	Section 5, References
(17) 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	Appendix L, Summary of Agency and Stakeholder Engagement
(18) Reference	Section 5, References
(19) Financial assurance	Section 1.9, Financial Assurance
(20) Certified Verification Agent (CVA) nominations for reports required in subpart G of this part	Appendix M, Certified Verification Agency Nomination
(21) Construction schedule	Section 1.1.1, Indicative Construction Schedule
(22) Air quality information	Section 4.1.3, Air Quality Appendix N, Air Emissions Calculations and Methodology
(23) Other information	Various locations, throughout COP
30 CFR § 585.627(a)	
(1) Hazard information	Section 4.1.1, Physical and Oceanographic Conditions
(2) Water quality	Section 4.1.2, Water Quality Appendix J, Sediment Transport Analysis
(3) Biological Resources, including benthic communities, marine mammals, sea turtles, coastal and marine birds, fish and shellfish, plankton, seagrasses, and plant life	Section 4.2.4, Benthic Resources, Fishes, Invertebrates, and Essential Fish Habitat Section 4.2.5, Marine Mammals Section 4.2.6, Sea Turtles Section 4.2.3, Avian and Bat Species Appendix D, Benthic Resource Characterization Report Appendix O, Avian and Bat Impact Assessment
(4) Threatened or endangered species	Section 4.2, Biological Resources Appendix R, Threatened and Endangered Species Review
(5) Sensitive biological resources or habitats	Section 4.2, Biological Resources
(6) Archaeological resources	Section 4.3, Cultural Resources Appendix F, Marine Archaeological Resource Assessment Appendix G, Terrestrial Archaeological Resource Assessment Appendix H, Historic Properties Assessment Appendix I, Visual Impact Assessment Appendix DD, Section 106 Phased Identification Plan
(7) Social and economic resources	Section 4.4, Socioeconomic Resources Appendix EE, Socioeconomic and Environmental Justice Studies
(8) Coastal and marine uses	Section 4.4.11, Other Coastal and Marine Uses
(9) Consistency Certification	Appendix P, Coastal Zone Management Act Consistency Certifications
(10) Other resources, conditions, and activities	Section 4.4.11, Other Coastal and Marine Uses

BOEM Requirement	Location in COP
30 CFR § 585.627(b)	
Consistency certification	Appendix P, Coastal Zone Management Act Consistency Certifications
30 CFR § 585.627(c)	
Oil Spill Response Plan	Appendix Q, Oil Spill Response Plan
30 CFR § 585.627(d)	
Safety Management System	Appendix A, Safety Management System

a/ Dominion Energy submitted a departure request from 30 CFR §§ 585.626(a)(4)(ii) and (iii) as the regulations pertain to the submittal of geotechnical survey results with the COP. The request was originally submitted to BOEM on June 16, 2020, with additional supporting information submitted on December 17, 2020, and a final complete request submitted on July 1, 2021. Dominion Energy is still awaiting approval of this departure request.

Table 1.1-2. Supplemental Filings

Appendix	Description	Regulatory Requirement	Submittal Date
Appendix C Marine Site Investigation Report	Geophysical and geotechnical surveys and data analysis to support preparation of the Marine Site Investigation Report were ongoing into the third quarter of 2021. Preliminary information from G&G surveys was provided in the Initial Site Characterization Report submitted in support of the Geotechnical Departure Request.	585.626(a)(1) 585.626(a)(2) 585.626(a)(4)(i) 585.626(a)(4)(iii) 585.626(a)(6) 585.627(a)(1) 585.627(a)(5)	Submitted October 29, 2021 Revised May 6, 2022
Appendix D Benthic Resource Characterization Report	Benthic survey was completed in August of 2020. Due to shutdowns related to the ongoing pandemic, results of infauna analysis were not received until the first quarter of 2021.	585.626(a)(3) 585.627(a)(3) 585.627(a)(4) 585.627(a)(5)	Submitted March 23, 2021 Revised May 6, 2022
Appendix E Essential Fish Habitat Assessment	Geophysical and geotechnical surveys and data analysis to support the Essential Fish Habitat Assessment were ongoing into the third quarter of 2021.	585.626(a)(3) 585.627(a)(3) 585.627(a)(4) 585.627(a)(5)	Submitted October 29, 2021 Revised May 6, 2022
Appendix F Marine Archaeological Resource Assessment	Geophysical and geotechnical surveys and data analysis to support the Marine Archaeological Resource Assessment were ongoing into the third quarter of 2021.	585.626(a)(5) 585.627(a)(6)	Submitted October 29, 2021 Revised May 6, 2022

Appendix	Description	Regulatory Requirement	Submittal Date
Appendix G Terrestrial Archaeological Resource Assessment	Dominion Energy has continued the process of coordinating property access for the Onshore Project Area so that field surveys can be completed. In support of the terrestrial archaeological resources survey, which is currently ongoing, Dominion Energy developed a survey plan that was submitted to the Bureau of Ocean Energy Management (BOEM) and Virginia Department of Historic Resources (VDHR) for review in April 2021, and revised to address comments in September 2021. To date, the Phase IA portion of the Terrestrial Archaeological Resources Assessment (TARA), which includes a reconnaissance survey of properties which Dominion Energy had access permission and associated reporting was completed in June 2021 (see Appendix G). The Phase IB portion of the TARA is ongoing for properties which Dominion Energy has access permission, and associated reporting for properties surveyed to date is included with this COP revision. Properties that Dominion Energy does not have access to at this time will be assessed in accordance with Appendix DD, Section 106 Phased Identification Plan.	585.626(a)(5) 585.627(a)(6)	Submitted June 30, 2021 Revised October 29, 2021 and May 6, 2022
Appendix H Historic Properties Assessment	In support of the Historic Properties Assessment, Dominion Energy developed onshore and offshore survey plans that were submitted to BOEM for review. The survey plans have since been superseded by the draft Historic Properties Assessments submitted in June 2021. The surveys, reporting, and analysis for the Historic Properties Assessment is included with this COP revision.	585.626(a)(5) 585.627(a)(6)	Submitted June 30, 2021 Revised October 29, 2021 and May 6, 2022
Appendix I Visual Impact Assessment	In support of the Visual Impact Assessment, Dominion Energy developed onshore and offshore survey plans that were submitted to BOEM for review. The survey plans have since been superseded by the draft Visual Impact Assessments submitted in June 2021. The surveys, reporting, and analysis for the Visual Impact Assessment are included with this COP revision.	585.626(a)(5)	Submitted June 30, 2021 Revised October 29, 2021 and May.6, 2022

Appendix	Description	Regulatory Requirement	Submittal Date
Appendix R Threatened and Endangered Species Review	Dominion Energy has continued coordinating property access for the Onshore Project Area so that field surveys can be conducted. To the extent possible, property access was obtained in the second quarter of 2021. To date, threatened and endangered species evaluations have been completed on properties where access has been granted and associated reporting on surveys performed to date is included with this COP revision.	585.627(a)(4)	Submitted June 30, 2021 Revised October 29, 2021 and May 6, 2022
Appendix T Obstruction Evaluation and Additional Analysis: • Air Traffic Flow Analysis; and, • Aircraft Detection Lighting System Efficacy Analysis	The Obstruction Evaluation and Radar Line of Site Screening were submitted with the COP in December 2020. Due to shutdowns related to the ongoing pandemic, information from the Freedom of Information Act request to the Federal Aviation Administration was not received until the first quarter of 2021.	14 CFR Part 77, as applicable 14 CFR § 77.9	Submitted March 23, 2021 Revised October 29, 2021
Appendix U Wetland Delineation Report	Dominion Energy has continued coordinating property access for the Onshore Project Area so that field surveys can be completed. To date, wetland delineations have been completed on properties where access has been granted and associated reporting on delineations performed to date is included with this COP revision.	585.627(a)(5)	Submitted June 30, 2021 Revised October 29, 2021 and May 6, 2022
Appendix CC Seabed Morphology	The Seabed Morphology assessment incorporates information from the geophysical and geotechnical surveys.	585.626(a)(6)	Submitted June 16, 2021 Revised October 29, 2021 and May 6, 2022
Appendix DD Section 106 Phased Identification Plan	The Phased Identification Plan is being developed in compliance with NHPA Section 106 regulations and guidance provided by BOEM. The Plan will outline the processes that will guide the Project through the completion of any remaining cultural resources assessments.	585.626(a)(5)(i), 585.627(a)(6)	Submitted October 29, 2021 Revised May 6, 2022
Appendix EE Socioeconomic and Environmental Justice Studies	In support of the Socioeconomic and Environmental Justice Studies, Dominion Energy utilized the 2020 Economic Impact Study that was developed by Magnum Economics which outlined the potential impact of offshore wind development in the Hampton Roads Region. Dominion Energy also prepared an Environmental Justice Screening Report for the Onshore Project Area.	585.627(a)(7)	Submitted October 29, 2021 and November 5, 2021 Revised May 6, 2022

Dominion Energy submitted a Site Assessment Plan and Construction and Operations Plan Survey Plan to BOEM on February 14, 2020 (modifications submitted on March 26, April 10, May 20, and September 8, 2020, and February 1, and March 29, 2021) to conduct high-resolution geophysical (HRG), geotechnical, benthic, and other survey activities in the Lease Area, Offshore Export Cable Route Corridor, and Onshore Project Area, including the Onshore Export Cable Route, Switching Station, Interconnection Cable Routes, and Onshore Substation (hereinafter called the “Project Area”). On June 12 and September 25, 2020 and April 13, 2021, BOEM acknowledged that all comments on the Site Assessment Plan and Construction and Operations Survey Plan had been addressed, and survey work commenced in Spring 2020 and continued through August 2021. These surveys inform overall Project design and engineering and allow for siting flexibility. Geophysical and reconnaissance level geotechnical data acquired through this field program to support the COP is provided in Appendix C, Marine Site Investigation Report. Additional data, including data from deep borings at each turbine location, will be provided in the Facility Design Report/Fabrication Installation Report (FDR/FIR) as required for the Project.

1.1.1 Indicative Construction Schedule

An indicative construction schedule for the construction and development of the Lease Area is provided in Table 1.1-3. The schedule assumes that all permits and authorizations will be received by the start of onshore construction in Q3 2023 and offshore construction in Q4 2023. Start of operations is anticipated to be conducted in groups of up to eight turbines beginning in Q3 2025. Construction schedules are subject to various factors, for example, state and federal permitting, financial investment decisions, supply chain considerations, and weather conditions. Therefore, flexibility on construction schedules is important. As such, the PDE covers reasonably foreseeable schedule scenarios, from which maximum design scenarios are conservatively selected as part of the assessment process.

On March 18, 2022 the Virginia State Corporation Commission (SCC) issued an affiliates act approval (Case No. PUR-2021-00292) for the CVOW Commercial Project to contract for use of the Charybdis to install wind turbines for the Project. On April 19, 2022, Dominion Energy filed a petition for approval of this arrangement with the North Carolina Utilities Commission (Docket No. E-22, Sub 633). A decision by the North Carolina Utilities Commission is expected in the second half of 2022. Charybdis is a U.S.-flagged, Jones Act-compliant wind turbine installation vessel currently under construction and expected to enter service by the end of 2023. Charybdis is contracted for use on projects in the Northeast prior to mobilizing to the Project in the summer of 2025. The vessel will be used from Q3 2025 to late 2026 to transport and install WTGs. It is important for the Project to meet this installation window for Charybdis, as Charybdis is expected to be sought after for offshore wind turbine installation contracts for other projects in the U.S.

1.2 Project Design Envelope

Development of an offshore wind facility is an extensive and complex process spanning several years. As such, it is not possible to establish a final form of development at the time of the COP submittal. In Europe, it is an accepted practice for offshore wind farm projects to present a range of potential final design parameters through a realistic maximum design scenario approach to the assessment. This is achieved by assessing the maximum parameters for key components (e.g., WTGs, foundations, and installation methodologies) within which the Project will be limited. By assessing the realistic maximum design scenario for each component, the environmental, cultural, and social impact assessment can be robust while allowing for flexibility further on in the development process. The term used to describe the process and set of parameters adopted for a specific project is sometimes referred to as a PDE.

The primary goal of applying a design envelope is to allow for meaningful assessments by the jurisdictional agencies of the proposed project activities while concurrently providing the Lessee reasonable flexibility to make prudent development and design decisions prior to construction. Offshore wind technologies are rapidly advancing and evolving, and the flexibility to take advantage of industry advancements and innovative technologies as a project progresses through development is critical to ensuring that the most technologically sound, environmentally appropriate, and cost-effective project is constructed. In addition, as projects progress through the permitting process and ongoing consultations, flexibility is needed to be able to effectively apply feedback, new design data, and permitting conditions placed on the project.

Table 1.1-3. Indicative Construction Schedule

Activity	2023		2024				2025				2026				2027	
	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
Scour Protection Pre-Installation																
Monopile and transition piece transport and onshore staging																
Monopile Installation (piling between May 1 and October 31)[1]																
Scour Protection Post-Installation																
Transition Piece Installation																
WTG pre-assembly and Installation																
Inter-Array Cable Installation																
Offshore Substation Installation (piling between May 1 and October 31)																
Offshore Export Cable Installation																
Onshore Export and Interconnection Cable Installation																
Switching Station Construction																
Onshore Substation Upgrade Construction																
Commissioning																

[1] Dominion Energy anticipates that all WTG Monopile and Offshore Substation Jacket foundations will be installed by October 31, 2025. However, as a contingency to account for the potential for delays due to weather, and/or other unanticipated events, Dominion Energy has proposed installation of up to 15 foundations in 2026. If required to accommodate delays in the installation schedule, the 15 installations would occur between May 1 and September 30, 2026.

In an effort to analyze and apply industry-wide best practices in the U.S., BOEM funded a study titled *Phased Approaches to Offshore Wind Developments and Use of the Project Design Envelope, Final Technical Report* (Rowe et al. 2017). The study provided the foundation for BOEM's guidance document entitled *Draft Guidance Regarding the Use of a Project Design Envelope in a Construction and Operations Plan* (BOEM 2018). Within this guidance, BOEM defines a design envelope as "a reasonable range of project designs" associated with various components of the project (e.g., WTGs, foundations, and installation methodologies) (BOEM 2018). The design envelope is used to assess the potential impacts on key environmental and human use resources (e.g., marine mammals, fish, benthic habitats, commercial fisheries, navigation, etc.) focusing on the design parameter (within the defined range) that represents the realistic maximum design scenario for each unique resource (Rowe et al. 2017).

The definition of what is considered the realistic maximum design scenario varies based on the potentially impacted resource and is provided at the beginning of each subsection within Section 4, Site Characterization and Assessment of Impact-Producing Factors. The Maximum Project Design Scenario, a full Lease Area buildout, is also detailed in Section 3, Description of Proposed Activity. Dominion Energy has ensured that only "realistic" development scenarios are considered when defining these. For example, while different sizes of foundation are included in the application, the largest foundations may not be required to support the smallest WTG. In this case, the assessment would identify and describe the greatest impact associated with the foundation type that would be installed with that size WTG. The range of options in the PDE applies for all of the Project Area.

Dominion Energy will continue to evaluate detailed design and engineering studies to identify conditions and the Project components that would be best suited to the Lease Area. Dominion Energy also plans to commence fabrication of certain Project components in advance of BOEM approval of the COP and Nominated Certified Verification Agent (CVA) and BOEM No Objection to the FDR/FIR.

On November 13, 2020, Dominion Energy submitted a departure request to BOEM from the requirements of 30 CFR § 585.700(b) that was approved on February 10, 2021. Dominion Energy also submitted a separate departure request from 30 CFR §§ 585.626(a)(4)(ii) and (iii) as the regulations pertain to the submittal of geotechnical survey results with the COP. The request was originally submitted to BOEM on June 16, 2020, with additional supporting information submitted December 17, 2020, and a final complete request submitted on July 1, 2021. Dominion Energy received approval of this departure request on March 23, 2022. Additionally, Dominion Energy submitted departure requests from 30 CFR § 585.700(b) to BOEM on September 1, and December 9, 2021. Dominion Energy received confirmation from BOEM that the early fabrication of certain Project components does not require a departure request unless the fabrication takes place on the OCS, which closed out these two departure requests. Dominion Energy will submit any future departure requests to BOEM as applicable.

Based on discussions with BOEM conducted in 2020, Dominion Energy has applied a PDE approach to describe Project facilities and activities. Details regarding the PDE for the Project Area are provided in Section 3, Description of Proposed Activity. A summary of PDE parameters is provided in Table 1.2-1.

Table 1.2-1. Summary of PDE Parameters

Project Parameter Details
General (Layout and Project Size)
• 176 to 205 WTGs • Anticipated to begin offshore construction in 2024 (foundations) and 2025 (WTGs) • Construction of the Project is expected to be complete within approximately 3 years
WTGs and Foundations
• Siemens Gamesa Renewable Energy SG 14-222 DD WTG with power boost technology • 14- to 16-MW WTGs characterized as “minimum” and “maximum” capacity • Rotor diameter ranging from 725 to 761 ft (221 to 232 m) • Hub height from mean sea level (MSL) ranging from 446 to 489 ft (136 to 149 m) • Turbine tip height from MSL ranging from 804 to 869 ft (245 to 265 m) • Installation of monopiles through pile-driving • Scour protection is proposed to be installed around WTG Monopile Foundations Installation vessels to include jack-up, platform supply, crew transfer, tugs, barges, heavy-lift vessels, fall pipe vessels, walk-to-work, and other support vessel types as necessary
Inter-Array Cables
• Up to 66-kilovolt (kV) cables buried 3.3 to 9.8 ft (1 to 3 m) beneath the seabed • Up to 300 miles (484 km) total length of Inter-Array Cables (average Inter-Array Cable length of 5,868 ft [1,789 m] between turbines) • Installation by jet trenching, chain cutting, trench former, and/or other available technologies • Installation vessels to include deep draft cable lay, walk-to-work, crew transfer, trenching support, burial tool, survey, multipurpose support vessels, and other support vessel types as necessary
Offshore Export Cables
• Up to nine 230-kV Offshore Export Cables buried 3.3 to 16.4 ft (1 to 5 m) beneath the seabed • Nine Offshore Export Cables (in a single corridor) • Up to 416.9 mi (671 km) total length of Offshore Export Cable • Installation by jet trenching, plowing, chain cutting, trench former, and/or other available technologies • Installation vessels to include pull-in support barge, tug, multipurpose support, survey, shallow draft cable lay, hydroplow, crew transfer, deep-draft, walk-to-work, trenching support, burial tool vessels, and other support vessel types as necessary • Cable protection at the cable crossings
Offshore Substations and Foundations
• Three Offshore Substations • Offshore Substations installed atop piled jacket foundations • Scour protection installed at all foundation locations • Installation vessels to include barge, tug, transport, heavy lift, anchor handling, jack-up vessels, platform support, and other support vessel types as necessary
Onshore Facilities
• Landfall of Offshore Export Cable(s) will be completed via Trenchless Installation • Maximum area of temporary disturbance for Cable Landing Location 2.8 ac (1.1 ha maximum temporary workspace at the Nearshore Trenchless Installation Area approximately 8.8 ac [3.6 ha]). • Construction work area for the Switching Station, maximum of approximately 46.4 ac (18.8 ha) • Construction work area for the Upgrades at the Onshore Substation (existing Dominion Energy Fentress substation), maximum of approximately 25.1 ac (10.2 ha) • Maximum Onshore Export Cable length of approximately 4.41 mi (7.10 km) • Maximum Interconnection Cable length of approximately 20.3 mi (32.7 km) • Maximum area of temporary disturbance for Onshore Export Cable Route of approximately 66 ac (27.6 ha) • Maximum area of temporary disturbance for Interconnection Cable Route of approximately 342.8 ac (138.7 ha)

1.3 Purpose and Need

Under the Outer Continental Shelf Lands Act (OCSLA), the Secretary of the Interior is responsible for the administration of mineral and wind exploration and development of the OCS. For wind development, the Act empowers the Secretary to grant leases, easements, and rights-of-way and to formulate regulations as necessary to carry out the provisions of the Act. BOEM is responsible for offshore renewable energy development in federal waters. BOEM's renewable energy program occurs in four distinct stages[2] planning, leasing, site assessment, and construction and operations. BOEM engages key stakeholders throughout this process, as early communication with interested and potentially affected parties is critical to managing potential conflicts.

BOEM prepared a final Programmatic Environmental Impact Statement (PEIS)[3] in support of establishing its program for authorizing renewable energy and alternate use activities on the OCS. The final PEIS examines the potential environmental effects of the program on the OCS and identifies policies and best management practices that may be adopted for the program.

As stated above, the purpose of this Project is to provide clean, reliable offshore wind energy; to increase the amount and availability of renewable energy to Virginia and North Carolina consumers; to create the opportunity to displace electricity generated by fossil fuel-powered plants, and to offer substantial economic and environmental benefits to the Commonwealth of Virginia. The Project also directly supports the goals of the 2020 law passed by the Virginia General Assembly, the Virginia Clean Economy Act (VCEA), which supports development of 2,500 to 3,000 MW of clean, reliable offshore wind energy to be in service by 2028. The VCEA is intended to build a clean energy future for the Commonwealth of Virginia that reduces carbon emissions and creates significant economic improvement through local job creation and supply chain formation in both the Commonwealth of Virginia and neighboring states. This Project, as designed, should provide approximately 8.8 million megawatt-hours of carbon-free power to the grid on an annual basis. This equates to over 5.3 million metric tons of carbon dioxide that will be reduced from the power generating fleet to meet the needs of Dominion Energy’s customers. The onshore electrical portion will connect to the Pennsylvania-New Jersey-Maryland (PJM) regional electric transmission grid, and at peak output the project will power approximately 660,000 homes.

Wind, along with solar, are the least-cost generation options, so they will–by default–be dispatched first to offset production from fossil-fueled units in order to keep the price of electricity as low as reasonably possible.

This Project is not only an important steppingstone toward commercial-scale offshore wind development, but also it will further Dominion Energy’s commitment to 3,000 MW of solar and wind energy under development or in operation by the beginning of 2022. The VCEA supports this Project by deeming it in the public interest subject to several conditions, such as competitive procurement and a cost cap. This Project will be the largest offshore renewable wind energy initiative undertaken in federal waters and the first of its kind owned by an electric utility company.

2 https://www.boem.gov/Commercial-Leasing-Process-Fact-Sheet/
3 https://www.boem.gov/Renewable-Energy-Program/Regulatory-Information/Guide-To-EIS.aspx

The Project will directly respond in a cost-effective manner to this expressed need and demand and help achieve significant reductions of greenhouse gas emissions across the region. To meet this need and demand in a timely and efficient manner, it is imperative that the design and permitting for the Project proceed as expeditiously as possible so that the Project can be constructed and commence operations in advance of these State-mandated deadlines.

1.4 Regulatory Framework

1.4.1 Federal Permits, Approvals, and Consultations

Under the OCSLA, the Secretary of the Interior was charged with the administration of mineral exploration and development of the OCS (Title 43, Chapter 29, Subchapter I, § 1301). In 2005, the OCSLA was amended to authorize the Department of the Interior (DOI) to issue leases, easements, and rights-of-way for alternate uses and alternative energy development on the OCS (Section 388 of the Energy Policy Act of 2005). Through this amendment and subsequent delegation by the Secretary of the Interior, BOEM has the authority to issue these leases and regulate activities that occur within them, including the authorization of a COP.

As the federal agency charged with issuing the OCS Lease and reviewing and approving the COP, BOEM will serve as the lead federal agency for the entire Project throughout the permitting process. BOEM will also authorize an easement that will be necessary for the portion of the Offshore Export Cables that are located in federal waters outside of the Lease Area.

As part of the COP approval process, BOEM must ensure that any activities approved are safe, conserve natural resources on the OCS, are undertaken in coordination with relevant federal agencies, provide a fair return to the U.S., and are compliant with all applicable laws and regulations (30 CFR § 585.102). NEPA also requires the preparation of an Environmental Impact Statement (EIS) for any major federal action significantly affecting the quality of the human environment.

While BOEM is the primary federal agency governing the development of a renewable energy facility within the Lease Area, given the locations of the Project components, several other federal, state, and local agencies also have regulatory authority over the Project. A list of the required approvals and consultations and their current status is provided in Table 1.4-1. At this time, Dominion Energy has not applied for other federal or state permits associated with construction and O&M of the Project, but plans to begin submitting permit applications in Q4 2021.

A crossing agreement is a form of Joint Use Agreement used for the common usage of intersecting utilities. The Offshore Export Cables will cross several fiber optic communications cables, resulting in required cable crossings. The Interconnection Cables will also require several cable crossings. Dominion Energy has begun coordination with the owners of the fiber optic cables to ensure that crossing agreements are in place as early as practicable in the Project planning process, and will continue to coordinate with the owners of any additional fiber optic cables that are installed. An agreement will also need to be established with appropriate entities to run onshore transmission lines across or under existing rights-of-way (ROWs). Dominion Energy will establish a permanent ROW to enable assets to be maintained. In areas where the space required for construction will exceed the area of the permanent ROW, Dominion Energy will request additional temporary ROW, as needed.

The Fixing America's Surface Transportation (FAST) Act (December 2015), which is a federal streamlining directive that applies to all COPs, is optional for applicants. Title 41 of the FAST Act (FAST-41) (42 U.S.C. § 4370m) was designed to improve the timeliness, predictability, and transparency of the Federal environmental review and authorization process for covered infrastructure projects. FAST-41 created a new entity – the Federal Permitting Improvement Steering Council (FPISC), composed of agency Deputy Secretary-level members and chaired by an Executive Director appointed by the President. FAST-41 establishes new procedures that standardize interagency consultation and coordination practices. Importantly, FAST-41 creates a new authority for agencies to issue regulations for the collection of fees, which, if implemented, will allow the Council to direct resources to critical functions within the interagency review process. FAST-41 codifies into law the use of the Permitting Dashboard to track project timelines. Dominion Energy is pursuing the FAST-41 directive in support of the COP.

Dominion Energy submitted a FAST-41 Initiation Notice (FIN) to the FPISC on February 1, 2021, which resulted in a determination that the Project was covered under FAST-41. FPISC hosted an interagency Coordinated Project Plan (CPP) workshop on April 4, 2021 and the permitting timetable for the Project was posted to the Permitting Dashboard on April 13, 2021.[4] Dominion Energy continues to work closely with FPISC and BOEM to address any data requests in a timely manner to ensure that timeframes indicated on the Permitting Dashboard are maintained.

1.4.2 State and Local Permits, Approvals, and Consultations

As Project components are proposed in the Commonwealth of Virginia, approvals from the applicable state and local agencies will also be required. At the state level, the Virginia Marine Resources Commission (VMRC) will issue a VMRC Permit for the portions of the Project located over, under or on certain state waters under the Virginia Code and regulations (Section 10 Waters, tidal waters, and non-tidal waterways). The Virginia Department of Environmental Quality (VDEQ) will issue a Virginia Water Protection (VWP) Individual Permit pursuant to the Code of Virginia and the Section 401 Water Quality Certification requirements of the federal Clean Water Act (CWA). The U.S. Environmental Protection Agency (EPA) also requires that the Project submit air permit applications under the Clean Air Act (CAA) for marine vessels or other equipment used to construct and/or operate the Project. EPA has delegated authority to VDEQ to issue OCS air permits; however, there is not currently a regulatory avenue for EPA to delegate authority to VDEQ to implement and enforce the requirements of the OCS program beyond 25 nm (46.3 km). As such, EPA will retain responsibility for processing the OCS air permit due to the distance of the Project offshore.

As a public utility, in order to construct and operate electric utility facilities within the Commonwealth, the Virginia Code requires Dominion Energy to obtain a certificate of public convenience and necessity (CPCN) under Va. Code § 56-265.2 A.1, as well as approval under Va. Code § 56-46.1, from the SCC. For purposes of the CVOW Commercial Project, these approvals are needed for the portion of the Offshore Export Cable from three miles offshore landward, as well as all of the Onshore Project Components. Dominion Energy also must seek other approvals from SCC, including those related to cost recovery for

[4] See https://www.permits.performance.gov/permitting-project/coastal-virginia-offshore-wind-commercial-project for more information

the Project under Va. Code §§ 56-585.1 A.6 and 56-585.1:11. Dominion Energy intends to apply to the SCC for these approvals in Q4 2021.

The SCC's decisions regarding approvals related to cost recovery must, by statute, be provided within nine months of Dominion Energy's filing of its application. Thus, Dominion Energy likely will not have a decision from the SCC related to cost recovery until early August 2022. The timelines for SCC's decisions related to the CPCN and approval under Va. Code § 56-46.1 are not prescribed by statute. Typically, SCC has provided its decisions related to these approvals along similar timelines as the cost recovery decision, when applications for each are made together. As such, while not mandated by statute, Dominion Energy would expect SCC's decision on the CPCN and approval under Va. Code § 56-46.1 in temporal proximity to SCC's decision regarding cost recovery.

Coastal Zone Management Act Consistency

The Coastal Zone Management Act of 1972 (CZMA) requires that federal actions likely to affect any land or water use, or natural resource of a state's coastal zone, be conducted in a manner that is consistent with the state's federally approved Coastal Zone Management Program (CZMP). The Virginia CZMP was established in 1986 and is administered by VDEQ, which serves as the lead agency for the network of Virginia state agencies and local governments that administer the CZMP. The enforceable policies that make up the CZMP include:

- Fisheries Management (Virginia Administrative Code [VAC] §28.2-200 through §28.2-713 and VAC §29.1-100 through §29.1-570);
- Subaqueous Lands (VAC §28.2-1200 through §28.2-1213);
- Wetlands Management (VAC §28.2-1300 through §28.2-1320 and §62.1-44.15.5);
- Dunes Management (VAC §28.2-1400 through §28.2-1420);
- Point and Nonpoint Source Pollution Control (VAC §10.1-560 *et seq*. and §62.1-44.15);
- Shoreline Sanitation (VAC §32.1-164 through §32.1-165);
- Air Pollution Control (VAC §10-1.1300); and
- Coastal Lands Management (Chesapeake Bay Preservation Act, VAC §10.1-2117 through §10.1-2134 and regulations 4 VAC 50-90).

Given the distance of the Lease Area to the shoreline in the State of North Carolina and the potential for visual impacts from the Project, the North Carolina CZMA has also been considered. The North Carolina Coastal Area Management Act (CAMA) establishes a cooperative coastal area management program between local and state governments. CAMA is the overarching statutory authority for: (1) the state guidelines adopted by regulations in Chapter 7 of Title 15A of the North Carolina Administrative Code (NCAC), (2) local land use plans, and (3) the state permitting process for major development actions. The intention of the program is to provide a management system through policies and standards to protect, preserve, and conserve coastal natural resources while providing a balanced opportunity to use coastal resources for the purposes of economic development, recreation and tourist facilities, transportation, and historic, cultural, and scientific resources.

The North Carolina CZMP was established in 1978 and is administered by the North Carolina Division of Coastal Management (DCM), which serves as the lead agency for the network of North Carolina state agencies and local governments that administer the CZMP. Projects within North Carolina's coastal waters must comply with the key elements of North Carolina's Coastal Management Program, which include:

- The Coastal Area Management Act;
- the State's Dredge and Fill Law;
- Chapter 7 of Title 15A of the NCAC;
- regulations passed by the Coastal Resources Commission (CRC);
- local land-use plans certified by the CRC; and
- a network of other state agencies' laws and regulations.

Appendix P Coastal Zone Management Act Consistency Certifications has been prepared pursuant to 15 CFR § 930.39 and provides the data and information necessary to certify that the construction and O&M of the CVOW Commercial Project will be consistent with the CZMP(s), in accordance with CZMA § 307(c)(3)(A), 16 U.S.C. § 1456(c)(3)(A), and 15 CFR § 930, subpart D. Appendix P presents a summary of each enforceable policy under the CZMP and how the CVOW Commercial Project will be consistent with each policy, including a reference to specific sections of the COP that address each policy.

On April 7, 2022, VDEQ sent a letter to Dominion Energy requesting that they agree with VDEQ to stay the Commonwealth's federal consistency review for the Project until September 1, 2022. On April 12, 2022, Dominion Energy provided a response to that letter agreeing to the stay, which allows the Commonwealth to collect additional information from the BOEM draft EIS, scheduled to be issued on August 1, 2022. Dominion Energy anticipates that BOEM's draft EIS, along with additional information provided in the COP, will provide sufficient information for the VMRC to determine the Project's consistency with the Marine Fisheries enforceable policy within the 3-nm (5.6-km) offshore jurisdictional reach of the Commonwealth.

A summary of all required permits and their status is provided in Table 1.4-1.

Table 1.4-1. Required Approvals and Consultations

Regulatory Agency	Permit or Approval	Statutory Basis	Status
BOEM	Outer Continental Shelf Lands Commercial Lease, Site Assessment Plan, and COP	OCSLA 43 U.S.C. § 1337(p)	BOEM published request for competitive interest in Federal Register on December 3, 2012. On November 1, 2013, BOEM issued the Commercial Lease OCS-A 0483. Per BOEM direction issued on December 3, 2013 this COP is submitted to BOEM in accordance with 30 CFR §§ 585.626 and 627.
BOEM	Facility Design Report and Fabrication and Installation Report	30 CFR § 585.700	These reports will be submitted prior to installation of facilities as described in this COP.
USACE Norfolk District	Individual Permit Section 10 Permit for structure in navigable U.S. waters Section 404 Dredge Discharge Permit in navigable U.S. waters Section 408 Permit for activities in a Civil Works Project	Rivers and Harbors Act—Section 10 33 U.S.C. §§ 333(e), 403, and CWA Section 404 33 U.S.C. § 1344	Pre-application consultation was initiated on November 17, 2020. An agency pre-application meeting was held on March 9, 2022 and Dominion Energy plans to submit their application in May 2022. Information required to support the acquisition of these permits is provided in this COP.
BOEM, USACE, and Cooperating Agencies	NEPA Compliance (Categorical Exclusion, Environmental Assessment and Finding of No Significant Impact or Environmental Impact Statement and Record of Decision)	NEPA 42 U.S.C §§ 4321 *et seq.* Energy Policy Act of 2005	An Environmental Impact Statement and Finding of No Significant Impact for the commercial wind lease issuance and site assessment activities on the Atlantic OCS offshore New Jersey, Delaware, Maryland, and Virginia was published on February 2, 2012. Scoping related to the construction and O&M of the Project with primary federal permitting agencies will be conducted during the COP review process. Information required to support NEPA review has been provided in this COP.

Regulatory Agency	Permit or Approval	Statutory Basis	Status
National Oceanic and Atmospheric Administration's (NOAA's) National Marine Fisheries Service (NOAA Fisheries)	Section 7 Consultation under the Endangered Species Act of 1973 (ESA) ESA Incidental Take Permit (ITP)	ESA 16 U.S.C. § 660 16 U.S.C. §§ 1531 *et seq.*	Information to support consultation between federal permitting agencies and federal wildlife resource agencies has been provided in this COP (Section 4.2, Biological Resources, and Appendix R, Threatened and Endangered Species Review).
	Marine Mammal Protection Act (MMPA) Letter of Authorization (LOA)	MMPA 16 U.S.C. §§ 1361 *et seq.*	Information to support consultation between federal permitting agencies and federal wildlife resource agencies has been provided in this COP (Section 4.2, Biological Resources). Dominion Energy will use information provided in this COP, additional detail from ongoing Project engineering, and information received from pre-application consultations to prepare the application for the LOA for re-submittal in Q2 2022.
	Magnuson-Stevens Fishery Conservation and Management Act	Magnuson-Stevens Fishery Conservation and Management Act 16 U.S.C. §§ 1801 *et seq.*	Information to support consultation between federal permitting agencies and federal wildlife resource agencies has been provided in this COP (Section 4.2, Biological Resources, Appendix D, Benthic Resource Characterization Report, Appendix E, Essential Fish Habitat Assessment, and Appendix R, Threatened and Endangered Species Review).
U.S. Fish and Wildlife Service (USFWS) Northeast Region (Region 5)	Section 7 Consultation under the ESA ESA ITP if required	ESA 16 U.S.C. §1531 Migratory Bird Treaty Act, 16 U.S.C. §§ 703 *et seq.* Bald and Golden Eagle Protection Act 16 U.S.C. § 668	Information to support consultation between federal permitting agencies and federal wildlife resource agencies has been provided in this COP (Section 4.2, Biological Resources and Appendix R, Threatened and Endangered Species Review).
Advisory Council on Historic Preservation (ACHP)	NHPA Section 106 and 110 Consultations	NHPA 54 U.S.C. § 306108 and 16 U.S.C. § 470	Information to support consultation between federal permitting agencies and Virginia Department of Historic Resources has been provided in this COP (Section 4.3, Cultural Resources, and Appendix F, Marine Archaeological Resource Assessment, Appendix G, Terrestrial Archaeological Resource Assessment, Appendix H, Historic Properties Resource Assessment, and Appendix DD, Section 106 Phased Identification Plan)

Regulatory Agency	Permit or Approval	Statutory Basis	Status
USCG, Sector Virginia	Approval for Private Aids to Navigation (PATON) Local Notice to Mariners (LNTM) Captain of the Port (COTP) Letter	49 U.S.C. § 44718 33 U.S.C. § 1221	Lighting and marking has been developed in consultation with the USCG and provided in this COP (Section 3.4.2, Onshore Construction, and Appendix S, Navigation Safety Risk Assessment). Dominion Energy will prepare the PATON and LNTM a minimum of 4 months prior to commencement of operations and a minimum of 2 weeks before commencing activities, respectively.
BOEM, USCG, USACE, or U.S. Department of the Navy, as appropriate	Permits/Permissions and Approvals Required for Unexploded Ordnance (UXO) Survey, Identification and Disposition	10 U.S.C. § 2710	These permits/permissions and approvals will be completed prior to construction.
Federal Aviation Administration (FAA)	Onshore Obstruction Evaluation/Notice Criteria Tool	14 CFR Part 77, as applicable 14 CFR § 77.9	Information to support consultation between the FAA and the DoD has been provided in this COP (Section 4.4.10, Aviation and Radar and Appendix T, Obstruction Evaluation and Airspace Analysis). FAA coordination for the onshore portion of the project will occur following further detailed engineering of structures, when structure heights have been determined.
U.S. Department of Defense (DoD)	Consultation	Public Law 114-92, National Defense Authorization Act (NDAA) of 2016, Amendment to § 358, FY11 NDAA	Information to support consultation between the federal permitting agencies and DoD has been provided in this COP (Section 4.4.8, Department of Defense and Outer Continental Shelf National Security Maritime Uses and Appendix S, Navigation Safety Risk Assessment).
EPA, Region 3, Air Programs Branch	OCS Air Permit	Clean Air Act 42 U.S.C. §§ 7401 *et seq*.	The required OCS Notice of Intent (NOI) was submitted to EPA Region 3 and neighboring state agencies (VDEQ and North Carolina Department of Environmental Quality) on November 30, 2020 and anticipates submittal of the initial OCS air permit application in Q2 2022. EPA has delegated authority to VDEQ to issue OCS air permits; however, there is not currently a regulatory avenue for EPA to delegate authority to VDEQ to implement and enforce the requirements of the OCS program beyond 25 nm (46.3 km). As such, EPA will retain responsibility for processing the OCS air permit due to the distance of the Project offshore.

Regulatory Agency	Permit or Approval	Statutory Basis	Status
VDEQ, NCDCM, BOEM	Concurrence with Federal Consistency Certification	Section 307 of the Coastal Zone Management Act (CZMA), 16 U.S.C. § 1456	Information necessary to support the Federal Consistency Certification has also been included in Appendix P, Coastal Zone Management Act Consistency Certifications. On April 7, 2022, VDEQ sent a letter to Dominion Energy requesting that they agree with VDEQ to stay the Commonwealth's federal consistency review for the Project until September 1, 2022. On April 12, 2022, Dominion Energy provided a response to that letter agreeing to the stay, which allows the Commonwealth to collect additional information from the BOEM draft EIS, scheduled to be issued on August 1, 2022. Dominion Energy anticipates that BOEM's draft EIS, along with additional information provided in the COP will provide sufficient information for VMRC to determine the Project's consistency with the Marine Fisheries enforceable policy within the 3-nm (5.6-km) offshore jurisdictional reach of the Commonwealth.
VMRC	Submerged Land Permit	Code of Virginia §28.2-1200 through §28.2-1213; 4 VAC 20	Approval will be obtained through the Joint Permit Application Process. Information to support the acquisition of the authorization has been provided in this COP (Section 1.0, Introduction, Section 2.0, Project Siting and Design Development, Section 3.0, Description of Proposed Activity, Section 4.0, Site Characterization and Assessment of Impact-Producing Factors, and Appendix K, Conceptual Project Design Drawings).
VDEQ	Water Quality Certification Virginia Water Protection Permit	CWA Section 401	Approval will be obtained through the Joint Permit Application Process. Information to support review of the Project under the CWA has been provided in this COP (Section 1.0, Introduction, Section 2.0, Project Siting and Design Development, Section 3.0, Description of Proposed Activity, Section 4.0, Site Characterization and Assessment of Impact-Producing Factors, and Appendix K, Conceptual Project Design Drawings).

Regulatory Agency	Permit or Approval	Statutory Basis	Status
	Conformity Determination	Clean Air Act 42 U.S.C. §§ 7401 *et seq.*	Dominion Energy has been informed by EPA and VDEQ that General Conformity requirements (40 CFR 93 Subpart B) apply. VDEQ is currently in the process of updating its State Implementation Plan, which includes a maintenance plan for the Hampton Roads Air Quality Control Region, and Dominion Energy has submitted estimated emissions for inclusion in the State Implementation Plan.
	Emergency Generator General Permit	9 VAC §5-540-90	An emergency generator general permit application will be submitted to VDEQ and approval received prior to construction if required.
	Construction Stormwater General Permit Authorization	9 VAC §25-31-170	Information to support the acquisition of the authorization will be provided upon approval of the COP.
	Stormwater Pollution Prevention Plan	9 VAC §25-870-55	Information to support the acquisition of the authorization will be provided upon approval of the COP.
	Erosion and Sediment Control Plan	9 VAC §25-840	Information to support the acquisition of the authorization will be provided upon approval of the COP
Virginia State Corporation Commission (SCC)	Certificate of Public Convenience and Necessity (CPCN)	Code of Virginia § 56-265.2	Construction and O&M of transmission lines and/or facilities above 115 kV in Virginia requires the issuance of a CPCN from the State Corporation Commission. A Coordinated Environmental Review facilitated by VDEQ will be conducted. The CPCN Application was submitted to the SCC on November 5, 2021.
Virginia Department of Conservation and Recreation (VDCR)	Virginia Scenic Rivers and invasive species consultation; invasive species management plan	N/A	To be conducted in support of permit applications.
Virginia Department of Wildlife Resources (VDWR)	Natural heritage/protected species consultation	N/A	To be conducted in support of permit applications.
Virginia Department of Historic Resources (VDHR)	Historic properties consultation	N/A	To be conducted in support of permit applications.
Virginia Department of Agriculture and Consumer Services (VDACS)	Consultation	N/A	To be conducted in support of permit applications.
Virginia Department of Forestry (VDOF)	Consultation	N/A	To be conducted in support of permit applications.

Regulatory Agency	Permit or Approval	Statutory Basis	Status
City of Virginia Beach	Floodplain Development Permit Land Disturbance Permit Conditional Use Permit/Site Plan Review	To be determined	Information to support the acquisition of the authorization will be provided upon approval of the COP.
Chesapeake	Floodplain Development Permit Conditional Use Permit/Site Plan Review	To be determined	Information to support the acquisition of the authorization will be provided upon approval of the COP.
Local Wetlands Board Virginia Beach	Local Wetlands Approvals	To be determined	Approval will be obtained through the Joint Permit Application Process. Information to support review of the Project under the has been provided in this COP (Section 4.1.2, Water Quality and Appendix U, Wetland Delineation Report).
Various Virginia Counties / Municipalities, and Virginia Department of Transportation	Transportation permits if needed; use of wide load and similar vehicles on public roads	24 VAC §30-151	Information to support the acquisition of the authorization will be provided upon approval of the COP.

1.5 Agency and Public Outreach

Starting with initial planning and subsequent execution and delivery of the Lease in November 2013, Dominion Energy has undertaken a comprehensive engagement and outreach campaign. The purpose of this program has been to solicit feedback from Project stakeholders, including federal, state and local regulatory and resource management agencies, elected officials, interest groups, and the public to advance the permitting and development process and to create positive awareness of the Project by highlighting local community, statewide, and regional benefits.

Outreach in support of development of the CVOW Pilot and Commercial Projects has been ongoing since 2011. From 2011 to 2014, Dominion Energy consulted with Virginia stakeholders during the earliest stages of development and planning. From 2015 to present, Dominion Energy has completed more than 20 required studies and surveys. In 2019, Dominion Energy began to meet with federal, state, and local officials and other stakeholders to discuss the Project. At these meetings, Dominion Energy provided background information on the Project, including the scope, proposed environmental surveys and evaluations, and the anticipated timing of the permit applications. Appendix L, Summary of Agency and Stakeholder Engagement, summarizes the agency coordination and pre-application meetings conducted on behalf of the Project through April 15, 2022. Attendees, meeting agendas and meeting notes can be provided for individual meetings upon request.

Dominion Energy recognizes the importance of commercial and recreational fisheries in the Hampton Roads region and brought on a dedicated Fisheries Liaison Officer (FLO) in 2017, who has been coordinating with fisheries stakeholders to facilitate communications for this Project within the commercial and recreational fishing community. Engagement with the commercial and recreational fishing community has been ongoing since 2012 through the CVOW Pilot Project, which provided stakeholders with a high degree of baseline knowledge about Dominion Energy's plans to develop offshore wind projects in Virginia. Dominion Energy will continue to build on these efforts for the life of the CVOW Commercial Project as described in more detail in Section 4.4.6, Commercial and Recreational Fishing and Appendix V, Fisheries Communication Plan.

Dominion Energy also contacted Native American tribes to invite them to be a part of the Project process and to request information to be considered in the document. Dominion Energy intends to continue tribal coordination and anticipates that this early and ongoing consultation will lead to a more streamlined and effective permitting process for the Project. Project information was also provided during this time period to stakeholders representing various interest groups, including maritime stakeholders such as the Virginia Maritime Association, the Virginia Pilot Association, the American Waterways Operators, the Port of Virginia, Virginia Power commercial customers, State Military Reservation (SMR), the U.S. Coast Guard (USCG), the U.S. Navy (Navy), the Hampton Roads Alliance, and the Cities of Chesapeake and Virginia Beach. On November 12, 2020 Dominion Energy hosted an interagency meeting to provide a Project overview to key regulatory stakeholders. In 2021, Dominion Energy continued to engage other industry stakeholders, as well as elected officials representing the region by hosting in-person and virtual open houses in June and August 2021.

Dominion Energy is committed to continued stakeholder communications and effective public outreach. The public outreach program includes the following:

- Identifying and meeting with local associations, citizen groups, environmental justice communities, and other non-governmental organizations to inform them about the Project and address any issues that may be raised;
- Establishing key advisory/research partnership roles with the Virginia Institute of Marine Science (VIMS) and the Virginia Aquarium;
- Meeting with key federal, state, and local agencies, elected officials, and other potentially interested stakeholders to identify issues;
- Holding public and virtual open houses to provide information about the Project; and
- Maintaining a Project-specific web site with information on the status of the Project[5]. Details available on the web site include: a description of the Project, including photos and visual simulations; news briefs; contacts for additional information; and other appropriate Project-related information.

A summary of Dominion Energy's stakeholder engagement and outreach through April 15, 2022 is provided in Appendix L.

1.6 Company Overview

Dominion Energy is a power and energy company headquartered in Richmond, Virginia that operates in 16 states across the U.S., offering clean, safe, reliable, and affordable energy to more than 7.5 million customers. Dominion Energy's operating segments include power generation, power delivery, and gas infrastructure, and fall into two basic categories of service: making energy and moving energy. Dominion Energy invests in the communities where is operates and its employees live and work and strives to protect the natural resources within those communities. Dominion Energy's first and most important core value is to send every employee home safe and sound, every day. Dominion Energy's mission is to serve its customers safely and reliably; strengthen communities; minimize environmental impact; and reward shareholders.

Through efforts to work towards sustainability, Dominion Energy reduced carbon dioxide emissions by 70 percent since 2005 and set a goal of net zero carbon and methane emissions by 2050 for both the electric and natural gas businesses. Currently, more than 85 percent of Dominion Energy's energy generation comes from clean energy sources or natural gas. Investments in infrastructure and new projects, such as offshore wind generation, solar and battery storage, facilitate its goal to better serve its customers and protect the planet.

Dominion Energy's dedication to a clean environment continues to be reflected in renewable energy initiatives. Dominion Energy's current renewable energy portfolio includes more than 4,600 MW of solar generation in operation or under development. When fully operational, Dominion Energy's combined resources can supply power to more than 1.1 million typical households at peak output. Dominion Energy has the third-largest solar portfolio among utility holding companies in the U.S., and plans to add nearly 16,000 MW of solar over the next 15 years, which is nearly a 40-fold increase from current capacity.

[5] https://coastalvawind.com/

Dominion Energy's CVOW Pilot Project, a two 6-MW wind turbine project on a site leased by the Virginia Department of Energy (Virginia Energy, formerly the Virginia Department of Mines, Minerals and Energy [DMME]), completed construction in October 2020 and commenced commercial operation in January of 2021. This will further inform development for the Project in the adjacent Virginia Wind Energy Area leased by Dominion Energy from BOEM. It will also help create the expertise and the necessary domestic supply chains that will ultimately lower the costs of offshore wind development.

1.7 Authorized Representative and Designated Operator

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

Name of Authorized Representative	Joshua J. Bennett
Title	Vice President, Offshore Wind
Phone Number	(804) 638-0248
Email	joshua.j.bennett@dominionenergy.com
Address	707 East Main Street, Richmond, VA 23219

1.8 Certified Verification Agent

Pursuant to 30 CFR § 585.705, a CVA must be engaged to certify to BOEM that the proposed facility is designed to withstand the environmental and functional load conditions for the intended life of a project at its proposed location. In accordance with 30 CFR § 585.706, Dominion Energy has included the CVA nomination and BOEM's CVA approval, received February 2, 2022, as Appendix M under confidential cover.

1.9 Financial Assurance

In accordance with 30 CFR § 585.516, Dominion Energy is required to provide BOEM a supplemental bond, a decommissioning bond, or other financial assurance to assure that lessee obligations can be fulfilled prior to issuance of the COP. BOEM, however, has the authority to allow evidence of financial strength and reliability to meet financial assurance requirements, as detailed in 30 CFR § 585.527. BOEM approved Dominion Energy's use of financial strength for the CVOW Pilot Project.

Dominion Energy has a strong financial standing and a long history of undertaking, self-funding, or obtaining the necessary financing for large infrastructure projects in a responsible manner. Demonstration of financial strength as required by 30 CFR § 585.527 will be provided during the COP process.

1.10 Design Standards

Dominion Energy is currently developing individual codes and standards documents for each of the four offshore technical areas: Foundations, Offshore Substations, Inter-Array and Offshore Export Cables, and WTGs. These documents will be reviewed by the CVA prior to submission to BOEM. The CVA will finish the review of each document with a letter approving the use of standards. For each of the four technical areas, Dominion Energy will provide the codes and standards documents together with the CVA letters to BOEM for review and comment. The Hierarchy of Standards is provided in Appendix B.

2 PROJECT SITING AND DESIGN DEVELOPMENT

The Project has evolved through considerable iterations since an initial conceptual study was completed more than 10 years ago (Dominion Virginia Power 2010) in response to the establishment of the Virginia Offshore Wind Development Authority (VOWDA) to promote the development of wind resources off of Virginia's Atlantic coast. Dominion Energy's commitment to offshore wind led to the development of the CVOW Pilot Project (formerly called the Virginia Offshore Wind Technology Advancement Project [VOWTAP]) starting in 2013, which completed construction in 2020 and is located adjacent to the Project on a separate research lease. For the Project, Dominion Energy secured the Lease from BOEM (2013) through a competitive bidding process in 2013, with the intent to develop between 2,500 MW and 3,000 MW (2.5 to 3.0 gigawatts [GW]) of renewable energy by January 2028.

Since acquiring the Lease in 2013, Dominion Energy considered numerous potential options and alternatives to support the selection of the PDE for the Project to allow for flexibility in engineering and design. This PDE facilitates the advancement of the Project review and approval processes through BOEM under the terms of the Lease as well as other federal, state, and local regulations. This process has involved both siting and design alternatives for Project elements such as alternative locations for the Project's infrastructure, foundation designs, and technological infrastructure (e.g., onshore grid connections, onshore and offshore substation locations, export/transmission cable routes, WTGs, and WTG layouts).

This section describes the Project siting, components, and technology that are being considered in defining the PDE for the Project, in accordance with BOEM's *Guidelines for Information Requirements for a Renewable Energy Construction and Operations Plan* ([COP Guidelines] BOEM 2020). This section presents a description of the development and evolution of the PDE from the Lease Area to the Point of Interconnection (POI) and includes key project components within that footprint. Project overview maps are included throughout this section where applicable.

2.1 Project Siting and Design

The siting process started with BOEM's evaluation of the Virginia WEA in its environmental assessment of commercial wind lease issuance and site assessment activities (BOEM 2012). This resulted in the designation of the Lease Area, with Dominion Energy as the leaseholder, and proposed development of the Project.

Dominion Energy has been engaged in Project siting activities since the Lease was signed in 2013. Project siting has been conducted with respect to submarine and terrestrial constraints to identify the most feasible and least impactful means to deliver energy from the Project to the electric power transmission grid. The evolution of the PDE is informed by several factors, including: desktop assessments, site-specific surveys and analyses; supply chain capacity; commercial availability; and, engagement with regulators and stakeholders (a complete record of stakeholder outreach and engagement is provided in Appendix L, Summary of Agency and Stakeholder Engagement). Where available, existing public data was also used to inform the siting assessment. The following sections document the criteria used in evaluating various alternatives and refining the components that define the PDE.

2.1.1 Key Offshore Project Components

The Offshore Project Area includes the entire Lease Area, where between 176 and 205 WTGs and three Offshore Substations and the Inter-Array Cables would be installed, and the Offshore Export Cable Route Corridor where up to nine export cables would be installed pursuant to approved right-of-way (ROW).

2.1.1.1 Wind Turbine Generator Layout

Dominion Energy's identified Preferred Alternative based on all relevant legal and practical considerations (Preferred Alternative) would achieve the Commonwealth of Virginia's legislative requirement of between 2,500 MW and 3,000 MW of offshore wind energy using the highest-capacity WTG available at the time of Project execution. The layout would allow spacing of WTGs of 0.75 by 0.93 nm (1.39 by 1.72 km) in an offset grid pattern and would include three Offshore Substations placed in the rows in the grid pattern. The Offshore Project Components are expected to be developed over a three-year construction period beginning in 2024.

The number of WTGs required was determined as part of the WTG selection process to include the number of turbines required to reach the required capacity of the Project, including some spare positions for contingency and the potential opportunity to achieve a higher total capacity. In evaluating layout options for the WTGs, Dominion Energy has considered the array of existing marine uses within the Lease Area, including shipping, commercial/recreational fishing, Department of Defense (DoD) training and testing, and Department of Homeland Security activity. These marine uses, in addition to environmental constraints, were factored into the engineering analysis of available conceptual options in developing the PDE.

From a power-generation perspective, the preferred layout is to have the WTGs arranged in such a way that the total wake effects for the individual turbines are minimized, which together with an aim to maintain a uniform layout to ease navigation, resulted in an offset grid pattern as part of the PDE. The spacing provided within this offset grid pattern is anticipated to be consistent with the findings expected to be published in the Final USCG Atlantic Coast Port Access Route Study. See Section 3, Description of Proposed Activity, for additional information on the turbine layouts carried forward in the PDE.

The fish haven area, located along the northern boundary of the Lease Area, includes several charted wrecks, debris, and other intentionally scuttled items that compose an array of artificial reef sites. While this area is included in the PDE for the Project, Dominion Energy has developed several layout options with the fish haven as an exclusion zone (e.g., without WTGs, Inter-Array Cables, or other infrastructure). Alternatively, if seabed conditions within the fish haven area are feasible to support the buildout of WTGs, such development may be a favorable addition of vertical hard structure within this fish haven area where placement of structure, in addition to increased capacity for the Project, may be beneficial to marine resources, recreational fishing, and other marine uses within the fish haven area.

The possibility of a layout with corridors of 1 nm in one or both directions in the layout grid was assessed; however; 1 nm spacing would preclude the Lease Area from attaining the goal in the Virginia Clean Economy Act to achieve a project capacity of between 2,500 MW and 3,000 MW of offshore wind power by 2028. The WTG selected for the Project has the largest capacity of any WTGs currently available in the market, and it is not possible to place a sufficient number of WTGs within the Lease Area to achieve the required name plate capacity without having WTG spacing smaller than 1 nm by 1 nm (1.9 km by 1.9 km).

During the WTG selection process, the following alternative layouts were initially considered but not carried forward, in part due to even closer spacing than proposed using SG 14-222 DD 14 to 16-MW WTGs: 217 WTGs with individual capacity of 12 MW and 274 WTGs with individual capacity of 9.5 MW. Those layouts were not carried forward because they were less attractive not only from a cost-benefit perspective, but also would also result in a significantly larger environmental impact, particularly seabed disturbance and underwater noise emission due to a larger number of foundation positions to install. More information on impacts of underwater noise can be found in Section 4.2.5, Marine Mammals and Section 4.2.6, Sea Turtles. Furthermore, those alternative layouts would significantly increase the number of WTGs, resulting in even tighter spacing than the Preferred Alternative.

Table 2.1-1 summarizes the WTG layout Alternatives and identifies those that were eliminated and those that are carried forward in the Preferred Alternative and PDE for the Project. The WTG spacing for the Preferred Alternative is shown within the context of vessel types common to the Offshore Project Area in Figure 2.1-1. The Project overview is shown in Figure 2.1-2 and the Preferred Alternative WTG layout is shown below in Figure 2.1-3.

Table 2.1-1. WTG Layout Alternatives

Layout Option	Number of WTGs & Offshore Substations	Spacing of WTGs	Description	Carried Forward in the PDE?
Alternative 1 (Preferred Alternative and Minimum Design Scenario)	176 WTG positions 3 Offshore Substations	East-West = 0.93 nm Northwest-Southeast = 0.75 nm	176 WTGs (SG 14-222 DD, 14.7 MW each, with power boost)	Yes – Preferred Alternative and Minimum Design Scenario
Alternative 2 (Maximum Design Scenario)	205 WTG positions 3 Offshore Substations	East-West = 0.93 nm Northwest-Southeast = 0.75 nm	205 WTGs (SG 14-222 DD, 14 to 16 MW each)	Yes – Maximum Design Scenario
Alternative 3	142 WTGs, 2 to 3 Offshore Substations	East-West = 1.00 nm North-South = 1.00 nm	142 WTGs (14 to 16 MW each) including positions within the fish haven area	No; Will not meet the goals in the Virginia Clean Economy Act with 2.5 to 3.0 GW in service by Jan 2028
Alternative 4	274 WTGs, 2 to 3 Offshore Substations	East-West = approx. 0.60 nm Northwest-Southeast = approx. 0.80 nm	274 WTGs (9.5 MW each) including positions within the fish haven area	No; Will not meet the goals in the Virginia Clean Economy Act with 2.5 to 3.0 GW in service by Jan 2028
Alternative 5	217 WTGs, 2 to 3 Offshore Substations	East-West = approx. 0.65 nm Northwest-Southeast = approx. 0.90 nm	274 WTGs (12 MW each) including positions within the fish haven area	No; Will not meet the goals in the Virginia Clean Economy Act with 2.5 to 3.0 GW in service by Jan 2028
Alternative 6	Not determined	Not determined	Up to 4 stages of development, approximately 400 to 600 MW each.	No; Was explored early in the Project development but later eliminated as an Alternative. Dominion Energy made an operational decision for the Project not to proceed with phased development, but to develop the full Lease Area over a period of three years of construction.

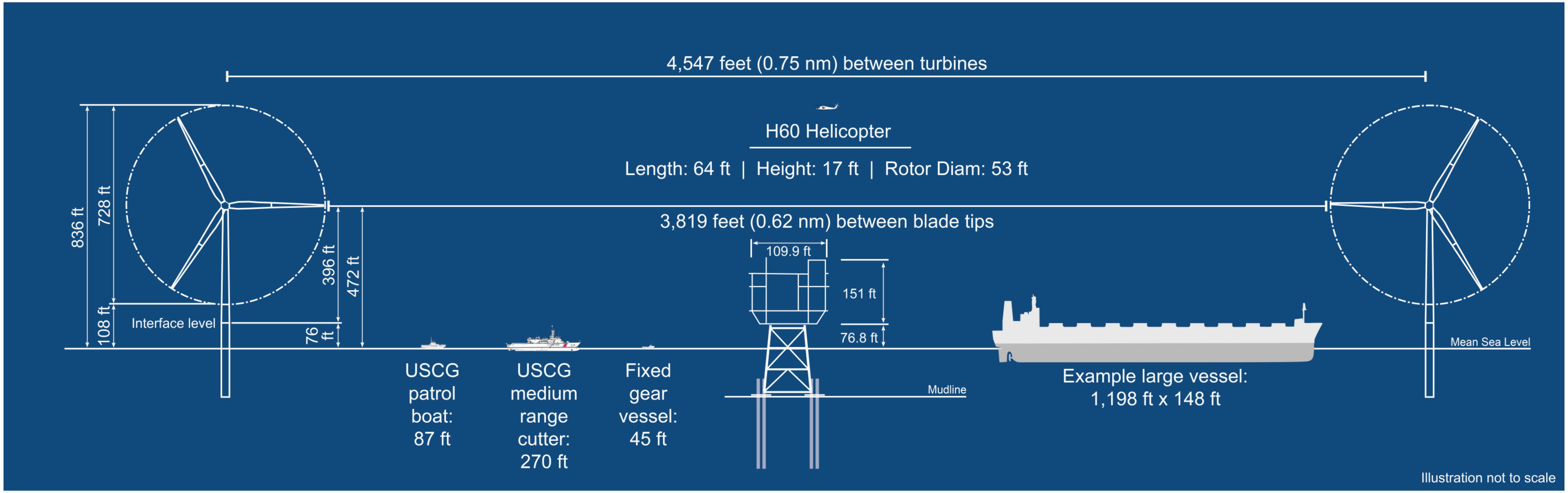


Figure 2.1-1. Scaled Representation of Vessel Types Common to the Offshore Project Area Relative to WTG Rotor Diameter and 0.75 nautical mile (nm) Turbine Spacing

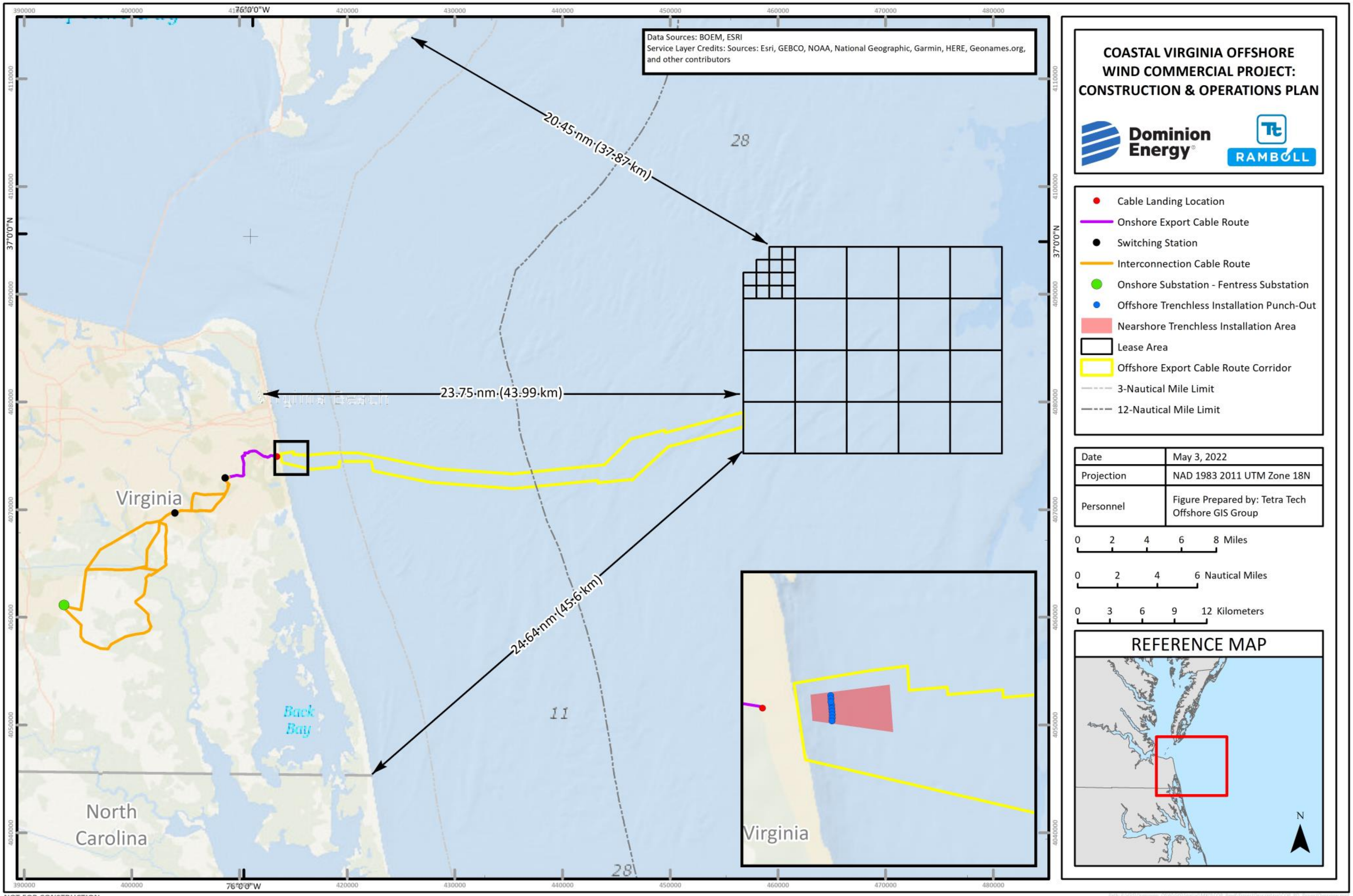


Figure 2.1-2. CVOW Commercial Project Overview

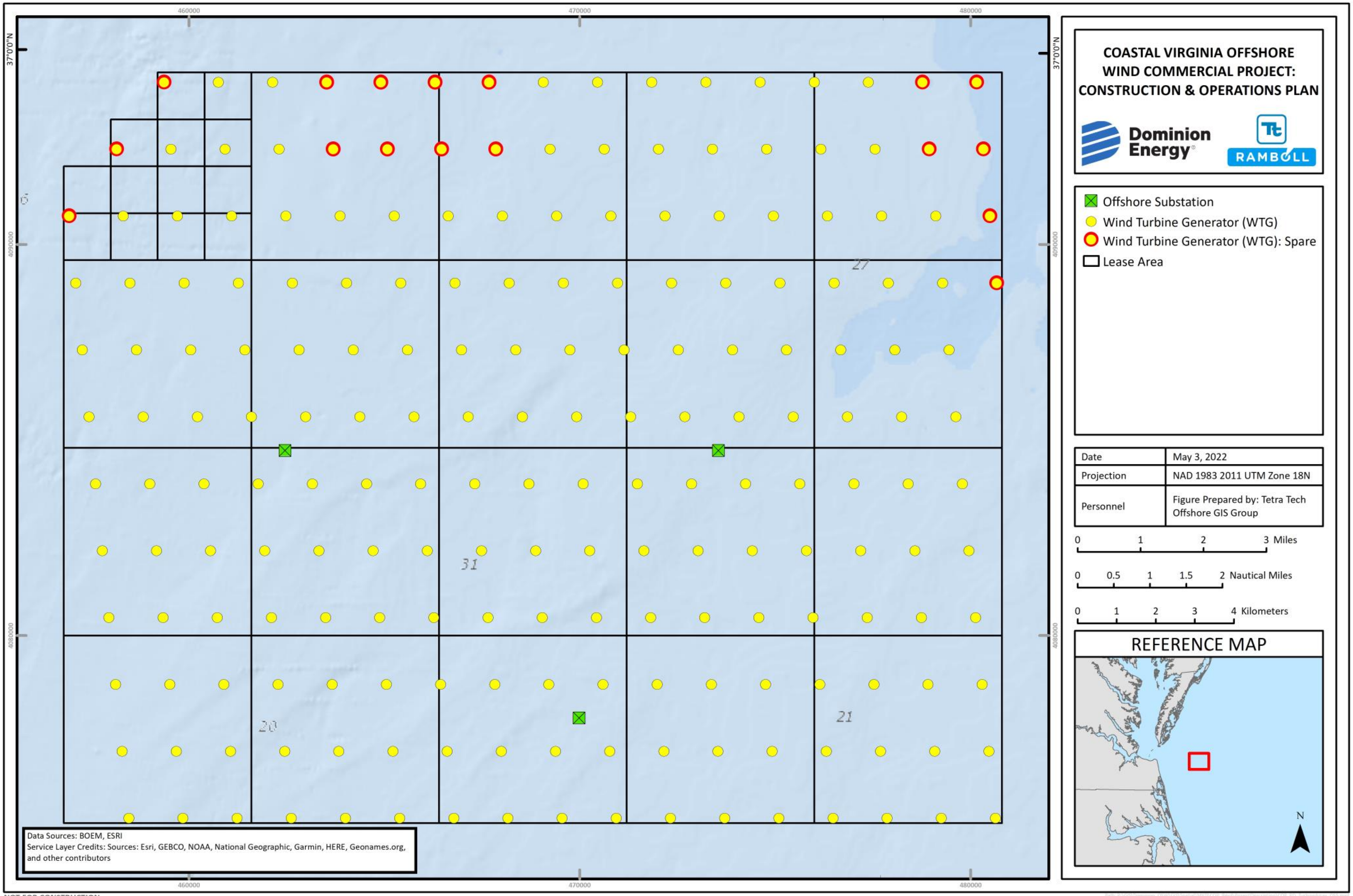


Figure 2.1-3. WTG and Offshore Substation Layout for the Maximum Design Scenario

2.1.1.2 Offshore Export Cable Routing

An offshore routing constraints analysis was conducted along the Offshore Export Cable Route Corridor as well as the adjacent CVOW Pilot Project cable route, dating back to 2013 when the Project was first identified. Constraints analyses have been conducted and are identified in Appendix W, Preliminary Cable Burial Risk Assessment. This constraints analysis identified potential Offshore Export Cable Routes; evaluated routing feasibility; and identified other challenges associated with existing cable assets, such as the Dam Neck Ocean Disposal Site (DNODS), and Navy training and testing locations. The potential challenges and complexities of the offshore export cable routing (e.g., length, seabed features, burial depth, installation hazards, biological/cultural resources, commercial/recreational fishing, etc.) were considered as part of the selection criteria for the Preferred and Alternative Cable Landing Locations. To the extent possible, the most direct route served as the starting point in developing the Offshore Export Cable Route Corridor. This also is driven by technical constraints and costs, including cable costs, installation time, and limits associated with available and efficient HVAC transmission (see Appendix W, Preliminary Cable Burial Risk Assessment for additional details). Additional discussion regarding high-voltage direct-current (HVDC) as an alternative for cable technology is provided in Section 2.2.5, Offshore Export Cables.

As described in Section 4.1.1, Physical and Oceanographic Conditions, the seabed offshore of Virginia Beach is predominantly characterized as fine to medium-grained sand with isolated patches of coarse-grained sand and occasional gravel. Grab samples collected during the 2013 Fugro HRG Survey contained primarily poorly to well-graded sand and silty sand. Shallow- and medium-penetration sub-bottom profiler data collected during the 2013 Tetra Tech CVOW Pilot Project survey (Tetra Tech 2013), the 2013 Fugro HRG survey (Fugro 2013), and the 2020/2021 TerraSond/Alpine HRG surveys as well as the 2020 geotechnical investigations indicate that the seabed is typically composed of unconsolidated sand with interbedded silt, clay, and gravel. These seabed conditions are generally amenable to facilitate cable burial, except in areas of existing cable crossings.

The U.S. Army Corps of Engineers (USACE) typically manages and regulates dredged and maintained channels. The location and depths of navigation channels are authorized by the federal government, and the USACE periodically performs condition surveys to identify when maintenance dredging may be needed to keep channels available at the authorized depth. Should a cable route cross a maintained channel, it must be buried deep enough below the authorized depth to ensure that the channel can be maintained safely without posing a risk to the cable and must account for future increases in channel depth. As such, the crossing of federally maintained channels should be avoided to the extent practical by the cable routing. According to USACE guidance, offshore export cables are required to be buried 15 ft (4.6 m) below the federally authorized channel depth or 15 ft (4.6 m) below the existing seabed, whichever is deeper, to minimize the chance of interaction with maintenance dredging of channels. Although the Offshore Export Cables for this Project will not cross any navigation channels, the USACE Norfolk District will be engaged throughout the planning and engineering processes so that Dominion Energy fully understands plans to re-align or deepen the Atlantic Ocean Channel (AOC) and confirm where dredged materials would be deposited, relative to the proposed Offshore Export Cable Route Corridor.

Dominion Energy prepared a Preliminary Cable Burial Risk Assessment (Appendix W); a probabilistic method to determine a recommended depth of lowering (DOL) at each point along the cable route that will protect the cable from external aggression and minimize risk both to and from the cable. In order to achieve the target DOL, a burial tool capable of the target trench depth will be specified. A summary of the pre-mitigation Preliminary Cable Burial Risk Assessment (Appendix W) findings is as follows:

- **Anchoring**: The initial probabilistic study indicates that a depth of lowering not less than 3.3 ft (1.0 m) is necessary, with up to 8.2 ft (2.5 m) in select segments based on risk tolerance and pending more detailed additional information;
- **Vessel traffic/navigation channels**: The Offshore Export Cable Route Corridor passes close to the southern extent of the USACE maintained deep water shipping channel (Chesapeake Southern approaches). It is understood that there are potential initial plans to extend the channel, as well as the possibility of deepening it to accommodate larger vessels;
- **Military activity**: The approaches to Chesapeake Bay are heavily trafficked by Navy vessels. Such traffic may or may not be visible via Automatic Identification System data; therefore, this specific risk to the cable is difficult to quantify;
- **Dropped objects**: Due to the volume of commercial and military vessels transiting the area, dropped objects are a risk and should be further studied;
- **Fishing**: The area is lightly fished. Fishing-related risk mitigation is not considered to be a major driver of the overall burial depth along the Offshore Export Cable Route;
- **Sediment mobility**: Mobile sediments and sand waves are present, particularly the central and eastern sections of the Offshore Export Cable Route Corridor, though mobile seabed is not anticipated to be extreme and should be mitigated through additional burial depth and/or pre-installation clearing of sand waves or ridges;
- **Unexploded Ordnance (UXO)/Munitions and Explosives of Concern (MEC)**: Due to the Virginia Capes (VACAPES) Operating Area and associated firing range, UXO/MEC is a concern, particularly from anti-aircraft munitions;
- **Geotechnical** (soft seabed, hard soils, etc.): Seabed conditions are generally suitable to reaching target burial depths of 6.6 to 9.8 ft (2 to 3 m) through the use of properly selected burial tools. Some areas of dense sands and very stiff clays should be expected. Softer seabed and loose sands may also allow increased penetration by anchors in some limited areas of the Offshore Export Cable Route Corridor;
- **Dredging/dumping/borrow areas/mining**: The maintained Atlantic Ocean Channel and the associated DNODS both occur in close proximity to the Offshore Export Cable Route and will be part of discussions with the USACE to understand specific burial requirements. Some risk due to these activities will remain and shall be mapped out and refined as more data and information become available; and
- **Crossings/other cable assets**: The preliminary Offshore Export Cable Route crosses three in-service fiber optic cables. Additionally, there are potential conflicts with those cables plus an extra installed (unoccupied) duct at the shore landing site. Detailed analysis and design of the crossings must occur in conjunction with negotiations with these cable asset owners and should also account for the risk of anchor strikes and related factors.

The Offshore Export Cable Route would need to run parallel to the CVOW Pilot Project export cable (in-service since October 2020), as well as cross three in-service telecommunications cable systems: MAREA, BRUSA, and DUNANT. All three of the telecommunications cable systems approach from the east and land at the Croatan Beach parking lot.

Though the details of the cable are not available to the public, it is inferred that a Navy subsea cable asset was installed approximately 4 nm (7 km) south of the Offshore Export Cable Routes. The only evidence of this cable asset that has been located in the public domain is referenced in the Final Environmental Assessment (EA) for the Sandbridge Beach Erosion Control and Hurricane Protection Project on Virginia Beach in 2018 (USACE 2018). In addition, the Offshore Export Cable Route Corridor separating the two sand resource area polygons due south of DNODS is another indication that a cable passes through the area.

The Offshore Export Cable Route would also need to cross the DNODS dredged material placement area, which has been used actively for dredged material placement since 1967. The DNODS receives approximately 1.2 million cubic yards of dredged material every two years to support the maintenance dredging of federal navigation channels. Since this is a federally authorized project, Section 408 considerations apply to the DNODS. Offshore Export Cables would be routed in coordination with USACE to minimize interference with planned disposal and/or sand resource extraction activities within the DNODS. The in-service telecommunications cables and the CVOW Pilot Project ROW alignments traverse DNODS Zones 2 and 5, since these are the zones of the DNODS earmarked to receive sediment of a finer nature. Because this material is not suitable for beach nourishment, these cells would not be anticipated to be used as sand borrow areas.

Two sand borrow areas are known to exist in the vicinity of the Offshore Export Cable Route Corridor. The first is offshore of the northern part of the City of Virginia Beach, known as the Cape Henry Borrow Area. The other is the Sand Bridge Borrow Area, located off of Dam Neck/Sand Bridge. These areas represent potential sand resources to be used to replenish eroded beaches to provide important protection from tropical storms to local communities. Impacts to the utility of sand resources may complicate permitting considerations. Sand borrow operations in the vicinity of cables also pose an inherent risk of incident.

Due to the proximity of extensive DoD training and testing operating areas within the VACAPES Range Complex, as well as the onshore proximity of the Navy's Dam Neck Annex to the Cable Landing Locations, the DoD is a major stakeholder to any routes being developed in this area and will continue to be engaged on cable routing plans for the Project. Dominion Energy successfully coordinated these efforts in support of construction of the CVOW Pilot Project and will continue to coordinate throughout development of the Project.

2.1.2 Key Onshore Project Components

The Onshore Project Area includes the Cable Landing Location, Onshore Export Cable Route, the Switching Station, Interconnection Cable Route, and the Onshore Substation.

2.1.2.1 Cable Landing Locations

The Offshore Export Cable Route Corridor includes approaches to all Cable Landing Locations considered. The Offshore Export Cable Route Corridor exits the Lease Area between aliquots 6112 and 6162 and runs west-southwest, roughly paralleling the CVOW Pilot Project corridor. The route then turns to the southwest and crosses the DUNANT, MAREA, and BRUSA telecommunications systems to become the southernmost cable running towards shore. After the crossings, the route turns west-southwest and then west. This keeps the route 0.75 nm (1.4 km) north of the "No-Go" line from the Navy Office of Seafloor Cable Protection for cable systems approaching from the north. The route continues south of the traffic separation scheme (TSS) and the Chesapeake Bay Buoy, running parallel to the CVOW Pilot Project corridor, with no direct overlap with the federal navigation channel. The route then turns to the west-northwest and enters Warning Area 390 and Special Use Airspace (SUA) W-50 and then DNODS Cells 2 and 5. The route continues into the beach crossing R-6606 and Danger Zone 405 before landing at the alternative locations listed below.

The transition from the Offshore Export Cables to the Onshore Export Cables would occur at the Cable Landing Location. Dominion Energy identified the Cable Landing Location as the Proposed Parking Lot, west of the Firing Range at SMR (formerly known as Camp Pendleton), with alternative locations considered but eliminated at a combination of Croatan Beach Parking Lot (five cables) and the SMR Beach Parking Lot (four cables), or the Croatan Beach Parking Lot (all nine cables). Additional alternatives are described below with consideration for engineering, environmental, logistical, and cost constraints. Additional context, descriptions, and assessment of these approaches to the cable landing are discussed in Appendix W, Preliminary Cable Burial Risk Assessment.

The Cable Landing Location and Alternatives considered but eliminated from the PDE are included in Table 2.1-2, shown in Figure 2.1-4, and described further within the subsections below.

Proposed Parking Lot, west of the Firing Range at the SMR

The Cable Landing Location at the Proposed Parking Lot, west of the Firing Range at SMR, would be near the end of Rifle Range Road, adjacent to the existing CVOW Pilot Project landing location. The Proposed Parking Lot, west of the Firing Range at SMR would be suitable for the construction of the trenchless installation vaults and the start of the terrestrial routes. Nearshore trenchless installation in the offshore direction could cross the duct of the existing CVOW Pilot Project and preclude the need for nearshore shallow-water crossings. Horizontal directional drilling (HDD) would also be considered from the landing site to a point inland to minimize impacts to Lake Christine and other features at the SMR. While this Cable Landing Location requires extensive coordination and planning, this option is likely to be the most successful in terms of available space, technical issues, and the mitigation of stakeholder issues relative to the other landing locations considered, and is therefore the only Cable Landing Location carried forward in the PDE.

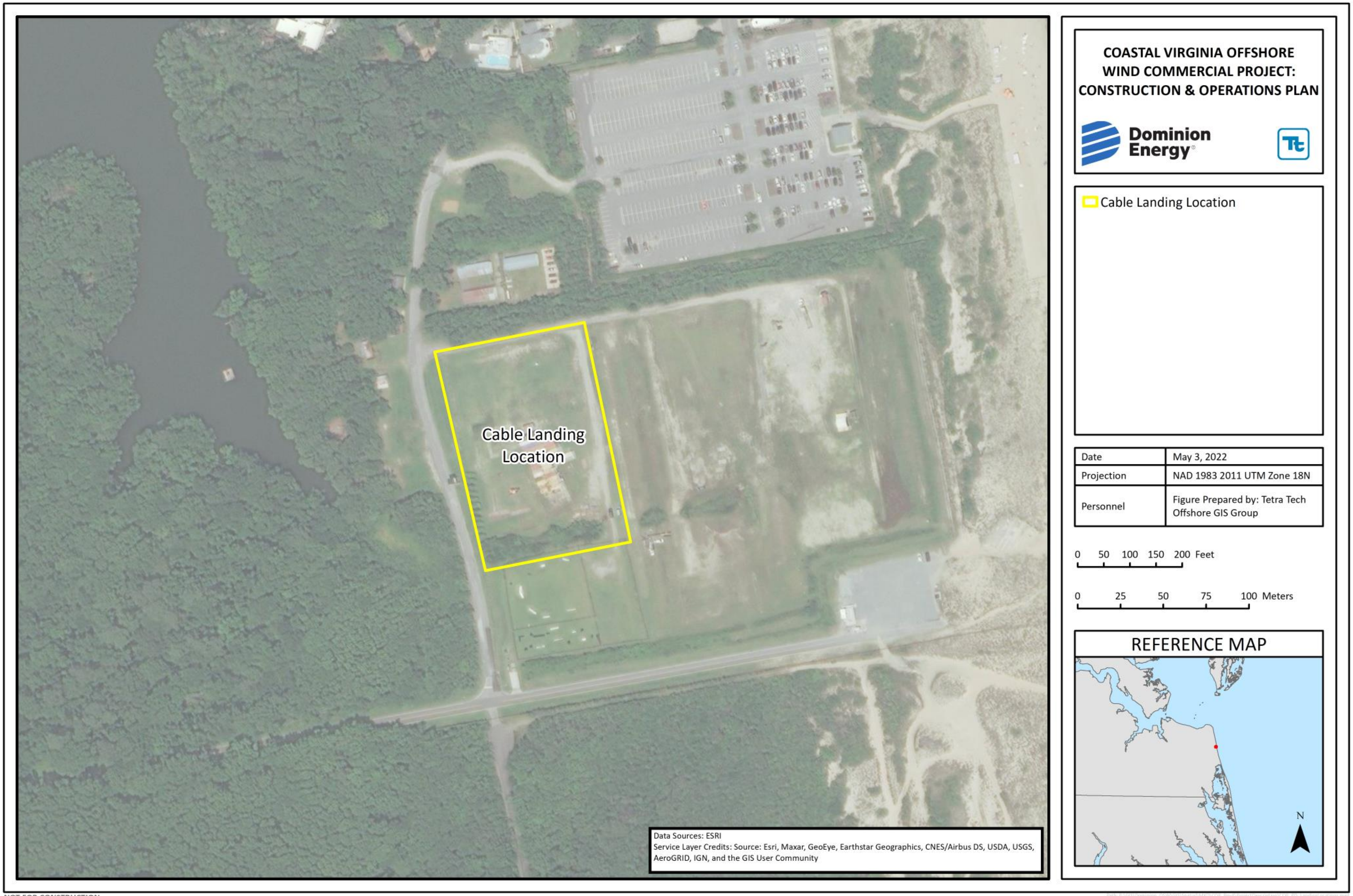


Figure 2.1-4. Onshore Project Components—Cable Landing Location

Table 2.1-2. Cable Landing Location Alternatives

Cable Landing Location	Cable Landing Location Description	Offshore Export Cable Route Distance in nautical mile (kilometer)	Carried Forward in the Project Design Envelope?
Proposed Parking Lot, west of Firing Range at SMR	This would have all nine cables land at the Proposed Parking Lot, west of the Firing Range at SMR, located east of Regulus Avenue and north of Rifle Range Road, directly south of the Croatan Beach parking lot.		Yes
Croatan Beach/SMR Beach Parking Lots – 5/4 Cable Split	This would split the Cable Landing Locations between the Croatan Beach Parking Lot (five cables) and the SMR Beach Parking Lot (four cables). The Croatan Beach Parking Lot is a public parking lot located off of Washington Avenue east of Lake Christine, just north of the SMR. The SMR Beach Parking Lot is near the eastern terminus of Rifle Range Road, located directly south of the Croatan Beach parking lot and adjacent to the existing CVOW Pilot Project landing location.	24.4 (45.1)	No
Croatan Beach Parking Lot	This would have all nine cables land at the Croatan Beach Parking Lot.		No
Rudee Inlet	This potential Cable Landing Location would be on either the north or south side of Rudee Inlet or on the Rudee Heights peninsula behind General Booth Boulevard and conveyed under the inlet and associated channel and dredging areas via horizontal directional drilling, then run along General Booth Boulevard to the Switching Station.	24.1 (44.7)	No
Croatan Neighborhood	This potential Cable Landing Location runs into a vacant lot in the Croatan Beach neighborhood.		No
10th Street Virginia Beach	This potential Cable Landing Location runs into a vacant lot on 10th Street.		No
Dam Neck Annex	This potential Cable Landing Location is off Dam Neck Road near the Dam Neck Naval Annex.	24.6 (45.5)	No
Sandbridge Road	This potential Cable Landing Location is in the vicinity of Sandbridge Road, near the Back Bay Wildlife Refuge.	23.6 (43.7)	No

Croatan Beach Parking Lot

The Croatan Beach Parking Lot is a public parking lot located off Washington Avenue east of Lake Christine, just north of the SMR. The Croatan Beach Parking Lot has also previously been used for fiber optic cable landing locations via HDD. The location of the existing fiber infrastructure proves a positive from the perspective of technical feasibility, adequate layout space, and ability to use the area for offseason construction without causing undue detriment to the local community and stakeholders. Nearshore trenchless installation from this lot could traverse under the existing telecommunications cable HDD ducts, mitigating the need for nearshore shallow-water cable asset crossings, which can be complex and prone to issues due to sediment mobility. To implement this, detailed deconfliction of the nearshore trenchless installation and landing areas would be required. Deconfliction of the terrestrial route must also consider the existing fiber optic cable backhaul routes, which further limit space. For reasons stated above, this location is not carried forward in the PDE.

SMR Beach Parking Lot

The SMR Beach Parking Lot is a non-public parking lot located at the end of Rifle Range Road east of Lake Christine, along the beachfront of the SMR. The SMR Beach Parking Lot is also the HDD landing location of the existing CVOW Pilot Project export cable. This location could not accommodate all nine cables, therefore if this location is used it would be part of the 5/4 split (5 cables at Croatan Beach Parking Lot, 4 cables at SMR Beach Parking Lot) and there is adequate layout space to accommodate that configuration without causing undue detriment to the SMR activities. Nearshore trenchless installation from this parking lot could traverse under the existing CVOW Pilot Project cable HDD ducts, mitigating the need for nearshore shallow-water cable asset crossings, which can be complex and prone to issues due to sediment mobility. To implement this, detailed deconfliction of the Nearshore trenchless installation and landing areas would be required. For reasons stated above, this location is not carried forward in the PDE.

Rudee Inlet

Challenges related to this location include the requirement to run an offshore export cable route through the DNODS Cells 2 and 5 to the north of the existing telecommunications cables, to avoid adding nearshore crossings of the fiber cables. This is a deviation from the Offshore Export Cable Route Corridor surveyed in 2020. It may also require further deconfliction of the AOC and TSS, with Section 408 considerations and additional maritime stakeholder involvement. The maintained (dredged) inlet channel, seawalls, and moving sand shoals immediately outside of the inlet could be avoided through the siting of the nearshore trenchless installation. A second trenchless installation from the landing site to a point further inland could further mitigate some of the issues with congestion and limited space for cable routing. For example, a landing immediately north of Rudee Inlet (e.g., near Atlantic Avenue and 2nd Street) could have a nearshore trenchless installation to the southeast, avoiding the inlet and shoreline stabilization features. An additional trenchless installation from that location could convey the cable under the inland portion of Rudee Inlet waterway and allow routing down General Booth Boulevard. Similarly, if a longer nearshore trenchless installation was found to be feasible and if space were available, a landing on the Rudee Heights peninsula behind Rudee Inlet could allow for a single nearshore trenchless installation per cable offshore and facilitate a land cable route down General Booth Boulevard. All of these options have significant land availability and stakeholder constraints that may be fatal flaws upon further investigation. For reasons stated above, this location is not carried forward in the PDE.

Croatan Beach Neighborhood

Challenges related to this cable landing location include the residential location and active neighborhood association. The streets are very narrow, further complicating logistics and physical use of this area, especially in regard to mobilizing nearshore trenchless installation equipment. Installation of the terrestrial route along these narrow streets may not be feasible, especially if multiple cables are landed and a larger duct bank is required to be installed under the street. Narrow streets may not allow for one-way traffic during terrestrial construction, which may limit access to homes and the beaches during installation, potentially representing a fatal flaw to receiving local stakeholder approvals. A terrestrial route to the Switching Station through the Croatan Beach neighborhood would face stakeholder constraints due to the narrow streets and limited access. For reasons stated above, this location is not carried forward in the PDE.

10th Street

The offshore approach to this cable landing location would require crossing of the TSS and the AOC, which would likely trigger the need for deeper burial as dictated by the USACE under the Section 408 process. Should the AOC be deepened in this area in the future, the cable would be installed at a depth where it would remain undisturbed by deeper dredging of the tow-way deep water vessel route. The approach would also pass approximately 1.5 nm (2.8 km) south of the Navy's Shipboard Electronic Systems Evaluation Facilities (SESEF) Buoy. Given the sensitive nature of the testing related to the SESEF, substantial coordination with the DoD would be required to ensure there is no conflict. It is possible that a nearshore trenchless installation rig may be able to set up in the parking lot between 9th and 10th Streets. The nearshore trenchless installation path could then drill along 10th Street to avoid drilling under any building or major structures to access to the shoreline. The offshore and onshore constraints associated with this landing are complex and therefore, this location is not carried forward in the PDE.

Dam Neck Annex

The Dam Neck Annex cable landing location targets a parking lot just south of the Shifting Sands Beach Club. The traverse across the last 3 nm (5.6 km) of the nearshore area is not as perpendicular to the shoreline as is usually preferred for cable routing, due to the need to traverse the DNODS Cells 2 and 5. The more perpendicular approach is usually preferred to get the cable through the surf zone and area of storm wave influence as directly as possible. A potential landing at the Dam Neck Annex was initially investigated due to accessibility and available space at the landing for nearshore trenchless installation operations. As this area is used by the Dam Neck Annex for various activities, infringing on these spaces represents a significant stakeholder issue. Initial discussions with the DoD regarding the Dam Neck Annex indicated that stakeholder issues and permissions to utilize the property for the landing and terrestrial route may not be acceptable and alternative locations should be considered. For reasons stated above, this location is not carried forward in the PDE.

Sandbridge Road

A potential landing in the vicinity of Sandbridge Road was investigated at a desktop level for feasibility. Discussions with the Navy's Office of Seafloor Cable Protection resulted in the determination of an exclusion zone for any subsea cable routes approaching from the north of the Sandbridge Road area. This line originates along the shoreline at Dam Neck Annex and extends to the shelf break to the east. This feature, and perhaps others like it, may be the reason the DoD prohibits any cables approaching from the north from crossing the DoD exclusion line and traversing south across the seabed to the Sandbridge area, which eliminated Sandbridge as a potential offshore export cable landing location. As such, a route to land in the area of the Sandbridge community or any points further south is precluded given this fatal flaw. For reasons stated above, this location is not carried forward in the PDE.

2.1.2.2 Onshore Export Cable Route

The Onshore Export Cables will convey the energy produced by the Project from the Cable Landing Location to a Common Location north of Harpers Road. The Onshore Export Cables will be installed via open trench, microtunneling, and HDD. Onshore Export Cable Route Alternatives associated with routing options from the Cable Landing Location were retained for the PDE (in no particular order), as listed below:

- **Onshore Export Cable Route – Alternative 1 (Not Carried forward in PDE)**: Alternative 1 would have all nine cables land at the Proposed Parking Lot, west of the Firing Range at SMR. The SMR plans to build a parking lot, which would be located between the Cable Landing Location and Regulus Avenue, and the Cable Landing Location would be converted to a parking lot. The 4.7 mi (7.6 km)-long route to the Harpers Switching Station would include a HDD below Lake Christine, running northwest through SMR land, then crossing General Booth Boulevard just south of the Virginia Aquarium with an HDD below Owl Creek and following Bells Road, then crossing South Birdneck Road and coming onto the Naval Air Station (NAS) Oceana Parcel from the east. From the NAS Oceana Parcel, the route proceeds south along Oceana Boulevard, then west along Harpers Road to a Common Location north of Harpers Road.
- **Onshore Export Cable Route – Alternative 2 (Carried forward in PDE)**: This Alternative would also have all nine cables land at the same Proposed Parking Lot, west of the Firing Range at SMR following the same route to the same Common Location north of Harpers Road. The only difference in the 4.3 mi (6.9 km)-long route is that the portion of the route on the NAS Oceana Parcel runs west to Oceana Boulevard instead of turning to the south within the NAS Oceana Parcel before reaching Oceana Boulevard, then on to a Common Location north of Harpers Road.
- **Onshore Export Cable Route – Alternative 3 (Not Carried forward in PDE)**: This Alternative would have five cables land at the Croatan Beach Parking Lot (a public parking lot located off Washington Avenue east of Lake Christine) and four cables land at the SMR Beach Parking Lot. The 4.4 mi (7.1 km)-long route would follow Regulus Avenue, to Rifle Range Road, to General Booth Boulevard, to Oceana Boulevard, coming into the Switching Station on the NAS Oceana parcel, pending Navy approval, from the south.
- **Onshore Export Cable Route – Alternative 4 (Not Carried forward in PDE)**: This Alternative would also have five cables land at the Croatan Beach Parking Lot and four cables land at the SMR Beach Parking Lot. Similar to Alternative 3, Alternative 4 would follow a 2.4 mi (3.9 km)-long route to the Switching Station, with the exception of following South Birdneck Road at the General Booth Boulevard intersection. Alternative 4 would come into the Switching Station on the NAS Oceana parcel, pending Navy approval, from the east.
- **Onshore Export Cable Route – Alternative 5 (Not Carried forward in PDE)**: This Alternative would have all nine cables land at the Croatan Beach Parking Lot. The 4.3 mi (6.9 km)-route to the Switching Station on the NAS Oceana parcel, pending Navy approval would follow Regulus Avenue, to Rifle Range Road, to South Birdneck Road, to General Booth Boulevard, and Oceana Boulevard from the south.
- **Onshore Export Cable Route – Alternative 6 (Not Carried forward in PDE)**: This Alternative would also have all nine cables land at the Croatan Beach Parking Lot, same as Alternative 5, following a similar 2.3 mi (3.7 km)-long route to the Switching Station, with the exception of following South Birdneck Road at the General Booth Boulevard intersection, coming into the Switching Station on the NAS Oceana parcel, pending Navy approval, from the east.

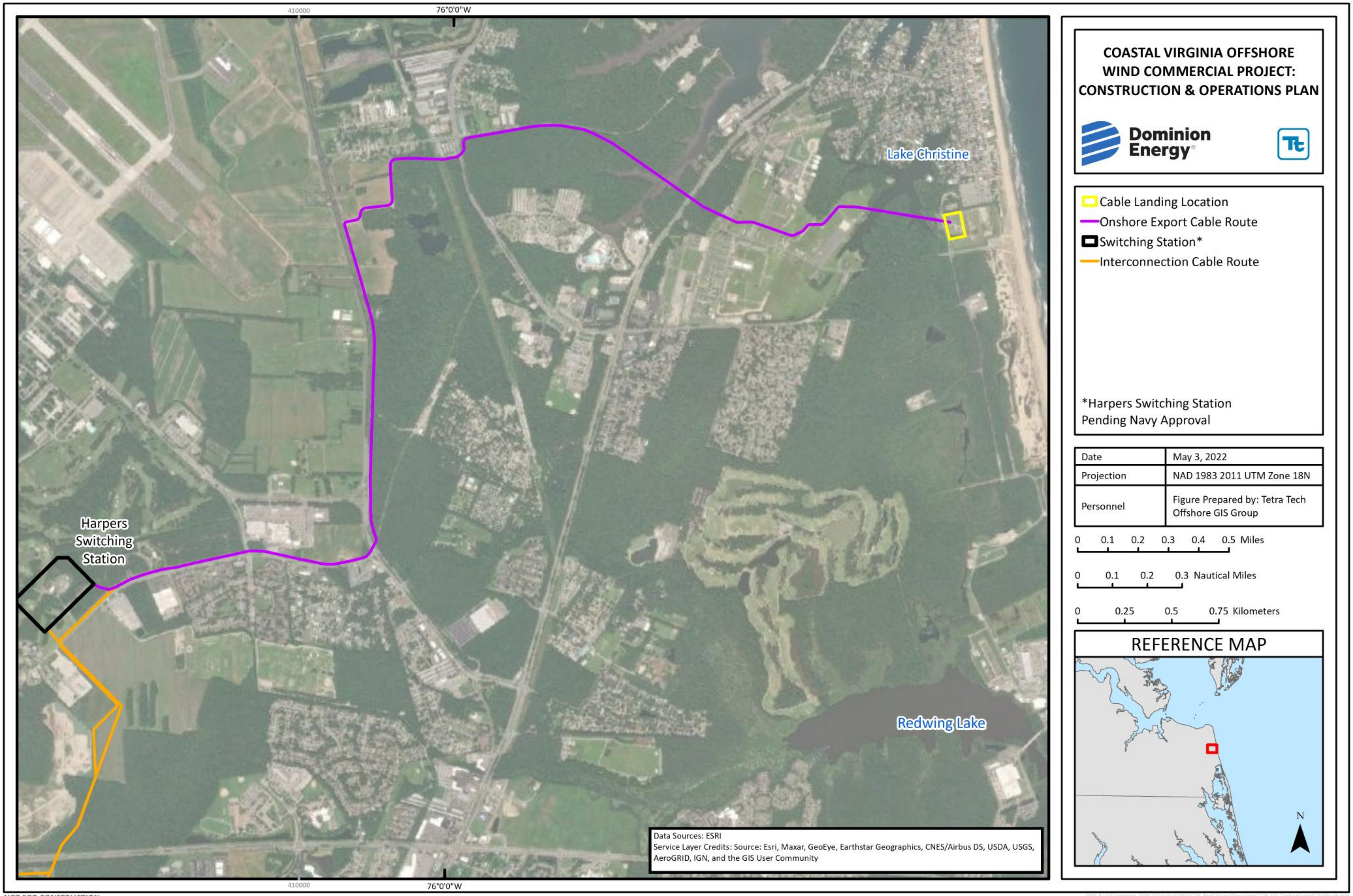
- **Onshore Export Cable Route – Alternative 7 (Not Carried forward in PDE)**: This Alternative would also have all nine cables land at the same Proposed Parking Lot, west of the Firing Range at SMR, as Alternative 1, following a similar 2.3 mi (3.6 km)-long route, with the exception of a jog to the north along Regulus Avenue before converging with the Alternative 1 route west of Lake Christine within SMR land.

The Onshore Export Cable Route carried forward in the PDE is shown in Figure 2.1-5. Route length, route description, construction/operational corridors, and other details are included in Section 3, Description of Proposed Activity.

2.1.2.3 Switching Station

A Switching Station would be required to consolidate the energy of the Onshore Export Cables and to transition an underground cable configuration to an overhead configuration. Dominion Energy also considered locations for a separate "Transition Station" where the Interconnection Cable Route transitions from underground to overhead facilities transmission configuration, but determined a common location for the underground cables to transition to overhead cables is preferrable to minimize the Project footprint. Therefore, "Switching Station" is carried forward in the PDE and "Transition Station" is not carried forward in the PDE. Siting the most suitable location for a new Switching Station must consider cost, constructability, design requirements, consistency with existing land use and zoning, and minimization of disturbance, environmental and human impacts. Dominion Energy evaluated the current capacity load and potential for upgrades at existing substations. Dominion Energy considered several possible locations and configurations for the development of the Switching Station:

- Switching Station at the NAS Oceana Parcel (not carried forward in PDE)—located on NAS Oceana property between Oceana Boulevard and South Birdneck Road;
- Transition Station at the Common Location south of Harpers Road (would require connection to the Switching Station at the NAS Oceana Parcel (not carried forward in PDE);
- Switching Station at the Common Location north of Harpers Road (carried forward in PDE and referred to as "Harpers Switching Station");
- Transition Station located north of Princess Anne Road (would require connection to the Switching Station at the NAS Oceana Parcel or Common Location south of Harpers Road, not carried forward in PDE);
- Switching Station located north of Princess Anne Road (carried forward in PDE, and referred to as "Chicory Switching Station");
- Switching Station at the Oceana Boulevard Parcel (not carried forward in PDE)—located on NAS Oceana property at the northeastern end of runway 5R/23L; and
- Switching Station at the Corporate Landing Parcel (not carried forward in PDE)—located at Dam Neck Road and Corporate Landing Parkway.



NOT FOR CONSTRUCTION

Figure 2.1-5. Onshore Project Components—Onshore Export Cable Route Carried Forward in the PDE

2.1.2.4 Interconnection Cable Route

The Interconnection Cables will transfer the electricity from the Common Location north of Harpers Road to the existing Fentress Substation (Onshore Substation, the POI) and would consist of circuits of three with an operating voltage of 230 kilovolts (kV). From the Common Location north of Harpers Road, Interconnection Cable Route Alternatives 1 through 5 would continue on to the Onshore Substation as overhead alternatives and the new Harpers Switching Station would be located at NAS Oceana Parcel, pending Navy approval. Interconnection Cable Route Alternative 6 would continue underground from the Common Location north of Harpers Road to the new Chicory Switching Station north of Princess Anne Road, where it would transition to overhead before continuing on to the Onshore Substation. As described above, Dominion Energy considered several alternatives including both separate and combined Switching and Transition Station facilities. Alternatives associated with the combined switching and transition station facilities (referred to as the Switching Station)—Harpers Switching Station or Chicory Switching Station—were retained for the PDE.

The overhead structures within the Interconnection Cable Route Corridor would consist of three single circuits. Note that while interconnections are commonly referred to as ‘circuits’, for consistency with terminology commonly associated with offshore wind projects, ‘cables’ is used throughout.

Dominion Energy is considering overhead and hybrid Interconnection Cable Route Alternatives (in no particular order of preference) within the PDE for the Interconnection Cable Route, as summarized in Section 3, Description of Proposed Activity, and shown in Figure 2.1-6. The Study Area includes an approximately 170 square-mile area delineated by Dominion Energy’s Atlantic and Lynnhaven Substations to the north; the Atlantic Ocean coastline to the east; Green Run, Stumpy Lake, and Thrasher Substations to the northwest; Chesapeake Substation to the west; and the existing Fentress Substation (Onshore Substation), the POI, to the south. The Study Area lies within portions of the developed cities of Virginia Beach and Chesapeake and includes the Gum Swamp and associated North River wetlands complex and more rural areas. It encompasses dense residential and commercial developments, large and numerous publicly owned lands, forested wetlands, watercourses and associated floodplains, including the Intracoastal Waterway, agricultural fields, military airport facilities, sports complexes, and golf courses.

Dominion Energy conducted a comparative analysis using geographical information system (GIS) resources to assess the benefits, constraints, and risks of several route options to identify the preferred Interconnection Cable Route. The analysis considered route length, land use, constructability, existing utilities/ROWs, and environmental constraints (e.g., wetlands and water bodies, historic and cultural resources, sensitive species habitat, potential for contamination, and potential community opposition). Dominion Energy anticipates that a maximum construction and operational corridor width of 86.5 ft (26 m) would be needed for underground cables and that a maximum construction and operational corridor width of 250 ft (76.2 m) would be needed for overhead cables. Existing ROWs will be utilized to the extent practical.

Potential routing constraints and collocation opportunities in developing the Hybrid and Overhead Interconnection Cable Route Alternatives between the Switching Station and the Onshore Substation include, but are not limited to, the following:

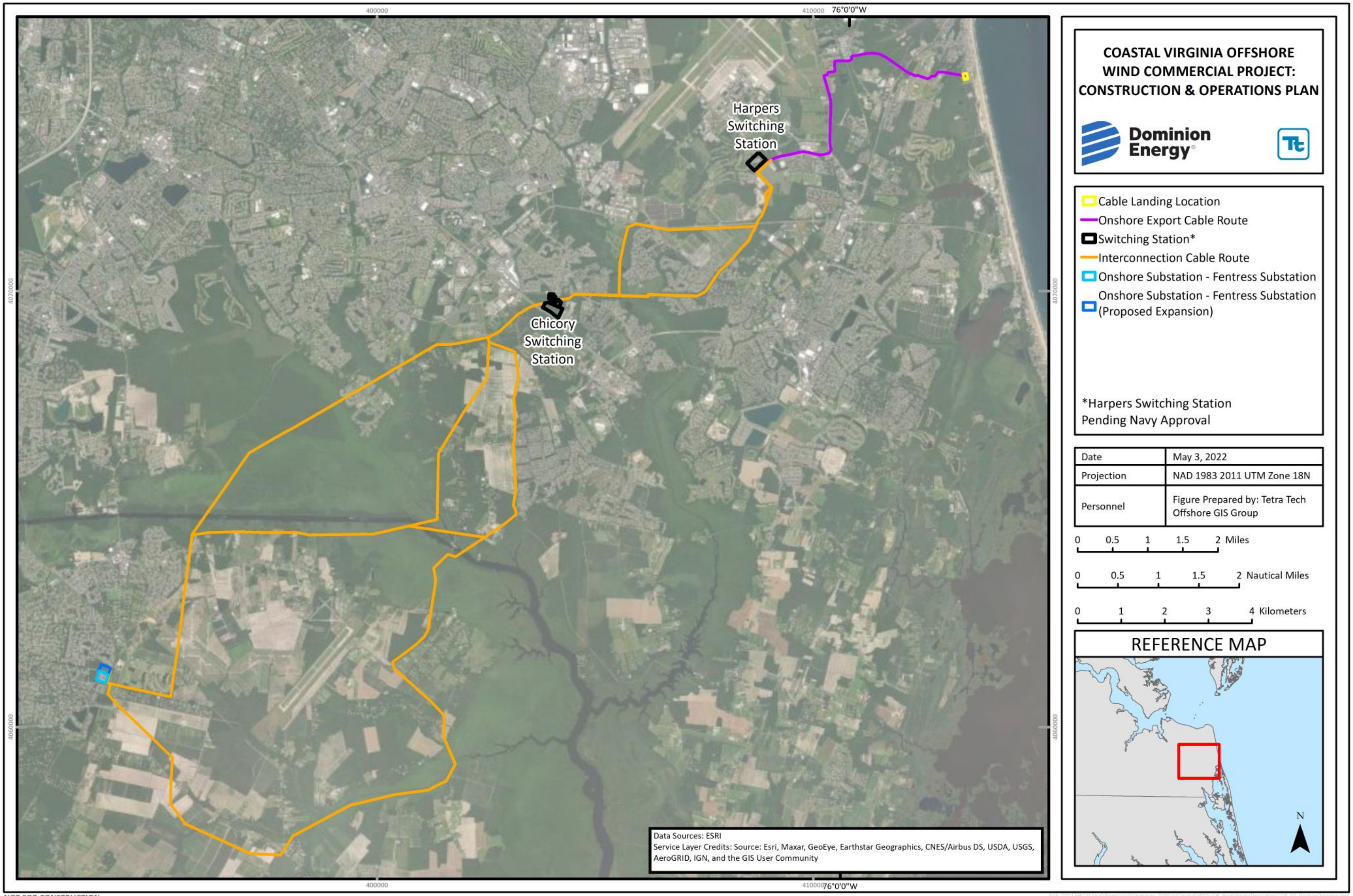


Figure 2.1-6. Onshore Project Components – Overhead Interconnection Cable Routes and Onshore Substation

NAS Oceana: Several alternatives considered development of the Switching Station on a parcel within NAS Oceana property, pending Navy approval. Dominion Energy has already been in discussions with the Navy regarding a lease/purchase option for this parcel as well as leases or easements for ROWs. The infrastructure within NAS Oceana (e.g., runways, buildings, roadways, training areas, etc.) limits routing opportunities to the north and west while existing development blocks routing opportunities to the south and southeast. The Interconnection Cable Route Alternatives identified cross the southeastern edge of NAS Oceana before turning south into undeveloped open lands north of Dam Neck Road. Based on the location of the Switching Station, further study of NAS Oceana flight approach surfaces are needed to determine possible limitations on tower heights near runways 14R/32L and 14L/32R.

Residential Areas: The high density of residential development to the south and west of the NAS Oceana Parcel limits the routing options in all directions. All Interconnection Cable Route Alternatives are designed to avoid residential areas as much as possible and to limit new ROWs acquisition on residential lots.

City of Virginia Beach-owned Property: South and west of NAS Oceana is a relatively large area described in the 2017 Virginia Beach Master Plan as the Interfacility Traffic Area, where the City of Virginia Beach purchased multiple tracts of undeveloped lands to control development within the high-noise level jet flight path area connecting NAS Oceana and Naval Auxiliary Landing Field Fentress. Parklands owned by the City of Virginia Beach are discussed below. Other holdings by the city include parcels acquired for construction and operation of the Southeast Expressway and Greenbelt—a previously planned 21.4-mile-long planned highway between Virginia Beach and Chesapeake (see Existing Transmission Line description below).

Other city-owned lands in the area include large, wooded lots as well as large agricultural and forested land holdings southwest of the Virginia Beach National Golf Course. Conceptual development plans for city-owned lands in these areas are described in the Virginia Beach Master Plan. It should be noted that in Virginia, publicly-owned lands can be a constraint to transmission line routing because these lands can only be used with the consent and permission of the public land owner. They are not subject to condemnation by Dominion Energy consistent with Virginia law.

City of Virginia Beach Parks: There are several city-owned parks, including several large parks, present in the study area. City-owned parks include: the North Landing Park, Virginia Beach National Golf Course, Princess Anne Athletic Complex, Virginia Beach Sportsplex, and the US Field Hockey National Training Center and Hockey Complex. Other less developed city parks in the routing area include the Holland Pines Park, the West Neck Creek Natural Area, the Rolling Woods Park, and the Litchfield Manor Park.

Back Bay National Wildlife Refuge: Numerous federally owned parcels make up the refuge, which extends from Lake Tecumseh in the north to Back Bay, located in the southeastern portion of the Study Area, approximately 10 miles south of Dominion's Sandbridge Substation. None of the Interconnection Cable Route Alternatives currently included in the PDE cross the refuge.

North Landing River: The Virginia DCR's North Landing River Natural Area Preserve is one of Virginia's largest natural area preserves consisting of an extensive wetland complex including the forested swamps and tidal marshes of the lower North Landing River. In addition to the Commonwealth's land holdings (3,441 acres), The Nature Conservancy (TNC) owns an additional 7,500 acres of land known as the North Landing Preserve. Four Interconnection Cable Route Alternatives currently included in the PDE cross North Landing River near the bridge at North Landing Road, but none of these alternatives cross TNC lands in this area. While none of the Interconnection Cable Route Alternatives currently included in the PDE cross TNC lands near the bridge at North Landing Road, two Interconnection Cable Route Alternatives cross TNC lands further west adjacent to an existing Dominion transmission line across the Intracoastal Waterway.

Intracoastal Waterway: This federally owned waterway is maintained by USACE and subject to its regulatory jurisdiction and is also an historic district (Albemarle & Chesapeake Canal) listed on the National Register of Historic Places (NRHP). The waterway connects the Southern Branch of the Elizabeth River to the west and North Landing River to the East. Two of the Interconnection Cable Route Alternatives currently included in the PDE cross a segment of the waterway/canal adjacent to an existing Dominion transmission line.

Existing Transmission Lines and other Collocation Opportunities: Several existing transmission line corridors, primarily owned and operated by Dominion Energy, may provide opportunities for collocation. The Virginia State Corporation Commission (SCC) requires that existing transmission lines be considered as routing opportunities to the fullest extent when planning new transmission lines. Many of the existing transmission line corridors within the Study Area are in heavily developed areas where homes and other buildings have been built to the edge of the ROW, precluding expansion to accommodate additional lines. However, portions of these corridors were considered as potential routing opportunities during routing of the onshore transmission lines and two others cross the Intracoastal Waterway just east of the North Landing Road bridge over the North Landing River.

Another major routing opportunity in the study area is the previously planned Southern Expressway and Greenbelt (SEGB), a 21.4-mile-long planned highway conceived as an east-west connection between Virginia Beach and Chesapeake. The SEGB project was jointly proposed by the VDOT and the Federal Highway Administration in the Cities of Virginia Beach and Chesapeake, with a Final Environmental Impact Statement completed in 2008. Although the Project has since been terminated, the City of Virginia Beach (and to a much lesser extent the City of Chesapeake) acquired undeveloped lands that form a partial corridor from the NAS Oceana area to an interconnect with I-64 and I-464, near the Dozier Corner area in Chesapeake. Some of this corridor is adjacent to Dominion's existing transmission line Nos. 147/2118. In other areas, residential developments have been built around the corridor or within it. A portion of the undeveloped corridor crosses the Princess Anne Athletic Complex. Much of the land that forms a portion of this corridor that could be useable to support a transmission line is owned by the City of Virginia Beach.

Forested Wetlands, Streams, and Rivers: Between the developed areas of the cities of Virginia Beach and Chesapeake is a large expanse of the Gum Swamp. The swamp extends on either side of the Intracoastal Waterway. This undeveloped area is characterized by forested wetland and flowing waters. Notable landowners in the Gum Swamp area include the City of Virginia Beach, TNC, USACE, and the U.S. Government.

National Register of Historic Places Listed and Eligible Properties: In addition to the Albemarle & Chesapeake Canal, the Study Area encompasses numerous NRHP-listed and -eligible historic resources (See Section 4.3.3, Aboveground Historic Resources for additional information), including several historic districts. These districts include: Cedar Grove/James Bell House (near the NAS Oceana Parcel); the SMR, Princess Anne Courthouse Village, and Virginia Beach Courthouse Village (in Virginia Beach); and Blue Ridge-Fentress, Centerville-Fentress, and Centre Hill (in Chesapeake near the Onshore Substation).

In addition to the major constraints listed above, the study area also contains unavoidable crossings of federally owned land, city-owned land, city-owned parkland, and privately owned conservation land. Because these constraints are unavoidable, consultation with the applicable agency or owner is ongoing to determine the feasibility of the route alternatives. A summary of Dominion Energy's stakeholder engagement and outreach is provided in Appendix L.

Once the routing constraints and collocation opportunities were identified and assessed based on the level of information available prior to the start of agency and stakeholder consultations, potential overhead and hybrid route alternatives were identified within the Study Area between Harpers Road and the Onshore Substation. Collocating the potential Interconnection Cable Route Alternatives with existing transmission lines and other routing opportunities was prioritized. However, large scale (i.e., point to point) collocation opportunities with existing transmission lines between Harpers Road and the Onshore Substation were determined to not be viable due to bottlenecks caused by residential developments and city parks, among other factors. The various transmission lines that currently traverse the area between Harpers Road and the Onshore Substation cross numerous residential developments and commercial areas. In many cases, the residential lots or commercial buildings are built up to edges of the transmission line ROWs on one or both sides of the corridor. These developments generally preclude the expansion of the ROW to accommodate development of a new transmission line entirely collocated with an existing line.

In addition to collocation along the SEGB corridor, three existing transmission line corridors offer shorter opportunities for collocation within the Study Area. These include transmission line numbers 147/2118, which extend between NAS Oceana and Landstown Substation; transmission line numbers 271/Idle Line-74, which extend between Landstown and Fentress Substations; and transmission line number 2085, which extends between Landstown and West Station Substations. Each of these areas were incorporated into the Interconnection Cable Route Alternatives.

The routing discussed above is limited by overhead transmission line route location availability, particularly in the northeast to central part of the Study Area that incorporates the most developed portions of the City of Virginia Beach (i.e., between London Bridge Road and the Virginia Beach Sports Center). Existing development is the major constraint, followed by public land ownership and the abundance of wetlands. Lands to the east and south of the NAS Oceana Parcel were also investigated for potential routes to the south to try to avoid the congested municipal and commercial areas of Virginia Beach. However, existing residential development right up to the Back Bay National Wildlife Refuge and the large expanses of tidal wetland making up the Refuge prohibit the development of routes through or around this area. Essentially, almost all lands between the NAS Oceana Parcel and the Princess Anne Athletic Complex are already fully developed, are publicly owned, or consist of forested or tidal wetland areas. Where sufficient space is available and constraints are absent, Overhead Interconnection Cable Route Alternatives were routed through the existing constraints to provide as many preliminary options as possible to allow productive discussions with stakeholders.

Once the routing opportunities and constraints were identified and assessed based on the level of information available prior to the start of agency and stakeholder consultations, potential overhead, underground, and hybrid routes were identified for further investigation between Harpers Road and the Onshore Substation. Initially, eight overhead routes and five hybrid routes were identified and included in the PDE in the December 2020 COP.

In March 2021, after collection of additional information, engineering review, and consultations with the Cities of Virginia Beach and Chesapeake and other agencies, Dominion Energy determined that three of the initial eight overhead routes and the five initial hybrid routes were not feasible to construct and/or permit due to various reasons, including greater impacts of eliminated routes to the human and natural environments. These routes subsequently were eliminated from further consideration and removed from the PDE. Additional refinements were made to the remaining overhead routes to resolve engineering/constructability issues, address agency/stakeholder comments, or avoid or minimize impacts on the natural and cultural environments, and one new hybrid route was identified.

The six Interconnection Cable Route Alternatives have been renumbered since the December 2020 version of the COP and remain unchanged since the June 2021 version of the COP. Table 2.1-3 below lists all Interconnection Cable Route Alternatives initially identified and considered, including the new Hybrid Route, and how those that remain in the PDE have been renamed and renumbered.

Table 2.1-3. Interconnection Cable Route Alternatives

Interconnection Cable Route Alternatives included in December 2020 PDE	Interconnection Cable Route Alternatives currently included in June 2021, October 2021, December 2021, and May 2022 PDE
Overhead Interconnection Cable Route Alternative 1	Not Carried Forward in PDE
Overhead Interconnection Cable Route Alternative 2	Interconnection Cable Route Alternative 2
Overhead Interconnection Cable Route Alternative 3	Interconnection Cable Route Alternative 3
Overhead Interconnection Cable Route Alternative 4	Not Carried Forward in PDE
Overhead Interconnection Cable Route Alternative 5	Interconnection Cable Route Alternative 4
Overhead Interconnection Cable Route Alternative 6	Interconnection Cable Route Alternative 5
Overhead Interconnection Cable Route Alternative 7	Not Carried Forward in PDE
Overhead Interconnection Cable Route Alternative 8	Interconnection Cable Route Alternative 1 (Preferred Alternative)
Hybrid Interconnection Cable Route Alternative 1	Not Carried Forward in PDE
Hybrid Interconnection Cable Route Alternative 2	Not Carried Forward in PDE
Hybrid Interconnection Cable Route Alternative 3	Not Carried Forward in PDE
Hybrid Interconnection Cable Route Alternative 4	Not Carried Forward in PDE
Hybrid Interconnection Cable Route Alternative 5	Not Carried Forward in PDE
Not Applicable	Interconnection Cable Route Alternative 6

As stated above, a total of 13 Interconnection Cable Route Alternatives were initially considered; however, only five overhead and one hybrid Interconnection Cable Route Alternatives were carried forward in the PDE, as listed below:

- **Interconnection Cable Route Alternative 1 (Previously called Interconnection Cable Route Alternative 8, Carried forward in PDE) – Preferred Alternative**: This approximately 14.2 mi (22.9 km)-long overhead route runs southwest from the Common Location north of Harpers Road along the formerly proposed Southeastern Parkway Corridor, crossing Dam Neck Road and London Bridge Road, then joins with existing Dominion-owned transmission lines (lines 147/2118) heading west for 1.8 mi (2.9 km). From there, the route continues southwest again along the formerly proposed Southeastern Parkway Corridor, crossing Princess Anne Road and Landstown Road, then re-joins with existing Dominion-owned transmission lines (lines 271, Idle Line-74, and/or 2240) for the remaining 6.0 mi (9.6 km) to the Onshore Substation.

- **Interconnection Cable Route Alternative 2 (Previously called Interconnection Cable Route Alternative 2, Carried forward in PDE)**: This approximately 15.2 mi (24.3 km)-long overhead route follows the same route as Overhead Interconnection Cable Route Alternative 1, with the exception of an approximately 6.2 mi (10.0 km) segment that runs south from the Princess Anne Sports Complex, crossing Salem Road, and Indian River Road parallel and to the west of North Landing Road before crossing the Albemarle and Chesapeake Canal, then runs west and re-joins existing Dominion-owned transmission lines (lines 271, Idle Line-74, and 2240) for the remaining 3.4 mi (5.5 km) to the Onshore Substation.
- **Interconnection Cable Route Alternative 3 (Previously called Interconnection Cable Route Alternative 3 Carried forward in PDE)**: This approximately 15.7 mi (25.3 km)-long overhead route follows the same route as Overhead Interconnection Cable Route Alternative 2, with the exception of an approximately 2.7 mi (4.3 km) segment that runs west along Dam Neck Road, past London Bridge Road, then turns south just before Taylor Farms, where it again aligns with Overhead Interconnection Cable Route Alternative 1 for the remaining 12.2 mi (19.6 km) to the Onshore Substation.
- **Interconnection Cable Route Alternative 4 (Previously called Interconnection Cable Route Alternative 5, Carried forward in PDE)**: This approximately 16.6 mi (26.7 km)-long overhead route follows the same route as Overhead Interconnection Cable Route Alternative 2, with the exception of an approximately 4.5 mi (7.2 km) segment that joins existing Dominion-owned transmission lines (line 2085) between Landstown Road and Indian River Road, then crosses Upton's Lane and crosses the Albemarle and Chesapeake Canal west of North Landing Road, where it again aligns with Overhead Interconnection Cable Route Alternative 2 for the remaining 6.4 mi (10.3 km) to the Onshore Substation.
- **Interconnection Cable Route Alternative 5 (Previously called Interconnection Cable Route Alternative 6, Carried forward in PDE)**: This approximately 20.2 mi (32.3 km)-long overhead route follows the same route as Overhead Interconnection Cable Route Alternative 4, with the exception of an approximately 11.2 mi (18.0 km) segment that runs southwest from Upton's Lane, crosses the Albemarle and Chesapeake Canal east of North Landing Road, then follows Mount Pleasant Road, Fentress Airfield Road, and Blackwater Road, crossing the Pocaty River twice before heading west across agricultural fields, then approaches the Onshore Substation from the southeast.
- **Hybrid Interconnection Cable Route Alternative 6 (Carried forward in PDE)**: This hybrid 14.2 mi (22.9 km)-long route includes approximately 4.5 mi (7.2 km) of underground and 9.7 mi (15.6 km) of overhead cable that mostly follows the same route as Overhead Interconnection Cable Route Alternative 1, with the exception of the location of the Switching Station. The route would

continue following Overhead Interconnection Cable Route Alternative 1 as an underground transmission line until a point north of Princess Anne Road where it would transition to an overhead transmission line configuration. A Switching Station (Chicory Switching Station) would be built north of Princess Anne Road, therefore no aboveground Station would be built at Harpers Road. From the Chicory Switching Station, the route aligns with Overhead Interconnection Cable Route Alternative 1 for the remaining 9.7 mi (15.5 km) to the Onshore Substation.

- **Interconnection Cable Route Alternative 7 (Previously called Hybrid Interconnection Cable Route Alternative 1, Not Carried Forward in PDE)**: This approximately 22.1 mi (35.6 km)-long hybrid route follows the same route as Overhead Interconnection Cable Route Alternative 5, with the exception of the segment that runs along Dam Neck Road, past London Bridge Road, then turns south just before Taylor Farms, where it again aligns with Overhead Interconnection Cable Route Alternative 5. This route also takes a more southerly crossing of the Albemarle-Chesapeake Canal and then again diverges along Land of Promise Road south of the Fentress Airfield, from Long Ridge Road to Whittamore Road.
- **Interconnection Cable Route Alternative 8 (Previously called Hybrid Interconnection Cable Route Alternative 2, Not Carried Forward in PDE)**: This approximately 17.5 mi (28.2 km)-long hybrid route follows the same route as Overhead Interconnection Cable Route Alternative 2 from the NAS Oceana parcel, pending Navy approval, with the exception of the segment between Holland Road and Salem Road south of the Virginia National Golf Club.
- **Interconnection Cable Route Alternative 9 (Previously called Hybrid Interconnection Cable Route Alternative 3, Not Carried Forward in PDE)**: This approximately 21.9 mi (35.2 km)-long hybrid route from the NAS Oceana parcel, pending Navy approval, is collocated along Oceana Boulevard, to General Booth Boulevard, Princess Anne Road, then crosses to the west over West Neck Creek and the North Landing River, where it then follows the same route as the Overhead Interconnection Cable Route Alternative 5.
- **Interconnection Cable Route Alternative 10 (Previously called Hybrid Interconnection Cable Route Alternative 4, Not Carried Forward in PDE)**: This approximately 22.2 mi (35.7 km)-long hybrid route from the NAS Oceana parcel, pending Navy approval, is collocated along General Booth Boulevard, Nimmo Parkway, Upton Drive, Princess Anne Road, then crosses to the west over West Neck Creek and the North Landing River, where it then follows the same route as the Overhead Interconnection Cable Route Alternative 5.
- **Interconnection Cable Route Alternative 11 (Previously called Hybrid Interconnection Cable Route Alternative 5, Not Carried Forward in PDE)**: This approximately 22.6 mi (36.4 km)-long hybrid route from the NAS Oceana parcel, pending Navy approval, is collocated along General Booth Boulevard, then through mixed residential/commercial areas along Upton Drive, Sandbridge Road, then two options through agricultural fields west of New Bridge Road, crosses Princess Anne Road, then crosses to the west over West Neck Creek and the North Landing River, where it then follows the same route as the Overhead Interconnection Cable Route Alternative 5.

Additional descriptions of the Interconnection Cable Route lengths, route descriptions, construction/operational corridors, and other details are included in Section 3, Description of Proposed Activity.

2.1.2.5 Onshore Substation

Dominion Energy has been evaluating potential POI locations since an initial Integration Study conducted in 2010 (Dominion Virginia Power 2010), which at that time identified the Landstown Substation and the Fentress Substation as potentially suitable POIs due to their proximity to the Offshore Project Area and potential cable landing locations, as well as the capacity available for generation injection into the grid. The 2010 study, however, pointed out that an injection of 2,700 MW of energy would overload the Landstown Substation by 145 percent at existing capacity (Dominion Virginia Power 2010). The Fentress Substation was therefore identified as a more favorable POI location because of its capacity for additional power, proximity to the Project, as well as being an integrated 230-kV and 500-kV substation—the only 500-kV substation located within a reasonable distance to the Cable Landing Location Alternatives in Virginia Beach, Virginia. As part of this same study, the PJM Interconnection Regional Transmission Organization, the local electrical power transmission system operator, also considered the Fentress Substation as a feasible option in its evaluation of multiple points along the East Coast for interconnection of a large offshore wind power generation project.

This early study and resulting analysis, combined with the planning and execution of the CVOW Pilot Project, has resulted in Dominion Energy conducting a thorough analysis of POI locations. While the Fentress Substation represents the only feasible POI location for a project of this size, there are several transmission line alternative routes (as provided in Section 2.1.2.4, Interconnection Cable Routes) that could deliver the full 2,500 MW to 3,000 MW of power to the Fentress Substation and to the PJM grid.

Dominion Energy evaluated and submitted a project to the PJM in the fall of 2019 for the injection of 2,640 MW of energy at the Fentress Substation. PJM has completed the Feasibility Studies and System Impact Studies for this project submittal and is currently evaluating the Facility Studies. The construction of a new 230 kV Switching Station will be required to collect the energy and send the power to the Fentress Substation. The new Interconnection Cables with an operating voltage of 230 kV will terminate at the Fentress Substation, where they will be converted to 500 kV via nine single-phase new 230/500-kV transformers and two spare transformers. Six new 500-kV breakers will be required to expand the Fentress Substation to accommodate the addition of the new transformers.

2.2 Key Project Component Technologies

While the Preferred Alternative for the Project includes 176 SG 14-222 DD 14.7-MW WTGs, monopiles for the WTGs, and three HVAC Offshore Substations, alternative technologies for key Project Components were also considered in the design of the Project, as described in this section. The Project development activities performed, which included engineering of the components, site surveys, and outreach to the market, had the objective to establish a PDE that is commercially, technically, and environmentally feasible to achieve a Project capacity of 2,500 to 3,000 MW.

2.2.1 Wind Turbine Generators

The Preferred Alternative for the Project includes 176 SG 14-222 DD WTGs with individual capacity of 14.7 MW including power boost. Several different WTGs of various sizes available in the market were considered for the Project. The WTG model was selected through a competitive tender process, where it was concluded that the selected WTG is the most commercially attractive and technically robust choice out of the turbines offered to achieve a Project capacity of 2,500 to 3,000 MW.

The selected WTG was the most attractive from an overall environmental perspective as well. Out of the considered WTGs, the selected WTG requires the fewest number of positions, which results in a smaller ground disturbance, fewer underwater noise emissions, and allows for wider turbine spacing. The large WTGs on fewer positions is a cost-effective solution that also comes with an opportunity to optimize the construction schedule for the Project.

2.2.2 Wind Turbine Generator Foundations

As part of the Research Activities Plan for the CVOW Pilot Project (Dominion Energy 2015), several foundation types were evaluated as alternatives. Each foundation type was evaluated based on seabed type, water depth, and supply chain capacity/availability. The analysis of foundation types completed as part of the CVOW Pilot Project informed the analysis, selection, and design parameters for the Project. Other foundation types were considered. However, once it was established that the supply chain could provide monopiles with sizes applicable for the Project, and after consideration of the superior advantages of monopiles, the alternative foundation types were not carried forward in the PDE:

- **Monopiles** (Preferred Alternative): Monopiles are considered the WTG Foundation Preferred Alternative for the Project based on water depth and the expected sediment conditions within the Lease Area. Monopile foundations include a single vertical, cylindrical steel pile driven into the seabed. Unless a continuous monopile with directly attached secondary structures is selected, a steel transition piece, which may contain secondary structure components (e.g., boat landings and access platforms), would be connected to the monopile with a bolted flange and a grouted skirt. (see Section 3, Description of Proposed Activity). Monopiles are considered to be the most technically feasible and cost-effective of available options for the Project based on water depth and the seabed conditions within the Lease Area. Furthermore, monopiles are also a well-proven concept with a mature supply chain and the largest market share. The foundation design includes scour protection installed at the base;
- **Jackets** (not carried forward in the PDE): Numerous projects have been constructed using jacket foundations. Jackets are feasible in deeper water depths or in weak soil conditions where a monopile would become too large for cost-effective fabrication and installation. For the Project, jackets would have been less cost-effective than monopiles;
- **Suction buckets** (not carried forward in the PDE): Some projects in Europe have used suction bucket jackets; however, no commercial-scale projects have been constructed using monopile buckets. Suction buckets are only applicable in specific soil conditions. Due to the limited applications and dependence on soil conditions, suction buckets would be considered less feasible than conventional monopiles for the Project;
- **Gravity-Based Structures (GBS)** (not carried forward in the PDE): GBS technologies were eliminated from consideration for the Project, as GBS has only been applied on a limited number of offshore wind projects in substantially shallower water depths and would require heavy

structures with large footprints and expensive installation setup, as well as comprehensive seabed preparation prior to installation; and

- **Floating foundations** (not carried forward in the PDE): are only considered feasible for substantially deeper water depths and currently have not yet been applied on commercial-scale projects.

2.2.3 Inter-Array Cables

The Preferred Alternative for the Inter-Array Cable system is a voltage of 66-kV, with the individual cables sized to the capacity required. The most commonly used voltage for inter-array cables is 66-kV, and the alternative would be using 33-kV cables, which would not be feasible for a large-scale project with large-capacity WTGs. Using 33-kV cables would require fewer WTGs per inter-array cable string, and thus a substantially larger number of inter-array cable strings, which would significantly increase cost, technical complexity, and ground disturbance.

2.2.4 Offshore Substations

Two scenarios were evaluated with consideration to the number of offshore substations: three offshore substations, each with a capacity of up to 1,000 MW, or two offshore substations, each with a capacity of up to 1,500 MW. Dominion Energy evaluated both options and decided to include three offshore substations in the PDE for this Project in order to ensure that a number of global manufacturers are capable of constructing and installing offshore substations of this size in order to maintain flexibility when selecting suppliers.

In general terms, a lower number of offshore substations is desirable since it comes with lower fabrication cost, shorter installation time, and lower O&M cost. However, when the offshore substation reaches a certain size, the installation options become limited, driving up the complexity and cost. Globally, there are only a few offshore substations with capacity beyond 1,000 MW under construction, while some offshore substations with capacity of up to 1,000 MW have been constructed. The alternative of fewer or more than three offshore substations has, therefore, not been carried forward.

2.2.5 Offshore Export Cables

Dominion Energy evaluated the costs, benefits, and engineering constraints of utilizing HVAC vs. HVDC offshore export cables. The Preferred Alternative for the Project is multiple (up to nine) HVAC Offshore Export Cables, each with three conductor cores, rather than HVDC. HVDC was not carried forward as an alternative to HVAC since it comes with a significantly higher construction cost than HVAC and is only considered feasible on projects situated significantly farther from shore.

The Preferred Alternative for the Offshore Export Cables is nine 230-kV HVAC cables with an outside diameter up to 11.4 in (290 millimeters [mm]). 230 kV complies with the voltage level required when connecting to the grid, and it is expected that nine offshore export cables are needed to transfer the electricity from the Offshore Substations to shore. The Preferred Alternative is the maximum Offshore Export Cable diameter that the market is expected to be able to supply to the Project.

An alternative with a lower number of cables would require cable sizes that exceed what can be supplied by the market and is thereby not considered feasible. A larger number of cables would be more costly and would require a wider Offshore Export Cable Route Corridor and increase the ground disturbance.

Dominion Energy considered the use of both HDD and Direct Steerable Pipe Thrusting (DSPT or Direct Pipe) as trenchless installation strategies to bring the Offshore Export Cable to shore to avoid impacts to the sensitive beach and dune habitats. After conferring with potential contractors on the nearshore trenchless installation, Dominion Energy determined that the HDD installation method, though viable, would require a pipe string out area which was not available for the offshore drill without impacting a forested area on SMR which they requested not to be disturbed. As such, based on this contractor input and project constraints, Dominion Energy is currently pursuing a DSPT installation solution, which has been determined to be the most appropriate installation technology.

2.3 Summary of Options Carried Forward in the Project Design Envelope

Dominion Energy has identified a variety of Alternatives that have benefited from the long history of the CVOW Pilot Project as well as the Project. This collective information was utilized to consider all available options and arrived at the Alternatives comprising the PDE, consisting of the Onshore and Offshore Project Components identified in Table 2.3-1.

Table 2.3-1. Summary of Project Components in the Project Design Envelope

Project Component	Preferred Alternative	Project Design Envelope
WTG	14.7 MW (SG 14-222 DD) with power boost technology	Up to 16 MW (SG 14-222 DD)
WTG Layout	176 WTGs with monopile foundation Spacing = 0.75 to 0.93 nm No WTGs within the fish haven area	176 to 205 WTGs with monopile foundation Spacing = 0.75 to 0.93 nm Fish haven area may include WTGs
Foundations	Monopiles	Monopiles
Inter-Array Cables	66-kV Inter-Array Cables	66-kV Inter-Array Cables
Offshore Substations	Three Offshore Substations (up to 900 MW each) Actual capacity may vary depending on final capacity of the Project	Three Offshore Substations (up to 900 MW each) Actual capacity may vary depending on final capacity of the Project
Offshore Export Cables	Up to nine buried submarine HVAC cables located within the Offshore Export Cable Route Corridor Cable Landing Location at the Proposed Parking Lot, west of the Firing Range at SMR	Up to nine buried submarine HVAC cables located within the Offshore Export Cable Route Corridor Cable Landing Location at the Proposed Parking Lot, west of the Firing Range at SMR
Onshore Export Cable Route (Cable Landing Location to Common Location north of Harpers Road)	Cable Landing Location at the Proposed Parking Lot, west of the Firing Range at SMR to the Common Location north of Harpers Road	
Switching Station	Two Alternatives, depending on Interconnection Route; “Harpers Switching Station” or “Chicory Switching Station”	
Interconnection Cable Route (Common Location north of Harpers Road to Onshore Substation/POI)	Switching Station to the Onshore Substation/POI; five overhead Alternatives, one hybrid Alternative, with two Switching Station Alternatives (of these, one will be selected)	
Onshore Substation	Fentress Substation	

3 DESCRIPTION OF PROPOSED ACTIVITY

This section describes the Offshore and Onshore Project Components, which are comprised of components proposed as part of the PDE (see Section 1.2 Project Design Envelope). Activities associated with the construction and installation, O&M, and decommissioning of the Project Components are also discussed. A quick reference guide to the Project terms, components, and activities that will be referenced throughout the COP can be found in the Executive Summary.

3.1 Project Location

The proposed locations for development of the Project have been selected based on the environmental and engineering site characterization studies that have been completed to date. The location of Project Components will be further refined based on final engineering design as well as ongoing discussions, agency reviews, public input, and the NEPA review process.

The Offshore Project Components, including the WTGs, Inter-Array Cables, and Offshore Substations, would be located in federal waters within the Lease Area, while the Offshore Export Cable Route would traverse both federal and state territorial waters. The boundary of the Lease Area is located 20.45 nm (37.87 km) from the northwest corner to the Eastern Shore Peninsula and 23.75 nm (43.99 km) from Virginia Beach, Virginia. The Lease Area itself is 13.0 nm (24.08 km) from the westernmost to easternmost edge, 10.4 nm (19.26 km) from the northernmost to southernmost edge, and 112,799 total acres in size. Figure 3.1-1 provides an overview of the location of the Offshore Project Area. The Onshore Project Components would include the Onshore Export Cables, Switching Station, Interconnection Cables, and an Onshore Substation. The Onshore Project Components would be located within the municipalities of Virginia Beach and Chesapeake, Virginia. Figure 3.1-2 provides an overview of the locations of the Onshore Project Area, including alternative routing options.

During construction and installation, the Project would involve temporary construction laydown area(s) and construction port(s) in Europe or North America. The operation stage of the Project would include an onshore O&M facility with an associated Operations and Maintenance Port. Additional detail regarding these sites is provided in Section 3.5, Operations and Maintenance.

For the purposes of this COP, the Offshore Project Area refers to the maximum footprint of the facilities from and including the Lease Area to the Offshore Trenchless Installation Punch-Out location (includes Offshore Export Cable Route Corridor), to the Nearshore Trenchless Installation Area (refers to the area from the Offshore Trenchless Installation Punch-Out location approximately 1,000 to 1,800 ft [305 to 549 m] from shore to the Cable Landing Location onshore in Virginia Beach). The Onshore Project Area refers to the maximum footprint of the facilities including the area from the Cable Landing Location to the POI at the Onshore Substation (includes Onshore Export Cable Route Corridor, Switching Station, Interconnection Cable Route Corridor, and Onshore Substation.)

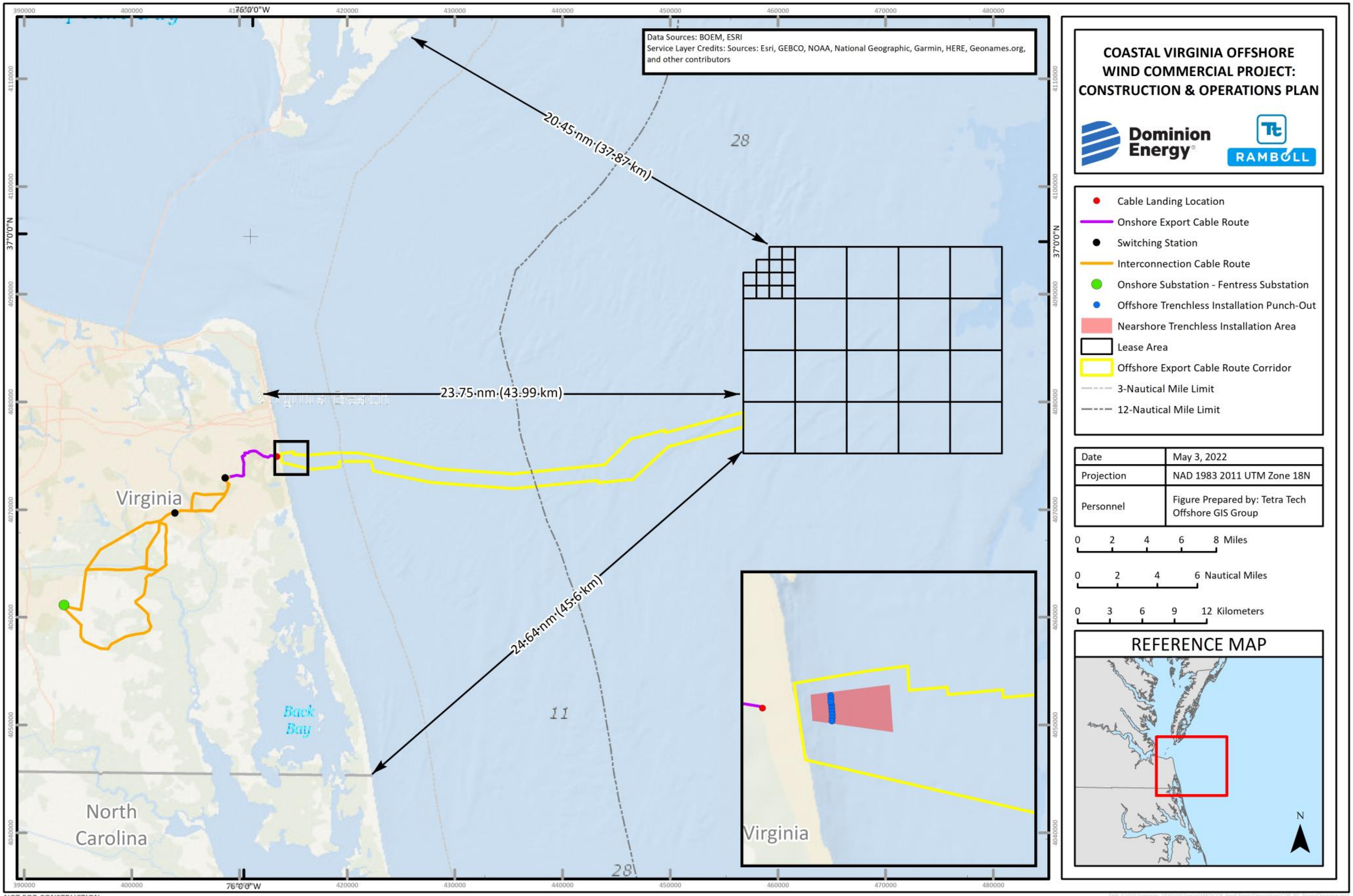


Figure 3.1-1. CVOW Commercial Offshore Project Area Overview

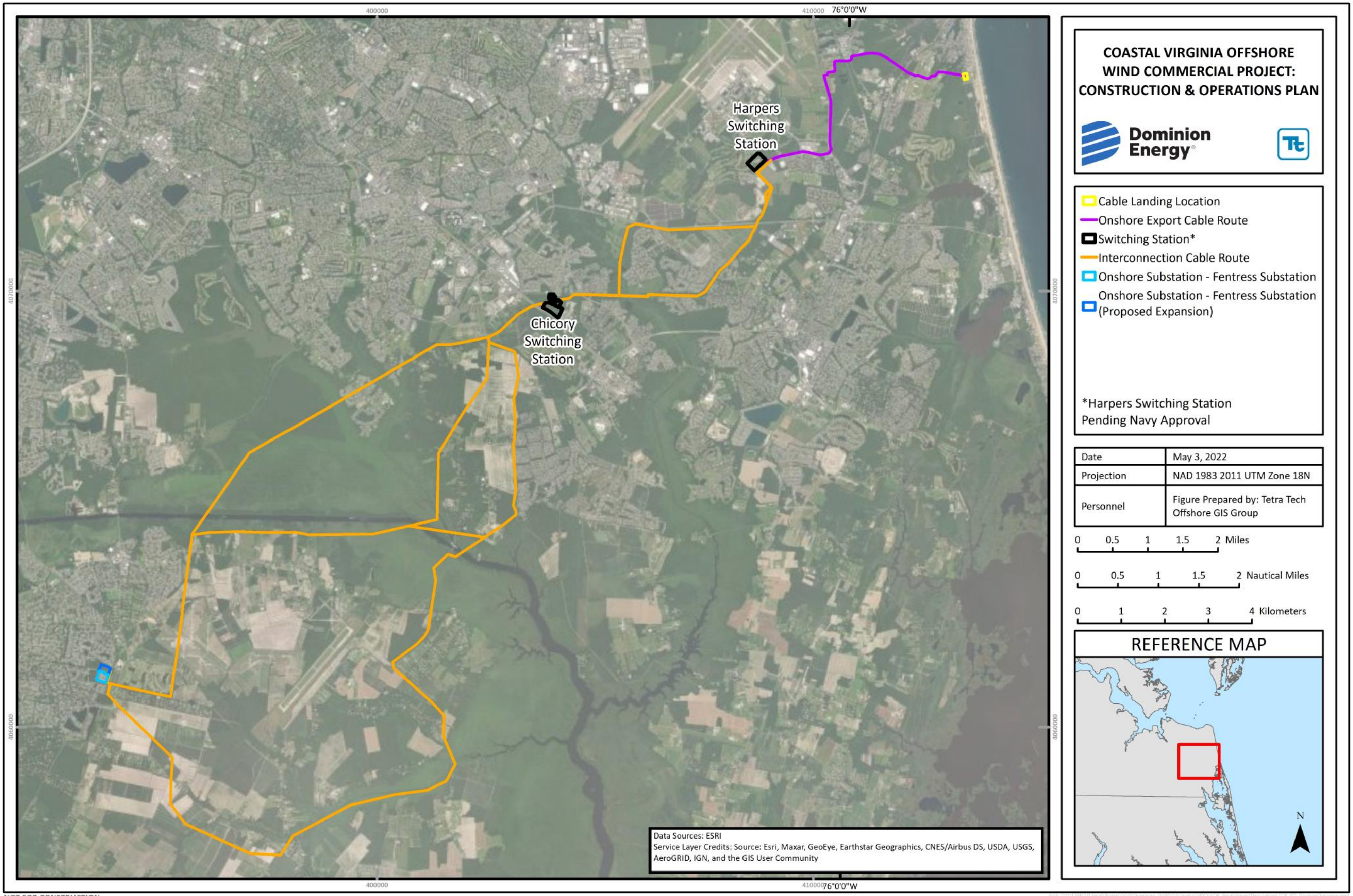
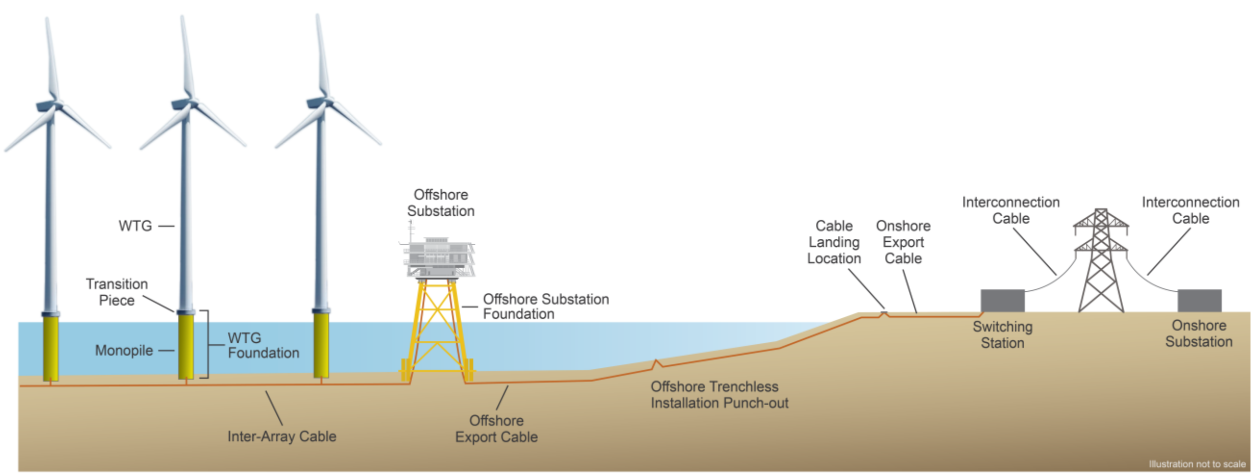


Figure 3.1-2. CVOW Commercial Onshore Project Area Overview (including alternative routing options)

3.2 Project Infrastructure Overview

The design of an offshore wind project requires a number of elements that are engineered in consideration of the characteristics of the environment in which they would be located and for the purpose they serve. Relative to and consistent with the PDE concept, Dominion Energy is considering a range of potential project design values and construction and installation techniques associated with various components of the Project. The use of a PDE is necessary to anticipate changes in available technology and Project economics and to ensure that the outcome of the environmental review and approval process for the Project can be accommodated within the Project's final design.

While much of the infrastructure of an offshore wind project is located in the offshore marine environment, the need to interconnect with the existing onshore electrical grid requires that several of the infrastructure elements are located on land. Within the Lease Area, the WTGs would generate electricity that would be transferred to the Offshore Substations via a series of Inter-Array Cables. The Offshore Substations would then transform the power to a higher voltage for transmission and transport to shore by the Offshore Export Cables. The Offshore Export Cables will be brought ashore via Trenchless Installation (DSPT) at the Cable Landing Location, where they would transition into the Onshore Export Cables that will transport the power to a Common Location north of Harpers Road. The Interconnection Cable Route begins at the Common Location north of Harpers Road. The Interconnection Cables will transmit and transport the power from Harpers Road to the Onshore Substation, which would be the final POI into the existing electrical grid. The Switching Station will be located either north of Harpers Road (preferred), pending Navy approval, or north of Princess Anne Road and will collect power and facilitate transition from underground transmission line to overhead transmission line. Only 1 switching station will be constructed. The Switching Station north of Princess Anne Road would only be constructed if Interconnection Cable Route Alternative 6 is selected. Easement negotiations for the Harpers Switching Station are still ongoing with the Navy, and a location approximately 1,100 ft (335.3 m) to the east of the current location (still north of Harpers Road) is also currently under consideration. If needed, Dominion Energy will provide a revised footprint for the Harpers Switching Station upon completion of the easement negotiations with the Navy. Figure 3.2-1 provides a generalized schematic of the major Project components.



Note: The Interconnection Cable will begin before the Switching Station, at a Common Location north of Harpers Road

Figure 3.2-1. Generalized Schematic of Major Project Components

In addition to the proposed infrastructure, Portsmouth Marine Terminal (PMT) is an existing port facility located on the west bank of the Elizabeth River. Dominion Energy and the Port of Virginia have executed a lease agreement for PMT to support the staging of components and construction vessels for the Project. Dominion Energy is considering locations in Newport News, Portsmouth and Norfolk, Virginia, with Lambert's Point, which is located on a brownfield site, as the preferred location, to serve as the O&M facilities for the Project. For both PMT and the O&M facilities, in the event that upgrades or a new, build to suit, facility is needed for any purpose, construction would be undertaken by the lessor and would be separately authorized, as needed (see Section 3.3.2.6 for further details).

The following sections provide details regarding the PDE under consideration for each of the major Project Components, associated construction and installation processes and O&M activities, and a high-level overview of decommissioning. The subsections are organized to start with the WTGs in the Lease Area, where the electricity will be generated, and end at the POI into the existing electrical grid at the Onshore Substation. The final selections and construction and installation strategies would be reviewed by the CVA and submitted to BOEM prior to construction and installation.

3.3 Project Design

This section further describes the proposed Project infrastructure and provides details on design and siting methodologies.

3.3.1 Offshore Project Components

The Offshore Project Components are comprised of the WTGs, WTG Monopile Foundations (including the monopiles and transition pieces), the Inter-Array Cables, the Offshore Substations, Offshore Substation Jacket Foundations (jacket foundations), and the Offshore Export Cables, each of which is described below.

3.3.1.1 Wind Turbine Generators

As discussed in Section 1.2, Project Design Envelope, Dominion Energy has selected Siemens Gamesa Renewable Energy (SGRE) as the WTG supplier. To anticipate advancements in the available WTG technology, Dominion Energy requires flexibility in the final design of the WTG. Therefore, the PDE sets both minimum and maximum realistic design scenarios for both WTG design and layout parameters against which potential environmental effects can be assessed.

While a range of designs of WTG from SGRE may be considered, all WTGs for the Project are expected to follow the traditional offshore WTG design with three blades and a horizontal rotor axis. Specifically, the blades will be connected to a central hub, forming a rotor that turns a shaft connected to the generator. The generator will be located within a containing structure known as the nacelle situated adjacent to the rotor hub. The nacelle will be supported by a tower structure affixed to the WTG Monopile Foundation. The nacelle will be able to rotate or "yaw" on the vertical axis to face the oncoming wind direction.

In support of the development of the Project, Dominion Energy has selected the SGRE SG 14-222 DD WTG. Table 3.3-1 provides a summary of the physical characteristics of the SG 14-222 DD WTG. See Figure 3.3-1 and Appendix K, Conceptual Design Drawings for simplified drawings demonstrating the size and components of the Preferred Alternative for the WTG. For the purpose of the assessments presented within this COP, the WTG design envelope has been defined by minimum and maximum parameters that are representative of the SGRE WTGs currently on the market or expected to become available in time to be used for the Project. Regardless of WTG size, Dominion Energy is permitting up to 205 WTG positions, including alternative, or spare, positions.

Table 3.3-1. Summary of WTG Parameters

Parameter	Minimum	Maximum	Preferred Alternative
Project nameplate capacity	2,500 MW	3,000 MW	2,587 MW
WTG generating capacity	14 MW	16 MW	14.7 MW with power boost technology
Cut in wind Speed	6.7 miles per hour (mph) (3 meters per second [m/s])	11.2 mph (5 m/s)	6.7 mph (3 m/s)
Cut out wind speed	55.9 mph (25 m/s)	67.1 mph (30 m/s)	62.6 mph (28 m/s)
Total number of WTGs	176	205	176
Turbine tip height from mean sea level (MSL)	804 ft (245 m)	869 ft (265 m)	836 ft (255 m)
Hub height from MSL	446 ft (136 m)	489 ft (149 m)	472 ft (144 m)
Rotor diameter	725 ft (221 m)	761 ft (232 m)	728 ft (222 m)
Distance from bottom of turbine tip to Highest Astronomical Tide (HAT) (air gap)	82 ft (25 m)	115 ft (35 m)	108 ft (33 m)

The below shown simplified elevation drawing shows the **preferred alternative for the COP**. Please note that the shown interface level does not correlate with the foundation FEED study, which shows an interface level of 22 mMSL as the assumption.

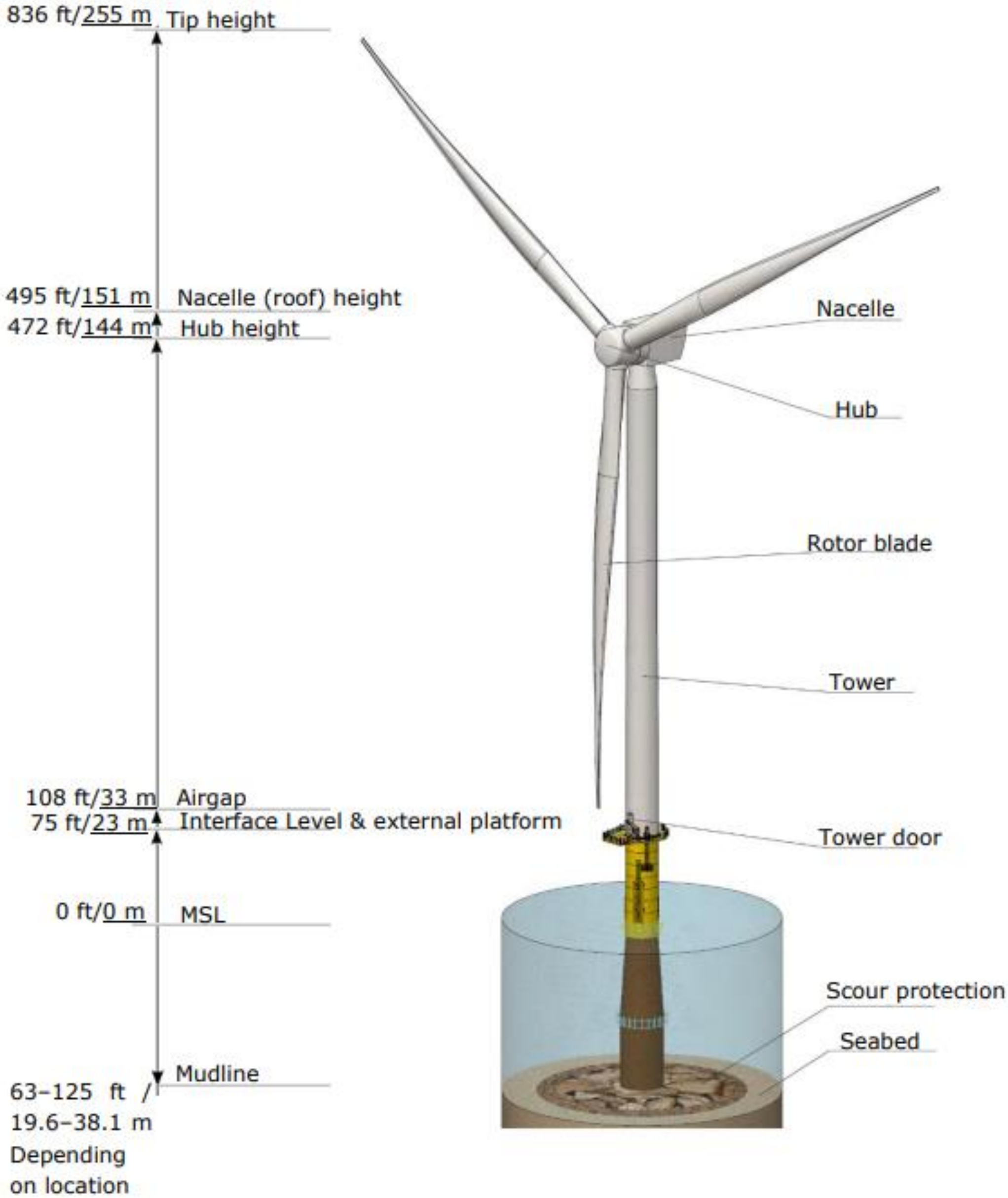


Figure 3.3-1. Simplified Elevation Drawing of the WTG

A brief technical description of the main components of the SG 14-222 DD WTG are provided below.

The SG 14-222 DD rotor is a three-bladed cantilevered construction, mounted upwind of the tower. The power output is controlled by pitch regulation. The rotor speed is variable and is designed to maximize the aerodynamic efficiency.

The blades are made of fiberglass-reinforced epoxy and carbon fiber-reinforced epoxy, manufactured using the SGRE propriety IntegralBlade® manufacturing process. The blades are mounted on pitch bearings and can be feathered for shutdown purposes. Each blade has its own independent pitching mechanism capable of feathering the blade under any operating condition. The blade pitch arrangement allows for optimization of the power output throughout the operating range, and the blades are feathered during standstill to minimize wind loads.

The rotor hub is cast in nodular cast iron and is fitted to the generator rotor with a flange connection. The hub provides a comfortable working environment for service technicians during maintenance of blade roots and pitch bearings. A cast, hollow and fixed main shaft ensures a comfortable internal access from the canopy to the hub. A cast bed frame connects the shaft to the tower. The yaw bearing is an externally geared ring with a friction bearing. A series of electric planetary gear motors drives the yawing.

The rotating parts of the WTG are supported by a single bearing. The bearing is a double row tapered roller bearing. The bearing is lubricated by an automatic lubrication system.

The generator is a fully enclosed synchronous generator with permanent magnet excitation. The generator rotor construction and stator windings are designed for high efficiency at partial loads. The generator is positioned between the tower and the hub producing a comfortably lean arrangement of the internals in the nacelle. The mechanical brake is fitted to the generator and has hydraulic calipers.

The weather screen and housing around the machinery in the nacelle is made of glass fiber-reinforced plastic panels.

The WTG is mounted on a tapered tubular steel tower. The tower has internal ascent and direct access to the yaw system and nacelle. It is equipped with platforms and internal electric lighting.

The controller is a microprocessor-based industrial controller, complete with switchgear and protection devices. It is self-diagnosing and has an interface for easy readout of status and adjustment of settings. The NetConverter® power conversion system allows generator operation at variable speed, frequency and voltage while supplying power at constant frequency and voltage to the medium-voltage transformer connected to the Offshore Substation. The power conversion system is a modular arrangement for easy maintenance and is water cooled.

The SG 14-222 DD WTG is also equipped with the SGRE Supervisory Control and Data Acquisition (SCADA) system. This system offers remote control and a variety of status views and useful reports. The status views present information including electrical and mechanical data, operation and fault status, meteorological data and grid station data. The SCADA system will comply with North American Electric Reliability Corporation and cybersecurity requirements that were included in the turbine supply agreement with SGRE. In addition, the WTG is equipped with the unique Turbine Condition Monitoring System, which monitors the vibration level of the main bearing and compares the actual vibration spectra with a set of established reference spectra. It can also provide result review, detailed analysis, and reprogramming.

The WTG operates automatically. It is self-starting when the wind speed reaches an average of about 6.7 to 11.2 miles per hour (mph) (3 to 5 meters per second [m/s]). The output increases approximately linearly with the wind speed until the wind speed reaches around 42.7 to 49.2 ft/s (13 to 15 m/s). At that point, the power is regulated at rated power. The Self-Sustained Turbine functionality enables the wind turbine to maintain itself to a certain level during periods with no connection to the power grid. This is an integrated power-backup system (composed of batteries).

The Wake Adapt controller feature allows the wind farm operator to apply optimized wake control techniques at park level. Wake control refers to techniques to adapt the operation of upstream WTGs to increase the kinetic energy in the wind inflow to downstream turbines. By adjusting the operation of each WTG in a wind farm collectively through the park-level control, the wake control improves the annual energy production of the wind farm.

The WTG will be equipped with Power Boost technology, which is a software enhancement that will enable the WTGs to generate power output above nameplate capacity under certain operational conditions. Power Boost functionality will be governed by certain operational limits such as ambient temperature, internal components temperatures, pitch angles, and wind turbulence level. The SG 14-222 DD WTG Power Boost Technology, which would increase the generation capacity of each WTG up to approximately 14.7 MW under certain operating conditions.

In contrast to some WTGs that automatically shut down outside of their operational limits for self-protection, the SG 14-222 DD WTG is equipped with the High Wind Ride Through (HWRT) system. The HWRT system will slowly ramp down power output instead, enabling smoother production ramp-down and thereby a more reliable electrical grid. The SG 14-222 DD WTG has been designed to withstand site conditions, including hurricane force winds expected in the Lease Area. The WTGs will also be protected both externally and internally by a lightning protection system.

Each of the WTGs will require various oils and lubricants to support the operation of the WTGs. Table 3.3-2 provides a summary of the oils and lubricants proposed, as well as the anticipated volumes. Dominion Energy does not anticipate the need for fuel during the operation of the WTGs. In addition, the WTGs will be designed to minimize the potential for spills and leaks through the implementation of containment measures. The spill containment strategy for each WTG is comprised of preventive, detective, and containment measures. These measures will be developed and implemented prior to construction activities. See Appendix Q for a preliminary version of the Oil Spill Response Plan that will continue to be developed as the Project matures.

Table 3.3-2. Oil/Lubricant Parameters per WTG

WTG Component	Oil/Lubricant	Type	Expected Amount
Nacelle	Grease (lubrication systems)	Optipit (Castrol), Mobilith 007	82 gallons (gal, 310 liters [l])
	Water/glycol (cooling fluid)	BASF Glysantin G30-91	476 gal (1,800 l)
	Gear oil (yaw gears)	Castrol Optigear Synthetic X 320	up to 3 x 5 gal (12 x 20 l)
	Ester Oil (Transformer)	Midel 7131	1,717 gal (6,500 l)
Hollow shaft (Generator)	Hydraulic oil (hydraulic system)	Castrol Hyspin AWH-M32	132 gal (500 l)
Hub	Grease (lubrication systems)	Shell Rhodina BBZ	48 gal (180 l)

WTG Component	Oil/Lubricant	Type	Expected Amount
	Hydraulic oil (pitch system hydraulic accumulators)	Castrol Hyspin AWH-M32	92 gal (350 l)
	Nitrogen (pitch system hydraulic accumulators)	Nitrogen	16,643 gal (63,000 l)
Tower	Water/Glycol (damping liquid)	BASF Glysantin G30-91	3,698 gal (14,000 l) a/

Note:
a/ Final volume and type are subject to Project-specific WTG configuration

WTG Control System

Each WTG will have its own control system to carry out functions like yaw control and ramp down in high wind speeds. As described above, each WTG will contain a SCADA system, which will allow Dominion Energy to monitor performance and to control operations remotely. In the event of a planned or emergency maintenance shut down, the SCADA systems will be utilized.

Operation of the WTGs will be continuously monitored by the SCADA system, which has the capability of being both locally and remotely operated over a local area network to ensure the WTGs are operating within their specified design limits. The SCADA system will consist of, at minimum, the main SCADA, a Remote Terminal Unit, a server, a router and firewalls. The SCADA system will be air gapped, meaning that it will be operated only from locations within the safe perimeter of the Project, following the North American Electric Reliability Corporation and cybersecurity requirements that were included in the turbine supply agreement with SGRE.

Communication systems include public address, general alarm, closed circuit television, and local area network. As further described in Section 3.5.1, Offshore Operations and Maintenance, the final operations and maintenance plan will include details of the WTG control system and emergency plans for shutdowns.

WTG Monopile Foundations

For the purpose of this COP, monopiles are being considered to support Project WTG Monopile Foundations. The WTG Monopile Foundation concept consists of two parts, a lower foundation pile (monopile) driven into the seabed and an upper transition piece mounted on top of the monopile (together referred to as the WTG Monopile Foundation). The transition piece is connected to the WTG tower above and to the monopile below with bolted flanges. The transition piece also has a grouted skirt that acts to prevent water ingress to the monopile-transition piece bolted flange, as well as distributing vessel impact loads onto the boat landing. Each WTG Monopile Foundation will consist of a monopile structure and transition piece that will contain supporting structures such as access ladders, boat landing, and platforms. Illustrative examples of the WTG Monopile Foundation are provided in Figure 3.3-2 and Figure 3.3-3.

The corrosion protection system of the WTG Monopile foundations is designed in accordance to the relevant industry standard for offshore structures. The protection strategy for specific areas of the structure is determined based on the exposure environment. The corrosion protection design consists of a combination of coating and cathodic protection. Where these mitigation measures do not suffice or cover the full design lifetime of the structure, corrosion allowance is applied and accounted for in the design or maintenance of the corrosion protection systems. The external and internal cathodic protection is based on an Impressed Currents Cathodic Protection system. A water replenishment system in the form of strategically located replenishment holes will be implemented to avoid acidification inside the monopile due to the Impressed Currents Cathodic Protection system. A ventilation system under the airtight compartment is also included to avoid build-up of hazardous gases. Once operational after WTG energization, the Impressed Currents Cathodic Protection system will be monitored remotely during the lifetime of the WTG Monopile foundations to ensure functionality and protection of the WTG Foundations. The WTG Monopile Foundations are foreseen to have scour protection installed around the base of the monopile. The need, type, and method for installing scour protection will be determined by the installation contractor in consultation and coordination with relevant jurisdictional agencies prior to construction and installation to ensure an optimal design suiting the intended installation methods.

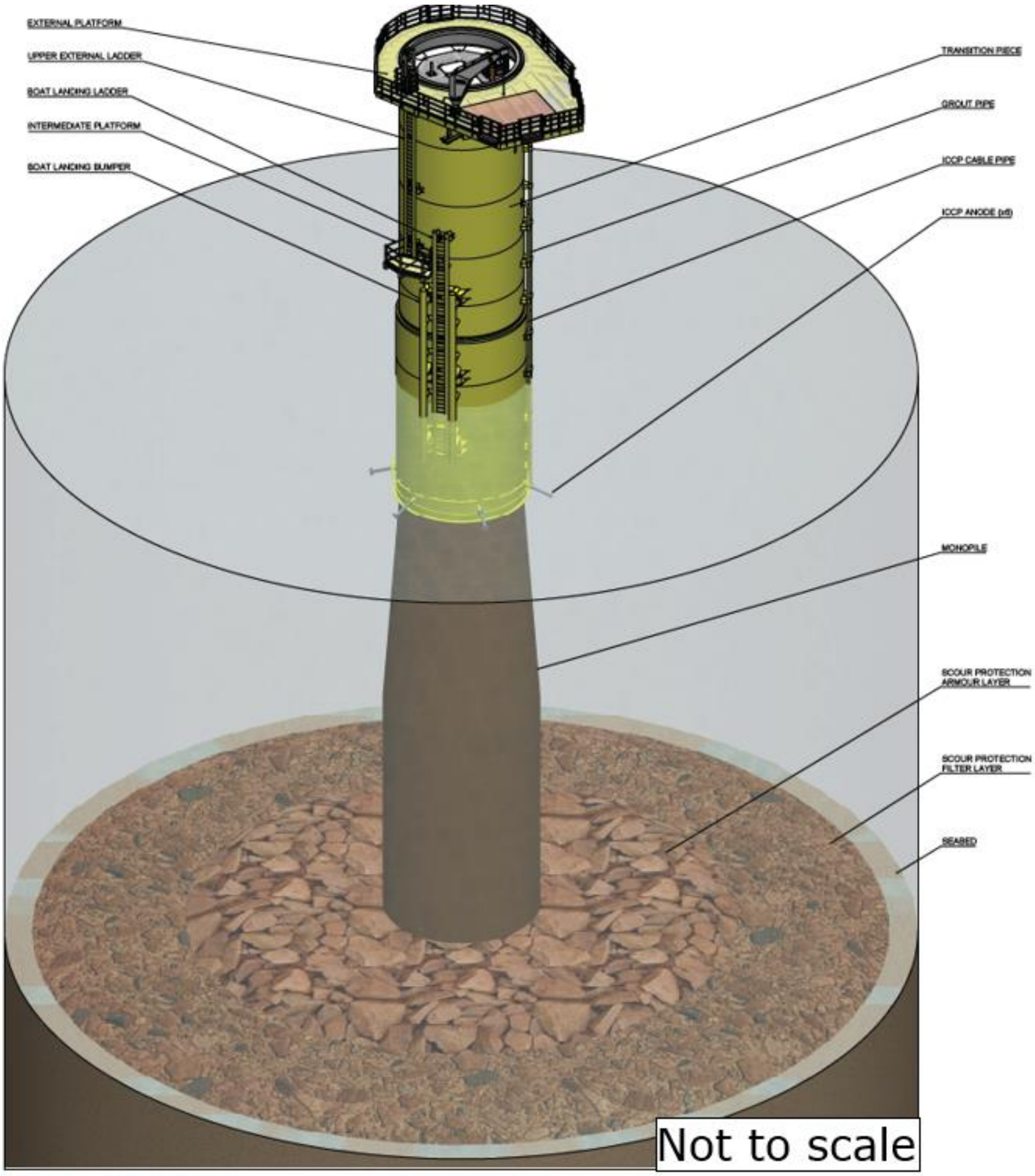


Figure 3.3-2. Illustrative Example of the WTG Monopile Foundation

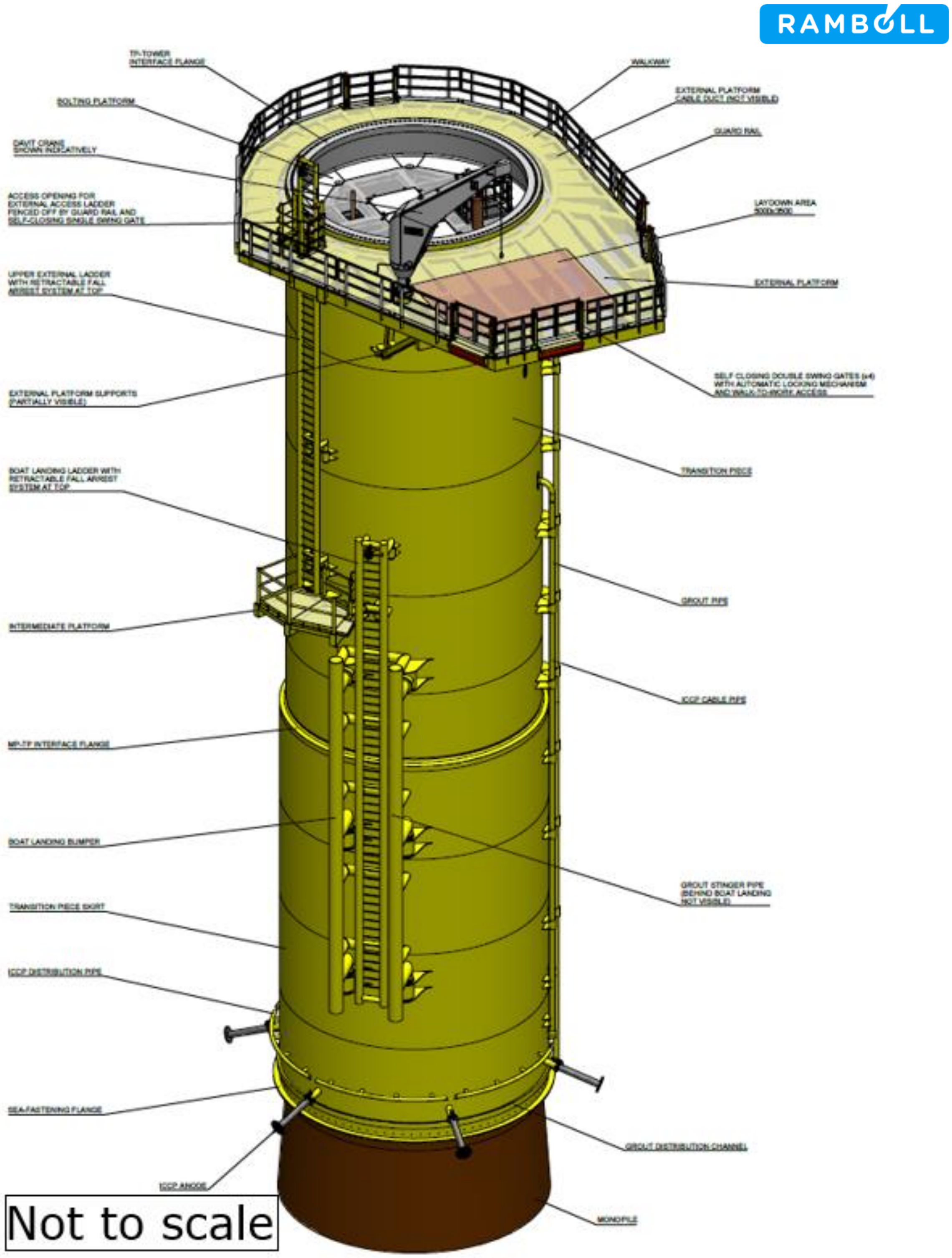


Figure 3.3-3. Illustrative Example of the Transition Piece

The final design of the WTG Monopile Foundations will be determined by the final engineering design process, informed by factors including WTG loads, water depth, soil conditions, and wave and tidal conditions at each final installation location. While the monopiles will vary in geometry and penetration depth across the Lease Area, the transition pieces will be designed in clusters based on the range of water depths and metocean conditions within the Lease Area. For purposes of this COP, the WTG Monopile Foundations have been conceptually designed in a number of clusters based on the water depth variation across the Lease Area. The WTG minimum and maximum foundation design parameters are provided below in Table 3.3-3.

Table 3.3-3. WTG Monopile Foundation Design Parameters

Foundation Parameter	Minimum	Maximum	Preferred Alternative
Monopile			
Number of monopiles	176	205	176
Monopile diameter a/	23 ft (7 m)	31 ft (9.5 m)	26 – 31 ft (8 – 9.5 m)
Base diameters (with scour protection) b/	95 ft (29 m)	230 ft (70 m)	98 – 180 ft (30 – 55 m)
Seabed penetration	82 ft (25 m)	197 ft (60 m)	82 – 165 ft (25 – 55 m)
Diameter at highest astronomical tide (HAT)	23 ft (7 m)	36 ft (11 m)	26 – 33 ft (8 – 10 m)

Notes:
a/ Per WTG Monopile Foundation
b/ Per WTG Monopile Foundation if scour protection is required

Dominion Energy believes that it is possible to design and install the size and type of monopiles included in the PDE to the desired target penetration depth. This is based on current knowledge of the ground conditions from the data collected in support of the CVOW Pilot Project, in addition to extensive geotechnical investigations completed to date in the Lease Area that were completed specifically to inform the CVOW Commercial Project. Dominion Energy completed extensive geophysical and geotechnical surveys, as well as benthic surveys, metocean data collection, capacity analysis and stakeholder outreach to inform final siting and design of the Project. Additional detail, including a preliminary drivability assessment based on site-specific data, decades of use in offshore wind, and engagement with manufacturers, will be included in the FDR/FIR to be reviewed by the CVA and submitted to BOEM prior to construction and installation.

WTG Layout

Designing and optimizing the layout of the WTGs is a complex, iterative process taking into account a large number of inputs and constraints including, but not necessarily limited to:

- Site conditions:
  - Wind speed and direction;
  - Water depth;
  - Seabed conditions;
  - Environmental constraints (anthropogenic and natural); and
  - Seabed obstructions (e.g., wrecks, UXO, existing cables);
- Design considerations:
  - Turbine type;
  - Construction/installation set-up;

- Foundation design;
- Electrical design; and

- Stakeholder considerations:
  - Commercial and Recreational Fishing (see Section 4.4.6); and
  - Marine Transportation and Navigation (see Section 4.4.7 and Appendix S, Navigation Safety Risk Assessment).

As further described in Section 4, Site Characterization and Assessment of Impact-Producing Factors, the design of the WTG layout considered all existing uses of the Lease Area and surrounding areas such as vessel traffic patterns, commercial and recreational fishing activities, minimization of impacts to biological and cultural resources, as well as the safety of mariners and Project personnel. The WTG layout has been designed to maximize power density in the Lease Area and minimize costs to the ratepayer to support the goals of the Virginia Clean Economy Act. Based on these considerations, the WTG layout was designed to include a 397 ft (121 m) setback (measured from the center point of the WTG) from the edge of the Lease Area to minimize potential impacts to existing uses and resources within and adjacent to the Lease Area. The setback is based on an assumed WTG blade length of 364 ft (111 m) plus 3.3 ft (1 m) to account for the rotation axis, with an additional 33 ft (10 m) buffer to ensure that all WTG components are fully located within the Lease Area. Additionally, a 984 ft (300 m) buffer was placed around known biological and cultural resources such as artificial reefs or shipwrecks. These buffers would also be adhered to if micrositing is required due to the presence of previously unknown resources that may be identified from assessment of the survey data.

Dominion Energy anticipates that between 176 and 205 WTGs would be installed in the Lease Area to reach the Project generation capacity required to produce between 2,500 MW and 3,000 MW of renewable energy. For purposes of this COP, Dominion Energy is considering up to 205 WTG construction and installation locations within the Lease Area as the maximum design scenario (See Figure 3.3-4). Of the 205 WTG construction and installation locations, the remaining locations are considered spare locations to provide the flexibility to switch positions if any of the 176 preferred WTG locations are determined unfavorable for WTG Monopile Foundation construction and installation, which would minimize the risk associated with uncertainties concerning the findings of geophysical surveys, geotechnical sampling, and Project development. Within the layout containing 176 preferred locations, the three Offshore Substations will be placed in one of the spare WTG locations that are shown in the maximum turbine layout (See Figure 3.3-5). Additionally, some WTG Monopile Foundation installation locations may be shifted by up to 500 ft (152 m) from the proposed WTG Monopile Foundation installation locations to avoid obstructions and local site condition variations, which may be identified from assessment of the survey data, considered unfeasible for placement of WTG Monopile Foundations.

The preferred WTG layout would be arranged in a grid pattern oriented at 35 degrees to minimize wake losses within the wind farm. WTGs would be spaced approximately 0.75 nm (1.39 km) in an east-west direction and 0.93 nm (1.72 km) in a north-south direction. However, the distances between some turbines in the final WTG layout may be slightly larger or smaller, subject to micrositing. The proposed maximum WTG layout is shown below in Figure 3.3-4.

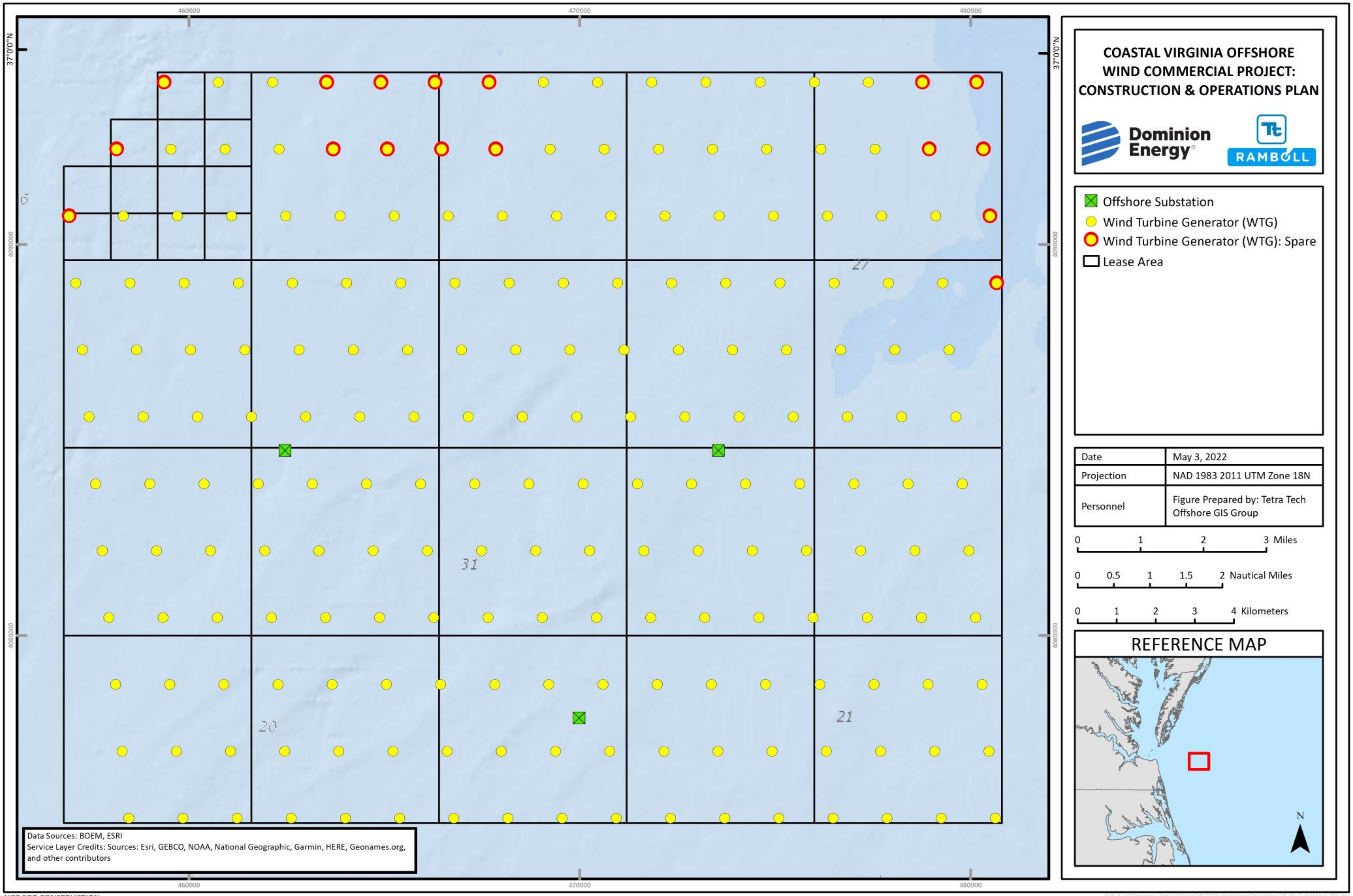


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Figure 3.3-4. CVOW Commercial WTG and Offshore Substation Maximum Layout

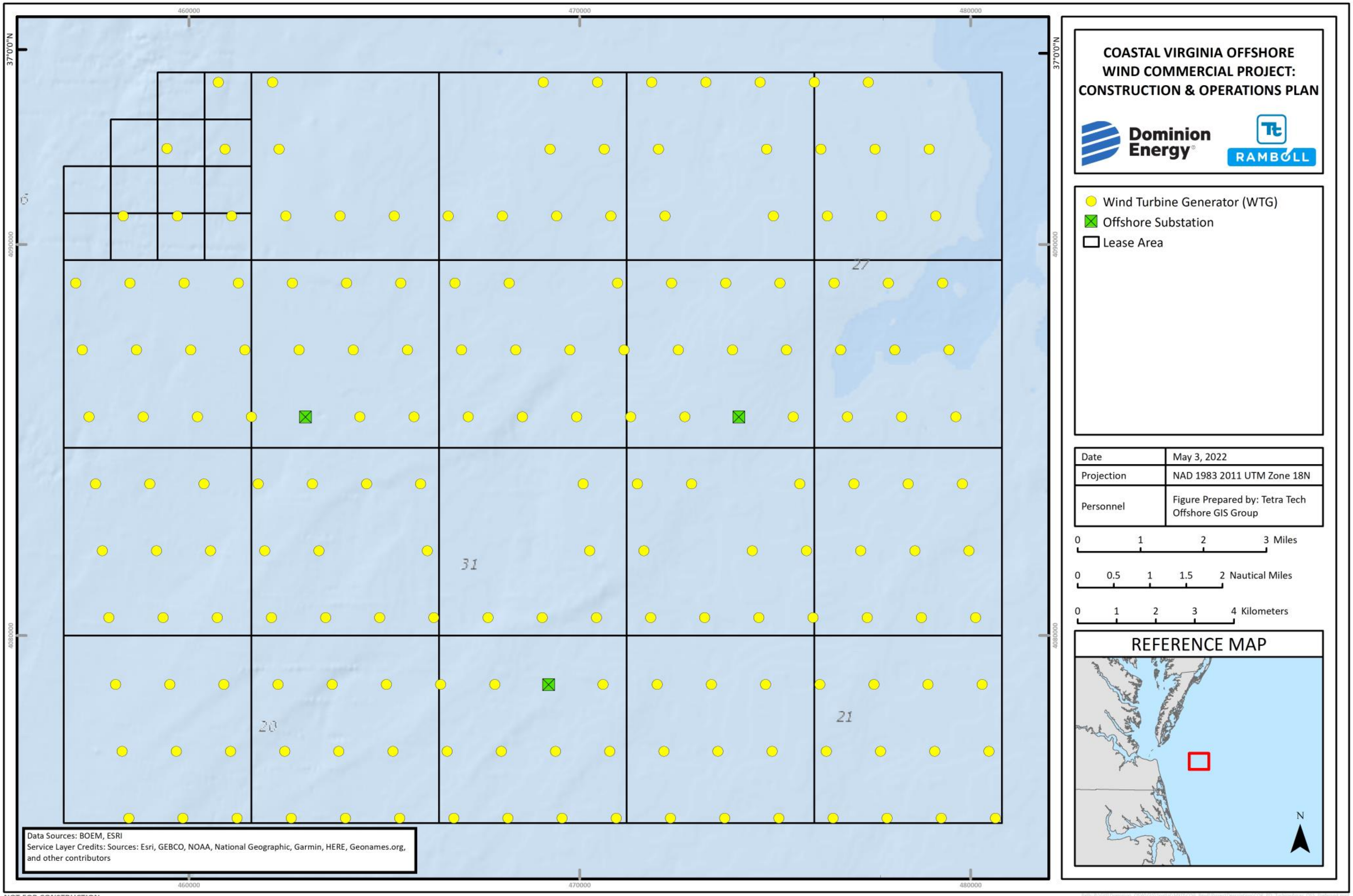


Figure 3.3-5. CVOW Commercial WTG and Offshore Substation Preferred Alternative Layout

The spare WTG locations are located along the northwestern and northeastern boundaries of the Lease Area and within an area referred to as the fish haven area along the northern border of the Lease Area. The fish haven area is an area of documented various recreational fisheries uses within the Offshore Project Area, particularly within the portion of the Lease Area called the "Triangle Wrecks" (also known as "Triangle Reef"). In the event that WTGs need to be shifted due to constraints at the preferred locations, preference would first be given to one of the feasible unused WTG locations from the Maximum WTG Layout, and then the spare locations in the northeastern and northwestern corners of the Lease Area, respectively, when possible. Any WTGs within the fish haven area would be sited to avoid the items associated with the artificial reef, as well as other biological or cultural resources identified during geophysical surveys. The final WTG layout will be provided as part of the FDR/FIR, to be reviewed by the CVA and submitted to BOEM prior to construction and installation.

3.3.1.2 Inter-Array Cable

The Inter-Array Cables will carry the electrical current produced by the WTGs to the Offshore Substations. The Inter-Array Cable system will be comprised of a series of cable "strings" that interconnect WTGs to the Offshore Substations. The Inter-Array Cables will consist of strings of three-core copper and/or aluminum conductor, with a rated voltage of 72.5 kV and an operating voltage of 66 kV, connecting up to eight WTGs per string. The Preferred Alternative currently included in the PDE for the Inter-Array Cable strings includes variable cable dimensions. The Preferred Alternative would utilize all-copper conductor cables with the largest cable diameter of 7.1 inches (in) (180 millimeters [mm]). The smaller diameter cable would be used to connect the WTGs located furthest from the Offshore Substation, which would then transition to the larger cable diameter as the Inter-Array Cables approach the Offshore Substation.

Assuming utilization of the preferred positions within the WTG layout, Dominion Energy anticipates up to 12 WTG strings would be connected to each Offshore Substation, for a total of up to 36 WTG strings. However, if WTGs are shifted to spare locations, the Inter-Array Cable layout would need to be reassessed and the number of WTGs per string and/or the number of WTG strings connecting to each Offshore Substation may be modified to maintain a reasonable balance of power between Offshore Substations. Table 3.3-4 provides a summary of the PDE for the Inter-Array Cable design parameters. An illustration of a representative cross-section of an Inter-Array Cable can be found in Figure 3.3-6 and illustrations of the maximum and preferred Inter-Array Cable layouts are provided in Figure 3.3-7 and Figure 3.3-8.

Table 3.3-4. Inter-Array Cable Maximum Design Parameters

Parameter	Minimum	Maximum	Preferred Alternative
Number of Cables	176	230	178
Length per Cable	4,505 ft (1,373 m)	31,804 ft (9,694 m)	5,111 ft (1,558 m) to 31,804 ft (9,694 m), varies by location
Total Length of Cable	228.6 mi (367.9 km)	300.7 mi (484 km)	229.4 mi (369 km)
Operating Voltage	59.4 kV	66 kV	66 kV
Cable Diameter	5.6 in (142 mm)	7.9 in (200 mm)	Up to 7.1 in (up to 180 mm)

Figure 3.3-6. Representative Cross Section of an Inter-Array Cable

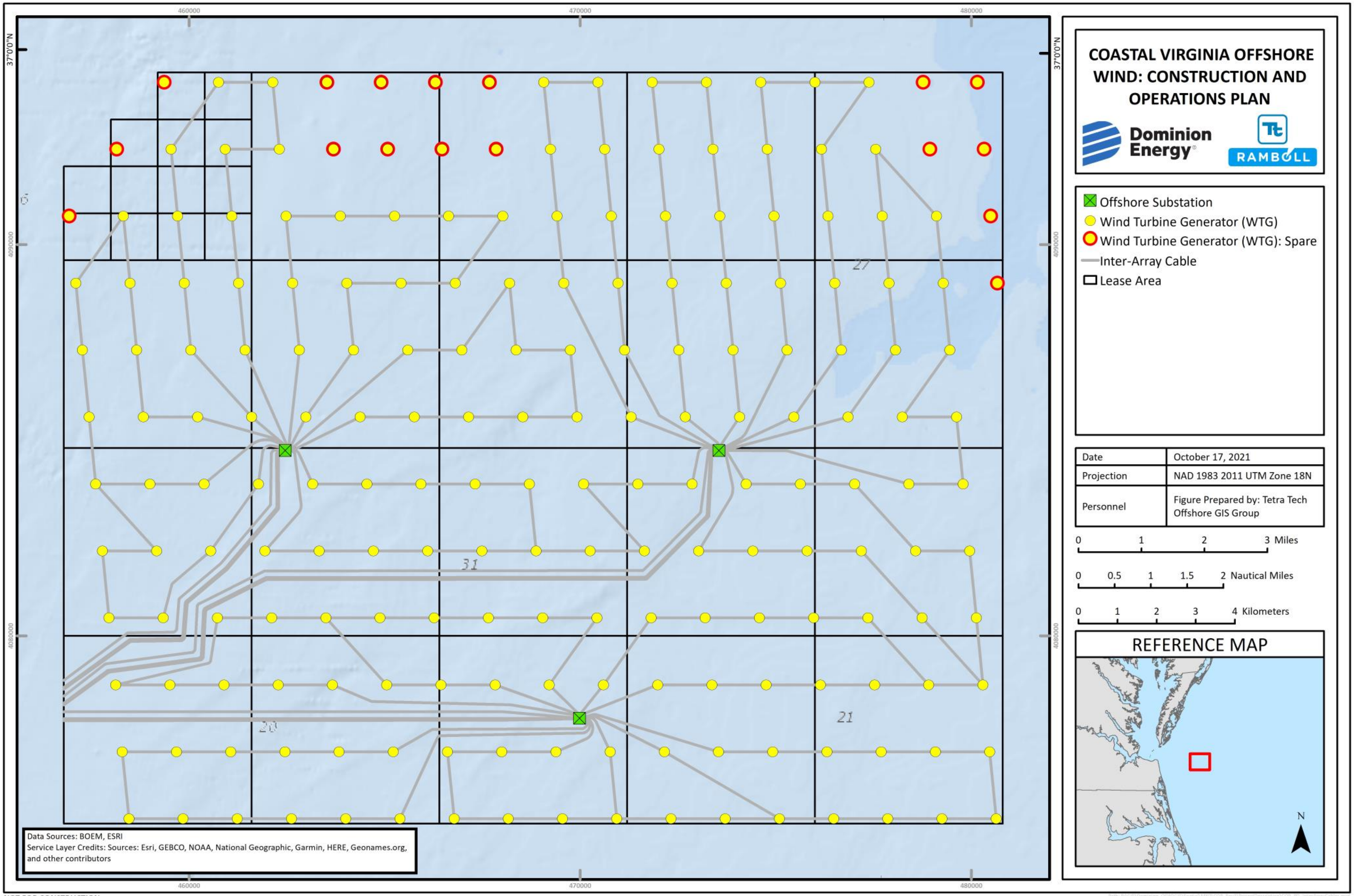


Figure 3.3-7. Maximum Inter-Array Cable Layout

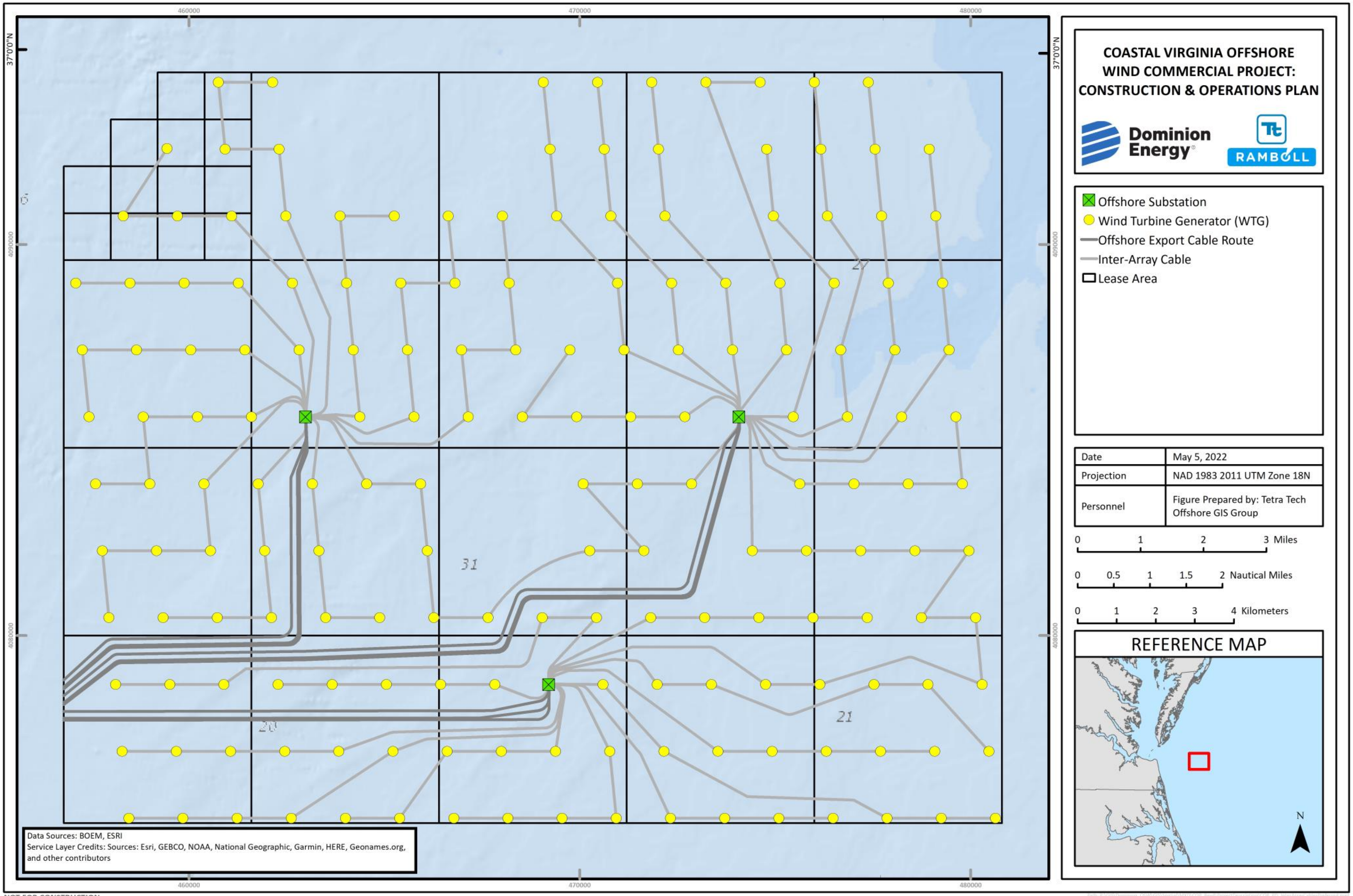


Figure 3.3-8. Preferred Inter-Array Cable Layout

3.3.1.3 Offshore Substation

The Offshore Substation is an offshore platform containing the electrical components necessary to collect the power generated by the WTGs (via the Inter-Array Cable system) and transform it to a higher voltage for transmission and transport of that power to the Project's onshore electricity infrastructure (via the Offshore Export Cables). Dominion Energy is proposing to construct three Offshore Substations each with a rated capacity of up to 900 MW, respectively. The locations of the three 900-MW Offshore Substations, are shown in Figure 3.3-4. The Offshore Substation is comprised of two main components: (1) a foundation attached to the seafloor and (2) a topside that contains the decks holding the main electrical and support equipment. Each Offshore Substation will contain equipment for high-voltage transmission, including three main transformers, three high voltage shunt reactors and three auxiliary transformers, and other facilities such as heating and ventilation systems, low-voltage distribution, diesel generator, uninterrupted power supply/batteries, pollution prevention system, SCADA systems, communications systems, safety systems, and control panels for operation of the substation auxiliary systems, WTGs and the high voltage/medium voltage power transmission.

The Offshore Substation will contain multiple deck levels, including the roof deck, utility deck, cooler deck, main deck, cable deck and cellar deck (located on the Offshore Substation Jacket Foundation), which will hold the equipment, cables, and maintenance/shelter area. Dominion Energy is also considering adding a helipad to support monitoring and maintenance to each of the Offshore Substations for normal and emergency access by helicopters. The addition of a helipad would increase the size of the roof deck, which is accounted for in the maximum design parameters, and may also affect the orientation of the decks and increase the weight of the Offshore Substation.

The corrosion protection system of the Offshore Substation is designed according the industry standard for offshore structures. The Offshore Substation Jacket Foundation will be a combined solution of cathodic protection (i.e., sacrificial anodes most likely aluminum-indium-alloy) and a coating system. The sacrificial anodes should be inspected during the lifetime to ensure functionality and protection of the Offshore Substation. The Offshore Substation topside will be protected by a coating system. Coating system will be inspected and maintained to ensure functionality and protection of the Offshore Substation.

A summary of the Offshore Substation topside design parameters are provided in Table 3.3-5 including helideck and antenna mast and an example of an Offshore Substation is provided in Figure 3.3-9.

Table 3.3-5. Offshore Substation Topside Design Parameters

Parameter	Minimum	Maximum	Preferred Alternative
Voltage transformed at Offshore Substation	66/230 kV		66 kV to 230 kV
Width	98 ft (30 m)	203 ft (62 m)	109.9 ft (33.5 m)
Length	178 ft (54.4 m)	242 ft (74 m)	242 ft (74 m)
Height*	58 ft (17.8 m)	177 ft (54 m) b/	151 ft (46 m)*
Base Height above MLLW (air gap) a/	56 ft (17 m)	151 ft (46 m)	76.8 ft (23.4 m)

Notes:
a/ Includes foundation jacket structure.
b/ Includes antenna mast + foundation jacket structure + helipad above MLLW

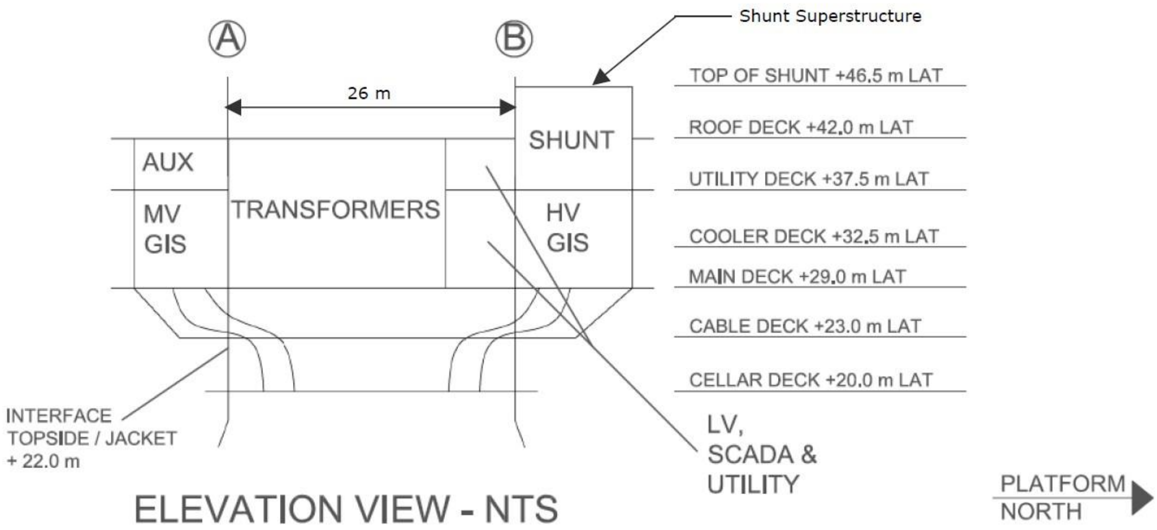


Figure 3.3-9. Example Schematic of the Offshore Substation Topside

Each of the Offshore Substations will require various oils, fuels, and lubricants to support operation. The Offshore Substation topside will be designed to minimize the potential for spills and leaks through the implementation of containment measures. The spill containment strategy for each Offshore Substation is comprised of preventive, detective, and containment measures. Each Offshore Substation will also contain a collection and sump system including an oil water separator system, specifically designed to collect and contain the volume of a single fluid within a suitable response time. Table 3.3-6 provides a summary of the Offshore Substation oils, fuels, and lubricants proposed for use at each Offshore Substation, as well as the anticipated volumes (see also Appendix Q, Oil Spill Response Plan).

Table 3.3-6. Oil/Fuel/Lubricant Parameters per Offshore Substation

Offshore Substation Component	Oil/Fuel/Lubricant	Type	Expected Amount
Transformer	Mineral oil	Shell Diala S4 ZX-1	55,500 gallons (gal) (210,000 liters [l])
Shunt Reactor	Mineral oil	-	26,400 gal (100,000 l)
Earthing Transformer	Dielectric insulating fluid	MIDEL 7131	4,200 gal (15,750 l)
66 kV Gas Insulated Switchgear	Sulfur hexafluoride gas	-	4,409 pounds (lb) (2,000 kilograms [kg])
235 kV Gas Insulated Switchgear	Sulfur hexafluoride gas	-	5,070 lb (2,300 kg)
Diesel Generator Tank	Diesel	-	47,620 lb (21,600 kg)

Offshore Substation Jacket Foundations

Dominion Energy is proposing the use of piled jacket foundations to support the Offshore Substations; both pre- and post-installed pile designs are under consideration as part of the PDE, however, pre-installed piled jacket foundations are considered the Preferred Alternative. While the individual Offshore Substations will be similar in size, the final design of the Offshore Substation piled jacket foundations will be position specific and determined by the final engineering design process, informed by factors including water depth, soil conditions, wave and tidal conditions. Table 3.3-7 provides a summary of the Offshore Substation Jacket Foundation design parameters and Figure 3.3-10 below provides a general schematic of the Offshore Substation Jacket Foundation.

Table 3.3-7. Offshore Substation Jacket Foundation Installation Design Parameters

Foundation Parameter	Minimum	Maximum	Preferred Alternative
Number of piles a/	4	4	4
Pile diameter	4.9 ft (1.5 m)	9.0 ft (2.8 m)	9.0 ft (2.8 m)
Base dimensions	98 ft x 98 ft (30 m x 30 m)	306.8 ft x 283.8 ft (93.5 m x 86.5 m)	118.1 ft x 91.9 ft (36.0 m x 28.0 m)
Scour protection diameter (per leg)	0 ft (0 m)	230 ft (70 m)	N/A
Seabed penetration	131 ft (40 m)	269 ft (82 m)	229.7 ft to 269 ft (70 m to 82 m)
Seabed footprint (without scour protection) a/	9,687 ft^2 (900 m^2)	87,070 ft^2 (8,088 m^2)	13,777 ft^2 (1,280 m^2)
Seabed footprint (with scour protection) b/	N/A	497,092 ft^2 (46,181 m^2)	NA c/
Dimensions at Lowest Astronomical Tide	65.6 ft x 98.4 ft (20 m x 30 m)	98.4 ft x 131.2 ft (30 m x 40 m)	101.7 ft x 77.1 ft (31.0 m x 23.5 m)

Notes:
a/ Per Offshore Substation Jacket Foundation considering additional area for the pre-pile template
b/ Per Offshore Substation Jacket Foundation if scour protection is required
c/ Scour protection for Offshore Substation Jacket Foundations is not currently anticipated in the Preferred Alternative. However, impact calculations have been based on a maximum 230 ft (70 m) diameter of scour protection for each leg of the foundation to provide flexibility as the detailed engineering progresses.

The cellar deck, the lowest of several decks on the Offshore Substation, is part of the Offshore Substation Jacket Foundation and would be an open deck with access from the boat landing and the upper decks. The primary purpose of the cellar deck is to facilitate the cable pull-in and to make it possible to perform this prior to construction and installation of the Offshore Substation topside. The cellar deck would include room for a maximum of 18 J-tubes for Inter-Array Cables (and up to one spare J-tube), and up to five J-tubes for Offshore Export Cables, for a total of up to 24 J-tubes. The cellar deck would provide sufficient space for a cable pulling winch and cable hang-offs..

The Offshore Substation Jacket Foundations are not currently foreseen to have scour protection installed around the base of the piled jackets. However, if detailed engineering indicates the need for scour protection, the type, and method for installing scour protection will be determined in consultation and coordination with relevant jurisdictional agencies prior to construction and installation.

Based on current knowledge of the ground conditions from the data collected in support of the CVOW Pilot Project, in addition to geotechnical investigations completed in the Lease Area, Dominion Energy believes that it is possible to design and install the size and type of piled jacket foundations included in the PDE to the desired target penetration depth. Dominion Energy has completed extensive geophysical and geotechnical surveys, as well as benthic surveys, metocean data collection, capacity analysis and stakeholder outreach to inform final siting and design of the Project. Additional detail, including a drivability assessment based on site-specific data, decades of use in offshore wind, and engagement with manufacturers, will be included in the FDR.

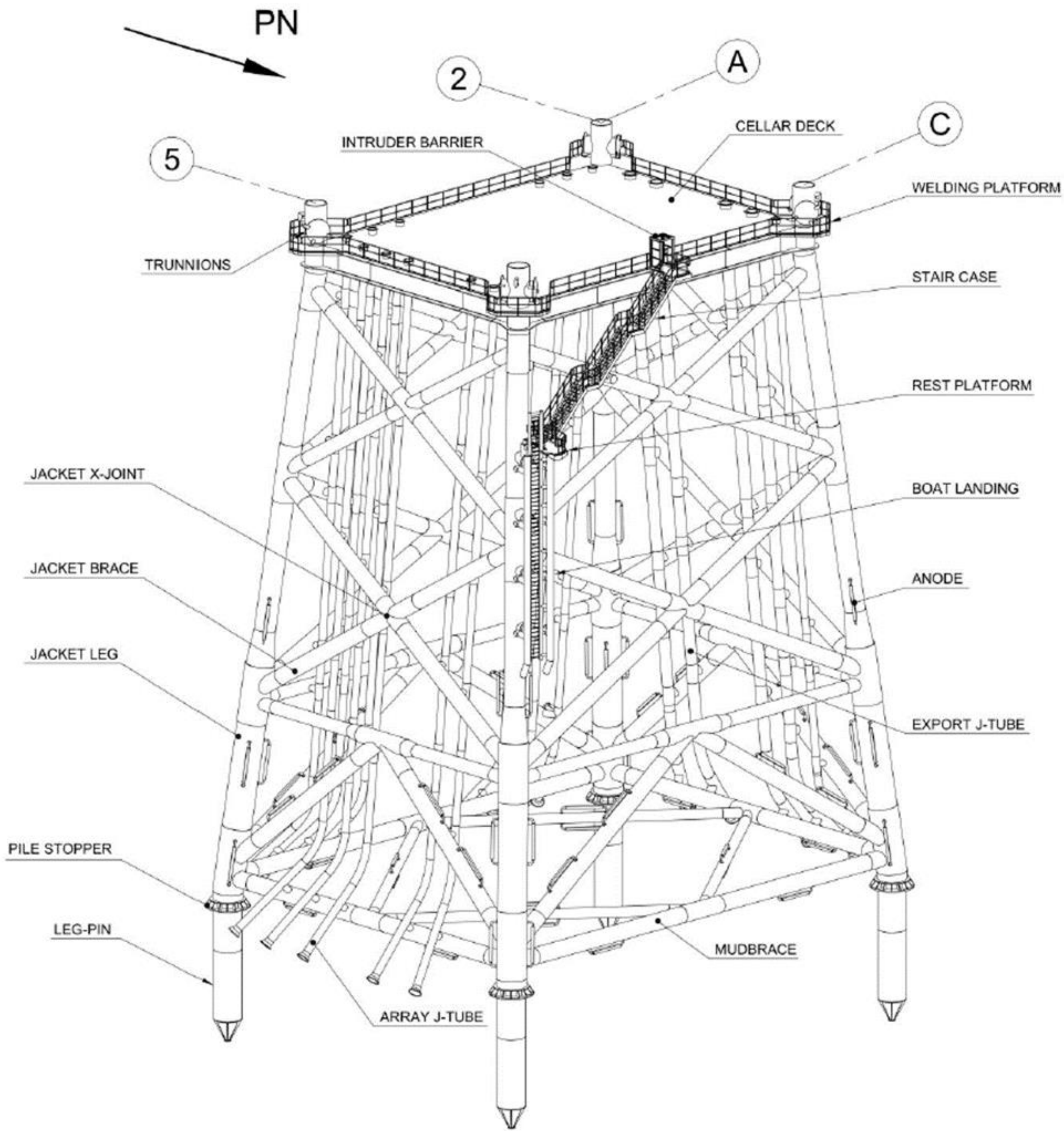


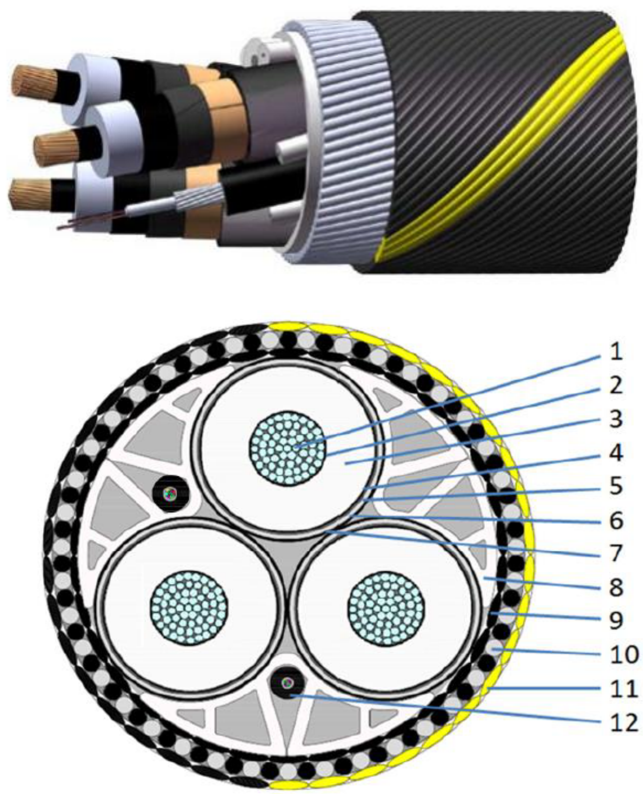
Figure 3.3-10. Example Schematic of the Offshore Substation Jacket Foundation

3.3.1.4 Offshore Export Cable

The Offshore Export Cables would transfer the electricity from the Offshore Substations to the Cable Landing Location in Virginia Beach, Virginia. The WTGs would be connected via the Inter-Array cables to the Offshore Substations, and each Offshore Substation will be connected to Onshore Project Facilities via the Offshore Export Cables.

The Offshore Export Cables have been designed based on the energy capacity needs of the Project as well as consideration of site-specific installation conditions, including seabed temperature, burial depth, and seabed thermal resistivity. The design of the Offshore Export Cables will be further refined based on the results of the system studies, geotechnical surveys, and landfall design.

Electricity would be transferred from each of the three Offshore Substations to the Cable Landing Location via three 3-core copper and/or aluminum-conductor 230-kV subsea cables (Figure 3.3-11), for a total of nine Offshore Export Cables. Upon exiting the Lease Area, the nine Offshore Export Cables would merge to become one overall Offshore Export Cable Route Corridor containing all nine Offshore Export Cables. The Offshore Export Cable Route Corridor between the western edge of the Lease Area and the Cable Landing Location would range from 9,400 ft (2,865 m) down to 1,749 ft (533 m) wide. Variability in the Offshore Export Cable Route Corridor width is driven by several external constraints that are present at different locations along the Offshore Export Cable Route Corridor including existing telecom cable and transmission cable crossings; the DoD exclusion area to the south; the vessel traffic lane and proposed Atlantic Coast Port Access Study safety fairway to the north; crossing DNODS; obstructions, exclusion areas, and seabed conditions identified from existing data and surveys; potential risks due to the use of the area by third parties; and the approach to the Nearshore Trenchless Installation Area.



Not to scale – indicative only

No.	Description	Details
1	Conductor	Aluminium circular stranded, compacted, longitudinally water blocked, Semi conductive Water Swellable Tape on top of conductor
2	Conductor screen	Extruded bonded semi conductive compound
3	Insulation	XLPE (cross linked Polyethylene)
4	Insulation screen	Extruded bonded semi conductive compound
5	Water Blocking	Semi conductive Water Swellable Tape
6	Metal sheath	Lead alloy sheath
7	Inner sheath	Extruded Semi conductive Polyethylene on each phase
8	Fillers	Plastic fillers
9	Armour bedding	Polypropylene Yarns
10	Armouring	One layer mixed: 50% Stainless steel wires and 50% PE rod
11	Serving	Polypropylene Yarns
12	OF cable	2 x Optical Fibers Cable with 48 fibres: 44 SM and 4 MM

Figure 3.3-11. Cross-Section of Typical Subsea Cable

The maximum Offshore Export Cable Route Corridor width of 9,400 ft (2,865 m) would be maintained along portions of the Offshore Export Cable Route Corridor where available space and seabed conditions permit. Along areas of the Offshore Export Cable Route Corridor where the Offshore Export Cable Route Corridor width must be reduced to 1,749 ft (533 m) to avoid constraints and obstructions, several additional design factors were considered to evaluate the reduced cable spacing required to fit within the available area, including flexibility (or lack thereof) in size of repair bight; further discussion with cable installers on cable repair vessel requirements; maximizing generation availability following a fault and during cable repair; and the level of contingency included in the cable specification.

Along the approximately 1.9 mi (3 km) section of the Offshore Export Cable Route Corridor that crosses through the DNODS, USACE has indicated that only cells 2 and 5 should be utilized for cable installation. Due to the width of the available area between DNODS cells 2 and 5, and the telecom and transmission cables previously installed in that area, the section of the Offshore Export Cable Route Corridor through the DNODS must be further reduced to 1,749 ft (533 m). The specific spacing of the Offshore Export Cables through the DNODS is currently anticipated to be 164 ft (50 m) throughout DNODS, and all cables will be contained within Zones 2 and 5. A detailed engineering assessment will be prepared and cable spacing details will be provided in the FDR/FIR, to be reviewed by the CVA and submitted to BOEM prior to installation.

Within the Offshore Export Cable Route Corridor, the nine Offshore Export Cables would generally be spaced approximately 164 to 2,716 ft (50 to 828 m) apart. At certain locations, the Offshore Export Cables may be spaced 164 to 328 ft (50 to 100 m) apart based on natural and environmental constraints. The Offshore Export Cable Route Corridor and individual Offshore Export Cable Routes within the corridor are shown in Figure 3.3-12. The maximum design scenario for the Offshore Export Cables is provided below in Table 3.3-8.

Table 3.3-8. Offshore Export Cable Design Parameters

Offshore Export Cable Feature	Minimum	Maximum	Preferred Alternative
Number of Cables	9	9	9
Voltage per Circuit	230 kV	230 kV	230 kV
Cable Diameter	10.2 in (259 mm)	11.4 in (290mm)	10.2 in (259 mm)
Total Corridor Length (from the Lease Area to the Cable Landing Location)	37.28 mi (60 km)	49.01 mi (79 km)	37.28 mi (60 km) to 44.74 mi (72 km)
Area of Construction Corridor (Offshore Work Area to Offshore Substations) a/	1,334.36 ac (540.00 ha)	2,635.37, ac (1,066.50, ha)	1,334.36 ac (540.00 ha) to 1,601.24 ac (648.00 ha)
Requested Operational Right-of-Way Width a/	1,969 ft (600 m)	2,953 ft (900 m)	1,969 ft (600 m) to 2,953 ft (900 m)

a/ Based on total corridor length multiplied by number of cables (9) multiplied by minimum 33 ft (10 m) (preferred) and maximum 50 ft (15 m) width of trencher

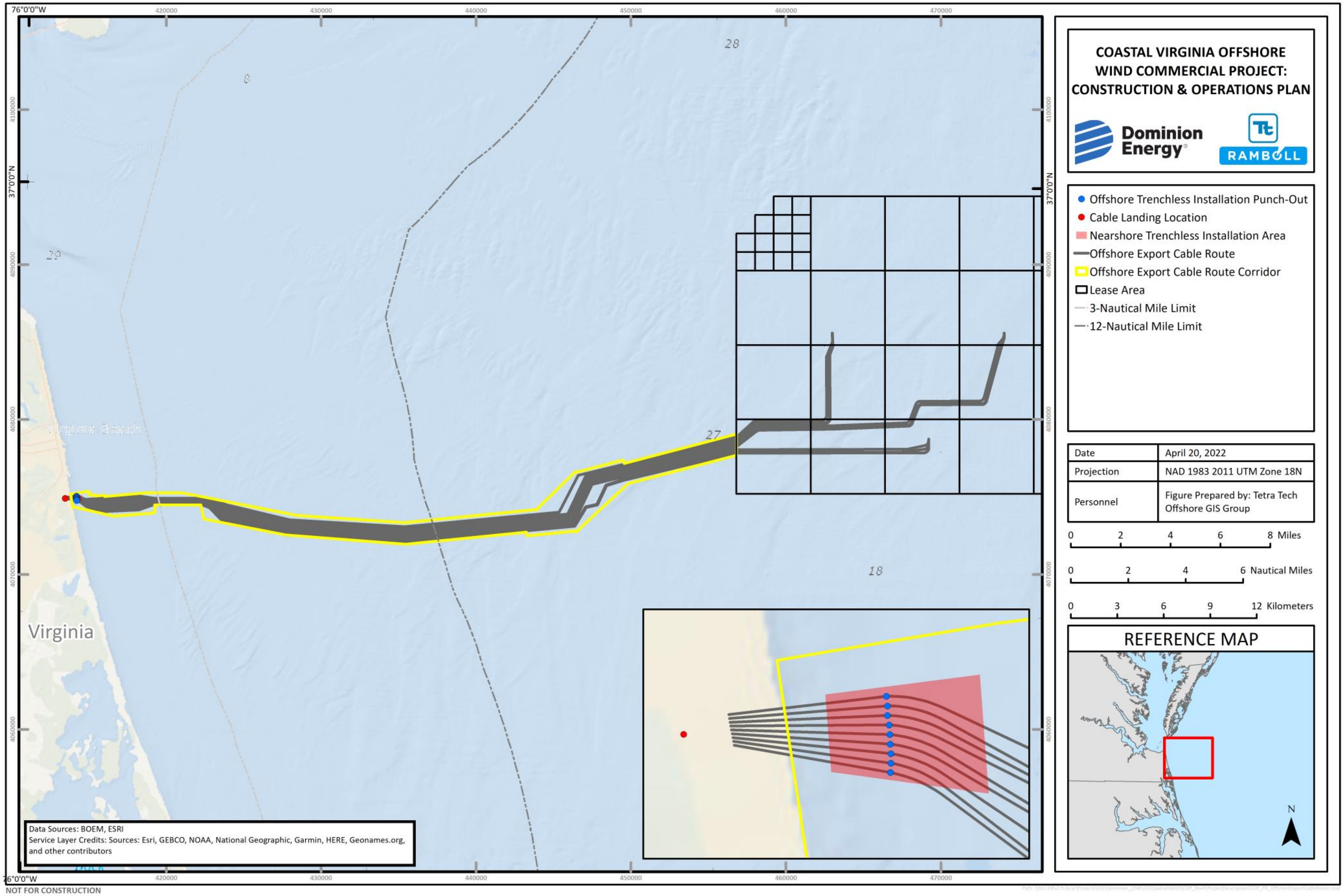


Figure 3.3-12. Offshore Export Cable Route Corridor and Offshore Export Cable Routes

Cable/Pipeline Crossings

Dominion Energy has identified three cables located within the Offshore Export Cable Route Corridor that will be crossed by the Offshore Export Cables. These cables include three in-service telecoms cables. The telecoms cables are the MAREA, BRUSA, and DUNANT cables.

At cable crossing locations, both the existing infrastructure and the Offshore Export Cables must be protected. This protection and crossing method will be determined on a case-by-case basis depending on the specifications of each crossing, including the depth and angle of crossing and through negotiations with each individual asset owner. At a minimum, it is expected that each asset crossing will include two layers of some form of cable protection that would be installed prior to and post Offshore Export Cable installation and, potentially, a third layer of protection if stabilization and scour protection of the cable crossing is deemed necessary (see Figure 3.3-13).

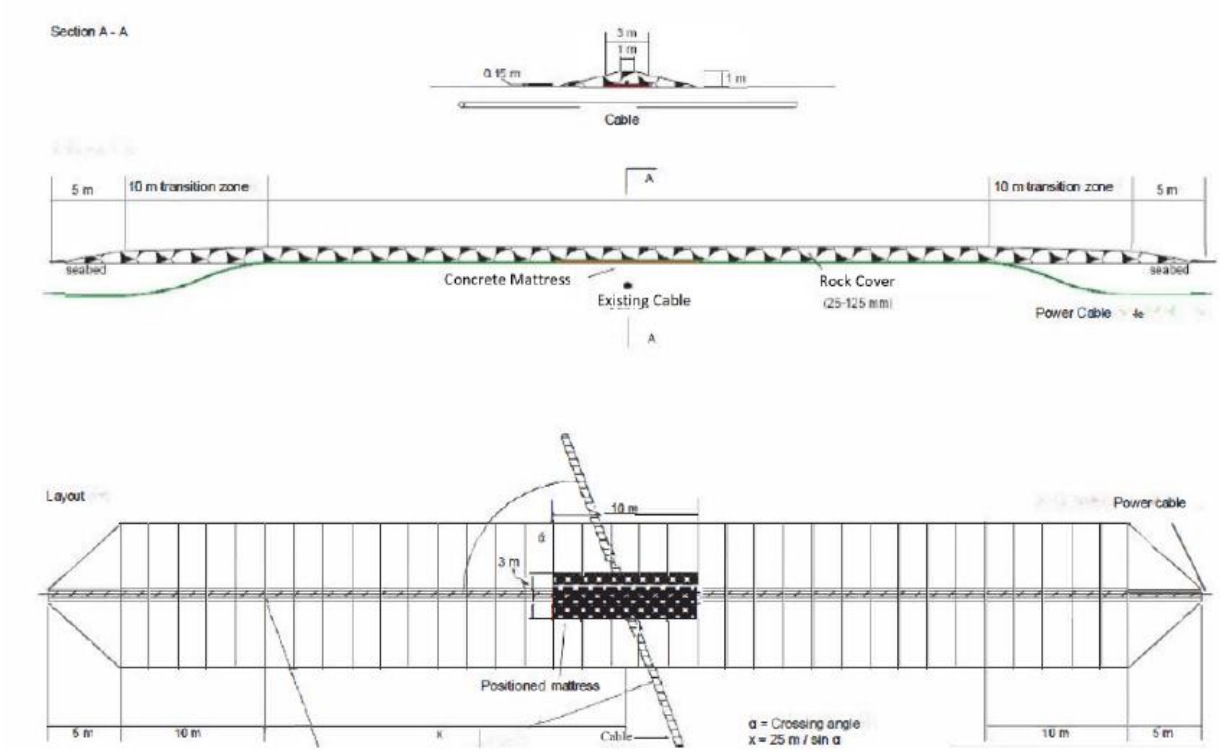


Figure 3.3-13. Example Schematic of Offshore Export Cable Crossing

Final crossing designs will be completed in coordination with each of the asset owners and formalized in crossing agreements. Cable crossing design drawings, separation, and burial/cover details will be provided in the FDR/FIR, to be reviewed by the CVA and submitted to BOEM prior to installation.

3.3.2 Nearshore and Onshore Project Components

3.3.2.1 Cable Landing Location

As stated in Section 3.2, Project Infrastructure Overview, the intersection of the Offshore Export Cables and Onshore Export Cables would occur at the Cable Landing Location, located at the Proposed Parking

Lot west of the Firing Range at SMR in Virginia Beach, Virginia (see Figure 3.3-14). The easement agreement for the Proposed Parking Lot west of the Firing Range at SMR will be finalized after the Certificate of Public Convenience and Necessity (CPCN) is received from the Virginia State Corporation Commission (SCC). The parking lot agreement has not yet been finalized, as Dominion Energy is trying to work through the implications of a permanent parking lot (i.e. stormwater controls). Dominion Energy plans to use Trenchless Installation (DSPT) to install the Offshore Export Cable under the beach and dune from the Offshore Trenchless Installation Punch-Out approximately 1,000 to 1,800 ft (304 to 549 m) offshore of the Cable Landing Location(s) to a maximum depth of 125 ft (38 m) below grade. The Offshore Export Cables would be brought to shore through a series of conduits. Upon exiting the conduits, the nine 230-kV Offshore Export Cables would be spliced in a series of nine separate single circuit vaults laid in a single ROW and transition to the Onshore Export Cables at the Cable Landing Location (See Section 3.3.2.2, Onshore Export Cable). The Onshore Export Cables will be installed via open trench, microtunneling and HDD. The operational footprint for Cable Landing Location is anticipated to be approximately 2.8 ac (1.1 ha).

The Proposed Parking Lot west of the Firing Range at SMR is located east of Regulus Avenue and north of Rifle Range Road. The Proposed Parking Lot west of the Firing Range at SMR would be suitable for the construction of the planned Nearshore Trenchless Installation and the start of the terrestrial routes. The HDDs would be considered from the landing site to a point inland to minimize impacts to Rifle Range Road and other features at the SMR.

DSPT Method

DSPT combines some of the benefits of both microtunneling and HDD. The overall bore path of a DSPT installation may be similar to that of an HDD alignment or shallower depending on subsurface conditions.

DSPT involves using a direct steerable tunnel boring machine (DSTBM) to excavate ground along the design alignment while simultaneously pushing steel casing pipes behind the DSTBM using a pipe thrusting machine. The pipe thrusting machine is situated on the ground surface or (typically) in a shallow pit, and uses pipe clamps to grip the outside circumference of the pipe and thrust the steel casing pipe behind the DSTBM in compression. This provides the force required to progress the DSTBM forward, which excavates the ground at the leading edge of the casing pipe.

The overall DSPT construction process typically consists of the following steps:

- The pipe thruster is setup at an angle typically less than 15 degrees. The DSTBM is launched through a sheet pile wall of the shaft along the design alignment.
- The pipe thruster uses vices to clamp onto the circumference of a steel casing pipe and pushes the DSTBM followed by the casing pipes along the design alignment. The pipe thruster can also perform other functions including pulling out existing steel pipes from the ground or pushing or pulling casing pipes into already existing borehole.

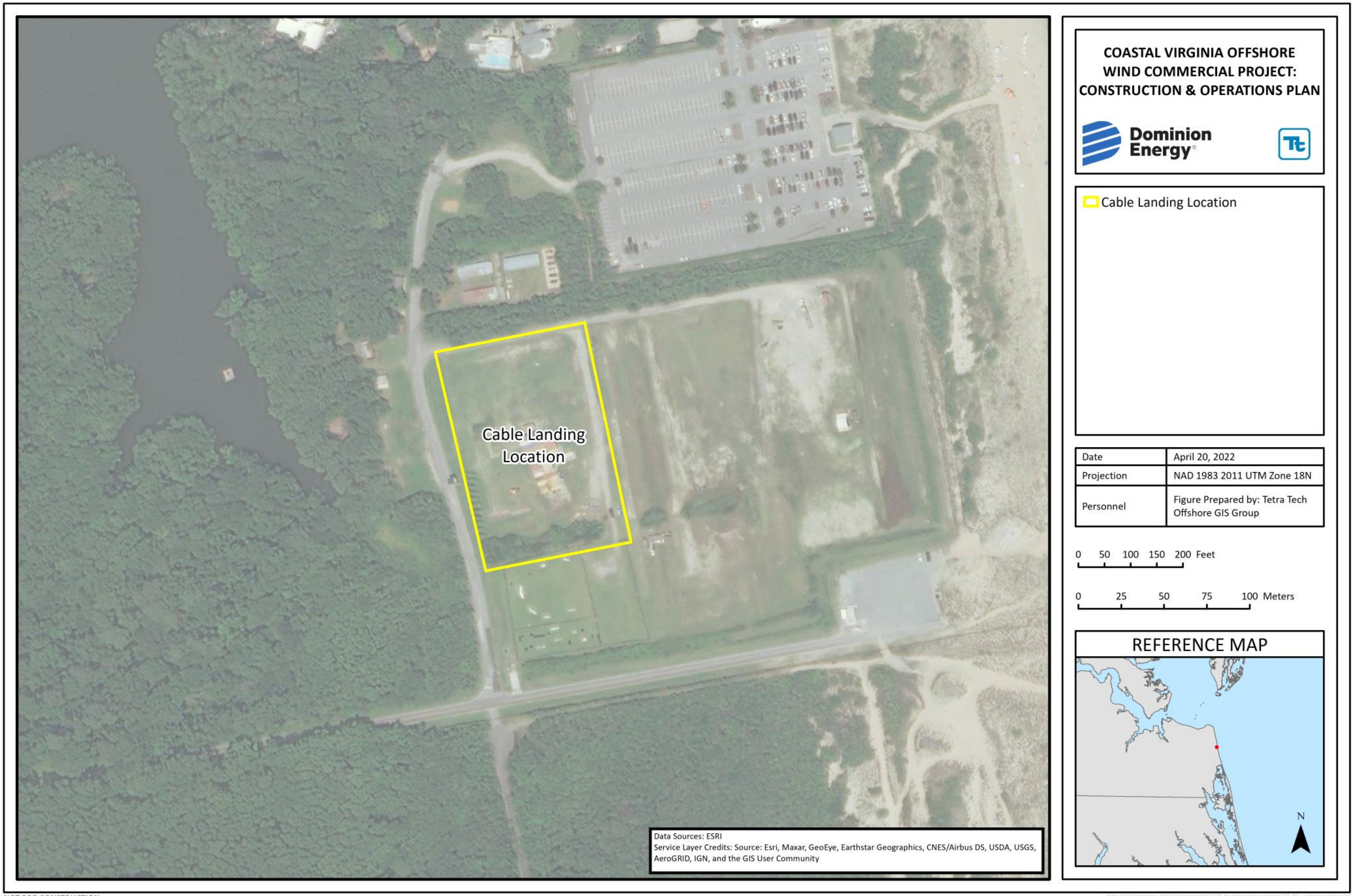


Figure 3.3-14. Onshore Project Components—Cable Landing Location

- The DSTBM is deployed in front of the casing pipes. Although similar to a conventional microtunnel boring machine, a DSTBM uses fiberoptic gyroscopes for increased alignment accuracy and machine tracking in combination with having multiple trailing sections with articulating joints to support installation along a curved alignment.
- Strings of steel casing pipes are assembled, welded, and tested on site in preparation for the installation. The casing pipe is then laid out with the umbilical lines inside and held at the desired entry angle using rollers and cranes or movable support structures. The steel casing pipes are pushed behind the DSTBM up to the exit location.
- The DSTBM is extracted on the exit side along with the umbilical lines to complete the installation. In case of offshore applications, divers, barges, and associated construction equipment are used to extract the DSTBM and load it onto the barge for demobilization. Based on the project requirements, it is possible to uninstall the steel casing pipe by pulling it using the pipe thruster.

DSPT equipment including pumps, motors, powerpacks, drill mud processing systems, storage tanks, and associated construction equipment will be situated at the DSPT entry location at the Cable Landing Location to support the boring operations. The unique advantage of DSPT is that it is mostly a unidirectional system, where only the equipment required to extract the DSTBM is temporarily staged at the exit location in the Nearshore Trenchless Installation Area, thus reducing the overall work area impact at the exit location.

3.3.2.2 Onshore Export Cable

The Onshore Export Cables would transfer the electricity from the Cable Landing Location at the Proposed Parking Lot west of Firing Range at SMR, in Virginia Beach, Virginia to a Common Location north of Harpers Road and would be comprised of 27 single-phase Onshore Export Cables with an operating voltage of 230 kV (maximum of 241.5 kV) installed underground within the Onshore Export Cable Route Corridor. The Project is currently evaluating one Onshore Export Cable Route within the PDE for the Project. The Onshore Export Cable Route will HDD below Lake Christine, running northwest through SMR land, then crossing to General Booth Boulevard just south of the Virginia Aquarium with an HDD below Owl's Creek and following Bells Road, then crossing to South Birdneck Road and, pending Navy approval, onto the NAS Oceana Parcel, from the east. From the NAS Oceana Parcel, the route proceeds south along Oceana Boulevard, then west along Harpers Road to a Common Location north of Harpers Road. The Onshore Export Cable Route is approximately 4.41 mi (7.10 km) long and the operational corridor will be approximately 51 ac (20.5 ha). The Onshore Export Cable Route is shown in Figure 3.3-15.

3.3.2.3 Switching Station

The Switching Station is proposed to be constructed either north of Harpers Road (Harpers Switching Station, preferred) or north of Princess Anne Road (Chicory Switching Station), in Virginia Beach, Virginia (Switching Station; see Figure 3.3-15). Only 1 switching station will be constructed. The Chicory Switching Station would only be constructed if Interconnection Cable Route Alternative 6 is selected. See Section 4.5.3, Land Use and Zoning, for comprehensive site information. The Switching Station would collect power and convert an underground cable configuration to an overhead configuration. The power would then be transmitted to the existing Onshore Substation location for distribution to the grid.

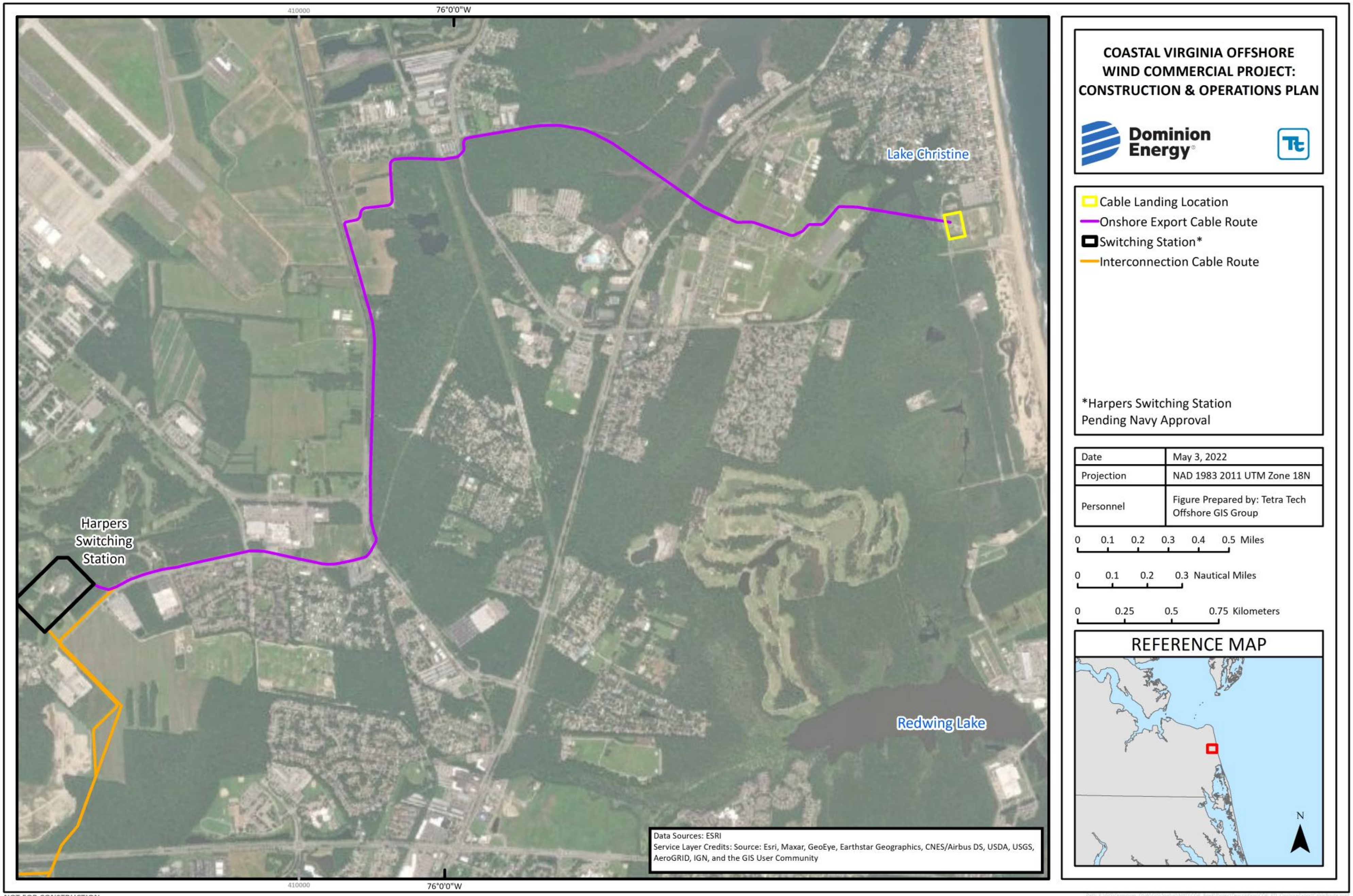


Figure 3.3-15. Onshore Project Components—Onshore Export Cable Route

The Switching Station is an electric transmission system asset and would be comprised of circuit breakers, gas-insulated switchgear, shunt reactors, and static synchronous compensators. The Switching Station would be an aboveground, fenced facility which will include the station electrical components described above and associated site development stormwater management facilities/storage ponds. The facility and its components will generally have the appearance of a typical larger Dominion Energy substation.

The operational footprint of the Harpers Switching Station is anticipated to be approximately 21 ac (8.5 ha), with an additional 6.5 ac (2.6 ha) for stormwater management facilities, and 5.8 ac (2.4 ha) for relocation of fairways and a maintenance building associated with the adjacent golf course. The operational footprint of the Chicory Switching Station is anticipated to be approximately 27.5 ac (11.1 ha).

The Switching Station would serve as a transition point where the power transmitted through twenty-seven Onshore Export Cables with an operating voltage of 230 kV coming from the Cable Landing Location would be collected to three Interconnection Cables with an operating voltage of 230 kV that would connect to the expanded Onshore Substation at Fentress, to be finally stepped up to 500 kV.

Dominion Energy is currently considering either an open-air or gas insulated design for the Switching Station. The gas insulated Switching Station design would be approximately one and a half times smaller in size of the open-air substation design, inclusive of the reactive equipment required for the installation of the underground transmission lines. The Switching Station will include a gas insulated switchgear building, control and security enclosures, three static synchronous compensators, eleven shunt reactors, static poles, and other ancillary equipment. The shunt reactors will contain approximately 1,600 gallons of oil each, with appropriate secondary containment. The tallest structure associated with the Switching Station will be the backbone and shield poles with an operating voltage of 230 kV which are both 75 ft (22.9 m) high. The facility is planned to be surrounded by a security fence approximately 15 ft (4.6 m) in height. The Switching Station will have a maximum of three emergency back-up generators, each 260 kW, generating 3-Phase, 120/240-volt alternating-current at 782 Amperes. The fuel source will include two 2,100-gallon (gal, 7,949.4-liter [l]) propane tanks for each generator. Representative schematics of the Switching Station can be found in Appendix K, Conceptual Design Drawings.

3.3.2.4 Interconnection Cable

A triple-circuit transmission line with an operating voltage of 230 kV would be constructed from a Common Location north of Harpers Road along an Interconnection Cable Route Corridor to the expanded/upgraded Onshore Substation at Fentress. The Interconnection Cable would be installed as either all overhead transmission facilities (preferred), or a combination of overhead and underground (hybrid) transmission facilities. Dominion Energy is evaluating five Overhead Interconnection Cable Route Alternatives and one Hybrid Interconnection Cable Route Alternative from Harpers Road to the Onshore Substation, at the POI.

Dominion Energy anticipates that a maximum construction and operational corridor width of 86.5 ft (26 m) would be needed for underground cables and that a maximum construction and operational corridor width of 250 ft (76.2 m) would be needed for overhead cables. Existing ROWs will be utilized to the extent practical. The overhead structure configuration within the Interconnection Cable Route Corridor generally would consist of a three single circuit structure configuration. The height of the overhead Interconnection Cables will be between 75 ft (22.9 m) and 170 ft (51.8 m). The final height of the overhead Interconnection Cables is dependent on the terrain within the route. As such, final heights will be determined following site specific surveys and detailed engineering. Note that while interconnections are commonly referred to as ‘circuits’, for consistency with terminology commonly associated with offshore wind projects, ‘cables’ is used throughout.

A description of each Interconnection Cable Route being evaluated as part of this Project is outlined in Table 3.3-9 (also see Section 2), and an overview of each of the routes is shown in Figure 3.3-16.

3.3.2.5 Onshore Substation

The Onshore Substation would be expanded/upgraded and is located northwest of the intersection at Centerville Turnpike and Etheridge Manor Boulevard in Chesapeake, Virginia. See Section 4.4.3, Land Use and Zoning, for comprehensive site information. The Onshore Substation would serve as the final POI for power distribution to the Pennsylvania-New Jersey-Maryland Interconnection (PJM) grid.

As discussed in Section 2, Project Siting and Design Development, the Onshore Substation was identified as a potential POI location because of its proximity to the Project, as well as being an integrated 230/500-kV substation—the only 500-kV substation located within a reasonable distance to the Cable Landing Location(s) in Virginia Beach, Virginia. The Onshore Substation will require expansion/upgrades to accommodate the electricity from the Project.

The current footprint of the Onshore Substation is approximately 11.7 ac (4.7 ha). The expansion/upgrades to the Onshore Substation footprint are anticipated to require approximately an additional 8.9 ac (3.6 ha), for a total of 20.6 ac (8.3 ha). Stormwater management facilities associated with the Onshore Substation will require an additional 4.5 ac (1.8 ha). The Onshore Substation expansions/upgrades would serve as the POI for the three 230/500-kV transformers for connection into the grid.

The existing equipment at the Onshore Substation impacted by this Project includes one 500-kV transmission line, two 230/500-kV transformer banks, and security fence.

The Onshore Substation expansion/upgrades will include the addition of three 230/500-kV transformer banks, a 500-kV gas insulated switchgear building, static poles, and other ancillary equipment. There will be nine new single-phase 230/500 kV transformers and three spares, with approximately 14,000 gal (52,995.8 l) of oil for each transformer. Each transformer will include an appropriately sized oil containment system. The tallest structure associated with the expansion/upgrades to the Onshore Substation will be the 500-kV backbone and is currently designed at 115 ft (35.1 m). Six new 500-kV breakers will be required to expand the Fentress Substation to accommodate the addition of the new transformers. The facility is planned to be surrounded by a security fence approximately 20 ft (6.1 m) in height. The Onshore Substation will have a maximum of two emergency back-up generators, one will be rated at 310 kW and the other at 410 kW, generating 3-Phase, 120/240-volt alternating current at 418 Amperes. The fuel source will include a 2,100 gal (7,949.4 l) propane tank for each generator. There will also be one generator classified as standby, rated at 150 kW, generating 3-Phase, 120/240-volt alternating current at 451 Amperes. The fuel source will include propane.

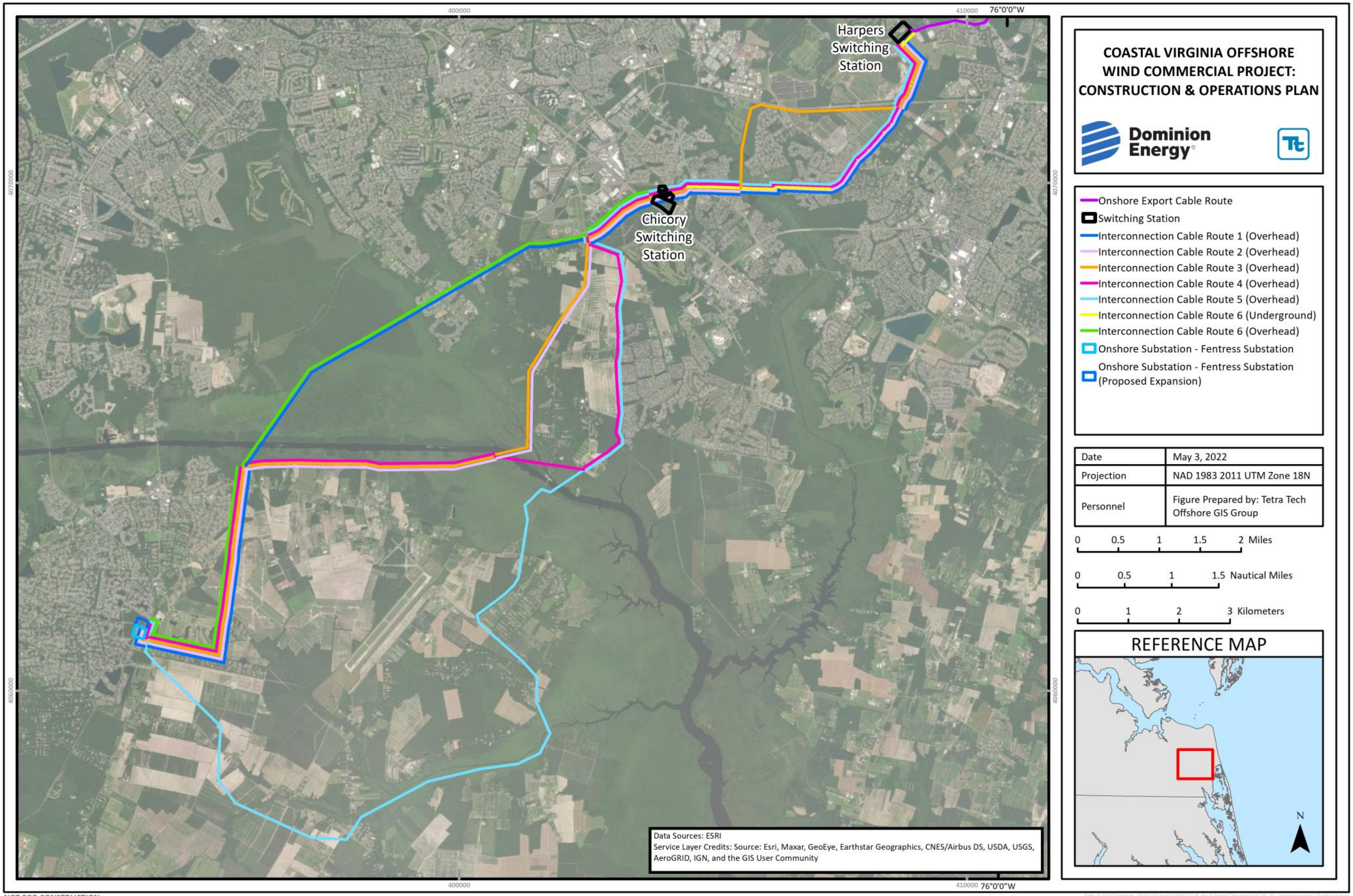


Figure 3.3-16. Onshore Project Components—Interconnection Cable Routes (including alternative routing options), Switching Stations and Onshore Substation

Table 3.3-9. Interconnection Cable Route Alternatives

Route Alt. #	Onshore Route Description	Route Length (miles) a/	Operational Corridor Area, Existing (acres)	Operational Corridor Area, Proposed (acres)
Overhead Routes				
1 (Preferred)	This overhead route runs southwest from the Common Location north of Harpers Road along the formerly proposed Southeastern Parkway Corridor, crossing Harpers Road, Dam Neck Road and London Bridge Road, then joins with existing Dominion-owned transmission lines (lines 147/2118) heading west for 1.8 mi (2.9 km). From there, the route continues southwest again along the formerly proposed Southeastern Parkway Corridor, crossing Princess Anne Road, Landstown Road, Salem Road, and Indian River Road, then re-joins with existing Dominion-owned transmission lines (lines 271, Idle Line-74, and/or 2240) for the remaining 6.0 mi (9.6 km) to the Onshore Substation.	14.2	121.5	132.2
2	This overhead route follows the same route as Overhead Interconnection Cable Route Alternative 1, with the exception of an approximately 6.2 mi (10.0 km) segment that runs south from the Princess Anne Sports Complex, crossing Salem Road, and Indian River Road parallel and to the west of North Landing Road before crossing the Albemarle and Chesapeake Canal, then runs west and re-joins existing Dominion-owned transmission lines (lines 271, Idle Line-74, and 2240) for the remaining 3.4 mi (5.5 km) to the Onshore Substation.	15.3	56.7	209.2
3	This overhead route follows the same route as Overhead Interconnection Cable Route Alternative 2, with the exception of an approximately 2.7 mi (4.3 km) segment that runs west along Dam Neck Road, past London Bridge Road, then turns south just before Taylor Farms, where it again aligns with Overhead Interconnection Cable Route Alternative 2 for the remaining 12.2 mi (19.6 km) to the Onshore Substation.	15.7	52.0	220.0
4	This overhead route follows the same route as Overhead Interconnection Cable Route Alternative 2, with the exception of an approximately 4.5 mi (7.2 km) long segment that joins existing Dominion-owned transmission lines (line 2085) between Landstown Road and Indian River Road, then crosses Upton's Lane and crosses the Albemarle and Chesapeake Canal west of North Landing Road, where it again aligns with Overhead Interconnection Cable Route Alternative 2 for the remaining 6.4 mi (10.3 km) to the Onshore Substation.	16.6	73.4	222. 6
5	This overhead route follows the same route as Overhead Interconnection Cable Route Alternative 4, with the exception of an approximately 11.2 mi (18.0 km) long segment that runs southwest from Upton's Lane, crosses the Albemarle and Chesapeake Canal east of North Landing Road, then follows Mount Pleasant Road, Fentress Airfield Road, and Blackwater Road, crossing the Pocaty River twice before heading west across agricultural fields, then approaches the Onshore Substation from the southeast.	20.3	26.7	316.4

Route Alt. #	Onshore Route Description	Route Length (miles) a/	Operational Corridor Area, Existing (acres)	Operational Corridor Area, Proposed (acres)
Hybrid Route				
6	This hybrid route follows the same route as Overhead Interconnection Cable Route Alternative 1, with the exception of the location of the Switching Station. The route would continue following Overhead Interconnection Cable Route Alternative 1 as an underground transmission line until a point near Princess Anne Road where the underground transmission line would transition from underground to an overhead transmission line configuration. A Switching Station (Chicory Switching Station) would be built north of Princess Anne Road. No aboveground Switching Station would be built at Harpers Road. From the Chicory Switching Station, the route becomes overhead and aligns with Overhead Interconnection Cable Route Alternative 1 for the remaining 9.88 mi (15.9 km) to the Onshore Substation.	14.2 [OH =9.7] [UG =4.5]	113.6	99.6

a/ OH = overhead; UG = underground

3.3.2.6 Construction and Operations and Maintenance Ports

Dominion Energy and the Port of Virginia have executed a lease agreement for a portion of the existing PMT facility in the city of Portsmouth, Virginia, to serve as a Construction Port. The Construction Port will be used to store monopiles and transition pieces and to store and pre-assemble wind turbine generation components. Dominion Energy understands that the Virginia Port Authority (VPA) is planning to improve PMT to support broad-scale offshore wind development. Dominion Energy anticipates that the port upgrades will meet the needs of Dominion Energy's efforts to construct an offshore wind farm off the coast of Virginia..

Dominion Energy currently is evaluating several alternatives to lease portions of existing facilities in the Hampton Roads, Virginia Region for an O&M Facility for the Project. The preferred lease location for the O&M Facility is Lambert's Point, which is located on a brownfield site in Norfolk, Virginia. Dominion Energy and the Port of Virginia are also evaluating leasing portions of the existing facilities at VPA's PMT or Newport News Marine Terminal. Dominion Energy anticipates that they will require a building with an area of up to approximately 0.8 ac (0.3 ha), and a height of up to approximately 45 ft (13.7 m) to meet the needs of an O&M Facility for an offshore wind farm off the coast of Virginia.

For both PMT and the O&M facilities, in the event that upgrades or a new, build to suit, facility is needed for any purpose, construction would be undertaken by the lessor and would be separately authorized, as needed.

3.4 Construction and Installation

This section describes the construction and installation strategies, equipment, and timing for the Offshore and Onshore Project components that are currently under consideration.

3.4.1 Offshore Construction and Installation

3.4.1.1 Wind Turbine Generators

Construction and installation of the WTGs will include the following sequence of activities: installation of the first two layers of scour protection, construction of the WTG Monopile Foundation; pull-in of the Inter-Array Cable, and construction of the WTG. The cable pull-in may also be done after the WTG construction and installation, if required. The types of vessels used to conduct these activities are outlined in Section 3.4.1.5, Summary of Construction Vessels and Helicopters.

The environmental conditions (wave; current) at the WTG construction and installation location will determine the design of the two layers of scour protection. The first (filter) layer, and possibly the second (amour) layer, of scour protection would be installed prior to construction and installation of the WTG Monopile Foundation. On specific locations, the second layer might be installed post WTG Monopile Foundation installation, depending on whether different large stone sizes are needed in specific locations. Scour protection would consist of small and large rocks sourced from the U.S. and/or Canada and would be installed with a dynamically positioned (DP) vessel equipped with a fallpipe. Dominion Energy anticipates that one scour protection installation vessel will be needed to complete installation of scour protection prior to commencing construction and installation of the WTG Monopile Foundations.

Installation of the scour protection will be completed throughout the first year of installation, if post WTG Monopile Foundation installation of the second layer of scour protection is required, it will be completed following each WTG Monopile Foundation construction and installation period as needed.

Following installation of the scour protection, the WTG Monopile Foundations would be transported to the Offshore Project Area. Sufficient buffer stock of WTG Monopile Foundations will be required prior to commencing WTG construction and installation to ensure that as many WTG Monopile Foundations can be installed during the first construction and installation season as possible.

Installation of the WTG Monopile Foundations would entail lifting, upending, and placement of each WTG Monopile Foundation at its construction and installation location. Each monopile would be lifted off by the on-board crane of the installation vessel with a dedicated lifting tool. The monopile would be placed on the seabed on top of the pre-installed scour protection layers and driven to the target depth of penetration by an on-board vibrohammer and hydraulic hammer while guided by the pile gripper. Depending on location and specific seabed characteristics, without pile-driving, it is anticipated that placement of the monopile will result in some level of initial penetration into the sea floor. Following placement of the monopile, pile-driving will be used to install the WTG Monopile Foundation to the target penetration depth for that foundation. Monopiles will be installed by either one or more dynamically positioned heavy lift vessels (HLVs) or jack-up vessels (JUVs) with sufficient crane capacity. Monopiles would be installed in one or more years between May 1 and October 31 to avoid the North Atlantic right whale migration season (See Section 4.2.5, Marine Mammals).

During pile-driving activities, Dominion Energy will implement near-field and/or far-field noise mitigation systems to minimize underwater sound propagation. Examples of near-field noise mitigation systems include the Hydro Sound Damper, the Noise Mitigation Sleeve or the AdBm Noise Mitigation System. The basic principle of the near field noise mitigation system is to hold air around the pile that will scatter, damp, and reflect underwater sound waves during piling. The Hydro Sound Damper system uses special air-filled balloons and polyethylene elements for noise reduction by scattering and reflection of underwater sound waves and additional foam elements of materials with high damping effects. The AdBm system is similar, using lamellas with resonators. The Noise Mitigation Sleeve is a large pipe which is placed around the pile to be driven.

Dominion Energy is considering the use of a double big bubble curtain (DBBC) for far field noise mitigation. A bubble curtain system is a compressed air system (air bubble barrier) for sound absorption in water. Sound stimulation of air bubbles at or close to their resonance frequency effectively reduces the amplitude of the radiated sound wave by means of scattering and absorption effects. A bubble curtain functions as follows: air is pumped from a separate vessel with compressors into nozzle hoses lying on the seabed and it escapes through holes that are provided for this purpose. Thus, bubble curtains are generated within the water column due to buoyancy. Noise emitted by pile-driving must pass through those ascending air bubbles and is thus attenuated. The sound attenuating effect of the noise mitigation system bubble curtain or air bubbles in water is caused by sound scattering on air bubbles (resonance effect) and (specular) reflection at the transition between water layer with and without bubbles (air-water-mixture; impedance leap). The DBBC consists of two hose rings deployed at a certain radius (depending on the water depth) around the WTG Monopile Foundation location. The main bubble curtain equipment includes:

- Hose with holes for the air bubbles and chains as weight to keep it on the seabed;
- The operation and placement vessel; and
- The air compressors (sometimes placed on a separate vessel).

The deployment of the DBBC hoses would be executed before the installation vessel is in position. Two air hoses would be placed in a circular or elliptical shape at radii of approximately 591 ft (180 m) and 755 ft (230 m) from the monopile installation location. DBBCs will be pre-deployed at two to three WTG Monopile Foundation installation locations and would be recovered as soon as the piling is completed and re-deployed at another WTG Monopile Foundation installation location.

Passive Acoustic Monitoring will occur during all foundation installation activities. Additionally, sound field verification would be performed at a subset of WTG Monopile Foundation installation locations to monitor the underwater sound produced during vibratory and impact pile driving. Sound field verification would likely entail deployment of buoys with an array of hydrophones at several distances from the WTG Monopile Foundation installation locations. Details of the acoustic monitoring sound field verification programs are still under development and the final details will be determined by the installation contractor in consultation and coordination with relevant jurisdictional agencies prior to construction and installation.

Installation of the transition piece will entail lifting and placing the transition piece on top of the installed monopile, establishing a bolted connection between both structures. Additionally, the transition piece skirt will be filled with grout material after the bolted connection with the monopile has been secured. Completion works would be conducted to ensure the integrity of the transition piece before successor construction and installation activities commence.

The transition pieces would be supplied by feeder barges to the Offshore Project Area. A HLV would then place the transition piece on top of the pre-installed monopile. Construction and installation of the transition pieces may start later than the construction and installation of the monopiles to ensure a sufficient number of pre-installed monopiles completed within WTG construction and installation window. Monopile construction and installation vessels would continue with construction and installation of the transition pieces during the non-piling season to optimize and minimize total construction and installation time for the Project.

The WTG construction and installation process consists of the load-out, offshore transport, mechanical erection, and offshore commissioning of the WTGs. Once the Inter-Array Cables have been pulled into the WTG Monopile Foundation, WTG construction and installation will commence. As a fallback, Inter-Array Cables could also be installed after the WTG. The WTG components, including the fully assembled tower section, nacelle, and blades, will be transported to the Lease Area by a JUV. Alternatively, additional WTG construction and installation vessels may be used to reduce construction and installation time. Dominion Energy has taken the Jones Act into consideration in its transportation and installation strategy. A Dominion Energy affiliate company has commissioned a U.S.-flagged, Jones Act-compliant wind turbine installation vessel (Charybdis), which will be used to install the Project's wind turbines. The WTG construction and installation vessels will most likely be of JUV-type. Floating construction and installation vessels may be used as well. Dominion Energy anticipates up to four sets of WTGs will be transported to site per vessel's trip. Once on-site, construction and installation of the WTGs will commence, with fully assembled towers being the first components to be installed on the foundations, followed by the nacelle and blades. Dominion

Energy proposes to install up to two WTGs at a time in an accelerated construction and installation scenario. WTG construction and installation activities are anticipated to last up to 27 months. The anticipated area to be temporarily impacted during construction and installation of the WTGs is provided below in Table 3.4-1.

Table 3.4-1. WTG Construction and Installation Parameters

Vessel	Operation	Total Temporary Area Impacted ac (ha) a/
Monopile		
Fallpipe vessel b/	Scour Protection Installation	0 (0)
Platform supply vessel: Bubble curtain installation c/	Noise Mitigation	148.1 (59.9)
Noise monitoring buoys d/	Noise Monitoring–anchor weight of noise monitoring buoy	0.8 (0.3)
Heavy lift vessel (HLV) b/	Monopile Construction and Installation	0 (0)
Feeder Spread b/	Monopile Feeder	0 (0)
Transition Piece		
HLV b/	Transition piece Construction and Installation	0 (0)
Feeder Spread e/	Transition Feeder	0 (0)
WTG		
JUV f/	WTG Loading	13.9 (5.6)
JUV g/	WTG Construction and Installation	41.8 (16.9)
Multirole Subsea Support Vessel with Walk to Work (W2W) h/	WTG Commissioning	0 (0)

Notes:

a/ All disturbance will occur within areas previously cleared by the Qualified Marine Archaeologist. Disturbance areas for each of the activities listed above are expected to overlap each other in the same WTG construction and installation area (984.3 ft [300 m]). As such, the area of temporary impact should not be considered cumulative (i.e. impacts should not be added together).

b/ Floating marine spread

c/ +/-0.5 m potential displacement when installing/removing bubble curtain

d/ Max 4 buoys (2 per hose, per position) and 2 m² disturbance assumed per location

e/ Floating marine spread

f/ WTG loading with a JUV, 4 legs, 176 positions, 4 WTG sets on deck, 200 m² spud can size from Seajacks Scylla

g/ WTG construction and installation with a JUV, 4 legs, 176 positions, 200 m² spud can size from Seajacks Scylla

h/ Floating marine spread equipped with Walk to Work gangway

Preliminary assessment of leg penetrations of the JUV indicates that penetrations of more than 33 ft (10 m) can be expected at some WTG installation locations which is similar to what was experienced during installation of the CVOW Pilot Project where leg penetrations up to 66 ft (20 m) below mudline were reported (Ørsted 2020). Surveys have shown that during pulling of the legs the holes will be refilled with seabed material to a large extent (“natural backfill”). Remaining hole depths for the CVOW Pilot Project were measured with maximum depth of 8 ft (2.5 m) during the as-built survey.

The bathymetric survey data from the CVOW Pilot Project O&M survey that was conducted in the summer of 2021 (2021 Operations and Maintenance SGRE-TS survey) have been compared to the as-built CVOW Pilot Project bathymetric survey data from 2020. Figure 3.4-1 below shows the bathymetry around the southern WTG (T2A) and the 5 spudcan holes closest to that monopile. As a pre-emptive measure for CVOW Pilot Project, the one spud-can hole closest to each of the monopiles was actively backfilled with filter material (in addition to the natural backfill) as shown in Figure 3.4-1. However, later analyses of the lateral monopile capacity have shown that this was not necessary from a design viewpoint.

In the lower part of Figure 3.4-1, the profile shows that the spudcan holes that were partially backfilled as mentioned above, have depths between 6.6 to 7.2 ft (2.0 to 2.2 m) from the bathymetrical baseline, indicating that after one year, natural backfill up to 0.3 m is locally visible in these two spudcan holes. In addition, further seabed mobility and natural back-fill is noticeable in the surroundings indicating seafloor values are trending towards a more bathymetrical baseline.

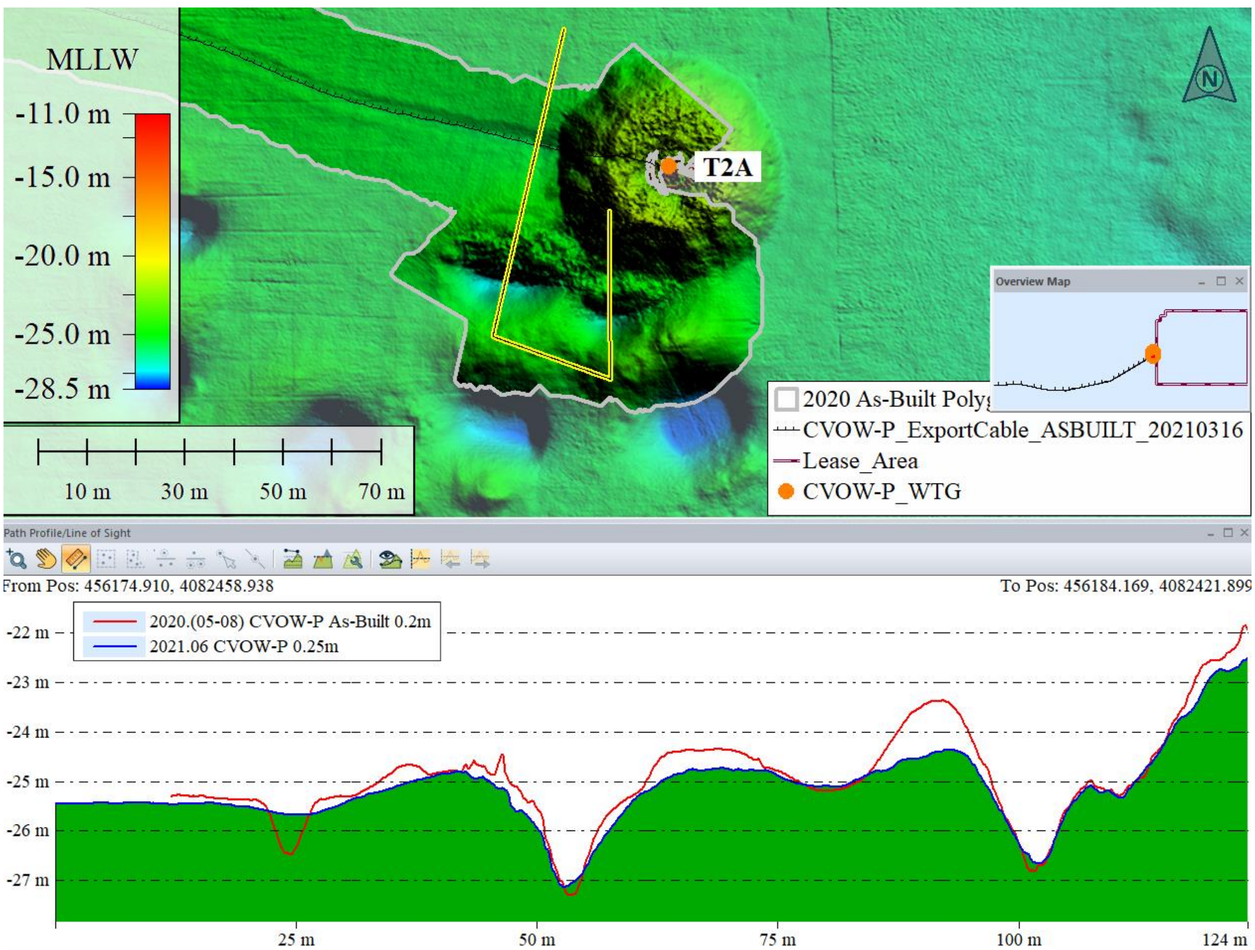


Figure 3.4-1. Bathymetry around WTG T2A

The proposed approach for the Project is as follows:

- Pre-emptive active backfilling of spudcan holes is not planned;

- The influence of spudcan holes will be assessed in terms of the penetration depth, footprint of the hole, remaining hole depth (after extraction) and distance to monopile and scour protection. Following the jacking operation related site-specific assessment and leg penetration analysis on a location by location basis, the sensitivity assessment shall take place before the actual operation and shall define limits below or above an active backfilling will become necessary;
- Measured leg penetrations and as-built hole depth will be compared to the predictions;
- Only in case of a detrimental effect on the integrity of the foundation or the scour protection, which cannot be compensated by remaining safety margins in the design or other measures, would an active backfilling operation be performed; and
- The installation manual shall set limits to the use of water jetting during leg extraction at locations with sensitive very silty soil.

To facilitate appropriate activities on the Lease, Dominion Energy intends to submit a request for departure from the regulations at 30 CFR §§ 585.637(a) and 585.708(a)(5)(ii) to allow commencement of WTG operations one WTG string at a time on a rolling basis. Each WTG string would consist of any connected WTGs, supporting Inter-Array and Offshore Export Cables, and required supporting equipment on the corresponding Offshore Substation. Allowing commencement of operations to occur on a rolling basis as WTG strings are completed would minimize risks to the structural and operational integrity of the WTGs over the operational lifetime of the Project and avoid unnecessary delays in generating renewable energy for customers.

The design life of the WTG only accounts for limited cumulative standstill time where the WTG would not be in operation due to grid circumstances such as outages or WTG failures. Aside from structural requirements, the WTGs require energization not only for idling (pitching and yawing) as soon as possible after mechanical completion, but also to ensure preservation of electrical equipment by maintaining the required ambient conditions through e.g. dehumidification and heating systems. Delaying commercial operations until construction and installation of all WTGs is complete and the administrative process of finalizing the FIR for activities that the CVA has witnessed firsthand would cut into the overall standstill time, reduce the lifespan of the pitch bearings, and increase fatigue on the foundation and blades.

Dominion Energy has included multiple FDR/FIRs and a rolling commissioning plan in the CVA Scope of Work in order to support the process and procedure to commission the WTGs. Each string, and supporting Inter-Array Cabling, Export Cabling and associated Offshore Substation equipment will contain the required approval documentation for those components within the string, prior to being on-line.

Dominion Energy proposes that the CVA would provide a provisional certification upon completion of the WTG 240-hour reliability test. Additionally, the associated cable will have passed its Site Acceptance Test for the WTG reliability tests prior to start and the facility will have passed the required PJM grid tests before the end of the WTG reliability tests. The turbines are designed for continuous operation upon completion of the 240-hour reliability test (except for grid compliance checks when new generation is added to the grid), which is the industry standard for proving the readiness of an offshore wind facility to enter commercial operation.

Below is a proposed cumulative construction and installation schedule for WTGs to become available for Commercial Operations:

- 2024: up to 95 WTGs constructed/installed;
- 2025: up to 92 WTGs constructed/installed; up to 40 WTGs commissioned;
- 2026: up to 18 WTGs constructed/installed; up to 120 WTGs commissioned; and
- 2027: up to 16 WTGs commissioned, and any potential backlog from 2026.

3.4.1.2 Inter-Array Cable

For the purposes of the COP, Dominion Energy has established a maximum design envelope for the Inter-Array Cables that identified a range of cable installation methods and requirements based on the current knowledge of the ground conditions from the geophysical and geotechnical investigations completed in the Lease Area, and also based on experience installing the offshore export cable for the CVOW Pilot Project. The final installation methods and target burial depths will be determined by the final engineering design process, informed by detailed geotechnical data, discussion with the chosen installation contractor, risk assessments, and coordination with regulatory agencies and stakeholders. Detailed information on the final technique(s) selected will be included in the FDR/FIR to be reviewed by the CVA and submitted to BOEM prior to installation.

The details related to the installation of the Inter-Array Cables are described in the following sections. Generally, installation activities consist of pre-installation activities, such as surveys and route clearance/pre-lay grapnel runs, laying and burial of the cable (either simultaneously or done in two separate campaigns), and post-installation surveys. Preliminary target and minimum depths of burial were established based on the Preliminary Cable Burial Risk Assessment (Appendix W) as well as the factors listed above, but the final depth will be no greater than 9.8 ft (3 m). In the event that the target burial depth cannot be achieved along various portions of the Inter-Array Cables, Dominion Energy will assess and potentially implement secondary protection methods such as rocks, geotextile sand containers, basalt sand containers, or concrete mattresses. If burial depths cannot be achieved, the process to implement such secondary protection will be addressed in the FDR/FIR. However, Dominion Energy does not currently anticipate the need for additional cable protection on the Inter-Array Cables. Installation of the Inter-Array Cables is expected to take approximately 38 to 44 weeks, assuming a cable burial speed of 492 to 657 feet per hour (150 to 200 meters per hour). A summary of the Inter-Array Cable installation parameters is detailed in Table 3.4-2.

Table 3.4-2. Inter-Array Cable Installation Parameters

Parameter	Minimum	Maximum
Total Length per Cable	5,111 ft (1,558.0 m)	31,804 ft (9,694 m)
Target Burial Depth	2.6 ft (0.8 m)	9.8 ft (3 m)
Trench Width (Temporary)	16 ft (5 m)	65.62 ft (20 m)
Seabed Footprint (Temporary)	1.9 ac (0.8 ha)	48 ac (19 ha)

Pre-Installation Activities

Prior to the installation of the Inter-Array Cable, Dominion Energy will complete route clearance, including UXO surveys, and pre-lay grapnel activities to identify and remove as appropriate any obstructions within the proposed 82 ft (25 m)-wide Inter-Array Cable installation corridors. UXO identification surveys, in particular, will be completed in a wider corridor of 164.04 ft (50 m) to allow for re-routing of the cable as necessary to avoid identified features, where clearance is not possible. A pre-lay grapnel run would also be required to ensure that seabed conditions were clear of potential obstructions that could disturb, damage and compromise cable installation. For the pre-lay grapnel run operation, a pre-lay grapnel run vessel shall be mobilized together with the required survey and positioning equipment, grapnel anchor(s) and towing winch. The vessel will tow the grapnel train along the designed cable route, monitoring tension in the towing line to identify and collect debris from the route. Three passes of pre-lay grapnel runs, one along the centerline and two parallel to the centerline, will be undertaken to ensure routes are clear. Any debris collected within the pre-lay grapnel run train will be recovered to deck and disposed of onshore, should it be possible. If debris is considered too large to recover it will be left on the seabed, position logged and further action shall be taken should it be deemed necessary.

The seabed disturbance footprint for UXO identification and mitigation is anticipated to be approximately 5 ac (2 ha), assuming an average disturbance of 161.5 ft^2 (15 m^2) per mitigation of one UXO. These pre-installation activities are necessary to allow the Inter-Array Cable lay and burial to be completed with minimal impacts from hazards along the route that could result in cable and/or equipment damage, timing delays, and/or insufficient burial.

Cable Lay and Burial Activities

Once the pre-installation activities are complete, the Inter-Array Cables will be loaded onto a cable lay vessel at the cable fabrication facility and brought to the Lease Area for lay and burial. Dominion Energy proposes to complete installation with the following methods, included in the PDE: jet plow, jet trenching, chain cutting, trench former, hydroplow (simultaneous lay and burial), mechanical plowing (simultaneous lay and burial), pre-trenching (both simultaneous and separate lay and burial), mechanical trenching (simultaneous lay and burial), and/or other available technologies. Though chain cutting is not currently anticipated as a means of Inter-Array Cable installation for the Project, it would be used only as a last resort in locations where the substrate is too hard for other cable installation tools to be effective.

For all the proposed installation methods, a 16.4 ft (5 m) wide temporary trench is created into which the cable is fed while the equipment is towed along the seabed. The cable burial equipment will rest on skids or wheels with a width of approximately 23 ft (8 m). The Inter-Array Cable will be buried to a minimum depth of 2.6 ft (0.8 m) and to a maximum depth of 9.8 ft (3 m); however, the exact depth will be dependent on the substrate encountered along the route.

Post-Installation Surveys and Cable Protection

Upon completion of the cable laying and burial activities, Dominion Energy will conduct post-lay and post-burial surveys to verify both cable location and buried depth. Post-lay surveys will be conducted from a vessel using a remotely operated vehicle or burial assessment sled. Results of this analysis will determine the need for additional cable protection. At this time, Dominion Energy does not anticipate the need for cable protection along the Inter-Array Cable Routes. The location of the Inter-Array Cables and associated cable protection, if deemed necessary, will be provided to the National Oceanic and Atmospheric Administration's (NOAA's) Office of Coast Survey after installation is completed so that they may be marked on nautical charts.

3.4.1.3 Offshore Substation

As discussed in 3.2, Project Infrastructure Overview, Dominion Energy will utilize pre-piled jacket foundations to support the Offshore Substations. Engineering for each site specific piled jacket foundation is ongoing; however, Table 3.4-3 provides the anticipated maximum temporary disturbance associated with construction and installation of the piled jacket foundations per Offshore Substation.

Table 3.4-3. Offshore Substation Construction and Installation Vessel Impact Area

Vessel	Operation	Total Temporary Area Impacted ac (ha) a/
Fallpipe Vessel b/	Scour Protection Installation	0 (0)
Pin Pile template c/	Installation of Piles	1.9 (0.8)
HLV d/	Offshore Substation Pre-Piling	0 (0)
HLV e/	Offshore Substation Jacket Construction and Installation	0 (0)
Feeder Spread e/	Offshore Substation Jacket Supply	0 (0)
HLV e/	Offshore Substation Topside Construction and Installation	0 (0)
Feeder Spread e/	Offshore Substation Topside Supply	0 (0)
CTV/JUV f/	Offshore Substation Commissioning	3.6 (1.5)

Notes:

a/ All disturbance will occur within areas previously cleared by the Qualified Marine Archaeologist. Disturbance areas for each of the activities listed above are expected to overlap each other in the same Offshore Substation construction and installation area. As such, the area of temporary impact should not be considered cumulative (i.e. impacts should not be added together).

b/ Floating marine spread

c/ Assumed 600 m^2 per pin pile template location, pending detailed design

d/ Floating marine spread

e/ Floating marine spread

f/ Commissioning by a 4-leg JUV, 5 times re-positioning per topside due to bad weather, 200m² spud can size from Seajacks Scylla

The jacket footprint will be up to 75.5 ft (23 m) from jacket center toward each direction. All permanent impacts and a portion of the temporary construction impacts would occur within the maximum 216.5 ft x 255.9 ft (66 m x 78 m) footprint of the Offshore Substation Jacket foundations, with additional temporary construction impact occurring within a 656.2 ft x 164.0 ft (200 m x 50 m) area adjacent to the western side of each Offshore Substation to support the potential jacking of the JUV which may be used for Offshore Substation commissioning.

The details related to the construction and installation of the piled jackets for the Offshore Substation Jacket Foundations are anticipated to be similar to that described above for the WTG Monopile Foundations with monopiles: pre-construction and installation survey and site preparation activities, placement of the jacket, and pile-driving (or pile-driving before placement of jacket in the case of pre-piled jacket). Dominion Energy proposes to install the piles for the Offshore Substation Jacket Foundations within the same campaign as the WTG Monopile Foundations during the anticipated piling season (May 1 through October 31), followed by Offshore Substation topside construction and installation.

Construction and installation of the Offshore Substation topside will take place following the construction and installation of the piled jacket foundation. Once the Offshore Substation topside is brought to the site, the topside will be lifted and placed on the foundation via a crane on a floating HLV or floating crane vessel. The topside will then be welded to the foundation, after which the Offshore Substation will undergo commissioning and final connection of the Offshore Export Cables and Inter-Array Cables.

Dominion Energy proposes to install the Offshore Substation topside throughout the year. Each Offshore Substation topside is anticipated to take approximately 2.5 days (net) to install and a total of 120 days per topside is anticipated for the complete construction, installation and commissioning of the three topsides.

Pre-Construction and Installation Activities and Site Preparation

Prior to construction and installation of the piled jacket foundations, an area of up to 656.16 ft (200 m) around the center of each Offshore Substation location will be checked and cleared for debris, large boulders, and UXO. Based on no encounters with boulders/rocks—either in the course of the extensive survey activities for the CVOW Pilot or Commercial Projects—Dominion Energy does not anticipate the need for boulder removal, but has included the possibility that it may be needed following further detailed engineering and installation planning. Furthermore, route clearance (e.g., by means of Pre-Lay Grapnel Runs) will be performed along the Offshore Export Cable Route Corridor and Inter-Array Cable routes prior to any installation activity.

Placement of Jacket

Once the construction and installation location has been prepared, the jacket will be brought to the site via feeder barge or vessel. The jacket will be lifted and placed in the designated target position via a floating DP HLV.

Pile-Driving

The Offshore Substation Jacket Foundation piles will be installed before the jacket is placed on the seabed (pre-installed). A piling template will be lowered onto the location where the jacket will be installed. The piles will be lifted and placed into the template and driven to the target depth by means of a vibrohammer and a hydraulic hammer. After all piles are installed, the template will be recovered and used for the next Offshore Substation Jacket Foundation. Both impact and vibratory pile driving are planned to be used.

Specifications for the pile-driving activities can be found in Section 4.1.5, Underwater Acoustic Environment. Dominion Energy proposes to pile drive one piled jacket foundation at a time. Each Offshore Substation Jacket Foundation is anticipated to take approximately 5 days to install, with a total of 30 days anticipated for the complete construction and installation of the three piled jackets.

As with the monopiles, Dominion Energy also proposes to use appropriate noise mitigation measures in accordance with applicable requirements and in accordance with the tolerance requirements in relation to inclination and elevation.

Connection of Offshore Substation

Following construction and installation of the Offshore Substation Jacket Foundations, the connection between jacket and piles will be grouted The Offshore Substation topside will then be brought to the site and installed.

3.4.1.4 Offshore Export Cable

The Offshore Export Cables will be installed within an Offshore Export Cable Route Corridor ranging in size from approximately 9,400 ft (2,865 m) down to 1,749 ft (533 m) wide. The Offshore Export Cables will be buried to a target depth of approximately 3.3 ft (1 m) to 16.4 ft (5 m) below stable seabed elevation to minimize the risk of cable exposure or damage; however, depending on seabed conditions, actual burial depth may vary. Stable seabed elevation is the minimum seabed level over the lifetime of the Project, identified by assessing the rate of movement of mobile sediment. The target burial depth may vary along different sections of the Offshore Export Cable Route Corridor but the final depth will be no greater than 16.4 ft (5 m) below grade. In the portion of the Offshore Export Cable that crosses through DNODS, 14.8 ft (4.5 m) of cover may be added in addition to the target burial depth of 9.8 ft (3 m) for a total maximum depth of burial of 24.6 ft (7.5 m) through that area. In the event that the target burial depth cannot be achieved along various portions of the Offshore Export Cables, Dominion Energy will assess and potentially implement secondary protection methods such as rocks, geotextile sand containers, basalt sand containers, or concrete mattresses. The process to implement such secondary protection will be addressed in the FDR/FIR.

Dominion Energy performed a Preliminary CBRA (Appendix W) that assessed, at high-level, the area risks present within the Lease Area itself as well as the surrounding region, and preliminarily identified and quantified risk factors along the Projects Offshore Export Cable Route Corridor. External constraints that were considered in design of the Offshore Export Cable Route Corridor are discussed in further detail in the Preliminary CBRA. Target burial depths at specific locations along the Offshore Export Cable Route Corridor may be refined following the results of the ongoing geophysical survey data analysis, additional sediment mobility studies (see Appendix CC Seabed Morphology Study), and coordination with USACE and other stakeholders, and will be formalized in the FDR/FIR, to be submitted to BOEM prior to installation.

The method of cable protection system recommended by the CBRA to mitigate risks may include direct burial, rock dumping, laying concrete mattresses, and ducting, noting that the cable protection method may influence the cable’s current rating significantly and also complicate the cable recovery in the event of required repairs. Other risk mitigations to protect installed cable could include anchorage/fishing exclusion zones. Cable protection is described in detail below.

Installation Methodology

Dominion Energy has completed preliminary geophysical and geotechnical surveys along the Offshore Export Cable Route Corridor to inform preliminary cable routing and selection of the most appropriate tools for installation of the Offshore Export Cables to the target burial depths. Based on the current understanding of site-specific conditions between the Cable Landing Location in Virginia Beach, Virginia, and the Lease Area, Dominion Energy anticipates the following burial tools as the primary installation methodologies:

- Jet Trench;
- Trench former;
- Chain cutting;
- Hydroplow;
- Mechanical plowing (simultaneous lay and burial);
- Pre-trenching (both simultaneous and separate lay and burial); and
- Mechanical trenching (simultaneous lay and burial).

Installation of the nearshore section of the Offshore Export Cables will be conducted utilizing pre-lay survey, pre-lay grapnel run (see Section 3.4.1.2, Inter-Array Cable), and a pull-in method through a pre-installed landfall conduit. Cable jointing, post-jointing tests, the cable lay operations, the cable pull-in at the Offshore Substations and the cable burial operations might also occur with a cable laying vessel or separate burial assistance vessel equipped with a jet trencher or other burial tool(s). A 32.8-ft (10-m)-wide temporary trench is created into which the cable is fed while the equipment is towed along the seabed. The nearshore section of the Offshore Export Cable will be installed by a shallow draft cable lay vessel. The cable lay vessel loads the cables either at the manufacturing yard or at a marshalling port depending on the detailed schedule for the cable installation. The cable lay vessel would start with the shore pull-in at the Offshore trenchless installation Punch-Out. The cable lay and bury will occur simultaneously using one of the available technologies outlined above. The cable ends will be sealed temporarily, wet stored, and protected on the seabed.

The final manufacturing location for the Offshore Export Cables has been determined to be in Europe for the purposes of this COP. Offshore Export Cables would be transported to the U.S. by either the cable lay vessel itself and/or by deck carriers equipped with turntables. For the purposes of this COP, Dominion Energy has assumed that all nearshore Offshore Export Cables would be transported on deck carriers while the other Offshore Export Cables would be picked up at the fabrication yard by the cable lay vessel. The separately transported Offshore Export Cables would either be directly transpooled at the marshalling port to the cable lay vessel or temporarily stored on turntables at the quayside in a U.S. port. The Offshore Export Cables are split into a nearshore section and a farshore section that are connected to each other by a subsea cable joint. Two nearshore and three farshore Offshore Export Cable installation campaigns would be the preferred installation strategy. Alternative strategies are under consideration and are dependent on several factors such as cable manufacturing location, transport method, burial method, use of a separate burial vessel or not, as well as additional considerations.

The farshore sections of the Offshore Export Cables and the Inter-Array Cables would be installed with a large DP cable lay vessel. The installation is foreseen to start at the wet stored cable ends from the Nearshore Trenchless Installation Area. The wet stored Offshore Export Cable ends would be picked-up, jointed to the farshore section of the Offshore Export Cable, and then laid down on the seabed. Jointing of the Offshore Export Cables and Inter-Array Cables will be performed either from a DP vessel or a JUV. If a JUV is utilized, Dominion Energy anticipates that one jack-up will be required per cable. The farshore Offshore Export Cables would be surface laid from the Nearshore Trenchless Installation Area towards the Offshore Substations (three Offshore Export Cables per Offshore Substation) and pulled into the cable deck of the Offshore Substation jacket foundations for temporary storage. A sequence of the above mentioned activities will be determined after further engineering assessment. A DP Trencher Support Vessel or Cable Laying Vessel equipped with a jet-trencher would bury the farshore Offshore Export Cables to a target depth of between 3.3 ft (1 m) to 16.4 ft (5 m). Though chain cutting is not currently anticipated as a means of Offshore Export Cable installation for the Project, chain cutting would be required if jetting is not possible due to soil conditions that could be encountered during cable installation (i.e., rock, very hard/very stiff clay, etc.).

The Offshore Export Cable termination and testing campaign would be supported by a separate vessel. Dominion Energy is considering a Service Operation Vessel with motion compensated gangway to transfer people to the foundations for the termination and testing campaign.

The net durations related to the Nearshore Trenchless Installation and Offshore Export Cable installation have been provided in the base case alternative and are as follows:

- The Nearshore Trenchless Installation is assumed at a rate of 9 to 18 days per /unit;
- Cable laying speed of the nearshore cables is 197 to 1,148 ft/hr (60 to 350 m/hr), including the simultaneous burial;
- Cable laying speed of the farshore cables is 197 to 1,148 ft/hr (60 to 350 m/hr); and
- Cable jointing takes 10 days per joint.

Based on the identified range of installation methods and requirements, Dominion Energy has established a design envelope for installation of the Inter-Array Cables and Offshore Export Cables that reflects the maximum seabed disturbance (Table 3.4-4). Temporary seabed disturbance during Offshore Export Cable installation includes Offshore Export Cable Route Corridor pre-lay grapnel runs, and associated installation vessel anchoring; and permanent disturbance (includes areas where additional cable protection may be required post-installation). Based on analysis of the geophysical and geotechnical survey data, which did not identify any boulders larger than 1.6 ft (0.5 m), Dominion Energy does not anticipate the need for seabed preparation activities (i.e., sandwave and boulder removal) beyond the pre-lay grapnel run.

Table 3.4-4. Offshore Export and Inter-Array Cable Installation Vessel Parameters

Vessel	Operation	Total Temporary Area Impacted ac (ha)
Pontoon a/	Nearshore Export Cable installation anchor handling	355 (144)
Cable lay vessel b/	Cable Laying	1,393 (564)
Cable Trenching c/	Jetting	2,892.4 (1,170.4)
Cable lay vessel e/	Wet End Storage	0.2 (0.1)
Cable jointing vessel f/	Jointing of the Inter-Array and Offshore Export Cables	3 (1.2)
- g/	Cable Crossings	0 (0)
Support Vessel h/	pre lay grapnel run	1,393 (564)
	TOTAL	**6,036.6 (2,443.7)**

Vessel	Operation	Total Temporary Area Impacted ac (ha)

Notes:
a/ Nearshore anchor corridors
b/ Cable lay operation affects the same ground as later affected by the pre lay grapnel run operation
c/ Multiple burial passes would impact the same area and are thus are only counted a single time
d/ Floating marine spread
e/ 9 offshore ends of the Offshore Export Cables will be wet stored prior to the Offshore Substation pull-ins
f/ 4-leg JUV, total of 9 jack-ups (1 per cable) 3,600 ft^2 (334.9 m^2) per spud can (60 x 60 ft [18.3 x 18.3 m])
g/ Floating marine spread
h/ Three parallel passes are performed

Sandwave Removal

As described in Table 3.4-4, prior to installation of the Offshore Export Cables, seabed preparation activities will include the pre-lay grapnel run, but Dominion Energy does not currently anticipate the need for any sandwave removal. In the event that further detailed engineering determines that there is a need for sandwave removal, the amount of sandwave removal anticipated would be provided at that time. Sandwave removal is typically completed for the following reasons:

- Many of the cable installation tools proposed require a relatively flat seabed surface to comport with the operational criteria (pitch and roll) of the tools; and
- Sandwaves are generally mobile in nature. Therefore, the Offshore Export Cables must be buried beneath the stable seabed elevation to prevent cable exposure occurring over time. In areas where larger sandwaves exist, this can only be achieved by removing a portion of the mobile features before installation takes place.

Although the Project does not anticipate the need to remove sandwaves, in the event such a situation arises, the process would be implemented as described further below.

Sandwave removal would require clearing of the area, most likely using subsea excavation methods, depending on the volume and technical requirements. If required, sandwave removal will be done using controlled flow excavation. Controlled flow excavation would employ a tool suspended above the seabed from a vessel, to induce a controlled flow of water directed at the seabed to be displaced. Induced water currents therefore force the local seabed into suspension, where it is directed into the immediately surrounding area and, in the absence of the induced flow, the suspended sediment settles back to the seabed around the area of excavation. Steady movement of the suspended tool along the seabed feature, supported by real-time monitoring with profilers, will allow controlled sweeping of sandwaves and loose sediment.

Pre-sweeping of sandwaves may be performed to provide a sufficient excavated platform at the base of the sandwave for the installation tool to operate, for instance, where gradients may otherwise hinder movement of the tools. The total width of excavation would depend on the depth of excavation and slopes required to maintain the required trench base width and may be subject to further engineering.

Multibeam and other surveys may be conducted throughout the preparation and installation stages of the project, to confirm seabed conditions and establish reference base lines for engineering.

Boulder Removal

Boulder removal is not currently anticipated based on completed surveys and the installation of the CVOW Pilot project. In the event that a boulder is encountered, boulder removal may be required in targeted locations within the Offshore Export Cable Route Corridor. Boulder removal can be performed using a combination of methods to optimize clearance of boulder debris of varying size and frequency. Although no boulders over 0.5 m or other subsea obstructions were identified during analysis of geophysical data, if boulders are encountered during installation, they will be moved from the Offshore Export Cable Route Corridor, either through use of subsea grabs, or ploughs. Boulders or other obstructions will be relocated to areas, as close as feasible to their original positions. Dominion Energy has assumed the route would be cleared of boulders within the footprint of the cable, as needed. Boulder removal would occur prior to installation and would be completed by a support vessel based on pre-construction surveys.

Cable Protection

Preliminary target and minimum depths of burial were established based on the Cable Burial Risk Assessment (Appendix W). In the event that the target burial depth cannot be achieved along various portions of the Offshore Export Cable Route Corridor, Dominion Energy will assess and potentially implement secondary protection methods such as rocks, geotextile sand containers, or concrete mattresses. The process to implement such secondary protection will be addressed in the FDR/FIR.

The location of the Offshore Export Cables and associated cable protection will be provided to NOAA's Office of Coast Survey after installation is completed so that they may be marked on nautical charts. The area of impact for cable protection is accounted for in Table 3.4-4.

For the purpose of the environmental assessments presented within this COP, Dominion Energy has assumed that the Offshore Export Cable Route Corridor will require additional protection at the 3 fiber optic cable crossing locations and at the Omega joint location, which is anticipated to be located between mile posts 13 and 17 (kilometer posts 21 and 28), using a combination of the following solutions depending on the technical requirements:

- Dumped rocks,
- Geotextile sand containers, and/or
- Concrete mattresses.

Dominion Energy anticipates that the cable protection in these areas would be a maximum of 738 ft (225 m) long by 115 ft (35 m) wide by 16 ft (5 m) high at each of the 27 fiber optic cable crossings (9 Offshore Export Cables crossing 3 fiber optic cables) and at the 9 Omega joint locations, which is approximately 2 percent of the total length of the Offshore Export Cables. Schematics of these measures are provided in Appendix K, Conceptual Design Drawings.

3.4.1.5 Summary of Construction Vessels and Helicopters

Construction of the Project will require the support of numerous vessels (see Table 3.4-5). Dominion Energy would anticipate that the number of vessels would be the same for the Preferred Alternative and Maximum Design Scenario. Dominion Energy anticipates helicopter transfers to be required during construction from 2024-2026 at a frequency of up to 4 flights per week. For each vessel type, the route plan for the vessel operation area will be developed to meet industry guidelines and best practices in accordance with International Chamber of Shipping guidance. The Project will require operational Automatic Identification Systems (AIS) on all vessels associated with the construction, operation, and decommissioning of the Project, pursuant to USCG and AIS carriage requirements. AIS will be required to monitor the number of vessels and traffic patterns for analysis and compliance with vessel speed requirements. All vessels will operate in accordance with applicable rules and regulations for maritime operation within U.S. federal and state waters. Similarly, all aviation operations, including flying routes and altitude, will be aligned with relevant stakeholders including Federal Aviation Administration (FAA) and state and local regulations. Additionally, the Project will adhere to vessel speed restrictions as appropriate in accordance with NOAA requirements, Lease stipulations, and COP approval conditions. Emissions associated with vessel activities are addressed in Section 4.1.3, Air Quality and Section 4.4.12, Public Health and Safety.

Table 3.4-5. Preliminary Summary of Offshore Vessels for Construction—envelope figures regarding CO_2 air emissions directly related to construction of the wind farm based on the preferred alternative

Vessel ID	Vessel Role	Vessel Class	Number of Vessels	Breadth (ft)	Width (ft)	Draft| (ft)	Average Fuel Consumption (t/d)	Days on Project per vessel @ P50 WDT for 176 locations	Total Fuel Consumption @ P50 WDT for 176 locations (mt)	Days on Project @P50 WDT, incl. Spare Pos.	Total Fuel Consumption @ P50 WDT incl. spare pos. (mt)	Days on Project @P90 WDT, incl. Spare Pos.	Total Fuel Consumption @ P90 WDT incl. spare positions (mt)	Most Likely Operation Period*	Frequency of Transit	Transit Destination
1	Scour Protection Installation	Fall Pipe Vessel	1	131	656	39	25	470	11,750	547	13,686	657	16,423	10/2023 to 12/2024 and 02/2025 to 10/2025	Weekly	Canada/USA
2	Transport monopile/transition pieces from U.S. port to installation site	U.S. barge	2	105	400	20	0	589	0	686	0	823	0	04/2024 to 12/2025	(188+17)/2 = 103 cycles in total for all barges	Portsmouth, VA
3	Tugs for MP/TP transport barges	U.S. ocean-going tug	3	40	125	21	15	589	26,505	686	30,872	823	37,047	04/2024 to 12/2025	103 + 52 = 155 cycles in total	Portsmouth, VA
4	Monopile/transition piece/Offshore Substation Installation	HLV	1	161	709	50	55	575	31,625	670	36,836	804	44,203	04/2024 to 12/2025	N/A	N/A
5	Anchor handler	Anchor Handling Tug (AHT)	2	40	125	21	8	575	9,200	670	10,716	804	12,859	04/2024 to 12/2025	188+17 = 205 cycles in total per AHT	Portsmouth, VA
6	Noise Monitoring	Crew Transfer Vessel (CTV)	2	33	86	6	5	366	3,660	426	4,263	512	5,116	05/2024 to 10/2024 and 05/2025 to 10/2025	Daily	Portsmouth, VA
7	Noise Mitigation	Platform Support Vessel	1	60	263	19	20	366	7,320	426	8,526	512	10,231	05/2024 to 10/2024 and 05/2025 to 10/2025	2 cycles in total + X due to bad weather	Portsmouth, VA
8	Secondary works	CTV/Platform Support Vessel	1	102	457	20	15	386	5,790	450	6,744	540	8,093	12/2025 to 12/2026	Daily	Portsmouth, VA
9	Crew Transfer	CTV	1	33	86	6	8	588	4,704	685	5,479	822	6,575	04/2024 to 12/2025	Every 2nd day	Portsmouth, VA
12a	Transport pin-piles from U.S. port to installation site	barge + tug or transport vessel	1					37	0	0	0	0	0	05/2024 to 08/2025	3 cycles in total	Portsmouth, VA
12	Transport jackets from EU port to installation site	barge + tug or transport vessel	1	158	739	35	0	122	0	142	0	171	0	11/2024 to 04/2025	3 cycles in total	Europe or GoM area
13	Transport topsides from port to installation site	tug + barge or transport vessel	1	158	739	35	0	133	0	155	0	186	0	11/2024 to 04/2025	3 cycles in total	Portsmouth, VA
14	Commissioning	DP2 JUV	2	230	132	20	5			240	2400	288	2,880	11/2024 to 07/2025	N/A	N/A
15	Nearshore Trenchless Installation	Drill Rig spread	2	40	9	N/A	0			218	0	262	0	09/2023 to 02/2024	N/A	N/A

Vessel ID	Vessel Role	Vessel Class	Number of Vessels	Breadth (ft)	Width (ft)	Draft (ft)	Average Fuel Consumption (t/d)	Days on Project per vessel @ P50 WDT for 176 locations	Total Fuel Consumption @ P50 WDT for 176 locations (mt)	Days on Project @P50 WDT, incl. Spare Pos.	Total Fuel Consumption @ P50 WDT incl. spare pos. (mt)	Days on Project @P90 WDT, incl. Spare Pos.	Total Fuel Consumption @ P90 WDT incl. spare positions (mt)	Most Likely Operation Period*	Frequency of Transit	Transit Destination
16	Nearshore Marine assistance	U.S. Multi-Purpose Support Vessel (Multicat)	2	40	92	14	6			218	2,621	262	3,145		Weekly	Portsmouth, VA
17	Nearshore Marine assistance	U.S. tug (small)	1	26	76	10	5			218	1,092	262	1,310		Weekly	Portsmouth, VA
18	Landfall	Landfall Beach spread	1	N/A	N/A	N/A	2	374	748	436	871	523	1,046		Weekly	N/A
19	Shore pull-in	U.S. Pull-in support barge	1	60	180	6	10	374	3,740	436	4,356	523	5,228		Weekly	Portsmouth, VA
20	Shore pull-in	U.S. workboat (tug)	4	26	76	10	5	374	7,480	436	8,713	523	10,455		Weekly	Portsmouth, VA
21	Pre-lay Grapnel Run	Multipurpose Support Vessel	1	56	240	19	10	55	550	64	641	77	769		Weekly	Portsmouth, VA
22	Pre-Installation Survey	Survey Vessel	1	42	181	11	4	129	516	150	601	180	721		Weekly	Portsmouth, VA
23	Cable Laying and Burial	Shallow-draft Cable Lay Vessel	1	79	289	15	20	374	7,480	436	8,713	523	10,455	01/2023 to 04/2024 and 07/2024 to 09/2025	N/A	N/A
24	Anchor handling	Multi-Purpose Support Vessel (Multicat)	2	40	92	14	6	374	4,488	436	5,228	523	6,273		N/A	
25	Transport Cable	Multipurpose Support Vessel	3	79	289	15	20	94	5,640	109	6,569	131	7,883		N/A	TBD
26	Cable Burial	Hydroplow (Jetting)	1	20	53	14	0	374	0	436	0	523	0		N/A	N/A
27	Crew Transfer	CTV	2	33	86	6	8	374	5,984	436	6,970	523	8,364		Every 2nd day	Portsmouth, VA
28	As-built Survey	Survey Vessel	1	42	181	11	4	33	132	38	154	46	185		Weekly	Portsmouth, VA
29	Pre-lay Grapnel Run (Offshore Export Cable)	Multipurpose Support Vessel	1	37	197	9	10	55	550	64	641	77	769		Weekly	Portsmouth, VA
30	Pre-lay Survey (Offshore Export Cable)	Survey Vessel	1	42	181	11	4	129	516	150	601	180	721		Weekly	Portsmouth, VA
31	Cable Laying and burial (Offshore Export Cable)	Deep-draft Cable Lay Vessel	1	105	529	22	29	383	11,107	446	12,937	535	15,525	01/2023 to 04/2024 and 08/2024 to 09/2025 and 11/2025 to 02/2026	N/A	N/A
32	Cable Laying and burial (Offshore Export Cable)	Deep-draft Cable Lay Vessel	1	112	561	28	29	336	9,744	391	11,350	470	13,619			
33	Crew Transfer (Offshore Export Cable)	Walk-to-work vessel (W2W)	1	53	355	19	10	431	4,310	502	5,020	602	6,024		N/A	N/A
34	Crew Transfer (Offshore Export Cable)	CTV	1	33	86	6	8	431	3,448	502	4,016	602	4,819		Every 2nd day	Portsmouth, VA

Vessel ID	Vessel Role	Vessel Class	Number of Vessels	Breadth (ft)	Width (ft)	Draft| (ft)	Average Fuel Consumption (t/d)	Days on Project per vessel @ P50 WDT for 176 locations	Total Fuel Consumption @ P50 WDT for 176 locations (mt)	Days on Project @P50 WDT, incl. Spare Pos.	Total Fuel Consumpt ion @ P50 WDT incl. spare pos. (mt)	Days on Project @P90 WDT, incl. Spare Pos.	Total Fuel Consumpt ion @ P90 WDT incl. spare positions (mt)	Most Likely Operation Period*	Frequency of Transit	Transit Destination
35	Cable Burial (Offshore Export Cable)	Trenching Support or cable laying Vessel	1	105	529	25	0	432	0	503	0	604	0		N/A	N/A
36	Cable Burial (Offshore Export Cable)	Trenching Support Vessel or Cable laying Vessel	1	112	561	28	0	433	0	504	0	605	0			
37	Cable Burial (Offshore Export Cable)	Burial tool (Post-lay Jetting)	2	25	46	19	3	865	5,190	1008	6,045	1,209	7,254		N/A	N/A
38	As-built Survey (Offshore Export Cable)	Survey Vessel	1	42	181	11	4	33	132	38	154	46	185		Weekly	Portsmouth, VA
39	Pre-lay Grapnel Run (Inter-Array Cable)	Multipurpose Support Vessel	1	56	240	19	10	78	780	91	909	109	1,090	01/2023 to 04/2024 and 11/2024 to 05/2026	Weekly	Portsmouth, VA
40	Pre-lay Survey (Inter-Array Cable)	Survey Vessel	1	42	181	11	4	37	148	43	172	52	207		Weekly	Portsmouth, VA
41	Cable Laying and burial (Inter-Array Cable)	Deep-draft Cable Lay Vessel	1	105	529	25	29	399	11,571	465	13,478	558	16,173		N/A	N/A
42	Crew Transfer (Inter-Array Cable)	W2W	2	53	355	19	15	217	6,510	253	7,583	303	9,099		N/A	N/A
43	Crew Transfer (Inter-Array Cable)	CTV	2	33	86	6	8	399	6,384	465	7,436	558	8,923		Every 2nd day	Portsmouth, VA
44	Cable Burial (Inter-Array Cable)	Trenching Support Vessel or Cable Laying Vessel	1	105	529	37	0	400	0	466	0	559	0		N/A	N/A
45	Cable Burial (Inter-Array Cable)	Burial tool (Post-lay Jetting)	1	25	46	19	3	399	1,197	465	1,394	558	1,673		N/A	N/A
46	As-built Survey (Inter-Array Cable)	Survey Vessel	1	42	181	11	4	27	108	31	126	38	151		Weekly	Portsmouth, VA
47	WTG Installation	JUV	1	184	473	23	20	660	0	769	15,375	923	18,450	08/2025 to 02/2027	Vessel 1: Every 10-14 days Vessel 2: N/A	Vessel 1: Portsmouth, VA Vessel 2: N/A
48	Transport WTGs from U.S. port to installation site	U.S. barge	2	105	400	20	0			660	0	792	0		Approximately every 3 days	Portsmouth, VA
49	Transport WTGs from U.S. port to installation site	U.S. ocean going tug	3	40	125	21	8			660	15833	792	19,000		Approximately every 3 days	Portsmouth, VA
50	Crew Transfer	CTV	2	33	86	6	8			660	5278	792	6,334		Daily	Portsmouth, VA

Vessel ID	Vessel Role	Vessel Class	Number of Vessels	Breadth (ft)	Width (ft)	Draft| (ft)	Average Fuel Consumption (t/d)	Days on Project per vessel @ P50 WDT for 176 locations	Total Fuel Consumption @ P50 WDT for 176 locations (mt)	Days on Project @P50 WDT, incl. Spare Pos.	Total Fuel Consumpt ion @ P50 WDT incl. spare pos. (mt)	Days on Project @P90 WDT, incl. Spare Pos.	Total Fuel Consumpt ion @ P90 WDT incl. spare positions (mt)	Most Likely Operation Period*	Frequency of Transit	Transit Destination
51	Commissioning spread	Multirole subsea Support Vessel with W2W	1	68	335	26	10			660	13194	792	15,833	08/2025 to 04/2027	Bi-weekly	Portsmouth, VA
52	Site Security	Safety vessel, Nearshore Trenchless Installation	1	var	var	var	5			1.557	7786	1.8684	9,343	09/2023 to 08/2027	Bi-weekly	Portsmouth, VA
53	Observation Vessel	CTV	2	33	86	6	5			1.557	15571	1.8684	18,685	09/2023 to 08/2027	Daily	Portsmouth, VA
54	Removing sandwaves [i.a.]	Trailer Suction Hopper Dredger	1	var	var	var	25			98	2453	117.6	2,944	2023	Daily	Portsmouth, VA
55	Boulder Picking [i.a.]	Anchor Handling Tug + crane barge	2	181	60	12	10			98	1963	117.6	2,356	2023	Weekly	Portsmouth, VA
56	Boulder Ploughing [i.a.]	Anchor Handling Tug + towed plough	1	299	73	27	70			131	916	157.2	1,099	2023	Weekly	Portsmouth, VA
57	Crossing Protection (concrete mattresses)	Fall Pipe Vessel	1	131	656	39	25	90	2,250	105	2,621	126	3,145	2024 to 2026	Between 3 and 27 cycles	Portsmouth, VA
								TOTAL:	**201,257**		**318,901**		**382,681**			

N/A = not applicableThe preferred plan is to use JUV
Fuel consumption economy speed 15.90 m^3/day, Fuel Consumption DP mode 5.49 m^3/day, Fuel consumption anchor/port 3.03 m^3/day

3.4.2 Onshore Construction and Installation

Nearshore trenchless installation activities are anticipated to last 9 to 12 months. The target burial depth for trenchless installation will range between 10 to 125 ft (3 to 38 m). From the Onshore Trenchless Installation Work Area at the Cable Landing Location, the trenchless installation will be up to 2,500 ft (762 m) long and exit approximately 1,000 to 1,800 ft (304 to 549 m) offshore. The maximum temporary workspace at the Offshore Trenchless Installation Punch-Out would be up to approximately 80 acres (32.4 ha). Trenchless installation activities will be performed to a maximum depth of 125 ft (38 m) below grade. The cable conduit dimensions will be approximately 1.6 ft (0.5 m) in diameter. The following equipment may be used at both the trenchless installation entry and exit points: steel drill pipes, pumps, motors, powerpacks, drill mud processing systems, storage tanks, and associated construction equipment.

In an effort to reduce underwater and subsurface impact, pipe floatation devices, tugboats, jack-up barge, or floating barges may be used to support marine construction equipment required to perform the drilling operations and to handle the pipe on the water. The following subsurface impacts may occur within the Nearshore Trenchless Installation Area during nearshore trenchless installation activities:

- Installation of 9 cofferdams during cable pull in;
- Installation of up to twelve 42-in diameter goal posts per Direct Pipe conduit for a total of 108 goal posts; and
- One JUV jack-up per Direct Pipe conduit (total of 9 jack-ups).

Temporary steel pipe piles may be installed between the offshore trenchless installation exit locations and the barge for all the alignments to provide lateral stability to the drill string and/or the pipe by acting as 'goal-posts' during the installation process. The final size of the piles, depth of installation, hammer capacity, and associated sound is dependent on subsurface conditions; equipment availability; contractor's means and methods; field conditions including but not limited to location, wind speeds, ocean currents; and lateral loads on the piles due to construction operations. Additionally, The preferred installation method at the Offshore Trenchless Installation Punch-Out would require the use of cofferdams or conductor barrels to facilitate lowering the Direct Pipe burial to 6.6 ft (2 m) below the seabed to alleviate the need for additional cable protection and minimize the release of sediment and drilling fluids into the marine environment during Offshore Export Cable pull-in activities. For the preferred installation strategy, the cofferdams are expected to be approximately 1,000 ft to 1,800 ft (305 to 549 m) offshore and would be constructed by installing 20 inch (0.51 m) steel sheet piles in a tight configuration around an area of approximately 20 ft by 50 ft (6.1 m by 15 m). Cofferdams would be installed via vibratory pile driving Trenchless installation activities are anticipated to take approximately 9 to 12 months, with a total of 9 conduits and 4 to 5 weeks per conduit.

Marine construction equipment such as jack-up barges may be used near the Offshore Trenchless Installation Punch-Out location to support the drilling and/or product pipe installation process. Jack-up barges are temporarily setup by extending their supports into the mudline so as to withstand the self-weight of the jack-up barge and the construction equipment on it. The depth to which the supports extend into the mudline may vary depending on the location, type of barge, and subsurface conditions. This process eliminates the need to install piles.

If the preferred installation method of using cofferdams to bury the cable 6.6 ft (2 m) below the seabed is determined to not be feasible, Dominion Energy anticipates that the location where the Offshore Export Cables exit the seafloor at the Offshore Trenchless Installation Punch-Out location will require additional protection. This protection may consist of one or more of a number of solutions, including rock berms, concrete mattresses, etc. Dominion Energy anticipates that the cable protection at the Offshore Trenchless Installation Punch-Out location would be a maximum of 82 ft (25 m) long by 6.6 ft (2 m) wide by 1 ft (0.3 m) high at each of the 9 punch-out locations

The results of geotechnical and geophysical surveys will be used to select the most appropriate Cable Landfall Location construction and installation technique which will be formalized in the FDR/FIR, to be reviewed by BOEM prior to construction and installation.

The maximum area of temporary disturbance for the Cable Landing Location is anticipated to be approximately 2.8 ac (1.1 ha), and the maximum temporary workspace at the Nearshore Trenchless Installation Area would be up to approximately 8.8 ac ((3.6 ha). Onshore installation activities will include frac tanks, power pack, driller's cabin, excavator, mud pump, mud recycling plant, Conex boxes, the DSPTM, drill pipe skid, drill pipe, and an office trailer.

3.4.2.1 Onshore Export Cable

From the Cable Landing Location in Virginia Beach, Virginia, the Onshore Export Cable would be installed underground within vaults, HDD's, microtunneling and duct banks to the Switching Station over a period of 18 to 24 months. The installation methodology proposed would comply with local and state regulations and guidelines. Based on the existing conditions along each Onshore Export Cable Route, the Project would utilize a combination of open trenches, HDD, and duct banks at varying depths along the selected route.

The Onshore Export Cable Route installation would include the following main activities:

- Prepare the installation corridor;
- Install ductbank;
- Install HDD;
- Establish jointing bays;
- Pull onshore export and interconnection cables through the ducts;
- Join the cables; and
- Restore the installation corridor.

Onshore installation activities and equipment will include saw-cutting, excavator/back hoes, generators/light plants, dump trucks, concrete trucks, pavement milling machines, pavement placement machines, pavement rollers, hoe rams, asphalt breakers, roll-off, mud pump, transfer pump, mud pallet, mud cleaning system, heaters, d-beaters, charge pump, and temporary generators. The maximum proposed depth of disturbance for a typical open trench ductbank is 13 ft (4 m) below grade. The Onshore Export Cable will be installed within three separate ductbanks, each ranging from 5 to 10 ft (1.5 to 3 m) wide. The maximum area of temporary disturbance for the Onshore Export Cable is anticipated to be approximately 50.6 ac (20.5 ha).

Onshore HDD operations will require drill pads for rigs and cable installation. Drill pads will be removed and restored to preconstruction conditions following installation. Open trench/duct banks will require land disturbance including removal of trees, brush, stumps, and unsuitable soils. Open trench/duct bank areas will be constructed to engineering specifications (depth, width, height), encased in concrete, and returned to original grade. All areas will be restored and stabilized utilizing perennial vegetation.

If open trenching in areas within roadways is necessary, approval is required for work hours beginning during evening hours Sunday through Thursday to include night-time hours. Weekend noise waiver approvals may be required. During manhole installations, requests will be made for 72 to 96-hour continuous work schedules to include nighttime hours and daytime hours for 24-hour continuous operations until completed. There is a potential for pile driving and for the 24-hour dewatering systems to be temporarily installed ahead of manhole installations with regards to sandy soils in this area.

The methodology for the proposed HDD and microtunneling installation method are provided below.

HDD Method

HDD is a trenchless method for the installation of pipes, conduits and cables. HDD creates a pilot bore along the design pathway and reams the pilot bore in the one or more passes to a final diameter suitable for the product pipe(s), which is pulled into the prepared borehole to complete the installation process.

The HDD process consists of pilot bore, ream, swab and pullback:

- Step 1: Pilot bore is the first step in the drilling process where a HDD rig situated on the ground surface or in a shallow pit is used to drill a small diameter borehole using a pilot head of approximately 8-inch (203.2 mm) to 12-inch (304.8 mm) diameter using drill pipes of 5.5-inch (139.7 mm) to 7.625-inch (193.6 mm) diameter. The pilot bore typically enters the ground at an angle of 8 to 16 degrees from the horizontal and follows an arc-shaped vertical path to pass below the feature or obstruction and exits at the ground surface at a shallow angle.
- Step 2: Pilot bore is followed by the reaming process where the borehole is enlarged in incremental stages up to the required final borehole diameter which may be approximately 1.5 times the outer diameter of the product pipes(s) being installed. Reaming is followed by an optional swab pass where the borehole is stabilized and conditioned before pipe pullback.
- Step 3: In the final step, the pullback process is performed by assembling and fusion welding the pipe(s) in a single string or multiple strings based on available work area. The pipe(s) string is then laid out along one end of the HDD alignment and pulled into the borehole using a HDD rig situated on the other end of the HDD alignment.

HDD Equipment Setup and Role of Drilling Fluids

HDD equipment including steel drill pipes, pumps, motors, powerpacks, drill mud processing systems, storage tanks and associated construction equipment are typically situated at the HDD entry location to support the drilling operations. Typically, exit side equipment consists of excavators, drilling fluid processing systems and product pipe(s) handling equipment.

Steel drilling pipes are progressively loaded on the drilling rig to form a drill string inside the bore to continue the drilling process and dismantled on the exit side as the drill pipes exit the borehole. Throughout the drilling process, drilling fluid is pumped through the steel drill pipes. The drilling fluid is introduced into the formation via nozzles located on the pilot bit or reamer. Critical functions of drilling fluids include:

- Transport drill cuttings to the surface through the annulus between the bore wall and the drill pipe/product
- Prevent downhole equipment from overheating and providing the necessary lubrication
- Clean and stabilize the borehole, especially in loose or soft soils by building a low permeability filter cake and exerting a positive hydrostatic pressure against the borehole wall to prevent formation fluid from flowing into the borehole and drill fluids from the existing borehole.

There are various HDD drill tracking systems available to track the drill head in real time. Some of the popular systems include wireline tracking and magnetic beacon systems. For a project of this size and complexity, HDD pilot bore may be tracked using a gyro steering tool system which provides real-time data on the location of the downhole drilling assembly. Once the pilot bore is established from the designed entry to exit locations, subsequent stages of drilling follow the same pilot bore path to complete the installation process.

Microtunnel

Microtunnel is a trenchless construction method to install casing pipes from a jacking to a receiving shaft with minimal surface disturbance, through complex subsurface conditions ranging from soil to rock and typically below groundwater table. Generally, microtunneling is performed for casing pipe diameters ranging from 24 inches (609.6 mm) to 96 inches (2,438.4 mm); however, installing casing pipe diameters outside of this range is possible depending on the project conditions. The product pipe(s) is subsequently installed inside the casing pipe to complete the installation.

- Step 1: The process begins with the construction of engineered, watertight jacking and receiving shafts. The sizes of the shafts are based on the size of the pipe and microtunneling machine. The jacking shaft contains a guidance equipment, jacking equipment and a jacking frame situated against a thrust block.
- Step 2: The microtunnel process begins with the jacking of the microtunnel boring machine (MTBM) steering head followed by the trailing can. Upon sufficiently advancing the MTBM along the alignment, the first casing pipe is placed on the jacking frame and the service lines are connected. Microtunneling process continues by successive jacking of the casing pipes while simultaneously using the MTBM to excavate the material along the tunnel horizon.
- Step 3: In the final step, the MTBM and trailing can are driven into the receiving shaft from where it is recovered and demobilized. This process is followed by the removal of service lines inside the casing pipe and installation of the product pipe(s), thus completing the microtunneling process.

Microtunnel Equipment Setup and Role of Slurry

Microtunnel equipment including pumps, hoses, motors, powerpacks, slurry and excavated material processing systems, storage tanks and associated construction equipment are typically situated at the entry location to support the boring operations. Typically, exit side consists of equipment required to extract the MTBM.

The earth pressure balance required to control the rate of removal of soils in relation to the rate of the advance of the MTBM is provided by the slurry system which balances the existing earth and hydrostatic pressure by applying an equivalent face pressure at the head of the machine.

The location of the MTBM is tracked in real-time by the use of laser guidance systems.

3.4.2.2 Switching Station

Construction of the Switching Station would involve site clearing and grading, foundation and equipment construction, and site mitigation and restoration. It is expected that construction of the Switching Station will take 1 to 2 years. The Switching Station construction would include the following main activities:

- Site access;
- Site preparation, including clearing and/or filling (if necessary), excavation, and grading;
- Construction of stormwater management system;
- Construction of the foundations;
- Construction of the electrical infrastructure and other associated structures and services including connection to local utilities; and
- Land restoration and landscaping.

Prior to construction, Dominion Energy will conduct land and other surveys including geophysical, geotechnical, environmental, and cultural studies to support permits and approvals for construction of the Switching Station. Construction activities will include backhoes, excavators, bulldozers, skid-steer loaders, dump trucks, cranes, and temporary generators.

The Switching Station will contain both static pole steel structures and backbone foundations. The maximum depth for vibrated/driven pipe piles is anticipated to be 30 ft (9 m) for the static pole steel structures and 50 ft (15 m) for the backbone structures. The maximum areas of land disturbance associated with construction activities at the Switching Station is anticipated to be approximately 33.4 ac (13.5 ha).

3.4.2.3 Interconnection Cable

From the Common Location north of Harpers Road, the Interconnection Cable would be installed either overhead (Preferred) or a hybrid of overhead and underground to connect to the Onshore Substation. It is expected that construction and installation of the Interconnection Cable will take approximately 12 to 15 months. The Interconnection Cable installation would include the following main activities:

- Easement acquisition and ROW survey/flagging;
- Clearing and prep of ROW as needed, including installation of erosion control devices (ECDs);
- ROW access road grading;
- Tree clearing;
- Materials delivery;
- Foundation prep and install;
- Construction of structures/insulator strings;
- Stringing conductors;

- Interconnect and energize; and
- Restore the construction corridor.

Some trimming of tree limbs along the edge of the upland ROWs may be conducted to support construction activities. For any such minimal clearing, trees will be cut to no more than 3 inches (7.62 cm) above ground level. Danger trees, which are trees outside the ROW that have the potential to come within 10 ft (3 m) of the transmission wires or structures if they were to fall., may also need to be cut. Danger trees will be cut to be no more than three inches (7.62 cm) above ground level, will be limbed, and will remain where felled. Debris that is adjacent to homes will be disposed of by chipping or removal. In other areas, debris may be mulched or chipped as practicable. Danger tree removal will be accomplished by hand in wetland areas and within 100 ft (30.5 m) of streams, if applicable. Care will be taken not to leave debris in streams or wetland areas. Matting may be used for heavy equipment in these areas. Erosion control devices will be used on an ongoing basis during all clearing and construction activities.

Erosion control will be maintained and temporary stabilization for all soil disturbing activities will be used until the ROW has been restored. Upon completion of Interconnection Cable construction, Dominion Energy will restore the ROW utilizing site rehabilitation procedures outlined in Dominion Energy's Standards and Specifications for Erosion and Sediment Control and Stormwater Management for Construction and Maintenance of Linear Electric Transmission Facilities that was approved by the VDEQ. Time of year and weather conditions may affect when permanent stabilization takes place.

Construction and installation activities will include backhoes, excavators, bulldozers, skid-steer loaders, dump trucks, cranes, and temporary generators. Maximum vertical disturbance depth for vibrated/driven pipe piles for the single-circuit engineered steel monopole structures is anticipated to be 60 ft (18 m). Maximum vertical disturbance depth for vibrated/driven pipe piles for the double-circuit engineered steel monopole structures is anticipated to be 80 ft (24 m). For the underground route, the maximum proposed depth of disturbance for the open trench interconnect duct bank is 13 ft (4 m) below grade. Dominion Energy anticipates that a maximum construction and installation corridor width of 135 ft (23 m) would be needed for underground cables and 140 ft (43 m) for overhead cables for overhead cables. Anticipated temporary construction and installation corridors for each of the potential Interconnection Cable Routes are outlined in Table 3.4-6.

Table 3.4-6. Interconnection Cable Route Alternatives

Interconnection Route Type	Route Alt. #	Construction/Installation Corridor Area (ac)
Overhead	1 (Preferred)	254.4
	2	271.9
	3	277.9
	4	292.2
	5	405.5
Hybrid	6	286.1

3.4.2.4 Onshore Substation

It is expected that construction of the expanded/upgraded Onshore Substation will take up to approximately 1-2 years. Expansion/upgrades to the Onshore Substation would include the following main activities:

- Safety fencing would be installed along the perimeter of the expansion;

- Erosion controls would be implemented in accordance with the Dominion Energy's Erosion and Sediment Control Plan, which will be prepared based on the requirements at 9 VAC §25-840 and 9 VAC §25-870-55, respectively, as applicable;
- The site would be prepared, including clearing, filling, excavation, and grading as necessary;
- A stormwater management system would be installed in accordance with Dominion Energy's Stormwater Pollution Prevention Plan (SWPPP), which will be prepared based on the requirements at 9 VAC §25-840 and 9 VAC §25-870-55, respectively, as applicable;
- Foundations and sumps would be installed;
- Heavy-load vehicles would be used to deliver and place equipment;
- Cable installation would be completed, including connection of the Onshore Export Cables;
- Testing and commissioning of the new equipment; and
- Landscaping would be installed and/or restored as required by applicable regulations.

Construction activities will include backhoes, excavators, bulldozers, skid-steer loaders, dump trucks, cranes, and temporary generators. The deepest foundations for the Onshore Substation will be the backbone foundations. The maximum depth for vibrated/driven pipe piles is anticipated to be 50 ft (15 m) for the backbone structures. The maximum areas of land disturbance associated with construction activities at the Onshore Substation is anticipated to be approximately 21.4 ac (8.7 ha).

3.5 Operations and Maintenance

The commercial lifespan of the Project is expected to be up to 33 years, based on the operations term of the Project specified in the Lease.

The Project will be designed to operate with minimal day-to-day supervisory input, with key systems monitored from a central location, 24 hours a day. Dominion Energy intends on leasing a portion of an existing facility to act as the O&M facility. Dominion Energy is evaluating leasing options in VPA's PMT and Newport News Marine Terminal in the Hampton Roads area of Virginia. The preferred lease location for the O&M Facility is Lambert's Point, , which is located on a brownfield site in Norfolk, Virginia. This O&M facility will monitor operations and include office, control room, warehouse, shop, and pier space.

During the operations term, the Project will require both planned and unplanned inspections and maintenance, which will be carried out by a team of qualified engineers, technical specialists, and associated support staff. The team will ensure that all components are maintained and operated in a safe and reliable manner, compliant with regulatory conditions and in accordance with commercial objectives.

The O&M plan for both the Project's onshore and offshore infrastructure will be finalized as a component of the FDR/FIR review process. An Oil Spill Response Plan, Safety Management System and Emergency Response Plan will also be developed and implemented prior to construction and installation activities (see Appendices Q and A for preliminary versions of these that will continue to be developed as the Project matures in consultation with BOEM and the Bureau of Safety and Environmental Enforcement).

Construction and operation of the Project is expected to generate both solid and liquid wastes. Liquid waste will primarily consist of oils, fuels and water from construction and O&M vessels. Solid waste is expected to primarily consist of packaging and protective wrappings from Project materials and equipment, cable trimmings, . Project-related wastes will be disposed of in accordance with applicable regulations and will be reused or recycled to the extent practicable.

In accordance with 30 CFR § 585.626(b)(9), Dominion Energy has provided a preliminary list of wastes expected to be generated during Project construction (See Table 3.5-1). Following more detailed engineering, this list will be updated.

Table 3.5-1. Wastes Expected to be Generated During Project Construction and Operations

Types of Waste	Volume of Waste	Means of Storage or Discharge Method
Domestic water	0.1 m^3 per person per day	Tanks or discharged overboard after treatment
Uncontaminated bilge water	Subject to vessel size and equipment	Tanks or discharged overboard after treatment
Uncontaminated ballast water	Subject to vessel size and equipment	Discharged overboard or retained onboard as part of ballast management plan
Uncontaminated fresh or seawater used for vessel air conditioning	Subject to vessel size and equipment	Discharged overboard
Deck drainage and sumps	Subject to vessel size and equipment	Discharged overboard after treatment
Sewage from vessels	25 – 30 gal/person/day	Tanks or sewage treatment plant
Food waste	0.3 - 0.5 kilograms per person per day	Discharged overboard if applicable or onshore landfill
Solid trash or debris from vessel operations	0.1 m^3 per person per day	Onshore landfill or incineration
Chemicals, solvents, oils and greases	Subject to vessel type	Onshore landfill or incineration
Drilling cuttings, mud or borehole treatment chemicals, if used	Dependent on HDD type selected	N/a
Oily residue	1% of daily fuel consumption	N/a

3.5.1 Offshore Operations and Maintenance

All Offshore Project Components will require routine maintenance and inspections. It is anticipated that Crew Transfer Vessels and Service Operation Vessels will be used to support O&M activities offshore. Helicopters are currently being considered to support the Project; Dominion Energy is continuing to evaluate logistics, and the relevant impact assessments will be updated as needed.

Generally, offshore O&M activities will include:

- Inspections of Offshore Project Components for signs of corrosion, quality of coatings, and structural integrity of the WTG components;
- Inspections and maintenance of the WTG and Offshore Substation electrical components/equipment;
- Surveys of the Offshore Export Cables and Inter-Array Cables routes, to confirm the cables have not become exposed or that any cable protection measures have not worn away. Dominion Energy

anticipates that post-installation cable surveys will occur once a year. However, the final frequency and schedule of these surveys will be determine based upon various factors, to be detailed with and agreed upon during discussions with the applicable agencies;

- Sampling and testing (including of lubricating oils, etc.);
- Replacement of consumable items (such as filters, and hydraulic oils);
- Repair or replacement of worn, failed, or defective systems (such as WTG blades, bolts, corrosion protection systems, protective coatings, cables, etc.; including cleaning off subsea marine growth, realigning machinery, renewing cable protection using additional rock dumping or mattress placement, etc.);
- Updating or improving systems (such as control systems, sensors, etc.); and
- Disposal of waste materials and parts (in line with best practice and regulatory requirements).

To ensure the safety of both personnel and equipment, specifications for the grounding and bonding of the WTG are accounted for in SGRE's contract exhibits. Grounding and bonding of the WTGs will include lightning receptors close to blade tip and in other locations along the blade, integrated metal conductors in WTG blades, lightning conductors connected to WTG hub, carbon brush and spark gap to transfer the current to the hub casting, equipotential bonding and down-conductor system designed according to IEC 62305 and IEC 61400-24, nacelle to be fabricated as Faraday cage to protect inside components, equipotential bonding and down-conductor system on WTGs.

The WTGs will be monitored through the SCADA System (as discussed in Section 3.3.1.1, Wind Turbine Generators). The Offshore Export Cables and Inter-Array Cables will be monitored through Distributed Temperature Sensing equipment. The Distributed Temperature Sensing system will be able to provide a real time monitoring of temperature along the Offshore Export Cable Route, alerting Dominion Energy should the temperature changes, which could be the result of scouring of material and cable exposure.

In the event of a fault or failure of the Offshore Project Components, Dominion Energy will repair and replace the Project component in a timely manner. Should the Offshore Export Cables or Inter-Array Cables fault, the failed or damaged portion of the cable will be spliced and replaced with a new, working segment. This will require the use of various cable installation equipment, as described earlier in this Section.

Pursuant to 30 CFR § 585.200(b), in conjunction with its COP, Dominion Energy has the right to one or more Project easements, without further competition, as necessary for the full utilization of the lease. Dominion Energy will request an operational ROW within the Offshore Export Cable Route Corridor to support necessary O&M activities, particularly should a fault or failure occur, as soon as a more definitive route is identified. Additional licenses and/or easements required for the portion of the Offshore Export Cable Route Corridor in state waters are discussed in Section 1.4.2, State and Local Permits, Approvals, and Consultations.

Appropriate safety systems will be included on all WTGs, including fire detection and an audible and visible warning system, painting and marking, lightning protection, and appropriate lighting for aviation and maritime industries. The WTGs will contain an automatic detection system, which will detect fires, and activate alarms in the event of an outbreak. In addition to this, an alarm will be sent to the SCADA system indicating the location of the event. The substructure is assumed to be protected against corrosion by means of a combination of anodes and coating of structural members. Each WTG will contain a shelter area, in addition to safety and rescue equipment, should any event occur while maintenance crew are on-site.

Dominion Energy anticipates that up to 50 round trip helicopter trips would be required each year for O&M, as well as the following O&M vessel trips:

- 365 operating days for the service operations vessel, with 26 annual round trips to port; and
- 365 operating days for each crew transfer vessel, with 26 annual round trips to port per vessel.

3.5.2 Onshore Operations and Maintenance

The Switching Station and the Onshore Substation will be equipped with monitoring equipment. The Switching Station and the Onshore Substation will also be regularly inspected during the operations term, which may result in routine maintenance activities, including the replacement of and/or update to electrical components/equipment. The Onshore Export Cables and Interconnection Cables will require periodic testing, with readings taken from access chambers, but should not require maintenance, though occasional repair activities may be required should there be a fault or damage caused by a third party or unanticipated events.

Overhead lines will be inspected prior to each line being energized and then inspected every three years after. Overhead lines will also be inspected following localized storm events. ROW vegetation management crews will inspect the overhead easement every three years for woody vegetation and hazard trees. This Periodic maintenance to control woody growth will consist of hand cutting, machine mowing, and herbicide application.

3.5.3 Lighting and Marking of Offshore Project Components

The WTGs will be lit and marked in accordance with FAA and USCG requirements for aviation and navigation obstruction lighting, respectively. Dominion Energy will light and mark all WTGs in accordance with FAA Advisory Circular 70/7460-1M (FAA 2020), BOEM's Guidelines for Lighting and Marking of Structures Supporting Renewable Energy Development (2021), and *International Association of Marine Aids to Navigation and Lighthouse Authorities Recommendation O-139 on The Marking of Man-Made Offshore Structures* (IALA 2013), and United States Coast Guard Fifth District Local Notice to Mariners entry 36-20 as detailed below:

- All foundations will be painted yellow from the level of Highest Astronomical Tide (HAT) up to 50 ft (15.3 m) and utilize retro reflective material;
- WTG towers will have alphanumeric marking in black, approximately 10 ft (3 m) high and will be visible in all directions in both daytime and nighttime. A unique alphanumeric marking scheme will be subsequently determined, in coordination with the USCG. Letters will be easily visible by using either illumination or retro-reflecting material;
- WTGs above the yellow demarcation line for navigational aids will be painted no lighter than RAL 9010 Pure White and no darker than RAL 7035 Light Grey;
- All WTGs in excess of 699 ft (213 m) above ground level will require two synchronized flashing red lights (with medium intensity L-864 and LED color between 675 and 900 nanometers) placed

on the back of the nacelle on opposite sides with a flash rate of 30 flashes per minute. While every turbine may be outfitted with a light, not all may be turned on and there will be no unlit separations or gaps more than 0.5 mi (804 m) around the perimeter and no unlit separation or gaps of more than 1 mi (1.6 km) within the grid or cluster of turbines. In accordance with Advisory Circular 150-5345-43, obstruction light fixtures must include infrared (IR) emitters or be used in conjunction with a standalone IR emitter in order to be night vision goggle compatible; and

- Additionally, mid-level lighting (model L-810) will be required at a half-way point on the tower between the top of the nacelle and ground level. Mid-level lighting should be flashing red lights configured to flash in unison with the nacelle lighting and should contain a minimum of three of the L-810 lights.
- While not required by FAA guidance, Dominion Energy is also considering an Aircraft Detection Lighting System (ADLS) to minimize the number of hours/day aviation lighting is in full effect. This system would activate only when signaled by the presence of a nearby aircraft (vs. a continuous activation). This system has the potential to decrease visual impacts to other stakeholders due to the decreased hours/day that the lights are activated. The impact of implementing an ADLS system was examined as a part of the aviation assessments, which utilize local flight data to determine an area-specific result.

In accordance with IALA 0-139 and USCG Local Notice to Mariners (LNTM) entry 33-20, the following will also apply:

- Each WTG will be lit as an offshore structure in accordance with 33 CFR Part 67 and USCG First District LNTM entry 33-20;
- Lighting will be located on all WTG structures and visible throughout a 360-degree arc from the water's surface;
- Corner Towers/Significant Peripheral Structures will have quick flashing yellow lights energized at a 5 nm (9.3 km) range;
- Outer Boundary Towers will have yellow 2.5 second lights (FL Y 2.5s) energized at a 3 nm (5.6 km) range;
- Interior Towers will have yellow 6 second or yellow 10 second lights (FL Y 6/FL Y 10) energized at a 2 nm (3.7 km) range and all lights will be synchronized by their structure location within the field of structures;
- All temporary base, tower, and construction and installation components preceding the final structure completion will be marked with quick yellow obstruction lights visible throughout 360 degrees at a distance of 5 nm (9.3 km). These will not require permits, only USCG notification for appropriate marine notices and broadcasts until the final structure marking is established;
- The aids to navigation on each WTG will be mounted below the lowest point of the arc of the rotor blades and will exhibit at a height above HAT of no less than 20 ft (6 m) and no more than 50 ft (15 m);
- Sound signals will be located on all structures located at corners/Significant Peripheral Structures and will sound every 30 seconds (4 second blast, 26 seconds off) and will be set to project at a

range of 2 nm (3.7 km). This will not exceed 3 nm (5.6 km) spacing between perimeter structures, and will be Mariner Radio Activated Sound Signal activated by keying VHF Radio frequency 83A five times within ten seconds;

- Sound signals will be timed to energize for 45 minutes from last VHF activation;
- Aeronautical obstruction lights fitted to the tops of turbines will not be visible below their horizontal plane; and
- Aeronautical obstruction lights will be night vision imaging system compliant.

In addition, Dominion Energy is considering construction of closed circuit television systems for both security monitoring of the Project and as a capability that could assist with search and rescue operations in the Offshore Project Area if required. Additionally, Dominion Energy will work with stakeholders such as the USCG to ensure lighting in the Offshore Project Area can be controlled to maximize compatibility with night vision goggle equipment. Dominion Energy is in discussions with the USCG and BOEM regarding the Project Lighting and Marking Plan and any updates will be reflected in subsequent versions of the COP.

3.6 Decommissioning

In accordance with 30 CFR Part 585 and other BOEM requirements, Dominion Energy will be required to remove and/or decommission all Project infrastructure and clear the seabed of all obstructions following termination of Project operational activities and the Lease. The decommissioning process for the WTGs and Offshore Substations is anticipated to be the reverse of construction and installation, with Project components transported to an appropriate disposal and/or recycling facility. All foundations/Project components will be removed to 15 ft (4.6 m) below the mudline (30 CFR § 585.910(a)), unless other methods are deemed suitable through consultation with the regulatory authorities, including BOEM. Offshore Export Cables and Inter-Array Cables will be retired in place or removed in accordance with a Decommissioning Plan; Dominion Energy would need to obtain separate and subsequent approval from BOEM to retire any portion of the Project in place. Offshore Project components will be decommissioned using a similar suite of vessels, as described in Table 3.4-5. Environmental impacts are anticipated to be similar to those experienced during construction and installation activities, as described in Section 3.4, Construction and Installation. Onshore Project Components will be decommissioned in accordance with a plan developed with and approved by the appropriate parties (i.e. landowners and agencies). Although Dominion Energy has assumed a Project lifetime of up to 33 years based on the operations term of the Project specified in the Lease, some construction and installation and components may remain fit for continued service after such time. Unless otherwise authorized by BOEM, Dominion Energy will complete decommissioning within 2 years of termination of the Lease and either reuse, recycle, or responsibly dispose of all materials removed. Decommissioning activities will be detailed in a Decommissioning Plan, which is subject to an approval process that includes public comment and government agency consultation. The Decommissioning Plan will be developed based on a factor-based approach, utilizing the environmental and socioeconomic factors to determine a strategy and methodology that is appropriate at the time. As part of this plan, Dominion Energy will compile an inventory of Project components and detail the methods proposed to decommission the Project components. As Project components are decommissioned, Dominion Energy will record and remove from the inventory list. Additionally, Dominion Energy will perform site clearance bottom surveys to facilitate confirmation that Project components have been properly removed from the seafloor and that the Project Area is cleared of obstructions. This inventory will include those Project components described in Section 3.3, Project Design.

Table 3.6-1 provides additional detail on removal methods and assumptions that likely would be applicable based on present day understanding of available decommissioning approaches.

Table 3.6-1. Summary of Decommissioning Methods and Assumptions

Project Component	Removal Method	Comments and Assumptions
Wind Turbine Generator (WTG)	Removal of the WTGs is done using a reversed construction and installation method. Decommissioning of the turbines and towers is assumed to include removal of the rotor, nacelle, blades and tower to be removed in the reverse construction and installation order.	• Materials brought onshore to U.S. port for recycling and disposal; • Steel in the tower is assumed to be recycled; and • The blades are assumed to be recycled.
WTG Monopile Foundation	Removal of the monopiles is done using a reversed construction and installation method. Removal of the monopile is assumed to be cut off below the mud line and be lifted off by a HLV to a barge prior to decommissioning.	• Monopile to be cut at or just below mudline and transported to U.S. port for recycling; and • Steel is assumed to be recycled.
Offshore Substation topside	Removal of the Offshore Substation topside is done using a reversed construction and installation method. The Offshore Substation topside is assumed to be lifted off by a HLV to a barge prior to decommissioning.	• Transported to U.S. port for recycling and disposal; and • Steel from the topside is assumed to be recycled.
Offshore Substation Jacket Foundation	The Offshore Substation Jacket Foundation piles are assumed to be cut below the mud line, before the jacket is lifted off in one section by a HLV to a barge prior to decommissioning.	• Cut below mudline and transported to U.S. port for recycling; and • Steel from the jacket and piles is assumed to be recycled.
Cables	The Offshore Export Cables and Inter-Array Cables are assumed to be lifted out and cut into pieces or reeled in.	• Total removal of cable and transported to U.S. port for recycling; and • Core material to be recycled.
Onshore Substation	Removal of the all buildings and equipment, unless suitable for future use.	• Materials to be recycled; and • To be demolished and recycled unless suitable for future use. Site to be prepared for future use.
Onshore Export and Interconnection Cables	Removal of the Onshore Export Cable and Interconnection Cable is assumed to be limited to disconnecting and cutting at the fence line below ground level, this on both side.	• Remaining cable capped off and earthed; and • Removal of termination points and cut of cable 3 ft (0.9 m) below ground level.
Scour protection and rock filling	Alternatives: • Removal of scour protection and rock filling; and • Leave scour protection in place, as undisturbed as possible.	• Assumed to be removed unless leaving in place is deemed appropriate through consultation with the appropriate authorities.