Kitty Hawk Wind

AVANGRID

# Construction and Operations Plan

## Appendix CC - Obstruction Evaluation and Airspace Analysis

September 30, 2022


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# Appendix CC – Obstruction Evaluation and Airspace Analysis

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|---|---|---|
| Capitol Airspace Group | TETRA TECH | Megan E. Higgins |
| **September 30, 2022** | **September 30, 2022** | **September 30, 2022** |

| Revision Summary | | | | |
|---|---|---|---|---|
| **Rev** | **Date** | **Prepared by** | **Checked by** | **Approved by** |
| 01 | 11 Dec 2020 | Capitol Airspace Group | Tetra Tech, Inc. | Brian Benito Jr. |
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| Description of Revisions | | | |
|---|---|---|---|
| **Rev** | **Page** | **Section** | **Description** |
| 01 | All | All | Submitted to BOEM |
| 02 | All | All | Updates to Project Design Envelope |
| 03 | None | None | Updated based on Project name |

As of Q3 2022, the Company has updated the Project name from “Kitty Hawk Offshore Wind Project” to “Kitty Hawk North Wind Project”.

The technical content of this report has not been changed since the previous submission.

# Kitty Hawk Offshore Wind Project

Kitty Hawk Wind, LLC

*Offshore Corolla, NC*

*Obstruction Evaluation & Airspace Analysis*

30 JUNE 2021

Capitol Airspace Group

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# Summary

Capitol Airspace conducted an obstruction evaluation and airspace analysis for the Kitty Hawk Offshore Wind Project (the Project - consisting of the northwestern portion [black outline] of BOEM Lease Area OCS-A 0508 [purple outline]) located off the coast of Corolla, North Carolina. The purpose for this analysis was to identify obstacle clearance surfaces established by the Federal Aviation Administration (FAA) that could limit the placement of 1,042-foot (317.5-meter) above mean sea level (AMSL) wind turbines. At the time of this analysis, 70 wind turbine generator (WTG) locations had been identified (black points, ***Figure 1***). This analysis assessed height constraints overlying an approximately 75-square-mile (195-square-kilometer) study area (black outline, ***Figure 1***).

The Bureau of Ocean Energy Management (BOEM) is responsible for regulating renewable energy activities on the outer continental shelf in accordance with 30 CFR Part 585. As part of the application process for leases, grants, and easements, BOEM may require the inclusion of an aeronautical study to determine the proposal's impact on airspace use and safety. If a project is determined to have an unacceptable impact on civil aviation or military activities, it could result in denial of the application.

14 CFR Part 77 applies to all structures within US territorial airspace. 14 CFR Part 77.9 requires that that all structures exceeding 200 feet (60.96 meters) above ground level (AGL) be submitted to the FAA so that an aeronautical study can be conducted. The FAA's objective in conducting aeronautical studies is to ensure that proposed structures do not affect the safety of air navigation or the efficient utilization of navigable airspace by aircraft. The end result of an aeronautical study is the issuance of a determination of 'hazard' or 'no hazard' that can be used by the proponent to obtain necessary local construction permits. It should be noted that the FAA has no control over land use in the US and cannot enforce the findings of its studies. In instances where the project lies outside of US territorial airspace and lies in BOEM jurisdiction, BOEM will consult with the FAA for any airspace that the FAA may need to adjust.

The lowest obstacle clearance surfaces overlying the Project range from 749 to 4,549 feet (228.2 to 1,386.5 meters) AMSL and are associated with minimum vectoring altitude sectors. Proposed structures that exceed these surfaces would require an increase to minimum vectoring altitudes. If the FAA determines that this impact would affect as few as one radar vectoring operation per week, it could result in determinations of hazard.

A warning area overlies the Project. If the Navy uses this warning area regularly, it could result in military objections to proposed wind development.

This study did not consider electromagnetic interference on FAA communication or surveillance radar systems.

# Methodology

Capitol Airspace studied the proposed Project based on location information provided by Kitty Hawk Wind, LLC. Using this information, Capitol Airspace generated graphical overlays to determine proximity to airports (***Figure 1***), published instrument procedures, enroute airways, FAA minimum vectoring altitude and minimum Instrument Flight Rules (IFR) altitude charts, and military airspace and training routes.

Capitol Airspace evaluated all 14 CFR Part 77 imaginary surfaces, published instrument approach and departure procedures, visual flight rules operations, FAA minimum vectoring altitudes, minimum IFR altitudes, and enroute operations. All formulas, headings, altitudes, bearings and coordinates used during this study were derived from the following documents and data sources:

- 14 CFR Part 77 Safe, Efficient Use, and Preservation of the Navigable Airspace
- FAA Order 7400.2N Procedures for Handling Airspace Matters
- FAA Order 8260.3E United States Standard for Terminal Instrument Procedures
- FAA Order 8260.58B United States Standard for Performance Based Navigational (PBN) Instrument Procedure Design
- Technical Operations Evaluation Desk Guide for Obstruction Evaluation/Airport Airspace Analysis (1.5.1)
- United States Government Flight Information Publication, US Terminal Procedures
- National Airspace System Resource Aeronautical Data

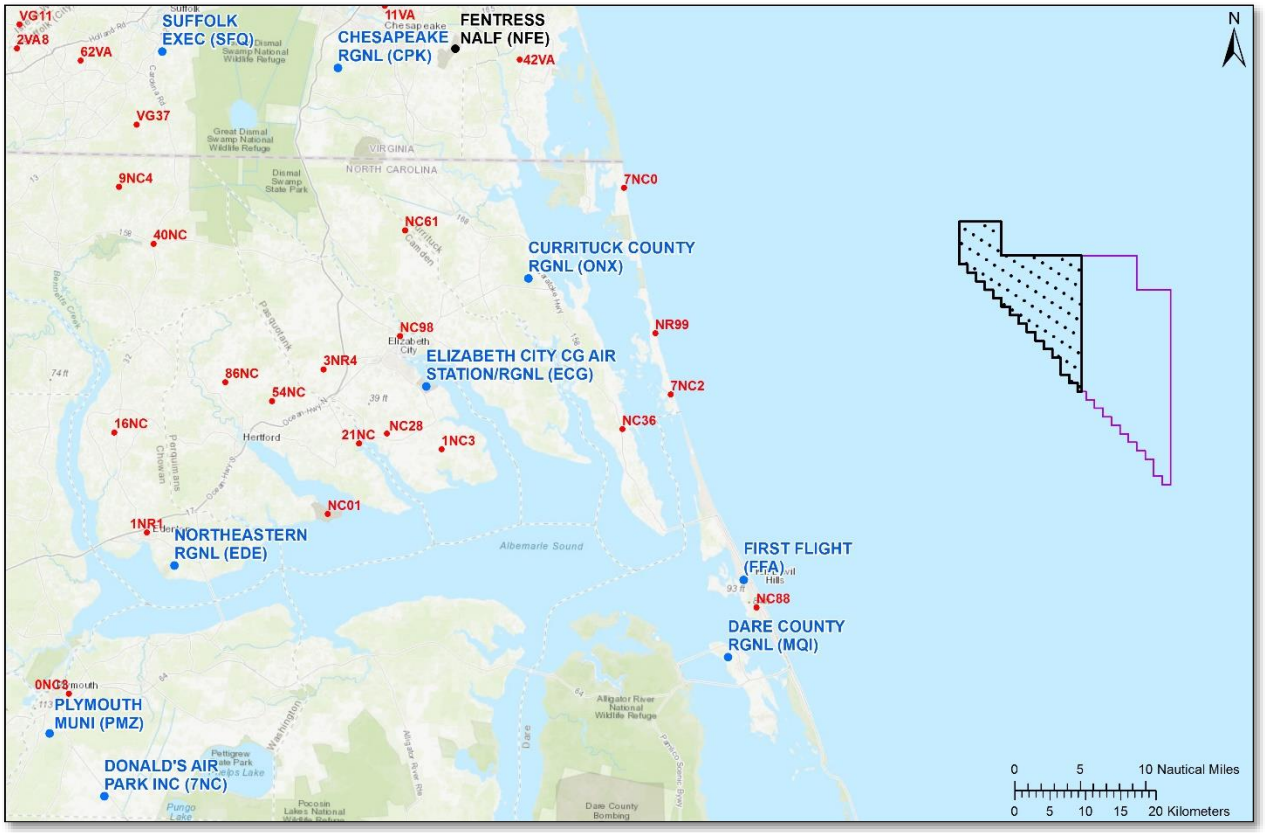



***Figure 1: Public-use (blue), military (black), and private-use (red) airports in proximity to the Project***

# Study Findings

### Territorial Airspace

The FAA conducts aeronautical studies for structures proposed within any state, territory, or possession of the United States, within the District of Columbia, or within territorial waters[1] surrounding the United States.[2] Although an offshore wind project may be located outside of territorial waters, BOEM may require an aeronautical study as part of the application process.

The Project is not located within territorial waters (purple, ***Figure 2***). Therefore, the FAA does not have a mandate to conduct aeronautical studies for WTGs proposed within the defined study area. Regardless, BOEM may require consultation with the FAA as part of the application process. Providing an aeronautical study is useful to these consultations.


***Figure 2: Territorial Airspace and the Project***

[1] The National Oceanic and Atmospheric Administration (NOAA) defines territorial waters as 12 nautical miles (NM) (22.2 kilometers[km]) measured from the official U.S. baseline – a recognized low water line along the coast. NOAA publishes this boundary in a publicly available ***Web Map Service***.

[2] As described in FAA Order 7400.2N 5-1-4(a) "Scope."

### 14 CFR Part 77.17(a)(2) Obstruction Standard and 77.19/21/23 Imaginary Surfaces

The FAA uses level and sloping imaginary surfaces to determine if a proposed structure is an obstruction to air navigation. Structures that are identified as obstructions are then subject to a full aeronautical study and increased scrutiny. However, exceeding a Part 77 imaginary surface does not automatically result in the issuance of a determination of hazard. Proposed structures must have airspace impacts that constitute a substantial adverse effect in order to warrant the issuance of determinations of hazard.

Military and public-use airport 14 CFR Part 77.17(a)(2) and 77.19/21/23 imaginary surfaces do not overlie the Project (***Figure 3***). However, at 1,042 feet (317.5 meters) AMSL, proposed WTGs would exceed 77.17(a)(1) – a height of 499 feet (152.1 meters) AGL at the site of the object.

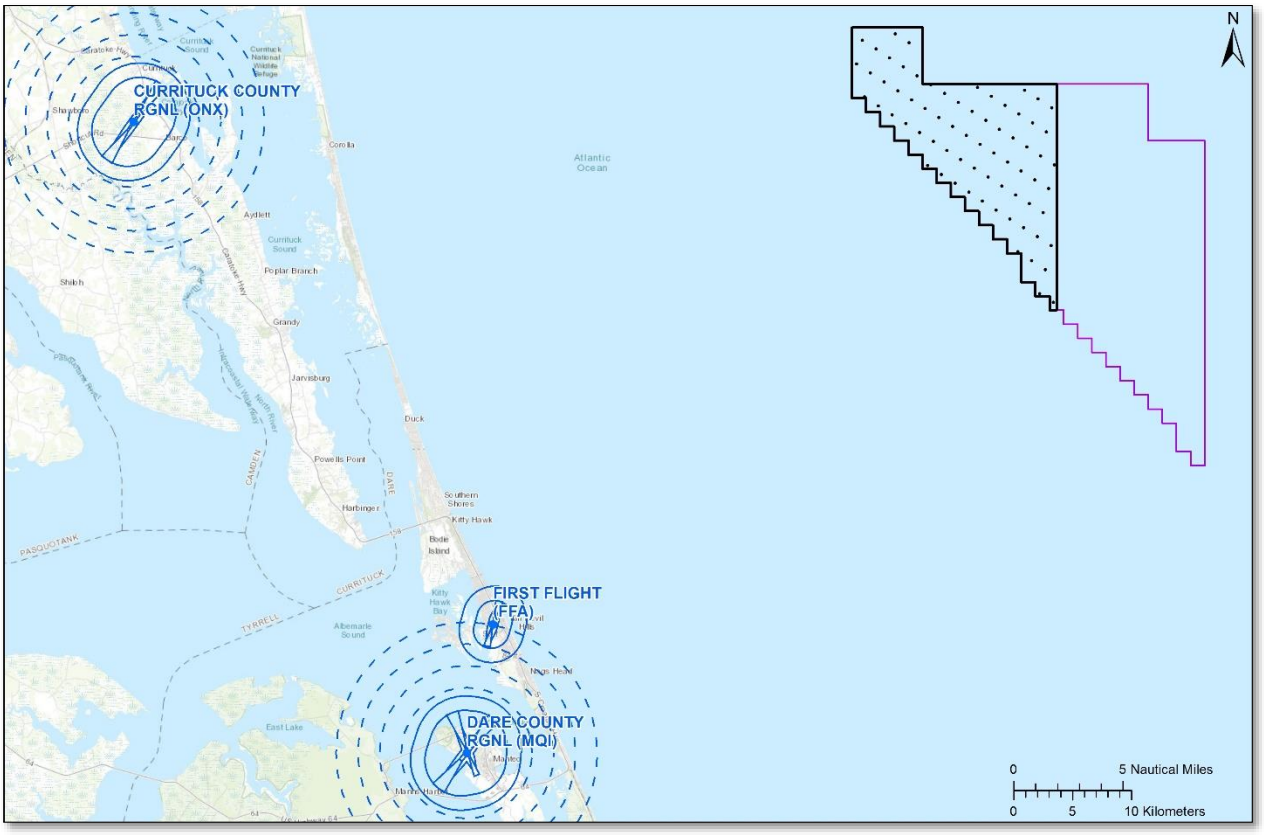



*Figure 3: 77.17(a)(2) (dashed blue) and 77.19 (solid blue) obstruction standards*

### Visual Flight Rules (VFR) Traffic Pattern Airspace

VFR traffic pattern airspace is used by pilots operating during visual meteorological conditions (VMC). The airspace dimensions are based upon the category of aircraft which, in turn, is based upon the approach speed of the aircraft. 14 CFR Part 77.17(a)(2) and 77.19 (as applied to a *visual* runway) imaginary surfaces establish the obstacle clearance surface heights within VFR traffic pattern airspace.

VFR traffic pattern airspace does not overlie the Project and should not limit 1,042-foot (317.5-meter) AMSL WTGs within the defined study area (***Figure 4***).

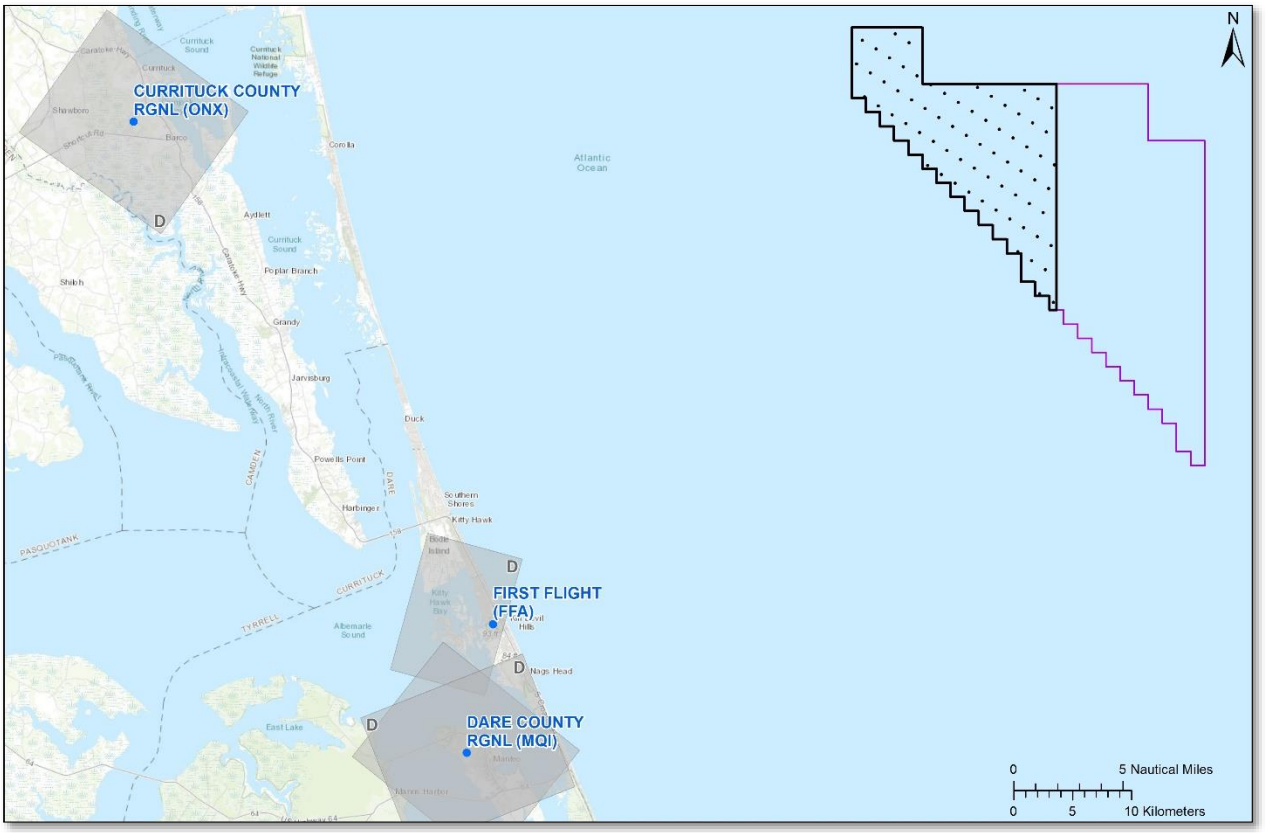



***Figure 4: VFR traffic pattern airspace in proximity to the Project***

### Visual Flight Rules (VFR) Routes

During periods of marginal VMC – low cloud ceilings and one statute mile visibility – pilots often operate below the floor of controlled airspace. Operating under these weather conditions requires pilots to remain within one statute mile (1.6 km) of recognizable landmarks such as roads, rivers, and railroad tracks. The FAA protects for known and regularly used VFR routes by limiting structure heights within two statute miles (3.2 km) of these routes to no greater than 14 CFR Part 77.17(a)(1) – a height of 499 feet (152.1 meters) AGL at the site of the object.

Operational data describing the usage of potential VFR routes is not available. If the FAA determines VFR routes overlie the Project and determines that they are flown regularly (as few as one operation per day), they could limit offshore wind development in excess of 499 feet (152.1 meters) AGL and within two statute miles (3.2 km) of these landmarks (e.g. hatched purple, ***Figure 5***). However, the Project is not located in proximity to any landmarks that could be the basis for VFR Routes (***Figure 5***).

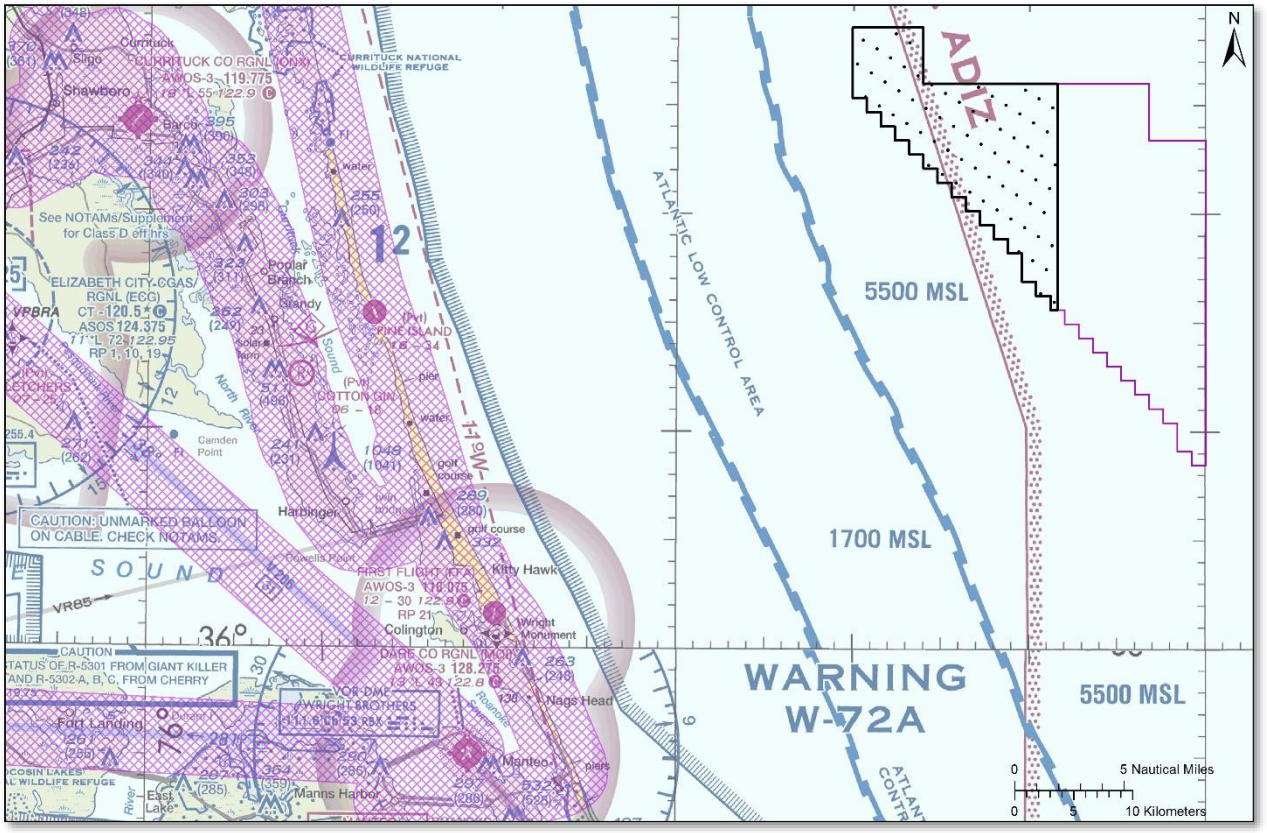



*Figure 5: Potential VFR routes in proximity to the Project*

### Instrument Departures

In order to ensure that aircraft departing during marginal weather conditions do not fly into terrain or obstacles, the FAA publishes instrument departure procedures that provide obstacle clearance to pilots as they transition between the terminal and enroute environments. These procedures contain specific routing and minimum climb gradients to ensure clearance from terrain and obstacles.

Proposed structures that exceed instrument departure procedure obstacle clearance surfaces would require an increase to instrument departure procedure minimum climb gradients. If the FAA determines that this impact would affect as few as one operation per week, it could be used as the basis for determinations of hazard.

Instrument departure procedure obstacle clearance surfaces (e.g., ***Figure 6***) do not overlie the Project and should not limit 1,042-foot (317.5-meter) AMSL WTGs within the defined study area.

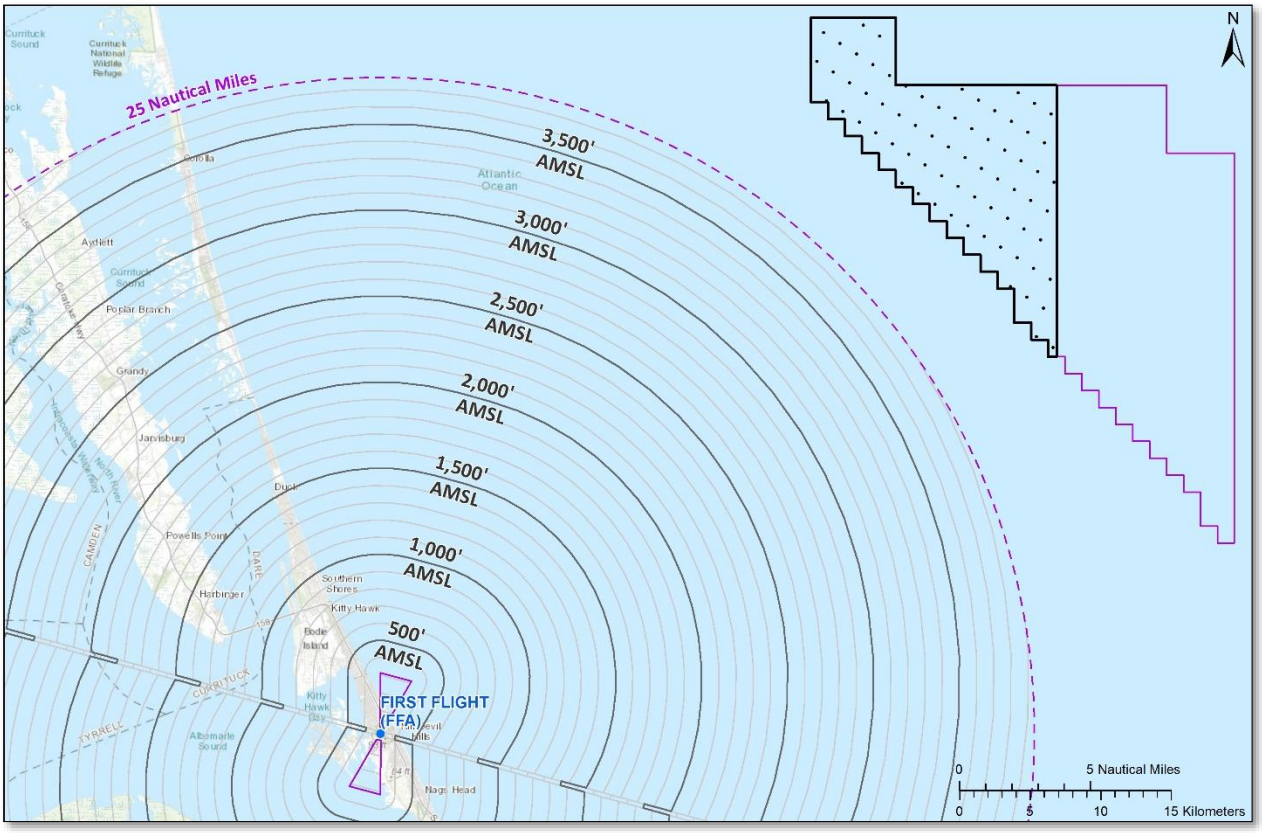



*Figure 6: First Flight (FFA) obstacle departure procedure assessment*

## Instrument Approaches

Pilots operating during periods of reduced visibility and low cloud ceilings rely on terrestrial and satellite based navigational aids (NAVAIDS) in order to navigate from one point to another and to locate runways. The FAA publishes instrument approach procedures that provide course guidance to on-board avionics that aid the pilot in locating the runway. Capitol Airspace assessed eight published instrument approach procedures at three public-use airports in proximity to the Project: [3]

Currituck County Regional (ONX)
RNAV (GPS) Approach to Runway 05
RNAV (GPS) Approach to Runway 23
VOR/DME-A Circling Approach

First Flight (FFA)
RNAV (GPS) Approach to Runway 03
RNAV (GPS) Approach to Runway 21

Dare County Regional (MQI)
RNAV (GPS) Approach to Runway 05
RNAV (GPS) Approach to Runway 17
RNAV (GPS) Approach to Runway 23

Proposed structures that exceed instrument approach procedure obstacle clearance surfaces would require an increase to their minimum altitudes. Increases to these altitudes, especially critical *decision altitudes (DA)* and *minimum descent altitudes (MDA)*, can directly impact the efficiency of instrument approach procedures. If the FAA determines this impact would affect as few as one operation per week, it could be used as the basis for determinations of hazard.

First Flight (FFA)
*Minimum Safe Altitudes*
Multiple minimum safe altitude (MSA) sectors overlie the Project. The MSAs are 2,100 feet (640 meters) AMSL. The obstacle clearance surfaces (e.g., hatched purple, ***Figure 7***) are 1,100 feet (335.2 meters) AMSL and would be the lowest height constraints overlying the western section of the study area. However, in accordance with FAA Order 7400.2N Paragraph 6-3-9(e)(5), MSAs are for emergency use only and cannot be used as the basis for determinations of hazard. Therefore, height constraints associated with MSAs are not included in the Composite Map (***Figure 13***). Additionally, 1,042-foot (317.5-meter) AMSL WTGs will not exceed these surfaces within the defined study area (green area, ***Figure 7***).

Other instrument approach procedure obstacle clearance surfaces do not overlie the Project and should not limit 1,042-foot (317.5-meter) AMSL WTGs within the defined study area.

[3] Capitol Airspace assessed instrument approach procedures within 35 NM (64.8 km) of the study area. Although approach surfaces – including terminal arrival areas (TAA), feeder segments, and initial segments – from airports further than 35 NM (64.8 km) may overlie the study area, the obstacle clearance surfaces present a lower risk to projects than the surfaces identified in this report. Therefore, height constraints associated with instrument approach surfaces for airports beyond 35 NM (64.8 km) were not considered and are not included in the ***Composite Map***.

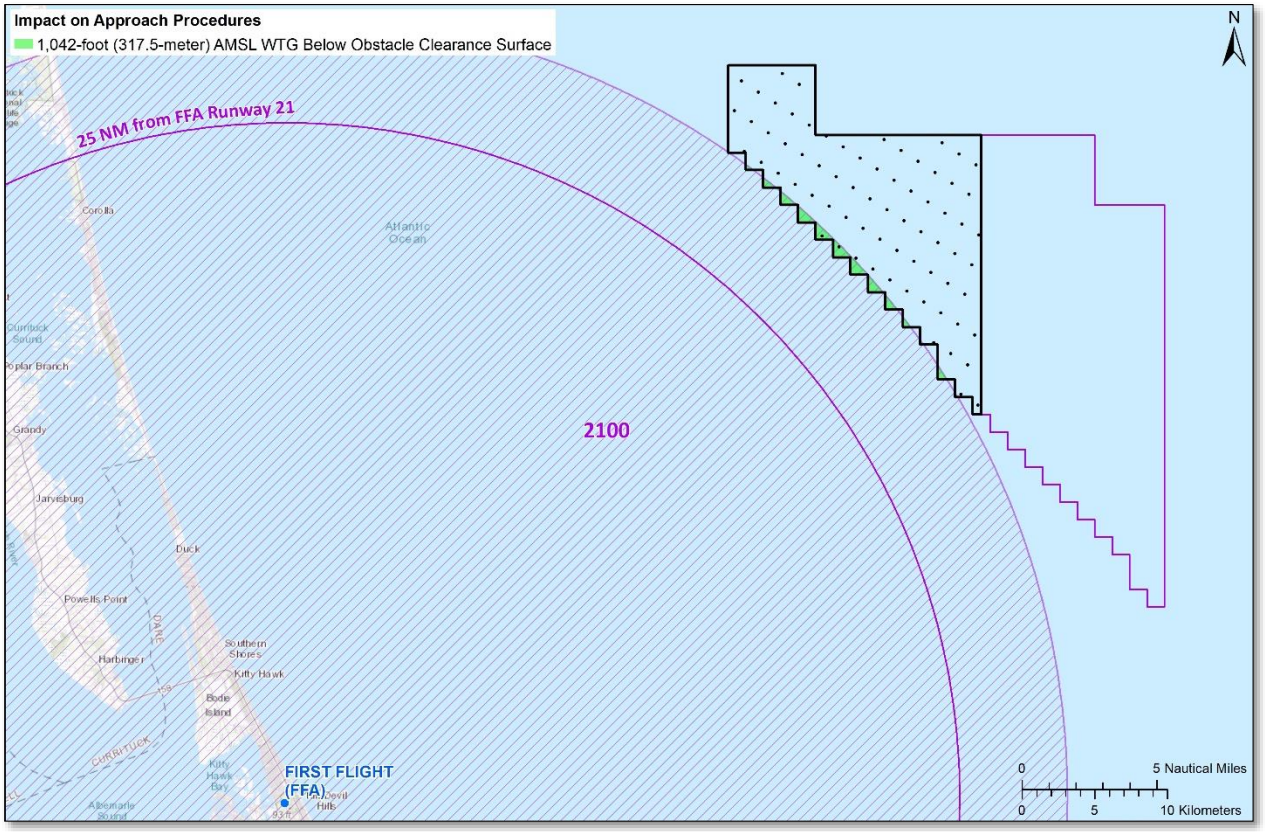



*Figure 7: First Flight (FFA) RNAV (GPS) Approach to Runway 21 MSA (solid purple) with obstacle evaluation area (hatched purple)*

### Enroute Airways

Enroute airways provide pilots a means of navigation when flying from airport to airport and are defined by radials between VHF omni-directional ranges (VORs). The FAA publishes minimum altitudes for airways to ensure clearance from obstacles and terrain. The FAA requires that each airway have a minimum obstacle clearance of 1,000 feet (304.8 meters) in non-mountainous areas and normally 2,000 feet (609.6 meters) in mountainous areas.

Proposed structures that exceed enroute airway obstacle clearance surfaces would require an increase to their minimum obstruction clearance altitudes (MOCA) and/or minimum enroute altitudes (MEA). If the FAA determines that this impact would affect as few as one operation per week, it could be used as the basis for determinations of hazard.

Low altitude enroute airway obstacle clearance surfaces (e.g., ***Figure 8***) do not overlie the Project and should not limit 1,042-foot (317.5-meter) AMSL WTGs within the defined study area.

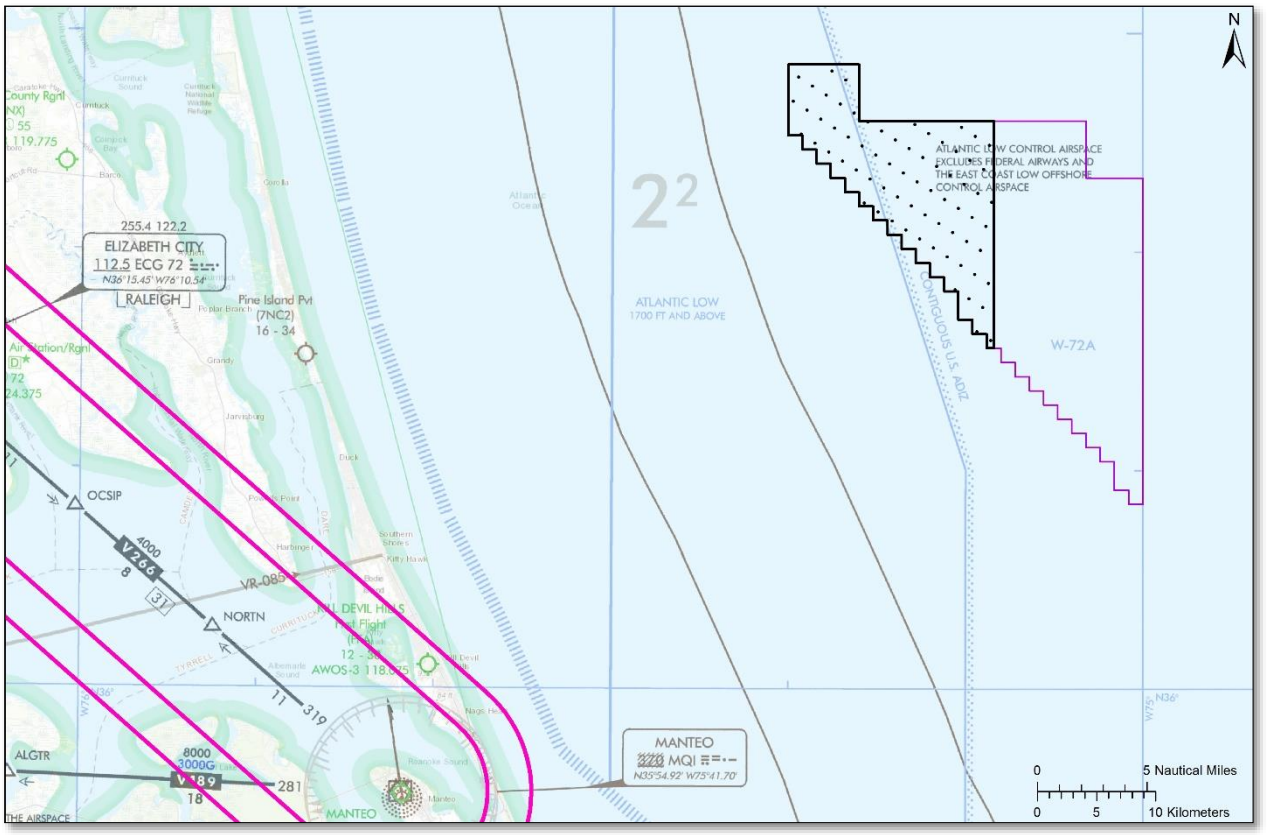



*Figure 8: Low altitude enroute chart L-35 with V266 obstacle evaluation areas (pink)*

### Minimum Vectoring/IFR Altitudes

The FAA publishes minimum vectoring altitude (MVA) and minimum instrument flight rules (IFR) altitude (MIA) charts that define sectors with the lowest altitudes at which air traffic controllers can issue radar vectors to aircraft based on obstacle clearance. The FAA requires that sectors have a minimum obstacle clearance of 1,000 feet (304.8 meters) in non-mountainous areas and normally 2,000 feet (609.6 meters) in mountainous areas.

Proposed structures that exceed MVA/MIA sector obstacle clearance surfaces would require an increase to the altitudes usable by air traffic control for vectoring aircraft. If the FAA determines that this impact would affect as few as one operation per week, it could result in determinations of hazard. [4]

#### Norfolk (ORF) Terminal Radar Approach Control (TRACON)

*Sector B (ORF_MVA_FUS5_2020)*

The MVA is 1,700 feet (518.1 meters) AMSL. The obstacle clearance surface (hatched purple, ***Figure 9***) is 749 feet (228.3 meters) AMSL and is the lowest height constraint overlying the northwestern section of the study area. At 1,042 feet (317.5-meter) AMSL, proposed WTGs in this area will exceed this surface (red area, ***Figure 9***). However, the study area is located approximately 26 NM (48.2 km) outside of Norfolk (ORF) TRACON controlled airspace. Therefore, Norfolk (ORF) TRACON may be willing to raise the Sector B MVA where it overlies the Project to accommodate wind development up to 1,042 feet (317.5 meters) AMSL. This mitigation option is subject to FAA review.

*Sector K (ORF_MVA_FUS3_2020 & ORF_MVA_FUS5_2020)*

The MVA is 5,500 feet (1,676.4 meters) AMSL. The obstacle clearance surface (hatched pink, ***Figure 9***) is 4,549 feet (1,386.5 meters) AMSL and is the lowest height constraint overlying most of the study area. However, this surface should not limit 1,042-foot (317.5-meter) AMSL WTGs within the defined study area (green area, ***Figure 9***).

#### Washington (ZDC) Air Route Traffic Control Center (ARTCC)

*Sector WNVF00 (ZDC_TAV_2020)*

The MIA is 5,800 feet (1,767.8 meters) AMSL (***Figure 10***). The obstacle clearance surface is 4,849 feet (1,477.9 meters) AMSL and is in excess of other, lower surfaces. Additionally, this surface should not limit 1,042-foot (317.5-meter) AMSL WTGs within the defined study area (green area, ***Figure 10***).

[4] Oceana (NTU) Radar Air Traffic Control Facility (RATCF) MVA sectors overlie the Project. However, RATCF MVA charts are not publicly available. It is possible that Oceana Approach Control minimum vectoring altitude sector obstacle clearance surfaces are lower than those described in this report. However, the study area is located approximately 20 NM (37 km) outside of Oceana (NTU) RATCF controlled airspace.

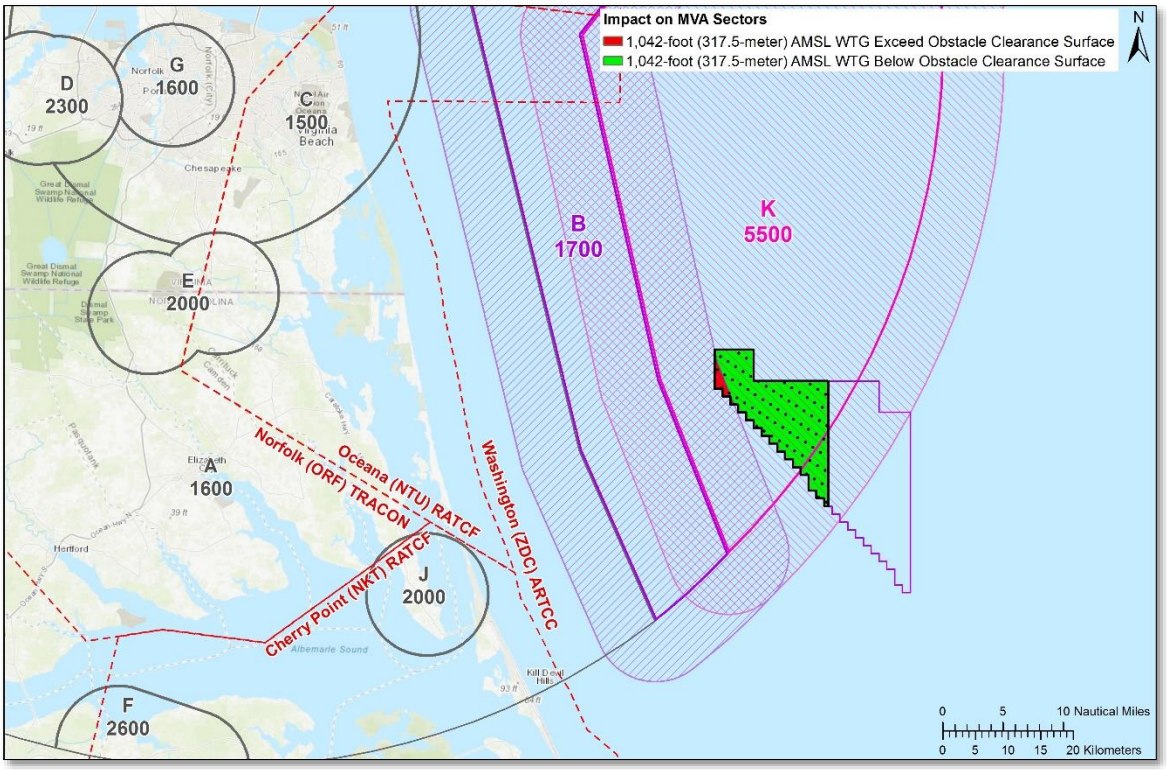



*Figure 9: Norfolk (ORF) TRACON FUSION 5 MVA sectors with Sector B (hatched purple) and Sector K (hatched pink) obstacle evaluation areas*

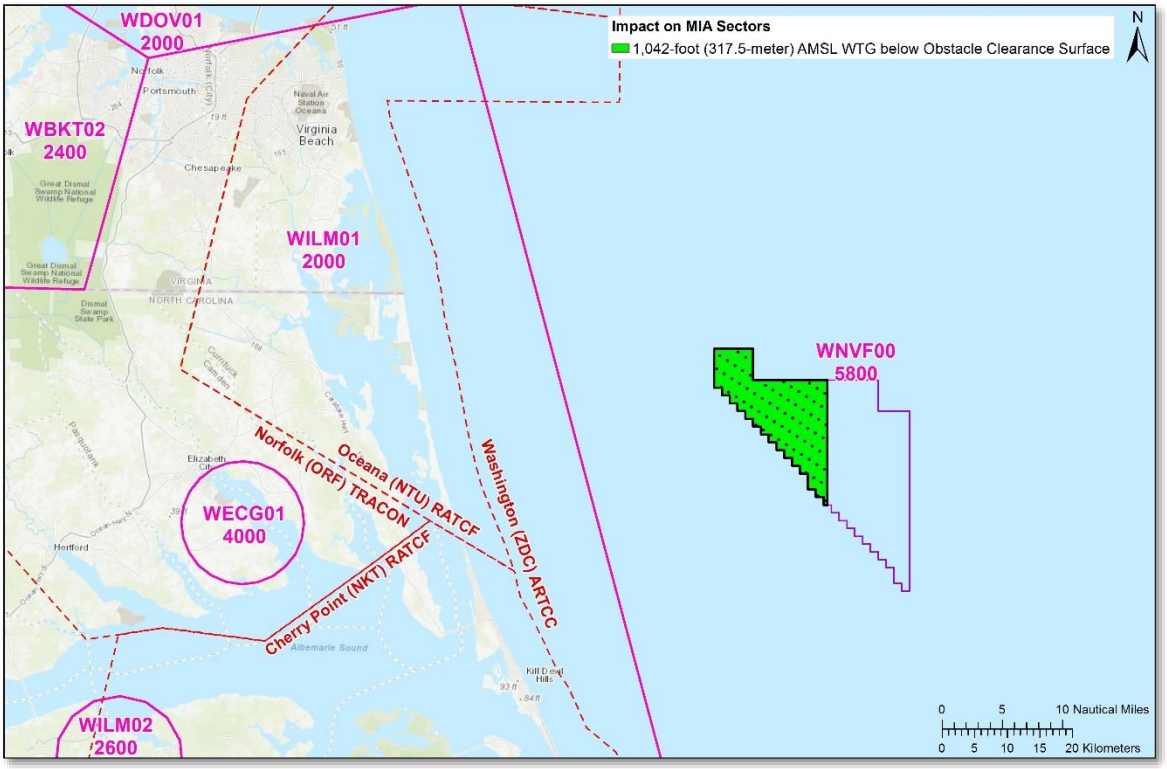



*Figure 10: Washington (ZDC) ARTCC MIA sectors (pink)*

### Terminal and Enroute NAVAIDs

The FAA has established protection areas in order to identify proposed structures that may have a physical and/or electromagnetic effect on NAVAIDs. The protection area dimensions vary based on the proposed structure type as well as the NAVAID type. Proposed structures located within these areas may interfere with NAVAID services and will require further review by FAA Technical Operations. If further review determines that proposed structures would have a significant physical and/or electromagnetic effect on NAVAIDs, it could result in determinations of hazard.

NAVAID protection areas do not overlie the Project (e.g., ***Figure 11***). Therefore, it is unlikely that proposed WTGs would have a physical or electromagnetic effect on terminal or enroute NAVAIDs.

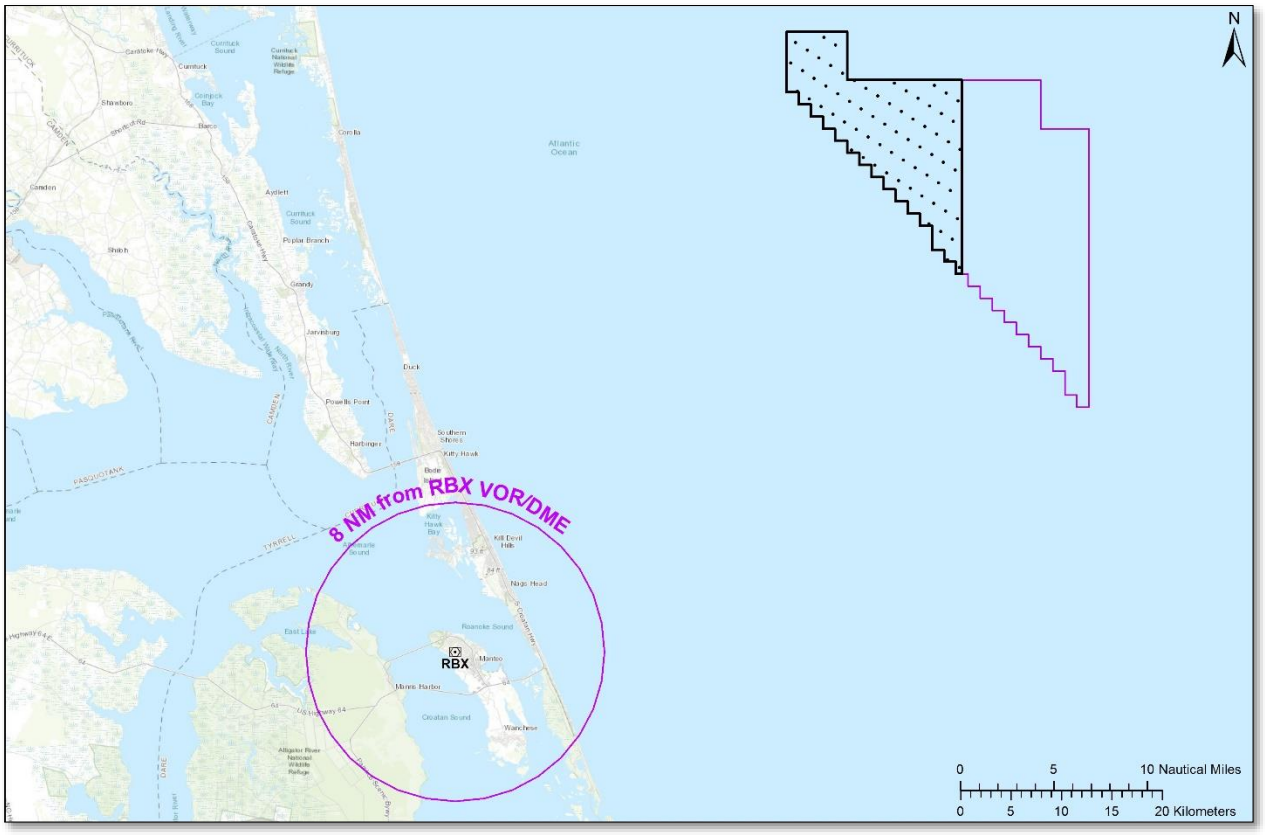



***Figure 11: Wright Brothers (RBX) VOR/DME screening surface and the Project***

### Military Airspace and Training Routes

Although the FAA does not consider impact on military airspace or training routes, they will notify the military of proposed structures located within these segments of airspace. Impact on these segments of airspace can result in military objections to the proposed development. If the planned development area is located on federal land, impact on military airspace or training routes may result in the denial of permits by BOEM.

Warning areas (W) overlying the Project (***Figure 12***):

U.S. Navy, Fleet Area Control and Surveillance Facility, Virginia Capes (FACSFAC VACAPES)

| *Route/Airspace* | *Minimum Altitude* |
|---|---|
| W-72A | Surface |

Due to the low altitude associated with this segment of airspace, it is possible that wind development could have an impact on its operations. If this segment of airspace is used frequently by the Navy, they may object to proposed wind development within the boundaries of this segment of airspace. Under the provisions of the 2018 National Defense Authorization Act (NDAA), the Military Aviation and Installation Assurance Siting Clearinghouse (Clearinghouse) may issue a Notice of Presumed Risk to National Security (NPR) letter to initiate mitigation discussions. These discussions are facilitated through the Clearinghouse and with the affected bases or organizations with operational interests. Per the legislative directive, NPR letters are provided to the Governor of the State(s). The Clearinghouse typically attempts to notify developers shortly before the issuance of an NPR letter.

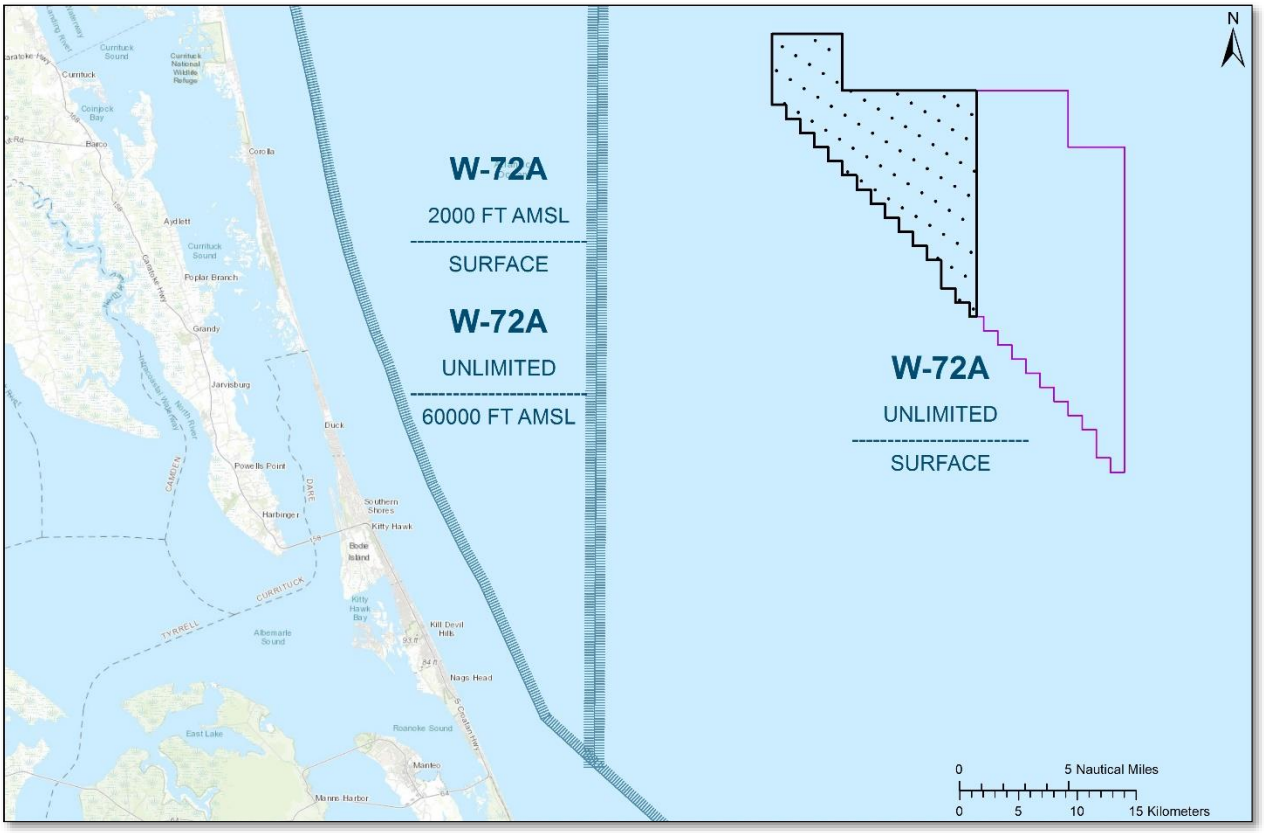



***Figure 12: Military airspace in proximity to the Project***

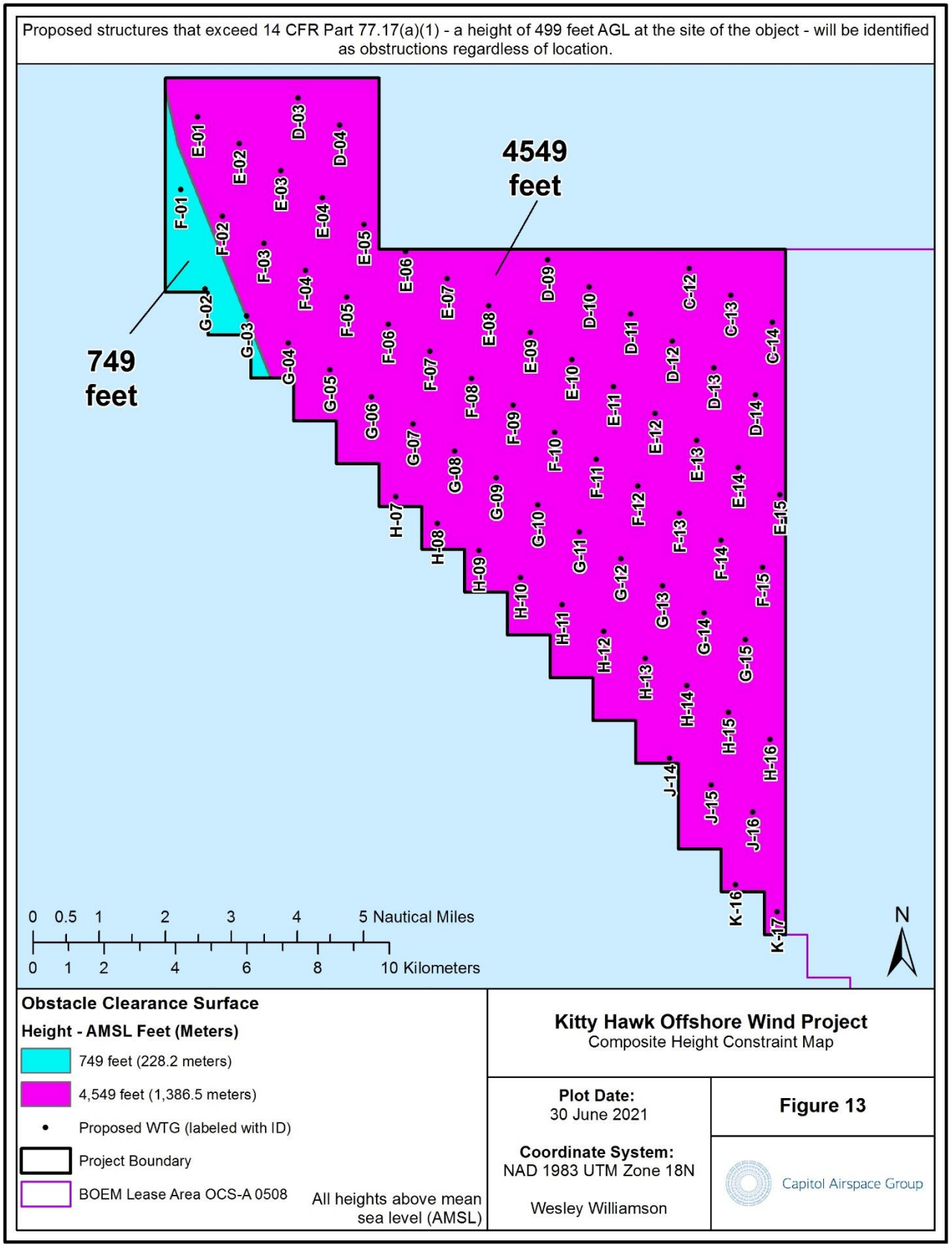
## Conclusion

At 1,042 feet (317.6-meters) AMSL, proposed WTGs would exceed 77.17(a)(1) – a height of 499 feet (152.1 meters) AGL at the site of the object – and would be identified as obstructions. However, heights in excess of 499 feet (152.1 meters) AGL are feasible provided proposed WTGs do not exceed FAA obstacle clearance surfaces. The lowest obstacle clearance surfaces overlying the Project range from 749 to 4,549 feet (228.2 to 1,386.5 meters) AMSL (***Figure 13***) and are associated with MVA sectors.

At 1,042 feet (317.5 meters) tall, proposed WTGs in the northwestern section of the study area (red area, ***Figure 9***) will require an increase to the Norfolk (ORF) TRACON FUSION 5 Sector B MVA. However, the study area is located outside of Norfolk (ORF) TRACON airspace. Therefore, Norfolk (ORF) TRACON may be willing to raise the Sector B MVA where it overlies the Project to accommodate up to 1,042-foot (317.5-meter) AMSL WTGs. This mitigation option is subject to FAA review.

Warning area W-72A overlies the Project (***Figure 12***). Due to the low floor altitude associated with this segment of airspace, wind development could have an impact on its operations. If the U.S. Navy uses this warning area regularly, it could result in military objections to proposed wind development.

If you have any questions regarding the findings of this study, please contact ***Dan Underwood*** or ***Wesley Williamson*** at (703) 256-2485.


Proposed structures that exceed 14 CFR Part 77.17(a)(1) - a height of 499 feet AGL at the site of the object - will be identified as obstructions regardless of location.
4549 feet
749 feet
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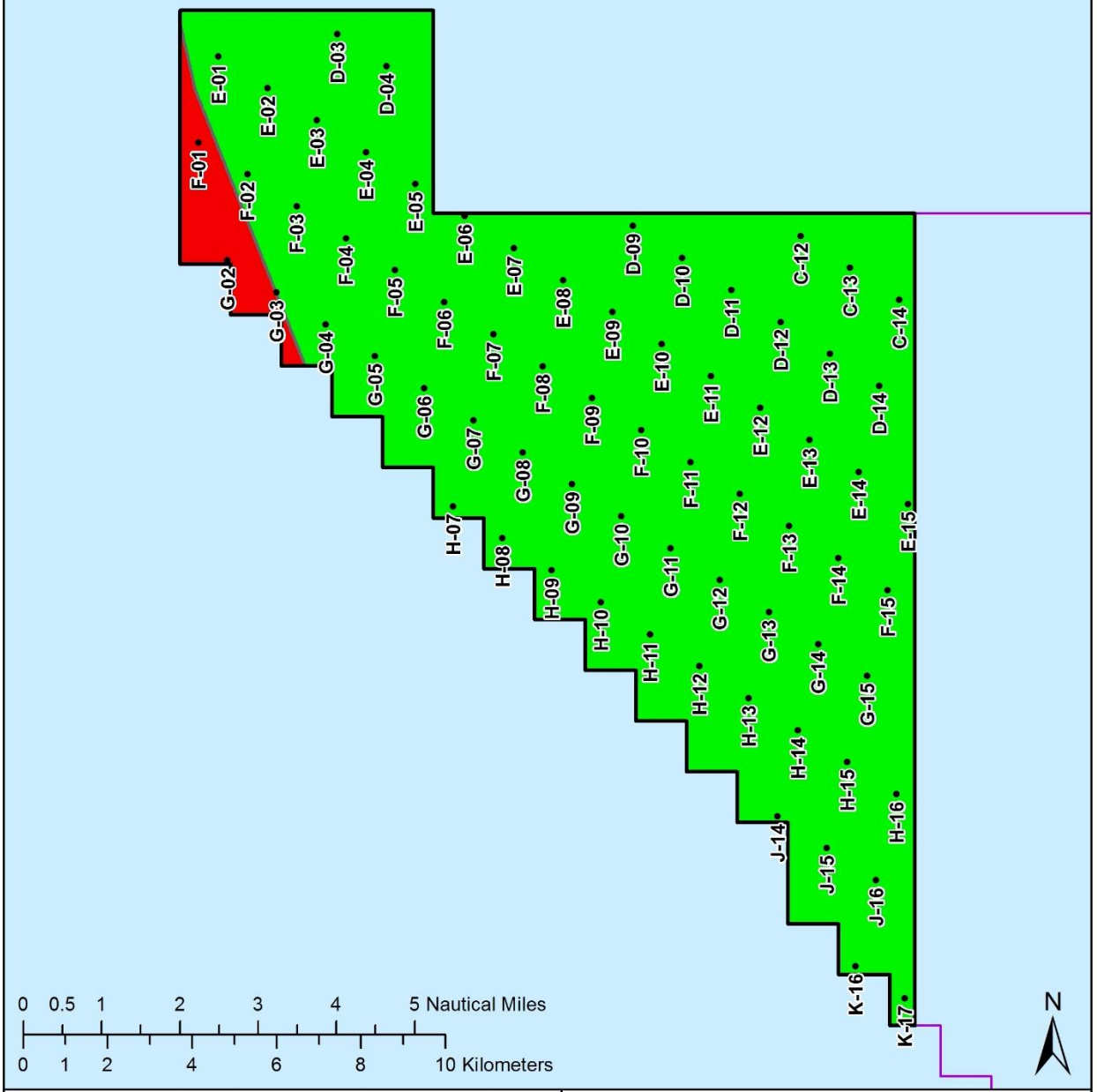
0 0.5 1 2 3 4 5 Nautical Miles
0 1 2 4 6 8 10 Kilometers
N
Obstacle Clearance Surface
Height - AMSL Feet (Meters)
749 feet (228.2 meters)
4,549 feet (1,386.5 meters)
Proposed WTG (labeled with ID)
Project Boundary
BOEM Lease Area OCS-A 0508
All heights above mean sea level (AMSL)
Kitty Hawk Offshore Wind Project
Composite Height Constraint Map
Plot Date:
30 June 2021
Coordinate System:
NAD 1983 UTM Zone 18N
Wesley Williamson
Figure 13
Capitol Airspace Group

Proposed structures that exceed 14 CFR Part 77.17(a)(1) - a height of 499 feet AGL at the site of the object - will be identified as obstructions regardless of location.




**Obstacle Clearance Surface**

**Height - AMSL Feet (Meters)**

- < 1,042 feet (317.5 meters)
- ≥ 1,042 feet (317.5 meters)
- Proposed WTG (labeled with ID)
- Project Boundary
- BOEM Lease Area OCS-A 0508

All heights above mean sea level (AMSL)

**Kitty Hawk Offshore Wind Project**
Above Mean Sea Level (AMSL) Clearance Map

**Plot Date:**
30 June 2021

**Coordinate System:**
NAD 1983 UTM Zone 18N

Wesley Williamson

**Figure 14**

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