# Sunrise Wind Farm Project

# Appendix Y1
# Obstruction Evaluation and Airspace Analysis

Prepared for:

Sunrise Wind | Powered by Ørsted & Eversource

August 23, 2021

Revision 1 – October 28, 2021

Revision 2 – August 19, 2022

# Sunrise Wind Farm Project

Stantec Consulting Services Inc

*Obstruction Evaluation & Airspace Analysis*

September 30, 2020

Capitol Airspace Group
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# Summary

Capitol Airspace conducted an obstruction evaluation and airspace analysis for the Sunrise Wind Farm Project (SRWF) located on the Outer Continental Shelf off the coast of Rhode Island & Massachusetts. The purpose for this analysis was to identify the potential for impacts on Visual Flight Rules (VFR) and Instrument Flight Rules (IFR) operations as a result of wind turbines that could have a minimum of 636-foot tall wind turbine generators (WTG) to a maximum of 968-foot tall WTGs.[1] This analysis assessed height constraints overlying an approximately 166-square-mile study area (black outline, ***Figure 1***) to aid in identifying impacts to proposed wind turbine locations.

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 a Federal Aviation Administration (FAA) 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 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 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 United States and cannot enforce the findings of its studies.

The lowest obstacle clearance surfaces overlying the SRWF range from 549 to 4,549 feet above mean sea level (AMSL) and are associated with instrument approach procedures, minimum vectoring altitude sectors, and minimum instrument flight rules (IFR) altitude sectors. With a design envelope range from 636 to 968 feet tall, proposed wind turbines in the northwestern and northeastern sections of the study area would exceed these surfaces and require an increase to minimum vectoring altitudes. If the increase to minimum vectoring altitudes is anticipated to affect as few as one radar vectoring operation per week, it may result in FAA objections to proposed wind development.

A warning area overlies the SRWF and could result in military objections to proposed wind development.

[1] Since the time the analysis herein was conducted, Sunrise Wind has elected to reduce the number of turbines from 122 to up to 94 at 102 potential positions and has chosen a WTG model within the original study parameters. Furthermore, the total structure height of the OCS–DC was reduced from 361 ft (110.0 m) to up to 295 ft (90 m). These reductions are anticipated to result in the same or lower levels of impact than those presented in this report.

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

*Capitol Airspace applies FAA defined rules and regulations applicable to obstacle evaluation, instrument procedures assessment and visual flight rules (VFR) operations to the best of its ability and with the intent to provide the most accurate representation of limiting airspace surfaces as possible. Capitol Airspace maintains datasets obtained from the FAA which are updated on a 28-day cycle. The results of this analysis are based on the most recent data available as of the date of this report. Limiting airspace surfaces depicted in this report are subject to change due to FAA rule changes and regular procedure amendments. Therefore, it is of the utmost importance to obtain FAA determinations of no hazard prior to making substantial financial investments in this project.*

## Methodology

Capitol Airspace studied the proposed Project based upon location information provided by Stantec Consulting Services Inc. 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, as well as 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 7400.2M Procedures for Handling Airspace Matters
- FAA Order 8260.3D 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
- National Oceanic and Atmospheric Administration Maritime Boundaries Data

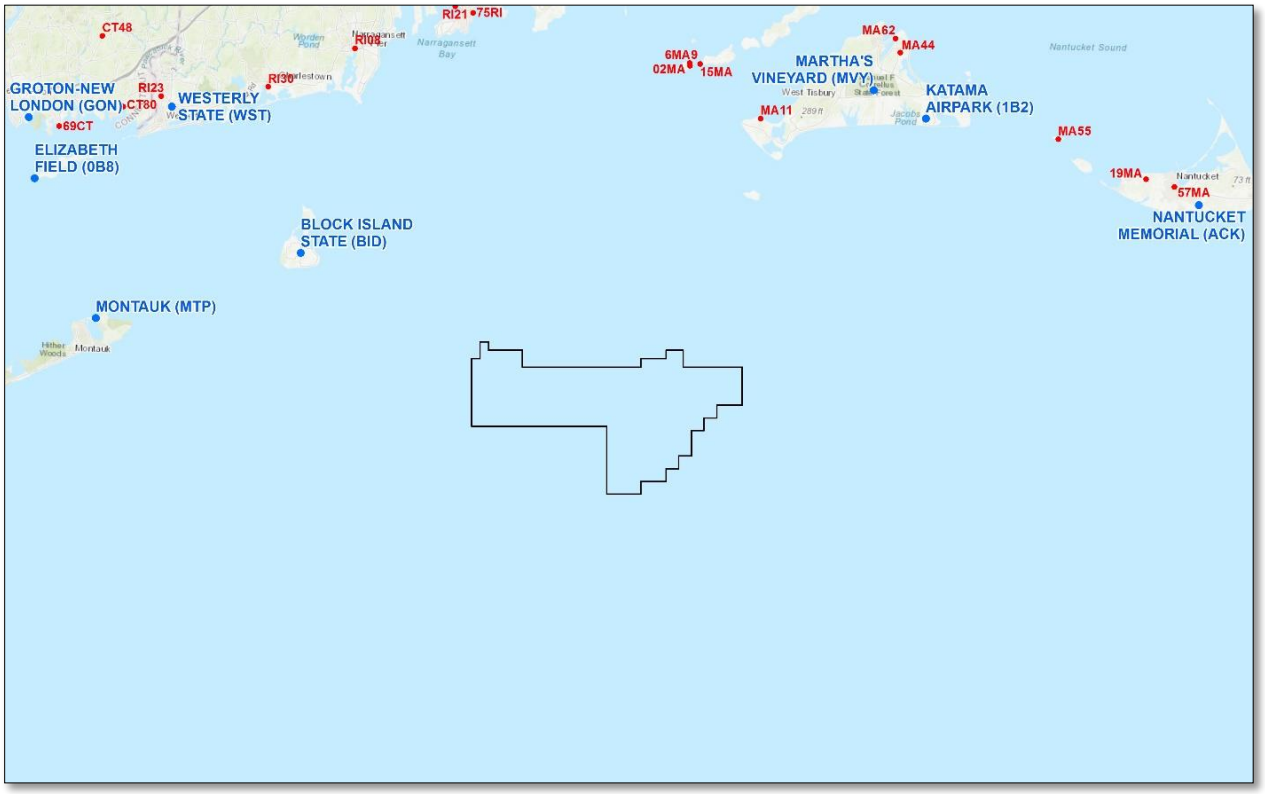



***Figure 1: Public-use (blue) and private-use (red) airports in proximity to the SRWF***

# 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[2] surrounding the United States.[3] 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 SRWF is not located within territorial waters (purple, ***Figure 2***). Therefore, the FAA does not have a mandate to conduct aeronautical studies for wind turbines proposed within the defined study area. However, BOEM may require consultation with the FAA as part of the application process, as well as an aeronautical study to support these consultations.

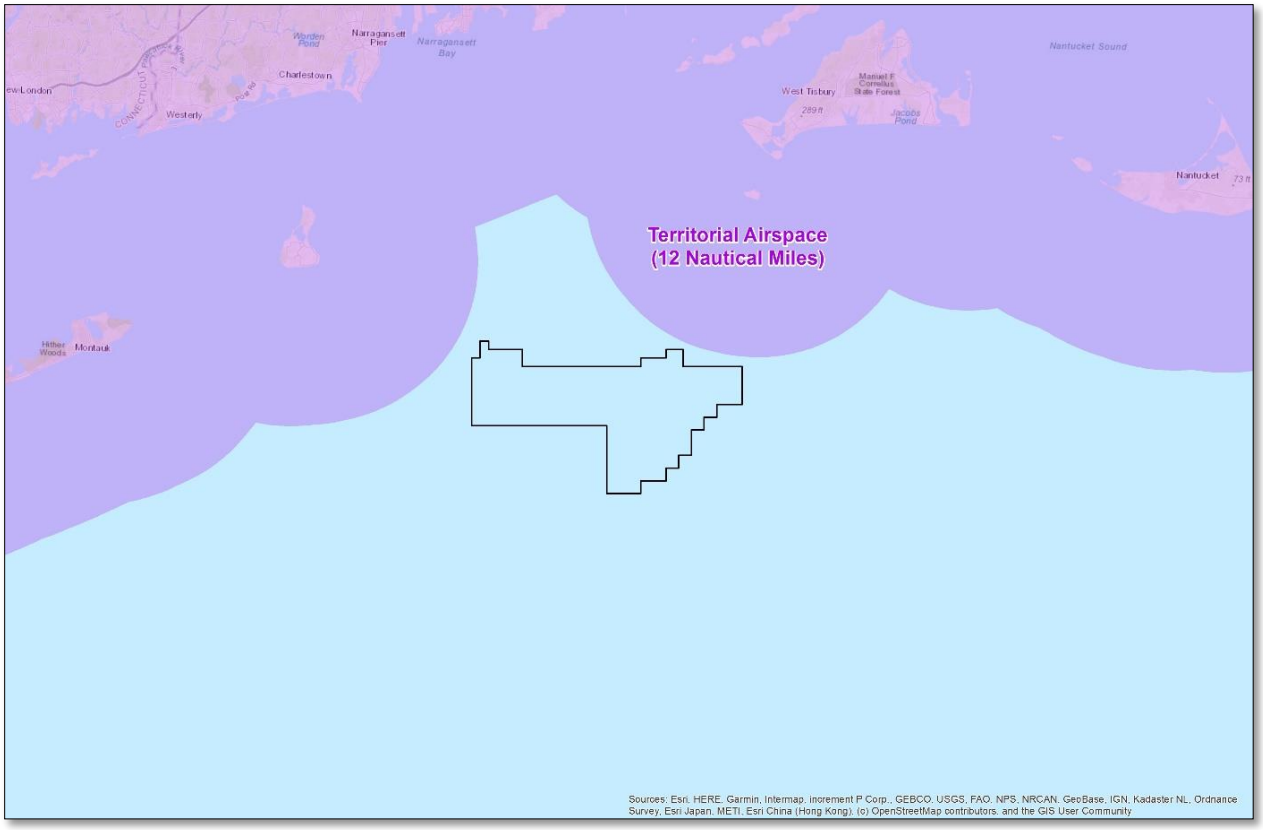



***Figure 2: Territorial Airspace in proximity to the SRWF***

[2] The National Oceanic and Atmospheric Administration (NOAA) defines territorial waters as 12 nautical miles 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***.

[3] As described in FAA Order 7400.2M 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 indicate that a structure would have an adverse effect on aviation operations. Proposed structures must have an impact on a significant volume of VFR or IFR operations in order to constitute a substantial adverse effect.

Military and public-use airport 14 CFR Part 77.17(a)(2) obstruction standard and 77.19/21/23 imaginary surfaces do not overlie the SRWF (***Figure 3***). However, at all proposed heights, wind turbines will exceed 77.17(a)(1) – a height of 499 feet AGL at the site of the object – and will be identified as obstructions regardless of location.

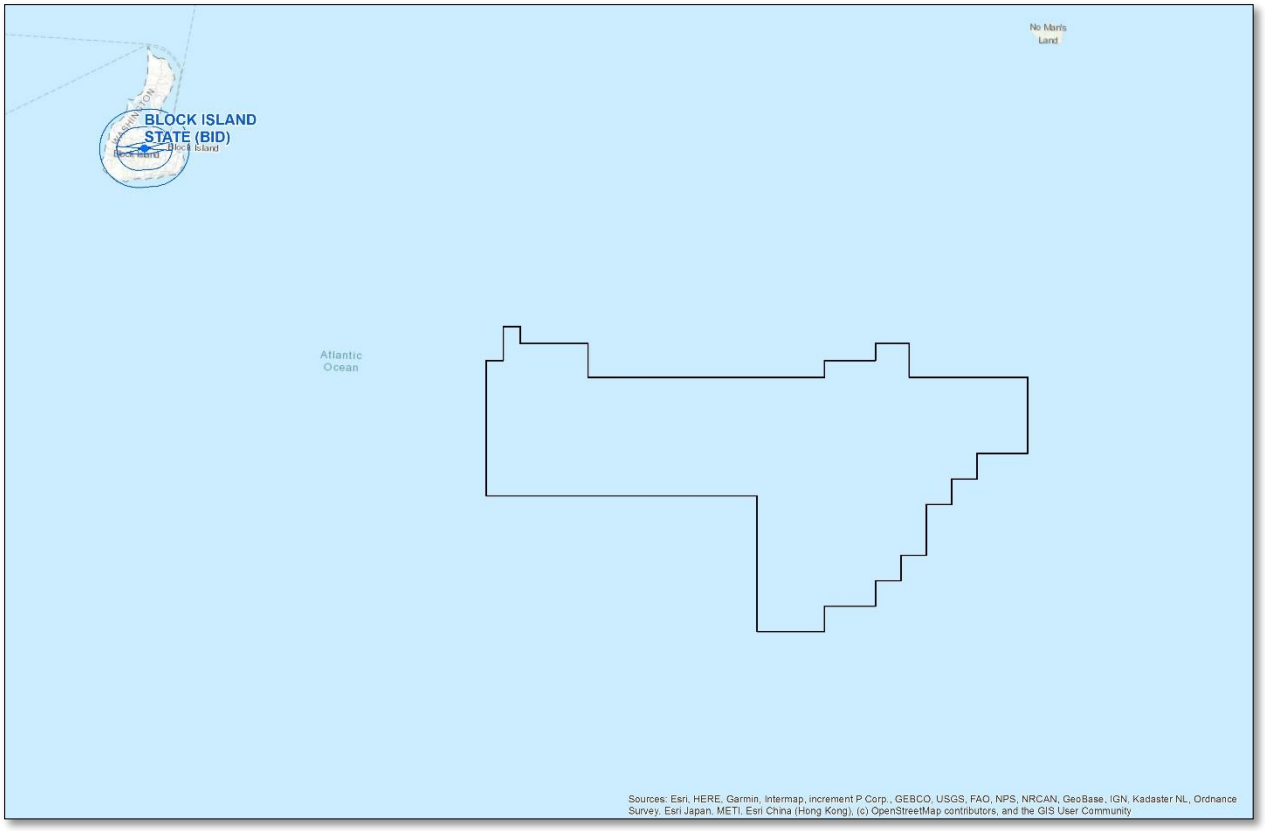



***Figure 3: 14 CFR Part 77.19 imaginary surfaces (solid blue) in proximity to the SRWF***

### 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 SRWF (***Figure 4***). As a result, 636 to 968-foot tall wind turbines within the defined study area should not have an impact on VFR traffic pattern airspace.

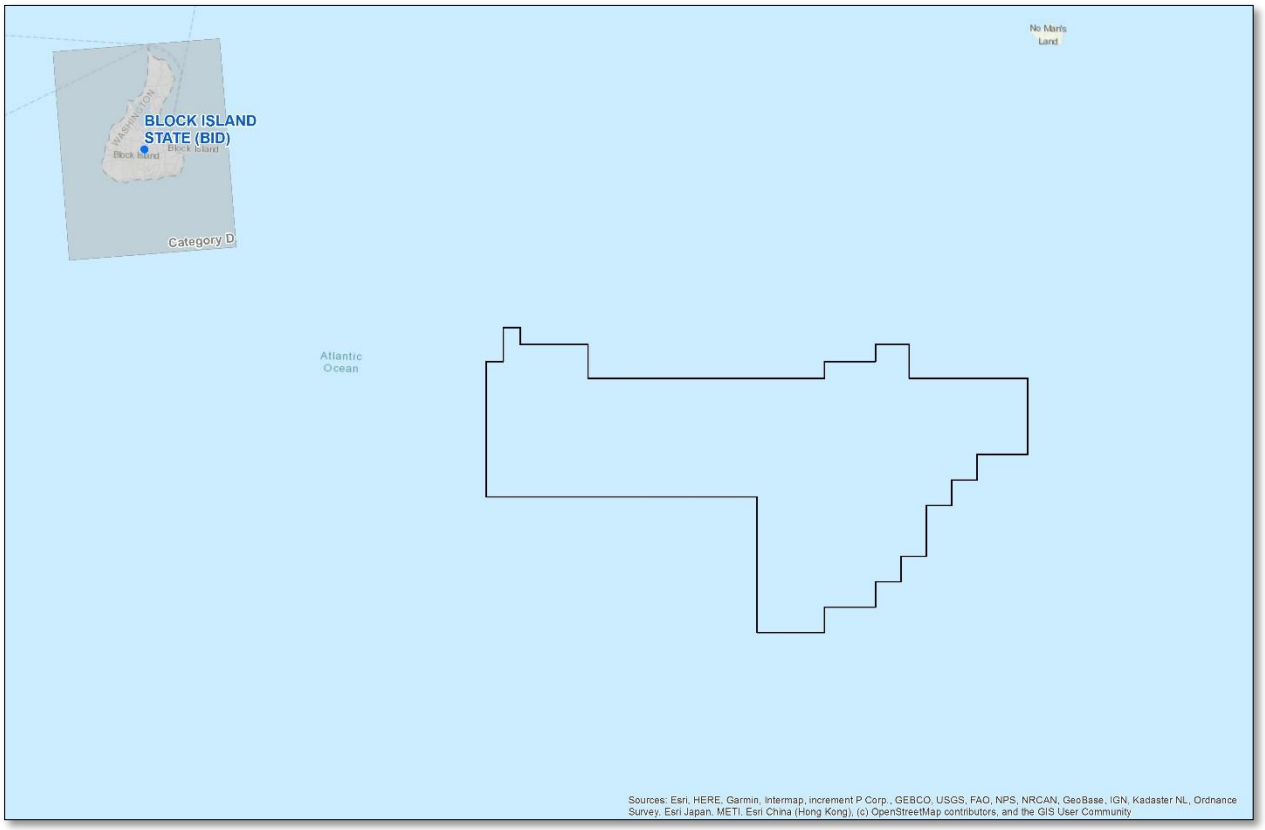



***Figure 4: VFR traffic pattern airspace in proximity to the SRWF***

### 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 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 of these routes to no greater than 14 CFR Part 77.17(a)(1) – a height of 499 feet AGL at the site of the object.

The SRWF is located in proximity to low-altitude enroute airways[4] that may be used as VFR routes (***Figure 5***). There is no dataset that identifies VFR routes or their utilization. However, a traffic flow analysis can be conducted to assess historical radar flight track data and identify regularly used low-level routes.[5] If the FAA determines that these VFR routes are flown regularly (as few as once per day), they could object to wind development in excess of 499 feet AGL and within two statute miles of these landmarks (hatched orange, ***Figure 5***).

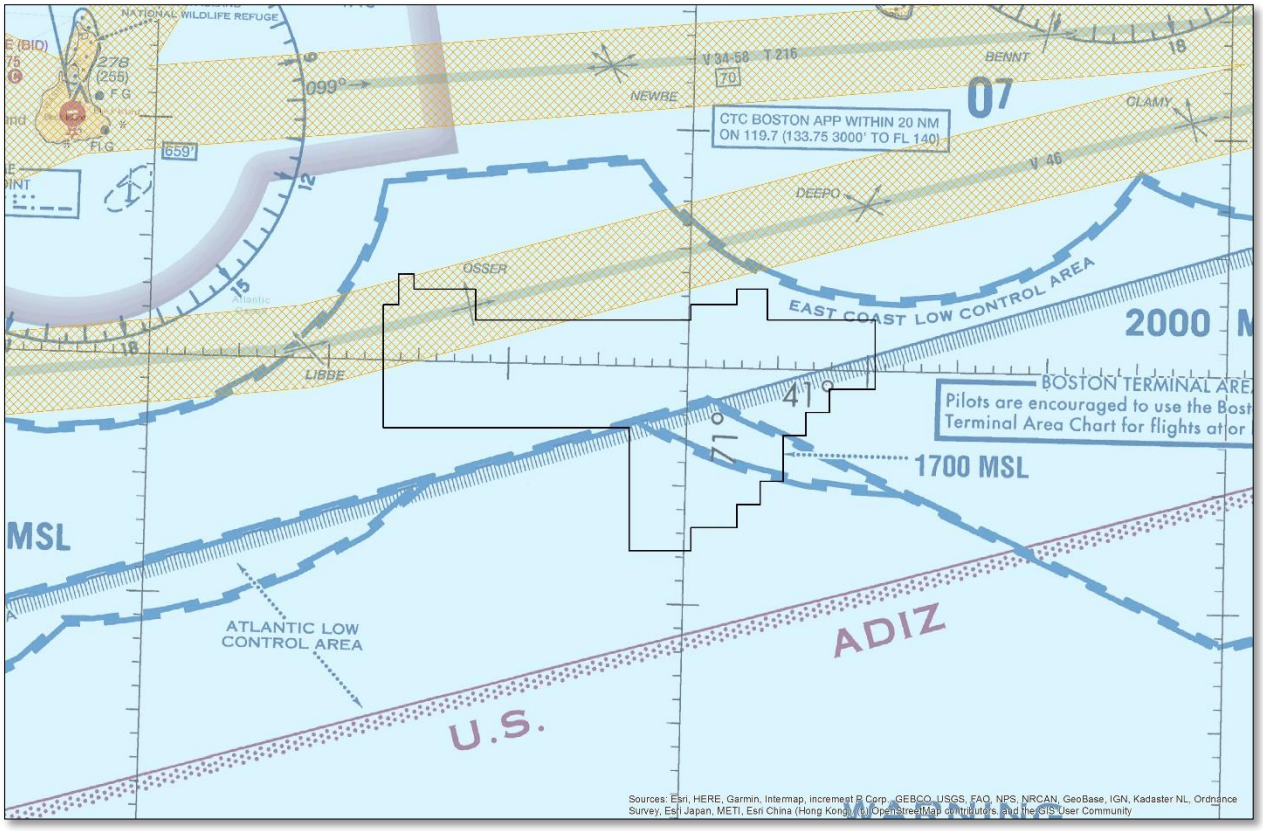



***Figure 5: Potential VFR routes in proximity to the SRWF***

[4] VFR traffic may use enroute airways at altitudes lower than the published minimum enroute altitude.

[5] Radar coverage must be adequate to detect low level VFR flights.

### 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 increase to minimum climb gradients is anticipated to affect as few as one flight per week, it may result in FAA objections to proposed wind development.

Instrument departure procedure obstacle clearance surfaces (e.g., ***Figure 6***) are in excess of other, lower surfaces. At 636 to 968 feet tall, proposed wind turbines within the defined study area would not exceed these surfaces and should not have an impact on instrument departure procedures.

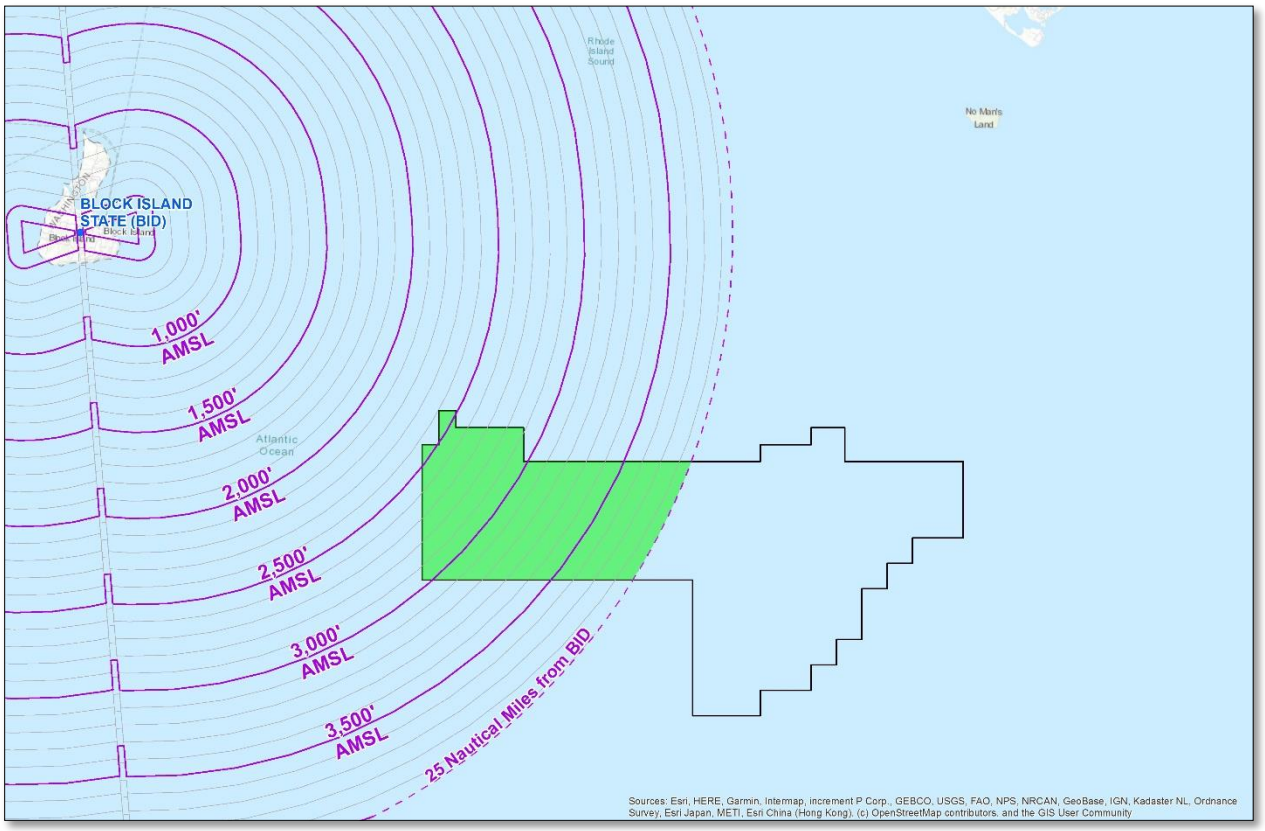



*Figure 6: Block Island State (BID) obstacle departure procedure assessment*

### 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 a total of 17 published instrument approach procedures at five public-use airports in proximity to the SRWF: [6, 7]

Block Island State (BID)
RNAV (GPS) Approach to Runway 10
RNAV (GPS) Approach to Runway 28
VOR/DME Approach to Runway 10
VOR Approach to Runway 28

Montauk (MTP)
RNAV (GPS) Approach to Runway 06
RNAV (GPS) Approach to Runway 24
VOR Approach to Runway 06

Westerly State (WST)
RNAV (GPS) Approach to Runway 07

Martha's Vineyard (MVY)
ILS or Localizer Approach to Runway 24
RNAV (GPS) Approach to Runway 06
RNAV (GPS) Approach to Runway 15
RNAV (GPS) Approach to Runway 24
RNAV (GPS) Approach to Runway 33
VOR Approach to Runway 06

Newport State (UUU)
RNAV (GPS) Approach to Runway 16
Localizer Approach to Runway 22
VOR/DME Approach to Runway 16

Proposed wind turbines 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 increase to instrument approach procedure minimum altitudes is anticipated to affect as few as one flight per week, it may result in FAA objections to proposed wind development.

[6] Capitol Airspace assessed instrument approach procedures within 30 nautical miles (NM) of the study area. Although approach surfaces – including Terminal Arrival Areas (TAA), feeder segments, and initial segments – from airports further than 30 NM 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 30 NM were not considered and are not included in the ***Composite Map***.

[7] Multiple minimum safe altitudes (MSA) overlie the study area. However, MSAs are for emergency use only and cannot be used as the basis for determinations of hazard in accordance with FAA Order 7400.2M Paragraph 6-3-9(e)(5). Therefore, height constraints associated with MSAs were not considered and are not included in the ***Composite Map***.

## Block Island State (BID)

*RNAV (GPS) Approach to Runway 28*

The *OSSER* to *WAVON* initial approach segment minimum altitude is 2,000 feet AMSL. The primary area obstacle clearance surface (purple outline, ***Figure 7***) is 1,000 feet AMSL and is one of the lowest height constraints overlying the northwestern section of the study area. However, at 636 to 968 feet tall, proposed wind turbines within the defined study area would not exceed this surface and should not require an increase to the minimum altitude (green area, ***Figure 7***).

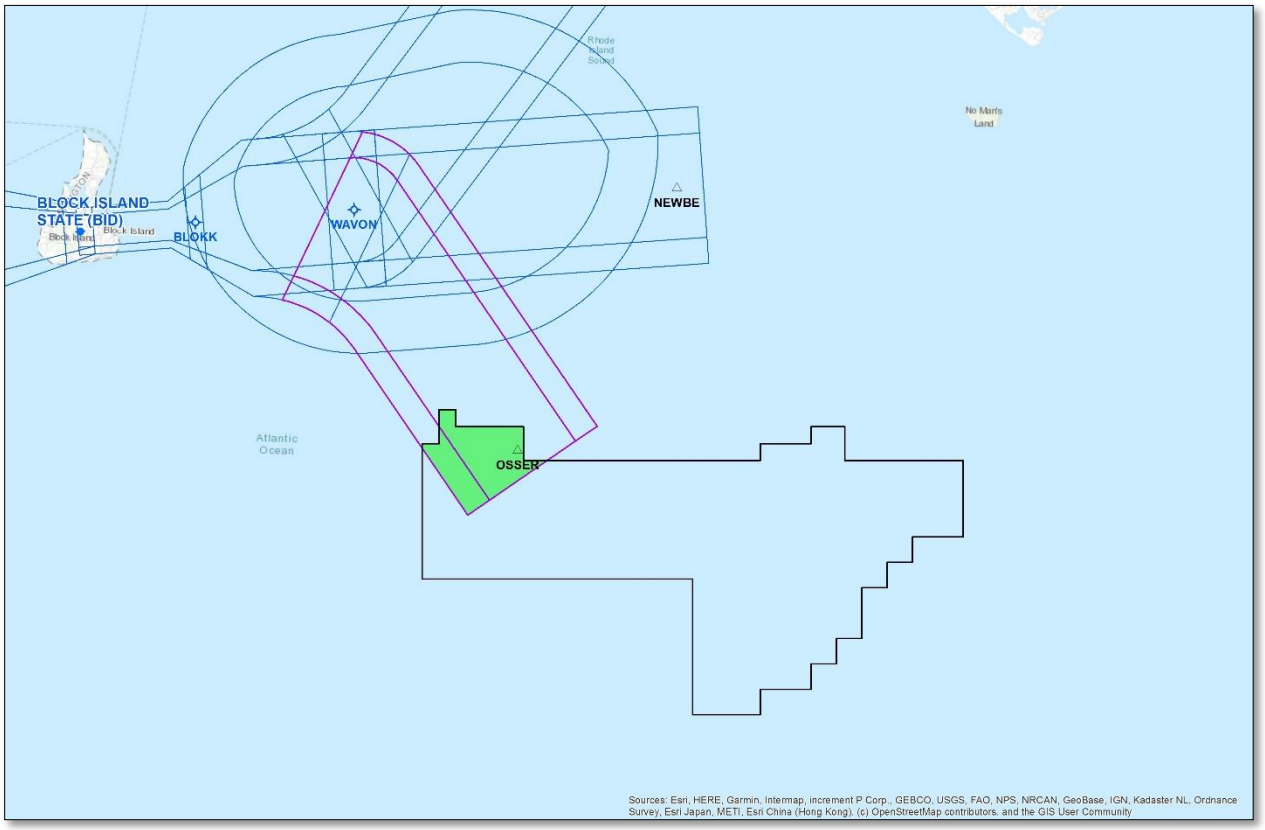



***Figure 7: Block Island State (BID) RNAV (GPS) Approach to Runway 28***

## 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 in non-mountainous areas and normally 2,000 feet 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).

### V46

*CLAMY* to *LIBBE*

The MOCA is 2,000 feet AMSL. The primary area obstacle clearance surface (inner purple outline, ***Figure 8***) is 1,000 feet AMSL and would be lower than the height constraints depicted in the Composite Map (***Figure 13***) in the northern section of the study area. However, 636 to 968-foot tall wind turbines would not exceed this surface and should not require an increase to the V46 MOCA. Additionally, due to the project's location beyond 22 nautical miles from the NAVAIDs defining V46, this surface should not be used as the sole basis for FAA objections to proposed offshore wind development.[8]

The MEA is 3,000 feet AMSL. The primary area obstacle clearance surface (inner purple outline, ***Figure 8***) is 2,000 feet AMSL and is in excess of other, lower surfaces. Additionally, 636 to 968-foot tall wind turbines would not exceed this surface and should not require an increase to the V46 MEA.

[8] In accordance with FAA Order 7400.2M Paragraph 6-3-9(d)(2), proposed structures beyond 22 nautical miles from an airway's supporting NAVAIDs that impact only the MOCA are not considered to have a substantial adverse effect. Therefore, height constraints associated with the V46 MOCA were not included in the ***Composite Map***.

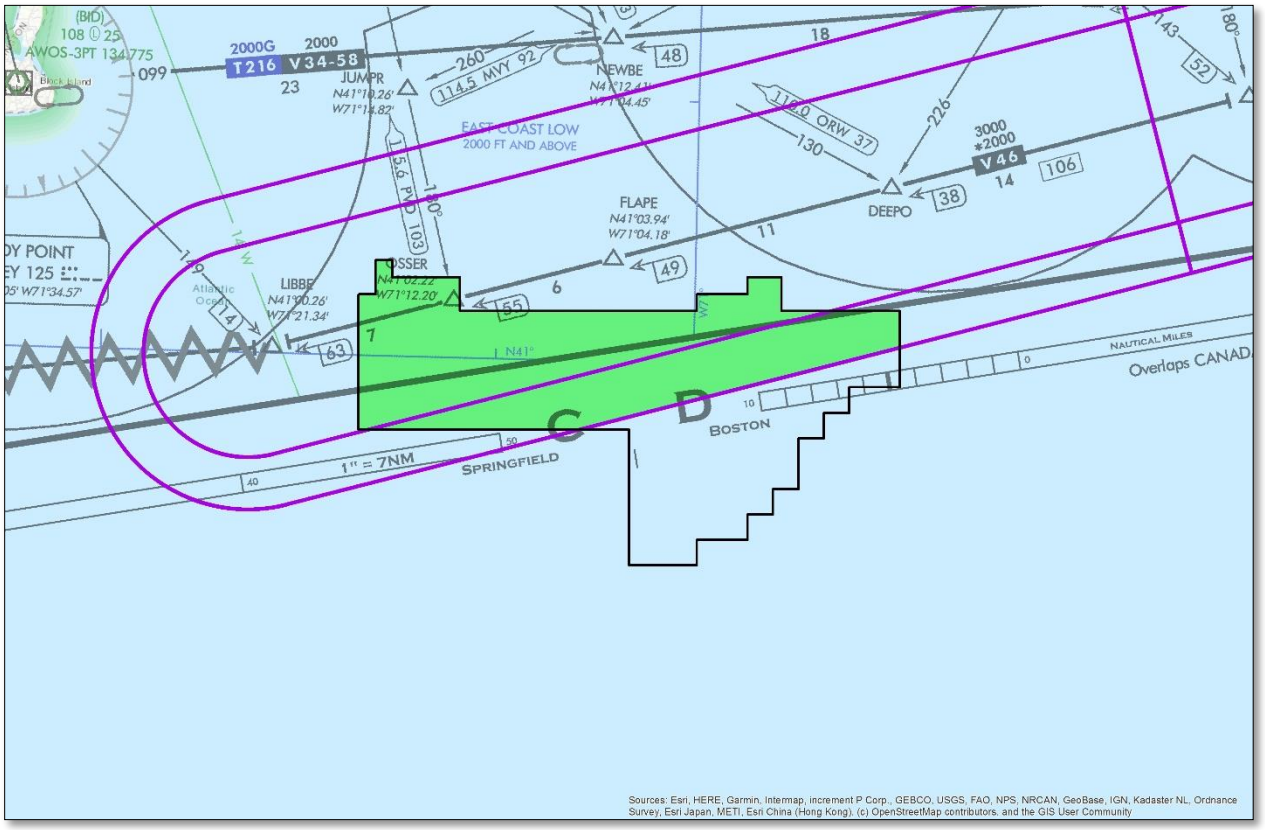



*Figure 8: Low altitude enroute chart L-33 with V46 obstacle evaluation area (purple outline)*

### 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 in non-mountainous areas and normally 2,000 feet 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.

Boston Consolidated (A90) Terminal Radar Approach Control (TRACON) MVA sectors, Providence (PVD) TRACON MVA sectors, and Boston (ZBW) Air Route Traffic Control Center (ARTCC) MIA sectors overlie the SRWF. The obstacle clearance surfaces range from 549 to 4,849 feet AMSL and are the lowest height constraints overlying most of the study area (***Table 1***). At 636 to 968 feet tall, wind turbines in the northwestern and northeastern sections of the study area (red areas, ***Figure 9*** & ***Figure 10***) would exceed multiple Boston Consolidated (A90) TRACON and Providence (PVD) TRACON MVA sectors' obstacle clearance surfaces and would require an increase to the associated MVAs. This mitigation is subject to FAA approval.

***Table 1: MVA/MIA sector analysis results***

| Facility | Chart | Sector | MVA/MIA (AMSL Feet) | OCS (AMSL Feet) | Limiting @ 636' | Limiting @ 968' |
|---|---|---|---|---|---|---|
| **ACT TRACON** | *A90_MVA_FUS3_2020* | *II* | 1500 | 549 | Yes | Yes |
| | | *U* | 2000 | 1049 | No | No |
| | | *T* | 5500 | 4549 | No | No |
| | *A90_MVA_FUS5_2019* | *FF* | 1500 | 549 | Yes | Yes |
| | | *HH* | 2300 | 1349 | No | No |
| | | *EE* | 5500 | 1549 | No | No |
| **PVD TRACON** | *PVD_MVA_FUS3_2019* *PVD_MVA_FUS5_2019* | *C* | 1500 | 549 | Yes | Yes |
| | | *N* | 2000 | 1049 | No | No |
| | | *G* | 2300 | 1349 | No | No |
| | | *H* | 5800 | 4849 | No | No |
| **ZBW ARTCC** | *ZBW_TAV_2020* | *bBOS04* | 2300 | 1349 | No | No |
| | | *bBOS06* | 5800 | 4849 | No | No |

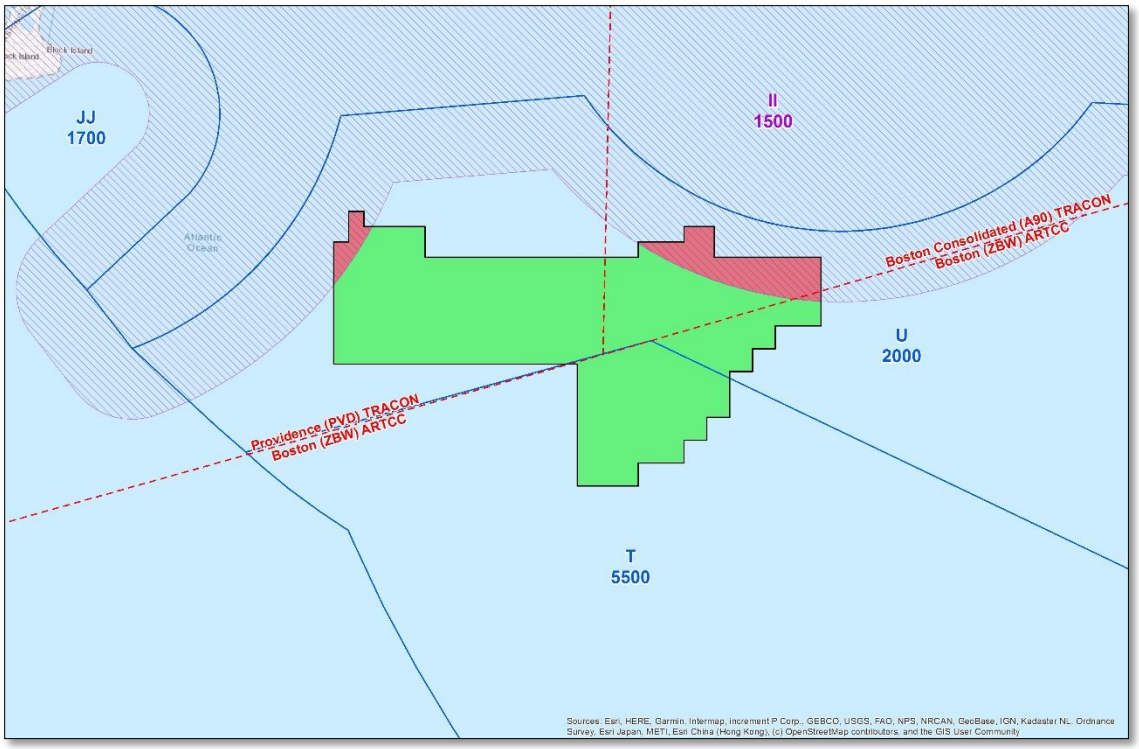



*Figure 9: Boston Consolidated (A90) TRACON FUSION 3 MVA sectors (blue) with Sector II obstacle evaluation area (hatched purple)*

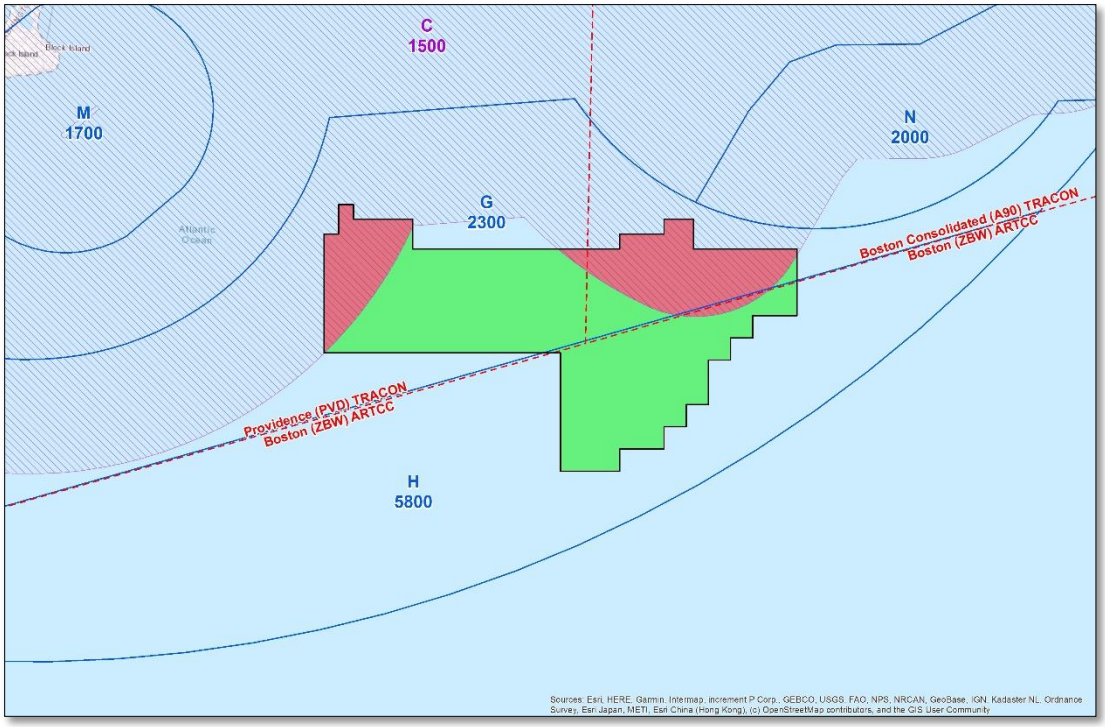



*Figure 10: Providence (PVD) TRACON FUSION 5 MVA sectors (blue) with Sector C obstacle evaluation area (hatched purple)*

### Terminal and Enroute Navigational Aids

The FAA has established protection areas in order to identify proposed structures that may have a physical and/or electromagnetic effect on navigational aids (NAVAIDs). The protection area dimensions vary based on the proposed structure type as well as the NAVAID type. Proposed structures 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 may result in FAA objections to proposed wind development.

NAVAID protection areas do not overlie the SRWF (***Figure 11***). As a result, it is unlikely that proposed wind turbines would have a physical or electromagnetic effect on terminal or enroute NAVAIDs.

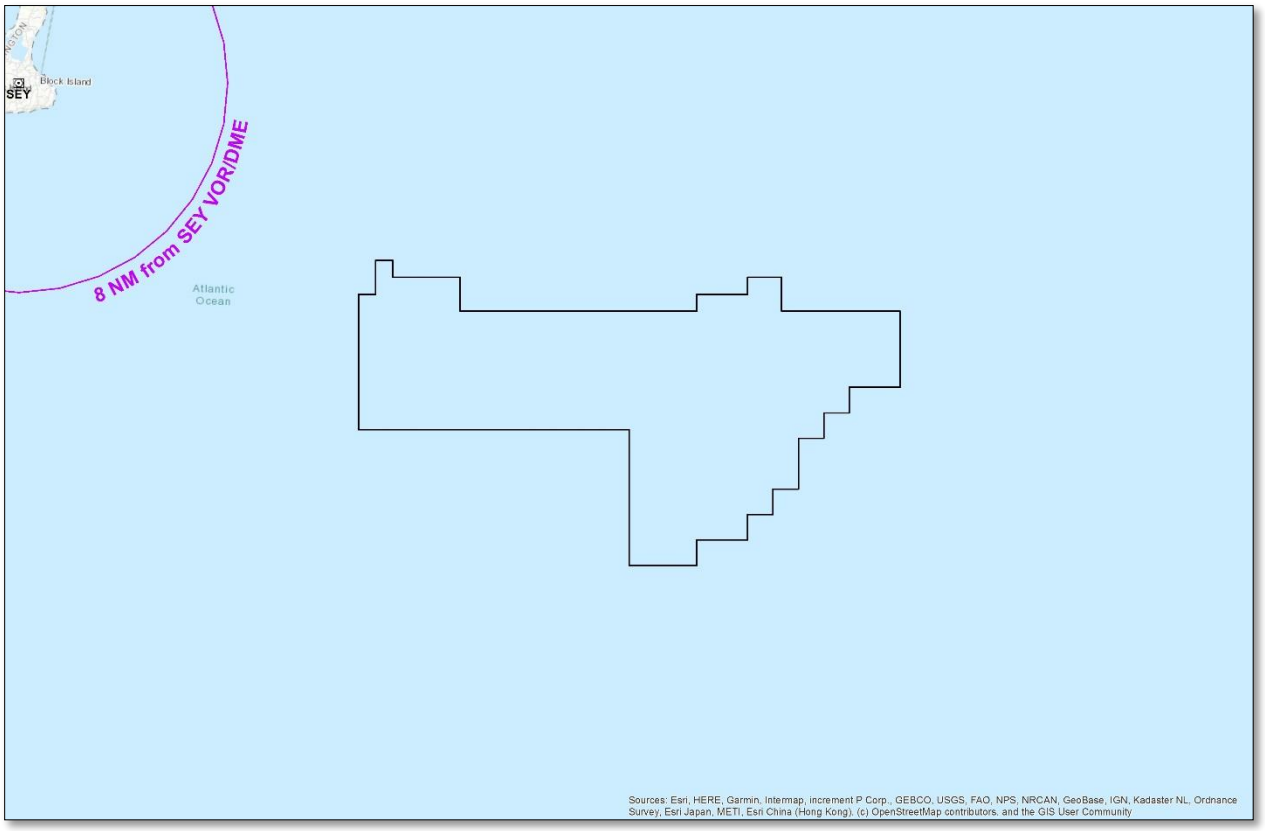



***Figure 11: Sandy Point (SEY) VOR/DME protection area and the SRWF***

### 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 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 on federal land, impact on military airspace or training routes may result in the denial of permits by the Bureau of Land Management.

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

US Navy, Fleet Area Control and Surveillance Facility, Virginia Capes (FACSFAC VACAPES)

| *Route/Airspace* | *Minimum Altitude* |
|---|---|
| W-105A | Surface |

Due to the low altitude associated with this airspace, wind development could have an impact on its operations. If the US Navy uses this airspace regularly, they may object to proposed wind development within its boundaries. 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.

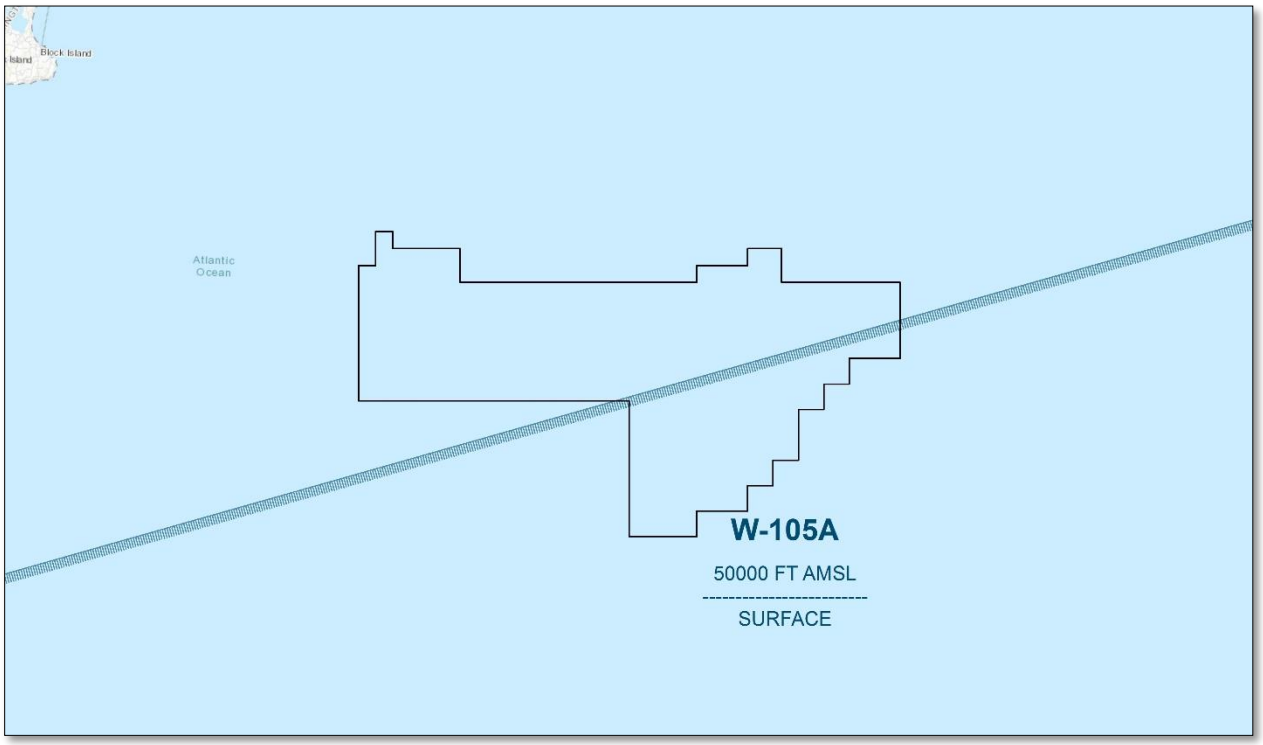



***Figure 12: Military airspace overlying the SRWF***

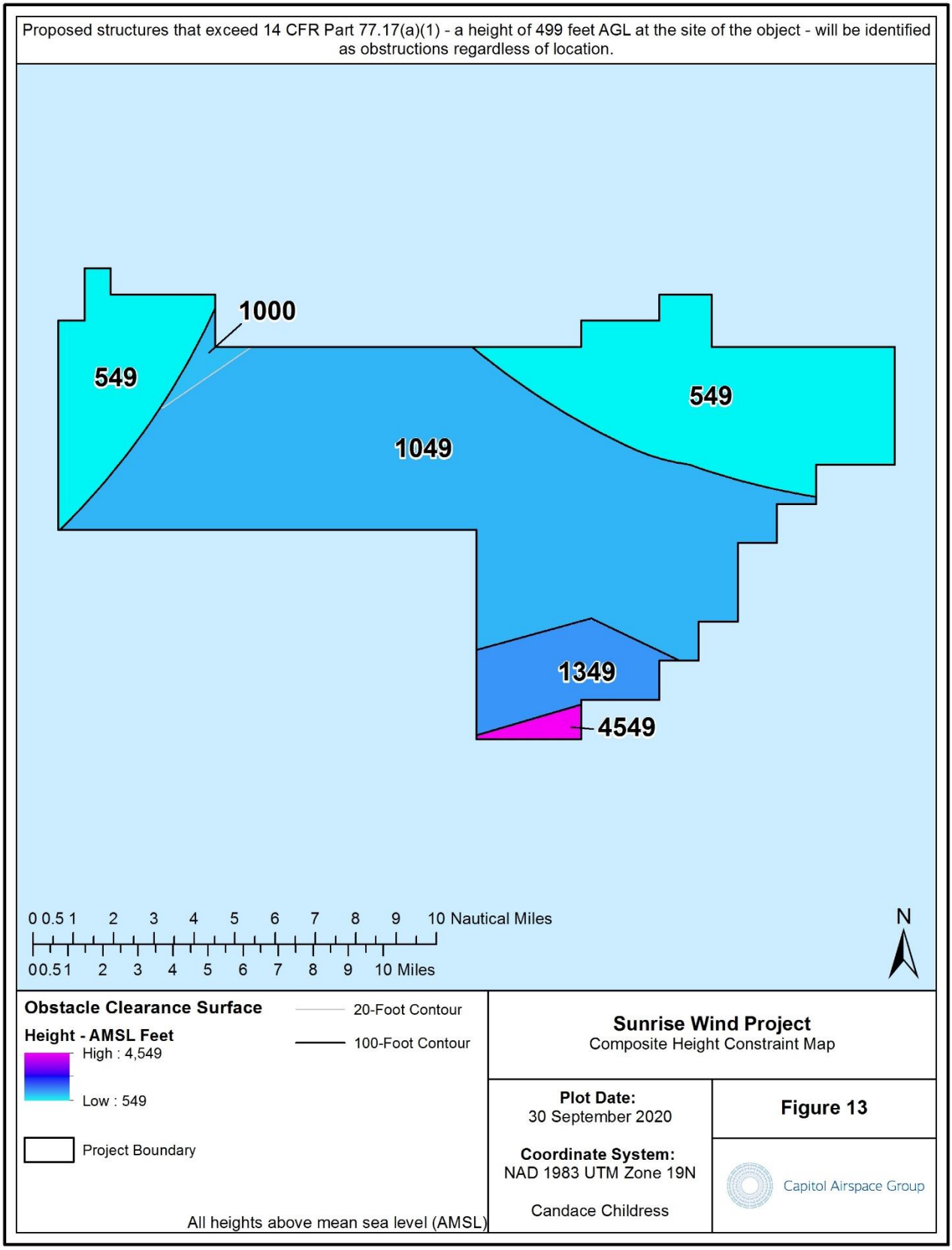
## Conclusion

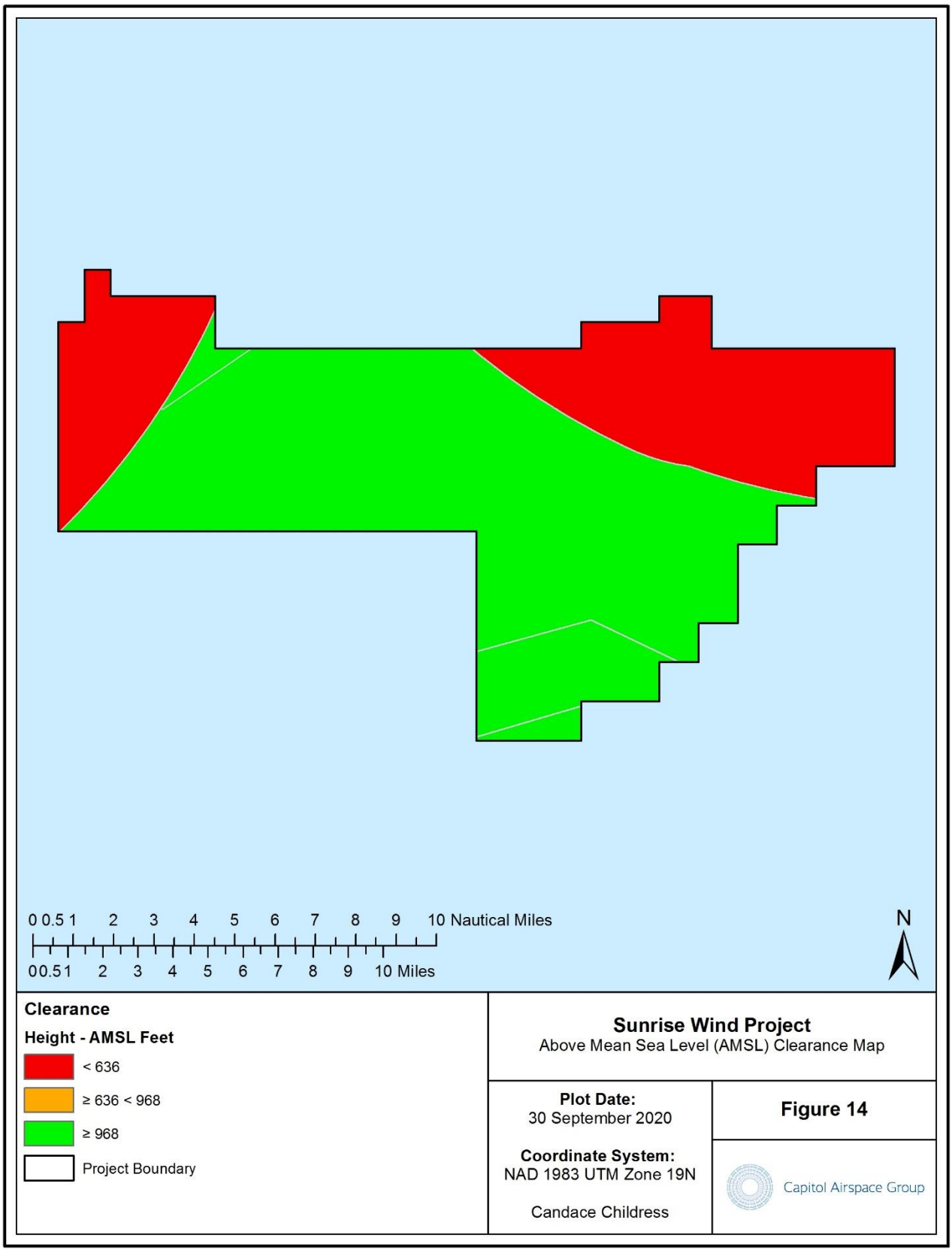
At a minimum of 636 feet to a maximum of 968 feet tall, proposed wind turbines will exceed 14 CFR Part 77.17(a)(1) – a height of 499 feet AGL at the site of the object – and will be identified as obstructions regardless of location. However, exceeding this standard does not automatically indicate that a structure would have an adverse effect on aviation operations. Proposed structures must have an impact on a significant volume of VFR or IFR operations in order to constitute a substantial adverse effect.

The lowest obstacle clearance surfaces overlying the SRWF range from 549 to 4,549 feet AMSL (***Figure 13***) and are associated with instrument approach procedures, MVA sectors, and MIA sectors. At 636 to 968 feet tall, proposed wind turbines in the northwestern and northeastern sections of the study area (red areas, ***Figure 9***, ***Figure 10***, & ***Figure 14***) would require an increase to Boston Consolidated (A90) TRACON and Providence (PVD) TRACON MVAs. These mitigations would be subject to FAA approval.

Warning Area W-105A overlies the SRWF (***Figure 12***). Impact on this airspace 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 ***Candace Childress*** 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.
1000
549
549
1049
1349
4549
0 0.5 1 2 3 4 5 6 7 8 9 10 Nautical Miles
0 0.5 1 2 3 4 5 6 7 8 9 10 Miles
N
Obstacle Clearance Surface
Height - AMSL Feet
High : 4,549
Low : 549
Project Boundary
20-Foot Contour
100-Foot Contour
All heights above mean sea level (AMSL)
Sunrise Wind Project
Composite Height Constraint Map
Plot Date:
30 September 2020
Coordinate System:
NAD 1983 UTM Zone 19N
Candace Childress
Figure 13
Capitol Airspace Group


0 0.5 1 2 3 4 5 6 7 8 9 10 Nautical Miles
0 0.5 1 2 3 4 5 6 7 8 9 10 Miles
N
Clearance
Height - AMSL Feet
< 636
≥ 636 < 968
≥ 968
Project Boundary
Sunrise Wind Project
Above Mean Sea Level (AMSL) Clearance Map
Plot Date:
30 September 2020
Figure 14
Coordinate System:
NAD 1983 UTM Zone 19N
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