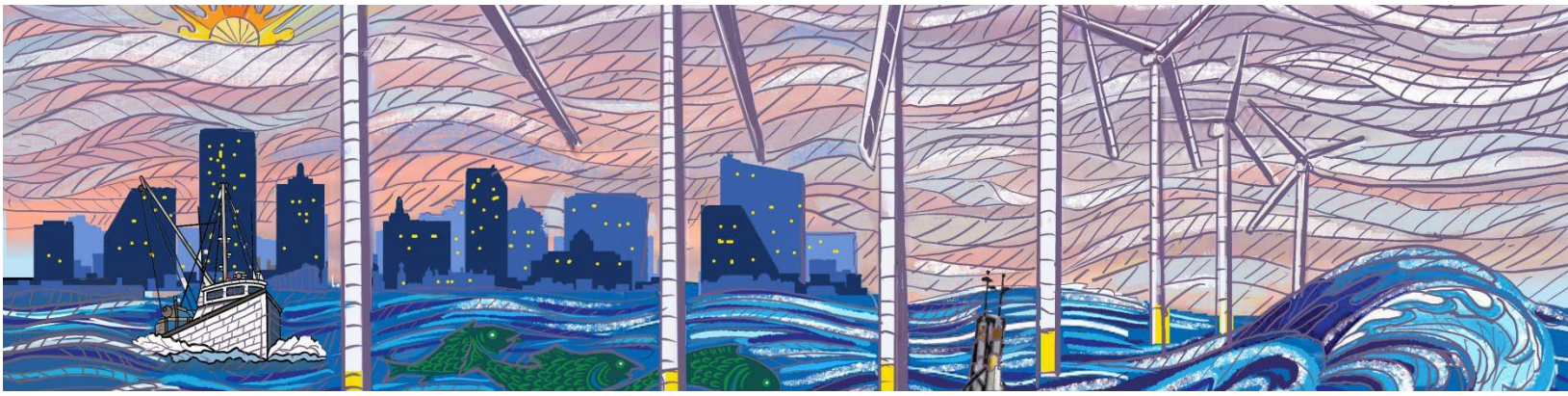


Appendix II-T1

Obstruction Evaluation & Airspace Analysis

May 2024

Atlantic Shores Offshore Wind

Environmental Design & Research

Offshore Atlantic and Ocean Counties, New Jersey

Obstruction Evaluation & Airspace Analysis

August 13, 2020, Revised December 15, 2021

Capitol Airspace Group

capitolairspace.com

(703) 256 - 2485

Summary

Capitol Airspace conducted an obstruction evaluation and airspace analysis for Atlantic Shores Offshore Wind, LLC (Atlantic Shores) off the coast of Atlantic and Ocean Counties, New Jersey. This assessment is a lease wide assessment of the Atlantic Shores Lease Area OCS-A 0499 (study area) (shaded gray area, ***Figure 1***). This report addresses the Wind Turbine Area (WTA)(solid black outline, ***Figure 1***) in the southern portion of the Lease Area, which includes two projects – Project 1 (dashed blue outline, ***Figure 1***) and Project 2 (dashed orange outline, ***Figure 1***) – and an Overlap Area (dashed purple outline, ***Figure 1***). The purpose for this analysis was to identify obstacle clearance surfaces established by the Federal Aviation Administration (FAA) that could limit the placement of 880, 890, and 1,048-foot tall wind turbines. At the time of this analysis, 200 wind turbine locations (black points, ***Figure 1***) had been identified in the WTA, divided amongst Project 1 and Project 2. This analysis assessed height constraints overlying each location as well as an approximately 287-square-mile study area (shaded gray area, ***Figure 1***) to aid in identifying optimal 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 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 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. For the portions of the Projects that lie outside of U.S. territorial airspace and in BOEM jurisdiction, BOEM will consult with the FAA for airspace impacts.

The lowest obstacle clearance surfaces overlying the Atlantic Shores WTA range from 649 to 1,049 feet above mean sea level (AMSL) and are associated with minimum vectoring altitude sectors and minimum instrument flight rules (IFR) altitude sectors. At 880, 890, and 1,048 feet tall, wind turbines in the northern and western sections of the WTA, including 114 proposed locations, would exceed these surfaces and 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.

Multiple low-altitude military training routes and warning areas overlie the Atlantic Shores study area and 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 Atlantic Shores Projects based on location information provided by Environmental Design & Research. 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 7400.2N 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 (1.6.1)
- United States Government Flight Information Publication, US Terminal Procedures
- National Airspace System Resource Aeronautical Data

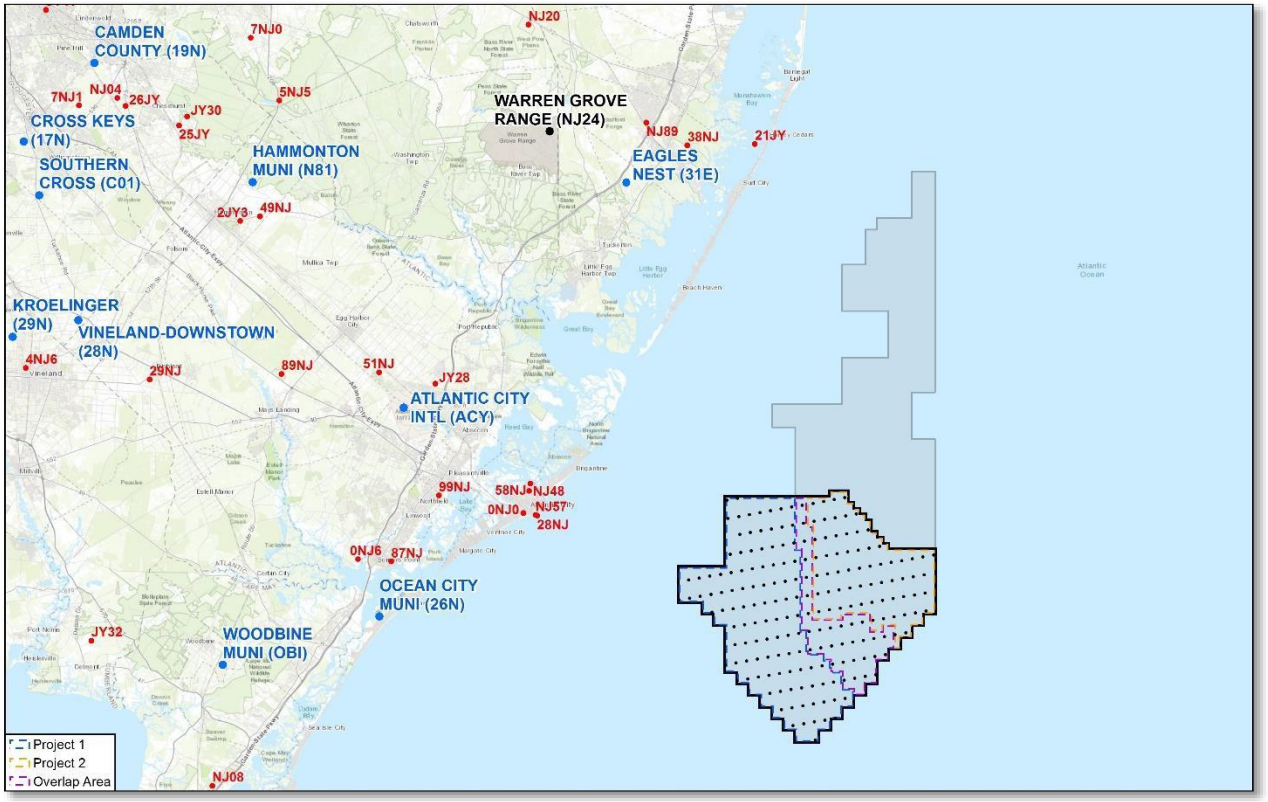


Figure 1: Public-use (blue), military (black), and private-use (red) airports in proximity to the Atlantic Shores study area

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.

Wind turbines in the northwestern section of the WTA, including 41 proposed locations within Project 1, 2 proposed locations within the Overlap Area, and 1 proposed location within Project 2, will be located within territorial waters (purple, ***Figure 2***) and must be submitted to the FAA.

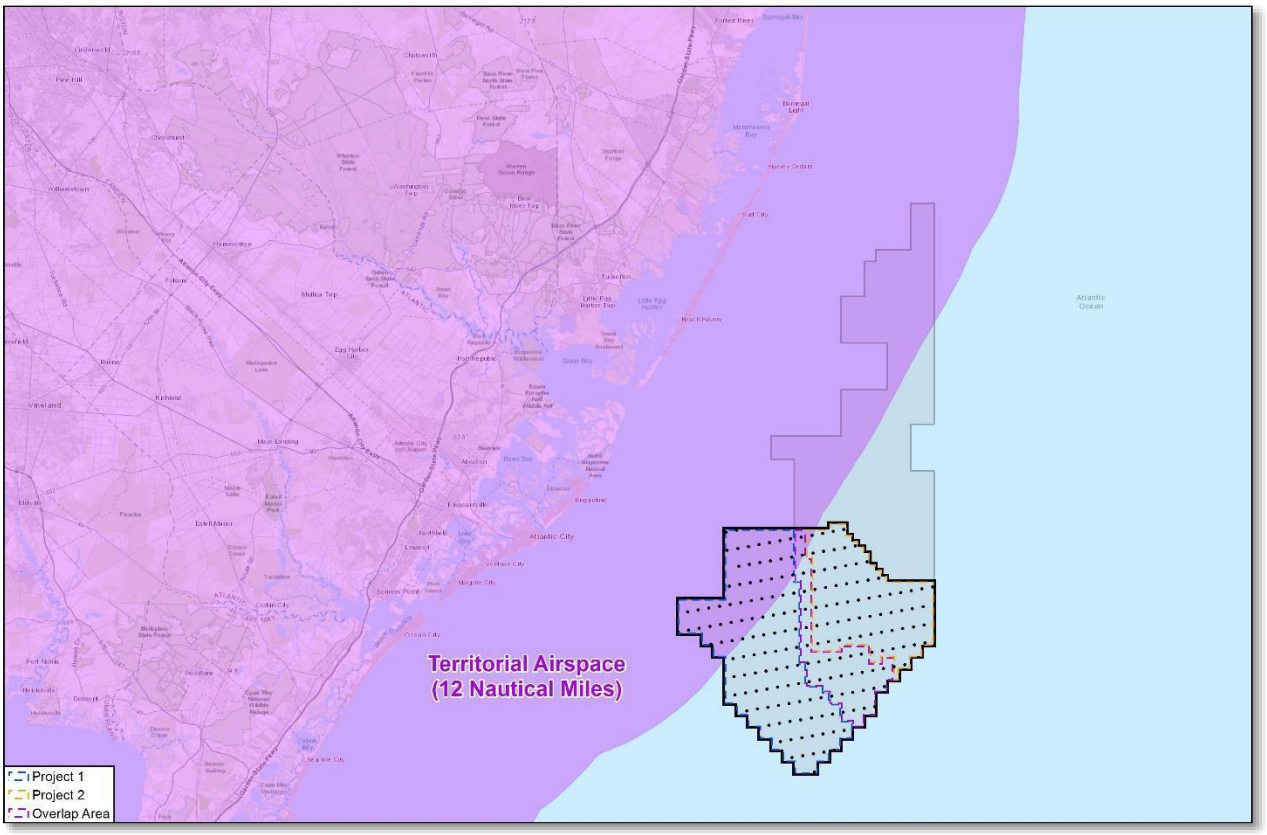


Figure 2: Territorial Airspace overlying the Atlantic Shores offshore wind project

[1] 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***.

[2] 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 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) obstruction standards and 77.19/21/23 imaginary surfaces do not overlie the Atlantic Shores study area (e.g., ***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.

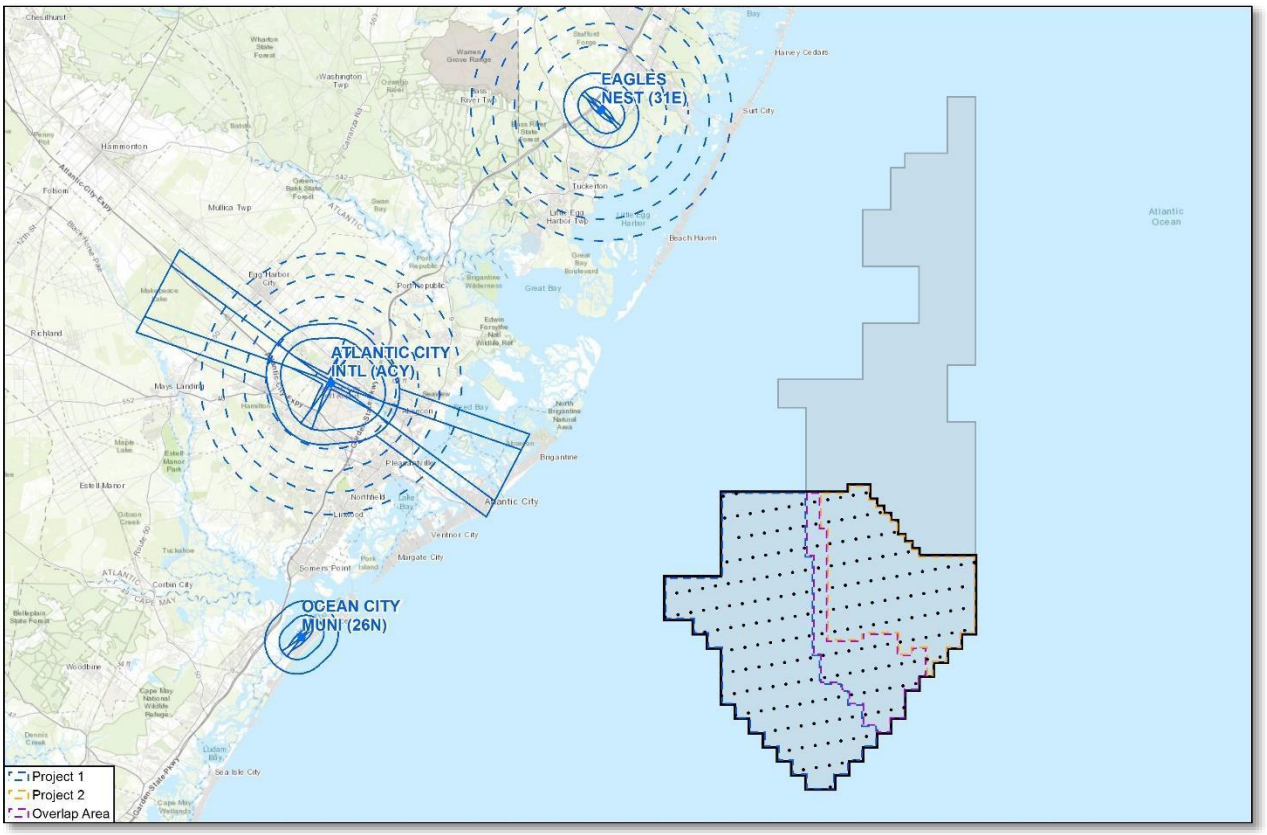


Figure 3: 77.17(a)(2) obstruction standard (dashed blue) and 77.19 imaginary surfaces (solid blue) in proximity to the Atlantic Shores study area

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 (***Figure 4***) does not overlie the Atlantic Shores study area and should not limit 880, 890, or 1,048-foot tall wind turbines within the WTA.

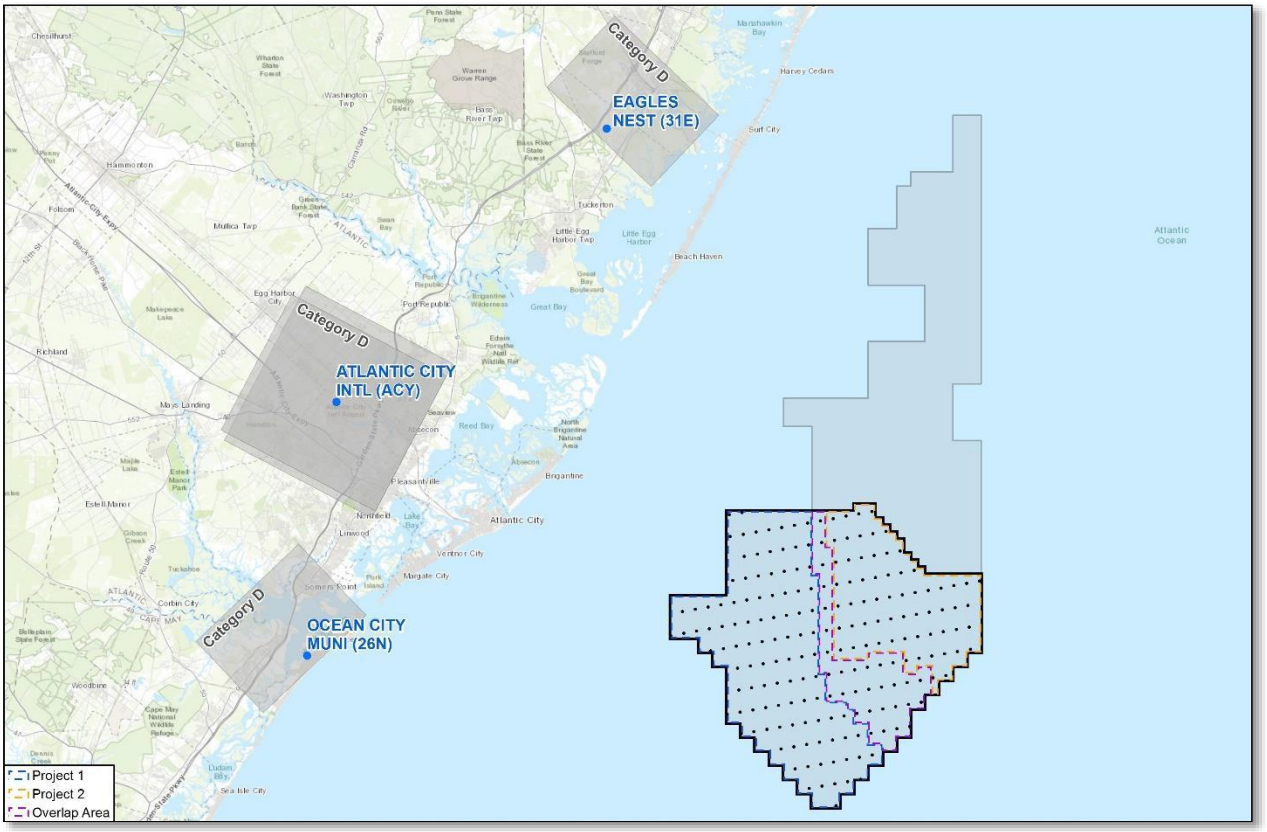


Figure 4: VFR traffic pattern airspace in proximity to the Atlantic Shores study area

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.

There is no dataset that identifies VFR routes or their utilization. However, no proposed wind turbines in the WTA are located within two statute miles of landmarks that could be used as VFR routes (hatched purple, ***Figure 5***). Therefore, VFR routes should not limit wind development within the WTA.

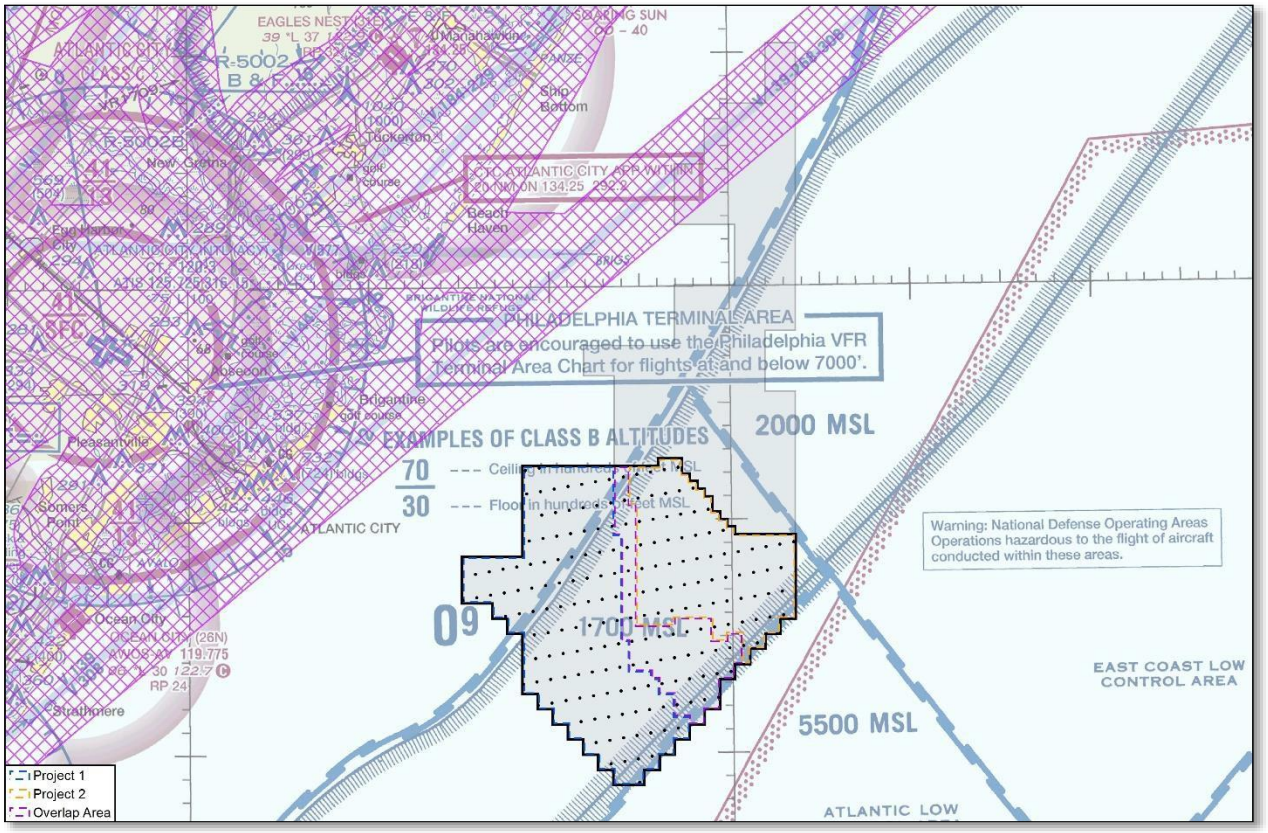


Figure 5: Potential VFR routes in proximity to the Atlantic Shores offshore study area

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***) are in excess of other, lower surfaces and should not limit 880, 890, or 1,048-foot tall wind turbines within the WTA.

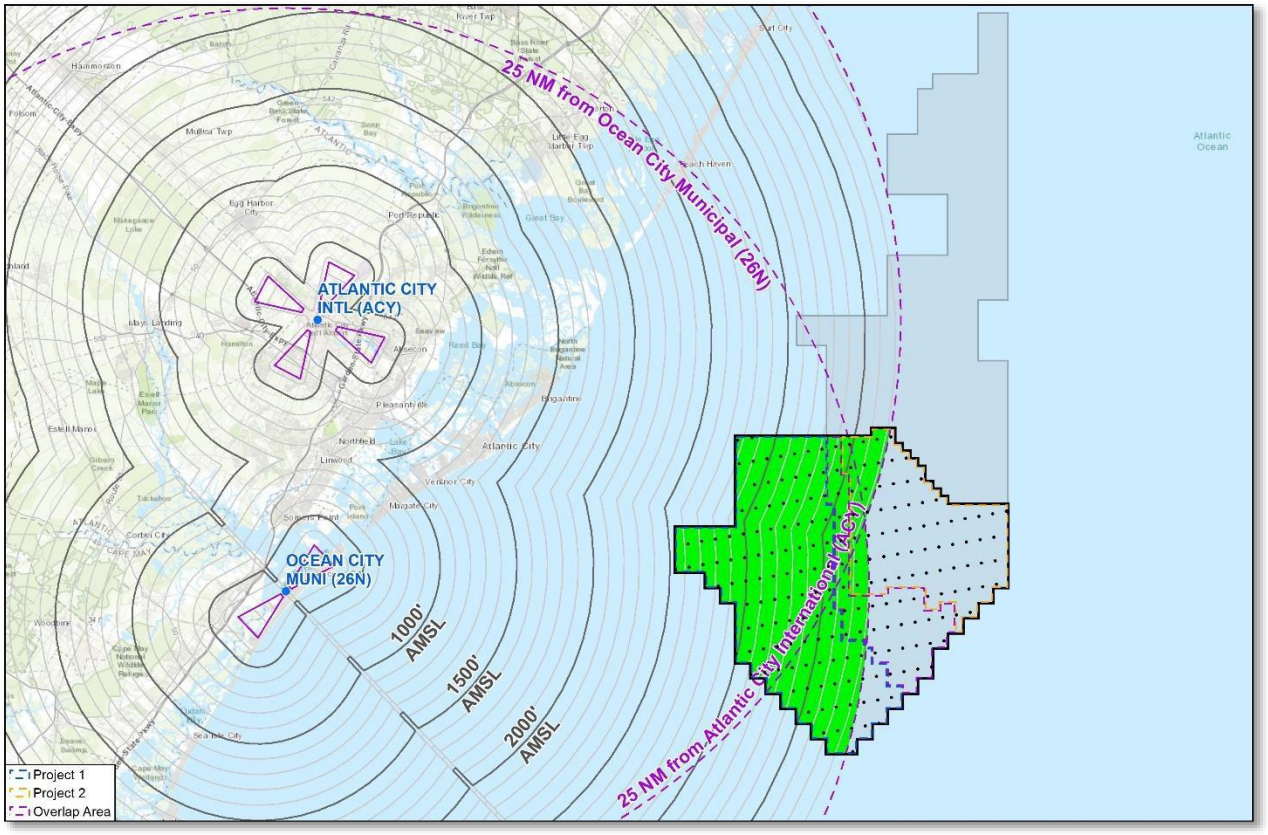


Figure 6: Atlantic City International (ACY) and Ocean City Municipal (26N) obstacle departure procedure assessments

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 34 published instrument approach procedures at six public-use airports and one military airport in proximity to the Atlantic Shores study area:[3]

Atlantic City International (ACY)
HI-ILS or Localizer Approach to Runway 13
ILS or Localizer Approach to Runway 13
ILS or Localizer/DME Approach to Runway 31
RNAV (RNP) Z Approach to Runway 13
RNAV (RNP) Z Approach to Runway 31
RNAV (GPS) Approach to Runway 04
RNAV (GPS) Approach to Runway 22
RNAV (GPS) Y Approach to Runway 13
RNAV (GPS) Y Approach to Runway 31
VOR/DME Approach to Runway 22
HI-VOR/DME or TACAN Approach to Runway 31
VOR Approach to Runway 04
VOR Approach to Runway 13
VOR Approach to Runway 31
Copter ILS or LOC/DME Approach to Runway 13

Eagles Nest (31E)
RNAV (GPS)-A Circling Approach
RNAV (GPS)-B Circling Approach

Woodbine Municipal (OBI)
RNAV (GPS) Approach to Runway 01
RNAV (GPS) Approach to Runway 19
VOR-A Circling Approach

Lakehurst Maxfield Field,
Joint Base McGuire Dix Lakehurst (KNEL)
RNAV (GPS) Approach to Runway 24
RNAV (GPS) Approach to Runway 33
VOR or VOR/DME or TACAN Y
Approach to Runway 33
TACAN Approach to Runway 24
TACAN Approach to Runway 33
NDB Approach to Runway 24

Lakewood (N12)
RNAV (GPS) Approach to Runway 06
RNAV (GPS) Approach to Runway 24

Ocean County (MJX)
ILS or Localizer Approach to Runway 06
RNAV (GPS) Approach to Runway 06
RNAV (GPS) Approach to Runway 24
VOR Approach to Runway 06
VOR Approach to Runway 24

Ocean City Municipal (26N)
GPS Approach to Runway 06

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.[4]

[3] 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***.

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

Atlantic City International (ACY)

ILS or Localizer/DME Approach to Runway 31

The *STEVV* hold-in-lieu of procedure turn minimum holding altitude (MHA) is 2,000 feet AMSL. The primary area obstacle clearance surface (inner purple outline, ***Figure 7***) is 1,000 feet AMSL and is in excess of other, lower surfaces. This surface could still limit 1,048-foot tall wind turbines in the northwestern section of the WTA (yellow area, ***Figure 7***), including 25 proposed locations within Project 1. However, the FAA may be willing to increase the *STEVV* holding pattern MHA in order to accommodate wind turbines up to 1,048 feet tall. This mitigation option is subject to FAA approval.

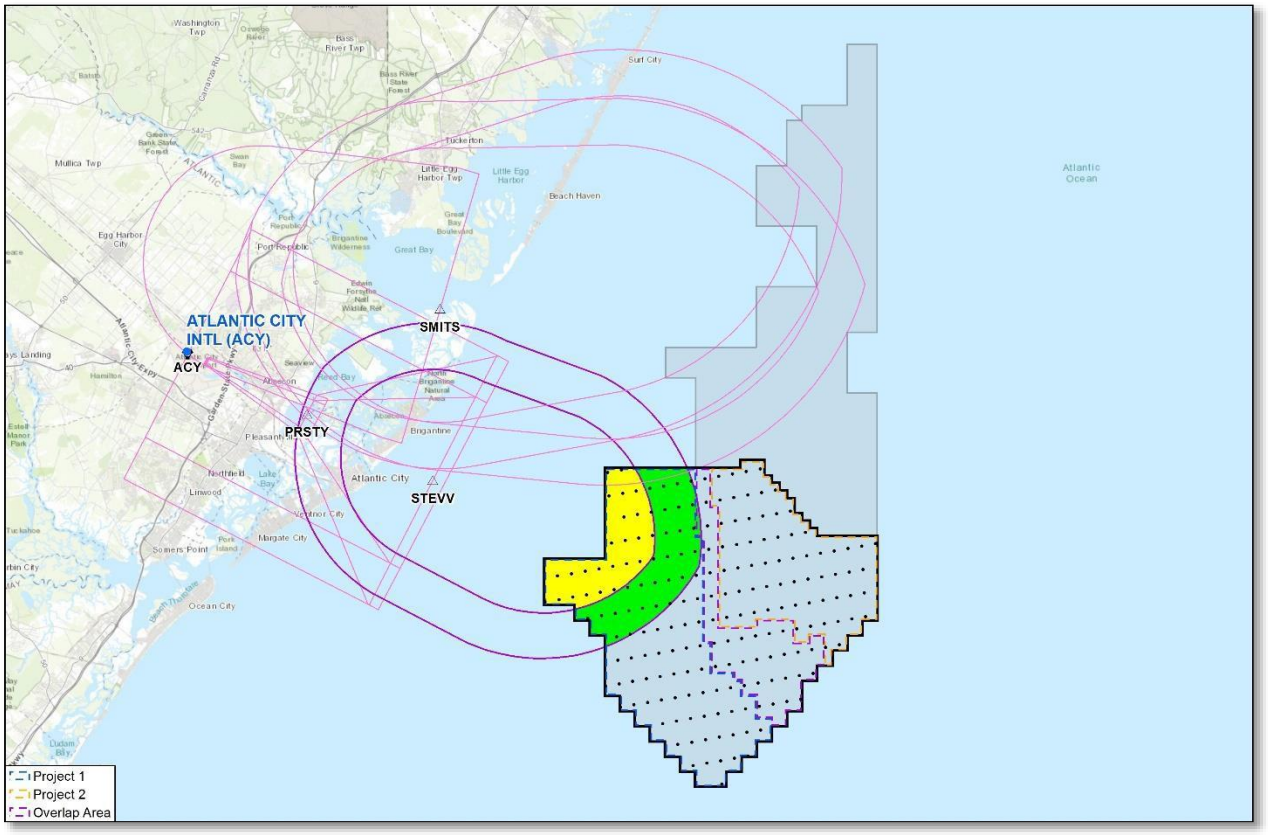


Figure 7: Atlantic City International (ACY) Localizer/DME Approach to Runway 31

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). 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***) are in excess of other, lower surfaces and should not limit 880, 890, or 1,048-foot tall wind turbines within the WTA.

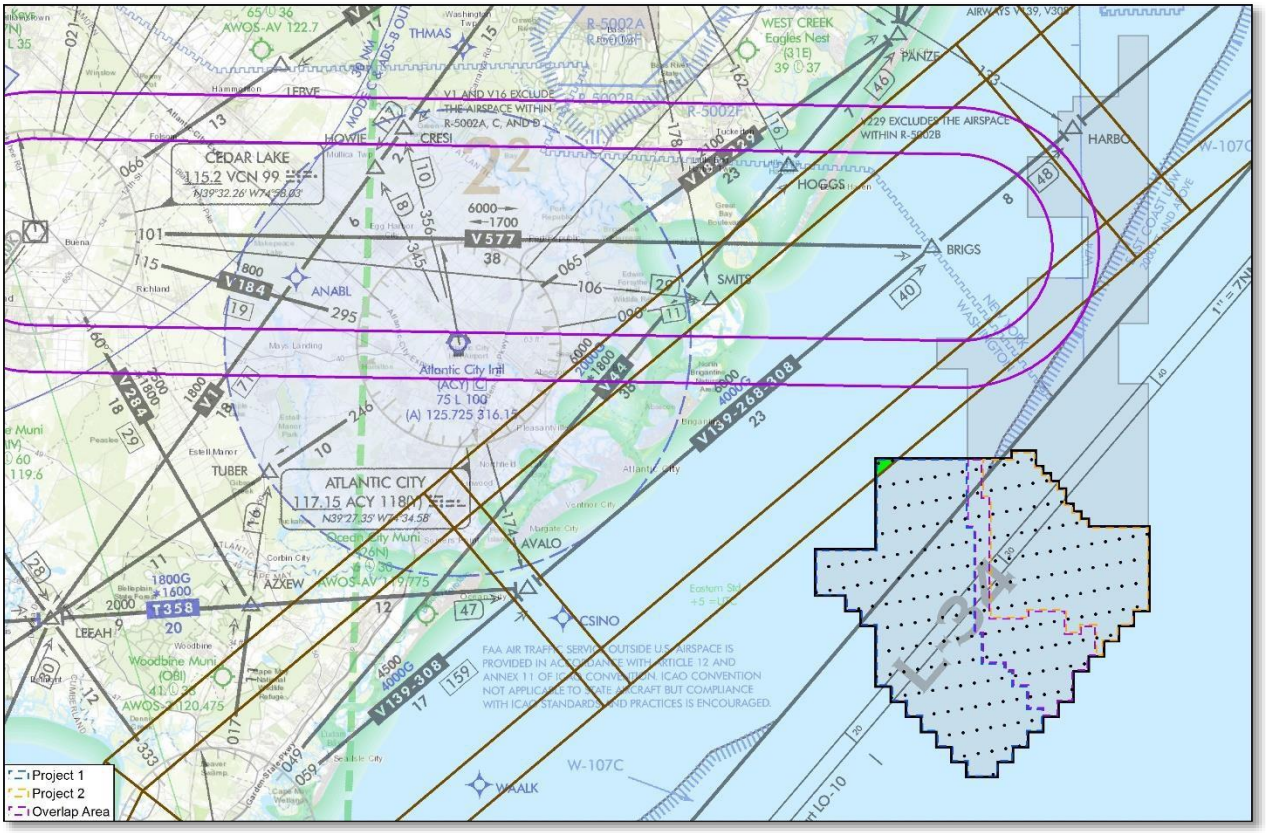


Figure 8: Low altitude enroute chart L-34 with V577 (purple) and V139-268-308 (brown) obstacle evaluation areas

Minimum Vectoring/IFR Altitudes[5]

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. If the FAA determines that this impact would affect as few as one operation per week, it could result in determinations of hazard.

Atlantic City (ACY) Terminal Radar Approach Control (TRACON) MVA sectors, Philadelphia (PHL) TRACON MVA sectors, New York (ZNY) Air Route Traffic Control Center (ARTCC) MIA sectors, and Washington (ZDC) ARTCC MIA sectors overlie the Atlantic Shores WTA. The obstacle clearance surfaces range from 649 to 4,849 feet AMSL and are the lowest height constraints overlying the WTA (***Table 1***, ***Figure 9***, ***Figure 10***, & ***Figure 11***). These sectors could limit 880, 890, and 1,048-foot tall wind turbines in the northern and western sections of the WTA (red areas, ***Figure 9*** & ***Figure 10***).

At all the proposed heights, wind turbines will require an increase to Philadelphia (PHL) TRACON MVAs (***Figure 10***). However, the Atlantic Shores offshore wind project is more than 39 NM outside of Philadelphia (PHL) TRACON airspace. Therefore, Philadelphia (PHL) TRACON may be willing to increase the affected MVAs where they overlie the study area. This mitigation option is subject to FAA approval.

At all the proposed heights, wind turbines will require an increase to Atlantic City (ACY) TRACON MVAs (***Figure 9***). If the FAA determines that this impact would affect as few as one radar vectoring operation per week, it could be used as the basis for determinations of hazard.

[5] The study area is in proximity to Dover (DOV) Radar Approach Control (RAPCON) and McGuire (WRI) RAPCON airspace. However, Department of Defense (DoD) MVA charts, including those for Navy Radar Air Traffic Control Facilities (RATCF), Army Radar Approach Control Facilities (ARAC), and Air Force RAPCON facilities, are not publicly released and could not be assessed. It is possible that MVA sectors associated with these facilities overlie the study area and result in lower height constraints than those depicted in this report.

Table 1: MVA/MIA sector analysis results

Facility	Chart	Sector	MVA/MIA (AMSL Feet)	OCS (AMSL Feet)	Limiting at 880', 890', and 1,048' AMSL			
					Project 1	Overlap Area	Project 2	Total
ACY TRACON	ACY_MVA_FUS3_2019	A	1600	649	66	4	4	74
		B	2000	1049	0	0	0	0
		F	5500	4549	0	0	0	0
	ACY_MVA_FUS5_2019	A	1600	649	83	8	23	114
		B	2000	1049	0	0	0	0
		H	1700	749	4	0	0	4
		F	5500	4549	0	0	0	0
PHL TRACON	PHL_MVA_FUS3_2020	A	1600	649	57	3	5	65
	PHL_MVA_FUS5_2020	A	1600	649	76	7	20	103
		L	1700	749	4	0	0	4
ZNY ARTCC	ZNY_TAV_2021	NNNY11	2300	1349	0	0	0	0
		NNNY21	2300	1349	0	0	0	0
ZDC ARTCC	ZDC_TAV_2020	WDOV01	2000	1049	0	0	0	0
		WNVF00	5800	4849	0	0	0	0

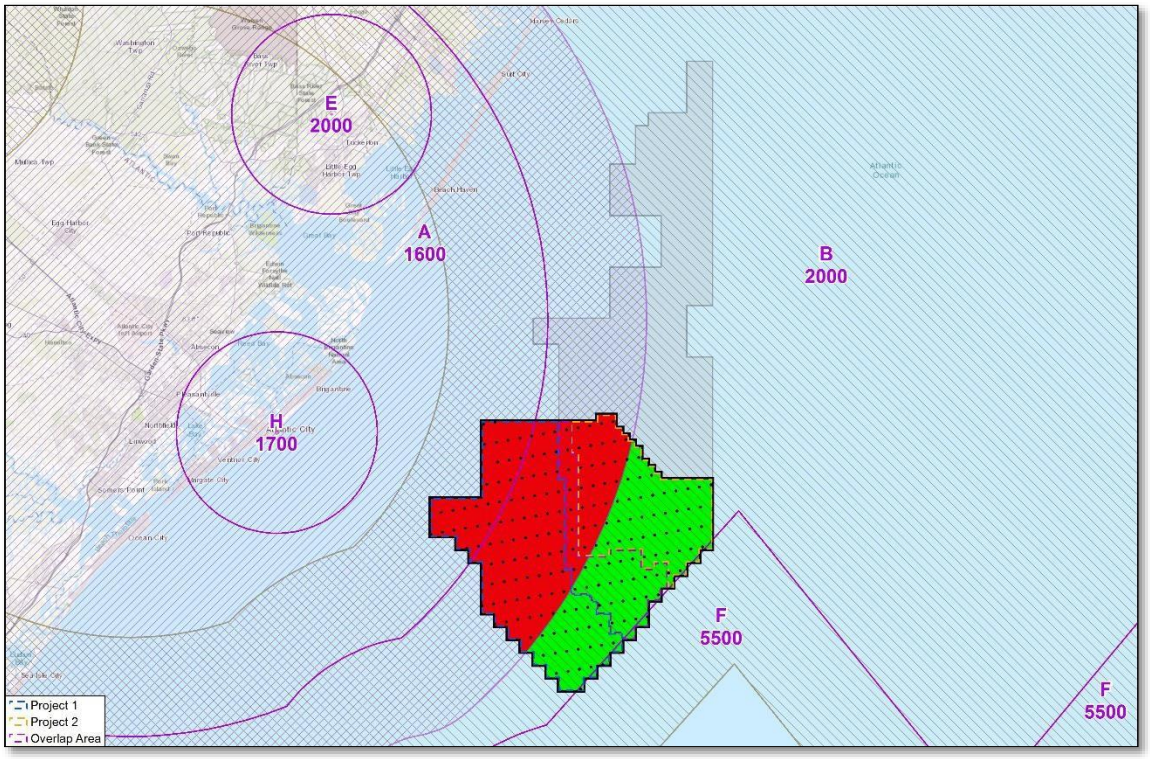


Figure 9: Atlantic City (ACY) TRACON FUSION 5 MVA sectors (purple) with Sector A (hatched purple) and Sector B (hatched brown) obstacle evaluation areas

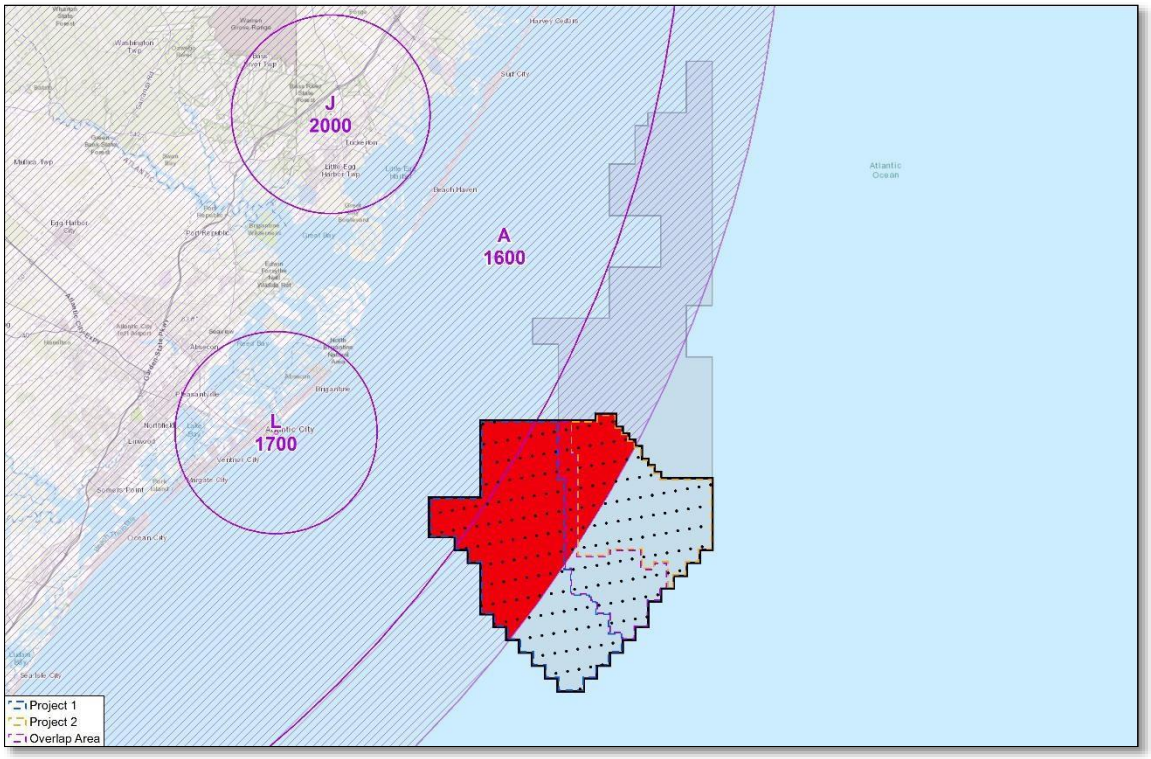


Figure 10: Philadelphia (PHL) TRACON FUSION 5 MVA Sectors (purple) with Sector A obstacle evaluation area (hatched purple)

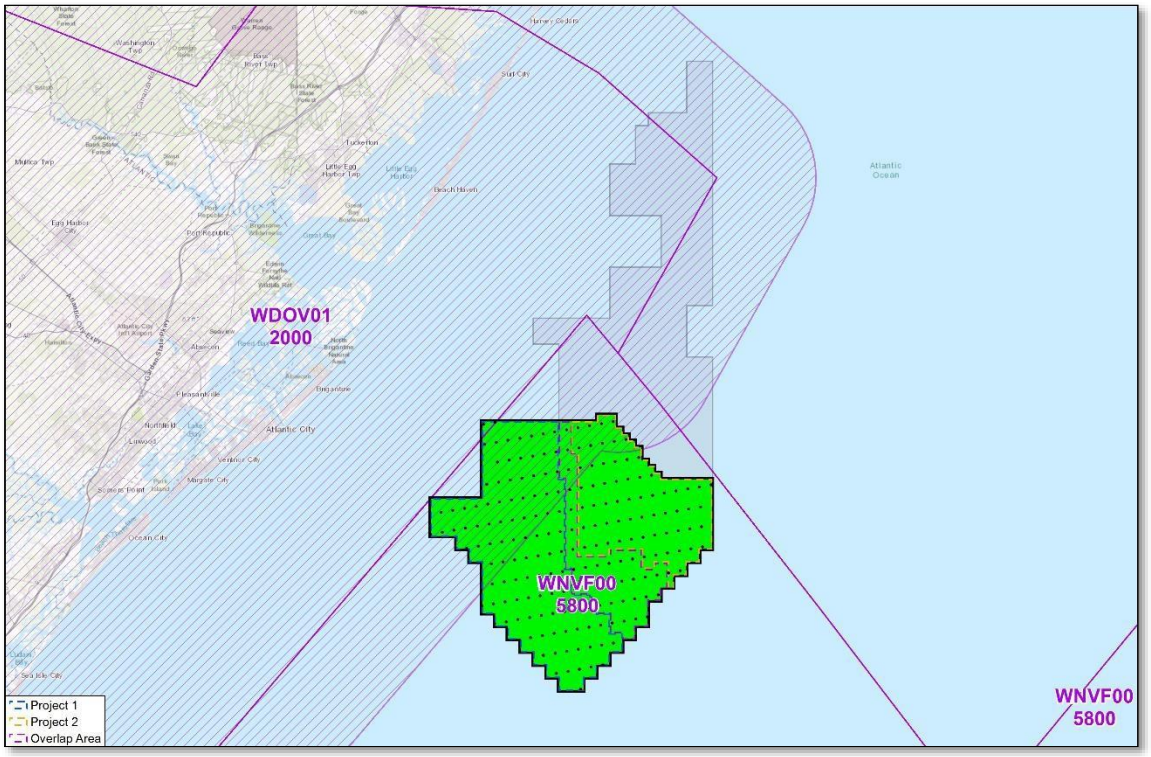


Figure 11: Washington (ZDC) ARTCC MIA sectors (purple) with Sector WDOV01 obstacle evaluation area (hatched purple)

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 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 Atlantic Shores study area (***Figure 12***). As a result, it is unlikely that proposed wind turbines within the WTA would have a physical or electromagnetic effect on terminal or enroute NAVAIDs.

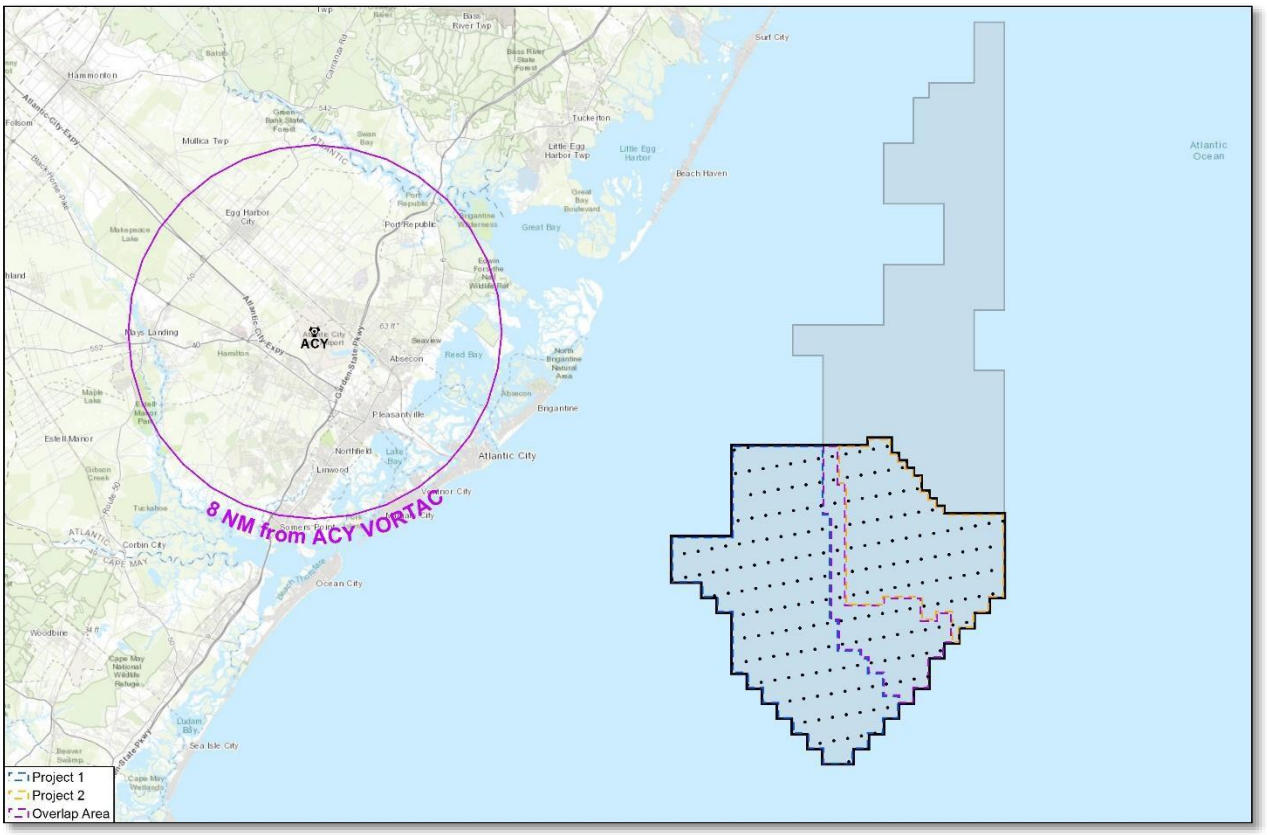


Figure 12: Atlantic City (ACY) VORTAC protection area

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 the Bureau of Land Management.

VFR military training routes (VR) and warning areas (W) overlying the Atlantic Shores WTA (***Figure 13***):

177th Fighter Wing, New Jersey Air National Guard (ANG)

Route/Airspace	*Minimum Altitude*
VR-1709	100 feet AGL

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

Route/Airspace	*Minimum Altitude*
W-107A	Surface
W-107C	Surface

Due to the low altitudes associated with this route and these warning areas, wind development could have an impact on their operations. If the New Jersey ANG or U.S. Navy use these segments of airspace regularly, they may object to proposed wind development within their 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.

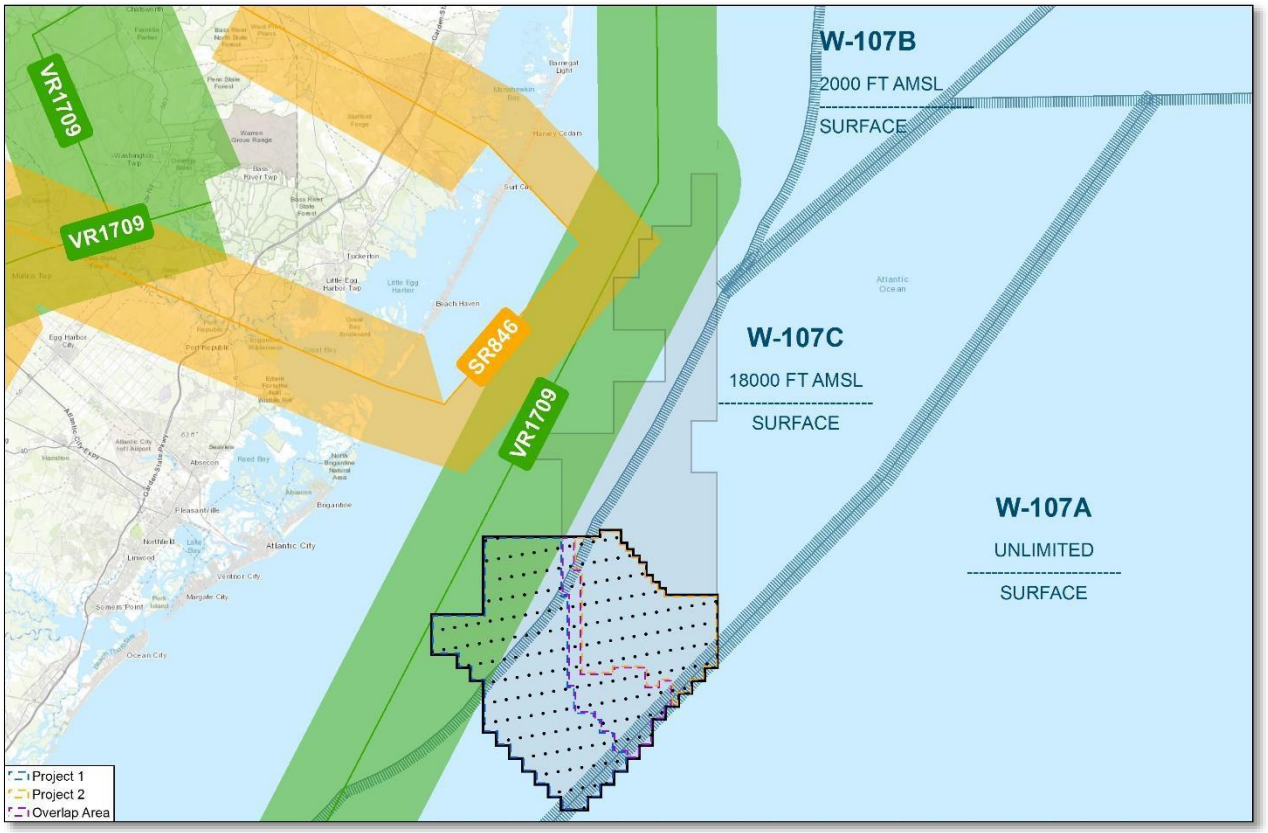


Figure 13: Military airspace and training routes overlying the Atlantic Shores study area

Conclusion

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. However, heights in excess of 499 feet AGL are feasible provided proposed wind turbines do not exceed FAA obstacle clearance surfaces.

The lowest obstacle clearance surfaces overlying the Atlantic Shores WTA range from 649 to 1,049 feet AMSL (***Figure 14***) and are associated with multiple MVA and MIA sectors. These surfaces could limit 880, 890, and 1,048-foot tall wind turbines in the northern and western sections of the WTA (red area, ***Figure 15***), including 83 proposed locations in Project 1, 8 proposed locations in the Overlap Area, and 24 proposed locations in Project 2.

At all proposed heights, wind turbines in the northern and western sections of the WTA (red area, ***Figure 10***) will require an increase to multiple Philadelphia (PHL) TRACON MVA sectors. However, the Atlantic Shores offshore wind project is more than 39 NM outside of Philadelphia (PHL) TRACON airspace. Therefore, this facility may be willing to raise the affected sectors MVAs where they overlie the WTA. This mitigation option is subject to FAA approval.

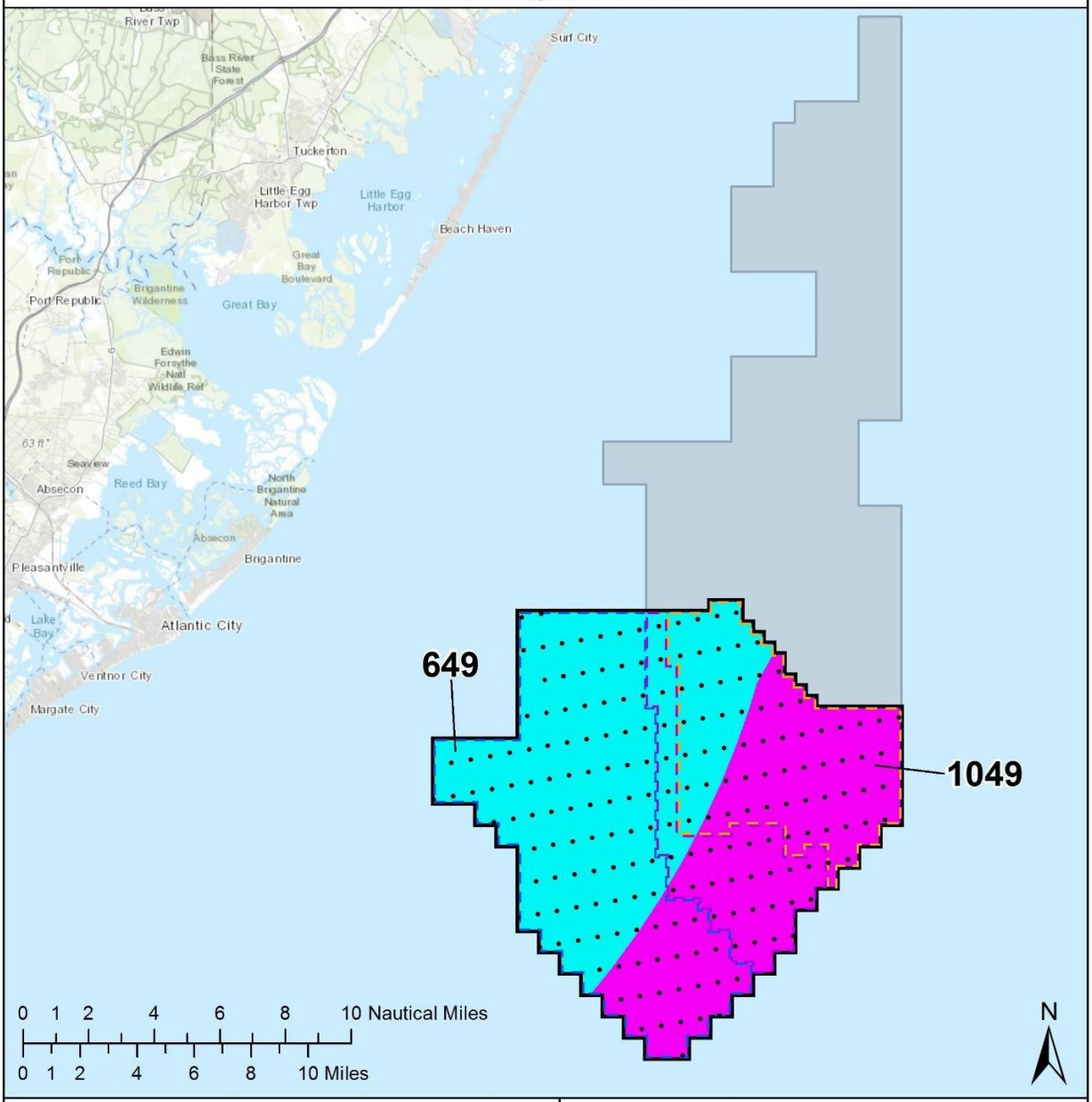
At 1,048 feet tall, wind turbines in the western section of the WTA (yellow area, ***Figure 7***) will require an increase to the Atlantic City (ACY) ILS or Localizer/DME Approach to Runway 31 *STEVV* hold-in-lieu of procedure turn MHA. However, the FAA may be willing to increase this altitude to accommodate wind turbines up to 1,048 feet tall. This mitigation option is subject to FAA approval.

At all proposed heights, wind turbines in the northern and western sections of the WTA (red area, ***Figure 9***) will require an increase to the Atlantic City (ACY) TRACON Sectors A and H MVAs. If the FAA determines that either of these impacts would affect as few as one radar vectoring operation per week, it could result in determinations of hazard.

Multiple low-altitude military training routes and warning areas overlie the Atlantic Shores WTA (***Figure 13***). Impact on these routes and areas 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.



Obstacle Clearance Surface

Height - AMSL

- 649
- 1,049

- Proposed Wind Turbine
- Project 1
- Overlap Area
- Project 2
- Wind Turbine
- Lease Area OCS-A 0499

All heights above mean sea level (AMSL)

Atlantic Shores Offshore Wind Project
Composite Height Constraint Map

Plot Date:
15 November 2021

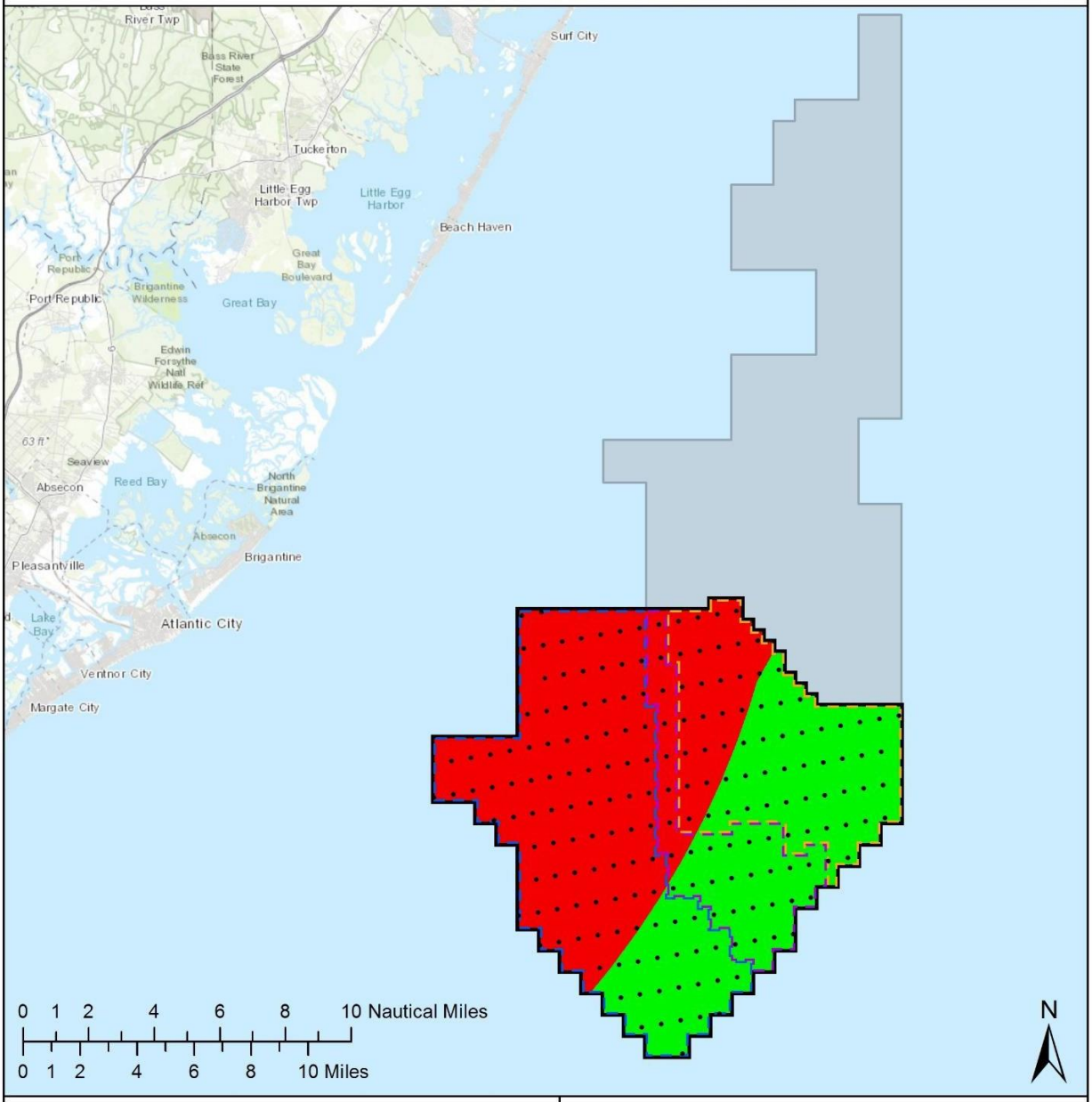
Coordinate System:
NAD 1983 UTM Zone 18N

Wesley Williamson

Figure 14

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

880', 890', and 1,048' Wind Turbines Exceed

880', 890', and 1,048' Wind Turbines Do Not Exceed

Proposed Wind Turbine

Project 1

Overlap Area

Project 2

Wind Turbine

Lease Area OCS-A 0499

Atlantic Shores Offshore Wind Project
Above Mean Sea Level (AMSL) Clearance Map

Plot Date:
15 November 2021

Coordinate System:
NAD 1983 UTM Zone 18N

Wesley Williamson

Figure 15

Capitol Airspace Group