

Eight Point Wind Project

NextEra Energy

Steuben County, New York

Obstruction Evaluation & Airspace Analysis

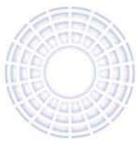
May 5, 2017



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Summary

Capitol Airspace conducted an obstruction evaluation and airspace analysis for the Eight Point wind project in Steuben County, New York. The purpose for this analysis was to identify obstacle clearance surfaces established by the Federal Aviation Administration (FAA) that could limit the placement of 432 foot above ground level (AGL) (purple, **Figure 1**) and 586 foot AGL (black, **Figure 1**) wind turbines. At the time of this analysis, 36 individual wind turbine locations had been identified. This analysis also assessed height constraints overlying an approximately 71 square mile study area to aid in identifying optimal wind turbine locations.

The FAA requires that all structures exceeding 200 feet 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 have an effect on the safety of air navigation and 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 United States and cannot enforce the findings of its studies.

Height constraints overlying the Eight Point wind project range from 2,749 to 3,049 feet above mean sea level (AMSL) and are associated with instrument approach procedures, enroute airways, and minimum vectoring altitude sectors. Proposed wind turbines that exceed these surfaces would require an increase to instrument approach procedure minimum altitudes, enroute airway minimum altitudes, and/or minimum vectoring altitudes. If the FAA determines one or the sum of these impacts to constitute a substantial adverse effect it could result in determinations of hazard.

United States Geological Survey (USGS) elevation data indicates that these surfaces could limit 432 foot AGL wind turbines at two of the proposed locations. These surfaces could limit 596 foot AGL wind turbines at all the of the proposed locations.

Additionally, multiple military training routes overlie the Eight Point wind project. Although impact on these routes cannot result in determinations of hazard it could result in military objections to proposed wind development.

This study did not consider electromagnetic interference on communications, navigation, or radar surveillance 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 56 day cycle. The results of this analysis/map 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.



Study Findings

14 CFR Part 77 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.

Public-use airport 14 CFR Part 77 imaginary surfaces (e.g. **Figure 2**) do not overlie the Eight Point wind project. However, at 586 feet AGL, 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 their location.

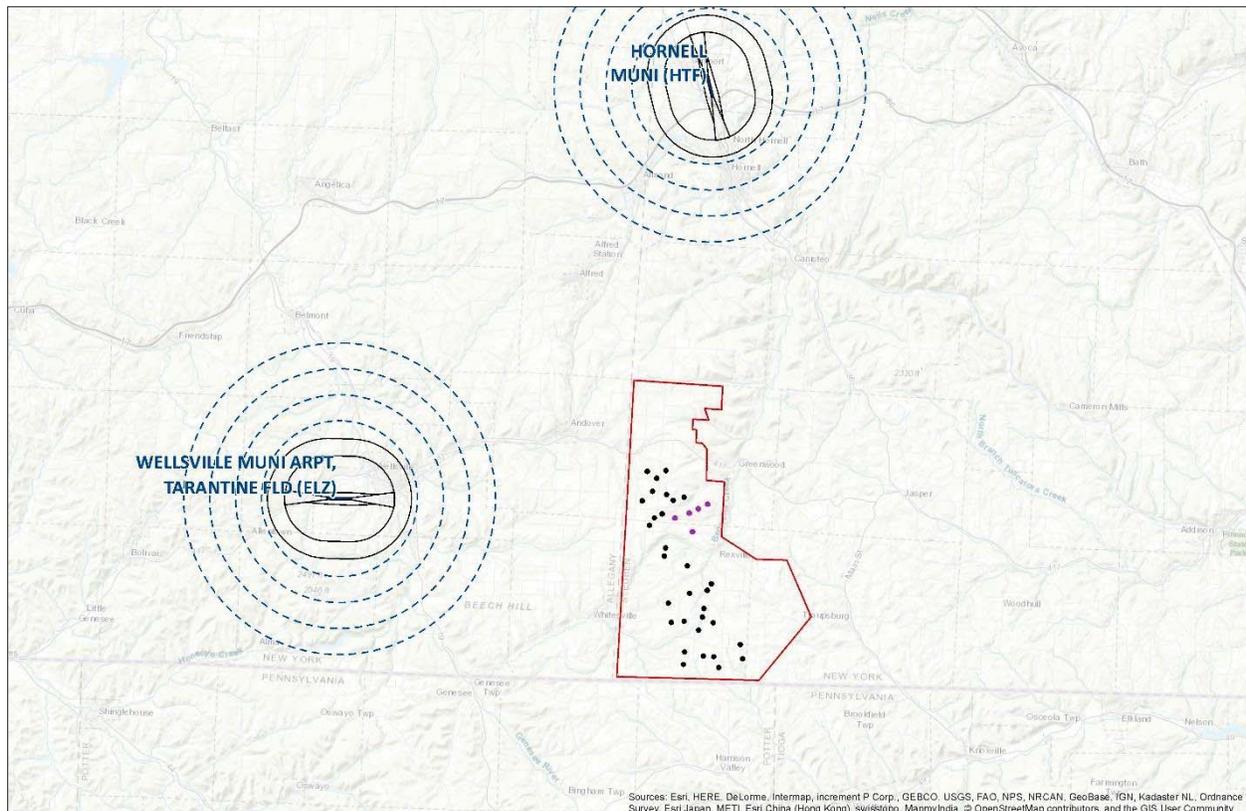


Figure 2: 14 CFR Part 77.17(a)(2) (dashed blue) and 77.19 (black) imaginary surfaces in proximity to the Eight Point wind project



Visual Flight Rules (VFR) Traffic Pattern Airspace

VFR traffic pattern airspace is used by pilots operating during visual meteorological conditions. 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. Due to the limiting nature of these surfaces, 586 foot AGL wind turbines will not be feasible within VFR traffic pattern airspace.

VFR traffic pattern airspace does not overlie the Eight Point wind project (e.g., [Figure 3](#)). Therefore, VFR traffic pattern airspace should not limit wind development within the defined study area.

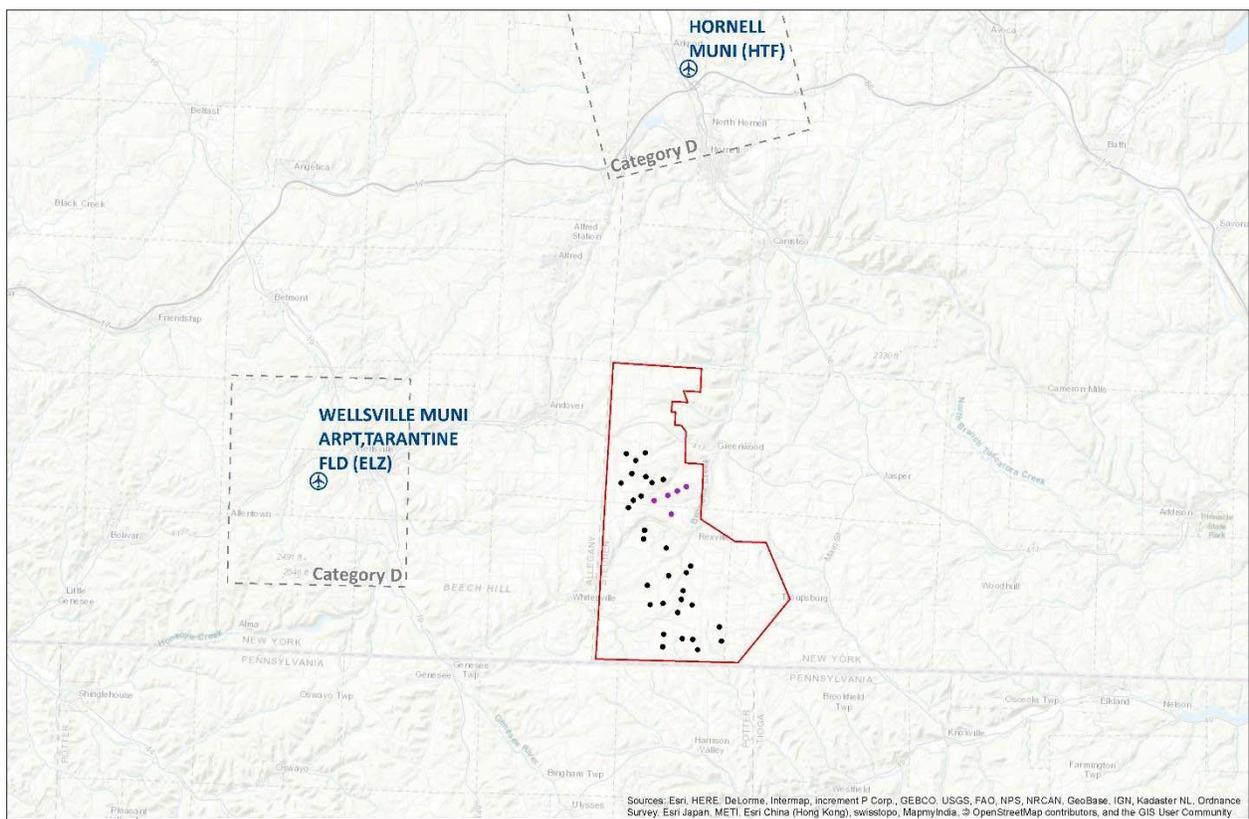
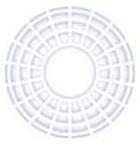


Figure 3: VFR traffic pattern airspace in proximity to the Eight Point wind project



Visual Flight Rules (VFR) Routes

During periods of marginal Visual Meteorological Conditions (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 land marks 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 Eight Point wind project is located in proximity to railroads, transmission lines, and highways that may be used as VFR routes (**Figure 4**). However, operational data describing the usage of these potential routes is not available. If the FAA determines that these potential VFR routes are flown regularly, they could limit wind development in excess of 499 feet AGL and within two statute miles of these landmarks (hatched orange, **Figure 4**).

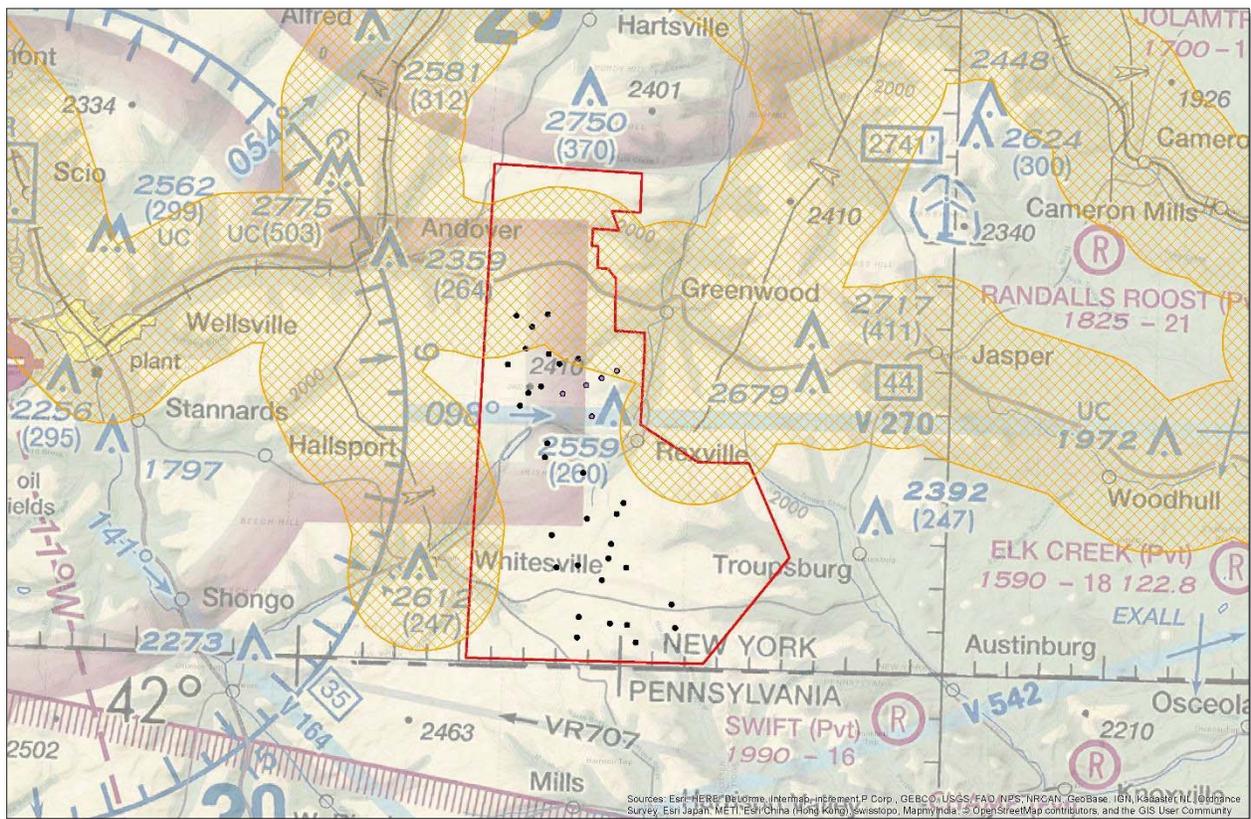
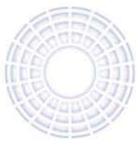


Figure 4: Potential VFR routes in proximity to the Eight Point wind project



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 minimum climb gradients and/or change to routing. If the FAA determines that this impact would constitute a substantial adverse effect, it could be used as the basis for determinations of hazard.

Instrument departure procedure obstacle clearance surfaces (e.g., [Figure 5](#)) are in excess of other lower surfaces and should not limit 432 or 586 foot AGL wind turbines at any of the proposed locations.

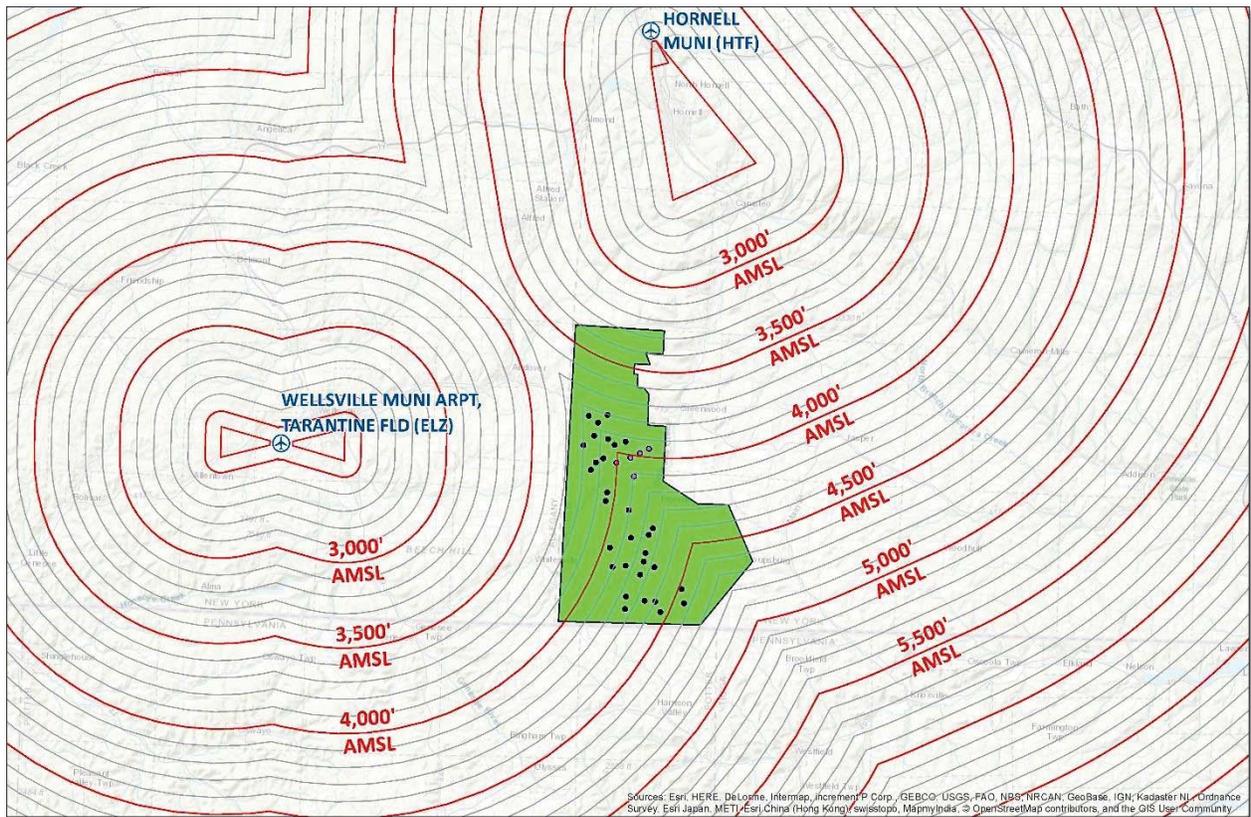
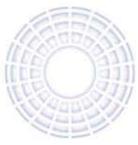


Figure 5: Hornell Municipal Airport (HTF) and Wellsville Municipal Airport (ELZ) obstacle departure procedure assessment



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 fifteen published instrument approach procedures at five airports in proximity to the Eight Point wind project.

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 to constitute a substantial adverse effect it could be used as the basis for determinations of hazard.

Wellsville Municipal Airport – Tarantine Field (ELZ)

RNAV (GPS) Approach to Runway 28

The intermediate segment overlies the study area. The associated obstacle clearance surfaces range from 2,900 to 4,100 feet AMSL and are in excess of other lower height constraints.

USGS elevation data indicates that this surface could limit 586 foot AGL wind turbines in small areas of higher terrain in western sections of the study area. However, none of the proposed wind turbines are located in this area.

Localizer/DME Approach to Runway 28 (Figure 6)

The procedure turn and intermediate segments overlie the study area. The associated obstacle clearance surfaces range from 2,900 to 4,000 feet AMSL and are some of the lowest height constraints in a small southwestern section of the study area.

USGS elevation data indicates that these surfaces could limit 586 foot AGL wind turbines at 10 of the proposed locations (orange areas, *Figure 6*).

Published instrument procedures assessed:

Dansville Municipal (DSV)

- RNAV (GPS) Approach to Runway 14
- RNAV (GPS) Approach to Runway 18
- RNAV (GPS)-A Circling Approach

Hornell Municipal (HTF)

- RNAV (GPS) Approach to Runway 18
- RNAV (GPS) Approach to Runway 36

Wellsville Municipal Airport – Tarantine Field (ELZ)

- RNAV (GPS) Approach to Runway 10¹
- RNAV (GPS) Approach to Runway 28¹
- Localizer/DME Approach to Runway 28¹
- VOR-A Circling Approach

Wellsboro Johnston (N38)

- RNAV (GPS) Approach to Runway 10
- RNAV (GPS) Approach to Runway 28
- VOR-A Circling Approach

¹ Major amendment scheduled for 5/24/2018 publication.

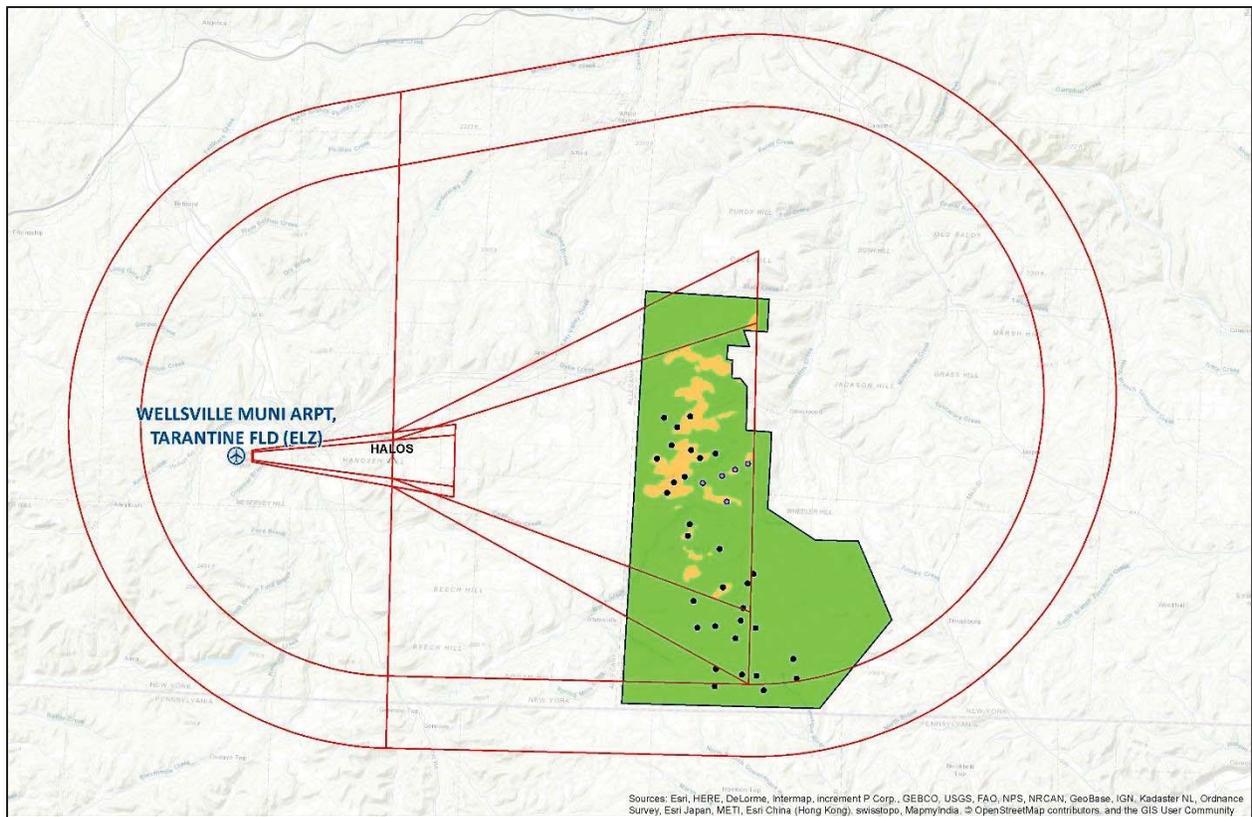


Figure 6: Wellsville Municipal Airport-Tarantine Field (ELZ) Localizer/DME Approach to Runway 28



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 of 1,000 feet of obstacle clearance 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 minimum obstruction clearance altitudes (MOCA) and/or minimum enroute altitudes (MEA). If the FAA determines that this impact would constitute a substantial adverse effect, it could be used as the basis for determinations of hazard.

V270

Wellsville VORTAC (ELZ) to WOMAN (purple, *Figure 7*)

The MOCA is 4,000 feet AMSL. Although this segment is located in FAA designated mountainous terrain, existing obstacles and terrain indicate that the FAA has likely reduced the required obstacle clearance from 2,000 to no greater than 1,200 feet. The resulting obstacle clearance surfaces range from 2,800 to 3,800 feet AMSL and are the lowest height constraint overlying the southwestern corner of the study area.

USGS elevation data indicates that these surfaces could limit 586 foot AGL wind turbines at 23 of the proposed locations (orange and red areas, *Figure 7*).

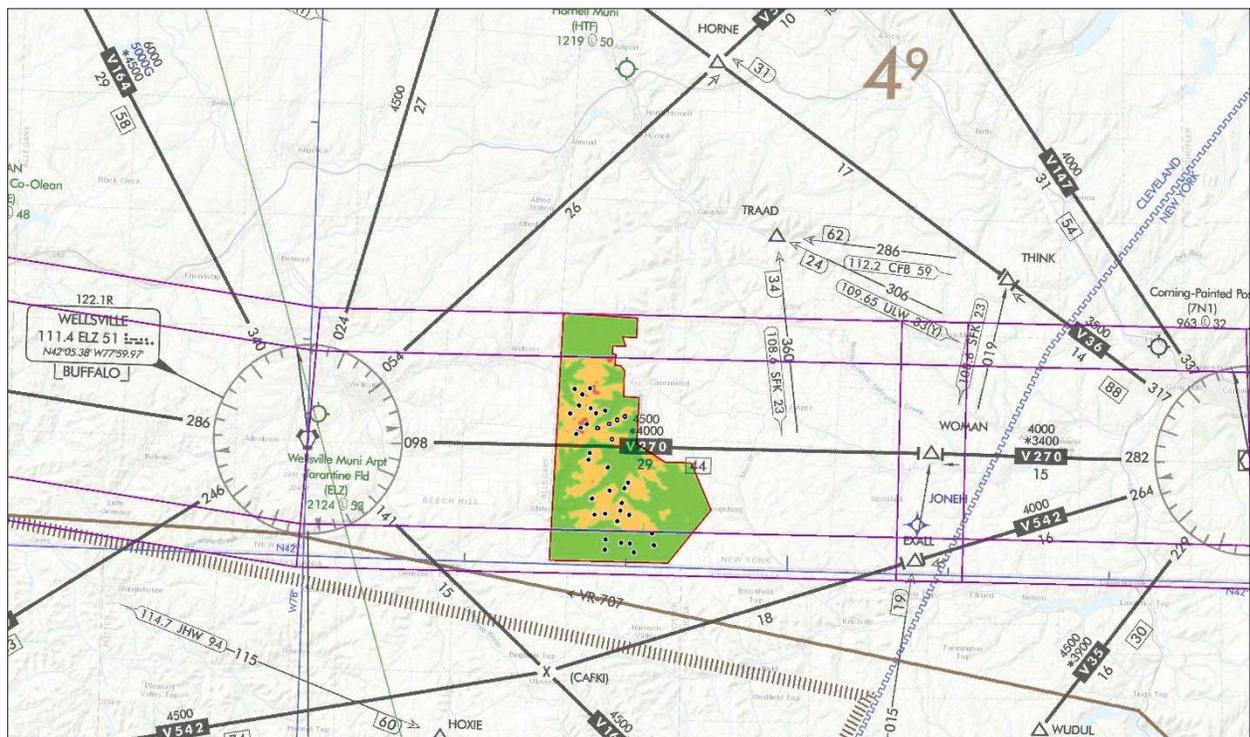
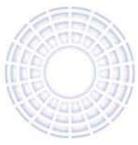


Figure 7: Low altitude enroute chart L-30 with V270 obstacle evaluation areas (red)



Minimum Vectoring/IFR Altitudes

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

Proposed structures that exceed minimum vectoring/IFR altitude sector obstacle clearance surfaces would require an increase to the lowest altitudes useable by air traffic controllers for vectoring aircraft. If the FAA determines that this impact would affect a significant volume of operations, it could result in determinations of hazard.

Elmira (ELM) Terminal Radar Approach Control (TRACON)

Sector F

The minimum vectoring altitude is 3,700 feet AMSL. Although this sector is located in designated mountainous terrain, existing obstacles indicate that the FAA has reduced the required obstacle clearance from 2,000 to 1,000 feet. The resulting obstacle clearance surface (dashed blue, [Figure 8](#)) is 2,749 feet AMSL and is the lowest surface overlying the majority of the study area.

USGS elevation data indicates that this surface could limit 432 foot AGL wind turbines at two of the proposed locations (red areas, [Figure 8](#)). This surface could limit 586 foot AGL wind turbines at all of the proposed locations (red and orange areas, [Figure 8](#)).

Sector I

The minimum vectoring altitude is 5,000 feet AMSL. The associated obstacle clearance surface is 3,049 feet AMSL and is the lowest surface overlying the southwestern corner of the study area. However, USGS elevation data indicates that this surface should not limit 432 or 586 foot AGL wind turbines within the defined study area.

Rochester (ROC) TRACON

Sector K (both 3 and 5 nautical mile FUSION charts)

The minimum vectoring altitude is 3,800 feet AMSL. Although this sector is located in designated mountainous terrain, FAA minimum vectoring altitude chart documentation indicates that the required obstacle clearance has been reduced from 2,000 to 1,000 feet. The resulting obstacle clearance surfaces (dashed blue, [Figure 9](#)) are 2,849 feet AMSL and are the lowest surfaces overlying the southwestern section of the study area.

USGS elevation data indicates that these surfaces could limit 586 foot AGL wind turbines at 17 of the proposed locations (orange areas, [Figure 9](#)).

² Cleveland (ZOB) Air Route Traffic Control Center (ARTCC) minimum IFR altitude sectors overlie the Eight Point wind project. However, the Cleveland (ZOB) ARTCC minimum IFR altitude chart was not publicly available at the time of this analysis and could not be assessed. As a result, it is possible that the associated obstacle clearance surfaces could be lower than other airspace surfaces described in this report.

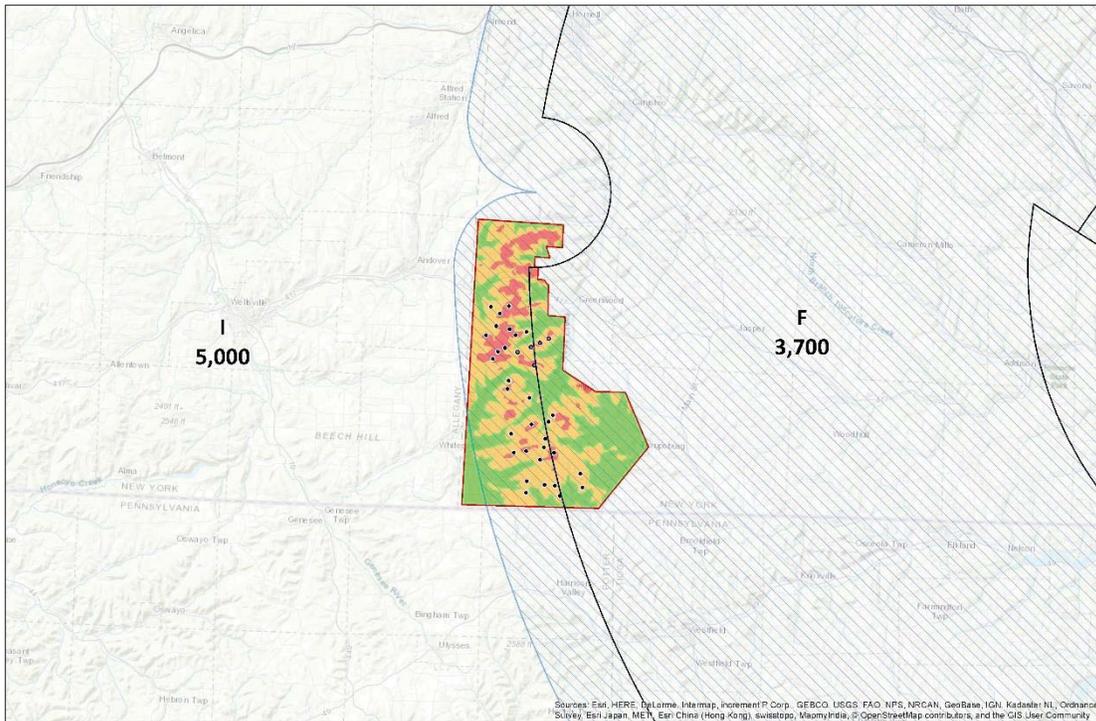


Figure 8: Elmira (ELM) TRACON minimum vectoring altitude sectors (black) with Sector F obstacle evaluation area (hatched blue)

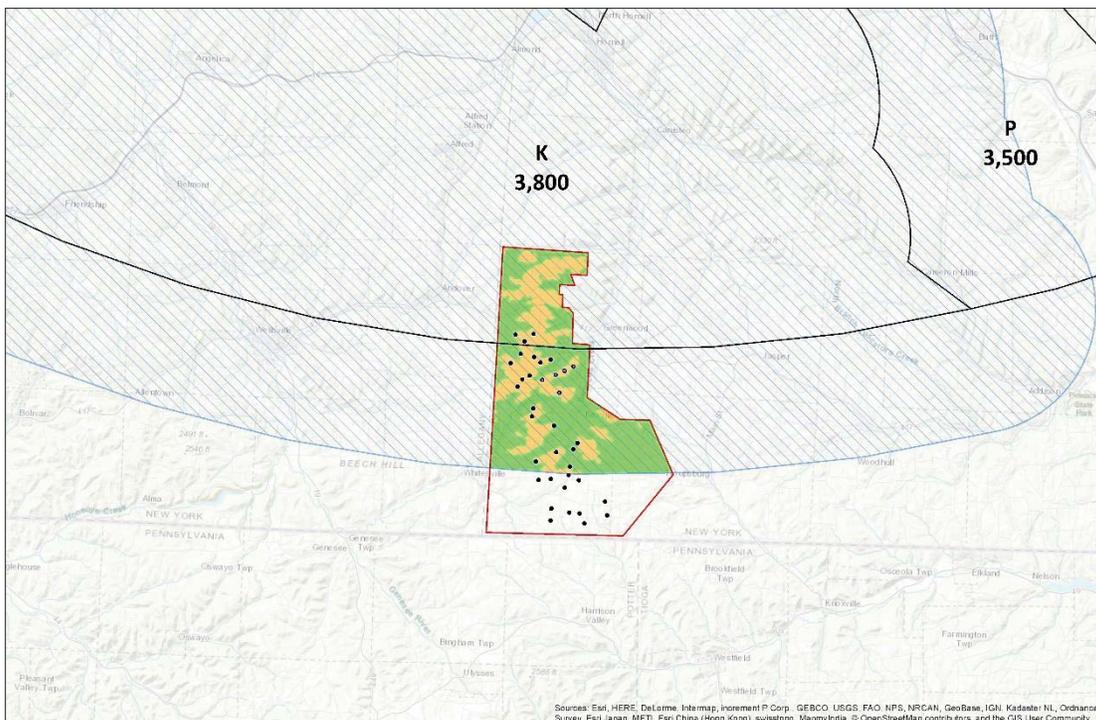
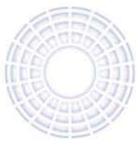


Figure 9: Rochester (ROC) TRACON 5 NM FUSION minimum vectoring altitude sectors (black) with Sector K obstacle evaluation area (hatched blue)



Military Airspace and Training Routes

Since the FAA does not protect for military airspace or training routes, impact on their operations cannot result in a determination of hazard. However, the FAA will notify the military of proposed wind turbines located within these segments of airspace. 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.

Visual flight rules routes (VR) and slow routes (SR) overlying the Eight Point wind project (**Figure 10**):

Niagara Falls Air Reserve Station

| Route | Minimum Altitude |
|--------|------------------|
| SR-823 | 300 feet AGL |
| SR-825 | 300 feet AGL |

Pennsylvania Air National Guard

| Route | Minimum Altitude |
|--------|------------------|
| VR-707 | 500 feet AGL |

Due to the low altitudes associated with VR and SR routes, it is possible that wind development could have an impact on their operations. If Niagara Falls Air Reserve Station or Pennsylvania Air National Guard uses these routes regularly, it may result in military objections to proposed wind development.

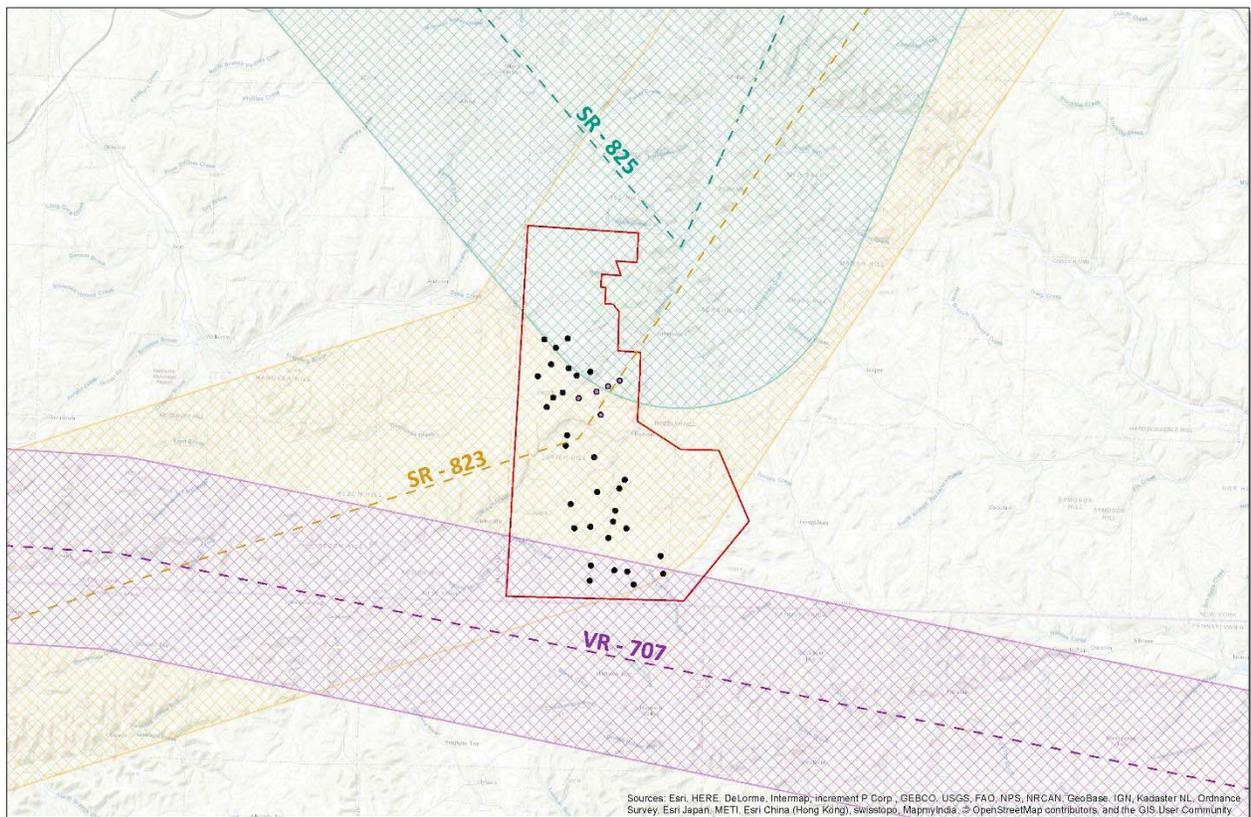


Figure 10: Military training routes and “slow” routes overlying the Eight Point wind project



Conclusion

At 586 feet AGL, all of the proposed wind turbines exceed 14 CFR Part 77.17(a)(2) – a height of 499 feet AGL at the site of the object – and will be identified as obstructions. However, heights in excess of 14 CFR Part 77.17(a)(1) are feasible provided proposed wind turbines do not exceed FAA obstacle clearance surfaces.

Obstacle clearance surfaces overlying the Eight Point wind project range from 2,749 to 3,049 feet AMSL (**Figure 11**) and are associated with Wellsville Municipal Airport instrument approach procedures (**Figure 6**), low altitude enroute airway V270 (**Figure 7**), as well as Elmira (ELM) TRACON and Rochester (ROC) TRACON minimum vectoring altitude sectors (**Figure 8** & **Figure 9**).

USGS elevation data indicates that 432 foot AGL wind turbines (purple, **Figure 11** & **Figure 12**) would have the following airspace impacts:

1. **Elmira (ELM) TRACON Minimum Vectoring Altitudes** - 2 wind turbines would require an increase to the Sector F minimum vectoring altitude.

USGS elevation data indicates that 586 foot AGL wind turbines (black, **Figure 11** & **Figure 12**) would have the following airspace impacts:

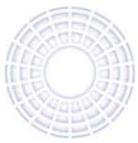
2. **Wellsville Municipal Airport Localizer/DME Approach to Runway 28** - 10 wind turbines would require an increase to the intermediate segment minimum altitude.
3. **Low Altitude Enroute Airway V270** - 23 wind turbines would require an increase to the airway's minimum altitudes unless the FAA has already reduced or is willing to further reduce required obstacle clearance.
4. **Elmira (ELM) TRACON Minimum Vectoring Altitudes** - 31 wind turbines would require an increase to the Sector F minimum vectoring altitude.
5. **Rochester (ROC) TRACON Minimum Vectoring Altitudes** - 12 wind turbines would require an increase to the 3 Nautical Mile FUSION Chart Sector K minimum vectoring altitude. 17 wind turbines would require an increase to the 5 Nautical Mile FUSION Chart Sector K minimum vectoring altitude.

If the FAA determines one or the sum of these impacts to constitute a substantial adverse effect it could result in determinations of hazard for up to 34 proposed wind turbines.

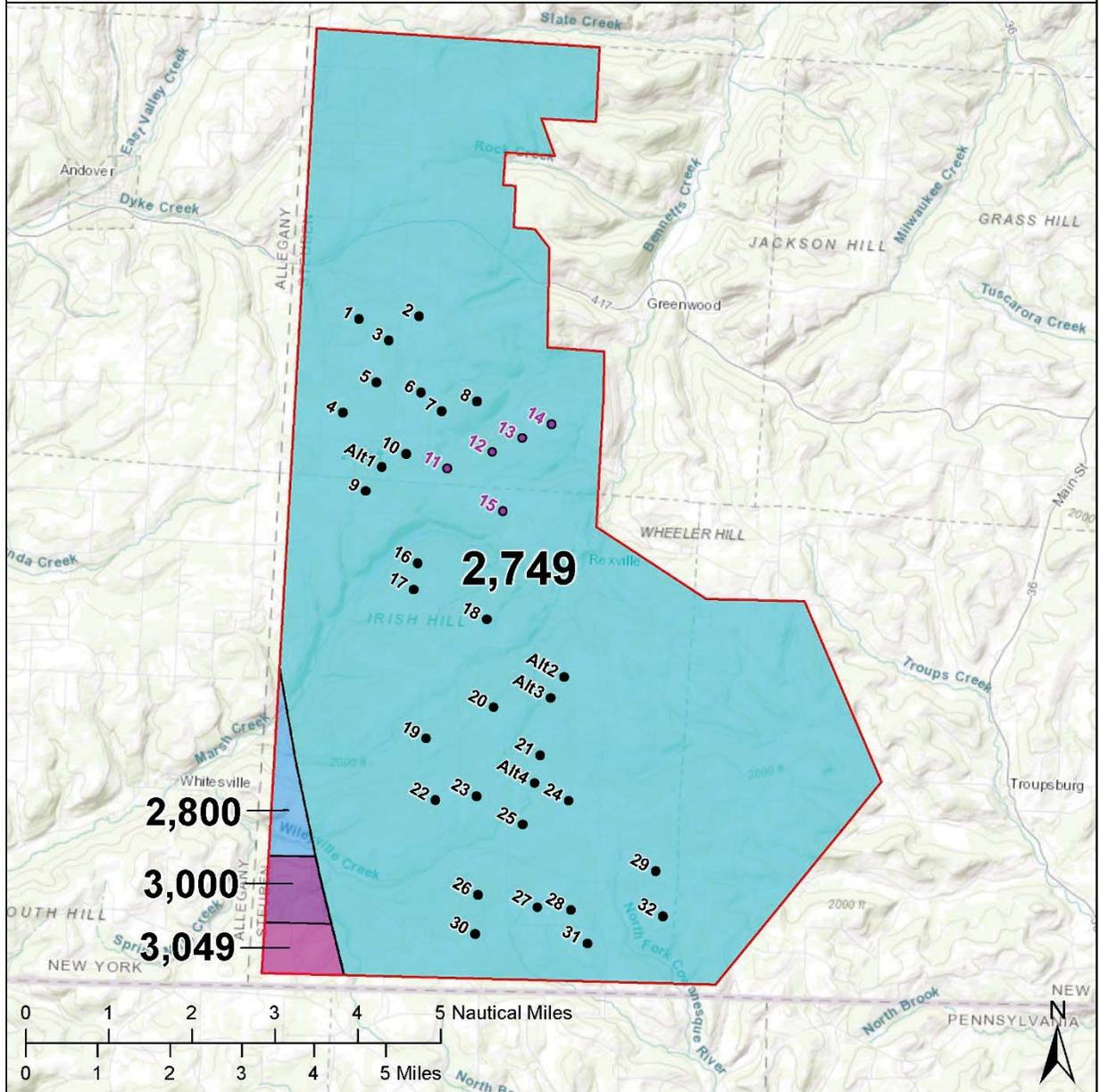
Multiple military training routes overlie the Eight Point wind project (**Figure 10**). Although impact on these routes cannot result in determinations of hazard it could result in military objections to proposed wind development.

The AGL Clearance Map (**Figure 12**) is based on USGS National Elevation Dataset (NED) 1/3 Arc Second data which has a vertical accuracy of generally +/- 7 meters. Therefore, the AGL Clearance Map should only be used for general planning purposes and not exact structure siting. In order to avoid the likelihood of determinations of hazard, proposed structure heights must adhere to the height constraints depicted in the Composite Map (**Figure 11**).

If you have any questions regarding the findings of this study, please contact **Ron Morgan** or **Nick Lee** 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 automatically be determined to be obstructions regardless of their location.

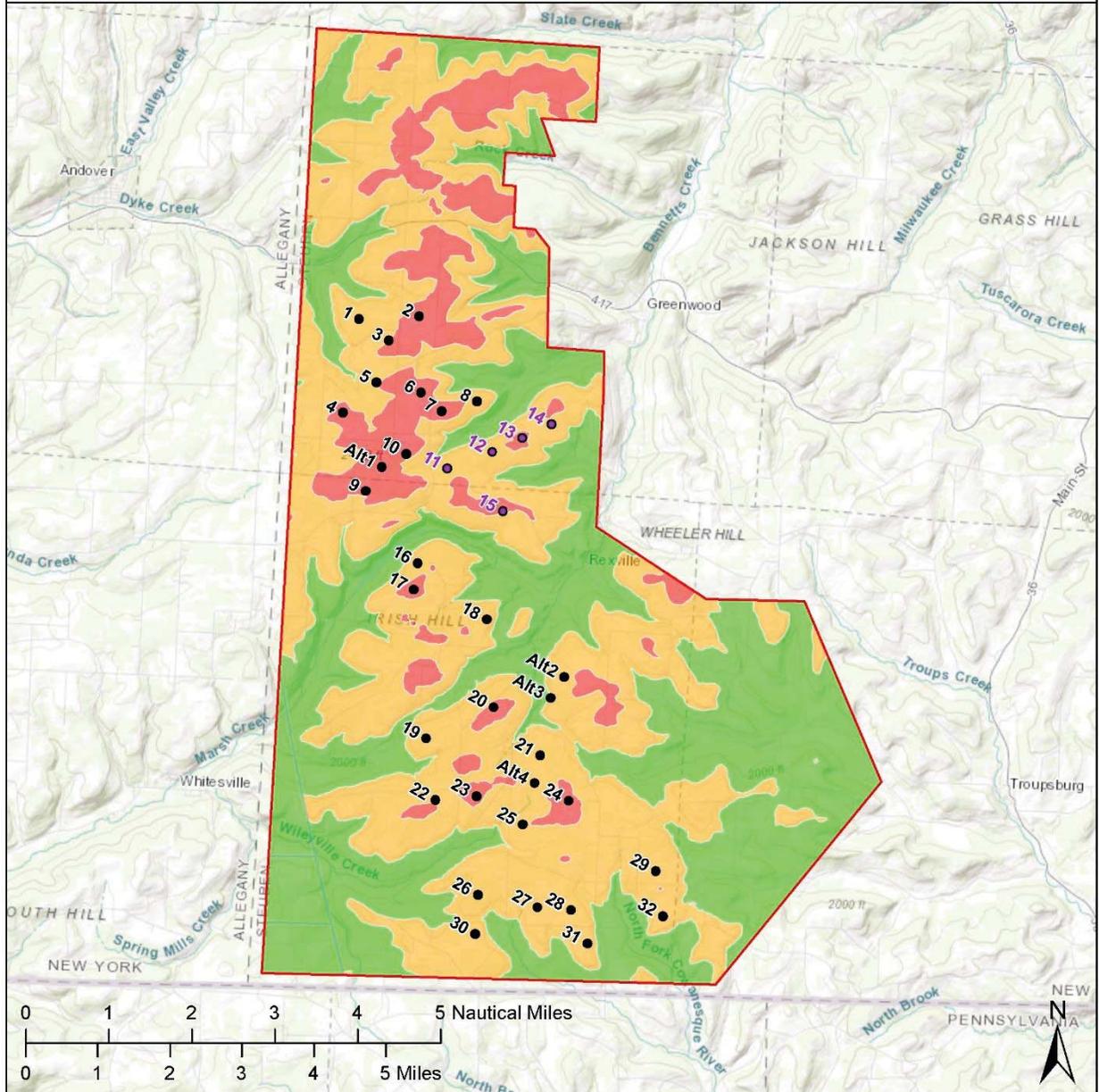


| Legend | |
|--|--|
| All heights above mean sea level (AMSL) | |
| Obstacle Clearance Surface Height - AMSL Feet | Proposed Turbine Location (Labeled with ID) |
| High : 3,049 | ● 586 foot AGL |
| Low : 2,749 | ● 432 foot AGL |

| | |
|--|------------------------|
| Eight Point Wind Project Composite Height Constraint Map | |
| Plot Date: 5 May 2017 | Figure 11 |
| Coordinate System: NAD 1983 UTM Zone 18N | |
| Nick Lee | Capitol Airspace Group |



The USGS 1/3 Arc Second Digital Elevation Model (DEM) data used to create this map has a vertical accuracy of +/- 7 meters. This map should only be used for general planning purposes and not exact structure siting.



| | | | |
|--|---|---|------------------|
| Legend | | Eight Point Wind Project Above Ground Level (AGL) Clearance Map | |
| Clearance Height - AGL Feet | Proposed Turbine Location (Labeled with ID) | Plot Date: 5 May 2017 | Figure 12 |
| <ul style="list-style-type: none"> < 432 432 - 586 ≥ 586 | <ul style="list-style-type: none"> 586 foot AGL 432 foot AGL | Coordinate System: NAD 1983 UTM Zone 18N Nick Lee | |
| | | Capitol Airspace Group | |