Seneca Wind Project

S-Power

Seneca County, Ohio

Military Training Route and Special Use Airspace Analysis

January 09, 2019

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Introduction

Capitol Airspace conducted a military training route (MTR) and special use airspace (SUA) analysis for the Seneca wind project in Seneca County, Ohio. The purpose of this analysis was to identify existing obstacles within MTR boundaries, critical distances to route boundaries and entry/exit points, as well as exclusion areas and noise avoidance areas. By identifying possible military concerns regarding the overall impact on the MTR or SUA, this analysis can assist in predicting potential risks to wind development and possible mitigation solutions. This analysis did not address FAA impacts or process.

Slow Routes (SR) overlie the Seneca wind project (***Figure 1***):

Mansfield Lahm Air National Guard Base

Route/Airspace	*Minimum Altitude*
SR-708	500 feet Above Ground Level (AGL)
SR-709	500 feet AGL
SR-715	500 feet AGL

No Special Use Airspace (SUA) overlies the project, or is affected by the routes that overlie the Seneca project.

Considering the low altitudes associated with these routes, it is possible that wind development could have an impact on military operations. It is possible that these routes are used frequently by aircraft from Mansfield Lahm Air National Guard Base and other nearby units. If this is the case, the originating activity of these routes may object to proposed wind development within the route boundaries. The units may also object to any wind development over 499 feet AGL due to the likely increase to the minimum cloud ceilings required to fly the routes.

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MTR Operations

Overview

The FAA does not protect for the majority of military airspace or training routes. As a result, impact on their operations will not likely 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 and may result in the issuance of a Determination of Unacceptable Risk to National Security by the Department of Defense.

Operating on an MTR

When operating within MTRs, pilots remain within the lateral and vertical confines of the published route. Routes are one-way unless otherwise noted and course reversals are not authorized. When practicable, pilots must avoid flight within 1500 feet vertically or 3 Nautical Miles (NM) horizontally of airports. Pilots are responsible for maintaining obstacle clearance, terrain avoidance, and compliance with air traffic directions regardless of the route's published altitudes. Obstacles generally must be avoided by 500 feet vertically and/or 3000 feet horizontally, unless otherwise noted in the AP/1B or local publications.[1] Obstacles include defined avoidance areas, airports, existing tall structures, and noise sensitive areas such as farms, schools, and population centers. Due to these required setbacks and the requirement to operate within the boundaries of the route, the DoD pilot must plan a route of flight that is often circuitous with choke points created where the width of the MTR is narrowed by obstacles.

The provision of Air Traffic Control (ATC) traffic advisories on IRs, VRs, and SRs is at the discretion of the Air Traffic Controller. Many VRs and SRs have minimum altitudes that are not within radar coverage and, as a result, receive limited or no air traffic service. Military and civilian aircraft operating under Visual Flight Rules (VFR) in the vicinity of MTRs are subject to "see and avoid" flight rules, and are therefore responsible for their own separation from terrain, obstacles, and other aircraft. Additionally, for IRs, aircraft must obtain specific ATC entry and exit clearances when radio coverage is available, or the aircraft must not exceed the last assigned or expected IFR clearance until contact is available.

As noted previously, aircraft separation on MTRs is at the discretion of the air traffic controller, unless otherwise delegated to military authorities as Military Authority Assumes Responsibility of Separation of Aircraft (MARSA). MARSA procedures are used when military aircraft must operate in close proximity and with close coordination. Typical applications of MARSA procedures include military formation flights and in-flight refueling operations.

MTR entry and exit is accomplished at specified points published in the AP/1B. MTRs cannot be flown unless properly scheduled through the designated scheduling or originating authority. When scheduling MTRs, Flight Service Stations (FSS) within 100 NM of the scheduled MTR are notified to provide information to civilian pilots to avoid the MTR. Pilots must inform the ATC facility if they are unable to

[1] AP/1B General Guidance Section

enter the route within the established time limits, the potential impact to other aircraft, and to advise intentions.

Methodology

Capitol Airspace studied the proposed Seneca wind project based on location information provided by S-Power. All MTR information, including their use and unit information, was derived from the AP/1B[2] as well as DoD documentation and research specific to the route. The AP/1B provides descriptions and operating instructions for all MTRs (Instrument Routes – IR, Visual Routes - VR, Slow Routes - SR). The AP/1B is the official source of route data for military users.

Using this information, Capitol Airspace evaluated three MTRs that overlie the study area. MTRs are managed by individual military units or bases known as the "scheduling activity." However, MTRs may be used by any Department of Defense (DoD) unit through prior coordination with the MTR's scheduling activity. Capitol Airspace used the scheduling activity's primary aircraft type(s), open source research, as well as any information provided in the AP/1B to determine the route usage. The information derived from the various data sources provides a "public view" of the military's operations along these routes. While there may be, and likely are operations unknown to the civilian populace, the military should generally conform to the route constraints depicted in the following textual and graphical depictions. Therefore, Capitol Airspace does not represent the following as an exhaustive representation of military operations along these routes and highly recommends early and direct consultation with the DoD to identify military operations that may be potentially limiting to wind development.

In order to predict whether DoD will object to a proposed wind project, Capitol Airspace conducted a constraints assessment of all affected military training routes. This assessment is primarily focused on identifying and mapping obstacles and areas within the route that would limit the military pilot's ability to fly and utilize the route. Capitol Airspace used all known information on flight limiting structures and areas, plotted them within the route to portray the remaining useable route width, and provided a graphical representation of the constraints along the route. Capitol Airspace then measured the distance between these choke points to determine if sufficient distance remained to allow the DoD to conduct training operations along the route. The routes may have additional areas of concern from the military that could include noise sensitivity areas that are not listed in the AP/1B that affect the overall viability of the route.

It should be noted that while Capitol Airspace creates these graphics based on publicly available information, only the DoD can make an absolute statement regarding its ability to operate within the constrained distances shown in these graphics.

[2] AP/1B, DoD Flight Information Publication, Area Planning, Military Training Routes – North and South America, Effective 0001L 08 Nov 2018 to 0001L 03 Jan 2019, published by the National Geospatial-Intelligence Agency (Note: this document is updated approximately every 7 weeks. Information provided in this report is accurate as of the date of publishing, but should be verified with the current AP/1B after the effective date has passed.)

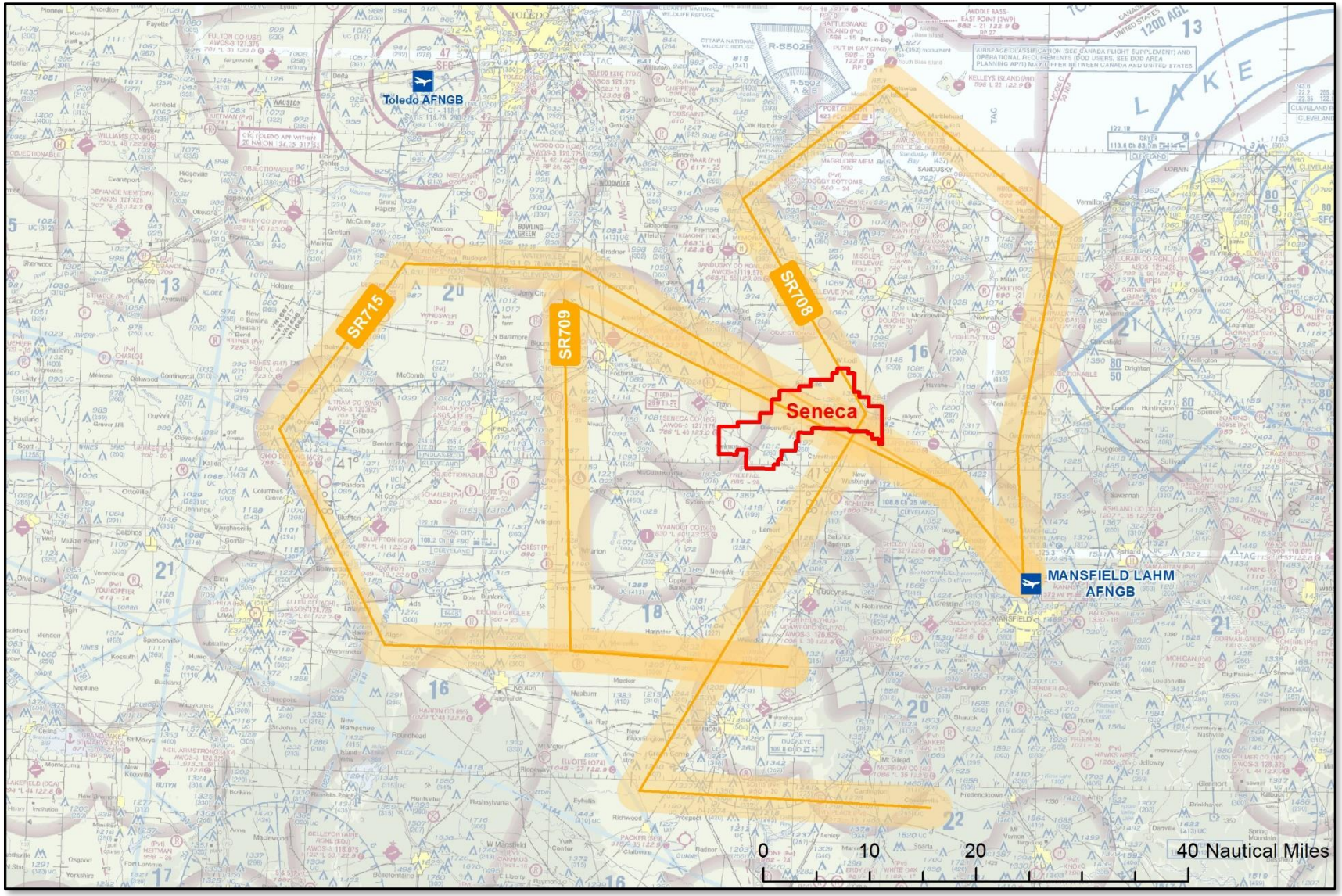

Figure 1: SR-708, SR-709, and SR-715 overlying the Seneca study area (red outline)

SR Route Procedures

Unlike IRs and VRs, SRs are not part of the MTR system and are low-level routes flown at or below 1500 feet AGL. High-speed aircraft cannot use low speed slow routes. SR operations are flown at airspeeds of 250 knots Indicated Airspeed (IAS) or less. Weather minima for flights on SRs are specified by the individual services or are listed in the remarks or special operating procedures for individual SRs.

SR-708 Background

SR-708 is a unidirectional route originated by the 179th Airlift Wing at Mansfield Lahm Air National Guard Base, Ohio. The scheduling activity is the same unit. The wing consists of one airlift Squadron – the 164th Airlift Squadron who operate the C-130H Hercules (***Figure 2***). The 164th Airlift Squadron operates a fleet of eight C-130H Hercules cargo aircraft known as the "workhorse of the Air Force." The C-130 primarily performs the tactical portion of the Air Force airlift mission. The aircraft is capable of operating from rough, dirt airstrips, and is the prime transport for airdropping troops and equipment into hostile areas as well as humanitarian and aeromedical evacuation operations. Per recent airport data, the unit operated approximately 12-14 flights daily.

Figure 2: C-130H Hercules

SR-708 is used from 0700-2300 local time daily. The route's use during daylight and night time hours could require NVG compatible lighting requirements upon request by the Air Force for the Seneca project. Altitudes as low as 500 feet AGL are authorized for this route. The AP/1B does not identify additional noise sensitive areas within the confines of the route.

SR-708 Analysis

The study area is 66.9 NM from the route's initial point (Checkpoint A). The closest checkpoints to the Seneca wind project are Point B located 39.4 NM southwest of the project, Point C located within the project boundary, and Point D located 18.2 NM north of the project. Assuming that the Air Force is conducting standard flight training operations for slow aircraft[3], the project area will likely be deemed incompatible with training operations due to a turn point (C) being within the project boundary and maneuvering and training considerations of the aircraft could be adversely affected.

Flights along this route are authorized as low as 500 feet AGL. Capitol Airspace identified obstacles along the route. The Air Force generally requires 500 feet of vertical separation, and/or 3000 feet lateral separation from an obstacle. Using this information, Capitol Airspace determined that, excluding the planned Seneca wind project, there are multiple locations along the route where the route width is

[3] Air Force Instruction 11-2C-130J, Flying Operations C-130J Operations Procedures, 31 January 2013.

completely obstructed by airfield avoidance areas. There are other chokepoints along the route between obstacles and airfield avoidance areas between 0.9 NM and 2.7 NM wide (***Figure 3***).

If the planned Seneca wind project is constructed, the route would be bisected near Point C. Capitol Airspace expects that the Air Force would likely object to the bi-section of the route, in particular at a turn point along the route. The Air Force could also include possible discussions of a negative overall cumulative effect of obstacles in the route.

SR-708 Mitigation

Mansfield Lahm AFNGB could request that the project remain on the western half of the SR-708 centerline at point C to mitigate the usable route width in this area. Using available obstruction and avoidance area data, the eastern half of the route near point C is clear of obstacles such that the Air Force would likely request to keep it clear. This would allow aircraft to make the turn at point C with obstacles in view to the left during a left turn (visible, versus under the aircraft where the obstacles would be unseen). By the project remaining west of the SR centerline near point C, the usable route width would be at least 2 NM depending on the placement of wind turbines. This could help to address potential Air Force concerns about the route in this area, barring possible discussions referencing overall cumulative effect of obstacles and avoidance areas on the route.

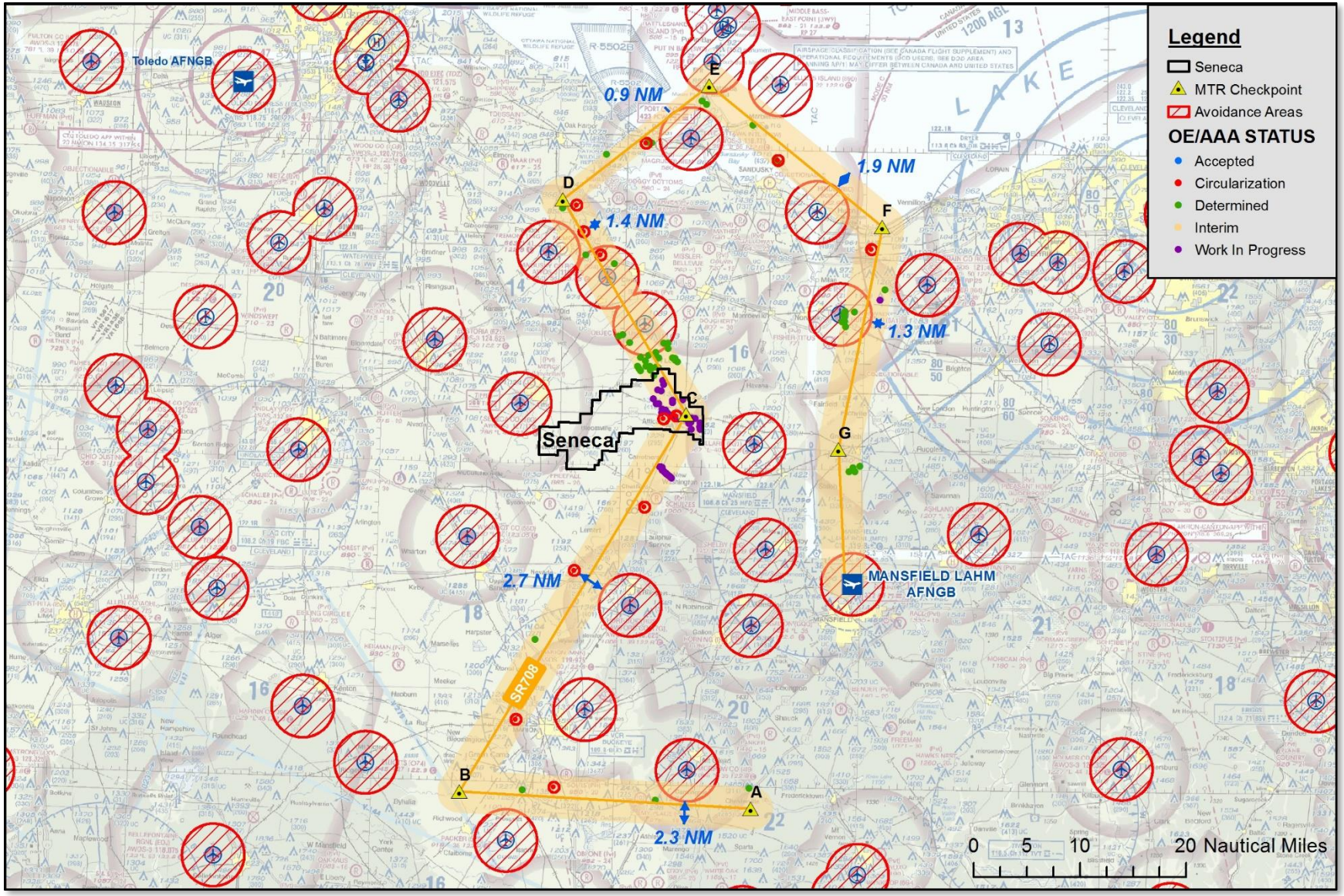

Figure 3: SR-708 Obstacles and Avoidance Areas (red hatched areas) with marked distances (blue – between obstacles) and OE/AAA Status of other proposed obstacles within the route

SR-709 Background

SR-709 is a unidirectional route originated by the 179th Airlift Wing at Mansfield Lahm Air National Guard Base, Ohio. The scheduling activity is the same unit. As noted previously, the wing consists of one airlift Squadron – the 164th Airlift Squadron who operate the C-130H Hercules (***Figure 4***). Aircraft are limited to a maximum speed of 250 knots along the route eliminating high-speed aircraft from using the route. Per recent airport data, the unit operated approximately 12-14 flights daily.

Figure 4: C-130H Hercules

SR-709 is used from 0700-2300 local time daily. The route's use during daylight and night time hours could require NVG compatible lighting requirements upon request by the Air Force for the Seneca project. Altitudes as low as 500 feet AGL are authorized for this route. The AP/1B does not identify additional noise sensitive areas within the confines of the route.

SR-709 Analysis

The study area is 75.3 NM from the route's initial point (Checkpoint A). The closest checkpoints to the Seneca wind project are Point C located 21.7 NM northwest of the project, and Point D located 13.2 NM southeast of the project.

Flights along this route are authorized as low as 500 feet AGL. Capitol Airspace identified obstacles along the route. The Air Force generally requires 500 feet of vertical separation, and/or 3000 feet lateral separation from an obstacle. Using this information, Capitol Airspace determined that, excluding the planned Seneca wind project, there are multiple locations along the route where the route width is significantly obstructed by airfield avoidance areas and obstacles (***Figure 5***).

If the planned Seneca wind project is constructed, the route would be bisected between Points C and D. Assuming that the Air Force is conducting standard flight training operations for slow aircraft[4], the project area could be deemed incompatible with training operations due to the project bisecting the route between points C and D. Aircraft maneuvering and training considerations could be adversely affected. Capitol Airspace expects that the Air Force would likely object to the bisection of the route, including possible discussions of a negative overall cumulative effect of obstacles in the route.

SR-709 Mitigation

Mansfield Lahm AFNGB could request that the project retain at least a 2NM wide flyable corridor. This 2NM corridor equates to half the route width and would remain obstacle free. Using the available obstruction and avoidance area data, the southern half of the route in the project area is clear of obstacles which would probably mean that the Air Force would request to keep it clear. Combined with the obstacles and route boundaries of SR-715, this area could be modified to allow a usable corridor for both SRs. The usable route would be at least 2 NM wide depending on the placement of wind turbines.

[4] Air Force Instruction 11-2C-130J, Flying Operations C-130J Operations Procedures, 31 January 2013.

This could help to address potential Air Force concerns about the route in this area, barring possible discussions referencing overall cumulative effect of obstacles and avoidance areas on the route.

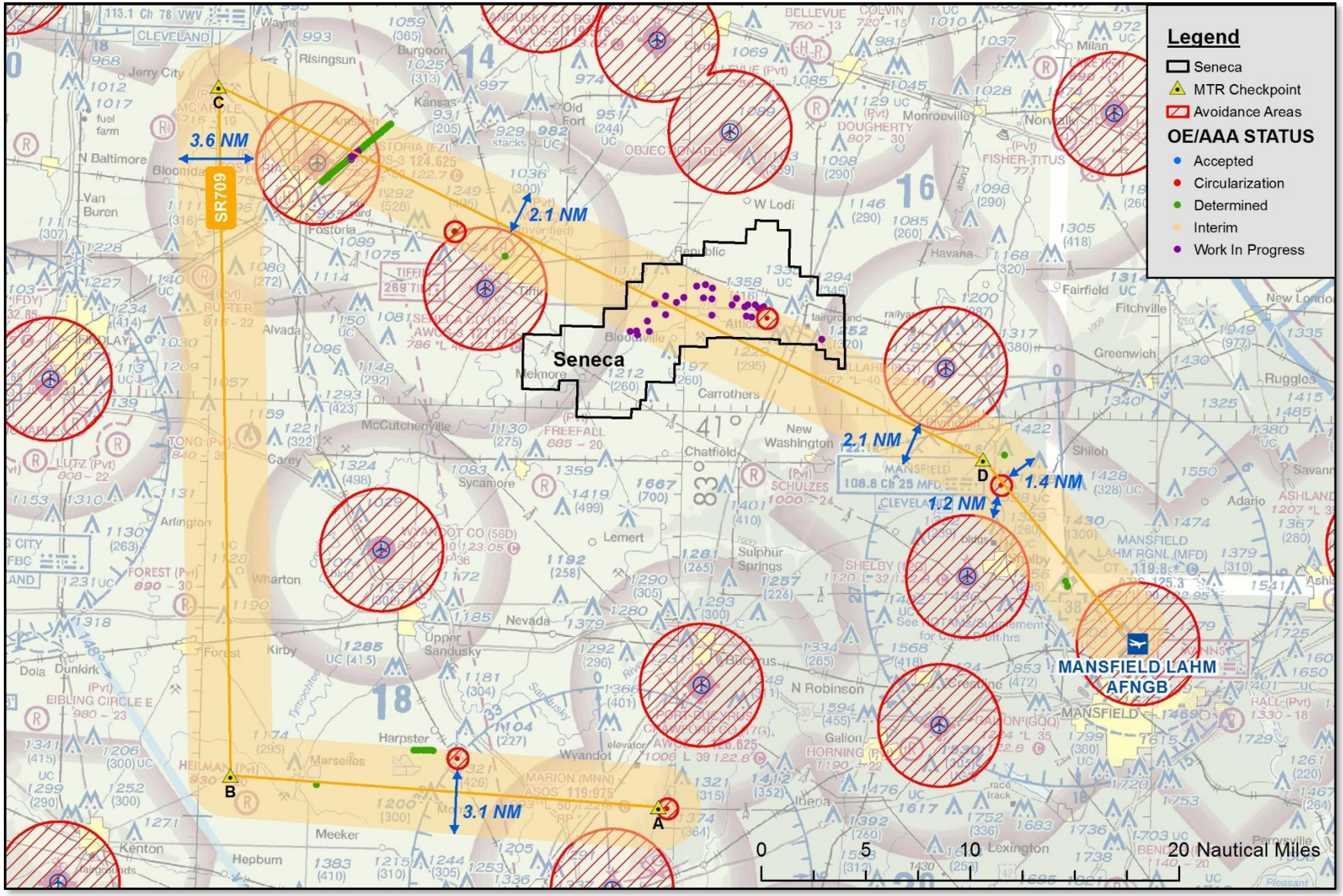

Figure 5: SR-709 Obstacles and Avoidance Areas (red hatched areas) with marked distances (blue – between obstacles) and OE/AAA Status of other proposed obstacles within the route

SR-715 Background

SR-715 is a unidirectional route originated by the 179th Airlift Wing at Mansfield Lahm Air National Guard Base, Ohio. The scheduling activity is the same unit. As noted previously, the wing consists of one airlift Squadron – the 164th Airlift Squadron who operate the C-130H Hercules (***Figure 6***). Aircraft are limited to a maximum speed of 250 knots along the route eliminating high-speed aircraft from using the route. Per recent airport data, the unit operated approximately 12-14 flights daily.

Figure 6: C-130H Hercules

SR-715 is used from 0700-2300 local time daily. The route's use during daylight and night time hours could require NVG compatible lighting requirements upon request by the Air Force for the Seneca project. Altitudes as low as 500 feet AGL are authorized for this route. The AP/1B does not identify additional noise sensitive areas within the confines of the route.

SR-715 Analysis

The study area is 119.3 NM from the route's initial point (Checkpoint A). The closest checkpoints to the Seneca wind project are Point F located 22.4 NM northwest of the project, and Point G located 7.9 NM southeast of the project.

Flights along this route are authorized as low as 500 feet AGL. Capitol Airspace identified obstacles along the route. The Air Force generally requires 500 feet of vertical separation, and/or 3000 feet lateral separation from an obstacle. Using this information, Capitol Airspace determined that, excluding the planned Seneca wind project, there are multiple locations along the route where the route width is significantly obstructed by airfield avoidance areas and obstacles (***Figure 7***).

If the planned Seneca wind project is constructed, the route would be bisected between Point F and G. Assuming that the Air Force is conducting standard flight training operations for slow aircraft[5], the project area could be deemed incompatible with training operations due to the project bisecting the route between points F and G. Aircraft maneuvering and training considerations could be adversely affected. Capitol Airspace expects that the Air Force would likely object to the bisection of this particular route, including possible discussions of a negative overall cumulative effect of obstacles in the route.

SR-715 Mitigation

Mansfield Lahm AFNGB could request that the project retain at least a 2NM wide flyable corridor. This 2NM corridor equates to half the route width and would remain obstacle free. Using the available obstruction and avoidance area data, the southern half of the route in the project area is clear of obstacles which would probably mean that the Air Force would request to keep it clear. Combined with the obstacles and route boundaries of SR-709, this area could be modified to allow a usable corridor for both SRs. The usable route would be at least 2 NM wide depending on the placement of wind turbines.

[5] Air Force Instruction 11-2C-130J, Flying Operations C-130J Operations Procedures, 31 January 2013.

This could help to address potential Air Force concerns about the route in this area, barring possible discussions referencing the overall cumulative effect of obstacles and avoidance areas on the route.

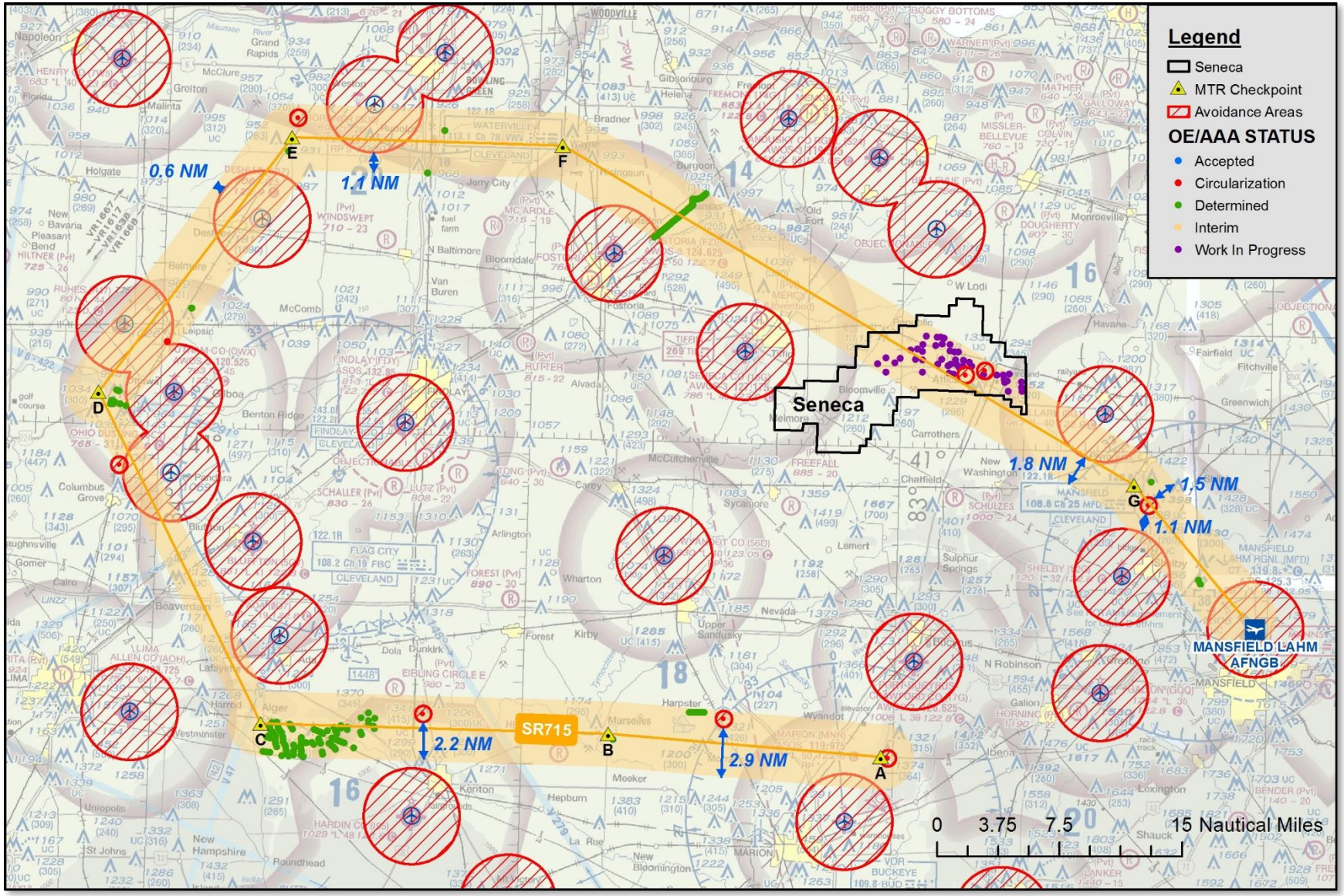

Figure 7: SR-715 Obstacles and Avoidance Areas (red hatched areas) with marked distances (blue – between obstacles) and OE/AAA Status of other proposed obstacles within the route

Conclusion

Three Mansfield Lahm Air National Guard Base military training routes overlie the Seneca wind project. Although impact on these routes and operations areas cannot result in determinations of hazard, it could result in military objections to proposed wind development. None of the possible mitigation areas preclude the Air Force from raising further objections to the current project area, and the Air Force may request a larger flyway by requesting the removal of additional turbine locations from the project area. For all the routes, the Air Force objections would most likely center on the impacts to multi-ship flight operations, especially if larger multi-engine aircraft are attempting to utilize the route. Many of the routes have extensive avoidance areas and obstacles. Military objections could include discussions based on the overall cumulative effect of obstacles on the usability of the route.

The overall Seneca project area impacts three MTR routes (***Figure 8***). In some areas, more than one route affects the project. The project area for wind development may work best for the military if it were divided into two sections, depending on any potential objections raised. While the proposed mitigation options may be acceptable to the Air Force, additional areas of concern could be noted.

The Air Force could request that the Seneca project remain on the western half of SR-708 in the area around point C to mitigate the usable route width in this area. Using available obstruction and avoidance area data, the eastern half of the route near point C is clear of obstacles such that the Air Force would likely request to keep it clear. This would also allow the Air Force to make the turn at point C with existing obstacles, and the wind turbines in view to the left of the aircraft during a left turn. By the project remaining west of the SR centerline near point C, the usable route width would be at least 2 NM in the eastern half of the route depending on the placement of wind turbines. A potential mitigation request by the Air Force could be to relocate or remove 11 turbines from the eastern section of the project area.

The Air Force could also request the Seneca project retain a usable flyway through the project area for SR-709 and SR-715. The project lies along SR-709 between points C and D, as well as SR-715 between points F and G. Points D and G (SR-709 and SR-715 respectively) are coincident meaning the routes are converging on this point. A possible solution to retaining a usable flyway could be the removal or relocation of turbines in the southern half of SR-715. This area also remains within the route boundaries of SR-709. Given the location of obstacles to the northwest of the project, as well as obstacles in the northern half of SR-715, this flyway flows with the route's direction and also provides a minimum 2 NM usable corridor – or half the MTR width at this location. A potential mitigation request by the Air Force could be to relocate or remove 7 turbines from this section of the project area.

Wind developers will likely receive a Notice of Presumed Risk to National Security when a project impacts an MTR or Special Use Airspace from the DoD Siting Clearinghouse (Clearinghouse). Capitol Airspace Group works with clients and the Clearinghouse to seek informal reviews as early as possible to identify potential compatibility concerns. Wind developers should request a preliminary review from the Clearinghouse in advance of filing an application with the Secretary of Transportation under Title 49 U.S.C., Section 44718.

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

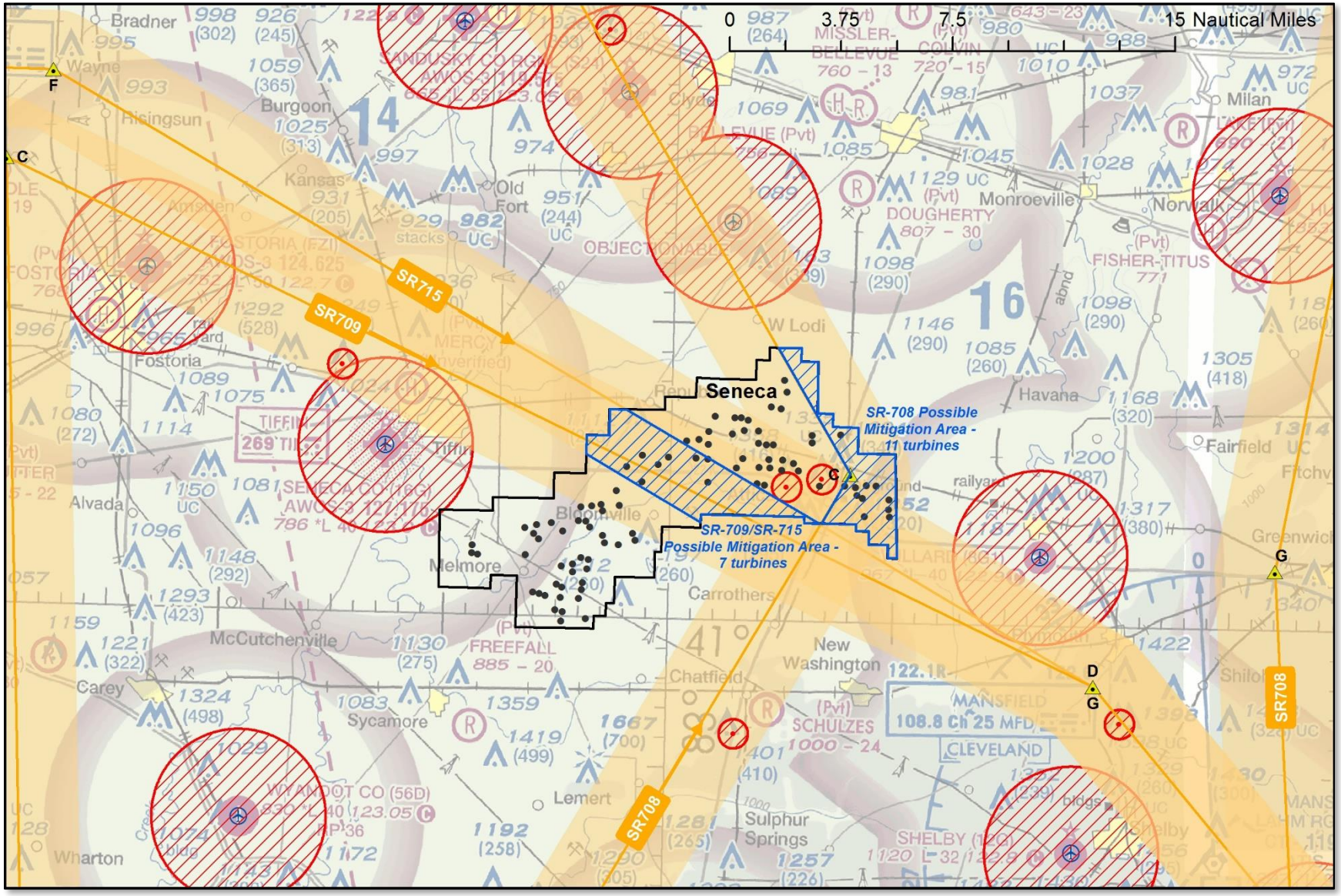
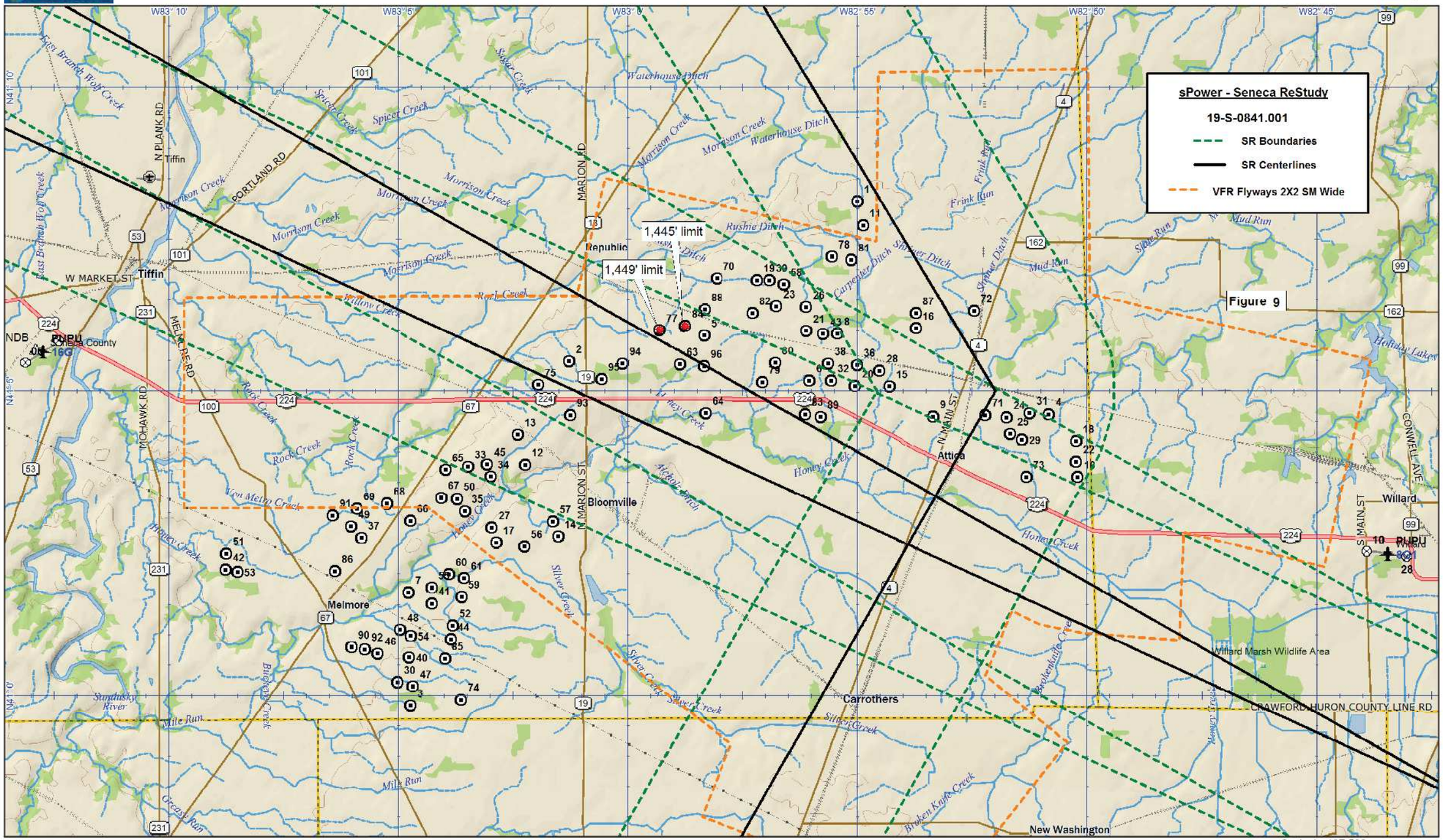


Figure 8: Seneca Wind Project with possible MTR mitigation areas (blue hatched areas)



sPower
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Common Acronyms and Abbreviations

1A Survey	A survey with horizontal +20 ft (6 m) and vertical +3 ft (1 m) accuracy
2C Survey	A survey with horizontal +50 ft (15 m) and vertical +20 ft (6 m) accuracy
AGL	Above Ground Level
AMSL	Above Mean Sea Level
ARP	Airport Reference Point
ARSR	Air Route Surveillance Radar
ARTCC	Air Route Traffic Control Center (Center)
ASI	Aviation Systems, Inc.
ASR	Airport Surveillance Radar
ATC	Air Traffic Control
CAT	Category
CFR	Code of Federal Regulations
DA	Decision Altitude
DHS	Department of Homeland Security
DME	Distance Measuring Equipment
DNH	Determination of No Hazard
DoD	Department of Defense
DOH	Determination of Hazard
EMI	Electromagnetic Interference
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulations
HP	Holding Pattern
IAP	Instrument Approach Procedures
ICA	Initial Climb Area
IFR	Instrument Flight Rules
ILS	Instrument Landing System
IMC	Instrument Meteorological Procedures
LNAV	Lateral Navigation
LPV	Localizer Performance with Vertical Guidance
LOC	Localizer Directional Aid
LoS	Line of Sight
LRR	Long Range Radar
MAH	Missed Approach Hold
MAP	Missed Approach Procedure
MDA	Minimum Descent Altitude
MEA	Minimum Enroute Altitude
MOA	Military Operations Areas
MOCA	Minimum Obstacle Clearance Altitude
MSA	Minimum Safe/Sector Altitude
MTR	Military Training Route
MVA	Minimum Vectoring Altitude
NAS	National Airspace System
NAVAID	Navigational Aid

NDB	Non-directional Beacon
NEH	Non-exceedance Height
NEXRAD	Next-Generation Radar (WSR-88D)
NM	Nautical Miles
NOAA	National Oceanic and Atmospheric Administration
NPH	Notice of Presumed Hazard
OCS	Obstacle Clearance Surface
PRI	Private Instrument Approach
PT	Procedure Turn
RAP	Radar Approach Procedure
RNAV	Area Navigation (GPS)
ROC	Required Obstacle Clearance
RWY	Runway
SFC	Surface
SID	Standard Instrument Departure
SM	Statute Mile
SR	Slow Speed Route
TAA	Terminal Arrival Area
TACAN	Tactical Air Navigation System
TPA	Traffic Pattern Airspace
TRACON	Terminal Radar Approach Control Facility
VFR	Visual Flight Rules
VNAV	Vertical Navigation
VOR	Very High Frequency Omnidirectional Range
WTG	Wind Turbine Generator

Executive Summary

As requested, ASI, has evaluated the feasibility of the Seneca Restudy Project, hereinafter referred to as the "Project," from an aviation and airspace point of view.

The goal of this analysis was to evaluate the regulatory compliance and potential impacts of wind turbines at heights of 453, 499, and 583 feet AGL. The FARs (14 CFR 77) requires structures that exceed 200 feet AGL to be submitted to the FAA for an aeronautical study to determine whether the structures may be a hazard (or not) to air navigation per 14 CFR §77.9.

The Project will impact military airspace assets; however, the FAA may not necessarily use this as a basis for an NPH for 453, 499, or 583 feet AGL wind turbines. The turbines will be in the LoS of FAA/DoD radar. See the sections infra on Military Airspace and Training Routes and Radar Systems Interference for more detail.

The Project impacts an approach into Seneca County Airport which limits Turbine 77 and Turbine 84. The limits are unlikely to be able to be mitigated. No other IAPs, including circling limits, impact the Project area.

There are no Departure, MVA or Enroute Airway limits on wind turbines in the Project area. See the sections infra on Departures, MVAs, and Enroute Airways for more detail.

This analysis did not consider EMI on communications or navigation systems.

Currently, Turbine 77 and Turbine 84 will penetrate an IAP and be limited to 1,449 and 1,445 feet AMSL, respectively (See red dots on attached Figure 9). The rest of the turbine layout does not penetrate any protected airspace but may exceed Obstruction Standards and Radar LoS, which would require a further study to be conducted by the FAA. Furthermore, turbines 9-13, 15-16, 18-26, 28-29, 31-34, 36, 38-39, 43, 45, 58, 63-64, 72-73, 75, 77-84, 87-89, and 93-96 penetrate SR routes and will require mitigation talks with the DoD.

Basic Project Information

We reviewed the Project against Federal aviation and airspace criteria set forth in:

- FAR Part 77 (14 CFR 77), the *Safe, Efficient Use and Preservation of the Navigable Airspace;*
- FAA Order 8260.3D, the *United States Standard for Terminal Instrument Procedures* (referred to as TERPs);
- FAA Order 8260.58A Change 1 & 2, the *United States Standard for Performance Based Navigation (PBN) Instrument Procedure Design;*
- FAA Order JO 7400.2L, the *Procedures for Handling Airspace Matters;*
- FAA Order 7610.4, *Special Military Operations;*
- DoD Flight Information Publication AP/IB, *Military Training Routes, North and South America*; and
- FAR Part 95 (14 CFR Part 95), Subpart B, *Designated Mountainous Areas.*

The criteria in these documents comprise the factors the FAA will use in evaluating the aeronautical compatibility and regulatory compliance of the Project when it is submitted for their official regulatory review under FAR Part 77 as specified in Title 49 U.S. Code Section 44718.

Our task was to apply those criteria and determine the airspace regulatory feasibility of wind turbines at 453, 499, and 583 feet AGL proposed in an area of approximately 91 NM^2 or about 77,126 acres in Seneca County, Ohio. Please see Figure 1 depicting the Project boundaries and surrounding area in the regional setting.

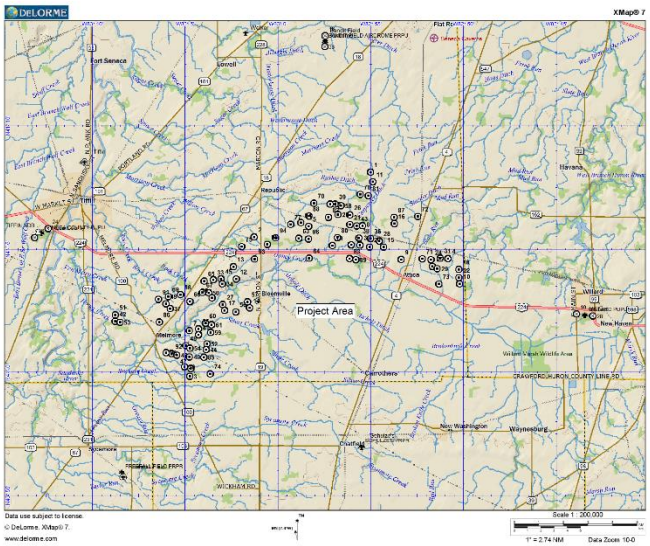


Figure 1: Regional Setting

Terrain within the Project area varies from approximately 787 feet AMSL to 972 feet AMSL. With proposed overall turbine heights of 453, 499, and 583 feet AGL, the highest point of the Project could theoretically be 1,555 feet AMSL. A 45-foot buffer is added for terrain variations and to establish the "Target Height"[1] of 1,600 feet AMSL.

The nearest public-use airport subject to the Federal regulatory criteria above is Bandit Field Airdrome (FAA Identifier: 5D9) located 9.36 NM north of the Project center point and is 4.95 NM from the Project's northern boundary. 5D9 is a Visual Flight Rules (VFR) airport with one turf runway (18/36), two based aircraft, and approximately 164 annual operations.

There are 24 other regional public and private-use facilities subject to the Federal regulatory criteria which were also evaluated for effect (See Table 1).

Table 1: Regional Public-Use Facilities

Airport	Distance (NM)	Direction	Approaches
Shelby Community Airport (12G)	17.56	SE	VOR-A
Fremont Airport (14G)	17.51	NW	RNAV (GPS) RWY 09
Seneca County Airport (16G)	9.93	W	RNAV (GPS) RWYs 06 & 24; VOR RWY 06; NDB RWY 24
Port Bucyrus-Crawford County Airport (17G)	16.87	S	RNAV (GPS) RWYs 04 & 22; VOR RWY 22
Morrow County Airport (4I9)	33.09	S	VOR-A
Wyandot County Airport (56D)	18.16	SW	VOR-A
Norwalk-Huron County Airport (5A1)	22.27	NE	RNAV (GPS) RWY 28
Hinde Airport (88D)	26.68	NE	N/A VFR
Willard Airport (8G1)	11.86	E	VOR-A
Findlay Airport (FDY)	30.53	W	RNAV (GPS) RWYs 07, 18, 25, & 36; VOR RWY 07

[1]The "Target Height" is not an official FAA vertical limitation but, rather, an in-house artificial convention used to limit the analysis to only relevant and material factors which might influence building heights and FAA approvability. In simple terms, if you do not exceed the "Target Height" your structures should have no FAA FAR Part 77 operational airspace issues.

Fostoria Metropolitan Airport (FZI)	19.28	W	RNAV (GPS) RWYs 09 & 27; VOR-A
Galion Municipal Airport (GQQ)	22.34	SE	RNAV (GPS) RWYs 05 & 23; VOR RWY 23
Ortner Airport (I64)	30.88	NE	N/A VFR
Mansfield Lahm Regional Airport (MFD)	26.14	SE	ILS OR LOC RWY 32; RNAV (GPS) RWYs 05, 14, 23, & 32; HI-VOR/DME OR TACAN RWY 14; VOR RWYs 14 & 32; NDB RWY 32; RAP
Marion Municipal Airport (MNN)	26.98	S	RNAV (GPS) RWYs 07, 13 & 25; LOC/DME RWY 25; VOR-A
Erie-Ottawa International Airport (PCW)	27.16	N	RNAV (GPS) RWYs 09 & 27; NDB RWY 27
Sandusky County Regional Airport (S24)	13.74	N	RNAV (GPS) RWYs 06 & 24
Samaritan Hospital Heliport (5OH1)	33.42	E	Copter RNAV (GPS) 22
Bellevue Hospital Heliport (4OH9)	14.21	N	Copter RNAV (GPS) 22
Fostoria Community Hospital Heliport (99OI)	20.44	W	Copter RNAV (GPS) 10 & 94
Memorial Hospital Heliport (OI79)	17.62	N	Copter RNAV (GPS) 09
Fisher-Titus Medical Center Heliport (OH08)	19.89	NE	Copter RNAV (GPS) 04
Magruder Memorial Heliport (2OH1)	26.50	N	Copter RNAV (GPS) 01
Firelands Community Hospital Nr 2 Heliport (OI87)	26.06	NE	Copter RNAV (GPS) 10

Analytical Findings

Part 77 Imaginary Surfaces

In 14 CFR §77.19 Imaginary Surfaces are defined as those which have a relationship to an airport and to each of its runways. The dimensions of each category of Imaginary Surface are based on the type of approach available or planned. Exceeding an Imaginary Surface does not automatically mean a DOH will be issued from the FAA. That outcome depends on other airspace factors as well, but it does trigger more in-depth scrutiny. The Project does not impact any Imaginary Surfaces.

TPA

TPA is used for VFR maneuvering by pilots in the area surrounding an airport. The dimensions of the TPA are based on the category of aircraft operating at the field and their approach speeds to the runways. In addition to approach speed, other factors such as: weight bearing capacity, runway surface type, and runway length are also considered. Be advised for any given airport, the FAA may apply a Traffic Pattern category that may not necessarily represent the type of traffic the airport receives, but the airport must be protected using that criteria. The Project does not impact any TPA.

Enroute Airways

In the NAS, there are both High Altitude Enroute Airways and Low Altitude Enroute Airways separated at 18,000 feet AMSL and are eight NM wide. In this evaluation, we are only concerned with Low Altitude Enroute Airways (known as Victor Airways). These airways are used by pilots to navigate between VOR NAVAIDs. The FAA publishes minimum altitudes for the 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 terrain areas and normally 2,000 feet in mountainous areas. These areas are delineated in 14 CFR Part 95, Subpart B. The Project falls within the non-mountainous area.

The Project will not impact any Victor Airways (See Figure 2).

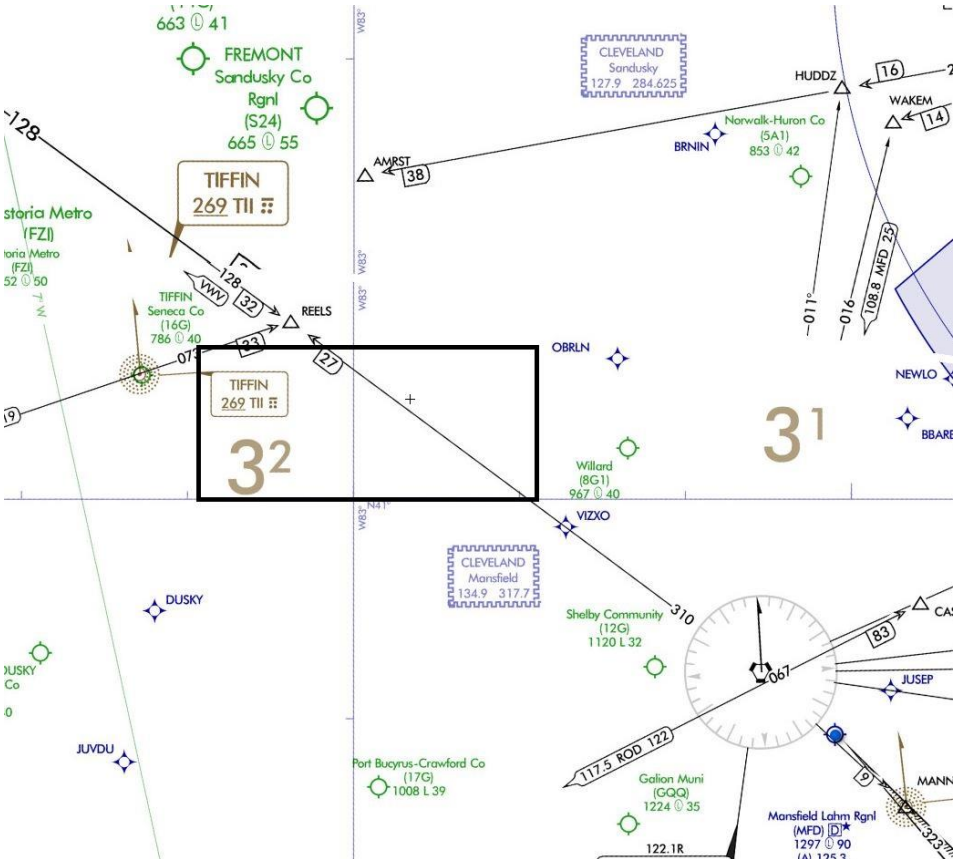


Figure 2: En-Route Chart

MVAs

MVAs are the lowest altitude clearances that may be assigned by ATC to pilots during vectoring or direct routing. These altitudes in an MVA chart depiction are broken up into sectors and encompass a 60 NM radial area around a radar station. There is a three NM buffer area around each sector within 40 NM of the station and a five NM buffer area around each sector beyond 40 NM.

The MVAs for all six ASRs in the area are above the Target Height.

- The MVAs for Detroit TRACON (D21), Canton-Akron (CAK), Columbus (CMH), Cleveland (CLE), Mansfield (MFD), and Toledo (TOL) in the Project area are all 3,000 feet AMSL. The standard ROC in non-mountainous terrain is 1,000 feet bringing the protected level to 2,000 feet AMSL. The Project area is below or outside the MVA sectors and will not be impacted by any MVAs (See attached MVA figures).

Radar Systems Interference

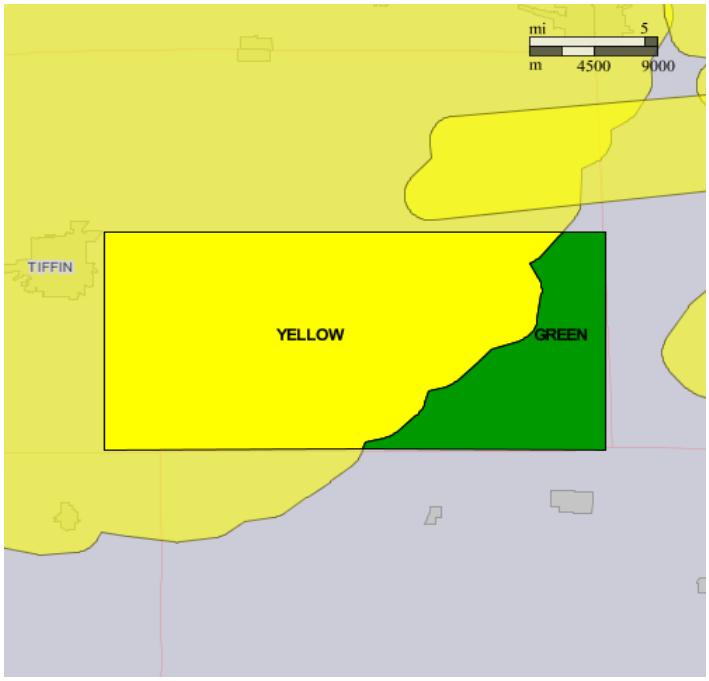
The DoD Screening Tool and LoS calculations indicate that areas of the Project are visible to FAA/DoD LRR (See Figures 3 and 3a). There are six ASRs within 75 NM and three ARSRs within 80 NM of the Project (See Table 2) and only MFD has a LoS to the Project. An in-depth FAA radar impact study after filing may be required.

The Project will not impact NEXRAD weather radar (See Figure 4). Further weather radar study is not necessary.

Table 2: ASR and ARSR Regional Radar Stations

Name	Type	Distance (NM)	Direction	MVA Sector (ft AMSL)
D21	ASR	71.79	N	I 3,000
CAK	ASR	70.69	E	H 3,000
CLE	ASR	55.19	E	H 3,000
CMH	ASR	64.16	S	K 3,000
MFD	ASR	26.01	SE	B 3,000
TOL	ASR	48.02	NW	A 3,000
Canton-Detroit (QDT)	ARSR	75.72	N	N/A
Brecksville-Cleveland (QDB)	ARSR	60.69	E	N/A
London (QWO)	ARSR	76.65	S	N/A

Figure 3: LRR Screening Tool



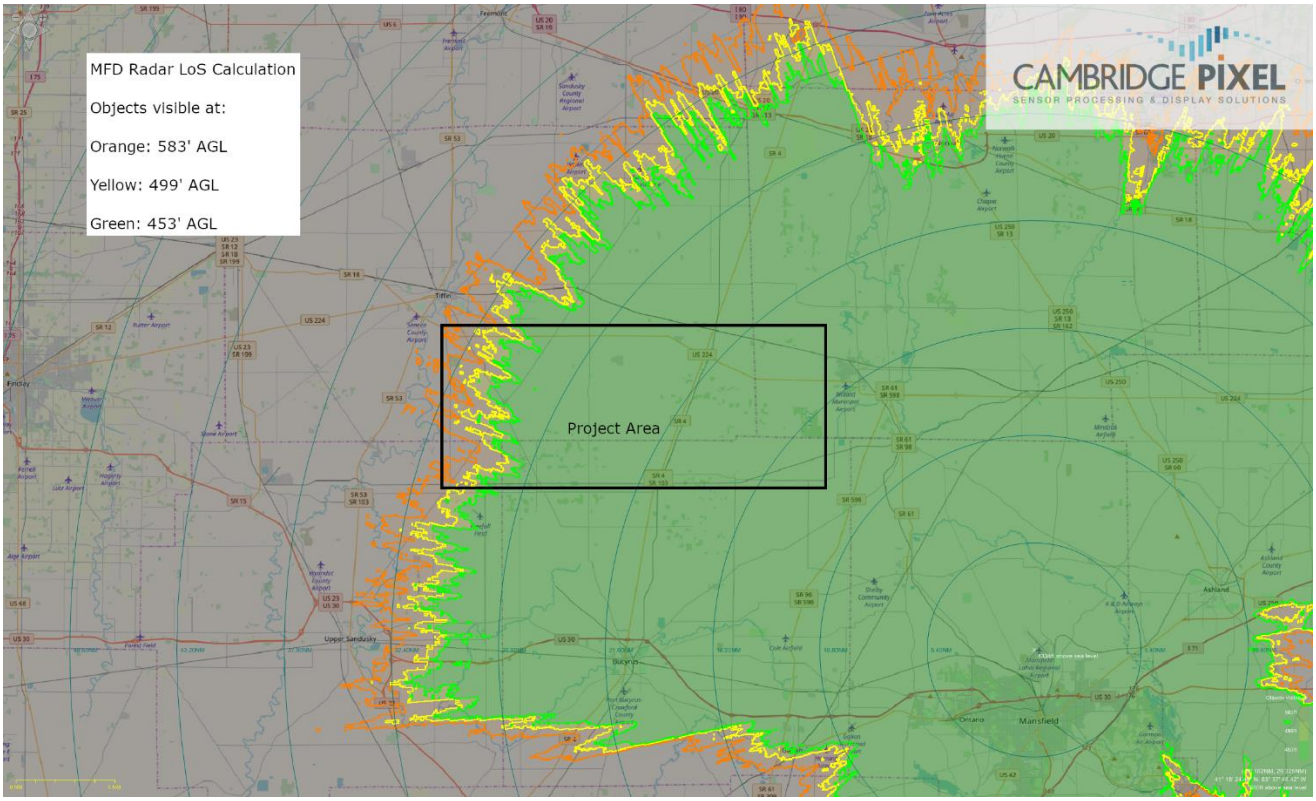
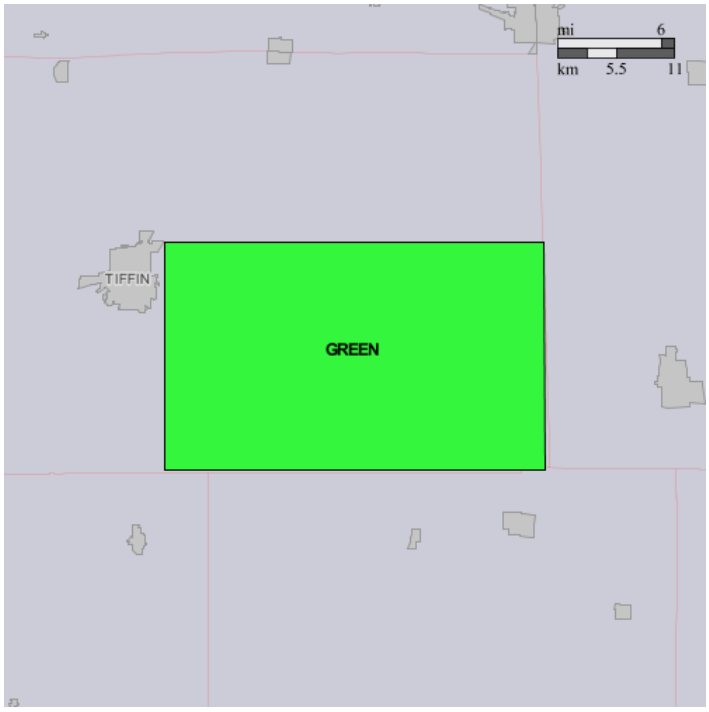


Figure 3a: MFD Radar LoS Calculation

Figure 4: NEXRAD Screening Tool



Military Airspace and Training Routes

The MTR Program is a joint venture by the FAA and the DoD, developed for use by military aircraft to gain and maintain proficiency in tactical “low level” flying. These low-level training routes are generally established below 10,000 feet AMSL for speeds in excess of 250 knots to accommodate both VFR and IFR. Visual MTRs (VRs) are generally designed to be flown below 1,500 feet AGL while Instrument MTRs (IRs) are designed to be flown above 1,500 feet AGL. SR routes, or slow speed routes, are flown at or below 1,500 feet AGL at speeds of 250 knots or less and are commonly used to practice bombing runs. The Project will impact three SR Routes but no other military airspace such as MOAs, Restricted Airspace, or MTRs (See Table 3 Figure 5, and Attached Figure 9).

Table 3: SR Routes

Name	Type	Operating Floor	Width (NM)	Travel Direction
SR708	SR	500’ AGL	2X2	N-NW
SR709	SR	500’ AGL	2X2	SE-NW
SR715	SR	500’ AGL	2X2	SE-NW

Turbines 9-13, 15-16, 18-26, 28-29, 31-34, 36, 38-39, 43, 45, 58, 63-64, 72-73, 75, 77-84, 87-89, and 93-96 penetrate SR routes and will require mitigation talks with the DoD.

Per FAA Order JO 7400.2L sections 6-3-8 (c)(3) and 6-3-9 (d)(4), a proposed structure’s location on a SR or MTR is not a basis for determining it to be a Hazard to Air Navigation. However, the FAA submits proposed projects to the DoD Siting Clearinghouse for review and the military may object to the Project’s impact on their training mission sustainability arising from the turbine locations and/or the effect on their SR or MTRs operational floors. In such situations, attempts are made to find a middle ground between the military’s need to protect their airspace assets and the proponent’s interest in the project. This step, if at all necessary, will be taken if and when the project is submitted to the FAA for review, with detailed turbine locations and heights.

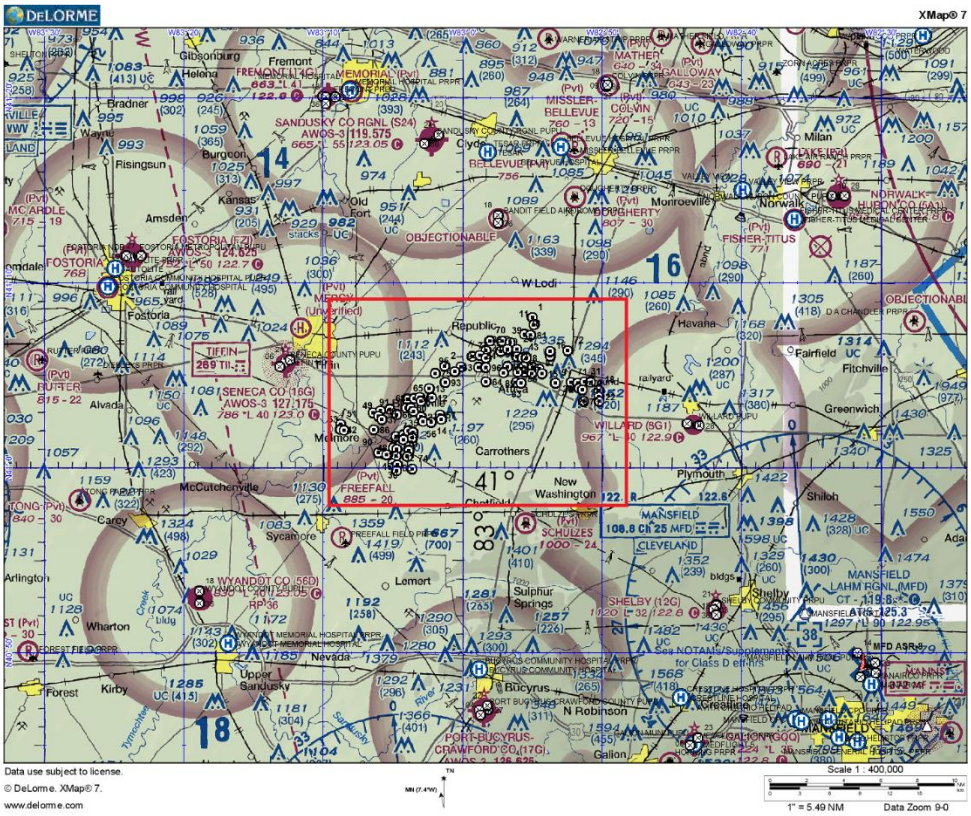


Figure 5: VFR Sectional Chart

IAPs

IAPs are used by pilots to land at airports during periods of IMC, i.e., when there is reduced visibility and low cloud ceilings. ASI analyzed 51 IAPs as part of this evaluation (See Table 1).

The RNAV (GPS) Approach into Runway 27 at FZI overlies several turbines in the southwest of the Project layout. There is a Feeder Route at 2,600 feet AMSL which has a ROC of 1,000 feet and an OCS of 1,600 feet AMSL, which is above any turbines in the Project (See Figure 6).

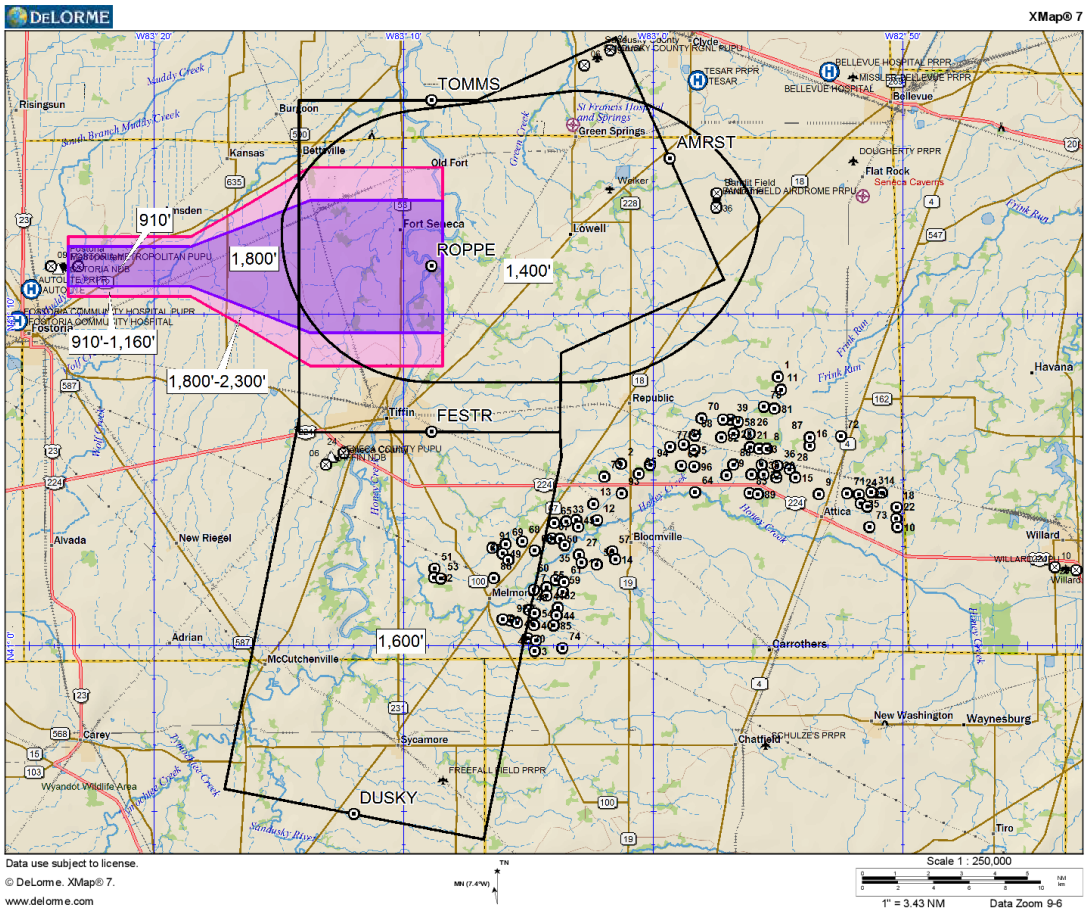


Figure 6: FZI RNAV (GPS) RWY 27 Approach

The RNAV (GPS) 24 approach overlies only Turbine 1 and the Protected OCS at 1,400 feet AMSL is above the total height of the Turbine (See Figure 7).

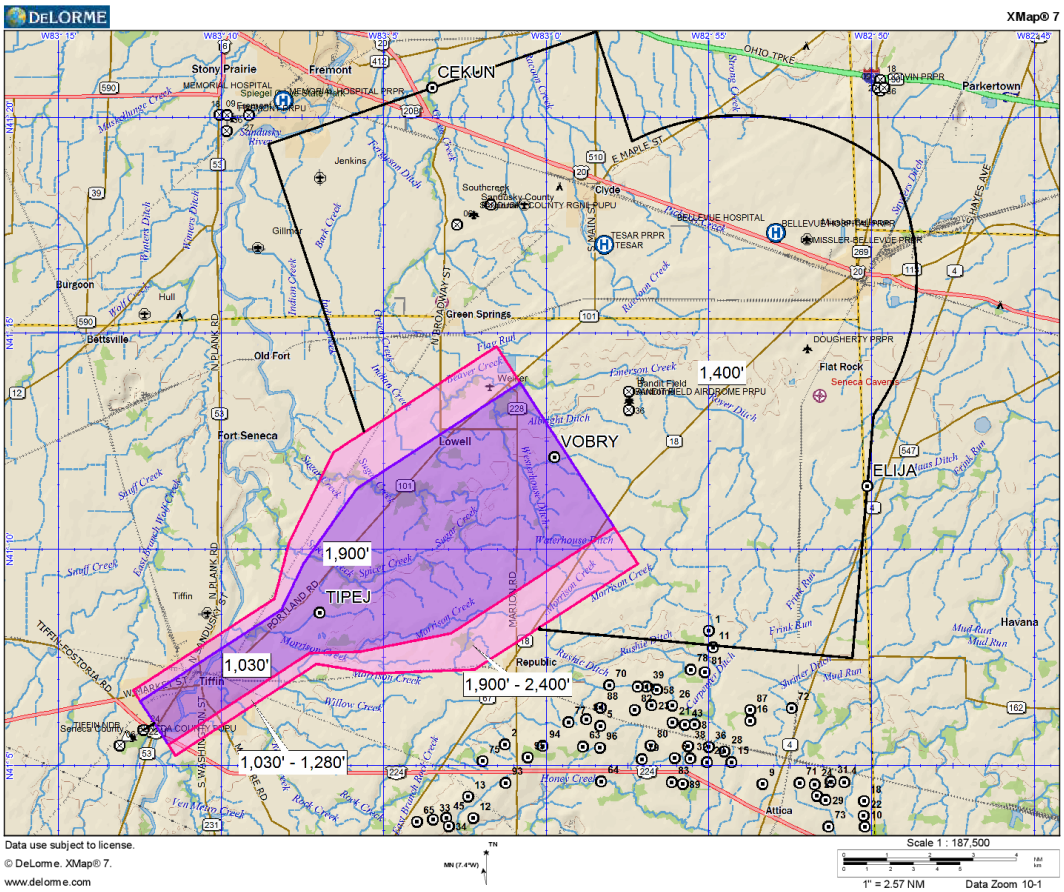


Figure 7: 16G RNAV (GPS) RWY 24 Approach

The NDB approach into Runway 24 at 16G impacts the Project area. Part of the final approach segment overlies Turbines 77 and 84 and will limit them to 1,449 and 1,445 feet AMSL, respectively. The table below depicts the limits to the approach (See Table 4 and Figure 8).

Table 4: 16G NDB RWY 24 Approach Limits

Criteria	Area	Final Minimums (ft AMSL)	ROC (ft)	OCS (ft AMSL)	Ground Limit 453 (ft AMSL)	Ground Limit 499 (ft AMSL)	Ground Limit 583 (ft AMSL)
Straight-in 24	Primary	1,460	350	1,110	657	611	527
Straight-in 24	Secondary	1,460	Varies	1,110-1,460	657-1,007	611-961	527-877
Circling	N/A	1,460	300	1,160	707	661	577

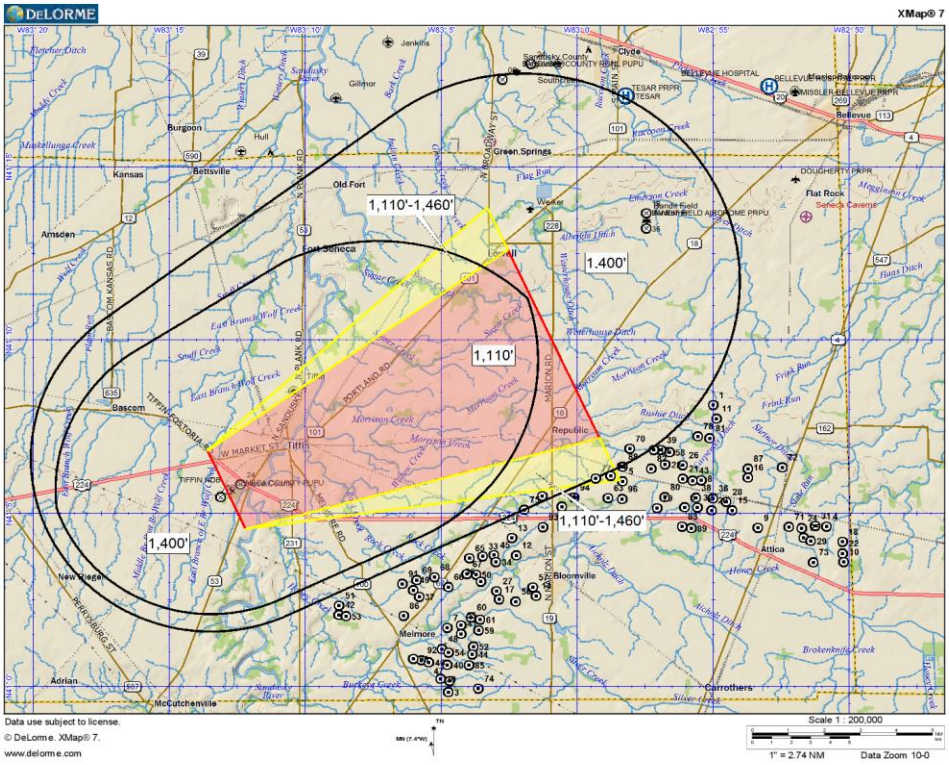


Figure 8: 16G NDB RWY 24 Approach

Approach Circling Areas

IAPs may include Approach Circling Minimums; however, there are none that impact the Project.

IFR and VFR Departure

The FAA protects aircraft from obstacles and terrain on departure, whether they are using VFR or IFR. Instrument departures usually have prescribed procedures either charted in a SID or a standard/accelerated climb to an altitude. Visual departures have more directional flexibility but are constrained by specific ceiling and visibility minima requirements and the “see and avoid” practice of FAR Part 91 §91.113. The IFR diverse departure has a 40:1 slope that is measured from the edge of the ICA trapezoid out to the end of the departure. The VFR departure is incorporated inside of the TPA of the airport. The Project is not impacted by instrument or visual departures.

VFR Flyways

A VFR Flyway is four SM wide, centered on a geographic landmark, i.e., highways, railroads, rivers, powerlines, canals, radials of a VOR NAVAID, Enroute Airways, and other man-made structures. The FAA will determine the potential for adverse impact, if any, upon VFR flights by structures sited within any possible Flyways that exceed the 499 feet AGL threshold. Depending on the activity level along the route, the FAA could declare the proposed structures sited within a VFR Flyway to be a potential hazard or perhaps an actual hazard to air navigation.

Conclusion

The results of this analysis indicate that an FAA aeronautical study will likely identify the following airspace impacts resulting from the proposed 453, 499, and 583-foot AGL wind turbines:

- **Imaginary Surfaces:** The Project lies outside of any Imaginary Surfaces.

- **Enroute Airways:** The Project will not impact any Enroute Airways (See Figure 2).

- **Minimum Vectoring Altitude Sectors:** The Project lies below all MVA sectors in the area.

- **Military Airspace:** There are 3 SR Routes that overlie most of the project area which will require mitigation with the DoD (See Table 3 and Figure 5).

- **Traffic Pattern Airspace:** The Project does not impact any TPA.

- **Instrument Departures:** The Project does not impact any departure procedures.

- **Instrument Approach Procedures:** Seneca County Airport has one approach that impacts the Project area. The MDA will prevent construction in certain areas on the approach course (See Figure 8).

- **Approach Circling Areas:** There are no Approach Circling Areas that impact the Project.

- **Radar Line of Sight:** The Project area is in LoS of one ASR which could trigger extended studies delaying the process and result in Determinations of Hazard (See Table 2 and Figures 3 and 3a).

- **VFR Flyways:** The FAA will determine the potential adverse impact, if any, of any possible VFR Flyways within the Project area.

- If the FAA determines that one impact or the cumulative impacts constitute a substantial adverse effect, that conclusion could be used as the basis for DOHs. In that event, for the Project to proceed, mitigation options will have to be identified, approved, and implemented. Be advised that all mitigation options are subject to FAA approval, which is not guaranteed.

- Ohio has enacted the Ohio Airport Protection Act which protects the horizontal, conical, primary, approach and transitional surfaces of airports. There is a Power Siting Board which has permitting authority over the construction or reconstruction of electric generating facilities including wind farms over 200 feet AGL and with the capacity of 50MW or more.

Cautionary Notes

- The FAA makes changes to the National Airspace System every day. New approaches are published, departure procedures are changed, new runways are planned, MVAs are modified, etc. Consequently, it is possible for the study findings to become obsolete in a relatively short time. We recommend the study findings be reviewed for currency before filing sites within the study area. Studies older than 12 months should automatically be re-visited, and their findings confirmed.

- While Federal requirements take precedence, local requirements for tall structures may still exist within the county and the municipality in addition to the Federal regulations. Furthermore, there may also be local zoning ordinances adopted at nearby airports. It is highly advisable to contact the specific county and/or city the turbines are in for any special requirements before construction.

- Furthermore, study findings are intended as a planning tool in conjunction with the resolution of other pertinent issues. Actual construction activities are not advisable until DNHs are issued for any structures that require filing.

- During the aeronautical study process, the FAA may request a certified survey with an accuracy of either 1A or 2C for mitigation. Those must be provided to receive DNHs.

- Approximate study times from the FAA filing are: Initial review 30-90 days. If Further Study (which includes a Public Comment period, if necessary) is required: an additional 60 days, with a possibility of more.

- 14 CFR 77.17 (a) states that: An existing object, including a mobile object, is, and a future object would be an obstruction to air navigation if it is of greater height than any of the following heights or surfaces:

    1) A height of 499 feet AGL at the site of the object. Any object that exceeds 499 feet AGL will exceed the Obstruction Standard and receive a NPH and may be circularized via public notice. It will require a further study requested from the FAA.

    2) A height that is 200 feet AGL, or above the established airport elevation, whichever is higher, within three NM of the established ARP, excluding heliports, with its longest runway more than 3,200 feet in actual length, and that height increases in the proportion of 100 feet for each additional NM from the airport up to a maximum of 499 feet at six or more NM is in exceedance of the Obstruction Standard and will receive a NPH and could require a further study requested from the FAA.

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Summary: Public Comment (documents regarding aviation and airspace analysis) electronically filed by Mr. Matt Butler on behalf of Mr. Chris Aichholz