

Wind Power GeoPlanner™

Microwave Study

Hoffman Falls



Prepared on Behalf of
Liberty Renewables Inc.

September 4, 2024



Table of Contents

1. Introduction	- 1 -
2. Project Overview	- 1 -
3. Two-Dimensional Fresnel Zone Analysis	- 2 -
4. Cross Sectional Analysis	- 7 -
5. Conclusion	- 8 -
6. Contact	- 8 -
Appendix: Turbine Locations	- 9 -

1. Introduction

Microwave bands that may be affected by the installation of wind turbine facilities operate over a wide frequency range (900 MHz – 23 GHz). Comsearch has developed and maintains comprehensive technical databases containing information on licensed microwave networks throughout the United States. These systems are the telecommunication backbone of the country, providing long-distance and local telephone service, backhaul for cellular and personal communication service, data interconnects for mainframe computers and the Internet, network controls for utilities and railroads, and various video services. This report focuses on the potential impact of wind turbines on licensed, proposed and applied non-federal government microwave systems.

2. Project Overview

Project Information

Name: Hoffman Falls

County: Madison

State: New York

Number of Turbines: 24

Blade Diameter: 158 meters

Hub Height: 117 meters



Figure 1: Area of Interest (AOI)

3. Two-Dimensional Fresnel Zone Analysis

Methodology

Our obstruction analysis was performed using Comsearch's proprietary microwave database, which contains all non-government licensed, proposed and applied paths from 0.9 - 23 GHz¹. First, we determined all microwave paths that intersect the AOI² defined as the area with a minimum of a 2-mile buffer from all turbine locations and listed them in Table 1. These paths and the area of interest that encompasses the planned turbine locations with a minimum 2-mile buffer are shown in Figures 2, 3 and 4.

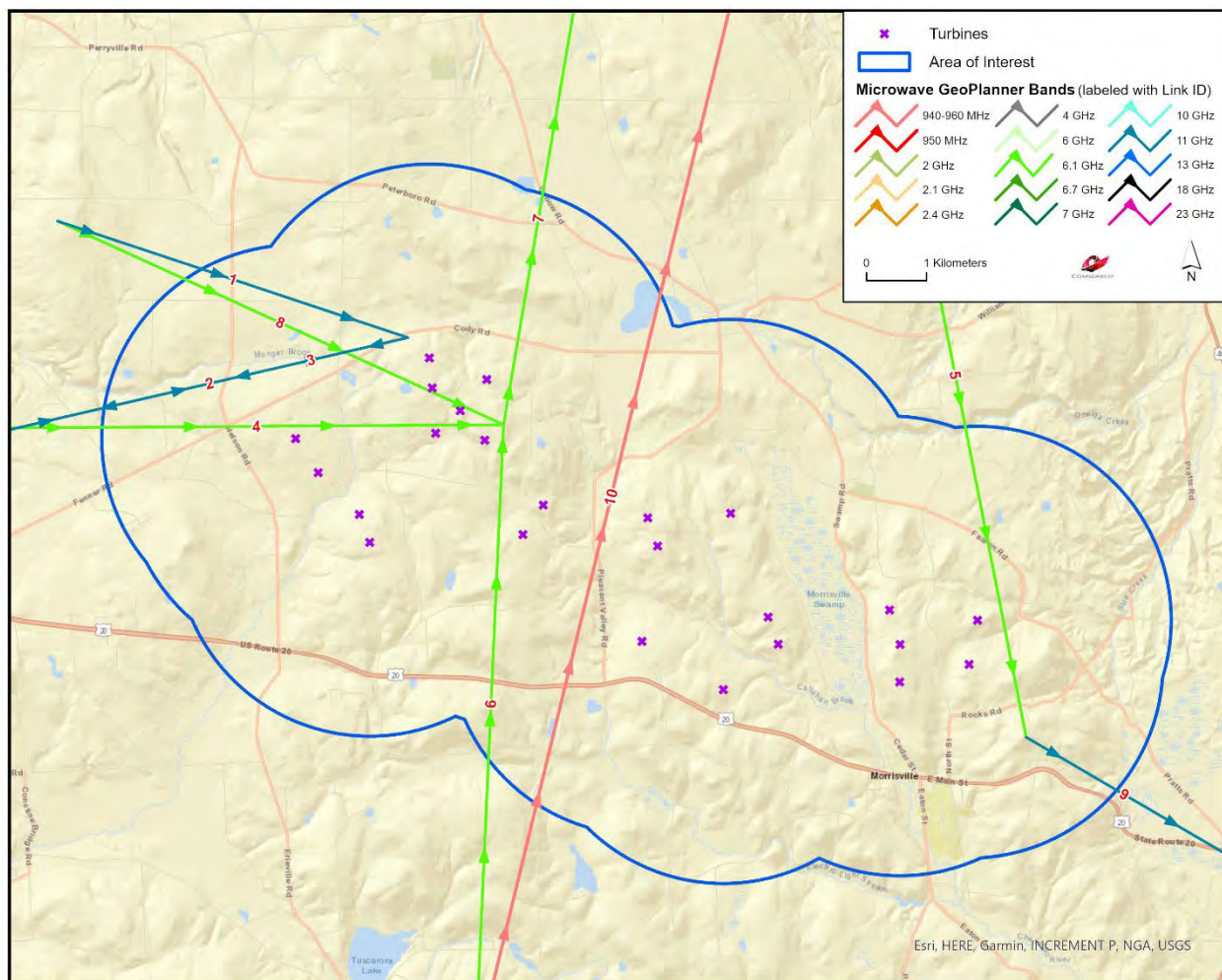


Figure 2: Microwave Paths that Intersect the AOI

¹ Please note that this analysis does not include unlicensed microwave paths or federal government paths that are not registered with the FCC.

² We use FCC-licensed coordinates to determine which paths intersect the area of interest. It is possible that as-built coordinates may differ slightly from those on the FCC license.

ID	Status	Callsign 1	Callsign 2	Band	Path Length (km)	Licensee
1	Licensed	WQZA455	WQZA456	11 GHz	6.14	Conterra Ultra Broadband, LLC
2	Licensed	WQGG694	WQGP490	11 GHz	11.26	Cellco Partnership - (W-NY)
3	Licensed	WQGP490	WQGG694	11 GHz	11.26	Cellco Partnership - (W-NY)
4	Licensed	WQNH518	WQNH560	6.1 GHz	23.88	Madison, County Of
5	Licensed	WQNH536	WQNH563	6.1 GHz	15.39	Madison, County Of
6	Licensed	WQNH559	WQNH560	6.1 GHz	9.99	Madison, County Of
7	Licensed	WQNH560	WQNH547	6.1 GHz	14.52	Madison, County Of
8	Licensed	WQNH561	WQNH560	6.1 GHz	8.15	Madison, County Of
9	Licensed	WQNH563	WQNH550	11 GHz	7.98	Madison, County Of
10	Licensed	WQBX986	WQCB227	940-960 MHz	95.51	New York, State of

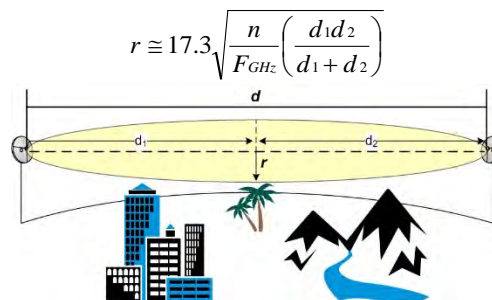
Table 1: Summary of Microwave Paths that Intersect the AOI

(See enclosed mw_geopl.xlsx for more information and
GP_dict_matrix_description.xls for detailed field descriptions)

Verification of Coordinate Accuracy

It is possible that as-built coordinates may differ from those on the FCC license. For this project, nine of these paths cross within close proximity of the proposed turbines and the tower locations for these paths will have a critical impact on the result. Therefore, we verified these locations using aerial photography. Some of the towers were found to be slightly off and were moved to their locations based on the aerial photos³.

Next, we calculated a Fresnel Zone for each path based on the following formula:



Where,

- r = Fresnel Zone radius at a specific point in the microwave path, meters
- n = Fresnel Zone number, 1
- F_{GHz} = Frequency of microwave system, GHz
- d₁ = Distance from antenna 1 to a specific point in the microwave path, kilometers
- d₂ = Distance from antenna 2 to a specific point in the microwave path, kilometers

³ See enclosed mw_geopl.shp (adjusted locations based on aerial photography/basis for report images and results) and mw_geopl_fcc.shp (locations solely based on FCC licensed information) for details.

In general, this is the area where the planned wind turbines should be avoided, if possible. Likewise, Comsearch recommends that an area directly in front of each microwave antenna should be avoided. This corresponds to the Consultation Zone which measures 1 kilometer along the main beam of the antenna and 24 ft (7.3 meters) wide. A depiction of the Fresnel Zones and Consultation Zones for each microwave path listed can be found in Figures 3 and 4, and is also included in the enclosed shapefiles^{4,5}.

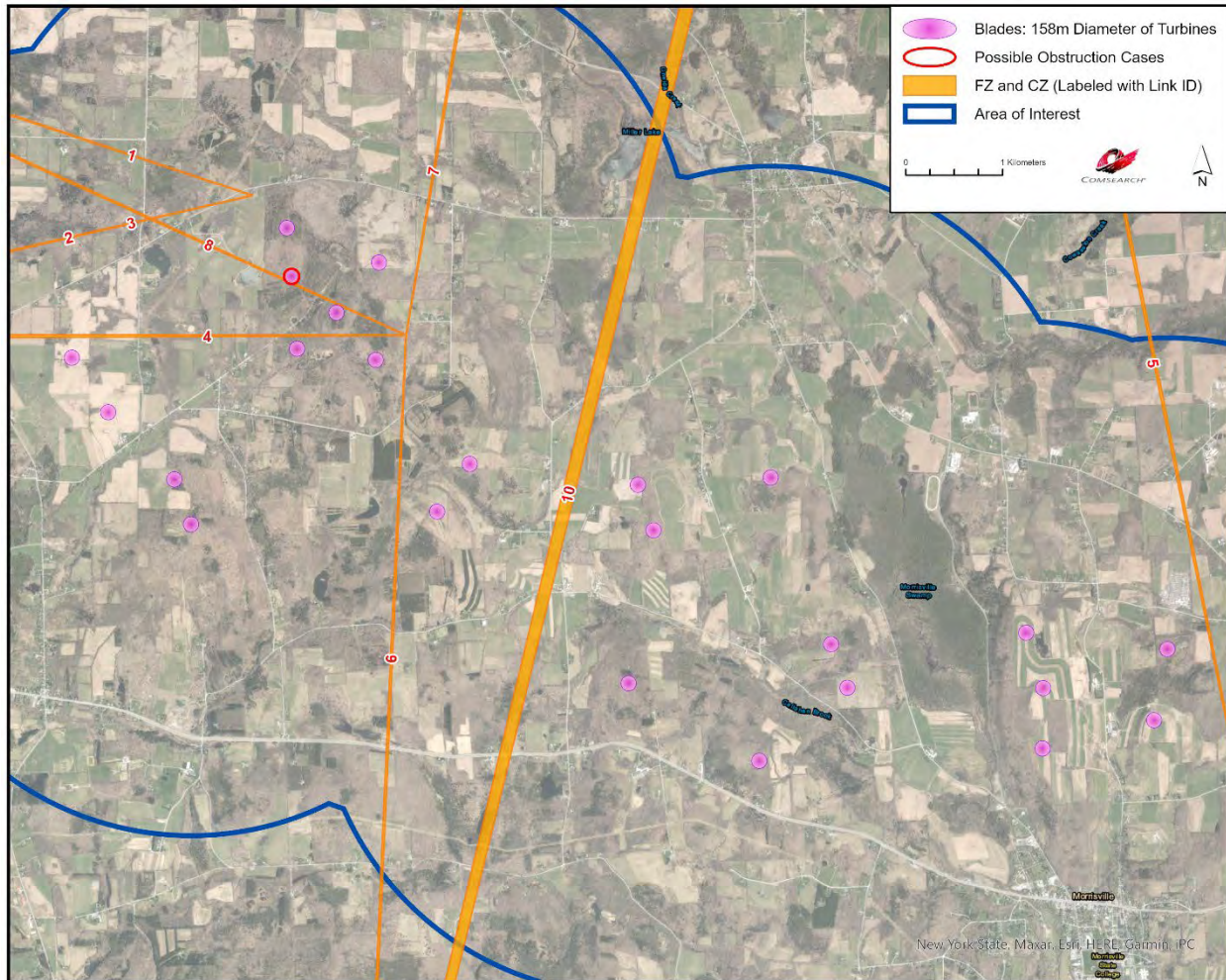


Figure 3: Fresnel Zones and Consultation Zones in the Area of Interest

⁴ The ESRI® shapefiles enclosed are in NAD 83 UTM Zone 18 projected coordinate system.

⁵ Comsearch makes no warranty as to the accuracy of the data included in this report beyond the date of the report. The data provided in this report is governed by Comsearch's data license notification and agreement located at http://www.comsearch.com/files/data_license.pdf.

Discussion of Potential Two Dimensional Obstructions

Total Microwave Paths	Paths with Affected Fresnel Zones	Total Turbines	Turbines Intersecting the 2D Fresnel Zones
10	1	24	1

Table 2: Fresnel Zone Analysis Result

For this project, twenty-four turbines were considered in the analysis, each with a blade diameter of 158 meters and turbine hub height of 117 meters. Of those turbines, one was found to intersect the Fresnel Zone of one microwave path. Figure 4 contains a detailed depiction of the potential obstruction scenario and Table 3 contains a summary of the affected turbine. A cross sectional analysis was performed in Section 4 to determine the diagonal clearance value for this case.

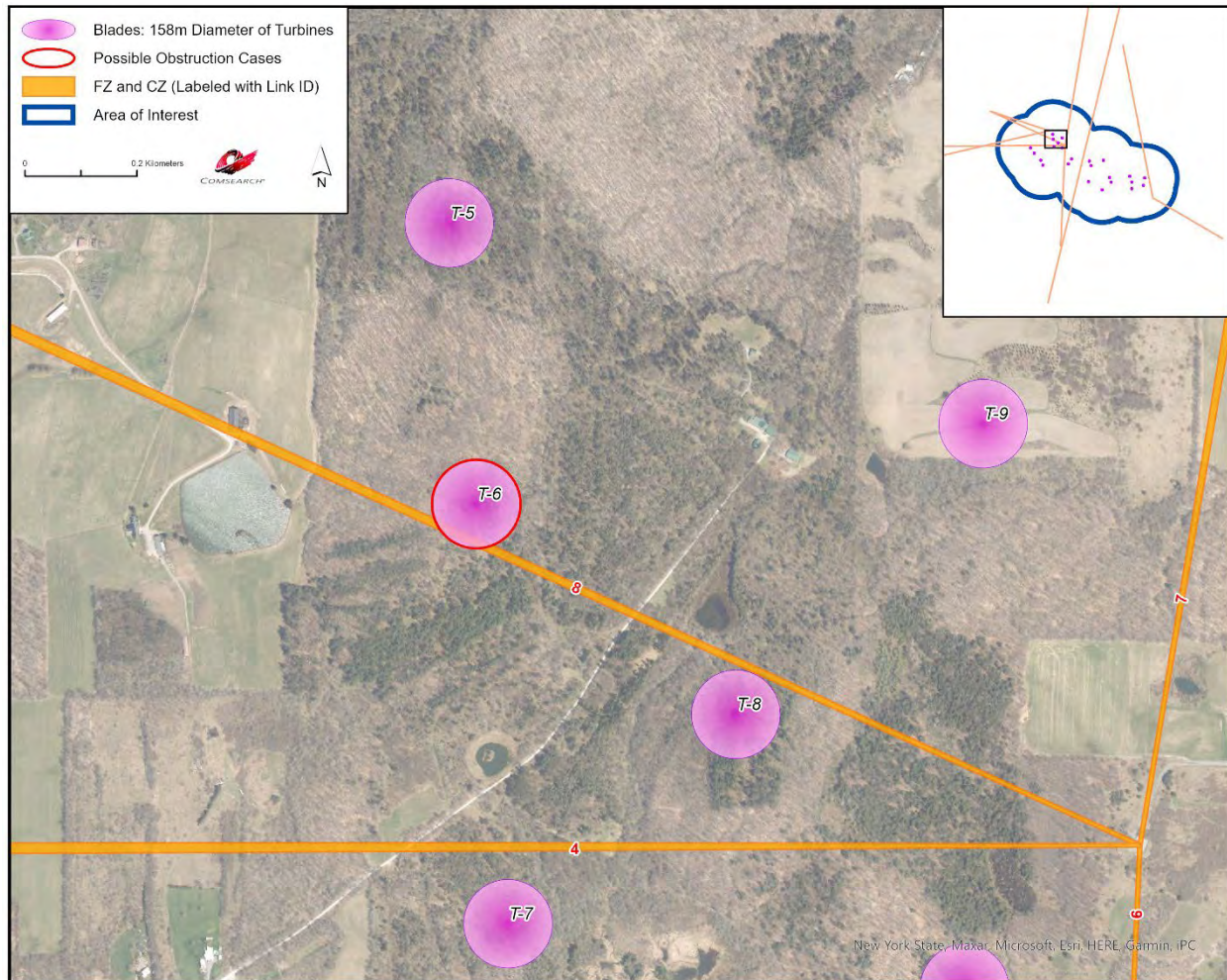


Figure 4: Potential Obstruction Cases

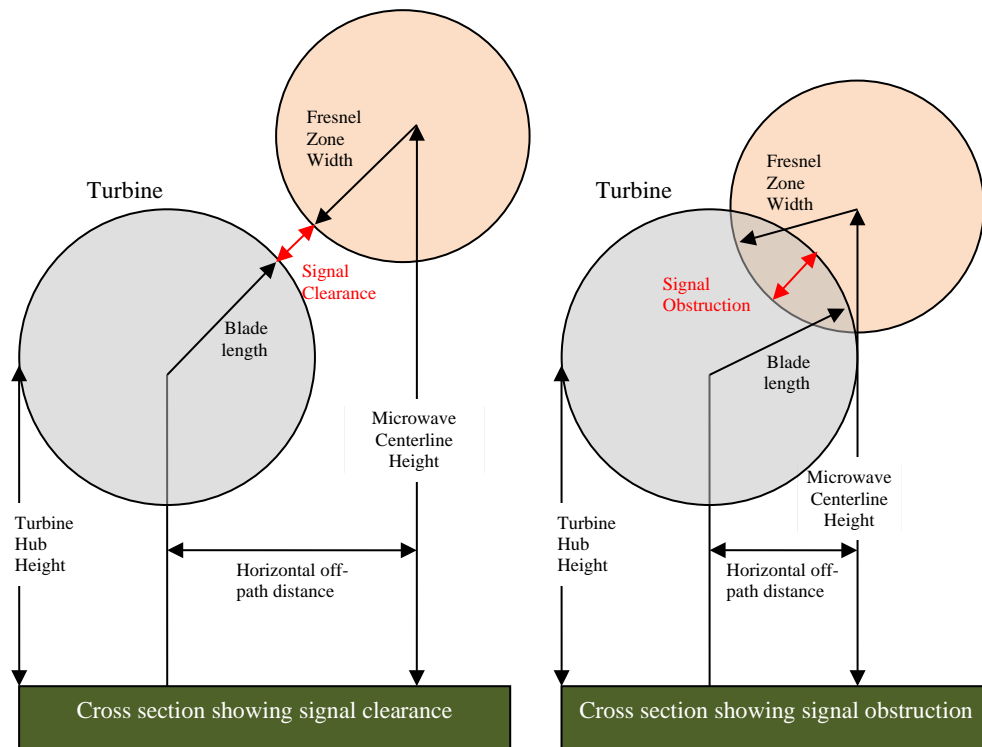
Turbine ID	Latitude (NAD83)	Longitude (NAD83)	Affected Microwave Path ID	Fresnel Zone Radius at Turbine Location (m)	Horizontal off-path Distance (m)	Distance along the path from site 1 (km)	Horizontal Clearance (m)
T-6	42.956522	-75.745822	8	7.34	61.99	6.82	-24.35

Table 3: Turbines that Intersect Fresnel Zones

4. Cross Sectional Analysis

Our Fresnel Zone analysis in the previous section identified one potential obstruction case that needs to be further examined from a cross sectional perspective. The case that will be analyzed in this section can be found in Table 3.

Our cross sectional analysis calculates the precise height and width of 100% of the first Fresnel Zone at the turbine location based on the antenna heights of the two link endpoints and the earth curvature bulge at the specific turbine location. The horizontal off-path distance was calculated in the previous section and the turbine hub height and blade length were provided by the client. The cross sectional analysis uses these values to calculate the clearance between the blades and the microwave Fresnel Zone as shown in the two diagrams below.



The results of the cross sectional calculations can be seen in Table 4. It shows positive clearance values indicating clearance of the Fresnel Zones.

Microwave Path ID	Fresnel Zone Radius at Turbine Location (m)	Microwave Centerline Height at Turbine Location (m)	Turbine ID	Hub Height (m)	Blade Length (m)	Cross Sectional Clearance (m)
8	7.34	34.40	T-6	117	79	16.93

Table 4: Cross Sectional Analysis Results

5. Conclusion

Our study identified ten microwave paths within the Hoffman Falls project area. The Fresnel Zones for these microwave paths were calculated and mapped. A total of twenty-four turbines were considered in the analysis, each with a blade diameter of 158 meters and a hub height of 117 meters. Of those turbines, none were found to have potential obstruction with the microwave systems in the area.

6. Contact

For questions or information regarding the Microwave Study, please contact:

Contact person: David Meyer
 Title: Senior Manager
 Company: Comsearch
 Address: 21515 Ridgetop Circle, Suite 300, Sterling, VA 20166
 Telephone: 703-726-5656
 Fax: 703-726-5595
 Email: David.Meyer@CommScope.com
 Web site: www.comsearch.com

Appendix: Turbine Locations

Turb Num	Longitude	Latitude	Ground Elevation (m)
T-1	-75.773543	42.948941	510.40
T-2	-75.768446	42.943972	485.36
T-3	-75.760450	42.937521	524.76
T-4	-75.758277	42.933364	553.54
T-5	-75.746466	42.961029	556.26
T-6	-75.745822	42.956522	563.11
T-7	-75.745046	42.949788	530.80
T-8	-75.740104	42.953183	558.83
T-9	-75.734756	42.957884	545.55
T-10	-75.735056	42.948816	555.90
T-11	-75.727873	42.933495	539.43
T-12	-75.723022	42.939202	509.28
T-13	-75.702677	42.918923	506.41
T-14	-75.701717	42.937400	488.86
T-15	-75.699610	42.933135	492.91
T-16	-75.686049	42.911790	489.68
T-17	-75.677068	42.922707	458.90
T-18	-75.674963	42.918672	447.45
T-19	-75.652358	42.923920	495.08
T-20	-75.650180	42.913158	502.45
T-21	-75.650148	42.918780	509.34
T-22	-75.636078	42.915871	487.45
T-23	-75.634459	42.922490	454.57
T-24	-75.684876	42.938175	454.66