

Wind Power GeoPlanner™

Microwave Study

Jericho Rise Wind Farm LLC



Prepared on Behalf of
EDP Renewables

July 13, 2015



COMSEARCH
A CommScope Company

Table of Contents

1. Introduction	- 1 -
2. Project Overview	- 1 -
3. Fresnel Zone Analysis	- 2 -
4. Cross Sectional Analysis	- 7 -
5. Conclusion	- 8 -
6. Contact	- 8 -

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: Jericho Rise Wind Farm LLC

County: Franklin

State: New York

Number of Turbines: 37

Number of Alternative Turbines: 7

Blade Diameter: 114 meters

Hub Height: 93 meters

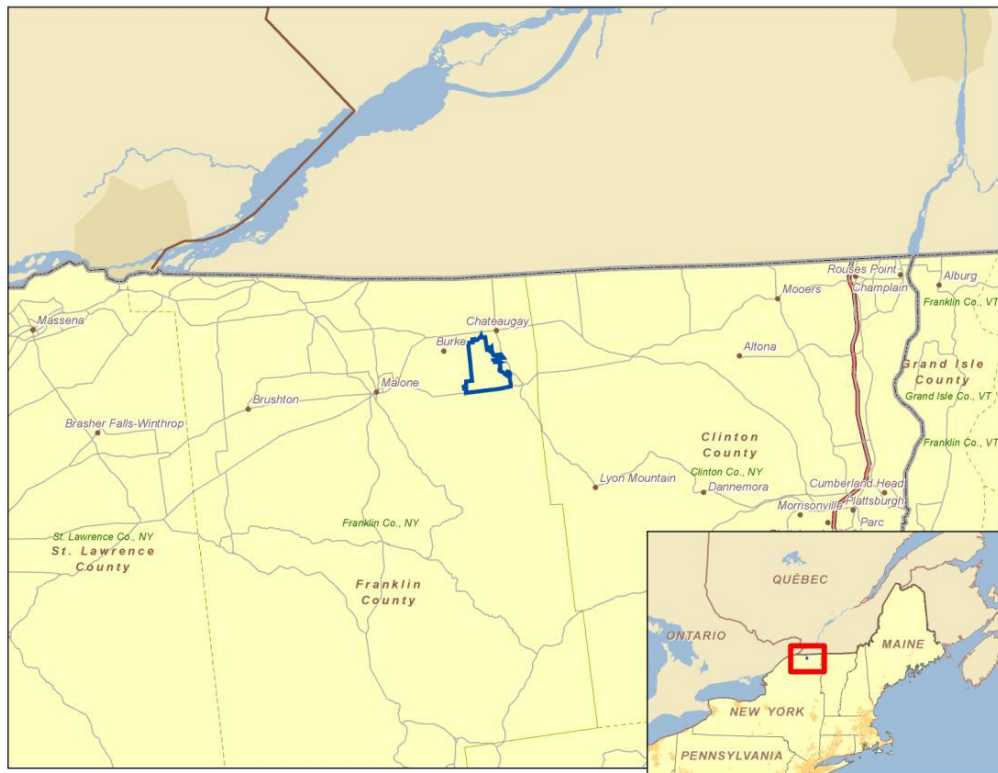


Figure 1: Area of Interest

3. 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 area of interest² and listed them in Table 1. These paths and the area of interest that encompasses the planned turbine locations are shown in Figure 2.

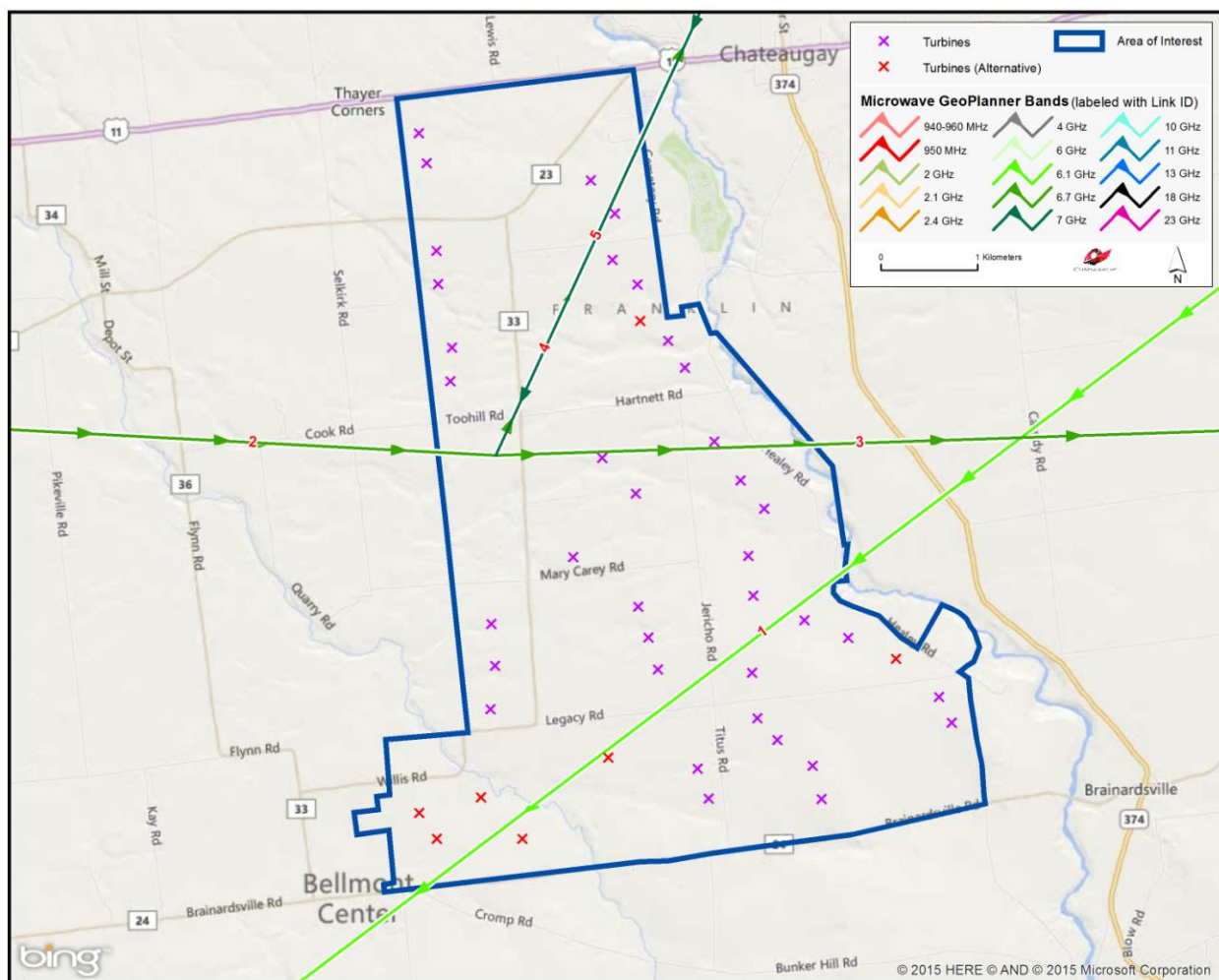


Figure 2: Microwave Paths that Intersect the Area of Interest

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	WMQ392	WMQ391	Lower 6 GHz	34.83	New Cingular Wireless PCS, LLC (NY)
2	Licensed	WNEK637	WNEV804	Upper 6 GHz	56.61	New York Power Authority
3	Licensed	WNEV804	WQGJ812	Upper 6 GHz	10.41	New York Power Authority
4	Licensed	WNEV804	XOJ519	Upper 6 GHz	44.86	New York Power Authority
5	Licensed	XOJ519	WNEV804	7 GHz	44.86	Hydro-Quebec

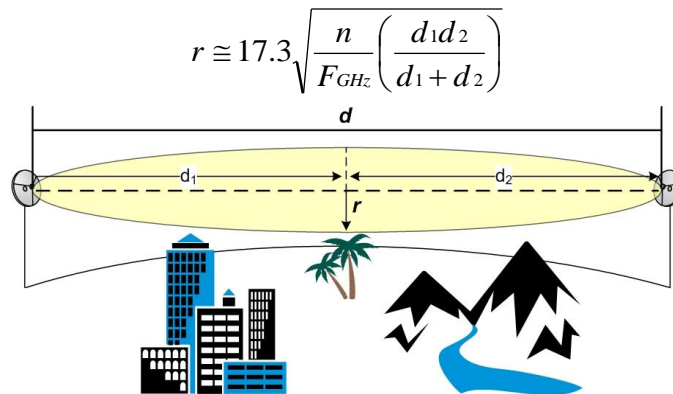
Table 1: Summary of Microwave Paths that Intersect the Area of Interest

(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, path IDs 1, 3, 4 and 5 pass with 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
- d_1 = Distance from antenna 1 to a specific point in the microwave path, kilometers
- d_2 = Distance from antenna 2 to a specific point in the microwave path, kilometers

³ See enclosed *mw_geopl.shp* and *mw_geopl_fcc.shp* for details.

In general, this is the area where the planned wind turbines should be avoided, if possible. A depiction of the Fresnel Zones for each microwave path listed can be found in Figure 3, and is also included in the enclosed shapefiles^{4,5}.

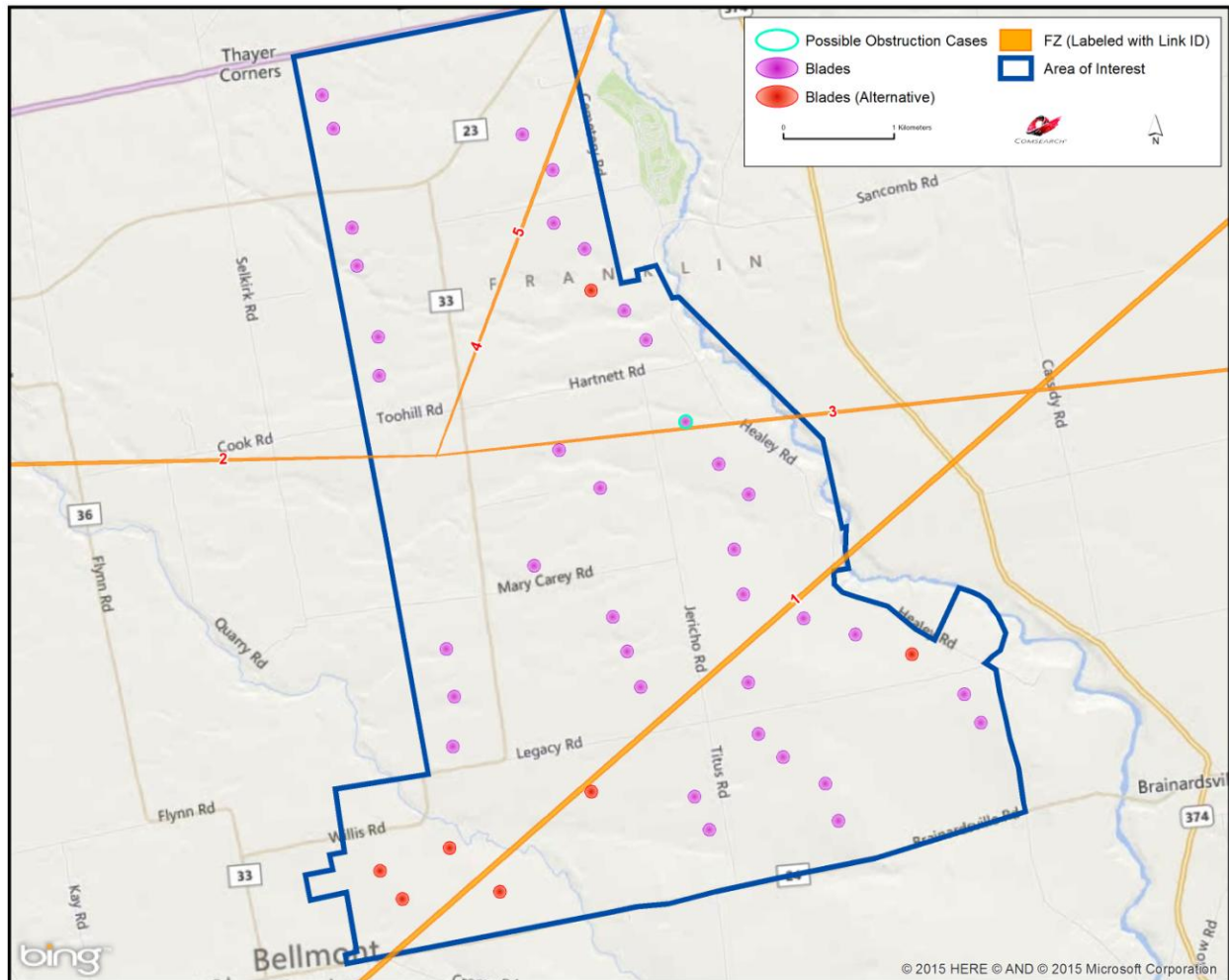


Figure 3: Fresnel Zones in the Area of Interest

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 2 Dimensional Obstructions

Total Microwave Paths	Paths with Affected Fresnel Zones	Total Turbines	Total Turbines (Alternative)	Turbines intersecting the Fresnel Zones	Turbines (Alternative) intersecting the Fresnel Zones
5	1	37	7	1	0

Table 2: Fresnel Zone Analysis Result

For this project, 37 turbines and 7 alternative turbines were considered in the analysis, each with a blade diameter of 114 meters and turbine hub height of 93 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 scenarios 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 these cases.

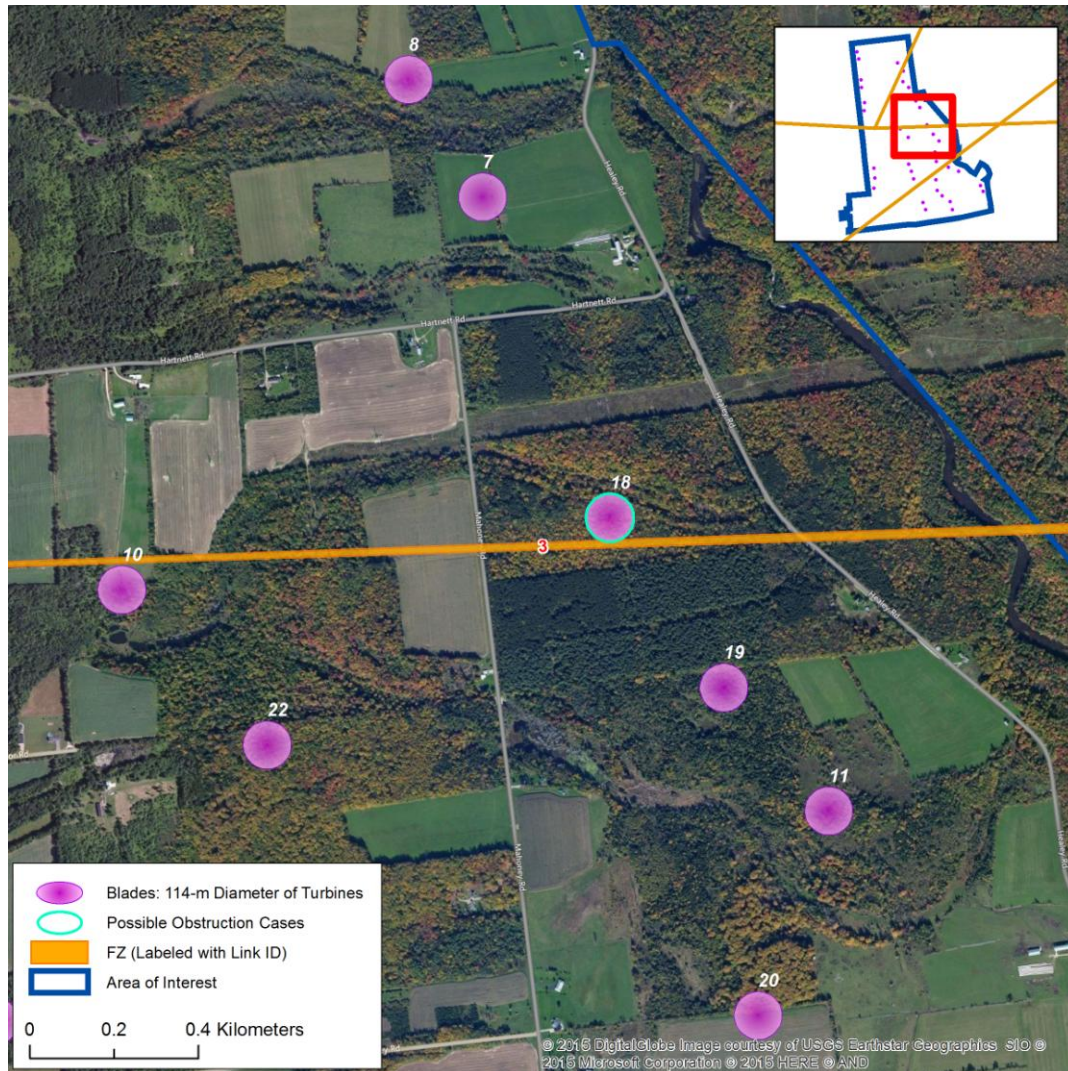


Figure 4: Potential Obstruction Cases

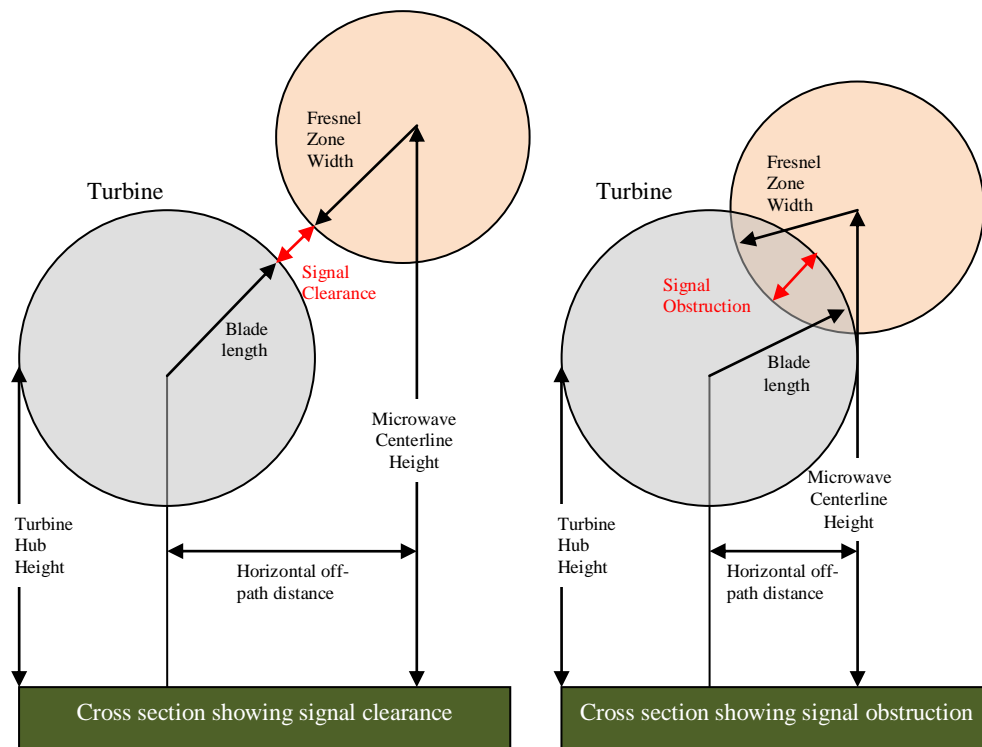
Turbine ID	Latitude (NAD83)	Longitude (NAD83)	Affected Microwave Link ID	Fresnel Zone Width at Turbine Location (m)	Horizontal off-path Distance (m)	Distance along the path from site 1 (km)	Horizontal Clearance (m)
18	44° 53' 24.793" N	74° 5' 21.314" W	3	8.90	62.11	2.27	-3.8

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 below. It shows a positive value indicating clearance of the Fresnel Zone.

Microwave Link ID	Fresnel Zone Width at Turbine Location (m)	Microwave Centerline Height at Turbine Location (m)	Turbine ID	Hub Height (m)	Blade Length (m)	Cross Sectional Clearance (m)
3	8.90	45.11	18	93	57	12.52

Table 4: Cross Sectional Analysis Results

5. Conclusion

Our study identified five microwave paths intersecting the Jericho Rise Wind Farm LLC project area. The Fresnel Zone for these microwave paths were calculated and mapped. One turbine was found to intersect the two dimensional Fresnel Zone of one microwave path. Based on the cross sectional analysis, it was determined that the blades should clear the Fresnel Zone. Therefore, no turbines will cause obstruction to the microwave system in the area.

6. Contact

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

Contact person: Denise Finney
 Title: Account Manager
 Company: Comsearch
 Address: 19700 Janelia Farm Blvd., Ashburn, VA 20147
 Telephone: 703-726-5650
 Fax: 703-726-5595
 Email: dfinney@comsearch.com
 Web site: www.comsearch.com