Wind Power GeoPlanner™

Microwave Study

Wild Meadows

Prepared on Behalf of
Iberdrola Renewables

November 21, 2013

COMSEARCH®
A CommScope Company

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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: Wild Meadows

County: Grafton and Merrimack

State: New Hampshire

Number of Turbines: 23

Blade Diameter: 112 meters

Hub Height: 94 meters

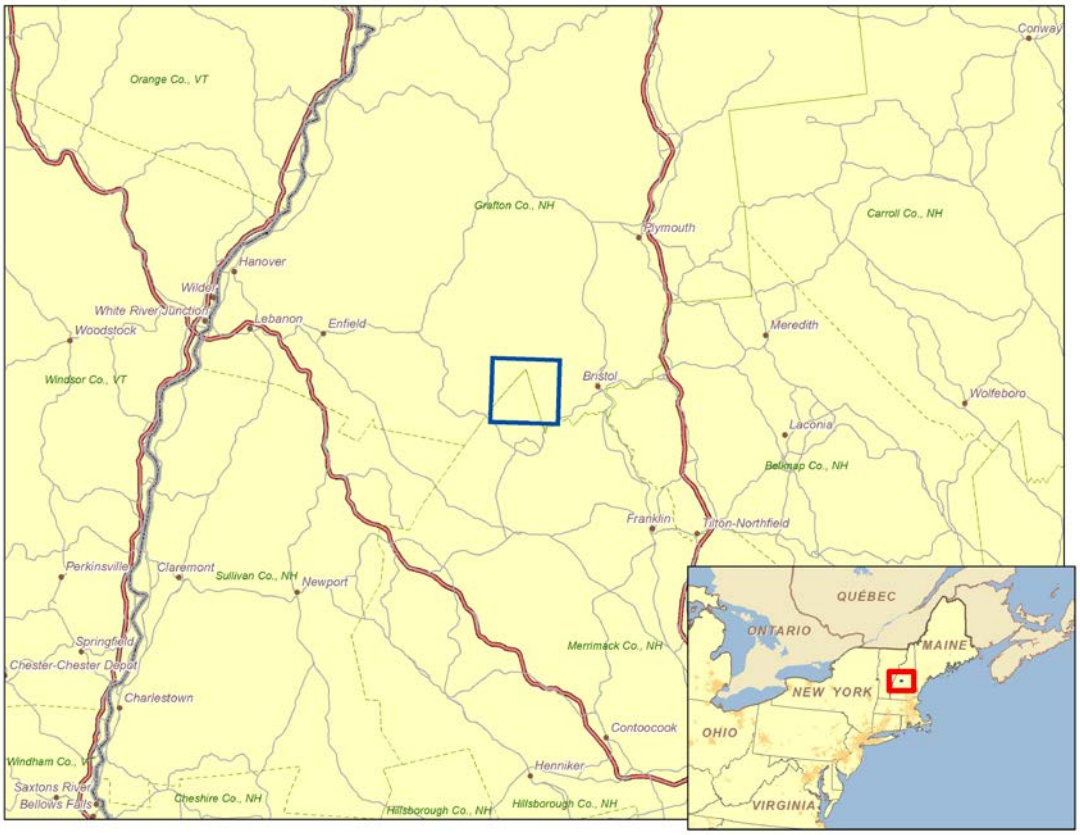


Figure 1: Area of Interest

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 GHz[1]. First, we determined all microwave paths that intersect the area of interest[2] and listed them in Table 1. These paths and the area of interest that encompasses the planned turbine locations are shown in Figure 2.

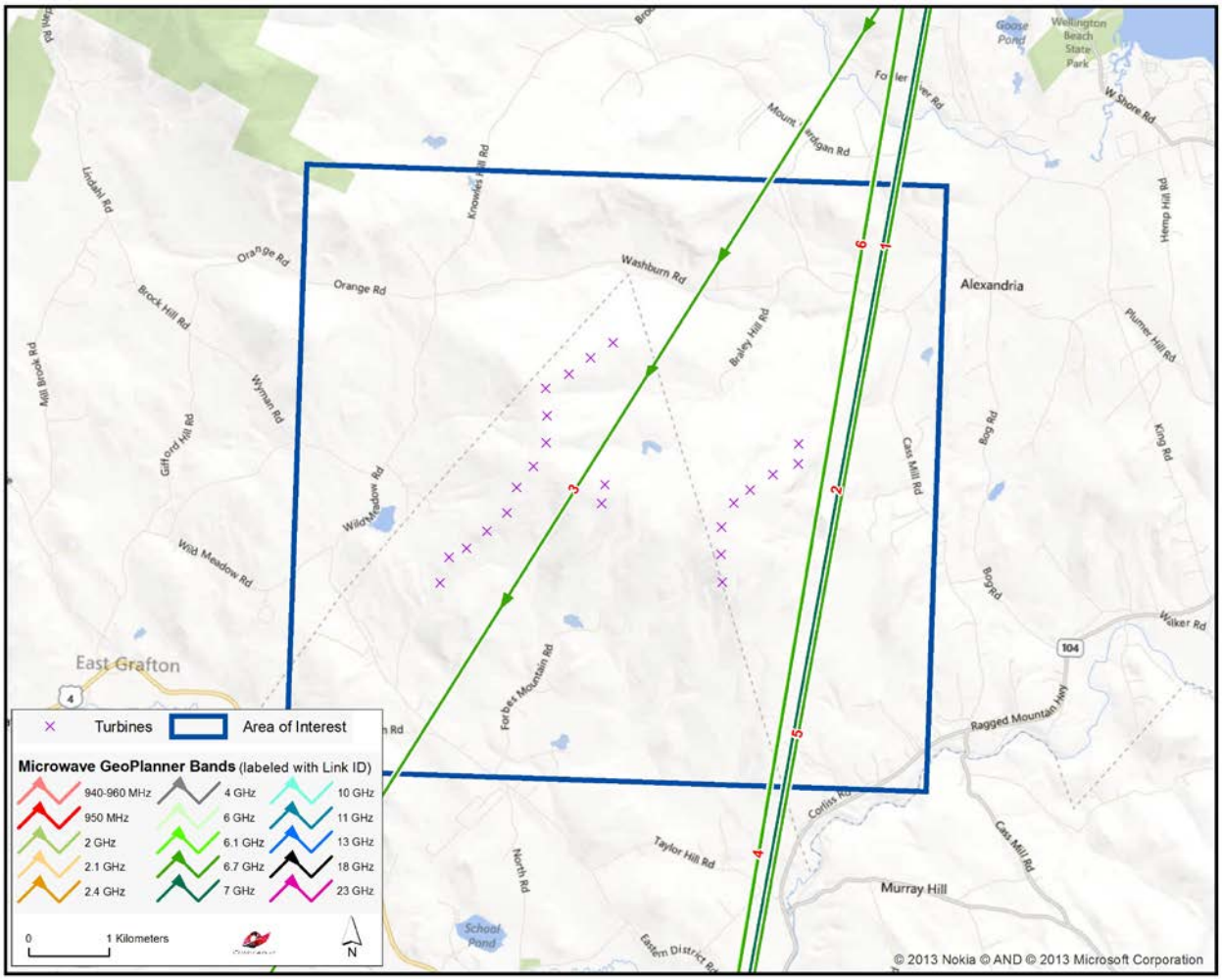


Figure 2: Microwave Paths that Intersect the Area of Interest

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

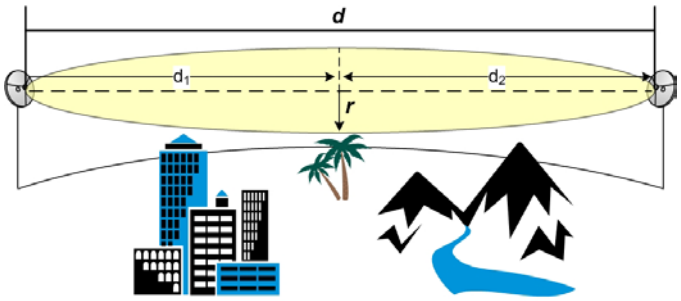
[2] We use FCC-licensed coordinates to determine which paths intersect the area of interest. It is possible that as-built coordinates may differ slightly from those on the FCC license.

ID	Status	Callsign 1	Callsign 2	Band	Path Length (km)	Licensee
1	Licensed	KQW50	KQW51	Upper 6 GHz	86.89	National Grid USA Service Company, Inc
2	Licensed	KYL53	RXONLY	7 GHz	86.89	New Hampshire Public Broadcasting
3	Licensed	WMT288	WPJC713	Upper 6 GHz	83.02	NH #1 Rural Cellular, Inc.
4	Licensed	WPQN962	WPQN964	Upper 6 GHz	39.89	New Hampshire Dept. of Safety
5	Licensed	WPQN962	WPQN966	Upper 6 GHz	86.89	New Hampshire Dept. of Safety
6	Licensed	WQOE867	WQOE834	Lower 6 GHz	39.90	New Hampshire Dept. of Safety

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)

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

$$r \cong 17.3\sqrt{\frac{n}{F_{GHz}}\left(\frac{d_1 d_2}{d_1 + d_2}\right)}$$



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

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[3,4].

[3] The ESRI® shapefiles enclosed are in NAD 83 UTM Zone 19 projected coordinate system.

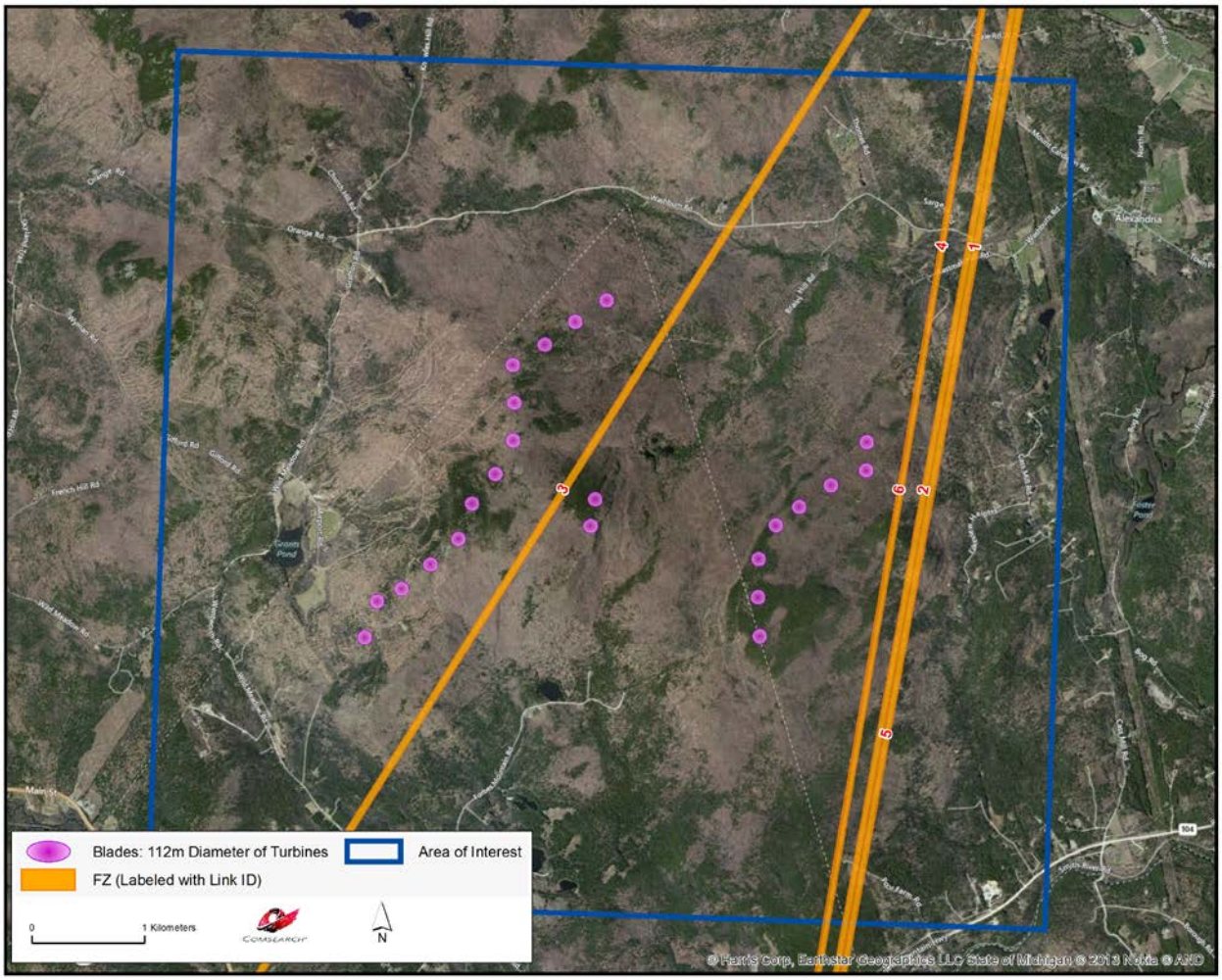


Figure 3: Microwave Paths with Fresnel Zones

[4] 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.

4. Conclusion

Total Microwave Paths	Paths with Affected Fresnel Zones	Total Turbines	Turbines intersecting the Fresnel Zones
6	0	23	0

Table 2: Fresnel Zone Analysis Result

Our study identified six microwave paths intersecting the Wild Meadows area of interest. The Fresnel Zones for these microwave paths were calculated and mapped in order to assess the potential impact from the turbines. A total of 23 turbines were considered in the analysis, each with a blade diameter of 112 meters and turbine hub height of 94 meters. Of those turbines, none were found to have potential obstruction with the microwave systems in the area.

5. 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

Wind Power GeoPlanner™

Communication Tower Study

Wild Meadows

Prepared on Behalf of
Iberdrola Renewables

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COMSEARCH®
A CommScope Company

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1. Introduction

Comsearch compiles and provides information on communications towers identified within a defined area of interest related to proposed wind energy facilities. This information is useful in the planning stages of the wind energy facilities to identify the communication tower locations and owner-operator information. This data can be used in support of the communications needs of the wind energy facilities or to avoid any potential impact to the current communications services provided in that region.

This study was performed for the Wild Meadows wind energy project in Grafton County and Merrimack County, New Hampshire.

2. Summary of Results

Our enhanced tower structures report is derived from a variety of sources including the FCC's Antenna Structure Registration (ASR) database, Universal Licensing System (ULS), national and regional tower owner databases, and the local planning and zoning boards. The data is imported into GIS software, and the structures are geographically mapped relative to the wind energy area of interest (AOI) as defined by the customer. Each tower location on the map is identified with an ID number and associated with detailed structure information (see Table 1).

Using the data sources described above, no tower structures or communication antennas were identified within the wind energy area of interest. An extended search on the broadcast antennas revealed no AM, FM and TV stations within four kilometers of the project area. The nearest tower structure identified was located approximately five kilometers from the AOI border. It is owned by American Tower Corporation and serves wireless communication operators in the area.

Tower ID	ASR Number	Owner	Structure Height AGL (m)	City	Latitude (NAD83)	Longitude (NAD83)
Tower001	N/A	American Tower Corp.	60.35	Grafton, NH	43.579331	-71.961592

Table 1: Summary of Tower Structures

The closest communication antenna is about 350 meters from the AOI border which is a land mobile site as shown in Table 2.

ID	Tower ID	Callsign	Service Type	Licensee	Antenna Height AGL (m)	City	Latitude (NAD83)	Longitude (NAD83)
1	N/A	WQJK256	Land Mobile	ALEXANDRIA TOWN OF	12.1	ALEXANDRIA, NH	43.611000	-71.796222

Table 2: Summary of Communication Antennas

The communication tower and antenna locations relative to the AOI are depicted in Figure 1. A photo snapshot of the tower is provided in Figure 2. Contact information for both entities is provided in an Excel attachment.

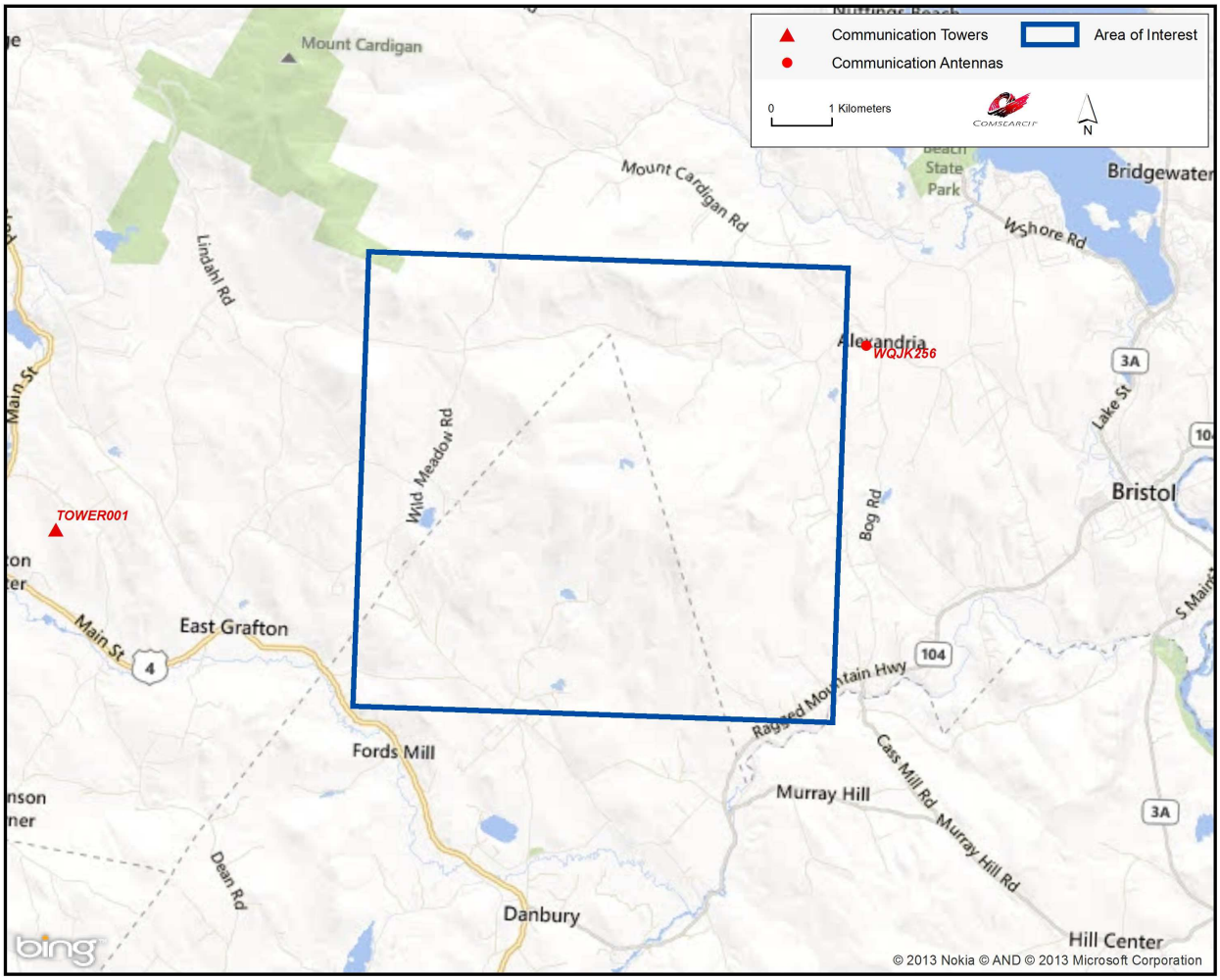

Figure 1: Communication Towers / Antennas near Area of Interest

Figure 2: Full View of Tower001

3. Discussion of Separation Distances

In planning the wind energy turbine locations, a conservative approach would dictate not locating any turbines in close proximity to existing tower structures to avoid any possible impact to the communications services provided by the structures. A reasonable separation distance between communication towers and wind turbine towers is a function of two things: (1) the physical turning radius of the wind turbine blades and (2) the characteristics of the communication systems on the communication tower.

Since wind turbine blades can rotate 36º, the first consideration of separation distance to other structures is clearance of the blades. If the blade radius is 50 meters, than a separation distance greater than 50 meters is necessary. From a practical standpoint, a setback distance greater than the maximum height of the turbine is necessary to insure a "fall" safety zone in the unlikely event of a turbine tower failure. Setback requirements for "fall" safety are typically specified by the local zoning ordinances.

The required separation distance based on the characteristics of the communication systems will vary depending on the type(s) of communication antennas are installed on the tower. For example, AM, FM and TV communication antennas should be separated by distances that allow for normal coverage. For FM and TV stations, the separation distances can be as great as 4 kilometers and for AM stations, 3 kilometers.

For radar, special studies are conducted to determine a reasonable distance from turbine towers, taking into account the unique characteristics of the radar. For microwave links, line-of-sight (LOS) is used as the criteria for separation distance as well as the physical clearance of the turbine blades. For land mobile and mobile phone systems, setback distances are based on FCC interference emissions from electrical devices in the land mobile and mobile telephone frequency bands.

Finally, the tower structures identified could be a potential benefit in support of communications network needs for the wind energy facility. An example would be the implementation of a Supervisory Control and Data Acquisition (SCADA) system that monitors and provides communications access to the wind energy facility.

4. Conclusion

Our study identified no communication towers or antennas within the Wild Meadows project area. The closest tower structure is about five kilometers from the AOI border,which serves wireless communication operators in the area. The closest communication antenna is about 350 meters from the AOI border which provides land mobile radio service. Neither of them should be impacted by the Wild Meadow wind project based on their respective separation distance requirement.

5. Contact

For questions or information regarding the Communication Tower Study, please contact:

Contact person:	Denise Finney
Title:	Account Manager
Company:	Comsearch
Address:	197 Janelia Farm Blvd., Ashburn, VA 2147
Telephone:	73-726-565
Fax:	73-726-5595
Email:	dfinney@comsearch.com
Web site:	www.comsearch.com