

Wind Power GeoPlanner™

Licensed Microwave Report

Copenhagen Wind Farm, LLC



Prepared on Behalf of
OwnEnergy

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COMSEARCH
A CommScope Company

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1. Introduction

The use of wind energy, one of the oldest forms of harnessing a natural energy source, is now one of the world's fastest growing alternative energy sources. The United States is committed to the use of wind energy, and over the next several years billions of dollars will be spent on wind power projects. However, as new wind turbine generators are installed around the country, it is important to note that they may pose an interference threat to existing microwave systems and broadcast stations licensed to operate in the United States.

Wind turbines can interfere with microwave paths by physically blocking the line-of-sight between two microwave transmitters. Additionally, wind turbines have the potential to cause blockage and reflections (“ghosting”) to television reception. Blockage is caused by the physical presence of the turbines between the television station and the reception points. Ghosting is caused by multipath interference that occurs when a broadcast signal reflects off of a large reflective object—in this case a wind turbine—and arrives at a television receiver delayed in time from the signal that arrives via direct path.

Many states and other jurisdictions recognize the need for regulations addressing interference to radio signal transmissions from the wind turbine installations. Specifically, local planning authorities typically require project developers to ensure wind turbines will not cause interference. In some cases they require developers to notify the telecommunication operators in the area of the proposed wind turbine installation. Other factors prompting developers to undertake proactive investigation into potential interference include the need to prevent legal and regulatory problems and the desire to promote goodwill within the community—a good neighbor approach.

Comsearch has developed and maintains comprehensive technical databases containing information on licensed microwave networks throughout the United States. Microwave bands that may be affected by the installation of wind turbine facilities operate over a wide frequency range (900 MHz – 23 GHz). 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 non-federal government microwave systems. Comsearch provides additional wind energy services, a description of which is available upon request.

2. Summary of Results

An overall summary of results appears below.

Project Information

Name: Copenhagen Wind Farm, LLC

County: Lewis

State: New York

Total Microwave Paths	Paths with Obstructions	Total Turbines	Turbine Obstructions
12	3	62	5

Methodology

Our obstruction analysis was performed using Comsearch's proprietary microwave database, which contains all non-government licensed paths from 0.9 - 23 GHz¹. First, we determined all microwave paths that intersect the area of interest². The area of interest was defined by the client and encompasses the planned turbine locations. Next, for each microwave path that intersected the project area, we calculated a Worst Case Fresnel Zone (WCFZ). The mid-point of a full microwave path is the location where the widest (or worst case) Fresnel zone occurs. Fresnel zones were calculated for each path using the following formula.

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

Where,

- R_n = 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

For worst case Fresnel zone calculations, $d_1 = d_2$

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.

The calculated WCFZ radius, giving the linear path an area or swath, buffers each microwave path in the project area. See the Tables and Figures section for a summary of paths and WCFZ distances. In general, this is the two-dimensional area where the planned wind turbines should be avoided, if possible. A depiction of the WCFZ can be found in the Tables and Figures section, and is also included on the enclosed spreadsheet and shapefiles^{3,4}.

Discussion of Potential Obstructions

For this project, 62 turbines were considered in the analysis, each with a blade diameter of 100 meters and turbine hub height of 96 meters. Of those turbines, 5 were found to have a potential conflict with 3 microwave paths. The next section contains a detailed depiction of the potential obstruction scenarios and a tabular summary of the affected turbines and microwave paths.

When turbines fall within the two-dimensional WCFZ, Comsearch offers and recommends a detailed clearance study, which considers the vertical Z-height clearance objectives. The results of the detailed study may clear the potential conflict without requiring turbine relocation. Please contact Denise Finney at (703) 726 – 5650 to request a detailed study.

³ The ESRI® shapefiles enclosed are in NAD 83 UTM Zone 18 projected coordinate system.

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.

3. Tables and Figures

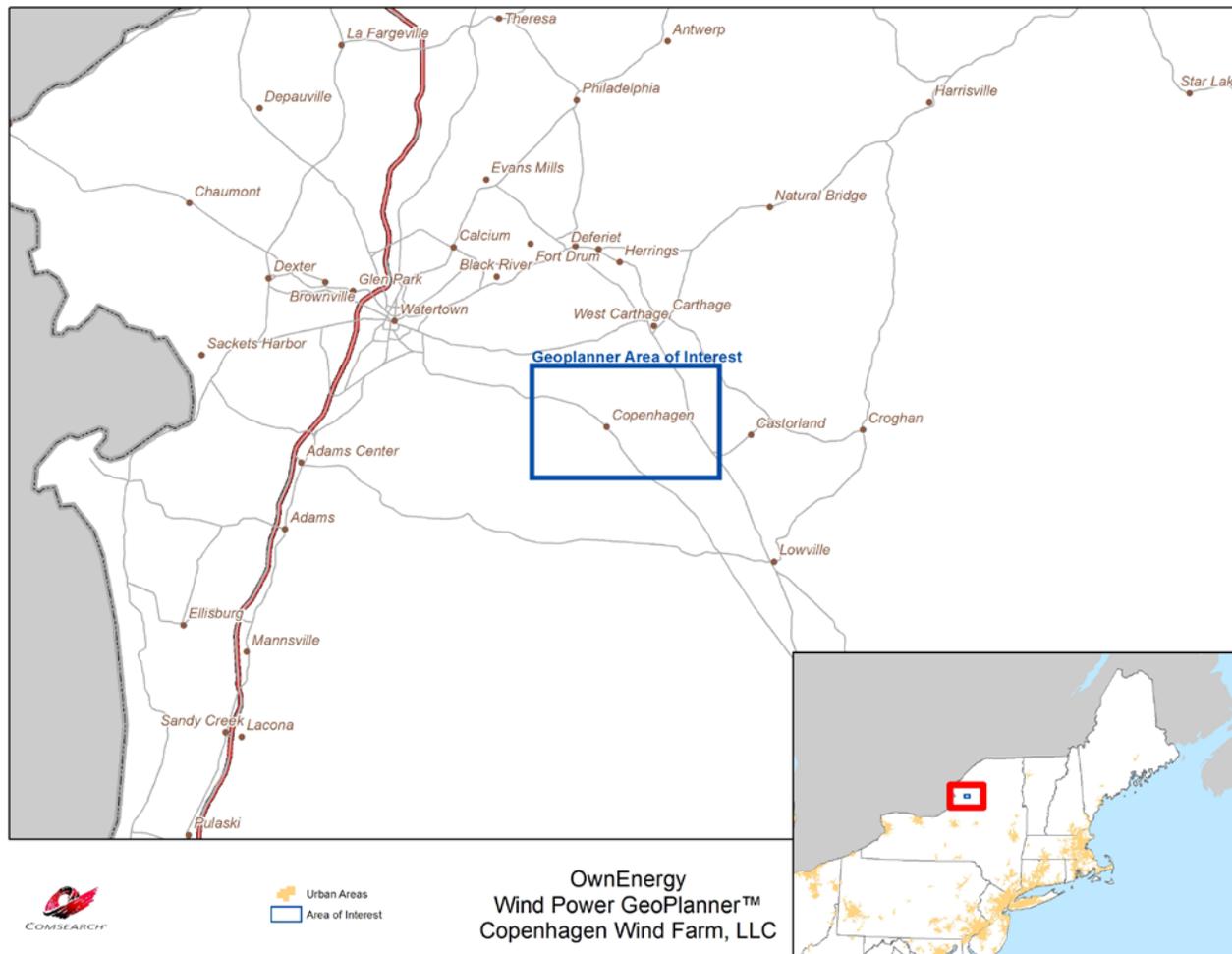


Figure 1: Area of Interest

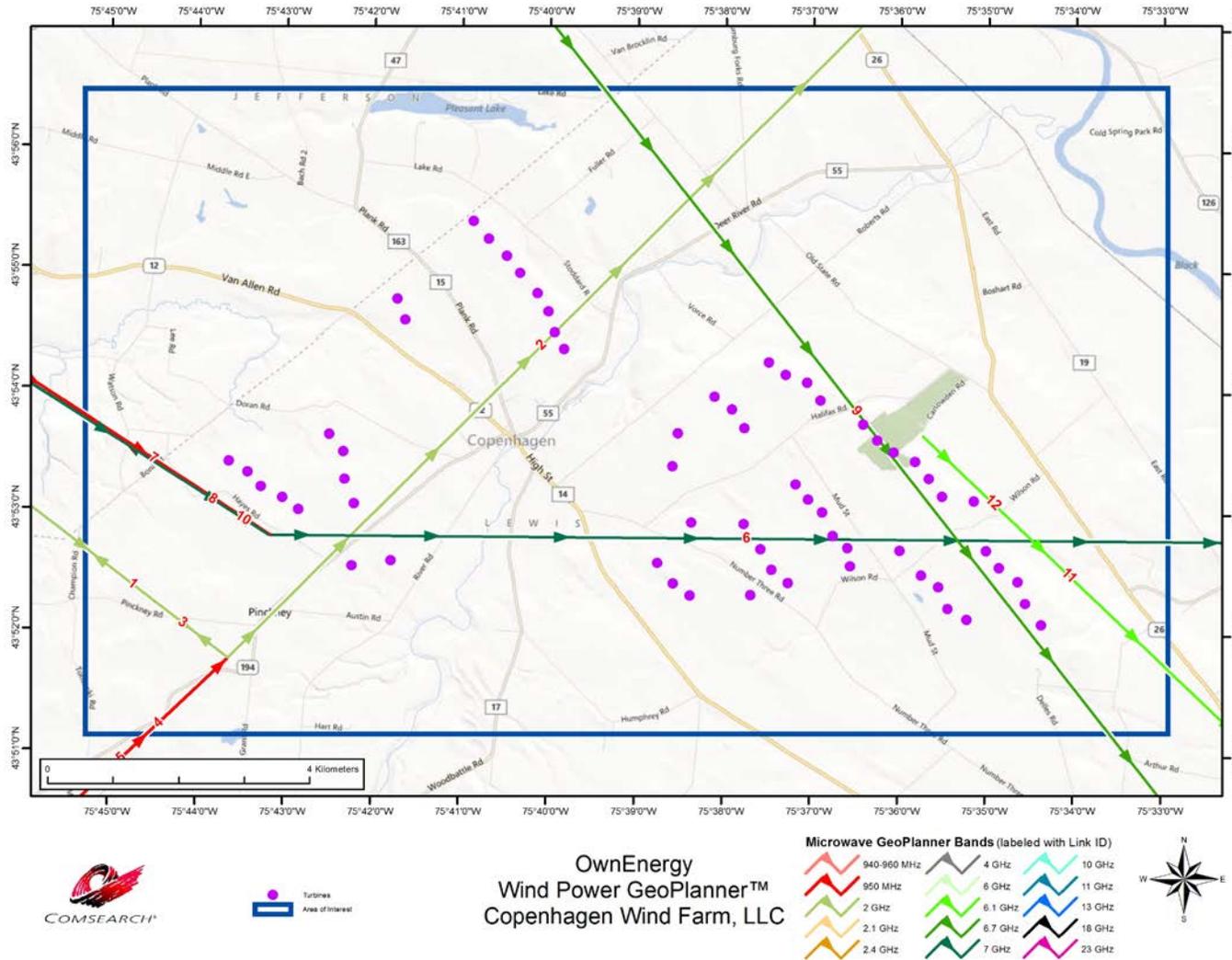
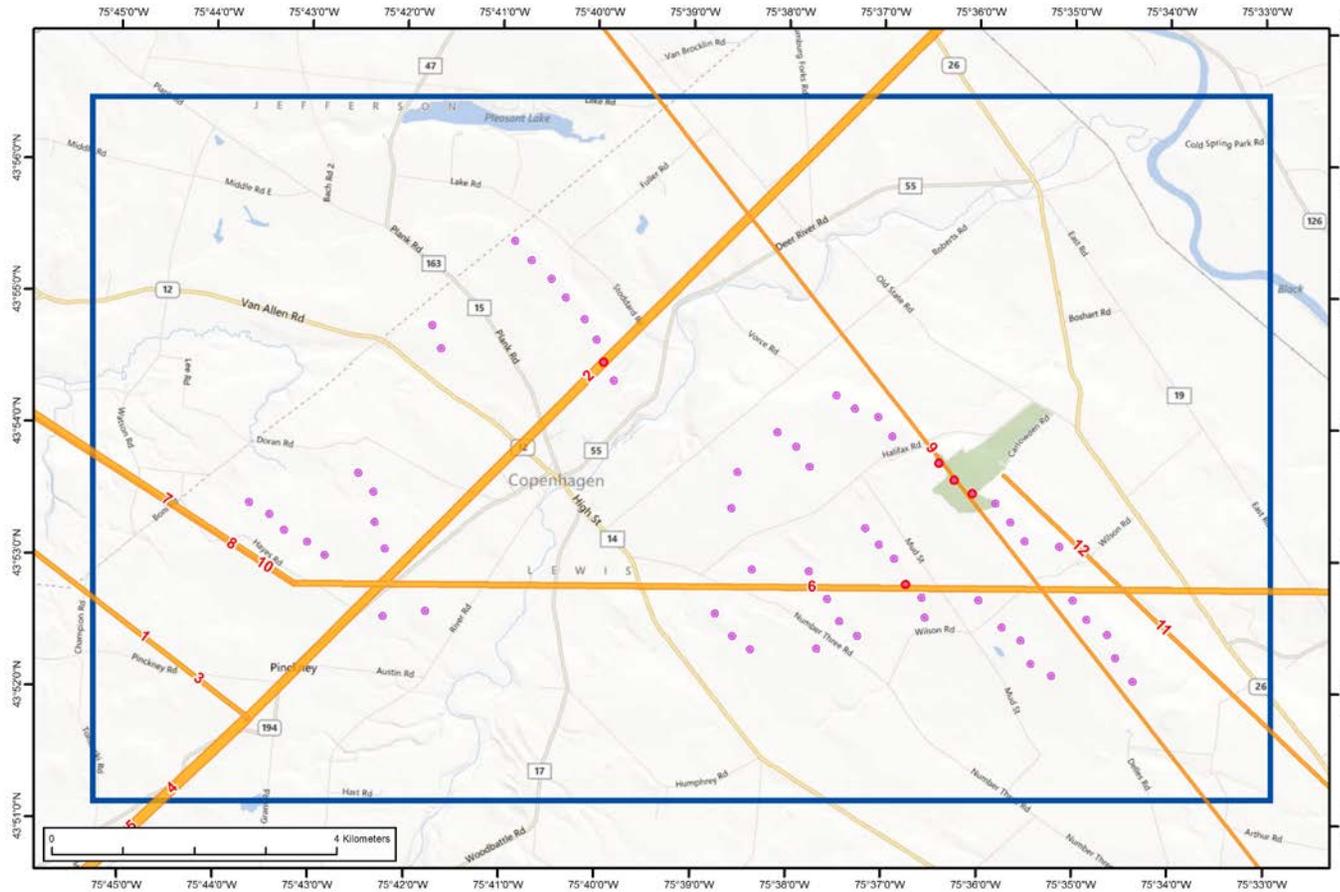


Figure 2: Microwave Paths that Intersect the Area of Interest



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-  Possible Obstruction Cases
-  Blades: 100m Diameter of Turbines
-  WCFZ (Labeled with Link ID)
-  Area of Interest



Figure 3: Microwave Paths with WCFZ Buffers

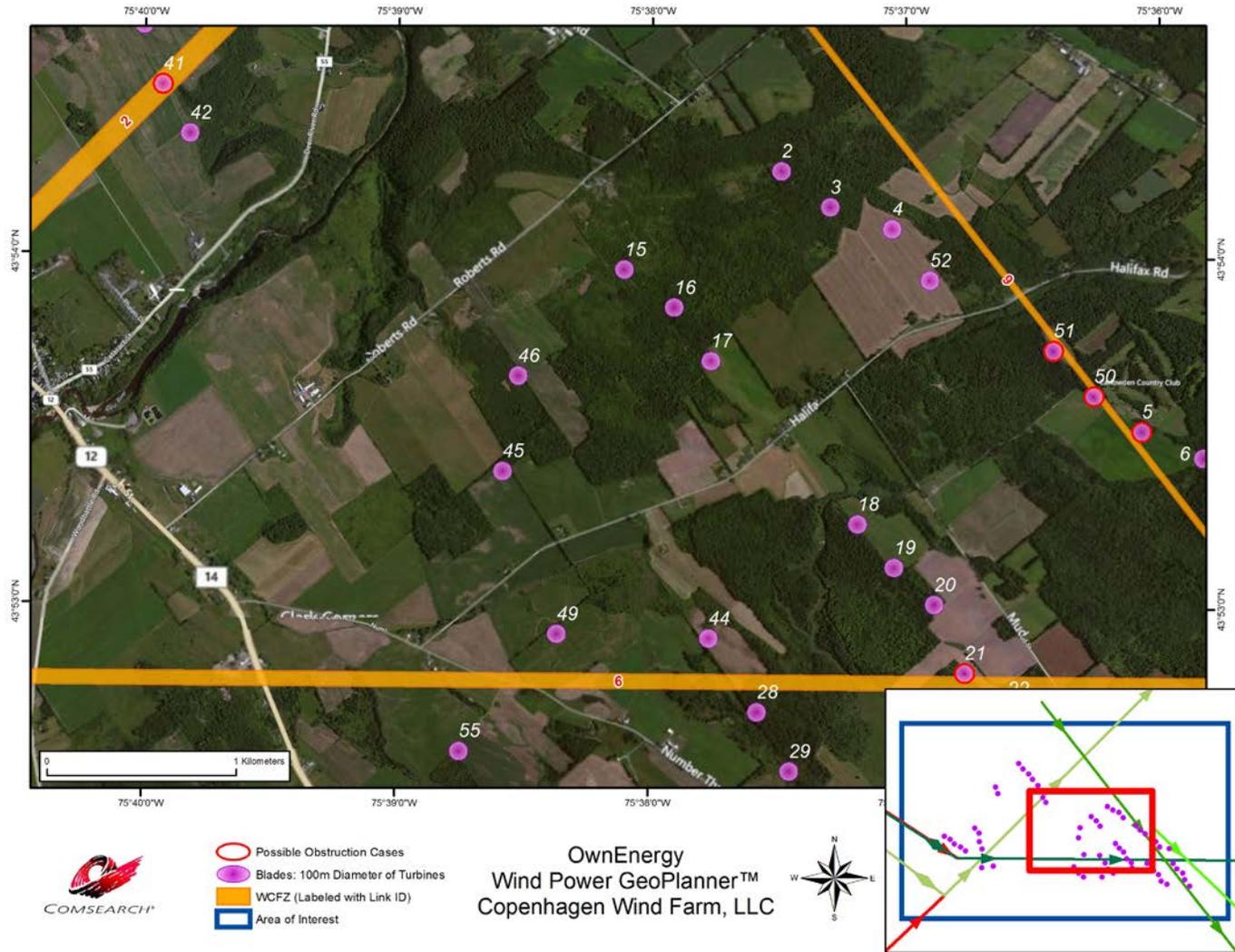


Figure 4: Potential Obstruction Scenarios

ID	Site Name 1	Site Name 2	Callsign 1	Callsign 2	Band	Licensee	WCFZ (m)
1	STUDIO	WPBS TX	WDV64	RXONLY	2 GHz	ST LAWRENCE VALLEY EDUCATIONAL TV COUNCI	27.78
2	WPBS TX	WNPI TX	WDV65	RXONLY	2 GHz	ST LAWRENCE VALLEY EDUCATIONAL TV COUNCI	59.99
3	WPBS TX	STUDIO	WFD557	RXONLY	2 GHz	ST LAWRENCE VALLEY EDUCATIONAL TV COUNCI	27.78
4-5	NEWHAVEN	WATERTOWN	WHS460	RXONLY	950 MHz	Public Broadcasting Central New York	69.76
6	HAYES RD	RECEIVE	WLO834	RXONLY	7 GHz	Newport Television LLC	39.40
7	WEALTHA AVE	HAYES RD	WMV203	RXONLY	950 MHz	COMMUNITY BROADCASTERS, LLC	40.37
8	WWTI STUDIO	WWTI XMTR	WPNF658	RXONLY	7 GHz	Newport Television LLC	15.10
9	COPENHAGEN	LOWVILLE	WPOS289	WPOS284	Upper 6 GHz	New Cingular Wireless PCS, LLC (NY)	15.02
10	WWTI XMTR	WWTI STUDIO	WPXU224	RXONLY	7 GHz	Newport Television LLC	15.10
11-12	DENMARK	GREIG	WQPN273	WQPN272	Lower 6 GHz	Conterra Ultra Broadband, LLC	19.21

Table 1: Microwave Paths that Intersect the Area of Interest

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

Turbine ID	Latitude (NAD83)	Longitude (NAD83)	Affected Microwave Link IDs
5	43.891774	-75.600930	9
21	43.880224	-75.612477	6
41	43.908044	-75.665523	2
50	43.893455	-75.604089	9
51	43.895603	-75.606769	9

Table 2: Turbines that Cause Potential Obstructions



4. Contact Us

For questions or information regarding the Licensed Microwave Report, 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