

# **Appendix E**

## **Capital Airspace Group Report**

# Plum Creek Wind Project

Plum Creek Wind Farm, LLC

*Cottonwood, Murray, and Redwood Counties, Minnesota*

---

Microwave Path Analysis

October 31, 2024



Capitol Airspace Group

[capitolairspace.com](http://capitolairspace.com)

(703) 256 - 2485

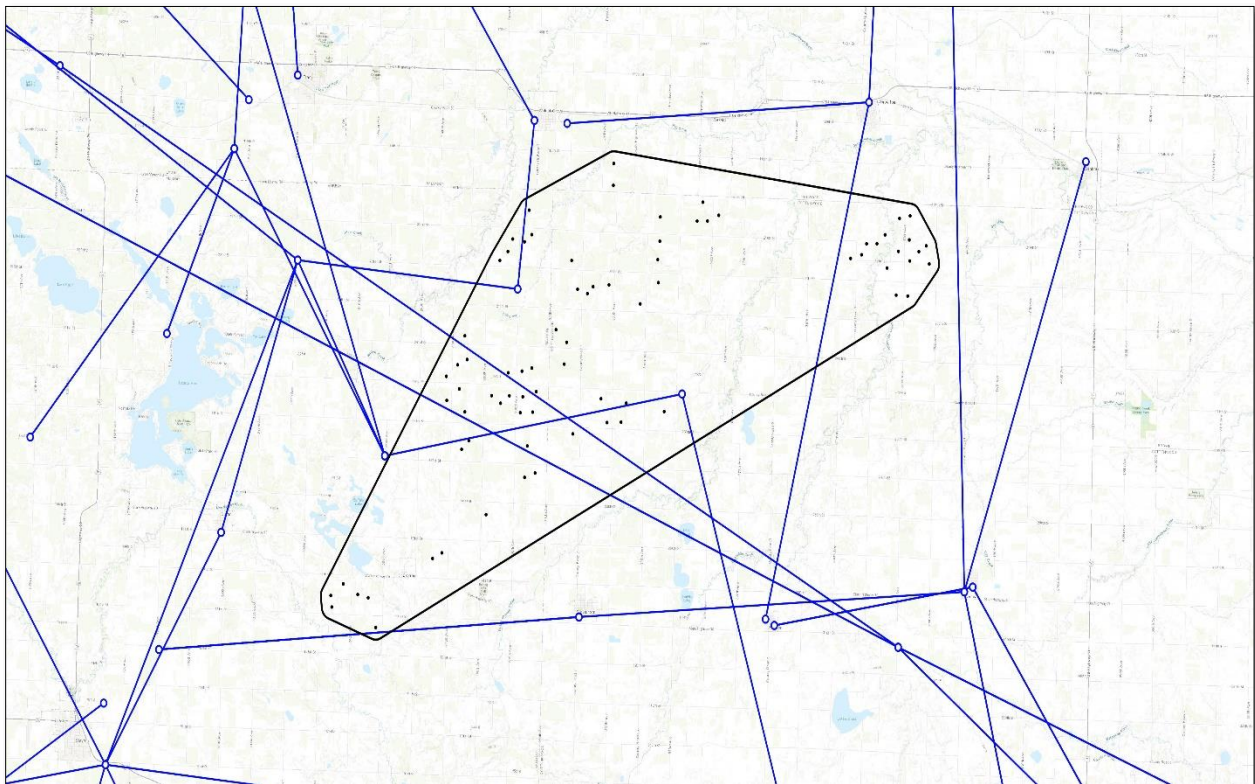


## Introduction

Capitol Airspace conducted a microwave path analysis for the Plum Creek wind project in Cottonwood, Murray, and Redwood Counties, Minnesota. The purpose of this analysis was to identify licensed and applied coordinated non-federal microwave paths that could limit the placement of proposed 113-meter hub height/163-meter rotor diameter wind turbines. At the time of this analysis, 78 wind turbine locations had been identified (black points, [Figure 1](#)). This analysis assessed each location, including its rotor-swept volume, to determine if it could obstruct Fresnel zones associated with microwave paths in proximity to the Plum Creek wind project.

Point-to-point microwave transmission is a critical component of the national communications infrastructure. Microwave paths enable broadband data transmission that supports telephone, cellular, and personal communication service (PCS) networks, wireless internet providers, audio and video transmission from television studios to transmitter sites, as well as many other industry and utility applications. To ensure signal reliability, these paths are sited to avoid any line-of-sight obstructions.

Proposed structures that intersect a microwave link's Fresnel zone can create a line-of-sight obstruction that degrades link performance. Depending on the proposed structure type, the percentage of the Fresnel zone obstructed, and the microwave system configuration, this impact could degrade signal reliability and require revisions to the microwave system. However, due to the narrow width of most Fresnel zones, micrositing wind turbines outside of these zones is often a feasible mitigation option.



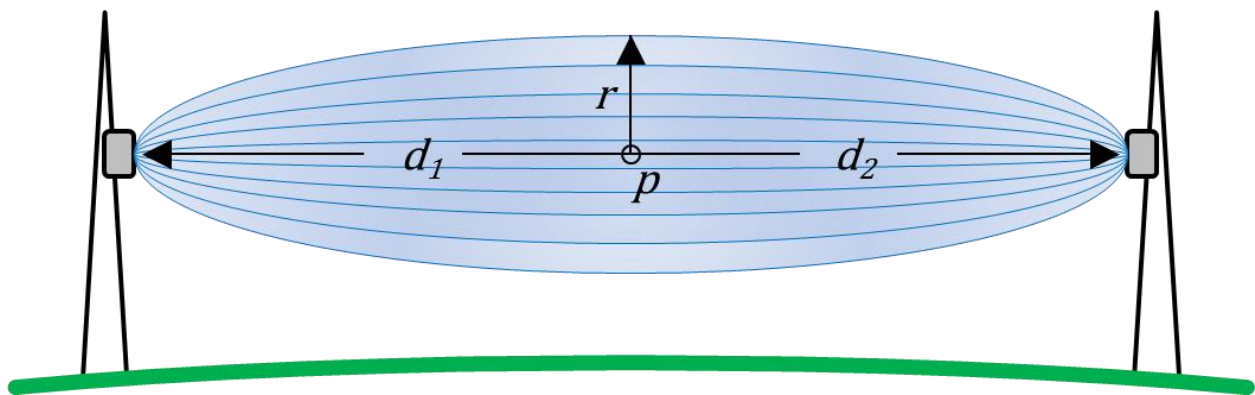
**Figure 1: Licensed microwave links (blue) in proximity to the Plum Creek wind project**



## Methodology

Capitol Airspace studied the proposed project based upon location information provided by Plum Creek Wind Farm, LLC. With this information, Capitol Airspace used a Geographic Information System (GIS) to determine proximity to both licensed and applied coordinated non-federal microwave paths contained in the Federal Communication Commission (FCC) Universal Licensing System (ULS) database.

This analysis considers impact on microwave paths resulting from the physical blockage of the first Fresnel zone (**Figure 2**). The first Fresnel zone is a three-dimensional volume whose radius at a given point is calculated using the path frequency and distance from the transmitting and receiving antennas. The Fresnel zone radius is largest at the path midpoint (where  $d_1 = d_2$ ) and is inversely related to the path frequency. Higher frequencies result in smaller Fresnel zone radii while lower frequencies result in larger Fresnel zone radii.



**Figure 2: Fresnel zone example**

In many cases, ULS database microwave transmitter and receiver antenna locations are inaccurate (e.g. **Figure 3**). Available satellite and aerial imagery were used to improve the coordinates for locations associated with microwave paths in proximity to the defined study area.



**Figure 3: Example of using aerial imagery to correct erroneous ULS database antenna location**



## Findings

Eight microwave links with twenty paths overlie the Plum Creek wind project ([Table 1](#) & [Figure 4](#)).

**Table 1: Microwave paths with Fresnel zones overlying the Plum Creek wind project**

Licensee	Call Sign	Path	Status	Transmitter	Receiver	Frequency (MHz) <sup>1</sup>
AT&T Mobility Spectrum, LLC	WROU985	2	Licensed	WESTBROOK	MN SLAYTON	6197.24
		3	Licensed	WESTBROOK	MN SLAYTON	6226.89
	WROU986	2	Licensed	MN SLAYTON	WESTBROOK	5945.20
		3	Licensed	MN SLAYTON	WESTBROOK	5974.85
Midcontinent Communications	WRPS439	2	Licensed	MN MU0006	MN CO0001	11565.00
	WRTR201	1	Licensed	MN CO0001	MN MU0006	11075.00
		2	Licensed	MN CO0001	MN CO0002	11245.00
	WRTR203	2	Licensed	MN CO0002	MN CO0001	10755.00
MINNESOTA VALLEY TELEVISION IMPROVEMENT CORPORATION	WQZP352	1	Licensed	WALNUT GROVE	CARTER	11405.00
	WQZP587	1	Licensed	SOM TRACY	CARTER	11245.00
	WQZP588	1	Licensed	CARTER	SOM TRACY	10755.00
		2	Licensed	CARTER	WALNUT GROVE	10915.00
Northern Border Pipeline Company	WQDT290	1	Licensed	CS12	Jeffers	5974.85
	WQDT291	1	Licensed	Jeffers	CS 12	6226.89
Nuvera Communications, Inc.	WRBN736	1	Licensed	STORDEN <sup>2</sup>	LAMBERTON <sup>3</sup>	11565.00
	WRBN748	1	Licensed	LAMBERTON <sup>3</sup>	STORDEN <sup>2</sup>	11075.00
Pioneer Wireless LLC	WSDG774	1	Licensed	HOMERTON	SIDNEY	11305.00
		2	Licensed	HOMERTON	SIDNEY	11265.00
	WSDG781	3	Licensed	SIDNEY	HOMERTON	10815.00
		4	Licensed	SIDNEY	HOMERTON	10775.00

<sup>1</sup> Microwave paths may be licensed to operate using more than one frequency. For the purposes of calculating Fresnel zone radii, the lowest frequency was used to create the largest Fresnel zone.

<sup>2</sup> This antenna location could not be associated with a single antenna structure due to the multiple antenna structure candidates in proximity to the FCC ULS database coordinates. As a result, Capitol Airspace increased the Fresnel zone radius at this antenna location to encompass all the potential antenna structure candidates.

<sup>3</sup> The exact position of the microwave antenna at this location could not be validated using aerial imagery. As a result, Capitol Airspace increased the Fresnel zone radius at this location to encompass the entire antenna structure's footprint.

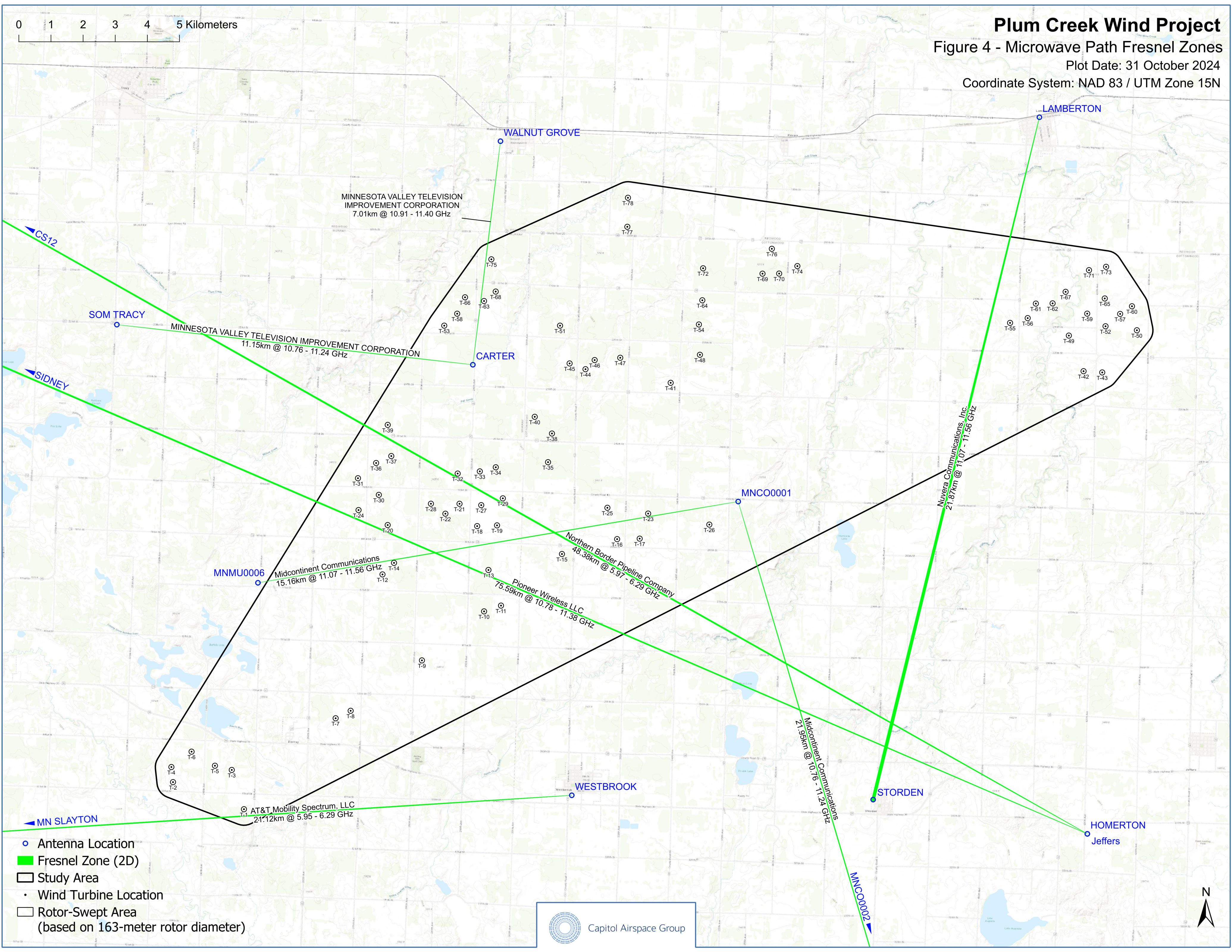


## Conclusion

The results of this analysis indicate that twenty paths associated with eight microwave links overlie the Plum Creek wind project. However, none of the proposed wind turbines (including their rotor-swept area) overlap the associated two-dimensional Fresnel zones (green, [Figure 4](#)). As a result, the proposed wind turbines should not create a line-of-sight obstruction for any licensed or applied non-federal microwave links. If micrositing is required or additional locations are planned, wind turbines should be sited outside of the lateral boundaries of the Fresnel zones (green, [Figure 4](#)) in order to avoid the likelihood of signal blockage.

If you have any questions regarding the findings of this study, please contact [Chris Harrington](#) or [Matilda Svensson](#) at (703) 256-2485.





# Plum Creek Wind Project

Figure 4 - Microwave Path Fresnel Zones

Plot Date: 31 October 2024

Coordinate System: NAD 83 / UTM Zone 15N

0 1 2 3 4 5 Kilometers

- Antenna Location
- Fresnel Zone (2D)
- Study Area
- Wind Turbine Location
- Rotor-Swept Area (based on 163-meter rotor diameter)



Capitol Airspace Group

