Attachment D – Microwave Path Analysis for the Rugby Wind Repower Project

Rugby Wind Repower Project

Rugby Wind LLC

Pierce County, North Dakota

Microwave Path Analysis

January 5, 2024

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Introduction

Capitol Airspace conducted a microwave path analysis for the Rugby Wind Repower project in Pierce County, North Dakota. The purpose for this analysis was to identify licensed and applied coordinated non-federal microwave paths that could limit repowering existing wind turbines. At the time of this analysis, 71 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 Rugby Wind Repower 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.

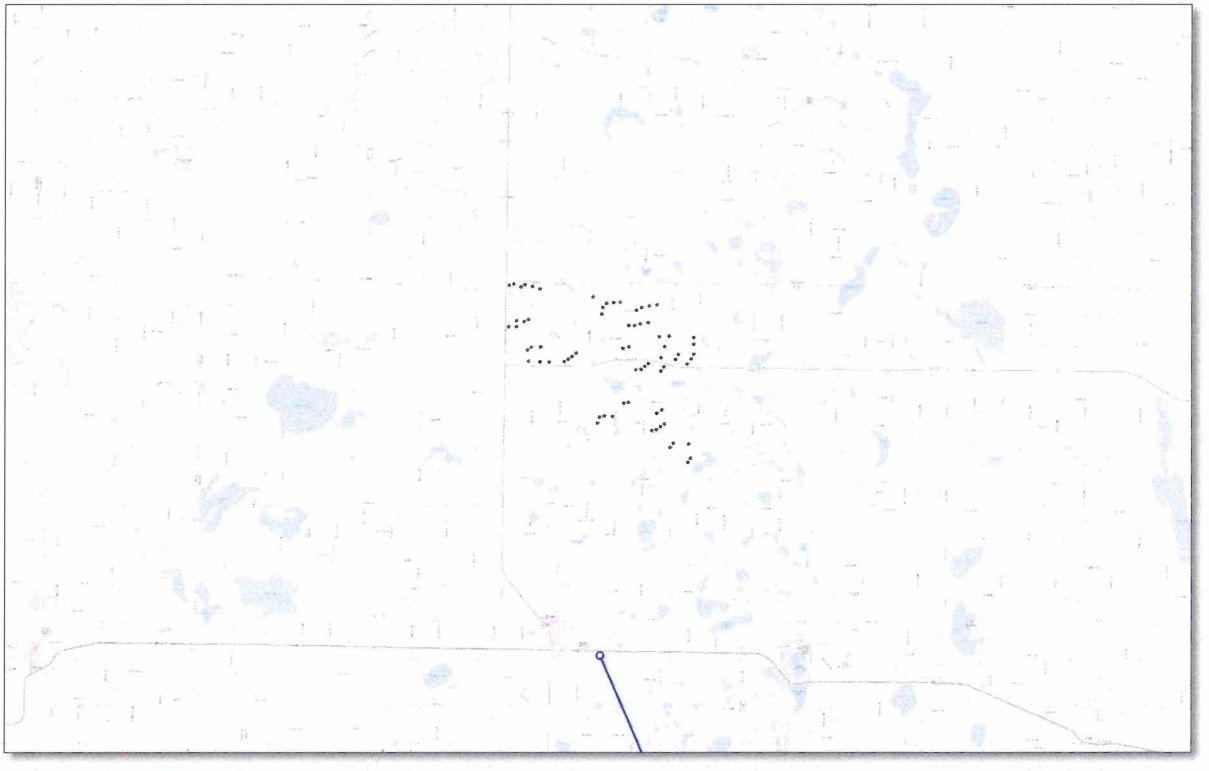

Figure 1: Licensed microwave links (blue) in proximity to the Rugby Wind Repower project

Capitol Airspace maintains a database obtained from the FCC which is updated daily. The results of this analysis are based on FCC data available as of the date of this report.

Methodology

Capitol Airspace studied the proposed project based upon location information provided by Rugby Wind LLC. Using 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.

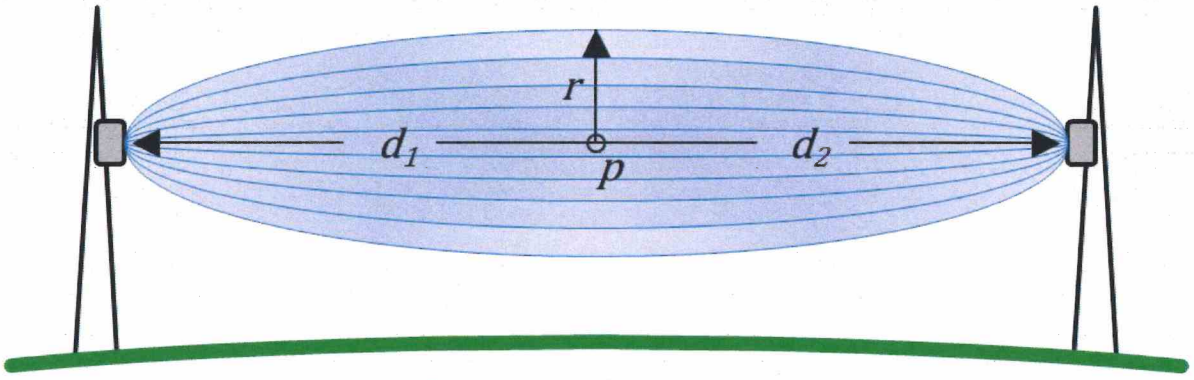

Figure 2: Fresnel zone example

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.

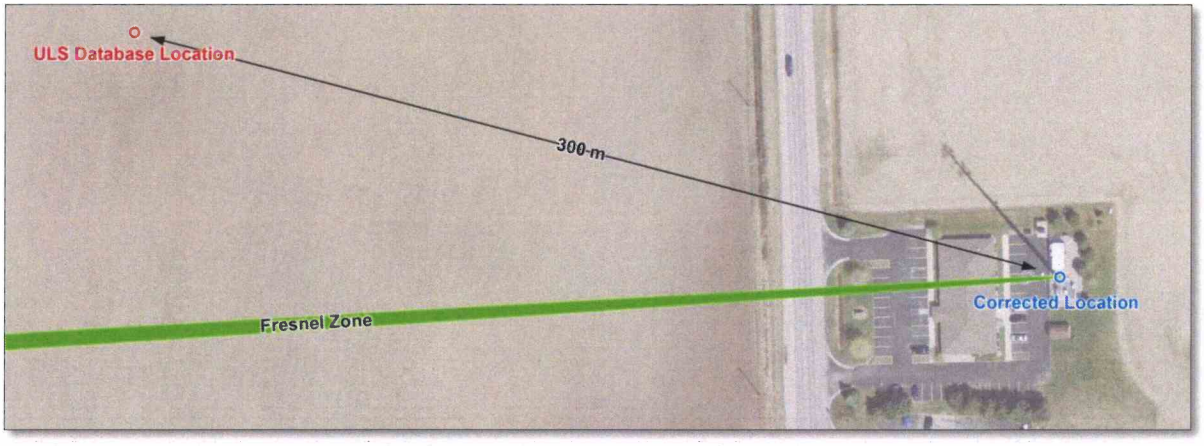

Figure 3: Example of using aerial imagery to correct erroneous ULS database antenna location

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Findings

No microwave links overlie the Rugby Wind Repower project (***Table 1***).

Table 1: Microwave paths with Fresnel zones overlying the Rugby Wind Repower project

Licensee	Call Sign	Path	Status	Transmitter	Receiver	Frequency (MHz)[1]
-	-	-	-	-	-	-

Conclusion

The results of this analysis indicate that microwave path Fresnel zones do not overlie the Rugby Wind Repower project. As a result, repowering wind turbines at any of the proposed locations should not create a line-of-sight obstruction for any applied or licensed non-federal microwave links.

If you have any questions regarding the findings of this study, please contact ***Dan Underwood*** or ***Sophia Bullard*** at (703) 256-2485.

[1] 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.