

Appendix I
Triple H Wind Project Wind Power GeoPlanner™ Microwave
Study

Wind Power GeoPlanner™

Microwave Study

Triple H Wind Project



Prepared on Behalf of
Infinity Renewables

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Table of Contents

1. Introduction	- 1 -
2. Project Overview	- 1 -
3. Fresnel Zone Analysis	- 2 -
4. Conclusion	- 5 -
5. Contact	- 5 -

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: Triple H Wind Project

County: Hyde and Hughes

State: South Dakota

Number of Turbines: TBD

Blade Diameter: 116 meters

Hub Height: 80 meters

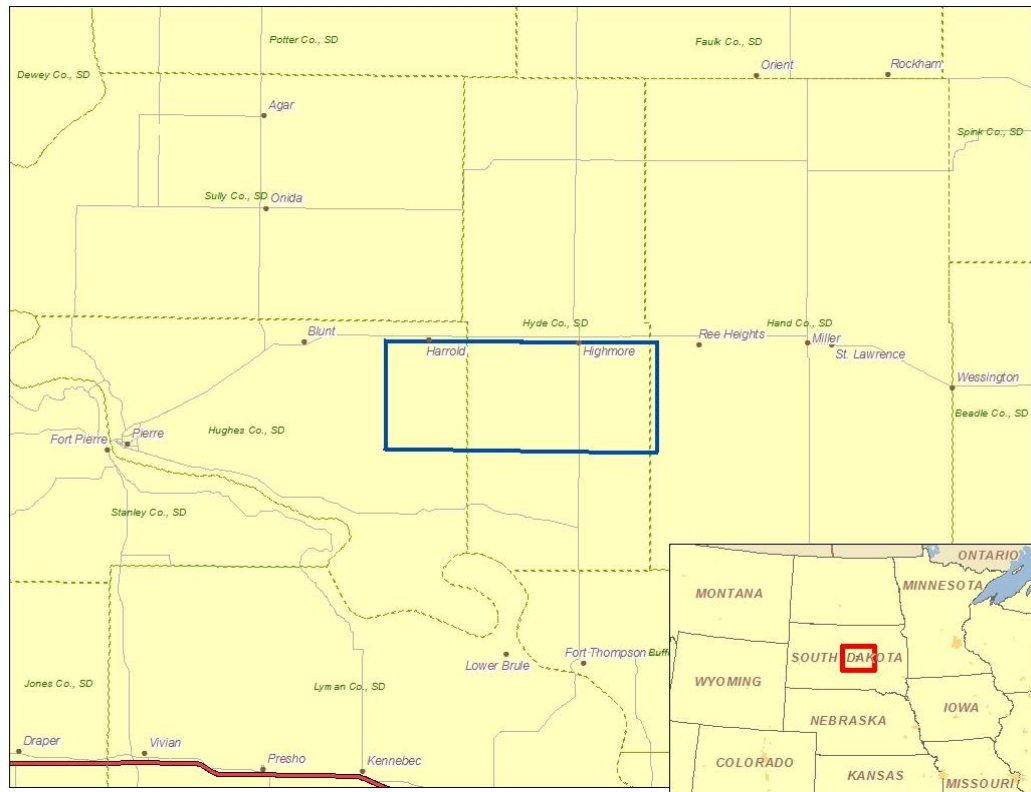


Figure 1: Area of Interest

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.

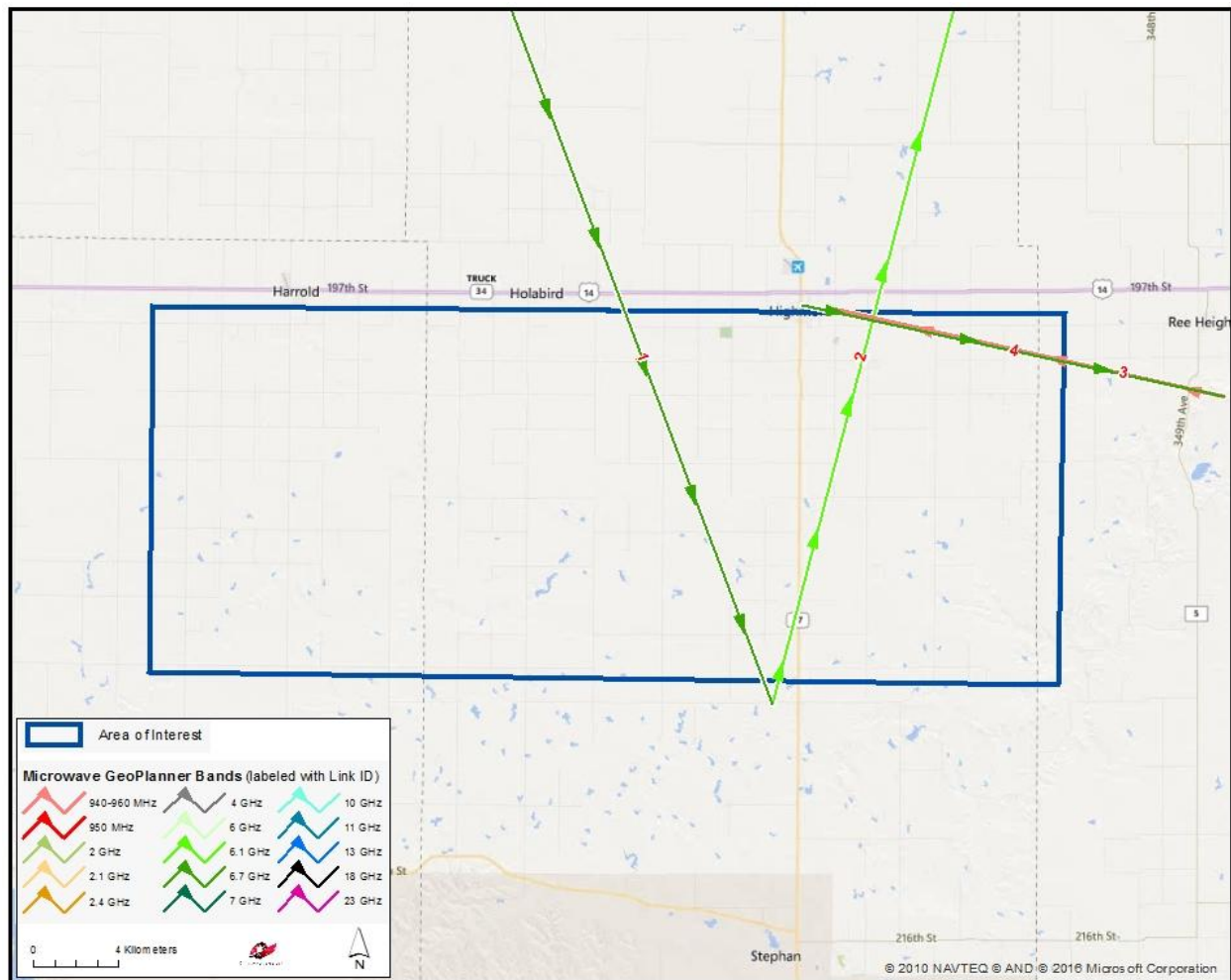


Figure 2: Microwave Paths that Intersect the Area of Interest

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

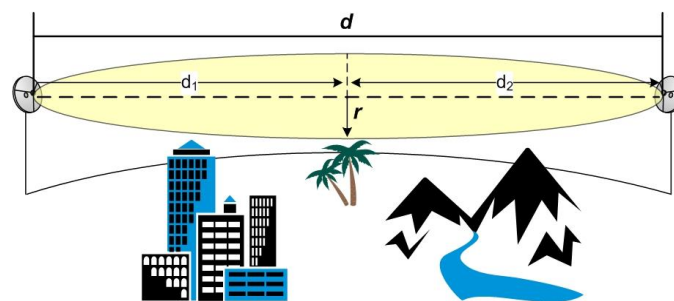
² We use FCC-licensed coordinates to determine which paths intersect the area of interest. It is possible that as-built coordinates may differ slightly from those on the FCC license.

ID	Status	Callsign 1	Callsign 2	Band	Path Length (km)	Licensee
1	Licensed	WBD224	WBD225	6.7 GHz	77.00	Basin Electric Power Cooperative
2	Licensed	WBD225	WQRB909	6.1 GHz	59.49	Basin Electric Power Cooperative
3	Licensed	WQKM509	WQNE257	940-960 MHz	18.84	NorthWestern Corporation
4	Licensed	WQUQ655	WQKM509	6.7 GHz	20.35	NorthWestern Corporation

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:

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


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

The calculated Fresnel Zone shows the narrow area of signal swath and is calculated for each microwave path in the project area. In general, this is the area where the planned wind turbines should be avoided, if possible. A depiction of the individual Fresnel Zones is shown in Figure 3, and is also included in the shapefiles^{3,4}.

³ The ESRI® shapefiles enclosed are in NAD 83 UTM Zone 14 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.

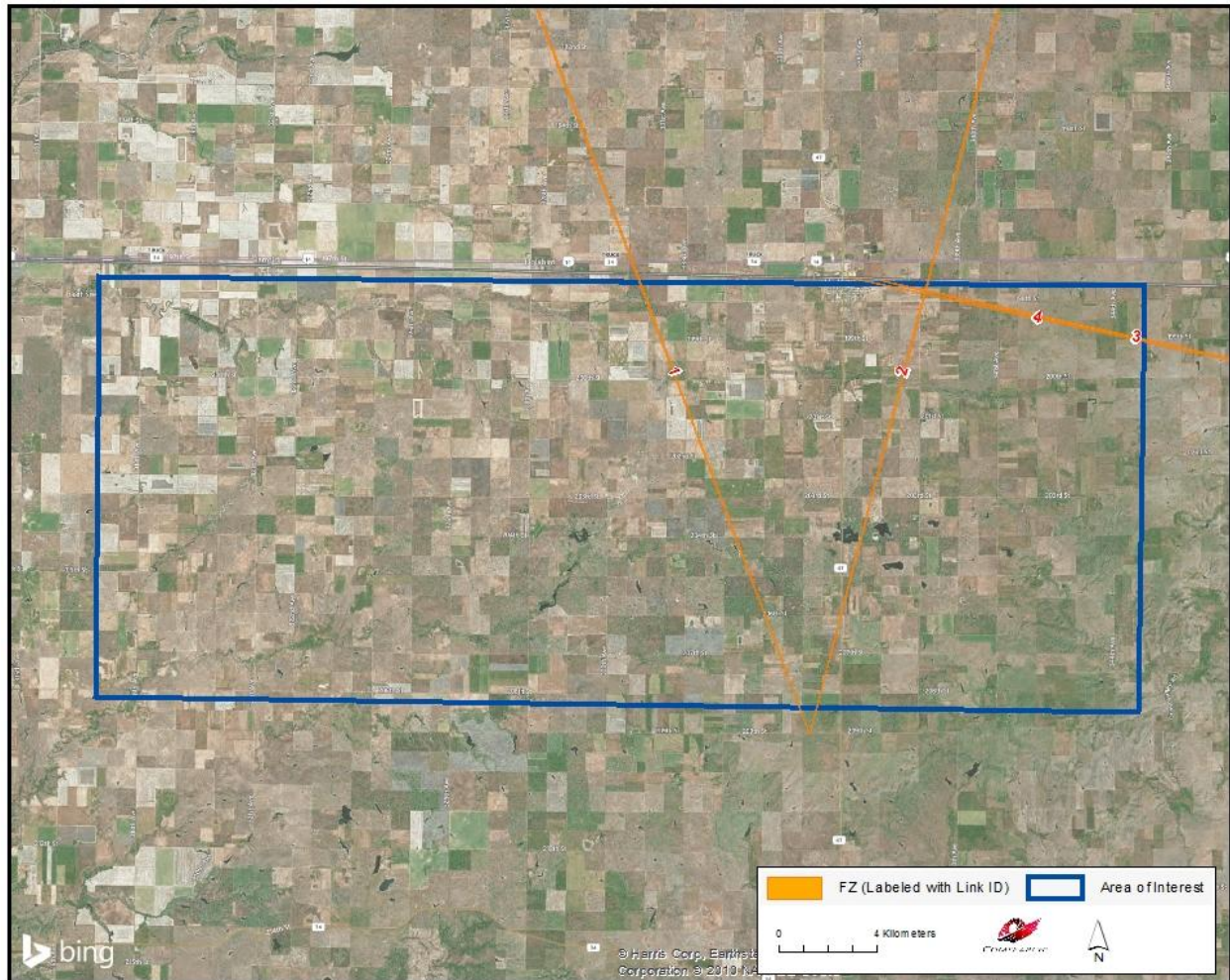


Figure 3: Fresnel Zones in the Area of Interest

Discussion of Potential Obstructions

Total Microwave Paths	Paths with Affected Fresnel Zones	Total Turbines	Turbines intersecting Fresnel Zones
4	N/A	N/A	N/A

For this project, turbine locations were not provided; thus we could not determine if any potential obstructions exist between the planned wind turbines and the incumbent microwave paths. If the latitude and longitude values for turbine locations are provided, Comsearch can identify where a potential conflict might exist.

4. Conclusion

Our study identified four microwave paths intersecting the Triple H Wind Project area. The Fresnel Zones for these microwave paths were calculated and mapped. We recommend that all turbines be sited in locations that will not obstruct the Fresnel Zones.

5. Contact

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

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