

APPENDIX E

**WIND POWER GEOPLANNER™
LICENSED MICROWAVE REPORT**

Wind Power GeoPlanner™

Licensed Microwave Report

Mohave County Wind Farm



Prepared on Behalf of
BP Wind Energy North
America

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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: Mohave County Wind Farm

County: Mohave

State: Arizona

Total Microwave Paths	Paths with Obstructions	Total Turbines	Turbine Obstructions
13	N/A	N/A	N/A

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, 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.

³ The ESRI® shapefiles enclosed are in NAD 83 UTM Zone 11 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

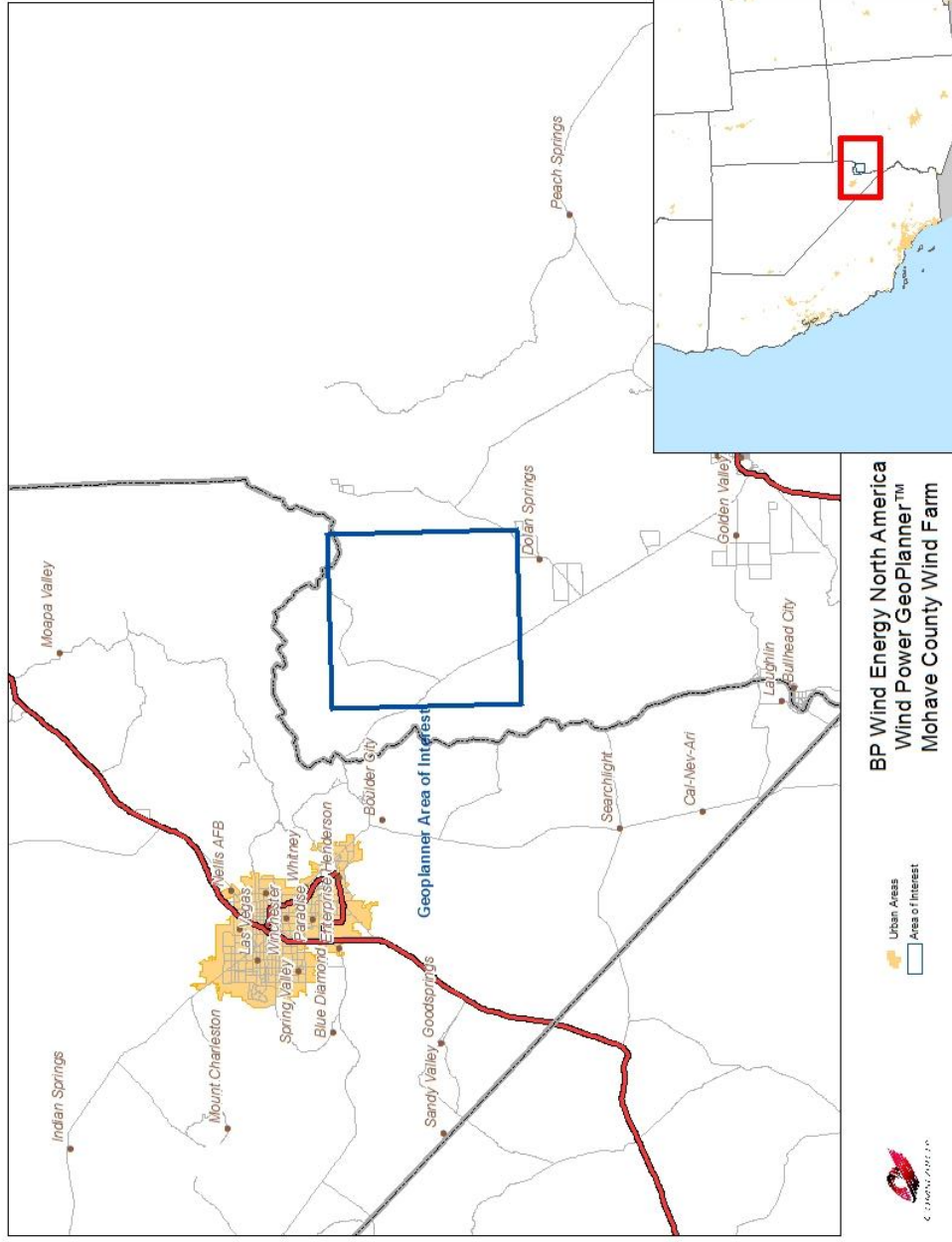


Figure 1: Area of Interest

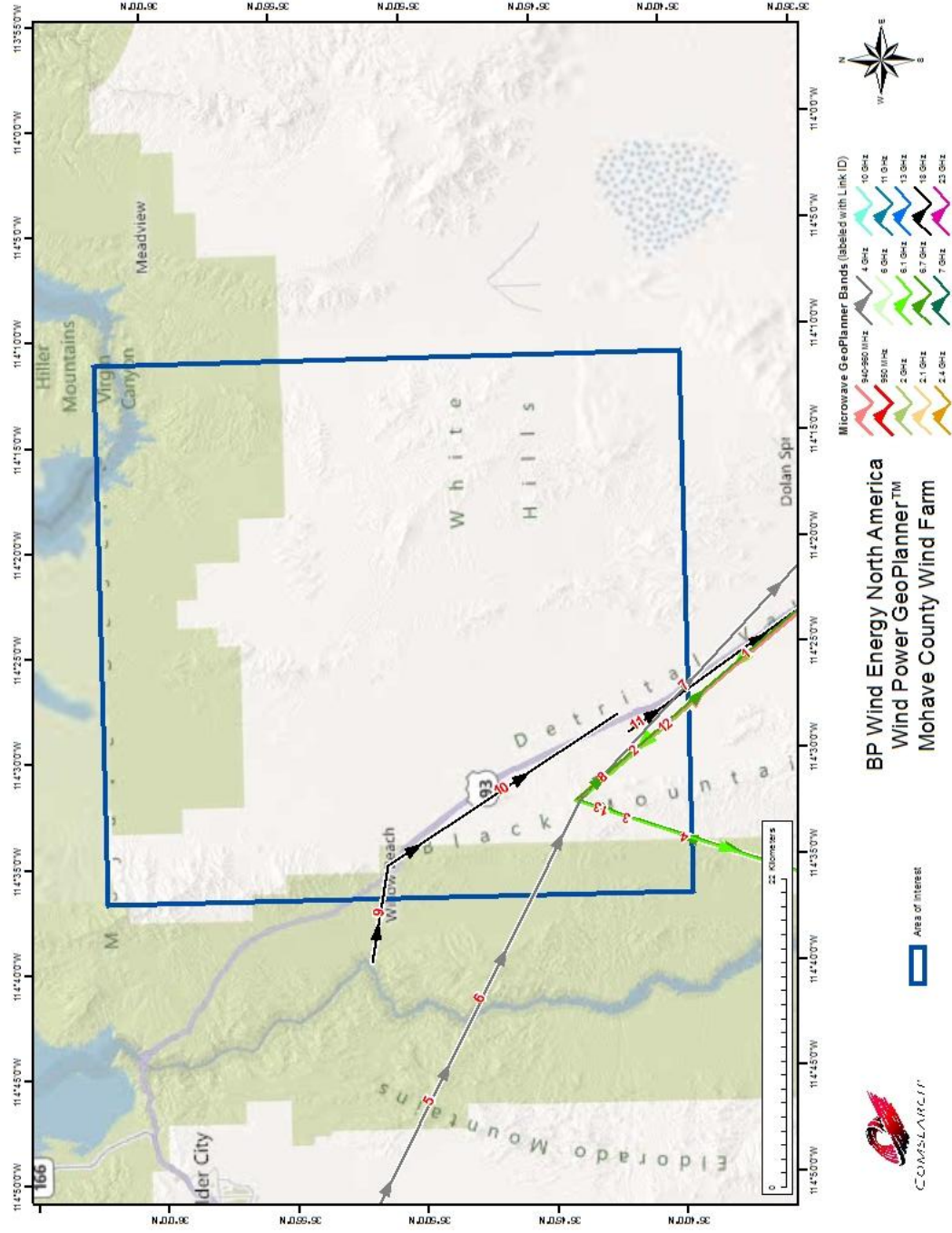


Figure 2: Microwave Paths that Intersect the Area of Interest

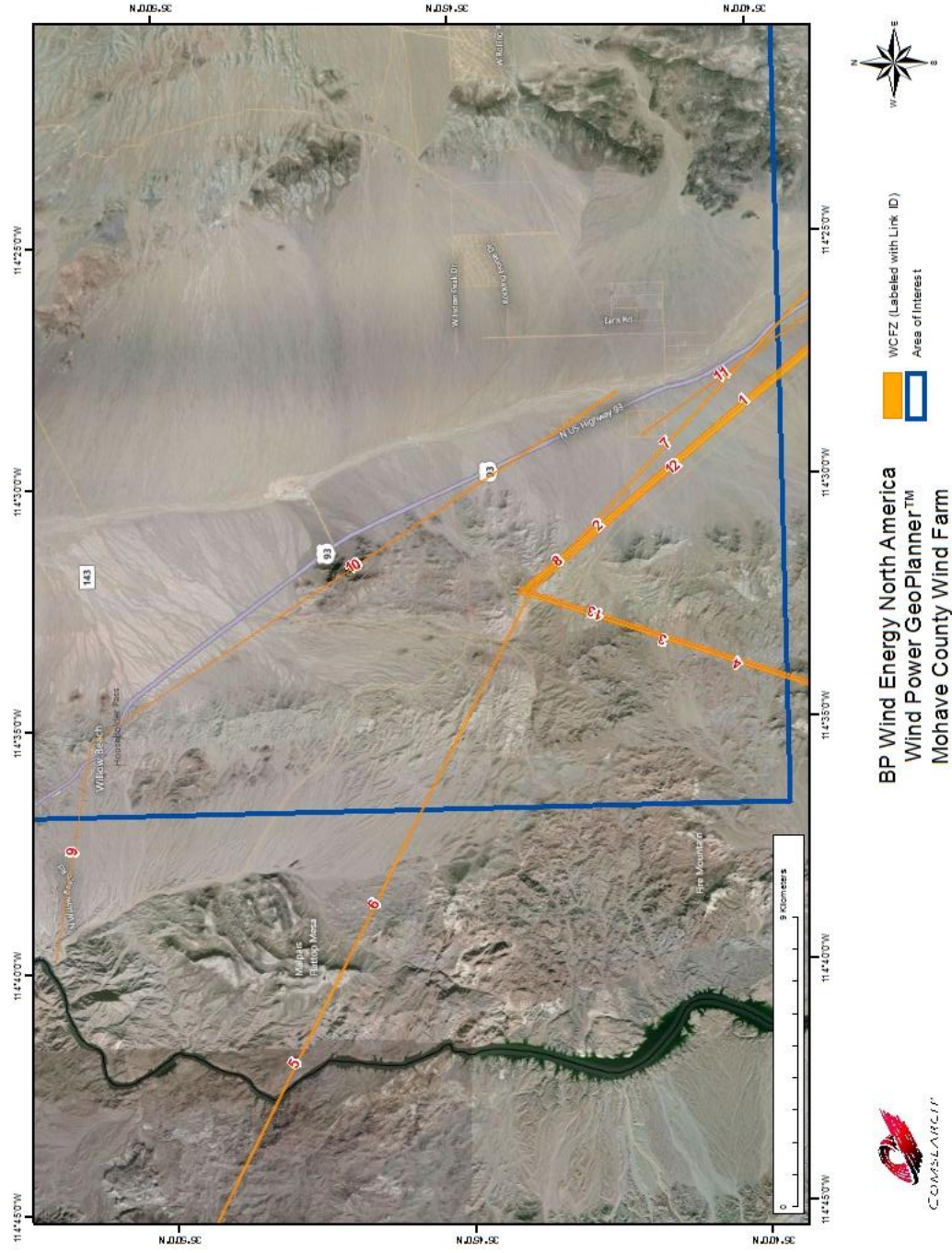


Figure 3: Microwave Paths with WCFZ Buffers

ID	Site Name 1	Site Name 2	Call sign 1	Call sign 2	Band	Licensee	WCFZ (m)
1*	HUALAPAI MTN	WILLOW BEACH	KCW23	KHM36	Lower 6 GHz	ARIZONA, STATE OF DEPT OF PUBLIC SAFETY	33.27
2	WILLOW BEACH	HUALAPAI	KHM36	KCW23	Upper 6 GHz	ARIZONA, STATE OF DEPT OF PUBLIC SAFETY	31.94
3*	WILLOW BEACH	CHRISTMAS TR	KHM36	WAH714	Lower 6 GHz	ARIZONA, STATE OF DEPT OF PUBLIC SAFETY	26.22
4	CHRISTMAS TR	WILLOW BEACH	WAH714	KHM36	Upper 6 GHz	ARIZONA, STATE OF DEPT OF PUBLIC SAFETY	25.17
5, 6	LAS VEGAS JC	WILLOW BEACH	WLB203	WLB236	4 GHz	CNG Communications, Inc.	31.19
7	WILLOW BEACH	CHLORIDE	WLB236	WLB235	4 GHz	CNG Communications, Inc.	30.27
8	WILLOW BEAC	HAYDEN PEAK	WPNI527	WPNI524	940-960 MHz	UNS Electric, Inc.	85.36
9	WILLOW BEAC	MIDDLE HUMP	WPOT288	WPOT289	18 GHz	Citizens Utilities Rural Company, Inc.	5.26
10	MIDDLE HUMP	GARDEN ROAD	WPOT289	WPOT290	18 GHz	Citizens Utilities Rural Company, Inc.	8.87
11	WHITE HILLS	BEE DRIVE	WPOT291	WPOT292	18 GHz	Citizens Utilities Rural Company, Inc.	9.52
12	KINGMAN JCT	WILLOW BEACH	WPTG764	WLB236	Lower 6 GHz	CNG Communications, Inc.	33.23
13	WILLOW BEACH	XMAS TREE	WQGI426	WQGI397	Upper 6 GHz	Sparkplug Southwest, LLC	25.15

* Status is "Proposed" and the path may not be fully constructed.

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)



4. Contact Us

For questions or information regarding the Licensed Microwave Report, contact:

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