

**BASIN ELECTRIC  
POWER COOPERATIVE**

1717 EAST INTERSTATE AVENUE  
BISMARCK, NORTH DAKOTA 58503-0564  
PHONE: 701-223-0441  
FAX: 701-557-5336



July 8, 2009

**RECEIVED**

Annette Bendish, Counsel  
North Dakota Public Service Commission  
600 East Boulevard Avenue; Dept. 408  
Bismarck, ND 58505

JUL 09 2009

**PUBLIC SERVICE COMMISSION**

Re: PUC Case No. PU-08-75

Dear Ms. Bendish:

Enclosed is a supplemental filing to Basin Electric's Late-Filed Exhibit #2, Minot Air Force Base, filed on May 26, 2009. The supplemental filing consists of a series of e-mail communications between Mr. James C. Sheldon, a Basin Electric engineer, and Mr. David Pooley of the U.S. Air Force.

Also enclosed is the Wind Power GeoPlanner Custom Microwave Report prepared by Comsearch on behalf of Basin Electric dated July 2, 2009.

If you have any questions concerning this letter or the enclosures, please call me at 701/557-5713.

Sincerely,

Deborah Fohr Levchak  
Staff Counsel

dfl/mw

Enclosures

c: Jerry Lien, PSC

35 PU-08-75 Filed: 7/9/2009 Pages: 20  
Supplemental Filing to Late-Filed Exhibit #2

## Deborah Levchak

---

**From:** James C. Sheldon (ELEC)  
**Sent:** Tuesday, July 07, 2009 11:54 AM  
**To:** Deborah Levchak  
**Subject:** PrairieWinds Project ND1 -- USAF  
**Attachments:** Turbine\_Layout.xls; Microwave Report PrairieWinds 1 July 2009.pdf

-----Original Message-----

**From:** Pooley, David F Civ USAF AFSPC AFSPC/A6NRI [mailto:David.Pooley@PETERSON.af.mil]  
**Sent:** Monday, July 06, 2009 9:28 AM  
**To:** James C. Sheldon (ELEC)  
**Cc:** Amanda Wangler; Ron Rebenitsch; 526 ICBMSG/CAG; Myers, Walter D Mr Civ USAF AFSPC AFSPC/A6NRI; Ogden, Terry A Civ USAF AFSPC AFSPC/A6NRI; Connolley, Scott D Civ USAF AFSPC AFSPC/A6NRI; Markel, Wayne E Civ USAF ACC ACC/A60F; Dalton, Keith R TSgt USAF ACC 5 CS/SCOS; 5 CS/CC Commander; Huettl, Ronald G Civ USAF ACC 5 CES/CEP; Nelson, Kevin P Civ USAF ACC 5 CES/CD; Larsen, James A Civ USAF AFSPC 91 MMXS/MMXFI  
**Subject:** RE: PrairieWinds - 1 Project

Jim,

Thanks for the heads up and attached Comsearch obstruction report. I am not aware of any changes to the microwave links planned to support AFSPC requirements (your planned turbine locations and our planned links, below) around Minot AFB so from an electromagnetic perspective everything looks good.

I am sure you all are in contact with the Civil Engineers at Minot AFB to ensure there are no other issues (i.e. HICS cables).

Thank you for working with us to evaluate and sort out any potential electromagnetic issues.

David Pooley  
Command Spectrum Manager  
HQ AFSPC/A6NRI  
150 Vandenberg St, Ste 1105  
Peterson AFB, CO 80914-4184  
(719) 554-6400, DSN prefix 692-, Fax -9438 david.pooley@peterson.af.mil  
David.pooley@afspc.af.smil.mil

Mr. Pooley,  
Attached is the Comsearch obstruction report. They completed a detailed analysis and reported that there are not any obstructions.  
Let me know if you would like anything else.  
Thanks,  
Jim

James C. Sheldon, EIT  
Electrical Engineer II - Telecommunications Basin Electric Power Cooperative  
1717 East Interstate Avenue  
Bismarck, ND 58503-0564

E-mail: jsheldon@bepc.com  
Direct Line: (701) 557-5780  
Fax: (701) 224-5322

Please note new 557 prefix.

-----Original Message-----

From: Pooley, David F Civ USAF AFSPC AFSPC/A6NRI [mailto:David.Pooley@PETERSON.af.mil]  
Sent: Tuesday, June 30, 2009 11:49 AM  
To: James C. Sheldon (ELEC)  
Cc: Ron Rebenitsch; Amanda Wangler  
Subject: RE: PrairieWinds - 1 Project

Jim,

Recommend having Comsearch review sites C42, C43, D50, D53, D56 & D58. That way we both have documentation supporting no impact. I believe Comsearch uses Microwave GeoPlanner and should be able to generate a report fairly quickly.

This is pretty much the first time we've tackled this issue within the ICBM missile field. My senior leadership will need to see we've well vetted the potential impact.

Thanks,

David Pooley, YA-2, DAF  
HQ AFSPC/A6NRI

-----Original Message-----

From: James C. Sheldon (ELEC) [mailto:JSheldon@bepc.com]  
Sent: Thursday, June 25, 2009 2:41 PM  
To: Pooley, David F Civ USAF AFSPC AFSPC/A6NRI  
Cc: Ron Rebenitsch; Amanda Wangler  
Subject: RE: PrairieWinds - 1 Project

Mr. Pooley,

The software I have access to is limited to microwave path analysis (Micropath) and Google Earth Pro. If you are still concerned that the path may be blocked, we can have the path and turbine analyzed by Comsearch to determine if there will be any interference.

Thanks,  
Jim

James C. Sheldon, EIT  
Electrical Engineer II - Telecommunications Basin Electric Power Cooperative  
1717 East Interstate Avenue  
Bismarck, ND 58503-0564

E-mail: jsheldon@bepc.com  
Direct Line: (701) 557-5780  
Fax: (701) 224-5322

Please note new 557 prefix.

-----Original Message-----

From: Pooley, David F Civ USAF AFSPC AFSPC/A6NRI [mailto:David.Pooley@PETERSON.af.mil]  
Sent: Wednesday, June 24, 2009 10:03 AM

To: James C. Sheldon (ELEC)  
Cc: Ron Rebenitsch; Amanda Wangler  
Subject: RE: PrairieWinds - 1 Project

Jim,

Attached is what I put together with the few tools I have. AF Space Command is in the process of obtaining a software tool like ICS telecom and HTZ warefare to be able to perform a more detailed analyses of potential disturbances that might result from wind turbines on surrounding telecom systems. The tool will estimate received signal and interference levels due to reflections from turbines/wind farms on fixed, mobile or radar systems.

Do you have access to such a tool just to take a closer look at the turbines that are near the microwave link path? What is the mitigation plan should the turbines be close enough to affect the path? I only ask that we take a closer look at a few locations to determine if any mitigation is required.

Thanks,

David Pooley, YA-2, DAF  
HQ AFSPC/A6NRI

-----Original Message-----

From: James C. Sheldon (ELEC) [mailto:JSheldon@bepc.com]  
Sent: Wednesday, June 24, 2009 6:42 AM  
To: Pooley, David F Civ USAF AFSPC AFSPC/A6NRI  
Cc: Ron Rebenitsch; Amanda Wangler  
Subject: RE: PrairieWinds - 1 Project

Mr. Pooley,

As per your request below, attached is the Google Pro screen capture that I utilized to determine the clearance between the microwave path and the closest wind turbine. This is the only microwave path that crosses the project, based upon the coordinates that you provided. Please contact me with any questions.

Thanks,

Jim

James C. Sheldon, EIT  
Electrical Engineer II - Telecommunications Basin Electric Power Cooperative  
1717 East Interstate Avenue  
Bismarck, ND 58503-0564

E-mail: jsheldon@bepc.com  
Direct Line: (701) 557-5780  
Fax: (701) 224-5322

Please note new 557 prefix.

-----Original Message-----

From: Pooley, David F Civ USAF AFSPC AFSPC/A6NRI [mailto:David.Pooley@PETERSON.af.mil]

Sent: Tuesday, June 23, 2009 11:45 AM  
To: James C. Sheldon (ELEC)  
Subject: RE: PrairieWinds - 1 Project  
Importance: High

Jim,

Is there any report or analysis results concerning the D-01 and South Base LMR Tower link? I'd like to see what tool(s) you use for the analysis. It will be helpful to know should the question comes up or to put minds at ease.

Thanks!

David Pooley, YA-2, DAF  
HQ AFSPC/A6NRI

-----Original Message-----

From: James C. Sheldon (ELEC) [mailto:JSheldon@bepc.com]  
Sent: Tuesday, June 16, 2009 8:24 AM  
To: Pooley, David F Civ USAF AFSPC AFSPC/A6NRI  
Cc: Amanda Wangler; Ron Rebenitsch  
Subject: RE: PrairieWinds - 1 Project

Good morning Mr. Pooley,  
Basin Electric is planning to begin construction of the PrairieWinds Project this summer. The project manager, Ron Rebenitsch, has asked me to make sure your questions and concerns have been answered. Could you please respond that we have answered your questions and you have no further concerns?

Thanks,  
Jim

-----Original Message-----

From: James C. Sheldon (ELEC)  
Sent: Friday, January 09, 2009 11:57 AM  
To: Pooley, David F Civ USAF AFSPC AFSPC/A6NRI  
Cc: Amanda Wangler  
Subject: RE: PrairieWinds - 1 Project

Mr. Pooley,

The path between D-01 and the LMR tower is the only path that crosses the wind project and it is not obstructed by any turbines or blades. Let me know if you have any other questions.

Thanks,  
Jim

-----Original Message-----

From: Pooley, David F Civ USAF AFSPC AFSPC/A6NRI [mailto:David.Pooley@PETERSON.af.mil]  
Sent: Wednesday, January 07, 2009 10:38 AM  
To: James C. Sheldon (ELEC)  
Cc: Amanda Wangler  
Subject: RE: PrairieWinds - 1 Project

Jim,  
Can you also see if any of the planned turbine locations could possibly impact our PTP links? I've been working through the planned turbine locations and so far they all appear to be just south of the South Base LMR tower. But my tools are a bit crude and I have to look at one turbine at a time.

David Pooley, YA-2, DAF  
HQ AFSPC/A6NRI

-----Original Message-----

From: James C. Sheldon (ELEC) [mailto:JSheldon@bepc.com]  
Sent: Wednesday, January 07, 2009 9:21 AM  
To: Pooley, David F Civ USAF AFSPC AFSPC/A6NRI  
Cc: Amanda Wangler  
Subject: RE: PrairieWinds - 1 Project

Mr. Pooley,  
I've reviewed the information provided and there will not be any interference issues between our communication systems. Basin uses licensed lower 6 GHz radios and none of the paths cross each other as shown on the attached word document. Contact me with any questions.  
Thanks,  
Jim

James C. Sheldon, EIT  
Electrical Engineer II - Telecommunications Basin Electric Power Cooperative  
1717 East Interstate Avenue  
Bismarck, ND 58503-0564

E-mail: jsheldon@bepc.com  
Direct Line: (701) 557-5780  
Fax: (701) 224-5322

Please note new prefix.

-----Original Message-----

From: Pooley, David F Civ USAF AFSPC AFSPC/A6NRI [mailto:David.Pooley@PETERSON.af.mil]  
Sent: Monday, January 05, 2009 12:09 PM  
To: Amanda Wangler; James C. Sheldon (ELEC)  
Cc: Oliver, Kurt; Polisky, Les; Pitts, Edward Civ AFFMA/DOO; Howard, David M Civ USAF ACC ACC/A6OF  
Subject: PrairieWinds - 1 Project

Amanda,

I have attached a data sheet for the PTP45600 radios we will be using. The power and bandwidth info can be found on the data sheet. Some sites will have connectorized radios and some sites will have integrated radios. For this activity, assume they are all integrated (worst case for transmit power). The frequency is all 4.5GHz. The modulation is QPSK. Approximate lat/long coordinates and antenna heights are listed below:

Site	lat/long	tower height(ft)
B-01	47d54'32"N 100d55'37"W	100 (Link to Base)
C-01	47d52'53"N 101d00'36"W	100 (Link to Base)
D-01 tower)	47d47'43"N 101d17'53"W	200 (Link to South base LMR
G-01 tower)	48d07'12"N 101d57'39"W	100 (Link to South base LMR
Base tower)	48d25'04"N 101d19'22"W	250 (Link to South base LMR

South Base LMR tower 48d00'14"N 101d17'59"W 200

With this information, can your engineer (Jim Sheldon) evaluate your planned locations for any potential comm. issues?

Thanks...

David Pooley, YA-2, DAF  
HQ AFSPC/A6NRI

-----Original Message-----

From: Amanda Wangler [mailto:AWangler@bepc.com]  
Sent: Monday, November 03, 2008 10:56 AM  
To: Pooley, David F Civ USAF AFSPC AFSPC/A6NRI  
Cc: James C. Sheldon (ELEC)  
Subject: PrairieWinds - 1 Project

David,

Thank you for your time today. Here is the information for you analysis.  
Please don't hesitate to contact me if you need any additional information.  
Jim Sheldon is the communications engineer on the project and will be working with you to mitigate any interference we may cause.

Text file:

GIS files:

As I mentioned, we have recently contacted James Larson regarding an updated picture showing our turbine locations in regards to the underground cable as discussed in the following email:

Thanks,  
Amanda

Amanda Wangler, PE  
Electrical Engineer III  
Basin Electric Power Cooperative  
Phone: 701-355-5771  
awangler@bepc.com

# Wind Power GeoPlanner™

## Custom Microwave Report

PrairieWinds 1



Prepared on Behalf of  
Basin Electric Power  
Cooperative

July 2, 2009



**COMSEARCH**  
A CommScope Company



## **Table of Contents**

<b>1. Introduction</b>	<b>- 1 -</b>
<b>2. Summary of Results</b>	<b>- 2 -</b>
<b>3. Tables and Figures</b>	<b>- 4 -</b>
<b>4. Recommended Ancillary Reports</b>	<b>- 10 -</b>
<b>5. Contact Us</b>	<b>- 11 -</b>



## **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 a US Air Force microwave system. Comsearch provides additional wind energy services, a description of which can be found at the end of this report.

## 2. Summary of Results

An overall summary of results appears below.

### Project Information

Name: PrairieWinds 1

County: Ward

State: North Dakota

Number of Microwave Paths	Number of Turbines	Number of Potential Obstructions
1	85	0

### Methodology

Our obstruction analysis was performed using microwave path data provided by the US Air Force. One path in particular, which connects site D-01 to the South Base LMR tower at Minot Air Force Base, was assessed for potential obstruction. The area of interest was defined by the client and encompasses the planned turbine locations. For the 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.

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

Where,

- $R_n$  = Fresnel Zone radius at a specific point in the microwave path, meters
- $n$  = Fresnel Zone number, 1
- $F_{\text{GHz}}$  = 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,  $d_1 = d_2$

The calculated WCFZ radius, giving the linear path an area or swath, buffers the microwave path in the project area. See the Tables and Figures section for a summary of the path 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 overlaid on topographic basemaps can be found in the Tables and Figures section, and is also included on the enclosed CD<sup>1</sup>.

#### **Discussion of Potential Obstructions**

For this project, 85 turbines were considered in the analysis, each with a blade diameter of 77 meters and turbine height of 80 meters.

None of the turbines were found to have a potential conflict with the incumbent microwave path. Turbine C42 was the closest to the WCFZ at a distance of 28.2 meters, but no obstruction is predicted. However, due to the close proximity of multiple turbines to the WCFZ, accuracy of the coordinates is a critical component of the analysis. Comsearch used coordinates provided by the US Air Force under the assumption that they were accurate.

<sup>1</sup> The ESRI® shapefiles contained on the enclosed CD are in NAD 83 UTM Zone 14 projected coordinate system.

### 3. Tables and Figures

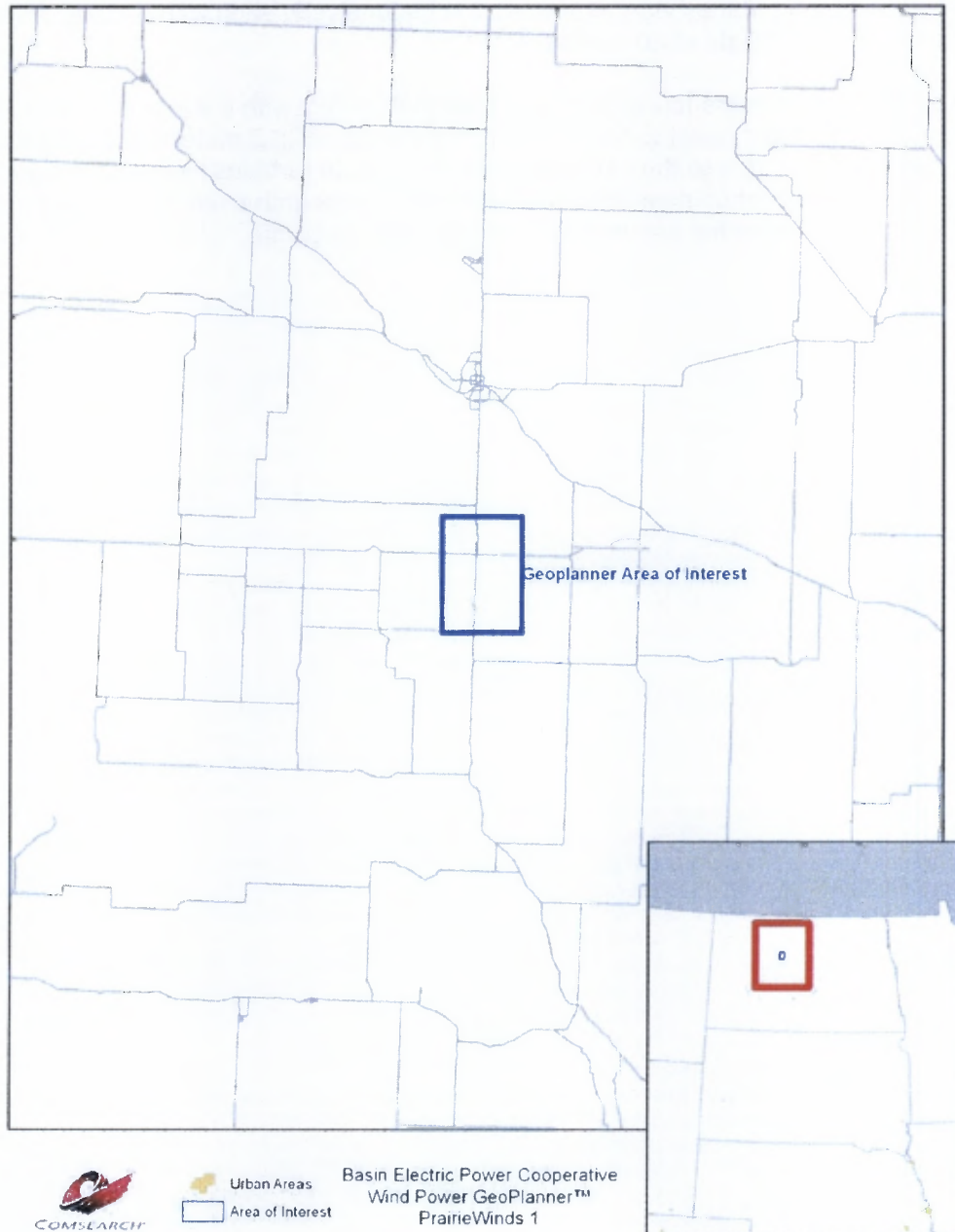


Figure 1: Area of Interest

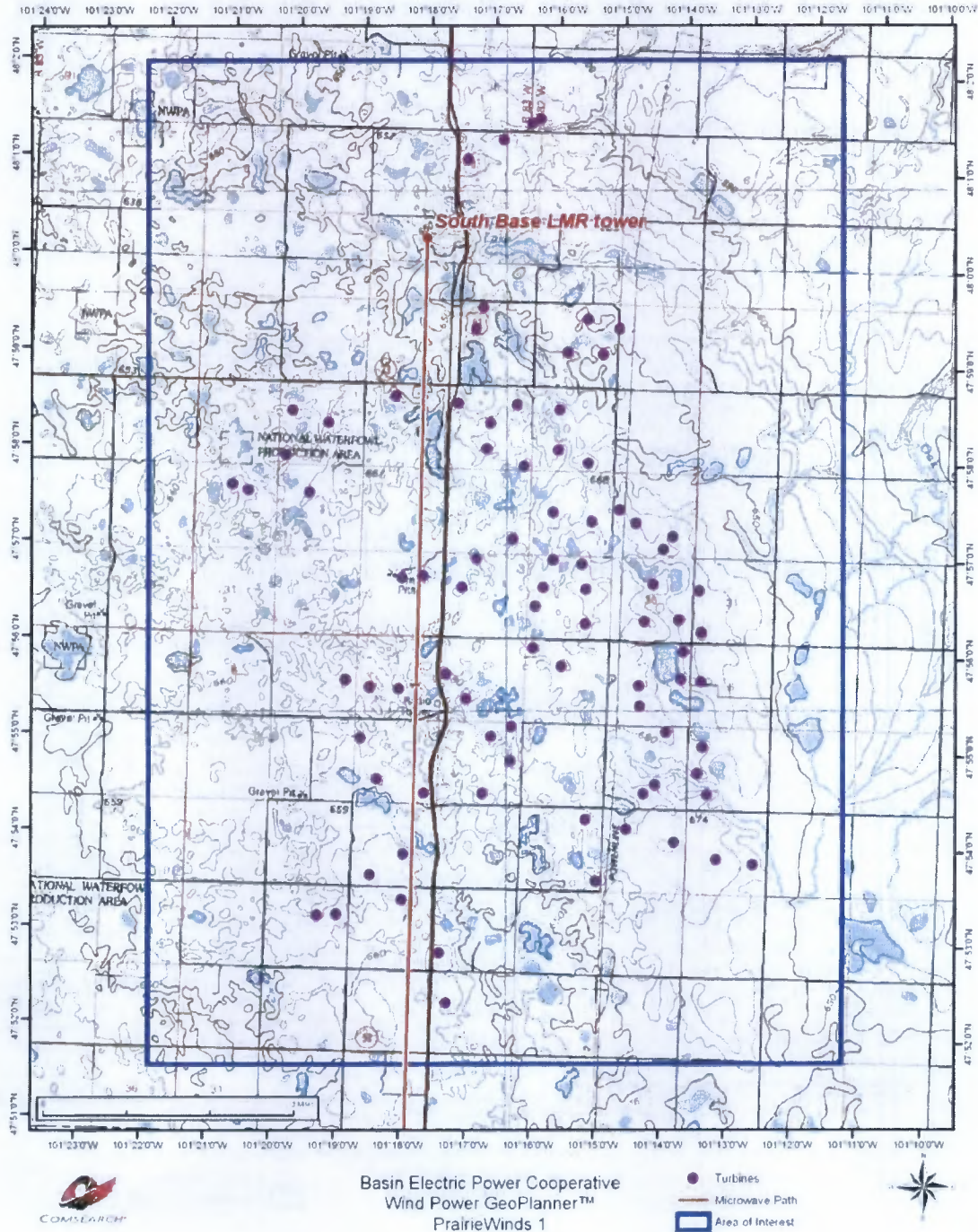


Figure 2: Microwave Paths that Intersect the Area of Interest

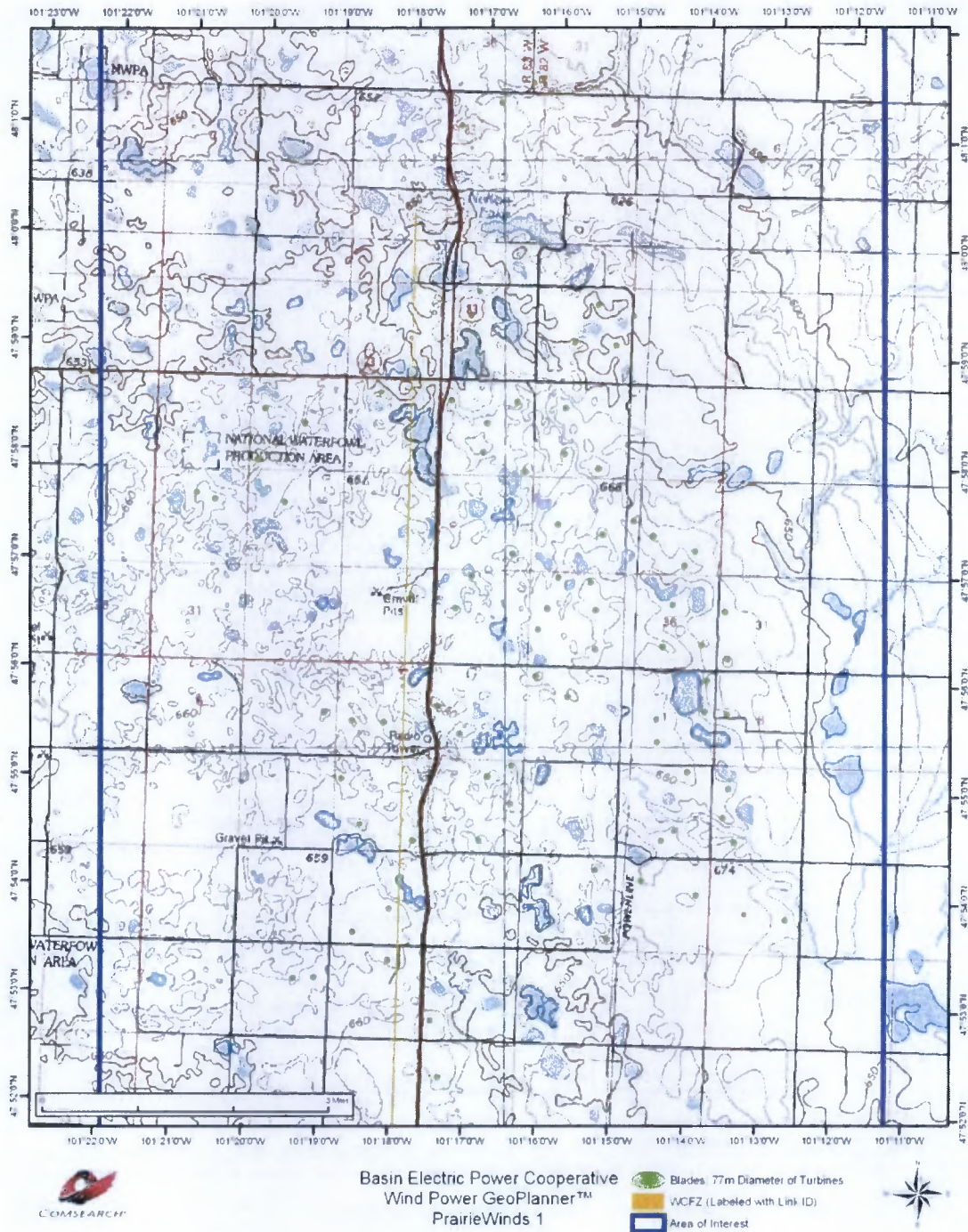


Figure 3: Microwave Paths with WCFZ Buffers

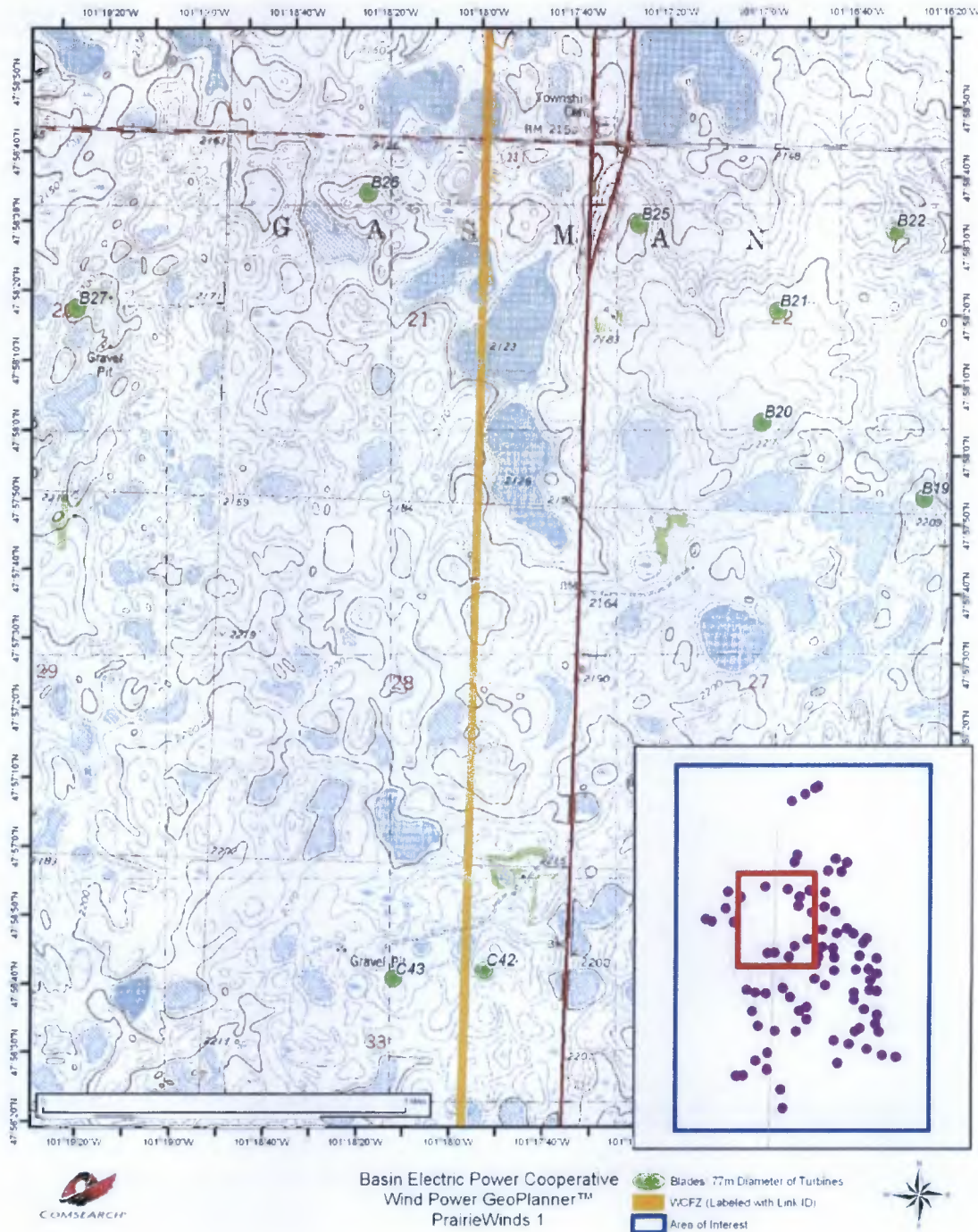


Figure 4: Microwave Paths with WCFZ Buffers

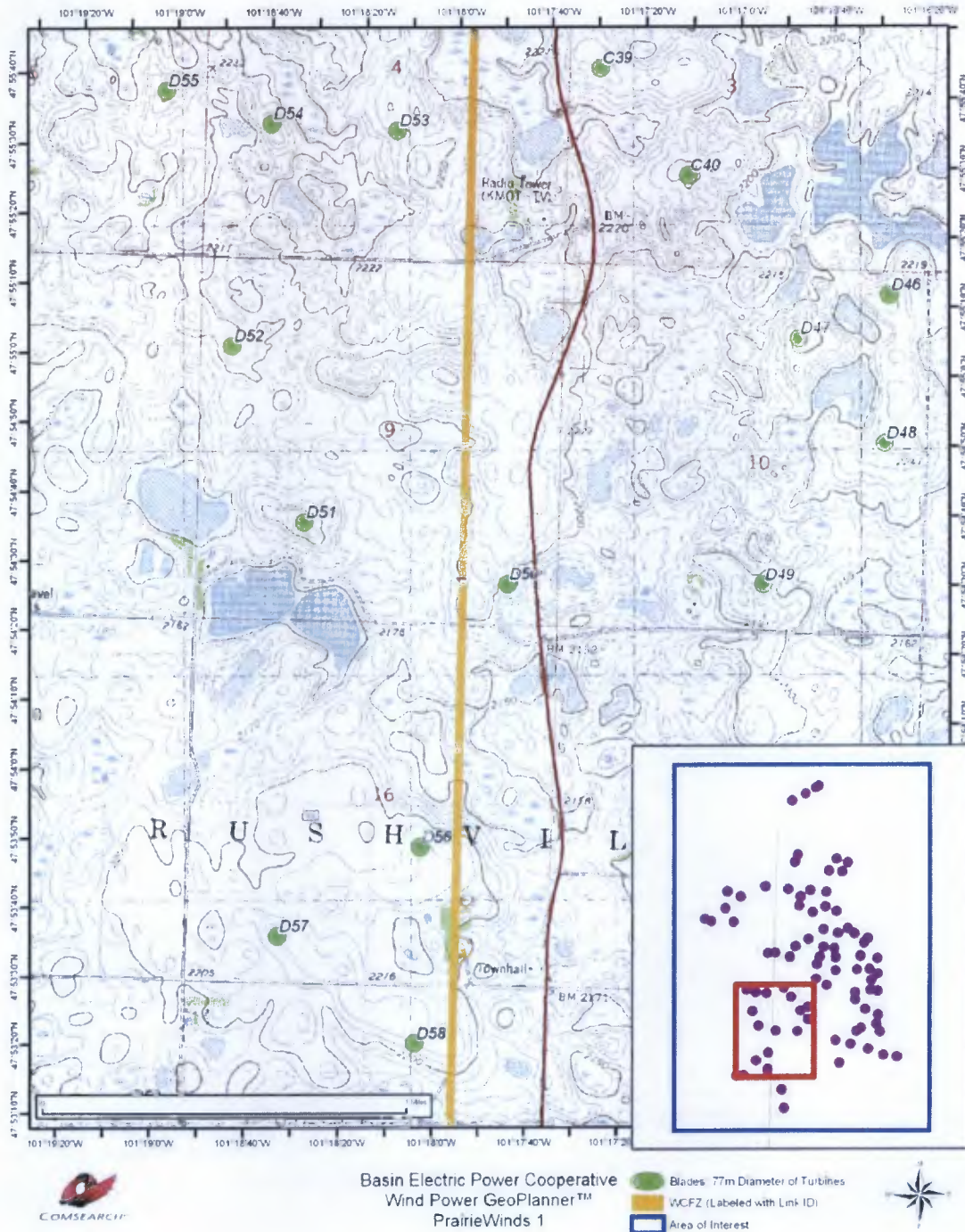


Figure 5: Microwave Paths with WCFZ Buffers

ID	Site Name 1	Site Name 2	Latitude 1	Longitude 1	Latitude 2	Longitude 2	Band	WCFZ (m)
1	D-01	South Base LMR tower	47.79527778	-101.2980556	48.00388889	-101.2997222	4.5 GHz	19.64

Table 1: Microwave Path Assessed for Potential Obstruction

## 4. Recommended Ancillary Reports

Comsearch offers the following wind energy services.

- **Licensed Microwave Report** – Assess all licensed non-Federal Government microwave paths and worst case Fresnel Zones that intersect the wind energy project area. If any potential obstructions exist, perform a **Detailed Fresnel Zone Analysis** to consider the actual horizontal and vertical Fresnel Zone clearances.
- **Coordination with Federal Government Systems** - Coordinate with NTIA, the agency that manages government spectrum, to determine if the proposed wind energy project will impact Federal Government links.
- **TV Analysis** - Plot off-air TV stations within 100 miles of the project area to identify which communities may have signal reception issues.
- **Ancillary Telecommunication Studies** – Conduct obstruction studies of other potentially-affected wireless telecommunication systems. This includes:
  - Land Mobile Sites
  - AM and FM Broadcast Stations
  - Advanced Wireless and Mobile Phone Carriers
  - Cable Facilities
  - Radio Astronomy Sites
- **Tower Structures** - Identify and map tower structures owned by the top five tower companies and those found in the FCC's Antenna Structure Registration database.
- **TV Baseline Measurements** - Perform baseline measurements of off-air TV stations in the vicinity of the wind energy facility. The measurements will be performed at various locations in population centers and at locations where the potential for signal blockage, multipath and electromagnetic noise degradation is probable.
- **Measurements to Identify Government and Unlicensed Operators** – Identify all commercial and government signals in the area, including unlicensed operators. Frequency range of this measurement will be from 400 MHz – 12,000 MHz.
- **Post Installation Measurements and Consultation** - Perform measurements after the installation of the wind energy facility. The measurements will be made at all sites where signal blockage, multipath and/or electromagnetic noise is reported and/or suspected. If the measurements and analysis verify signal blockage, multipath or electromagnetic noise due to the wind turbines, provide consulting services to mitigate the conditions. Perform radiation hazard compliance measurements.
- **Regulatory Support** - Complete and file FAA forms on behalf of the wind energy developer.





## **5. 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:	<a href="mailto:dfinney@comsearch.com">dfinney@comsearch.com</a>
Web site:	<a href="http://www.comsearch.com">www.comsearch.com</a>