

Wind Power GeoPlanner™

Land Mobile & Emergency Services Report

Buckeye Wind Project



Prepared on Behalf of
Buckeye Wind, LLC

October 13, 2017



Table of Contents

1. Introduction	- 1 -
2. Summary of Results	- 2 -
3. Impact Assessment	- 6 -
4. Recommendations	- 7 -
5. Contact	- 7 -

1. Introduction

An assessment of the emergency services in the Buckeye Wind Project area was performed by Comsearch to identify potential impact from the planned turbines. We evaluated the registered frequencies for the following types of first responder entities: police, fire, emergency medical services, emergency management, hospitals, public works, transportation and other state, county, and municipal agencies. We also identified all industrial and business land mobile radio (LMR) systems and commercial E911 operators within the proposed wind energy facility boundaries. This information is useful in the planning stages of the wind energy facility because the data can be used in support of facility communications needs and to evaluate any potential impact on the emergency services provided in that region. An overview of the project area, which is located in Champaign County, Ohio, appears in Figure 1.

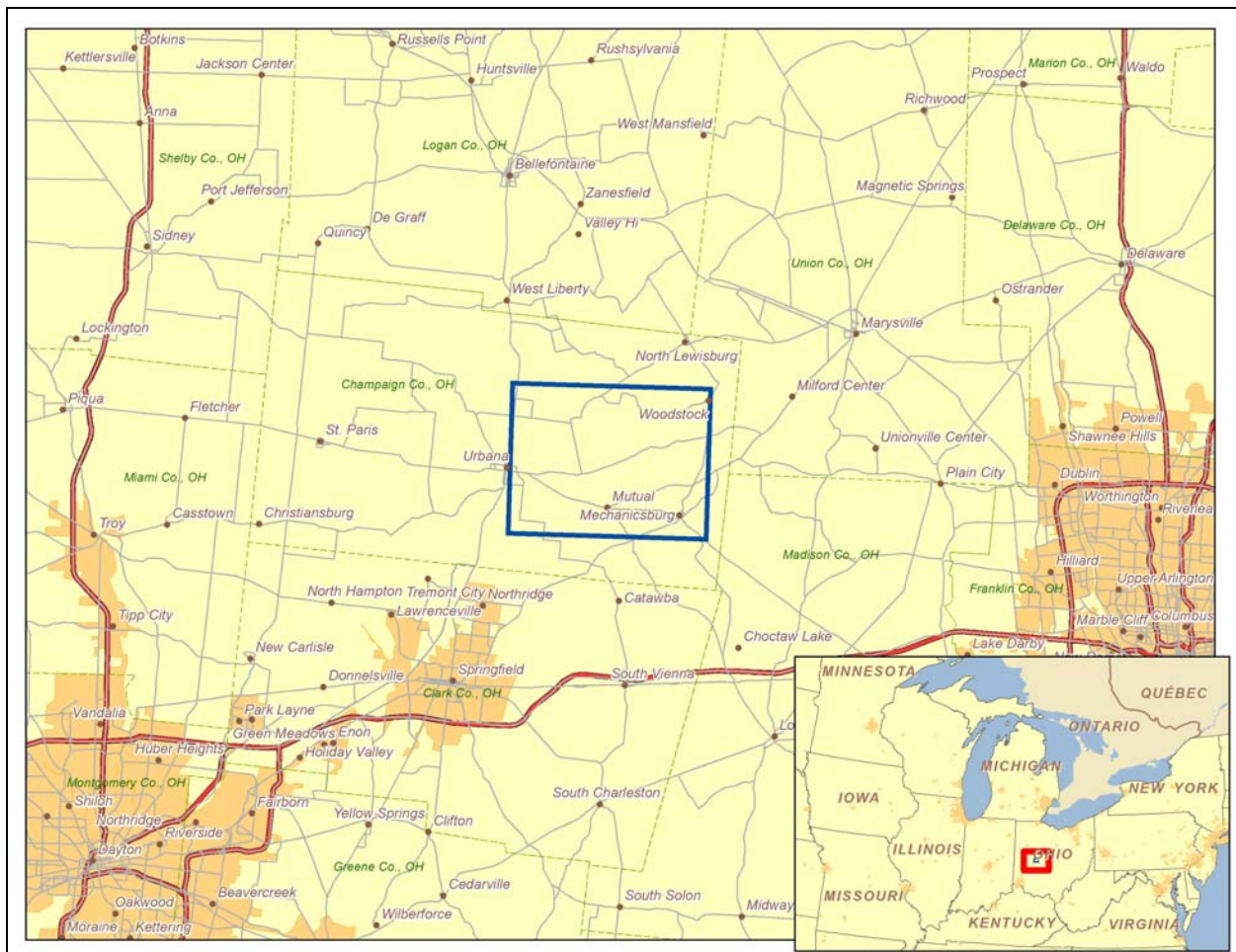


Figure 1: Area of Interest (AOI)

2. Summary of Results

Our land mobile and emergency services incumbent data¹ was derived from the FCC's Universal Licensing System (ULS) and the FCC's Public Safety & Homeland Security bureau. We identified both site-based licenses as well as regional area-wide licenses designated for public safety use.

Site-Based Licenses

The site-based licenses were imported into GIS software and geographically mapped relative to the wind energy project area of interest as defined by the customer. Each site on the map was given an ID number and associated with site information in a data table. A depiction of the fixed-site licenses in and around the project area appears in Figure 2.

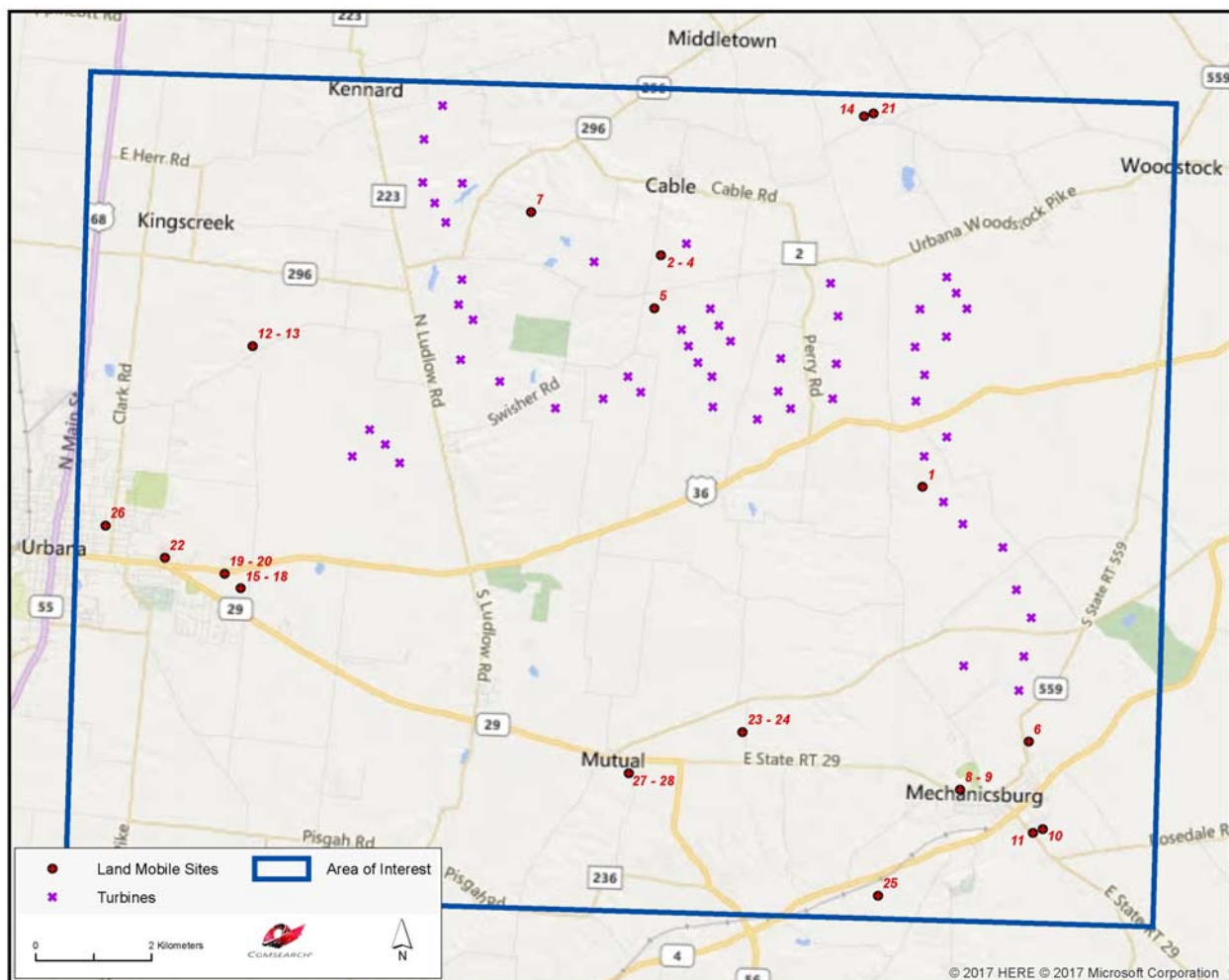


Figure 2: Land Mobile & Emergency Service Sites in Area of Interest

Figure 2 identifies twenty-eight site-based licenses in and around the Buckeye Wind Project area of interest. Specific information about these sites is provided in Table 1.

ID	Call Sign	Frequency Band (MHz)	Licensee	Antenna Height AGL (m)	Latitude (NAD83)	Longitude (NAD83)	Distance to Nearest Turbine (km)
1	WPIY325	150-174	Ohio, State of	5.0	40.122278	-83.576583	0.44
2	KZE754	150-174	Champaign, County of	53.3	40.157222	-83.631111	0.49
3	WQGE387	150-174	Northeast Champaign County Fire District	77.7	40.157222	-83.631111	0.49
4	WQHN970	150-174	Champaign County Communication Ctr.	53.3	40.157222	-83.631111	0.49
5	WPVA425	450-470	Champaign, County of	44.0	40.148944	-83.632139	0.60
6	WPQJ973	450-470	Tri-County Regional Jail Facility	9.0	40.083111	-83.553528	0.90
7	WNWW947	450-470	Heath, Stephen A.	40.0	40.163389	-83.657694	1.29
8	WPIG995	150-174	Mechanicsburg, Village of	41.0	40.075333	-83.567194	1.99
9	WPIG995	450-470	Mechanicsburg, Village of	34.0	40.075333	-83.567194	1.99
10	KAT425	25-50	Mechanicsburg Sand & Gravel, Inc.	21.0	40.069500	-83.550194	2.44
11	WQWS254	150-174	M'burg Exempted Village School District	41.0	40.068889	-83.552194	2.48
12	WQQH916	769-775 / 799-805	Ohio, State of	68.0	40.141139	-83.713417	2.49
13	WQTD267	800/900	Ohio, State of	68.0	40.141139	-83.713417	2.49
14	WPUN554	150-174	Triad Local Schools	30.5	40.179889	-83.590722	2.95
15	KCW649	150-174	Urbana, City of	30.0	40.103389	-83.714361	2.99
16	KQC458	150-174	Pioneer Rural Electric Cooperative, Inc.	79.0	40.103389	-83.714361	2.99
17	WGL408	150-174	Buckeye Power, Inc.	69.0	40.103389	-83.714361	2.99
18	WPKN788	450-470	P & R Spectrum Resources, Inc.	81.0	40.103389	-83.714361	2.99
19	KQA422	150-174	Urbana, City of	52.0	40.105611	-83.717694	3.00
20	KQA422	150-174	Urbana, City of	60.0	40.105611	-83.717694	3.00
21	WNAA596	150-174	Triad Local School	20.0	40.180333	-83.588806	3.03

¹ Comsearch makes no warranty as to the accuracy of the data included in this report beyond the date of the report. The data presented in this report is derived from the land mobile station's FCC license and governed by Comsearch's data license notification and agreement located at http://www.comsearch.com/files/data_license.pdf

ID	Call Sign	Frequency Band (MHz)	Licensee	Antenna Height AGL (m)	Latitude (NAD83)	Longitude (NAD83)	Distance to Nearest Turbine (km)
22	WPUW586	150-174	Community Mercy Health Partners	15.2	40.107833	-83.729917	3.68
23	WNUX651	800/900	Dayton Power & Light Company	46.0	40.083333	-83.611667	4.00
24	WQOR624	800/900	Dayton Power & Light Company	49.1	40.083333	-83.611667	4.00
25	WNFD447	150-174	Boerger, Michael K.	8.0	40.058389	-83.583250	4.25
26	WPHP337	450-470	Urbana City Schools	28.0	40.112556	-83.742139	4.43
27	WPIG995	150-174	Mechanicsburg, Village of	19.8	40.076333	-83.634528	6.09
28	WPIG995	450-470	Mechanicsburg, Village of	12.2	40.076333	-83.634528	6.09

Table 1: Land Mobile & Emergency Service Sites in Area of Interest

Area-Wide Licenses

The regional area-wide licenses were compiled from FCC data sources and identified for each county in the wind energy project area. The Buckeye Wind Project is located in Champaign County, Ohio, part of Public Safety Region #33, which contains all of the counties in the State of Ohio. The regional public safety operations are overseen by the entity listed below.

Robert M. Bill
Chairperson
MARCS Program Office
4200 Surface Road
Columbus, OH 43228
phone: 614-995-0063
email: region33.rpc@gmail.com

The chairperson for Region #33 serves as the representative for all public safety entities in the area and is responsible for coordinating current and future public safety use in the wireless spectrum. In the bands licensed by the FCC for area-wide first responders, which include 220 MHz, 700 MHz, 800 MHz and 4.9 GHz, as well as the traditional Part 90 public safety pool of frequencies, twenty licenses were found for the State of Ohio and two for the County of Champaign (see Table 2). These area-wide licenses are designated for mobile use only.

ID	Licensee	Area of Operation	Frequency Band (MHz)
1	Adams, Township of	Countywide: Champaign	150-174
2	American National Red Cross	Statewide: Ohio	25-50, 150-174, 450-470
3	Athens, County of	Statewide: Ohio	0-10
4	Barberton, City of	Statewide: Ohio	800/900
5	Champaign, County of	Countywide: Champaign	150-174, 450-470
6	Columbus Department of Public Safety Division of Support Svcs.	Statewide: Ohio	0-10, 800/900, 2450-2500
7	Delaware, County of	Statewide: Ohio	0-10
8	Delaware County 911	Statewide: Ohio	800/900
9	Greene, County of	Statewide: Ohio	450-470, 800/900
10	Guernsey, County of	Statewide: Ohio	150-174
11	Midwest K9 Search Unit	Statewide: Ohio	150-174
12	National Ski Patrol System, Inc.	Statewide: Ohio	150-174
13	Northern Indiana Search & Rescue	Statewide: Ohio	150-174
14	Ohio, State of	Statewide: Ohio	0-10, 25-50, 150-174, 421-430, 450-470, 769-775/799-805, 800/900, 4940-4990
15	Ohio Department of Natural Resources	Statewide: Ohio	150-174, 4940-4990
16	Ohio Department of Transportation	Statewide: Ohio	0-10
17	Ohio Organized Crime Investigations Commission	Statewide: Ohio	2450-2500
18	Ohio State Highway Patrol	Statewide: Ohio	25-50, 150-174, 450-470, 2450-2500
19	Parma Fire Department	Statewide: Ohio	769-775/799-805, 800/900
20	Parma Heights, City of	Statewide: Ohio	150-174, 800/900
21	Saint Marys, Township of	Statewide: Ohio	800/900
22	Westlake, City of	Statewide: Ohio	150-174, 450-470

Table 2: Regional Licenses

E911 Operators

Wireless operators are granted area-wide licenses from the FCC to deploy their cellular networks, which often include handsets with E911 capabilities. Since mobile phone market boundaries differ from service to service, we disaggregated the carriers' licensed areas down to the county level. We have identified the type of service for each carrier in Champaign County, Ohio in Table 3.

Mobile Phone Carrier	Service ²
AT&T	AWS, Cellular, PCS, WCS, 700 MHz
DISH Network	AWS, 700 MHz
Grain Management	PCS
Sprint	PCS
T-Mobile	AWS, PCS, 700 MHz
Verizon	AWS, Cellular, PCS, 700 MHz

Table 3: Mobile Phone Carriers in Area of Interest with E911 Service

3. Impact Assessment

The first responder, industrial/business land mobile sites, area-wide public safety, and commercial E-911 communications as described in this report are typically unaffected by the presence of wind turbines, and we do not anticipate any significant harmful effect to these services in the Buckeye Wind Project area. Although each of these services operates in different frequency ranges and provides different types of service including voice, video and data applications, there is commonality among these different networks in regards to the impact of wind turbines on their service. Each of these networks is designed to operate reliably in a non-line-of-sight (NLOS) environment. Many land mobile systems are designed with multiple base transmitter stations covering a large geographic area with overlap between adjacent transmitter sites in order to provide handoff between cells. Therefore, any signal blockage caused by the wind turbines does not materially degrade the reception because the end user is likely receiving signals from multiple transmitter locations. Additionally, the frequencies of operation for these services have characteristics that allow the signal to propagate through wind

² AWS: Advanced Wireless Service at 1.7/2.1 GHz
CELL: Cellular Service at 800 MHz
PCS: Personal Communication Service at 1.9 GHz
WCS: Wireless Communications Service at 2.3 GHz
700 MHz: Lower 700 MHz Service

turbines. As a result, very little, if any, change in their coverage should occur when the wind turbines are installed.

When planning the wind energy turbine locations in the area of interest, a conservative approach would dictate not locating any turbines within 77.5 meters of land mobile fixed-base stations to avoid any possible impact to the communications services provided by these stations. This distance is based on FCC interference emissions from electrical devices in the land mobile frequency bands. As long as the turbines are located more than 77.5 meters from the land mobile stations, they will meet the setback distance criteria for FCC interference emissions in the land mobile bands.

4. Recommendations

In the event that a public safety entity believes its coverage has been compromised by the presence of the wind energy facility, it has many options to improve its signal coverage to the area through optimization of a nearby base station or even adding a repeater site. Utility towers, meteorological towers or even the turbine towers within the wind project area can serve as the platform for a base station or repeater site.

5. Contact

For questions or information regarding the Land Mobile & Emergency Services Report, please 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:	dfinney@comsearch.com
Web site:	www.comsearch.com

Wind Power GeoPlanner™

Microwave Study

Buckeye Wind Project



Prepared on Behalf of
Buckeye Wind, LLC

October 11, 2017



Table of Contents

1. Introduction	- 1 -
2. Project Overview	- 1 -
3. Two-Dimensional Fresnel Zone Analysis	- 2 -
4. Cross Sectional Analysis	- 7 -
5. Conclusion	- 8 -
6. Contact	- 8 -

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: Buckeye Wind Project

County: Champaign

State: Ohio

Number of Turbines: 55

Blade Diameter: 140 meters

Hub Height: 80 meters

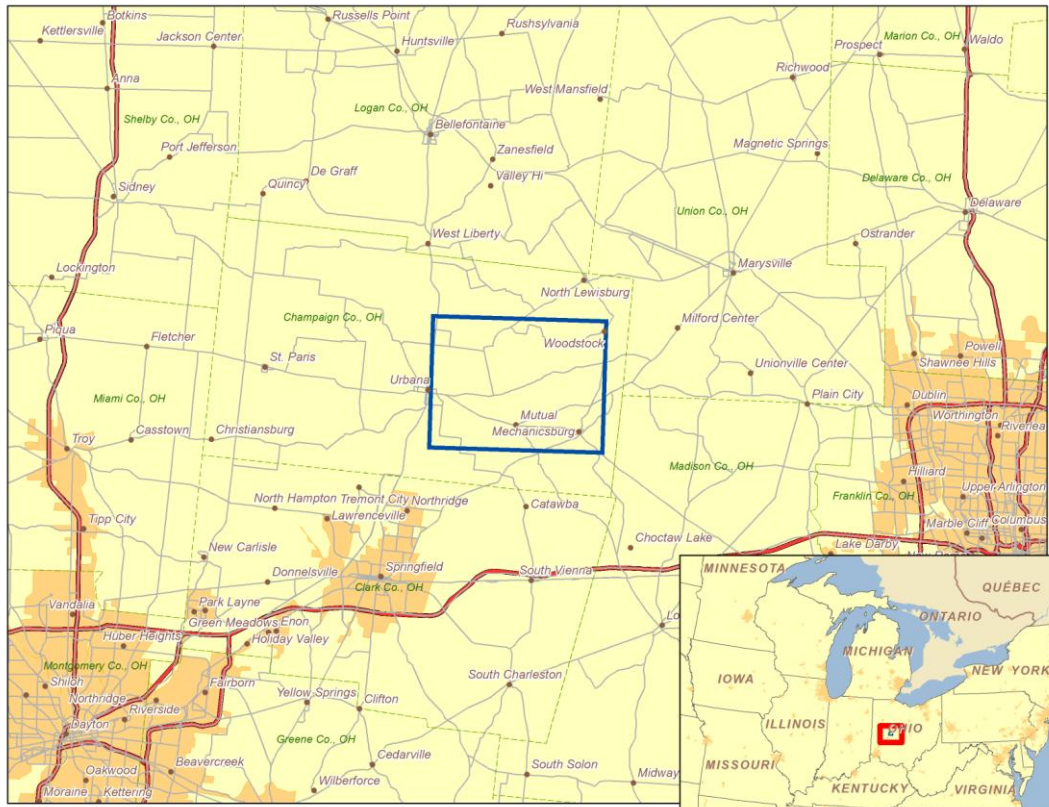


Figure 1: Area of Interest

3. Two-Dimensional 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.

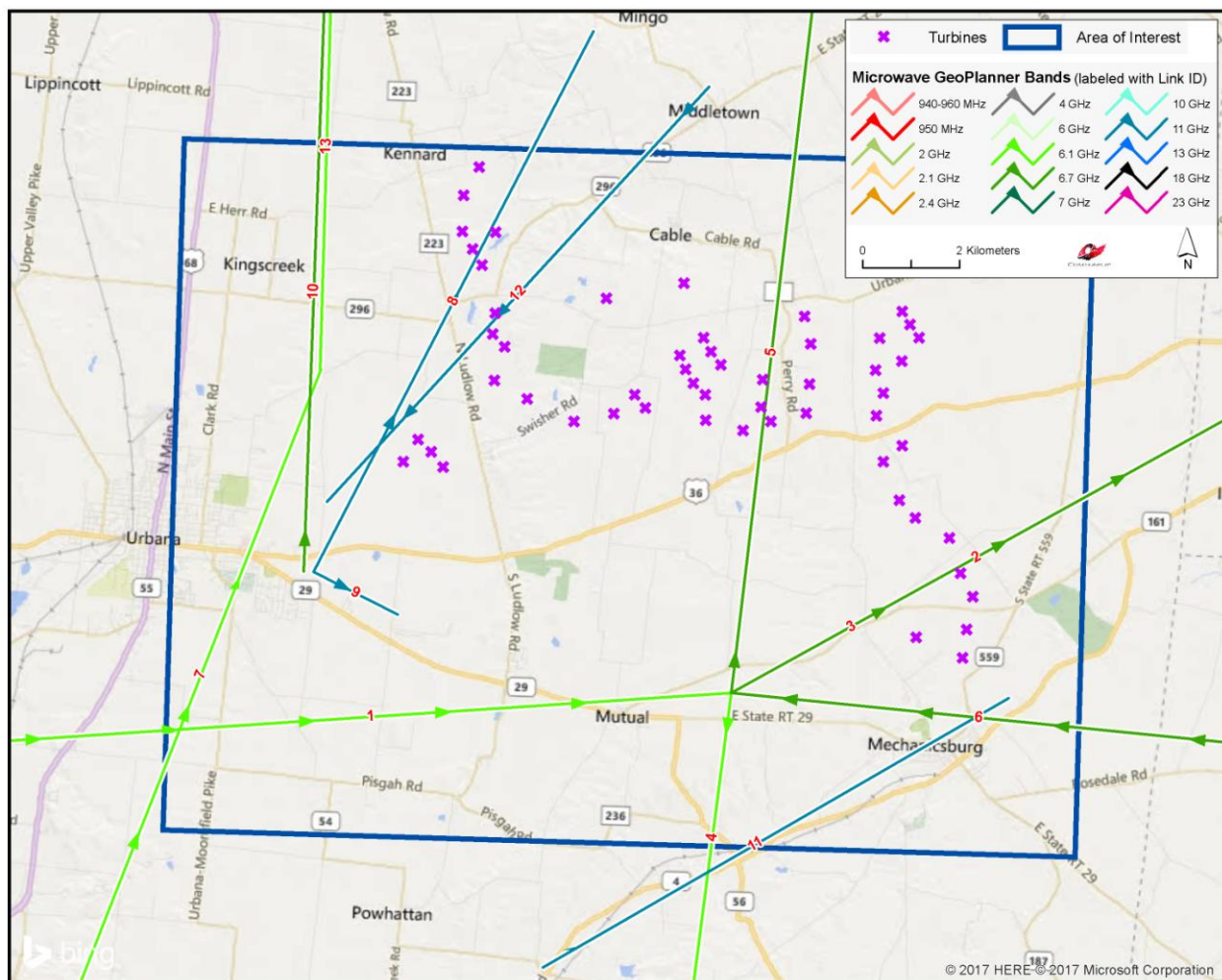


Figure 2: Microwave Paths that Intersect the Area of Interest

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	KJL70	KJL71	Lower 6 GHz	15.12	Dayton Power & Light Company
2-3	Licensed	KJL71	KJL69	Upper 6 GHz	28.39	Dayton Power & Light Company
4	Licensed	KJL71	WPOQ523	Lower 6 GHz	29.63	Dayton Power & Light Company
5	Licensed	KJL71	WQOE601	Upper 6 GHz	26.08	Dayton Power & Light Company
6	Licensed	WIW84	KJL71	Upper 6 GHz	35.76	American Electric Power Service Corp
7	Licensed	WLT268	WML268	Lower 6 GHz	22.41	New Par - Ohio Region
8	Licensed	WQNE790	WQNE789	11 GHz	12.58	Pioneer Rural Electric Cooperative Inc.
9	Licensed	WQNE790	WQNE792	11 GHz	2.01	Pioneer Rural Electric Cooperative Inc.
10	Licensed	WQNX771	WQNK793	Upper 6 GHz	30.57	W.A.T.C.H. TV Company Inc.
11	Licensed	WQRY893	WQRY921	11 GHz	11.10	Sprintcom, Inc
12	Licensed	WQRY910	WQRY900	11 GHz	11.64	Sprintcom, Inc
13	Licensed	WQVZ783	WQVY326	Lower 6 GHz	26.40	Agile Network Builders LLC

Table 1: Summary of Microwave Paths that Intersect the Area of Interest

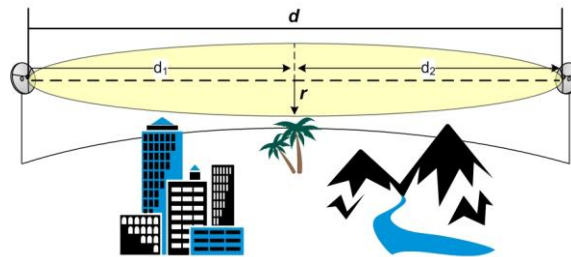
(See enclosed *mw_geopl.xlsx* for more information and
GP_dict_matrix_description.xls for detailed field descriptions)

Verification of Coordinate Accuracy

It is possible that as-built coordinates may differ from those on the FCC license. For this project, path IDs 2-3, 5, 8 and 12 cross within close proximity of the proposed turbines and the tower locations for these paths will have a critical impact on the result. Therefore, we verified these locations using aerial photography. Some of the towers were found to be slightly off and were moved to their locations based on the aerial photos³.

Next, we calculated a Fresnel Zone for each path based on the following formula:

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



³ See enclosed *mw_geopl.shp* and *mw_geopl_fcc.shp* for details.

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

In general, this is the area where the planned wind turbines should be avoided, if possible. A depiction of the Fresnel Zones for each microwave path listed can be found in Figure 3 and Figure 4, and is also included in the enclosed shapefiles^{4,5}.

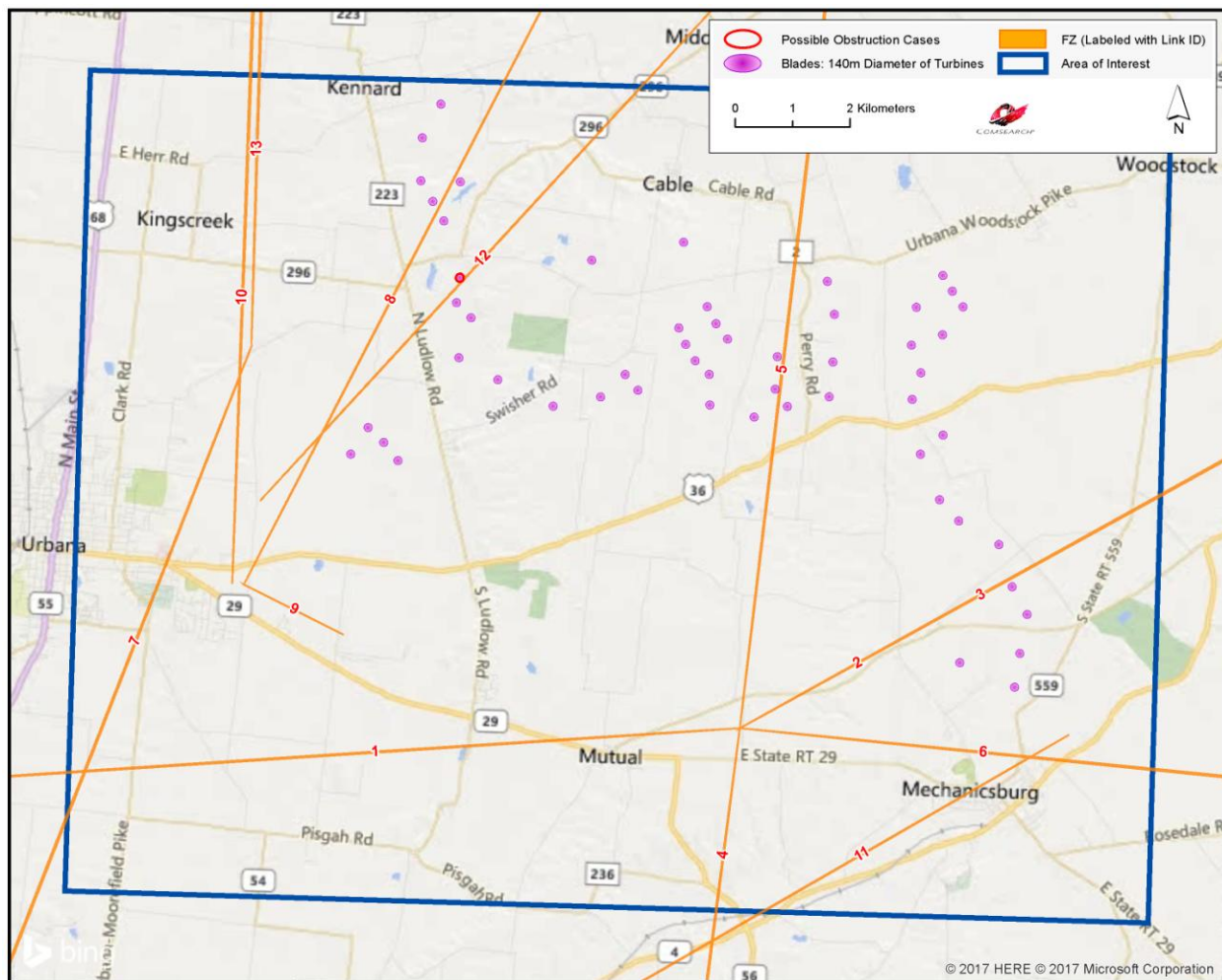


Figure 3: Fresnel Zones in the Area of Interest

⁴ The ESRI® shapefiles enclosed are in NAD 83 UTM Zone 17 projected coordinate system.

⁵ 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.

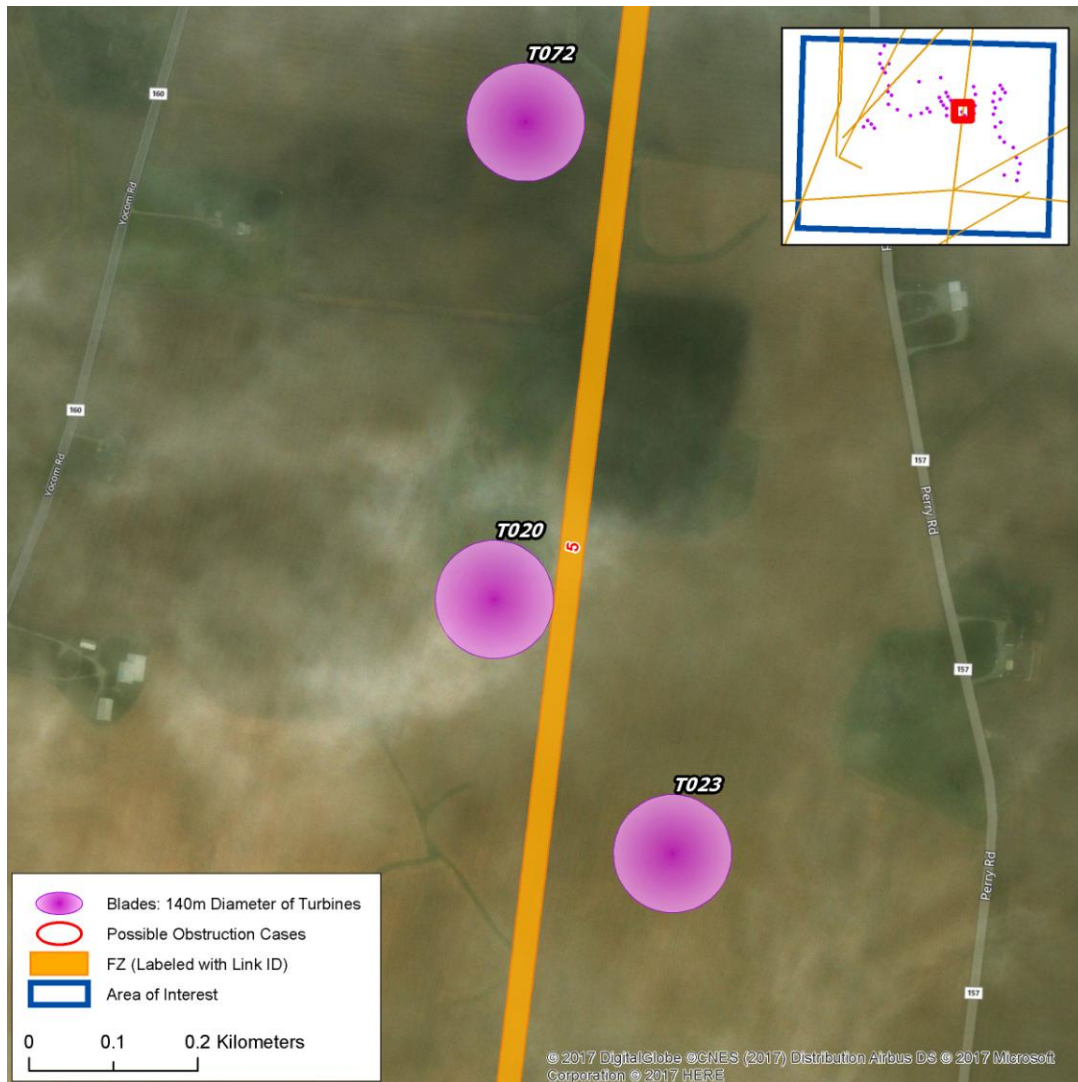


Figure 4: Fresnel Zones in the Area of Interest (Turbine T020)

Discussion of Potential Two Dimensional Obstructions

Total Microwave Paths	Paths with Affected Fresnel Zones	Total Turbines	Turbines intersecting the Fresnel Zones
13	1	55	1

Table 2: Fresnel Zone Analysis Result

For this project, 55 turbines were considered in the analysis, each with a blade diameter of 140 meters and turbine hub height of 80 meters. Of those turbines, one was found to intersect the Fresnel Zone of one microwave path. Figure 5 contains a detailed depiction of the potential obstruction scenario and Table 3 contains a summary of the affected turbine. A cross sectional analysis was performed in Section 4 to determine the diagonal clearance value for these cases.

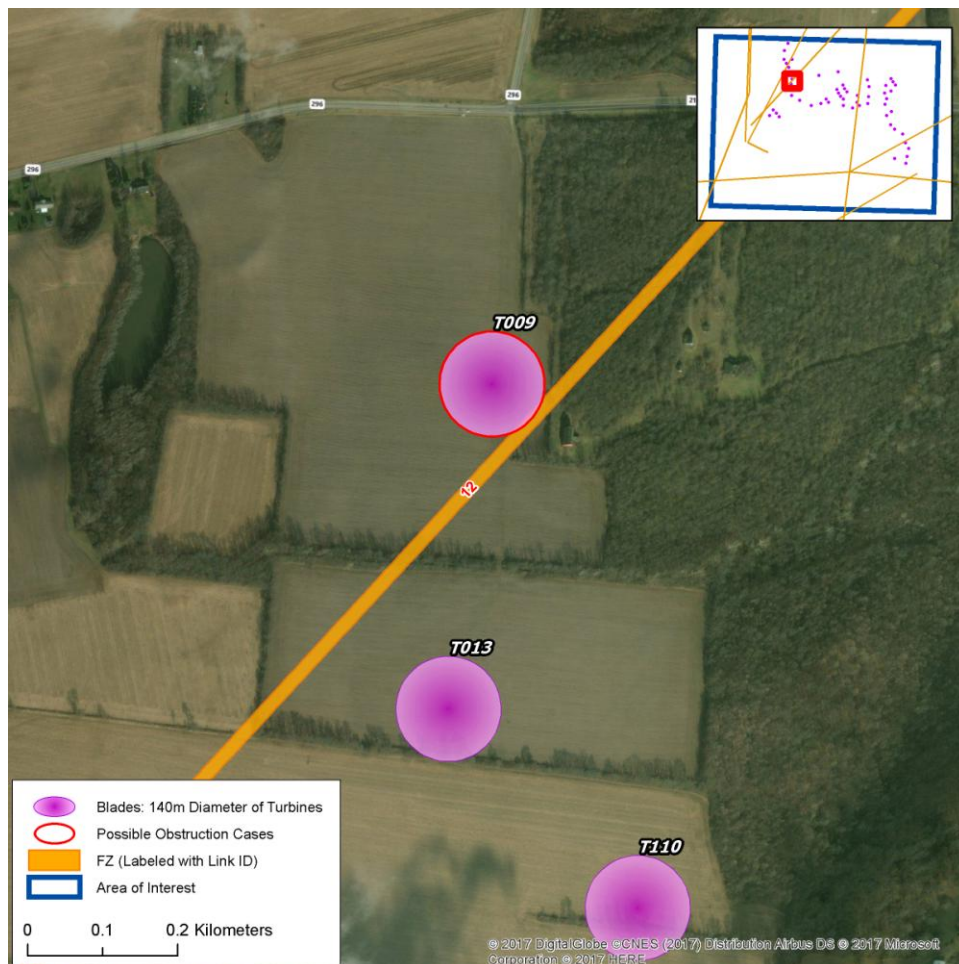


Figure 5: Potential Obstruction Case (Turbine 009)

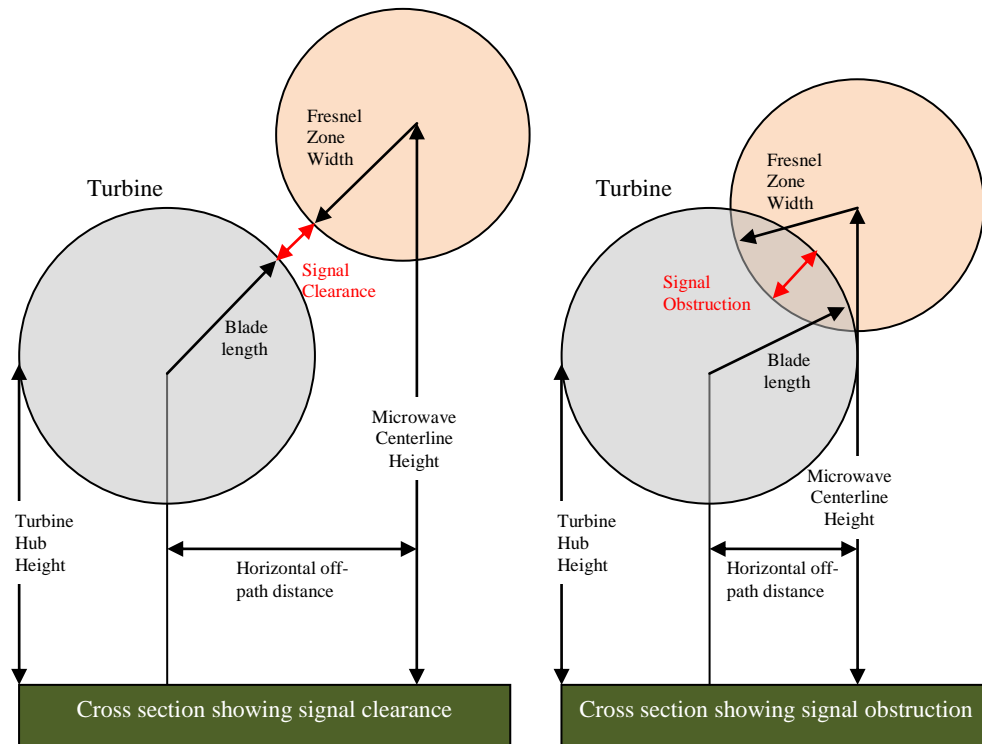
Turbine ID	Latitude (NAD83)	Longitude (NAD83)	Affected Microwave Path ID	Fresnel Zone Width at Turbine Location (m)	Horizontal off-path Distance (m)	Distance along the path from site 1 (km)	Horizontal Clearance (m)
T009	40.152535	-83.671368	12	8.77	72.00	6.44	-6.76

Table 3: Turbine that Intersect Fresnel Zones

4. Cross Sectional Analysis

Our Fresnel Zone analysis in the previous section identified one potential obstruction case that needs to be further examined from a cross sectional perspective. The case that will be analyzed in this section can be found in Table 3.

Our cross sectional analysis calculates the precise height and width of 100% of the first Fresnel Zone at the turbine location based on the antenna heights of the two link endpoints and the earth curvature bulge at the specific turbine location. The horizontal off-path distance was calculated in the previous section and the turbine hub height and blade length were provided by the client. The cross sectional analysis uses these values to calculate the clearance between the blades and the microwave Fresnel Zone as shown in the two diagrams below.



The results of the cross sectional calculations can be seen in Table 4 below. It shows negative clearance value indicating obstruction of the Fresnel zones.

Microwave Path ID	Fresnel Zone Width at Turbine Location (m)	Microwave Centerline Height at Turbine Location (m)	Turbine ID	Hub Height (m)	Blade Length (m)	Cross Sectional Clearance (m)
12	8.77	108.90	T009	80	70	-1.18

Table 4: Cross Sectional Analysis Results

5. Conclusion

Our study identified 13 microwave paths intersecting the Buckeye Wind Project area. The Fresnel Zones for these microwave paths were calculated and mapped. Turbine T009 was found to intersect the two dimensional Fresnel Zone of one microwave path (ID12). Based on the cross sectional analysis, it was determined that it may obstruct this microwave path and potentially cause signal degradation.

Turbine T020 was found to be very close to the Fresnel Zone and special caution should be taken during micro-siting of this turbine.

The above analysis result was based on a turbine model of 140 meters in rotor diameter and 80 meters in hub height. The actual turbine model for Buckeye Wind Project has not been selected yet and the result may change with a different combination of turbine parameters. For example, if a smaller blade is selected for T009 it may clear the Fresnel Zone. This report will be updated when a selection of turbine model is made.

6. Contact

For questions or information regarding the Microwave Study, please 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: dfinney@comsearch.com
Web site: www.comsearch.com

Wind Power GeoPlanner™

AM and FM Radio Report

Buckeye Wind Project



Prepared on Behalf of
Buckeye Wind, LLC

October 13, 2017



Table of Contents

1. Introduction	- 1 -
2. Summary of Results	- 1 -
3. Impact Assessment	- 5 -
4. Recommendations	- 5 -
5. Contact	- 5 -

1. Introduction

Comsearch analyzed AM and FM radio broadcast stations whose service could potentially be affected by the proposed Buckeye Wind Project in Champaign County, Ohio.

2. Summary of Results

AM Radio Analysis

Comsearch found eight database records¹ for AM stations within approximately 30 kilometers of the project, as shown in Table 1 and Figure 1. These records represent station WBLL, which broadcasts from Bellefontaine, Ohio, to the north of the project area of interest (AOI); stations WIZE and WULM, from Springfield, Ohio, to the southwest; and station WQTT, from Marysville, Ohio, to the northeast. All four stations are licensed separately for daytime and nighttime operations.

ID	Call Sign	Status ²	Frequency (kHz)	Transmit ERP ³ (kW)	Operation Time	Latitude (NAD 27)	Longitude (NAD 27)	Required Separation Distance ⁴ (km)	Distance to Nearest Turbine (km)
1	WBLL	LIC	1390	0.5	Daytime	40.368056	-83.733889	0.22	21.50
2	WBLL	LIC	1390	0.081	Nighttime	40.368056	-83.733889	0.22	21.50
3	WIZE	LIC	1340	1.0	Daytime	39.942500	-83.787500	0.22	21.76
4	WIZE	LIC	1340	1.0	Nighttime	39.942500	-83.787500	0.22	21.76
5	WQTT	LIC	1270	0.5	Daytime	40.246111	-83.330556	2.36	22.90
6	WQTT	LIC	1270	0.5	Nighttime	40.246111	-83.330556	2.36	22.90
7	WULM	LIC	1600	1.0	Daytime	39.953056	-83.868611	0.19	24.24
8	WULM	LIC	1600	0.034	Nighttime	39.953056	-83.868611	0.19	24.24

Table 1: AM Radio Stations within 30 Kilometers of Project Area

¹ Comsearch makes no warranty as to the accuracy of the data included in this report beyond the date of the report. The data presented in this report is derived from the AM/FM station's FCC license and governed by Comsearch's data license notification and agreement located at http://www.comsearch.com/files/data_license.pdf. The coordinates provided for AM station KVWC were adjusted slightly based on aerial imagery.

² LIC = Licensed and operational station; APP = Application for construction permit; CP=Construction permit granted; CP MOD = Modification of construction permit.

³ ERP = Transmit Effective Radiated Power.

⁴ The required separation distance is based on the lesser of 10 wavelengths or 3 kilometers for directional antennas and 1 wavelength for non-directional antennas.

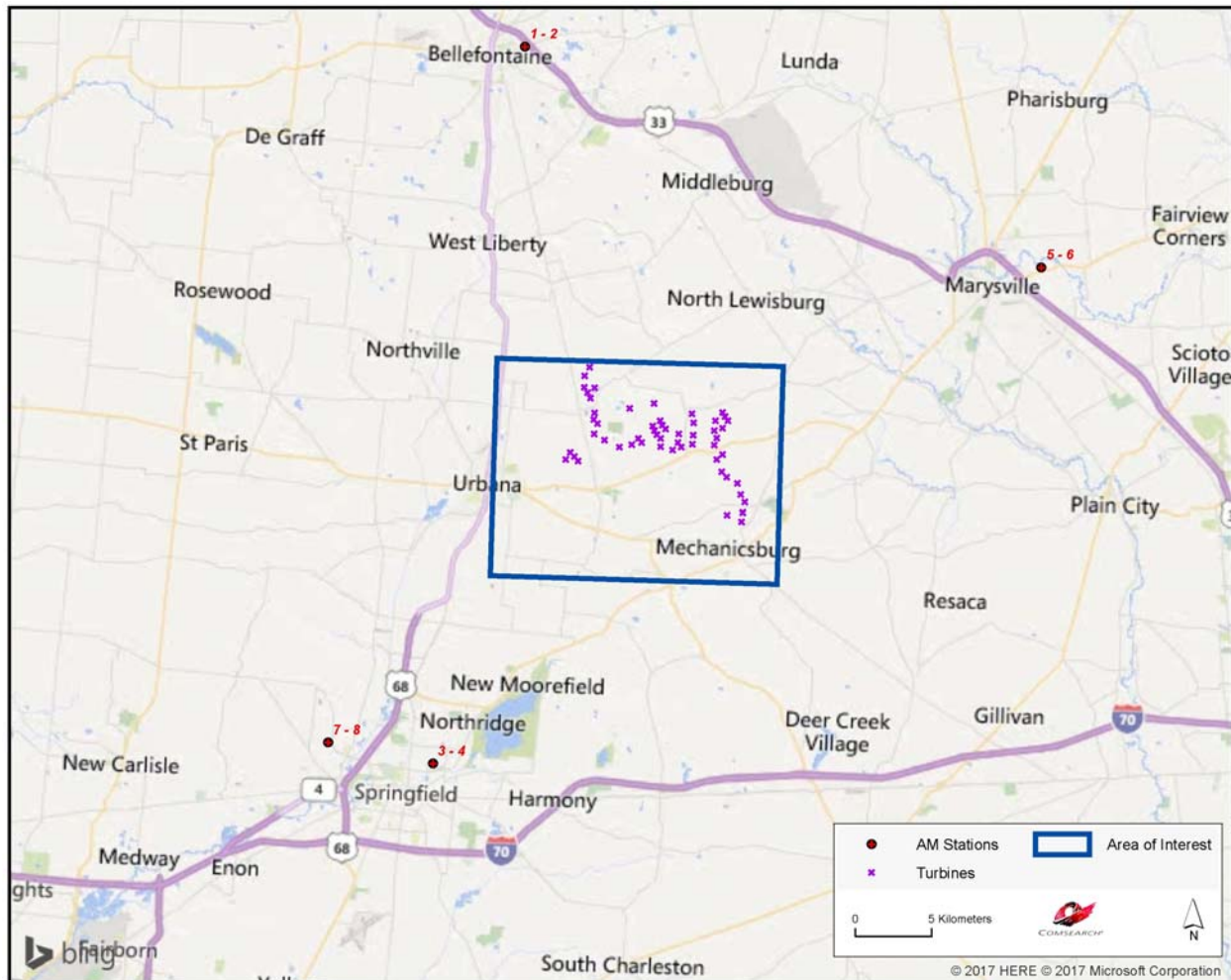


Figure 1: AM Radio Stations within 30 Kilometers of Project Area

FM Radio Analysis

Comsearch determined that there were twenty-one database records for FM stations within 30 kilometers of the Buckeye Wind Project, as shown in Table 2 and Figure 2. Only nineteen of these stations are currently licensed and operating, seven of which are low-power or translator stations that broadcast with limited range.

ID	Call Sign	Status ⁵	Service ⁶	Frequency (MHz)	Transmit ERP ⁷ (kW)	Latitude (NAD 27)	Longitude (NAD 27)	Distance to Nearest Turbine (km)
1	W295CI	LIC	FX	106.9	0.15	40.103611	-83.715833	3.04
2	W295CI	CP	FX	106.9	0.25	40.103611	-83.715833	3.04
3	W279BB	LIC	FX	103.7	0.013	40.049167	-83.768333	10.56
4	WSOH	LIC	FM	88.9	0.4	40.335333	-83.662722	17.34
5	WOAR	LIC	FM	88.3	1.0	39.931667	-83.610000	18.28
6	WPKO-FM	LIC	FM	98.3	1.75	40.368056	-83.733889	21.50
7	W297BP	LIC	FX	107.3	0.25	40.368056	-83.733889	21.50
8	W231BY	LIC	FX	94.1	0.01	40.369167	-83.729722	21.54
9	WUSO	LIC	FM	89.1	0.1	39.935833	-83.811389	23.26
10	WEEC	LIC	FM	100.7	50.0	39.961667	-83.868056	23.47
11	WEEC	LIC	FS	100.7	0.5	39.961667	-83.868056	23.47
12	WEEC	LIC	FS	100.7	8.0	39.961667	-83.868056	23.47
13	W254BJ	LIC	FX	98.7	0.01	39.961611	-83.868111	23.47
14	WDHT	LIC	FM	102.9	50.0	39.953056	-83.868611	24.24
15	WDHT	LIC	FS	102.9	4.5	39.953056	-83.868611	24.24
16	WCYC-LP	LIC	FL	105.1	0.03	39.886389	-83.447222	24.54
17	WBMO	LIC	FM	106.3	6.0	39.884167	-83.425278	25.53
18	WDEQ-FM	LIC	FM	91.7	0.1	40.315000	-83.923056	25.82
19	WNNP	LIC	FM	104.3	3.4	40.306111	-83.329167	26.68
20	W283AJ	CP MOD	FX	96.7	0.25	40.261639	-83.273444	28.02
21	WEFC-LP	LIC	FL	92.7	0.1	39.976111	-83.240000	29.83

Table 2: FM Radio Stations within 30 Kilometers of Project Area

⁵ LIC = Licensed and operational station; APP = Application for construction permit; CP=Construction permit granted; CP MOD = Modification of construction permit.

⁶ FM = FM broadcast station; FX = FM translator station; FL = Low-power FM station; FS = FM auxiliary (backup) station; FB = FM booster station.

⁷ ERP = Transmit Effective Radiated Power.

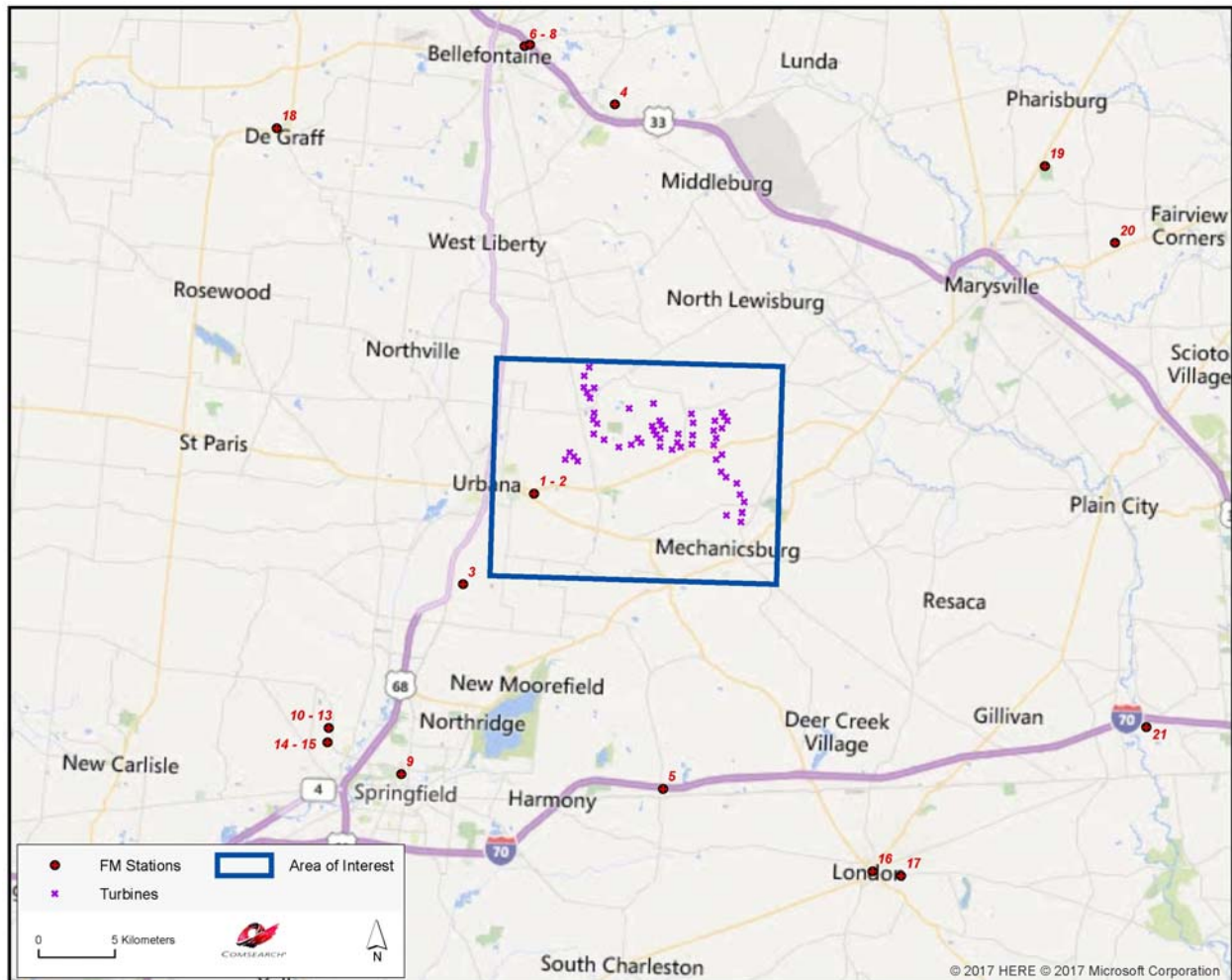


Figure 2: FM Radio Stations within 30 Kilometers of Project Area

3. Impact Assessment

The exclusion distance for AM broadcast stations varies as a function of the antenna type and broadcast frequency. For directional antennas, the exclusion distance is calculated by taking the lesser of 10 wavelengths or 3 kilometers. For non-directional antennas, the exclusion distance is simply equal to 1 wavelength. Potential problems with AM broadcast coverage are only anticipated when AM broadcast stations are located within their respective exclusion distance limit from wind turbine towers. The closest AM station to the Buckeye Wind Project, WBLL, is more than 21 kilometers from the nearest turbine location. As there were no stations found within 3 kilometers of any of the proposed turbines, which is the maximum possible exclusion distance based on a directional AM antenna broadcasting at 1000 KHz or less, the project should not impact the coverage of local AM stations.

The coverage of FM stations is generally not susceptible to interference caused by wind turbines, especially when large objects, such as wind turbines, are sited in the *far field* region of the radiating FM antenna in order to avoid the risk of distorting the antenna's radiation pattern. The closest FM station to the Buckeye Wind Project, W295CI, is more than 3 kilometers from the nearest turbine. At this distance, there should be adequate separation to avoid radiation pattern distortion.

4. Recommendations

Since no impact on the licensed and operational AM or FM broadcast stations' broadcast, retransmission, or reception was identified in our analysis, no recommendations or mitigation techniques are required for this project.

5. Contact

For questions or information regarding the AM and FM Radio Report, please contact:

Contact person:	Denise Finney
Title:	Account Manager
Company:	Comsearch
Address:	19700 Janelia Farm Blvd., Ashburn, VA 20147
Telephone:	703-726-5650 (office) / 703-726-5595 (fax)
Email:	dfinney@comsearch.com
Web site:	www.comsearch.com

Wind Power GeoPlanner™

Impact Assessment on Pioneer Electric's Wireless Network

Buckeye Wind Project



Prepared on Behalf of
Buckeye Wind, LLC

October 19, 2017



Table of Contents

1. Introduction	- 1 -
2. Project Overview	- 1 -
3. Two-Dimensional Fresnel Zone Analysis	- 2 -
4. Cross Sectional Analysis	- 9 -
5. Conclusion	- 10 -
6. Contact	- 11 -

3. Two-Dimensional Fresnel Zone Analysis

Methodology

Our obstruction analysis was performed using data¹ found in the FCC registration database as well as data provided by the client. First, we compiled all the data including tower locations, antenna heights and frequency band. Second, we determined the microwave paths that intersect the area of interest and listed them in Table 1. These paths and the area of interest that encompasses the planned turbine locations are shown in Figure 2.

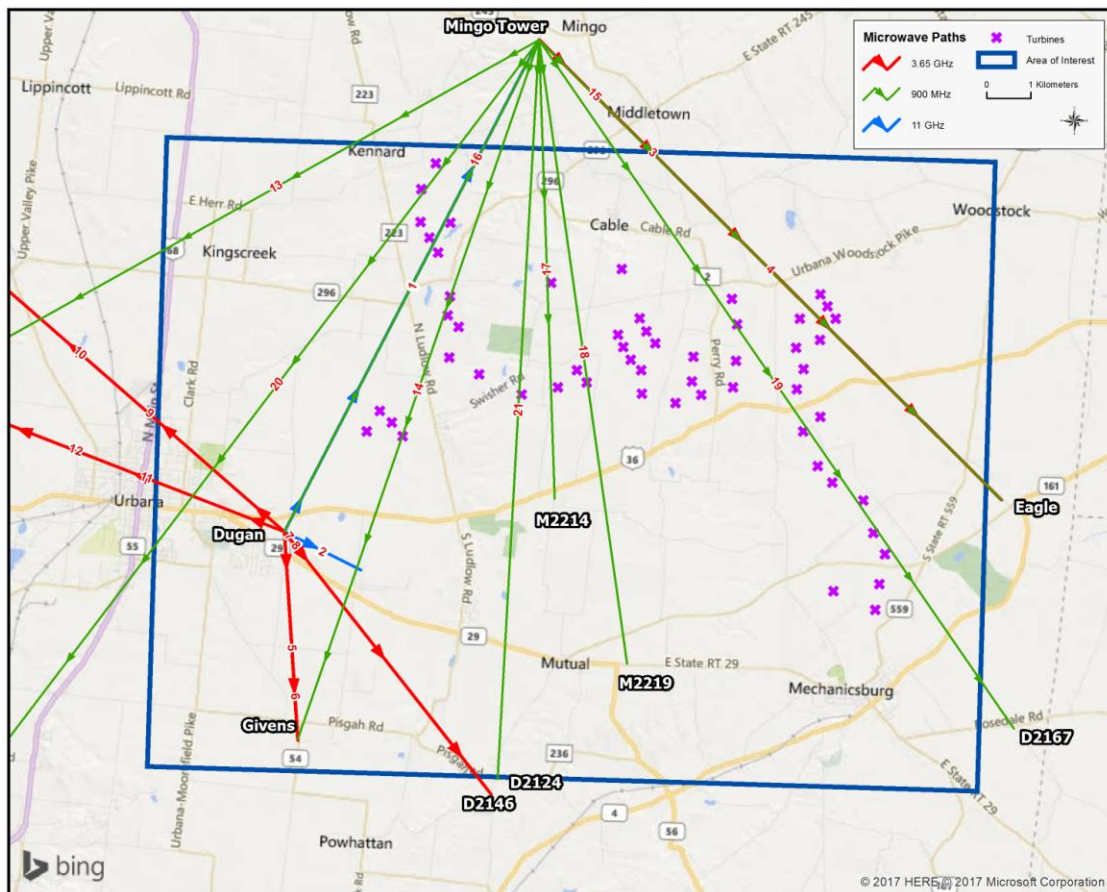


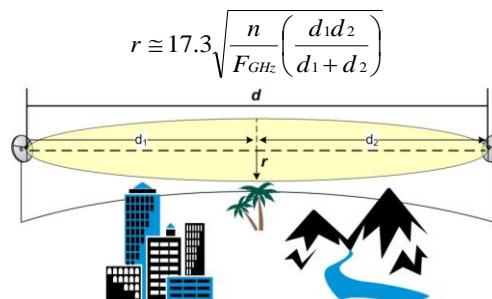
Figure 2: Microwave Paths that Intersect the Area of Interest

¹ 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.

ID	Site Name 1	Site Name 2	Band	Path Length (km)	Data Source
1	URBANA TOWER	MINGO TOWER	11 GHz	12.6	FCC
2	URBANA TOWER	URBANA OFFIC	11 GHz	2.0	FCC
3	Mingo Tower	Eagle Sub	3.65 GHz	14.8	Provided by Client
4	Mingo Tower	Eagle Sub	3.65 GHz	14.8	Provided by Client
5	Dugan Tower	Givens Sub	3.65 GHz	4.7	Provided by Client
6	Dugan Tower	Givens Sub	3.65 GHz	4.7	Provided by Client
7	Dugan Tower	D2146	3.65 GHz	7.6	Provided by Client
8	Dugan Tower	D2146	3.65 GHz	7.6	Provided by Client
9	Dugan Tower	D2452	3.65 GHz	16.7	Provided by Client
10	Dugan Tower	D2452	3.65 GHz	16.7	Provided by Client
11	Dugan Tower	NW Urbana Sub	3.65 GHz	8.9	Provided by Client
12	Dugan Tower	NW Urbana Sub	3.65 GHz	8.9	Provided by Client
13	Mingo Tower	NW Urbana Sub	900 MHz	16.2	Provided by Client
14	Mingo Tower	Givens	900 MHz	16.8	Provided by Client
15	Mingo Tower	Eagle	900 MHz	14.8	Provided by Client
16	Mingo Tower	Dugan Tower	900 MHz	12.6	Provided by Client
17	Mingo Tower	M2214	900 MHz	10.4	Provided by Client
18	Mingo Tower	M2219	900 MHz	14.3	Provided by Client
19	Mingo Tower	D2167	900 MHz	19.0	Provided by Client
20	Mingo Tower	M2013	900 MHz	21.4	Provided by Client
21	Mingo Tower	D2124	900 MHz	16.8	Provided by Client

Table 1: Summary of Microwave Paths that Intersect the Area of Interest

Next, we calculated a Fresnel Zone for each path based on the following formula:



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

In general, this is the area where the planned wind turbines should be avoided, if possible. A depiction of the Fresnel Zones for each microwave path listed can be found in Figure 3, and is also included in the enclosed shapefiles^{2,3}.

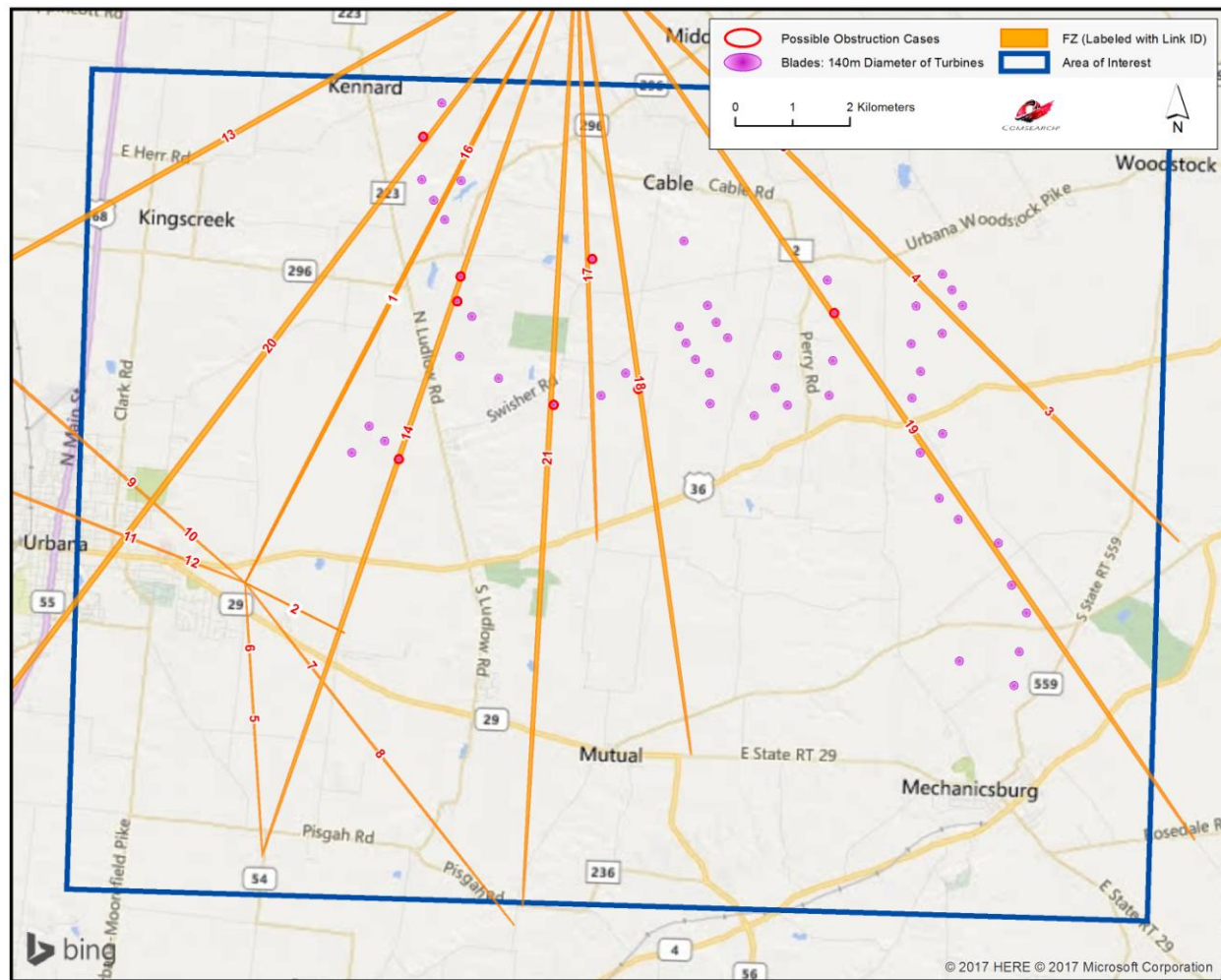


Figure 3: Fresnel Zones in the Area of Interest

² The ESRI® shapefiles enclosed are in NAD 83 UTM Zone 17 projected coordinate system

³ 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.

Discussion of Potential Two Dimensional Obstructions

Total Microwave Paths	Paths with Affected Fresnel Zones	Total Turbines	Turbines intersecting the Fresnel Zones
21	6	55	8

Table 2: Fresnel Zone Analysis Result

For this project, 55 turbines were considered in the analysis, each with a blade diameter of 140 meters and turbine hub height of 80 meters. Of those turbines, eight were found to intersect the Fresnel Zones of six microwave paths. Figure 4 through Figure 7 contain a detailed depiction of the potential obstruction scenarios and Table 3 contains a summary of the affected turbines. A cross sectional analysis was performed in Section 4 to determine the diagonal clearance value for these cases.

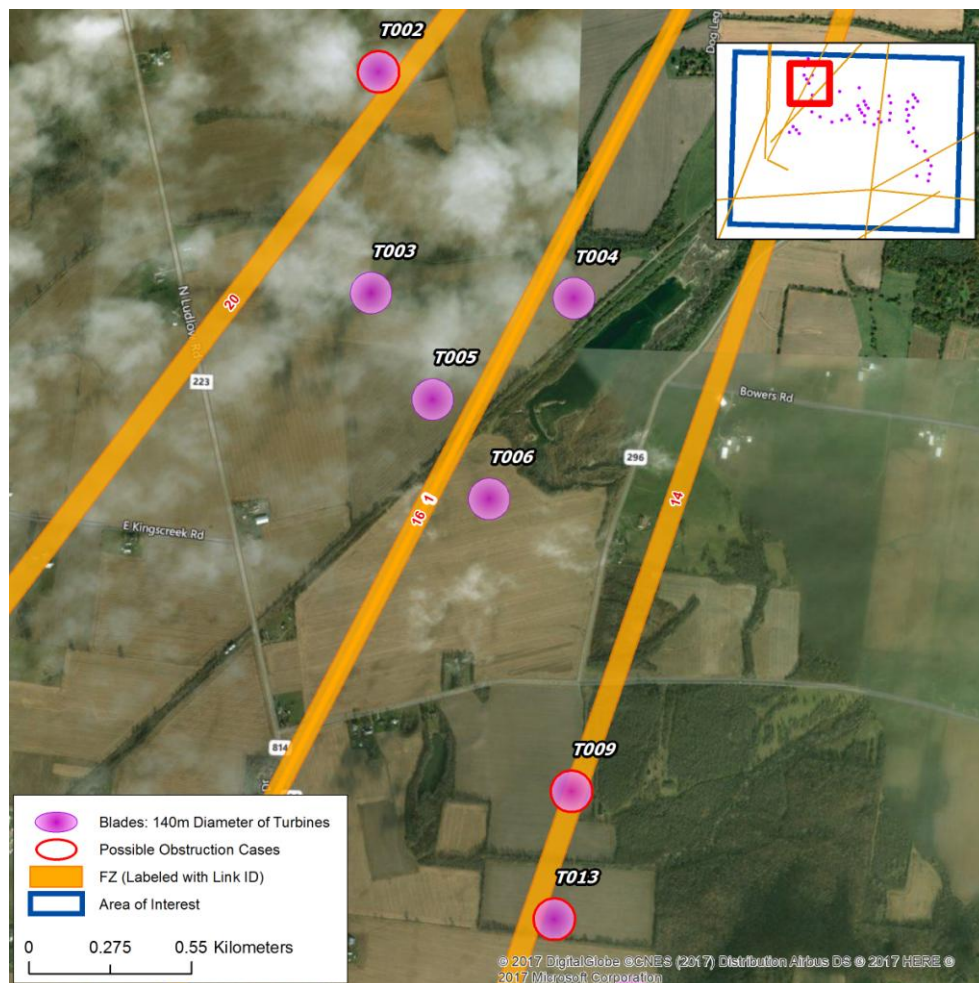


Figure 4: Potential Obstruction Cases (T002, T009 and T013)

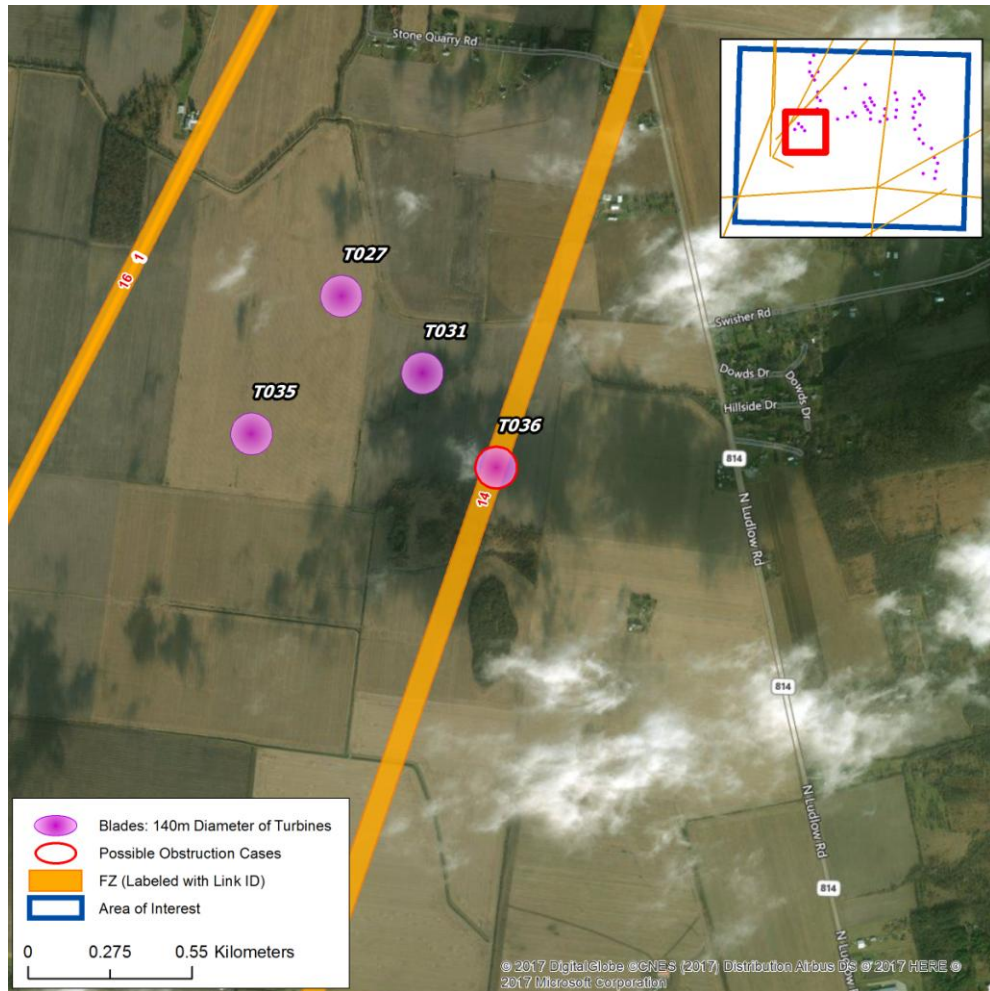


Figure 5: Potential Obstruction Cases (T036)

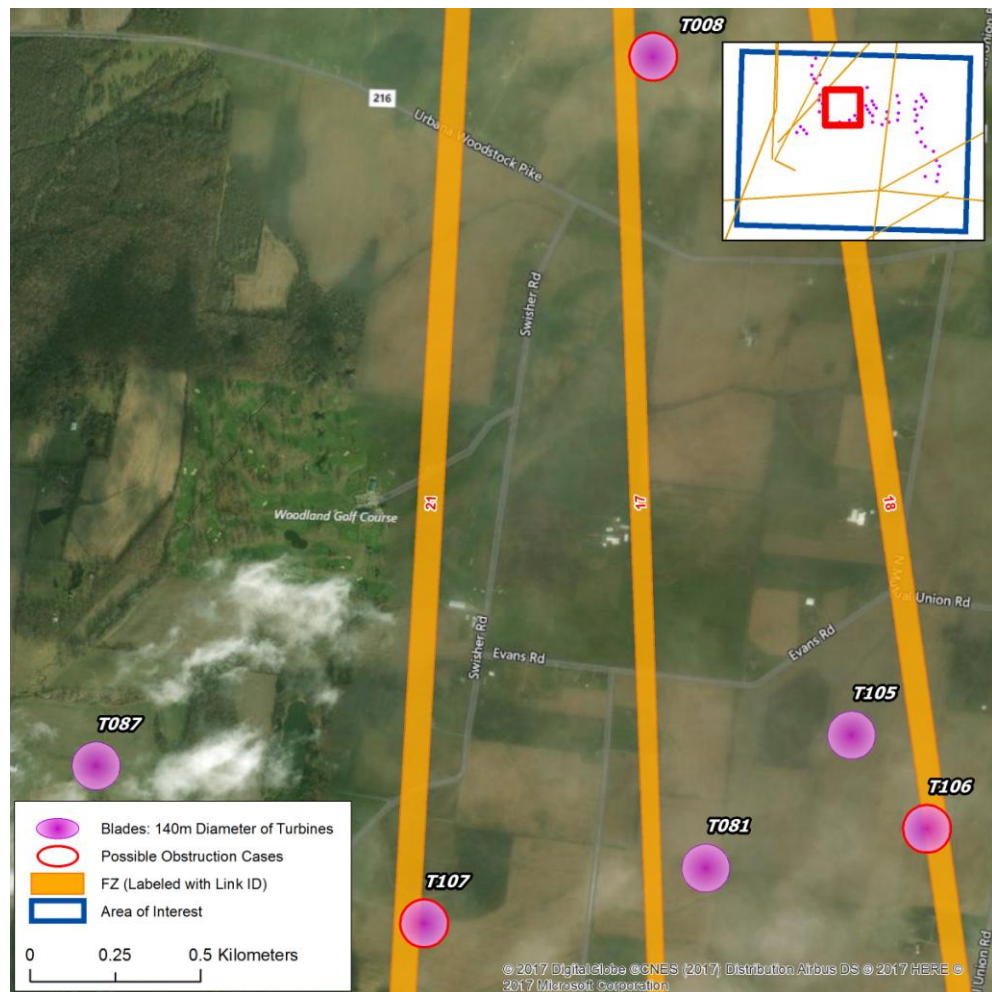


Figure 6: Potential Obstruction Cases (T008, T106 and T107)

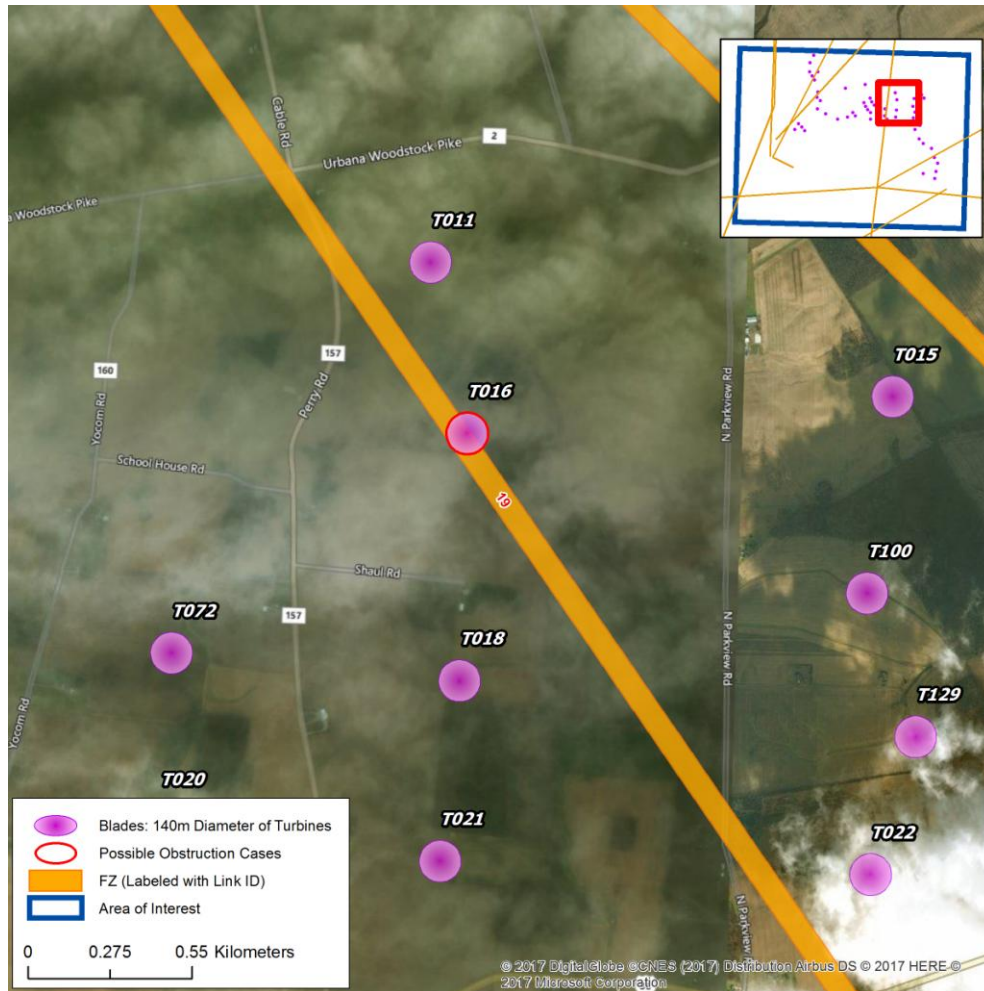


Figure 7: Potential Obstruction Cases (T016)

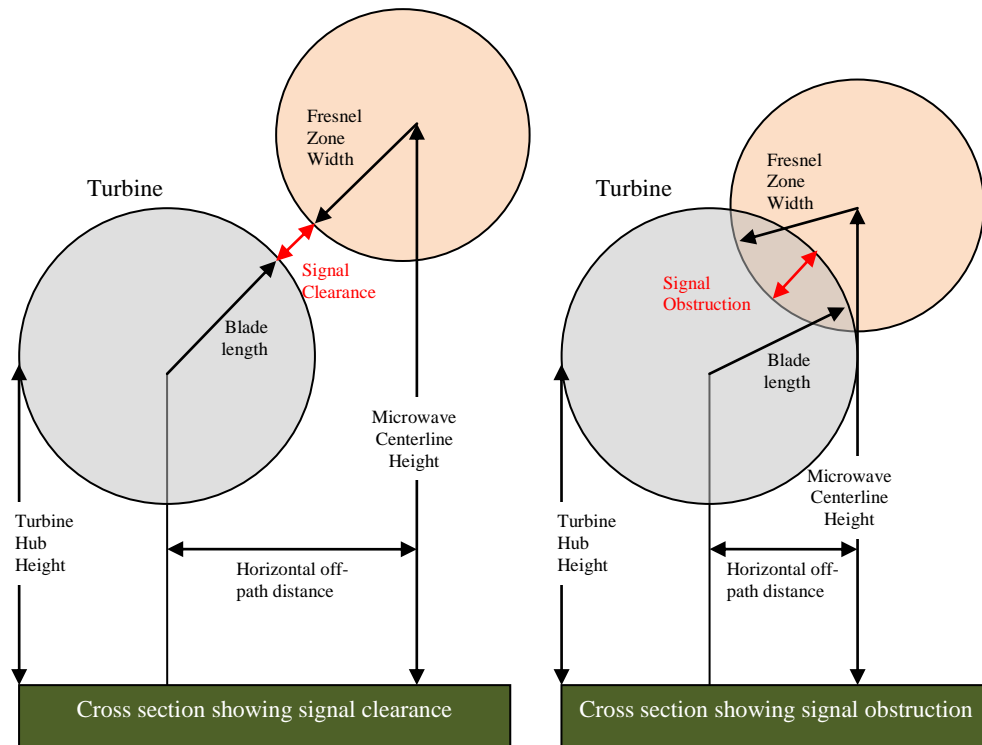
Turbine ID	Latitude (NAD83)	Longitude (NAD83)	Affected Microwave Path ID	Fresnel Zone Width at Turbine Location (m)	Horizontal off-path Distance (m)	Distance along the path from site 1 (km)	Horizontal Clearance (m)
T002	40.17423631	-83.67987537	20	33.87	74.69	4.32	-29.18
T008	40.15588836	-83.64459172	17	29.37	82.63	5.53	-16.74
T009	40.15253489	-83.67136767	14	36.03	12.04	6.17	-93.99
T013	40.14863129	-83.67189546	14	36.50	73.97	6.60	-32.54
T016	40.14853900	-83.59480514	19	39.14	26.85	7.87	-82.29
T036	40.12364185	-83.68286156	14	37.04	6.80	9.52	-100.24
T106	40.13576291	-83.63439835	18	34.31	26.10	7.86	-78.21
T107	40.13287545	-83.65157358	21	37.34	50.50	8.07	-56.84

Table 3: Turbines that Intersect Fresnel Zones

4. Cross Sectional Analysis

Our Fresnel Zone analysis in the previous section identified eight potential obstruction cases that need to be further examined from a cross sectional perspective. The cases that will be analyzed in this section can be found in Table 3.

Our cross sectional analysis calculates the precise height and width of 100% of the first Fresnel Zone at the turbine location based on the antenna heights of the two link endpoints and the earth curvature bulge at the specific turbine location. The horizontal off-path distance was calculated in the previous section and the turbine hub height and blade length were provided by the client. The cross sectional analysis uses these values to calculate the clearance between the blades and the microwave Fresnel Zone as shown in the two diagrams below.



The results of the cross sectional calculations can be seen in Table 4 below. It shows negative clearance values indicating obstruction of the Fresnel zones.

Microwave Path ID	Fresnel Zone Width at Turbine Location (m)	Microwave Centerline Height at Turbine Location (m)	Turbine ID	Hub Height (m)	Blade Length (m)	Cross Sectional Clearance (m)
20	33.87	98.13	T002	80	70	-27.01
17	29.37	34.92	T008	80	70	-5.24
14	36.03	83.52	T009	80	70	-93.49
14	36.50	80.88	T013	80	70	-32.53
19	39.14	45.93	T016	80	70	-65.76
14	37.04	62.87	T036	80	70	-88.61
18	34.31	33.45	T106	80	70	-50.94
21	37.34	40.70	T107	80	70	-43.35

Table 4: Cross Sectional Analysis Results

5. Conclusion

This study assessed Pioneer Electric's 900 MHz, 3650 MHz and 11 GHz communication paths⁴ using two-dimensional Fresnel Zone and cross-sectional profiles to determine if the paths could be obstructed. Eight turbines were found to intersect the two dimensional Fresnel Zones of six microwave paths. Based on the cross sectional analysis, it was determined that they may obstruct the microwave paths and potentially cause signal degradation.

The above analysis result was based on a turbine model of 140 meters in rotor diameter and 80 meters in hub height. The actual turbine model for Buckeye Wind Project has not been selected yet and the result may change with a different combination of turbine parameters. This report will be updated when a final selection of turbine model is made.

⁴ Technical parameters such as coordinates and antenna heights were provided by the client. The validity and accuracy of the results are highly dependent on these values. A change in coordinates or antenna height could result in different obstruction cases or clearance values.

6. Contact

For questions or information regarding the Microwave Study, please 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:	dfinney@comsearch.com
Web site:	www.comsearch.com

Wind Power GeoPlanner™

Off-Air TV Analysis

Buckeye Wind Project



Prepared on Behalf of
Buckeye Wind, LLC

October 13, 2017



Table of Contents

1. Introduction	- 1 -
2. Summary of Results	- 1 -
3. Impact Assessment	- 6 -
4. Recommendations	- 7 -
5. Contact	- 7 -
6. Appendix A	- 8 -

Off-air television stations broadcast signals from terrestrially-based facilities directly to television receivers. Comsearch identified those off-air stations whose service could potentially be affected by the proposed Buckeye Wind Project in Champaign County, Ohio. Comsearch then examined the coverage of the stations and the communities in the area that could potentially have degraded television reception due to the location of the proposed wind turbines.

The proposed wind energy project area and local communities are depicted in Figure 1, below.



This map displays the Columbus, Ohio metropolitan area and surrounding regions. A blue rectangle highlights the 'Area of Interest' in the central part of the map, near the intersection of major highways. Numerous red dots, representing TV stations, are scattered across the map, many with numerical callouts indicating their channel numbers. Major highways are shown as thick purple lines with their respective shields. The map includes a legend in the top right corner, a scale bar (0 to 20 Kilometers), a north arrow, and the COMEARCH logo. The Bing logo is visible in the bottom left corner, and the copyright notice '© 2017 HERE, © 2017 Microsoft Corporation' is in the bottom right corner.

TV stations at a distance of 100 kilometers or less are the most likely to provide off-air coverage to the project area and neighboring communities. These stations are listed in Table 1, below, and a plot depicting their locations is provided in Figure 3. There are a total of fifty-five database records for stations within approximately 100 kilometers of the limits of the project AOI. Of these stations, only thirty-six are currently licensed and operating, thirteen of which are low-power stations or translators. Translator stations are low-power stations that receive

October 13, 2017

A map of the Columbus, Ohio area and surrounding regions. The map displays major highways (Interstates 70, 75, 270, 675 and State Routes 30, 33, 45, 68, 71, 35) and numerous cities and towns including Columbus, Westerville, Delaware, Marion, Urbana, Springfield, Dayton, and Cincinnati. Red dots with numbers represent TV stations, and purple dots represent turbines. A blue rectangular box highlights a specific area of interest in the Urbana region. A legend in the bottom left corner identifies the symbols for TV Stations and Turbines, and includes a scale bar (0 to 10 Kilometers) and a north arrow. The map is credited to HERE and Microsoft Corporation, 2017.

Comsearch Proprietary

ID	Call Sign	Status	Service ²	Channel	Transmit ERP ³ (kW)	Latitude (NAD 27)	Longitude (NAD 27)	Distance to Nearest Turbine (km)
1	WLWD-LD	LIC	TX	20	8.7	39.962222	-83.863611	23.18
2	-	CP	TX	3	0.03	40.140556	-83.141111	35.44
3	WCPX-LP	CP	LD	25	9.5	40.017222	-83.019722	46.49
4	WCSN-LD	LIC	LD	33	15.0	40.017222	-83.019722	46.49
5	WCPX-LP	LIC	TX	48	150.0	40.017222	-83.019722	46.49
6	WCMH-TV	LIC	DT	14	902.0	39.971111	-83.027778	47.01
7	WDEM-CD	LIC	DC	17	1.05	39.971111	-83.027778	47.01
8	WCLL-CD	LIC	DC	19	15.0	39.971111	-83.027778	47.01
9	WBNS-TV	LIC	DT	21	1000.0	39.971111	-83.027778	47.01
10	W44DC-D	LIC	LD	44	15.0	39.971111	-83.027778	47.01
11	WOCB-CD	CP	DC	32	2.08	40.313056	-83.051111	47.62
12	WOCB-CD	LIC	DC	39	2.4	40.313056	-83.051111	47.62
13	WTTE	LIC	DT	36	1000.0	39.937222	-83.021111	48.75
14	WSYX	LIC	DT	48	1000.0	39.937222	-83.021111	48.75
15	W23BZ-D	LIC	LD	23	15.0	39.891944	-83.045556	48.88
16	WGCT-CD	LIC	DC	8	0.19	40.031111	-82.974889	50.02
17	WOSU-TV	LIC	DT	38	503.0	40.159167	-82.923056	54.13
18	WWRD-LP	LIC	TX	32	13.0	39.680000	-84.082222	59.54
19	WWRD-LP	CP	LD	42	15.0	39.680000	-84.082222	59.54
20	WXCB-CD	CP	DC	25	10.0	40.612778	-83.130000	63.23
21	WXCB-CD	LIC	DC	45	15.0	40.612778	-83.130000	63.23
22	WMNO-CD	LIC	DC	28	7.5	40.627556	-83.129889	64.56
23	WHIO-TV	LIC	DT	41	1000.0	39.733889	-84.248056	64.30
24	WHIO-TV	LIC	DX	41	1000.0	39.733889	-84.248056	64.30
25	WHIO-TV	LIC	DT	41	1000.0	39.733889	-84.248056	64.30
26	WPTD	LIC	DT	16	163.0	39.721111	-84.250000	65.39
27	WLWD-LD	LIC	LD	20	5.0	39.724611	-84.254889	65.43
28	WBDT	LIC	DT	26	770.0	39.724611	-84.254889	65.43
29	WRGT-TV	LIC	DT	30	498.0	39.724611	-84.254889	65.43
30	WKEF	APP	DT	18	525.0	39.724444	-84.255000	65.45
31	WRCX-LP	LIC	TX	40	34.0	39.724444	-84.255000	65.45
32	WRCX-LP	CP	LD	40	0.32	39.724444	-84.255000	65.45

² Definitions of service and status codes:

DT – Digital television broadcast station

LD – Low-power digital television broadcast station

TX – Translator station

DC – Class A digital television broadcast station

DX – Digital auxiliary (backup) facility

LIC – Licensed and operational station

CP – Construction permit granted

CP MOD – Modification of construction permit

APP – Application for construction permit, not yet operational

³ ERP = Transmit Effective Radiated Power

ID	Call Sign	Status	Service ²	Channel	Transmit ERP ³ (kW)	Latitude (NAD 27)	Longitude (NAD 27)	Distance to Nearest Turbine (km)
33	WRCX-LP	APP	LD	40	15.0	39.724444	-84.255000	65.45
34	WDTN	LIC	DT	50	1000.0	39.718611	-84.256111	65.96
35	W22DE	LIC	TX	22	54.0	39.720556	-84.261111	66.13
36	WWHO	LIC	DT	46	1000.0	39.588889	-83.112222	67.46
37	WLQP-LP	LIC	TX	18	7.7	40.634194	-84.208000	67.72
38	W23DE-D	LIC	LD	23	3.0	40.634194	-84.208000	67.72
39	WLMO-LP	LIC	TX	38	15.0	40.634194	-84.208000	67.72
40	W23DE-D	CP	LD	43	7.85	40.634194	-84.208000	67.72
41	WSFJ-TV	LIC	DT	24	1000.0	40.079000	-82.694861	73.31
42	WSFJ-TV	CP	DT	24	500.0	40.079000	-82.694861	73.31
43	WLIO	LIC	DT	8	27.5	40.747556	-84.131750	73.96
44	WLIO	CP	DT	8	16.5	40.747556	-84.131750	73.96
45	WLQP-LP	CP	TX	25	7.5	40.747556	-84.131750	73.96
46	WLQP-LP	CP	TX	25	7.5	40.747556	-84.131750	73.96
47	WOHL-CD	LIC	DC	35	9.0	40.747556	-84.131750	73.96
48	WLMO-LP	CP	TX	38	5.3	40.747556	-84.131750	73.96
49	WLMO-LP	CP	TX	38	5.3	40.747556	-84.131750	73.96
50	WLQP-LP	CP	LD	45	15.0	40.747556	-84.131750	73.96
51	WLMO-LP	CP	LD	47	15.0	40.747556	-84.131750	73.96
52	WTLW	CP	DT	2	0.46	40.763056	-84.183056	77.75
53	WTLW	LIC	DT	44	165.0	40.763056	-84.183056	77.75
54	W32DS-D	LIC	LD	32	6.8	40.552917	-84.517250	82.59
55	WOOH-LD	CP	LD	29	15.0	39.952278	-82.506806	90.88

Table 1: Off-Air TV Stations within 100 Kilometers of Project Area

3. Impact Assessment

Based on a contour analysis of the licensed stations within 100 kilometers of the Buckeye Wind Project, it was determined that thirteen of the full-power digital stations⁴, identified below in Table 2, may have their reception disrupted in and around the project. The areas primarily affected would include TV service locations within 10 kilometers of the wind energy project that have clear line-of-sight (LOS) to a proposed wind turbine but not to the respective station. After the wind turbines are installed, communities and homes in these locations may have degraded reception of these stations. This is due to multipath interference caused by signal scattering as TV signals are reflected by the rotating wind turbine blades and mast.

ID	Call Sign	Status	Service ⁵	Channel	Transmit ERP ⁶ (kW)	Latitude (NAD 27)	Longitude (NAD 27)	Distance to Nearest Turbine (km)
6	WCMH-TV	LIC	DT	14	902.0	39.971111	-83.027778	47.01
9	WBNS-TV	LIC	DT	21	1000.0	39.971111	-83.027778	47.01
13	WTTE	LIC	DT	36	1000.0	39.937222	-83.021111	48.75
14	WSYX	LIC	DT	48	1000.0	39.937222	-83.021111	48.75
17	WOSU-TV	LIC	DT	38	503.0	40.159167	-82.923056	54.13
23	WHIO-TV	LIC	DT	41	1000.0	39.733889	-84.248056	64.30
24	WHIO-TV	LIC	DX	41	1000.0	39.733889	-84.248056	64.30
25	WHIO-TV	LIC	DT	41	1000.0	39.733889	-84.248056	64.30
26	WPTD	LIC	DT	16	163.0	39.721111	-84.250000	65.39
28	WBDT	LIC	DT	26	770.0	39.724611	-84.254889	65.43
29	WRGT-TV	LIC	DT	30	498.0	39.724611	-84.254889	65.43
34	WDTN	LIC	DT	50	1000.0	39.718611	-84.256111	65.96
36	WWHO	LIC	DT	46	1000.0	39.588889	-83.112222	67.46
41	WSFJ-TV	LIC	DT	24	1000.0	40.079000	-82.694861	73.31
43	WLIO	LIC	DT	8	27.5	40.747556	-84.131750	73.96

Table 2: Licensed Off-Air TV Stations Subject to Degradation

⁴ Station WHIO-TV is licensed separately for two co-located full-power antenna configurations (IDs 23 and 25 in Table 2) as well as a backup antenna (ID 24). The service contours of all three intersect the Buckeye Wind Project.

⁵ Definitions of service and status codes:

DT – Digital television broadcast station

DX – Digital auxiliary (backup) facility

LIC – Licensed and operational station

⁶ ERP = Transmit Effective Radiated Power

4. Recommendations

While TV signals are reflected by wind turbines, which can cause multipath interference to the TV receiver, modern digital TV receivers have undergone significant improvements to mitigate the effects of signal scattering. When used in combination with a directional antenna, it becomes even less likely that signal scattering from wind farms will cause interference to digital TV reception.

Nevertheless, signal scattering could still impact certain areas currently served by the TV station mentioned above, especially those that would have line-of-sight to at least one wind turbine but not to the station antenna. In the unlikely event that interference is observed in any of the TV service areas, it is recommended that a high-gain directional antenna be used, preferably outdoors, and oriented towards the signal origin in order to mitigate the interference.

Both cable service and direct broadcast satellite service will be unaffected by the presence of the wind turbine facility and may be offered to those residents who can show that their off-air TV reception has been disrupted by the presence of the wind turbines after they are installed.

5. Contact

For questions or information regarding the Off-Air TV Analysis, please 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:	dfinney@comsearch.com
Web site:	www.comsearch.com

Appendix A

ID	Call Sign	Status	Service ⁷	Channel	Transmit ERP ⁸ (kW)	Latitude (NAD 27)	Longitude (NAD 27)	Distance to Nearest Turbine (km)
1	WLWD-LD	LIC	TX	20	8.7	39.962222	-83.863611	23.18
2	-	CP	TX	3	0.03	40.140556	-83.141111	35.44
3	WCPX-LP	CP	LD	25	9.5	40.017222	-83.019722	46.49
4	WCSN-LD	LIC	LD	33	15.0	40.017222	-83.019722	46.49
5	WCPX-LP	LIC	TX	48	150.0	40.017222	-83.019722	46.49
6	WCMH-TV	LIC	DT	14	902.0	39.971111	-83.027778	47.01
7	WDEM-CD	LIC	DC	17	1.05	39.971111	-83.027778	47.01
8	WCLL-CD	LIC	DC	19	15.0	39.971111	-83.027778	47.01
9	WBNS-TV	LIC	DT	21	1000.0	39.971111	-83.027778	47.01
10	W44DC-D	LIC	LD	44	15.0	39.971111	-83.027778	47.01
11	WOCB-CD	CP	DC	32	2.08	40.313056	-83.051111	47.62
12	WOCB-CD	LIC	DC	39	2.4	40.313056	-83.051111	47.62
13	WTTE	LIC	DT	36	1000.0	39.937222	-83.021111	48.75
14	WSYX	LIC	DT	48	1000.0	39.937222	-83.021111	48.75
15	W23BZ-D	LIC	LD	23	15.0	39.891944	-83.045556	48.88
16	WGCT-CD	LIC	DC	8	0.19	40.031111	-82.974889	50.02
17	WOSU-TV	LIC	DT	38	503.0	40.159167	-82.923056	54.13
18	WWRD-LP	LIC	TX	32	13.0	39.680000	-84.082222	59.54
19	WWRD-LP	CP	LD	42	15.0	39.680000	-84.082222	59.54
20	WXXB-CD	CP	DC	25	10.0	40.612778	-83.130000	63.23
21	WXXB-CD	LIC	DC	45	15.0	40.612778	-83.130000	63.23
22	WMNO-CD	LIC	DC	28	7.5	40.627556	-83.129889	64.56
23	WHIO-TV	LIC	DT	41	1000.0	39.733889	-84.248056	64.30
24	WHIO-TV	LIC	DX	41	1000.0	39.733889	-84.248056	64.30
25	WHIO-TV	LIC	DT	41	1000.0	39.733889	-84.248056	64.30

⁷ Definitions of service and status codes:

TV – Analog television broadcast station

DT – Digital television broadcast station

DS – Digital special temporary authority (STA)

LP – Low power analog television broadcast station

LD – Low power digital television broadcast station

CA – Class A analog television broadcast station

DC – Class A digital television broadcast station

DX – Digital auxiliary (backup) facility

TX – Translator station

DD – Distributed digital television system

LIC – Licensed and operational station

CP – Construction permit granted

CP MOD – Modification of construction permit

APP – Application for construction permit, not yet operational

STA – Special transmit authorization, usually granted by FCC for temporary operation

⁸ ERP = Transmit Effective Radiated Power

ID	Call Sign	Status	Service ⁷	Channel	Transmit ERP ⁸ (kW)	Latitude (NAD 27)	Longitude (NAD 27)	Distance to Nearest Turbine (km)
26	WPTD	LIC	DT	16	163.0	39.721111	-84.250000	65.39
27	WLWD-LD	LIC	LD	20	5.0	39.724611	-84.254889	65.43
28	WBDT	LIC	DT	26	770.0	39.724611	-84.254889	65.43
29	WRGT-TV	LIC	DT	30	498.0	39.724611	-84.254889	65.43
30	WKEF	APP	DT	18	525.0	39.724444	-84.255000	65.45
31	WRCX-LP	LIC	TX	40	34.0	39.724444	-84.255000	65.45
32	WRCX-LP	CP	LD	40	0.32	39.724444	-84.255000	65.45
33	WRCX-LP	APP	LD	40	15.0	39.724444	-84.255000	65.45
34	WDTN	LIC	DT	50	1000.0	39.718611	-84.256111	65.96
35	W22DE	LIC	TX	22	54.0	39.720556	-84.261111	66.13
36	WWHO	LIC	DT	46	1000.0	39.588889	-83.112222	67.46
37	WLQP-LP	LIC	TX	18	7.7	40.634194	-84.208000	67.72
38	W23DE-D	LIC	LD	23	3.0	40.634194	-84.208000	67.72
39	WLMO-LP	LIC	TX	38	15.0	40.634194	-84.208000	67.72
40	W23DE-D	CP	LD	43	7.85	40.634194	-84.208000	67.72
41	WSFJ-TV	LIC	DT	24	1000.0	40.079000	-82.694861	73.31
42	WSFJ-TV	CP	DT	24	500.0	40.079000	-82.694861	73.31
43	WLIO	LIC	DT	8	27.5	40.747556	-84.131750	73.96
44	WLIO	CP	DT	8	16.5	40.747556	-84.131750	73.96
45	WLQP-LP	CP	TX	25	7.5	40.747556	-84.131750	73.96
46	WLQP-LP	CP	TX	25	7.5	40.747556	-84.131750	73.96
47	WOHL-CD	LIC	DC	35	9.0	40.747556	-84.131750	73.96
48	WLMO-LP	CP	TX	38	5.3	40.747556	-84.131750	73.96
49	WLMO-LP	CP	TX	38	5.3	40.747556	-84.131750	73.96
50	WLQP-LP	CP	LD	45	15.0	40.747556	-84.131750	73.96
51	WLMO-LP	CP	LD	47	15.0	40.747556	-84.131750	73.96
52	WTLW	CP	DT	2	0.46	40.763056	-84.183056	77.75
53	WTLW	LIC	DT	44	165.0	40.763056	-84.183056	77.75
54	W32DS-D	LIC	LD	32	6.8	40.552917	-84.517250	82.59
55	WOOH-LD	CP	LD	29	15.0	39.952278	-82.506806	90.88
56	WFND-LD	LIC	LD	22	15.0	41.111111	-83.648333	103.47
57	WFND-LD	CP	LD	22	7.5	41.111417	-83.647972	103.51
58	WMFD-TV	LIC	DT	12	14.0	40.763889	-82.617778	105.53
59	WOHZ-CD	LIC	DC	41	15.0	40.763889	-82.617778	105.53
60	WKOI-TV	LIC	DT	39	600.0	39.512222	-84.635833	105.56
61	WBGU-TV	LIC	DT	27	153.0	41.136667	-83.906667	108.05
62	W16DM-D	CP	LD	16	0.5	40.872806	-84.588000	109.06
63	W29EL-D	CP	LD	29	0.5	40.872806	-84.588000	109.06
64	W42EP-D	CP	LD	42	0.5	40.872806	-84.588000	109.06
65	W49EM-D	CP	LD	49	0.5	40.872806	-84.588000	109.06
66	W43CZ-D	LIC	LD	43	11.0	40.709222	-82.486278	110.86
67	WSTR-TV	LIC	DT	33	360.0	39.200278	-84.522778	124.91

ID	Call Sign	Status	Service ⁷	Channel	Transmit ERP ⁸ (kW)	Latitude (NAD 27)	Longitude (NAD 27)	Distance to Nearest Turbine (km)
68	W33BW	LIC	TX	33	30.0	40.747278	-82.314889	125.34
69	WIVX-LD	LIC	LD	51	1.1	40.633056	-82.196111	128.29
70	WOTH-CD	LIC	DC	20	15.0	39.125111	-84.498889	130.77
71	WCPO-TV	LIC	DT	22	880.0	39.125111	-84.498889	130.77
72	WBQC-LD	LIC	LD	47	15.0	39.125111	-84.498889	130.77
73	WKRC-TV	LIC	DT	12	15.55	39.116389	-84.501944	131.74
74	WDYC-LD	LIC	LD	36	9.0	39.116389	-84.501944	131.74
75	WLWT	CP	DT	20	790.0	39.124167	-84.521667	131.91
76	WCET	LIC	DT	34	400.0	39.124167	-84.521667	131.91
77	WLWT	LIC	DT	35	1000.0	39.124167	-84.521667	131.91
78	WDYC-LD	CP	LD	36	15.0	39.124167	-84.521667	131.91
79	WPTO	LIC	DT	28	400.0	39.121944	-84.547778	133.34
80	WXIX-TV	LIC	DT	29	227.0	39.121944	-84.547778	133.34
81	WHIZ-TV	CP	DT	30	500.0	39.928333	-81.985000	135.34
82	WHIZ-TV	LIC	DT	40	620.0	39.928333	-81.985000	135.34
83	WOOH-LP	LIC	TX	16	22.7	39.948611	-81.963056	136.87
84	WOOH-LP	CP	LD	16	15.0	39.948611	-81.963056	136.87
85	WGGN-TV	LIC	DT	42	450.0	41.075083	-82.451111	139.47
86	WCVN-TV	LIC	DT	24	53.5	39.030833	-84.506389	140.11
87	WCUH-LD	CP MOD	LD	16	5.0	40.977250	-84.966056	140.61
88	WCUH-LD	LIC	LD	16	5.0	40.977250	-84.966056	140.61
89	W41DS-D	CP MOD	LD	41	6.0	40.977250	-84.966056	140.61
90	W41DS-D	LIC	LD	41	6.0	40.977250	-84.966056	140.61
91	W04DU-D	CP	LD	4	3.0	40.977222	-84.966111	140.61
92	WEDX-LD	CP MOD	LD	29	6.0	40.977222	-84.966111	140.61
93	W43DI-D	CP MOD	LD	43	10.0	40.977222	-84.966111	140.61
94	W43DI-D	LIC	LD	43	6.0	40.977222	-84.966111	140.61
95	WODP-LD	CP MOD	LD	49	7.0	40.977222	-84.966111	140.61
96	WODP-LD	LIC	LD	49	6.0	40.977222	-84.966111	140.61
97	W22DV-D	CP MOD	LD	22	10.0	40.746361	-85.173222	141.70
98	W22DV-D	APP	LD	22	6.0	40.746361	-85.173222	141.70
99	WDFM-LP	LIC	TX	26	7.5	41.291389	-84.537500	143.30
100	WIPB	LIC	DT	23	250.0	40.093611	-85.392222	144.96
101	WOUB-TV	LIC	DT	27	250.0	39.314444	-82.149722	148.26

Table A: Off-Air TV Stations within 150 Kilometers of Project Area

This foregoing document was electronically filed with the Public Utilities

Commission of Ohio Docketing Information System on

12/22/2017 4:07:28 PM

in

Case No(s). 17-2516-EL-BGA, 17-2517-EL-BGA

Summary: Application Exhibit I - Communications reports electronically filed by Mr. Ryan D. Elliott on behalf of Buckeye Wind LLC and Champaign Wind LLC