

July 10, 2019

Ms. Tanowa Troupe, Secretary
Ohio Power Siting Board
Docketing Division
180 East Broad Street, 11th Floor
Columbus, OH 43215

**Re: Case Nos. 09-479-EL-BGN, 11-3446-EL-BGA, 16-469-EL-BGA,
and 16-2404-EL-BGA**
In the Matter of the Application of Hardin Wind Energy LLC for a Certificate of
Environmental Compatibility and Public Need for the Hardin Wind Farm.

**Compliance with Conditions 46 and 47, Case No. 09-479-EL-BGN, and
Conditions 7 and 8, Case No. 11-3446-EL-BGA – Microwave Studies**

Dear Ms. Troupe:

Hardin Wind Energy LLC (“Applicant”) is certified to construct a wind-powered electric generation facility in Hardin County, Ohio, in accordance with the orders issued by the Ohio Power Siting Board (“OPSB”) in the above-referenced cases.

At this time, the Applicant is filing the following attachments: Attachment 1, Microwave Study dated June 20, 2019; Attachment 2, WATCH TV Impact Assessment dated June 28, 2019; and Attachment 3, Land Mobile and Emergency Services Report dated June 26, 2019. These documents are being provided in compliance with Conditions 46 and 47 of the OPSB’s March 22, 2010 Order in Case No. 09-479-EL-BGN, and Conditions 7 and 8 of the OPSB’s August 29, 2011 Order in Case No. 11-3446-EL-BGA.

We are available, at your convenience, to answer any questions you may have.

Respectfully submitted,

/s/ Christine M.T. Pirik
Christine M.T. Pirik (0029759)
William V. Vorys (0093479)
Dickinson Wright PLLC
150 East Gay Street, Suite 2400
Columbus, Ohio 43215
Attorneys for Hardin Wind Energy LLC

cc: Ed Steele
Derek Collins
Andrew Conway

COLUMBUS 39579-20 118958v1

Hardin Wind Energy LLC
Case Nos. 09-479-EL-BGN, 11-3446-EL-BGA, 16-469-EL-BGA, and 16-2404-EL-BGA
July 10, 2019

Attachment 1

Microwave Study dated June 20, 2019

Christine M.T. Pirik (0029759)
(Counsel of Record)
William V. Vorys (0093479)
Dickinson Wright PLLC
150 East Gay Street, Suite 2400
Columbus, Ohio 43215
Phone: (614) 591-5461
Email: cpirik@dickinsonwright.com
vvorys@dickinsonwright.com
Attorneys for Hardin Wind Energy LLC

Wind Power GeoPlanner™

Microwave Study

Hardin Wind Energy Project



Prepared on Behalf of
Invenergy LLC

June 20, 2019



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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 the non-federal government microwave systems licensed, applied and proposed at the FCC and the unlicensed microwave system owned by Mid Ohio Energy Cooperative Inc., an electric distribution cooperative located in Kenton, Ohio.

2. Project Overview

Project Information

Name: Hardin Wind Energy

County: Hardin

State: Ohio

Number of Turbines: 60

Blade Diameter: 127 and 116 meters

Hub Height: 88.6 and 90 meters



Figure 1: Area of Interest

3. Two-Dimensional Fresnel Zone Analysis

Methodology

In addition to the microwave data provided by Mid Ohio Energy, 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. Paths that were not operating in the area on 06/13/2011 or have been decommissioned were not considered.

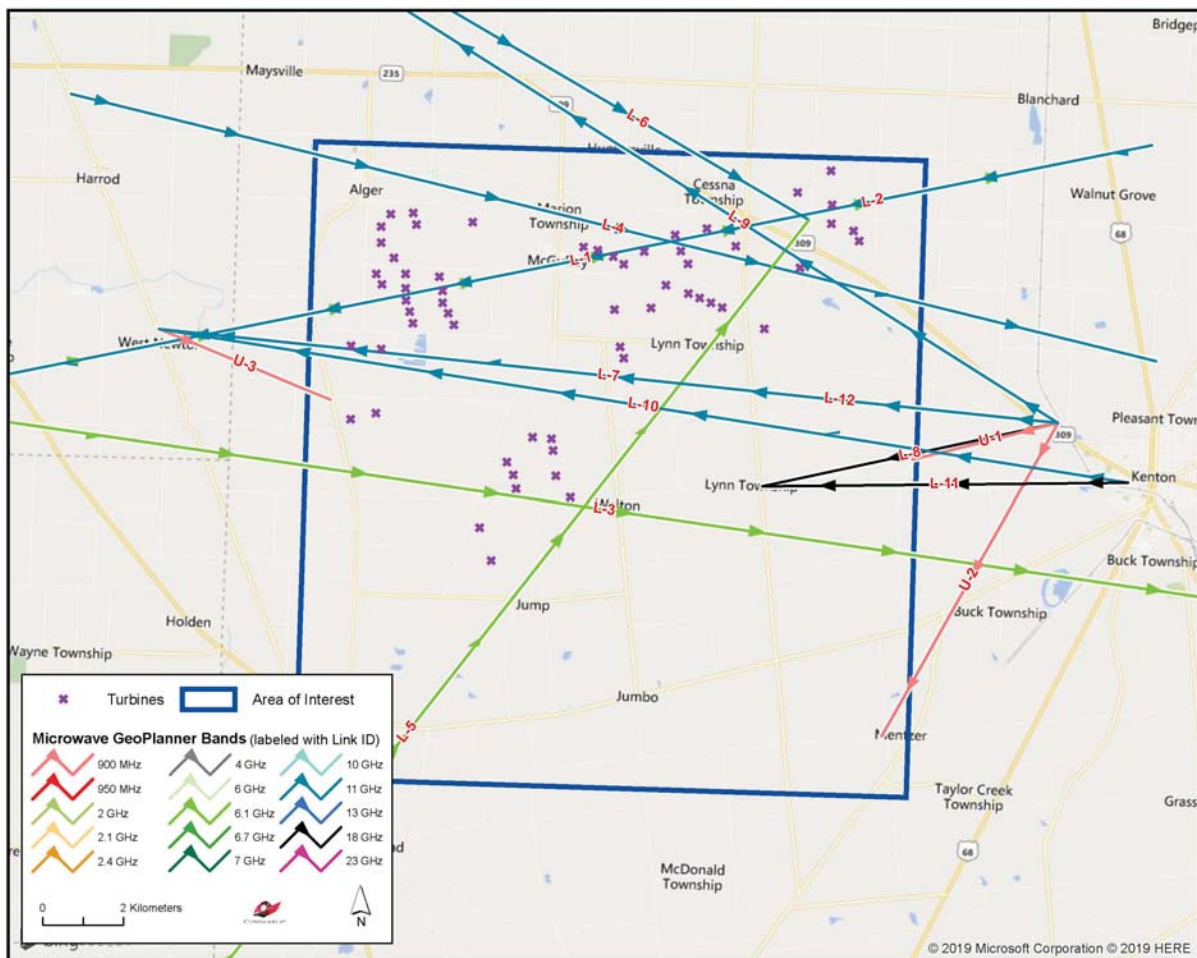


Figure 2: Microwave Paths that Intersect the Area of Interest

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 and coordinates provided by Mid Ohio Energy to determine which paths intersect the area of interest. It is possible that as-built coordinates may differ slightly from these coordinates.

ID	Status	Site Name 1	Site Name 2	Callsign 1	Callsign 2	Band	Path Length (km)	Licensee/Owner
L-1	Licensed	LIMA	KENTON	WPUG339	WPUG341	6.1 GHz	34.79	W.A.T.C.H. TV Company Inc.
L-2	Licensed	KENTON	LIMA	WPUG341	WPUG339	11 GHz	34.79	W.A.T.C.H. TV Company Inc.
L-3	Licensed	0-1011941	6-25318	WQNA532	WQNA533	6.1 GHz	59.06	AB Services LLC
L-4	Licensed	SBAOH03357-B	ATC81629	WQQT246	WQQI778	11 GHz	27.76	Comprehensive Wireless LLC
L-5	Licensed	INDIAN CREEK	KENTON	WQVZ662	WQVZ800	6.1 GHz	24.19	Agile Network Builders LLC
L-6	Licensed	OHIO NORTH	KENTON	WQWC965	WQVZ800	11 GHz	16.19	Agile Network Builders LLC
L-7	Licensed	KENTON TWR	W NEWTON SUB	WQXL304	WQLH337	11 GHz	22.48	Mid Ohio Energy Cooperative Inc.
L-8	Licensed	KENTON TWR	LYNN SUB	WQXL304	WQNK932	18 GHz	7.52	Mid Ohio Energy Cooperative Inc.
L-9	Licensed	KENTON TWR	ADA SUBSTN	WQXL304	WQXJ440	11 GHz	23.91	Mid Ohio Energy Cooperative Inc.
L-10	Licensed	KENTON TWR	W NEWTON SUB	WQLH334	WQLH337	11 GHz	24.39	Mid Ohio Energy Cooperative Inc.
L-11	Licensed	KENTON TWR	LYNN SUB	WQLH334	WQNK932	18 GHz	9.09	Mid Ohio Energy Cooperative Inc.
L-12	Licensed	KENTON TWR	W NEWTON SUB	WQXL304	WQLH337	11 GHz	22.48	Mid Ohio Energy Cooperative Inc.
U-1	Unlicensed	KENTON TWR	N KENTON-LYNN Tie Pt	N/A	N/A	900 MHz	3.73	Mid Ohio Energy Cooperative Inc.
U-2	Unlicensed	KENTON TWR	LYNN-Rt 31 Tie Pt	N/A	N/A	900 MHz	8.94	Mid Ohio Energy Cooperative Inc.
U-3	Unlicensed	W NEWTON SUB	LYNN-W NEWTON Tie Pt	N/A	N/A	900 MHz	4.61	Mid Ohio Energy Cooperative Inc.

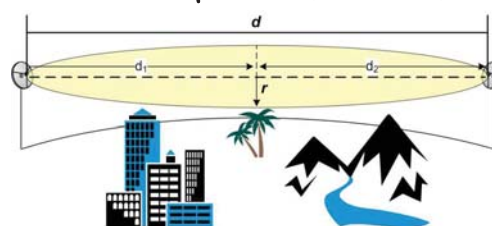
Table 1: Summary of Microwave Paths that Intersect the Area of Interest

(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, nine paths 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 photos or the coordinates provided by Mid-Ohio Energy³.

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 (adjusted locations based on aerial photography/basis for report images and results) and mw_geopl_fcc.shp (locations solely based on FCC licensed information) 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. Likewise, Comsearch recommends that an area directly in front of each microwave antenna should be avoided. This corresponds to the Consultation Zone which measures 1 kilometer along the main beam of the antenna and 24 ft (7.3 meters) wide. A depiction of the Fresnel Zones and Consultation 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}.

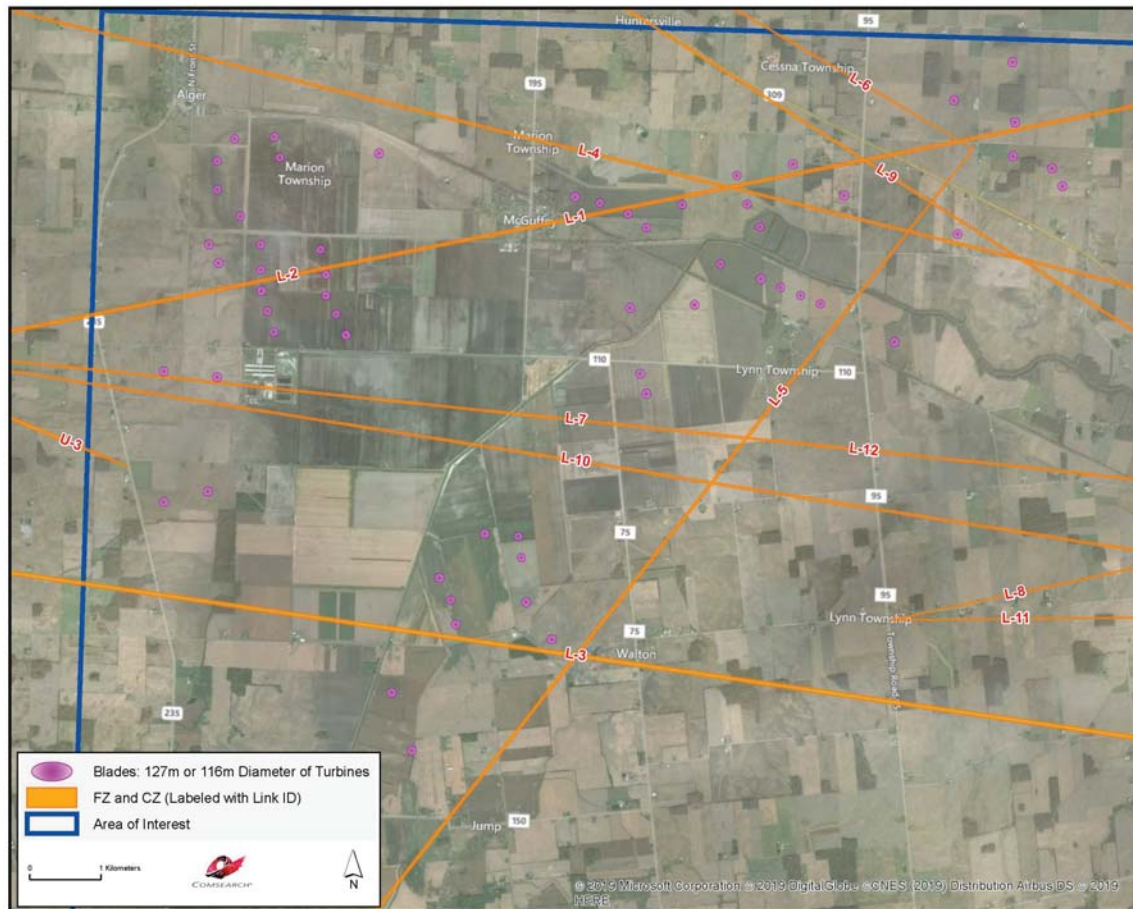
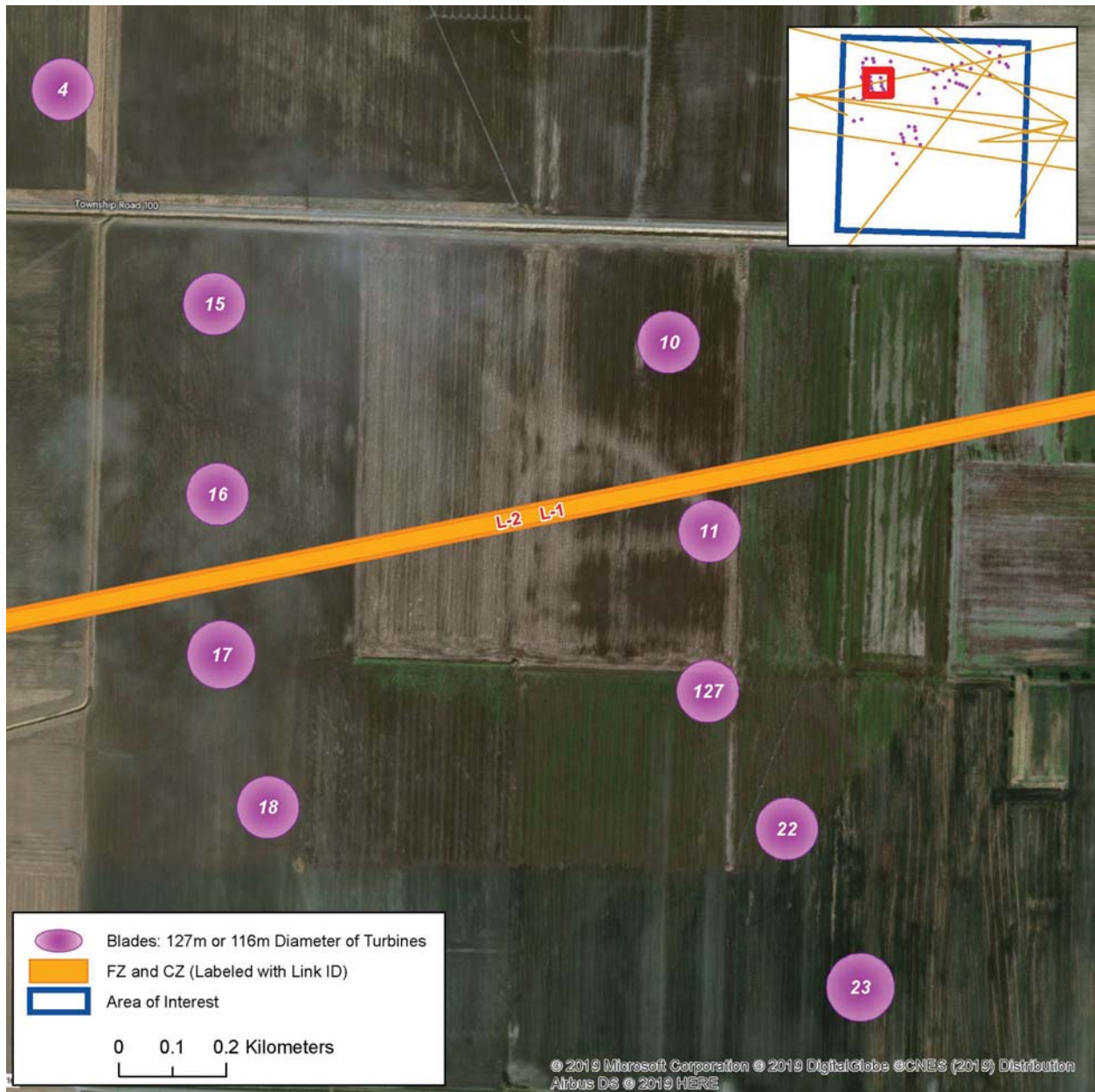


Figure 3: Fresnel Zones and Consultation Zones in the Area of Interest

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 and Consultation Zones in the Area of Interest
(Turbine 11)*

4. Conclusion

Total Microwave Paths	Paths with Affected Fresnel Zones	Total Turbines	Turbines intersecting the Fresnel Zones
15	0	60	0

Table 2: Fresnel Zone Analysis Result

Our study identified 15 microwave paths intersecting the Hardin Wind Energy Project area of interest. The Fresnel Zones for these microwave paths were calculated and mapped in order to assess the potential impact from the turbines. A total of 60 turbines were considered in the analysis, each with a blade diameter of 127 or 116 meters and a hub height of 88.6 or 90 meters. Of those turbines, none were found to have potential obstruction with the microwave systems in the area.

5. Contact

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

Contact person: David Meyer
Title: Senior Manager
Company: Comsearch
Address: 19700 Janelia Farm Blvd., Ashburn, VA 20147
Telephone: 703-726-5656
Fax: 703-726-5595
Email: dmeyer@comsearch.com
Web site: www.comsearch.com

Appendix: Turbine Locations

ID	Type	Blade Length (m)	Hub Height (m)	Latitude	Longitude
1	2.7-116	58.0	90.0	40.70115534	-83.83491476
2	2.7-116	58.0	90.0	40.69824988	-83.83768997
3	2.7-116	58.0	90.0	40.69464270	-83.83750130
4	2.7-116	58.0	90.0	40.69134951	-83.83351570
5	2.7-116	58.0	90.0	40.70153325	-83.82832594
6	2.7-116	58.0	90.0	40.69894681	-83.82728153
10	2.7-116	58.0	90.0	40.68744280	-83.82000306
11	2.7-116	58.0	90.0	40.68429753	-83.81897116
12	2.8-127	63.5	88.6	40.69990829	-83.81078914
15	2.7-116	58.0	90.0	40.68783676	-83.83003002
16	2.7-116	58.0	90.0	40.68465331	-83.82982426
17	2.8-127	63.5	88.6	40.68196502	-83.82962765
18	2.7-116	58.0	90.0	40.67943487	-83.82849127
19	2.7-116	58.0	90.0	40.67680574	-83.82735080
20	2.8-127	63.5	88.6	40.68764479	-83.83857679
21	2.8-127	63.5	88.6	40.68535306	-83.83690581
22	2.7-116	58.0	90.0	40.67935432	-83.81705907
23	2.8-127	63.5	88.6	40.67673948	-83.81532812
33	2.8-127	63.5	88.6	40.67138983	-83.84541043
35	2.8-127	63.5	88.6	40.67086998	-83.83652801
37	2.8-127	63.5	88.6	40.65494128	-83.84474643
38	2.8-127	63.5	88.6	40.65642690	-83.83745321
52	2.8-127	63.5	88.6	40.65218688	-83.79119839
54	2.8-127	63.5	88.6	40.64638982	-83.79848935
55	2.7-116	58.0	90.0	40.64361840	-83.79651702
56	2.8-127	63.5	88.6	40.64056196	-83.79552619
59	2.7-116	58.0	90.0	40.65197971	-83.78560776
60	2.7-116	58.0	90.0	40.64930996	-83.78501179
62	2.8-127	63.5	88.6	40.64367938	-83.78393800
64	2.8-127	63.5	88.6	40.63905729	-83.77951284
65	2.8-127	63.5	88.6	40.63168270	-83.80584323
68	2.8-127	63.5	88.6	40.62440354	-83.80219291
80	2.8-127	63.5	88.6	40.68131990	-83.76823070
83	2.8-127	63.5	88.6	40.69514666	-83.77793915

ID	Type	Blade Length (m)	Hub Height (m)	Latitude	Longitude
84	2.7-116	58.0	90.0	40.69449853	-83.77380587
85	2.7-116	58.0	90.0	40.69320785	-83.76904254
86	2.7-116	58.0	90.0	40.69153480	-83.76594390
88	2.7-116	58.0	90.0	40.69460278	-83.76007112
91	2.7-116	58.0	90.0	40.69851768	-83.75115571
92	2.7-116	58.0	90.0	40.69492351	-83.74928000
94	2.8-127	63.5	88.6	40.70017079	-83.74187424
98	2.8-127	63.5	88.6	40.69640450	-83.73319908
101	2.7-116	58.0	90.0	40.68722320	-83.75340049
103	2.8-127	63.5	88.6	40.68548432	-83.74661999
104	2.7-116	58.0	90.0	40.68450970	-83.74329063
105	2.7-116	58.0	90.0	40.68357181	-83.73992738
106	2.7-116	58.0	90.0	40.68257927	-83.73658565
107	2.8-127	63.5	88.6	40.67802928	-83.72408342
108	2.8-127	63.5	88.6	40.68196357	-83.75752609
111	2.8-127	63.5	88.6	40.70889363	-83.71543458
112	2.8-127	63.5	88.6	40.71396496	-83.70583942
113	2.8-127	63.5	88.6	40.70636099	-83.70515266
114	2.8-127	63.5	88.6	40.70205216	-83.70529776
115	2.8-127	63.5	88.6	40.70065615	-83.69875565
116	2.8-127	63.5	88.6	40.69843812	-83.69692638
118	2.8-127	63.5	88.6	40.69195562	-83.71409549
123	2.7-116	58.0	90.0	40.69210345	-83.74704581
125	2.8-127	63.5	88.6	40.67299210	-83.76619430
126	2.8-127	63.5	88.6	40.67048796	-83.76507339
127	2.7-116	58.0	90.0	40.68161532	-83.81889356

Hardin Wind Energy LLC
Case Nos. 09-479-EL-BGN, 11-3446-EL-BGA, 16-469-EL-BGA, and 16-2404-EL-BGA
July 10, 2019

Attachment 2

WATCH TV Impact Assessment dated June 28, 2019

Christine M.T. Pirik (0029759)
(Counsel of Record)
William V. Vorys (0093479)
Dickinson Wright PLLC
150 East Gay Street, Suite 2400
Columbus, Ohio 43215
Phone: (614) 591-5461
Email: cpirik@dickinsonwright.com
wvorys@dickinsonwright.com
Attorneys for Hardin Wind Energy LLC

Wind Power GeoPlanner™

Watch TV Impact Assessment

Hardin



Prepared on Behalf of
Invenergy LLC

June 28, 2019



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1. Introduction

Comsearch provides assessments on communication towers identified within or near a defined area of interest related to proposed wind energy facilities. This information is useful in the planning stages of the wind energy facilities to identify the communication tower locations and operator information, along with any setback requirements. This assessment can be used in support of the wind energy facilities communications needs or to avoid any potential impact to the current communications services provided in that region.

This report focuses on the potential impact of Invenenergy's proposed wind turbines in the Hardin project area on the communication services offered by Watch TV. Watch TV provides television programming and wireless internet service to subscribers in the area. Based on the information provided by Watch TV in July 2011, the system consists of approximately 150 video channels servicing 9,000 cable customers, 4,000 cable and internet customers and at least 2000 internet-only customers. The communication channels for video and internet services operate in the FCC-licensed Broadband Radio Service band at 2.5 GHz. Additional frequency bands are used to provide microwave backhaul to the communication sites.

Figure 1 shows the Watch TV Towers that have subscribers potentially affected by the turbines planned for the Hardin project area. There are presently 79 subscribers utilizing Tower 1 and 36 subscribers utilizing Tower 2. The black dots represent the Tower 1 subscribers and the red dots represent the Tower 2 subscribers. The data provided by Watch TV covers their operational information as of 06/13/2011.

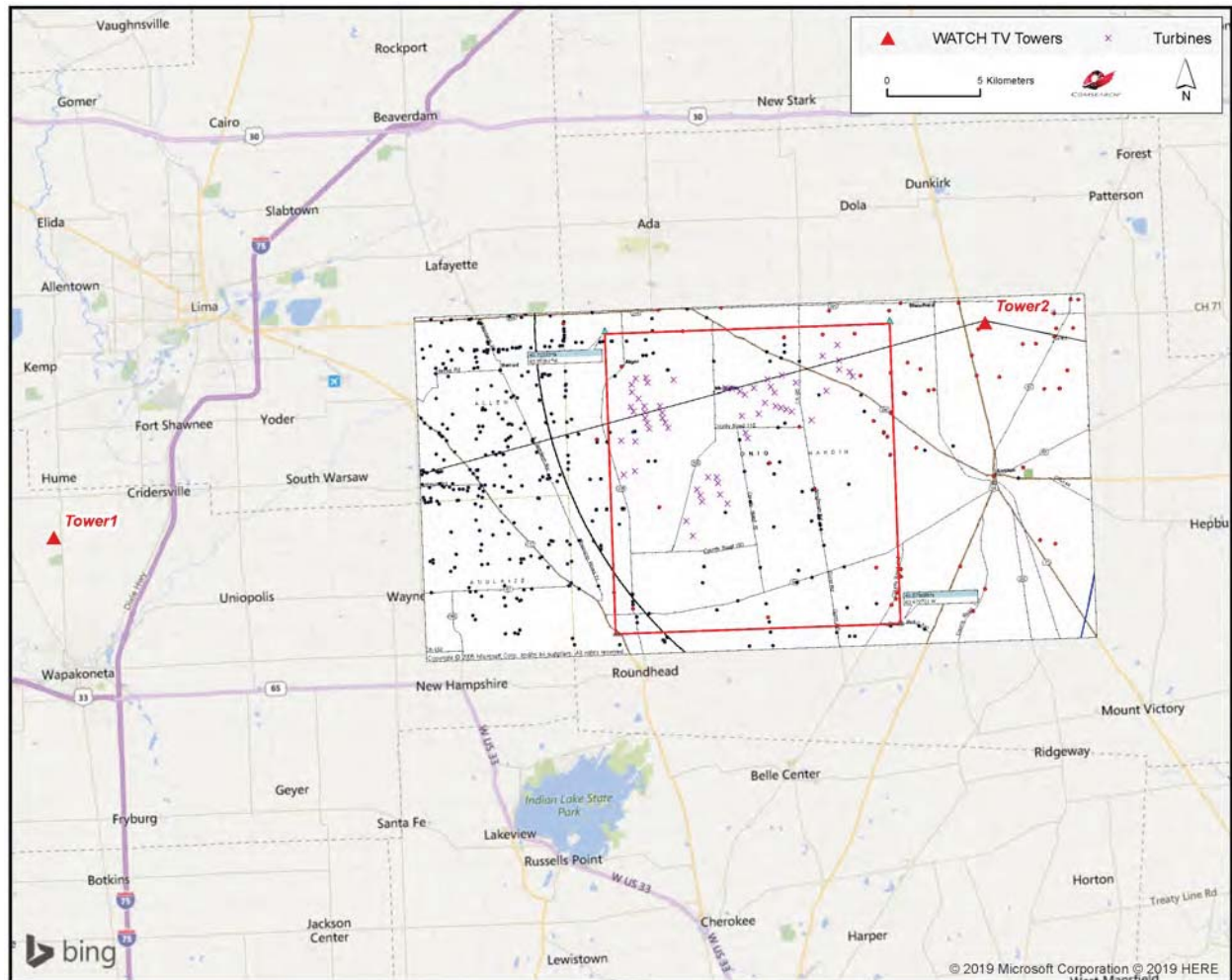


Figure 1: Hardin Project Area in relation to Watch TV Towers and nearby Subscribers

2. Summary of Results

Methodology

This study was performed using Comsearch's proprietary databases in conjunction with external data sources such as the Federal Communications Commission (FCC) licensing system. The area of interest was defined by the client and encompasses the planned turbine location, which is located in Hardin County, Ohio. A depiction of the wind project area appears below.



Figure 2: Hardin Wind Energy Project Area of Interest

Figures 3 through 6 contain aerial views and photographs of Tower 1 (ASR 1012273). Figure 7 contains an aerial view of Tower 2 (ASR 1230770). A summary of the towers' physical characteristics is presented in Table 1.



Figure 3: Aerial View of ASR 1012273 (Tower 1)



Figure 4: Aerial View of Base of Tower 1



Figure 5: Photograph looking up the Tower 1



Figure 6: Photograph of Top of Tower 1

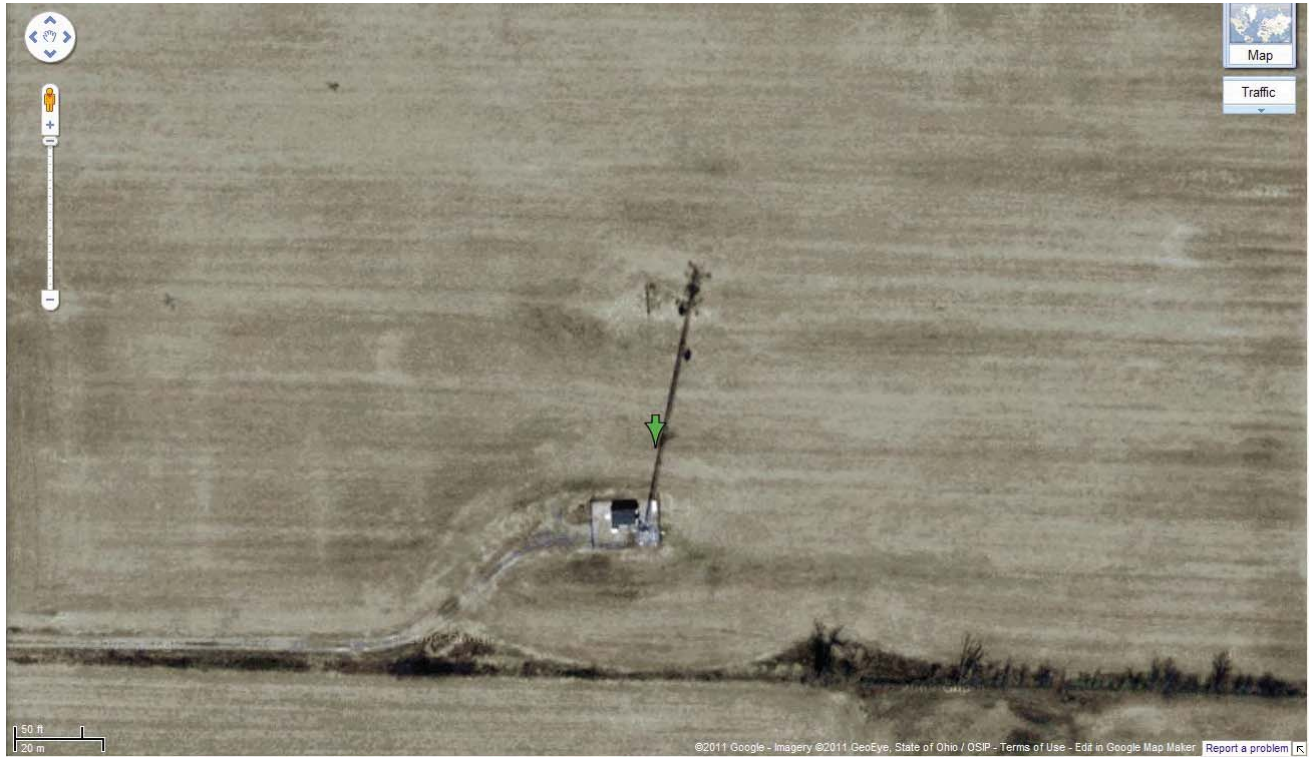


Figure 7: Aerial View of ASR 1230770 (Tower 2)

ID	ASR Number	Tower Owner	Structure Height AGL (m)	Structure Height AGL w/ Appurtenances (m)	Latitude (NAD83)	Longitude (NAD83)
1	1012273	WATCH TV Company	341.4	342.0	40-38-3.1 N	84-12-28.8 W
2	1230770	WATCH TV Company	91.4	91.4	40-43-19.3N	83-36-41.9W

Table 1: Summary of Communication Towers

Results

There are three aspects of Watch TV operations that could be affected by the installation of the Hardin wind energy project: (1) the microwave point-to-point backhaul used to carry signals to and from the tower for the Watch TV video and internet feeds (2) the satellite earth stations that are installed near the base of Tower 1, which provide program for the television portion of the system and (3) the propagation paths between the subscribers and the 2.5 – 2.7 GHz base stations on the towers.

Comsearch's Wind Power GeoPlanner™ Microwave Report¹ analyzed the first aspect, Watch TV's microwave point-to-point backhaul system. The findings of the study showed that the Watch TV microwave backhaul will be unaffected by the presence of the Hardin project.

The second aspect relates to earth stations at the base of Tower 1. Satellite earth stations used for program content reception will operate normally if their line-of-sight to the domestic geostationary satellite is unobstructed by the Hardin wind turbines. Figure 1 shows the relative location of Tower 1 and the proposed location of the wind turbines. Since Tower 1 is a significant distance from the closest turbine (over 30 kilometers), no impact to the reception of the satellite signals should occur.

The third aspect, propagation to and from the subscribers, needs to be examined on a case by case basis. The subscriber antenna is a high gain antenna and for best performance should have reliable signal strength from the transmit antennas. Comsearch's approach for dealing with this issue would be to analyze the relative position of the subscribers in the area and determine whether they can expect reliable and good quality service after the wind turbines are installed. This evaluation is discussed further in the next section.

¹ See Comsearch's Wind Power GeoPlanner™ Microwave Report, dated May 5, 2016. The FCC-licensed paths licensed to Watch TV were taken into account.

3. Wireless Cable and Internet Impact Assessment

Figure 8 contains a map and six concerns expressed by Watch TV. These concerns pertain to the Watch TV microwave backhaul and 2.5 GHz point-to-multipoint (PMP) subscriber services. Each situation was analyzed and reviewed by Comsearch and our responses are provided below.

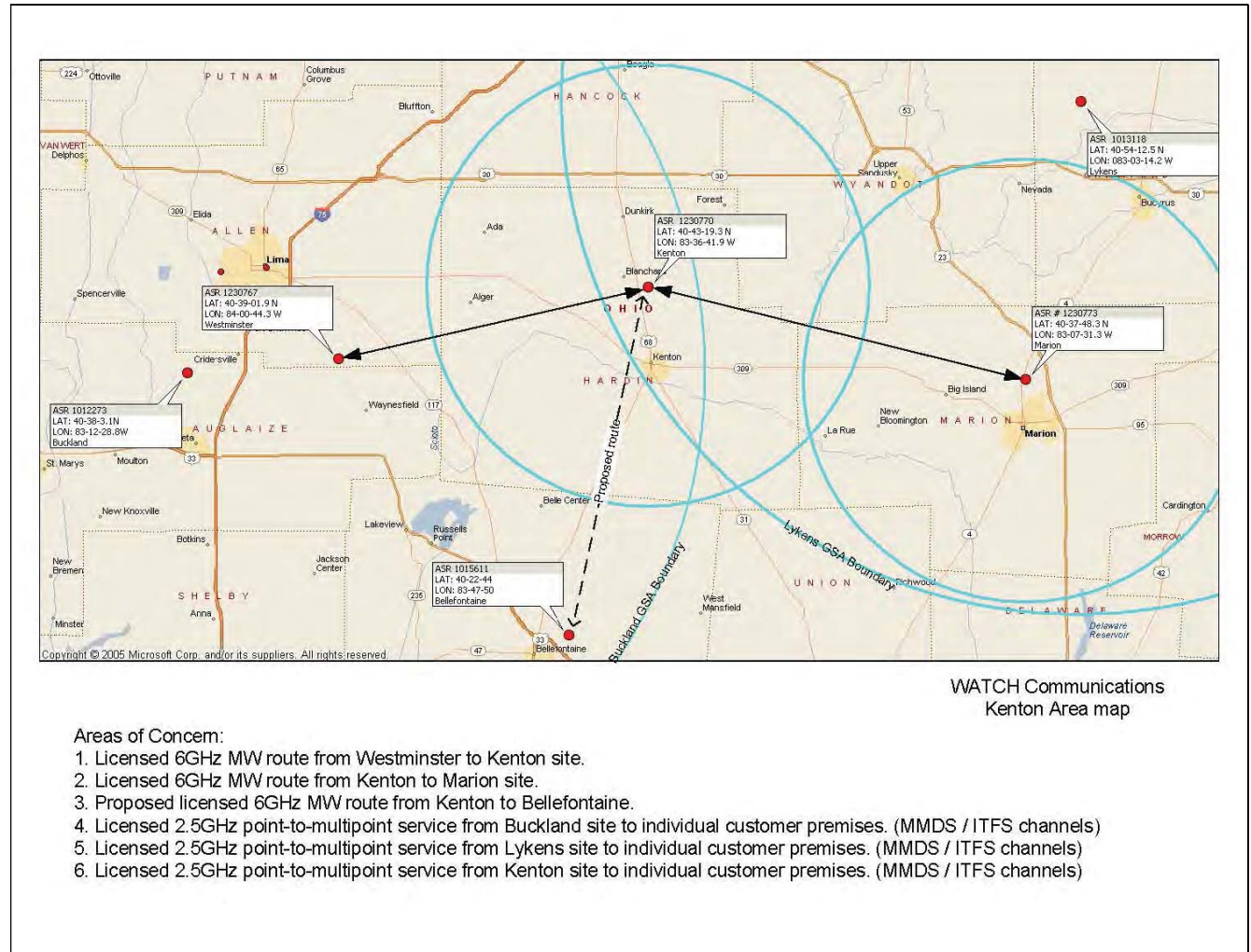


Figure 8: Areas of Concern Expressed by Watch TV

1. Licensed 6 GHz path from Westminister to Kenton: This path was considered in Comsearch's microwave study and the proposed turbine sites are located outside of the Fresnel zone (FZ) for this path.
2. Licensed 6 GHz path from Kenton – Marion: This path is completely outside of the project area of interest and therefore will not be impacted by the proposed project.

3. Proposed licensed 6 GHz path from Kenton – Bellefontaine: According to FCC ASR, the tower at Bellefontaine has changed its ASR licensed number to 1276625 and the 6 GHz path is now fully licensed. This path has sufficient clearance to the turbines considering the distance from the path to the closest turbine is about seven kilometers.
- 4-6. Licensed 2.5 GHz point-to-multipoint (PMP) service from Buckland, Lykens and Kenton to individual customer premises: WATCH TV has FCC licenses to provide PMP service within their defined geographic service area (GSA) boundaries. These licenses allow them to transmit signals within each GSA, and the locations of both the base stations and individual customer premise sites are covered by the area-wide GSA license. This is typical of any geographic-based FCC license where the licensee has the regulatory authority to transmit in a given frequency range over their service area without specifying each particular transceiver location. This same method is used in many other area-wide licensing bands such as the cellular phone service. In reviewing the map provided to us, the following observations can be made:
 - Lykens PMP site: The GSA boundaries shown on the map indicate that there are no planned turbines within the GSA and thus the Lykens site should not be impacted by the proposed project.
 - Kenton and Buckland PMP sites: The GSA boundaries of both of these PMP sites overlap the project area of interest. The proposed turbines are in an overlapping service region where signal may be provided to individual customer premise locations from either the Kenton or the Buckland PMP site. Therefore, if the path from one of these sites to a customer premise location is blocked by a turbine, an alternative path to the other PMP site is likely to be possible. Although the FCC license grants Watch TV the authority to transmit signals from each licensed PMP site within the service area identified, the license does not guarantee that all possible customer premise locations within the GSA boundary will be clear of line-of-sight obstructions or have sufficient signal reception.

Additional Discussion for Kenton and Buckland PMP Sites

Based on input from Watch TV, we have determined that the Buckland PMP site (Tower 1) transmits at 50 Watts and the antenna is omni-directional with a gain of 13.6 dBi. The receiving antennas on the tower are located approximately 100 feet below the transmitting antenna and consist of eight 45° sector antennas with 14 dBi gain. These antennas receive the up-link internet transmissions from the system's subscribers. The subscribers transmit a 2-Watt signal utilizing an antenna with 28 dBi of gain. The subscriber receiving antenna has a gain of approximately 28 dBi for both video and internet transmissions. The digital modulation for the system is 64 QAM. The structure height of the Kenton tower (Tower 2) is considerably lower than the Buckland site, but the system parameters should be similar.

Because of the widespread location of the subscribers for WATCH TV's video and internet services, whether in the project area-of-interest or outside of it, there is a possibility that the up-link and down-link path from the subscriber antenna to the WATCH Communications base station antennas on the tower may be obstructed by one or more wind turbines. The impact will need to be examined on a case-by-case basis and is a function of the location of the subscriber's antenna with respect to the base station antennas and the turbine locations. If

there is a degradation of the received signal level, it may affect the quality of service, both video and internet. Since the subscriber antenna has the flexibility of being relocated and/or redirected there is some measure of mitigation or avoidance.

4. Conclusions & Recommendations

After assessing the three aspects of Watch TV operations that could be affected by the installation of the Hardin wind energy project, we have determined the following.

- (1) Because the proposed turbines are outside the Fresnel zone (FZ) for Watch TV's microwave paths, the point-to-point backhaul should not be impacted.
- (2) There should be no impact on the reception of the satellite signals by Watch TV's earth stations because the separation distance to the turbines is great enough that all of the earth stations should have full coverage of the U. S. geostationary domestic satellite arc.
- (3) In assessing the 2.5 GHz subscriber deployments in the vicinity, we found that there may be some obstructed paths, but there are potential workarounds. Since the subscriber unit antennas have narrow beam widths, most of the blockage may be avoided once the wind turbines are installed. For those paths that are found to be completely obstructed or subject to signal degradation after the turbines are installed, the subscriber antenna may be moved to obtain clearance or the subscriber antenna may be re-directed to an adjacent Watch TV base station antenna.

5. Contact Us

For questions or information regarding the Watch TV Impact Assessment, please contact:

Contact person:	David Meyer
Title:	Senior Manager
Company:	Comsearch
Address:	19700 Janelia Farm Blvd., Ashburn, VA 20147
Telephone:	703-726-5656
Fax:	703-726-5595
Email:	dmeyer@comsearch.com
Web site:	www.comsearch.com

Hardin Wind Energy LLC
Case Nos. 09-479-EL-BGN, 11-3446-EL-BGA, 16-469-EL-BGA, and 16-2404-EL-BGA
July 10, 2019

Attachment 3

Land Mobile and Emergency Services Report dated June 26, 2019

Christine M.T. Pirik (0029759)
(Counsel of Record)
William V. Vorys (0093479)
Dickinson Wright PLLC
150 East Gay Street, Suite 2400
Columbus, Ohio 43215
Phone: (614) 591-5461
Email: cpirik@dickinsonwright.com
wvorys@dickinsonwright.com
Attorneys for Hardin Wind Energy LLC

Wind Power GeoPlanner™

Land Mobile & Emergency Services Report

Hardin Wind



Prepared on Behalf of
Hardin Wind Energy LLC

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An assessment of the emergency services in the Hardin 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 Hardin County, Ohio, appears below 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.

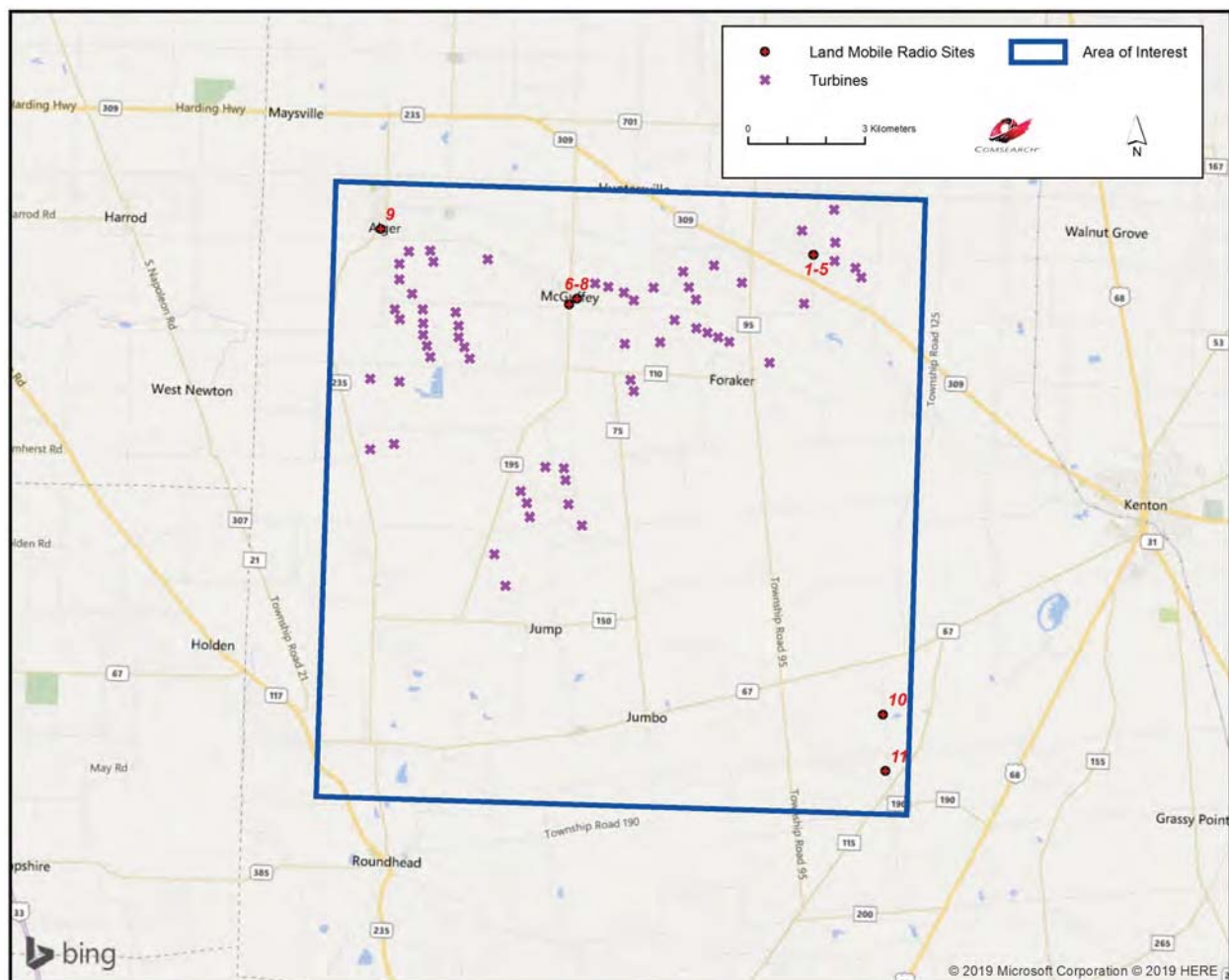


Figure 2: Land Mobile & Emergency Service Sites in Area of Interest

Figure 2 identifies eleven site-based licenses in and around the Hardin 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	KVJ767	150-174	Hardin, County of	105.0	40.703389	-83.711750	0.57
2	WPQG816	800/900	Ohio, State of	105.0	40.703389	-83.711750	0.57
3	WQRJ358	769-775/ 799-805	Ohio, State of	101.0	40.703389	-83.711750	0.57
4	WQTR394	800/900	Ohio, State of	105.0	40.703389	-83.711750	0.57
5	WQTR674	150-174	Hardin County Sheriff's Office	105.0	40.703389	-83.711750	0.57
6	KSP333	150-174	McGuffey Volunteer Fire Co.	21.0	40.691444	-83.783278	0.61
7	WQTR673	150-174	Hardin County Sheriff's Office	15.0	40.691444	-83.783278	0.61
8	WQOG244	450-470	Rohrs Farms	21.0	40.690056	-83.785500	0.85
9	WQTR673	150-174	Hardin County Sheriff's Office	7.0	40.706194	-83.843639	0.93
10	WQLQ316	450-470	Findlay Implement Co.	41.0	40.597306	-83.686306	9.15
11	WQQL540	450-470	Layman Farms	34.0	40.584222	-83.684944	10.06

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

Mid-Ohio Energy

In addition to the fixed-site licenses above, four mobile locations defined by center point and radius were found to intersect the Hardin Wind project area for the local Land Mobile license issued to Mid-Ohio Energy under call sign KQA357. These locations are listed in Table 2 and depicted with respect to the project area in Figure 3.

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	Mobile Area Radius (km)	Latitude (NAD83)	Longitude (NAD83)
3	KQA357	150-174, 450-470	Mid-Ohio Energy Cooperative, Inc.	32.0	40.658639	-83.637250
4	KQA357	450-470	Mid-Ohio Energy Cooperative, Inc.	64.0	40.645056	-83.146861
6	KQA357	450-470	Mid-Ohio Energy Cooperative, Inc.	32.0	40.647278	-83.616028
8	KQA357	450-470	Mid-Ohio Energy Cooperative, Inc.	32.0	40.674389	-83.900667

Table 2: KQA357 Mobile Locations Intersecting Project Area

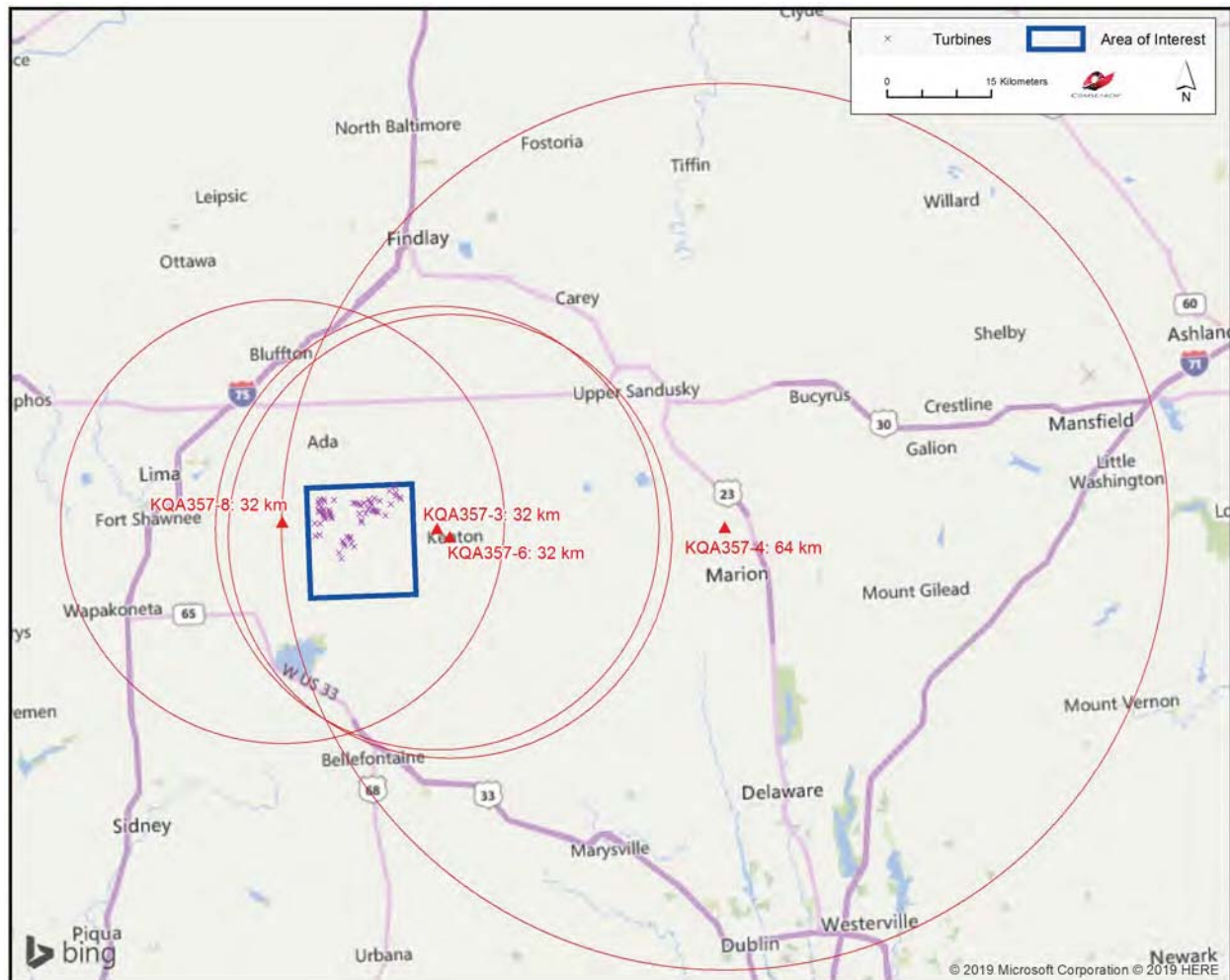


Figure 3: KQA357 Mobile Locations Intersecting Project Area

Area-Wide Licenses

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

Robert M. Bill

Chairperson, Public Safety Region #33

MARCS Program Office

4200 Surface Road

Columbus, OH 43228

phone: 614-995-0063

email: region33.rpc@gmail.com / bob.bill@das.ohio.gov

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-one licenses were found for the State of Ohio and three for the County of Hardin (see Table 3). These area-wide licenses are designated for mobile use only.

ID	Licensee	Area of Operation	Frequency Band (MHz)
1	Ada Liberty Joint Ambulance Board	Countywide: Hardin	150-174
2	American National Red Cross	Statewide: Ohio	25-50, 150-174, 450-470
3	Athens County	Statewide: Ohio	0-10
4	Barberton, City of	Statewide: Ohio	800/900
5	Columbus Dept. of Public Safety/Div. of Support Services	Statewide: Ohio	800/900, 2450-2500
6	Delaware, County of	Statewide: Ohio	0-10
7	Delaware County 911	Statewide: Ohio	800/900
8	Greene, County of	Statewide: Ohio	800/900
9	Guernsey, County of	Statewide: Ohio	150-174
10	Hardin, County of	Countywide: Hardin	150-174, 450-470
11	Liberty, Township of	Countywide: Hardin	150-174
12	Midwest K9 Search Unit	Statewide: Ohio	150-174

ID	Licensee	Area of Operation	Frequency Band (MHz)
13	National Ski Patrol System, Inc.	Statewide: Ohio	150-174
14	Northern Indiana Search & Rescue	Statewide: Ohio	150-174
15	Ohio, State of	Statewide: Ohio	0-10, 25-50, 150-174, 406-413, 450-470, 769-775/799-805, 800/900, 4940-4990
16	Ohio Department of Natural Resources	Statewide: Ohio	150-174, 4940-4990
17	Ohio Department of Transportation	Statewide: Ohio	0-10
18	Ohio Emergency Management Agency	Statewide: Ohio	150-174
19	Ohio Organized Crime Investigations Commission (OOCIC)	Statewide: Ohio	2450-2500
20	Ohio State Highway Patrol	Statewide: Ohio	25-50, 150-174, 450-470, 2450-2500
21	Parma Fire Department	Statewide: Ohio	769-775/799-805
22	Parma Heights, City of	Statewide: Ohio	150-174, 800/900
23	Saint Marys, Township of	Statewide: Ohio	800/900
24	Westlake, City of	Statewide: Ohio	150-174

Table 3: 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 Hardin County, Ohio, in Table 4.

Mobile Phone Carrier	Service ²
AT&T	AWS, Cellular, PCS, WCS, 700 MHz
DISH Network	AWS, 700 MHz

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

Mobile Phone Carrier	Service ²
Sprint	PCS
TerreStar	AWS
T-Mobile	AWS, PCS, 700 MHz
Verizon	AWS, Cellular, PCS, 700 MHz

Table 4: 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 Hardin 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 with regard 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 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:	David Meyer
Title:	Senior Manager
Company:	Comsearch
Address:	19700 Janelia Farm Blvd., Ashburn, VA 20147
Telephone:	703-726-5656
Fax:	703-726-5595
Email:	dmeyer@comsearch.com
Web site:	www.comsearch.com

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Summary: Notification of Compliance with Conditions 46 and 47 (09-479) and Conditions 7 and 8 (11-3446) – Microwave Studies electronically filed by Christine M.T. Pirik on behalf of Hardin Wind Energy LLC