Appendix O. Microwave and Communications Assessments

Wind Power GeoPlanner™

Microwave Study

Silver Queen

Prepared on Behalf of
ReGenerate Consulting

November 27, 2023

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Table of Contents

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: Silver Queen
County: Carroll and Crawford
State: Iowa

Number of Turbines: 93
Blade Diameter: 140 meters
Hub Height: 98 meters

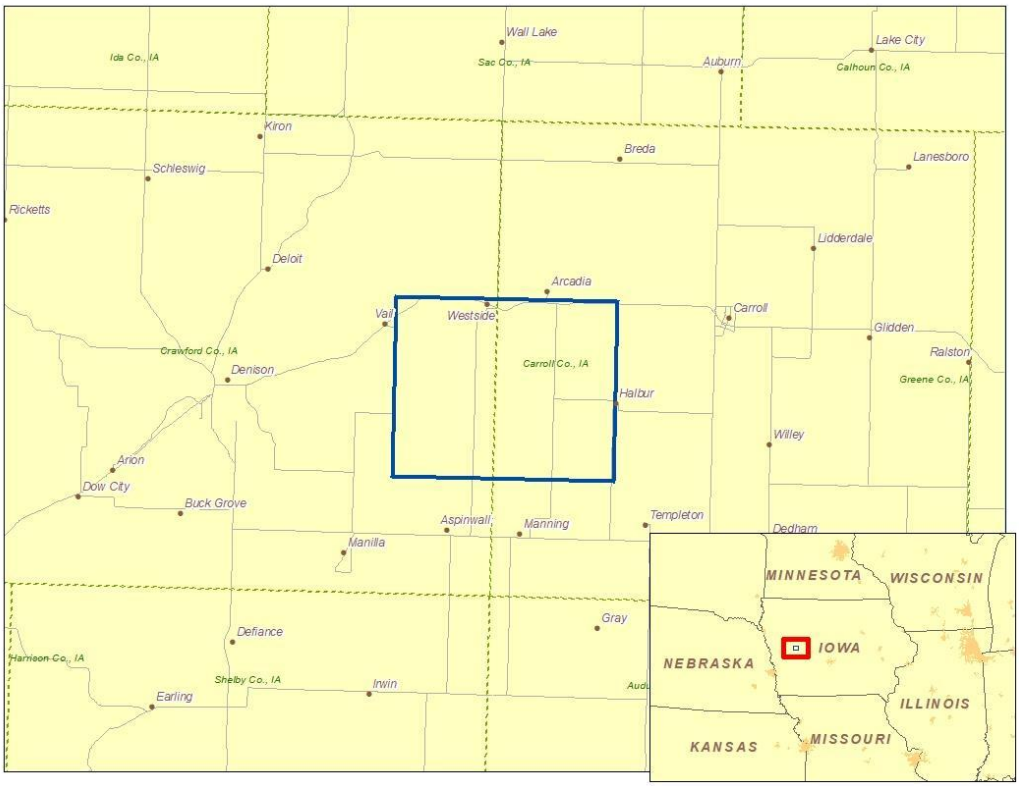


Figure 1: Area of Interest

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 GHz[1]. First, we determined all microwave paths that intersect the area of interest[2] and listed them in Table 1. These paths and the area of interest that encompasses the planned turbine locations are shown in Figure 2.

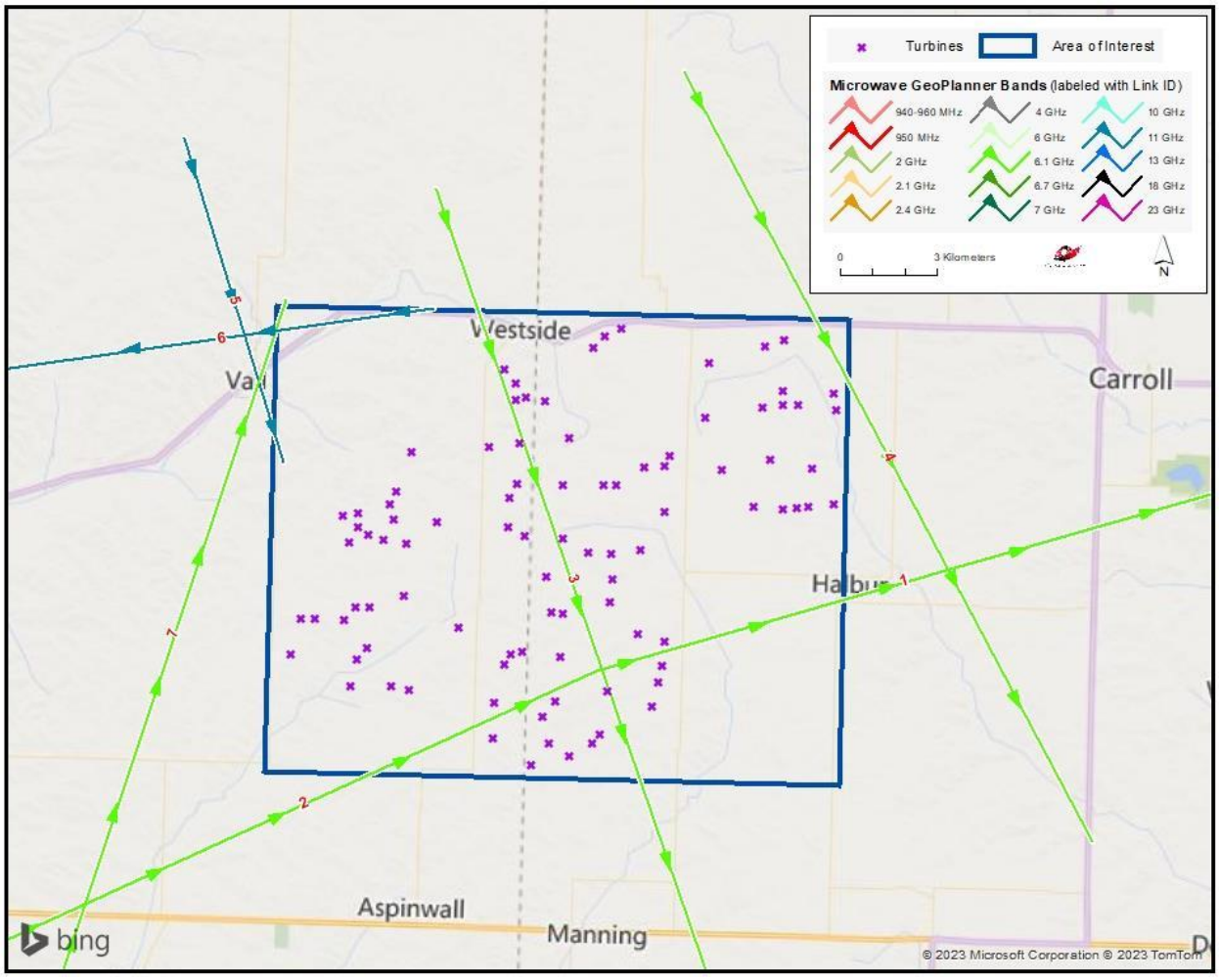


Figure 2: Microwave Paths that Intersect the Area of Interest

[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	WEE362	WEE361	6.1 GHz	28.46	Union Pacific Railroad Company
2	Licensed	WEE363	WEE362	6.1 GHz	33.14	Union Pacific Railroad Company
3	Licensed	WQOJ811	WQNY729	6.1 GHz	32.04	MidAmerican Energy Company
4	Licensed	WQUZ824	WPYT873	6.1 GHz	27.20	Corn Belt Power Cooperative
5	Licensed	WREX817	WREX819	11 GHz	10.57	Business Only Broadband, LLC
6	Licensed	WRNP355	WRNP354	11 GHz	23.01	AMG Technology Investment Group LLC
7	Licensed	WRXG670	WRXG673	6.1 GHz	22.17	Crawford, County of (IA)

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

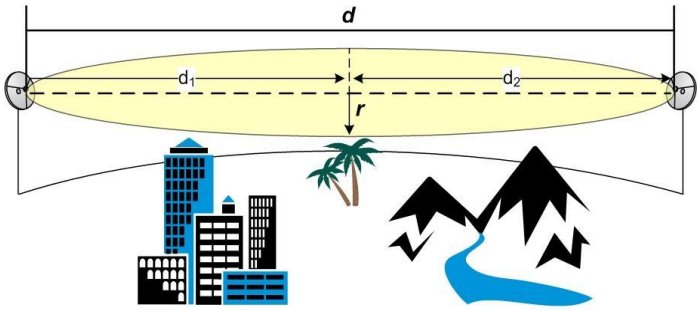
(See enclosed mw_geopl.xlsx for more information and GP_dict_matrix_description.xls for detailed field descriptions)

Verification of Coordinate Accuracy

It is possible that as-built coordinates may differ from those on the FCC license. For this project, four 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. One antenna of link ID 3 was found to be slightly off and was moved to its location based on the aerial photos[3].

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

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



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

[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.

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 is also included in the enclosed shapefiles[4,5].

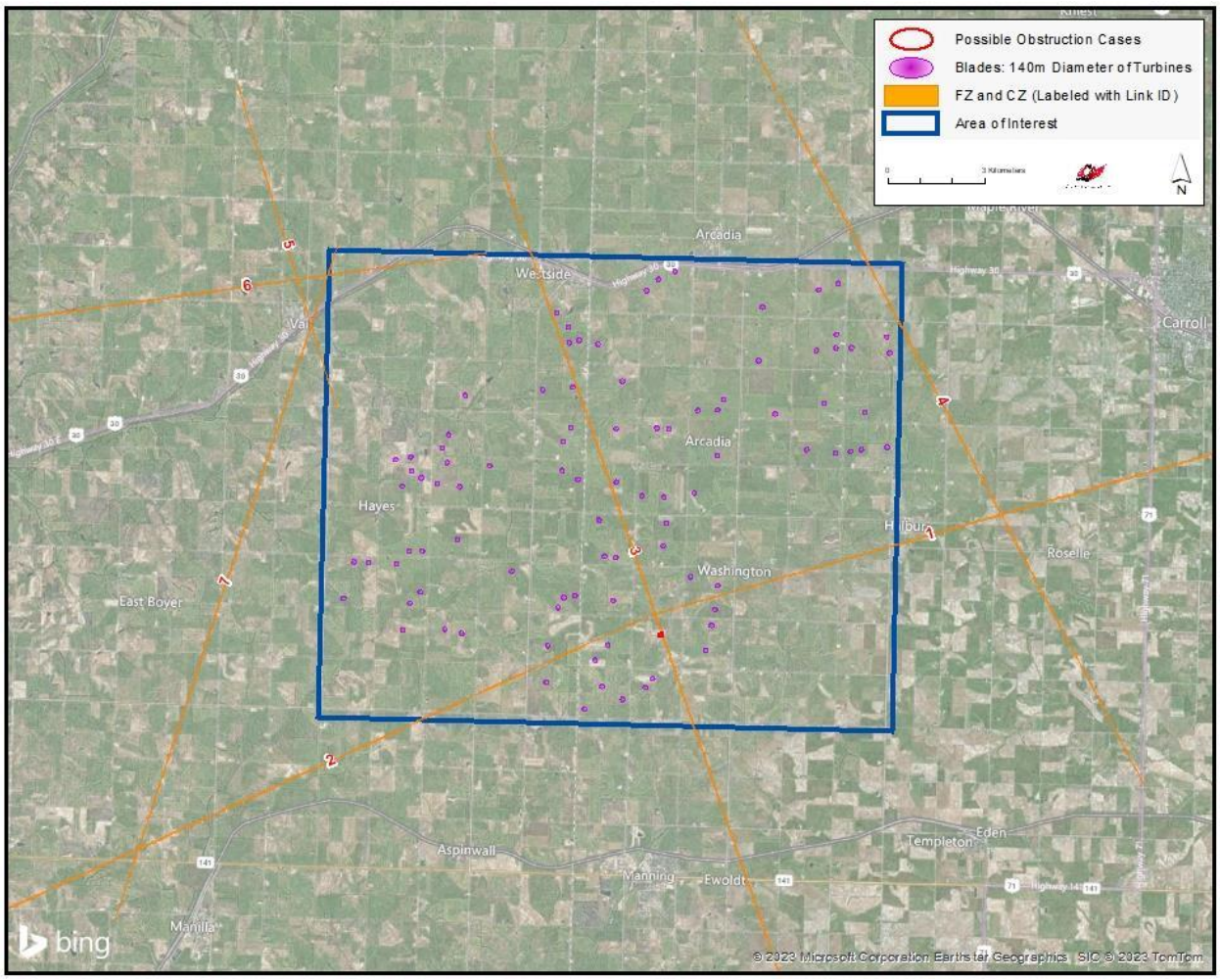


Figure 3: Fresnel Zones and Consultation Zones in the Area of Interest

[4] The ESRI® shapefiles enclosed are in NAD 83 UTM Zone 15 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.

Discussion of Potential Two Dimensional Obstructions

Total Microwave Paths	Paths with Affected Fresnel Zones	Total Turbines	Turbines Intersecting the 2D Fresnel Zones
7	1	93	1

Table 2: Fresnel Zone Analysis Result

For this project, 93 turbines were considered in the analysis, each with a blade diameter of 140 meters and turbine hub height of 98 meters. Of those turbines, one was found to intersect the Fresnel Zone of one microwave path. Figure 4 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 this case.

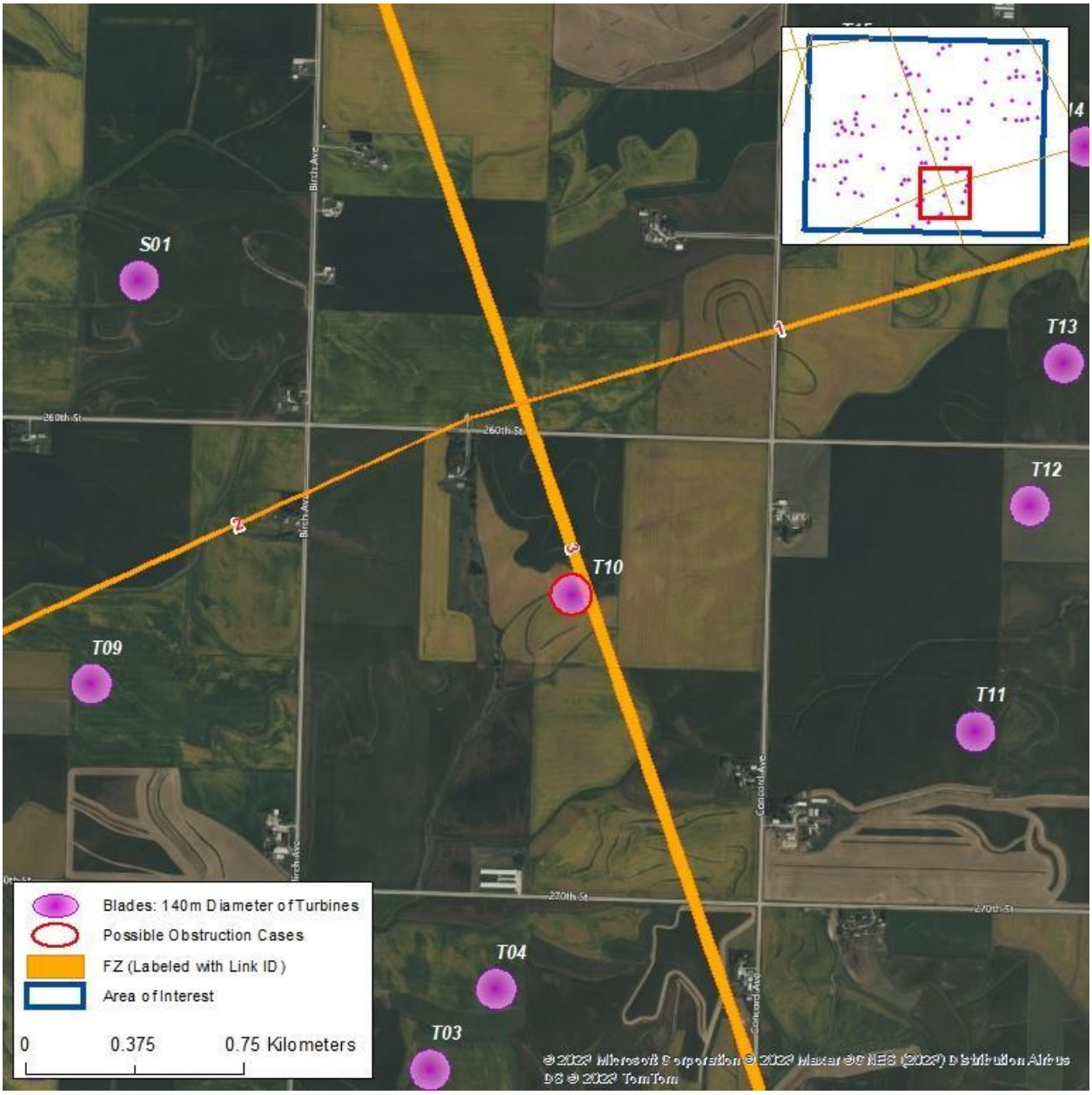


Figure 4: Potential Obstruction Case

Turbine ID	Latitude (NAD83)	Longitude (NAD83)	Affected Microwave Path ID	Fresnel Zone Radius at Turbine Location (m)	Horizontal off-path Distance (m)	Distance along the path from site 1 (km)	Horizontal Clearance (m)
T10	41.974554	-95.061966	3	19.69	55	16.49	-34.69

Table 3: Turbines that Intersect Fresnel Zones

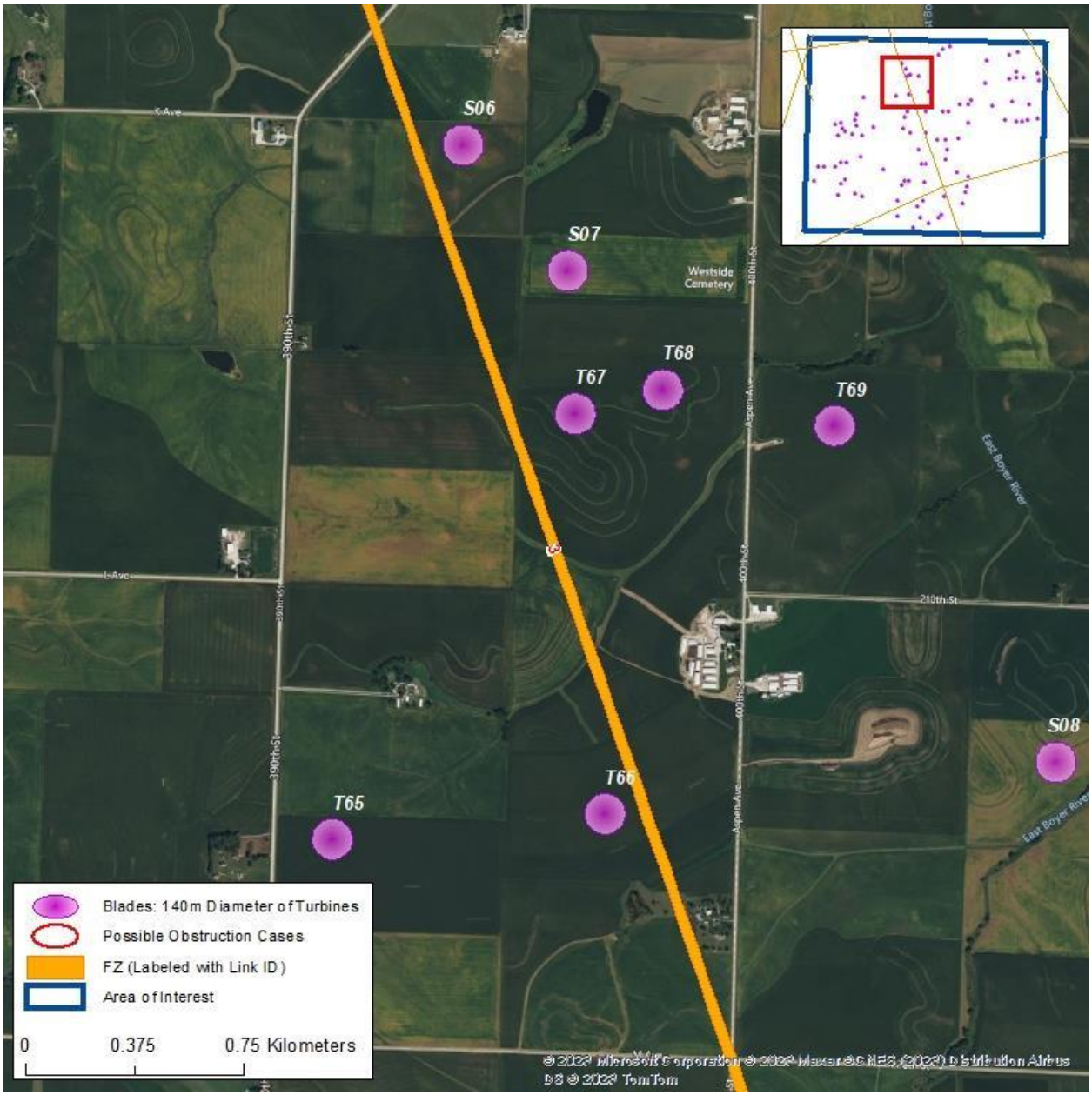
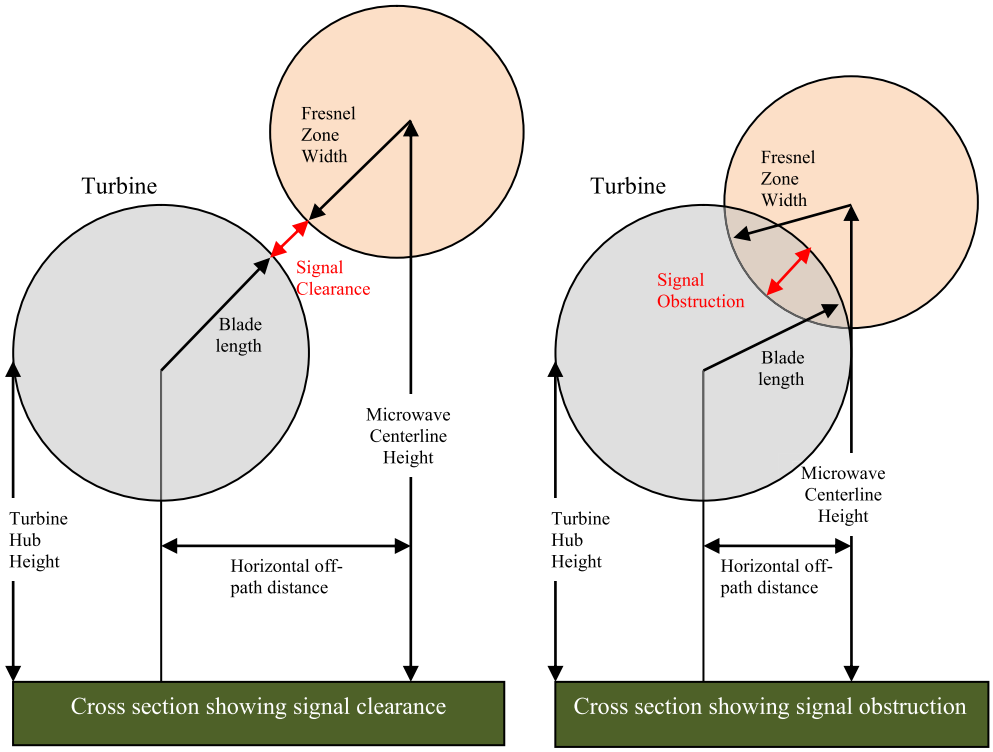


Figure 5: Turbines Close to the Fresnel Zones

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. This path has an additional set of diversity antennas located at separate heights from the main antennas. These are represented as an additional case in this section. 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. It shows negative clearance values indicating obstruction of the Fresnel zones.

Microwave Path ID	Fresnel Zone Radius at Turbine Location (m)	Microwave Centerline Height at Turbine Location (m)	Turbine ID	Hub Height (m)	Blade Length (m)	Cross Sectional Clearance (m)
3	19.69	39.69	T10	98	70	-9.54
3 div	19.69	33.42	T10	98	70	-4.87

Table 4: Cross Sectional Analysis Results

5. Conclusion

Our study identified seven microwave paths within the Silver Queen project area. The Fresnel Zones and Consultation Zones for these microwave paths were calculated and mapped. One turbine was found to intersect the Fresnel Zone of one microwave path based on the cross sectional analysis. Table 5 below shows the distances and directions that the turbine would need to move to clear any Fresnel Zones causing potential obstructions in its currently sited locations.

Turbine ID	Direction to Move Turbine	Approximate Azimuth	Distance from Currently Sited Location (meters)
T10	SW	240	35

Table 5: Recommended Turbine Adjustment to Avoid Potential Signal Obstruction

6. Contact

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

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Web site:	www.comsearch.com

Appendix: Turbine Locations

Name	Latitude	Longitude
S01	41.983964	-95.080237
S02	42.017260	-95.080190
S03	42.022792	-95.157762
S04	42.029321	-95.143663
S05	42.040561	-95.137872
S06	42.064218	-95.104051
S08	42.045550	-95.078775
S09	42.052250	-95.027646
S10	42.040721	-95.002541
S11	42.038519	-94.987085
S12	42.028765	-94.978467
S13	42.055325	-94.978354
S15	42.067389	-95.026736
S16	42.072545	-95.005700
S17	42.074508	-94.998308
T01	41.953292	-95.090099
T02	41.956272	-95.075780
T03	41.959733	-95.067362
T05	41.960524	-95.104666
T06	41.959748	-95.083681
T08	41.970812	-95.104473
T09	41.971436	-95.081811
T10	41.974554	-95.061966
T11	41.970615	-95.045063
T12	41.977644	-95.043013
T14	41.988817	-95.041073
T15	41.991080	-95.051310
T16	41.985144	-95.094676
T18	41.981557	-95.100919
T20	41.973696	-95.136947
T21	41.974699	-95.143346
T22	41.974130	-95.159059
T24	41.985008	-95.152971
T25	41.982685	-95.181761
T26	41.992958	-95.178151
T27	41.992893	-95.172757
T28	41.992831	-95.162069
T29	41.996422	-95.157504
T30	41.996540	-95.152506
T31	41.999936	-95.139357
T32	41.996266	-95.083945
T33	41.996065	-95.079632
T34	42.006429	-95.086260
T35	41.999618	-95.061946

Name	Latitude	Longitude
T37	42.013543	-95.070382
T38	42.013303	-95.062064
T39	42.014650	-95.050713
T40	42.014535	-95.160759
T41	42.021985	-95.163444
T43	42.017080	-95.153614
T44	42.015499	-95.147605
T49	42.017670	-95.094653
T50	42.020171	-95.100714
T52	42.032214	-95.097831
T53	42.032215	-95.080757
T54	42.032682	-95.065348
T55	42.032595	-95.060755
T56	42.025345	-95.042311
T57	42.037846	-95.050110
T59	42.041044	-95.040460
T60	42.037431	-95.020952
T61	42.027596	-95.008744
T62	42.026895	-94.997740
T64	42.027978	-94.988120
T65	42.042616	-95.108778
T66	42.043612	-95.097471
T68	42.056788	-95.095497
T69	42.055806	-95.088320
T73	42.071179	-95.070423
T74	42.074394	-95.066183
T75	42.076771	-95.059991
T76	42.055478	-95.005991
T77	42.056327	-94.998618
T79	42.056491	-94.992798
T80	42.020950	-95.127918
T81	42.014864	-95.139084
T82	41.991529	-95.118697
S07	42.060401	-95.099570
S14	42.059804	-94.979593
T04	41.962284	-95.064703
T07	41.967094	-95.086460
T13	41.982091	-95.041762
T17	41.984408	-95.098866
T23	41.981802	-95.156766
T36	42.006098	-95.061015
T42	42.019012	-95.157289
T46	42.021521	-95.144051
T47	42.025592	-95.145943
T51	42.028210	-95.100614
T58	42.038163	-95.042613
T63	42.027343	-94.992275

Name	Latitude	Longitude
T67	42.055983	-95.099114
T78	42.060170	-94.998516

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AM and FM Radio Report

Silver Queen

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1. Introduction

Comsearch analyzed AM and FM radio broadcast stations whose service could potentially be affected by the proposed Silver Queen Wind Project in Carroll and Crawford Counties, Iowa.

2. Summary of Results

AM Radio Analysis

Comsearch found four database records[1] for AM stations within approximately 30 kilometers of the project, as shown in Table 1 and Figure 1. The closest AM station to the project, KCIM, which broadcasts out of Carroll, Iowa, is located to the east of the project area of interest (AOI), 7.85 km from the nearest turbine.

ID	Call Sign	Status[2]	Frequency (kHz)	Transmit ERP[3] (kW)	Operation Time	Latitude (NAD 83)	Longitude (NAD 83)	Required Separation Distance[4] (km)	Distance to Nearest Turbine (km)
1	KCIM	LIC	1380	0.5	Daytime	42.037764	-94.884431	0.22	7.85
2	KCIM	LIC	1380	0.028	Nighttime	42.037764	-94.884431	0.22	7.85
3	KDSN	LIC	1530	0.5	Daytime	42.036100	-95.329164	0.20	13.40
4	KDSN	LIC	1530	0.013	Nighttime	42.036100	-95.329164	0.20	13.40

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.

[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.

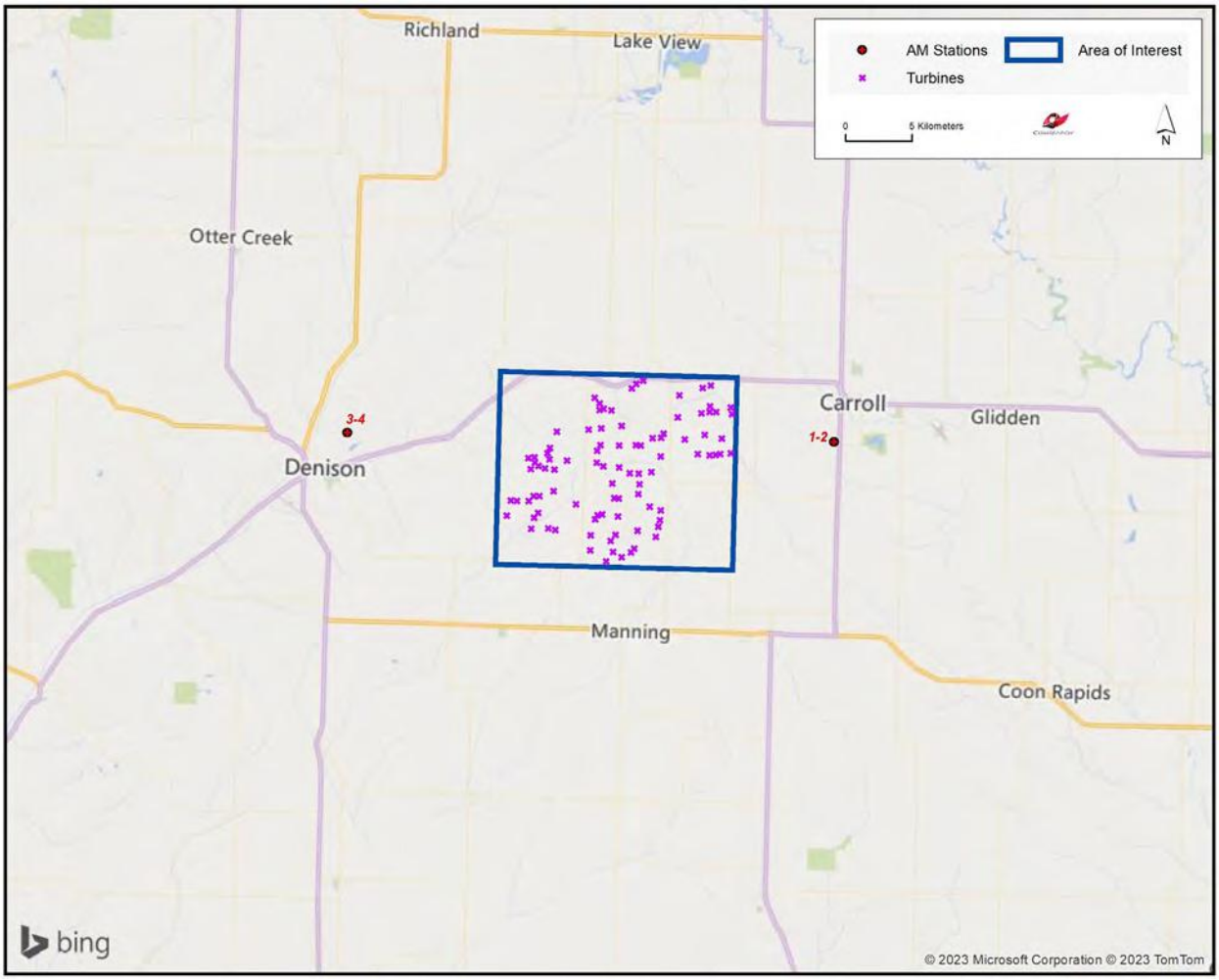

Figure 1: AM Radio Stations within 30 Kilometers of Project Area

FM Radio Analysis

Comsearch determined that there were twelve database records for FM stations within a 30-kilometer radius of the Silver Queen Wind project, as shown in Table 2 and Figure 2. Eight of these stations are currently licensed and operating, two of which are translator stations and three are low power stations that operate with limited range. The closest station is KFIM-LP, which is currently licensed in Carroll, Iowa, to the east of the project area, 7.80 km from the nearest proposed turbine location.

ID	Call Sign	Service[5]	Status[6]	Frequency (MHz)	Transmit ERP[7] (kW)	Latitude (NAD 83)	Longitude (NAD 83)	Distance to Nearest Turbine (km)
1	KFIM-LP	FL	LIC	102.1	0.1	42.049139	-94.884500	7.80
2	KKRL	FM	LIC	93.7	100.0	42.049139	-94.884444	7.80
3	K236CV	FX	LIC	95.1	0.198	42.049139	-94.884444	7.80
4	KYMJ-LP	FL	LIC	103.1	0.1	42.066083	-94.867750	9.23
5	KYMJ-LP	FL	CP	103.1	0.1	42.059167	-94.866389	9.28
6	KDSN-FM	FM	LIC	104.9	6.0	42.036111	-95.329167	13.40
7	KNSC	FM	LIC	90.7	10.0	42.120528	-94.813861	15.28
8	KIKD	FM	LIC	106.7	25.0	42.120528	-94.813861	15.28
9	K285ET	FX	LIC	104.9	0.25	42.136083	-95.341917	19.46
10	KSHW	FM	CP	91.9	0.6	42.048833	-94.729278	20.63
11	-	FM	CP	89.9	0.1	42.182778	-95.324722	22.10
12	-	FM	CP	88.7	100.0	42.305833	-95.249167	29.39

Table 2: FM Radio Stations within 30 km

[5] FM = FM broadcast station; FX = FM translator station; FS = FM auxiliary (backup) station; FL = FM low power station.

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

[7] ERP = Transmit Effective Radiated Power.

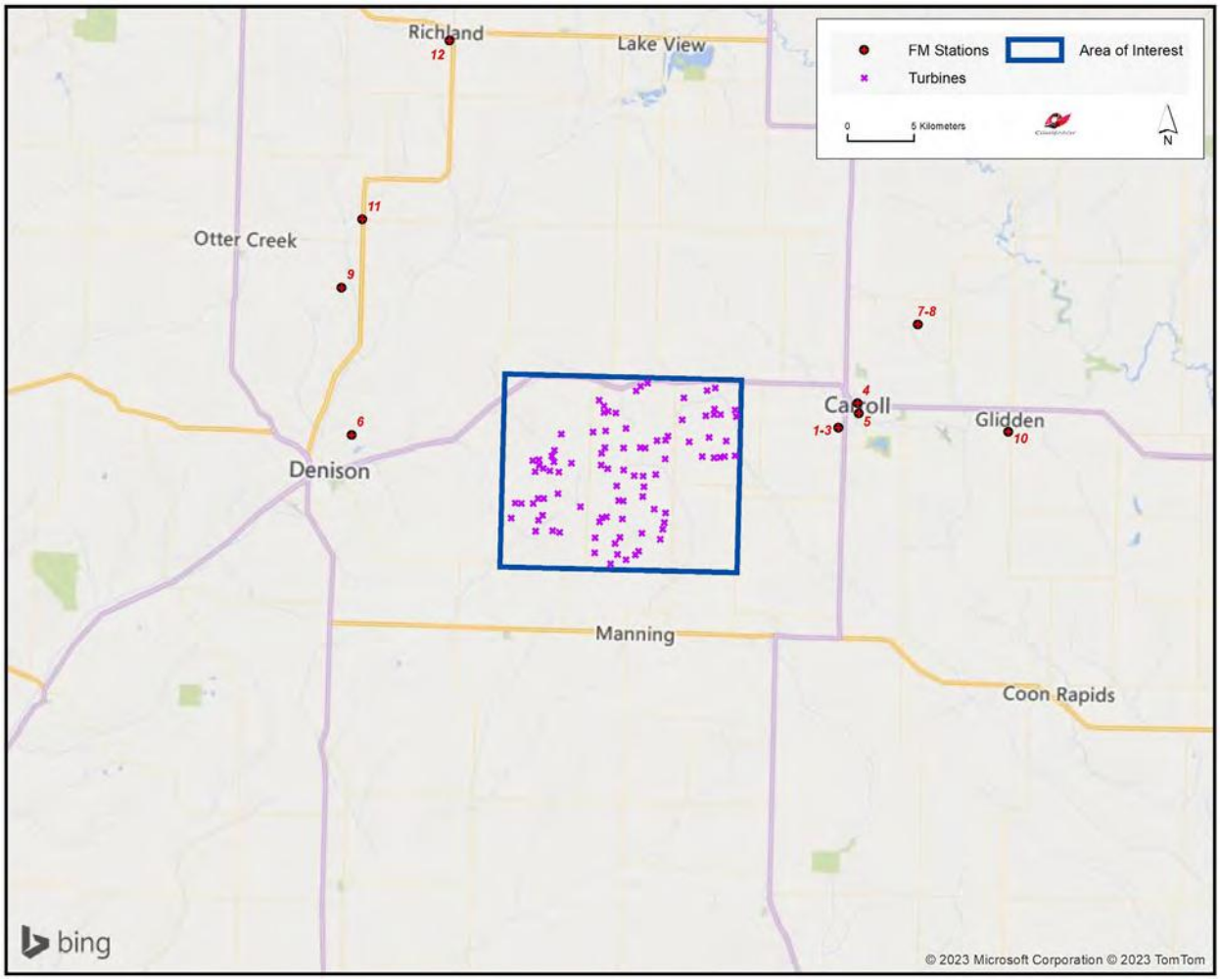

Figure 2: FM Radio Stations within 30 km

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 (KCIM) is located 7.85 km from the nearest turbine location. As there were no stations found within 3 kilometers of the project, 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 sensitive to interference due to wind turbines, especially when large objects (e.g., wind turbines) are located in the far field region of the radiating antenna to avoid the risk of distorting its radiation pattern. Station KFIM-LP would be the nearest FM station to any given turbine at 7.80 km away. 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 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:

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GPS Study

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1. Introduction

This report examines whether or not the proposed Silver Queen Wind Project would cause signal blockage of GPS antennas which are used as part of a network of continuously operating reference stations (CORS). These stations are registered with the NOAA CORS database and are used to measure GPS carrier phase and code range information to mitigate the effects of the atmosphere, multipath, and timing errors on satellite signals. These measurements are used to generate correction files which are then stored and used to post-process GPS data collected by various users including government, academic and private organizations to improve data accuracy. The correction files are available free of charge and can be found at the following website link: www.ngs.noaa.gov/CORS from a few days to several months after the GPS data was collected.

Likewise, this report examines the impact on the FAA's Wide-Area Augmentation System (WAAS) which was developed primarily to assist aerial navigation but could also be used for agricultural, surveying, recreational and other applications. WAAS antennas are located throughout North America which collect signals from GPS satellites to correct position, velocity, or timing errors and improve data accuracy. Unlike the CORS methodology for correcting GPS data, the WAAS network provides GPS error correction in real time. If real-time correction is not needed, however, CORS offers greater accuracy. Each WAAS station sends data to one of three WAAS Master Stations (WMS) via a terrestrial communications link and transmits messages to one of three WAAS geosynchronous (GEO) satellites using any one of six ground uplink stations (GUS). GPS users could then access the correction data via downlink from one of the GEO satellites.

2. Project Area

The location of the Silver Queen Project in Carroll and Crawford Counties, Iowa is shown in Figure 1.

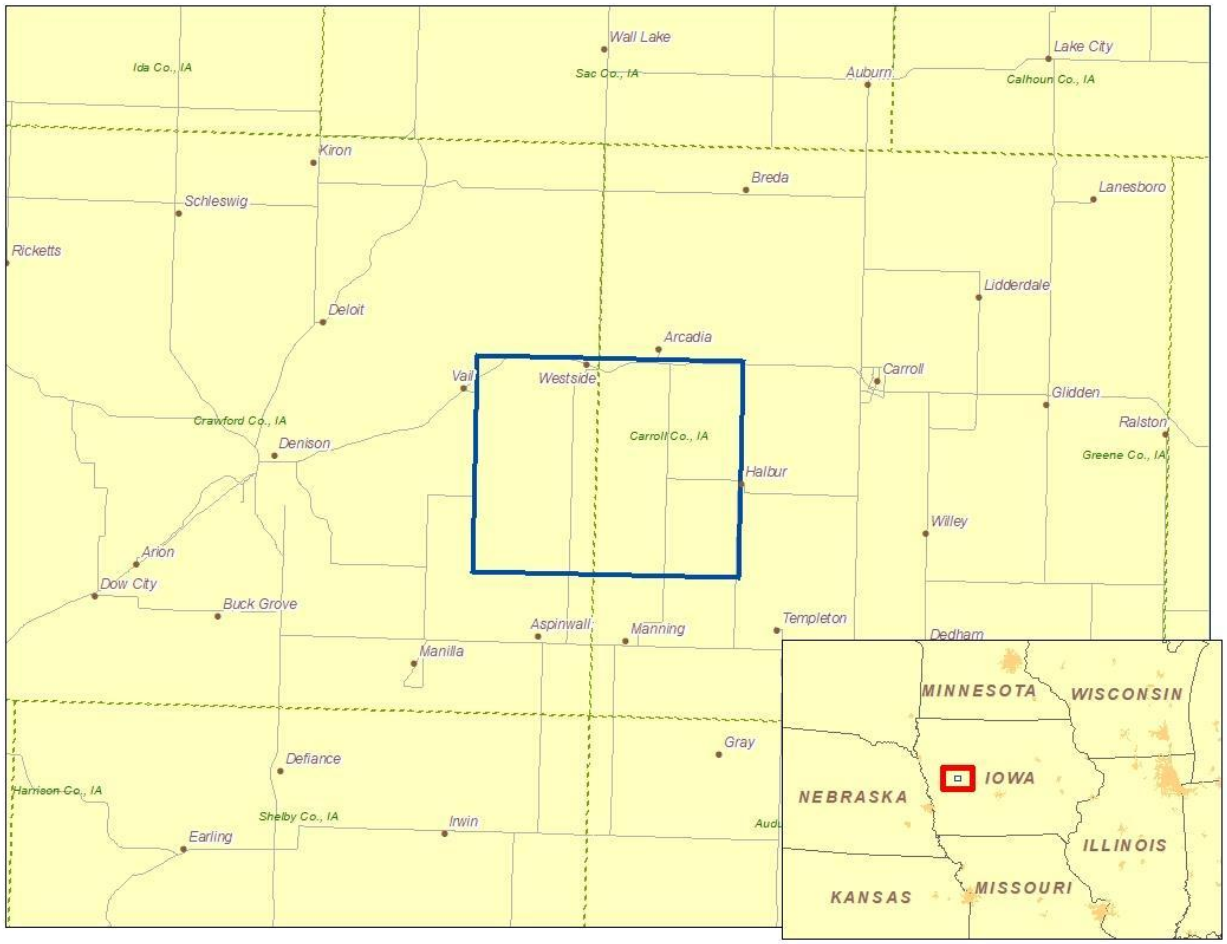

Figure 1: Location of the Silver Queen Wind Project in Iowa

3. Impact Assessment

The locations of the project area of interest (AOI) with respect to the three nearest CORS antenna locations are shown in Figure 2. The callsigns of the three antennas and corresponding distances to the closest turbine are listed in table 1.

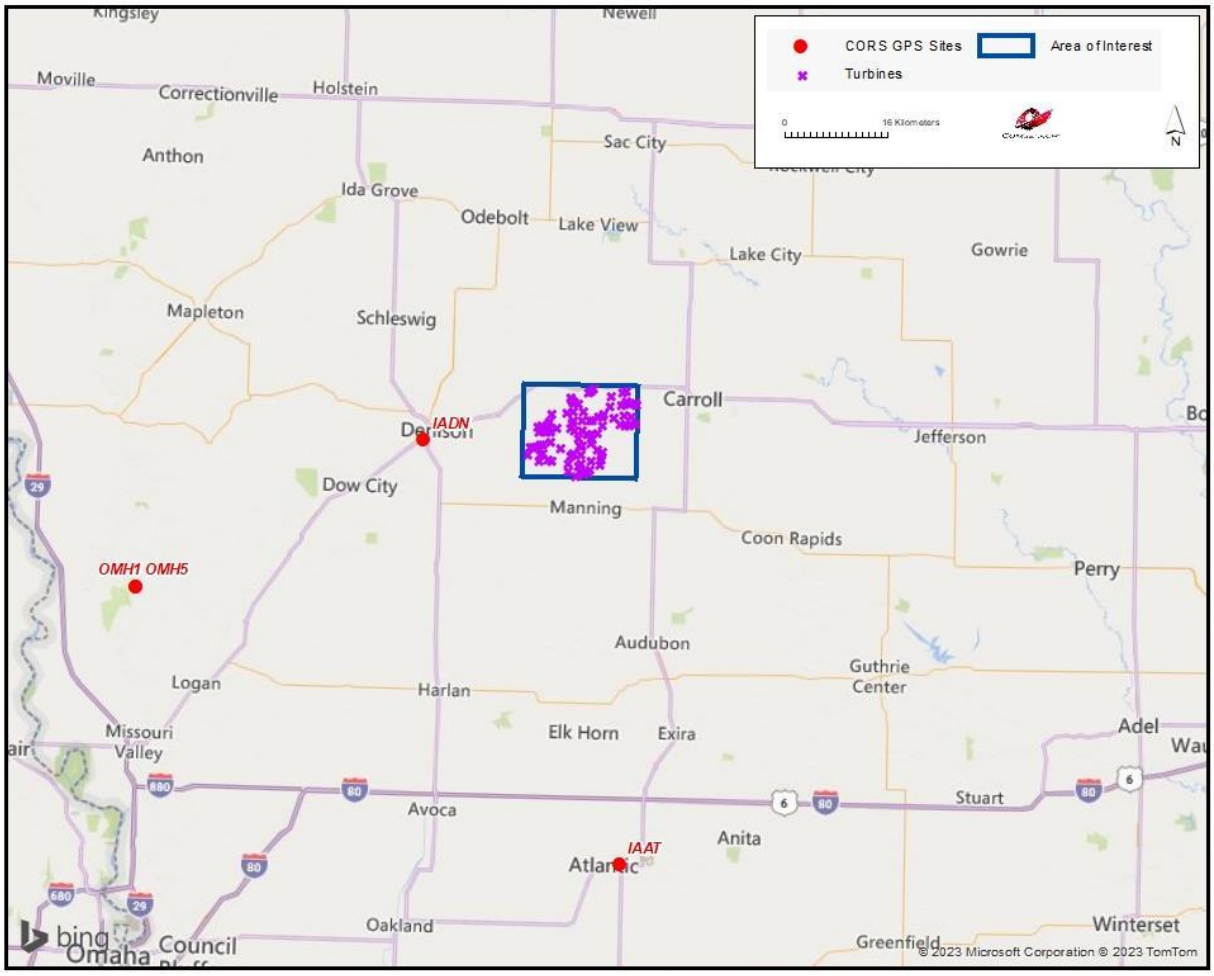

Figure 2: Nearest CORS Antennas and the Silver Queen Wind Project Area

Name	Latitude (NAD83)	Longitude (NAD83)	Distance to the Closest Turbine (km)
IADN	41.997222	-95.375556	16.14
IAAT	41.405278	-94.987778	61.46
OMH1/OMH5	41.778056	-95.911111	64.68

Table 1: Nearest CORS Antennas and Distances to the Closest Proposed Turbine

The closest WAAS antenna is registered under callsign KZMP and is 324 km from the Area of Interest in Farmington, Minnesota.

To determine the potential impact of the proposed turbines on the CORS or WAAS GPS antennas, the horizon distance of the nearest GPS antenna to the closest turbine is calculated. If this distance is greater than its separation distance from the turbine, then line-of-sight (LOS) to certain satellites could be obstructed from the GPS antenna, assuming relatively flat terrain with no nearby trees or buildings looking towards the AOI from the GPS antenna.

The distance to the horizon for a given GPS antenna is a function of its height and is given by:

$$D = (2*H_G)^{½} \qquad \text{(Equation 1)}$$

Where:

- D = Distance to horizon from GPS antenna in miles
- H_G = Height of GPS antenna in feet

Using an estimated antenna height of 15 ft AGL, the horizon distance from the nearest CORS station (IADN) is determined. From Equation 1, this gives a horizon distance of roughly 5 miles or 7.9 km. Since IADN is located 16.14 km away, no harmful impact to the GPS station antennas is anticipated.

4. Conclusion and Recommendations

Based on the calculated separation distances discussed in Section 3, no harmful impacts to antenna line-of-sight are anticipated to the closest CORS or WAAS GPS antennas.

Furthermore, GPS antennas receive signals from an ample number of medium earth orbit (MEO) satellites that encircle the globe. While the number of GPS satellites varies depending on their life cycle and how many spares are in orbit, there are currently 32 MEO satellites orbiting the Earth along six different orbital planes, each of which are inclined 55 degrees from the equator. Therefore, MEOs form a constellation so that a minimum of four satellites are at least 15 degrees above the horizon at any given time across the globe. And since MEO satellites are in constant motion relative to the Earth, if one becomes obstructed by objects such as trees, grain bins, towers, hills, wind turbines, etc, then other satellites in orbit from the constellation reappear in another part of the sky with a stronger signal.

Therefore, while GPS antennas are capable of detecting signals even from satellites very low on the horizon, it is constantly monitoring and utilizing stronger signals from multiple satellites as they move in different directions across the sky. As a result, Comsearch does not anticipate any harmful impact on the CORS or WAAS system.

5. Contact

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1. Introduction

An assessment of the emergency services in the Silver Queen 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 Carroll and Crawford Counties, Iowa, appears below in Figure 1.

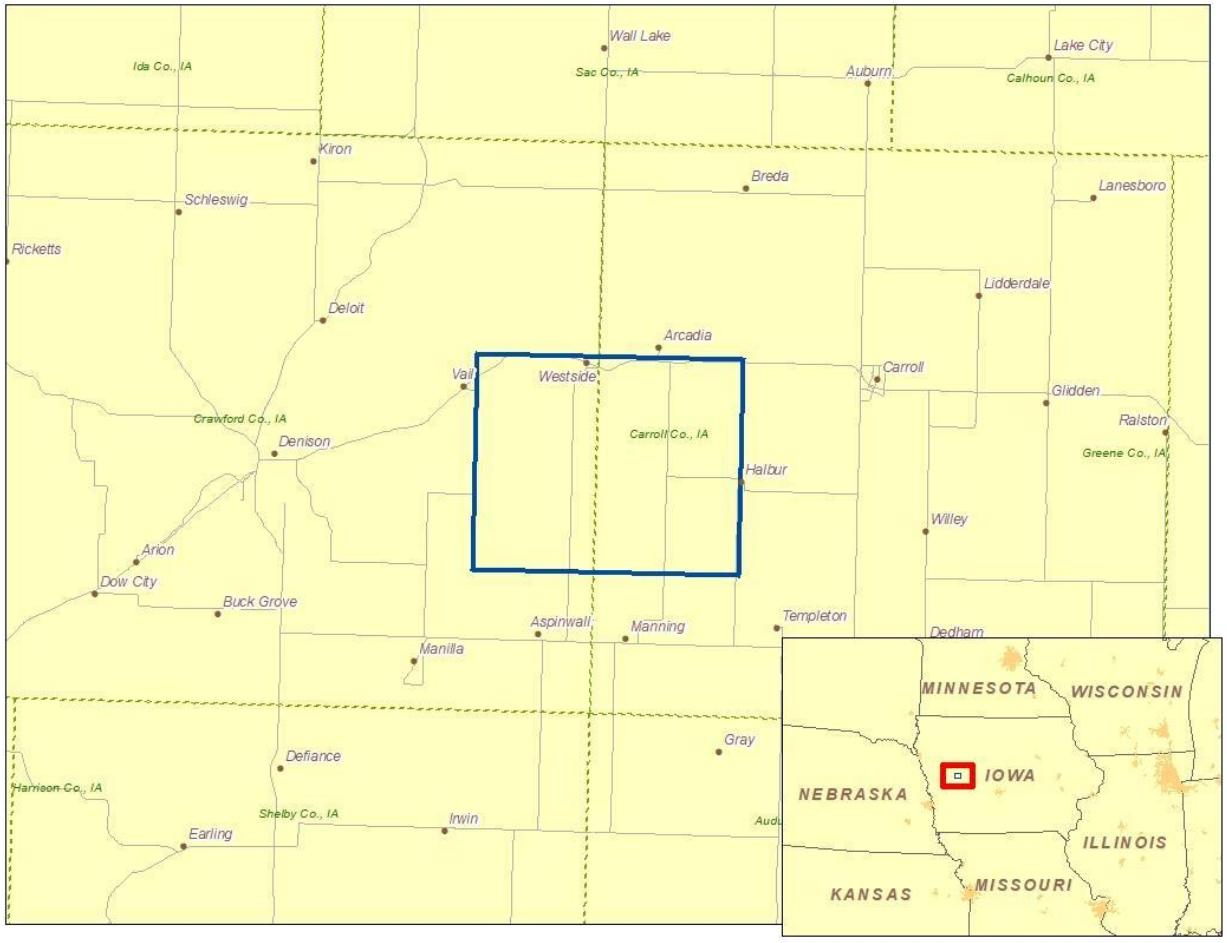

Figure 1: Area of Interest (AOI)

2. Summary of Results

Our land mobile and emergency services incumbent data[1] 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 the project area appears in Figure 2.

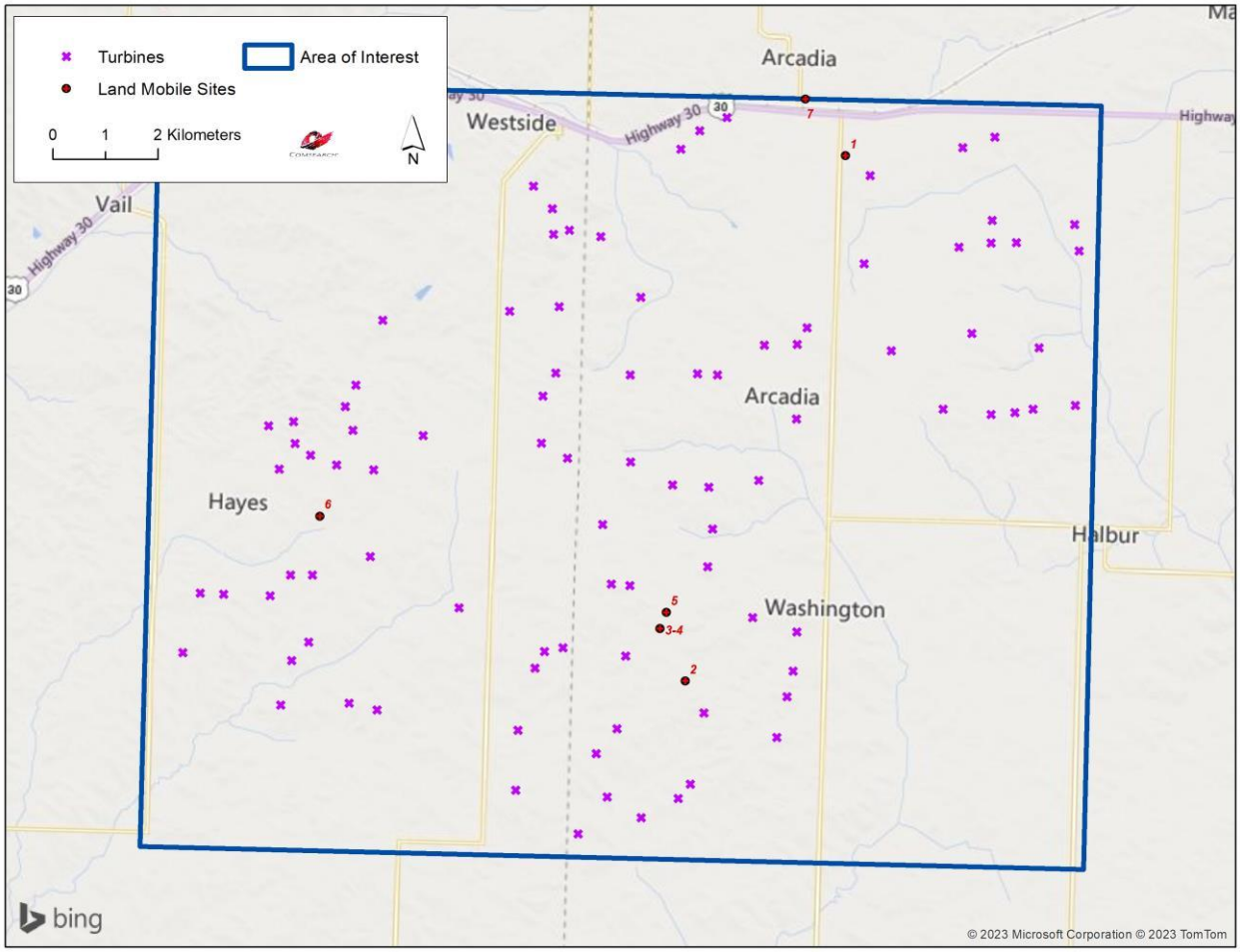

Figure 2: Land Mobile & Emergency Service Sites in Area of Interest

[1] Comsearch makes no warranty as to the accuracy of the data included in this report beyond the date of the report. The data 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

Figure 2 identifies seven site-based licenses in and around the Silver Queen 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	WRJQ439	450-470	HAUBRICH, MIKE	15.0	42.070722	-95.032500	0.60
2	WNDF902	150-174	UNION PACIFIC RAILROAD COMPANY	25.0	41.979944	-95.066389	0.70
3	KCZ782	150-174	WEST CENTRAL IOWA WATER ASSOCIATION	43.0	41.988861	-95.072500	0.84
4	WPPG752	150-174	CARROLL,COUNTY OF	38.0	41.988861	-95.072500	0.84
5	WPTR845	450-470	West Central Iowa Rural Water Association	43.0	41.991639	-95.071083	0.86
6	WNQU821	150-174	SCHULTE, GARY A	24.0	42.006667	-95.151111	1.02
7	WRBU728	450-470	General Electric International, Inc.	54.8	42.080278	-95.042000	1.54

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

Mobile Licenses

In addition to the fixed-site licenses above, 423 mobile licenses defined by center point and radius were found to intersect the Silver Queen project area. Appendix A contains a tabular summary of these stations.

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 Silver Queen project is located in Carroll and Crawford Counties, Iowa, part of Public Safety Region #15, which contains all the counties in Iowa. The regional public safety operations are overseen by the entity listed below.

Rob Dehnert - Chairperson
City of West Des Moines-Westcom
Address: PO Box 65320, West Des Moines, IA 50265-0320
Phone: 515-273-0762
Email: rob.dehnert@wdm.iowa.gov

The chairperson for Region #15 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-two licenses were found for the State of Iowa, two for the County of Carroll, and two for the County of Crawford (see Table 2). These area-wide licenses are designated for mobile use only.

ID	Licensee	Area of Operation	Frequency Band (MHz)
1	AMERICAN NATIONAL RED CROSS	Statewide: IA	25-50
2	BUCHANAN, COUNTY OF	Statewide: IA	150-174
3	CARROLL, COUNTY OF	Countywide: CARROLL, IA	150-174
4	CEDAR RAPIDS, CITY OF	Statewide: IA	450-470, 2450-2500
5	CITY OF OTTUMWA (HAZMAT) SOUTHEAST IOWA RESPONSE GROUP	Statewide: IA	150-174
6	CITY OF WATERLOO POLICE DEPARTMENT	Statewide: IA	2450-2500
7	CITY OF WEST DES MOINES	Statewide: IA	800/900
8	CRAWFORD COUNTY MEMORIAL HOSPITAL	Countywide: CRAWFORD, IA	150-174
9	CRAWFORD, COUNTY OF	Countywide: CRAWFORD, IA	150-174
10	DES MOINES, CITY OF	Statewide: IA	150-174, 450-470, 800/900, 2450-2500

ID	Licensee	Area of Operation	Frequency Band (MHz)
11	Emmet County	Statewide: IA	0-10
12	IOWA DEPARTMENT OF NATURAL RESOURCES	Statewide: IA	450-470
13	IOWA DEPT OF AG AND LAND STEWARDSHIP	Statewide: IA	450-470
14	Iowa Dept of Public Safety	Statewide: IA	150-174, 450-470, 800/900, 2450-2500
15	IOWA, STATE OF	Statewide: IA	150-174, 769-775/799-805
16	IOWA, STATE OF, DOT	Statewide: IA	150-174, 800/900
17	LEES SUMMIT UNDERWATER RECOVERY, INC	Statewide: IA	150-174
18	LINN, COUNTY OF	Statewide: IA	450-470, 2450-2500
19	NATIONAL SKI PATROL SYSTEM INC	Statewide: IA	150-174
20	OMAHA PUBLIC POWER DISTRICT	Statewide: IA	800/900
21	POTTAWATTAMIE, COUNTY OF	Statewide: IA	450-470, 2450-2500
22	SAC, COUNTY OF	Statewide: IA	150-174
23	St Anthony Regional Hospital	Countywide: CARROLL, IA	150-174
24	STAR 1 SEARCH AND RESCUE	Statewide: IA	150-174
25	WATERLOO POLICE DEPARTMENT	Statewide: IA	450-470
26	WOODBURY, COUNTY OF	Statewide: IA	150-174

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 Carroll and Crawford Counties, Iowa, in Table 3.

Mobile Phone Carrier	Service[2]
AT&T	700 MHz, AWS, Cellular, PCS, WCS
DISH Network	700 MHz, AWS
T-Mobile	AWS, PCS
US Cellular	700 MHz, AWS, Cellular, PCS
Verizon	700 MHz, AWS, Cellular, PCS

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 Silver Queen 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.

[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

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:

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Title:	Senior Manager
Company:	Comsearch
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Telephone:	703-726-5656
Fax:	703-726-5595
Email:	David.Meyer@CommScope.com
Web site:	www.comsearch.com

Appendix A

ID	Call Sign	Frequency Band (MHz)	Licensee	Mobile Area Radius (km)	Latitude (NAD83)	Longitude (NAD83)
1	KNIG560	450-470	ADAIR CASEY COMMUNITY SCHOOLS	56.0	42.414972	-94.566917
2	WQRG467	150-174	ADAMS LAND & LIVESTOCK LLC	40.0	42.065222	-95.212611
3	WPMA623	800/900	AG PARTNERS LC	113.0	42.579139	-94.842472
4	WRPW892	450-470	AG PROCESSING, INC.	32.0	41.918833	-95.070778
5	WROD944	150-174	Ahrenholtz, Kyle S	40.0	41.674944	-95.115194
6	KJU346	150-174, 450-470	Alegent Creighton Health	121.0	41.237500	-95.925278
7	WNZD427	450-470	ALPHA WIRELESS COMMUNICATIONS CO	75.0	42.687472	-95.501389
8	WRAW320	150-174	AMERICAN BAPTIST HOMES OF THE MIDWEST	40.0	41.648056	-95.324583
9	WQEI908	450-470	AMERICAN TIME & SIGNAL CO.	20.0	42.015444	-95.342250
10	WQVN419	450-470	AMERICAN TIME & SIGNAL CO.	20.0	42.014778	-95.359139
11	KNAY613	450-470	ARCADIA LIMESTONE COM	121.0	42.082750	-95.040278
12	WQRE438	450-470	ASPINWALL COOP	32.0	41.849167	-95.259722
13	WQMY974	450-470	AUDUBON COMMUNITY SCHOOLS DISTRICT	32.0	41.745556	-94.973889
14	KNJB362	150-174	AUDUBON, CITY OF	32.0	41.720833	-94.928056
15	KNJB362	150-174	AUDUBON, CITY OF	56.0	41.720833	-94.928056
16	WNUG306	150-174	AUDUBON, COUNTY OF	56.0	41.720833	-94.928056
17	WNGG479	450-470	AVERA MC KENNAN HOSPITAL	322.0	43.530528	-96.713667
18	WRXG440	150-174	B & J Pumping LLC	32.0	42.339111	-94.861083
19	WNSD912	450-470	BABCOCK LIQUID, LLC	121.0	42.411306	-95.005083
20	WNPF944	150-174, 450-470	BATTLE CREEK IDA GROVE COMMUNITY SCHOOLS	48.0	42.338833	-95.464056
21	KUN352	25-50	BLAIR COMMUNITY SCHOOLS	121.0	41.531111	-96.136694
22	WQXF641	450-470	Blair, Trent	40.0	42.296806	-94.799500
23	WRYC897	150-174	BLENNER FARMS	40.0	42.431111	-95.262500
24	KYS865	150-174	BNSF Railway Co.	40.0	41.729083	-95.473250

ID	Call Sign	Frequency Band (MHz)	Licensee	Mobile Area Radius (km)	Latitude (NAD83)	Longitude (NAD83)
25	KYS865	150-174	BNSF Railway Co.	40.0	41.913333	-95.059639
26	WQSR520	800/900	BOBKIN WIRELESS, LLC	113.0	42.481611	-96.268694
27	WQSR520	800/900	BOBKIN WIRELESS, LLC	113.0	42.720000	-95.434250
28	WRJN220	150-174	Borkowski, Brian	24.0	41.760361	-95.208778
29	WNVZ347	150-174	BOYER VALLEY COMMUNITY SCHOOL	80.0	41.926667	-95.493333
30	WRPZ428	450-470	BRACE, TODD	32.0	41.751528	-95.305139
31	WNGM542	150-174	BRINCKS, GEORGE L	48.0	41.918861	-94.941667
32	WRWA707	150-174	BRUCH, MIKE	40.0	41.818861	-94.977167
33	WQAL456	150-174	BURLEY, ROBERT	40.0	42.343333	-94.682222
34	KAA431	150-174	BURT COUNTY PUBLIC POWER DISTRICT	97.0	41.785556	-96.224444
35	WQNW272	150-174	BUSS, JASON W	80.0	41.611944	-96.011944
36	WRYU202	150-174	Cadwell, Blake H	80.0	41.797028	-95.204194
37	WRDV508	450-470	CARROLL COMMUNITY SCHOOL	24.0	42.100250	-94.857083
38	WNKA607	150-174	CARROLL, CITY OF	56.0	42.061639	-94.863861
39	WPUP618	450-470	CARROLL, CITY OF	32.0	42.072194	-94.865528
40	KCS243	150-174, 450-470	CARROLL, COUNTY OF	32.0	42.072194	-94.865528
41	KFX369	150-174	CARROLL, COUNTY OF	56.0	42.100250	-94.858028
42	WPAC856	150-174	CARROLL, COUNTY OF	32.0	42.071361	-94.900556
43	WPLQ322	150-174	CARROLL, COUNTY OF	32.0	42.072194	-94.865528
44	WRFS290	450-470	CARROLL, COUNTY OF	32.0	42.064444	-94.866667
45	WPPG752	150-174	CARROLL,COUNTY OF	40.0	41.999972	-94.833583
46	WPCJ745	150-174	CARSTENSEN, KEVIN	40.0	42.356083	-95.235833
47	WNSS660	150-174	CARSTENSEN, KURT	40.0	42.410528	-95.283333
48	WQQA893	150-174	Chevron USA Inc.	32.0	42.045139	-94.641194
49	KLV926	150-174	CHICAGO, CENTRAL & PACIFIC RAILROAD COMPANY	40.0	42.022056	-95.361972

ID	Call Sign	Frequency Band (MHz)	Licensee	Mobile Area Radius (km)	Latitude (NAD83)	Longitude (NAD83)
50	KLV926	150-174	CHICAGO, CENTRAL & PACIFIC RAILROAD COMPANY	40.0	42.257167	-95.072639
51	WQWZ984	150-174	CHICAGO, CENTRAL & PACIFIC RAILROAD COMPANY	40.0	42.266222	-94.974500
52	WNWU979	450-470	Chipman, Rick	64.0	41.629722	-95.429444
53	WQJR981	150-174	CHRISTENSEN, LAMONT	40.0	41.788333	-95.266111
54	WNSF542	150-174	CHRISTENSEN, ROBERT J	56.0	42.117194	-95.176111
55	KD50046	450-470	CLARK, DOROTHY V DBA ELECTRONIC REALTY COMPANY	121.0	41.591944	-93.631333
56	WQKV719	150-174	CLAYTON, JOHN	40.0	41.866389	-95.356944
57	WPHH544	450-470	CONNER, MATT	121.0	42.105528	-94.743028
58	KNFF596	450-470	COON, MARVIN P:COON, ROGER D:COON, PAUL DBA COON FARMS	80.0	42.237194	-94.450250
59	WNMY499	450-470	COREY AGR INC OF LYTTON	64.0	42.387472	-94.808583
60	WQQJ885	450-470	CORN BELT POWER COOPERATIVE	32.0	42.085111	-94.734500
61	WQTZ642	150-174	Cranston Farms Inc.	32.0	42.339361	-95.224861
62	WNSX407	150-174	CRAWFORD, COUNTY OF	50.0	42.031667	-95.309444
63	WQAV630	450-470	CRAWFORD, COUNTY OF	32.0	42.045917	-95.319778
64	WQKL451	150-174	CRAWFORD, COUNTY OF	32.0	42.045917	-95.319778
65	WQYP271	150-174, 450-470	CRAWFORD, COUNTY OF	32.0	42.017500	-95.356667
66	WRDM319	150-174	CRAWFORD, COUNTY OF	32.0	42.169861	-95.442028
67	WRDM319	150-174	CRAWFORD, COUNTY OF	32.0	42.017667	-95.356694
68	WRDM319	150-174	CRAWFORD, COUNTY OF	32.0	42.045917	-95.319778
69	WPQA259	450-470	CURTIS & CONWELL LARSON	32.0	42.270278	-95.315000
70	WQYP440	450-470	CYCLONE CUSTOM PUMPING	32.0	42.035833	-94.967778
71	WPGH554	450-470	D & D KLOCKE INC	32.0	41.900000	-94.917500
72	WQZQ258	450-470	Danner, Martin	32.0	42.019472	-94.781972
73	WQMK902	450-470	DANNER, MATT	48.0	41.878083	-94.898556

ID	Call Sign	Frequency Band (MHz)	Licensee	Mobile Area Radius (km)	Latitude (NAD83)	Longitude (NAD83)
74	WNMC350	150-174	DAVIS, RUSS	48.0	42.502750	-95.064167
75	KUZ669	150-174	DENISON COMMUNITY SCHOOL DISTRICT	40.0	42.027528	-95.349222
76	WRXQ408	150-174	Denison Job Corps	24.0	42.016667	-95.326944
77	KBR633	150-174	DENISON, CITY OF	40.0	42.031944	-95.350000
78	KNJZ545	150-174	DENISON, CITY OF	32.0	42.169861	-95.442028
79	KNJZ545	150-174	DENISON, CITY OF	32.0	42.017667	-95.356694
80	KNJZ545	150-174	DENISON, CITY OF	33.0	42.045917	-95.319778
81	WNYI265	150-174	DONN, CARY L	64.0	41.837500	-95.855000
82	WNYI265	150-174	DONN, CARY L	64.0	41.874167	-95.811944
83	KAR528	25-50	DOUGHERTY FARMS INC	121.0	40.954167	-94.715528
84	WNSS661	150-174	DOUGHERTY, JAMES F	40.0	42.311083	-94.775250
85	WRDA784	150-174	Dow City-Arion Community Fire Department Inc.	32.0	41.929000	-95.497167
86	WRQJ888	150-174	DREES, JESSI RAE	40.0	42.086389	-95.227222
87	WQVI331	150-174	EAGLE ACRES, INC.	32.0	41.770556	-94.997444
88	WPHF742	450-470	ELECTRONIC ENGINEERING CO.	64.0	42.607750	-95.000278
89	WPHF742	450-470	ELECTRONIC ENGINEERING CO.	64.0	42.391639	-94.704417
90	WNXS394	800/900	Electronic Specialties, Inc	113.0	42.729167	-94.442778
91	WPHS573	800/900	Electronic Specialties, Inc	113.0	42.757194	-95.623611
92	WNDX386	800/900	Electronic Specialties, Inc.	113.0	42.673861	-95.309722
93	WNNO338	450-470	Electronic Specialties, Inc.	80.0	42.527472	-94.530250
94	WNRI504	800/900	Electronic Specialties, Inc.	113.0	42.941111	-94.733889
95	WNWC364	450-470	Electronic Specialties, Inc.	80.0	42.481361	-94.208306
96	WPAF843	450-470	Electronic Specialties, Inc.	64.0	42.607750	-95.000278
97	WPCH905	450-470	Electronic Specialties, Inc.	80.0	42.666639	-94.668583
98	WPHC972	450-470	Electronic Specialties, Inc.	80.0	42.481361	-94.208306

ID	Call Sign	Frequency Band (MHz)	Licensee	Mobile Area Radius (km)	Latitude (NAD83)	Longitude (NAD83)
99	WPIJ682	450-470	Electronic Specialties, Inc.	113.0	42.643028	-95.184444
100	WPIT218	800/900	Electronic Specialties, Inc.	113.0	42.481361	-94.208306
101	WPPV350	800/900	Electronic Specialties, Inc.	113.0	42.391083	-94.635528
102	WRAD930	150-174	EMPIRE LAND AND CATTLE	32.0	41.915167	-95.570167
103	WQWD364	800/900	ESSELLS, DAVID	50.0	41.554833	-94.903583
104	KNBI824	150-174	FARM SERVICE COOP	40.0	41.825000	-95.341944
105	WRDF985	150-174	FARM SERVICE COOP	80.0	41.349056	-95.385722
106	WSF250	150-174	FARM SERVICE COOP	64.0	42.013611	-95.352222
107	WQOI789	150-174	FARM SERVICE COOP IRWIN	40.0	41.789278	-95.205028
108	WPPT503	450-470	FARMERS AREA COOP SCHLESWIG	32.0	42.166389	-95.436111
109	WPPT503	450-470	FARMERS AREA COOP SCHLESWIG	32.0	42.082750	-95.040000
110	WQVF306	450-470	FARMERS AREA COOPERATIVE ELEVATORS CO DBA FARMERS COOPERATIVE	32.0	42.082750	-95.040000
111	WQTX765	150-174	FARMERS COOPERATIVE	40.0	41.870250	-94.684694
112	WQTX765	150-174	FARMERS COOPERATIVE	40.0	41.852917	-94.559750
113	KSX485	150-174	FARMERS COOPERATIVE CO	40.0	42.422472	-95.033611
114	WPNW412	450-470	FARMERS COOPERATIVE ELEVATOR CO	32.0	42.331639	-95.353889
115	KNHJ403	800/900	FIRST DIGITAL HOLDINGS LLC	113.0	41.215000	-96.075306
116	WPED559	800/900	FIRST DIGITAL HOLDINGS LLC	113.0	41.241111	-95.963639
117	WPMR777	800/900	First Student Inc	113.0	41.319444	-95.981667
118	WQJB229	450-470	Flint Hills Resources Arthur, LLC	32.0	42.331639	-95.355861
119	WQJB229	450-470	Flint Hills Resources Arthur, LLC	32.0	42.331889	-95.354194
120	WPBE256	450-470	FORT DODGE COUNTRY CLUB	121.0	42.507750	-94.235528
121	WQNU858	450-470	Froggy Bottom	161.0	42.740500	-96.415972
122	KUX868	25-50	FT DODGE ASPHALT	121.0	42.500806	-94.152472

ID	Call Sign	Frequency Band (MHz)	Licensee	Mobile Area Radius (km)	Latitude (NAD83)	Longitude (NAD83)
123	KNJK352	150-174	GCC Alliance Concrete Inc.	48.0	42.339444	-95.497500
124	WRBU728	450-470	General Electric International, Inc.	32.0	42.080278	-95.042000
125	WQTB437	150-174	GOCHENOUR BROTHERS FARMS	75.0	41.836167	-95.925472
126	WNWZ665	450-470	GOETTSCH, ROBERT	56.0	41.486667	-95.391667
127	WQTB445	150-174	GOETZ FARMS INC.	40.0	41.865750	-95.362972
128	BLP00963	25-50, 150-174	GRAY TELEVISION LICENSEE, LLC	145.0	41.257222	-95.963917
129	WQYA769	150-174	GROTE, BRIAN J	35.0	41.776944	-95.387500
130	WQTT671	150-174	GROTE, DENNIS	40.0	41.875028	-95.614861
131	WPPD445	150-174	GUNDERSEN LUTHERAN MEDICAL CENTER	600.0	43.794417	-91.249583
132	WNQS224	450-470	GUTHRIE COUNTY RURAL ELECTRIC COOPERATIVE ASSOC	64.0	41.630556	-94.487750
133	WQWV306	150-174	HAGAN, MIKE	48.2	41.861667	-94.554167
134	WQTF830	450-470	HANDLOS, ADAM	32.0	42.008139	-94.640306
135	WQSI253	450-470	HANDLOS, CORY	32.0	41.745556	-94.973889
136	KNFP457	150-174	HARLAN MUNICIPAL UTILIITES	40.0	41.661944	-95.338611
137	WNYY451	450-470	HARRISON COUNTY RURAL ELECTRICAL COOPERATIVE	56.0	41.684361	-95.703722
138	WRJQ439	450-470	HAUBRICH, MIKE	32.0	42.070722	-95.032500
139	WQTB442	150-174	HAVICK, CURT	80.0	42.072778	-95.798611
140	WQBB437	150-174	HAWN, DOUGLAS	40.0	42.091917	-94.538028
141	BLP00407	150-174, 470-512, 800/900	HEARST PROPERTIES INC.	129.0	41.593056	-93.629667
142	KAN550	450-470	Hearst Properties Inc.	121.0	41.308889	-96.026167
143	WQND261	72-76, 150-174, 450-470, 470-512	Hearst Properties Inc.	129.0	41.250167	-95.928667
144	WQKT535	450-470, 470-512, 800/900	Hearst Stations Inc.	482.0	39.006833	-94.503333
145	WRMM815	450-470	Heartland Divide Wind II, LLC	32.0	41.826139	-94.815056

ID	Call Sign	Frequency Band (MHz)	Licensee	Mobile Area Radius (km)	Latitude (NAD83)	Longitude (NAD83)
146	WRMM815	450-470	Heartland Divide Wind II, LLC	32.0	41.792722	-94.767889
147	WRBU465	450-470	Heartland Divide Wind Project, LLC	32.0	41.755889	-94.750861
148	WNSS662	450-470	HILDRETH, RAY	32.0	42.275528	-94.741361
149	WQTN646	150-174	HOFFMAN, DAVID	40.0	41.979139	-94.797472
150	WPRH317	150-174	HOFFMAN, JOHN E	20.0	41.896917	-94.829972
151	WQYZ781	150-174	HOFFMAN, THOMAS	40.0	41.934333	-94.635556
152	WREJ462	150-174	HOFFMANN, PAT	40.0	41.771306	-95.479417
153	WQDR597	150-174	HORN MEMORIAL HOSPITAL	40.0	42.338833	-95.464056
154	KNAB573	450-470	HOYLE FARMS INC	57.0	41.903583	-94.534694
155	WNPF953	450-470	HOYLE, SHERWOOD	56.0	41.903583	-94.534694
156	KNIK396	150-174	Huegerich, Chris	40.0	42.180528	-94.986389
157	WQUD626	450-470	Hultgren Implement	32.0	42.313028	-95.252278
158	WQIM995	150-174	HUNTER, BRIAN D	50.0	42.022222	-94.546111
159	KB55300	450-470	IHM LICENSES, LLC	129.0	41.584722	-93.641611
160	WNQN312	450-470	ILER, DAVID	32.0	42.219639	-94.685889
161	WQNN747	450-470	INGRAHAM CONSTRUCTION	121.0	42.469417	-93.811667
162	WQDV323	150-174	Interstate Power & and Light Company	290.0	43.557167	-93.661056
163	WQDV323	150-174	Interstate Power & and Light Company	290.0	42.686944	-91.826389
164	WQMN422	800/900	Interstate Power & Light Company	113.0	42.767500	-95.584722
165	WNNH903	800/900	Interstate Power and Light Company	113.0	42.007500	-94.241028
166	WNNH903	800/900	Interstate Power and Light Company	113.0	42.063333	-93.889444
167	WNNH904	800/900	Interstate Power and Light Company	113.0	42.880528	-95.221389
168	WNNH904	800/900	Interstate Power and Light Company	113.0	42.836083	-94.836917
169	WNNH905	800/900	Interstate Power and Light Company	113.0	41.489444	-94.780000
170	WNNH905	800/900	Interstate Power and Light Company	113.0	42.085111	-94.734500

ID	Call Sign	Frequency Band (MHz)	Licensee	Mobile Area Radius (km)	Latitude (NAD83)	Longitude (NAD83)
171	WNNH905	800/900	Interstate Power and Light Company	113.0	41.631500	-94.489528
172	WNNH905	800/900	Interstate Power and Light Company	113.0	41.112500	-94.346944
173	WNNH906	800/900	Interstate Power and Light Company	113.0	42.442111	-95.239583
174	WNNH907	800/900	Interstate Power and Light Company	113.0	42.690556	-95.509444
175	WQVK205	800/900	INTERSTATE POWER AND LIGHT COMPANY	113.0	41.344639	-94.481444
176	WQVK869	800/900	INTERSTATE POWER AND LIGHT COMPANY	113.0	41.263861	-94.873722
177	WQWY242	800/900	INTERSTATE POWER AND LIGHT COMPANY	113.0	41.581528	-94.209917
178	WQTI693	800/900	Iota Spectrum Holdings, LLC	113.0	42.505028	-96.389611
179	WQTI737	800/900	Iota Spectrum Holdings, LLC	113.0	42.505028	-96.389611
180	WQSR516	800/900	Iota Spectrum Partners, LP	113.0	42.505028	-96.389611
181	WQSR517	800/900	Iota Spectrum Partners, LP	113.0	42.505028	-96.389611
182	WQSR523	800/900	Iota Spectrum Partners, LP	113.0	42.505028	-96.389611
183	WQSR524	800/900	Iota Spectrum Partners, LP	113.0	42.505028	-96.389611
184	WQSR527	800/900	Iota Spectrum Partners, LP	113.0	42.505028	-96.389611
185	WQWB668	800/900	Iota Spectrum Partners, LP	50.0	41.554833	-94.903583
186	WQWC415	800/900	Iota Spectrum Partners, LP	50.0	41.554833	-94.903583
187	WQWC437	800/900	Iota Spectrum Partners, LP	50.0	41.554833	-94.903583
188	WQWC760	800/900	Iota Spectrum Partners, LP	50.0	41.554833	-94.903583
189	WQWC761	800/900	Iota Spectrum Partners, LP	50.0	41.554833	-94.903583
190	WQWD358	800/900	Iota Spectrum Partners, LP	50.0	41.554833	-94.903583
191	WQWD697	800/900	Iota Spectrum Partners, LP	50.0	41.554833	-94.903583
192	WQWD715	800/900	Iota Spectrum Partners, LP	50.0	41.554833	-94.903583
193	WQWD729	800/900	Iota Spectrum Partners, LP	50.0	41.554833	-94.903583
194	WQWE208	800/900	Iota Spectrum Partners, LP	50.0	41.554833	-94.903583
195	WQWE265	800/900	Iota Spectrum Partners, LP	50.0	41.554833	-94.903583

ID	Call Sign	Frequency Band (MHz)	Licensee	Mobile Area Radius (km)	Latitude (NAD83)	Longitude (NAD83)
196	WQWE338	800/900	Iota Spectrum Partners, LP	50.0	41.554833	-94.903583
197	WQWE583	800/900	Iota Spectrum Partners, LP	50.0	41.554833	-94.903583
198	WQWF574	800/900	Iota Spectrum Partners, LP	50.0	41.554833	-94.903583
199	WRCA291	800/900	Iota Spectrum Partners, LP	50.0	41.554833	-94.903583
200	KD46076	150-174	IOWA CENTRAL COMMUNITY COLLEGE	80.0	42.488861	-94.203028
201	WPBX505	450-470	IOWA DEPARTMENT OF TRANSPORTATION	121.0	42.020000	-93.622722
202	KNHM284	450-470	Iowa Dept of Public Safety	121.0	41.870528	-93.918556
203	KES990	150-174	IOWA, STATE OF, DOT	80.0	42.608028	-95.151111
204	WQQL206	150-174	IRWIN FIRE DEPARTMENT	40.0	41.790417	-95.206306
205	WPEX613	150-174	JENSEN, ALAN	48.0	41.542500	-94.995278
206	WNPF638	450-470	JOHNSON, REESE: JOHNSON, ZANE, DBA: JOHNSON BROTHERS	32.0	42.135389	-95.150000
207	WQOA386	150-174	JOHNSTON, GEORGE	40.0	41.894472	-94.654889
208	WRAX950	150-174	JOHNSTON, STEVE	40.0	41.759944	-94.839222
209	WRDY552	150-174	K & C Brown LLP	40.0	42.256250	-95.572417
210	WQXF687	150-174	K & T ENTERPRISES INC.	40.0	41.631194	-95.121806
211	WXZ617	150-174	KAY, LARRY	64.0	41.453611	-95.170278
212	WQMZ280	150-174	KEANE, DAVID G	80.0	41.685917	-95.480833
213	WNXW546	800/900	KEANE, RICHARD M	113.0	41.717222	-95.485583
214	WNUS357	450-470	KEEVAN, BUCKINGHAM	80.0	41.306111	-95.362778
215	WQTC358	150-174	KENT FARMS LLC	48.0	42.261028	-94.847028
216	WNCH332	450-470	KING, KAROL	80.0	41.731944	-95.964444
217	WNBU297	150-174	KLINK, RANDY	40.0	42.144417	-95.207778
218	WNAJ910	150-174	KLOCKE, LAMBERT J	40.0	42.369694	-94.754972
219	WQTI461	450-470	KLOCKE, MICHAEL P	40.0	41.950000	-94.730000

ID	Call Sign	Frequency Band (MHz)	Licensee	Mobile Area Radius (km)	Latitude (NAD83)	Longitude (NAD83)
220	WPSJ355	450-470	KNOBBE BROTHERS	32.0	42.196111	-94.835833
221	WREL237	150-174	KNUDSEN, DAN	40.0	41.642139	-95.187806
222	WREM393	450-470	L. Stork Farms, Inc.	32.0	42.122361	-94.724417
223	KZB269	150-174	LAKE VIEW, CITY OF	32.0	42.302750	-95.052500
224	WROW654	450-470	Landus Cooperative	32.0	41.920028	-94.942083
225	WPJJ392	450-470	LARSON, CLAYTON	32.0	42.330528	-95.245278
226	KNDL272	450-470	LARSON, LINDSEY:LARSON, DEBRA	121.0	42.062194	-94.391361
227	WNMG978	150-174	LEE, RICHARD I	80.0	41.618056	-95.285278
228	WQQP817	150-174	LINDSKOOG, DENNIS	40.0	42.253583	-95.270556
229	WPZI280	25-50, 150-174	LONG JOHN SILVERS	120.0	41.600556	-93.608833
230	WRUH661	450-470	Lorenzen, Bruce	32.0	42.302778	-95.340444
231	WNUZ826	150-174	LUNDELL, JIM; LUNDELL, VANCE DBA LUNDELL BROS	40.0	42.255556	-95.325833
232	WPGK731	450-470	LWC COMMUNICATIONS, INC.	121.0	42.511111	-96.420306
233	WNSI633	450-470	LYMAN RICHEY CORPORATION	121.0	41.264444	-96.248056
234	WQDK229	150-174	M J BIERL FARMS INC	40.0	42.038972	-95.072861
235	WRBU696	150-174	MANILLA MANOR	16.0	41.893111	-95.231361
236	KNJX672	150-174	MANILLA, CITY OF	40.0	41.890167	-95.231528
237	WRE350	150-174	MANILLA, CITY OF	24.0	41.887500	-95.236944
238	WRDI876	450-470	MANNING SENIOR LIVING	8.0	41.902056	-95.056167
239	WPFR648	150-174	Maple Valley-Anthon Oto Community Schools	80.0	42.380556	-95.861389
240	WNPE632	450-470	MENTZER, RAYMOND	56.0	42.404417	-95.207500
241	WNKG822	450-470	MENZ, STEVE:MENZ, EDWARD E:MENZ, DAVE DBA MENZ FARMS	80.0	41.845250	-94.109667
242	WQJY285	150-174	MEREDITH COMMUNICATIONS, L.C.	161.0	41.435278	-94.833611
243	WPDS224	800/900	Metropolitan Utilities District	113.0	41.309167	-96.095583

ID	Call Sign	Frequency Band (MHz)	Licensee	Mobile Area Radius (km)	Latitude (NAD83)	Longitude (NAD83)
244	WPGV302	800/900	MIDAMERICAN ENERGY COMPANY	113.0	42.498861	-94.167194
245	WQIV823	450-470	MIDAMERICAN ENERGY COMPANY	80.0	41.419167	-95.403889
246	WQIV823	450-470	MIDAMERICAN ENERGY COMPANY	80.0	42.059194	-94.857722
247	WQJI283	450-470	MIDAMERICAN ENERGY COMPANY	80.0	42.362667	-95.486944
248	WQJI283	450-470	MIDAMERICAN ENERGY COMPANY	80.0	42.339694	-94.773583
249	WQJI438	450-470	MIDAMERICAN ENERGY COMPANY	80.0	42.091667	-95.954444
250	WQJI833	450-470	MIDAMERICAN ENERGY COMPANY	80.0	41.844167	-94.996389
251	WQKA980	450-470	MIDAMERICAN ENERGY COMPANY	80.0	41.564500	-95.893111
252	WQKA981	450-470	MIDAMERICAN ENERGY COMPANY	80.0	42.646667	-95.211389
253	WQKA982	450-470	MIDAMERICAN ENERGY COMPANY	80.0	41.404722	-95.164889
254	WQLH987	450-470	MIDAMERICAN ENERGY COMPANY	32.0	41.844167	-94.996389
255	WQLQ363	450-470	MIDAMERICAN ENERGY COMPANY	32.0	42.059194	-94.857722
256	WQLQ387	450-470	MIDAMERICAN ENERGY COMPANY	32.0	42.047500	-95.406667
257	WQTC974	450-470	Mid-Plains Insulation	200.0	41.226472	-96.144333
258	WYN386	450-470	MILLARD PUBLIC SCHOOLS	121.0	41.251389	-96.139472
259	WQSY993	150-174	MILLER, JAY K	32.0	41.882972	-95.207861
260	WNUE566	150-174	MOELLER, DEVIN D	72.0	41.504722	-95.108333
261	WQZA733	450-470	MOHR, LYNN	32.0	42.251028	-94.898583
262	WQSR526	800/900	MORGAN, BRIAN D	113.0	42.505028	-96.389611
263	WRYH277	450-470	Muff, Jeremy	32.0	41.879611	-95.553611
264	WRWK894	450-470	NEES, MICHAEL D	32.0	41.847500	-94.716111
265	WQUW810	450-470	NEES, THOMAS A	32.0	42.157222	-94.880278
266	KD25998	450-470	NEUMAYER, CLIFFORD:NEUMAYER, CLYDE DBA NEUMAYER BROS	40.0	42.188861	-94.916944
267	WPYY805	150-174	NEW FEED LLC	32.0	42.125139	-94.780278

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268	WQOQ669	450-470	New Harvest Wind Project, LLC	32.0	42.140722	-95.466333
269	WQQR878	450-470	NEW HOPE VILLAGE	32.0	42.080556	-94.848611
270	KNAY918	150-174	NEWARK COLFAX FIRE DISTRICT	135.0	42.591083	-94.020222
271	WNYY450	450-470	NORTH WEST RURAL ELECTRIC COOPERATIVE	40.0	42.362500	-95.487778
272	WRFF577	450-470	NUTRIEN AG SOLUTIONS 2595	32.0	42.052139	-94.726778
273	KLH865	150-174	NUTRIEN AG SOLUTIONS INC	40.0	42.283583	-95.097500
274	WNHI404	150-174	NUTRIEN AG SOLUTIONS INC	48.0	42.421083	-94.934722
275	WNPB926	450-470	NUTRIEN AG SOLUTIONS INC	80.0	42.185000	-95.801944
276	WPMB635	150-174	NUTRIEN AG SOLUTIONS INC	32.0	42.312750	-95.253056
277	WPZS678	150-174	NUTRIEN AG SOLUTIONS INC	40.0	42.182778	-94.975278
278	WZY869	150-174	NUTRIEN AG SOLUTIONS INC	64.0	41.742222	-95.691667
279	WPLT267	800/900	OAKLAND FOODS LLC	113.0	41.329167	-95.385000
280	WNDP481	150-174	ODEBOLT, CITY OF	32.0	42.311083	-95.254722
281	WQWL333	150-174	OHLINGER, RICHARD	75.0	41.604306	-95.478583
282	KA3453	150-174, 450-470	OMAHA PUBLIC POWER DISTRICT	121.0	41.520833	-96.076417
283	KNER504	800/900	OMAHA PUBLIC POWER DISTRICT	113.0	41.509444	-96.088083
284	WPPY921	800/900	OMAHA PUBLIC POWER DISTRICT	113.0	42.147500	-96.444472
285	WPSZ331	800/900	Omaha Public Power District	113.0	41.574694	-96.387222
286	WPSZ331	800/900	Omaha Public Power District	113.0	41.268333	-96.194722
287	WPSZ331	800/900	Omaha Public Power District	113.0	41.509444	-96.088083
288	WRCU690	450-470	Onken Ag Services	32.0	42.151417	-94.811667
289	WPAF379	450-470	PELLA CORPORATION	16.0	42.061889	-94.840083
290	WQER990	450-470	PERRY, CITY OF	16.0	41.855556	-94.855556
291	WPGY216	25-50	PERU, CITY OF	80.0	41.480833	-95.728889
292	WRNS535	450-470	Petersen, Chad	32.0	42.164361	-95.427944

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293	WPHQ603	150-174	PETERSEN, DARWIN	65.0	42.319417	-95.350833
294	WQAR748	150-174	Petersen, Dennis	50.0	42.237222	-95.221111
295	WPDN982	150-174	PETERSEN, JOHN C	40.0	42.055528	-94.667472
296	WQSR519	800/900	PHILIP M. EASTMAN AND JEAN Y. EASTMAN INTER VIVOS TRUST DATED DECEMBER 4, 1999	113.0	42.505028	-96.389611
297	WQSR521	800/900	PHOENIX BROADBAND, LLC	113.0	42.505028	-96.389611
298	WRAE448	450-470	Pit Crew Inc.	32.0	42.280139	-94.904444
299	WPDP851	450-470	PLENDL BROS	121.0	42.585278	-96.068361
300	WREP356	150-174	POEN FARMS CORPORATION	40.0	42.313611	-95.266389
301	WPVC572	450-470	POET Biorefining-Coon Rapids	32.0	41.862778	-94.629167
302	WQBK835	150-174	Puck, Ben D	40.0	41.857750	-95.066361
303	WPCN473	450-470	PUDENZ, BRAD	80.0	42.137750	-94.818306
304	WQAH876	150-174	R. J. HAULING INC.	40.0	42.318056	-95.107500
305	WRVV638	150-174	RAASCH, MATT	40.0	42.386472	-95.275389
306	WPXS674	800/900	RACOM Corporation	113.0	42.471111	-96.425278
307	WQAN389	800/900	RACOM Corporation	113.0	41.691806	-93.763861
308	WQKD856	800/900	RACOM Corporation	113.0	42.636667	-95.669167
309	WQKD866	800/900	RACOM Corporation	113.0	42.047500	-95.406667
310	WQKD871	800/900	RACOM Corporation	113.0	42.485556	-94.186111
311	WQKD873	800/900	RACOM Corporation	113.0	41.316583	-95.299861
312	WQKD887	800/900	RACOM Corporation	113.0	41.256944	-95.955000
313	WQKD888	800/900	RACOM Corporation	113.0	41.253333	-96.119167
314	WQKD889	800/900	RACOM Corporation	113.0	41.972222	-95.907778
315	WQKD895	800/900	RACOM Corporation	113.0	41.072222	-95.156667
316	WQKD896	800/900	RACOM Corporation	113.0	41.686111	-94.159167

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317	WQKD901	800/900	RACOM Corporation	113.0	42.493333	-96.305833
318	WQKD904	800/900	RACOM Corporation	113.0	42.645278	-95.176111
319	WQKD913	800/900	RACOM Corporation	113.0	41.691806	-93.763861
320	WQKD918	800/900	RACOM Corporation	113.0	41.490833	-94.965833
321	WQKD922	800/900	RACOM Corporation	113.0	42.048333	-94.855000
322	WQKD924	800/900	RACOM Corporation	113.0	42.362500	-95.486944
323	WQSL428	150-174	RASMUSSEN, TIM	40.0	41.616389	-94.829722
324	WQTB443	150-174	RAUTERKUS, SAM	40.0	41.829444	-95.267667
325	WQSC534	450-470	Reever Family Farms Inc	32.0	42.092472	-94.723306
326	WSF759	150-174	REINIG FARMS CORP	40.0	41.646667	-95.443611
327	WNDP457	150-174	REIS, DOUGLAS:REIS, JOSEPH DBA REIS BROTHERS STATION LLC	97.0	42.457750	-95.147500
328	WRUL551	150-174	RENZE, ZACH	40.0	42.252306	-94.891278
329	WNWC589	450-470	RIESGAARD, JERRY	56.0	41.625000	-94.813306
330	WQZY575	150-174	RIESSELMAN, ROBERT	40.0	41.890944	-95.098500
331	WQHY533	150-174	RINK, RANDY	121.0	42.104639	-96.648194
332	KNBQ859	150-174	ROBINSON IMPLEMENT INC	40.0	41.760722	-95.208917
333	KDO203	150-174, 450-470	SAC CITY CITY OF	32.0	42.308556	-95.255778
334	KDO203	150-174, 450-470	SAC CITY CITY OF	32.0	42.309444	-95.039750
335	KDO203	150-174, 450-470	SAC CITY CITY OF	32.0	42.249806	-94.873417
336	WQHA412	150-174, 450-470	SAC COUNTY AMBULANCE COMMISSION	32.0	42.308556	-95.255778
337	WQHA412	150-174	SAC COUNTY AMBULANCE COMMISSION	32.0	42.309444	-95.039750
338	WQHA412	150-174, 450-470	SAC COUNTY AMBULANCE COMMISSION	32.0	42.249806	-94.873417
339	WROP822	450-470	Sac County Wind, LLC	32.0	42.343056	-95.183083
340	KAA414	150-174	SAC, COUNTY OF	40.0	42.423306	-94.985278

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341	WNYG568	150-174	SAC, COUNTY OF	40.0	42.396917	-94.998333
342	WNGG480	450-470	SANFORD USD MEDICAL CENTER	322.0	43.524972	-96.739222
343	WQSR518	800/900	SBH SPECTRUM, LLC	113.0	42.481611	-96.268694
344	WQSR518	800/900	SBH SPECTRUM, LLC	113.0	42.720000	-95.434250
345	WQUU966	150-174	SCHECHINGER SEED COMPANY	40.0	41.683361	-95.429667
346	WQQJ278	150-174	SCHLESWIG COMMUNITY SCHOOL	40.0	42.163889	-95.428333
347	WQPD336	150-174	SCHLESWIG, CITY OF	24.0	42.165944	-95.436972
348	WQOV633	150-174	SCHNEIDER, DALE	40.0	41.993972	-95.246139
349	WRWK239	450-470	SCHOMERS, MICHAEL	32.0	41.735472	-95.401583
350	WNQU821	150-174	SCHULTE, GARY A	48.0	42.006667	-95.151111
351	WQTH698	150-174	SCHULTES, GEORGE	40.0	41.608333	-94.833333
352	WNNV974	150-174	SCHWARTE, ROBERT	64.0	41.420000	-94.885528
353	WNNG854	450-470	SCHWEERS, CURT	64.0	42.113861	-95.048889
354	KRJ642	150-174	SHELBY COUNTY MYRTUE MEMORIAL HOSPITAL	40.0	41.672500	-95.353333
355	KAG861	150-174, 450-470	SHELBY, COUNTY OF	40.0	41.672500	-95.353333
356	WPCQ654	150-174	SHELBY, COUNTY OF	40.0	41.656944	-95.320278
357	WPTB449	150-174	SHELBY, COUNTY OF	35.0	41.672500	-95.353333
358	WQKW844	450-470	Siemens Gamesa Renewable Energy, Inc.	32.0	42.166944	-95.440278
359	WQSJ915	450-470	SIEVERTSEN, JEFF	32.0	41.849167	-95.259722
360	WNVM914	450-470	SLEEZER SR, DALE	80.0	42.768861	-95.403056
361	WNXA272	25-50	SMITH, ZENE O	32.0	42.070806	-94.863306
362	WPGK983	450-470	Smithfield Farmland Corp.	16.0	42.023056	-95.353056
363	WPGK983	450-470	Smithfield Farmland Corp.	32.0	42.023056	-95.353056
364	WQYY423	450-470	Smitty Bee Honey Inc.	32.0	41.824167	-95.340833
365	WNVA592	450-470	South Central Calhoun Schools	72.0	42.393306	-94.649417

ID	Call Sign	Frequency Band (MHz)	Licensee	Mobile Area Radius (km)	Latitude (NAD83)	Longitude (NAD83)
366	WPET201	450-470	SPRING VALLEY RADIO	120.0	41.584167	-93.667444
367	WPGG364	450-470	SPRING VALLEY RADIO	121.0	41.584167	-93.667444
368	WNVQ732	450-470	SPRING VALLEY RADIO CORP.	121.0	41.587500	-93.628556
369	KYF375	450-470	St Anthony Regional Hospital	13.0	42.061083	-94.872472
370	WQBX835	450-470	St Anthony Regional Hospital	10.0	42.069167	-94.864722
371	WQUZ947	450-470	ST ANTHONY REGIONAL HOSPITAL	32.0	42.056361	-94.883056
372	KQT723	150-174, 450-470	STA BILT CONSTRUCTION COMPANY INC	80.0	41.645000	-95.297222
373	WRXI649	150-174	Stanislav, Jason	80.0	41.870222	-96.062444
374	WNXE987	150-174	STEHR, WILLIAM J	48.0	42.345250	-95.245278
375	WPTX730	800/900	TEAM AIR EXPRESS SERVICES INC	113.0	41.259000	-95.937972
376	WQSZ652	150-174	TEGELS, LYLE	32.0	42.282472	-94.970556
377	WQCB265	450-470	THE ANDERSONS DENISON ETHANOL	32.0	41.988861	-95.399889
378	WQCB265	450-470	THE ANDERSONS DENISON ETHANOL	32.0	41.991083	-95.396139
379	WQSR514	800/900	THE THEODORA L. RINK, SPECIAL ACCOUNT, REVOCABLE LIVING TRUST	113.0	42.505028	-96.389611
380	WNUK586	150-174	THELEN, JOSEPH G	32.0	42.077778	-95.246667
381	WPEK278	450-470	TIEFENTHALER AG LIME INC	48.0	42.182194	-94.956944
382	WNPD351	450-470	TIEFENTHALER, DAN	40.0	42.202750	-94.920278
383	WRKZ253	450-470	TMDuncan LLC	80.0	41.977417	-94.069667
384	KNIY901	800/900	TRI STATE COMMUNICATIONS INC	113.0	42.494167	-96.415000
385	WNSR635	800/900	TRI STATE COMMUNICATIONS INC	113.0	41.811389	-96.296694
386	WROP986	450-470	Triple H Farm Works Inc.	32.0	42.085167	-95.538417
387	WPYZ557	450-470	TTWN Networks, LLC	120.0	41.260889	-95.929167
388	WNJR416	450-470	TYSON FOODS INC	56.0	42.000278	-95.374722
389	WNDF902	150-174	UNION PACIFIC RAILROAD COMPANY	40.0	41.849000	-95.425306

ID	Call Sign	Frequency Band (MHz)	Licensee	Mobile Area Radius (km)	Latitude (NAD83)	Longitude (NAD83)
390	WNDF902	150-174	UNION PACIFIC RAILROAD COMPANY	40.0	41.979944	-95.066389
391	WNDW431	800/900	UNPLUGGED WIRELESS	97.0	42.484972	-94.205528
392	WNXY737	450-470	UNPLUGGED WIRELESS	121.0	41.491667	-94.136889
393	WQYN658	450-470	UpWind Solutions, Inc.	32.0	42.146083	-95.051389
394	WQPK319	450-470	Van Wall	32.0	41.851583	-95.341333
395	WQPK319	450-470	Van Wall	32.0	42.226500	-95.319528
396	WQQX434	450-470	Van Wall	32.0	41.730333	-94.822972
397	WQLT271	450-470	VAN WALL EQUIPMENT	32.0	42.159944	-94.839444
398	WQOZ328	450-470	VAN WALL EQUIPMENT	32.0	41.993278	-95.571611
399	WQOZ328	450-470	VAN WALL EQUIPMENT	32.0	42.101444	-95.439750
400	WQOZ328	450-470	VAN WALL EQUIPMENT	32.0	42.045833	-95.319444
401	WQOZ328	450-470	VAN WALL EQUIPMENT	32.0	41.920028	-94.942167
402	WQOZ328	450-470	VAN WALL EQUIPMENT	32.0	41.997222	-94.723750
403	WQKW647	450-470	VONNAHME, WILLIAM F	32.0	42.154472	-95.092472
404	BLP01524	150-174	WAITT BROADCASTING, INC.	129.0	42.497778	-96.393639
405	WQSV430	450-470	WALDEMAR, BRAD	32.0	42.150861	-95.277111
406	WNQH208	450-470	WEBB, NICHOLAS J	121.0	42.062194	-94.391361
407	WNUT465	450-470	WELLS, JOHN	80.0	42.625250	-94.808861
408	WPFC570	450-470	WEST CENTRAL COOP	48.0	42.040528	-94.635250
409	WNBU220	450-470	West Central Cooperative	56.0	42.268306	-94.490528
410	WNPD349	450-470	WEST CENTRAL COOPERATIVE	56.0	41.886917	-94.943056
411	WPTR845	450-470	West Central Iowa Rural Water Association	32.0	41.991639	-95.071083
412	KCZ782	150-174	WEST CENTRAL IOWA WATER ASSOCIATION	40.0	41.988861	-95.072500
413	WQFD853	150-174	WESTERN IOWA ENERGY LLC	40.0	42.262806	-95.095806
414	WPLX872	150-174	WHITE, JOHN H	40.0	41.644722	-95.170556

ID	Call Sign	Frequency Band (MHz)	Licensee	Mobile Area Radius (km)	Latitude (NAD83)	Longitude (NAD83)
415	WQJN804	450-470	WIEDERIN TRUCKING INC	40.0	42.143972	-94.858861
416	WQZR382	450-470	Williams, Scott H	32.0	42.319556	-94.787028
417	WQDB764	450-470	WINQUIST, STEVE	32.0	42.189167	-95.331667
418	WNPF550	450-470	WITT BROTHERS FARMS LLC	72.0	41.488056	-95.784167
419	WNSE774	150-174	WOODBINE MUNICIPAL UTILITIES	80.0	41.736111	-95.694722
420	WREJ211	150-174	WOOSTER, JUSTIN	40.0	41.807028	-95.118500
421	KD49978	450-470	WRC COMMUNICATIONS	121.0	41.591944	-93.631333
422	WNRL480	150-174	WUEBKER, LOREN	56.0	42.422472	-94.629694
423	WQBG262	150-174	Youngren, Preston	40.0	42.414722	-95.250556

Table A: Mobile Licenses Intersecting Project Area

Wind Power GeoPlanner™

Off-Air TV Analysis

Silver Queen

Prepared on Behalf of
ReGenerate Consulting

November 28, 2023

COMSEARCH®
A CommScope Company

Table of Contents

1. Introduction

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 Silver Queen wind project in Carroll and Crawford Counties, Iowa. 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.

2. Summary of Results

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

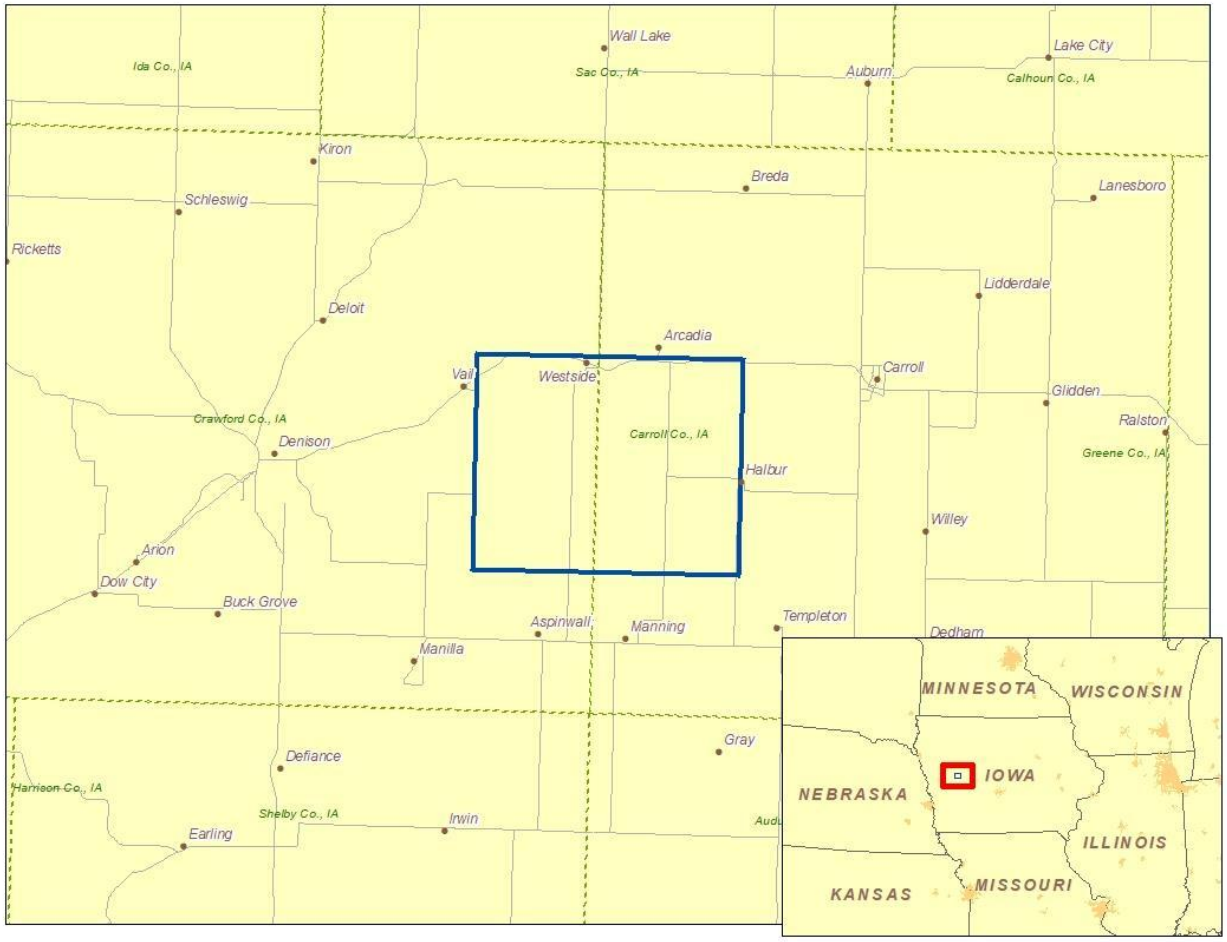

Figure 1: Wind Farm Project Area and Local Communities

To begin the analysis, Comsearch compiled all off-air television stations[1] within 150 kilometers of the proposed turbines. TV stations at a distance of 150 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, on the next page, and a plot depicting their locations is provided in Figure 2. There are a total of 57 database records for stations within approximately 150 kilometers of the proposed turbines. Of these stations, only 45 stations are currently licensed and operating, 19 of which are low-power stations or translators. Translator stations are low-power stations that receive signals from distant broadcasters and retransmit the signal to a local audience. These stations serve local audiences and have limited range, which is a function of their transmit power and the height of their transmit antenna.

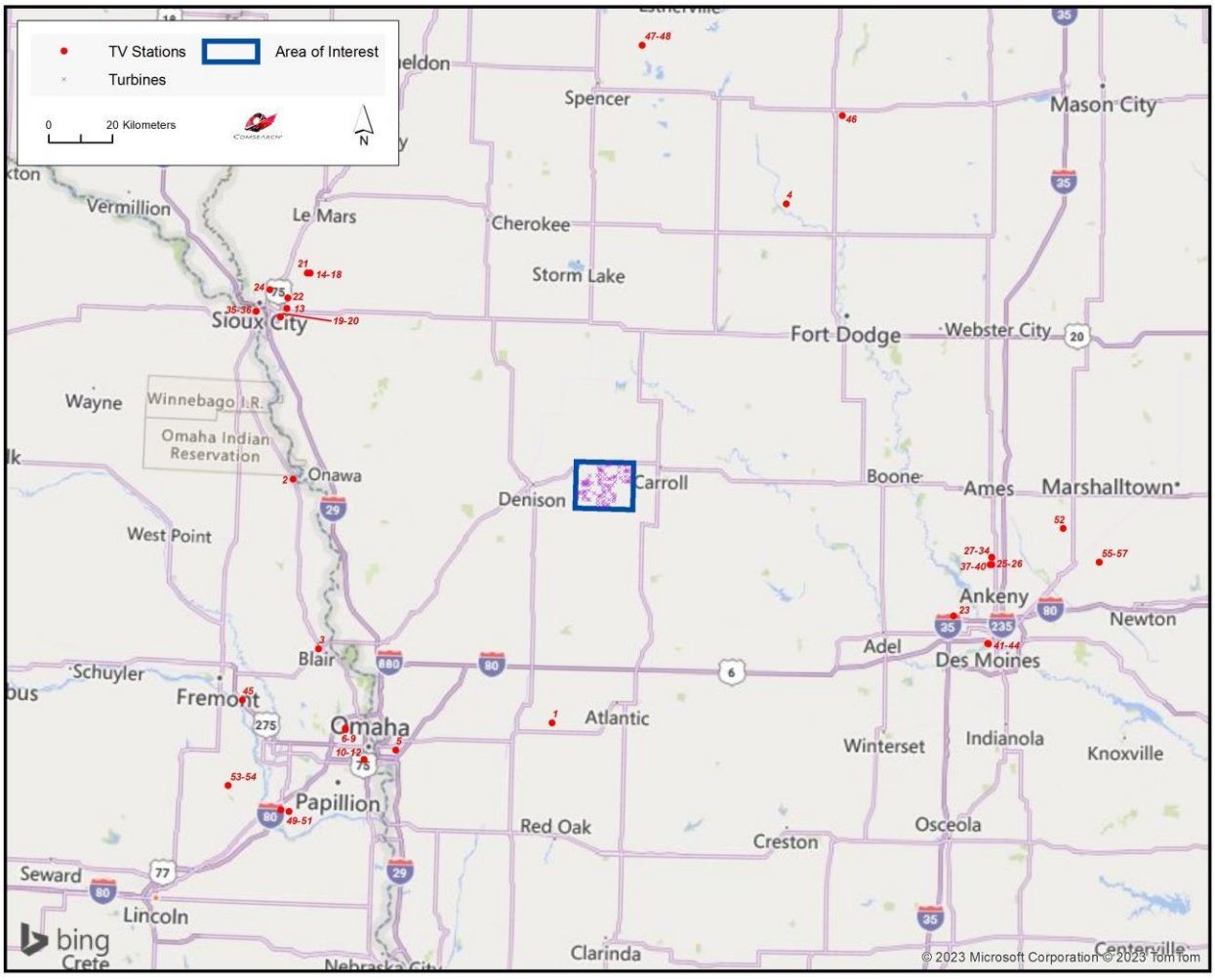

Figure 2: Plot of Off-Air TV Stations within 150 Kilometers of Proposed Turbines

[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 TV 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	Status	Service[2]	Channel	Transmit ERP[3] (kW)	Latitude (NAD 83)	Longitude (NAD 83)	Distance to the Closest Turbine (km)
1	KHIN	LIC	DTV	35	600.0	41.344167	-95.256111	69.05
2	K34IB-D	LIC	LPT	34	0.03	42.005806	-96.257222	89.17
3	K24GO-D	LIC	LPT	24	0.03	41.531361	-96.136944	93.95
4	KTIN	LIC	DTV	25	600.0	42.817417	-94.411639	95.59
5	KBIN-TV	LIC	DTV	33	200.0	41.254167	-95.835556	97.56
6	WOWT	LIC	DTV	22	1000.0	41.311111	-96.027222	102.61
7	KYNE-TV	LIC	DTV	17	36.1	41.308889	-96.026167	102.73
8	KETV	LIC	DTV	20	700.0	41.308889	-96.026167	102.73
9	KMTV-TV	LIC	DTV	31	652.0	41.306833	-96.027139	102.95
10	KQMK-LD	LIC	LPD	21	10.0	41.224889	-95.953222	105.94
11	KOHA-LD	LIC	LPD	27	15.0	41.224889	-95.953222	105.94
12	KOHA-LD	CP	LPD	30	15.0	41.224889	-95.953222	105.94
13	KSXC-LD	LIC	LPD	26	15.0	42.484861	-96.305556	107.38
14	KTIV	LIC	DTV	14	1000.0	42.586667	-96.221944	107.50
15	KPTH	LIC	DTV	30	871.0	42.586667	-96.221944	107.50
16	KMEG	LIC	DTV	32	1000.0	42.586667	-96.221944	107.50
17	K03IS-D	LIC	LPD	3	0.3	42.586667	-96.222222	107.52
18	K06QG-D	LIC	LPD	6	0.3	42.586667	-96.222222	107.52
19	K31PP-D	APP	LPD	31	15.0	42.460278	-96.329056	107.85
20	K31PP-D	LIC	LPD	31	0.1	42.460278	-96.329056	107.85
21	KCAU-TV	LIC	DTV	9	43.9	42.586389	-96.232500	108.19
22	KSIN-TV	LIC	DTV	28	400.0	42.514722	-96.304444	108.91
23	K32NM-D	LIC	LPD	32	15.0	41.664722	-93.756944	109.18

[2] Definitions of service and status codes:
ACA - Analog Class A
DCA - Digital Class A
DRT - Digital Replacement Translator
DT - ETL testing
DTS - Distributed Transmission System
DTV - Full Service Television
DTX - Digital TV Auxiliary
LPA - Low Power Analog TV
LPD - Low Power Digital TV
LPT - Digital TV Translator
LPX - Analog TV Translator
TS - Legacy Service for Analog TV Auxiliary
TV - Analog TV legacy

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
AMD - Amendment

[3] ERP = Transmit Effective Radiated Power

ID	Call Sign	Status	Service[2]	Channel	Transmit ERP[3] (kW)	Latitude (NAD 83)	Longitude (NAD 83)	Distance to the Closest Turbine (km)
24	K27LD-D	LIC	LPD	27	0.2	42.534556	-96.373417	114.93
25	KCCI	LIC	DTV	8	44.6	41.809722	-93.621389	115.15
26	KFPX-TV	LIC	DTV	36	270.0	41.809722	-93.621389	115.15
27	KDSM-TV	LIC	DTV	16	1000.0	41.830000	-93.615167	115.18
28	KDIT-CD	LIC	DCA	17	15.0	41.830000	-93.615167	115.18
29	KDMI	LIC	DTV	19	839.0	41.830000	-93.615167	115.18
30	KDMI	APP	DTV	19	1000.0	41.830000	-93.615167	115.18
31	KDMI	STA	DTV	19	335.6	41.830000	-93.615167	115.18
32	KCWI-TV	APP	DTV	23	1000.0	41.830000	-93.615167	115.18
33	KCWI-TV	STA	DTV	23	246.0	41.830000	-93.615167	115.18
34	KCWI-TV	LIC	DTV	23	246.0	41.830000	-93.615167	115.18
35	K16NY-D	LIC	LPD	16	4.4	42.472500	-96.422500	115.36
36	KBWF-LD	LIC	LPD	29	15.0	42.472500	-96.422500	115.36
37	WOI-DT	LIC	DTV	5	13.9	41.809167	-93.615000	115.68
38	KDIN-TV	LIC	DTV	11	22.5	41.809167	-93.615000	115.68
39	WHO-DT	LIC	DTV	13	36.5	41.809167	-93.615000	115.68
40	KDIN-TV	APP	DTV	34	1000.0	41.809167	-93.615000	115.68
41	WOI-DT	CP	DRT	33	3.2	41.587472	-93.628806	122.37
42	WOI-DT	LIC	DRT	50	3.2	41.587472	-93.628806	122.37
43	WBXF-CD	CP	DCA	28	15.0	41.586944	-93.626111	122.60
44	WBXF-CD	LIC	DCA	28	9.3	41.586944	-93.626111	122.60
45	K36QD-D	CP	LPT	36	3.0	41.379389	-96.415750	122.70
46	KDIT-LD	LIC	LPD	17	0.5	43.068056	-94.202500	128.23
47	K18KG-D	LIC	LPD	18	6.9	43.255556	-94.976667	131.12
48	KBVK-LD	LIC	LPD	20	6.8	43.255556	-94.976667	131.12
49	KPTM	LIC	DTV	26	800.0	41.071083	-96.225639	133.60
50	KXVO	LIC	DTV	29	630.0	41.071083	-96.225639	133.60
51	KAJS-LD	LIC	LPD	32	15.0	41.074806	-96.256667	134.99
52	K31PO-D	CP	LPT	31	2.0	41.912750	-93.346472	135.85
53	KUON-TV	LIC	DTV	12	75.0	41.138333	-96.455833	141.78
54	KUON-TV	CP	DTV	27	650.0	41.138333	-96.455833	141.78
55	KAJR-LD	LIC	LPD	21	15.0	41.817917	-93.209806	148.52
56	KRPG-LD	LIC	LPD	24	15.0	41.817917	-93.209806	148.52
57	KCYM-LD	LIC	LPD	26	15.0	41.817917	-93.209806	148.52

Table 1: Off-Air TV Stations within 150 Kilometers of Proposed Turbines

3. Impact Assessment

Based on a contour analysis of the licensed stations within 150 kilometers of the Silver Queen, it was determined that 16 of the full-power digital stations, 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 turbines 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	Channel	Transmit ERP (kW)	Latitude (NAD 83)	Longitude (NAD 83)	Distance to the Closest Turbine (km)
1	KHIN	LIC	DTV	35	600.0	41.344167	-95.256111	69.05
4	KTIN	LIC	DTV	25	600.0	42.817417	-94.411639	95.59
6	WOWT	LIC	DTV	22	1000.0	41.311111	-96.027222	102.61
8	KETV	LIC	DTV	20	700.0	41.308889	-96.026167	102.73
9	KMTV-TV	LIC	DTV	31	652.0	41.306833	-96.027139	102.95
14	KTIV	LIC	DTV	14	1000.0	42.586667	-96.221944	107.50
15	KPTH	LIC	DTV	30	871.0	42.586667	-96.221944	107.50
16	KMEG	LIC	DTV	32	1000.0	42.586667	-96.221944	107.50
21	KCAU-TV	LIC	DTV	9	43.9	42.586389	-96.232500	108.19
25	KCCI	LIC	DTV	8	44.6	41.809722	-93.621389	115.15
27	KDSM-TV	LIC	DTV	16	1000.0	41.830000	-93.615167	115.18
29	KDMI	LIC	DTV	19	839.0	41.830000	-93.615167	115.18
34	KCWI-TV	LIC	DTV	23	246.0	41.830000	-93.615167	115.18
37	WOI-DT	LIC	DTV	5	13.9	41.809167	-93.615000	115.68
38	KDIN-TV	LIC	DTV	11	22.5	41.809167	-93.615000	115.68
39	WHO-DT	LIC	DTV	13	36.5	41.809167	-93.615000	115.68

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

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:

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Web site:	www.comsearch.com

Wind Power GeoPlanner™

Wireless Internet Services Report

Silver Queen

Prepared on Behalf of
ReGenerate Consulting

November 29, 2023

COMSEARCH®
A CommScope Company

Table of Contents

1. Introduction

Wireless internet providers, often called WISPs (Wireless Internet Service Providers), deliver internet services via radio transmission to business and/or residential subscribers. They compete with wired internet service providers such as the local phone and cable companies. Wireless internet providers can use various frequency bands in both licensed and unlicensed spectrum. Many rural community WISPs operate in the unlicensed spectrum since there is a lower barrier to entry without the costs associated with acquiring licensed spectrum. The most common unlicensed bands for this purpose are the 900 MHz, 2.4 GHz, and 5.8 GHz bands. There is also some recent activity in the "lite-licensed" 3.65 GHz band.

This report attempts to identify wireless internet providers in proximity to the Silver Queen Wind Farm project and evaluates the potential impact of wind turbines on their operations in and around the project area.

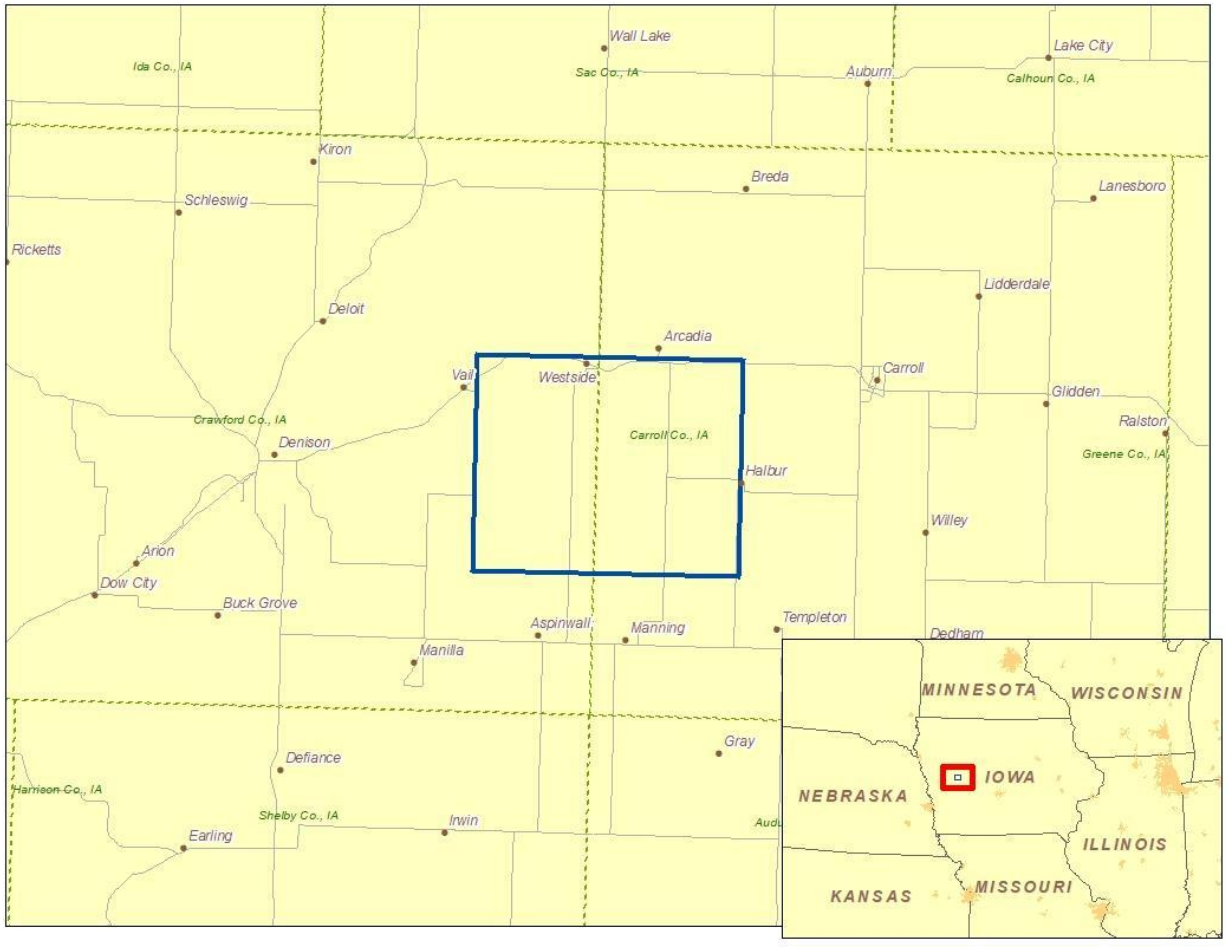

Figure 1: Silver Queen Project Area

2. Summary of Results

Methodology

Our wireless internet service analysis uses searches of our own wireless databases and other reliable data sources such as the FCC's ULS database. However, most bands used for wireless internet services (primarily the unlicensed bands) have no reliable data source available since according to FCC rules, these systems are not required to license or register their transmitter locations. Therefore, the only band with a reliable data set to evaluate is the 3.65 GHz WBS (Wireless Broadband Systems) band, which by FCC rule requires registration of base and fixed transmitters. Our analysis will include any providers found in this band, but will not necessarily include providers with unlicensed systems. This is due to the lack of available data and the providers' lack of interference protection as a consequence of their unlicensed status.

Results

Comsearch performed a search of 3.65 GHz band licenses within 50 km of the Silver Queen area of interest. Our search of this band identified no wireless internet systems within that range of the project area.

Unlicensed Bands

As mentioned previously, there are no reliable data sources for unlicensed wireless internet systems because they are not required to license or register their transmitter locations according to FCC rules. Through web research, Comsearch was able to identify various Internet service providers throughout the state of Montana that use satellite, DSL, or fiber networks to offer their services. However, no wireless internet service provider operating in the unlicensed band was identified in and around the project area.

3. Recommendations / Conclusion

As there were no registered wireless broadband system (WBS) transmitters found within 50 km to the proposed Silver Queen Area of Interest, the project should not impact the coverage of wireless internet service providers in the 3.65 GHz WBS band.

In the event that a wireless internet service provider operating in one of the unlicensed bands believes that their coverage has been compromised by the presence of the wind energy facility, they have many options to improve their signal coverage to the area. This includes the optimization of surrounding base stations or the addition of a new sector or cell site. Utility towers, other communications towers, or even a turbine tower within the wind project area can serve as the platform for a new base station, cell enhancer, or repeater.

4. Contact

For questions or information regarding the Wireless Internet Services Report, please contact:

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