

Appendix E

Telecommunications Studies

Red Pine Wind Project
Lincoln County, Minnesota

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Wind Power GeoPlanner™

AM and FM Radio Report

Red Pine Wind Project



Prepared on Behalf of
Red Pine Wind Project,
LLC

March 8, 2016



COMSEARCH
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1. Introduction

Comsearch analyzed AM and FM radio broadcast stations whose service could potentially be affected by the proposed Red Pine Wind Project in Lincoln and Lyon Counties, Minnesota. Three distinct turbine layouts, as provided by the developer, were considered in the analysis.

2. Summary of Results

AM Radio Analysis

Comsearch found one database record¹ for AM stations within approximately 30 kilometers of the project, as shown in Tables 1 and 2 and Figure 1. This record represents station KMHL, which broadcasts out of Marshall, Minnesota, to the east of the project.

ID	Call Sign	Status ²	Frequency (kHz)	Transmit ERP ³ (kW)	Operation Time	Latitude (NAD 27)	Longitude (NAD 27)
1	KMHL	LIC	1400	1.0	Unlimited	44.449722	-95.761944

Table 1: AM Radio Stations within 30 Kilometers

ID	Call Sign	Required Separation Distance ⁴ (km)	Distance to Center of AOI (km)	Turbine Layout V100		Turbine Layout V117		Turbine Layout V126	
				Distance to Nearest Turbine (km)	Turbine ID	Distance to Nearest Turbine (km)	Turbine ID	Distance to Nearest Turbine (km)	Turbine ID
1	KMHL	0.21	28.62	26.18	54	26.56	53	25.93	39

Table 2: AM Radio Stations with Respect to Project 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 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.

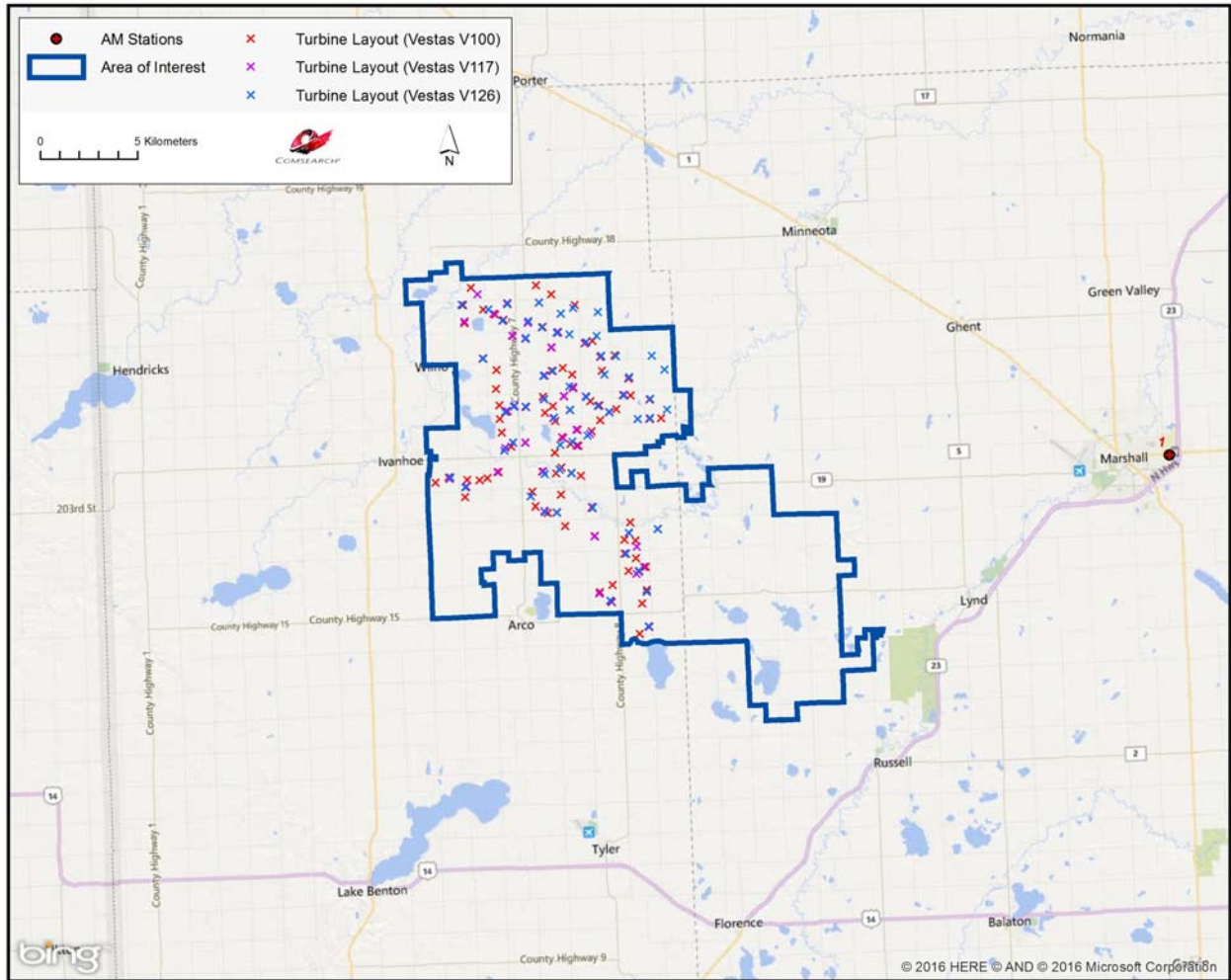


Figure 1: AM Radio Stations within 30 Kilometers

FM Radio Analysis

Comsearch determined that there were six records for FM stations within a 30-kilometer radius of the Red Pine Wind Project, as shown in Tables 3 and 4 and Figure 2. All of these stations are currently licensed and operating, three of which are low-power or translator stations that operate with limited range.

ID	Call Sign	Status ⁵	Service ⁶	Frequency (MHz)	Transmit ERP ⁷ (kW)	Latitude (NAD 27)	Longitude (NAD 27)
1	K212FH	LIC	FX	90.3	0.115	44.325556	-95.871944
2	K277AI	LIC	FX	103.3	0.25	44.325556	-95.871944
3	KARL	LIC	FM	105.1	45.0	44.325556	-95.871944
4	KARZ	LIC	FM	107.5	15.0	44.325556	-95.871944
5	KKCK	LIC	FM	99.7	100.0	44.282222	-96.318056
6	K227AN	LIC	FX	93.3	0.14	44.327778	-95.825000

Table 3: FM Radio Stations within 30 Kilometers

ID	Call Sign	Distance to Center of AOI (km)	Turbine Layout V100		Turbine Layout V117		Turbine Layout V126	
			Distance to Nearest Turbine (km)	Turbine ID	Distance to Nearest Turbine (km)	Turbine ID	Distance to Nearest Turbine (km)	Turbine ID
1	K212FH	23.86	19.26	99	19.25	60	19.29	60
2	K277AI	23.86	19.26	99	19.25	60	19.29	60
3	KARL	23.86	19.26	99	19.25	60	19.29	60
4	KARZ	23.86	19.26	99	19.25	60	19.29	60
5	KKCK	23.87	19.48	94	19.42	57	19.59	58
6	K227AN	26.93	22.79	99	22.78	60	22.82	60

Table 4: FM Radio Stations with Respect to Project Turbines

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

⁶ FM = FM broadcast station; FX = FM translator station; FL = FM low-power station; FS = FM auxiliary station.

⁷ ERP = Transmit Effective Radiated Power.

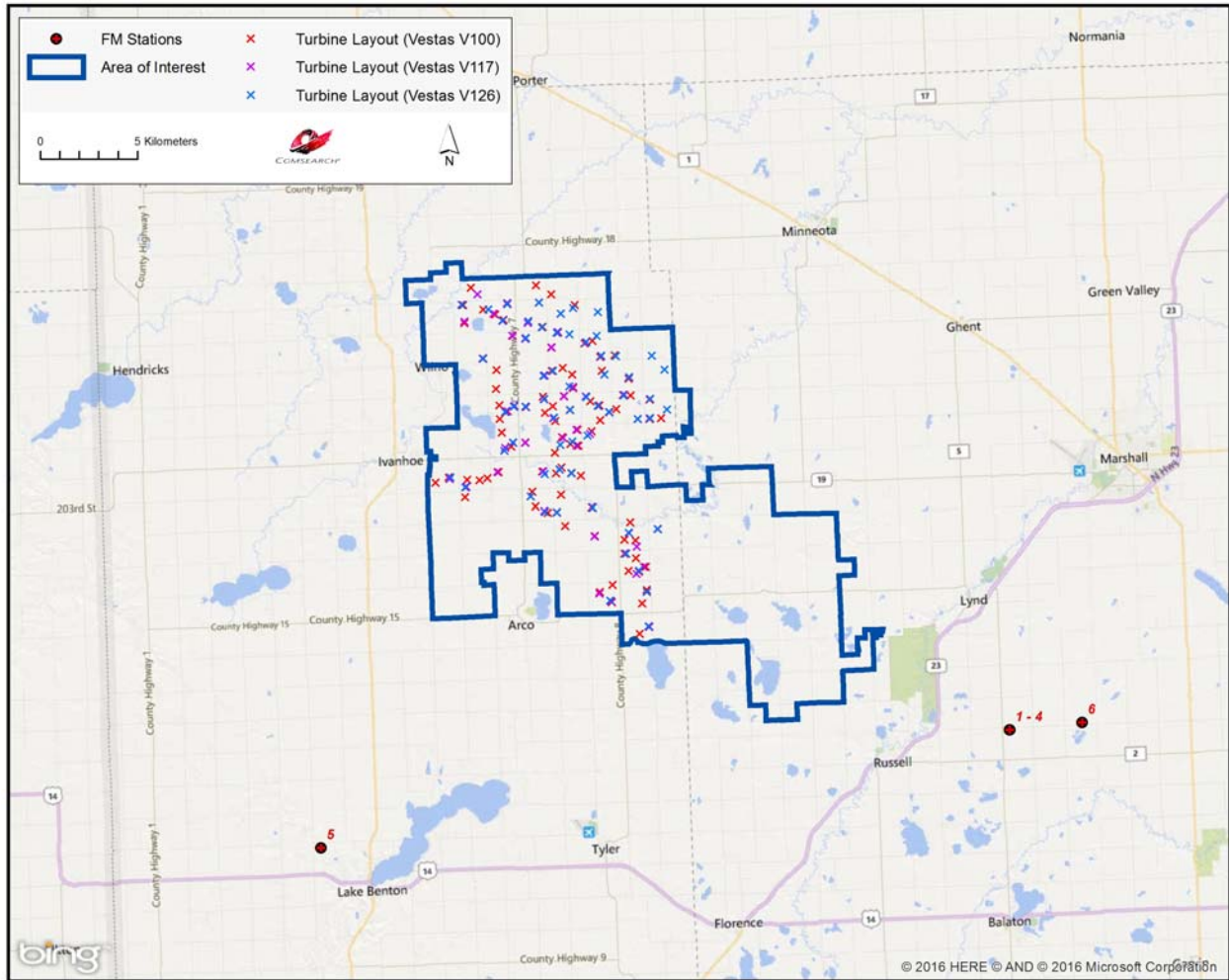


Figure 2: FM Radio Stations within 30 Kilometers

3. Impact Assessment

The exclusion distance for AM broadcast stations varies as a function of the antenna type and broadcast frequency. For directional antennas, the exclusion distance is calculated by taking the lesser of 10 wavelengths or 3 kilometers. For non-directional antennas, the exclusion distance is simply equal to 1 wavelength. Potential problems with AM broadcast coverage are only anticipated when AM broadcast stations are located within their respective exclusion distance limit from wind turbine towers. The closest AM station to the Red Pine Wind Project, KMHL, is more than 25.9 kilometers from the nearest turbine in all three turbine layouts. 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 susceptible to interference caused by wind turbines, especially when large objects, such as wind turbines, are sited in the *far field* region of the radiating FM antenna in order to avoid the risk of distorting the antenna's radiation pattern. The closest operational stations to the Red Pine Wind Project, K212FH, K277AI, KARL, and KARZ, are located more than 19.2 kilometers from the nearest turbine in all three turbine layouts. 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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Wind Power GeoPlanner™

Microwave Study

Red Pine Wind Project



Prepared on Behalf of
Red Pine Wind Project,
LLC

March 10, 2016



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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 licensed, proposed and applied non-federal government microwave systems

2. Project Overview

Project Information

Name: Red Pine Wind Project
County: Lincoln and Lyon
State: Minnesota

Number of Turbines¹: 100/60/60
Blade Diameter: 100/117/126 meters
Hub Height: 80 meters

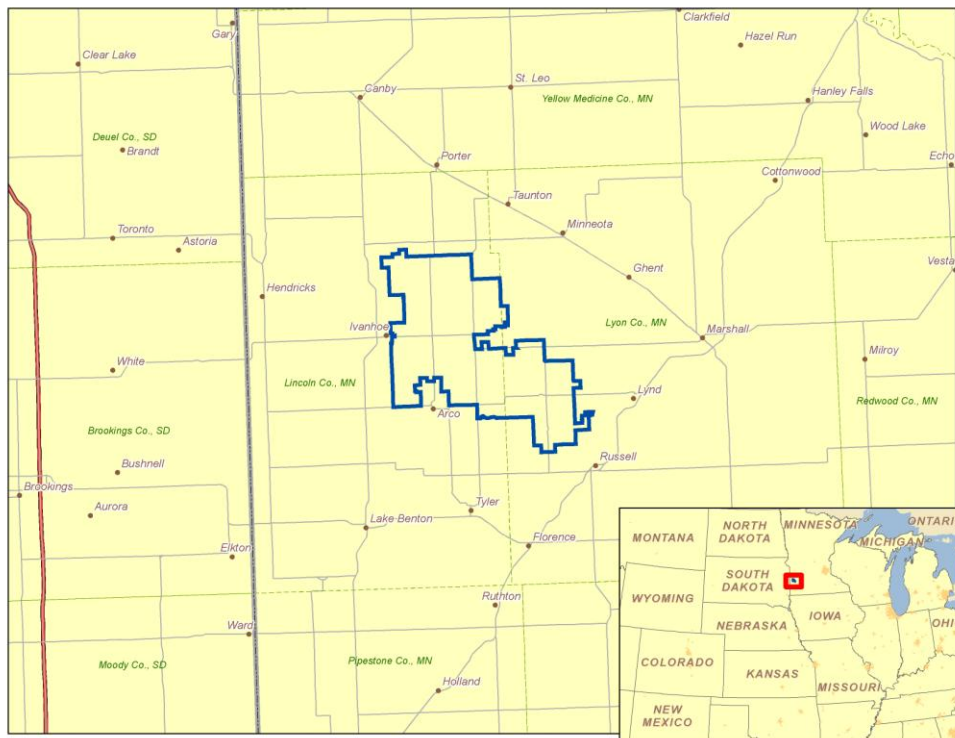


Figure 1: Area of Interest

¹ Three sets of turbine layouts with different models (Vestas V100, V117 and V126) were considered in this study.

3. 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 GHz². First, we determined all microwave paths that intersect the area of interest³ and listed them in Table 1. These paths and the area of interest that encompasses the planned turbine locations are shown in Figure 2.

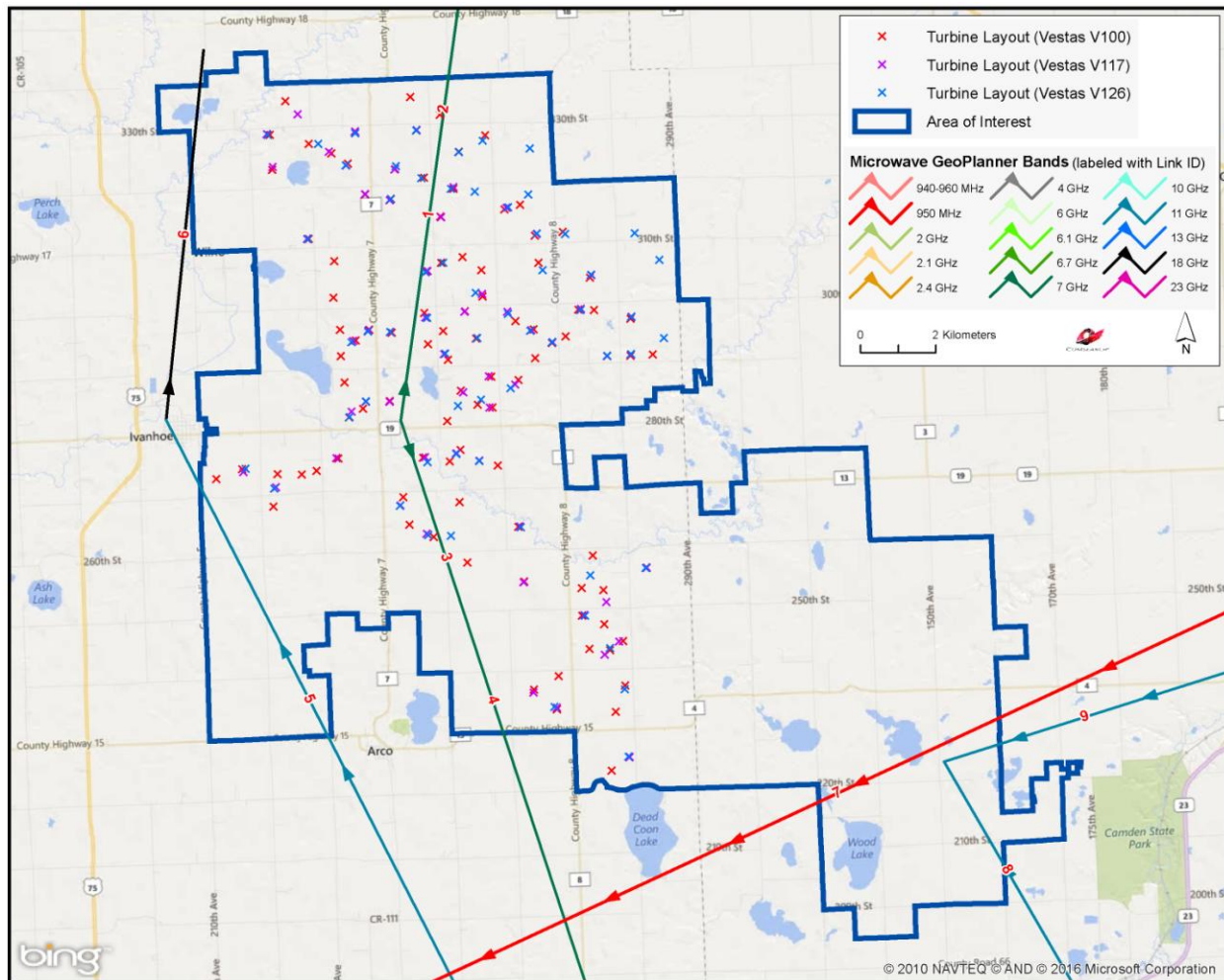


Figure 2: Microwave Paths that Intersect the Area of Interest

² Please note that this analysis does not include unlicensed microwave paths or federal government paths that are not registered with the FCC.

³ 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	WPNE584	RXONLY	7 GHz	79.66	West Central Minnesota Educ TV Corp.
2	Licensed	WPNE585	RXONLY	7 GHz	79.66	West Central Minnesota Educ TV Corp.
3	Licensed	WPNE586	RXONLY	7 GHz	65.26	West Central Minnesota Educ TV Corp.
4	Licensed	WPNE587	RXONLY	7 GHz	65.26	West Central Minnesota Educ TV Corp.
5	Licensed	WQGD798	WQGD801	11 GHz	22.32	Affiniti LLC
6	Licensed	WQGD801	WQGD809	18 GHz	9.87	Affiniti LLC
7	Licensed	WQJX386	RXONLY	950 MHz	48.10	KMHL BROADCASTING COMPANY
8	Licensed	WQWD544	WQWU506	11 GHz	18.80	Sprint Spectrum L.P.
9	Licensed	WQWU518	WQWU506	11 GHz	17.52	Sprint Spectrum L.P.

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

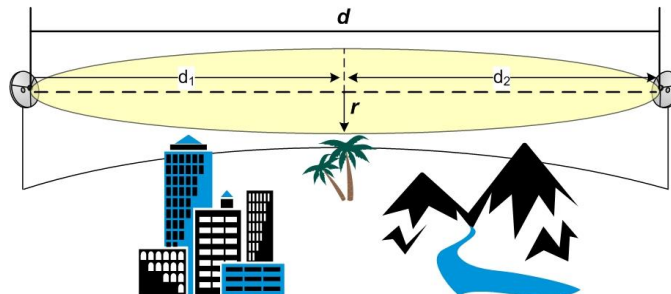
(See enclosed mw_geopl.xlsx for more information and GP_dict_matrix_description.xls for detailed field descriptions)

Verification of Coordinate Accuracy

It is possible that as-built coordinates may differ from those on the FCC license. For this project, path IDs 1-5 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 photos⁴.

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

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



⁴ See enclosed mw_geopl.shp and mw_geopl_fcc.shp for details.

Where,

- r = Fresnel Zone radius at a specific point in the microwave path, meters
- n = Fresnel Zone number, 1
- F_{GHz} = Frequency of microwave system, GHz
- d_1 = Distance from antenna 1 to a specific point in the microwave path, kilometers
- d_2 = Distance from antenna 2 to a specific point in the microwave path, kilometers

In general, this is the area where the planned wind turbines should be avoided, if possible. A depiction of the Fresnel Zones for each microwave path listed can be found in Figure 3 through 5, and is also included in the enclosed shapefiles^{5,6}.

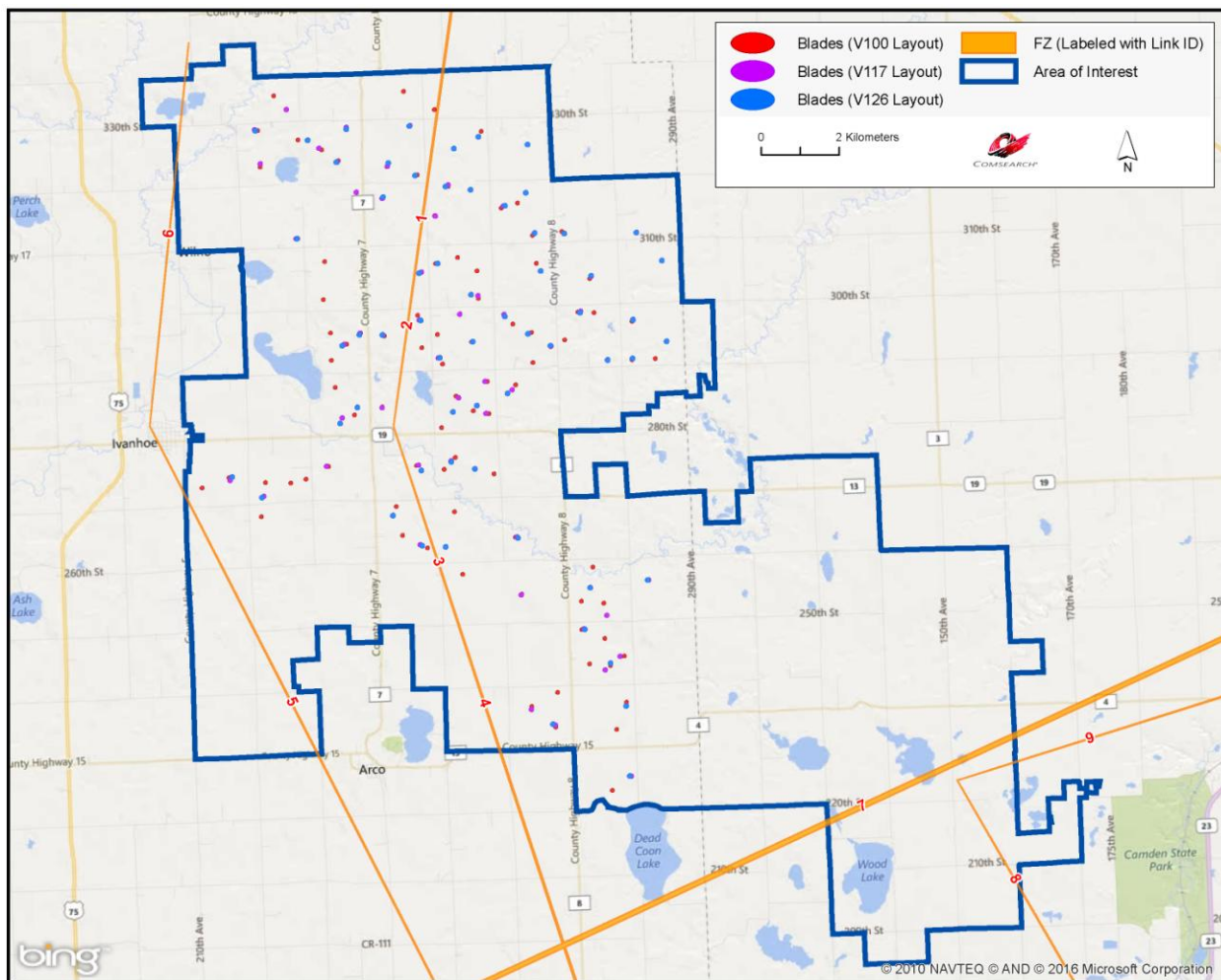


Figure 3: Microwave Paths with Fresnel Zones

⁵ The ESRI® shapefiles enclosed are in NAD 83 UTM Zone 14 projected coordinate system.

⁶ 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.

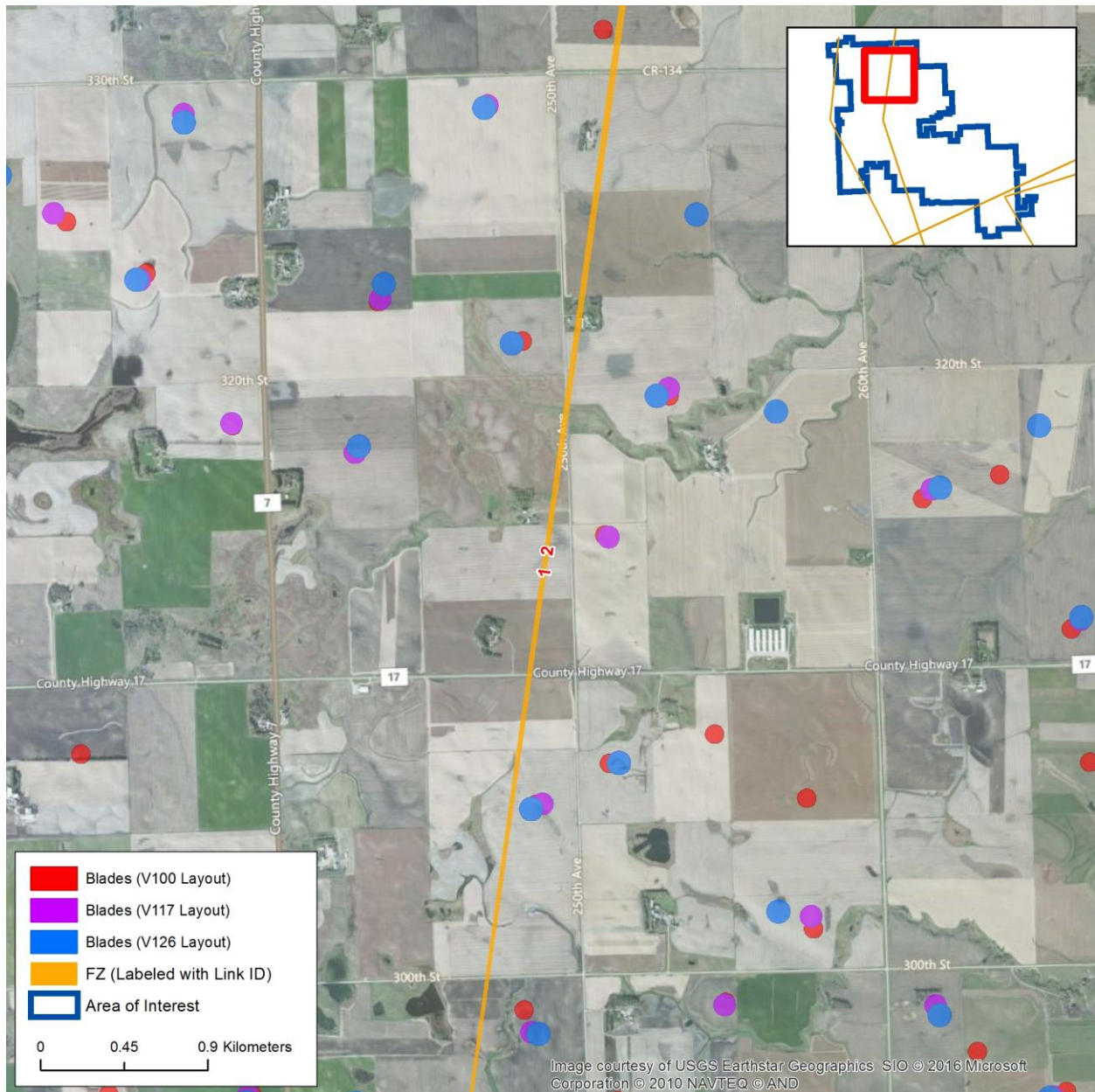


Figure 4: Microwave Paths with Fresnel Zones (Path IDs 1-2)

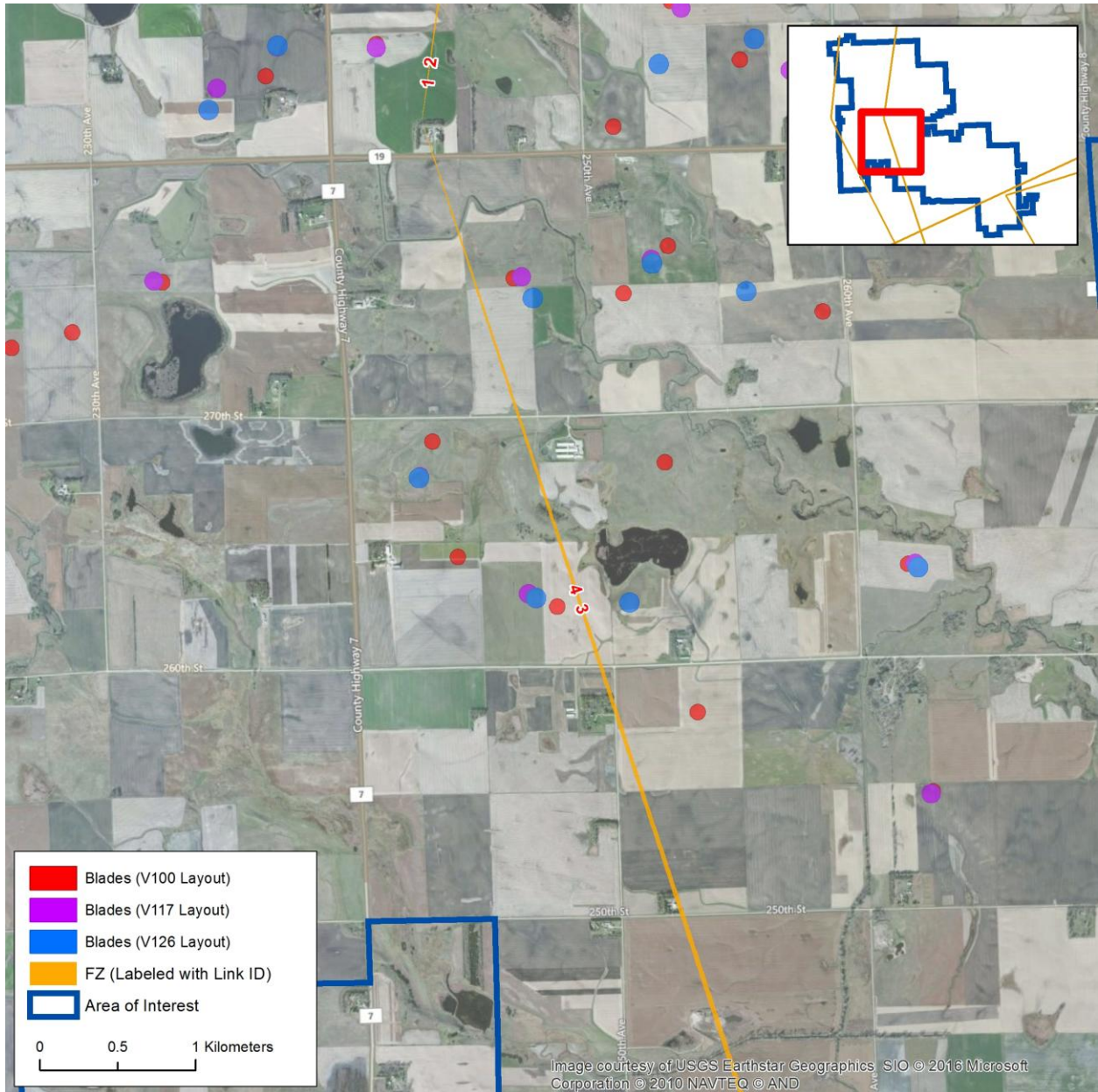


Figure 5: Microwave Paths with Fresnel Zones (Path IDs 3-4)

4. Conclusion

Total Microwave Paths	Paths with Affected Fresnel Zones	Total Turbines	Turbines intersecting the Fresnel Zones
9	0	100/60/60	0

Table 2: Fresnel Zone Analysis Result

Our study identified nine microwave paths intersecting the Red Pine Wind 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. Three sets of turbine layouts with different blade lengths were considered in the analysis. 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:

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Wind Power GeoPlanner™

Off-Air TV Analysis

Red Pine Wind Project



Prepared on Behalf of
Red Pine Wind Project,
LLC

March 8, 2016



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To begin the analysis, Comsearch compiled all off-air television stations¹ within 150 kilometers of the project. Appendix A contains a tabular summary of these stations. A plot depicting their locations appears in Figure 2, below.

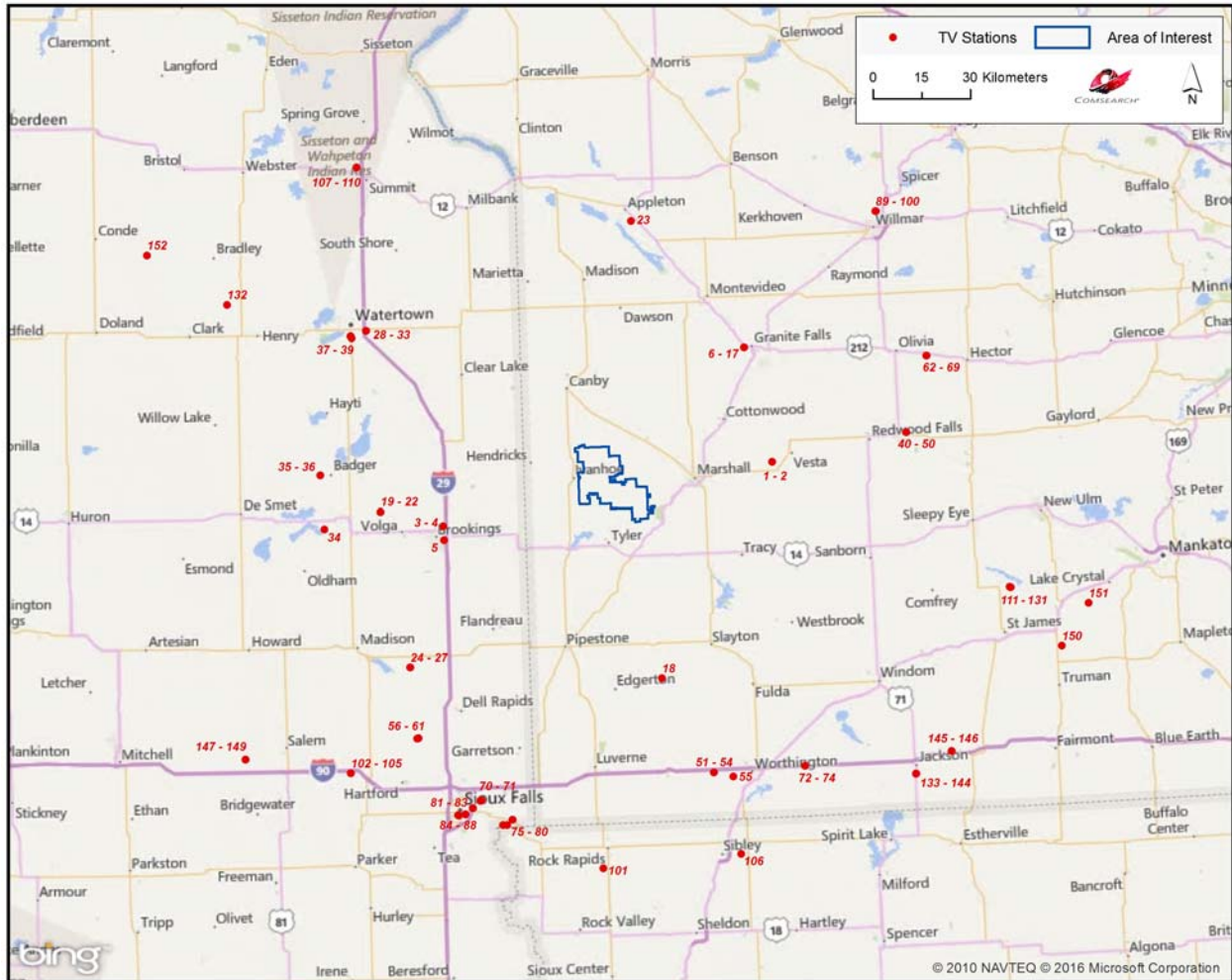


Figure 2: Plot of Off-Air TV Stations within 150 Kilometers of Project Area

TV stations at a distance of 75 kilometers or less are the most likely to provide off-air coverage to the project area and neighboring communities. These stations are listed in Tables 1 and 2, below, and a plot depicting their locations is provided in Figure 3. There are a total of twenty-three database records for stations within approximately 75 kilometers of the project. Of these stations, only eighteen are currently licensed and operating, fifteen of which are low-power stations or translators. Translator stations are low-power stations that receive signals from

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.

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. The three remaining stations broadcast at full power and are licensed under call signs KRWF, KSMN, and KWCM-TV.

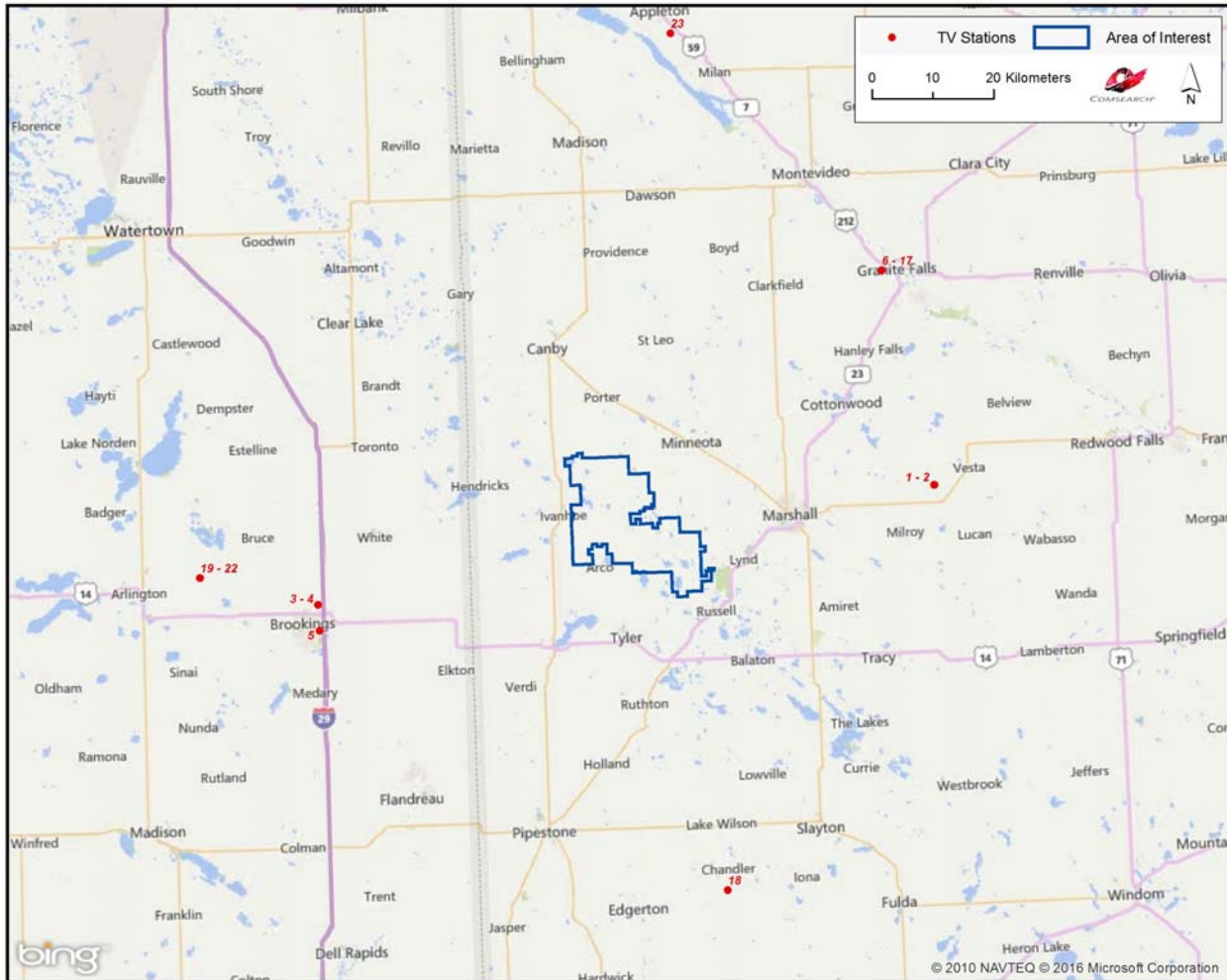


Figure 3: Plot of Off-Air TV Stations within 75 Kilometers of Project Area

ID	Call Sign	Status	Service ²	Channel	Transmit ERP ³ (kW)	Latitude (NAD 27)	Longitude (NAD 27)
1	KRWF	LIC	DT	27	58.0	44.484167	-95.490833
2	K43MH-D	LIC	LD	43	5.5	44.484167	-95.490556
3	K40FZ	APP	LD	40	7.014	44.339472	-96.768556
4	K40FZ	LIC	TX	40	13.5	44.339444	-96.768611
5	K50DG-D	LIC	LD	50	4.5	44.300833	-96.766667
6	K14OL-D	LIC	LD	14	1.8	44.804722	-95.580278
7	K16CP-D	LIC	LD	16	1.8	44.804722	-95.580278
8	K21LF-D	LIC	LD	21	1.8	44.804722	-95.580278
9	K22DO-D	LIC	LD	22	1.7	44.804722	-95.580278
10	K24CS-D	LIC	LD	24	1.8	44.804722	-95.580278
11	K29JW-D	LIC	LD	29	1.8	44.804722	-95.580278
12	K32DR-D	LIC	LD	32	1.8	44.804722	-95.580278
13	K35DK-D	LIC	LD	35	1.8	44.804722	-95.580278
14	K40MC-D	LIC	LD	40	1.8	44.804722	-95.580278
15	K41MF-D	LIC	LD	41	1.8	44.804722	-95.580278
16	K45DJ-D	LIC	LD	45	1.8	44.804722	-95.580278
17	K49LV-D	LIC	LD	49	1.8	44.804722	-95.580278
18	KSMN	LIC	DT	15	200.0	43.897778	-95.947222
19	K27LB-D	CP	LD	27	2.0	44.383222	-97.010111
20	K38NI-D	CP	LD	38	2.0	44.383222	-97.010111
21	K42KO-D	CP	LD	42	2.0	44.383222	-97.010111
22	K45LV-D	CP	LD	45	2.0	44.383222	-97.010111
23	KWCM-TV	LIC	DT	10	50.0	45.167500	-96.000556

Table 1: Off-Air TV Stations within 75 Kilometers of Project Area

ID	Call Sign	Distance to Center of AOI (km)	Turbine Layout V100		Turbine Layout V117		Turbine Layout V126	
			Distance to Nearest Turbine (km)	Turbine ID	Distance to Nearest Turbine (km)	Turbine ID	Distance to Nearest Turbine (km)	Turbine ID
1	KRWF	50.38	47.60	54	48.12	31	47.29	39
2	K43MH-D	50.40	47.62	54	48.14	31	47.31	39
3	K40FZ	52.86	44.14	65	44.88	40	44.96	45

² Definitions of service and status codes:
DT – Digital television broadcast station
LD – Low power digital television broadcast station
LIC – Licensed and operational station
APP – Application for construction permit, not yet operational

³ ERP = Transmit Effective Radiated Power

4	K40FZ	52.87	44.15	65	44.89	40	44.96	45
5	K50DG-D	53.84	45.39	65	46.12	40	46.21	45
6	K14OL-D	58.73	54.06	22	54.20	31	52.63	25
7	K16CP-D	58.73	54.06	22	54.20	31	52.63	25
8	K21LF-D	58.73	54.06	22	54.20	31	52.63	25
9	K22DO-D	58.73	54.06	22	54.20	31	52.63	25
10	K24CS-D	58.73	54.06	22	54.20	31	52.63	25
11	K29JW-D	58.73	54.06	22	54.20	31	52.63	25
12	K32DR-D	58.73	54.06	22	54.20	31	52.63	25
13	K35DK-D	58.73	54.06	22	54.20	31	52.63	25
14	K40MC-D	58.73	54.06	22	54.20	31	52.63	25
15	K41MF-D	58.73	54.06	22	54.20	31	52.63	25
16	K45DJ-D	58.73	54.06	22	54.20	31	52.63	25
17	K49LV-D	58.73	54.06	22	54.20	31	52.63	25
18	KSMN	62.30	54.71	100	54.93	60	54.94	60
19	K27LB-D	71.11	62.08	65	62.82	40	62.88	45
20	K38NI-D	71.11	62.08	65	62.82	40	62.88	45
21	K42KO-D	71.11	62.08	65	62.82	40	62.88	45
22	K45LV-D	71.11	62.08	65	62.82	40	62.88	45
23	KWCM-TV	80.94	71.08	2	71.92	10	71.93	5

Table 2: Off-Air TV Stations with Respect to Project Turbines

3. Impact Assessment

The three full-power digital stations, KRWF, KSMN, and KWCM-TV, may have their reception disrupted in and around the Red Pine Wind Project. The areas primarily affected would include TV service locations within 10 kilometers of the wind energy project that have clear line-of-sight (LOS) to a proposed wind turbine but not to the respective station. After the wind turbines are installed, communities and homes in these locations may have degraded reception of these three stations. This is due to multipath interference caused by signal scattering as TV signals are reflected by the rotating wind turbine blades and mast.

However, based on the low number of full-power TV channels available in the immediate vicinity of the project area, it is unlikely that off-air television stations are the primary mode of television service for the local communities. TV cable service, where available, and direct broadcast satellite service (DBS) are more likely the dominant modes of service delivery.

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 stations mentioned above, especially those that would have line-of-sight to at least one wind turbine but not to a respective 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

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Web site:	www.comsearch.com

Appendix A

ID	Call Sign	Status	Service ⁴	Channel	Transmit ERP ⁵ (kW)	Latitude (NAD 27)	Longitude (NAD 27)	Distance to Center of AOI (km)
1	KRWF	LIC	DT	27	58.0	44.484167	-95.490833	50.38
2	K43MH-D	LIC	LD	43	5.5	44.484167	-95.490556	50.40
3	K40FZ	APP	LD	40	7.014	44.339472	-96.768556	52.86
4	K40FZ	LIC	TX	40	13.5	44.339444	-96.768611	52.87
5	K50DG-D	LIC	LD	50	4.5	44.300833	-96.766667	53.84
6	K14OL-D	LIC	LD	14	1.8	44.804722	-95.580278	58.73
7	K16CP-D	LIC	LD	16	1.8	44.804722	-95.580278	58.73
8	K21LF-D	LIC	LD	21	1.8	44.804722	-95.580278	58.73
9	K22DO-D	LIC	LD	22	1.7	44.804722	-95.580278	58.73
10	K24CS-D	LIC	LD	24	1.8	44.804722	-95.580278	58.73
11	K29JW-D	LIC	LD	29	1.8	44.804722	-95.580278	58.73
12	K32DR-D	LIC	LD	32	1.8	44.804722	-95.580278	58.73
13	K35DK-D	LIC	LD	35	1.8	44.804722	-95.580278	58.73
14	K40MC-D	LIC	LD	40	1.8	44.804722	-95.580278	58.73
15	K41MF-D	LIC	LD	41	1.8	44.804722	-95.580278	58.73
16	K45DJ-D	LIC	LD	45	1.8	44.804722	-95.580278	58.73
17	K49LV-D	LIC	LD	49	1.8	44.804722	-95.580278	58.73
18	KSMN	LIC	DT	15	200.0	43.897778	-95.947222	62.30
19	K27LB-D	CP	LD	27	2.0	44.383222	-97.010111	71.11
20	K38NI-D	CP	LD	38	2.0	44.383222	-97.010111	71.11
21	K42KO-D	CP	LD	42	2.0	44.383222	-97.010111	71.11
22	K45LV-D	CP	LD	45	2.0	44.383222	-97.010111	71.11
23	KWCM-TV	LIC	DT	10	50.0	45.167500	-96.000556	80.94
24	K21LK-D	CP	LD	21	2.0	43.949417	-96.909472	83.62
25	K30LV-D	CP	LD	30	2.0	43.949417	-96.909472	83.62
26	K33LR-D	CP	LD	33	2.0	43.949417	-96.909472	83.62
27	NEW	APP	LD	48	2.0	43.949417	-96.909472	83.62
28	K19KH-D	CP	LD	19	2.0	44.884917	-97.047917	88.30

⁴ Definitions of service and status codes :

TV – Analog television broadcast station
 DT – Digital television broadcast station
 DS – Digital special temporary authority (STA)
 LP – Low power analog television broadcast station
 LD – Low power digital television broadcast station
 CA – Class A analog television broadcast station
 DC – Class A digital television broadcast station
 TX – Translator station
 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

⁵ ERP = Transmit Effective Radiated Power

ID	Call Sign	Status	Service ⁴	Channel	Transmit ERP ⁵ (kW)	Latitude (NAD 27)	Longitude (NAD 27)	Distance to Center of AOI (km)
29	K20KZ-D	CP	LD	20	2.0	44.884917	-97.047917	88.30
30	K30LU-D	CP	LD	30	2.0	44.884917	-97.047917	88.30
31	K39LN-D	CP	LD	39	2.0	44.884917	-97.047917	88.30
32	K22KF-D	CP	LD	22	15.0	44.885000	-97.048056	88.32
33	K23LI-D	CP	LD	23	15.0	44.885000	-97.048056	88.32
34	KESD-TV	LIC	DT	8	15.0	44.337778	-97.228333	88.99
35	K35GR	APP	LD	35	6.76	44.487528	-97.238806	89.05
36	K35GR	LIC	TX	35	11.9	44.487500	-97.238889	89.06
37	K32DK-D	LIC	LD	32	2.28	44.865556	-97.105833	91.05
38	K42FI	APP	LD	42	6.516	44.871139	-97.109361	91.60
39	K42FI	LIC	TX	42	10.0	44.871111	-97.109444	91.61
40	K17BV-D	LIC	LD	17	0.398	44.549722	-94.966667	92.59
41	K19CV-D	LIC	LD	19	0.395	44.549722	-94.966667	92.59
42	K22KU-D	LIC	LD	22	0.39	44.549722	-94.966667	92.59
43	K25II-D	LIC	LD	25	0.387	44.549722	-94.966667	92.59
44	K28LL-D	LIC	LD	28	0.382	44.549722	-94.966667	92.59
45	K33LB-D	LIC	LD	33	0.375	44.549722	-94.966667	92.59
46	K36KW-D	LIC	LD	36	0.373	44.549722	-94.966667	92.59
47	K39CH-D	LIC	LD	39	0.369	44.549722	-94.966667	92.59
48	K46FY-D	LIC	LD	46	0.36	44.549722	-94.966667	92.59
49	K48GQ-D	LIC	LD	48	0.357	44.549722	-94.966667	92.59
50	K50KF-D	LIC	LD	50	0.354	44.549722	-94.966667	92.59
51	K17MA-D	CP	LD	17	1.0	43.631861	-95.761556	94.76
52	K27ML-D	CP	LD	27	1.0	43.631861	-95.761556	94.76
53	K42LR-D	CP	LD	42	1.0	43.631861	-95.761556	94.76
54	K50NJ-D	CP	LD	50	1.0	43.631861	-95.761556	94.76
55	K22HJ-D	LIC	LD	22	1.8	43.617222	-95.688889	98.21
56	K18IW-D	LIC	LD	18	3.0	43.752317	-96.885061	98.23
57	K31KU-D	LIC	LD	31	3.0	43.752317	-96.885061	98.23
58	K32JG-D	LIC	LD	32	3.0	43.752317	-96.885061	98.23
59	K32JG-D	CP	LD	32	3.0	43.751389	-96.889111	98.51
60	K18IW-D	CP	LD	18	3.0	43.751389	-96.889444	98.53
61	K31KU-D	CP	LD	31	3.0	43.751389	-96.889444	98.53
62	K18IR-D	LIC	LD	18	0.79	44.759167	-94.873056	105.11
63	K20JY-D	LIC	LD	20	0.79	44.759167	-94.873056	105.11
64	K23FP-D	LIC	LD	23	0.79	44.759167	-94.873056	105.11
65	K38LC-D	LIC	LD	38	0.79	44.759167	-94.873056	105.11
66	K47JE-D	APP	TX	47	2.04	44.759167	-94.873056	105.11
67	K47JE-D	LIC	LD	47	0.62	44.759167	-94.873056	105.11
68	K49AJ-D	LIC	LD	49	0.79	44.759167	-94.873056	105.11
69	K51AL-D	LIC	LD	51	0.79	44.759167	-94.873056	105.11
70	NEW	APP	LD	23	3.0	43.574722	-96.650556	105.52



ID	Call Sign	Status	Service ⁴	Channel	Transmit ERP ⁵ (kW)	Latitude (NAD 27)	Longitude (NAD 27)	Distance to Center of AOI (km)
71	KCSD-TV	LIC	DT	24	80.9	43.574444	-96.655278	105.70
72	K20LV-D	CP	LD	20	1.0	43.639583	-95.413722	105.88
73	K24KZ-D	CP	LD	24	1.0	43.639583	-95.413722	105.88
74	K44LS-D	CP	LD	44	1.0	43.639583	-95.413722	105.88
75	K20MB-D	CP MOD	LD	20	15.0	43.518611	-96.534667	108.06
76	KELO-TV	LIC	DT	11	30.0	43.518611	-96.534722	108.06
77	KSFY-TV	LIC	DT	13	22.7	43.518611	-96.534722	108.06
78	KDLT-TV	LIC	DT	47	1000.0	43.505000	-96.556111	110.03
79	KTTW	LIC	DT	7	7.5	43.505278	-96.571944	110.41
80	KWSD	LIC	DT	36	36.9	43.505278	-96.571944	110.41
81	K22KD-D	CP	LD	22	3.0	43.553889	-96.684722	108.75
82	K56GF	CP	LD	23	15.0	43.553889	-96.684722	108.75
83	K56GF	LIC	TX	56	10.1	43.553889	-96.684722	108.75
84	K04RR-D	CP	LD	4	3.0	43.538056	-96.713889	111.34
85	K06QJ-D	CP	LD	6	3.0	43.538056	-96.713889	111.34
86	KAUN-LP	LIC	TX	42	0.88	43.535556	-96.742778	112.60
87	KCWS-LP	LIC	TX	44	0.68	43.535556	-96.742778	112.60
88	KCPO-LP	LIC	TX	26	7.57	43.534167	-96.739167	112.61
89	K30FZ-D	LIC	LD	30	11.0	45.166111	-95.043889	117.06
90	K14LF-D	LIC	LD	14	0.475	45.166111	-95.043611	117.08
91	K15IS-D	CP	LD	15	0.4	45.166111	-95.043611	117.08
92	K17FA-D	LIC	LD	17	0.5	45.166111	-95.043611	117.08
93	K19IH-D	LIC	LD	19	0.55	45.166111	-95.043611	117.08
94	K28IF-D	LIC	LD	28	0.65	45.166111	-95.043611	117.08
95	K34HO-D	LIC	LD	34	0.65	45.166111	-95.043611	117.08
96	K39FE-D	LIC	LD	39	0.65	45.166111	-95.043611	117.08
97	K44AE-D	LIC	LD	44	0.7	45.166111	-95.043611	117.08
98	K46AC-D	LIC	LD	46	0.7	45.166111	-95.043611	117.08
99	K48AH-D	LIC	LD	48	0.55	45.166111	-95.043611	117.08
100	K50HZ-D	LIC	LD	50	0.54	45.166111	-95.043611	117.08
101	K43LX-D	LIC	LD	43	15.0	43.376667	-96.196111	118.77
102	K33NF-D	CP	LD	33	1.0	43.659861	-97.147083	119.80
103	K35LZ-D	CP	LD	35	1.0	43.659861	-97.147083	119.80
104	K38OZ-D	CP	LD	38	1.0	43.659861	-97.147083	119.80
105	K48OK-D	CP	LD	48	1.0	43.659861	-97.147083	119.80
106	K26JI-D	LIC	LD	26	14.0	43.402778	-95.670833	121.24
107	K14OP-D	CP	LD	14	1.0	45.340028	-97.071028	124.65
108	K25MD-D	CP	LD	25	1.0	45.340028	-97.071028	124.65
109	K32KJ-D	CP	LD	32	1.0	45.340028	-97.071028	124.65
110	K35KS-D	CP	LD	35	1.0	45.340028	-97.071028	124.65
111	K16CG-D	LIC	LD	16	1.8	44.107778	-94.598611	127.20
112	K20LP-D	LIC	LD	20	1.3	44.107778	-94.598611	127.20

ID	Call Sign	Status	Service ⁴	Channel	Transmit ERP ⁵ (kW)	Latitude (NAD 27)	Longitude (NAD 27)	Distance to Center of AOI (km)
113	K23MF-D	LIC	LD	23	1.3	44.107778	-94.598611	127.20
114	K24JV-D	LIC	LD	24	1.8	44.107778	-94.598611	127.20
115	K29IE-D	LIC	LD	29	3.0	44.107778	-94.598611	127.20
116	K31KV-D	LIC	LD	31	1.8	44.107778	-94.598611	127.20
117	K35KI-D	LIC	LD	35	1.8	44.107778	-94.598611	127.20
118	K40BU-D	LIC	LD	40	1.8	44.107778	-94.598611	127.20
119	K45LJ-D	LIC	LD	45	1.8	44.107778	-94.598611	127.20
120	K49HE-D	LIC	LD	49	3.0	44.107778	-94.598611	127.20
121	K23MF-D	CP	LD	51	3.0	44.107778	-94.598611	127.20
122	K14KE-D	LIC	LD	14	1.5	44.106944	-94.595556	127.46
123	K21DG-D	LIC	LD	21	2.0	44.106944	-94.595556	127.46
124	K26CS-D	LIC	LD	26	2.0	44.106944	-94.595556	127.46
125	K30FN-D	LIC	LD	30	12.0	44.106944	-94.595556	127.46
126	K32GX-D	LIC	LD	32	1.2	44.106944	-94.595556	127.46
127	K34JX-D	LIC	LD	34	2.0	44.106944	-94.595556	127.46
128	K38MY-D	LIC	LD	38	1.9	44.106944	-94.595556	127.46
129	K41IZ-D	LIC	LD	41	2.0	44.106944	-94.595556	127.46
130	K44AD-D	LIC	LD	44	2.0	44.106944	-94.595556	127.46
131	K58IZ-D	CP	LD	58	0.04	44.106944	-94.595556	127.46
132	KDLO-TV	LIC	DT	3	14.4	44.965556	-97.589444	129.97
133	K19HZ-D	LIC	LD	19	3.1	43.603333	-94.992500	130.09
134	K23FO-D	LIC	LD	23	3.1	43.603333	-94.992500	130.09
135	K30KQ-D	LIC	LD	30	2.1	43.603333	-94.992500	130.09
136	K35IZ-D	LIC	LD	35	3.1	43.603333	-94.992500	130.09
137	K36IV-D	LIC	LD	36	1.5	43.603333	-94.992500	130.09
138	K51KT-D	APP	LD	36	2.1	43.603333	-94.992500	130.09
139	K40LA-D	LIC	LD	40	2.1	43.603333	-94.992500	130.09
140	K41EG-D	LIC	LD	41	3.1	43.603333	-94.992500	130.09
141	K43MJ-D	LIC	LD	43	2.1	43.603333	-94.992500	130.09
142	K45EH-D	LIC	LD	45	3.1	43.603333	-94.992500	130.09
143	K50KL-D	LIC	LD	50	2.1	43.603333	-94.992500	130.09
144	K51KT-D	LIC	LD	51	3.1	43.603333	-94.992500	130.09
145	K33MW-D	CP	LD	33	2.0	43.661250	-94.853194	133.79
146	K39MD-D	CP	LD	39	2.0	43.661250	-94.853194	133.79
147	Q14A-D	CP	LD	14	1.0	43.703056	-97.547694	140.84
148	K30NS-D	CP	LD	30	1.0	43.703056	-97.547694	140.84
149	K40NS-D	CP	LD	40	1.0	43.703056	-97.547694	140.84
150	KEYC-TV	LIC	DT	12	52.7	43.937222	-94.411389	147.88
151	K43JE-D	LIC	LD	43	10.82	44.051528	-94.299722	151.91
152	KABY-TV	LIC	DT	9	19.4	45.106389	-97.899167	158.80

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

Appendix F

Phase I Cultural Literature Review

Red Pine Wind Project
Lincoln County, Minnesota

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Phase Ia Cultural Resources Literature Review

Red Pine Wind Project

Lincoln and Lyon Counties, Minnesota

Prepared for:

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Project Number: 0006243.00

Date: 03/01/2016

MANAGEMENT SUMMARY

Westwood Professional Services Inc. (Westwood) was retained by EDF Renewable Energy to conduct a Phase Ia Literature Search consisting of background and archival research for the Red Pine Wind Project located in Lincoln and Lyon Counties, MN. These investigations were conducted to determine: 1) if previously recorded archaeological sites or historic/architectural resources are located within the project area, and 2) the potential for unrecorded archaeological sites or historic/architectural resources. The review was conducted by an examination of materials available at the Office of the State Archaeologist, the MN State Historic Preservation Office (SHPO), the Minnesota Historical Society Library and others.

The project area is in SHPO Archaeological Region 2s (Prairie Lake South). Five previously identified archaeological sites and eight historic/architectural resources were identified within the project area with an additional 8 archaeological sites and 29 historic/architectural resources being identified in the one-mile buffer. Previously executed surveys were of limited scope and have not fully examined the project area for cultural resources.

Westwood recommends a Phase I Archaeological Reconnaissance Survey for locations that may be physically impacted by construction of the proposed project. An assessment of the potential visual impact of the proposed project on the National Register of Historic Places listed and eligible structures may be required should the project come under federal review.

It should also be noted that human burials related to the abandoned Island Lake Presbyterian Cemetery might still be present in the NE ¼ of Section 34, Township 111N, Range 43W. The cemetery should be field verified for its location. If grave markers are not present, this quarter section should be avoided by construction due to the possibility of unmarked burials.

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EXHIBIT

Exhibit 1: Project Location

1.0 INTRODUCTION

Westwood Professional Services Inc. (Westwood) was retained by EDF Renewable Energy to conduct a Phase Ia Cultural Resources Literature Review consisting of background and archival research for the Red Pine Wind Project in Lincoln and Lyon Counties, Minnesota. The literature review was conducted in support of preparation of a Large Wind Energy Conversion System Site Permit Application. Amanda Gronhvd of 10,000 Lakes Archaeology served as Principal Investigator for the project.

The proposed project and the one-mile buffer included in the study area is located in seven townships in Lincoln County, Minnesota and five townships in Lyon County, Minnesota (Exhibit 1). A listing of townships and sections included in the defined project boundary is provided in **Table 1-1** below.

County	Township Name	Township	Range	Section(s)
Lincoln	Marshfield	110	44	1-3
	Lake Stay	111	44	1-36
	Ash Lake	111	45	1-3, 10-15, 22-27, 34-36
	Limestone	112	44	1-36
	Royal	112	45	1-5, 9-16, 22-27, 34-36
	Alta Vista	113	44	30, 31-36
	Marble	113	45	25, 26, 34-36
Lyon	Lyons	T110	42	5-7
	Coon Creek	T110	43	1-6, 8-17, 20-23
	Lynd	111	42	18,19, 30-32
	Island Lake	T111	43	3-36
	Nordland	T112	43	7, 18-20, 29-34

2.0 SCOPE OF WORK

The Phase Ia Cultural Resources Literature Review was conducted to provide an inventory of previously recorded cultural resources within the project area. The area of consideration also included a one-mile buffer surrounding the entire project area. This was done to ascertain if any recorded resources located immediately adjacent to the project area might be either physically or visually impacted by the proposed work. The one-mile buffer also increased the area examined to give a better indication of possible site types that may be located within the project area. Furthermore, the literature review assisted in determining levels of previous

disturbance, the amount and degree of previous cultural resources work within the area, and the potential for unrecorded cultural resources.

3.0 METHODOLOGY

The project area was examined using background research and a literature review. The environmental background and historic contexts were examined to assess the probability of sites and what types of sites might be identified.

On February 17th, 2016, Westwood Cultural Resource Specialist Ryan P. Grohnke updated a previous review of the general project area by conducting a review of files at the Minnesota Office of the State Archaeologist (OSA) located at Fort Snelling in St. Paul, MN, and the Minnesota State Historic Preservation Office (SHPO) and the Minnesota Historical Society Library located at the Minnesota History Center in St. Paul, MN. Archaeological site and historic/architectural structure inventory files were examined to obtain a list of all previously recorded archaeological (historic and prehistoric) and historic/architectural resources within the project area. Archaeological reports for the county were reviewed to determine a listing of all surveys conducted within the project area. A request was also made by email to the Minnesota SHPO for a database search. Other documentary research sources used to identify potential cultural/historical resources in the area included county and township histories, historic contexts, environmental background, historic maps and atlases, the 1874 Historic Andreas Atlas, Trygg maps, Winchell's *Aborigines of Minnesota*, and historic maps.

4.0 RESULTS OF BACKGROUND INVESTIGATIONS

4.1 Environmental Background

According to the Minnesota Department of Natural Resources Ecological Classification System, the project area is within the Coteau Moraines subsection of the North Central Glaciated Plains Section of the Prairie Parkland Province. The project study area consists of gently rolling to sloping terrain. Most of the area has a mantle of glacial until overlying bedrock measuring 600 to 800 feet thick. Soils are predominantly well-drained loams (Minnesota DNR 2016).

Bison were the dominant large ungulates in the region through the Woodland period and until the mid-Nineteenth Century. White-tailed deer, elk, black and grizzly bears and gray wolves were also present in the prairie region of Minnesota during this time period. Aquatic and semi-aquatic mammals were present in wetlands, shallow lakes and riverine areas. Such species include muskrats, beaver, mink, otters, and raccoons. Wetlands, shallow lakes and rivers also supported large populations of waterfowl and fish. Waterfowl species included mallard, blue-winged teal, gadwalls, shovelers, redheads, canvas backs, scaups, ruddy ducks, Canada geese, snow geese and swans.

Sandhill cranes were also abundant on the prairie. Shallow lakes provided “a rich floral assemblage which includes such edible plants as water lilies and cattails. Wild rice was present. ...but it wasn’t extensive” (Anfinson 1990:147). Upland areas supplied floral resources such as ground plum and prairie turnip.

Several small lakes, ponds, and sloughs are present within the area. The most significant water body within the project area is the South Branch of the Yellow Medicine River. Multiple tributaries of the South Branch of the Yellow Medicine River, the Yellow Medicine River and Three Mile Creek dissect the landscape, generally flowing from west to east or southwest to northeast, with the water ultimately draining into the Minnesota River.

Presettlement vegetation consisted almost entirely of tallgrass prairie. Limited areas of wet prairies, marshes and sloughs, and river bottom forests could also be found in the project area (Marschner 1974). After Euro-American settlement, most of the original prairie was cultivated and used for farmland.

4.2 Cultural History

Minnesota SHPO has developed archaeological contexts for Minnesota and the Upper Midwest. These contexts are based on years of prehistoric and historic research in the region to examine Minnesota’s historic (Contact and Post-Contact) and prehistoric (Pre-contact) past. They are general descriptive interpretations of the history of Minnesota. They give basic observations of current theories relating to prehistoric and historic people from different locations throughout the history of Minnesota.

The Pre-Contact period is focused solely on Native American peoples before the arrival of Euro-Americans. This period is divided into four traditions: Paleoindian, Archaic, Woodland and Plains Village and Mississippian/Oneota. These traditions are defined by changes in technology and food sources exploited.

The cultural histories focused solely on the interaction of American Indians and Euro-Americans are divided into the Contact and Post-Contact periods. These contexts range from the first contact between Europeans and American Indians during European exploration in the region (Contact), through Euro-American settlement of traditionally American Indian lands (Post-contact).

PRE-CONTACT PERIOD

Paleoindian Tradition (12,000 to 8,000 Before Present [B.P.]

According to the most accepted theory, the first people to arrive in North America, the Paleoindians, crossed the Bering land bridge between Siberia and Alaska. When they arrived, approximately half of North America was covered by glacial ice. As the glaciers melted, the people moved south and eventually spread throughout the entirety of the Americas (Dobbs 1990). Pleistocene megafauna, such as mammoth and mastodon, roamed the land.

Paleoindian sites are relatively uncommon and difficult to locate by archaeologists due to buried deposits. The lack of stratified sites and the small number of artifacts from sites suggests that Paleoindian people lived in small, nomadic groups (Frison 1998).

Glacial meltwater created glacial lakes, including Lake Agassiz, and many other smaller glacial lakes. As these lakes drained, the water began to cut river valleys. Modern vegetation began to cover the region. The changing environment, and possibly human overkill, led to the extinction of several species of megafauna.

Paleoindians were small groups known best for hunting large megafauna including mammoth, mastodon, and *Bison antiquus* - an extinct bison up to one-third larger than modern bison (Frison 1998). By 11,000 years B.P. mammoth and other megafauna became extinct and Paleoindians shifted their hunting focus to bison, the next largest mammal (Frison 1998). Evidence also suggests that these people not only hunted megafauna and large mammals, but also exploited other food sources such as fish, berries, nuts, and small mammals (Tankersley 1998).

The earliest Paleoindian spearpoints are easily identified by a distinctive flute down both sides. During the middle of the Paleoindian period lanceolate, nonfluted points began to emerge. During the late Paleoindian periods we see a shift from fluted and lanceolate to exclusively lanceolate points.

The earliest of the fluted point style is known as the Clovis point, dating from 12,000 – 11,000 years B.P. (Justice 1987). The original Clovis point was recovered from the Blackwater Draw site and named after the nearby town of Clovis, New Mexico. The spearpoints from Blackwater Draw were found in direct association with late Pleistocene fauna including Columbian mammoth, horse, camel, bison, and saber-tooth cat (Dobbs 1990).

Following the Clovis point is the Folsom point, differentiated from Clovis by a decrease in length and an increase in the length of the flute. Dates of the Folsom Complex last from approximately 11,000 – 10,200 years B.P. (Hofman 1995). The Folsom point and type site is named after the city of Folsom, New Mexico, where a Folsom projectile point was recovered with the ribcage of the now extinct species of bison, *Bison antiquus* (Dobbs 1990).

The Late Paleoindian period generally begins toward the end of the Folsom Complex and lasts to the beginning of the Archaic Period. Late Paleoindian technology is marked by a change from the distinctive Folsom style. Lanceolate points vary greatly in style, but share the features of being nonfluted, unnotched, and finely flaked. They arrive in the archaeological record during the Folsom Complex and continue to the end of the Paleoindian Tradition (Dobbs 1990).

Archaic Tradition (8,000 to 2,800 B.P.)

Evidence suggests that Archaic people lived in small groups occupying seasonal camps, much like their Paleoindian predecessors (Jones et.al. 2003), although some research counters this belief, suggesting that community size increased and groups became more sedentary (Dobbs 1990). The major innovations differentiating the Archaic people from the Paleoindian people include a change in projectile point technology, the invention of groundstone tools, and a change in subsistence strategies. The Archaic Tradition is also noted for the development of regional differences (Anfinson 1987).

By 8,000 years B.P. the glacial ice sheet and Lake Agassiz had both receded into Canada. The post-Pleistocene climate change had become more stable, but still lacked the environmental stability of modern times. Fluctuating precipitation and temperature brought significant changes in the vegetation creating more specific biomes (Dobbs 1990).

By the beginning of the Archaic period the Pleistocene megafauna had long become extinct. This extinction promoted a shift towards a more effective, somewhat more localized hunting and gathering subsistence. Hunters now focused on bison, deer, and small mammals. Some archaeologists believe that Archaic people became more regionalized partly due to the major biomes. This regionalization allowed the people to perfect the exploitation of local raw material and food sources (Dobbs 1990).

The Archaic Tradition technology is marked by a change in projectile point manufacture. Projectile points shifted from lanceolate to notched and stemmed points and the flaking quality begins to diminish. Other innovations of the Archaic people is the appearance of groundstone tools created by friction from grinding,

polishing, and pecking igneous, and metamorphic rocks such as granite and basalt, and the emergent use of native copper (Anfinson 1987).

As with Paleoindian sites in Minnesota, Archaic sites are few and far between. Sites have likely been destroyed or buried by various natural geologic processes, making these sites more difficult to discover. As of 1990, of the few Archaic sites located, even fewer had been excavated, making it difficult to fully define the economies of the Archaic Tradition in Minnesota (Dobbs 1990).

Copper artifacts dating to the Archaic Tradition have been recovered throughout Minnesota. The use of copper begins approximately 7,000 years B.P. and persists until approximately 3,500 years B.P. The copper is found in large glacial drift nodules in the region and prehistoric copper mines have been located on Lake Superior's Isle Royale (Dobbs 1990).

Woodland Tradition (2,800 B.P. to European Contact)

The Woodland Tradition is generally divided into three periods throughout the Midwest. These periods are Early Woodland, Middle Woodland, and Late Woodland; although Anfinson (1987) has suggested a division of Initial Woodland and Terminal Woodland for Minnesota. Current research suggests that these divisions can be further divided into Brainerd, Southeast Minnesota Early Woodland, Havana Related, Laurel, Fox Lake, and Lake Benton.

The Woodland Tradition is marked by the emergence of ceramic pottery vessels and the appearance of earthen burial mounds. The multiple contexts describing the Woodland period are a result of increased regionalization of the Woodland people (Anfinson 1990).

By Approximately 5,000 years B.P. the climate shifted from dry and warm to moist and cool. This climatic shift led to a change in some areas of Minnesota. The prairie-forest margin that had moved into Wisconsin, at approximately 7,000 B.P, had moved west back out of Wisconsin and into Minnesota by 5,000 B.P. By approximately 3,000 years B.P., the forest in northern Minnesota had shifted over the border to North Dakota. Although some areas saw major changes, some areas appeared much the same by 3,000 B.P as they did at the time of arrival of European explorers (Anfinson 1990).

The Woodland people most certainly exploited similar food sources to their Archaic ancestors. Bison, deer, and small mammals were still a major food source. Plants, such as wild rice, were exploited more heavily than in previous times and there is evidence of cultivation of maize and squash (Dobbs 1990).

The primary technological advance during the Woodland Tradition is the advent of ceramic pottery. The original divisions of Early, Middle, and Late Woodland were differentiated by their technology. Ceramics during the Early Woodland period are normally thick and crude with cord-marked decoration on the exterior. Middle Woodland shows early evidence of earthen burial mounds. Late Woodland continues the tradition of ceramics and burial mounds, but ceramic decorations and styles become more regionalized (Anfinson 1990).

Plains Village & Mississippian/Oneota Traditions (1,100 B.P. to European Contact)

Significant changes in subsistence and settlement patterns characterize the Plains Village and Mississippian/Oneota cultures in Minnesota. The people of this period continued to manufacture ceramic vessels and construct earthen burial mounds. Populations became larger and even more regionalized than previous. These traditions last from the end of the Terminal Woodland Tradition to first contact with European explorers (Anfinson 1987).

Evidence suggests that the Plains Village Tradition developed out of the Woodland Tradition. The development of the Mississippian/Oneota Traditions are still unclear, possibly a development of people migrating from other areas to the Midwest. Another possibility is the regionalization of groups allowed a people to create distinctive ideas, and life-ways (Anfinson 1987).

The Plains Village and Mississippian/Oneota Traditions span through the time of the Little Ice age. The Little Ice Age is marked by cooler winter temperatures than current and slightly warmer summers. Vegetation at this time is approximately equivalent to the vegetation at the time of the first European Explorers (Dobbs 1990).

The Plains Village and Mississippian/Oneota would have focused heavily on bison for a food source. Corn horticulture intensified as people limited the number of different species of plants to exploit and as they became more regionalized. Perhaps the intensification of corn horticulture is a response to larger community size.

The site types assigned to the Plains Village and Oneota complexes are similar to the Woodland Tradition and the archaeological remains of these complexes range from cemeteries to small burials, limited use sites to extensive habitation sites. Site location is also consistent with the previous period and depends on numerous factors including the location of specific resources the people were using or the presence of a particular desirable environment.

CONTACT/POST CONTACT PERIOD (1630 to Present)

This period generally refers to the span of time extending from the first European explorations until intensive Euro-American settlement of the region. Minnesota's historical period began in 1673 when French explorers Marquette and Joliet discovered the upper portion of the Mississippi River. Ten years later, Catholic Missionary Father Louis Hennepin returned to France to write the first book about Minnesota, *Description de la Louisiane*, telling his story of exploring Minnesota and being held captive by the Dakota Indians.

The territory containing modern-day Minnesota was claimed by Spain, France, Great Britain, and eventually the United States. Lieutenant Zebulon Montgomery Pike led the first United States expedition through Minnesota in 1805. Fort St. Anthony (later Ft. Snelling) was completed between 1819 and 1824, and in 1836 the Wisconsin Territory including a portion of Minnesota, was formed. Minnesota became a territory in 1849 and achieved statehood on May 11, 1858. The fur trade drove much of the European exploration and settlement in Minnesota through the mid-1800s.

While the fur trade impacted the American Indian communities throughout all of Minnesota, European settlement in the area exploded after the 1860s. At that time, intensive settlement and agriculture dramatically transformed the landscape, displacing a large number of American Indians. In 1862, tensions between white settlers and American Indians exploded resulting in the Dakota Conflict.

As white settlers made Minnesota their home, farming became the predominant industry. Wheat was the cash crop, and mills spring up along major waterways across the state, notably in Minneapolis. Minnesota dominated the world in wheat processing until the 1930s.

In addition to milling, Minnesota was also a leader in lumbering and iron mining. Lumbering played a significant role in the development of northern Minnesota, with the industry peaking between 1899 and 1905, and iron mining began affecting the state's economy in 1884 when the Soudan Mine began shipping ore. The development of the Soudan Mine opened the Vermilion Iron Range, Minnesota's first of three iron ranges, and over the next two decades mines sprang up across the northern and central portions of the state. The Mesabi, Cuyuna, and Vermilion Iron Ranges employed thousands of people and brought millions of dollars into Minnesota's economy.

In Southern Minnesota this period is marked by an agricultural economy. Railroads built lines across the region to transport goods to and from major markets like Minneapolis/St. Paul, Chicago and Sioux City.

Possible archaeological site types associated with this period are generally consistent with those of earlier periods, but the influence of European and Euro-American traders, missionaries, settlers, and industries affected the locations of these sites. This period also includes the settlement patterns, subsistence activities, and economic strategies employed by Euro-American immigrants beginning in the mid-19th century. Associated archaeological and historic site types categorized in the Contact/Post-Contact period include standing structures as well as archaeological sites.

History of Lincoln County

Joseph H. Nicollet and John C. Fremont were the first European explorers to make a record of the area now known as Lincoln County. The expedition took place in 1838. Nicollet and Fremont were commissioned to lead a group of scientists to explore the region between the Missouri and Mississippi rivers.

This region of Minnesota was occupied by the Dakota Indians until the land was relinquished to the United States government under the 1851 Traverse De Sioux and Mendota treaties. During the summer of 1862 a few settlers built houses and began cultivating land around Lake Benton. Burned remnants of these early settlements were discovered during the late 1860's. While it is speculated that the 1862 Dakota Conflict may have been responsible, the fate of the occupants is unknown.

The county was officially established in 1873 and named in honor of Abraham Lincoln. Many of the early settlers were of Norwegian, Danish and Icelandic descent. The original county seat was established in Marshfield, but as the city had no courthouse people began to move to the towns of Tyler and Lake Benton. The county seat was then moved to Lake Benton, where the railroad had donated land for a courthouse. In 1901, landowners from Ivanhoe donated land for a courthouse and an election was held calling for the county seat to be moved to Ivanhoe. Following the questionable election and lengthy court battles, the county seat was moved from Lake Benton to Ivanhoe in 1904 (Lincoln County 2010).

History of Lyon County

Like Lincoln County, the Dakota Indians had occupied the area that is now Lyon County for many years, until the land was relinquished to the United States government under the 1851 Traverse De Sioux and Mendota treaties. The first

known Euro-American to live in the county was the American Fur Company trader, Joseph LaFramboise. Beginning in 1835, LaFramboise lived with his family in what is now Lyon County for two years while trading with the Native Americans. Previous to this, other Euro-Americans had possibly explored or travelled through the region, but no records of prior settlement exist.

Although there was additional short lived settlement in the county in the mid to late 1850's, and then in the mid 1860's following the Dakota Conflict, there was no permanent Euro-American settlement until 1867 when several homes were constructed near the Redwood River. The county was established formally in 1869. It was named Lyon to honor General Nathaniel Lyon who was the first Union General to die during the Civil War. County business was originally conducted in Upper Lynd until 1874 when the county seat was established in Marshall (Rose 1912).

5.0 LITERATURE REVIEW

The literature review was conducted at the OSA, the Minnesota SHPO and the Minnesota Historical Society Library. Additional resources examined included county and township histories, historic contexts, environmental background, historic maps and atlases, the 1874 Historic Andreas Atlas, Trygg maps, Winchell's *Aborigines of Minnesota*, and various online sources. Established or platted cemeteries were not investigated as part of this research; however, information on abandoned and possibly unmarked or unrecorded cemeteries was investigated when feasible.

5.1 Archaeological Region

The project area is located in the Prairie Lake South (2s) Archaeological Region of Minnesota as defined by Anfinson (1990). The majority of prehistoric sites in this part of the region are expected to be located near water, with base camps near the woods of more substantial lakes and rivers, temporary camps near any water source, and winter camps in large river valleys. Resource procurement sites are most common near water, but could also be found in upland areas.

5.2 Previous Surveys

A review of previous survey reports at the Minnesota SHPO indicated that five previous archaeological field surveys and a literature review have been conducted within the project area.

Archaeological Field Services, Inc. (AFS) performed a survey of a small portion of the project area in 1979 for the Bureau of Land Management (AFS 1980). The only portion of the project area investigated in the course of that survey was the island in

Island Lake in Section 34 of Township 111N, Range 43W. Site 21LY0006 was identified during the AFS investigations.

AFS also conducted additional limited linear portions of the project area in 1980 for the proposed Northern Border Pipeline (Hudak 1980). Site 21LY0072 was identified during that investigation.

The project area was included in a literature review of the general region. This review was detailed in *Cultural Resources Literature Search and Records Review of the Upper Minnesota River Subbasin, Southwestern Minnesota and Northeastern South Dakota*. The report was prepared for the Department of the Army, Corps of Engineers in 1980.

The MN DNR conducted investigations of a two acre parcel of land on the southeastern shoreline of Goose Lake in 1997 (Skaar 1997). The Goose Lake project area was in the NE ¼ of Section 32, Township 111N, Range 43W. No cultural resources were identified during the DNR investigations.

The Archeology Laboratory at Augustana College surveyed a limited portion of the project area in 2009 for a proposed fiber optic project (Buhta and Kruse 2009). Site 21LY0129 was identified during the Archeology Laboratory's investigations.

A linear survey was performed in a limited location within the project area in 2013 by HDR Engineering (Eigenberger 2013) for Brookings Substation to Lyon Substation Segment of the CapX2020 transmission line. Site 21LN0076 was identified during this survey.

5.3 Archaeological Resources

A review of records at the Minnesota SHPO and OSA indicated that 13 previously recorded archaeological sites have been identified within the study area that includes the project area and a one-mile buffer (Exhibit 1). Five of the previously recorded archaeological sites are located within the project area and the additional eight sites are located within the one-mile buffer. Site 21LYb is an alpha site. An alpha site is a reported, but unverified archaeological site. This site was identified through either an informant's report, but has not yet been verified by a professional archaeologist. All of the 13 sites are prehistoric and artifact scatters, lithic scatters, or single artifact finds. None of these sites have been listed or evaluated as eligible for listing on the National Register of Historic Places (NRHP), although it is possible that not all of the sites have yet been evaluated. The list of recorded archaeological sites is summarized in Table 5-1.

Table 5-1: Previously Recorded Archaeological Sites				
Site Number	Site Name	Site Type	Location	Project/Buffer
21LN0016	None	Single Artifact	T113N, R44W, Sec. 32	Buffer
21LN0027	Arco Site	Lithic Scatter	T111N, R44W, Sec. 31	Buffer
21LN0042	Stay Lake Access Site I	Artifact Scatter	T111N, R44W, Sec. 29	Buffer
21LN0043	Stay Lake Access Site II	Lithic Scatter	T111N, R44W, Sec. 29	Buffer
21LN0044	Stay Lake Access Site III	Lithic Scatter	T111N, R44W, Sec. 29	Buffer
21LN0076	None	Lithic Scatter	T112N, R45W, Sec. 1	Project
21LN0077	Stay Lake AMA	Lithic Scatter	T111N, R44W, Sec. 29	Buffer
21LY0006	Island Lake Island	Artifact Scatter	T111N, R43W, Sec. 34	Project
21LY0033	Wilmes	Single Artifact	T110N, R43W, Sec. 16	Project
21LY0072	Wood Lake	Lithic Scatter	T110N, R43W, Sec. 9	Project
21LY0110	None	Artifact Scatter	T110N, R43W, Sec. 8	Buffer
21LY0129	None	Single Artifact	T110N, R43W, Sec. 4	Project
21LYb	Bukhardt/Claeys	Lithic Scatter	T110N, R43W, Sec. 21	Buffer

Key: Site Number = site designation applied by State Archaeologist; Site Name = name given to site; Site Type = defined site use type; Location = amended legal description of recorded property; Project/Buffer = location of site within defined project area (Project) or within a one-mile buffer (Buffer).

5.4 Architectural Resources

A review of records at the Minnesota SHPO indicated that eight historic/architectural resources have been previously inventoried within the project area. An additional 29 historic/architectural resources have been previously inventoried within the associated one-mile buffer. Two of these resources have been listed or evaluated as eligible for listing on the NRHP, although it is possible that some of the other resources have yet been evaluated (Exhibit 1). The Ivanhoe Creamery (Inventory Number LN-IVC-012) in the City of Ivanhoe is certified as eligible for listing on the NRHP. The Lincoln County Courthouse and Jail (Inventory Number LN-IVC-016), also in the City of Ivanhoe, is listed on the NRHP. The list of recorded Historic/Architectural resources is summarized in Table 5-2.

Table 5-2: Previously Recorded Historic/Architectural Resources			
SHPO Number	Description	Location	Project/Buffer
LN-ARC-001	Bethany Lutheran Church	T111N, R44W, Sec. 31	Buffer
LN-ARC-002	German Lutheran Church	T111N, R44W, Sec. 31	Buffer
LN-ARC-003	Arco Creamery	T111N, R44W, Sec. 31	Buffer
LN-ARC-004	Arco School	T111N, R44W, Sec. 31	Buffer
LN-ARC-005	Commercial building	T111N, R44W, Sec. 31	Buffer
LN-ARC-006	House	T111N, R44W, Sec. 31	Buffer
LN-ARC-007	Pedersen Filling Station	T111N, R44W, Sec. 31	Buffer
LN-IVC-001	Geo Graff House	T112N, R45W, Sec. 34	Buffer
LN-IVC-002	House	T112N, R45W, Sec. 34	Buffer
LN-IVC-003	House	T112N, R45W, Sec. 34	Buffer
LN-IVC-004	House	T112N, R45W, Sec. 34	Buffer
LN-IVC-005	School	T112N, R45W, Sec. 34	Buffer
LN-IVC-006	House	T111N, R45W, Sec. 3	Buffer
LN-IVC-007	House	T111N, R45W, Sec. 3	Buffer
LN-IVC-008	House	T112N, R45W, Sec. 34	Buffer
LN-IVC-009	House	T112N, R45W, Sec. 34	Buffer
LN-IVC-010	Ivanhoe Methodist Church	T112N, R45W, Sec. 34	Buffer
LN-IVC-011	Bandstand	T112N, R45W, Sec. 34	Buffer
LN-IVC-012	Ivanhoe Creamery	T112N, R45W, Sec. 34	Buffer
LN-IVC-013	Commercial building	T112N, R45W, Sec. 34	Buffer
LN-IVC-014	Commercial building	T112N, R45W, Sec. 34	Buffer
LN-IVC-015	Funeral Home	T112N, R45W, Sec. 34	Buffer
LN-IVC-016	Lincoln County Courthouse and Jail	T112N, R45W, Sec. 34	Buffer
LN-LST-001	ACO Silo	T111N, R44W, Sec. 10	Project
LN-LST-002	school	T111N, R44W, Sec. 4	Project

Table 5-2: Previously Recorded Historic/Architectural Resources			
SHPO Number	Description	Location	Project/Buffer
LN-LMS-001	church	T112N, R44W, Sec. 20	Project
LN-LMS-002	school	T112N, R44W, Sec. 29	Project
LN-LMS-003	Ivanhoe Depot (moved)	T112N, R44W, Sec. 19	Project
LN-ROY-001	St. John Cantius Catholic Church	T112N, R45W, Sec. 23	Buffer
LN-ROY-003	Bridge 7245	T112N, R45W, Sec. 22	Buffer
LY-CCT-002	farmhouse	T110N, R43W, Sec. 15	Buffer
LY-CCT-004	Bridge 42517	T110N, R43W, Sec. 16	Buffer
LY-ILK-001	Zion Lutheran Church	T111N, R43W, Sec. 28	Project
LY-ILK-002	school	T111N, R43W, Sec. 29	Project
LY-ILK-003	Bridge 42514	T111N, R43W, Sec. 5	Project
LY-LDT-001	O.C. Gregg Retirement Home	T111N, R42W, Sec. 30	Buffer
LY-NRD-002	Peterson Cabin	T112N, R43W, Sec. 29	Buffer

Key: SHPO Number = inventory number for recorded property in SHPO files; Description = name of historic structure or description of type of structure; Location = amended legal description of recorded property; Project Area / Buffer = denotes if listed site is within the defined project area or within the one-mile buffer.

Just outside of the one-mile buffer (between 1 and 1.5 miles from the project area) is the Camden State Park CCC/WPA/Rustic Style Historic District (Exhibit 1). This resource is of special note as it is listed on the NRHP. With 13 NRHP contributing resources, it is considered historically significant under Criteria A (are associated with events that have made a significant contribution to the broad patterns of our history) for its place in the state park system providing recreation to western Minnesota. Also, it is significant under Criteria C (embody the distinctive characteristics of a type, period, or method of construction, or represent the work of a master; or possess high artistic values, or represent a significant concentration of resources whose individual components are united historically by function or plan) for planning by the National Park Service to use the topography of the river to determine the “various functional areas in the park” (MHS 2016).

5.5 Additional Sources

Various other archival resources were also investigated to determine the potential for unrecorded archaeological or historic resources within the project area. *An*

Illustrated Historical Atlas of Minnesota (Andreas 1874) indicates the Island Lake Post Office was located in the NE ¼ of Section 34, Township 111N, Range 43W. This atlas shows multiple lakes that have been drained and rivers/creeks that have been rerouted over the last century. Also present in the Andreas Atlas is a road in Sections 25 and 26 of T111N, R45W, Sections 28-30 and 34-36 of T111N, R44W, Sections 33-36 of T111N, R43W, and Sections 5-7 of T110N, R43W.

The possible cultural resources evident on the Trygg maps (1969) include the Big Stone Lake to Yankton road that is in the same location as the road indicated on the Andreas Atlas. Trygg also shows a “house and breaking” in Section 32 of T113N, R44W and a railroad survey in section 11-13 of T110N, R43W.

A review of historic plat maps, specifically Lincoln County in 1898 (Northwest Publishing Co. 1898) and Lyon County in 1902 (Northwest Publishing Co. 1902) show multiple structures throughout the project area, generally associated with Euro-American settlement. These structures are primarily farmsteads (homes and outbuildings), but the occasional church and school are also found in the area.

According to the website of the Prairieland Genealogical Society (2009), the Island Lake Presbyterian Cemetery, dated to 1892, once existed in the NE ¼ of Section 34, Township 111N, Range 43W (Exhibit 1). While the Prairieland Genealogical Society lists the cemetery as abandoned and desecrated (possibly implying destruction) the potential for unmarked yet extant human remains exists.

6.0 SUMMARY AND RECOMMENDATIONS

The literature review identified 13 archaeological sites within one-mile of the project area, of which five were located in the defined boundaries of the project area. In addition, 37 historic/architectural resources were identified within one-mile of the project area, of which eight were located in the defined boundaries of the project area. The few surveys that have been conducted in the project area to date have only investigated small parcels of land, or were limited in scope.

Upon review of the archaeological sites and survey data compiled for the defined project area, Westwood concludes that the paucity of recorded archaeological sites within the project area are not necessarily indicative of a lack of cultural resources in the area, but instead may reflect the lack of survey coverage. The project area has a moderate to high potential for cultural resources due to the multiple water sources that have existed in the county, as well as this region being an area traditionally occupied by the Dakota people. Westwood recommends a Phase I Archaeological Reconnaissance Survey for locations that may be physically impacted by construction of the proposed project. An assessment of the potential visual impact of the

proposed project on the NRHP listed and eligible resources, the Ivanhoe Creamery (Inventory Number LN-IVC-012), the Lincoln County Courthouse and Jail, and the Camden State Park CCC/WPA/Rustic Style Historic District may be required should the project come under federal review.

Human burials related to the abandoned Island Lake Presbyterian Cemetery may still be present in the NE ¼ of Section 34, Township 111N, Range 43W. The cemetery should be field verified for its location. If grave markers are not present, this quarter section should be avoided by construction due to the possibility of unmarked burials.

Should the project be deemed a Federal Undertaking (requiring a Federal permit, license, or approval; being located on federally owned or managed land; or receiving Federal financial assistance) a cultural resources survey would most likely be mandated. The scope of required cultural resource investigations would then be determined by the functioning Federal lead agency in cooperation with the State Historic Preservation Office (SHPO) and pertinent Tribal Historic Preservation Offices (THPO) as defined in both Section 101 of the National Environmental Policy Act of 1969 (NEPA) and Section 106 of the National Historic Preservation Act of 1966 (as amended) (NHPA).

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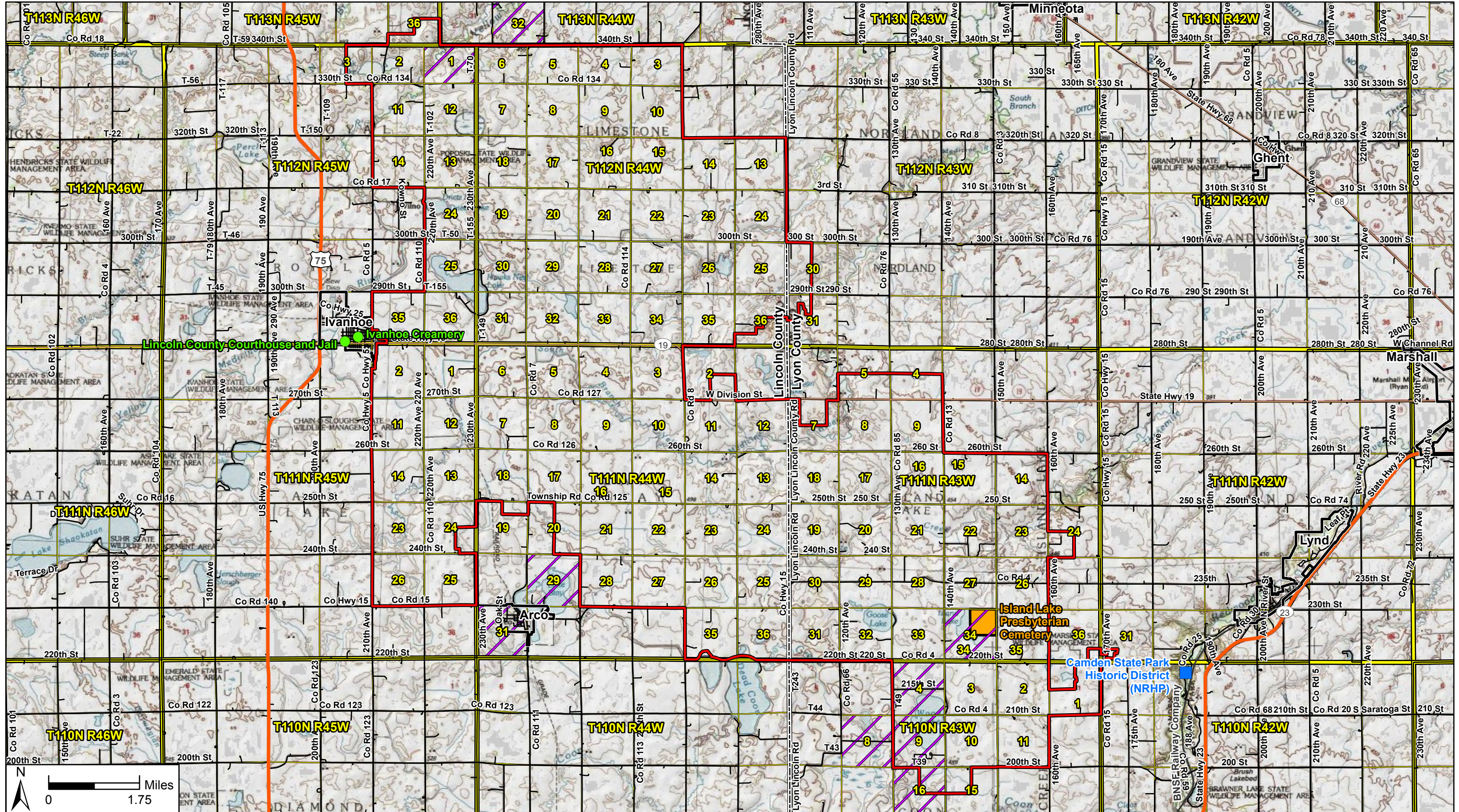
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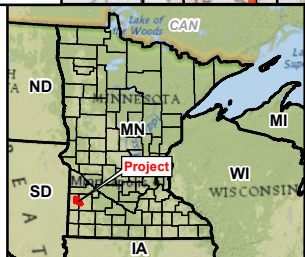
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Westwood
 Toll Free (888) 937-5150 westwoodps.com
 Westwood Professional Services, Inc.



Legend

- Proposed Turbine
- Current Project Boundary
- Municipal Boundary
- County Boundary
- PLS Township Boundary
- PLS Section Boundary
- Highway
- Major Road
- Minor Road
- Railroad
- Camden State Park Historic District (NRHP)
- NRHP Listed or Eligible Historic Structure
- Potential Location of Abandoned Cemetery
- PLS Section with Archaeological Site(s)

Note: Due to the sensitive nature of archaeological resources, locations have been generalized to section level.

Red Pine Wind Project

Lincoln & Lyon Counties, Minnesota

Project Location

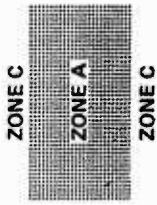
Appendix G

FEMA Floodplain Panels

Red Pine Wind Project
Lincoln County, Minnesota

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KEY TO MAP



ZONE DESIGNATIONS*

Base Flood Elevation Line with elevation in feet
 Base Flood Elevation where uniform within zone
 Elevation Reference Mark
 River Mile

573
 (EL 987)
 RM7 X
 +MT.5

*EXPLANATION OF ZONE DESIGNATIONS

A flood insurance map displays the zone designations for a community according to designated flood hazards. The zone designations used by FEMA are:

- EXPLANATION**
- A** Areas of 100-year flood base flood elevations and flood hazard factors not determined
 - AO** Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet, average depth of inundation not shown, but the flood hazard factors are determined
 - AH** Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet, base flood elevations are shown, but the flood hazard factors are determined
 - A1-A30** Areas of 100-year flood, base flood elevations and flood hazard factors determined
 - A99** Areas of 100-year flood to be protected by flood protection system under construction, base flood elevations and flood hazard factors not determined
 - B** Areas between limits of the 100-year flood and 500-year flood, or certain areas subject to 100-year flooding with average depths less than one (1) foot or where the contributing drainage area is less than one square mile, or areas protected by levees from the base flood (Medium shading)
 - C** Areas of minimal flooding (No shading)
 - D** Areas of undetermined, but possible flood hazard
 - V** Areas of 100-year coastal flood with velocity (wave action), base flood elevations and flood hazard factors not determined
 - V1-V30** Areas of 100-year coastal flood with velocity (wave action), base flood elevations and flood hazard factors determined

NOTES TO USER

Certain areas not in the special flood hazard areas (zones A and V) may be protected by flood control structures.

This map is for flood insurance purposes only. It does not necessarily show all areas subject to flooding in the community or all potential features outside special flood hazard areas.

To determine if flood insurance is available in this community contact your insurance agent or call the National Flood Insurance Program at (800) 638-4426.

INITIAL IDENTIFICATION: JUNE 10, 1977
 FLOOD HAZARD BOUNDARY MAP REVISIONS:
 FLOOD INSURANCE RATE MAP EFFECTIVE: JULY 3, 1985
 FLOOD INSURANCE RATE MAP REVISIONS:

FEDERAL EMERGENCY MANAGEMENT AGENCY

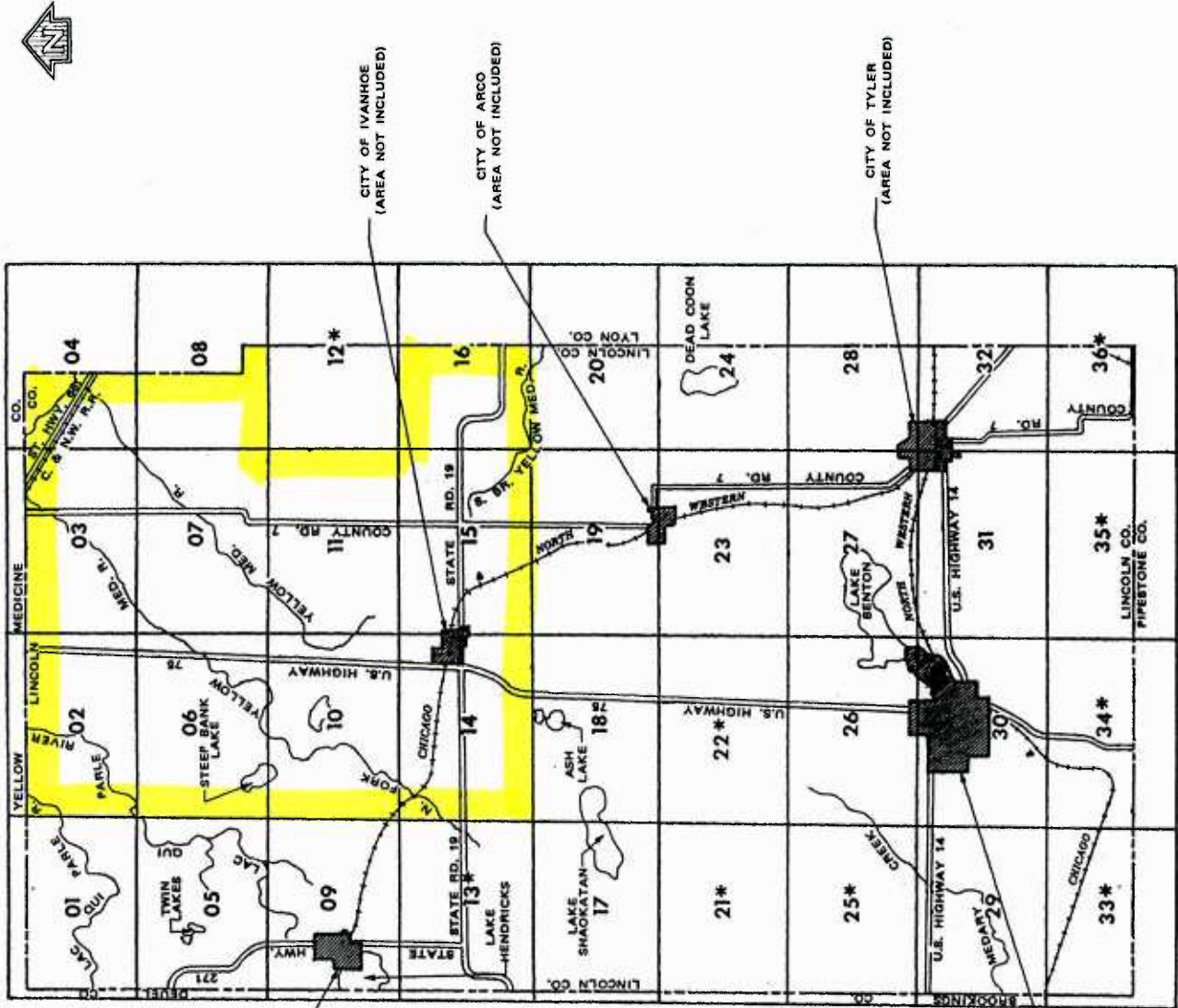


FIRM

**FLOOD INSURANCE RATE MAP 01-36
 MAP INDEX**

LINCOLN CO., MN
 (UNINC. AREAS)

COMMUNITY NUMBER 270665 B



CITY OF HENDRICKS
 (AREA NOT INCLUDED)

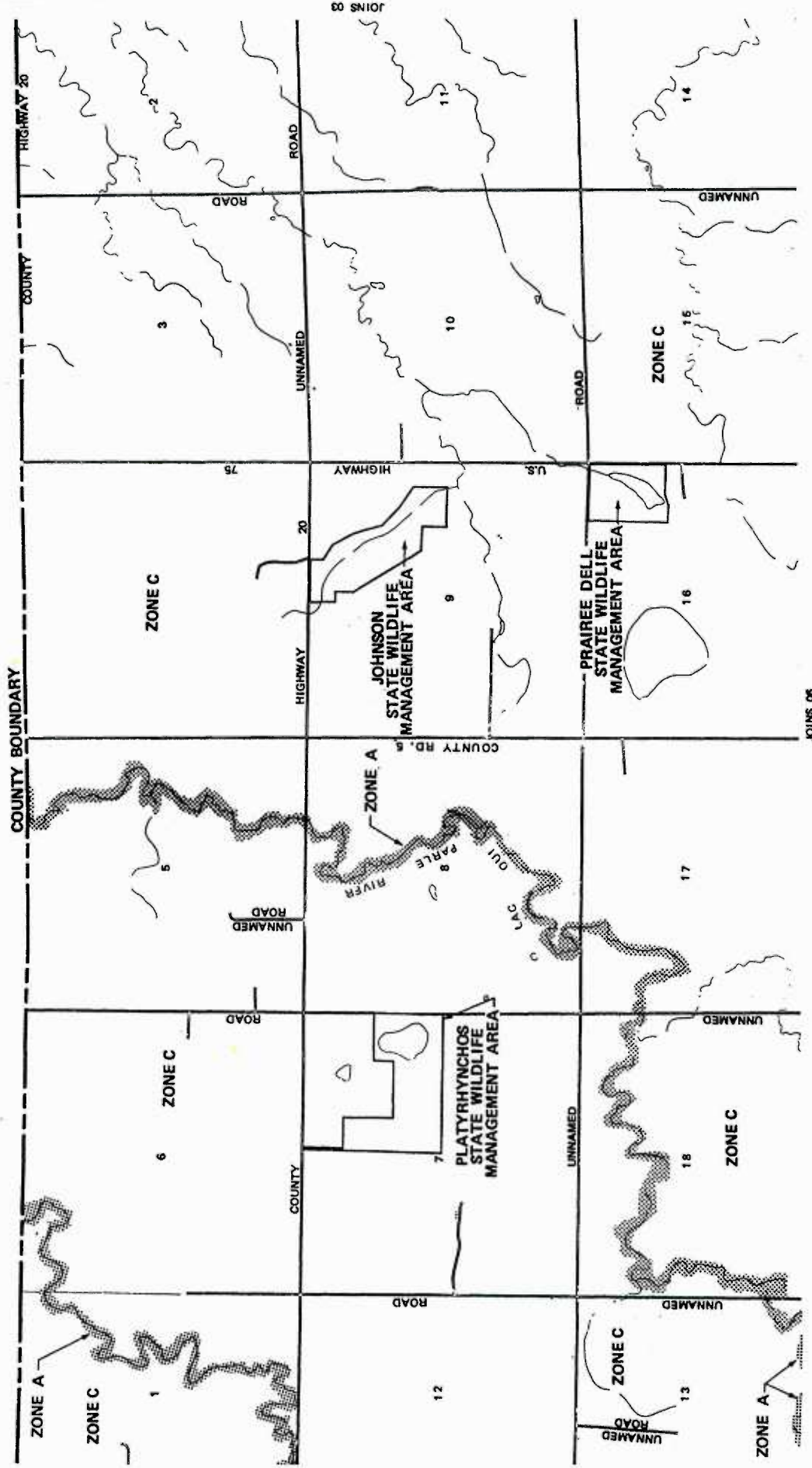
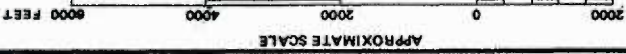
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CITY OF ARCO
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CITY OF TYLER
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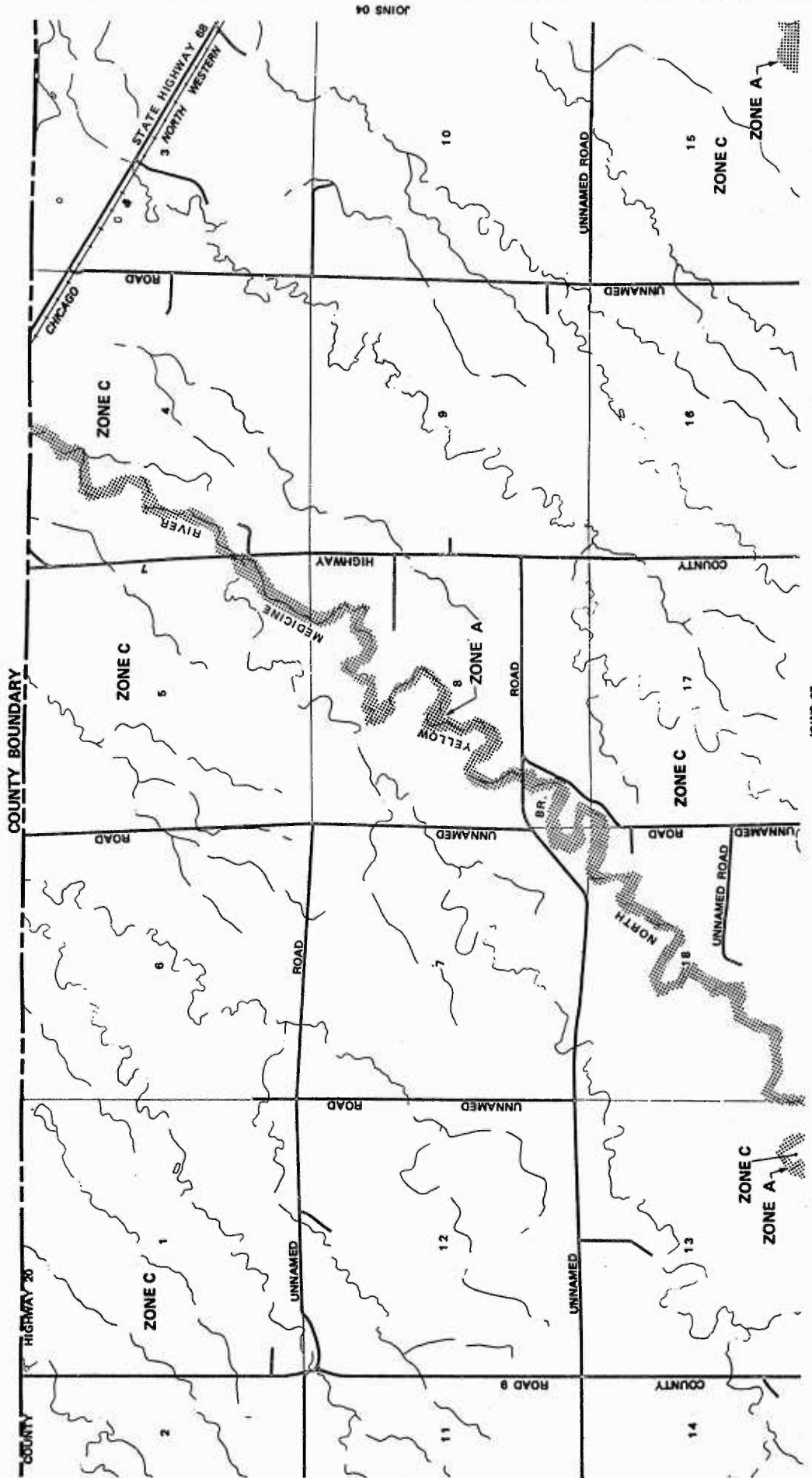
CITY OF LAKE BENTON
 (AREA NOT INCLUDED)

*NOT PRINTED



JOINS 06

MAP 2



JOINS 02

JOINS 07

JOINS 04

COUNTY BOUNDARY

HIGHWAY 20

COUNTY

ZONE C

ZONE C

ZONE C

ROAD

UNNAMED ROAD

ROAD 9

COUNTY

UNNAMED ROAD

UNNAMED ROAD

ROAD

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UNNAMED ROAD

STATE HIGHWAY 88

CHICAGO RIVER

MEDICINE RIVER

YELLOW RIVER

NORTH BR.

UNNAMED ROAD

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UNNAMED ROAD

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ROAD 9

COUNTY

UNNAMED ROAD

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STATE HIGHWAY 88

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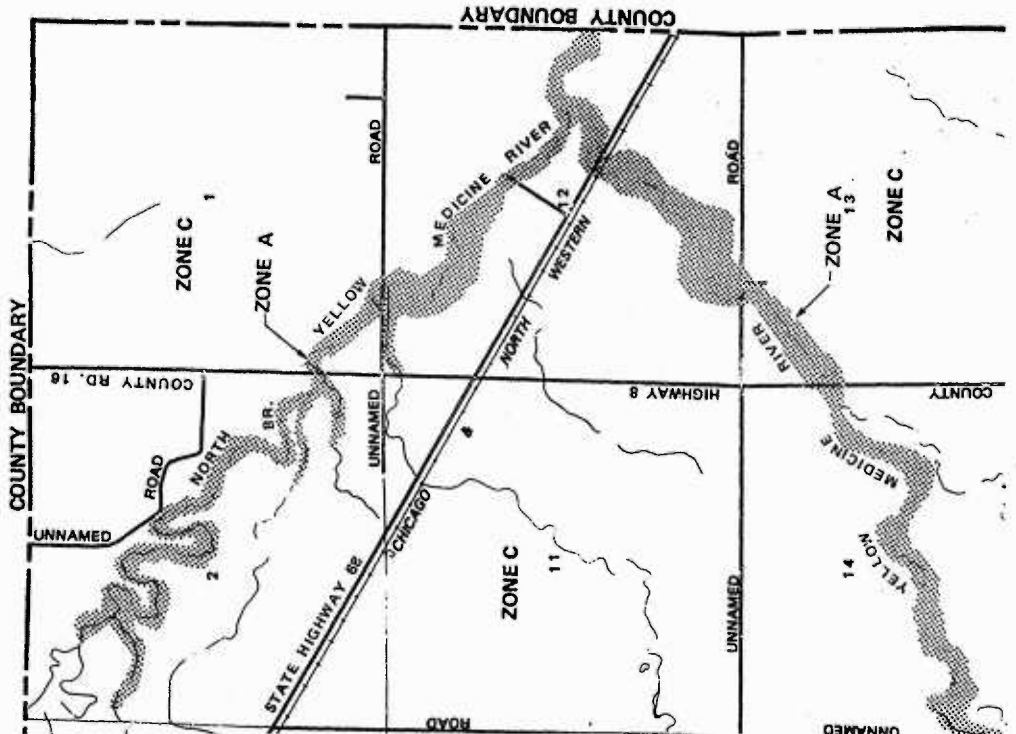
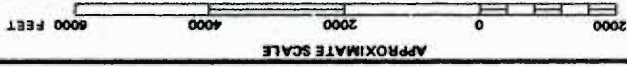
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FLOOD INSURANCE RATE MAP
COMMUNITY NUMBER 270653

LINCOLN CO., MN
(UNINC. AREAS)

FEDERAL EMERGENCY MANAGEMENT AGENCY

MAP 04

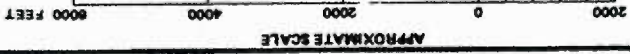


JOINS 08

MAP 4

EFFECTIVE DATE
JULY 3, 1985

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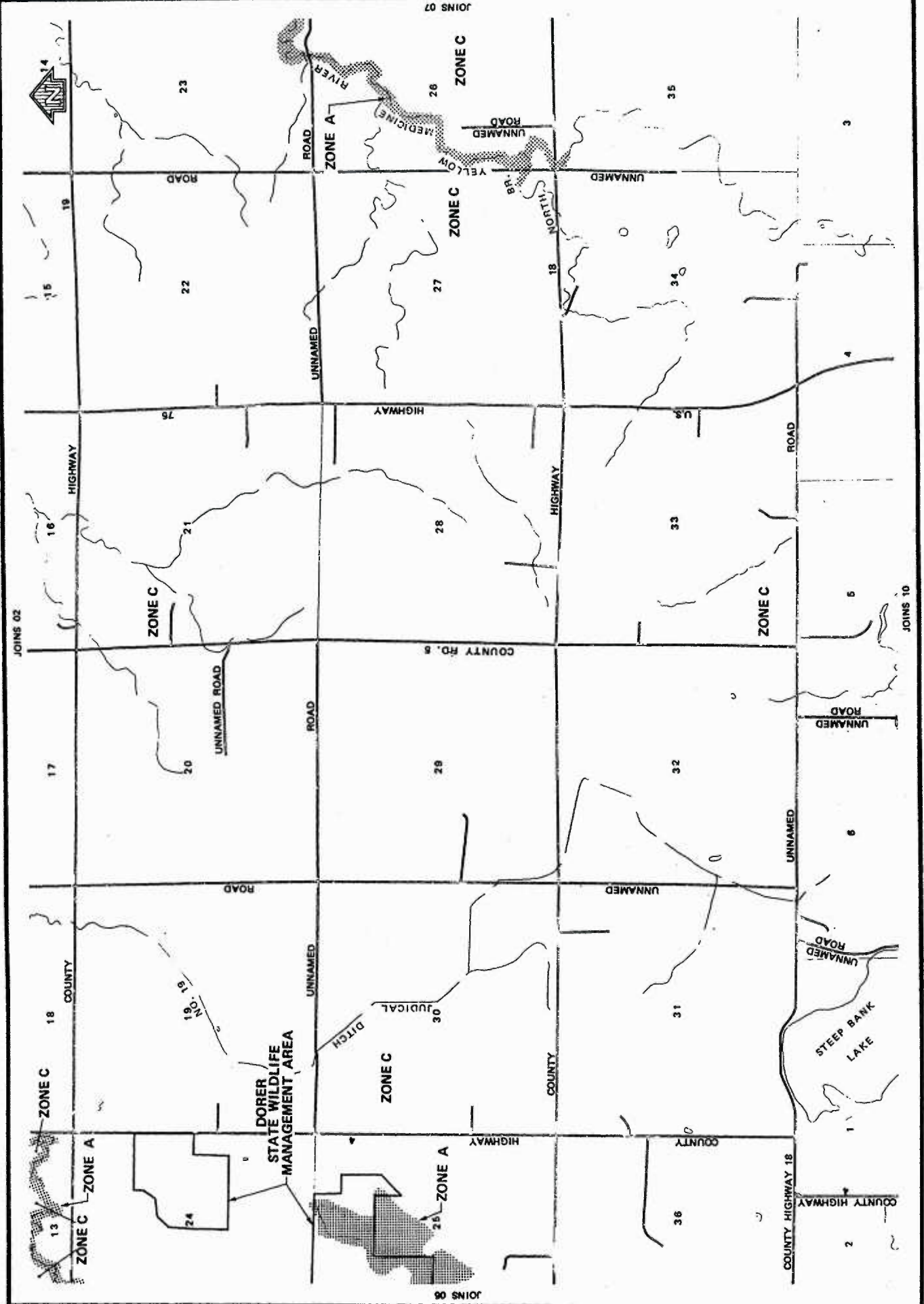


FEDERAL EMERGENCY MANAGEMENT AGENCY

(LINCOLN CO., MN
UNINC. AREAS)

MAP 06

MAP C



JOINS 02

JOINS 10

JOINS 08

JOINS 07

MAP 7

M

FEDERAL EMERGENCY MANAGEMENT AGENCY

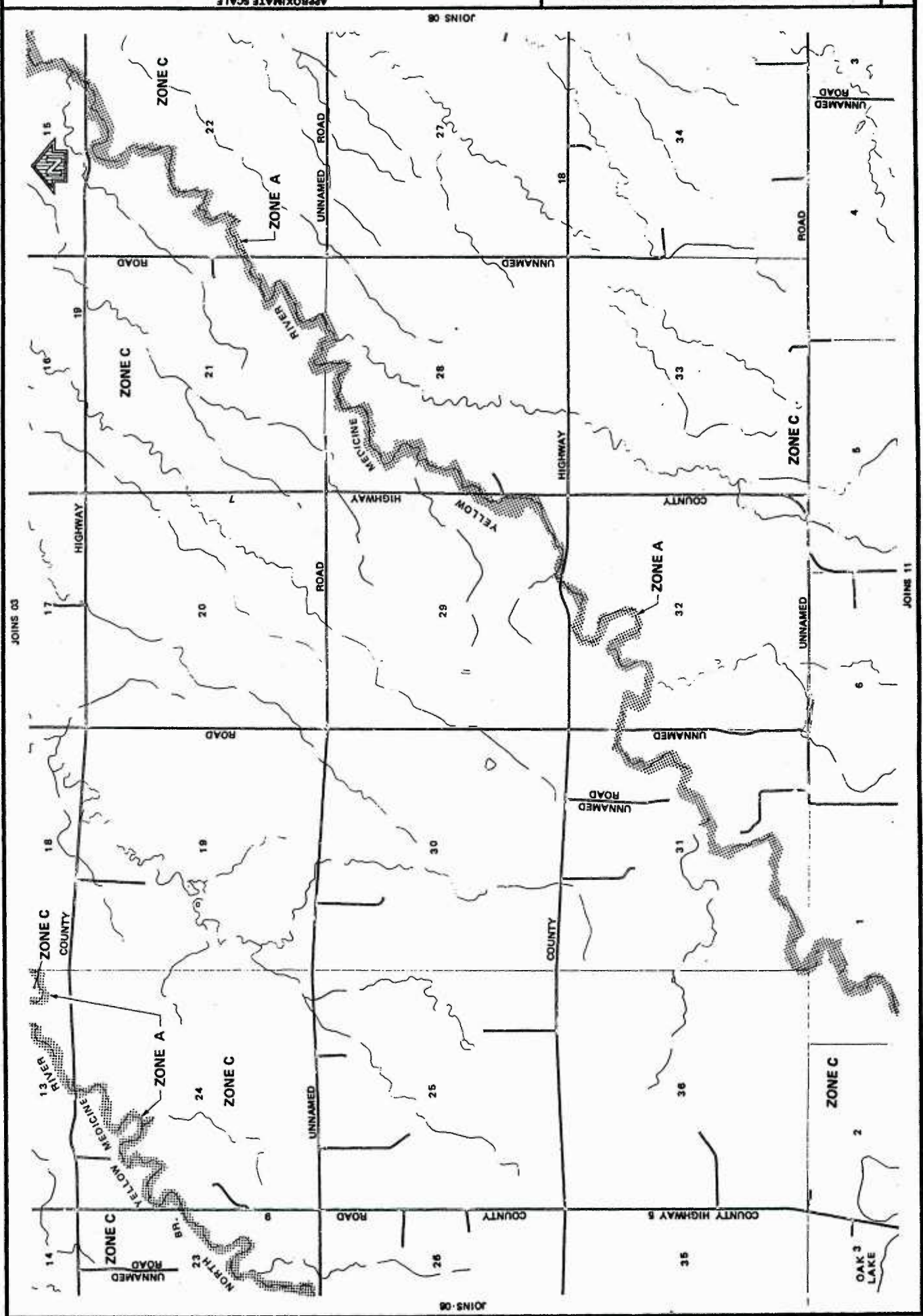
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APPROXIMATE SCALE
6000 FEET

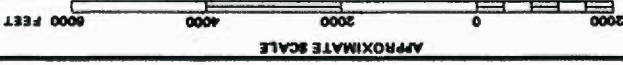


EFFECTIVE DATE
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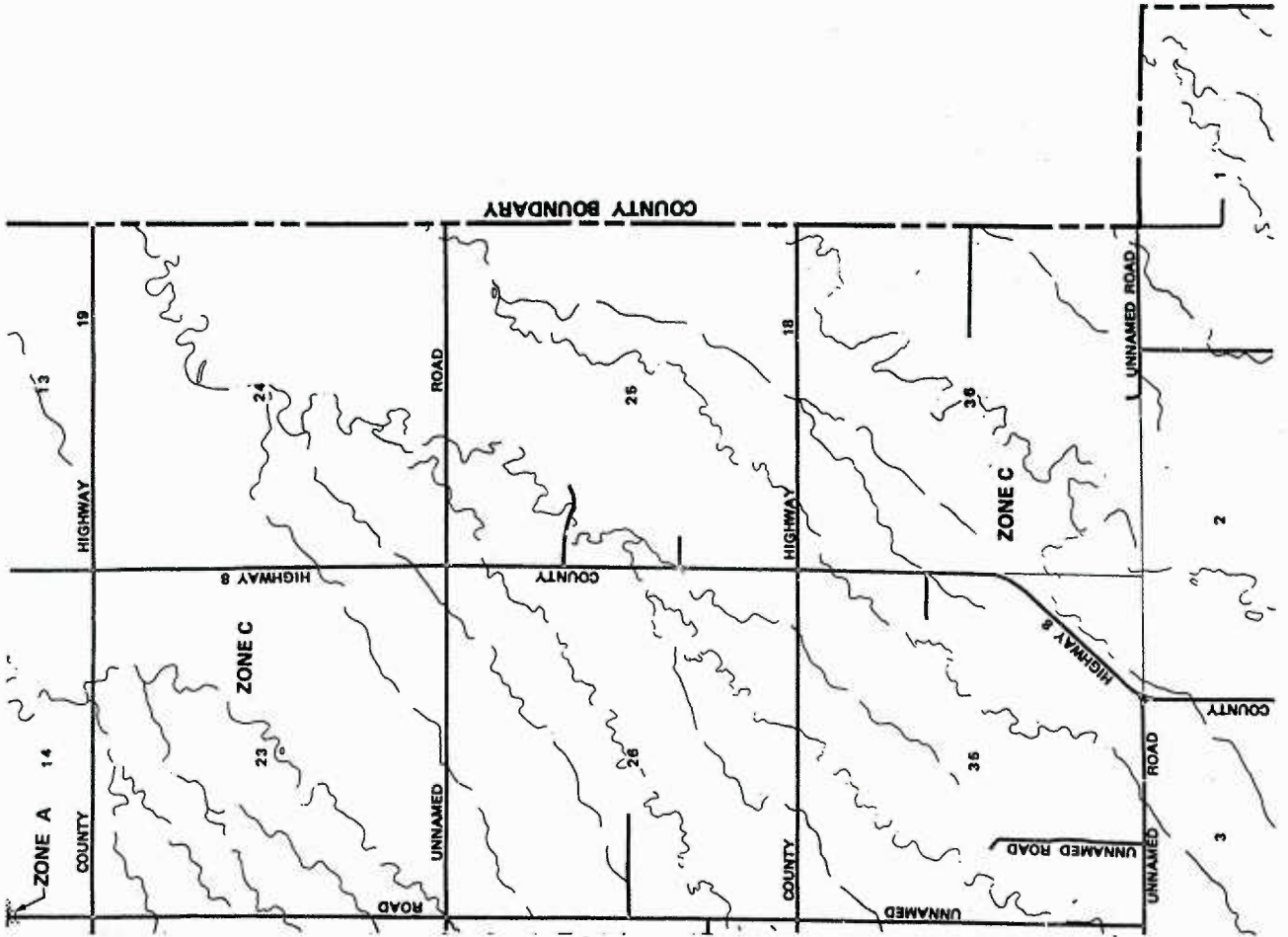
FEDERAL EMERGENCY MANAGEMENT AGENCY
LINCOLN CO., MN
(UNINC. AREAS)

MAP 08

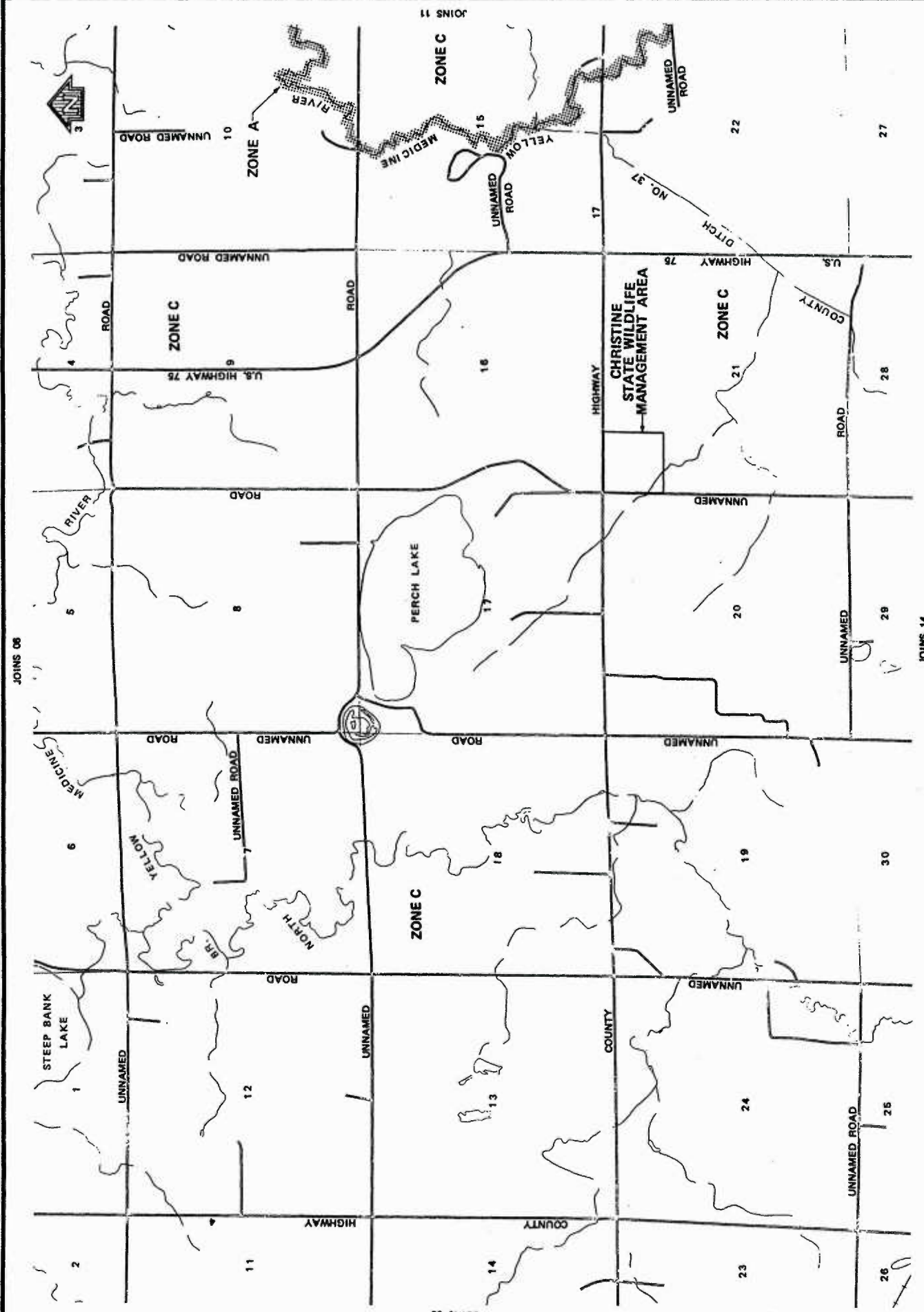
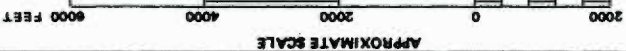


JOINS 04

JOINS 12



MAP 8

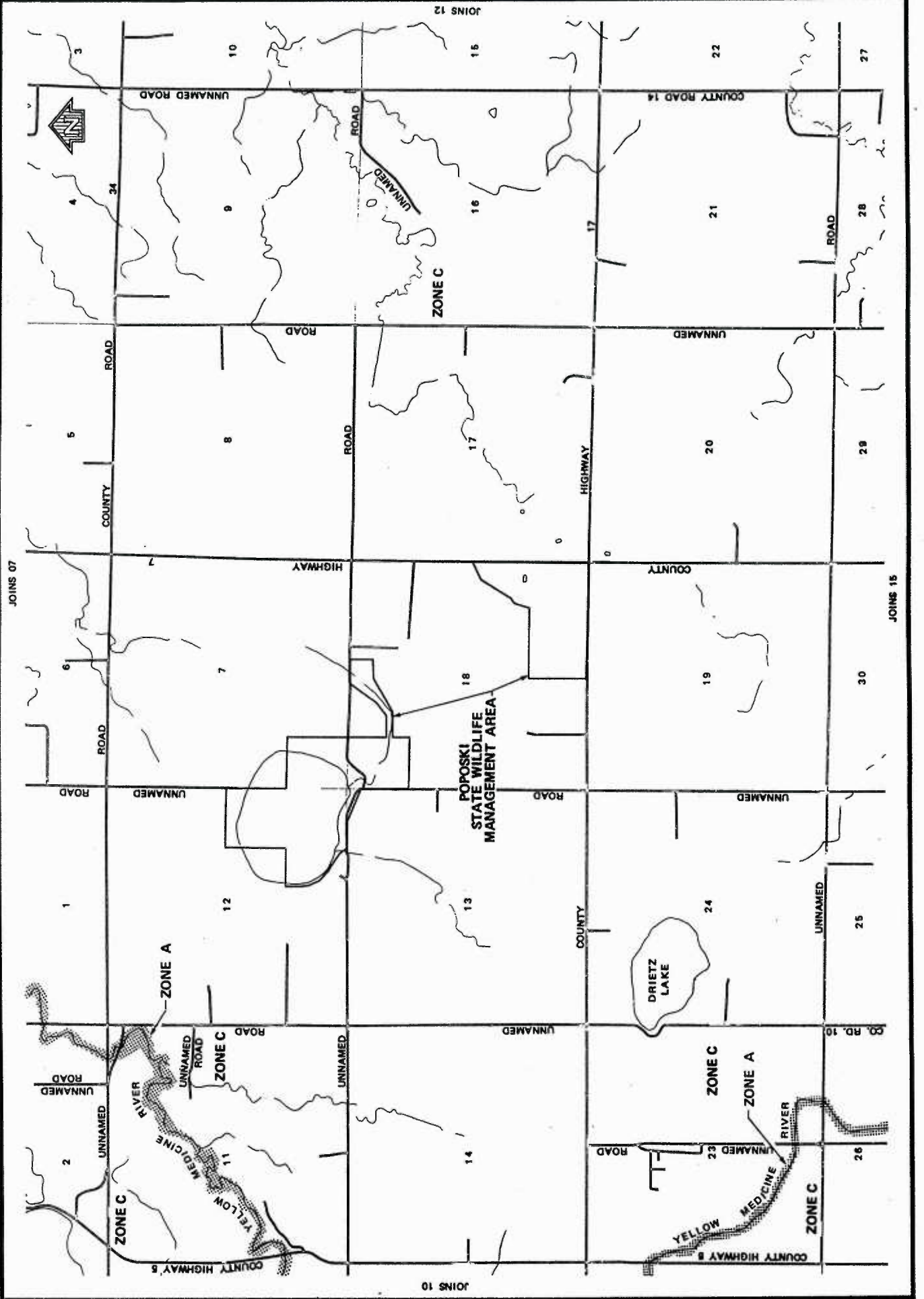


JOINS 06

JOINS 14

JOINS 09



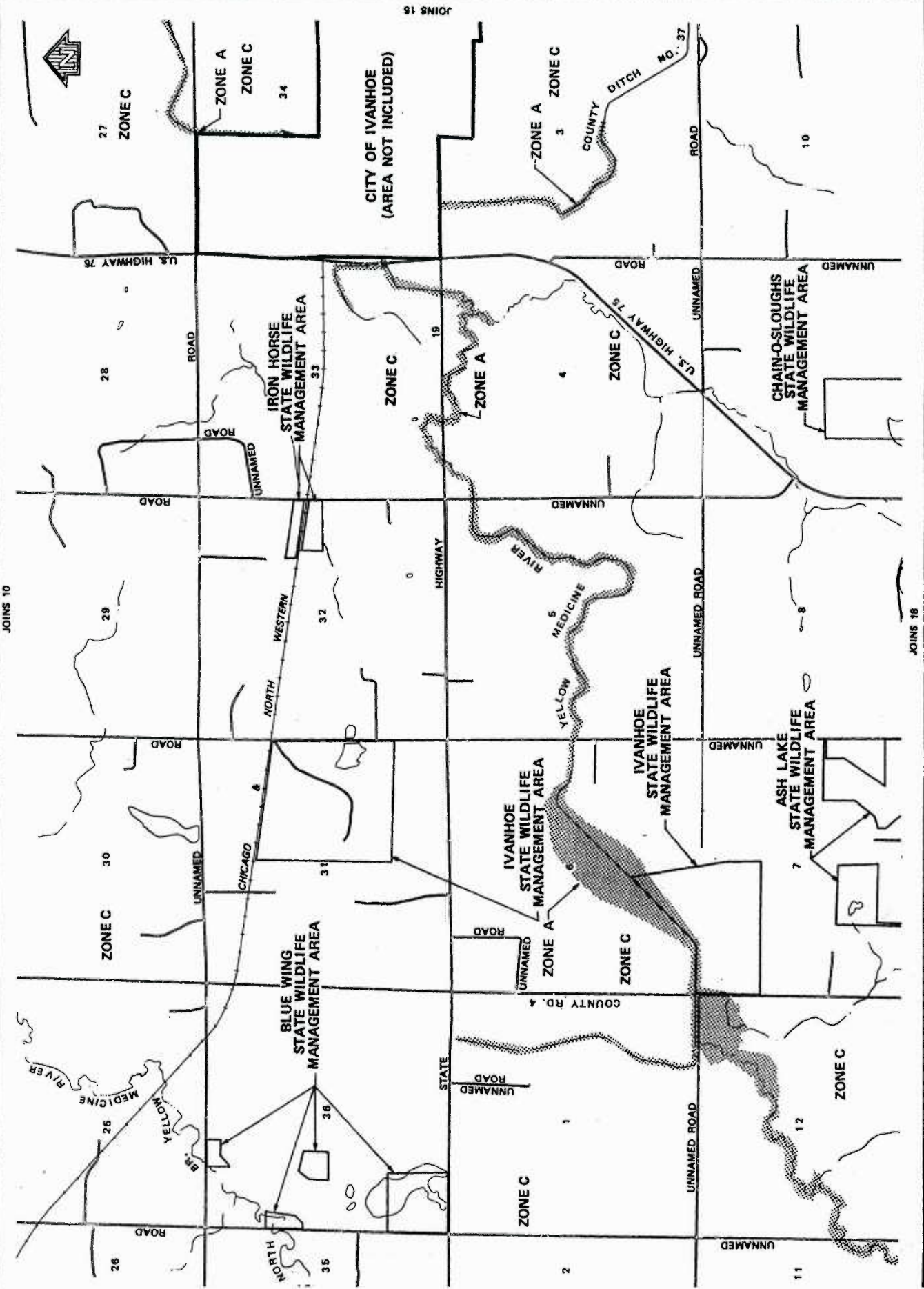
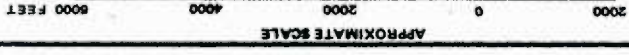


MAP 14

MAP 14

FEDERAL EMERGENCY MANAGEMENT AGENCY
LINCOLN CO., MN
(UNINC. AREAS)

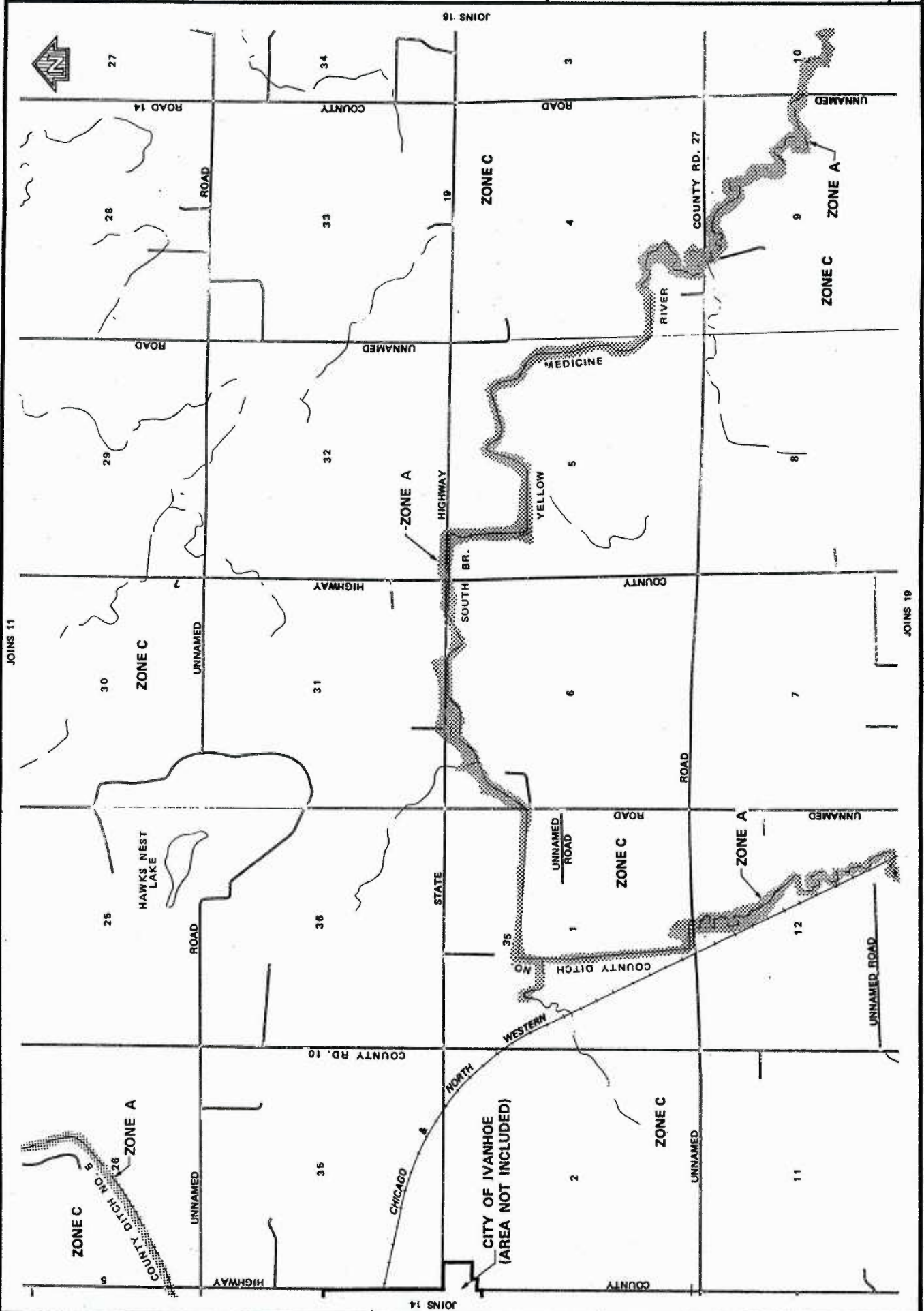
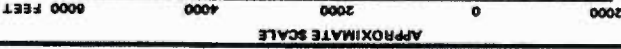
FLOOD INSURANCE RATE MAP
COMMUNITY NUMBER 270653
EFFECTIVE DATE
JULY 3, 1985



JOINS 18

JOINS 10

JOINS 15



MAP 16

MAP 16

FEDERAL EMERGENCY MANAGEMENT AGENCY
LINCOLN CO., MN
(UNINC. AREAS)

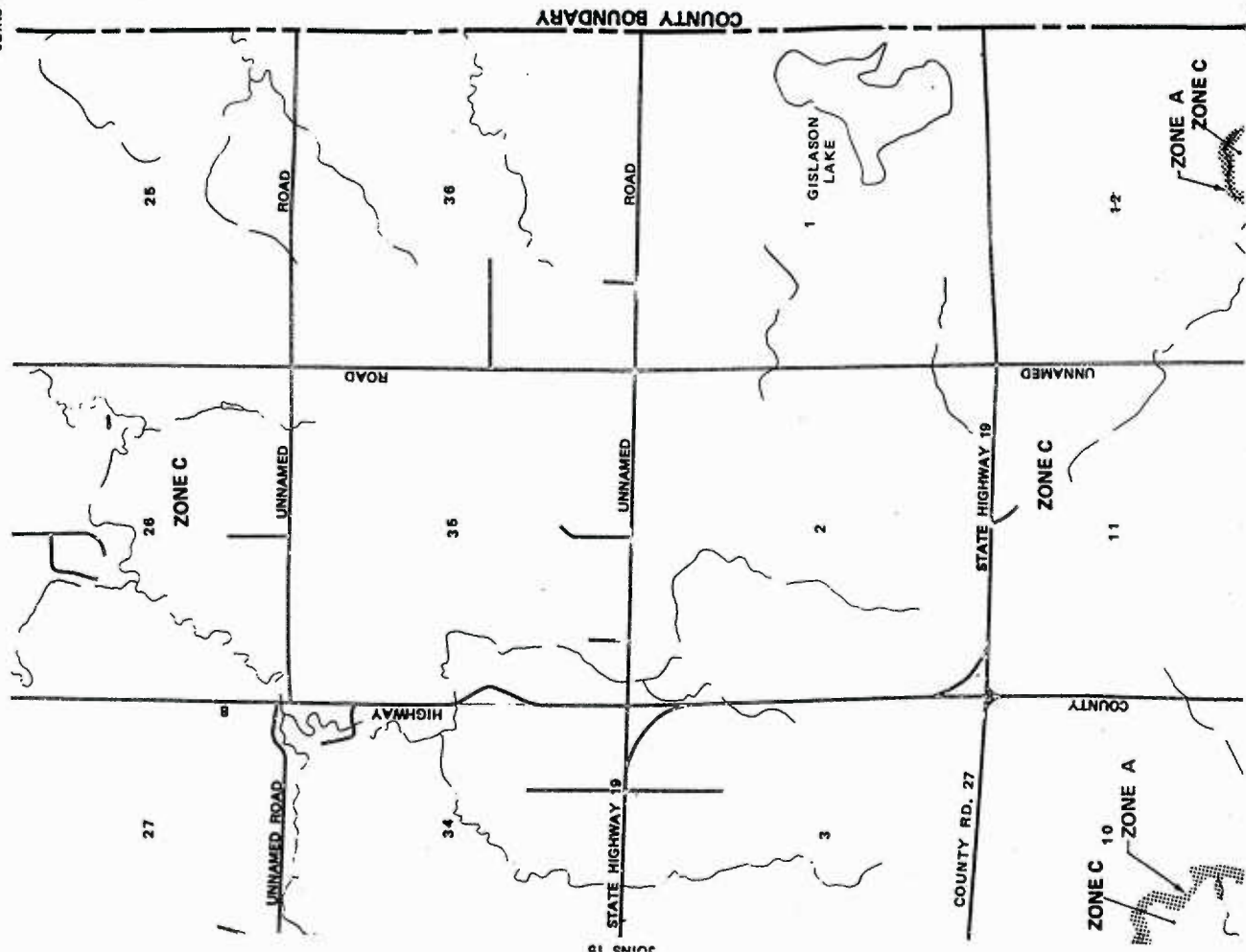
FLOOD INSURANCE RATE MAP
COMMUNITY NUMBER 270653

EFFECTIVE DATE
JULY 3, 1986



JOINS 12

JOINS 20



CURTIS 19

Appendix H

Site Characterization Study

Red Pine Wind Project
Lincoln County, Minnesota

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Westwood

Site Characterization Study
Red Pine Wind Project

Lincoln and Lyon Counties, Minnesota

February 26, 2016



Prepared For:

EDF Renewable Development, Inc.
10 2nd Street, Suite 400
Minneapolis, MN 55413

Site Characterization Study

Red Pine Wind Project

Lincoln and Lyon Counties, Minnesota

Prepared for:

EDF Renewable Development, Inc.
10 2nd Street, Suite 400
Minneapolis, MN 55413

Prepared by:

Westwood Professional Services
7699 Anagram Drive
Eden Prairie, MN 55344
(952) 937-5150

Project Number: 0006243.00

Date: 2/26/2016

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EXECUTIVE SUMMARY

EDF Renewable Development, Inc. (EDF) is investigating the environmental issues associated with the development of the Red Pine Wind Farm (Project) located in Lincoln and Lyon Counties, Minnesota to assess the risk that the Project poses to avian species and their habitats, species of federal and state conservation importance, and sensitive habitats such as conservation areas, water resources, and native plant communities. This report is based on a desktop study that reviewed and analyzed a series of datasets on sensitive resources, avian species, land cover, conservations lands, and water resources and will help identify potential environmental risks associated with Project development and inform coordination with staff of the Minnesota Department of Natural Resources (MN DNR) and U.S. Fish & Wildlife Service (USFWS) regarding potential regulatory implications.

EDF is proposing construction of a large wind energy facility near the city of Marshall, Minnesota, which is in Lincoln and Lyon Counties, Minnesota. The proposed Project will be constructed on approximately 70,518.8 acres (110.2 sq. mi.) of total land area, and is anticipated to have a total nameplate capacity of up to 200 megawatts (MWs). Topography within the Project Area is generally undulating consisting of rolling hills, stream networks, a few lakes and numerous wetlands. Based on the NLCD dataset, 68% of the Project Area is cultivated cropland with the remaining area composed of disturbed/developed land, grassland, wetland, forest, and pastureland. NWI wetlands total 6,400 acres, or less than 10% of the Project, nearly all of which are seasonally flooded basins (2,115 acres) and shallow open water communities (1,422 acres). Watercourses within the Project include intermittent and perennial streams and drainage ditches. Due to the acreage of water resources and grassland within the Project, it is likely wildlife will be drawn to and utilize the Project. However, given the predominance of agriculture and fragmented habitat within the Project Area, there is limited suitable habitat to support rare and sensitive species.

Within 10 miles of the Project there are 86 Wildlife Management Areas (WMAs), 14 of which are mapped at least partially within the Project. These areas are primarily associated with Popowski Lake, South Branch Yellow Medicine River, Threemile Creek, and Weltz Slough and are likely to draw wildlife to the region. Mapping resources also indicate there are several areas of public and private conservation land within the Project Area that may support wildlife including the 163.1-acre Yellow Medicine River WPA, approximately 7,281.9 acres of CRP land, approximately 873.9 acres enrolled in a PWP or RIM program, 14 WMAs (1,294 acres), and three WLI areas (Arco, Lake Stay/Island Lake Township, and Dead Coon Lake/Coon Creek Target Areas) are located partially within the Project (3,734.9 acres). Also, 208 sites within the Project are mapped as MBS sites (8,323 acres) of which 90 percent are classified as moderate or below the threshold of biodiversity significance. Mapped MBS sites also encompass 13 different types of native plant communities within the Project including two calcareous fens. The abundance of conservation and public lands suggests migratory birds and wildlife are likely to utilize the Project to some capacity; however, much of the habitat available in these areas is degraded to some extent and is unlikely to support rare and sensitive species.

No Important Bird Areas (IBA) are located within the Project Area; the closest IBA area covers Lake Benton and is located approximately seven miles south of the Project Area. Nesting habitat for raptors is moderate within the Project Area, as there are several large lakes with wooded margins. Both bald and golden eagles were documented along BBS and Christmas Bird Count Routes near to the Project. No federally threatened or endangered species were listed within 10 miles the Project Area based on NHIS, BBS, CBC, and the USFWS's Information for Planning and Conservation (IPaC) database. Several state listed species were documented within ten miles of the Project based on these databases and include: state threatened Wilson's phalarope, the state endangered Henslow's sparrow and loggerhead shrike and several species of concern. It is anticipated the Project will be used as flyover, stopover habitat, and nesting habitat for a variety of birds, but it is unlikely to draw sensitive or rare species. Avian fatalities are anticipated to be consistent with other nearby wind farms but may be higher than wind farms with more agriculture.

Five of the seven bat species present in Minnesota were determined to have a high or moderate potential to occur within the Project Area. These include the little brown bat (*Myotis lucifugus*), big brown bat (*Eptesicus fuscus*), silver haired bat (*Lasionycteris noctivagans*), hoary bat (*Lasiurus cinereus*), eastern red bat (*Lasiurus borealis*), and the tri-colored bat (*Pipistrellus subflavis*). It is likely bats will utilize wooded stream corridors and wetland areas within the Project for foraging and roosting habitat. No mines, caves, karst, or pseudokarst formations are known to occur within or near the Project Area or surrounding region. Bat fatality within the Red Pine Wind Project is not anticipated to exceed fatality rates of neighboring wind farms but may be higher than wind farms with more agriculture.

Results from the MN DNR NHIS database review for the Project Area indicated 18 records of rare plants and animals within the Project (MN DNR 2015). The mapped occurrences include two animal assemblages, seven records of vertebrate animals, five records of invertebrate animals, and four records of plants. Within ten miles of the Project Area, 76 additional NHIS records of plants and animals are mapped; 4 animal assemblage, 22 vertebrate animal, 21 invertebrate animal, and 29 plant records. Eighteen of the 50 State-listed species listed within Lincoln and Lyon Counties were found to have a high to moderate likelihood of occurring within the Project Area. These species include the northern grasshopper mouse, prairie vole, Richardson's ground squirrel, American white pelican, bald eagle (delisted), Bell's vireo, Forester's tern, Henslow's sparrow, loggerhead shrike, trumpeter swan, Wilson's phalarope, Blanding's turtle, Topeka shiner, Dakota skipper, phlox moth, Poweshiek skipperling, Regal fritillary, and the western white prairie-clover.

Results from the Site Characterization Study generally indicate the Project has moderate probability for adverse impacts on wildlife and sensitive resources. However, EDF is committed to avoiding sensitive and rare natural features and wildlife and siting turbines to minimize impacts to the extent practicable.

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- Exhibit 3: Land Cover
- Exhibit 4: Water Resources
- Exhibit 5: Biological Resources & Sensitive Habitats
- Exhibit 6: Public & Private Conservation Lands
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1.0 INTRODUCTION

1.1 Purpose

EDF is investigating the environmental issues associated with the development of the Red Pine Wind Farm (Project) located in Lincoln and Lyon Counties, Minnesota to assess the risk that the Project poses to avian and bat species and their habitats, species of federal and state conservation importance, and sensitive habitats such as conservation areas, water resources, and native plant communities. This report is based on a desktop study that reviewed and analyzed a series of datasets on sensitive resources, avian and bat species, land cover, conservations lands, and water resources. Results from this study will serve as a Tier 2 site characterization of the Project according to the USFWS Land-Based Wind Energy Guidelines tiered approach for assessing potential adverse effects to species of concern and their habitats (USFWS 2013). This report will help identify potential environmental risks associated with Project development and inform coordination with staff of the Minnesota Department of Natural Resources (MN DNR) and U.S. Fish & Wildlife Service (USFWS) regarding potential regulatory implications. In addition, Westwood prepared a Critical Issues analysis for the Project in 2011. The documents are intended to be reviewed together, and information relevant to each has been referenced rather than repeated.

1.2 Project Description

EDF is proposing construction of a large wind energy facility west of the city of Marshall in the west-central and east-central portions of Lyon and Lincoln Counties, respectively; west of the town of Marshall, Minnesota (**Exhibit 1**). This part of southwest Minnesota is already home to several operating, utility-scale windfarms and the Red Pine Project Area is proposed in an existing gap where some of the best Minnesota wind resources exist. The proposed wind project will be constructed on approximately 70,519 acres (110 square miles [sq. mi.]) acres total land area of primarily privately owned land, and is anticipated to have a total nameplate capacity of roughly 200 MWs. Turbine tower heights of 80 - 166 meters (m) are proposed, with 100 - 126 m rotor diameters. The Project will include turbines, a system of access roads, underground electrical collection cables, a project substation, an operations and maintenance (O&M) facility, and permanent meteorological towers. Temporary land disturbances during construction will be necessary for crane routing, underground electrical collection lines, laydown and staging areas, road improvements for equipment access, and a construction yard.

1.3 Regional Overview

According to the MN DNR Ecological Classification System, the Project Area is located primarily in the Coteau Moraines subsection (251Bb) of the North-central Glaciated Plains

section, of the Prairie Parkland province (MN DNR 2016). The Coteau Moraines sub-section is located on an elevated glacial landform that stretches across southwestern Minnesota, southeast South Dakota, and northwest Iowa and is divided into two distinct parts; the middle and outer Coteau. The landform is the product of thick deposits of pre-Wisconsin age glacial till (600-800 feet thick). The Coteau Moraines is a mixture of rolling moraine ridges through its center, and around its edges characterized by a series of end moraines and escarpments. Few large lakes and drainage networks are found throughout the Coteau Moraines.

Pre-settlement vegetation of the Coteau Moraines consisted primarily of tallgrass prairie. Wet prairie and woodland could also be found along stream and river margins. Given the thick deposits of loess across the region and the predominance of loamy well-drained soils, present vegetation and land use throughout this sub-section is overwhelmingly dominated by row crop agriculture. Drought, high winds, and severe thunderstorms are common disturbances in the region. Average annual precipitation is from 24 to 27 inches (MN DNR 2016).

2.0 PROJECT AREA PHYSIOGRAPHY AND NATURAL RESOURCES

Topography within the Project is generally undulating consisting of rolling hills, stream networks, a few lakes and numerous wetlands (**Exhibit 2**). Overall, the Project area slopes downward from southwest to northeast from a high elevation of 1,936 feet above mean sea level (amsl) to a low of 1,094 feet amsl. Topography in the east part of the Project is more undulating with some deeply incised stream channels with elevations in the west part of the Project that generally slope downward to the east. There are no mapped karst areas or caves within the Project Area. Karst areas in MN are generally limited to Pine County and other areas in southeast MN (MnGeo 2016).

2.1 Land Cover

Land cover mapping for the Project Area was obtained from the U.S. Geological Survey National Land Cover Database (USGS 2011). The data is based on a 16-class land cover classification scheme that has been applied consistently across the United States at a spatial resolution of 30 meters and is created through a decision-tree classification of Landsat satellite data (circa 2011)(Home *et. al* 2015). Based on the NLDC dataset, approximately 68 percent of the Project Area is cultivated cropland, consisting primarily of corn, soybeans, and alfalfa (**Exhibit 3** and **Table 1**). The NLDC data indicates the remaining area is composed of pastureland, disturbed/developed land, wetland, grassland, and forest.

Table 1: NLCD Land Cover Types and Approximate Acreage within the Project

Land Cover Type	Total Area (Acres)	Percent of Project Area
Cultivated Crops	47,813.6	67.8
Hay/Pasture	9,173.9	13.0
Grassland	7,350.1	10.4
Disturbed/Developed	3,242.0	4.6
Open Water	1,877.0	2.7
Emergent Herbaceous Wetlands	730.0	1.0
Deciduous Forest	285.5	0.4
Woody Wetlands	43.8	< 0.5
Mixed Forest	2.9	< 0.5
TOTAL	70,519	100

2.1.1 Implications

The Project is located in what was once the largest tract of grassland in the world. Wildlife species use grasslands and native prairie for food, cover, and nesting during breeding and migration. However, native prairies and grasslands have been severely reduced from agricultural conversion, urban development, and improper grazing techniques.

Land cover mapping indicates that grassland and pasture areas account for about 23 percent of the Project Area. For the most part, pasture and grassland areas are fragmented across the Project; however, several larger tracts of grassland and pasture occur in the northwest, southwest, and east-central areas of the Project. These larger tracts of grassland are more likely to support wildlife. Forested areas appear limited to areas along stream corridors, near lentic water features, and around homesteads. These areas and the water resources they are associated with, provide important nesting and foraging habitat for wildlife; offering an ecological respite from the highly disturbed agricultural surroundings. However, based on the limited acreage, habitat fragmentation, and disturbance, it is unlikely grassland and forested areas within the Project will support significant diversity or high numbers of sensitive species.

2.2 Water Resources

3.2.1 Wetlands

According to NWI spatial data, 2,202 wetlands were identified within the proposed Project Area comprising approximately 6,400 acres or 9 percent of the Project Area (**Table 2** and **Exhibit 4**). The majority of the wetland acreage was classified as seasonally flooded basins (n=958), shallow open water communities (n=236), and shallow marshes (n=430).

Table 2: NWI Wetlands within the Project Area	Wetland Type	Number in Project Area	Total Area (Acres)	Percent of Project Area
Seasonally Flooded Basin	958	2,115.5	3.0	
Shallow Open Water Community	236	1,422.3	2.0	
Shallow Marsh	430	1,182.7	1.7	
Wet Meadow	267	1,059.7	1.5	
Non-Vegetated Aquatic Community	12	374.4	0.5	
Hardwood Wetlands	196	156.9	0.2	
Shrub Wetlands	91	84.0	0.1	
Hardwood Wetlands / Seasonally Flooded Basin	2	2.4	<0.1	
Artificially Flooded Shallow Open Water Community	7	1.7	<0.1	
Deep Marsh	3	0.5	<0.1	
TOTAL	2,202	6,400	9.1	

3.2.2 Lakes, Streams, and Ditches

There are several mapped MN DNR Public Water Lakes and Wetlands (PWI) within the Project Area totaling approximately 1,853 acres, (Table 3). The National Hydrography Dataset (NHD) also mapped several waterbodies within the Project; most of which correspond with mapped PWI and NWI water features. Several large lakes and wetlands are mapped within 10 miles of the Project, including Gislason Lake, Coon Creek Marsh, Dead Coon Lake, Stay Lake, Perch Lake, Ash Lake, Benton Lake, Twin Lake, Rock Lake, Skaokotan Lake, and Hendricks Lake.

Intermittent and perennial MN DNR Public Watercourses cover approximately 71 linear miles within the Project Area and include South Branch of the Yellow River, Three Mile Creek, Coon Creek, Yellow Medicine River, and several unnamed watercourses. NHD mapping indicates an additional 100 miles of intermittent watercourses and ditches, many of which are tributaries to the mapped PWI watercourses. The Minnesota River is located approximately 50 miles east of the Project.

Table 3: Mapped PWI Lakes, Wetlands, and Watercourses within the Project Area

PWI Name	Type	Area/Length within Project
Drietz Lake	Public Water Lake	76.0 acres
Wood Lake	Public Water Lake	374.2 acres
Hawksnest Lake	Public Water Lake	301.2 acres
Island Lake	Public Water Lake	179.7 acres
Walkup Slough	Public Water Lake	160.0 acres
Goose Lake	Public Water Lake	157.1 acres
Popowski Lake	Public Water Lake	143.2 acres
Oak Lake	Public Water Lake	110.0 acres
Unnamed (South portion)	Public Water Lake	71.6 acres

PWI Name	Type	Area/Length within Project
Unnamed	Public Water Lake	61.6 acres
Highpoint Lake	Public Water Lake	50.5 acres
Furgamme WMA	Public Water Lake	47.3 acres
Schrunk Slough	Public Water Lake	34.4 acres
Unnamed (North portion)	Public Water Lake	2.1 acres
Unnamed	Public Water Wetland	60.8 acres
Weltz Slough	Public Water Wetland	23.6 acres
South Branch Yellow Medicine River (County Ditch 35)	River, Perennial, and Intermittent	26.1 miles
Unnamed	Intermittent	25.1 miles
Threemile Creek	Intermittent and Perennial	11.9 miles
Coon Creek	Intermittent	4.0 miles
Yellow Medicine River	Perennial	3.7 miles

There are also no MN DNR Designated Wildlife Lakes within the Project Area or 10-mile buffer and no outstanding resource value waters, sensitive lakeshore, or trout streams or lakes within the Project Area. One designated trout stream, Redwood River, is located about one mile southeast of the Project.

3.2.3 Calcareous Fens

One calcareous fen is located within the Project Area and one is located directly adjacent to the Project; both of which are located along the southeast edge of the Project boundary. Calcareous fens are a rare wetland type found in Minnesota and are very calcium-rich environments due to their relationship with a groundwater discharge high in bicarbonates. As a result, the species that grow and utilize fens as habitat (i.e., calciphiles) are very specialized and are unlikely to migrate from the fens into other areas of the Project (MN DNR 2015).

3.2.4 FEMA Floodplains

There are four areas within the Project associated with FEMA mapped floodplains (Exhibit 4). Floodplains are mapped adjacent to the Yellow Medicine River in the northwest corner of the Project, the South Branch Yellow Medicine River across the central section of the Project, Coon Creek along a small portion of the southern Project boundary, and Three Mile Creek in a small area near the southeast Project boundary.

3.2.5 Implications

Lakes, wetlands, streams, and floodplains provide important habitat for a variety of plants and animals including sensitive species such as freshwater mussels and mayflies. The Project is located within the Prairie Pothole Region, a region of depressional wetlands and lakes created by glacier retreat during the Wisconsin glaciation (National Wildlife Federation 2016). The Project Area is also within both the Mississippi Flyway and the eastern edge of the Central Flyway, two of four major migration corridors in North America (Audubon 2016).

As a result, it is likely that migrating and breeding birds will utilize water resources within the Project Area, especially water features adjacent to native vegetation or pasture.

Water resources and land cover mapping suggest that less than 10 percent of the total Project Area is wetland or other water resources. Based on review of aerial photography, land cover and water resource mapping, it appears most wetlands within the Project are surrounded by agriculture and over 687 acres of the wetlands within the Project are classified as farmed. Two of the larger waterbodies within the Project, Goose Lake and Weltz Slough, are listed as impaired by the Minnesota Pollution Control Agency (MPCA) for nutrient loading and eutrophication and for failing to meet one or more bioassessment standards for aquatic plants and macroinvertebrates, respectively. Given the degradative nature of farming through and around wetlands, it is unlikely the wetlands within the Project will support sensitive or rare species, or be particularly attractive to migrating or breeding birds. However, many of the larger lakes and wetlands mapped within the Project are surrounded by conservation lands and are thus more likely to support wildlife and native habitats.

It is likely that many of the streams within the Project are somewhat degraded given the predominance of surrounding agriculture. The Yellow Medicine River, Threemile Creek, Coon Creek, South Branch Yellow Medicine River (County Ditch 35), Judicial Ditch 29, and unnamed creek are all listed as impaired by the MPCA for one or more of the following: fecal coliform, turbidity, Mercury in fish tissue, and or failing to meet one or more bioassessment standards for fish. In addition, based on NHD and PWI data, approximately 17 miles (10 percent) of the mapped watercourses within the Project are identified as ditches. Based on these factors, the likelihood is low that sensitive species would live along or within the aforementioned stream corridors within the Project. Generally, more appealing aquatic habitat for birds, sensitive wildlife, and plants is offered outside the Project near the Minnesota River, near some of the larger lakes and marshes in the surrounding area such as Hendricks, Shaokotan, and Benton Lakes, and the abundant water resources to the northeast of the Project. Furthermore, the Project will be designed to avoid wetlands and water resources to the extent practicable.

2.3 Sensitive Habitats

2.3.1 Railroad Right-of-way Prairies

There are no railroad right-of-way (ROW) prairies in the Project based on ROW Prairie mapping data (**Exhibit 5**). Limited areas are mapped within 10 miles south and southeast of the Project, but it is unlikely these corridors will draw significant wildlife to the Project Area given their distance from the Project and limited area.

2.3.2 MN DNR Native Plant Communities

There are 241 MN DNR Native Plant Communities mapped within the Project Area, accounting for 2,144 total acres (Exhibit 5). These plant communities are located primarily in the northwest corner, along the eastern border, and southeastern portion of the Project. The plant communities are fairly fragmented across these areas; however, several areas are mapped as larger plan community complexes. MN DNR Native Plant Communities mapped within the Project include 13 different community types, most of which are southern dry hill prairie.

Of the 241 mapped MN DNR Native Plant Communities, ecological condition ranks ranged from AB to D and some were not ranked (**Table 4**). Ecological condition ranks fall on a continuum from A to D, where A represents communities of the highest ecological integrity and D represents those with the lowest. A ranking of NR indicates no ranking has been assigned. Over 91 percent of the MN DNR native plant community acreage mapped within the Project have assigned ecological conditions of C, CD, or D; indicating these communities have fair to poor ecological integrity and have been altered and degraded by human activity or invasive species (MN DNR 2014). For example, C and D rated dry hill prairies are likely dominated by exotic grasses and native graminoids more tolerant of disturbance such as grama grass (*Bouteloua spp.*) and smooth brome (*Bromus inermis*). In C and D rated prairie mixed cattail marshes and prairie wetland complexes plants such as Kentucky bluegrass (*Poa pratensis*), reed canary grass (*Phalaris arundinacea*), and perennial clovers will likely be the predominant cover (MN DNR 2014).

Although not in the Project Area, there is a large native plant community complex approximately one mile southeast of the Project associated with Redwood River and another adjacent the southeast edge of the Project. Both complexes include several types of plant communities and contain communities with condition rankings of A and B. Several additional native plant complexes are located within ten miles the Project to the north- and southwest of the Project that similarly support several records of high integrity communities.

Table 4: MN DNR Native Plant Communities within the Project Area

Native Plant Community Type	Condition Ranks	No. Records	Size (acres)
Dry Hill Prairie (Southern)	B, BC, C, CD, D, NR	110	1,328.9
Dry Sand - Gravel Prairie (Southern)	AB, BC, C, CD, D, NR	27	315.6
Mesic Prairie (Southern)	AB, B, BC, C, CD, D, NR	22	196.6
Prairie Wetland Complex	BC, C, CD, D, NR	23	181.2
Basswood - Bur Oak - (Green Ash) Forest	C, CD, D, NR	18	39.9
Southern Seepage Meadow/Carr	BC, C, NR	10	20.8
Wet Prairie (Southern)	BC, C, CD, D, NR	5	18.0
Southern Wet Prairie	C, CD, D	1	11.2
Prairie Wet Meadow/Carr	NR	6	10.2
Calcareous Fen (Southwestern)	BC	7	7.3

Table 4: MN DNR Native Plant Communities within the Project Area

Native Plant Community Type	Condition Ranks	No. Records	Size (acres)
Prairie Meadow/Carr	AB, BC, C, D	1	6.5
Seepage Meadow/Carr, Tussock Sedge Subtype	C	7	4.2
Prairie Mixed Cattail Marsh	AB, C, CD, D, NR	4	3.9
Total		241	2,144

2.3.3 Minnesota Biological Survey Sites of Biodiversity Significance

Minnesota Biological Survey (MBS) sites of biodiversity significance represent areas with varying levels of native biodiversity that may contain high quality native plant communities, rare animals, and/or animal aggregations. A biodiversity significance rank is assigned based on the number of rare species, the quality of the native plant communities, size of the site, and context within the landscape. Of the 208 MBS sites located within the Project Area, 57 are classified as below the minimum biodiversity significance threshold and 51 are classified as having moderate biodiversity significance (**Table 5**). Sites characterized as “below” lack occurrences of rare natural features and rare species but offer conservation value at the local level. Sites considered “moderate” do contain rare features and species but are disturbed. In addition, an area in the northwest and one in the southeast, both of which extend beyond the Project area, are characterized as having outstanding biodiversity significance, and two areas along the eastern border of the property encompass sites characterized as having high biodiversity significance. The MBS sites within the Project encompass the mapped MN DNR Native Plant communities within the Project and are often associated with water resources; primarily falling along stream corridors or buffering lakes and wetland complexes.

Based on MBS mapping data, the Project Area is surrounded by MBS areas; however, most sites are classified as *below* or *moderate*. Four additional areas rated as outstanding and 17 additional areas rated as high are located within ten miles of the Project.

Table 5: MBS Sites of Biodiversity Significance in the Project Area

Biodiversity Significance	No. Sites	Size (acres)
MBS site below minimum biodiversity significance threshold	57	4,696.1
MCBS site with moderate biodiversity significance	51	2,857.3
MCBS site with outstanding biodiversity significance	2	493.7
MCBS site with high biodiversity significance	6	276.8
Total	208	8,324

2.3.4 Regionally Significant Ecological Areas

Regionally Significant Ecological Areas (RESA) Areas are tracts of land identified by the MN DNR that potentially provide important habitat space. Areas are derived through GIS

modeling of natural resource and landscape datasets and aerial imagery. Unlike the MN DNR Native Plant Community and MBS Sites, RESA does not involve any field verification. RESAs cover around 12,002 acres of the Project and encompass almost all MN DNR Native Plant Communities and Sites of Biodiversity Significance mapped within the Project.

2.3.5 Implications

Areas identified within the Project Area as MN DNR Native Plant Communities or MBS Sites of Biodiversity Significance were predominantly classified as areas of moderate to severe disturbance and limited persistence of native vegetation, wildlife, and diversity. Although these areas are unlikely to support rare species, they do offer valuable habitat in an area substantially disturbed and utilized for row crop agriculture and are predominantly associated with mapped water resources, grassland, and forested areas. It is likely these areas will attract migrating and breeding birds, and raptors. In addition, these areas are likely to support a variety of reptiles, amphibians, and small mammals that succeed in highly fragmented landscapes such as mice and other rodents. The Red Pine Project is committed to turbine siting and project design that avoids impacts to water resources and sensitive habitats to the degree practicable.

3.0 CONSERVATION LAND USE

Two types of conservation lands that occur in the study area were reviewed: protected government lands and private lands in government conservation programs. To identify conservation lands within the Project Area, publically available GIS data was reviewed for federal and state management lands including: Wildlife Management Areas (WMAs), State parks, Scientific and Natural Areas (SNAs), Working Lands Initiative Target Areas, National Wildlife Refuges (NWR), Waterfowl Production Areas (WPAs), Conservation Reserve Program (CRP) lands, Reinvest in Minnesota (RIM) lands, and National Conservation Easement Lands (**Exhibit 6**).

3.1 State Lands

3.1.1 Wildlife Management Areas

WMAs are managed by the MN DNR. They are part of the outdoor recreation system and are established to protect those lands and waters that have high potential for waterfowl production, public hunting, trapping, fishing, and other recreational uses. There are 14 WMAs that are located at least partially within the Project Area including Bosqu, Coot, Elmer Weltz, Furgamme, Hawks Nest, Muldental, Pooski, Prairie Marshes, Rogge, Rost, Salix, Sioux Prairie, Thostenson, and Tillemans WMAs which in total, cover approximately 1,294 acres of the Project (**Exhibit 6**). WMA areas within the Project Area correspond to MBS sites and mapped water features. Four additional WMAs are located within one mile of the Project

and 68 others are located within ten miles of the Project, primarily to the northwest, west, and southeast.

3.1.2 State Parks

State Parks are lands preserved for their natural beauty, historic interest, recreation, or other use by the State. No State parks are located in the Project area; however, Camden State Park is located within one mile to the southeast of the Project. No other State parks are located within ten miles of the Project (Exhibit 6). Camden State Park is located along the Redwood River and is home to woodlands, wetlands, and prairie and supports populations of songbirds, raptors, shorebirds, and fish species such as brown trout (*Salmo trutta*). It is possible the Project may be utilized as flyover or stopover habitat for birds species migrating or inhabiting the Park.

3.1.3 Scientific and Natural Areas (SNA)

SNAs are sites set aside by the MN DNR to protect rare resources and natural features. No SNAs are mapped within the Project or within 10 miles of the Project.

3.1.4 Working Lands Initiative – Target Areas

The Working Lands Initiative (WLI) was established in 2005 to enhance conservation efforts in the Prairie Pothole Region of Minnesota. Under this initiative, State and federal agencies work with conservation groups to identify, map, and protect the most productive wetland areas in the most efficient way possible. Target Areas are locations where a significant investment has already been made (i.e., conservation lands) or major components of habitat are already in place.

Three WLI areas; the Arco, Lake Stay/Island Lake Township, and Dead Coon Lake/Coon Creek Target Areas are located partially within the Project and cover approximately 3,735 acres along in southwest, southeast, and east-central edges of the Project (Exhibit 6). Seven other target areas are located within 10 miles of the Project, including the Hendricks/Royal/Shookatan, Ash Lake Township Target Area located directly adjacent to the west-central border of the Project. These areas are already substantially composed of State, national and private conservation easement areas and also encompass mapped MBS sites.

3.2 Federal Lands

3.2.1 National Wildlife Refuge (NWR)

The NWR System is run by the USFWS and protects areas important for native vegetation and wildlife across the United States. There are no NWRs located in the Project Area. Parcels belonging to The Northern Tallgrass Prairie National Wildlife Refuge are located directly adjacent to the eastern border of the Project and about nine miles south of the project. The refuge provides habitat for native prairie plants and may also provide habitat

for sensitive wildlife such as the grasshopper sparrow (*Ammodramus savannarum*) and Dakota skipper (*Hesperia dacotae*). That being said, both areas are associated with MBS sites rated as below the minimum biodiversity significance threshold.

3.2.2 Waterfowl Production Areas (WPA)

WPAs are public lands managed by the USFWS that preserve wetlands and grasslands critical to waterfowl and other wildlife. The 163-acre Yellow Medicine River WPA located in the east-central portion of the Project is the only WPA located within the Project based on WPA dataset mapping. The Yellow Medicine River WPA is associated with a MBS site ranked as below the minimum biodiversity significance threshold and encompasses several mapped NWI wetlands. Based on National Conservation Easements Database (NCED) mapping, three additional Lyon County WPA areas are located within the Project Area covering an additional 267 acres. These areas are associated with MBS sites ranked as *moderate* or *below* the minimum biodiversity significance threshold. There are 14 additional WPAs mapped within 10 miles of the Project (Exhibit 6).

3.3 Private Lands and Easements

3.3.1 Conservation Reserve Program (CRP)

CRP lands are private lands enrolled in a federal farm program through the U.S. Department of Agriculture Farm Service Agency (USDA FSA). CRP lands are maintained in perennial vegetative cover for the duration of enrollment, which is typically 10 years unless the enrollment is renewed. Based on 2007 data, there are approximately 535 CRP areas (7,282 acres) within the Project (Exhibit 6). CRP areas within the Project primarily buffer stream corridors and wetland areas and are often adjacent to mapped MSB sites and WMA areas. CRP land also exists in the area surrounding the Project.

3.3.2 Reinvest in Minnesota

Lands under permanent easement in the RIM program are managed by the Minnesota Board of Water and Soil Resources (BWSR). These easements help protect and improve water quality, reduce soil erosion, and enhance fish and wildlife habitat by retiring private marginal cropland from agricultural production, planting permanent vegetation, and restoring previously drained wetlands.

There are several easement programs included in RIM: Conservation Reserve Easement Program (CREP), Reinvest in Minnesota-Wetland Reserve Program (RIM-WRP), and Permanent Wetland Preserve (PWP). According to 2009 RIM easement mapping, approximately 874 acres of land within the Project Area is identified as being enrolled in permanent CREP and other RIM programs (Exhibit 6). In the surrounding 10-mile buffer, approximately 6,866 additional acres of land is enrolled in the RIM program.

3.3.3 National Conservation Easement Database (NCED)

The NCED is a compilation of easement records from public agencies and land trusts. As previously mentioned, the NCED identified three additional WPAs within the Project. Several additional easement areas, not mapped in the aforementioned datasets, are also identified by the NCED within 10 miles of the Project.

3.4 Implications

Much of the protected government lands and private lands in government conservation programs located within the Project Area and surrounding region are associated with water resources, grasslands, and other sensitive habitat areas. Based on the cumulative mapping of sensitive resource areas and public and conservation lands, it appears there are areas within the Project likely to attract or support sensitive species or communities. There are also several areas within 10 miles to the northwest, northeast, southeast, and southwest of the Project that are likely to attract wildlife and harbor sensitive species. As a result, the Project Area may have temporary use for birds and wildlife migrating through the area. EDF is committed to turbine siting and project design that avoid impacts to public and conservation lands, and will adhere to regulatory setback requirements associated with these areas to the degree practicable.

4.0 WILDLIFE

4.1 Birds

Most species known to occur in Lincoln and Lyon counties, except for game birds (Galliformes), and non-native species such as European starlings (*Sturnus vulgaris*), rock pigeons (*Columba livia*), and house sparrows (*Passer domesticus*) are protected by the Migratory Bird Treaty Act (MBTA). According to the USFWS (2012), the MBTA is a “strict liability statute,” meaning that proof of intent to harm or kill a migratory bird is not required for an action to be considered a violation of the MBTA. The USFWS recognizes, however, that some birds may be harmed or killed even if all reasonable measures to avoid these outcomes are implemented. The USFWS, as cited in Schwartz (2004), prefers to take a proactive partnership approach to the protection of migratory birds, though it will utilize regulations and enforcement when disregard for the law is demonstrated (USFWS 2003). As such, consideration of potential bird impacts from proposed wind energy projects is advised, and involvement of federal and/or state agency wildlife professionals from the pre-development phase onward is recommended (USFWS 2003).

4.1.1 MIGRATION

4.1.1.1 Migration Routes

The Project Area and surrounding region can broadly be defined as occurring within the Central and Mississippi Flyways, two of the major bird migration corridors (Exhibit 7). The Central Flyway generally follows the Great Plains in the United States and Canada and encompasses all of the area between the Mississippi River and the Rocky Mountains and merges to the east with the Mississippi Flyway. The Mississippi Flyway generally extends from Ohio and Indiana southwest to the Mississippi River, although the western border of the flyway is much less defined and likely extends into the Project Area.

The Project Area is located in a region with little information on the species composition and passage rates of diurnal and nocturnal migrants such as passerines and bats. However, several large lakes and wetland are mapped near and within the Project Area as noted in Section 3.2. Two of the larger water bodies within the Project Area are Hawksnest Lake and Wood Lake. Both of these areas likely provide habitat for migratory waterfowl, shorebirds, and passerines, raising the possibility that birds from these areas may pass through the Project Area during spring and fall migration. Additionally, Lake Benton, located approximately 7 miles south of the Project Area, is located within an Important Bird Area and likely attracts birds across a diverse spectrum of Orders.

There are two populations of the federally endangered Whooping Crane, the Western and Eastern Flocks. The migration route nearest to the Project Area involves the Western Flock, who migrates through the Midwest between their wintering location in southeast Texas and their nesting spot in the Northwest Territories and Saskatchewan. The migration route is approximately 95 miles west of the Project Area and therefore does not appear to be a concern for this Project (Exhibit 5).

4.1.1.2 General Features of Bird Migration

Daily Timing. The daily timing of migration varies among species. Many species of passerines travel at night, usually taking off within 0.5 to 1 hour after sunset and continuing to fly for several hours. Typically, a gradual reduction occurs in the numbers of birds that fly after midnight. The numbers of passerines migrating in the daytime tend to decline in the latter part of the morning and through the afternoon (Richardson 1998).

Almost all hawk, eagle, and vulture migration is during daytime, with takeoff often delayed until mid-morning when thermal updrafts become stronger. Raptors such as falcons that are less dependent on soaring often take off earlier in the day than the soaring species (Richardson 1998).

Waterfowl migrate both by day and by night, as do shorebirds. Shorebirds often take off in late afternoon. The timing of takeoff by shorebirds can be modified by tidal cycles, with

departures on long flights often occurring as the tide is rising and covering foraging or roosting areas.

Altitudes. Altitudes of migration are highly variable and strongly influence the probability that some groups of migrating birds are more likely to collide with wind turbines. Most nocturnal migrants fly well above turbine height, and are at risk only during takeoff or landing. The same is true by day in many areas; however, migration altitudes are variable and are often strongly affected by the weather (Richardson 1998).

Migrating birds tend to fly lower when moving into opposing winds than when flying with following winds. This is related to the fact that, due to ground friction, wind speeds are typically lower close to the ground than at higher altitudes. Birds flying into opposing winds can reduce their energy costs and the time needed to fly a given distance by flying low. There the wind speed is reduced and the birds' ground speed will be higher for a given air speed (Richardson 1998).

Therefore, numbers of migrating birds flying at low altitudes ("turbine height") may be as high or higher when winds are opposing as when they are following, even though total numbers of birds aloft are usually much reduced with opposing winds (Richardson 1998). In order to use weather forecasts as a basis for predicting (a few hours in advance) the occasions when collision risk is high, specific data on numbers of birds migrating at low altitudes under different weather conditions would be needed.

Concentrations Along Linear Topographic Features. During daytime, migrating birds often concentrate in rather narrow streams along linear topographic features such as coastlines, rivers, and ridges. This is especially true where the linear features are oriented within about 45 degrees of the preferred flight direction (Richardson 1998). The nearby Des Moines River potentially fits into this category for migratory purposes.

Concentrations Near Favored Stopover Habitat. Some types of migrants, such as shorebirds and waterfowl, often concentrate in restricted areas of suitable habitat while resting and feeding between migratory flights. These can be interior lakes or marshes, coastal bays and mud flats, or other areas that can provide food and/or shelter for birds. Migration can be concentrated into corridors when the birds are either taking off or landing. Although wetland birds attain some of the highest altitudes during migration, generally flying well above the height of wind turbines, many have large bodies relative to their wingspan, necessitating long takeoff and approach distances at stopover sites (Newton 2008). Thus, wetland birds are most at risk from collisions with wind turbines while ascending from or descending to stopover and foraging sites (Drewitt and Langston 2008; Kingsley and Whittam 2003). While there are only a limited number of larger lakes and wetland areas within the Project Area, large bodies of water present nearby suggests that populations of wading birds and waterfowl could pass through the Project Area during migration. Agricultural lands, especially those close to water, can provide important foraging areas for migrating wetland

birds. Land outside of the Project Area appears to be a better combination of these resources due to the presence of larger water bodies.

4.1.2 SPECIES DIVERSITY

To gain a better understanding of species diversity near the Project, eBird, Breeding Bird Survey (BBS), and Christmas Bird Count (CBC) data were gathered from locations near the Project. Data were compiled to offer a representation of bird species found throughout the year.

4.1.2.1 eBird Data

According to the eBird online checklist data for bird observations in Minnesota (eBird 2016), 272 and 227 bird species occur within Lincoln and Lyon Counties, respectively, either as residents or as migrants/transients. Most bird species that occur as summer and winter residents within the Project Area and surrounding region are associated with agricultural fields, as well as native shortgrass and mixed prairie vegetation communities. Some of the more common resident passerines and other small bird species likely to occur in the Project Area and surrounding region include the killdeer (*Charadrius vociferus*), snow bunting (*Plectrophenax nivalis*), red-winged blackbird (*Agelaius assimilis*), rock pigeon (*Columba livia*), barn swallow (*Hirundo rustica*), American robin (*Turdus migratorius*), horned lark (*Eremophila alpestris*), common grackle (*Quiscalus quiscula*), and American goldfinch (*Spinis tristis*). Waterfowl such as the mallard (*Anas platyrhynchos*) and the Canada goose (*Branta canadensis*) are also likely to be present due to the scattered lakes and wetlands located within the Project Area.

4.1.2.2 Breeding Bird Surveys

The BBS is a cooperative effort between the USGS's Patuxent Wildlife Research Center and Environment Canada's Canadian Wildlife Service to monitor the status and trends of North American bird populations. Currently, approximately 3,700 BBS routes are active (USGS 2015). BBS are conducted during the peak of the nesting season. Each route is 24.5 miles long, with a total of 50 stops located at 0.5-mile intervals along the route. A three-minute point count is conducted at each stop, during which the observer records all birds heard or seen within 0.25 mile of the stop.

Three active BBS routes located within or near the Project Area were used. These routes include: Tyler, which runs through the western portion of the Project within Lincoln County as well as into Pipestone County; Tracy, which is located approximately 12 miles to the southeast and extends into Lyon and Murray Counties; and Redwood Falls, which is approximately 13 miles to the northeast and is located in Lyon and Redwood Counties (**Exhibit 7**). **Table 6** provides a summary of the total number of species and individuals observed for each BBS route. Diversity ranged from 80-101 species of birds per survey route and between all three routes 114 total species were observed. Several state species of

concern were observed along the aforementioned BBS routes and include Forester's tern (*Sterna forsteri*), lark sparrow (*Chondestes grammacus*), Franklin's gull (*Leucophaeus pipixca*), purple martin (*Progne subis*), and American white pelican (*Pelecanus erythrorhynchos*). In addition, 10 USFWS Birds of Conservation Concern (BCC) were observed (Appendix A).

Table 6: BBS Surveys Routes near the Project Area

BBS Route	Latest Survey Date	Total Years of Survey data	Total Number of Species
Tyler	2014	15	80
Tracy	2013	6	86
Redwood Falls	2014	33	101

4.1.2.3 Christmas Bird Counts

CBC surveys are conducted in the early winter in over 2,100 locations across North America. Two CBC sites deemed close enough to the Project to provide comparable data were used and include the Cottonwood site, located approximately 15 miles northwest of the Project and the Marshall CBC site, located approximately 6 miles to the east. The Cottonwood CBC provided data from 1965-2015, and the Marshall CBC provided data from 1971-2015, although early data is limited.

Table 7 provides a summary of the total number of species and individuals observed for each CBC route. Diversity ranged from 87-92 species of birds per survey route. Between the two routes 104 total species were observed. One State listed endangered species, the loggerhead shrike (*Lanius ludovicianus*), was observed during the CBC. Additionally, three State listed species of concern, the northern grasshopper sparrow (*Ammodramus savannarum*), Franklin's gull (*Leucophaeus pipixcan*), and short-eared owl (*Asio flammeus*), and three Species of conservation concern including the bald eagle were observed.

Table 7: CBC Routes near the Project Area

CBC Route	Latest Survey Date	Total Number of Species
Cottonwood	2015	92
Marshall	2015	87

4.1.3 RAPTORS

A wide variety of raptor species are expected to occur within the Project Area and surrounding region year-round or on a seasonal basis. The most commonly occurring species

include the American kestrel (*Falco sparverius*), great-horned owl (*Bubo virginianus*), northern harrier (*Circus cyaneus*), red-tailed hawk (*Buteo jamaicensis*), rough-legged hawk (*Buteo lagopus*), great-horned owl (*Bubo virginianus*), Swainson's hawk (*Buteo swainsoni*), broad-winged hawk (*Buteo platypterus*), turkey vulture (*Cathartes aura*), and bald eagle (*Haliaeetus leucocephalus*). Although both CBC routes list the golden eagle (*Aquila chrysaetos*) as a species sighted, each have only listed one individual on one occasion- the Cottonwood CBC in 1999 and the Marshall CBC in 1979 (Audubon Society, 2015). Therefore, the likelihood of golden eagles being present within the Project Area is relatively small. See Appendix A for the full listing of raptor species.

Unlike many other migrants, most migrating raptors do not maintain high altitudes during migration. Instead, they conserve energy by gaining lift from updrafts and thermals and gliding long distances, slowly losing altitude until reaching the next updraft or thermal. Therefore, instead of concentrating at stopovers, raptors concentrate in areas that provide the best updrafts and thermals, especially during fall migration (Newton 2008; Goodrich and Smith 2008). Ridges, cliffs, and mountain ranges oriented perpendicular to prevailing winds produce the strongest updrafts. Although some ridges consistently provide strong updrafts, the location of updrafts can vary daily with local wind and weather conditions. As a result, when updrafts are not available, many raptors will adjust their migration routes to take advantage of thermals, which form over surfaces that heat up the air faster (e.g., rock, sand, bare ground, pavement). Raptor movements also are guided by linear landscape features including tall ridges and rivers oriented in the direction of migration (Goodrich and Smith 2008; Hawks and Mika 2012; Kerlinger 1989). While the Project Area does possess a great deal of bare ground, this is characteristic of the surrounding region following harvest, due to heavy agricultural uses of the land. Therefore, the Project Area would not cause a funneling of raptors, but rather a broad migration through the region.

Most raptor species nest in elevated areas such as tree stands, cliff ledges, or artificial structures. Other known summer resident raptors, which include the northern harrier and short-eared owl are ground-nesting by nature and prefer nesting in grasslands or wetlands. While the Project Area is an agriculturally-dominated landscape, habitat for raptor nesting does exist. There are several large lakes with surrounding tree stands that provide habitat for bald eagles and other raptors nesting in elevated areas, while wetland and grasslands areas are abundant enough where ground nesting raptors could potentially be found as well.

4.1.4 ENDANGERED, THREATENED, AND CONSERVATION SPECIES

4.1.4.1 State-Listed and MN DNR National Heritage Information System (NHIS) Data

The MN DNR's rare species guide identified 11 rare or listed bird species to be present within Lyon and Lincoln counties including the Acadian flycatcher (*Empidonax virescens*), American

white pelican, Bell's vireo (*Vireo bellii*), burrowing owl (*Athene cunicularia*), Forster's tern, Henslow's sparrow (*Ammodramus henslowii*), King Rail (*Rallus elegans*), loggerhead shrike, purple martin), trumpeter swan (*Cygnus buccinator*), and Wilson's phalarope (*Phalaropus tricolor*). One delisted species, the bald eagle, is also identified.

Avian-related NHIS data was analyzed within a 10-mile radius of the Project Area. According to this database, five state-listed species are present within one mile of the Project Area. These include the Henslow's sparrow (state endangered), Wilson's phalarope (state threatened), Bell's vireo (special concern), American white pelican (special concern), and Forster's tern (species of concern). Occurrences of the loggerhead shrike (state endangered), Acadian flycatcher (state threatened), and sandhill crane (*Grus canadensis*) (watch list) are all mapped within 5 miles of the Project Area, while the burrowing owl (state endangered), upland sandpiper (*Bartramia longicauda*), and trumpeter swan (special concern) are mapped within 10 miles of the Project Area.

Of these species, only the Henslow's sparrow, bald eagle, and American white pelican are rated as having a high potential to occur within the Project Area. For breeding, the Henslow's sparrow prefers large, undisturbed areas of grassland that are at least 247 acres in size (MN DNR 2016). Multiple plots of grassland and pasture within the Project are near to or surpass this acreage. The number of species occurrences and their close proximity to the Project Area (within one mile) further suggest a relatively high potential for this species to be present. Breeding and feeding resources are also present for the American white pelican within the Project Area in the form of shallow lakes and wetlands onsite. The combination of adequate habitat, presence of waterbird colonies within one mile of the Project, and the species' occurrence within one mile of the Project Area, the American white has a relatively high likelihood to occur within the Project Area.

Although no NHIS occurrences of bald eagles were mapped within ten miles of the Project, it is likely bald eagles utilize the Project for hunting, flyover, and nesting. As discussed previously, the Project Area offers moderate bald eagle habitat and several observations of bald eagles were documented in BBS and CBC data. However, far better quality hunting and nesting habitat is available near the Minnesota River and larger lakes in the surrounding area.

Westwood identified five species including the trumpeter swan, Forster's tern, Wilson's phalarope, loggerhead shrike, upland sandpiper, and Bell's vireo as having a moderate potential to occur within the Project Area. Of these, the Forster's tern, Wilson's phalarope, and trumpeter swan will likely utilize areas of open water and wetland within the Project Area; which provide suitable feeding and nesting habitat. However, these species are sensitive to pollution and contamination and fewer occurrences are mapped near the Project.

The Loggerhead shrike and upland sandpiper are both found in grassland habitat and pasture. Even though these species utilize similar habitat to that of the Henslow's sparrow, limited documented occurrences of shrikes and sandpipers were observed, and at a greater distance from the Project Area. The Bell's vireo was documented within one mile of the Project Area; however, this species was rated as having a moderate rather than high potential to occur within the Project Area due to the single documented occurrence as well as the limited availability of shrubby riparian corridors and woodlands, its preferred habitat, within the Project Area.

Three remaining avian species, the Acadian flycatcher, burrowing owl, and sandhill crane were all rated as having a low potential to occur within the Project Area. Acadian flycatchers are typically found in woodlands, which comprise less than one percent of the Project Area, and woody/shrubby stream banks. Burrowing owls utilize abandoned rodent dens for burrows and nesting and can be found in grazed pastures but tend to avoid areas near agricultural land. Due to the low species occurrence (n=1) within 10 miles, the burrowing owl was rated as a low occurrence potential. The final species rated as a low potential for occurrence is the sandhill crane. This is based on a single observed occurrence and its distance from the Project Area (within a 5-mile radius).

4.1.4.2 Federally Listed and U.S. Fish and Wildlife Service Birds of Conservation Concern

The formal BCC list was developed by USFWS as a result of a 1988 amendment to the Fish and Wildlife Conservation Act. This Act mandated that USFWS "identify species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act (ESA) of 1973." The goal of the BCC list is to prevent or remove the need for additional ESA bird listings by implementing proactive management and conservation actions and to consult on these species in accordance with Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds.

The Project Area is located within Bird Conservation Region (BCR) 11 (Prairie Potholes) (USFWS 2008). The USFWS lists 27 species as BCC within the Prairie Potholes Bird Conservation Region, 10 of which have been recorded on one or more of the three nearby BBS routes and/or one of the Christmas Bird Counts (Appendix A).

No federally threatened or endangered species were listed within the Project Area based on NHIS, BBS, CBC, and the USFWS's Information for Planning and Conservation (IPaC) database.

4.1.5 SENSITIVE AVIAN HABITAT

4.1.5.1 Important Bird Areas

The National Audubon Society lists IBAs as sites providing essential habitat for one or more species of birds. These include sites for breeding, wintering, and/or migrating birds and can range from only a few acres to thousands of acres in size. The nearest IBA is the Prairie Coteau Complex which is a collection of five areas that are located in Lincoln, Murray, Yellow Medicine, Pipestone, and Rock counties comprising a total of 177,997 acres. The closest of these IBA areas covers Lake Benton and is located approximately seven miles south of the Project Area (Exhibit 7). The Prairie Coteau Complex is a State recognized IBA where some 251 bird species have been observed, including five state-endangered species (Henslow's sparrow, burrowing owl, chestnut-collared longspur, loggerhead shrike, and horned grebe), one state-threatened species (Wilson's phalarope), and five species of special concern (marbled godwit, Franklin's gull, Forster's tern, short-eared owl, and Nelson's sparrow).

4.1.5.2 Leks

A lek is a location where certain species of birds congregate during the breeding season to perform open courtship displays (Minnesota DNR, 2016). One of these species is the Greater Prairie Chicken, a Minnesota state species of concern. The nearest known lek is located approximately 45 miles northeast of the Project Area.

4.1.5.3 Rookeries

Some species of waterbirds are known to nest together in colonies that are otherwise known as rookeries. Depending on the species, rookeries can be found on the ground or in elevated locations such as trees. It is also common for rookeries to include multiple species. According to NHIS data, one colonial water bird nesting site (rookery) is present within the Project Area, five rookeries are located within a 10-mile radius of the Project Area, including one located within the Project. The colonies are home to great egrets (*Ardea alba*), great blue herons (*Ardea herodias*), black-crowned night herons (*Nycticorax nycticorax*), and double-crested cormorants (*Phalacrocorax auritus*). Due to the presence of these colonies both within the Project Area and nearby, it is likely that congregations of these waterbirds will be seasonally present within the Project Area.

4.2 Bats

4.2.1 Species Occurrence

Based on Westwood's review of the bat species' natural history, distribution and understanding of the Project Area, a likelihood rating of *None*, *Low*, *Moderate*, or *High* was assigned to describe the probability of a particular species occurring within the Project Area. **Table 7** summarizes the listing status of these species, their typical habitat and State-wide distribution, and assigned a likelihood rating.

Table 7: Likelihood of Bat Species to Occur in the Project Area¹

Common Name	State/Federal Status	Typical Roosting Habitat	Potential for Occurrence
big brown bat	SC/None	Day roosts in man-made structures, caves, and hollow trees. Hibernates in caves and mines. Susceptible to white-nose syndrome.	High
silver-haired bat ³ (<i>Lasionycteris noctivagans</i>)	None/None	Roosts in tree branches and under bark. Migrates south in winter.	High
eastern red bat ³ (<i>Lasiurus borealis</i>)	None/None	Roost in leaf clumps in trees. Migrates south in winter.	High
hoary bat ³ (<i>Lasiurus cinereus</i>)	None/None	Roost in leaf clumps in trees. Migrates south in winter.	High
little brown myotis (<i>Myotis lucifugus</i>)	SC/None	Day roosts in man-made structures, caves, and hollow trees. Hibernates in caves and mines. Susceptible to white-nose syndrome.	High
tri-colored bat (<i>Pipistrellus subflavus</i>)	SC/None	Hibernates in caves, mines, and tunnels. Roosts in tree branches and under bark. No maternal colonies known to exist in MN. Susceptible to white-nose syndrome.	Moderate
northern long-eared bat (<i>Myotis septentrionalis</i>)	SC/THR	Hibernates in caves, mines, and manmade structures. Days roosts under tree bark in wooded areas; often around wetlands. Will also use abandoned structures. Night roosts in caves and mines. Susceptible to white-nose syndrome.	Low
¹ Information adapted from MN DNR (2016), CBI (2016).			
² Key to species status: SC = Special Concern; THR=Threatened; None=No Status			

Five of the seven species present in Minnesota were identified with high potential to occur within the Project Area. These include the little brown bat (*Myotis lucifugus*), big brown bat (*Eptesicus fuscus*), silver haired bat (*Lasionycteris noctivagans*), hoary bat (*Lasiurus cinereus*), and eastern red bat (*Lasiurus borealis*). Silver haired bats, hoary bats, and eastern red bats are migratory and commonly roost in trees and shrubs throughout the year and migrate south to warmer climates for the winter (MN DNR 2016, CBI 2016). The little brown bat and big brown bat typically hibernate during the winter in caves and summer roost in trees,

shrubs, caves, and buildings. The remaining two species are less likely to be found within the Project boundary due to lack of specified habitat present, the Project area being located outside of the typical ranges for these species, or they are a much less commonly occurring species.

4.2.2 Bat Roosting Areas and Potential Habitat

As described previously, the Project Area is dominated by agricultural land interspersed with wetlands and grasslands/pasture. Forested areas within the Project are primarily restricted to areas along stream corridors and around homesteads. Tree-roosting bats could utilize these wooded stream corridors and wetland areas for foraging and roosting habitat. Other roosting habitat may also include abandoned buildings and operational farmsteads. However, more suitable roosting habitat for tree roosting bats is likely available along the Minnesota River. No mines, caves, karst, or pseudokarst formations are known to occur within or near the Project Area or surrounding region; suggesting it is very unlikely any of the seven bat species found in Minnesota will utilize the site for hibernation and it is unlikely cave roosting species will utilize the Project for roosting habitat. However, all seven bat species may use water resources within the Project for foraging habitat.

4.3 Endangered, Threatened, and Conservation Species

The Project Area was evaluated for the presence of federal and State listed species, their habitat, and the potential for the proposed Project to affect such species. A review of the MN DNR NHIS database licensed to Westwood (LA763, May 2015), and endangered and threatened species lists from the MN DNR and USFWS (MN DNR 2015; USFWS 2016) was conducted to identify rare species known or likely to occur in the Project Area.

4.3.1 MN DNR National Heritage Information System (NHIS) Data

Results from the MN DNR NHIS database review for the Project Area indicated 18 records of rare plants and animals within the Project (MN DNR 2015). The mapped occurrences include two animal assemblages, seven records of vertebrate animals, five records of invertebrate animals, and four records of plants. It should be noted that the absence of rare species records in the Project cannot be construed as lack of occurrence. Instead, it may mean the area has not been surveyed. Within one mile of the site an additional 14 NHIS occurrences are mapped and include two additional animal assemblages and plants and five additional invertebrates and vertebrates (**Table 8**).

Table 8: Summary of MN DNR NHIS Records within One Mile of the Project Area

Species	Number of Mapped Occurrences within One Mile of Project Area	State/Federal Status
Vascular Plants		
hair-like beak-rush	1	THR/None
Missouri milk-vetch	1	SC/None
Red Three-awn	1	SC/None
slender milk-vetch	1	SC/None
western white prairie-clover	2	SC/None
Invertebrate Animals		
phlox moth	1	SC/None
poweshiek skipperling	5	END/END
regal fritillary	4	SC/None
Vertebrate Animals		
American white pelican	1	SC/None
Bell's vireo	1	SC/None
Forster's tern	1	SC/None
Henslow's sparrow	3	END/None
northern grasshopper mouse	1	SC/None
prairie vole	2	SC/None
Richardson's ground squirrel	1	SC/None
Wilson's phalarope	2	THR/None
Animal Assemblage		
colonial waterbird nesting site	4	None/None
Total	32	

MN DNR Mussel data mapped six occurrences of mussels within the surrounding one-mile buffer of the Project including occurrences of: cylindrical papershell (*Anodontoides ferussacianus*), fatmucket (*Lampsilis siliquoides*), white heelsplitter (*Lasmigona complanata*), giant floater (*Pyganodon grandis*), and creeper (*Strophitus undulates*). Of these occurrences, three were identified as dead and none are species identified as State or federally listed. In addition all occurrences were mapped within reaches of the Coon Creek.

4.3.2 Federally and State Listed Species

Federally listed species include those characterized by USFWS under the authority of the Endangered Species Act (ESA) of 1973 (16 United States Code [USC] 1531–1544) as

threatened or endangered, as well as those proposed for listing (i.e., candidate species). The ESA mandates the protection of federally listed threatened or endangered species, as well as habitat designated as critical habitat. Additionally, under the Bald and Golden Eagle Protection Act (BGEPA) (16 USC 668-668d, 54 Stat. 250), USFWS has the authority to review proposed actions with respect to impacts to the bald eagle and golden eagle. Review of the USFWS’ Information Planning and Conservation System (IPaC) identified two federally listed threatened or endangered species as potentially occurring within the Project Area and surrounding region. These include the northern long-eared bat and Dakota skipper (*Hesperia dacotae*). The USFWS’s listed species for Lincoln and Lyon Counties also included the federally endangered Topeka shiner and Poweshiek skipperling (*Oarisma Poweshiek*) and federally threatened western prairie fringed orchid (*Platanthera praeclara*). IPac also identified designated critical habitat for the Dakota skipper, poweshiek skipperling, and Topeka shiner within the Project Area. Critical habitat for the Poweshiek skipperling and Dakota skipper are mapped within the northwest and southwest corners of the project. These areas also correspond to outstanding MBS sites. Critical habitat for the Topeka shiner covers the western half of the Project Area.

State listed species include those characterized under Minnesota’s Endangered Species Statute and identified under Minnesota rules, Chapter 6134. Minnesota Rules, Parts 6212.1800-6212.2300 delegate the MN DNR authority to adopt rules to regulate the treatment of said species. Review of the MN DNR’s Rare Species Guide for Lincoln and Lyon Counties identified 45 rare species known to occur in Lincoln and Lyon Counties; including four mammals, 12 birds, one reptile, one fish, two mussels, eight insects, and 17 vascular plants (MN DNR 2016).

Based on the review of the listed species’ natural history and understanding of the Project Area, a likelihood rating was assigned of *None, Low, Moderate, or High* to describe the probability of a particular species occurring within the Project Area. **Table 9** summarizes the listing status of these species, their typical habitat, and assigned a likelihood rating. Of the State and federally listed species found in Lincoln and Lyon Counties, most are unlikely to be found within the Project Area either due to lack of specified habitat, predominance of agriculture and degraded habitat, and/or the Project Area is located outside of typical ranges.

Table 9: Summary State and Federally Listed Species Known to Occur in Lincoln and Lyon Counties

Common Name (<i>Scientific Name</i>)	State/Federal Status	Range and General Habitat Requirements	Potential for Occurrence
Mammals			
gray wolf (<i>Canis lupus</i>)	DL/THR	Habitat generalists – found in prairies, forests, mountains, etc. Primary reason for population decline is related to habitat destruction and	Low

Table 9: Summary State and Federally Listed Species Known to Occur in Lincoln and Lyon Counties

Common Name (<i>Scientific Name</i>)	State/Federal Status	Range and General Habitat Requirements	Potential for Occurrence
		human persecution.	
northern grasshopper mouse (<i>Onychomys leucogaster</i>)	SC/None	Prairies and plains with limited vegetation, often displaced by human activity due to territorial nature.	High
prairie vole (<i>Microtus ochrogaster</i>)	SC/None	In the upper Midwest found almost exclusively in undisturbed dry grassland (e.g., savanna and upland prairie). Very territorial with home ranges of 0.27-0.54 acres. Primary reason for population decrease is related to destruction of habitat	High
Richardson’s ground squirrel (<i>Urocitellus richardsonii</i>)	SC/None	Grasslands and agricultural areas with sandy soils; feeds on insects and plants. Home range no larger than 0.02 acres.	High
western harvest mouse (<i>Reithrodontomys megalotis</i>)	SC/None	Grasslands, prairies, and overgrown fields. Eats seeds, insects, and new of plants. Home ranges no larger than 1 acre.	Low
northern long-eared bat (<i>Myotis septentrionalis</i>)	SC/THR	Hibernates in caves, mines, and manmade structures. Days roosts under tree bark in wooded areas; often around wetlands. Will also use abandoned structures. Night roosts in caves and mines. Susceptible to white-nose syndrome.	Low
Birds			
Acadian flycatcher (<i>Empidonax virescens</i>)	SC/None	Large patches of mature forest near streams and wetlands. Feeds on insects and are sensitive to habitat fragmentation and deforestation.	Low
American white pelican (<i>Pelecanus erythrorhynchos</i>)	SC/None	Large shallow waterbodies with fish and available nesting islands. Primary reasons for population decline are related to habitat destruction and human disturbance.	High
bald eagle (<i>Haliaeetus leucocephalus</i>)	DL/None	Lakes, rivers, and deep marshes; will forage in open grasslands. Nest in perched areas like large trees and cliffs. Home ranges typically between 250 and 500 acres.	High
Bell’s vireo (<i>Vireo bellii</i>)	SC/None	Nests and forages in dense shrubby vegetation in fields, riparian areas, and woodland; eats insects and spiders.	Moderate

Table 9: Summary State and Federally Listed Species Known to Occur in Lincoln and Lyon Counties

Common Name (Scientific Name)	State/Federal Status	Range and General Habitat Requirements	Potential for Occurrence
burrowing owl (<i>Athene cunicularia</i>)	END/None	Grazed pastures, and native mixed grass prairies, usually avoid intense agriculture. Uses badger and Richardson’s ground squirrel nests as burrows. Eat mainly arthropods but may consume small animals.	Low
Forster's tern (<i>Sterna forsteri</i>)	SC/None	Wetland complexes with open water and emergent areas. Nest on muskrat houses and floating vegetation and primarily consume small fish; sensitive to disturbance and chemical contamination.	Moderate
Henslow’s sparrow (<i>Ammodramus henslowii</i>)	END/None	Uncultivated grasslands and old fields with dense litter layer. Usually inhabit grassland areas over 247 acres and consume invertebrates and seeds.	High
king rail (<i>Rallus elegans</i>)	END/None	Shallow wetland complexes with emergent vegetation. Feed on aquatic invertebrates and fish. Primary reason for population decline is related to wetland habitat loss and degradation.	Low
loggerhead shrike (<i>Lanius ludovicianus</i>)	END/None	Large tracts of upland grassland with small trees and shrubs; can be found in pastures, old fields, farmyards, and cemeteries. Eat large invertebrates and small animals.	Moderate
purple martin (<i>Progne subis</i>)	SC/None	Historically inhabited areas along forest edges and nested in woodpecker holes. They are now found nesting predominately in and near cities with nesting boxes and forage in pastures, parks, and other open spaces.	Low
trumpeter swan (<i>Cygnus buccinator</i>)	SC/None	Small ponds and lakes with extensive cattail and bulrush populations and a mixture of open water and emergent vegetation. Sensitive to disturbance and pollution.	Moderate
Wilson's phalarope (<i>Phalaropus tricolor</i>)	THR/None	Wet prairie, fens, and sedge/grass dominated wetlands with mosaic of open water and short vegetation. Sensitive to degradation of water	Moderate

Table 9: Summary State and Federally Listed Species Known to Occur in Lincoln and Lyon Counties

Common Name (<i>Scientific Name</i>)	State/Federal Status	Range and General Habitat Requirements	Potential for Occurrence
		quality.	
Reptiles			
Blanding's turtle (<i>Emydoidea blandingii</i>)	THR/None	Wetland complexes and adjacent sandy uplands, clam waters with abundant vegetation. Will also use shallow streams and oxbows, prairie marshes, and agricultural fields. May travel over a mile for nesting.	Moderate
Fish			
Topeka shiner (<i>Notropis Topeka</i>)	SC/END	Prairie rivers and stream pools and oxbows with sand or gravel bottoms.	Moderate
Invertebrates			
creek heelsplitter (<i>Lasmigona compressa</i>)	SC/None	Downstream of riffles in pools associated with creeks and small rivers with sand, gravel, or mud substrates. Feeds on organic matter and small microorganisms. Need yellow perch, black crappie, slimy sculpin, or softfin shiner as larval hosts.	Low
Dakota skipper (<i>Hesperia dacotae</i>)	END/THR	Dry to dry-mesic native prairie with mid-height grasses with some topographic variability. No evidence they succeed in restorations or disturbed prairie. Needs little bluestem, bluegrass, and pnic grass for larval host. Adults live for three weeks at most.	Moderate
elktoe (<i>Alasmidonta marginata</i>)	THR/None	Medium to large rivers with sandy and gravel substrates. Feeds on organic matter and small microorganisms. Juveniles require suckers and rockbass for hosts.	Low
Iowa skipper (<i>Atrytone arogos iowa</i>)	SC/None	Dry to dry-mesic native prairie with big and little bluestem.	Low
jumping spider (<i>Habronattus texanus</i>)	SC/None	Dry Prairie slopes; feed on insects. Little is known of this species life history in MN.	None
jumping spider (<i>Phidippus pius</i>)	SC/None	Unplowed native prairie; vulnerable to agricultural development. Very rare and little is known of its life history in MN.	Low
Ottoe skipper (<i>Hesperia ottoe</i>)	END/None	Native remnant dry-mesic and dry prairies with little bluestem, prairie	Low

Table 9: Summary State and Federally Listed Species Known to Occur in Lincoln and Lyon Counties

Common Name (<i>Scientific Name</i>)	State/Federal Status	Range and General Habitat Requirements	Potential for Occurrence
		dropseed, side-oats grama, narrow-leaved purple coneflower, big bluestem, and Indian grass.	
phlox moth (<i>Schinia Indiana</i>)	SC/None	Native upland prairie, savannas, and sandy open woodlands with prairie phlox.	Moderate
poweshiek skipperling (<i>Oarisma poweshiek</i>)	END/END	Wet to dry native tallgrass prairie with little bluestem and prairie dropseed grasses; sites with non-native grasses are unsuitable.	High
regal fritillary (<i>Speyeria idalia</i>)	SC/None	Native upland and wet prairie. Feed only on violets, especially bird’s-foot violet.	High
Plants			
American ginseng (<i>Panax quinquefolius</i>)	SC/None	Well-developed upland forest soils in closed canopy sugar maple, basswood, and red oak forests.	Low
dwarf spike-rush (<i>Eleocharis coloradoensis</i>)	SC/None	Margins of seasonally fluctuating prairie lakes. Not known to still exist in the state.	None
few-flowered spike-rush (<i>Eleocharis Quinqueflora</i>)	SC/None	Sparsely vegetated wet habitats including shorelines, fens, and wet prairies. Common in places concentrated with marl.	None
hair-like beak-rush (<i>Rhynchospora capillacea</i>)	THR/None	Calcareous fens margins and marl flats; sometimes found in spring fens.	Low
Hall's sedge (<i>Carex hallii</i>)	SC/None	Moist or wet saline prairies, mesic prairies, and bush prairies.	Low
missouri milk-vetch (<i>Astragalus missouriensis</i>)	SC/None	Dry sand-gravel prairies and dry hill prairies dominated by short grasses.	Low
plains prickly pear (<i>Opuntia macrorhiza</i>)	SC/None	Exposed bedrock and dry prairies.	Low
plains reedgrass (<i>Calamagrostis montanensis</i>)	SC/None	Dry short/mid-grass prairies with sandy soils.	Low
prairie mimosa (<i>Desmanthus illinoensis</i>)	SC/None	Tallgrass prairies and prairie lake shores.	Low
prairie moonwort (<i>Botrychium campestre</i>)	SC/None	Dry, dry hill, dry bedrock bluff, and sand gravel prairies with predominantly native species.	Low
red three-awn (<i>Aristida purpurea</i>)	SC/None	Dry and dry-mesic prairies with well-drained soils dominated by grasses. Commonly found on ridge crests and upper hillslopes and in areas degraded by grazing.	Low

Table 9: Summary State and Federally Listed Species Known to Occur in Lincoln and Lyon Counties

Common Name (Scientific Name)	State/Federal Status	Range and General Habitat Requirements	Potential for Occurrence
slender milk-vetch (<i>Astragalus flexuosus</i>)	SC/None	Dry and mesic prairies with loamy soils.	Low
small-leaved pussytoes (<i>Antennaria parvifolia</i>)	SC/None	Southern dry prairie, northern dry prairie, and southern dry savanna plant communities in areas with sandy soils.	Low
small white lady's-slipper (<i>Cypripedium candidum</i>)	SC/None	Deep-soil mesic prairies, wet prairies, sedge meadows, and calcareous fens populated with halictine and anderid bees. Does not grow in areas previously or currently grazed.	Low
snow trillium (<i>Trillium nivale</i>)	SC/None	Mesic hardwood forests dominated by sugar maple, basswood, and oaks.	Low
soft goldenrod (<i>Solidago mollis</i>)	SC/None	Dry and mesic prairies on gentle slopes.	Low
waterhyssop (<i>Bacopa rotundifolia</i>)	THR/None	Rainwater pools and pond margins.	None
western white prairie-clover (<i>Dalea candida</i>)	SC/None	South and west-facing slopes of dry hill prairies with sandy soils.	Moderate
western prairie fringed orchid (<i>Platanthera praeclara</i>)	END/THR	Mesic to wet tallgrass prairies and meadows, also found in old fields and ditches. Depend on hawkmoth for pollination; thus they are uncommon in areas with insecticide use.	Low

END = Endangered, THR = Threatened, SC = Species of concern (Rare, but with no regulatory listing status), DL = De-listed, None = No status

4.3.3 Implications

NHIS records and review of state and federally-listed species suggest the overall risk for rare and listed animals or plants to occur within or utilize the Project is moderate. The Project Area offers very little quality habitat for most species and it is likely much of the water resources within the Project exist in a degraded state due to the predominance of agricultural activity and land use within the Project and surrounding area. That being said, there are several areas surrounding the Project, and a few small pockets within the Project, that provide potentially suitable habitat for rare and sensitive species.

Eighteen NHIS species records are mapped in within the Project Area and only 14 additional records are mapped within one mile of the Project, indicating the documented occurrences of rare and sensitive species are moderate within and adjacent to the Project. NHIS occurrences within the Project include two animal assemblages, two insects, four plants, three mammals, and three birds; all of which were associated with outstanding, high, or moderately ranked MBS sites and most of which were observed within the past 10 years.

NHIS records mapped within five to 10 miles of the Project were primarily clustered around moderate to outstanding MBS sites and water resources.

Of the reviewed State and federally listed species, eight were identified as highly likely to occur within or utilize habitats within the Project Area. These include the northern grasshopper mouse, prairie vole, Richardson's ground squirrel, American white pelican, bald eagle (delisted), Henslow's sparrow, Poweshiek skipperling, and the regal fritillary. Ten of the reviewed species were identified as having moderate likelihood of occurring within the Project and include the Bell's vireo, Forester's tern, loggerhead shrike, trumpeter swan, Wilson's phalarope, Blanding's turtle, Topeka shiner, phlox moth, Dakota skipper, and the western white prairie-clover. Of these species the Poweshiek skipperling and Topeka shiner are federal listed as endangered and the Dakota skipper is federally listed as threatened. The Henslow's sparrow, loggerhead shrike, Blanding's turtle, Topeka shiner, Dakota skipper, Poweshiek skipperling, and Wilson's phalarope have state listing status with regulatory effect and are listed as endangered and threatened, respectively. The remaining species with high or moderate potential to occur within the Project Area are considered state species of concern.

Of the evaluated plant species, all were identified as having low or no potential of occurring within the Project Area except for the western white prairie-clover, which was identified as having moderate potential to occur within the Project. In addition, only 14 mapped occurrences of rare and listed plant species are located within five miles of the Project. Given the habitat specificity and pollinator specialization identified for the rare and listed species in Lincoln and Lyon Counties, it is unlikely most of these species could successfully colonize the Project (MN DNR 2016, FWS 2016). Western white prairie-clover was observed numerous times by MN DNR plant experts and the populations assessed were of high vitality. As a State species of concern, there are no specific regulatory protections associated with the western white prairie-clover; however, EDF is committed to the avoidance of rare natural features to the extent practicable.

Similar to plants, the insect species reviewed for Lincoln and Lyon Counties have highly specific habitat requirements and often have special plant specific associations. In addition only the regal fritillary, poweshiek skipperling, and phlox moth were mapped within 5 miles of the Project Area. Of the insect species reviewed none will likely have maximum dispersal distances greater than five miles (MN DNR 2016, USFWS 2016, Xerxes Society 2016). Based on NHIS occurrence frequency, their observation by experts, their proximity to the Project, and the areas of quality habitat available within the Project, the regal fritillary and poweshiek skipperling were determined to have high possibility to occur within the Project. The phlox moth was identified as having moderate potential to occur within the Project for similar reasons as above, however, occurrences were fewer and observations were often documented over ten years ago. Although critical habitat is mapped within the Project for the Dakota skipper, only one occurrence within 10 miles of the Project is documented in the

NHIS database. As such, the Dakota skipper has a moderate likelihood of occurring within the Project.

NHIS mussel data suggests 115 occurrences of freshwater mussels occur within ten miles of the Project, however, 37 were identified as dead and only six were identified within one mile of the Project. Only the creek heelsplitter (*Lasmigona compressa*) is considered a species of concern; all other species identified within the 10- mile buffer are not State or federally listed. It is worth noting that several NHIS records of freshwater mussels were mapped within streams that also intersect the Project Area, so it is possible these species may migrate within the stream corridors to areas within the Project. Two occurrences of Topeka shiners were also identified by NHIS data in the surrounding 10- mile buffer. The Topeka shiner was identified as having moderate potential to occur within the Project Area as the Project is located within mapped critical habitat however, the fish is sensitive to pollution and occurrences were few and located in stream reaches that do not intersect the Project Area.

No NHIS records of Blanding's turtles were mapped within 10 miles of the Project Area. Blanding's turtles are often found inhabiting wetlands and streams in agricultural areas, are less sensitive to pollution, and are known to travel several miles, thus, it is possible they may utilize suitable habitat within the Project Area. However, given the lack of recorded observations within 10 miles of the Project, the likelihood of the Blanding's turtles to occur within the Project Area is moderate (MN DNR 2016).

NHIS records indicated 17 occurrences of 12 bird species within 10 miles of the Project. Because the Project is located within 10 miles of several high quality habitat areas and public and conservation lands, it is likely the Project may be temporarily utilized by a variety of birds as stopover and flyover habitat. Of the listed and rare bird species for Lincoln and Lyon Counties, American white pelican, bald eagle (delisted), and Henslow's sparrow were identified as having high potential to occur within the Project and the Bell's vireo, Forester's tern, loggerhead shrike, Wilson's phalarope, and trumpeter swan were identified as having moderate potential to utilize the Project. All other reviewed bird species were identified as having low potential to occur within the Project due to lack of suitable habitat and or the Project location situated outside of typical ranges. A more detailed review of NHIS and listed bird species is documented in section 5.1.4.

NHIS records indicate nine occurrences of mammals within 10 miles the Project and two occurrences within the Project boundary. Westwood identified the northern grasshopper mouse, prairie vole, and Richardson's ground squirrel as having a high potential to occur within the Project. All four species require areas of grassland or fields for burrowing but tend to be sensitive to habitat disturbance. It is possible these species will utilize the Project for burrowing but will likely be limited to areas of pasture or grassland. The northern grasshopper mouse, prairie vole, and Richardson's ground squirrel were found within or very near the Project Area and the occurrences were documented in good condition and were

observed within the past 10 years. Although the western harvest mouse requires similar habitat, no NHIS occurrences are mapped within 10 miles of the Project. It is possible this species may utilize the Project; however, given the lack of recorded observations and the species’ small home range, the likelihood it will occur within the Project is low.

5.0 USFWS Land-Based Energy Guidelines

The *USFWS Land-Based Wind Energy Guidelines* (USFWS 2012) provide voluntary guidance for assessing potential impacts to wildlife and their habitats from wind energy development. These guidelines are founded upon a “tiered approach” for assessing potential impacts to wildlife and their habitats. The tiered approach is an iterative decision-making process for collecting information in increasing detail; quantifying the possible risks of proposed wind energy projects to wildlife and habitats; and evaluating those risks to make siting, construction, and operation decisions. Subsequent tiers refine and build upon issues raised and efforts undertaken in previous tiers.

The tiers are outlined briefly as:

- Tier 1 – Preliminary evaluation or screening of sites (landscape -level screening of possible project sites)
- Tier 2 – Site characterization (broad characterization of one or more potential project sites)
- Tier 3 – Field studies to document site wildlife conditions and predict project impacts (site-specific assessments at the proposed project site)
- Tier 4 – Post-construction fatality studies (to evaluate direct fatality impacts)
- Tier 5 – Other post-construction studies (to evaluate direct and indirect effects of adverse habitat impacts and assess how they may be addressed)

Table 10 provides a summary of the Tier 1 and Tier 2 Evaluation for the proposed Project.

Table 10: Tier 1 and 2 Evaluation Summary

Tier Question	Tier Question Summary
Tier 1 and 2	
Are there species of concern present on the potential site or is habitat present for these species?	Yes - Based on habitat available and NHIS species occurrence information, there is high potential for occurrence of the northern grasshopper mouse, prairie vole, Richardson’s ground squirrel, American white pelican, bald eagle, Henslow’s sparrow, poweshiek skipperling, and the regal fritillary and a moderate potential for the occurrence of the Bell’s vireo, Forester’s tern, loggerhead shrike,

Table 10: Tier 1 and 2 Evaluation Summary

Tier Question	Tier Question Summary
	trumpeter swan, Wilson’s phalarope, Blanding’s turtle, Topeka shiner, phlox moth, Dakota skipper, and the western white prairie-clover.
Is site development precluded by law or home to sensitive areas?	No - Project is located on private land. While sensitive areas are present within the Project Area, the Project turbines and facilities can be sited to avoid these areas and minimize impacts to sensitive species.
Are there known critical areas of wildlife congregation?	Yes- Colonial waterbird nesting sites are mapped within the Project Area.
Is there potential for habitat fragmentation or habitat loss?	No - Project Area is predominately cropland. Turbine siting will avoid wetlands, critical habitat, and other sensitive areas to the degree practicable to avoid potential habitat loss or fragmentation.
Are there plant communities of concern on-site?	Yes –While the Project Area is heavily dominated by cultivated cropland (68%), there are 13 mapped native plant community types totaling 2,144 acres and 9% of the Project is covered by wetland.
Which bird and bat species are likely to use proposed site?	Most likely species include common birds found in agricultural areas such as red-winged blackbirds, killdeer, and horned larks, common waterfowl such as Canada geese and mallards, and medium-frequency calling bats.
Is there potential for adverse effects to species of concern?	Yes - Potential is moderate given the several larger tracts of grassland within the Project, quantity of NHIS occurrences within the Project and surrounding area, and the predominance of agriculture within the Project and surrounding area identified within Tier 1 and Tier 2 studies. However, with the implementation of avoidance and mitigation measures, impacts are expected to be less than significant and no “take” of species of concern are anticipated to occur.

It should be noted that adherence to the USFWS Land-Based Wind Energy Guidelines is voluntary and does not relieve any individual, company, or agency of the responsibility to comply with laws and regulations. If a violation occurs, however, USFWS can consider a developer’s documented efforts to communicate with USFWS and adhere to the guidelines.

This site characterization study serves as the Tier 2 stage in the site selection process and provides the requisite site-specific information needed to determine whether or not a Tier 3 study is warranted. Results from the Tier 2 investigation in this report generally indicate a moderate probability of significant adverse impact to wildlife. This was based on the fact that few species of concern were known to be present in the Project Area; and critical areas of wildlife congregation, staging areas, winter ranges, nesting sites, migration stopovers or corridors, leks, or other areas of seasonal importance are not known to occur. It should be noted, however, that current information is inconclusive to address the risk to individual wildlife species in more detail.

The next stage in the evaluation process would be for Red Pine to conduct Tier 3 studies to adequately document the presence or probable absence of passerine birds; raptors; bats; rare, threatened, and endangered wildlife species; and natural communities and rare plants. While Tier 3 studies address many of the same issues and questions identified for Tiers 1 and 2, Tier 3 studies differ because they attempt to quantify the distribution, relative abundance, behavior, and site use of species of concern. Tier 3 data also attempt to estimate the extent that these factors expose these species to risk from the proposed wind energy facility.

While the outcome of Tier 1 through 3 studies generally determine the need for Tier 4 studies, fatality studies are generally required for wind energy projects. A post-construction monitoring study will likely be required to determine avian and bat mortality rates resulting from operation of the Project. The monitoring study would use standardized area searches of turbines at the project site in accordance with agency recommended guidelines. Specific information regarding the methods and metrics used, duration, and timing of the monitoring study would be contained in a Bird and Bat Conservation Strategy, which would likely be developed for the Project in accordance with the USFWS Guidelines for Land-Based Wind Energy Facilities.

6.0 SUMMARY AND CONCLUSIONS

Based on Federal and state lists and databases and habitat availability, Westwood identified seven state and federally listed species as having high likelihood of occurring within or utilize habitats within the Project Area. These include the northern grasshopper mouse, prairie vole, Richardson's ground squirrel, American white pelican, Henslow's sparrow, Poweshiek skipperling, and the regal fritillary. The delisted bald eagle was also identified as having a high potential to occur within the Project. Ten of the reviewed species were identified as having moderate likelihood of occurring within the Project and include the Bell's vireo, Forester's tern, loggerhead shrike, trumpeter swan, Wilson's phalarope, Blanding's turtle, Topeka shiner, phlox moth, Dakota skipper, and the western white prairie-clover. Of these species, the Poweshiek skipperling and Topeka shiner are federally listed as endangered and the Dakota skipper is federally listed as threatened. The Henslow's sparrow, loggerhead

shrike, Blanding's turtle, Topeka shiner, Dakota skipper, Poweshiek skipperling, and Wilson's phalarope have state listing status with regulatory effect and are listed as endangered and threatened, respectively. The remaining species with high or moderate potential to occur within the Project Area are considered state species of concern. Several bat species are also likely to utilize wooded stream corridors and wetland areas within the project for foraging and roosting habitat.

Several large tracts of grassland with high quality plant communities, several areas designated as conservation lands, and water resources likely support wildlife and rare or sensitive species within the Project Area. Based on the number and proximity of NHIS occurrences and information from cited data sources, it appears the Project provides adequate habitat for a variety of wildlife and plant communities. Although there is quality habitat available within and around the Project, the area is predominantly agricultural and the vast majority of the water resources, plant communities, and habitat areas are considered degraded and disturbed. Thus, areas of wildlife use will likely be concentrated with or near the higher quality habitat areas. Overall, the Project has moderate probability for adverse impacts on wildlife and sensitive resources. However, EDF is committed to avoiding special resource areas and will avoid impacts to water resources and quality habitat areas to the extent practicable.

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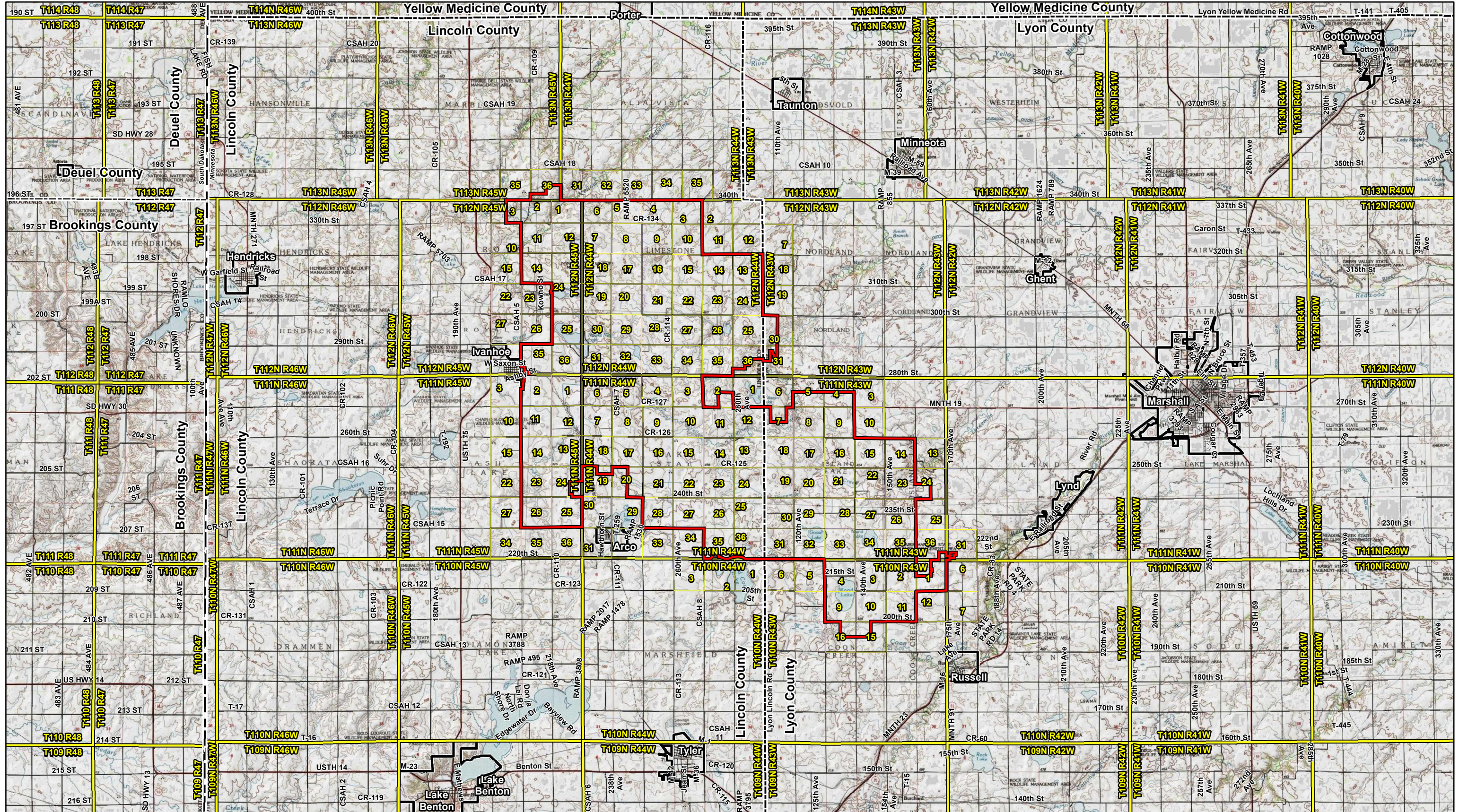
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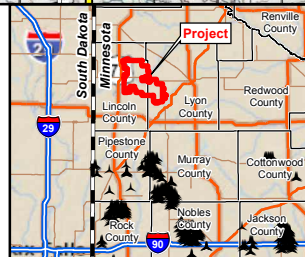
Exhibits

Red Pine Wind Farm

Lincoln and Lyon Counties, Minnesota



Data Source(s): Map and data are approximate. Westwood (2016); Geospatial Data Gateway (various dates); ESRI Basemap, Imagery (accessed 2016); ESRI (2012); MnDOT (various dates).



Legend

- Project Boundary
- PLS Township Boundary
- PLS Section Boundary
- Road
- State Boundary
- County Boundary
- Municipal Boundary



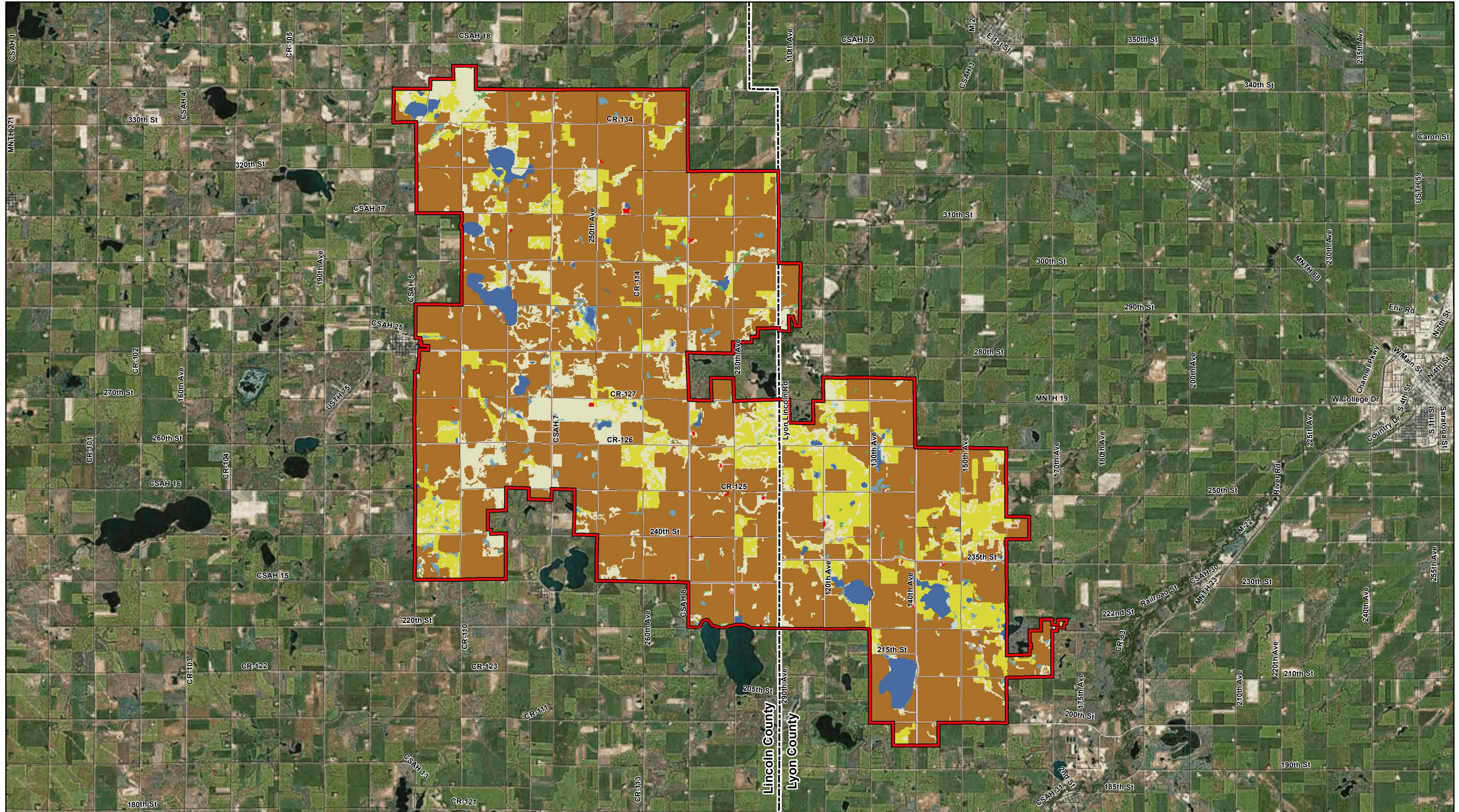
Red Pine Wind Project

Lincoln & Lyon Counties, Minnesota

Project Location &
USGS Topography

Westwood

Toll Free (888) 937-5150 westwoodps.com
Westwood Professional Services, Inc.



Data Source(s): Map and data are approximate. Westwood (2016); Geospatial Data Gateway (various dates); Minnesota NAIP Imagery (accessed 2016); ESRI (2012); MnDOT (various dates); U.S. Geological Survey (2011).

Legend

- Project Boundary
- Road
- County Boundary

- | | | |
|---|---|--|
| Open Water (2.66%) | Barren Land (0.19%) | Grassland/Herbaceous (10.42%) |
| Developed, Open Space (4.29%) | Deciduous Forest (0.4%) | Pasture/Hay (13.01%) |
| Developed, Low Intensity (0.23%) | Evergreen Forest (0%) | Cultivated Crops (67.8%) |
| Developed, Medium Intensity (0.08%) | Mixed Forest (0%) | Woody Wetlands (0.06%) |
| Developed, High Intensity (0%) | Shrub/Scrub (0%) | Emergent Herbaceous Wetlands (1.04%) |



Red Pine Wind Project

Lincoln & Lyon Counties, Minnesota

Land Cover

EXHIBIT 3

Westwood

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