ATTACHMENT C
(PART 2)

APPENDIX C

SHADOW FLICKER MODELING REPORT

Walleye Wind Project
Rock County, Minnesota

Prepared for:

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1.0 EXECUTIVE SUMMARY

The Walleye Wind Project (Project) is a proposed wind power generation facility proposed to consist of 40 wind turbines in Rock County, Minnesota. The Project is approximately 109 megawatts (MW) and is being developed by Walleye Wind, LLC, (Walleye Wind) an indirect, wholly-owned subsidiary of NextEra Energy Resources, LLC (NEER). Environmental Consulting & Technology, Inc. (ECT), retained to assist in the permitting of the Project, has retained Epsilon Associates, Inc. (Epsilon) to conduct a shadow flicker assessment for the proposed wind turbines for this Project. This report presents results of the shadow flicker modeling analysis.

Shadow flicker modeling was conservatively conducted for 46 General Electric (GE) wind turbines, which includes six (6) alternate wind turbine locations. The purpose of this analysis is to predict the annual durations of wind turbine shadow flicker at nearby receptors.

The maximum expected annual duration of shadow flicker at a modeling receptor in Minnesota resulting from the operation of the 40 proposed and six alternate wind turbines are 45 hours, 49 minutes. This is at a participating receptor. The maximum expected duration of annual shadow flicker at a non-participating receptor is 38 hours, 36 minutes. The modeling results are conservative in that modeling receptors were treated as "greenhouses" (i.e. having windows on all sides) and the surrounding area was assumed to be without vegetation or structures ("bare earth").

2.0 INTRODUCTION

The Initial Application included 51 prospective turbine locations; five of those locations were removed for the Application Amendment. The five locations that were removed included two primary turbines and three alternate turbines. The wind turbine array is numbered in a way that spatially matches the Initial Application, including the terms "primary" and "alternate". The removal of two primary turbines lowers the count for turbines designated as primary to 38 turbines. Walleye Wind, however, is proposing to construct 40 of the 46 prospective locations presented in the Application Amendment.

The Project will consist of 40 wind turbines using a combination of three potential General Electric (GE) models including the 2.82 MW, 114-meter hub height turbine; the 2.82 MW, 89-meter hub height turbine; and the safe harbor 2.32 MW, 80-meter hub height turbine. Figure 2-1 shows the locations of the 40 proposed and six (6) alternate wind turbines with the Project Boundary over aerial imagery.

Shadow flicker can be defined as an intermittent change in the intensity of light in a given area resulting from the operation of a wind turbine due to its interaction with the sun. An indoor observer experiences repeated changes in the brightness of the room as shadows cast from the wind turbine blades briefly pass by windows as the blades rotate. In order for this to occur, the wind turbine must be operating, the sun must be shining, and the window must be within the shadow region of the wind turbine, otherwise there is no shadow flicker. A stationary wind turbine only generates a stationary shadow similar to any other structure.

Based on the current design and operation of typical modern wind turbines, shadow flicker is not a cause of epileptic seizures. According to the Epilepsy Foundation, "Generally, flashing lights most likely to trigger seizures are between the frequency of 5 to 30 flashes per second (Hertz)."[1] The wind turbines for this Project have a maximum rotational speed of 15.7 rpm which corresponds to a shadow flicker frequency of 0.8 Hz. This frequency is well below the frequency identified by the Epilepsy Foundation; therefore, the triggering of epileptic seizures is not a concern with this Project.

This report presents the findings of a shadow flicker modeling study for the Project. The wind turbines were modeled with the WindPRO software package using information provided by Walleye Wind and ECT. The expected annual duration of shadow flicker was calculated at modeling receptors and shadow flicker isolines for the area surrounding the Project were generated. The results of the modeling are found within this report.

[1] Epilepsy Foundation, http://www.epilepsy.com/learn/triggers-seizures/photosensitivity-and-seizures. Accessed in June 2020.

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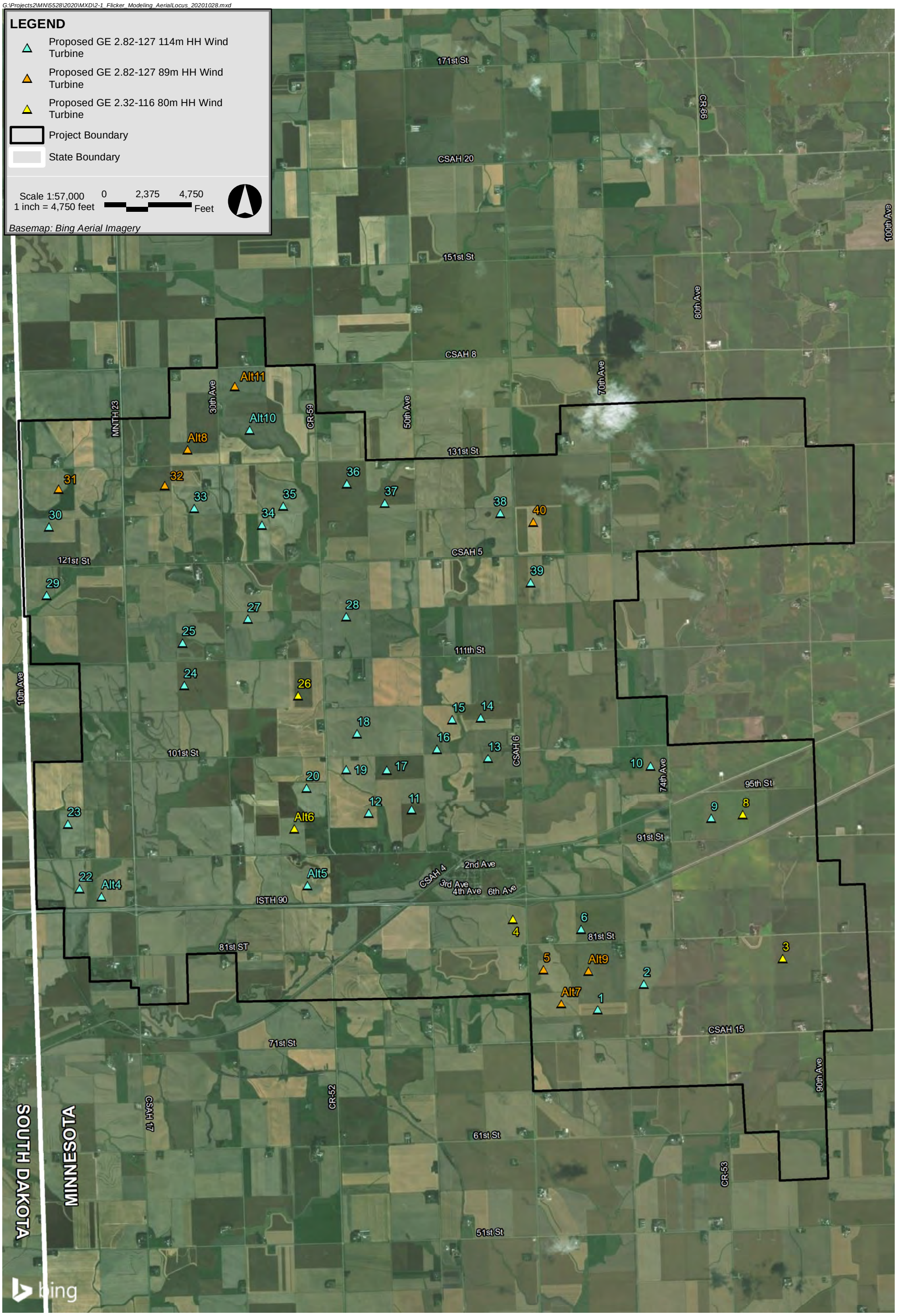
LEGEND

- Proposed GE 2.82-127 114m HH Wind Turbine
- Proposed GE 2.82-127 89m HH Wind Turbine
- Proposed GE 2.32-116 80m HH Wind Turbine
- Project Boundary
- State Boundary

Scale 1:57,000
1 inch = 4,750 feet
0 2,375 4,750 Feet

Basemap: Bing Aerial Imagery



Walleye Wind Project **Rock County, Minnesota**

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Figure 2-1
Aerial Locus

3.0 SHADOW FLICKER MODELING

3.1 Modeling Methodology

Shadow flicker was modeled using a software package, WindPRO version 3.3. WindPRO is a software suite developed by EMD International A/S and is used for assessing potential environmental impacts from wind turbines. Using the Shadow module within WindPRO, worst-case shadow flicker in the area surrounding the wind turbines was calculated based on data inputs including: location of the wind turbines, location of discrete receptor points, wind turbine dimensions, flicker calculation limits, and terrain data. Based on these data, the model was able to incorporate the appropriate sun angle and maximum daily sunlight for this latitude into the calculations. The resulting worst-case calculations assume that the sun is always shining during daylight hours and that the wind turbine is always operating. The WindPRO Shadow module can be further refined by incorporating sunshine probabilities and wind turbine operational estimates by wind direction over the course of a year. The values produced by this further refinement are known as the "expected" shadow flicker. Both worst-case and expected annual shadow flicker durations are presented in this section.

On September 28, 2020 the Project boundary was provided to Epsilon. This analysis is for the wind turbine array dated October 21, 2020. Of the 46 wind turbines in the layout, six (6) are alternate wind turbine locations. Locations of the turbines are shown in Figure 3-1 and the coordinates are provided in Appendix A. Five (5) wind turbines are GE 2.32-116 wind turbines with a 116.5-meter rotor diameter and a hub height of 80 meters. Thirty-three (33) wind turbines are GE 2.82-127 wind turbines with a 127.2-meter rotor diameter and a hub height of 114 meters. Eight (8) wind turbines are GE 2.82-127 wind turbines with a 127.2-meter rotor diameter and a hub height of 89 meters. Each wind turbine has the following characteristics based on the technical data provided by ECT, Walleye Wind, or NEER:

		GE 2.32-116	GE 2.82-127
♦ Rated Power	=	2,320 kW	2,820 kW
♦ Hub Height	=	80 meters	114 or 89 meters
♦ Rotor Diameter	=	116.5 meters	127.2 meters
♦ Cut-in Wind Speed	=	3 m/s	3 m/s
♦ Cut-out Wind Speed	=	32 m/s	30 m/s
♦ Maximum RPM	=	15.7 rpm	15.7 rpm

To-date, there are no federal, state, or local regulations regarding the maximum radial distance from a wind turbine to which shadow flicker should be analyzed applicable to this Project. In the United States, shadow flicker is commonly evaluated out to a distance of ten times the rotor diameter. According to the Massachusetts Model Bylaw for wind energy facilities, shadow flicker

impacts are minimal at and beyond a distance of ten rotor diameters.[2] Defining the shadow flicker calculation area has also been addressed in Europe where the ten times rotor diameter approach has been accepted in multiple European countries.[3] Some jurisdictions conservatively require a larger calculation area. The New Hampshire Site Evaluation Committee through rulemaking docket 2014-04 adopted rules on December 15, 2015 outlining application requirements and criteria for energy facilities, including wind energy facilities. As part of these revised regulations, Site 301.08(a)(2) requires an evaluation distance of at least 1 mile from a wind turbine.[4] Section 16-50j-94, part (g), of the Regulations of Connecticut State Agencies identifies the components required in a shadow flicker evaluation report which includes the calculation of shadow flicker from each proposed wind turbine to any off-site occupied structure within a 1.25 mile radius.[5] For this Project, ten times the largest rotor diameter of the proposed wind turbines corresponds to a distance of 0.79 miles (1,272 m). Conservatively, this analysis includes shadow flicker calculations out to 1.25 miles (2,012 m) from each wind turbine in the model for the proposed layout.

A dataset containing participation status information for property parcels in the proximity of the Project was provided by ECT on October 27, 2020. Parcels identified as leased within the dataset are participating and are indicated as such on Figure 3-1. Certain parcels in the vicinity of the Project are targeted to be leased by Walleye Wind and these parcels are indicated on Figure 3-1. All other parcels are considered non-participating.

A modeling receptor dataset was provided by ECT on January 20, 2020. A subset of these receptors, 512, which were classified as Noise Area Classification (NAC 1), were input into the WindPRO model in order to remain consistent with the sound level modeling analysis. A supplemental dataset with 153 receptors was provided on June 12, 2020. Therefore, a total of 665 receptors were included in the modeling. Two hundred and twenty-two (222) of these receptors are in South Dakota and have been included for informational purposes only. Each modeling point was assumed to have a window facing all directions ("greenhouse" mode) which yields conservative results. Participation status for each modeling receptor was assigned based on the data presented in Figure 3-1. All modeling receptors are identified in Figure 3-2 and receptors in Minnesota are distinguished as either participating, targeted, or non-participating. The model was set to limit calculations to 2,012 meters from a wind turbine, the equivalent of

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[2] Massachusetts Department of Energy Resources, "Model As-of-Right Zoning Ordinance or Bylaw: Allowing Use of Wind Energy Facilities" 2009.

[3] Parsons Brinckerhoff, "Update of UK Shadow Flicker Evidence Base" Prepared for Department of Energy and Climate Change, 2011.

[4] State of New Hampshire Site Evaluation Committee Site 300 Rules (2015), available at http://www.gencourt.state.nh.us/rules/state_agencies/site100-300.html Accessed in June 2020.

[5] State of Connecticut CSC Wind Regulations (2014), available at https://eregulations.ct.gov/eRegsPortal/Browse/RCSA?id=Title_16Subtitle_16-50jSection_16-50j-94&content=shadow%20flicker/ Accessed in June 2020.

1.25 miles. Consequently, shadow flicker at any of the 665 modeling receptors greater than the corresponding limitation distance from a wind turbine was zero. In addition to modeling discrete points, shadow flicker was calculated at grid points in the area surrounding the modeled wind turbines to generate flicker isolines. A 20-meter spacing was used for this grid.

The terrain height contour elevations for the modeling domain were generated from elevation information derived from the National Elevation Dataset (NED) developed by the U.S. Geological Survey. Conservatively, obstacles, i.e. buildings and vegetation, were excluded from the analysis. This is effectively a "bare earth" scenario which is conservative. When accounted for in the shadow flicker calculations, such obstacles may significantly mitigate or eliminate the flicker effect depending on their size, type, and location. In addition, shadow flicker durations were calculated only when the angle of the sun was at least 3° above the horizon.

Monthly sunshine probability values were input for each month from January to December. These numbers were obtained from a publicly available historical dataset for Sioux Falls, South Dakota from the National Oceanic and Atmospheric Administration's (NOAA) National Centers for Environmental Information (NCEI).[6] Table 3-1 shows the percentage of sunshine hours by month used in the shadow flicker modeling. These values are the percentages that the sun is expected to be shining during daylight hours.

The number of hours the wind turbines are expected to operate for the 16 cardinal wind directions was input into the model. An hourly dataset for one year of normalized and scaled wind speed and direction was provided by NEER Analytics for a height of 114 meters. Epsilon used this data to calculate the typical annual number of operational hours per wind direction sector. These hours per wind direction sector are used by WindPRO to estimate the "wind direction" and "operation time" reduction factors. Based on this dataset, the wind turbines would operate 98% of the year. Table 3-2 shows the distribution of operational hours for the 16 wind directions.

[6] NCEI (formerly NCDC), https://www1.ncdc.noaa.gov/pub/data/ccd-data/pctpos18.dat. Accessed in June 2020.

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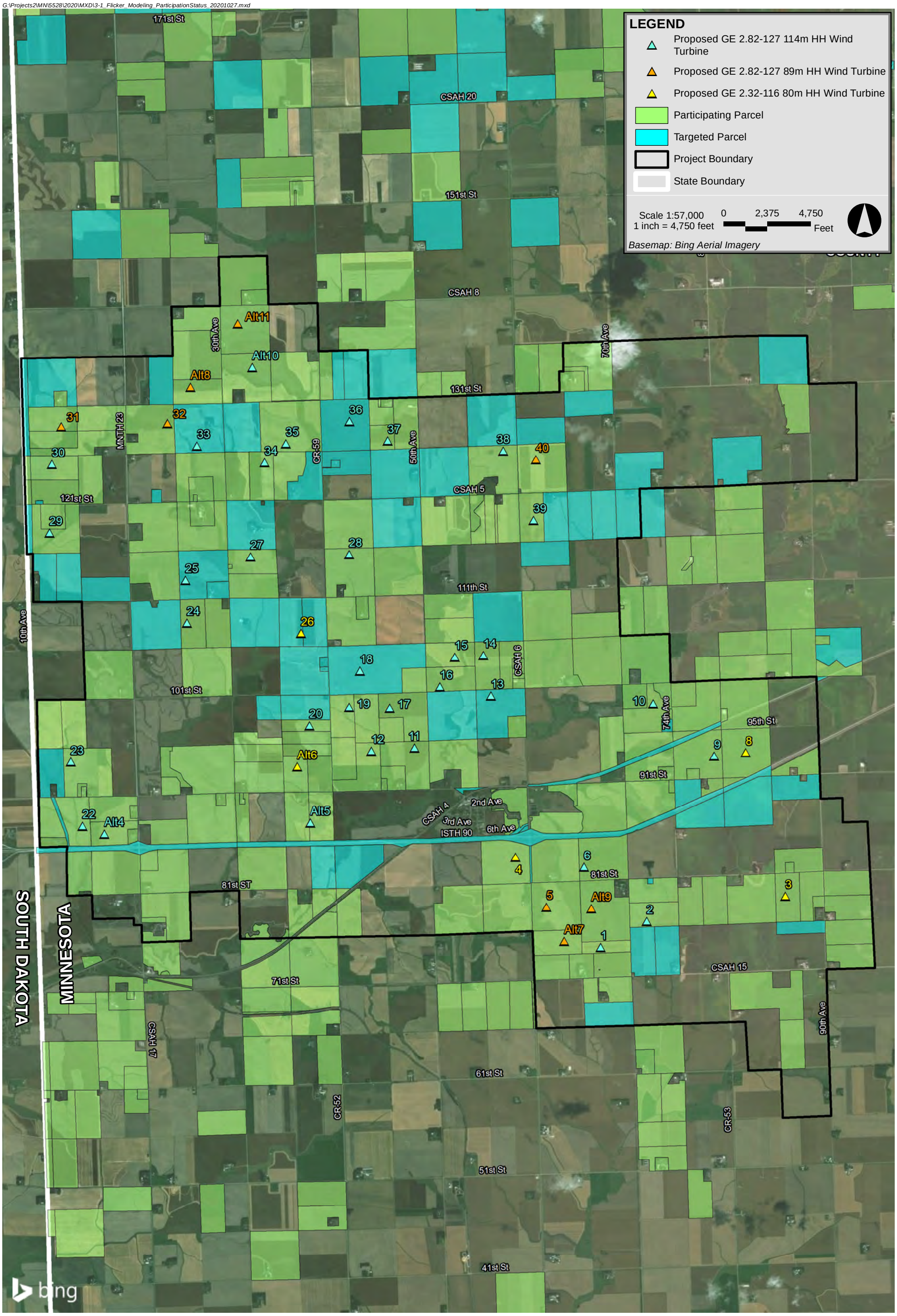

Walleye Wind Project **Rock County, Minnesota**

Epsilon Associates Inc.

Figure 3-1
Participation Status

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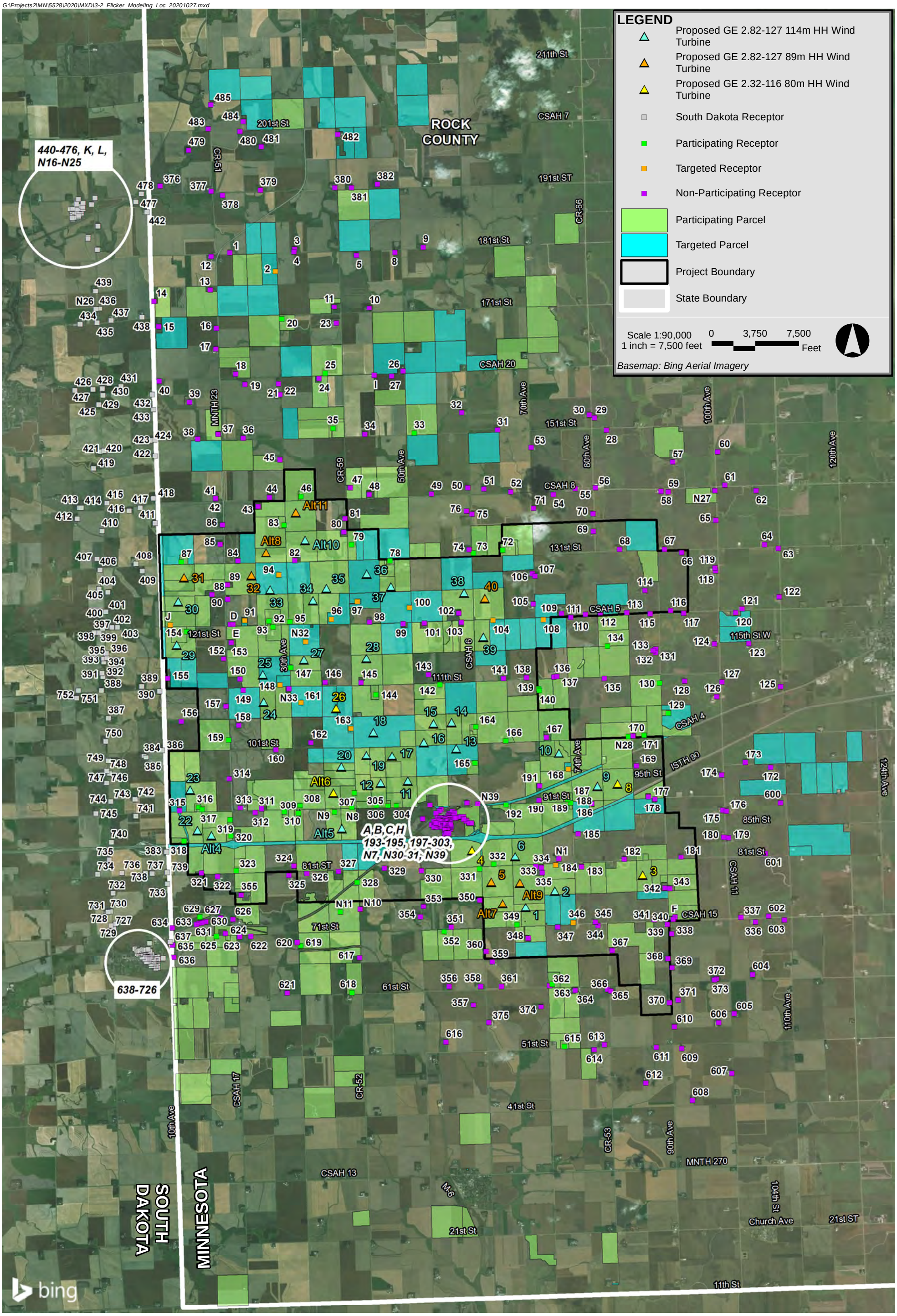

Walleye Wind Project **Rock County, Minnesota**

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Figure 3-2
Shadow Flicker Modeling Locations

Table 3-1 Monthly Percent of Possible Sunshine

Month	Possible Sunshine
January	53%
February	59%
March	46%
April	54%
May	55%
June	58%
July	71%
August	61%
September	59%
October	57%
November	49%
December	55%

Table 3-2 Operational Hours per Wind Direction Sector

Wind Sector	Operational Hours
N	505
NNE	368
NE	393
ENE	314
E	306
ESE	354
SE	699
SSE	1,070
S	872
SSW	451
SW	289
WSW	255
W	398
WNW	691
NW	853
NNW	674
Annual	8,492

3.2 Results

Following the modeling methodology outlined in Section 3.1, WindPRO was used to calculate shadow flicker at the 665 discrete modeling receptor points and generate shadow flicker isolines based on the grid calculations. Table B-1 in Appendix B presents the modeling results. Both worst-case and expected values are presented.

The modeled worst-case annual shadow flicker duration for all the 443 receptors in Minnesota receptors ranged from 0 hours, 0 minutes per year to 134 hours, 15 minutes per year. The maximum flicker was at a targeted receptor (#94) located in Minnesota. The maximum predicted annual flicker at a non-participating receptor (#84) is 107 hours, 26 minutes and the maximum predicted annual flicker at a participating receptor (#332) is 127 hours, 54 minutes. Both of these locations are also in Minnesota.

The predicted expected annual shadow flicker duration ranged from 0 hours, 0 minutes per year to 45 hours, 49 minutes per year for all the 443 receptors in Minnesota. The maximum expected flicker calculated for a Minnesota receptor was at a participating receptor (#331). The maximum modeled expected annual flicker at a non-participating receptor in Minnesota (#84) is 38 hours, 36 minutes. The maximum modeled expected annual flicker at a targeted receptor in Minnesota (#94) is 42 hours, 34 minutes. Many of the Minnesota receptors (227) were predicted to experience no annual shadow flicker. 152 locations in Minnesota were predicted to experience some shadow flicker but less than 10 hours per year. The modeling results showed that 53 locations in Minnesota would be expected to have between 10 hours and 30 hours of shadow flicker per year. Eleven (11) receptors in Minnesota are expected to have over 30 hours of flicker per year, four (4) of which are non-participating receptors. Figure 3-3 displays the modeled flicker isolines (expected hrs/yr) over aerial imagery in relation to modeled wind turbines and modeling receptors.

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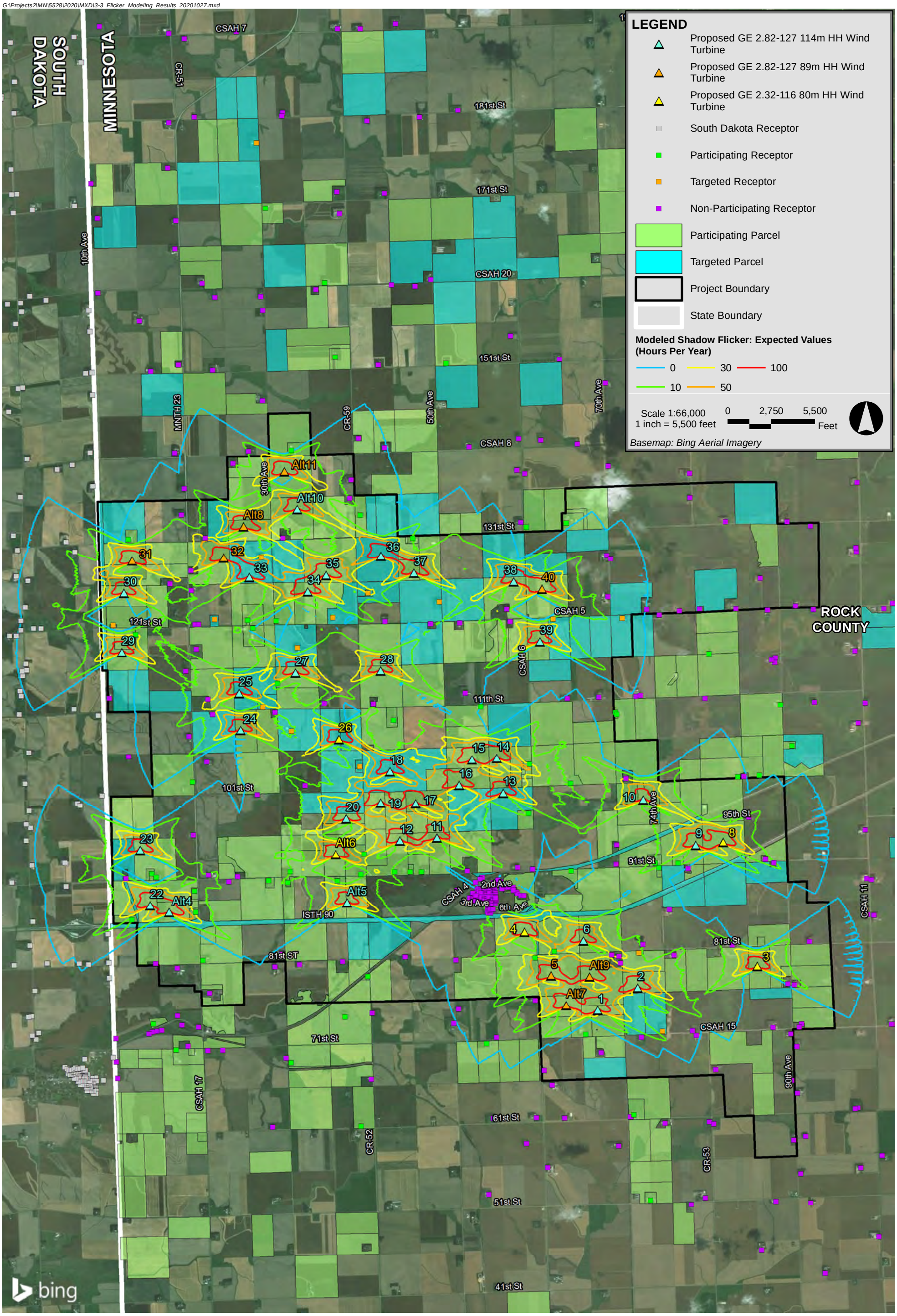

Walleye Wind Project **Rock County, Minnesota**

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Figure 3-3
Shadow Flicker Modeling Results

Appendix A
Wind Turbine Coordinates

Table A-1: Wind Turbine Coordinates

Wind Turbine ID	Wind Turbine Type	Hub Height (m)	Coordinates NAD83 UTM Zone 14N (meters)	
			X (Easting)	Y (Northing)
1	GE2.82-127	114	714847.01	4829981.05
2	GE2.82-127	114	715610.50	4830411.54
3	GE2.32-116	80	717905.41	4830828.86
4	GE2.32-116	80	713441.02	4831478.00
5	GE2.82-127	89	713949.59	4830645.22
6	GE2.82-127	114	714571.93	4831310.85
8	GE2.32-116	80	717246.81	4833207.71
9	GE2.82-127	114	716723.46	4833149.12
10	GE2.82-127	114	715718.36	4834015.46
11	GE2.82-127	114	711769.53	4833288.58
12	GE2.82-127	114	711056.84	4833232.61
13	GE2.82-127	114	713034.08	4834144.19
14	GE2.82-127	114	712910.21	4834816.55
15	GE2.82-127	114	712437.57	4834786.63
16	GE2.82-127	114	712189.35	4834297.47
17	GE2.82-127	114	711359.83	4833945.14
18	GE2.82-127	114	710864.83	4834556.46
19	GE2.82-127	114	710686.67	4833957.05
20	GE2.82-127	114	710029.81	4833653.25
22	GE2.82-127	114	706276.25	4831989.43
23	GE2.82-127	114	706084.32	4833053.16
24	GE2.82-127	114	708006.37	4835351.40
25	GE2.82-127	114	707979.63	4836058.08
26	GE2.32-116	80	709891.75	4835181.36
27	GE2.82-127	114	709058.41	4836449.34
28	GE2.82-127	114	710687.55	4836488.57
29	GE2.82-127	114	705731.84	4836844.04
30	GE2.82-127	114	705768.70	4837976.46
31	GE2.82-127	89	705926.51	4838597.87
32	GE2.82-127	89	707683.66	4838655.13
33	GE2.82-127	114	708171.41	4838280.47
34	GE2.82-127	114	709289.97	4838006.87
35	GE2.82-127	114	709643.04	4838319.17
36	GE2.82-127	114	710695.02	4838687.44
37	GE2.82-127	114	711323.10	4838366.17
38	GE2.82-127	114	713237.19	4838199.04
39	GE2.82-127	114	713738.22	4837050.42
40	GE2.82-127	89	713778.63	4838056.12
4 ALT	GE2.82-127	114	706637.94	4831858.89
5 ALT	GE2.82-127	114	710044.56	4832042.07
6 ALT	GE2.32-116	80	709827.94	4832974.42
7 ALT	GE2.82-127	89	714244.14	4830079.86
8 ALT	GE2.82-127	89	708060.80	4839255.08
9 ALT	GE2.82-127	89	714692.33	4830622.92
10 ALT	GE2.82-127	114	709088.07	4839580.70
11 ALT	GE2.82-127	89	708844.43	4840301.67

Appendix B

Shadow Flicker Modeling Results: Modeling Receptors

Table B-1: Shadow Flicker Modeling Results

Receptor ID	Coordinates NAD83 UTM Zone 14N (meters)		Participation Status	Receptor State (MN or SD)	Worst-Case Shadow Flicker Hours per Year	Worst-Case Shadow Flicker Days per Year	Worst-Case Shadow Flicker Hours per Day	Expected Shadow Flicker Hours per Year
	X (Easting)	Y (Northing)			(HH:MM/year)	(Days/year)	(HH:MM/day)	(HH:MM/year)
1	707116.78	4847096.66	Non-Participating	Minnesota	0:00	0	0:00	0:00
2	708305.93	4846606.91	Targeted	Minnesota	0:00	0	0:00	0:00
3	708808.42	4847183.67	Non-Participating	Minnesota	0:00	0	0:00	0:00
4	708792.98	4847121.48	Non-Participating	Minnesota	0:00	0	0:00	0:00
5	710426.31	4847027.49	Non-Participating	Minnesota	0:00	0	0:00	0:00
8	711430.37	4847100.31	Non-Participating	Minnesota	0:00	0	0:00	0:00
9	712168.22	4847234.98	Non-Participating	Minnesota	0:00	0	0:00	0:00
10	710761.49	4845648.59	Non-Participating	Minnesota	0:00	0	0:00	0:00
11	709848.84	4845674.79	Non-Participating	Minnesota	0:00	0	0:00	0:00
12	706632.23	4846993.25	Non-Participating	Minnesota	0:00	0	0:00	0:00
13	706608.96	4846127.80	Non-Participating	Minnesota	0:00	0	0:00	0:00
14	705141.88	4845829.90	Non-Participating	Minnesota	0:00	0	0:00	0:00
15	705259.97	4845158.83	Non-Participating	Minnesota	0:00	0	0:00	0:00
16	706765.76	4845113.79	Non-Participating	Minnesota	0:00	0	0:00	0:00
17	706751.88	4844577.57	Non-Participating	Minnesota	0:00	0	0:00	0:00
18	707270.50	4843918.01	Non-Participating	Minnesota	0:00	0	0:00	0:00
19	707512.81	4843649.75	Non-Participating	Minnesota	0:00	0	0:00	0:00
20	708478.92	4845354.11	Participating	Minnesota	0:00	0	0:00	0:00
21	708394.51	4843668.42	Non-Participating	Minnesota	0:00	0	0:00	0:00
22	708430.29	4843394.56	Non-Participating	Minnesota	0:00	0	0:00	0:00
23	709900.19	4845248.40	Non-Participating	Minnesota	0:00	0	0:00	0:00
24	709448.97	4843803.26	Non-Participating	Minnesota	0:00	0	0:00	0:00
25	709614.12	4843929.95	Participating	Minnesota	0:00	0	0:00	0:00
26	711647.33	4843990.24	Non-Participating	Minnesota	0:00	0	0:00	0:00
27	711345.52	4843862.96	Non-Participating	Minnesota	0:00	0	0:00	0:00
28	716954.85	4842454.09	Non-Participating	Minnesota	0:00	0	0:00	0:00
29	716642.97	4842773.33	Non-Participating	Minnesota	0:00	0	0:00	0:00
30	716510.64	4842848.35	Non-Participating	Minnesota	0:00	0	0:00	0:00
31	714115.37	4842462.46	Non-Participating	Minnesota	0:00	0	0:00	0:00
32	713178.15	4842909.97	Non-Participating	Minnesota	0:00	0	0:00	0:00
33	711938.71	4842378.30	Participating	Minnesota	0:00	0	0:00	0:00
34	710644.98	4842349.07	Non-Participating	Minnesota	0:00	0	0:00	0:00
35	709819.25	4842500.41	Participating	Minnesota	0:00	0	0:00	0:00
36	707468.78	4842249.89	Non-Participating	Minnesota	0:00	0	0:00	0:00
37	706814.15	4842351.53	Non-Participating	Minnesota	0:00	0	0:00	0:00
38	706284.12	4842225.69	Non-Participating	Minnesota	0:00	0	0:00	0:00
39	706067.54	4843190.56	Non-Participating	Minnesota	0:00	0	0:00	0:00
40	705275.87	4843735.83	Non-Participating	Minnesota	0:00	0	0:00	0:00
41	706750.62	4840653.78	Non-Participating	Minnesota	0:00	0	0:00	0:00
42	706742.54	4840668.93	Non-Participating	Minnesota	0:00	0	0:00	0:00
43	707861.60	4840458.05	Non-Participating	Minnesota	23:44	88	0:27	8:25
44	708158.48	4840697.92	Non-Participating	Minnesota	30:15	78	0:39	11:01
45	708427.46	4841672.29	Non-Participating	Minnesota	0:00	0	0:00	0:00
46	708976.50	4840717.57	Participating	Minnesota	0:00	0	0:00	0:00
47	710262.92	4840946.97	Non-Participating	Minnesota	3:35	24	0:14	1:04
48	710762.86	4840767.53	Non-Participating	Minnesota	1:25	14	0:09	0:23
49	712384.27	4840783.97	Non-Participating	Minnesota	0:00	0	0:00	0:00
50	713334.25	4840942.29	Non-Participating	Minnesota	0:00	0	0:00	0:00
51	713754.99	4840911.87	Non-Participating	Minnesota	0:00	0	0:00	0:00
52	714456.02	4840842.55	Non-Participating	Minnesota	0:00	0	0:00	0:00
53	714992.51	4842006.83	Non-Participating	Minnesota	0:00	0	0:00	0:00
54	715567.30	4840772.12	Non-Participating	Minnesota	0:00	0	0:00	0:00
55	716141.80	4840921.50	Non-Participating	Minnesota	0:00	0	0:00	0:00
56	716669.20	4840946.13	Non-Participating	Minnesota	0:00	0	0:00	0:00
57	718688.18	4841612.49	Non-Participating	Minnesota	0:00	0	0:00	0:00
58	718385.04	4840853.05	Non-Participating	Minnesota	0:00	0	0:00	0:00
59	718574.90	4840839.53	Non-Participating	Minnesota	0:00	0	0:00	0:00
60	719858.02	4841887.30	Non-Participating	Minnesota	0:00	0	0:00	0:00
61	720051.79	4841014.92	Non-Participating	Minnesota	0:00	0	0:00	0:00
62	720869.50	4840872.15	Non-Participating	Minnesota	0:00	0	0:00	0:00
63	721441.68	4839367.75	Non-Participating	Minnesota	0:00	0	0:00	0:00
64	721085.12	4839469.21	Non-Participating	Minnesota	0:00	0	0:00	0:00
65	719813.12	4840097.41	Non-Participating	Minnesota	0:00	0	0:00	0:00
66	718919.37	4839262.10	Non-Participating	Minnesota	0:00	0	0:00	0:00
67	718471.98	4839347.33	Non-Participating	Minnesota	0:00	0	0:00	0:00
68	717296.33	4839345.88	Non-Participating	Minnesota	0:00	0	0:00	0:00
69	716610.59	4839807.02	Non-Participating	Minnesota	0:00	0	0:00	0:00
70	716604.40	4840268.87	Non-Participating	Minnesota	0:00	0	0:00	0:00
71	715049.56	4840410.68	Non-Participating	Minnesota	0:00	0	0:00	0:00
72	714242.60	4839322.89	Participating	Minnesota	0:00	0	0:00	0:00

Table B-1: Shadow Flicker Modeling Results

Receptor ID	Coordinates NAD83 UTM Zone 14N (meters)		Participation Status	Receptor State (MN or SD)	Worst-Case Shadow Flicker Hours per Year	Worst-Case Shadow Flicker Days per Year	Worst-Case Shadow Flicker Hours per Day	Expected Shadow Flicker Hours per Year
	X (Easting)	Y (Northing)			(HH:MM/year)	(Days/year)	(HH:MM/day)	(HH:MM/year)
73	713478.59	4839242.77	Participating	Minnesota	0:00	0	0:00	0:00
74	713369.04	4839338.51	Non-Participating	Minnesota	0:00	0	0:00	0:00
75	713446.60	4840263.13	Non-Participating	Minnesota	0:00	0	0:00	0:00
76	713297.01	4840333.99	Non-Participating	Minnesota	0:00	0	0:00	0:00
78	711303.00	4839031.07	Participating	Minnesota	37:11	62	0:55	10:40
79	710297.92	4839470.58	Participating	Minnesota	10:16	56	0:24	3:40
80	710098.76	4839796.54	Non-Participating	Minnesota	28:11	96	0:28	10:00
81	710126.39	4840144.45	Non-Participating	Minnesota	20:04	71	0:26	6:12
82	708819.05	4839037.31	Non-Participating	Minnesota	59:07	154	0:39	22:31
83	708536.61	4839970.02	Participating	Minnesota	64:18	104	0:46	23:55
84	707329.06	4839034.08	Non-Participating	Minnesota	107:26	167	1:09	38:36
85	706870.81	4839475.06	Non-Participating	Minnesota	11:57	51	0:24	3:45
86	706925.99	4839978.62	Non-Participating	Minnesota	13:44	80	0:22	4:55
87	705855.19	4839004.53	Participating	Minnesota	2:11	18	0:11	0:42
88	706656.02	4838157.19	Non-Participating	Minnesota	53:51	149	0:33	16:49
89	707058.95	4838411.07	Non-Participating	Minnesota	93:10	203	0:46	30:30
90	707064.45	4838031.04	Non-Participating	Minnesota	37:24	145	0:27	13:12
91	707510.54	4837477.67	Targeted	Minnesota	13:31	107	0:18	4:47
92	708141.65	4837461.67	Participating	Minnesota	31:56	85	0:30	10:16
93	708243.59	4837310.77	Participating	Minnesota	0:04	2	0:02	0:01
94	708400.98	4838664.74	Targeted	Minnesota	134:15	161	1:34	42:34
95	708687.83	4837450.43	Participating	Minnesota	0:00	0	0:00	0:00
96	709771.69	4837511.27	Targeted	Minnesota	27:52	62	0:35	10:16
97	710445.82	4837977.55	Targeted	Minnesota	90:27	122	1:07	33:26
98	710772.80	4837437.00	Non-Participating	Minnesota	10:15	60	0:18	3:59
99	711645.42	4837393.46	Non-Participating	Minnesota	18:10	82	0:21	5:27
100	711810.77	4837813.61	Targeted	Minnesota	7:21	42	0:19	2:17
101	712200.34	4837408.33	Non-Participating	Minnesota	13:25	81	0:18	4:08
102	713104.19	4837670.84	Non-Participating	Minnesota	55:50	133	0:38	19:43
103	713167.31	4837435.71	Non-Participating	Minnesota	56:01	109	0:45	20:42
104	713992.36	4837483.37	Targeted	Minnesota	51:27	66	0:58	14:39
105	715042.04	4837912.39	Non-Participating	Minnesota	17:09	73	0:23	5:13
106	715021.68	4838699.63	Non-Participating	Minnesota	8:37	49	0:18	2:26
107	715090.43	4838637.19	Non-Participating	Minnesota	7:19	44	0:17	2:09
108	715313.77	4837500.27	Targeted	Minnesota	9:23	55	0:17	3:18
109	715783.84	4837663.54	Non-Participating	Minnesota	0:00	0	0:00	0:00
110	716026.85	4837558.63	Non-Participating	Minnesota	0:00	0	0:00	0:00
111	716411.22	4837638.23	Non-Participating	Minnesota	0:00	0	0:00	0:00
112	716797.43	4837677.61	Non-Participating	Minnesota	0:00	0	0:00	0:00
113	717493.50	4837682.56	Non-Participating	Minnesota	0:00	0	0:00	0:00
114	717959.58	4838266.65	Non-Participating	Minnesota	0:00	0	0:00	0:00
115	718096.72	4837655.04	Non-Participating	Minnesota	0:00	0	0:00	0:00
116	718635.34	4837734.24	Non-Participating	Minnesota	0:00	0	0:00	0:00
117	718973.38	4837665.43	Non-Participating	Minnesota	0:00	0	0:00	0:00
118	719803.30	4838775.43	Non-Participating	Minnesota	0:00	0	0:00	0:00
119	719789.20	4838850.50	Non-Participating	Minnesota	0:00	0	0:00	0:00
120	720329.65	4837683.29	Non-Participating	Minnesota	0:00	0	0:00	0:00
121	720497.83	4837781.83	Non-Participating	Minnesota	0:00	0	0:00	0:00
122	721468.69	4838097.90	Non-Participating	Minnesota	0:00	0	0:00	0:00
123	720672.05	4836880.47	Non-Participating	Minnesota	0:00	0	0:00	0:00
124	719773.40	4836874.47	Non-Participating	Minnesota	0:00	0	0:00	0:00
125	721504.01	4835748.19	Non-Participating	Minnesota	0:00	0	0:00	0:00
126	719835.22	4835489.72	Non-Participating	Minnesota	0:00	0	0:00	0:00
127	719971.96	4835872.49	Non-Participating	Minnesota	0:00	0	0:00	0:00
128	719000.79	4835890.62	Non-Participating	Minnesota	0:00	0	0:00	0:00
129	718569.06	4835055.95	Participating	Minnesota	0:00	0	0:00	0:00
130	718342.87	4835837.33	Participating	Minnesota	0:00	0	0:00	0:00
131	718247.08	4836742.93	Non-Participating	Minnesota	0:00	0	0:00	0:00
132	718240.47	4836646.55	Non-Participating	Minnesota	0:00	0	0:00	0:00
133	718177.51	4836701.05	Non-Participating	Minnesota	0:00	0	0:00	0:00
134	716977.83	4836815.57	Participating	Minnesota	0:00	0	0:00	0:00
135	716901.55	4835960.23	Non-Participating	Minnesota	0:00	0	0:00	0:00
136	715586.54	4836002.19	Non-Participating	Minnesota	0:00	0	0:00	0:00
137	715661.98	4836017.28	Non-Participating	Minnesota	0:00	0	0:00	0:00
138	714868.50	4835985.41	Non-Participating	Minnesota	0:00	0	0:00	0:00
139	715186.22	4835692.77	Participating	Minnesota	0:00	0	0:00	0:00
140	715206.94	4835652.83	Participating	Minnesota	0:00	0	0:00	0:00
141	714264.50	4835959.15	Non-Participating	Minnesota	7:35	36	0:15	2:05
142	712603.23	4835802.92	Participating	Minnesota	0:00	0	0:00	0:00
143	712308.20	4836059.46	Non-Participating	Minnesota	5:50	29	0:18	2:11
144	710937.13	4835543.44	Participating	Minnesota	10:11	56	0:19	3:20
145	710551.74	4835854.65	Non-Participating	Minnesota	9:55	57	0:16	3:44

Table B-1: Shadow Flicker Modeling Results

Receptor ID	Coordinates NAD83 UTM Zone 14N (meters)		Participation Status	Receptor State (MN or SD)	Worst-Case Shadow Flicker Hours per Year	Worst-Case Shadow Flicker Days per Year	Worst-Case Shadow Flicker Hours per Day	Expected Shadow Flicker Hours per Year
	X (Easting)	Y (Northing)			(HH:MM/year)	(Days/year)	(HH:MM/day)	(HH:MM/year)
146	709610.69	4835866.83	Non-Participating	Minnesota	26:46	98	0:25	8:31
147	708710.52	4836244.46	Participating	Minnesota	54:18	113	0:46	16:08
148	708431.38	4835795.37	Targeted	Minnesota	68:02	106	0:51	18:41
149	707467.79	4835655.21	Non-Participating	Minnesota	52:48	112	0:48	19:55
150	707382.61	4835946.18	Non-Participating	Minnesota	76:06	159	1:01	26:08
152	706957.43	4836478.77	Non-Participating	Minnesota	21:43	77	0:28	8:22
153	707156.95	4836908.27	Non-Participating	Minnesota	6:52	41	0:18	2:13
154	705991.93	4837185.67	Participating	Minnesota	109:57	105	1:12	30:03
155	705492.89	4835958.91	Non-Participating	Minnesota	0:00	0	0:00	0:00
156	705858.11	4834844.91	Non-Participating	Minnesota	0:00	0	0:00	0:00
157	707016.69	4835236.06	Non-Participating	Minnesota	15:26	40	0:30	5:00
158	707356.17	4834741.12	Non-Participating	Minnesota	0:00	0	0:00	0:00
159	707085.43	4834360.19	Participating	Minnesota	0:00	0	0:00	0:00
160	708322.34	4834109.83	Non-Participating	Minnesota	7:07	44	0:16	2:41
161	708977.90	4835337.39	Targeted	Minnesota	28:26	78	0:30	9:31
162	709241.42	4834293.09	Non-Participating	Minnesota	40:29	115	0:32	14:58
163	710284.41	4834655.57	Targeted	Minnesota	60:11	144	0:49	20:33
164	713539.68	4834701.97	Participating	Minnesota	98:50	196	0:47	32:45
165	713519.94	4833754.80	Participating	Minnesota	19:53	85	0:22	8:01
166	714328.91	4834335.98	Participating	Minnesota	27:29	117	0:23	9:40
167	715389.72	4834427.12	Non-Participating	Minnesota	75:51	89	0:59	29:06
168	715960.50	4833594.78	Targeted	Minnesota	31:45	84	0:35	11:47
169	717742.89	4833679.69	Non-Participating	Minnesota	55:47	111	0:43	15:21
170	717526.44	4834457.10	Participating	Minnesota	2:15	17	0:12	0:37
171	717942.71	4834486.94	Participating	Minnesota	0:00	0	0:00	0:00
172	721247.61	4833637.06	Non-Participating	Minnesota	0:00	0	0:00	0:00
173	720587.26	4833766.80	Non-Participating	Minnesota	0:00	0	0:00	0:00
174	719968.80	4833440.58	Non-Participating	Minnesota	0:00	0	0:00	0:00
175	720001.01	4832510.77	Non-Participating	Minnesota	0:00	0	0:00	0:00
176	720086.46	4832488.58	Non-Participating	Minnesota	0:00	0	0:00	0:00
177	718057.16	4832879.43	Non-Participating	Minnesota	45:58	121	0:33	18:56
178	718221.38	4832811.99	Non-Participating	Minnesota	30:31	115	0:26	12:38
179	720138.53	4831804.67	Non-Participating	Minnesota	0:00	0	0:00	0:00
180	720018.46	4831817.27	Non-Participating	Minnesota	0:00	0	0:00	0:00
181	718905.22	4831299.44	Non-Participating	Minnesota	8:18	34	0:23	2:27
182	717421.25	4831235.51	Non-Participating	Minnesota	57:14	101	0:46	21:33
183	716309.79	4831038.21	Non-Participating	Minnesota	53:21	127	0:45	14:51
184	715633.49	4831085.85	Targeted	Minnesota	38:30	149	0:29	12:10
185	716220.40	4831908.27	Non-Participating	Minnesota	7:18	67	0:15	2:13
186	716577.54	4832695.90	Non-Participating	Minnesota	0:00	0	0:00	0:00
187	716382.77	4832803.70	Participating	Minnesota	28:53	92	0:29	9:23
188	716021.03	4832717.66	Participating	Minnesota	19:25	71	0:26	5:57
189	715946.91	4832805.42	Participating	Minnesota	53:36	119	0:37	17:20
190	715198.78	4832781.62	Non-Participating	Minnesota	6:00	28	0:19	1:52
191	715208.57	4833157.75	Non-Participating	Minnesota	5:57	24	0:20	1:52
192	714338.84	4832655.97	Participating	Minnesota	0:00	0	0:00	0:00
193	713317.82	4832719.65	Non-Participating	Minnesota	7:02	36	0:18	2:55
194	712633.30	4832532.44	Non-Participating	Minnesota	10:50	59	0:17	4:42
195	712594.49	4832495.72	Non-Participating	Minnesota	13:37	60	0:18	5:47
197	712507.23	4832437.14	Non-Participating	Minnesota	3:43	32	0:10	1:32
198	712346.67	4832653.95	Non-Participating	Minnesota	21:16	68	0:23	9:03
199	712846.95	4832428.39	Non-Participating	Minnesota	5:52	40	0:13	2:33
200	712862.53	4832429.34	Non-Participating	Minnesota	5:27	38	0:13	2:21
201	712882.15	4832429.34	Non-Participating	Minnesota	5:18	38	0:13	2:17
202	712894.50	4832431.01	Non-Participating	Minnesota	5:02	36	0:13	2:10
203	712928.71	4832437.86	Non-Participating	Minnesota	10:39	57	0:16	3:59
204	712936.81	4832480.03	Non-Participating	Minnesota	10:56	50	0:16	4:10
205	712995.55	4832445.10	Non-Participating	Minnesota	11:47	50	0:17	4:30
206	712932.00	4832382.02	Non-Participating	Minnesota	8:06	48	0:16	2:57
207	712889.30	4832379.64	Non-Participating	Minnesota	6:49	41	0:16	2:27
208	712851.04	4832377.53	Non-Participating	Minnesota	8:39	60	0:13	3:43
209	712836.85	4832377.30	Non-Participating	Minnesota	9:05	58	0:13	3:53
210	712823.45	4832370.97	Non-Participating	Minnesota	9:09	56	0:13	3:53
211	712537.69	4832295.51	Non-Participating	Minnesota	0:00	0	0:00	0:00
212	712564.57	4832317.29	Non-Participating	Minnesota	0:00	0	0:00	0:00
213	712605.45	4832307.68	Non-Participating	Minnesota	0:00	0	0:00	0:00
214	712629.62	4832300.88	Non-Participating	Minnesota	0:00	0	0:00	0:00
215	712674.11	4832322.67	Non-Participating	Minnesota	1:16	23	0:05	0:30
216	712679.19	4832298.37	Non-Participating	Minnesota	0:05	5	0:01	0:02
217	712717.98	4832312.61	Non-Participating	Minnesota	1:56	28	0:06	0:47
218	712785.61	4832316.50	Non-Participating	Minnesota	4:25	40	0:10	1:51
219	712778.81	4832299.33	Non-Participating	Minnesota	3:03	34	0:08	1:16
220	712829.55	4832333.38	Non-Participating	Minnesota	6:58	48	0:12	2:57
221	712830.18	4832309.03	Non-Participating	Minnesota	10:11	75	0:15	3:58

Table B-1: Shadow Flicker Modeling Results

Receptor ID	Coordinates NAD83 UTM Zone 14N (meters)		Participation Status	Receptor State (MN or SD)	Worst-Case Shadow Flicker Hours per Year	Worst-Case Shadow Flicker Days per Year	Worst-Case Shadow Flicker Hours per Day	Expected Shadow Flicker Hours per Year
	X (Easting)	Y (Northing)			(HH:MM/year)	(Days/year)	(HH:MM/day)	(HH:MM/year)
222	712867.95	4832305.17	Non-Participating	Minnesota	5:26	32	0:16	1:55
223	713109.05	4832338.04	Non-Participating	Minnesota	13:53	58	0:18	5:14
224	713137.94	4832336.46	Non-Participating	Minnesota	14:16	56	0:18	5:24
225	713168.29	4832342.12	Non-Participating	Minnesota	14:01	52	0:19	5:21
226	713226.79	4832342.81	Non-Participating	Minnesota	11:48	44	0:19	4:34
227	713292.76	4832253.02	Non-Participating	Minnesota	16:16	55	0:20	6:12
228	713308.00	4832224.79	Non-Participating	Minnesota	17:29	59	0:21	6:37
229	713375.93	4832184.38	Non-Participating	Minnesota	18:41	59	0:22	7:05
230	713431.00	4832183.48	Non-Participating	Minnesota	17:07	53	0:23	6:34
231	712884.28	4832262.41	Non-Participating	Minnesota	5:18	31	0:16	1:52
232	712831.97	4832268.25	Non-Participating	Minnesota	4:44	29	0:15	1:40
233	712837.31	4832254.52	Non-Participating	Minnesota	4:40	28	0:15	1:39
234	712834.64	4832232.89	Non-Participating	Minnesota	4:34	28	0:15	1:38
235	712848.32	4832199.78	Non-Participating	Minnesota	4:37	27	0:15	1:40
236	712887.35	4832233.70	Non-Participating	Minnesota	5:06	29	0:16	1:49
237	712890.56	4832202.61	Non-Participating	Minnesota	5:03	29	0:16	1:48
238	712780.48	4832264.85	Non-Participating	Minnesota	0:53	20	0:04	0:21
239	712785.27	4832251.36	Non-Participating	Minnesota	0:27	16	0:02	0:10
240	712780.83	4832224.05	Non-Participating	Minnesota	4:10	25	0:15	1:30
241	712787.28	4832192.10	Non-Participating	Minnesota	4:12	25	0:15	1:32
242	712719.68	4832205.22	Non-Participating	Minnesota	0:00	0	0:00	0:00
243	712719.10	4832249.73	Non-Participating	Minnesota	0:00	0	0:00	0:00
244	712718.61	4832266.40	Non-Participating	Minnesota	0:00	0	0:00	0:00
245	712753.58	4832271.17	Non-Participating	Minnesota	0:33	16	0:03	0:13
246	712748.37	4832234.80	Non-Participating	Minnesota	0:00	0	0:00	0:00
247	712673.11	4832238.71	Non-Participating	Minnesota	0:00	0	0:00	0:00
248	712675.00	4832216.30	Non-Participating	Minnesota	0:00	0	0:00	0:00
249	712677.58	4832191.27	Non-Participating	Minnesota	2:42	17	0:12	1:04
250	712618.78	4832190.35	Non-Participating	Minnesota	10:36	36	0:22	4:09
251	712564.96	4832190.52	Non-Participating	Minnesota	15:49	46	0:25	6:08
252	712570.97	4832213.69	Non-Participating	Minnesota	11:07	38	0:22	4:21
253	712571.98	4832232.04	Non-Participating	Minnesota	7:33	31	0:19	2:58
254	712571.88	4832259.87	Non-Participating	Minnesota	2:13	17	0:11	0:52
255	712608.06	4832231.58	Non-Participating	Minnesota	3:03	19	0:12	1:12
256	712456.59	4832228.74	Non-Participating	Minnesota	17:20	51	0:24	6:40
257	712392.84	4832139.24	Non-Participating	Minnesota	13:57	59	0:23	5:01
258	712456.01	4832133.54	Non-Participating	Minnesota	19:16	73	0:25	7:05
259	712503.93	4832139.10	Non-Participating	Minnesota	22:19	67	0:26	8:21
260	712459.29	4832110.14	Non-Participating	Minnesota	17:09	78	0:25	6:13
261	712508.07	4832110.19	Non-Participating	Minnesota	22:00	73	0:26	8:08
262	712450.68	4832077.28	Non-Participating	Minnesota	14:13	54	0:25	5:05
263	712507.77	4832084.46	Non-Participating	Minnesota	19:46	79	0:26	7:12
264	712553.69	4832079.29	Non-Participating	Minnesota	24:10	75	0:27	8:55
265	712626.23	4832098.28	Non-Participating	Minnesota	26:41	64	0:29	10:09
266	712568.90	4832143.05	Non-Participating	Minnesota	22:53	59	0:27	8:44
267	712613.84	4832149.49	Non-Participating	Minnesota	19:19	51	0:27	7:28
268	712636.39	4832149.27	Non-Participating	Minnesota	17:19	47	0:27	6:44
269	712676.17	4832149.03	Non-Participating	Minnesota	12:45	39	0:24	5:00
270	712679.14	4832113.16	Non-Participating	Minnesota	20:17	51	0:29	7:52
271	712678.29	4832087.92	Non-Participating	Minnesota	25:19	59	0:30	9:43
272	712720.39	4832155.88	Non-Participating	Minnesota	4:39	23	0:15	1:50
273	712724.09	4832116.02	Non-Participating	Minnesota	14:03	41	0:26	5:30
274	712724.53	4832087.84	Non-Participating	Minnesota	24:31	73	0:30	9:29
275	712745.94	4832084.47	Non-Participating	Minnesota	22:36	70	0:29	8:46
276	712790.68	4832081.04	Non-Participating	Minnesota	17:02	61	0:26	6:38
277	712790.26	4832095.01	Non-Participating	Minnesota	13:07	55	0:22	5:05
278	712788.37	4832119.07	Non-Participating	Minnesota	6:44	41	0:15	2:34
279	712789.00	4832150.71	Non-Participating	Minnesota	4:05	24	0:15	1:30
280	712759.46	4832158.67	Non-Participating	Minnesota	3:56	24	0:15	1:27
281	712834.02	4832154.99	Non-Participating	Minnesota	4:23	26	0:16	1:36
282	712841.90	4832109.02	Non-Participating	Minnesota	4:19	25	0:16	1:35
283	712845.16	4832086.79	Non-Participating	Minnesota	5:29	36	0:16	2:04
284	712877.12	4832089.52	Non-Participating	Minnesota	4:32	26	0:16	1:40
285	712900.32	4832095.23	Non-Participating	Minnesota	4:41	26	0:16	1:43
286	712889.85	4832123.54	Non-Participating	Minnesota	4:40	26	0:16	1:43
287	712889.80	4832163.62	Non-Participating	Minnesota	4:47	27	0:16	1:44
288	712889.23	4832144.18	Non-Participating	Minnesota	4:45	27	0:16	1:44
289	712730.42	4832035.84	Non-Participating	Minnesota	34:48	88	0:33	13:16
290	712794.99	4832046.39	Non-Participating	Minnesota	26:27	74	0:32	10:16
291	712794.24	4832015.06	Non-Participating	Minnesota	35:16	86	0:35	13:33
292	712796.38	4831988.68	Non-Participating	Minnesota	40:54	94	0:36	15:35
293	712732.53	4831979.23	Non-Participating	Minnesota	40:51	104	0:34	15:15
294	712734.58	4832008.79	Non-Participating	Minnesota	39:01	94	0:33	14:45
295	712733.41	4831929.85	Non-Participating	Minnesota	35:35	114	0:34	13:03

Table B-1: Shadow Flicker Modeling Results

Receptor ID	Coordinates NAD83 UTM Zone 14N (meters)		Participation Status	Receptor State (MN or SD)	Worst-Case Shadow Flicker Hours per Year	Worst-Case Shadow Flicker Days per Year	Worst-Case Shadow Flicker Hours per Day	Expected Shadow Flicker Hours per Year
	X (Easting)	Y (Northing)			(HH:MM/year)	(Days/year)	(HH:MM/day)	(HH:MM/year)
296	712732.95	4831902.51	Non-Participating	Minnesota	31:08	91	0:35	11:22
297	712735.50	4831869.27	Non-Participating	Minnesota	29:00	85	0:35	10:41
298	712751.54	4831840.81	Non-Participating	Minnesota	29:18	80	0:36	10:56
299	712791.52	4831841.65	Non-Participating	Minnesota	34:13	89	0:38	12:39
300	712798.77	4831870.72	Non-Participating	Minnesota	38:08	101	0:38	13:58
301	712772.78	4831901.49	Non-Participating	Minnesota	38:23	110	0:36	14:04
302	712790.64	4831921.66	Non-Participating	Minnesota	45:49	113	0:37	16:58
303	712842.90	4831916.61	Non-Participating	Minnesota	51:32	109	0:39	19:19
304	711473.36	4832637.58	Participating	Minnesota	9:06	49	0:20	2:57
305	711252.43	4832635.31	Participating	Minnesota	14:09	58	0:23	4:31
306	710955.15	4832635.80	Participating	Minnesota	28:35	91	0:28	8:43
307	710371.01	4832978.05	Participating	Minnesota	109:40	171	1:00	36:15
308	708958.17	4832642.70	Participating	Minnesota	29:48	99	0:28	10:07
309	708910.35	4832432.23	Participating	Minnesota	25:22	94	0:25	8:41
310	708545.61	4832471.18	Participating	Minnesota	10:27	55	0:23	3:33
311	707948.72	4832546.75	Non-Participating	Minnesota	11:09	82	0:17	3:27
312	707785.26	4832449.07	Non-Participating	Minnesota	15:50	84	0:22	5:02
313	707392.79	4832577.65	Non-Participating	Minnesota	42:42	135	0:30	13:25
314	707103.01	4833341.74	Non-Participating	Minnesota	12:55	36	0:28	3:38
315	705808.16	4832506.07	Non-Participating	Minnesota	55:36	65	1:09	21:30
316	706307.90	4832597.14	Participating	Minnesota	0:00	0	0:00	0:00
317	706391.85	4832533.05	Participating	Minnesota	0:00	0	0:00	0:00
318	705921.04	4831717.10	Participating	Minnesota	32:34	61	0:41	10:11
319	707124.26	4832268.92	Participating	Minnesota	88:31	147	0:49	24:00
320	707148.31	4831858.58	Participating	Minnesota	78:32	81	1:21	27:11
321	706377.57	4830879.08	Non-Participating	Minnesota	0:00	0	0:00	0:00
322	706795.99	4830788.28	Non-Participating	Minnesota	0:00	0	0:00	0:00
323	707286.36	4830938.93	Participating	Minnesota	0:00	0	0:00	0:00
324	708796.80	4831061.44	Non-Participating	Minnesota	0:00	0	0:00	0:00
325	708665.52	4830816.87	Non-Participating	Minnesota	0:00	0	0:00	0:00
326	709134.89	4830862.41	Non-Participating	Minnesota	0:00	0	0:00	0:00
327	709959.89	4830915.52	Non-Participating	Minnesota	0:00	0	0:00	0:00
328	710444.83	4830632.98	Participating	Minnesota	0:00	0	0:00	0:00
329	711156.75	4831002.57	Non-Participating	Minnesota	0:00	0	0:00	0:00
330	712129.09	4830942.84	Non-Participating	Minnesota	10:31	54	0:19	3:22
331	713644.87	4830986.83	Participating	Minnesota	122:21	186	1:17	45:49
332	714014.30	4831109.09	Participating	Minnesota	127:54	212	0:52	44:29
333	715256.78	4831015.51	Non-Participating	Minnesota	100:30	225	0:45	32:49
334	715114.86	4831046.13	Non-Participating	Minnesota	98:56	181	0:53	30:27
335	715280.87	4830888.83	Non-Participating	Minnesota	76:14	164	0:46	23:24
336	720850.87	4829589.22	Non-Participating	Minnesota	0:00	0	0:00	0:00
337	720471.34	4829713.08	Non-Participating	Minnesota	0:00	0	0:00	0:00
338	718660.97	4829287.11	Non-Participating	Minnesota	0:00	0	0:00	0:00
339	718547.55	4829529.40	Non-Participating	Minnesota	0:00	0	0:00	0:00
340	718705.42	4829658.28	Non-Participating	Minnesota	0:00	0	0:00	0:00
341	718207.07	4829650.23	Non-Participating	Minnesota	0:00	0	0:00	0:00
342	718488.68	4830493.21	Non-Participating	Minnesota	8:48	38	0:19	3:42
343	718614.16	4830476.57	Non-Participating	Minnesota	24:44	66	0:31	10:32
344	716736.70	4829503.83	Non-Participating	Minnesota	3:01	22	0:13	1:07
345	716664.22	4829593.01	Non-Participating	Minnesota	3:26	23	0:14	1:15
346	716087.40	4829579.09	Targeted	Minnesota	16:05	61	0:24	6:26
347	715685.16	4829460.28	Non-Participating	Minnesota	12:16	58	0:19	5:19
348	714913.69	4829173.93	Non-Participating	Minnesota	0:00	0	0:00	0:00
349	714617.74	4829521.25	Participating	Minnesota	0:00	0	0:00	0:00
350	713650.85	4830171.47	Non-Participating	Minnesota	59:25	136	0:49	19:33
351	712905.87	4829462.35	Non-Participating	Minnesota	10:21	61	0:18	3:19
352	712717.46	4829343.28	Participating	Minnesota	5:10	36	0:13	1:40
353	712178.69	4830005.45	Non-Participating	Minnesota	3:07	23	0:12	0:57
354	712093.44	4829732.15	Non-Participating	Minnesota	0:00	0	0:00	0:00
355	707416.58	4830311.62	Non-Participating	Minnesota	0:00	0	0:00	0:00
356	712848.91	4827911.62	Non-Participating	Minnesota	0:00	0	0:00	0:00
357	713480.57	4827427.94	Non-Participating	Minnesota	0:00	0	0:00	0:00
358	713672.96	4827918.96	Non-Participating	Minnesota	0:00	0	0:00	0:00
359	713975.46	4828553.70	Non-Participating	Minnesota	0:00	0	0:00	0:00
360	713820.87	4828830.04	Non-Participating	Minnesota	0:00	0	0:00	0:00
361	714217.10	4827915.58	Non-Participating	Minnesota	0:00	0	0:00	0:00
362	715474.31	4827938.91	Non-Participating	Minnesota	0:00	0	0:00	0:00
363	715541.50	4827975.19	Participating	Minnesota	0:00	0	0:00	0:00
364	716139.42	4827816.29	Non-Participating	Minnesota	0:00	0	0:00	0:00
365	716987.91	4827842.08	Non-Participating	Minnesota	0:00	0	0:00	0:00
366	717070.79	4827804.48	Non-Participating	Minnesota	0:00	0	0:00	0:00
367	717108.39	4828849.54	Non-Participating	Minnesota	0:00	0	0:00	0:00
368	718562.18	4828640.41	Non-Participating	Minnesota	0:00	0	0:00	0:00
369	718674.18	4828400.30	Non-Participating	Minnesota	0:00	0	0:00	0:00

Table B-1: Shadow Flicker Modeling Results

Receptor ID	Coordinates NAD83 UTM Zone 14N (meters)		Participation Status	Receptor State (MN or SD)	Worst-Case Shadow Flicker Hours per Year	Worst-Case Shadow Flicker Days per Year	Worst-Case Shadow Flicker Hours per Day	Expected Shadow Flicker Hours per Year
	X (Easting)	Y (Northing)			(HH:MM/year)	(Days/year)	(HH:MM/day)	(HH:MM/year)
370	718602.36	4827497.49	Non-Participating	Minnesota	0:00	0	0:00	0:00
371	718830.45	4827566.20	Non-Participating	Minnesota	0:00	0	0:00	0:00
372	719830.43	4828111.38	Non-Participating	Minnesota	0:00	0	0:00	0:00
373	719778.19	4828092.97	Non-Participating	Minnesota	0:00	0	0:00	0:00
374	715248.44	4827383.73	Non-Participating	Minnesota	0:00	0	0:00	0:00
375	713888.51	4826969.27	Non-Participating	Minnesota	0:00	0	0:00	0:00
376	705300.91	4848839.14	Non-Participating	Minnesota	0:00	0	0:00	0:00
377	706631.09	4848703.62	Non-Participating	Minnesota	0:00	0	0:00	0:00
378	706929.07	4848599.18	Non-Participating	Minnesota	0:00	0	0:00	0:00
379	707922.77	4848733.84	Non-Participating	Minnesota	0:00	0	0:00	0:00
380	709860.15	4848794.24	Non-Participating	Minnesota	0:00	0	0:00	0:00
381	710296.98	4848793.31	Non-Participating	Minnesota	0:00	0	0:00	0:00
382	710975.28	4848884.65	Non-Participating	Minnesota	0:00	0	0:00	0:00
383	705464.17	4831442.94	Non-Participating	South Dakota	12:56	59	0:24	3:58
384	704881.41	4833942.19	Non-Participating	South Dakota	15:42	52	0:22	6:00
385	704934.04	4833903.19	Non-Participating	South Dakota	17:19	55	0:23	6:36
386	705349.51	4834096.40	Non-Participating	South Dakota	0:00	0	0:00	0:00
387	703947.03	4834924.62	Non-Participating	South Dakota	0:00	0	0:00	0:00
388	703763.96	4835653.19	Non-Participating	South Dakota	0:00	0	0:00	0:00
389	704815.83	4835753.70	Non-Participating	South Dakota	0:00	0	0:00	0:00
390	705281.73	4835629.59	Non-Participating	South Dakota	0:00	0	0:00	0:00
391	703806.27	4836008.60	Non-Participating	South Dakota	0:00	0	0:00	0:00
392	703780.24	4836101.13	Non-Participating	South Dakota	0:00	0	0:00	0:00
393	703830.86	4836391.37	Non-Participating	South Dakota	2:07	18	0:10	0:39
394	703819.58	4836476.57	Non-Participating	South Dakota	2:13	18	0:11	0:41
395	703911.83	4836498.35	Non-Participating	South Dakota	2:41	20	0:12	0:50
396	703896.36	4836623.39	Non-Participating	South Dakota	2:14	18	0:11	0:42
397	703578.28	4837163.05	Non-Participating	South Dakota	0:00	0	0:00	0:00
398	703706.65	4837165.34	Non-Participating	South Dakota	0:00	0	0:00	0:00
399	703797.22	4837269.88	Non-Participating	South Dakota	1:24	16	0:08	0:28
400	703798.54	4837450.44	Non-Participating	South Dakota	0:00	0	0:00	0:00
401	703882.11	4837706.72	Non-Participating	South Dakota	2:58	20	0:14	0:56
402	704040.36	4837303.55	Non-Participating	South Dakota	6:00	44	0:13	2:00
403	704182.61	4837300.48	Non-Participating	South Dakota	10:03	57	0:17	3:28
404	703706.65	4838294.81	Non-Participating	South Dakota	0:00	0	0:00	0:00
405	703933.92	4838215.27	Non-Participating	South Dakota	2:57	20	0:14	0:57
406	703729.98	4838798.96	Non-Participating	South Dakota	0:00	0	0:00	0:00
407	703653.42	4839079.13	Non-Participating	South Dakota	0:00	0	0:00	0:00
408	704667.13	4838957.64	Non-Participating	South Dakota	6:21	29	0:20	2:23
409	704830.38	4838768.26	Non-Participating	South Dakota	25:29	80	0:26	9:17
410	703785.10	4839818.54	Non-Participating	South Dakota	0:00	0	0:00	0:00
411	705171.09	4840026.31	Non-Participating	South Dakota	0:00	0	0:00	0:00
412	703132.24	4840141.30	Non-Participating	South Dakota	0:00	0	0:00	0:00
413	703198.00	4840427.17	Non-Participating	South Dakota	0:00	0	0:00	0:00
414	703241.98	4840429.71	Non-Participating	South Dakota	0:00	0	0:00	0:00
415	703913.94	4840550.82	Non-Participating	South Dakota	0:00	0	0:00	0:00
416	704492.38	4840341.24	Non-Participating	South Dakota	0:00	0	0:00	0:00
417	704782.58	4840430.67	Non-Participating	South Dakota	0:00	0	0:00	0:00
418	705123.49	4840673.16	Non-Participating	South Dakota	0:00	0	0:00	0:00
419	703564.36	4841448.22	Non-Participating	South Dakota	0:00	0	0:00	0:00
420	703746.52	4841901.08	Non-Participating	South Dakota	0:00	0	0:00	0:00
421	703834.63	4841918.03	Non-Participating	South Dakota	0:00	0	0:00	0:00
422	705169.14	4841778.72	Non-Participating	South Dakota	0:00	0	0:00	0:00
423	705155.44	4842202.20	Non-Participating	South Dakota	0:00	0	0:00	0:00
424	705039.92	4842185.90	Non-Participating	South Dakota	0:00	0	0:00	0:00
425	703698.42	4843134.63	Non-Participating	South Dakota	0:00	0	0:00	0:00
426	703076.93	4843496.03	Non-Participating	South Dakota	0:00	0	0:00	0:00
427	703543.71	4843522.22	Non-Participating	South Dakota	0:00	0	0:00	0:00
428	703791.36	4843544.69	Non-Participating	South Dakota	0:00	0	0:00	0:00
429	703807.51	4843371.35	Non-Participating	South Dakota	0:00	0	0:00	0:00
430	703964.87	4843675.19	Non-Participating	South Dakota	0:00	0	0:00	0:00
431	704279.70	4843597.33	Non-Participating	South Dakota	0:00	0	0:00	0:00
432	705095.53	4843395.34	Non-Participating	South Dakota	0:00	0	0:00	0:00
433	705119.32	4842994.01	Non-Participating	South Dakota	0:00	0	0:00	0:00
434	703210.31	4845218.38	Non-Participating	South Dakota	0:00	0	0:00	0:00
435	703655.30	4845259.88	Non-Participating	South Dakota	0:00	0	0:00	0:00
436	703718.90	4845630.64	Non-Participating	South Dakota	0:00	0	0:00	0:00
437	704017.84	4845316.26	Non-Participating	South Dakota	0:00	0	0:00	0:00
438	704824.64	4845406.00	Non-Participating	South Dakota	0:00	0	0:00	0:00
439	703610.45	4846099.04	Non-Participating	South Dakota	0:00	0	0:00	0:00
440	703662.42	4847171.38	Non-Participating	South Dakota	0:00	0	0:00	0:00
441	703673.57	4847781.75	Non-Participating	South Dakota	0:00	0	0:00	0:00
442	704957.99	4848148.24	Non-Participating	South Dakota	0:00	0	0:00	0:00
443	703017.12	4847952.56	Non-Participating	South Dakota	0:00	0	0:00	0:00

Table B-1: Shadow Flicker Modeling Results

Receptor ID	Coordinates NAD83 UTM Zone 14N (meters)		Participation Status	Receptor State (MN or SD)	Worst-Case Shadow Flicker Hours per Year	Worst-Case Shadow Flicker Days per Year	Worst-Case Shadow Flicker Hours per Day	Expected Shadow Flicker Hours per Year
	X (Easting)	Y (Northing)			(HH:MM/year)	(Days/year)	(HH:MM/day)	(HH:MM/year)
444	703019.78	4847976.89	Non-Participating	South Dakota	0:00	0	0:00	0:00
445	703016.93	4848052.49	Non-Participating	South Dakota	0:00	0	0:00	0:00
446	703080.20	4848056.20	Non-Participating	South Dakota	0:00	0	0:00	0:00
447	703065.43	4848024.42	Non-Participating	South Dakota	0:00	0	0:00	0:00
448	703065.57	4847991.56	Non-Participating	South Dakota	0:00	0	0:00	0:00
449	703129.99	4848006.74	Non-Participating	South Dakota	0:00	0	0:00	0:00
450	703168.99	4848023.70	Non-Participating	South Dakota	0:00	0	0:00	0:00
451	703013.19	4848105.25	Non-Participating	South Dakota	0:00	0	0:00	0:00
452	703005.94	4848179.89	Non-Participating	South Dakota	0:00	0	0:00	0:00
453	703059.93	4848181.42	Non-Participating	South Dakota	0:00	0	0:00	0:00
454	703062.63	4848147.55	Non-Participating	South Dakota	0:00	0	0:00	0:00
456	703124.69	4848133.99	Non-Participating	South Dakota	0:00	0	0:00	0:00
458	703244.13	4848113.26	Non-Participating	South Dakota	0:00	0	0:00	0:00
459	703241.16	4848188.31	Non-Participating	South Dakota	0:00	0	0:00	0:00
460	702954.97	4848228.98	Non-Participating	South Dakota	0:00	0	0:00	0:00
461	703074.13	4848229.08	Non-Participating	South Dakota	0:00	0	0:00	0:00
462	703121.89	4848302.50	Non-Participating	South Dakota	0:00	0	0:00	0:00
463	703121.79	4848256.23	Non-Participating	South Dakota	0:00	0	0:00	0:00
464	703180.66	4848312.57	Non-Participating	South Dakota	0:00	0	0:00	0:00
465	703176.46	4848235.57	Non-Participating	South Dakota	0:00	0	0:00	0:00
466	703242.02	4848232.13	Non-Participating	South Dakota	0:00	0	0:00	0:00
467	703289.44	4848250.13	Non-Participating	South Dakota	0:00	0	0:00	0:00
468	703285.28	4848305.42	Non-Participating	South Dakota	0:00	0	0:00	0:00
469	703238.10	4848313.94	Non-Participating	South Dakota	0:00	0	0:00	0:00
470	703118.81	4848430.03	Non-Participating	South Dakota	0:00	0	0:00	0:00
471	703117.32	4848399.72	Non-Participating	South Dakota	0:00	0	0:00	0:00
472	703118.49	4848369.89	Non-Participating	South Dakota	0:00	0	0:00	0:00
473	703283.34	4848401.65	Non-Participating	South Dakota	0:00	0	0:00	0:00
474	703504.59	4848360.63	Non-Participating	South Dakota	0:00	0	0:00	0:00
475	703164.64	4848496.77	Non-Participating	South Dakota	0:00	0	0:00	0:00
476	703598.30	4848527.13	Non-Participating	South Dakota	0:00	0	0:00	0:00
477	704664.41	4848425.57	Non-Participating	South Dakota	0:00	0	0:00	0:00
478	704813.86	4848633.46	Non-Participating	South Dakota	0:00	0	0:00	0:00
479	706044.71	4849773.17	Non-Participating	Minnesota	0:00	0	0:00	0:00
480	707387.55	4850254.10	Non-Participating	Minnesota	0:00	0	0:00	0:00
481	707945.22	4849861.93	Non-Participating	Minnesota	0:00	0	0:00	0:00
482	709936.28	4850179.20	Non-Participating	Minnesota	0:00	0	0:00	0:00
483	706553.32	4850323.54	Non-Participating	Minnesota	0:00	0	0:00	0:00
484	707466.63	4850517.83	Non-Participating	Minnesota	0:00	0	0:00	0:00
485	706627.42	4850969.47	Non-Participating	Minnesota	0:00	0	0:00	0:00
600	721504.45	4832717.79	Non-Participating	Minnesota	0:00	0	0:00	0:00
601	721107.43	4831397.47	Non-Participating	Minnesota	0:00	0	0:00	0:00
602	721193.76	4829744.37	Non-Participating	Minnesota	0:00	0	0:00	0:00
603	721607.87	4829645.45	Non-Participating	Minnesota	0:00	0	0:00	0:00
604	720771.23	4828229.30	Non-Participating	Minnesota	0:00	0	0:00	0:00
605	720294.73	4827201.39	Non-Participating	Minnesota	0:00	0	0:00	0:00
606	719889.27	4826965.25	Non-Participating	Minnesota	0:00	0	0:00	0:00
607	720233.54	4825646.32	Non-Participating	Minnesota	0:00	0	0:00	0:00
608	719207.30	4824943.60	Non-Participating	Minnesota	0:00	0	0:00	0:00
609	718925.56	4826292.09	Non-Participating	Minnesota	0:00	0	0:00	0:00
610	718736.06	4826853.88	Non-Participating	Minnesota	0:00	0	0:00	0:00
611	718258.61	4826322.24	Non-Participating	Minnesota	0:00	0	0:00	0:00
612	717984.98	4825391.46	Non-Participating	Minnesota	0:00	0	0:00	0:00
613	716906.43	4826389.27	Non-Participating	Minnesota	0:00	0	0:00	0:00
614	716639.93	4826263.50	Non-Participating	Minnesota	0:00	0	0:00	0:00
615	715859.70	4826343.35	Participating	Minnesota	0:00	0	0:00	0:00
616	712762.52	4826456.76	Non-Participating	Minnesota	0:00	0	0:00	0:00
617	710508.38	4828661.23	Non-Participating	Minnesota	0:00	0	0:00	0:00
618	710312.21	4827758.12	Participating	Minnesota	0:00	0	0:00	0:00
619	708971.55	4828978.11	Participating	Minnesota	0:00	0	0:00	0:00
620	708880.83	4829066.94	Non-Participating	Minnesota	0:00	0	0:00	0:00
621	708621.24	4827744.01	Non-Participating	Minnesota	0:00	0	0:00	0:00
622	707666.58	4829219.47	Non-Participating	Minnesota	0:00	0	0:00	0:00
623	707381.37	4829213.15	Non-Participating	Minnesota	0:00	0	0:00	0:00
624	707003.03	4829294.84	Non-Participating	Minnesota	0:00	0	0:00	0:00
625	706769.91	4829219.83	Participating	Minnesota	0:00	0	0:00	0:00
626	707202.71	4829656.80	Non-Participating	Minnesota	0:00	0	0:00	0:00
627	706884.07	4829695.44	Non-Participating	Minnesota	0:00	0	0:00	0:00
628	706800.75	4829875.13	Non-Participating	Minnesota	0:00	0	0:00	0:00
629	706334.75	4829721.80	Participating	Minnesota	0:00	0	0:00	0:00
630	706496.34	4829597.02	Non-Participating	Minnesota	0:00	0	0:00	0:00
631	706398.43	4829578.24	Non-Participating	Minnesota	0:00	0	0:00	0:00
632	706314.88	4829561.32	Non-Participating	Minnesota	0:00	0	0:00	0:00
633	706251.50	4829532.13	Non-Participating	Minnesota	0:00	0	0:00	0:00

Table B-1: Shadow Flicker Modeling Results

Receptor ID	Coordinates NAD83 UTM Zone 14N (meters)		Participation Status	Receptor State (MN or SD)	Worst-Case Shadow Flicker Hours per Year	Worst-Case Shadow Flicker Days per Year	Worst-Case Shadow Flicker Hours per Day	Expected Shadow Flicker Hours per Year
	X (Easting)	Y (Northing)			(HH:MM/year)	(Days/year)	(HH:MM/day)	(HH:MM/year)
634	705621.54	4829441.98	Non-Participating	Minnesota	0:00	0	0:00	0:00
635	705623.53	4828995.44	Non-Participating	Minnesota	0:00	0	0:00	0:00
636	705654.15	4828680.11	Non-Participating	Minnesota	0:00	0	0:00	0:00
637	705562.56	4829075.23	Non-Participating	South Dakota	0:00	0	0:00	0:00
638	705381.51	4828643.03	Non-Participating	South Dakota	0:00	0	0:00	0:00
639	705232.02	4828693.33	Non-Participating	South Dakota	0:00	0	0:00	0:00
640	705156.39	4828687.56	Non-Participating	South Dakota	0:00	0	0:00	0:00
641	705144.00	4828631.96	Non-Participating	South Dakota	0:00	0	0:00	0:00
642	705165.33	4828631.41	Non-Participating	South Dakota	0:00	0	0:00	0:00
643	705188.15	4828631.29	Non-Participating	South Dakota	0:00	0	0:00	0:00
644	705245.87	4828628.25	Non-Participating	South Dakota	0:00	0	0:00	0:00
645	705190.52	4828581.28	Non-Participating	South Dakota	0:00	0	0:00	0:00
646	705171.84	4828565.72	Non-Participating	South Dakota	0:00	0	0:00	0:00
647	705139.58	4828563.76	Non-Participating	South Dakota	0:00	0	0:00	0:00
648	705164.83	4828509.94	Non-Participating	South Dakota	0:00	0	0:00	0:00
649	705193.32	4828510.33	Non-Participating	South Dakota	0:00	0	0:00	0:00
650	705235.30	4828503.99	Non-Participating	South Dakota	0:00	0	0:00	0:00
651	705237.46	4828485.00	Non-Participating	South Dakota	0:00	0	0:00	0:00
652	705236.89	4828464.00	Non-Participating	South Dakota	0:00	0	0:00	0:00
653	705237.97	4828440.75	Non-Participating	South Dakota	0:00	0	0:00	0:00
654	705232.89	4828391.80	Non-Participating	South Dakota	0:00	0	0:00	0:00
655	705192.38	4828390.51	Non-Participating	South Dakota	0:00	0	0:00	0:00
656	705192.04	4828445.68	Non-Participating	South Dakota	0:00	0	0:00	0:00
657	705164.73	4828442.51	Non-Participating	South Dakota	0:00	0	0:00	0:00
658	705141.80	4828441.62	Non-Participating	South Dakota	0:00	0	0:00	0:00
659	705114.53	4828440.47	Non-Participating	South Dakota	0:00	0	0:00	0:00
660	705134.87	4828508.79	Non-Participating	South Dakota	0:00	0	0:00	0:00
661	705112.05	4828508.92	Non-Participating	South Dakota	0:00	0	0:00	0:00
662	705111.94	4828563.26	Non-Participating	South Dakota	0:00	0	0:00	0:00
663	705068.50	4828447.23	Non-Participating	South Dakota	0:00	0	0:00	0:00
664	705084.11	4828507.72	Non-Participating	South Dakota	0:00	0	0:00	0:00
665	705058.41	4828505.66	Non-Participating	South Dakota	0:00	0	0:00	0:00
666	705086.63	4828560.21	Non-Participating	South Dakota	0:00	0	0:00	0:00
667	705058.94	4828563.22	Non-Participating	South Dakota	0:00	0	0:00	0:00
668	705050.52	4828588.54	Non-Participating	South Dakota	0:00	0	0:00	0:00
669	705047.19	4828626.92	Non-Participating	South Dakota	0:00	0	0:00	0:00
670	705071.55	4828628.90	Non-Participating	South Dakota	0:00	0	0:00	0:00
671	705094.47	4828629.96	Non-Participating	South Dakota	0:00	0	0:00	0:00
672	705120.08	4828630.84	Non-Participating	South Dakota	0:00	0	0:00	0:00
673	705079.90	4828684.04	Non-Participating	South Dakota	0:00	0	0:00	0:00
674	705078.44	4828705.43	Non-Participating	South Dakota	0:00	0	0:00	0:00
675	705082.10	4828728.87	Non-Participating	South Dakota	0:00	0	0:00	0:00
676	705076.62	4828751.12	Non-Participating	South Dakota	0:00	0	0:00	0:00
677	705053.61	4828763.25	Non-Participating	South Dakota	0:00	0	0:00	0:00
678	705033.29	4828752.15	Non-Participating	South Dakota	0:00	0	0:00	0:00
679	705028.57	4828727.69	Non-Participating	South Dakota	0:00	0	0:00	0:00
680	705033.40	4828705.87	Non-Participating	South Dakota	0:00	0	0:00	0:00
681	705036.35	4828680.92	Non-Participating	South Dakota	0:00	0	0:00	0:00
682	704996.82	4828679.63	Non-Participating	South Dakota	0:00	0	0:00	0:00
683	704964.38	4828679.57	Non-Participating	South Dakota	0:00	0	0:00	0:00
684	704936.60	4828675.97	Non-Participating	South Dakota	0:00	0	0:00	0:00
685	704908.43	4828676.33	Non-Participating	South Dakota	0:00	0	0:00	0:00
686	704906.09	4828714.84	Non-Participating	South Dakota	0:00	0	0:00	0:00
687	704997.74	4828559.76	Non-Participating	South Dakota	0:00	0	0:00	0:00
688	705001.36	4828584.00	Non-Participating	South Dakota	0:00	0	0:00	0:00
689	704966.68	4828557.88	Non-Participating	South Dakota	0:00	0	0:00	0:00
690	704940.13	4828557.69	Non-Participating	South Dakota	0:00	0	0:00	0:00
691	705006.63	4828625.51	Non-Participating	South Dakota	0:00	0	0:00	0:00
692	704978.65	4828625.25	Non-Participating	South Dakota	0:00	0	0:00	0:00
693	704956.32	4828623.73	Non-Participating	South Dakota	0:00	0	0:00	0:00
694	704934.87	4828623.22	Non-Participating	South Dakota	0:00	0	0:00	0:00
695	704901.75	4828621.37	Non-Participating	South Dakota	0:00	0	0:00	0:00
696	704854.66	4828673.86	Non-Participating	South Dakota	0:00	0	0:00	0:00
697	704822.53	4828673.82	Non-Participating	South Dakota	0:00	0	0:00	0:00
698	704703.29	4828772.50	Non-Participating	South Dakota	0:00	0	0:00	0:00
699	704732.97	4828770.97	Non-Participating	South Dakota	0:00	0	0:00	0:00
700	704743.05	4828746.45	Non-Participating	South Dakota	0:00	0	0:00	0:00
701	704782.48	4828751.87	Non-Participating	South Dakota	0:00	0	0:00	0:00
702	704796.10	4828794.68	Non-Participating	South Dakota	0:00	0	0:00	0:00
703	704817.70	4828795.20	Non-Participating	South Dakota	0:00	0	0:00	0:00
704	704836.47	4828797.77	Non-Participating	South Dakota	0:00	0	0:00	0:00
705	704856.56	4828770.84	Non-Participating	South Dakota	0:00	0	0:00	0:00
706	704855.50	4828801.47	Non-Participating	South Dakota	0:00	0	0:00	0:00
707	704895.68	4828810.27	Non-Participating	South Dakota	0:00	0	0:00	0:00

Table B-1: Shadow Flicker Modeling Results

Receptor ID	Coordinates NAD83 UTM Zone 14N (meters)		Participation Status	Receptor State (MN or SD)	Worst-Case Shadow Flicker Hours per Year	Worst-Case Shadow Flicker Days per Year	Worst-Case Shadow Flicker Hours per Day	Expected Shadow Flicker Hours per Year
	X (Easting)	Y (Northing)			(HH:MM/year)	(Days/year)	(HH:MM/day)	(HH:MM/year)
708	704891.61	4828777.74	Non-Participating	South Dakota	0:00	0	0:00	0:00
709	704914.82	4828777.88	Non-Participating	South Dakota	0:00	0	0:00	0:00
710	704923.96	4828810.72	Non-Participating	South Dakota	0:00	0	0:00	0:00
711	704947.07	4828815.31	Non-Participating	South Dakota	0:00	0	0:00	0:00
712	704976.61	4828823.78	Non-Participating	South Dakota	0:00	0	0:00	0:00
713	705004.60	4828829.14	Non-Participating	South Dakota	0:00	0	0:00	0:00
714	705033.09	4828831.35	Non-Participating	South Dakota	0:00	0	0:00	0:00
715	704643.69	4828894.85	Non-Participating	South Dakota	0:00	0	0:00	0:00
716	704685.55	4828860.34	Non-Participating	South Dakota	0:00	0	0:00	0:00
717	704716.03	4828832.45	Non-Participating	South Dakota	0:00	0	0:00	0:00
718	704752.95	4828842.64	Non-Participating	South Dakota	0:00	0	0:00	0:00
719	704775.41	4828844.64	Non-Participating	South Dakota	0:00	0	0:00	0:00
720	704815.16	4828852.78	Non-Participating	South Dakota	0:00	0	0:00	0:00
721	704845.87	4828884.07	Non-Participating	South Dakota	0:00	0	0:00	0:00
722	704881.27	4828861.57	Non-Participating	South Dakota	0:00	0	0:00	0:00
723	704898.75	4828856.59	Non-Participating	South Dakota	0:00	0	0:00	0:00
724	704933.94	4828866.36	Non-Participating	South Dakota	0:00	0	0:00	0:00
725	704983.46	4828881.30	Non-Participating	South Dakota	0:00	0	0:00	0:00
726	705020.82	4829044.05	Non-Participating	South Dakota	0:00	0	0:00	0:00
727	704090.37	4829425.88	Non-Participating	South Dakota	0:00	0	0:00	0:00
728	704015.10	4829497.03	Non-Participating	South Dakota	0:00	0	0:00	0:00
729	704140.49	4829544.72	Non-Participating	South Dakota	0:00	0	0:00	0:00
730	704000.89	4829862.49	Non-Participating	South Dakota	0:00	0	0:00	0:00
731	703944.27	4829849.85	Non-Participating	South Dakota	0:00	0	0:00	0:00
732	704067.63	4830354.06	Non-Participating	South Dakota	0:00	0	0:00	0:00
733	705489.39	4830596.80	Non-Participating	South Dakota	0:00	0	0:00	0:00
734	703668.33	4830842.49	Non-Participating	South Dakota	0:00	0	0:00	0:00
735	703972.01	4831224.31	Non-Participating	South Dakota	0:00	0	0:00	0:00
736	704299.99	4830881.97	Non-Participating	South Dakota	0:00	0	0:00	0:00
737	704916.66	4830874.26	Non-Participating	South Dakota	9:16	56	0:13	2:53
738	705096.30	4830861.02	Non-Participating	South Dakota	1:26	24	0:05	0:24
739	705481.17	4830895.95	Non-Participating	South Dakota	0:00	0	0:00	0:00
740	704028.51	4831683.73	Non-Participating	South Dakota	0:00	0	0:00	0:00
741	704663.19	4832358.83	Non-Participating	South Dakota	14:47	71	0:20	4:56
742	704666.19	4832791.85	Non-Participating	South Dakota	11:06	55	0:21	3:42
743	704643.10	4832809.62	Non-Participating	South Dakota	10:36	54	0:20	3:33
744	704012.68	4832757.85	Non-Participating	South Dakota	0:00	0	0:00	0:00
745	703622.76	4832429.96	Non-Participating	South Dakota	0:00	0	0:00	0:00
746	703900.32	4833237.25	Non-Participating	South Dakota	0:00	0	0:00	0:00
747	703981.67	4833479.14	Non-Participating	South Dakota	0:00	0	0:00	0:00
748	703900.85	4833546.01	Non-Participating	South Dakota	0:00	0	0:00	0:00
749	703953.06	4833803.10	Non-Participating	South Dakota	0:00	0	0:00	0:00
750	703877.92	4834322.90	Non-Participating	South Dakota	0:00	0	0:00	0:00
751	703115.78	4835451.23	Non-Participating	South Dakota	0:00	0	0:00	0:00
752	703164.32	4835650.06	Non-Participating	South Dakota	0:00	0	0:00	0:00
A	712158.94	4832287.00	Non-Participating	Minnesota	9:08	48	0:19	3:17
B	712675.48	4832272.50	Non-Participating	Minnesota	0:00	0	0:00	0:00
C	712885.07	4832032.10	Non-Participating	Minnesota	16:38	59	0:26	6:29
D	707132.31	4837379.49	Non-Participating	Minnesota	20:32	100	0:20	8:15
E	707199.51	4837381.57	Non-Participating	Minnesota	13:51	71	0:18	5:29
F	718750.18	4829719.41	Non-Participating	Minnesota	0:00	0	0:00	0:00
H	712862.66	4832031.39	Non-Participating	Minnesota	20:43	66	0:29	8:05
I	710895.09	4843889.83	Non-Participating	Minnesota	0:00	0	0:00	0:00
J	705563.49	4837361.96	Targeted	Minnesota	0:00	0	0:00	0:00
K	703235.27	4848223.84	Non-Participating	South Dakota	0:00	0	0:00	0:00
L	703055.10	4848224.96	Non-Participating	South Dakota	0:00	0	0:00	0:00
N01	715712.50	4831245.52	Non-Participating	Minnesota	32:40	143	0:26	9:42
N07	712508.03	4832184.52	Non-Participating	Minnesota	20:11	56	0:25	7:43
N08	710307.95	4832588.36	Participating	Minnesota	8:42	44	0:18	2:50
N09	709858.42	4832463.19	Participating	Minnesota	17:41	63	0:34	6:34
N10	710527.10	4829926.70	Non-Participating	Minnesota	0:00	0	0:00	0:00
N11	710006.75	4829851.12	Participating	Minnesota	0:00	0	0:00	0:00
N16	703119.22	4848225.24	Non-Participating	South Dakota	0:00	0	0:00	0:00
N18	703012.25	4848234.77	Non-Participating	South Dakota	0:00	0	0:00	0:00
N19	703006.98	4847997.82	Non-Participating	South Dakota	0:00	0	0:00	0:00
N20	703184.00	4848093.37	Non-Participating	South Dakota	0:00	0	0:00	0:00
N21	703175.60	4848057.09	Non-Participating	South Dakota	0:00	0	0:00	0:00
N22	703289.81	4848227.56	Non-Participating	South Dakota	0:00	0	0:00	0:00
N23	703278.77	4848275.25	Non-Participating	South Dakota	0:00	0	0:00	0:00
N24	703426.63	4847498.89	Non-Participating	South Dakota	0:00	0	0:00	0:00
N25	703419.37	4847459.42	Non-Participating	South Dakota	0:00	0	0:00	0:00
N26	703621.29	4845626.04	Non-Participating	South Dakota	0:00	0	0:00	0:00
N27	719788.78	4840865.90	Non-Participating	Minnesota	0:00	0	0:00	0:00
N28	717647.77	4834465.50	Non-Participating	Minnesota	1:44	16	0:10	0:29

Table B-1: Shadow Flicker Modeling Results

Receptor ID	Coordinates NAD83 UTM Zone 14N (meters)		Participation Status	Receptor State (MN or SD)	Worst-Case Shadow Flicker Hours per Year	Worst-Case Shadow Flicker Days per Year	Worst-Case Shadow Flicker Hours per Day	Expected Shadow Flicker Hours per Year
	X (Easting)	Y (Northing)			(HH:MM/year)	(Days/year)	(HH:MM/day)	(HH:MM/year)
N30	713229.35	4832282.49	Non-Participating	Minnesota	15:35	56	0:20	5:55
N31	713010.86	4832312.23	Non-Participating	Minnesota	8:23	45	0:17	3:02
N32	709098.10	4836931.87	Targeted	Minnesota	23:21	94	0:23	6:39
N33	708666.86	4835693.48	Non-Participating	Minnesota	37:34	78	0:53	11:44
N39	713597.65	4832689.58	Non-Participating	Minnesota	3:28	26	0:13	1:20

ATTACHMENT C
(PART 3)

APPENDIX D

Walleye Wind, MN
Electromagnetic Interference Analysis

Walleye Wind LLC

October 2020

The following document was prepared by NextEra Analytics, an indirect wholly-owned subsidiary of NextEra Energy Resources, LLC (NEER) for the use of Walleye Wind, LLC, as an indirect wholly-owned subsidiary of NEER. NextEra Analytics has prepared this report based on available government information by the Federal Communications Commission (FCC) and internal analysis methods. We cannot guarantee the accuracy of the data collected by the FCC. Microwave tower and link information may be inaccurate or incomplete due to FCC applicant error.

Executive Summary

NextEra Analytics, an affiliate of Walleye Wind LLC (Walleye) assessed the potential for interference of licensed communication links in close proximity to the proposed Walleye Wind project area for the purposes of determining exclusion zones to aid the design of a proposed wind energy generation project. This report summarizes the microwave links and towers along with local cellular towers, media towers (AM and FM), television, and aviation towers, identified within and near the assessment area.

A review of the Federal Communications Commission (FCC) national database and the Universal Licensing System was conducted to identify these possible constraints. Wind turbine offset distances were taken in consideration for the design of the wind turbine array.

Electromagnetic analysis results show that interference is not expected to impact nearby microwave, AM, FM, cellular, TV, and aviation towers based on the array design.

The analysis is current as of January 23, 2020. NextEra Analytics recommends a refresh of this analysis if the proposed wind energy generation project has not been constructed after two years.

This report only provides analysis for licensed radio towers and links found within the FCC database. Many local municipalities (police, fire, etc.) do not license microwave links, NextEra Analytics recommends that Walleye Wind LLC coordinate with the appropriate local municipality officials. Also not included within the database are microwave towers and links utilized by the Federal government (Dept. of Defense, Dept. of Commerce, etc.), again for public safety concerns. A letter stating “No Harmful Interference Anticipated (NHIA)” has been received from the National Telecommunications and Information Agency (NTIA).

Walleye Wind, MN – Electromagnetic Interference

NextEra Analytics, an affiliate of Walleye Wind LLC (Walleye), assessed the potential for interference of licensed communication links in close proximity to the proposed Walleye Wind Project area for the purposes of determining exclusion zones to aid the design of a proposed wind energy generation project. This report summarizes the microwave links and towers along with local cellular towers, media towers (AM and FM), television, and aviation towers, identified within and near the assessment area.

A review of the FCC national database and the Universal Licensing System was conducted to identify these possible constraints. Wind turbine offset distances were taken into consideration for the design of the wind turbine array.

The site is located in Rock County, Minnesota, bordering South Dakota and roughly 10 kilometers north of Iowa. Figure 1 below, depicts the project location of Walleye Wind.

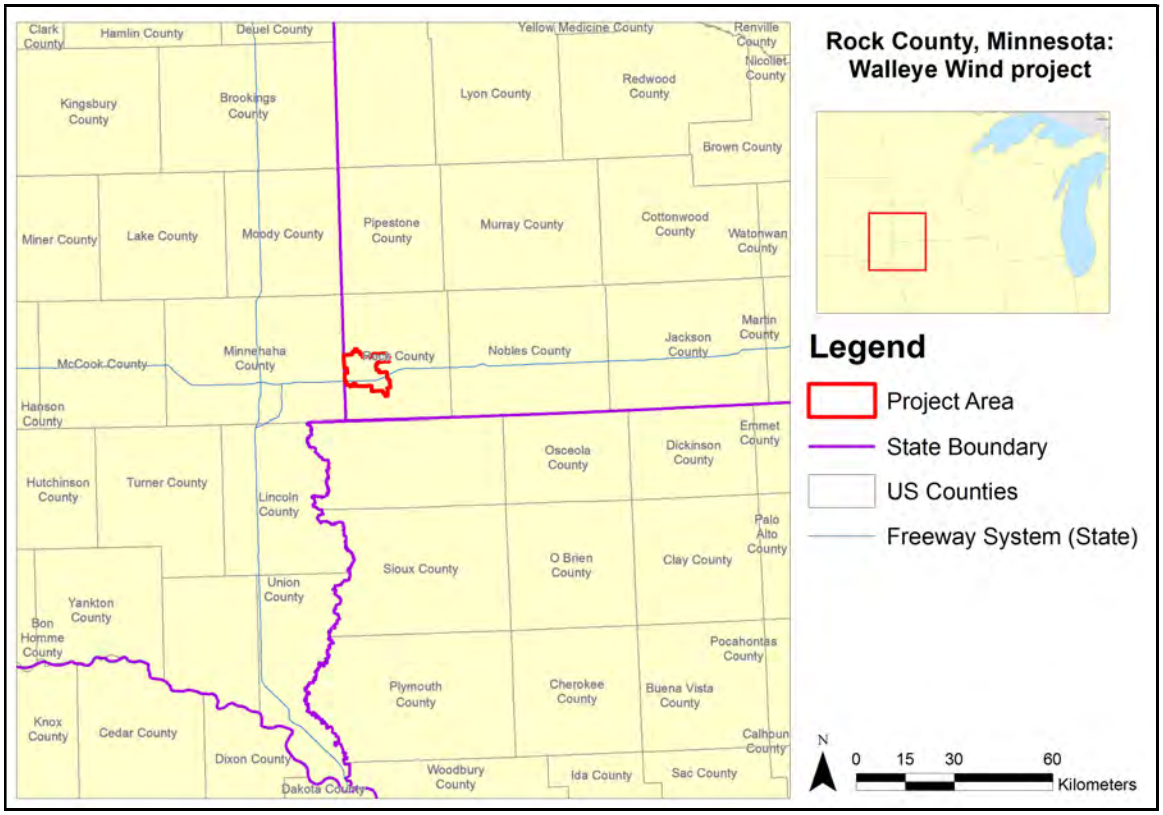

Figure 1: Walleye Wind Project Location

Turbine Technology

Walleye Wind is a proposed wind energy generation site that consists of 46 prospective turbine locations; wind turbines will be constructed in 40 of these 46 prospective locations.

The array filed with the MN PUC in June 2020 included 51 prospective turbine locations; five of those locations have been removed for this application amendment array. The five locations removed were primary turbines 7 and 21, and alternate turbines 1, 2, and 3. The removal of primary turbines 7 and 21 is the reason for the total number of primary turbines in Table 1 totaling 38 turbines. Additional turbine details are included in Table 1 and Figure 2.

Turbine Model	Total Height (m/ft)	Rotor Diameter (m/ft)	Ground Clearance (m/ft)	Number of Primary Turbines	Number of Alternate Turbines
GE 2.32 MW	138.3/453.7	116.5/382	21.8/71.7	4	1
GE 2.82 MW	178.1/584.3	127.2/417	51/167.3	27	3
GE 2.82 MW	152.1/499	127.2/417	25/82	2	3
GE 2.82 MW-NRO	178.1/584.3	127.2/417	51/167.3	3	-
GE 2.82 MW-NRO	152.1/499	127.2/417	25/82	2	1

Table 1: Turbine Technologies and Counts Array Details Comparing June 2020 Array to October 2020 Array

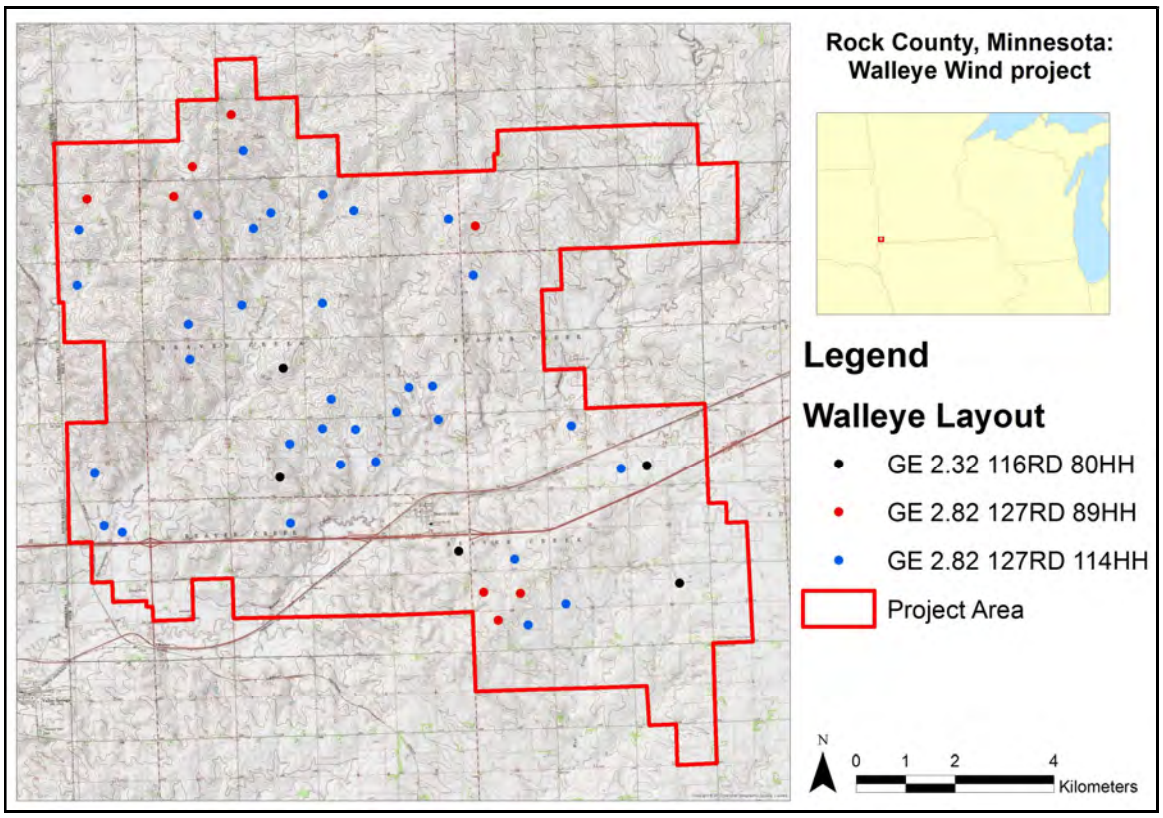

Figure 2: Walleye Wind Base Case Turbine Technology Allocation

Data Sources

Within the United States, the location of industrial and commercial telecommunication systems, including microwave links, are collected and maintained by the Wireless Telecommunications Bureau (WTB), a division of the FCC. This data is made publicly available through the ULS database, which contains licensing information on both current and permit pending facilities for microwave, cellular, media, and several radio services utilized by private industry (non-Federal telecommunication systems). License information supplied within the ULS database is updated daily, and is dependent upon information provided by each individual applicant.

NextEra Analytics used several data sources (ESRI satellite imagery, Google Earth, etc.) of high resolution imagery to aid in assessing the accuracy of the geographic locations of each microwave tower with links intersecting the project boundary or area of interest (AOI).

Methodology

The ULS database, described earlier, was used to identify the microwave towers, microwave links, cellular, AM, FM, and aviation towers within a 25-kilometer radius that may impact the Walleye Wind Farm. Television towers were identified within a 100-kilometer radius. The database provides detailed information for each radio tower and link, which was used to calculate turbine exclusion zones to ensure interference compliance.

Exclusion zones for wind turbines near microwave links are calculated using a theory proposed by Bacon (2002), which identifies the radius of the 2nd Fresnel zone, a theoretical sphere representative of a propagating radio wave, as an appropriate offset distance. Calculations of the 2nd Fresnel zone can be determined by:

$$2nd\ Fresnel\ zone\ Radius = \sqrt{\frac{2\lambda d_1 d_2}{d_1 + d_2}} \qquad (1)$$

Where:
d_1, d_2 = distances from each end of the radio path.
λ= wavelength of the corresponding radio frequency.

To account for precision errors within the ULS database, and to further reduce the potential for interference from a wind turbine, a Worst Case Fresnel Zone (WCFZ) was calculated for each microwave link. The WCFZ provides the maximum offset distance required, and is determined by the 2nd Fresnel zone radius obtained at the midpoint of the link, where $d_1 = d_2$. Adjusting Eq. 1 to calculate the WCFZ in meters yields the following:

$$WCFZ = 17.32\sqrt{\frac{nD}{4(F)}} \qquad (2)$$

Where:
D = distance between the transmitter and receiver towers.
F = frequency in GHz.
n = Fresnel zone, which for the 2nd Fresnel Zone n = 2.

The calculated radius distance from Eq. 2 provides a three-dimensional turbine exclusion zone around each microwave link that can be used to guide wind turbine array design.

In addition to the WCFZ calculated for each microwave link, NextEra Analytics applies an offset of one-half RD plus 10 meter to account for turbine blade

overhang. A turbine overhang offset using a 127m RD turbine technology is included within this analysis to represent the GE2.82-127 wind turbine generator.

The WTB cannot provide quality assurance for every license within the ULS database, so accuracy of the data relies on applicant certifications, and, in extreme cases, license audits. It has been NextEra Analytics' experience that most inaccuracies occur with regard to the location of the radio towers, where approximation or lack of precision of the geographic coordinates can result in a difference in the position of the tower by as much as 500 meters.

To fully account for these location errors, NextEra Analytics recommends on-site verification to identify the exact location of the transmitter and receiver towers. However, for this analysis, NextEra Analytics used high-resolution satellite imagery to identify possible tower location errors. Most microwave, media, and cellular towers extend well over 80m above ground level, and can be clearly viewed within high resolution satellite imagery. Each tower that may impact the project boundary was investigated for potential location error. Adjustments to the location of the microwave, media, and cellular towers are only made if clear evidence from the satellite imagery shows an inaccuracy.

Microwave Links and Microwave Towers

One microwave tower was identified within the project area, 26 microwave links have been identified near the project area, and eight have been found to intersect the AOI. The WCFZ for all of these links has been calculated, and the appropriate turbine offset has been used to minimize any harmful impact from the proposed turbine layout.

Figure 3 below illustrates the position of each microwave link with respect to the project boundary and turbine locations.

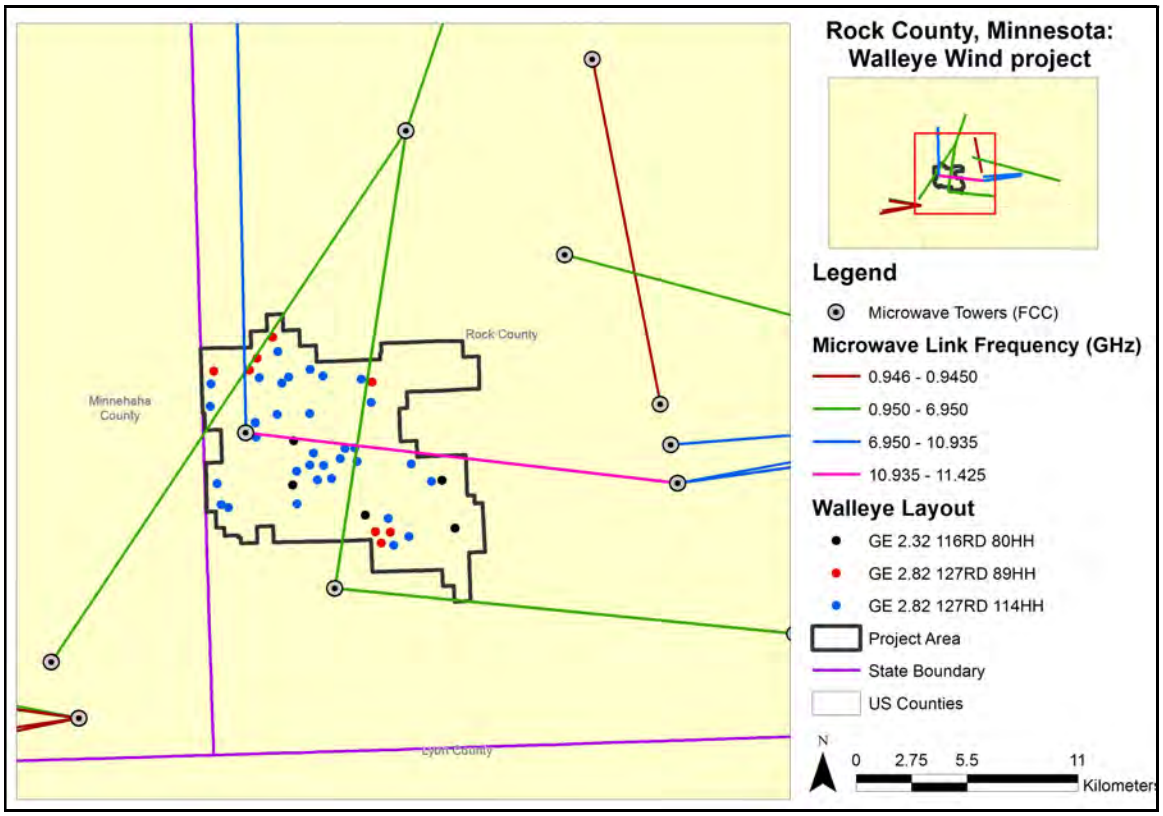

Figure 3: Walleye Wind with Microwave Links

Table 2 provides more detailed information on each microwave link in proximity to the area with the calculated WCFZ. Listed are the eight links that intersect the AOI.

ID	STATUS	TRANSMITTER CALLSIGN	MICROWAVE NAME	BAND FREQ (GHz)	WCFZ (m)	BEAM LENGTH (Km)
1	Active	WQOQ494	Minnesota, State of	6.6	22.8	23.0
2	Active	WQOU364	Minnesota, State of	6.8	22.5	23.0
3	Active	WQVP557	EAST RIVER ELECTRIC POWER COOP	6.6	26.9	31.7
4	Active	WQVP558	EAST RIVER ELECTRIC POWER COOP	6.8	26.5	31.7
5	Active	WQWB937	T-MOBILE LICENSE LLC	11.3	17.7	23.5
6	Active	WQWB939	T-MOBILE LICENSE LLC	10.8	18.0	23.5
7	Active	WQXG280	Sprint Spectrum L.P.	10.9	17.2	21.6
8	Active	WQXG281	Sprint Spectrum L.P.	11.4	16.8	21.6

Table 2: Detailed Information on Microwave Links That Intersect the Project Boundary

There are a number of links that are within relatively close proximity to turbines. The Worst Case Fresnel Zone was calculated for each microwave link and a conservative offset of 74 meters was used to reduce the probability of harmful interference. The offset of 74 meters was used because it is the length of a

turbine blade plus 10 meters. Figures 4-5 provide aerial imagery of the turbine layout relative to the Fresnel Zones and their offsets that intersect the project

boundary. Figures 6, 7, and 8 provide close ups on turbines between 30 and 200 feet from the Worst Case Fresnel Zone 74 meter offset.

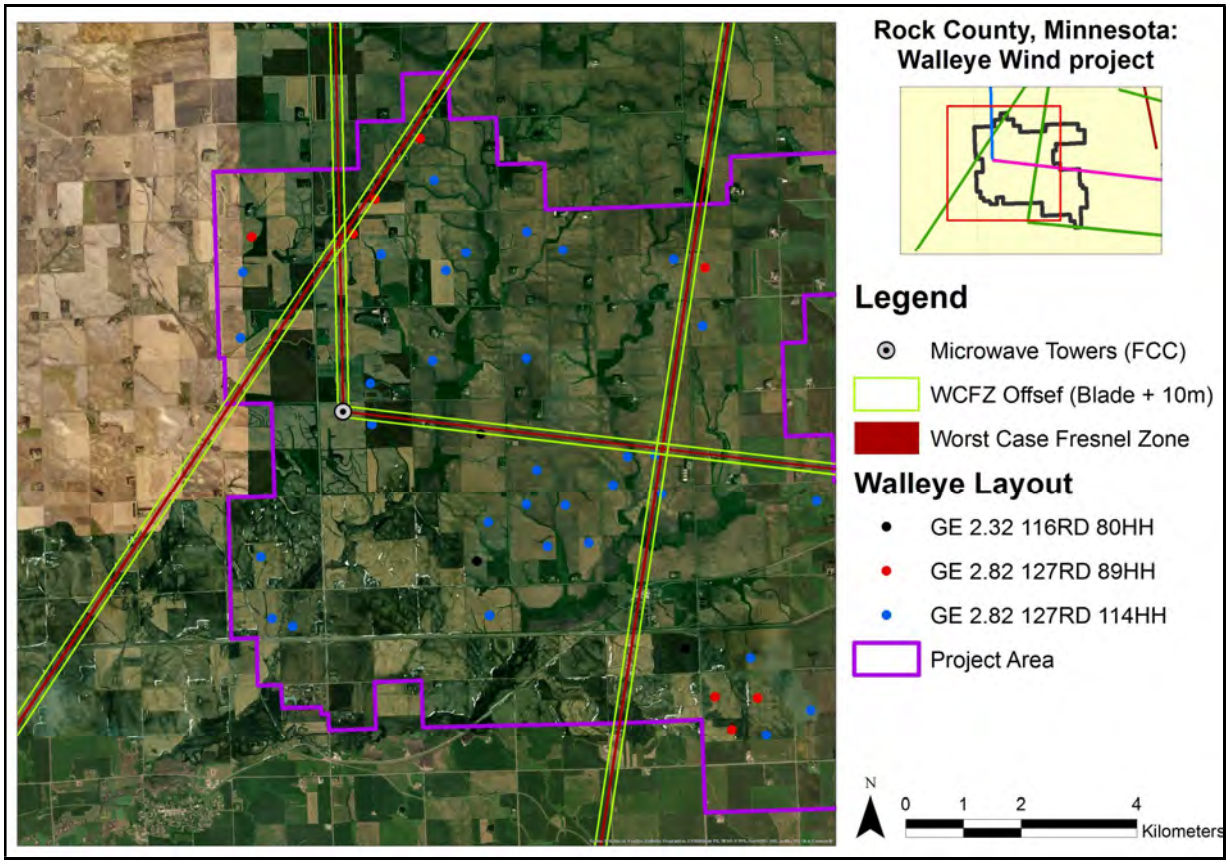

Figure 4: Walleye Wind Fresnel Zone West

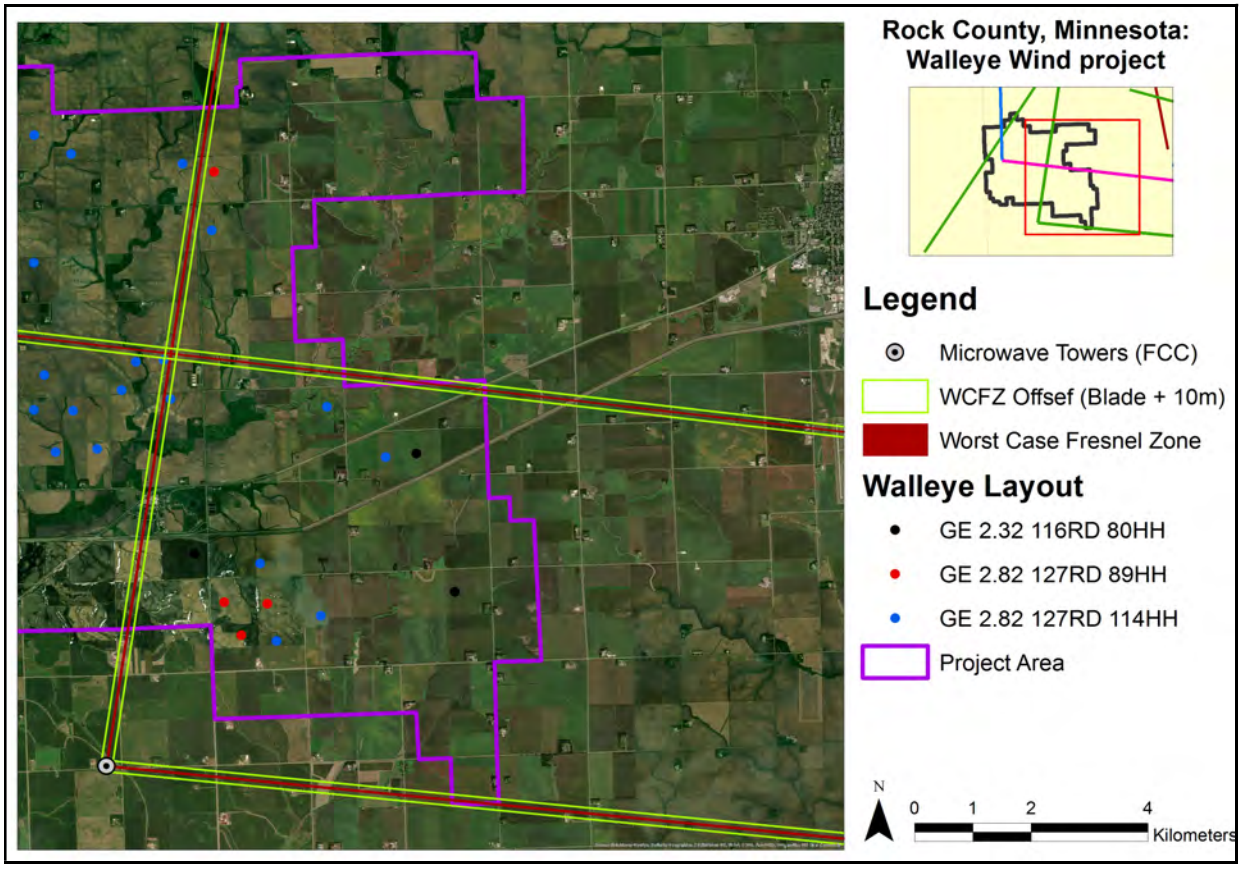

Figure 5: Walleye Wind Fresnel Zone East

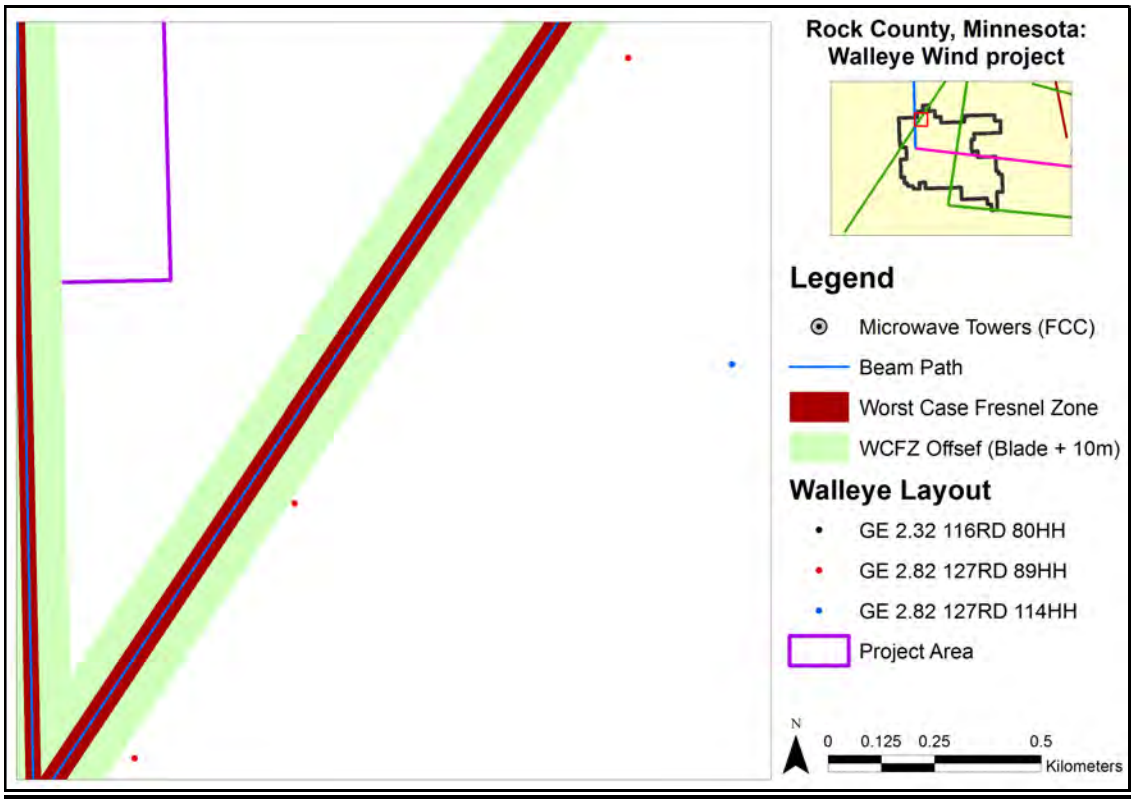

Figure 6: Walleye Wind Northwestern Close Up: Beam Path, WCFZ, WCFZ Offset

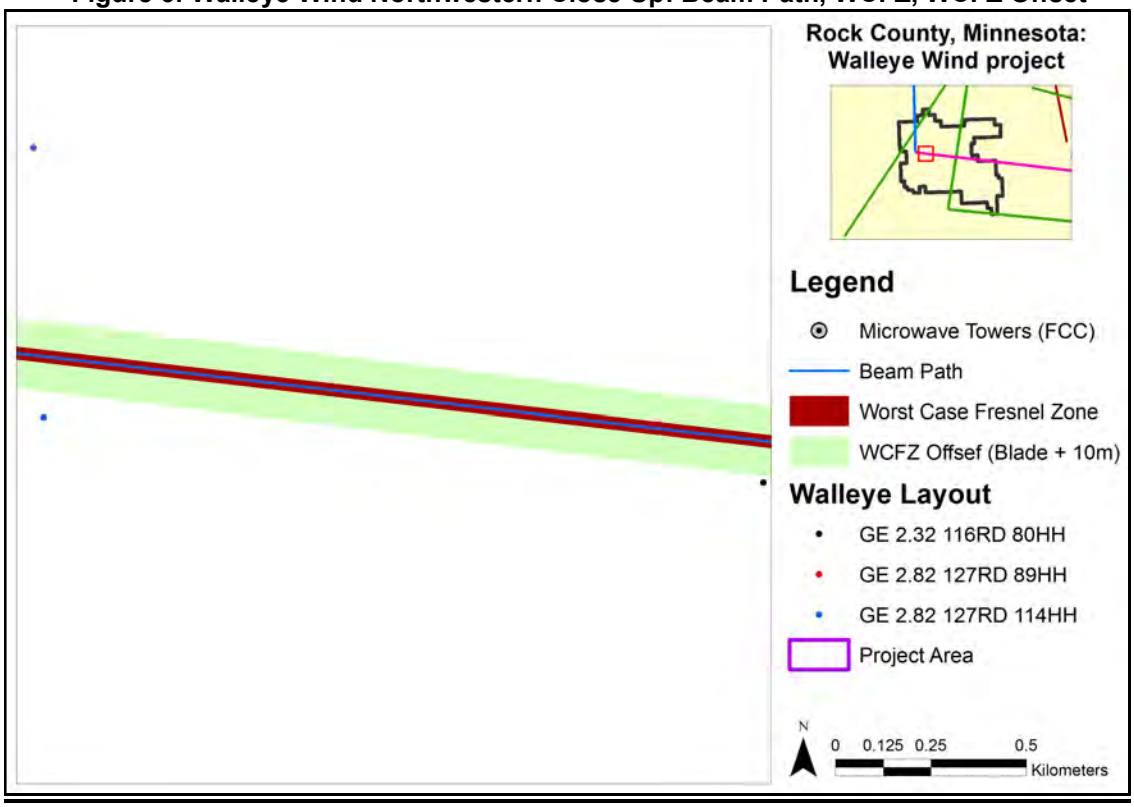

Figure 7: Walleye Wind Southwestern Close Up: Beam Path, WCFZ, WCFZ Offset

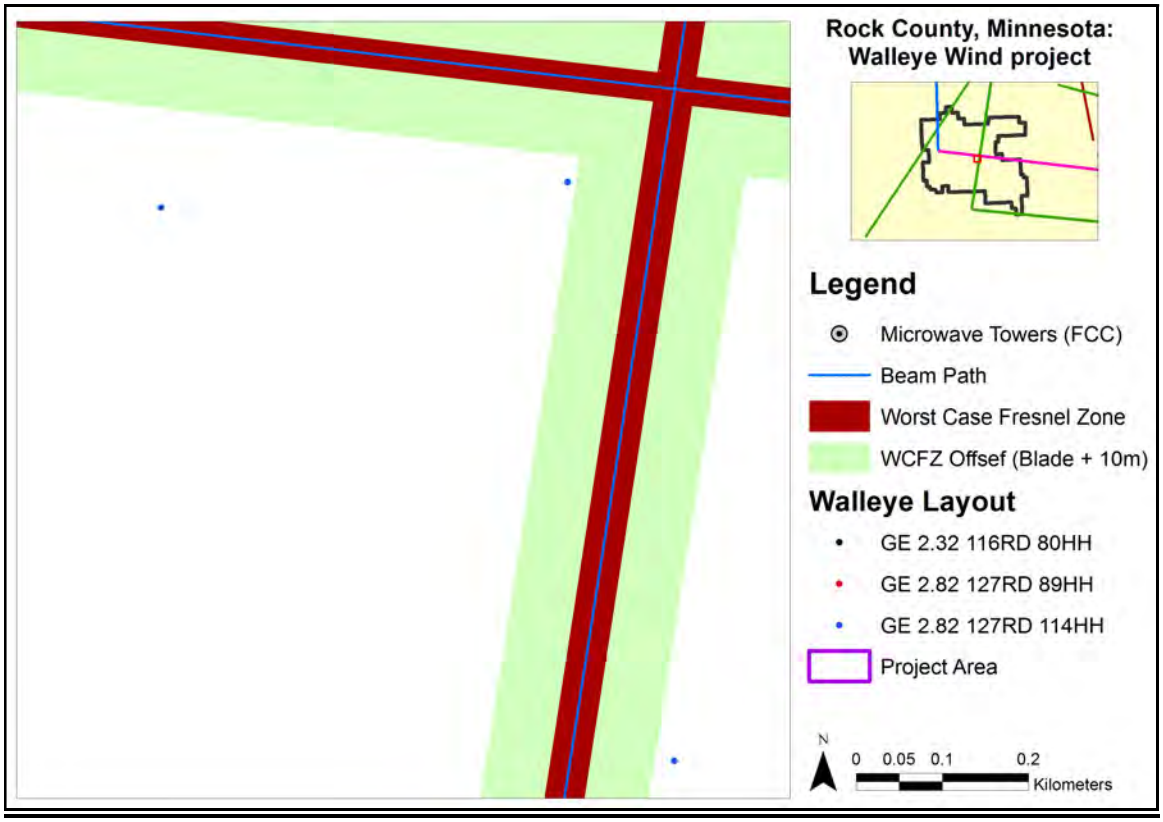

Figure 8: Walleye Wind Eastern Close Up: Beam Path, WCFZ, WCFZ Offset

Cellular Towers

One cellular tower was identified within the project boundary. Four other towers were discovered within 25 km of the project boundary. All five towers are identified in Table 3 and Figure 9.

Harmful interference associated with cellular towers is not likely as cellular transitions or packet switching occurs when a cellular link becomes unavailable.

ID	STATUS	CALLSIGN	LICENSEE	LATITUDE	LONGITUDE	DISTANCE TO AOI (km)
1	ACTIVE	KNKA597	AT&T Mobility Spectrum LLC	43.692139	-96.485806	2.8
2	ACTIVE	KNKN282	AT&T Mobility Spectrum LLC	43.718861	-96.227417	6.6
3	ACTIVE	KNKN282	AT&T Mobility Spectrum LLC	43.644167	-96.427111	0.0
4	ACTIVE	KNKN282	AT&T Mobility Spectrum LLC	43.855472	-96.424167	10.4
5	ACTIVE	KNKN290	ALLTEL Corporation	43.661389	-96.224722	4.7

Table 3: Cellular Towers within 25 km of the Project Boundary

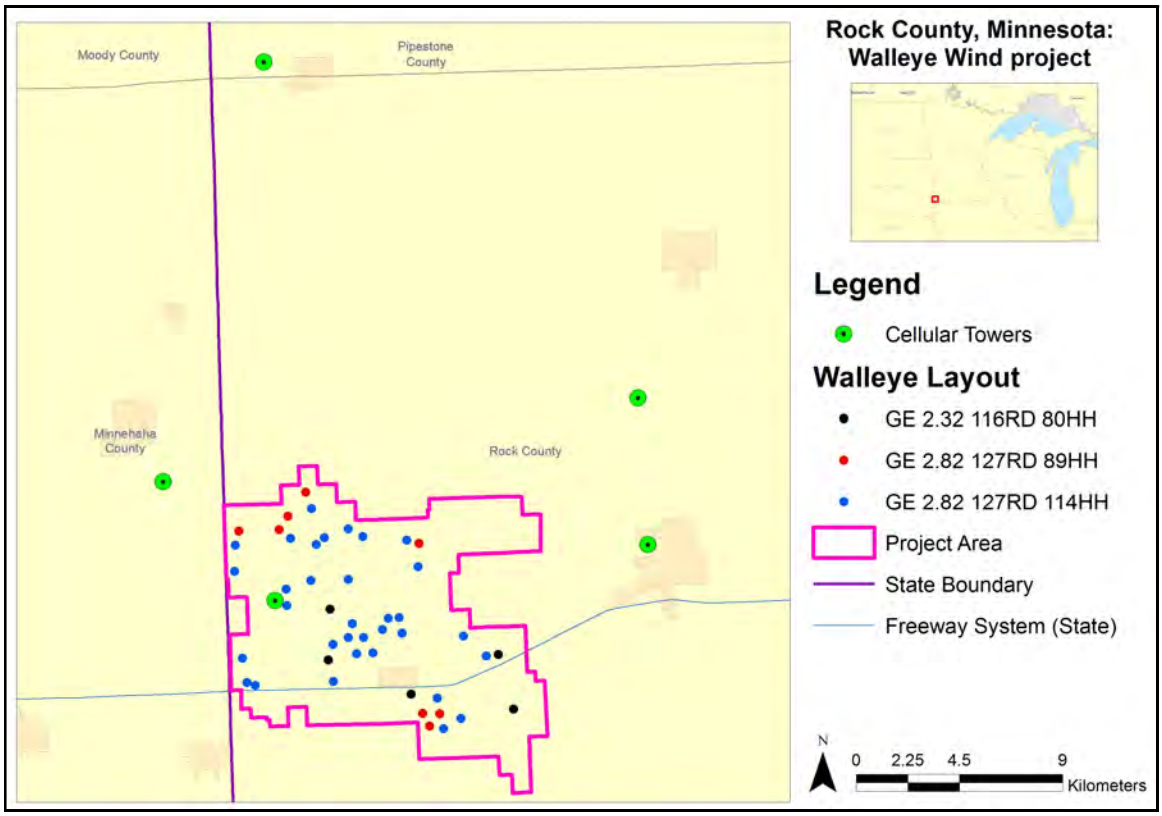

Figure 9: Cellular Towers within 25 km of the Project Boundary

Media Towers

No active AM radio towers were identified within the project boundary. One AM tower was discovered within 25 km of the project boundary and is included in Table 4 and Figure 10.

While no harmful interference to the AM tower is expected, reception of AM radio stations near each individual turbine may be impacted, especially for areas on the edge of AM radio coverage. The exclusion distance from AM towers is 1 wavelength from non-directional antennas and 10 wavelengths or 3 kilometers from directional antennas (Marlowe, 2015). Given most AM radio receptors will be nearby dwellings, which should have a sufficient offset from each turbine, any interruption to reception from the installation of wind turbines is expected to be minimal. The only AM tower, KQAD, is located 9.0 km from the project boundary, and has a broadcasting frequency of 800 kHz which corresponds to a wavelength of 375 m. Thus, the proposed layout is greater than 10 wavelengths away from the closest station.

ID	CALLSIGN	LICENSEE	FREQUENCY (kHz)	LATITUDE	LONGITUDE	DISTANCE TO AOI (km)
1	KQAD	ALPHA 3E LICENSEE LLC	800	43.650278	-96.171944	9.0

Table 4: AM Transmitter Towers within 25 km of the Project Boundary

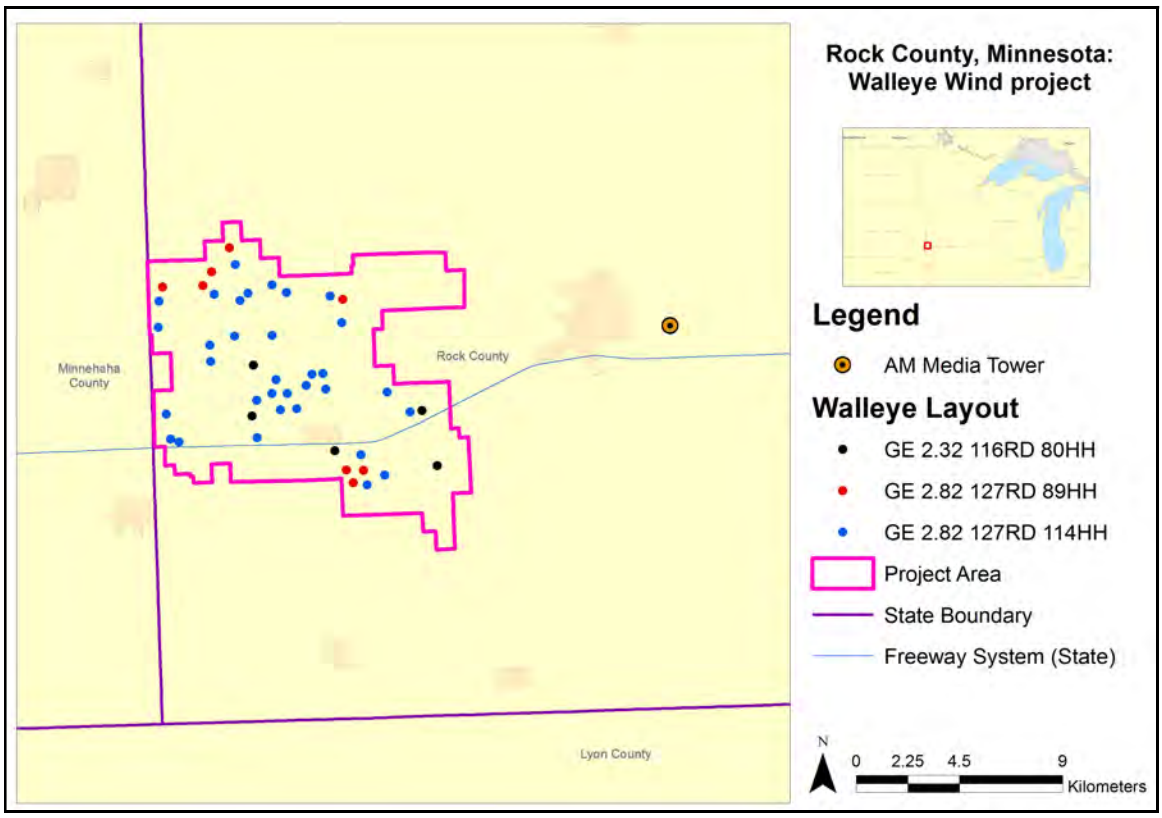

Figure 10: AM Transmitter Towers within 25 km of the Project Boundary

No active FM radio towers were identified within the project boundary. Four FM towers were discovered within 25 km of the project boundary and are included in Table 5 and Figure 11.

While no harmful interference to the FM towers is expected, reception of FM radio stations near each individual turbine may be impacted, especially for areas on the edge of FM radio coverage. The recommended exclusion distance for FM towers is approximately 4 kilometers. FM stations that are closer than 4 kilometers to wind turbines have the potential to experience interference (Marlowe, 2015). Given most FM radio receptors will be nearby dwellings, which should have a sufficient offset from each turbine, any interruption to reception from the installation of wind turbines is expected to be minimal. There are no active FM radio towers within 4 kilometers of the Walleye Wind project boundary.

ID	CALLSIGN	LICENSEE	FREQUENCY (MHz)	LATITUDE	LONGITUDE	DISTANCE TO AOI (km)
1	KLQL	ALPHA 3E LICENSEE LLC	101.1	43.806667	-96.206389	15.5
2	KNWC-FM	UNIVERSITY OF NORTHWESTERN-ST. PAUL	96.5	43.518611	-96.534722	13.6
3	KTWB	MIDWEST COMMUNICATIONS, INC.	92.5	43.518611	-96.534722	13.6
4	KXRB-FM	TOWNSQUARE MEDIA SIOUX FALLS LICENSE, LLC	100.1	43.518611	-96.534722	13.6

Table 5: FM Transmitter Towers within 25 km of the Project Boundary

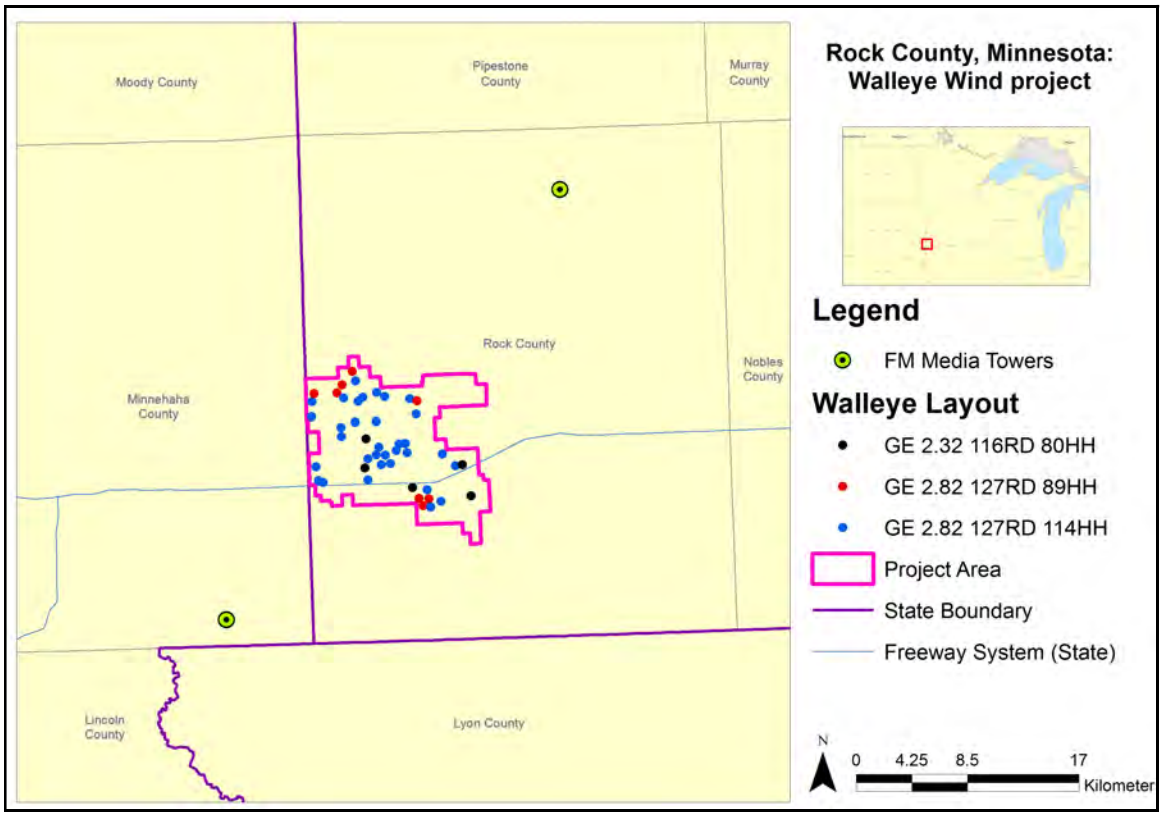

Figure 11: FM Transmitter Towers within 25 km of the Project Boundary

Television Stations

No digital or analog television stations were identified within the project boundary. Within 100km of the project boundary, there are 43 licensed television stations as determined by the FCC; Table 6 identifies these 43 stations, and Figure 12 depicts their locations. Of the 43 stations within 100km of the project boundary, nine of them fall within 50km of the boundary and are likely to be broadcasting to the region.

ID	CALLSIGN	CHANNEL	SERVICE	ERP (kW)	LAT	LONG	LICENSEE	Dist to AOI (km)
1	K14QR-D	14	ND	1	43.703333	-96.45175	LANDOVER 2 LLC	0.08
2	K30NS-D	30	ND	1	43.703333	-96.45175	LANDOVER 2 LLC	0.08
3	K40NS-D	40	ND	1	43.703333	-96.45175	LANDOVER 2 LLC	0.08
4	K33NF-D	33	ND	1	43.659861	-96.852556	LANDOVER 2 LLC	32.19
5	K35LZ-D	35	ND	1	43.659861	-96.852556	LANDOVER 2 LLC	32.19
6	K38OZ-D	38	ND	1	43.659861	-96.852556	LANDOVER 2 LLC	32.19
7	K48OK-D	48	ND	1	43.659861	-96.852556	LANDOVER 2 LLC	32.19
8	K43LX-D	43	DA	15	43.379167	-95.803333	IOWA PUBLIC BROADCASTING BOARD	45.91
9	K33PV-D	33	DA	15	43.376583	-95.803167	IOWA PUBLIC BROADCASTING BOARD	46.07
10	KELO-TV	11	ND	30	43.518611	-95.465	NEXSTAR BROADCASTING, INC.	67.29
11	KSFY-TV	13	ND	22.7	43.518611	-95.465	GRAY TELEVISION LICENSEE, LLC	67.29
12	K20MB-D	20	ND	13.2	43.518611	-95.465	GRAY TELEVISION LICENSEE, LLC	67.29
13	KABY-LD	20	ND	13.2	43.518611	-95.465	GRAY TELEVISION LICENSEE, LLC	67.29
14	KDLT-TV	21	ND	589	43.505	-95.443611	GRAY TELEVISION LICENSEE, LLC	69.22
15	KTTW	7	DA	7.5	43.505278	-95.427778	INDEPENDENT COMMUNICATIONS, INC.	70.48
16	KWSD	36	DA	36.9	43.505278	-95.427778	J.F. BROADCASTING, LLC	70.48
17	KWSD	36	DA	18.45	43.505278	-95.427778	J.F. BROADCASTING, LLC	70.48
18	KWSD	36	DA	1000	43.505278	-95.427778	J.F. BROADCASTING, LLC	70.48
19	KCSD-TV	24	ND	80.9	43.574417	-95.344417	SOUTH DAKOTA BOARD OF DIRECTORS FOR EDUCATIONAL TELECOMMUNIC	76.06
20	K22KD-D	22	ND	3	43.553889	-95.315	EDGE SPECTRUM, INC.	78.67
21	K56GF	23	ND	15	43.553889	-95.315	DIGITAL NETWORKS-MIDWEST, LLC	78.67
22	K56GF	56	DA	10.1	43.553889	-95.315	DIGITAL NETWORKS-MIDWEST, LLC	78.67
23	K56GF	56	DA	10.1	43.553889	-95.315	DIGITAL NETWORKS-MIDWEST, LLC	78.67
24	K04RR-D	4	ND	3	43.538083	-95.285694	DTV AMERICA CORPORATION	81.24
25	K06QJ-D	6	ND	3	43.538083	-95.285694	DTV AMERICA CORPORATION	81.24
26	K27LB-D	27	ND	2	44.383222	-96.9895	LANDOVER 2 LLC	82.19
27	K38NI-D	38	ND	2	44.383222	-96.9895	LANDOVER 2 LLC	82.19
28	K42KO-D	42	ND	2	44.383222	-96.9895	LANDOVER 2 LLC	82.19
29	K45LV-D	45	ND	2	44.383222	-96.9895	LANDOVER 2 LLC	82.19
30	KCPO-LP	26	ND	7.57	43.52675	-95.261833	G.I.G., INC.	83.33
31	KAUN-LP	25	ND	0.88	43.535556	-95.256944	J.F. BROADCASTING, LLC	83.58
32	KCWS-LP	27	ND	0.68	43.535556	-95.256944	J.F. BROADCASTING, LLC	83.58
33	KAUN-LP	42	ND	0.88	43.535528	-95.256917	J.F. BROADCASTING, LLC	83.58
34	KCWS-LP	44	ND	0.68	43.535528	-95.256917	J.F. BROADCASTING, LLC	83.58
35	NEW	35	DA	15	43.376667	-95.1945	CASEY C. PETERSON	91.89
36	K18IW-D	18	DA	3	43.752278	-95.114611	DTV AMERICA CORPORATION	94.50
37	K18IW-D	18	DA	3	43.752278	-95.114611	DTV AMERICA CORPORATION	94.50
38	K31KU-D	31	DA	3	43.752278	-95.114611	DTV AMERICA CORPORATION	94.50
39	K31KU-D	31	DA	3	43.752278	-95.114611	DTV AMERICA CORPORATION	94.50
40	K32JG-D	32	DA	3	43.752278	-95.114611	DTV AMERICA CORPORATION	94.50
41	K32JG-D	32	DA	3	43.752278	-95.114611	DTV AMERICA CORPORATION	94.50
42	K32JG-D	32	DA	3	43.752278	-95.114611	DTV AMERICA CORPORATION	94.50
43	K18IW-D	18	ND	3	43.751389	-95.110556	DTV AMERICA CORPORATION	94.82

Table 6: Television Stations within 100 km of the Project Boundary

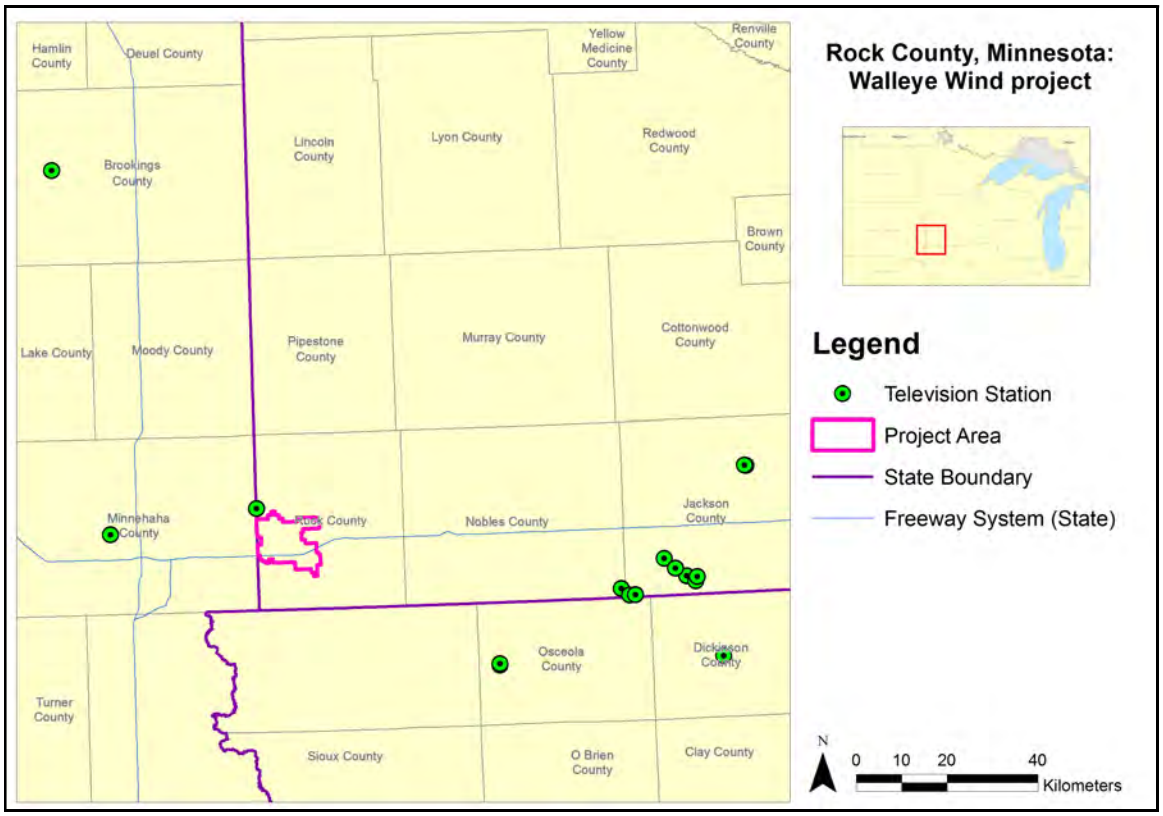

Figure 12: Television Stations within 100 km of the Project Boundary

While the impact of wind turbines on digital television reception is not well known due to limited cases and testing, any interference is expected to be limited to areas near the edge of station reception, areas near a turbine that is within the line-of-sight between the transmit tower and receptor, and areas of complex topography (OfCom, 2009). Most of the stations within 100km are low power stations or translator stations and have limited range and are not anticipated to experience reception degradation. There are 10 full power stations which have a possibility of experiencing reception degradation if the proposed wind farm is located in the line-of-sight. The callsigns of these 10 stations are as follows: KTTW, KELO-TV, KSFY-TV, KSMN, KDLT-TV, KCSD-TV, KUSD-TV, KWSD, KWSD, KWSD.

It is important to note that this assessment is based on broad assumptions, as it is difficult to accurately pinpoint the impact a large wind farm may have on each individual household due to a large number of external variables (topography, weather, antennae, etc.) which affect the propagation of the television radio signal.

Aviation Towers

No active aviation towers were identified within the project boundary. Two aviation towers were discovered within 25 km of the project boundary and are included in Table 7 and Figure 13.

While no harmful interference is expected for the aviation towers; Walleye Wind is subject to the Federal Aviation Agency (FAA) to determine any exclusion zones. Proposed turbine locations maintain the standard appropriate offset distances in addition to any setbacks set by the agency to minimize harmful impact.

ID	STATUS	CALLSIGN	LICENSEE	SERVICE	LATITUDE	LONGITUDE	DISTANCE TO AOI (km)
1	Active	KRQ9	LUVERNE, CITY OF	AF Aeronautical and Fixed	43.620806	-96.218639	5.4
2	Active	WQBL287	Minnesota, State of epartment of Transportation ffice of Aeronautics	AF Aeronautical and Fixed	43.621667	-96.213889	5.7

Table 7: Aviation Towers within 25 km of the Project Boundary

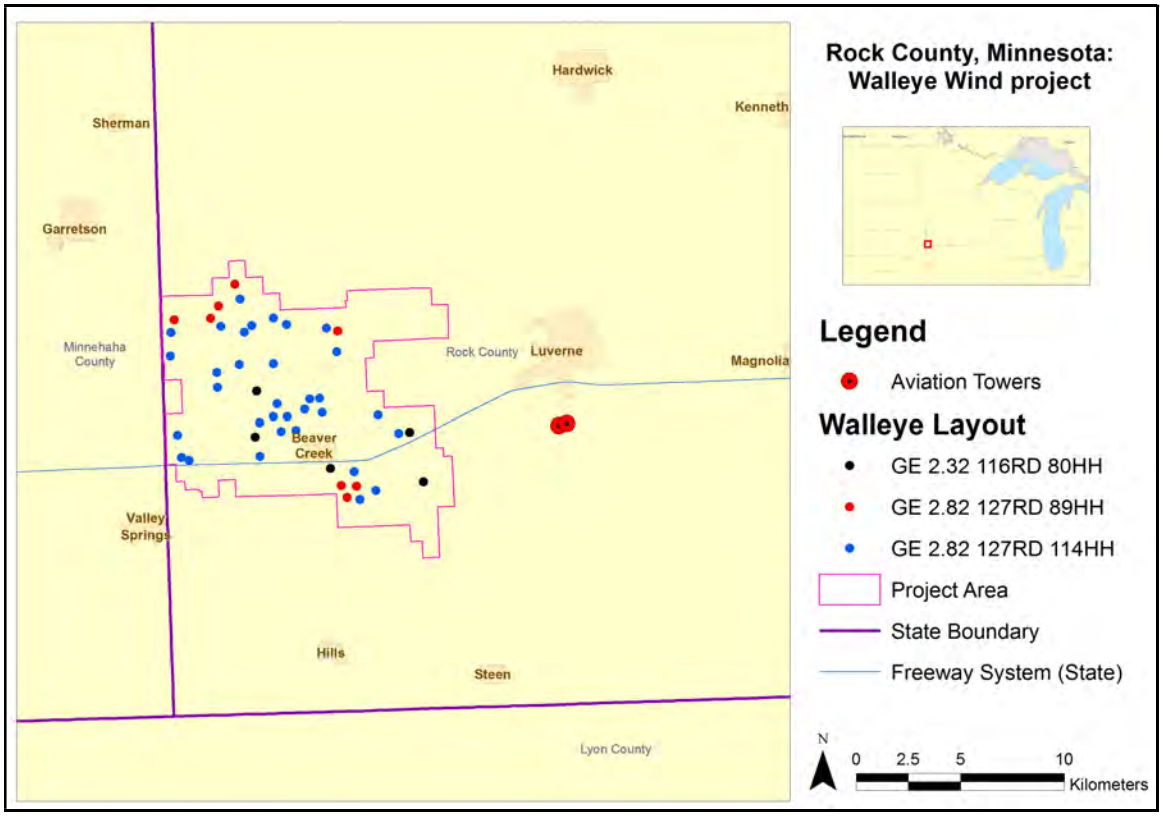

Figure 13: Aviation Towers within 25 km of the Project Boundary

Conclusion and Recommendations

NextEra Analytics analyzed the potential for wind turbine interference on licensed microwave links located within the proposed Walleye Wind Project energy generation site. This report summarizes the microwave towers, microwave links, cellular towers, media towers, television towers, and aviation towers within and near the project boundary.

Eight microwave links were found to intersect the project boundary, and an appropriate offset to the WCFZ has been utilized to mitigate harmful interference from the proposed turbine layout. No interference from the proposed turbine layout is expected near microwave, AM, FM, cellular, aviation, or TV towers. This analysis is current as of January 23, 2020. NextEra Analytics recommends a refresh of this analysis if the proposed wind energy generation project has not been constructed after two years.

It is important to note that this report only provides analysis for licensed radio towers and links found within the FCC-ULS database. Many local municipalities (police, fire, etc.) do not license microwave links, NextEra Analytics recommends Walleye Wind LLC coordinate with the appropriate local municipality officials. Also not included within the database are microwave towers and links utilized by the Federal government (Dept. of Defense, Dept. of Commerce, etc.), again for public safety concerns. A Federal communications study by the National Telecommunications and Information Agency (NTIA) has been conducted stating no harmful interference is expected in the project area.

References

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ATTACHMENT C
(PART 4)

APPENDIX J

Decommissioning Plan and Reclamation Cost Estimate

Walleye Wind, LLC
Rock County, Minnesota

October 2020

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1.0 INTRODUCTION

Walleye Wind, LLC (Walleye Wind), an indirect wholly-owned subsidiary of NextEra Energy Resources, LLC, is proposing the Walleye Wind Project (Project) in Rock County, Minnesota (Figure 1). Committed to environmental due diligence, Walleye Wind contracted Tetra Tech, Inc. (Tetra Tech) as a third-party contractor to prepare a Decommissioning Cost Estimate for the Project, which is attached to the Decommissioning Plan as **Appendix A.**

1.1 Project Background

Walleye is proposing to construct and operate a 109 megawatt (MW) wind energy facility that will consists of 40 wind turbine generators (WTGs). The approximate size of the Project area is 31,095 acres consisting largely of rural landscape dominated by agricultural and pasture lands typical of southwestern Minnesota. The total capacity will be generated using General Electric (GE) model turbines including: 36 2.82 MW, 28 with 114-meter hub height turbines and eight with 89-meter hub height turbines, and five safe harbor 2.32 MW, 80-meter hub height turbines. All of the turbines will utilize Low Noise Trailing Edge serrations on the turbine blades to reduce sound impacts.

The point of interconnection (POI) of the Project to the transmission system will be the existing 161 kilovolt (kV) Rock County Substation. The existing substation will be modified to accommodate a new 161 kV gen-tie line at the POI on the north side of the substation. This gen-tie line will extend approximately 500 feet from the substation to the Project's collector substation planned at the north side of the existing POI. Other major site components for this Project include one permanent meteorological tower, an operations and maintenance (O&M) building, an aircraft detection lighting systems (ADLS) unit or Lighting Intensity Dimming Solution (LIDS) system, gravel access roads, underground electrical collection lines, and pad-mounted transformers at each turbine. These Project facilities are described in more detail below.

The Project has been active development since 2016 and has a Power Purchase Agreement with Minnesota Municipal Power Agency and an interconnection agreement with the Midcontinent Independent Transmission System Operator and Northern States Power Company to connect the Project's 109 MW to the grid. The Project has an expected useful life of at least 30 years, which is consistent with the Project's contracted term. At the end of the Project's contracted life there may be opportunities to extend the life of the Project by repowering the Project by retrofitting the turbines and power system with upgrades based on new technology, which may allow the wind farm to produce efficiently and successfully for many more years. The commercial operation date for the Project is estimated to be on or about December 27, 2021.

1.2 Decommissioning Plan Objective

At the end of the Project's useful life, Walleye Wind will be decommissioning the Project, provided it is not repowered or retrofitted.

The purpose of this Decommissioning Plan is to establish the protocols for disassembly of the wind energy facility at the end of its useful life and to financially guarantee funding of the decommissioning process so that there is assurance that the site can be restored to a condition as close to a pre-construction state as feasible. As part of this Decommissioning Plan, Walleye Wind has provided a third-party, detailed, estimated cost schedule, prepared by Tetra Tech, Inc. for Project decommissioning activities (see **Appendix A**).

Walleye Wind will furnish a financial surety, bond, or other form of surety equal to the total estimated cost schedule to Rock County. That financial surety will ensure that if Walleye Wind is no longer solvent to finance the decommissioning process, adequate funds will be available to Rock County for administering and financing the decommissioning and reclamation process.

This Decommissioning Plan has been created to establish the approach and estimated cost for the following activities:

- Site Preparation and obtaining of necessary permits required for the structural dismantling activities (crane pads, crane paths, etc.)
- Installation of soil erosion and sedimentation control best management practices (BMPs)
- Disassembly and removal of existing turbines
- Abandonment or removal of existing infrastructure associated with the turbines
- Scarification and reseeding of disturbed areas, where applicable
- Establishment of vegetation on disturbed soils
- Mitigation for potential impacts on sensitive environmental features including agricultural soils
- Mitigation for potential impacts to agricultural facilities, agricultural drainage tiles, and public drainage ditches, if affected

The Decommissioning Plan has been developed per the following guidelines:

- Conformance with Minnesota Administrative Rules 7854.0500, subp.13;
- Energy Environmental Review and Analysis (EERA) Large Wind Energy Conversion System (LWECS) Application Guidance;
- EERA Recommendations on Review of Solar and Wind Decommissioning Plans (Commission Docket Number E999/M-17-123); and

- Request for Conditional Use Permit, Wind Turbines, Rock County Soil & Water Conservation District.

1.3 Anticipated Life of the Project

The economic operating life of the Project is expected to be at least 30 years. Once the Project has met its full design life and is not repowered or retrofitted, it will need to be decommissioned. The following sections provide a description of the decommissioning work and the estimated costs associated with that work.

2.0 DECOMMISSIONING PROCESS PROTOCOL

2.1 Decommissioning Notification

Once Walleye Wind has determined that the Project has reached the end of its useful life and is ready to be decommissioned, Walleye Wind will first notify participating landowners, local governments, and the Commission of initiation and commencement of planned decommissioning activities via a mailed letter 10 days prior to those planned activities. This letter will also provide the name and contact information of an individual designated by Walleye to manage landowner inquiries. Once restoration is completed, Walleye will notify all participating landowners, local government, and the Commission of decommissioning completion via a mailed letter within 30 days.

2.2 Decommissioning Preparation Activities

The first step in the Decommissioning Plan will be for Walleye Wind to contact all participating landowners to determine their preference on removal of access roads. For example, some landowners may prefer to leave access roads in place that benefit their farming activities.

Per section 11.4 of the LWECS Application Guidance document, Walleye Wind is providing the decommissioning, abandonment, and removal condition language for reference from the landowner lease agreements below:

> *Removal of Improvements. (a) Within eighteen (18) months after termination or expiration of the Easement Term, Operator shall, unless otherwise agreed by Owner, remove all of the Improvements on the Owner's Property and restore the Owner's Property to its approximate original condition that existed before Operator constructed its Improvements all at Operator's sole cost and expense. At termination or expiration of the Easement Term, Operator shall be required to remove facilities down to a level of forty-eight (48) inches below grade and return the grade to a condition comparable to conditions prior to Operator's installation of*

> *Improvements on the Owner's Property. If Operator fails to remove any portion of the Improvements or restore the Owner Property as required within the required time period, that portion of the Improvements shall be considered abandoned by Operator and Owner may remove that portion of the Improvements from the Owner's Property and dispose of it in its sole discretion without notice or liability to Operator. In the event Operator fails to remove any of the Improvements or restore the Owner's Property as required, and Owner removes any portion of the Improvements or restores the Owner's Property at Owner's expense, Operator shall reimburse Owner for all reasonable costs of removing that portion of the Improvements or restoration of the Owner's Property as required by the Site Permit and/or this Agreement, less any salvage or resale value received by Owner, within thirty (30) days after receipt of an invoice from Owner. If Operator fails to pay or reimburse Owner for any decommissioning, removal or restoration costs, Owner may withdraw such funds from the Decommissioning Security or pursue any other lawful remedy or recourse.*

Once the landowner coordination has occurred and the extent of disturbance areas are understood, Walleye Wind will develop a Storm Water Pollution Prevention Plan (SWPPP) and submit for a National Pollutant Discharge Elimination System (NPDES) permit based on the anticipated disturbances for both demolition and new temporary construction required for component removal. Crane pads and potential crane walks will be installed to support the turbine removal process after soil erosion Best Management Practices (BMPs) are in place. Other permits (such as those that may be needed for impacts to wetlands or other sensitive environmental features) will also be obtained, as applicable.

2.2.1 Erosion Control and Sedimentation Control Measures

General erosion control measures will be utilized, as appropriate, in the SWPPP and consist of the following BMPs:

- Silt fence or straw wattle installation on the downslope and adjacent to sensitive water features
- Slopes greater than four to one should be protected with erosion control blankets or mulch blankets
- Stabilization of disturbed soils with seed application
- Stripped topsoil shall be placed in soil stockpiles and placed in a manner to not interfere with natural drainage to waterways which could promote soil erosion. Topsoil stockpiles should be surrounded by either silt fence or straw wattles. If the

stockpile is to remain for an extended period of time, it should be temporarily seeded.

- Temporary construction entrances should be established consisting of 1" x 3" aggregate to limit off-site tracking of sediment to paved roads.
- Dust control
- Dewatering activities requiring a filtration bag.

2.3 Removal of Facilities

Decommissioning will include the dismantling and removal of the wind towers, WTGs, foundations, meteorological towers, access roads, underground collection lines, pad mounted transformers, collection substation, and the operations and maintenance (O&M) facility to a depth of four feet. Turbine tower sections will be dismantled utilizing cranes. A single large crane is typically used to disassemble the turbines, and smaller cranes would lift the parts onto trucks to be hauled away. Meteorological towers will also be similarly removed.

After dismantling and excavating the facility, high value components will be removed for scrap value. The remaining materials will be reduced to transportable size and removed from the site for disposal. Unsalvageable materials will be disposed of at authorized sites in accordance with applicable regulations.

Following the dismantling and removal of Project infrastructure, Walleye Wind will return the Project Area as close to preconstruction conditions as reasonable in accordance with the lease agreement between the landowner and Walleye Wind.

2.3.1 Turbines and MET Tower

The disassembly and removal of this equipment will essentially be the same as its installation, but in reverse order. For turbines, the rotor (hub and blades) are removed from the nacelle and, with the help of a smaller crane, turned horizontally and set on the ground. Next, the nacelle will be removed from the top of the tower, followed by each portion of the tower. Turbine tower portions will be sized on-site for transport by regular sized haul trucks (no oversize permits or specialized equipment needed). Once the turbine rotor has been removed, a crew and small crane will disassemble it into the hub and three loose turbine blades. When the rotor is disassembled, the blades will be sized for transport by regular sized haul trucks (no oversize permits or specialized equipment needed). The hub can also be removed once it is disassembled from the blades. Turbine foundations will be removed to a depth of four feet. The concrete will be reduced in size by excavator attachments and transported for disposal off-site.

The MET tower will also be removed in a similar fashion to the turbines. A small crane will be used to dismantle the structure from the top down and will be loaded onto trucks to be removed from the site.

2.3.2 Access Roads

Walleye Wind will work with landowners regarding whether the landowner prefers to keep the access roads in place. In the event landowners do not want to keep the access roads, or portions thereof, the access roads will be removed, and the land will be restored. Any geotextile fabric that is encountered during demolition will be taken to an approved landfill.

2.3.3 Underground Collection and Pad Mounted Transformers

All underground collection lines buried above four feet below the surface will be removed. In order to remove the collection lines, a trench will be opened and the cables pulled out. The cables will be cut into manageable sections and removed from the site.

Pad mounted transformers will be disconnected from the collection system and wind turbine generators once the electrical system has been shut off and hauled offsite. The concrete pads will be reduced in size by excavator attachments and transported for disposal off-site.

2.3.4 Collection Substation and O&M Facility

All above ground structures at the collection substation including the conductors, switches, transformers, fencing, and other components will be dismantled and removed from the site. Additionally, the structures at the Project O&M facilities will be removed. All concrete foundations will be crushed and transported for disposal off-site. Where feasible, all underground infrastructure associated with the substation or O&M facility, including underground conduits and grounding wires, will also be removed to a depth of four feet.

2.3.5 Aircraft Detection Lighting System or Lighting Intensity Dimming Solution System

Disassembly of the ADLS or LIDS unit will be completed, and all material/equipment will be removed from the site. Steel, conductors, switches, transformers, etc. will be reconditioned and reused, sold as scrap, recycled, or disposed of appropriately, depending on market value. The foundation will be removed to a depth of four feet below grade, and the excavated area will be filled, contoured, and revegetated. The site surface gravel will be removed for disposal. All unexcavated areas compacted by equipment used in decommissioning shall be de-compacted in a manner to adequately restore the topsoil

and subgrade material to the proper density consistent and compatible with the surrounding area. The area will be thoroughly cleaned, and all debris will be removed.

2.4 Salvage and Disposal

After dismantling the Project, high value components will be removed for scrap value. The remaining materials will be reduced to transportable size and removed from the site for disposal. Materials will be disposed where disposal is permitted and where there is capacity for the disposal. Generally, turbines, transformers, electrical components, and towers are refurbished and resold or are recycled for scrap. All unsalvageable materials will be disposed of at authorized sites in accordance with applicable regulations. Decommissioning of the turbines will include removal and transport of generators and towers offsite to disposal facilities and/or sale of towers and generators.

2.5 Hazardous Materials

During decommissioning, hazardous materials will be temporarily stored and utilized. These hazardous materials may consist of fuel, lubricating oil, hydraulic oil, propylene glycol, and other materials required for the decommissioning. Also, decommissioning will require the removal of pad mounted and grounding transformers that contain large quantities of cooling fluids, likely consisting of mineral oil.

Due to the presence of hazardous materials during decommissioning, there is the potential for spills and/or leaks. The primary concerns associated with these spills and/or leaks are the potential impacts to surface and ground water resources and the potential for soil contamination. A Spill Prevention, Control, and Countermeasure Plan (SPCC) will be created for decommissioning. The SPCC plan will detail the appropriate storage, cleanup, and disposal of hazardous wastes to ensure potential impacts are avoided.

Any wastes generated will be handled and disposed of in accordance with Minnesota Rule Chapter 7045, local rules and regulations, and the site specific SPCC. Any monitoring, transportation, or handling of materials will be conducted by trained and qualified personnel utilizing established procedures and proper equipment.

2.6 Restoration

Following the dismantling and removal of Project infrastructure, Walleye Wind will return the Project Area as close to preconstruction conditions as reasonable. Walleye Wind will implement the following:

- All areas where infrastructure has been removed will be graded and reseeded, as appropriate.
    - Walleye Wind will coordinate with local Natural Resources Conservation Service staff to revegetate non-cropland and pasture areas disturbed during

decommissioning with native seed mixes appropriate to the region. Reseeding with native seed mixtures will be used on restoration areas except in cropland areas and in areas where landowners indicate preference for other seeding plans. Reseeding of cropland areas will be conducted in coordination with the landowner.

  - After removal of all foundation materials, the areas will be filled with clean, compatible sub-grade material compacted to a density similar to the surrounding sub-grade material.

- Topsoil will be removed prior to removal of structures from all work areas and stockpiled and separated from other excavated material. The topsoil will be replaced to original depth and original surface contours reestablished where feasible. Any topsoil deficiency and trench settling shall be mitigated with imported topsoil consistent with the quality of the affected site.
- Areas compacted by equipment used in the decommissioning may be tilled in a manner adequate to restore the topsoil and subgrade material to a density consistent with the surrounding areas and then will be reseeded. The depth of compaction relief will depend on site-specific conditions.

3.0 DECOMMISSIONING SECURITY

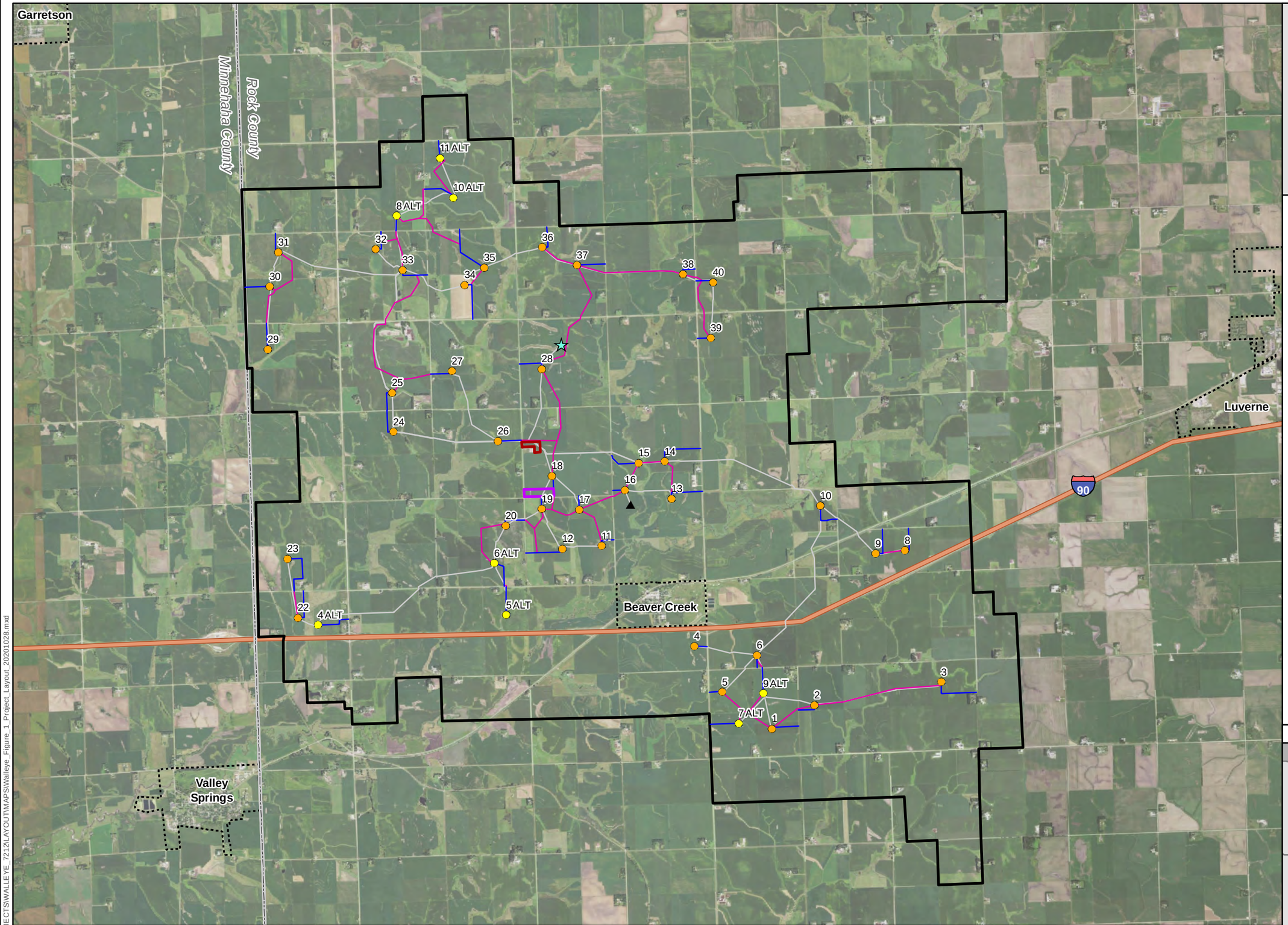
In **Appendix A**, the cost of decommissioning is estimated to be approximately $3,214,885 in 2020 dollars. Walleye Wind will be responsible for all costs associated with decommissioning. A negative net salvage rate will be used to ensure that there are adequate funds for decommissioning and restoration costs. The net salvage rate reflects the net of the estimated decommissioning costs and any offsetting proceeds from the salvaging and/or recycling of generation equipment. The net salvage rate will be negative in this case because the forecasted costs of decommissioning the facility are higher than the expected salvage proceeds. Walleye Wind will apply for Minnesota Public Utilities Commission approval of the negative net salvage rate. Once approved, Walleye is required to conduct a comprehensive dismantling study every five years and report to the Minnesota Public Utilities Commission as part of the Annual Review of Remaining Lives.

Figure 1
Walleye Wind Project Vicinity Map

Walleye Wind Project

Figure 1
Project Area and Facilities

Rock County, Minnesota



Project Features
- Project Boundary
- Primary Turbine
- Alternate Turbine
- Proposed MET Tower
- ADLS Tower
- Access Road
- Crane Path
- Collection Corridor
- Laydown Yard
- O&M/Substation

Jurisdiction
- County Boundary
- City/Town

Transportation
- Interstate

TETRA TECH

Reference Map

1:65,000 NAD 1983 UTM Zone 14N

0 0.5 1 2 Miles

NOT FOR CONSTRUCTION

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Appendix A
Walleye Wind Project Cost Estimate

TETRA TECH

MEMO

To:	Walleye Wind Project (Walleye Wind)
From:	Andrew Lintz, Tetra Tech Manuela Elizondo, Tetra Tech
Date:	Friday, October 30, 2020
Subject:	Reclamation Cost Estimate for Walleye Wind

The following memorandum describes the reclamation cost estimate for the Walleye Wind Project (Walleye Wind).

Third Party Estimated Cost of Decommissioning

At the time of retirement, the above-grade steel structures and turbine nacelles are assumed to have significant scrap value that will offset a portion of the cost to remove them. However, the Project will also incur costs for removal and disposal of the WTG blades, foundations, and other Project facilities, along with the costs for the restoration of the site following the removal of salvageable equipment and disposal of other items.

A reclamation cost estimate has been prepared for this Project and includes the costs to return the site to a condition compatible with the surrounding land and similar to the conditions that existed before development of the Project. Included in the estimate are the costs to decommission the power-generating equipment associated with the Project, as well as the costs to retire the Project facilities, with all equipment and structures removed to a depth of four feet below grade. These costs are offset by the estimated revenue that will be received for scrap value of steel, aluminum, and copper equipment; no resale of the Project facilities for reuse is considered. Accordingly, it is a “no resale” estimate.

The estimated decommissioning costs for the Project is prepared using available information from a variety of credible industry sources. As summarized in Appendix A, the current cost of decommissioning the Project is estimated to be approximately $80,372 per turbine or $29,494 per MW in 2020 dollars. This cost includes a partial offset from the salvage value of the towers, turbine components, and electrical equipment. This cost estimate assumes the use of 28 2.82 MW, 114-meter hub height WTGs, eight 2.82 MW, 89-meter hub height WTGs, and five safe harbor 2.32 MW, 80-meter hub height WTGs. Walleye Wind has identified 38 primary turbine locations; two additional locations were selected from the alternate turbine scenarios by Tetra Tech to represent worst-case locations (with a combination of longest roads and/or collection lines).

Tetra Tech, Inc.
350 Indiana Street, Golden, CO 80401
Tel 303.217.5700 Fax 303.980.3539 www.tetratech.com

Cost Assumptions

The scope of work and individual tasks were established using professional experience, in collaboration with Tetra Tech's engineering staff. The Project was broken into individual tasks that will be estimated separately to include labor requirements, equipment needs, and duration. Production rates will be established using professional experience and published standards that include RS Means (www.rsmeans.com). Labor rates prevalent to the geographic area of the Project will be obtained by referencing U.S. Department of Labor wage determinations. After the estimate is completed, typical average markups that are industry standard will be applied for contingency, overhead, and fee. Estimating methods and assumptions specific to this estimate will be as follows:

- Labor cost were developed by reviewing U.S. Department of Labor wage determinations and rates published by RS Means. An average rate will be developed that includes base wage, fringe, and payroll tax liability. The final rate used in the estimate is an average of 40 hours standard (ST), and 10 hours overtime (OT) per week, assuming a 50-hour work week during decommissioning activities.
- Equipment (commonly referred to as yellow iron) rates used in the estimate will be developed by reviewing rates published by RS Means, and historical vendor quotes. Rates include fuel, maintenance, and wear and tear of ground-engaging components. The rates assume the use of rental equipment rather than owned.
- Mobilization and demobilization costs reflect the actual cost to mobilize equipment, facilities, and crew to the Project site. A substantial portion of this cost is for the crane and crew required for turbine removal. This amount does not include the front loading of cost from other tasks.
- Work will be estimated on a unit cost basis, priced by task that follows the progression of work from start to finish. Unit costs will be developed by including the labor, equipment, and production rate required for each individual task. RS Means and estimator's experience will be utilized to establish the crew, equipment, and production for each individual task.
- Roads would be restored so that they become a part of the natural surroundings and are no longer recognizable to the greatest extent possible. Road gravel would be used to backfill foundation locations to within six inches of final grade. It is expected that the remaining road gravel will be accepted by local receivers with no additional disposal cost. Access roads located on agricultural land, assumed to be 50 percent of roads, will not be reseeded. On private lands, prior existing roads would be restored at the request of the current landowner.
- All concrete foundations will be removed to a depth of four feet below grade. Gravel from road removal will be utilized to backfill to within six inches of final grade, and then completed with an additional six inches of topsoil. Concrete foundation removal will be accomplished with the use of excavators with concrete breakers. Processed concrete will be transported off site under the same assumptions as road gravel.
- Underground electrical distribution cabling is assumed to be aluminum, at least 36 to 48 inches deep, and of low salvage value. As such, underground cable will be removed down to four feet below grade.
- Oil from transformers and nacelles will be drained prior to removal, and the oil will be disposed of following state and federal regulations. Oil disposal cost is assumed to be $4 per gallon.
- To reduce the cost of loading and transport, turbine components, substation transformers, and equipment will be sized on site utilizing shears and torch crews. Blades will be assumed to have no

scrap value and will incur an estimated cost of $95 per ton for trucking and landfill fees. Remaining material is assumed to have a scrap value, with a cost of $45 per ton for trucking, and a credit of $216 per ton for scrap.

- Turbine removal will require the construction and subsequent removal of temporary crane pads. Estimated cost of crane pads will be based on an engineered design from a similar project.
- The gen-tie line is composed of steel monopoles and cable. Towers are assumed to be recyclable and will be disassembled on site and shipped off site.
- O&M building will be assumed to have no scrap value and will be used to top loads of other waste. An allowance for 25 tons of demolition will be included for this building.
- Final restoration will include the placement of six inches of topsoil on all disturbed areas, with a final seeding utilizing a mix of native grasses. It will be assumed that no topsoil required for restoration is available on site as a result of the original installation.
- The costs for temporary facilities will be included in the restoration cost. These include one office trailer, two Conex storage units, portolets, first aid supplies, and utilities.
- Field management during construction activities will be added to the estimate. These costs will include one Superintendent, one Health and Safety Representative, and two Field Engineers. These positions are critical to the safe and successful execution of work.
- A contractors' home office, project management, overhead, and fee can vary widely by contractor. As such, averages will be developed for the estimate and added as a percentage of total cost. These will include five percent for home office and project management, and 13 percent for overhead and fee. Note that contractor contingency costs will not be included. Several other miscellaneous costs will be approximated, including permits, engineering, signage, fencing, traffic control, utility disconnects, etc. In the context of the overall estimate, these are incidental costs that will be covered in the estimate markups.
- The reclamation cost estimate is based on the current layout of 28 2.82 MW, 114-meter hub height WTGs, eight 2.82 MW, 89-meter hub height WTGs, and five safe harbor 2.32 MW, 80-meter hub height WTGs. The reclamation cost estimate may change if different types or sizes of WTGs are used for the Project.
- Walleye Wind has identified 38 primary turbine locations; two additional locations were selected from the alternate turbine scenarios by Tetra Tech to represent worst-case locations (with a combination of longest roads and/or collection lines).

Attachment 1 – Reclamation Cost Estimate

CBS Outline Report
TETRA TECH EC, INC.
Job Code: Walleye Wind
Description: Decommissioning Estimate

From Cost Item: . **To Cost Item: .**

Code	Description	Forecast (T/O) Quantity	Unit of Measure	Unit Cost	Total Cost (Forecast)	Currency
1	WALLEYE WIND RETIREMENT					
1.1	Mob / Demob	1.00	Lump Sum	907,217.85	907,217.85	U.S. Dollar
1.1.1	Equipment Mob	1.00	Lump Sum	101,500.00	101,500.00	U.S. Dollar
1.1.2	Site Facilities	1.00	Lump Sum	2,200.00	2,200.00	U.S. Dollar
1.1.3	Crew Mob & Site Setup	3.00	Day	15,703.57	47,110.71	U.S. Dollar
1.1.4	Crew Demob & Site Cleanup	2.00	Day	15,703.57	31,407.14	U.S. Dollar
1.1.5	Mob-Erection Sub	1.00	Lump Sum	725,000.00	725,000.00	U.S. Dollar
1.2	Site Facilities	4.00	Month	2,155.00	8,620.00	U.S. Dollar
1.3	Field Management	16.00	Week	18,282.31	292,517.01	U.S. Dollar
1.4	Substation & Switchyard Removal	1.00	Lump Sum	190,141.24	190,141.24	U.S. Dollar
1.4.1	Fence Removal	1.00	Day	1,286.19	1,286.19	U.S. Dollar
1.4.2	Transformer & Switchyard Equip Removal	1.00	Each	132,865.02	132,865.02	U.S. Dollar
1.4.2.1	Oil Removal & Disposal	1.00	Each	103,332.79	103,332.79	U.S. Dollar
1.4.2.1.1	Oil Removal	1.00	Each	1,982.79	1,982.79	U.S. Dollar
1.4.2.1.2	Oil Disposal	25,000.00	Gallon	4.00	100,000.00	U.S. Dollar
1.4.2.1.3	Trucking - Per Load	2.00	Each	675.00	1,350.00	U.S. Dollar
1.4.2.2	Demo & Prepare For Shipment Offsite	200.00	Ton	102.66	20,532.23	U.S. Dollar
1.4.2.3	Salvage & Recovery	200.00	Ton	45.00	9,000.00	U.S. Dollar
1.4.2.3.1	Scrap Trucking Cost	200.00	Ton	45.00	9,000.00	U.S. Dollar
1.4.3	UG Utility & Ground Removal	2.00	Day	1,286.19	2,572.37	U.S. Dollar
1.4.4	Remove Surface Stone	900.00	Cubic Yard	20.09	18,080.01	U.S. Dollar
1.4.4.1	Excavate & Loadout	900.00	Cubic Yard	2.54	2,286.33	U.S. Dollar
1.4.4.2	Stone Transport Offsite	900.00	Cubic Yard	17.55	15,793.69	U.S. Dollar
1.4.5	Remove Foundations To Subgrade	500.00	Cubic Yard	34.84	17,418.87	U.S. Dollar
1.4.5.1	Excavate / Remove Foundation - Various Depth	500.00	Cubic Yard	17.29	8,644.60	U.S. Dollar
1.4.5.2	Concrete Transport Offsite	500.00	Cubic Yard	17.55	8,774.27	U.S. Dollar
1.4.6	Misc. Material Disposal	1.00	Lump Sum	975.00	975.00	U.S. Dollar
1.4.6.1	Trucking - Per Load	1.00	Each	675.00	675.00	U.S. Dollar
1.4.6.2	Disposal Cost	10.00	Ton	30.00	300.00	U.S. Dollar
1.4.7	Restore Yard	1.00	Lump Sum	16,943.78	16,943.78	U.S. Dollar
1.4.7.1	Vegetative Cover	900.00	Cubic Yard	17.38	15,643.28	U.S. Dollar
1.4.7.1.1	Topsoil, Delivered	900.00	Cubic Yard	10.00	9,000.00	U.S. Dollar
1.4.7.1.2	Placement	900.00	Cubic Yard	7.38	6,643.28	U.S. Dollar
1.4.7.2	Re-Seed With Native Vegetation	1.70	Acre	765.00	1,300.50	U.S. Dollar
1.5	Transmission Line Removal	1.00	Lump Sum	4,017.32	4,017.32	U.S. Dollar
1.5.1	Conductor Removal	0.11	Mile	26,386.19	2,902.48	U.S. Dollar
1.5.1.1	Cut / Lower Cable, Size & Loadout	0.11	Mile	24,586.19	2,704.48	U.S. Dollar
1.5.1.2	Salvage & Recovery	4.40	Ton	45.00	198.00	U.S. Dollar
1.5.1.2.1	Scrap Trucking Cost	4.40	Ton	45.00	198.00	U.S. Dollar
1.5.2	Wood Monopole Removal	4.00	Each	278.71	1,114.84	U.S. Dollar
1.5.2.1	Cut & Load Poles	4.00	Each	109.96	439.84	U.S. Dollar
1.5.2.2	Trucking - Per Load	1.00	Each	675.00	675.00	U.S. Dollar
1.6	Construct & Remove Temporary Crane Pads	40.00	Each	7,593.04	303,721.72	U.S. Dollar
1.6.1	Crane Pad 4" Stone 8" depth	4,000.00	Ton	34.90	139,588.72	U.S. Dollar
1.6.2	Crane Pad 2" Stone 6" depth	3,000.00	Ton	38.20	114,588.72	U.S. Dollar
1.6.3	Remove stone after erection	40.00	Each	1,238.61	49,544.28	U.S. Dollar

Code	Description	Forecast (T/O) Quantity	Unit of Measure	Unit Cost	Total Cost (Forecast)	Currency
1.7	WTG Removal	40.00	Each	30,000.00	1,200,000.00	U.S. Dollar
1.7.1	Remove Top,Nacell, Rotor	40.00	Each	20,000.00	800,000.00	U.S. Dollar
1.7.2	Remove Base & Mld	40.00	Each	10,000.00	400,000.00	U.S. Dollar
1.8	WTG Sizing & Loadout - 2.82 MW, 114 Meter	28.00	Each	47,414.90	1,327,617.28	U.S. Dollar
1.8.1	Oil Removal & Disposal	28.00	Each	375.15	10,504.31	U.S. Dollar
1.8.1.1	Oil Removal	28.00	Each	198.28	5,551.81	U.S. Dollar
1.8.1.2	Oil Disposal	1,120.00	Gallon	4.00	4,480.00	U.S. Dollar
1.8.1.3	Trucking - Per Load	0.70	Each	675.00	472.50	U.S. Dollar
1.8.2	Demo & Prepare For Shipment Offsite	11,328.80	Ton	65.26	739,276.97	U.S. Dollar
1.8.3	Salvage & Recovery	28.00	Each	16,020.00	448,560.00	U.S. Dollar
1.8.3.1	Scrap Trucking Cost	9,968.00	Ton	45.00	448,560.00	U.S. Dollar
1.8.4	Blade T&D	1,360.80	Ton	95.00	129,276.00	U.S. Dollar
1.9	WTG Sizing & Loadout - 2.82 MW, 89 Meter	8.00	Each	40,248.24	321,985.88	U.S. Dollar
1.9.1	Oil Removal & Disposal	8.00	Each	375.15	3,001.23	U.S. Dollar
1.9.1.1	Oil Removal	8.00	Each	198.28	1,586.23	U.S. Dollar
1.9.1.2	Oil Disposal	320.00	Gallon	4.00	1,280.00	U.S. Dollar
1.9.1.3	Trucking - Per Load	0.20	Each	675.00	135.00	U.S. Dollar
1.9.2	Demo & Prepare For Shipment Offsite	2,716.80	Ton	65.26	177,288.65	U.S. Dollar
1.9.3	Salvage & Recovery	8.00	Each	13,095.00	104,760.00	U.S. Dollar
1.9.3.1	Scrap Trucking Cost	2,328.00	Ton	45.00	104,760.00	U.S. Dollar
1.9.4	Blade T&D	388.80	Ton	95.00	36,936.00	U.S. Dollar
1.10	WTG Sizing & Loadout - 2.32 MW, 80 Meter	4.00	Each	37,194.39	148,777.56	U.S. Dollar
1.10.1	Oil Removal & Disposal	4.00	Each	375.15	1,500.62	U.S. Dollar
1.10.1.1	Oil Removal	4.00	Each	198.28	793.12	U.S. Dollar
1.10.1.2	Oil Disposal	160.00	Gallon	4.00	640.00	U.S. Dollar
1.10.1.3	Trucking - Per Load	0.10	Each	675.00	67.50	U.S. Dollar
1.10.2	Demo & Prepare For Shipment Offsite	1,267.20	Ton	65.26	82,692.94	U.S. Dollar
1.10.3	Salvage & Recovery	4.00	Each	12,555.00	50,220.00	U.S. Dollar
1.10.3.1	Scrap Trucking Cost	1,116.00	Ton	45.00	50,220.00	U.S. Dollar
1.10.4	Blade T&D	151.20	Ton	95.00	14,364.00	U.S. Dollar
1.11	WTG Foundation Removal	40.00	Each	1,103.90	44,155.86	U.S. Dollar
1.11.1	Remove Cylindrical Pedestal & Extension	1,880.00	Cubic Yard	45.91	86,301.83	U.S. Dollar
1.11.3	Concrete Transport Offsite	1,880.00	Cubic Yard	11.96	22,494.04	U.S. Dollar
1.11.4	Rebar Salvage & Recovery	40.00	Each	(1,616.00)	(64,640.00)	U.S. Dollar
1.11.4.1	Scrap Trucking Cost	320.00	Ton	45.00	14,400.00	U.S. Dollar
1.11.4.2	Ferrous Metals Credit	320.00	Ton	(247.00)	(79,040.00)	U.S. Dollar
1.12	Pad Mount Transformer Removal	40.00	Each	3,465.63	138,625.06	U.S. Dollar
1.12.1	Oil Removal & Disposal	40.00	Each	2,960.83	118,433.18	U.S. Dollar
1.12.1.1	Oil Removal	40.00	Each	110.20	4,408.18	U.S. Dollar
1.12.1.2	Oil Disposal	28,000.00	Gallon	4.00	112,000.00	U.S. Dollar
1.12.1.3	Trucking - Per Load	3.00	Each	675.00	2,025.00	U.S. Dollar
1.12.2	Remove & Loadout Transformer	40.00	Each	109.96	4,398.37	U.S. Dollar
1.12.3	Salvage & Recovery	40.00	Each	360.00	14,400.00	U.S. Dollar
1.12.3.1	Scrap Trucking Cost	320.00	Ton	45.00	14,400.00	U.S. Dollar
1.12.4	Remove Foundations To Subgrade	40.00	Each	34.84	1,393.51	U.S. Dollar
1.12.4.1	Excavate / Remove Foundation - Various Depth	40.00	Cubic Yard	17.29	691.57	U.S. Dollar
1.12.4.2	Concrete Transport Offsite	40.00	Cubic Yard	17.55	701.94	U.S. Dollar
1.13	MET Tower Removal	1.00	Each	3,840.90	3,840.90	U.S. Dollar
1.13.1	Structure Demo	1.00	Each	2,503.99	2,503.99	U.S. Dollar
1.13.2	Remove Foundation	15.00	Cubic Yard	47.16	707.44	U.S. Dollar
1.13.3	Concrete Transport Offsite	15.00	Cubic Yard	11.96	179.47	U.S. Dollar

Code	Description	Forecast (T/O) Quantity	Unit of Measure	Unit Cost	Total Cost (Forecast)	Currency
1.13.4	Structure Salvage & Recovery	10.00	Ton	45.00	450.00	U.S. Dollar
1.13.4.1	Scrap Trucking Cost	10.00	Ton	45.00	450.00	U.S. Dollar
1.14	DeTect Radar Assembly Removal	1.00	Each	3,072.12	3,072.12	U.S. Dollar
1.14.1	Structure Demo	1.00	Each	2,503.99	2,503.99	U.S. Dollar
1.14.2	Remove Foundation	5.00	Cubic Yard	47.16	235.81	U.S. Dollar
1.14.3	Concrete Transport Offsite	5.00	Cubic Yard	11.96	59.82	U.S. Dollar
1.14.4	Structure Salvage & Recovery	5.00	Ton	45.00	225.00	U.S. Dollar
1.14.4.1	Scrap Trucking Cost	5.00	Ton	45.00	225.00	U.S. Dollar
1.14.5	Misc Waste T&D	0.50	Ton	95.00	47.50	U.S. Dollar
1.15	O&M Building Removal	1.00	Lump Sum	18,075.46	18,075.46	U.S. Dollar
1.15.1	Structure Demo	25.00	Ton	500.80	12,519.93	U.S. Dollar
1.15.2	Remove Foundations To Subgrade	120.00	Cubic Yard	34.84	4,180.53	U.S. Dollar
1.15.2.1	Excavate / Remove Foundation & Slab - Various Depth	120.00	Cubic Yard	17.29	2,074.70	U.S. Dollar
1.15.2.2	Concrete Transport Offsite	120.00	Cubic Yard	17.55	2,105.82	U.S. Dollar
1.15.3	Misc Interior T&D	5.00	Ton	95.00	475.00	U.S. Dollar
1.15.4	Structure Salvage & Recovery	20.00	Ton	45.00	900.00	U.S. Dollar
1.15.4.1	Scrap Trucking Cost	20.00	Ton	45.00	900.00	U.S. Dollar
1.16	Access Road Removal & Transport	18,694.00	Cubic Yard	11.07	206,890.84	U.S. Dollar
1.17	Underground Cable Removal - Power & Fiber	39.00	Mile	6,647.17	259,239.52	U.S. Dollar
1.17.1	Underground Cable Removal - Power & Fiber	39.00	Mile	6,115.50	238,504.38	U.S. Dollar
1.17.2	Fiber Cable T&D	39.21	Ton	95.00	3,725.14	U.S. Dollar
1.17.3	Power Cable Salvage & Recovery	378.00	Ton	45.00	17,010.00	U.S. Dollar
1.17.3.1	Scrap Trucking Cost	378.00	Ton	45.00	17,010.00	U.S. Dollar
1.18	Remove 18" x 24' Culverts	40.00	Each	488.23	19,529.28	U.S. Dollar
1.18.1	Remove Foundation	40.00	Each	476.27	19,050.68	U.S. Dollar
1.18.2	Concrete Transport Offsite	40.00	Cubic Yard	11.96	478.60	U.S. Dollar
1.19	Site Restoration	1.00	Lump Sum	300,780.77	300,780.77	U.S. Dollar
1.19.1	Topsoil Placement	72,593.00	Cubic Yard	2.95	214,335.77	U.S. Dollar
1.19.2	Re-Seed With Native Vegetation - Roads & Areas Disturbed By Construction	113.00	Acre	765.00	86,445.00	U.S. Dollar
1.20	Scrap Metal Credit	1.00	Lump Sum	(3,546,771.80)	(3,546,771.80)	U.S. Dollar
1.20.1	Substation Scrap Metal Credit	200.00	Ton	(247.00)	(49,400.00)	U.S. Dollar
1.20.2	T Line Scrap Metal Credit	4.40	Ton	(247.00)	(1,086.80)	U.S. Dollar
1.20.3	Turbine Scrap Metal Credit	13,412.00	Ton	(247.00)	(3,312,764.00)	U.S. Dollar
1.20.4	Padmount Transformer Scrap Metal Credit	320.00	Ton	(247.00)	(79,040.00)	U.S. Dollar
1.20.5	MET Tower Scrap Metal Credit	20.00	Ton	(247.00)	(4,940.00)	U.S. Dollar
1.20.6	DeTect Scrap Metal Credit	5.00	Ton	(247.00)	(1,235.00)	U.S. Dollar
1.20.7	O&M Bldg. Scrap Metal Credit	20.00	Ton	(247.00)	(4,940.00)	U.S. Dollar
1.20.8	UG Cable Scrap Metal Credit	378.00	Ton	(247.00)	(93,366.00)	U.S. Dollar
1.21	Home Office, Project Management (5% Of Cost)	1.00	Lump Sum	284,941.30	284,941.30	U.S. Dollar
1.22	Contractor OH & Fee (13% Of Cost)	1.00	Lump Sum	777,889.71	777,889.71	U.S. Dollar
Total:	**WALLEYE WIND RETIREMENT**				**3,214,884.87**	
Grand Total:					**3,214,884.87**	