Appendix F: Shadow Flicker Analysis

Riverbend Wind Project
Shadow Flicker Study – Fremont Township
Sanilac County, Michigan

September 02, 2022

Prepared for:

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Project No: 193709180

September 02, 2022

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1.0 INTRODUCTION

Algonquin Power (MI Energy Developments) LLC, owned by Algonquin Power & Utilities Corp. (AQN), parent company of Liberty Power, is proposing to develop an approximately 300-megawatt (MW) wind power generation facility in Sanilac County, Michigan. The Riverbend Wind Energy Project (the "Project") will include up to 50 wind turbine generator ("WTG" or "turbine") locations within Fremont and Speaker Townships. The Project currently is permitting three alternative layouts, Scenarios 25, 16 and 16a. The Project intends to construct up to 30 turbines within Fremont Township.

AQN retained Stantec Consulting Services Inc. (Stantec) to conduct an assessment of potential shadow flicker from operation of the Project wind turbines. The potential shadow flicker within approximately one (1) mile of proposed Project turbine sites was assessed. The analyses consider a 6.0-MW turbine with a 162-meter rotor diameter (162-6.0) and a 4.5-MW turbine with a 163-meter rotor diameter (163-4.5), such as those manufactured by Vestas.

This report summarizes the shadow flicker expected to affect Fremont Township residences due to the operation of the Project wind turbines under the various design layouts (Scenarios) as summarized in Table 1.

Table 1 Riverbend Wind Turbine Layout Designs (Scenarios)

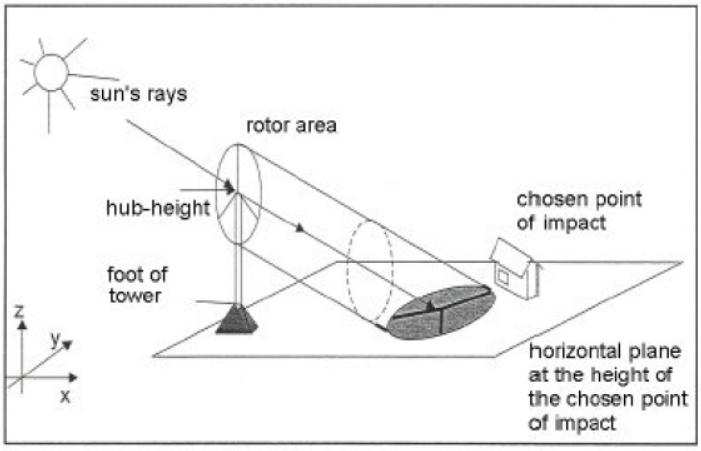
Scenario	Potential Turbine Pad Locations	Potential Turbine Pad Locations in Fremont
Scenario 25 (Sc25) – no alternate turbines	50 – 162-6.0 WTGs	26 – 162-6.0 WTGs
Scenario 16 (Sc16) – no alternate turbines	50 – 162-6.0 WTGs	26 – 162-6.0 WTGs
Scenario 16 (Sc16 wAlts) – with alternate turbines	56 – 162-6.0 WTGs	30 – 162-6.0 WTGs
Scenario 16a (Sc16a) – mixed WTG case, no alternate turbines	42 – 162-6.0 WTGs 8 – 163-4.5 WTGs	22 – 162-6.0 WTGs 4 – 163-4.5 WTGs
Scenario 16a (Sc16a wAlts) – mixed WTG case, with alternate turbines	48 – 162-6.0 WTGs 8 – 163-4.5 WTGs	26 – 162-6.0 WTGs 4 – 163-4.5 WTGs

2.0 SHADOW FLICKER AND REGULATIONS

2.1 DESCRIPTION OF SHADOW FLICKER

Shadow flicker is a term used to describe the intermittent change in the intensity of light cast on an area resulting from the rotation of an operating wind turbine's blades. The presence and intensity of shadow flicker are dependent on many factors, including but not limited to the position of the sun in relation to the turbine and receptor, distance of receptor from turbine, physical characteristics of the turbine and blades, time of day, season of year and topography of the Project area. Shadow flicker will only occur during the daytime, when skies are not overcast or cloudy. Turbines must be operational, as the flicker effect is caused by rotation of the blades as they intercept the sunlight cast on a receptor. When a turbine is not operating it may cast a stationary shadow, similar to other objects such as trees or utility poles.

The amount of shadow flicker received in an area is dependent on the alignment of the rotor blades in relation to the sun and receptor. Maximum shadow flicker is received when both the sun and rotor plane are perpendicular to the receptor. This alignment occurs when the wind is blowing directly from a source turbine towards a receptor. At times when the wind is blowing from other directions, the shadow cast on the target receptor is diminished and the shadow flicker effect passes more quickly.



Shadow flicker diminishes as the distance between the source turbine and receptor increases. Shadow flicker becomes less pronounced with distance, due to dissipation and the relative ratio of the turbine blade to the sun disk area.

2.2 REGULATIONS WITHIN THE PROJECT AREA

The Fremont Township Ordinance No. 100 (amended through June 22, 2021) states in, Section 13.2, Subsection B.20 that an analysis is to be conducted on potential shadow flicker on occupied structures and public roads and right of way. Reasonable measures are to be taken to mitigate actual impacts identified from the operation of the Project turbines. Shadow flicker on a habitable structure on the property of a non-participant of the Project shall not exceed thirty (30) hours per year.

3.0 SHADOW FLICKER ANALYSIS

AQN has commissioned this study to better understand the shadow flicker impact on area receptors due to the normal operation of the Project. Shadow flicker has been considered when designing the Project, with the goal of minimizing potential flicker on occupied structures, also referred to in this report as sensitive receptors (e.g., residences, schools, hospitals, churches), to the extent practicable.

The potential amount of shadow flicker on sensitive receptors within the Project area can be modeled using software such as EMD's WindPro, an application that considers the attributes and positions of the wind turbines in relation to receptors within the area. The model also considers the sun position as it passes through all 365 days per year and regional climatological information. The total nameplate generating capacity of the Project (50 turbines) will be approximately 300 MW.

Stantec assessed the potential expected shadow flicker due to operation of the Project under five design scenarios. The scenarios are summarized in Table 1 and described in more detail in Section 3.1.

3.1 SHADOW FLICKER ANALYSIS METHODS

The potential total annual time of shadow flicker on each receptor was estimated for the Project area using the Shadow module of WindPRO Version 3.4 software. WindPRO is an agency and industry-accepted modeling program that calculates the number of hours and days per year that any given receptor may receive shadow flicker from the source turbines.

A modeling analysis was completed to assess the expected shadow levels at receptors given the climatological conditions of the area. The shadow flicker calculation considers the percentage of sunshine based on local regional sunshine statistics; the alignment of the blades in relation to the receptor due to wind direction; and the amount of time that the blades would not be rotating due to wind speeds outside of the turbines operating parameters. The results of the analysis provide the number of annual hours that shadow flicker is expected to occur at the defined receptor. The analysis also provides an estimate of the maximum amount of time that a receptor may receive shadow flicker on any given day. The shadow flicker analysis uses a conservative 90% operational time for purposes of calculating the expected hours of shadow flicker.

The results provided in this report include the expected amount of shadow flicker annually on each receptor, given the climatological conditions of the area. Climatological information was acquired from the National Climatic Data Center (NCDC) regional meteorological stations. The percentage of sunshine probability was estimated from an analysis of sunshine statistics for the Project region.

The climatologically based expected hours of sunshine for the Project area are presented in Table 1. The frequency of wind (hours per year) expected in 12 compass directions is summarized in Table 2. The total number of hours that turbines are able to cause shadow flicker takes into account non-operational time due to low or high wind speeds. The turbine model that Riverbend Wind proposes will generally operate when winds at hub-height are between 3 and 30 meters per second.

Table 2 Sunshine Probability (sun hours/possible sun hours)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.35	0.43	0.49	0.52	0.57	0.63	0.67	0.67	0.64	0.56	0.42	0.31

Table 3 Turbine Operation Time per Sector (hours per year)

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW
461	406	395	415	456	571	1,003	962	860	1,131	741	483
TOTAL		7,884 hours									

The effect of shadow flicker is also dependent on the physical characteristics of the turbine and the distance between the source turbine and shadow receptor. The shadow flicker analyses summarized in this report are based on the Project design scenarios listed in Table 1 and described in this section utilizing turbines with the attributes listed in Table 4.

Table 4 Turbine Characteristics

Turbine Model	Turbine Nameplate (MW)	Hub Height (meters; feet)	Rotor Diameter (meters; feet)	Tip Height (meters; feet)
162-6.0	6.0	119.0; 390.4	162.0; 531.5	200.0; 656.2
163-4.5	4.5	118.5; 388.8	163.0; 534.8	200.0; 656.2

Elevations for turbines and receptors located within approximately one (1) mile of the turbines were calculated using the National Elevation Dataset digitally acquired from the U.S. Geological Survey.

The individual locations of the wind turbines are based on the five current Project layout scenarios provided by Riverbend Wind.

- Scenario 25 (Sc25) – is a layout of 50 162-6.0 turbines, with 26 proposed pad locations in Fremont Township. This scenario does not include alternate turbine locations. The proposed location of one turbine in Fremont Township differs from the Scenario 16 pad locations; therefore, the shadow flicker impact on individual receptors will differ.
- Scenario 16 (Sc16) – is a proposed layout of 50 162-6.0 turbines, with 26 potential pad locations in Fremont Township. This scenario does not include alternate turbines.
- Scenario 16 with alternates (Sc16 wAlts) – is a version of Scenario 16 with a total of 56 162-6.0 turbines, with 30 potential pad locations in Fremont Township. This scenario includes 6 alternate turbines (4 located in Fremont Township). This scenario will result in higher shadow flicker impact than is expected in the final turbine design, as it includes impacts from the alternate turbines.
- Scenario 16a (Sc16a) – is a version of Scenario 16 with the 26 proposed turbines located in the same positions. However, in this scenario, 4 of the turbines proposed in Fremont Township would be 163-4.5 turbines on 118.5-meter hub heights. The shadow flicker for this scenario is nearly identical to the base Scenario 16 impacts.

- Scenario 16a with alternates (Sc16a wAlts) – is a version of the Scenario 16 ”with alternates” case with the 30 potential pad locations in the same positions in Fremont Township. However, in this scenario 4 of the turbines proposed in Fremont Township, would be 163-4.5 turbines on 118.5-meter hub heights. This scenario includes 6 alternate turbines (4 located in Fremont Township). The shadow flicker for this scenario is nearly identical to the Scenario 16 “with alternates” impacts.

A total of 336 potential occupied or habitable structures (also referred to as receptors or sensitive receptors) within the surrounding area were identified by Riverbend Wind and Stantec utilizing aerial imagery and on-site reconnaissance in Fremont Township. Receptors in the analysis include occupied buildings within approximately one (1) mile of the turbine locations. There are 69 Project participants (landowners with land under Project leases/agreements) and 267 non-participants (landowners without Project leases/ agreements). Participation status is noted in the assessment results. The coordinates (UTM Zone 17) of turbine locations for each scenario are included in Appendix A. Receptor locations are provided in Appendix B.

The model utilizes a “greenhouse” approach which defines each receptor as a one-meter glass cube, representing a window able to receive shadow from all directions. Vegetation surrounding receptors will block or diminish the effect of shadow flicker. A conservative approach assuming that no vegetation is present was used in this preliminary model analysis.

Shadow flicker is widely considered imperceptible at a distance greater than 1,500 meters; however, Stantec conservatively analyzed the impact at all distances when more than 20 percent of the sun would be covered by a turbine blade. Shadow flicker does not occur when the sun-angle is less than three degrees above the horizon, due to atmospheric diffusion.

3.2 SHADOW FLICKER ANALYSIS RESULTS

The amount of shadow flicker on receptors within the Project area was calculated based on the climatological history of wind speed, wind direction, and percentage of sunshine for the turbine models in operation. Figures 1 through 5 present maps of the Fremont Township Project area along with the 30-hour contours of expected shadow flicker hours per year.

Table 5 provides a summary of the five scenarios and the expected shadow flicker on the 267 identified non-participating potential sensitive receptors located in Fremont Township and within approximately one (1) mile of Project turbines sites. The analysis was completed without considering the blocking effects of vegetation between the turbines and receptors; therefore, the actual shadow flicker impact on many receptors will be less than the modeled result given.

The analyses indicate that the majority of residences in Fremont Township will receive less than 10 hours of shadow flicker due to the operation of the Project turbines.

Table 5 Summary of Results – Expected Annual Shadow Flicker Hours on Occupied Structures of Non-Participants

Expected Shadow Flicker (Annual Hours on Occupied Structures)	**Scenario 25** (50 162-6.0 WTGs)	**Scenario 16** (50 162-6.0 WTGs)	**Scenario 16 wAlts** (56 162-6.0 WTGs)	**Scenario 16a** (50 162-6.0/ 163-4.5 WTGs)	**Scenario 16a wAlts** (56 162-6.0/ 163-4.5 WTGs)
Less than 10	161	143	127	143	127
10 – 20	67	71	79	70	79
20 – 30	21	38	39	39	39
Greater than 30	18	15	22	15	22

Detailed tabular results of the analyses are provided in Appendix B and include the following information.

- Receptor identification number
- Coordinates of receptor location (UTM-Zone 17)
- Expected annual hours of shadow flicker under each scenario

3.3 SHADOW FLICKER MITIGATION METHODS

As stated earlier, the blocking effects of vegetation between the turbines and receptors has not been considered in this analysis; therefore, the actual shadow flicker impact on many receptors will be less than the modeled result given. The total shadow flicker impact on receptors in the Scenarios 16 and 16a, with alternates, also is higher than expected for the final Project, as it considers impacts from 56 turbines, rather than the 50 proposed to be built. AQN is committed to operating the Project consistent with the requirements described in this report and to limit actual annual shadow flicker on non-participating inhabited residences to 30 hours (or less) annually. Upon completion of a Project design AQN will work with non-participating landowners, as needed, to identify, manage and mitigate shadow flicker overages using commercially reasonable mitigation measures. Mitigation measures that may be employed include, but are not limited to, the planting of trees and/or vegetative plantings, awning or curtain installation, and potential consideration of turbine curtailment.

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4.0 CONCLUSION

Potential shadow flicker from the operating Riverbend Wind Project on habitable structures and other sensitive receptors (e.g., schools, hospitals, churches) within one (1) mile of turbine locations was assessed using WindPRO's Version 3.4 Shadow Module software.

The majority of habitable structures in Fremont Township are expected to receive less than 10 hours of annual shadow flicker under each of the proposed scenarios. Upon completion of Project construction AQN will work with non-participating landowners, as needed, to identify, manage and mitigate shadow flicker overages using commercially reasonable mitigation measures. AQN will offer mitigation measures to residences with greater than 30 hours of actual annual shadow flicker on the structure. Based on the results of this analysis, no identified receptors within Fremont Township are expected to receive greater than 30 hours of shadow flicker per year after mitigation measures are employed.

FIGURES

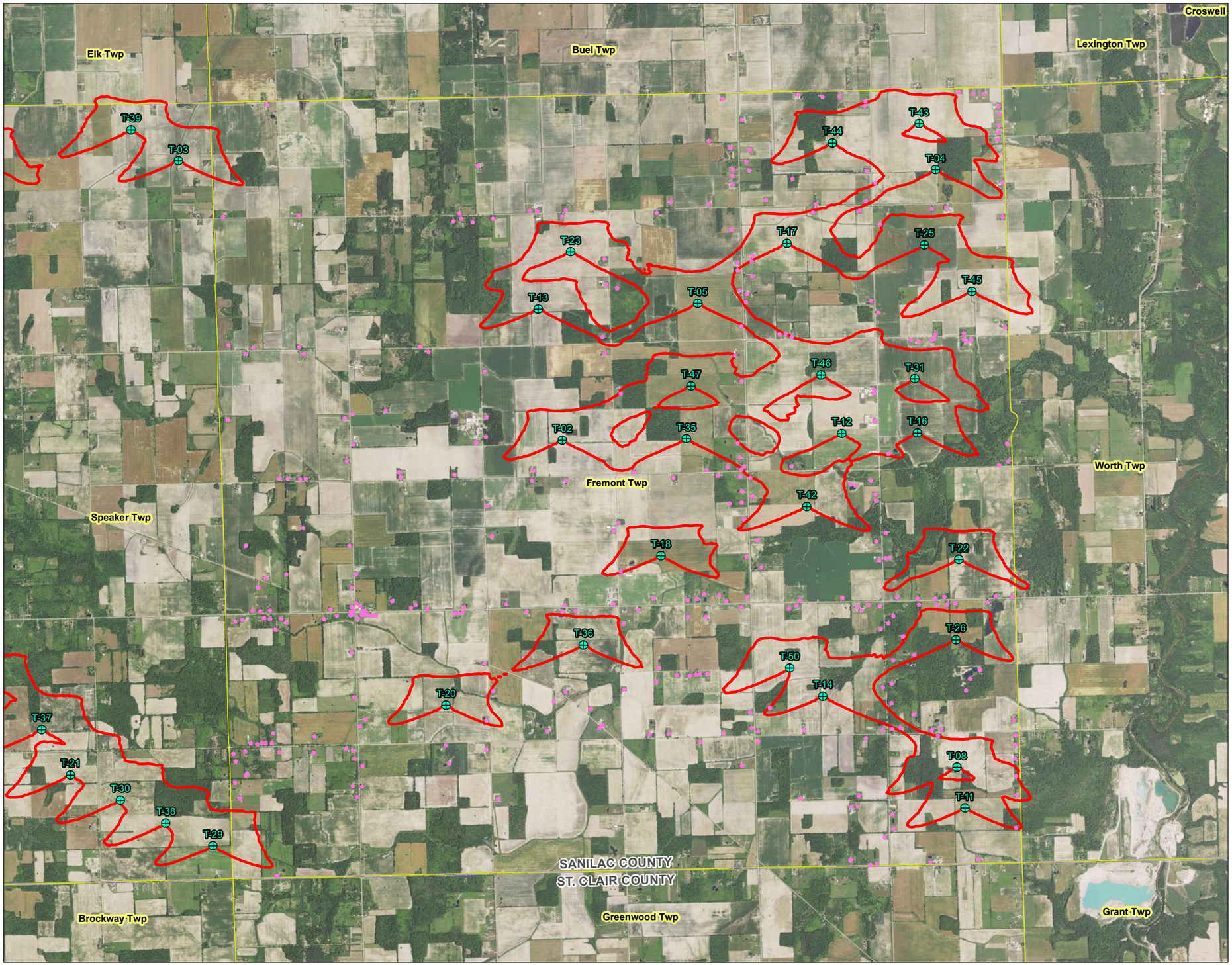

Figure No.

1

Title

Fremont Township Annual Expected Shadow Flicker - Scenario 25

Client/Project 193709180

Algonquin Power (MI Energy Developments) LLC
Riverbend Wind Project

Project Location
Sanilac Co., MI

Prepared by JM on 2022-08-24
TR by SF on 2022-08-24
IR by JB on 2022-09-01

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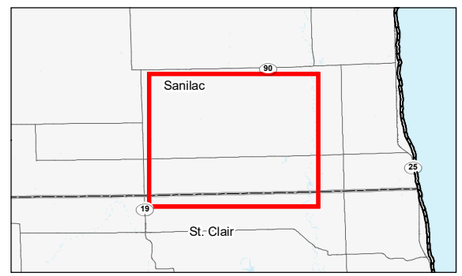
Legend

- Wind Turbine - Scenario 25
- Sensitive Receptor / Occupied Structure
- Township Boundary

Expected Annual Shadow Hours

- 30



Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Data Sources: Stantec, USGS, NADS
3. Background: 2020 NAIP

Stantec

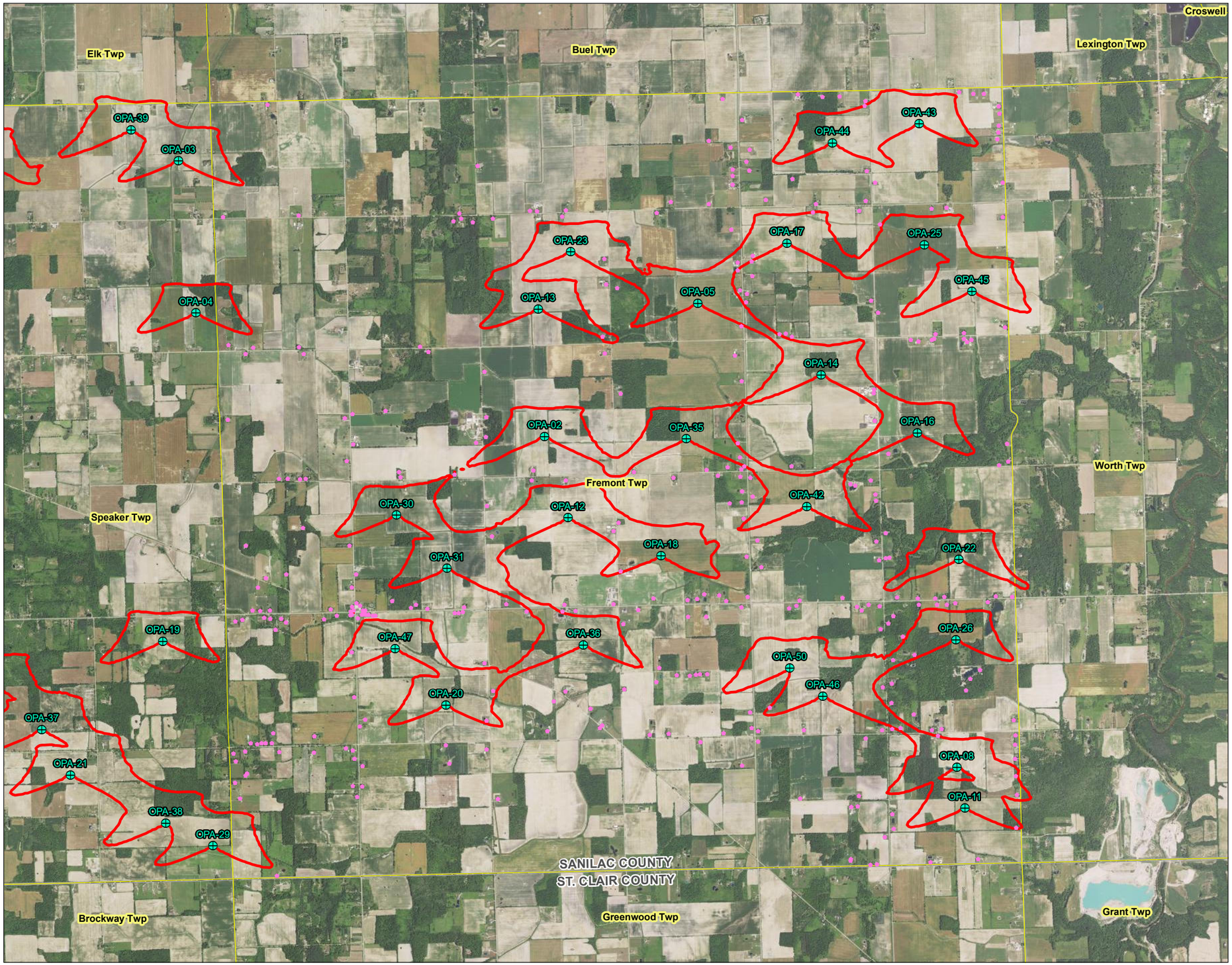


Figure No.

2

Title

Fremont Township Annual Expected Shadow Flicker - Scenario 16 (No Alternates)

Client/Project 193709180

Algonquin Power (MI Energy Developments) LLC
Riverbend Wind Project

Project Location
Sanilac Co., MI

Prepared by JM on 2022-08-24
TR by SF on 2022-08-24
IR by JB on 2022-09-01

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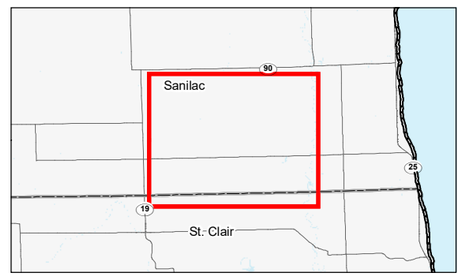
Legend

- Wind Turbine - Scenario 16
- Sensitive Receptor / Occupied Structure
- Township Boundary

Expected Annual Shadow Hours

- 30



Notes

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2. Data Sources: Stantec, USGS, NADS
3. Background: 2020 NAIP

Stantec

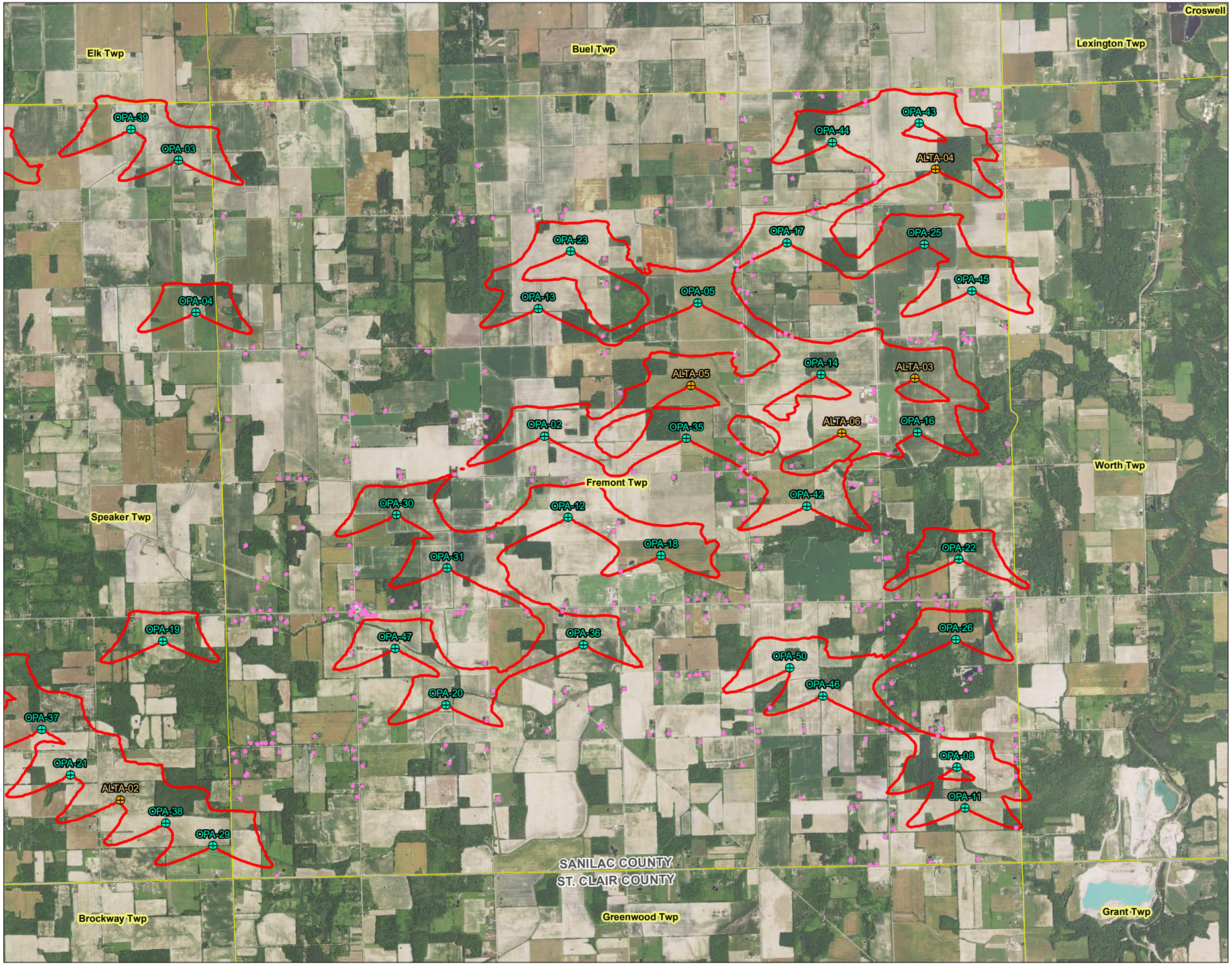

Figure No.

3

Title

Fremont Township Annual Expected Shadow Flicker - Scenario 16 (With Alternates)

Client/Project 193709180

Algonquin Power (MI Energy Developments) LLC
Riverbend Wind Project

Project Location
Sanilac Co., MI

Prepared by JM on 2022-08-24
TR by SF on 2022-08-24
IR by JB on 2022-09-01

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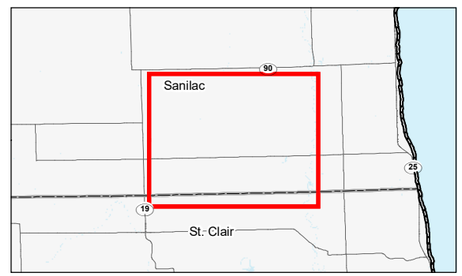
Legend

- Wind Turbine - Scenario 16 (Primary)
- Wind Turbine - Scenario 16 (Alternate)
- Sensitive Receptor / Occupied Structure
- Township Boundary

Expected Annual Shadow Hours

- 30



Notes

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3. Background: 2020 NAIP

Stantec

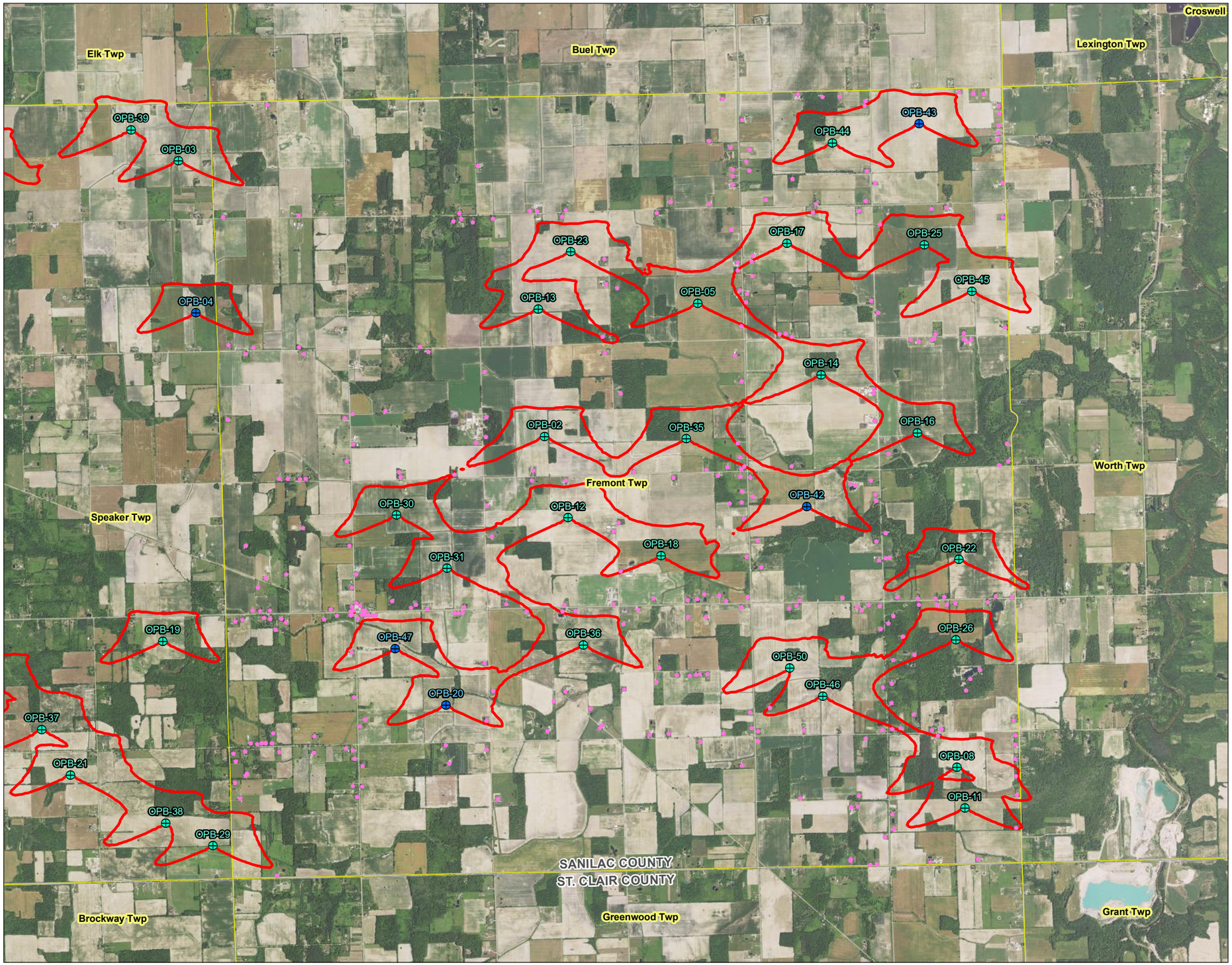

Figure No.

4

Title

Fremont Township Annual Expected Shadow Flicker - Scenario 16a (No Alternates - 162-6.0 / 163-4.5 Mixed Layout)

Client/Project

193709180

Algonquin Power (MI Energy Developments) LLC
Riverbend Wind Project

Project Location
Sanilac Co., MI

Prepared by JM on 2022-08-24
TR by SF on 2022-08-24
IR by JB on 2022-09-01

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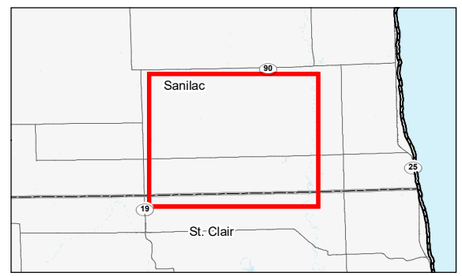
Legend

- Wind Turbine - Scenario 16A (162-6.0)
- Wind Turbine - Scenario 16A (163-4.5)
- Sensitive Receptor / Occupied Structure
- Township Boundary

Expected Annual Shadow Hours

- 30



Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Data Sources: Stantec, USGS, NADS
3. Background: 2020 NAIP

Stantec

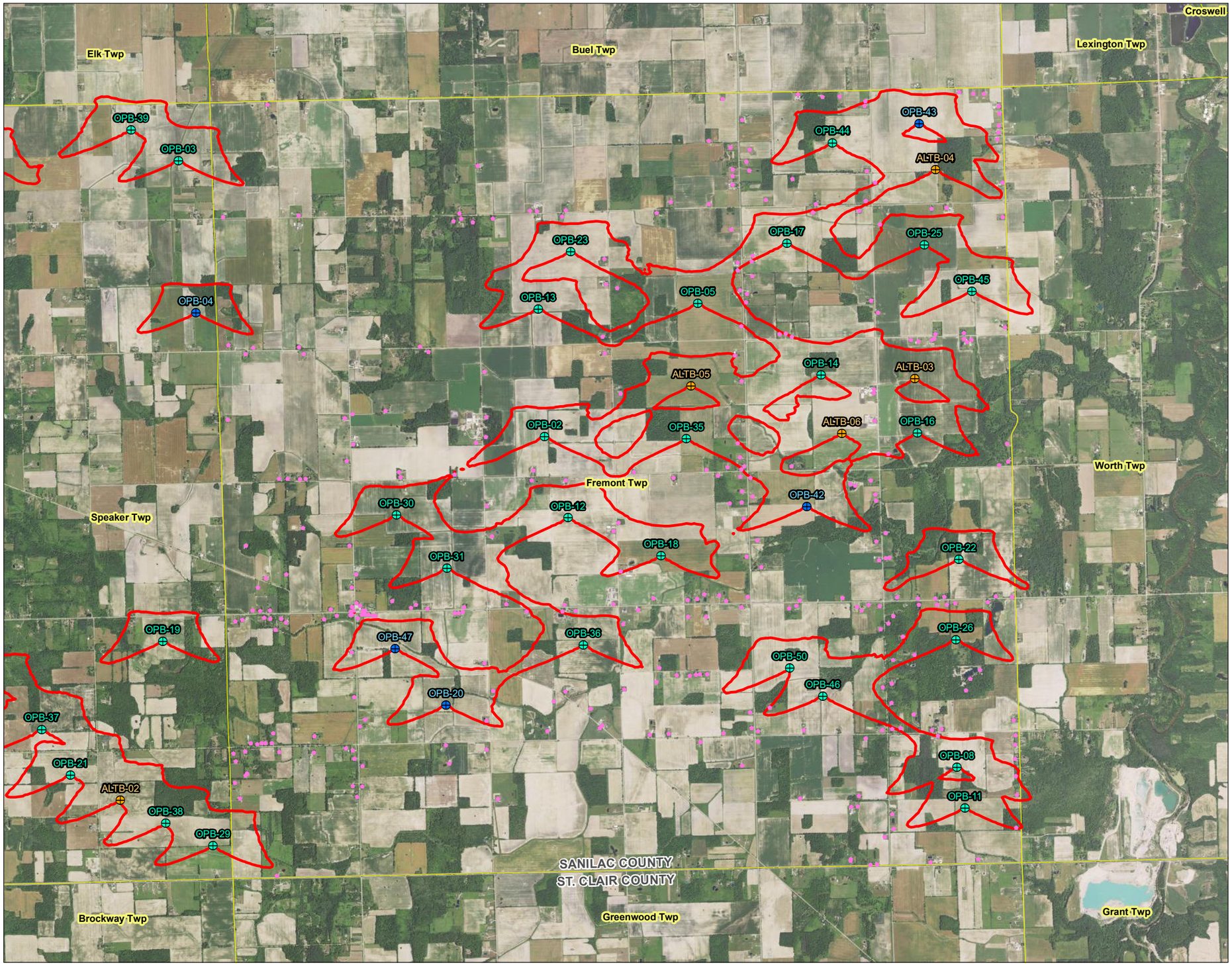


Figure No.

5

Title

Fremont Township Annual Expected Shadow Flicker - Scenario 16a (With Alternates - 162-6.0 / 163-4.5 Mixed Layout)

Client/Project 193709180

Algonquin Power (MI Energy Developments) LLC
Riverbend Wind Project

Project Location
Sanilac Co., MI

Prepared by JM on 2022-08-24
TR by SF on 2022-08-24
IR by JB on 2022-09-01

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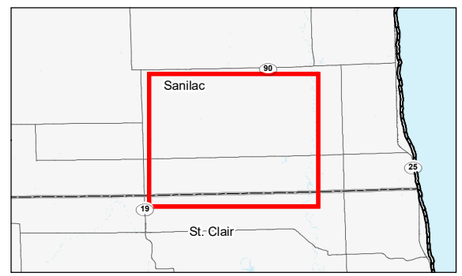
Legend

- Wind Turbine - Scenario 16A Primary (162-6.0)
- Wind Turbine - Scenario 16A Primary (163-4.5)
- Wind Turbine - Scenario 16A Alternate (162-6.0)
- Sensitive Receptor / Occupied Structure
- Township Boundary

Expected Annual Shadow Hours

- 30



Notes
1. Coordinate System: NAD 1983 UTM Zone 17N
2. Data Sources: Stantec, USGS, NADS
3. Background: 2020 NAIP

Stantec

APPENDICES

Appendix A

TURBINE COORDINATES

Appendix A Riverbend Wind - Potential Turbine Locations (Scenario 25)

Turbine Identification (Scenario 25)	X (UTM 17)	Y (UTM 17)
T-01	349,477	4,781,358
T-02	360,829	4,785,484
T-03	356,167	4,788,880
T-04	365,366	4,788,768
T-05	362,476	4,787,146
T-06	347,755	4,785,610
T-07	348,205	4,780,537
T-08	365,628	4,781,507
T-09	348,194	4,786,899
T-10	347,873	4,783,436
T-11	365,725	4,781,012
T-12	364,228	4,785,565
T-13	360,540	4,787,080
T-14	363,996	4,782,374
T-15	350,735	4,786,871
T-16	365,145	4,785,573
T-17	363,562	4,787,881
T-18	362,028	4,784,081
T-19	350,709	4,782,594
T-20	359,415	4,782,262
T-21	354,852	4,781,415
T-22	365,649	4,784,035
T-23	360,931	4,787,774
T-24	349,812	4,789,164
T-25	365,232	4,787,858

Turbine Identification (Scenario 25)	X (UTM 17)	Y (UTM 17)
T-26	365,614	4,783,058
T-27	349,007	4,780,683
T-28	351,442	4,780,545
T-29	356,585	4,780,552
T-30	355,459	4,781,111
T-31	365,116	4,786,230
T-32	353,690	4,788,905
T-33	351,540	4,787,001
T-34	353,018	4,786,959
T-35	362,338	4,785,502
T-36	361,087	4,782,993
T-37	354,504	4,781,969
T-38	356,012	4,780,830
T-39	355,590	4,789,259
T-40	350,492	4,787,415
T-41	350,001	4,780,971
T-42	363,801	4,784,679
T-43	365,168	4,789,330
T-44	364,114	4,789,101
T-45	365,807	4,787,294
T-46	363,977	4,786,278
T-47	362,394	4,786,145
T-48	350,889	4,781,974
T-49	353,886	4,782,524
T-50	363,595	4,782,713

Appendix A Riverbend Wind - Potential Turbine Locations (Scenarios 16 and 16a with Alternates)

Turbine Identification (Scenario 16)	Turbine Identification (Scenario 16a)	X (UTM 17)	Y (UTM 17)
OPA-01	OPB-01	349,477	4,781,358
OPA-02	OPB-02	360,615	4,785,528
OPA-03	OPB-03	356,167	4,788,880
OPA-04	OPB-04	356,376	4,787,030
OPA-05	OPB-05	362,476	4,787,146
OPA-06	OPB-06	347,755	4,785,610
OPA-07	OPB-07	348,205	4,780,537
OPA-08	OPB-08	365,628	4,781,507
OPA-09	OPB-09	348,194	4,786,899
OPA-10	OPB-10	347,873	4,783,436
OPA-11	OPB-11	365,725	4,781,012
OPA-12	OPB-12	360,901	4,784,538
OPA-13	OPB-13	360,540	4,787,080
OPA-14	OPB-14	363,977	4,786,278
OPA-15	OPB-15	350,735	4,786,871
OPA-16	OPB-16	365,145	4,785,573
OPA-17	OPB-17	363,562	4,787,881
OPA-18	OPB-18	362,028	4,784,081
OPA-19	OPB-19	355,973	4,783,039
OPA-20	OPB-20	359,415	4,782,262
OPA-21	OPB-21	354,852	4,781,415
OPA-22	OPB-22	365,649	4,784,035
OPA-23	OPB-23	360,931	4,787,774
OPA-24	OPB-24	349,812	4,789,164
OPA-25	OPB-25	365,232	4,787,858
OPA-26	OPB-26	365,614	4,783,058
OPA-27	OPB-27	349,007	4,780,683
OPA-28	OPB-28	351,442	4,780,545
OPA-29	OPB-29	356,585	4,780,552
OPA-30	OPB-30	358,814	4,784,572
OPA-31	OPB-31	359,429	4,783,926
OPA-32	OPB-32	353,690	4,788,905
OPA-33	OPB-33	351,540	4,787,001
OPA-34	OPB-34	353,018	4,786,959
OPA-35	OPB-35	362,338	4,785,502
OPA-36	OPB-36	361,087	4,782,993
OPA-37	OPB-37	354,504	4,781,969
OPA-38	OPB-38	356,012	4,780,830
OPA-39	OPB-39	355,590	4,789,259
OPA-40	OPB-40	350,492	4,787,415

Appendix A Riverbend Wind - Potential Turbine Locations (Scenarios 16 and 16a with Alternates)

Turbine Identification (Scenario 16)	Turbine Identification (Scenario 16a)	X (UTM 17)	Y (UTM 17)
OPA-41	OPB-41	350,001	4,780,971
OPA-42	OPB-42	363,801	4,784,679
OPA-43	OPB-43	365,168	4,789,330
OPA-44	OPB-44	364,114	4,789,101
OPA-45	OPB-45	365,807	4,787,294
OPA-46	OPB-46	363,996	4,782,374
OPA-47	OPB-47	358,800	4,782,950
OPA-48	OPB-48	350,889	4,781,974
OPA-49	OPB-49	353,886	4,782,524
OPA-50	OPB-50	363,595	4,782,713
ALTA-01	ALTB-01	350,709	4,782,594
ALTA-02	ALTB-02	355,459	4,781,111
ALTA-03	ALTB-03	365,116	4,786,230
ALTA-04	ALTB-04	365,366	4,788,768
ALTA-05	ALTB-05	362,394	4,786,145
ALTA-06	ALTB-06	364,228	4,785,565

Appendix B

RECEPTOR COORDINATES AND EXPECTED ANNUAL SHADOW HOURS

(FREMONT TOWNSHIP)

Appendix B Riverbend Wind Project - Receptor Locations and Expected Shadow Results

Rec ID ("-P" is Participant)	X (UTM 17)	Y (UTM 17)	Sc25 (hr:min)	Sc16 (hr:min)	Sc16 wAlts (hr:min)	Sc16a (hr:min)	Sc16a wAlts (hr:min)
R-0041	362,825	4,783,523	3:32	3:32	3:32	3:32	3:32
R-0042	363,212	4,781,949	8:20	8:20	8:20	8:20	8:20
R-0079	366,099	4,783,585	10:21	10:21	10:21	10:21	10:21
R-0104-P	359,903	4,785,520	8:36	18:35	18:35	18:35	18:35
R-0144	359,511	4,788,146	2:28	2:28	2:28	2:28	2:28
R-0148	361,516	4,784,479	21:11	44:06	44:06	44:06	44:06
R-0149	365,714	4,786,715	17:10	1:27	17:10	1:27	17:10
R-0157	360,400	4,783,403	15:36	28:31	28:31	28:32	28:32
R-0158	362,504	4,782,633	12:14	12:14	12:14	12:14	12:14
R-0177	356,710	4,788,192	0:00	0:00	0:00	0:00	0:00
R-0181-P	365,502	4,788,308	17:54	17:54	17:54	17:54	17:54
R-0182	363,472	4,786,773	33:28	27:02	33:28	27:02	33:28
R-0219	361,344	4,787,687	79:10	79:10	79:10	79:10	79:10
R-0225	358,339	4,781,145	1:23	1:23	1:23	1:23	1:23
R-0267	363,044	4,785,163	39:20	31:19	39:20	31:25	39:26
R-0273	362,582	4,783,338	8:11	8:11	8:11	8:11	8:11
R-0274	362,226	4,782,622	12:19	12:19	12:19	12:19	12:19
R-0276	365,793	4,782,578	1:28	1:28	1:28	1:28	1:28
R-0315	357,473	4,783,265	0:00	5:29	5:29	5:29	5:29
R-0316	358,091	4,783,350	2:43	23:19	23:19	23:26	23:26
R-0346-P	363,915	4,788,356	18:01	14:10	18:01	14:10	18:01
R-0348	364,586	4,787,178	4:58	4:58	4:58	4:58	4:58
R-0349	362,993	4,785,277	47:59	42:23	47:59	42:25	48:02
R-0355-P	360,857	4,783,485	12:18	16:03	16:03	16:03	16:03
R-0356	358,204	4,781,735	13:53	13:53	13:53	13:57	13:57
R-0386	357,645	4,785,008	0:00	3:51	3:51	3:51	3:51
R-0392	364,559	4,783,477	19:20	19:20	19:20	19:20	19:20
R-0424	356,919	4,781,121	10:26	7:26	10:26	7:26	10:26
R-0450	357,389	4,785,012	0:00	2:20	2:20	2:20	2:20
R-0451	358,291	4,785,431	0:00	0:00	0:00	0:00	0:00
R-0452	363,144	4,787,475	13:26	13:26	13:26	13:26	13:26
R-0458-P	361,588	4,782,451	1:13	1:13	1:13	1:13	1:13
R-0489	363,067	4,787,161	24:25	24:25	24:25	24:25	24:25
R-0497-P	361,290	4,781,978	1:26	1:26	1:26	1:27	1:27
R-0535-P	357,634	4,786,614	0:00	5:29	5:29	5:32	5:32
R-0538	362,844	4,785,155	10:31	7:00	11:31	7:03	11:34
R-0547	357,209	4,783,325	0:00	5:35	5:35	5:36	5:36
R-0549	362,794	4,781,920	9:48	9:48	9:48	9:48	9:48
R-0552	366,320	4,782,076	11:04	11:04	11:04	11:04	11:04
R-0590	365,477	4,783,576	0:45	0:45	0:45	0:45	0:45
R-0623-P	359,914	4,781,721	0:00	0:00	0:00	0:00	0:00
R-0626	363,015	4,781,526	0:00	0:00	0:00	0:00	0:00

Appendix B Riverbend Wind Project - Receptor Locations and Expected Shadow Results

Rec ID ("-P" is Participant)	X (UTM 17)	Y (UTM 17)	Sc25 (hr:min)	Sc16 (hr:min)	Sc16 wAlts (hr:min)	Sc16a (hr:min)	Sc16a wAlts (hr:min)
R-0658	360,460	4,784,996	3:13	21:49	21:49	21:49	21:49
R-0660	363,036	4,784,528	23:25	23:25	23:25	23:34	23:34
R-0661	364,766	4,784,347	19:48	19:48	19:48	19:53	19:53
R-0667	358,423	4,783,366	0:00	24:48	24:48	24:54	24:54
R-0668	358,332	4,783,505	0:00	21:55	21:55	21:58	21:58
R-0714-P	362,903	4,788,587	15:59	15:59	15:59	15:59	15:59
R-0722	358,439	4,782,080	9:25	9:25	9:25	9:29	9:29
R-0725-P	365,609	4,783,498	5:48	5:48	5:48	5:48	5:48
R-0755	362,783	4,789,633	2:52	2:52	2:52	2:52	2:52
R-0757	363,007	4,786,866	26:12	26:12	26:12	26:12	26:12
R-0759	365,805	4,786,702	15:32	1:16	15:32	1:16	15:32
R-0764-P	361,458	4,783,489	9:14	9:14	9:14	9:14	9:14
R-0805	359,979	4,784,313	0:00	39:10	39:10	39:10	39:10
R-0807-P	364,618	4,786,053	100:27	49:25	100:27	49:25	100:27
R-0817	359,625	4,783,390	2:16	10:54	10:54	10:58	10:58
R-0819-P	361,942	4,783,560	10:58	10:58	10:58	10:58	10:58
R-0845	360,439	4,788,269	14:33	14:33	14:33	14:33	14:33
R-0846-P	365,659	4,789,709	25:39	25:39	25:39	25:52	25:52
R-0847-P	361,706	4,785,098	19:38	20:47	20:47	20:47	20:47
R-0861	361,757	4,783,419	15:13	15:13	15:13	15:13	15:13
R-0862	365,168	4,783,478	22:36	22:36	22:36	22:36	22:36
R-0906	358,531	4,783,351	0:00	20:18	20:18	20:26	20:26
R-0909	364,863	4,780,757	17:09	17:09	17:09	17:09	17:09
R-0938	362,933	4,786,511	31:02	5:33	31:02	5:33	31:02
R-0939-P	364,650	4,784,253	22:46	22:46	22:46	22:50	22:50
R-0947-P	364,346	4,781,020	10:39	10:39	10:39	10:39	10:39
R-0979	357,249	4,789,564	6:45	6:45	6:45	6:45	6:45
R-0981	360,480	4,785,112	3:20	10:22	10:22	10:22	10:22
R-0993	356,856	4,781,315	12:33	9:31	12:33	9:31	12:33
R-0998	364,578	4,780,320	0:25	0:25	0:25	0:25	0:25
R-1027-P	363,694	4,789,685	8:13	6:56	8:13	6:56	8:14
R-1033-P	357,049	4,781,795	2:02	0:07	2:02	0:07	2:02
R-1034	358,562	4,783,351	0:00	19:08	19:08	19:17	19:17
R-1065	364,205	4,789,659	10:46	6:13	10:46	6:16	10:48
R-1066	365,954	4,789,691	11:02	11:02	11:02	11:06	11:06
R-1071	357,938	4,783,303	2:14	16:54	16:54	16:59	16:59
R-1106	366,213	4,786,855	4:36	0:00	4:36	0:00	4:36
R-1111	363,678	4,783,467	3:47	3:47	3:47	3:47	3:47
R-1148-P	359,918	4,784,683	0:00	12:21	12:21	12:21	12:21
R-1158	357,226	4,781,799	4:33	3:03	4:33	3:03	4:33
R-1159-P	364,843	4,781,970	28:36	28:36	28:36	28:36	28:36
R-1188-P	359,207	4,786,553	8:27	9:48	9:48	9:48	9:48

Appendix B Riverbend Wind Project - Receptor Locations and Expected Shadow Results

Rec ID ("-P" is Participant)	X (UTM 17)	Y (UTM 17)	Sc25 (hr:min)	Sc16 (hr:min)	Sc16 wAlts (hr:min)	Sc16a (hr:min)	Sc16a wAlts (hr:min)
R-1192	362,996	4,785,037	20:21	8:55	20:21	9:02	20:28
R-1198	357,004	4,781,433	8:19	6:04	8:19	6:04	8:19
R-1199	358,398	4,783,361	0:00	26:04	26:04	26:11	26:11
R-1200	364,853	4,782,807	39:02	39:02	39:02	39:02	39:02
R-1230	356,983	4,786,530	0:00	0:00	0:00	0:00	0:00
R-1236-P	361,894	4,781,897	5:39	5:39	5:39	5:39	5:39
R-1265	362,965	4,785,442	32:06	27:34	32:06	27:36	32:07
R-1266	365,162	4,786,682	5:46	3:59	5:46	3:59	5:46
R-1274	359,992	4,782,429	26:31	36:17	36:17	36:35	36:35
R-1309	366,137	4,789,303	20:45	9:04	20:45	9:08	20:48
R-1311	363,077	4,787,263	18:35	18:35	18:35	18:35	18:35
R-1320-P	366,342	4,781,895	11:41	11:41	11:41	11:41	11:41
R-1349	362,993	4,787,305	23:05	23:05	23:05	23:05	23:05
R-1350	362,186	4,785,023	6:24	8:01	8:01	8:01	8:01
R-1385	356,775	4,786,640	0:00	0:00	0:00	0:00	0:00
R-1387-P	362,616	4,788,355	13:49	13:49	13:49	13:49	13:49
R-1392	366,356	4,781,165	38:17	38:17	38:17	38:17	38:17
R-1430	365,368	4,783,561	5:46	5:46	5:46	5:46	5:46
R-1432	364,657	4,780,325	0:00	0:00	0:00	0:00	0:00
R-1461	360,525	4,788,264	13:18	13:18	13:18	13:18	13:18
R-1462	357,690	4,786,526	0:00	5:26	5:26	5:30	5:30
R-1463	358,247	4,784,200	0:00	4:07	4:07	4:07	4:07
R-1466	363,011	4,786,196	34:40	12:00	34:40	12:00	34:40
R-1470-P	361,174	4,782,213	1:40	1:40	1:40	1:41	1:41
R-1472	362,559	4,783,608	6:34	10:53	10:53	10:53	10:53
R-1473-P	364,685	4,784,020	8:28	8:28	8:28	8:28	8:28
R-1474	365,509	4,783,480	11:46	11:46	11:46	11:46	11:46
R-1516	356,977	4,781,696	4:34	2:18	4:34	2:18	4:34
R-1519	363,073	4,784,068	6:32	6:32	6:32	6:32	6:32
R-1557	360,153	4,783,487	7:59	18:02	18:02	18:02	18:02
R-1630	361,543	4,786,047	32:42	15:46	27:47	15:46	27:47
R-1674-P	361,459	4,784,376	17:11	58:59	58:59	58:59	58:59
R-1684	358,281	4,783,362	0:00	29:30	29:30	29:38	29:38
R-1685	358,767	4,783,525	0:00	1:08	1:08	1:08	1:08
R-1686	358,401	4,781,273	1:12	1:12	1:12	1:12	1:12
R-1718	359,746	4,788,133	3:53	3:53	3:53	3:53	3:53
R-1730	364,832	4,782,282	21:54	21:54	21:54	21:54	21:54
R-1766	360,049	4,781,119	0:00	0:00	0:00	0:00	0:00
R-1803	366,336	4,781,611	21:46	21:46	21:46	21:46	21:46
R-1834	363,214	4,781,818	0:00	0:00	0:00	0:00	0:00
R-1856	362,725	4,785,047	10:15	6:05	10:02	6:07	10:04
R-1863	357,231	4,783,803	0:00	11:16	11:16	11:16	11:16

Appendix B Riverbend Wind Project - Receptor Locations and Expected Shadow Results

Rec ID ("-P" is Participant)	X (UTM 17)	Y (UTM 17)	Sc25 (hr:min)	Sc16 (hr:min)	Sc16 wAlts (hr:min)	Sc16a (hr:min)	Sc16a wAlts (hr:min)
R-1864	358,307	4,781,605	2:40	2:40	2:40	2:42	2:42
R-1866	363,008	4,783,446	2:53	2:53	2:53	2:53	2:53
R-1867-P	364,766	4,784,047	10:40	10:40	10:40	10:45	10:45
R-1891	362,878	4,789,040	4:39	4:39	4:39	4:39	4:39
R-1892-P	364,533	4,788,754	13:43	2:12	13:43	2:12	13:43
R-1897-P	357,821	4,781,881	2:37	2:37	2:37	2:38	2:38
R-1898	360,652	4,781,947	5:07	5:07	5:07	5:08	5:08
R-1937	358,191	4,785,746	0:00	0:00	0:00	0:00	0:00
R-1940-P	364,631	4,785,716	59:27	23:29	59:27	23:29	59:27
R-1944	359,194	4,783,432	1:06	12:41	12:41	12:46	12:46
R-1979	359,521	4,785,059	5:41	30:16	30:16	30:16	30:16
R-1988	358,019	4,783,427	2:04	15:52	15:52	15:57	15:57
R-2017	360,874	4,788,272	1:46	1:46	1:46	1:46	1:46
R-2024	357,279	4,783,410	0:00	5:12	5:12	5:13	5:13
R-2053	363,119	4,785,026	30:16	19:56	30:16	20:04	30:25
R-2060-P	356,945	4,783,298	0:00	7:43	7:43	7:43	7:43
R-2061	357,303	4,781,801	5:03	3:42	5:03	3:42	5:03
R-2089	363,996	4,789,657	6:26	4:00	6:26	4:02	6:28
R-2104	356,837	4,781,670	4:04	1:10	4:04	1:10	4:04
R-2105	357,366	4,780,182	20:18	20:18	20:18	20:18	20:18
R-2134-P	363,136	4,787,652	28:29	28:29	28:29	28:29	28:29
R-2135	365,355	4,786,713	7:37	2:43	7:37	2:43	7:37
R-2138-P	359,638	4,783,447	2:17	10:46	10:46	10:50	10:50
R-2175	364,519	4,788,388	36:04	18:22	36:04	18:22	36:04
R-2176	363,019	4,784,859	18:00	16:35	18:00	16:39	18:04
R-2177	365,368	4,786,771	2:40	2:40	2:40	2:40	2:40
R-2185-P	357,815	4,781,688	4:28	4:28	4:28	4:29	4:29
R-2186	360,731	4,782,310	3:37	5:06	5:06	5:08	5:08
R-2188-P	364,945	4,781,985	36:30	36:30	36:30	36:30	36:30
R-2219	363,107	4,788,758	13:27	13:27	13:27	13:27	13:27
R-2227	361,574	4,783,247	23:48	23:48	23:48	23:48	23:48
R-2260	360,876	4,784,992	8:43	12:50	12:50	12:50	12:50
R-2261	366,146	4,789,455	13:40	7:05	13:40	7:08	13:44
R-2263-P	362,966	4,787,639	43:58	43:58	43:58	43:58	43:58
R-2273	358,273	4,783,690	0:00	6:08	6:08	6:08	6:08
R-2274	363,135	4,781,983	16:53	16:53	16:53	16:53	16:53
R-2302	359,989	4,788,177	6:28	6:28	6:28	6:28	6:28
R-2303	361,503	4,787,333	13:14	13:14	13:14	13:14	13:14
R-2304	361,365	4,787,375	13:52	13:52	13:52	13:52	13:52
R-2347	364,645	4,784,742	16:06	16:06	16:06	16:12	16:12
R-2356	366,336	4,781,780	12:19	12:19	12:19	12:19	12:19
R-2383	366,139	4,789,539	8:46	6:42	8:46	6:45	8:50

Appendix B Riverbend Wind Project - Receptor Locations and Expected Shadow Results

Rec ID ("-P" is Participant)	X (UTM 17)	Y (UTM 17)	Sc25 (hr:min)	Sc16 (hr:min)	Sc16 wAlts (hr:min)	Sc16a (hr:min)	Sc16a wAlts (hr:min)
R-2387	358,446	4,783,363	0:00	23:38	23:38	23:47	23:47
R-2388	358,995	4,783,443	0:00	0:29	0:29	0:30	0:30
R-2390	362,385	4,782,616	11:39	11:39	11:39	11:39	11:39
R-2391	363,591	4,783,435	3:29	3:29	3:29	3:29	3:29
R-2392	363,767	4,781,961	1:10	1:10	1:10	1:10	1:10
R-2425	363,071	4,788,868	8:30	8:30	8:30	8:30	8:30
R-2426	365,320	4,788,301	6:04	6:04	6:04	6:04	6:04
R-2427	362,585	4,785,121	7:59	6:26	9:00	6:28	9:02
R-2435	358,304	4,782,359	5:20	5:20	5:20	5:23	5:23
R-2468	359,583	4,788,238	2:42	2:42	2:42	2:42	2:42
R-2478	358,278	4,783,453	0:00	26:39	26:39	26:44	26:44
R-2515-P	361,323	4,786,737	36:41	32:12	36:41	32:12	36:41
R-2516	363,111	4,789,013	8:01	8:01	8:01	8:01	8:01
R-2517-P	364,443	4,788,271	26:44	19:39	26:44	19:39	26:44
R-2519	363,619	4,785,163	13:56	13:56	13:56	13:58	13:58
R-2520	364,582	4,784,993	12:53	12:53	12:53	12:58	12:58
R-2534	358,479	4,783,363	0:00	21:31	21:31	21:39	21:39
R-2535	358,264	4,783,398	0:00	29:40	29:40	29:49	29:49
R-2573	358,870	4,785,033	1:22	2:14	2:14	2:14	2:14
R-2607	363,308	4,788,404	3:28	3:28	3:28	3:28	3:28
R-2612	363,723	4,781,127	2:33	2:33	2:33	2:33	2:33
R-2613	366,299	4,783,578	13:23	13:23	13:23	13:23	13:23
R-2614-P	365,397	4,781,885	29:58	29:58	29:58	29:58	29:58
R-2642	357,630	4,788,213	4:57	4:57	4:57	4:57	4:57
R-2647	357,495	4,785,009	0:00	2:49	2:49	2:49	2:49
R-2648	364,334	4,784,947	23:26	23:26	23:26	23:40	23:40
R-2655	359,575	4,783,379	2:05	11:59	11:59	12:04	12:04
R-2658-P	362,740	4,783,596	3:00	3:00	3:00	3:00	3:00
R-2659	364,693	4,783,462	13:43	13:43	13:43	13:43	13:43
R-2693	362,905	4,788,693	7:30	7:30	7:30	7:30	7:30
R-2694-P	362,152	4,788,379	6:01	6:01	6:01	6:01	6:01
R-2695	364,670	4,787,037	7:08	7:08	7:08	7:08	7:08
R-2699	358,286	4,781,281	1:28	1:28	1:28	1:28	1:28
R-2702	362,456	4,782,630	11:49	11:49	11:49	11:49	11:49
R-2703	364,797	4,783,250	13:34	13:34	13:34	13:34	13:34
R-2704	364,414	4,783,458	18:36	18:36	18:36	18:36	18:36
R-2705	365,909	4,782,688	1:05	1:05	1:05	1:05	1:05
R-2758	362,471	4,783,551	7:44	8:38	8:38	8:38	8:38
R-2759	363,717	4,783,530	4:57	4:57	4:57	4:57	4:57
R-2760	364,704	4,783,184	13:04	13:04	13:04	13:04	13:04
R-2786	366,187	4,788,610	19:55	6:25	19:55	6:25	19:55
R-2799-P	361,318	4,782,015	1:22	1:22	1:22	1:22	1:22

Appendix B Riverbend Wind Project - Receptor Locations and Expected Shadow Results

Rec ID ("-P" is Participant)	X (UTM 17)	Y (UTM 17)	Sc25 (hr:min)	Sc16 (hr:min)	Sc16 wAlts (hr:min)	Sc16a (hr:min)	Sc16a wAlts (hr:min)
R-2877	356,988	4,784,198	0:00	1:39	1:39	1:39	1:39
R-2878	358,327	4,783,849	0:00	6:12	6:12	6:12	6:12
R-2880	364,846	4,780,934	10:50	10:50	10:50	10:50	10:50
R-2906	359,605	4,788,172	2:53	2:53	2:53	2:53	2:53
R-2908	363,203	4,784,261	4:29	4:29	4:29	4:29	4:29
R-2909	366,140	4,785,179	16:55	15:26	16:55	15:26	16:55
R-2915	357,479	4,783,852	0:00	10:02	10:02	10:02	10:02
R-2962	365,741	4,782,443	1:38	1:38	1:38	1:38	1:38
R-2982-P	357,713	4,785,009	0:00	5:37	5:37	5:37	5:37
R-2983	359,907	4,785,762	6:56	12:10	12:10	12:10	12:10
R-2985	365,071	4,786,700	4:49	4:49	4:49	4:49	4:49
R-2996-P	361,977	4,782,545	18:52	18:52	18:52	18:52	18:52
R-3024	364,515	4,789,604	26:54	24:03	26:54	24:13	27:04
R-3032-P	366,003	4,783,513	15:10	15:10	15:10	15:10	15:10
R-3073	364,238	4,783,564	7:30	7:30	7:30	7:30	7:30
R-3075-P	364,423	4,781,034	14:16	14:16	14:16	14:16	14:16
R-3076	365,107	4,782,145	13:48	13:48	13:48	13:48	13:48
R-3113	362,353	4,783,536	6:59	6:59	6:59	6:59	6:59
R-3151-P	357,681	4,784,417	0:00	6:55	6:55	6:55	6:55
R-3153	363,630	4,788,655	9:46	7:56	9:46	7:59	9:50
R-3157	359,528	4,783,376	1:58	13:22	13:22	13:27	13:27
R-3161	363,114	4,782,176	12:56	12:56	12:56	12:56	12:56
R-3197	364,343	4,780,392	9:05	9:05	9:05	9:05	9:05
R-3245	363,015	4,784,727	19:10	19:10	19:10	19:18	19:18
R-3247	364,638	4,784,819	15:47	15:47	15:47	15:52	15:52
R-3253	364,718	4,781,961	19:42	19:42	19:42	19:42	19:42
R-3287	358,282	4,785,800	0:00	0:00	0:00	0:00	0:00
R-3292	363,009	4,785,131	30:51	23:03	30:51	23:08	30:56
R-3301	357,283	4,783,315	0:00	5:25	5:25	5:25	5:25
R-3303	359,911	4,782,071	40:59	40:59	40:59	41:27	41:27
R-3304	362,015	4,782,710	15:11	15:11	15:11	15:11	15:11
R-3305	364,440	4,781,157	10:31	10:31	10:31	10:31	10:31
R-3308-P	366,347	4,780,774	33:00	33:00	33:00	33:00	33:00
R-3350	360,873	4,782,425	2:41	2:41	2:41	2:42	2:42
R-3351-P	364,972	4,783,092	28:51	28:51	28:51	28:51	28:51
R-3383	365,830	4,789,694	15:04	15:04	15:04	15:12	15:12
R-3392	358,435	4,783,413	0:00	22:48	22:48	22:53	22:53
R-3398	365,887	4,780,390	0:00	0:00	0:00	0:00	0:00
R-3442	358,410	4,783,411	0:00	24:32	24:32	24:37	24:37
R-3444	358,373	4,782,000	8:46	8:46	8:46	8:49	8:49
R-3448-P	365,153	4,783,555	15:54	15:54	15:54	15:54	15:54
R-3480	362,903	4,788,776	6:10	6:10	6:10	6:10	6:10

Appendix B Riverbend Wind Project - Receptor Locations and Expected Shadow Results

Rec ID ("-P" is Participant)	X (UTM 17)	Y (UTM 17)	Sc25 (hr:min)	Sc16 (hr:min)	Sc16 wAlts (hr:min)	Sc16a (hr:min)	Sc16a wAlts (hr:min)
R-3481	363,016	4,789,375	4:53	4:53	4:53	4:53	4:53
R-3482	366,135	4,789,223	19:54	9:34	19:54	9:38	19:58
R-3488	359,054	4,783,484	0:00	0:00	0:00	0:00	0:00
R-3490-P	365,311	4,780,351	0:00	0:00	0:00	0:00	0:00
R-3521	363,622	4,786,744	29:33	24:01	29:33	24:01	29:33
R-3531	362,364	4,783,338	7:29	7:29	7:29	7:29	7:29
R-3533	366,347	4,781,397	33:23	33:23	33:23	33:23	33:23
R-3569	358,350	4,783,316	0:00	28:36	28:36	28:47	28:47
R-3600	364,856	4,783,341	13:43	13:43	13:43	13:43	13:43
R-3633	358,683	4,785,836	0:00	1:07	1:07	1:07	1:07
R-3634-P	359,785	4,785,449	6:55	18:54	18:54	18:54	18:54
R-3639-P	357,124	4,781,787	3:38	1:52	3:38	1:52	3:38
R-3641-P	365,442	4,781,968	11:30	11:30	11:30	11:30	11:30
R-3668	357,320	4,781,918	2:35	1:20	2:35	1:20	2:35
R-3672	364,473	4,783,409	17:32	17:32	17:32	17:32	17:32
R-3701	359,804	4,788,813	1:37	1:37	1:37	1:37	1:37
R-3703-P	364,636	4,788,612	26:52	6:05	26:52	6:05	26:52
R-3713-P	360,836	4,783,396	23:21	27:48	27:48	27:49	27:49
R-3714	363,251	4,783,939	4:49	4:49	4:49	4:49	4:49
R-3715	364,728	4,782,477	19:01	19:01	19:01	19:01	19:01
R-3716	364,837	4,782,519	14:05	14:05	14:05	14:05	14:05
R-3760	357,176	4,781,800	3:53	2:17	3:53	2:17	3:53
R-3761	365,113	4,782,876	45:40	45:40	45:40	45:40	45:40
R-3762-P	365,324	4,781,954	21:39	21:39	21:39	21:39	21:39
R-3794	361,352	4,786,538	10:46	5:37	10:46	5:37	10:46
R-3795	364,508	4,789,546	36:23	31:02	36:23	31:10	36:31
R-3836	357,418	4,783,314	0:00	5:15	5:15	5:16	5:16
R-3838	359,887	4,782,771	16:48	23:24	23:24	23:28	23:28
R-3841-P	361,543	4,783,888	36:06	36:06	36:06	36:06	36:06
R-3878	366,121	4,789,140	21:17	10:41	21:17	10:46	21:22
R-3879-P	364,798	4,785,319	38:14	6:33	38:14	6:37	38:18
R-3885	356,864	4,781,572	8:48	6:04	8:48	6:04	8:48
R-3917	357,133	4,783,693	0:00	8:59	8:59	9:00	9:00
R-3936-P	356,767	4,785,729	0:00	0:00	0:00	0:00	0:00
R-3972-P	362,966	4,787,548	30:28	30:28	30:28	30:28	30:28
R-3973	366,238	4,785,438	6:48	6:20	6:48	6:20	6:48
R-4009-P	362,616	4,789,124	2:41	2:41	2:41	2:41	2:41
R-4010	366,188	4,788,192	6:38	6:38	6:38	6:38	6:38
R-4023	359,415	4,781,772	0:00	0:00	0:00	0:00	0:00
R-4065	363,356	4,782,231	32:51	32:51	32:51	32:51	32:51
R-4098	357,075	4,786,603	0:00	7:03	7:03	7:11	7:11
R-4099	362,886	4,788,041	15:16	15:16	15:16	15:16	15:16

Appendix B Riverbend Wind Project - Receptor Locations and Expected Shadow Results

Rec ID ("-P" is Participant)	X (UTM 17)	Y (UTM 17)	Sc25 (hr:min)	Sc16 (hr:min)	Sc16 wAlts (hr:min)	Sc16a (hr:min)	Sc16a wAlts (hr:min)
R-4107	357,163	4,783,407	0:00	5:39	5:39	5:39	5:39
R-4108	357,392	4,781,693	4:08	2:57	4:08	2:57	4:08
R-4137	365,717	4,786,785	12:31	1:25	12:31	1:25	12:31
R-4138	365,325	4,786,700	8:05	2:53	8:05	2:53	8:05
R-4147	357,068	4,783,410	0:00	6:20	6:20	6:21	6:21
R-4151	363,084	4,783,577	14:00	14:00	14:00	14:00	14:00
R-4173	360,833	4,788,203	9:07	9:07	9:07	9:07	9:07
R-4175	358,214	4,785,226	0:00	5:28	5:28	5:28	5:28
R-4179	366,254	4,785,223	7:39	7:39	7:39	7:39	7:39
R-4188	356,862	4,783,278	0:00	8:56	8:56	8:56	8:56
R-4190	358,294	4,783,410	0:00	29:09	29:09	29:16	29:16
R-4191	358,276	4,782,901	3:45	39:55	39:55	40:22	40:22
R-4192	358,286	4,781,708	9:31	9:31	9:31	9:33	9:33
R-4222	359,886	4,786,312	5:03	2:18	2:18	2:18	2:18
R-4224	361,982	4,788,241	8:25	8:25	8:25	8:25	8:25
R-4279	358,407	4,781,521	0:00	0:00	0:00	0:00	0:00
R-4280	362,127	4,781,910	4:36	4:36	4:36	4:36	4:36
R-4337	357,348	4,783,175	0:00	5:56	5:56	5:56	5:56
R-4339	363,145	4,784,796	21:03	21:03	21:03	21:15	21:15
R-4340	362,512	4,781,807	4:35	4:35	4:35	4:35	4:35
R-4341-P	363,877	4,788,255	34:00	29:56	34:00	29:56	34:00
R-4342	364,753	4,780,654	17:46	17:46	17:46	17:46	17:46
R-4345	364,901	4,783,569	15:54	15:54	15:54	15:54	15:54
R-4346	365,385	4,783,483	18:00	18:00	18:00	18:00	18:00
R-4504	364,693	4,788,110	29:17	29:17	29:17	29:17	29:17
R-4505	364,808	4,784,055	14:12	14:12	14:12	14:19	14:19
R-4507-P	360,992	4,783,405	13:06	16:08	16:08	16:08	16:08
R-4508	362,868	4,784,713	17:48	18:59	18:59	19:03	19:03
R-4509	363,548	4,786,779	29:25	23:35	29:25	23:35	29:25
R-4510	358,375	4,783,472	0:00	24:27	24:27	24:31	24:31
R-4526	359,461	4,781,552	0:00	0:00	0:00	0:00	0:00
R-4527	356,982	4,781,401	8:33	6:12	8:33	6:12	8:33
R-4565	358,257	4,783,359	0:18	29:12	29:12	29:21	29:21
R-4566	362,595	4,782,635	13:32	13:32	13:32	13:32	13:32
R-4567	358,849	4,785,091	1:18	1:57	1:57	1:57	1:57
R-4568	365,751	4,786,675	17:46	1:24	17:46	1:24	17:46
R-4573	359,102	4,786,621	4:03	6:17	6:17	6:17	6:17
R-4575-P	363,145	4,787,724	53:43	53:43	53:43	53:43	53:43
R-4576	364,393	4,784,928	20:53	20:53	20:53	21:06	21:06
R-4577-P	364,623	4,786,099	99:04	44:29	99:04	44:29	99:04
R-4580	364,340	4,780,372	8:51	8:51	8:51	8:51	8:51
R-4581	364,521	4,781,854	8:29	8:29	8:29	8:29	8:29