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Shadow Flicker Impact Analysis
for the
Oliver III Wind Energy Center
Oliver and Morton Counties, North Dakota

Prepared for

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Exhibit 24 – Second Revised Shadow Flicker Analysis
Oliver Wind III, LLC

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Acronyms and Abbreviations

Oliver Wind III	Oliver Wind III, LLC
GE	General Electric
Hz	Hertz
NCDC	National Climatic Data Center
Project	Oliver III Wind Energy Center Project
rpm	rotations per minute
UTM	Universal Transverse Mercator

1.0 OVERVIEW

Oliver Wind III, LLC (Oliver Wind III), a wholly owned, indirect subsidiary of NextEra Energy Resources, LLC (NEER), is proposing to develop the Oliver III Wind Energy Center (the Project) in Morton and Oliver counties, North Dakota. The proposed Project includes up to 48 wind turbines with a maximum nameplate capacity of approximately 100 megawatts. In addition to the 48 primary turbines, up to three (3) alternate turbine locations have also been considered. Alternate locations are proposed to provide siting flexibility based on on-going environmental studies and landowner preferences. Only 48 turbines will be constructed. Tetra Tech has conducted the following shadow flicker analysis for the Project to support Oliver Wind III's application for a Certificate of Site Compatibility under the North Dakota Public Service Commission.

2.0 PROJECT COMPONENTS

The Project will consist of up to 48 wind turbines. Five (5) of the turbines (numbers 26 through 30) will be the GE 1.79-100 turbine model and the rest of turbines will be the General Electric (GE) 2.1-116 turbine model. The two wind turbine models being considered for the Project, and evaluated for potential shadow flicker impacts, have the following characteristics:

- **GE 1.79-100** – 3-blade 100-meter diameter rotor, with a hub height of 80 meters and generating capacity of 1.79 MW. The GE 1.79-100 has a normal high rotor speed of 17.5 rotations per minute (rpm) which translates to a blade pass frequency of 0.87 hertz (Hz) (less than 1 alternation per second). The Project plans to install up to 5 GE 1.79-100 turbines.

- **GE 2.1-116** – 3-blade 116-meter diameter rotor, with a hub height of 80 meters and generating capacity of 2.1 MW. The GE 2.1-116 has a normal high rotor speed of 18.5 rpm which translates to a blade pass frequency of 0.93 Hz (less than 1 alternation per second). The Project plans to install up to 43 GE 2.1-116 turbines.

3.0 SHADOW FLICKER BACKGROUND

A wind turbine's moving blades can cast a moving shadow on locations within a certain distance of a turbine. These moving shadows are called shadow flicker, and can be a temporary phenomenon experienced at nearby residences or public gathering places. The impact area depends on the time of year and day (which determine the sun's azimuth and altitude angles) and the wind turbine's physical characteristics (height, rotor diameter, blade width, and orientation of the rotor blades). Shadow flicker impact to surrounding properties generally occurs during low angle sunlight conditions, typically during sunrise and sunset times of the day. However, when the sun angle gets very low (less than 3 degrees), sunlight passes through more atmosphere and

becomes too diffused to form a coherent shadow. Shadow flicker will not occur when the sun is obscured by clouds or fog, at night, or when the source turbine(s) are not operating. In addition, shadow flicker is only an issue when at least 20 percent of the sun's disc is covered by the turbine blades.

Shadow flicker intensity is defined as the difference in brightness at a given location in the presence and absence of a shadow. Shadow flicker intensity diminishes with greater receptor-to-turbine separation distance. Shadow flicker intensity for receptor-to-turbine distances beyond 2,500 meters (8,202 feet) is very low and generally considered imperceptible. In general, increasing proximity to turbines may make shadow flicker more noticeable, with the largest number of shadow flicker hours, along with greatest shadow flicker intensity, occurring nearest the wind turbines.

Shadow flicker frequency is related to the wind turbine's rotor blade speed and the number of blades on the rotor. From a health standpoint, the low flicker frequencies associated with wind turbines, are harmless, and public concerns that flickering light from wind turbines can have negative health effects, such as triggering seizures in people with epilepsy are unfounded. Epilepsy Action (working name for the British Epilepsy Foundation) states that there is no evidence that wind turbines can cause seizures (Epilepsy Action 2008). However, they recommend that wind turbine flicker frequency be limited to 3 Hz (For comparison, strobe lights used in discotheques have frequencies which range from about 3 Hz to 10 Hz (1 Hz = 1 flash per second). Since the proposed Project's wind turbine blade pass frequency is approximately 0.87 Hz (less than 1 alternation per second), no negative health effects to individuals with photosensitive epilepsy are anticipated.

Shadow flicker impacts are not regulated in applicable state or federal law, and there is no permitting threshold with regard to hours per year of anticipated impacts to a receptor from a wind energy project. However, a widely used industry standard of 30 hours per year, has been used for this shadow flicker impact analysis.

4.0 WINDPRO SHADOW FLICKER ANALYSIS

An analysis of potential shadow flicker impacts from the Project was conducted using the WindPro software package. As described above, the Project will install up to 48 wind turbines (5 GE 1.79-100 and the rest GE 2.1-116 model turbines). While only 48 turbines will be constructed, 51 turbines have been evaluated with WindPro so that the analysis includes assessment of up to three (3) alternative turbine locations (layout dated February 4, 2016). The analysis evaluated the following two turbine layout scenarios:

- Scenario A – 48 wind turbines (primary turbines only)
- Scenario B – 51 wind turbines (primary plus alternate turbines)

The WindPro analysis was conducted to determine shadow flicker impacts under realistic impact conditions (actual expected shadow). This analysis calculated the total amount of time (hours and minutes per year) that shadow flicker could occur at receptors surrounding the Project. The realistic impact condition scenario is based on the following assumptions:

- The elevation and position geometries of the wind turbines and surrounding receptors (potentially occupied residences). Elevations were determined using U.S. Geological Survey digital elevation model data. Positions geometries were determined using geographic information system and referenced to Universal Transverse Mercator (UTM) Zone 13 (NAD83).

- The position of the sun and the incident sunlight relative to the wind turbine and receptors on a minute-by-minute basis over the course of a year.

- Historical sunshine availability (percent of total hours available). Historical sunshine rates for the area (as summarized by the National Climatic Data Center [NOAA 2014] for nearby Bismarck, North Dakota) used in this analysis are as follows:

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
54%	52%	61%	58%	64%	67%	75%	72%	67%	53%	42%	45%

- Estimated wind turbine operations and orientation (based on approximately 2.5 years of wind data (10/23/2008–4/30/2011), including wind speed/wind direction frequency distribution, measured at a meteorological tower located approximately 50 miles northeast of the Project).

- Receptor viewpoints (i.e., house windows) are assumed to always be directly facing turbine to sun line of sight ("greenhouse mode").

WindPro incorporates terrain elevation contour information and the analysis accounts for terrain elevation differences. The sun's path with respect to each turbine location is calculated by the software to determine the cast shadow paths every minute over a full year. Sun angles less than

3 degrees above the horizon were excluded, for the reasons identified earlier in this section. Since shadow flicker is only an issue when at least 20 percent of the sun disc is covered by the blades, WindPro uses blade width dimension data to calculate the maximum distance from the turbine where shadow flicker must be calculated. Beyond this distance, the turbine will not contribute to the shadow flicker impact. It should be noted however, that WindPro provides a conservative estimate of shadow flicker as obstacles such as trees, haze, and visual obstructions (window facing, coverings) are not accounted for despite the likelihood of their reducing or eliminating shadow flicker impacts to receptors.

A total of 92 structures were identified within and near the Project Area; of these, 64 were determined to be occupied residences and are considered potential shadow-flicker receptors for the purpose of this analysis. A receptor in the model is defined as a 1 meter squared area (approximate size of a typical window), 3.28 feet (1 meter) above ground level. Approximate eye level is set at 4.94 feet (1.5 meters). Figure 1 shows the locations of all identified structures and the 64 shadow flicker receptors (occupied residences), along with the 51 potential turbine locations considered.

5.0 SHADOW FLICKER ANALYSIS RESULTS

As expected, WindPro predicts that shadow flicker impacts will be greatest at locations nearer to the wind turbines. Figure 2 illustrates the WindPro predicted shadow flicker impact areas. A detailed WindPro shadow flicker analysis summary, for each of the modeled receptor location, is provided in Attachment A.

Tables 1 and 2 present the WindPro predicted shadow flicker impacts for the top ten worst case impacts for the 92 identified receptors, for the turbine scenarios A and B, respectively. The predicted shadow flicker for all 92 receptors is presented in Appendix A. Because the Project is using a minimum turbine siting setback requirement of 1,400 feet based on the Public Service Commission's policy, which is farther than the 1,320 setback from occupied residences as required by the Morton County Wind Ordinance, the most sensitive receptors are generally not located in the high potential shadow flicker impact zones. The maximum predicted shadow flicker impact at any occupied residence receptor is 56 hours and 34 minutes per year (Receptor 810021) for both Scenario A (primary turbines only) and Scenario B (primary plus alternate turbines). The highest predicted shadow flicker impacts, 56 hours and 34 minutes, is approximately 1.3 percent of the potential available daylight hours. There are only two occupied receptors with shadow flicker impacts greater than 30 hours per year. Both of these residences are owned by landowners that are participating in the Project and have granted an easement for shadow flicker effects on the property. Only one of these occupied receptors (Receptor 810021) has predicted shadow flicker impacts greater than 30 hours per year for the primary turbines only scenario (Scenario A). A second receptor (7002) also has predicted shadow flicker impacts greater than 30 hours per year when both the primary and alternate turbines (Scenario B) are considered.

Table 1. WindPro Predicted Shadow Flicker Impacts for Receptors – Scenario A (Primary Turbines Only)					
Receptor ID	Shadow Hours per Year (expected) [hh:mm / year]	Receptor Type	Assumed Receptor Occupation Status	Project Participation Status	Distance to Nearest Turbine (meters)
810614	64:59	shed	Unoccupied	Participating	425.8
810021	56:34	house	Occupied	Participating	460.0
810023	27:00	abandoned house	Unoccupied	Participating	688.5
810144	25:18	abandoned house	Unoccupied	Participating	411.7
6005	24:11	house	Occupied	Not Participating	1,006.3
30008	20:37	relay tower 93	Unoccupied	Participating	320.8
6006	18:34	house	Occupied	Participating	917.7
6004	16:26	house	Occupied	Not Participating	715.8
6014	13:10	abandoned	Unoccupied	Participating	651.4
810132	12:59	3 silo	Unoccupied	Participating	809.3

Table 2. WindPro Predicted Shadow Flicker Impacts for Receptors – Scenario B (Primary Plus Alternate Turbines)					
Receptor ID	Shadow Hours per Year (expected) [hh:mm / year]	Receptor Type	Assumed Receptor Occupation Status	Project Participation Status	Distance to Nearest Turbine (meters)
810614	71:55	shed	Unoccupied	Participating	425.8
810021	56:34	house	Occupied	Participating	460.0
7002	32:43	house	Occupied	Participating	607.3
810023	27:00	abandoned	Unoccupied	Participating	688.5
810144	25:18	abandoned	Unoccupied	Participating	411.7
6005	24:11	house	Occupied	Not Participating	1,006.3
30008	20:37	relay tower	Unoccupied	Participating	320.8
6006	18:34	house	Occupied	Participating	917.7
6004	16:26	house	Occupied	Not Participating	715.8
7004	15:14	trailer	Unoccupied	Participating	482.4

The shadow flicker impact prediction statistics are summarized in Tables 3 and 4 below.

Table 3. Statistical Summary of WindPro Predicted Shadow Flicker Impacts at Modeled Receptor Locations – Scenario A (Primary Turbines Only)

Cumulative Shadow Flicker Time (expected)	Number of Receptors
Total	92
= 0 Hours	68
> 0 Hours < 10 Hours	13
≥ 10 Hours < 20 Hours	5
≥ 20 Hours < 30 Hours	4
≥ 30 Hours	2

Table 4. Statistical Summary of WindPro Predicted Shadow Flicker Impacts at Modeled Receptor Locations – Scenario B (Primary Plus Alternate Turbines)

Cumulative Shadow Flicker Time (expected)	Number of Receptors
Total	92
= 0 Hours	68
> 0 Hours < 10 Hours	12
≥ 10 Hours < 20 Hours	5
≥ 20 Hours < 30 Hours	4
≥ 30 Hours	3

6.0 CONCLUSION

The analysis of potential shadow flicker impacts from the Project on nearby receptors shows that shadow flicker impacts within the area of study are expected to be minor and well within acceptable ranges for avoiding nuisance conditions. Predicted shadow flicker impacts are less than the industry standard of 30 hours per year for all occupied residential receptors except two where the landowners have signed waivers granting easement for shadow flicker impacts on their property. Shadow flicker is not expected to be a significant environmental impact.

The analysis was deliberately conservative and actual shadow flicker is expected to occur for less than the modeled durations. The analysis assumes that the receptors all have a direct in-line view of the incoming shadow flicker sunlight and does not account for trees or other obstructions which may block sunlight. In reality, the windows of many houses will not face the sun directly for the key shadow flicker impact times. Adding to the analysis' conservatism, both the primary and alternate turbines were modeled cumulatively. Oliver Wind III will only construct up to 48 turbines, which is fewer wind turbines than were included in the Scenario B modeled results.

7.0 REFERENCES

Epilepsy Action. 2008. Information Web Page on Photosensitive Epilepsy. British Epilepsy Association. http://www.epilepsy.org.uk/info/photo_other.html. Accessed November 2015.

National Oceanic and Atmospheric Administration (NOAA). 2014. Comparative Climatic Data for the United States Through 2014.

Attachment A:
Detailed Summary of WindPro Shadow Flicker Analysis Results

Detailed Summary of WindPro Shadow Flicker Analysis Results Scenario A

Oliver III Receptor ID	UTM-E (m)	UTM-N (m)	WindPro Predicted Expected Shadow Flicker (Hours per Year)	Receptor Status	Project Participation Status	Distance to Nearest Turbine (m)
107	328,318	5,199,223	0:00:00	Occupied	Not Participating	4,087.2
111	332,294	5,197,910	0:00:00	Occupied	Not Participating	3,568.9
113	333,315	5,198,704	0:00:00	Occupied	Participating	2,691.7
117	334,380	5,197,276	0:00:00	Unoccupied	Not Participating	3,185.7
120	339,638	5,195,765	0:00:00	Unoccupied	Not Participating	2,132.1
123	340,219	5,195,497	0:00:00	Unoccupied	Not Participating	2,316.9
125	342,224	5,195,776	0:00:00	Unoccupied	Not Participating	2,733.0
130	342,338	5,201,598	0:00:00	Occupied	Not Participating	3,655.9
131	342,481	5,201,792	0:00:00	Occupied	Not Participating	3,856.3
134	342,502	5,201,888	0:00:00	Occupied	Not Participating	3,911.8
138	342,586	5,201,880	0:00:00	Occupied	Not Participating	3,986.3
170	327,196	5,203,001	0:00:00	Unoccupied	Not Participating	2,396.6
172	326,573	5,203,121	0:00:00	Occupied	Not Participating	2,931.2
173	326,614	5,203,107	0:00:00	Unoccupied	Not Participating	2,897.4
175	336,480	5,210,588	0:00:00	Occupied	Not Participating	4,752.5
5013	331,662	5,210,195	0:00:00	Occupied	Not Participating	4,984.8
5015	335,015	5,210,254	0:00:00	Occupied	Not Participating	4,698.5
5016	335,270	5,210,159	0:00:00	Occupied	Not Participating	4,526.4
5017	335,141	5,210,664	0:00:00	Occupied	Not Participating	5,046.7
5018	334,958	5,209,903	0:00:00	Occupied	Not Participating	4,390.6
5020	334,149	5,206,673	0:00:00	Occupied	Not Participating	2,606.4
5021	334,144	5,206,664	0:00:00	Occupied	Not Participating	2,608.2
5026	331,919	5,207,710	0:00:00	Occupied	Not Participating	2,505.1
6002	335,368	5,206,778	1:39:00	Unoccupied	Participating	1,563.6
6003	335,435	5,204,641	8:04:00	Unoccupied	Not Participating	1,135.1
6004	334,582	5,203,847	16:26:00	Occupied	Not Participating	715.8
6005	335,894	5,202,102	24:11:00	Occupied	Not Participating	1,006.3
6006	335,875	5,202,206	18:34:00	Occupied	Participating	917.7
6008	338,714	5,201,739	6:31:00	Occupied	Participating	1,178.5
6009	338,753	5,201,759	5:02:00	Unoccupied	Participating	1,183.6
6010	335,722	5,198,836	0:00:00	Occupied	Participating	1,190.8
6011	336,821	5,199,125	7:12:00	Occupied	Participating	849.0
6012	335,789	5,197,882	0:00:00	Unoccupied	Not Participating	2,110.9
6013	336,785	5,196,966	0:02:00	Occupied	Not Participating	1,329.4
6014	337,857	5,198,463	13:10:00	Unoccupied	Participating	651.4
7002	339,472	5,200,083	11:40:00	Occupied	Participating	607.3
7004	339,106	5,200,837	4:10:00	Unoccupied	Participating	482.4
7007	338,286	5,203,461	3:49:00	Occupied	Not Participating	767.2

Oliver III Receptor ID	UTM-E (m)	UTM-N (m)	WindPro Predicted Expected Shadow Flicker (Hours per Year)	Receptor Status	Project Participation Status	Distance to Nearest Turbine (m)
7010	338,391	5,204,385	0:00:00	Occupied	Not Participating	1,691.1
7016	337,949	5,204,464	5:49:00	Occupied	Not Participating	1,360.9
7020	341,032	5,200,597	0:00:00	Occupied	Not Participating	2,160.2
7023	342,191	5,197,153	0:00:00	Occupied	Not Participating	1,910.9
7027	342,126	5,197,130	0:00:00	Occupied	Not Participating	1,858.6
7029	341,907	5,197,106	3:34:00	Occupied	Not Participating	1,667.0
30008	337,240	5,201,768	20:37:00	Unoccupied	Participating	320.8
500009	336,405	5,207,685	0:00:00	Occupied	Participating	1,859.1
500013	330,397	5,207,060	0:00:00	Unoccupied	Not Participating	1,916.0
500015	329,972	5,208,020	0:00:00	Occupied	Not Participating	2,954.4
500016	330,022	5,206,923	0:00:00	Unoccupied	Not Participating	1,910.6
500023	328,917	5,203,693	5:56:00	Unoccupied	Participating	556.7
500034	337,954	5,210,133	0:00:00	Occupied	Not Participating	4,497.8
500038	337,720	5,211,843	0:00:00	Occupied	Not Participating	6,105.3
500042	335,296	5,211,142	0:00:00	Occupied	Not Participating	5,466.2
500046	335,293	5,211,109	0:00:00	Occupied	Not Participating	5,435.5
500048	335,435	5,209,595	0:00:00	Occupied	Not Participating	3,938.6
810006	339,698	5,209,012	0:00:00	Occupied	Not Participating	4,423.2
810009	336,106	5,208,385	0:00:00	Unoccupied	Not Participating	2,598.6
810013	336,115	5,209,049	0:00:00	Occupied	Participating	3,250.5
810021	331,249	5,204,371	56:34:00	Occupied	Participating	460.0
810023	330,451	5,204,493	27:00:00	Unoccupied	Participating	688.5
810029	330,511	5,205,949	2:01:00	Unoccupied	Not Participating	821.8
810036	341,396	5,194,840	0:00:00	Occupied	Not Participating	3,130.8
810040	340,215	5,195,314	0:00:00	Occupied	Not Participating	2,499.5
810043	338,198	5,195,469	0:00:00	Occupied	Not Participating	1,763.4
810044	338,224	5,195,477	0:00:00	Occupied	Not Participating	1,757.4
810048	337,653	5,195,304	0:00:00	Occupied	Not Participating	1,973.9
810051	337,439	5,194,605	0:00:00	Occupied	Not Participating	2,703.2
810054	337,303	5,194,404	0:00:00	Occupied	Not Participating	2,932.5
810058	337,338	5,196,332	0:00:00	Occupied	Not Participating	1,168.7
810063	337,149	5,195,323	0:00:00	Occupied	Not Participating	2,125.0
810068	336,713	5,195,341	0:00:00	Occupied	Not Participating	2,335.6
810070	336,646	5,195,342	0:00:00	Occupied	Not Participating	2,375.0
810074	336,623	5,195,344	0:00:00	Occupied	Not Participating	2,387.6
810079	336,099	5,195,320	0:00:00	Occupied	Not Participating	2,756.9
810083	335,553	5,195,486	0:00:00	Occupied	Not Participating	3,076.8
810087	335,690	5,195,807	0:00:00	Occupied	Not Participating	2,787.8

Oliver III Receptor ID	UTM-E (m)	UTM-N (m)	WindPro Predicted Expected Shadow Flicker (Hours per Year)	Receptor Status	Project Participation Status	Distance to Nearest Turbine (m)
810094	335,659	5,196,501	0:00:00	Occupied	Not Participating	2,535.4
810101	333,216	5,199,405	0:00:00	Occupied	Not Participating	1,985.2
810102	333,166	5,199,373	0:00:00	Occupied	Not Participating	2,014.9
810109	332,567	5,199,511	0:00:00	Occupied	Not Participating	1,950.0
810110	332,347	5,200,690	1:53:00	Unoccupied	Not Participating	1,024.7
810116	336,094	5,195,437	0:00:00	Occupied	Not Participating	2,680.9
810118	327,470	5,200,229	0:00:00	Occupied	Not Participating	3,684.4
810126	329,809	5,200,210	0:00:00	Unoccupied	Not Participating	2,332.1
810132	338,217	5,201,930	12:59:00	Unoccupied	Participating	809.3
810144	337,177	5,202,967	25:18:00	Unoccupied	Participating	411.7
810242	340,658	5,196,713	0:00:00	Occupied	Not Participating	1,125.1
810365	329,428	5,201,283	0:00:00	Unoccupied	Participating	1,771.0
810366	329,219	5,201,020	0:00:00	Unoccupied	Participating	2,084.8
810614	338,133	5,200,625	64:59:00	Unoccupied	Participating	425.8
810628	338,043	5,195,338	0:00:00	Unoccupied	Not Participating	1,891.5
810634	327,032	5,203,541	0:00:00	Unoccupied	Not Participating	2,378.9

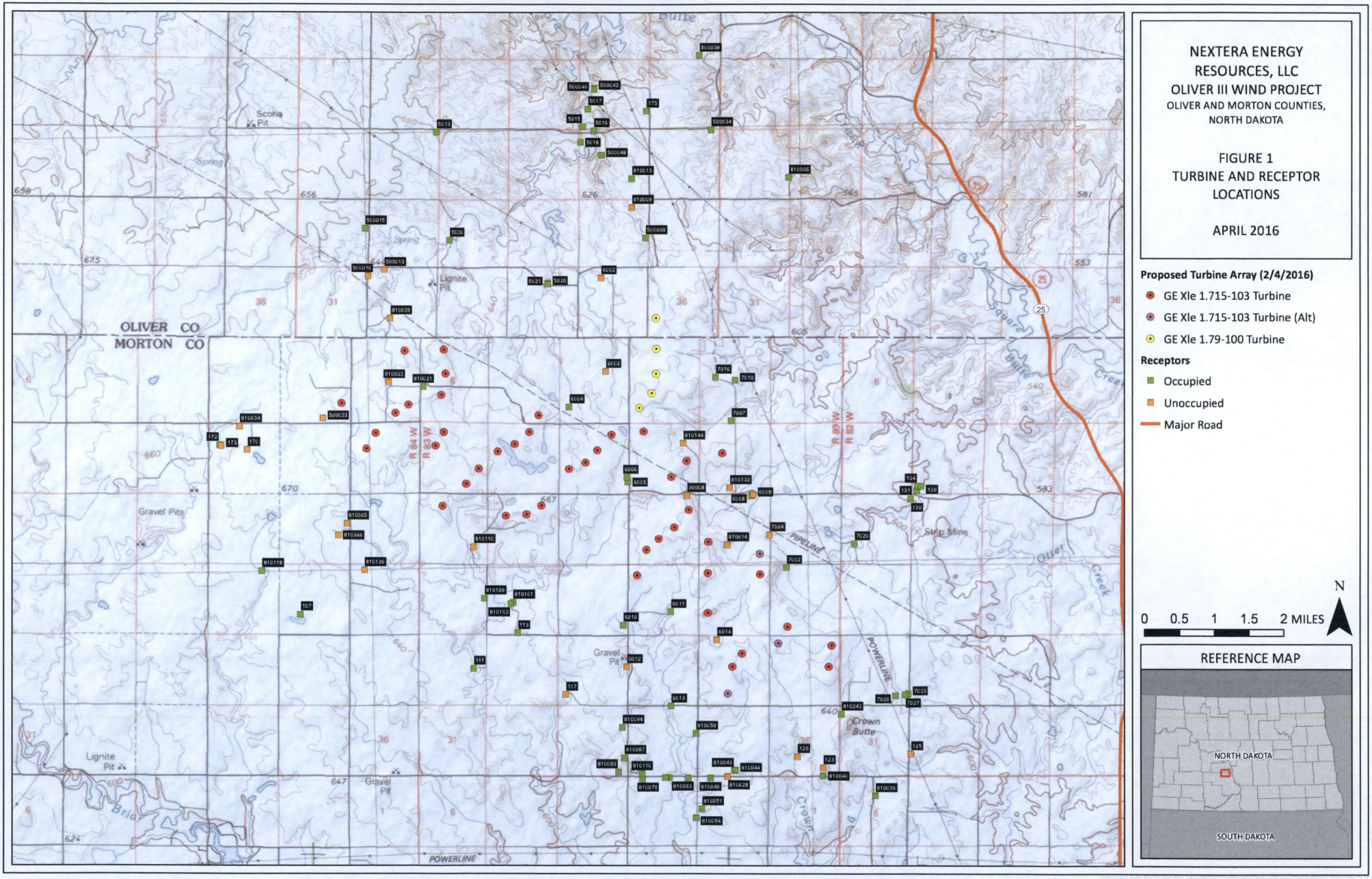
Detailed Summary of WindPro Shadow Flicker Analysis Results- Scenario B

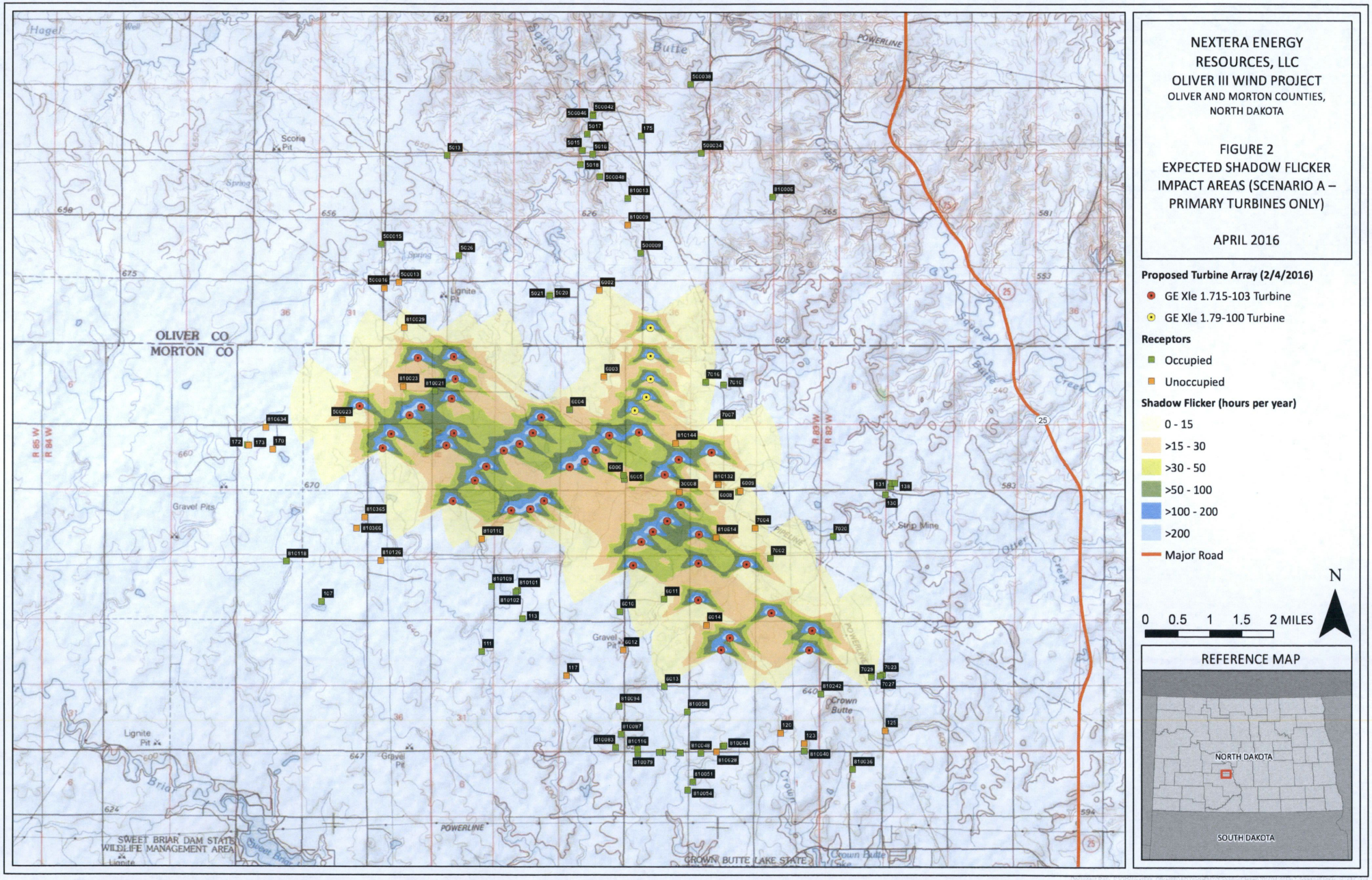
Oliver III Receptor ID	UTM-E (m)	UTM-N (m)	WindPro Predicted Expected Shadow Flicker (Hours per Year)	Receptor Status	Project Participation Status	Distance to Nearest Turbine (m)
107	328,318	5,199,223	0:00:00	Occupied	Not Participating	4,087.2
111	332,294	5,197,910	0:00:00	Occupied	Not Participating	3,568.9
113	333,315	5,198,704	0:00:00	Occupied	Participating	2,691.7
117	334,380	5,197,276	0:00:00	Unoccupied	Not Participating	3,185.7
120	339,638	5,195,765	0:00:00	Unoccupied	Not Participating	2,132.1
123	340,219	5,195,497	0:00:00	Unoccupied	Not Participating	2,316.9
125	342,224	5,195,776	0:00:00	Unoccupied	Not Participating	2,733.0
130	342,338	5,201,598	0:00:00	Occupied	Not Participating	3,655.9
131	342,481	5,201,792	0:00:00	Occupied	Not Participating	3,856.3
134	342,502	5,201,888	0:00:00	Occupied	Not Participating	3,911.8
138	342,586	5,201,880	0:00:00	Occupied	Not Participating	3,986.3
170	327,196	5,203,001	0:00:00	Unoccupied	Not Participating	2,396.6
172	326,573	5,203,121	0:00:00	Occupied	Not Participating	2,931.2
173	326,614	5,203,107	0:00:00	Unoccupied	Not Participating	2,897.4
175	336,480	5,210,588	0:00:00	Occupied	Not Participating	4,752.5
5013	331,662	5,210,195	0:00:00	Occupied	Not Participating	4,984.8
5015	335,015	5,210,254	0:00:00	Occupied	Not Participating	4,698.5
5016	335,270	5,210,159	0:00:00	Occupied	Not Participating	4,526.4
5017	335,141	5,210,664	0:00:00	Occupied	Not Participating	5,046.7
5018	334,958	5,209,903	0:00:00	Occupied	Not Participating	4,390.6
5020	334,149	5,206,673	0:00:00	Occupied	Not Participating	2,606.4
5021	334,144	5,206,664	0:00:00	Occupied	Not Participating	2,608.2
5026	331,919	5,207,710	0:00:00	Occupied	Not Participating	2,505.1
6002	335,368	5,206,778	1:39:00	Unoccupied	Participating	1,563.6
6003	335,435	5,204,641	8:04:00	Unoccupied	Not Participating	1,135.1
6004	334,582	5,203,847	16:26:00	Occupied	Not Participating	715.8
6005	335,894	5,202,102	24:11:00	Occupied	Not Participating	1,006.3
6006	335,875	5,202,206	18:34:00	Occupied	Participating	917.7
6008	338,714	5,201,739	6:31:00	Occupied	Participating	1,178.5
6009	338,753	5,201,759	5:02:00	Unoccupied	Participating	1,183.6
6010	335,722	5,198,836	0:00:00	Occupied	Participating	1,190.8
6011	336,821	5,199,125	7:12:00	Occupied	Participating	849.0
6012	335,789	5,197,882	0:00:00	Unoccupied	Not Participating	2,110.9
6013	336,785	5,196,966	2:56:00	Occupied	Not Participating	1,329.4
6014	337,857	5,198,463	15:01:00	Unoccupied	Participating	651.4
7002	339,472	5,200,083	32:43:00	Occupied	Participating	607.3
7004	339,106	5,200,837	15:14:00	Unoccupied	Participating	482.4
7007	338,286	5,203,461	3:49:00	Occupied	Not Participating	767.2

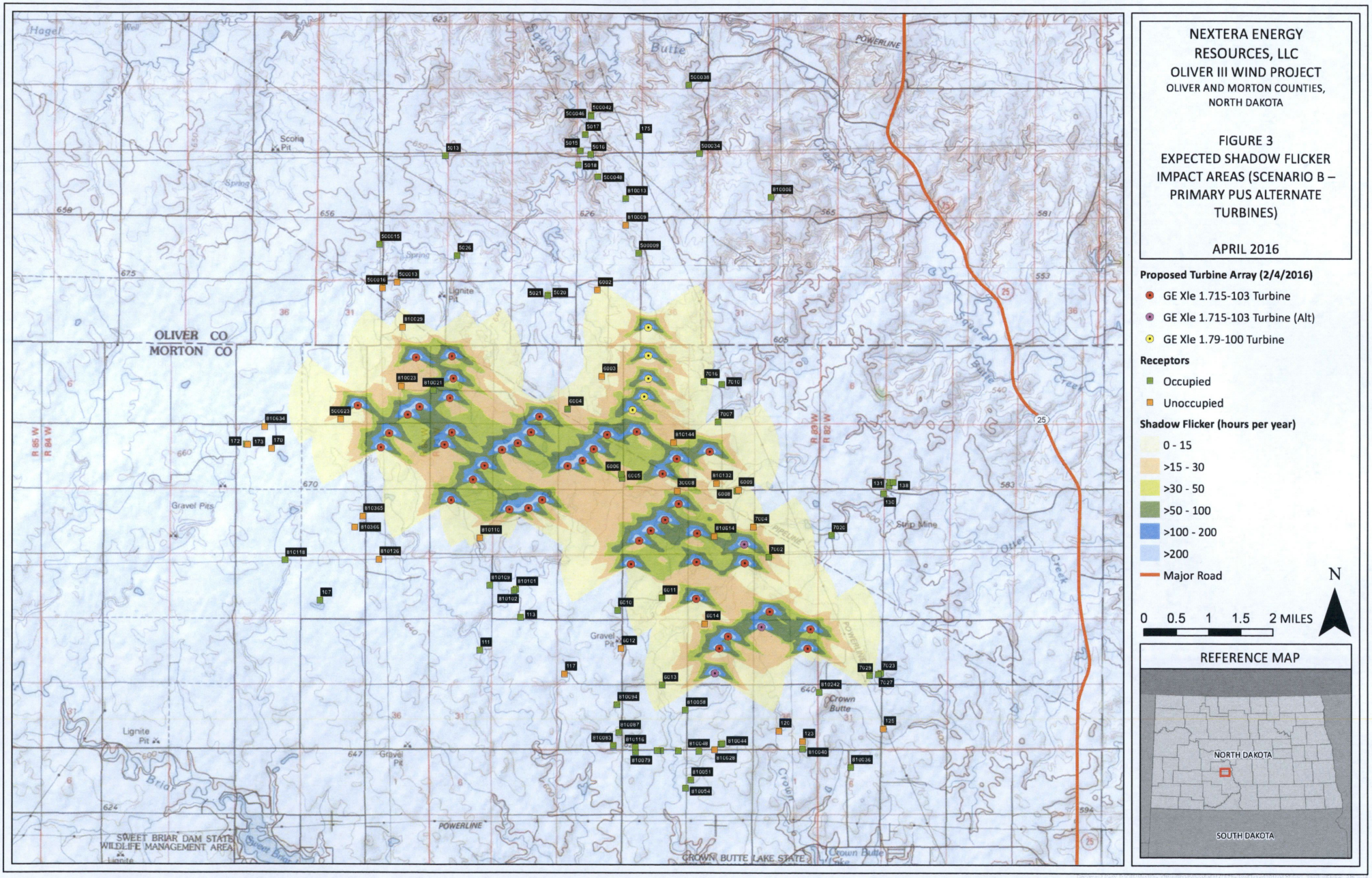
Oliver III Receptor ID	UTM-E (m)	UTM-N (m)	WindPro Predicted Expected Shadow Flicker (Hours per Year)	Receptor Status	Project Participation Status	Distance to Nearest Turbine (m)
7010	338,391	5,204,385	0:00:00	Occupied	Not Participating	1,691.1
7016	337,949	5,204,464	5:49:00	Occupied	Not Participating	1,360.9
7020	341,032	5,200,597	0:00:00	Occupied	Not Participating	2,160.2
7023	342,191	5,197,153	0:00:00	Occupied	Not Participating	1,910.9
7027	342,126	5,197,130	0:00:00	Occupied	Not Participating	1,858.6
7029	341,907	5,197,106	3:34:00	Occupied	Not Participating	1,667.0
30008	337,240	5,201,768	20:37:00	Unoccupied	Participating	320.8
500009	336,405	5,207,685	0:00:00	Occupied	Participating	1,859.1
500013	330,397	5,207,060	0:00:00	Unoccupied	Not Participating	1,916.0
500015	329,972	5,208,020	0:00:00	Occupied	Not Participating	2,954.4
500016	330,022	5,206,923	0:00:00	Unoccupied	Not Participating	1,910.6
500023	328,917	5,203,693	5:56:00	Unoccupied	Participating	556.7
500034	337,954	5,210,133	0:00:00	Occupied	Not Participating	4,497.8
500038	337,720	5,211,843	0:00:00	Occupied	Not Participating	6,105.3
500042	335,296	5,211,142	0:00:00	Occupied	Not Participating	5,466.2
500046	335,293	5,211,109	0:00:00	Occupied	Not Participating	5,435.5
500048	335,435	5,209,595	0:00:00	Occupied	Not Participating	3,938.6
810006	339,698	5,209,012	0:00:00	Occupied	Not Participating	4,423.2
810009	336,106	5,208,385	0:00:00	Unoccupied	Not Participating	2,598.6
810013	336,115	5,209,049	0:00:00	Occupied	Participating	3,250.5
810021	331,249	5,204,371	56:34:00	Occupied	Participating	460.0
810023	330,451	5,204,493	27:00:00	Unoccupied	Participating	688.5
810029	330,511	5,205,949	2:01:00	Unoccupied	Not Participating	821.8
810036	341,396	5,194,840	0:00:00	Occupied	Not Participating	3,130.8
810040	340,215	5,195,314	0:00:00	Occupied	Not Participating	2,499.5
810043	338,198	5,195,469	0:00:00	Occupied	Not Participating	1,763.4
810044	338,224	5,195,477	0:00:00	Occupied	Not Participating	1,757.4
810048	337,653	5,195,304	0:00:00	Occupied	Not Participating	1,973.9
810051	337,439	5,194,605	0:00:00	Occupied	Not Participating	2,703.2
810054	337,303	5,194,404	0:00:00	Occupied	Not Participating	2,932.5
810058	337,338	5,196,332	0:00:00	Occupied	Not Participating	1,168.7
810063	337,149	5,195,323	0:00:00	Occupied	Not Participating	2,125.0
810068	336,713	5,195,341	0:00:00	Occupied	Not Participating	2,335.6
810070	336,646	5,195,342	0:00:00	Occupied	Not Participating	2,375.0
810074	336,623	5,195,344	0:00:00	Occupied	Not Participating	2,387.6
810079	336,099	5,195,320	0:00:00	Occupied	Not Participating	2,756.9
810083	335,553	5,195,486	0:00:00	Occupied	Not Participating	3,076.8
810087	335,690	5,195,807	0:00:00	Occupied	Not Participating	2,787.8

Oliver III Receptor ID	UTM-E (m)	UTM-N (m)	WindPro Predicted Expected Shadow Flicker (Hours per Year)	Receptor Status	Project Participation Status	Distance to Nearest Turbine (m)
810094	335,659	5,196,501	0:00:00	Occupied	Not Participating	2,535.4
810101	333,216	5,199,405	0:00:00	Occupied	Not Participating	1,985.2
810102	333,166	5,199,373	0:00:00	Occupied	Not Participating	2,014.9
810109	332,567	5,199,511	0:00:00	Occupied	Not Participating	1,950.0
810110	332,347	5,200,690	1:53:00	Unoccupied	Not Participating	1,024.7
810116	336,094	5,195,437	0:00:00	Occupied	Not Participating	2,680.9
810118	327,470	5,200,229	0:00:00	Occupied	Not Participating	3,684.4
810126	329,809	5,200,210	0:00:00	Unoccupied	Not Participating	2,332.1
810132	338,217	5,201,930	12:59:00	Unoccupied	Participating	809.3
810144	337,177	5,202,967	25:18:00	Unoccupied	Participating	411.7
810242	340,658	5,196,713	0:00:00	Occupied	Not Participating	1,125.1
810365	329,428	5,201,283	0:00:00	Unoccupied	Participating	1,771.0
810366	329,219	5,201,020	0:00:00	Unoccupied	Participating	2,084.8
810614	338,133	5,200,625	71:55:00	Unoccupied	Participating	425.8
810628	338,043	5,195,338	0:00:00	Unoccupied	Not Participating	1,891.5
810634	327,032	5,203,541	0:00:00	Unoccupied	Not Participating	2,378.9

Attachment B:
Figures


NEXTERA ENERGY RESOURCES, LLC
OLIVER III WIND PROJECT
OLIVER AND MORTON COUNTIES, NORTH DAKOTA
FIGURE 1
TURBINE AND RECEPTOR LOCATIONS
APRIL 2016
Proposed Turbine Array (2/4/2016)
GE Xle 1.715-103 Turbine
GE Xle 1.715-103 Turbine (Alt)
GE Xle 1.79-100 Turbine
Receptors
Occupied
Unoccupied
Major Road
N
0 0.5 1 1.5 2 MILES
REFERENCE MAP
NORTH DAKOTA
SOUTH DAKOTA
OLIVER CO
MORTON CO
Scoria Pit
Lignite Pit
Gravel Pits
Gravel Pit
Strip Mine
Crown Butte
POWERLINE
PIPELINE
Square Butte Creek
Otter Creek
Spring
Brid
Crown
R 84 W
R 83 W
R 82 W


NEXTERA ENERGY RESOURCES, LLC
OLIVER III WIND PROJECT
OLIVER AND MORTON COUNTIES, NORTH DAKOTA
FIGURE 2
EXPECTED SHADOW FLICKER IMPACT AREAS (SCENARIO A – PRIMARY TURBINES ONLY)
APRIL 2016
Proposed Turbine Array (2/4/2016)
GE Xle 1.715-103 Turbine
GE Xle 1.79-100 Turbine
Receptors
Occupied
Unoccupied
Shadow Flicker (hours per year)
0 - 15
>15 - 30
>30 - 50
>50 - 100
>100 - 200
>200
Major Road
N
0 0.5 1 1.5 2 MILES
REFERENCE MAP
NORTH DAKOTA
SOUTH DAKOTA
OLIVER CO
MORTON CO
POWERLINE
SWEET BRIAR DAM STATE WILDLIFE MANAGEMENT AREA
CROWN BUTTE LAKE STATE
Gravel Pits
Lignite Pit
Scoria Pit
Strip Mine
Crown Butte
Butte
Square Butte Creek
Otter Creek
R 85 W
R 84 W
R 83 W
R 82 W


NEXTERA ENERGY RESOURCES, LLC
OLIVER III WIND PROJECT
OLIVER AND MORTON COUNTIES, NORTH DAKOTA
FIGURE 3
EXPECTED SHADOW FLICKER IMPACT AREAS (SCENARIO B – PRIMARY PUS ALTERNATE TURBINES)
APRIL 2016
Proposed Turbine Array (2/4/2016)
GE Xle 1.715-103 Turbine
GE Xle 1.715-103 Turbine (Alt)
GE Xle 1.79-100 Turbine
Receptors
Occupied
Unoccupied
Shadow Flicker (hours per year)
0 - 15
>15 - 30
>30 - 50
>50 - 100
>100 - 200
>200
Major Road
N
0 0.5 1 1.5 2 MILES
REFERENCE MAP
NORTH DAKOTA
SOUTH DAKOTA
OLIVER CO
MORTON CO
POWERLINE
Scoria Pit
Lignite Pit
Gravel Pits
Gravel Pit
Strip Mine
Crown Butte
SWEET BRIAR DAM STATE WILDLIFE MANAGEMENT AREA
CROWN BUTTE LAKE STATE