

7.0 CONCLUSIONS

A sound level modeling assessment was conducted for the Swan Lake Wind Project that is proposed within Yankton and Turner Counties, South Dakota. This assessment is specific to Yankton County. The Project will consist of up to 97 wind turbines across Yankton and Turner Counties. The sound model included nine (9) alternate wind turbine locations, totaling 106 wind turbines in the model. Thirty-seven (37) of the modeled wind turbines are within Yankton County. The Project is anticipated to be composed of GE 2.82-127 LNTE wind turbines at a hub height of 89 meters. The model included 63 wind turbines in a noise reduced operation, of which 22 are within Yankton County. A collector substation was also included in the sound model.

Project-only sound levels were modeled at property lines in the vicinity of the Project to evaluate compliance with the Yankton County Zoning Ordinance and at residences to evaluate sound level criteria set forth by NextEra Energy Resources.

The predicted worst-case sound levels from the Swan Lake Wind Project at non-participating parcel boundaries are below the applied Yankton County sound limit of 60 dBA.

The highest predicted worst-case L_{eq} sound level at a participating home in Yankton County is 45 dBA at receptors #92 and 418. The highest predicted worst-case L_{eq} sound level at a non-participating home in Yankton County is 45 dBA at receptors #451, 439, and 283. Therefore, all participating residences are at or below the 50 dBA NEER threshold and all non-participating residences are at or below the 45 dBA NEER threshold.

Therefore, the Project complies with the Yankton County ordinance and meets the requirements set forth by NEER under the modeled operation scenario.

Appendix A

Project Wind Turbine Coordinates

Table A-1: Wind Turbine Array 20240718 with Operation Details

Wind Turbine ID	Wind Turbine Type	Operation	Hub Height (m)	Coordinates NAD 1983 UTM Zone 14N	
				X (m)	Y (m)
1	GE 2.82-127 LNTE	NRO	89	632581.02	4792422.31
2	GE 2.82-127 LNTE	Normal Operation	89	632997.25	4792383.08
3	GE 2.82-127 LNTE	Normal Operation	89	633420.34	4792385.15
4	GE 2.82-127 LNTE	Normal Operation	89	630932.15	4791198.35
5	GE 2.82-127 LNTE	NRO	89	632601.17	4791576.58
6	GE 2.82-127 LNTE	NRO	89	632232.61	4789541.85
7	GE 2.82-127 LNTE	Normal Operation	89	632636.32	4790213.14
8	GE 2.82-127 LNTE	NRO	89	633018.06	4790286.32
9	GE 2.82-127 LNTE	NRO	89	633441.05	4790348.83
10	GE 2.82-127 LNTE	NRO	89	633817.95	4790788.82
11	GE 2.82-127 LNTE	NRO	89	635760.43	4789626.99
12	GE 2.82-127 LNTE	NRO	89	631861.55	4788400.86
13	GE 2.82-127 LNTE	NRO	89	632282.70	4788387.21
14	GE 2.82-127 LNTE	Normal Operation	89	637502.75	4788479.60
15	GE 2.82-127 LNTE	Normal Operation	89	637876.90	4788590.95
16	GE 2.82-127 LNTE	Normal Operation	89	632710.55	4786762.84
17	GE 2.82-127 LNTE	NRO	89	632235.18	4786354.56
18	GE 2.82-127 LNTE	Normal Operation	89	632704.93	4786201.96
19	GE 2.82-127 LNTE	Normal Operation	89	633090.14	4786288.19
20	GE 2.82-127 LNTE	NRO	89	633520.87	4786371.61
21	GE 2.82-127 LNTE	Normal Operation	89	635507.28	4787211.16
22	GE 2.82-127 LNTE	Normal Operation	89	635908.32	4787243.71
23	GE 2.82-127 LNTE	NRO	89	637941.92	4787063.62
24	GE 2.82-127 LNTE	NRO	89	638587.71	4787269.91
25	GE 2.82-127 LNTE	Normal Operation	89	639037.56	4787267.20
26	GE 2.82-127 LNTE	NRO	89	639443.85	4787288.77
27	GE 2.82-127 LNTE	Normal Operation	89	640875.19	4786471.76
28	GE 2.82-127 LNTE	Normal Operation	89	642293.35	4786251.18
29	GE 2.82-127 LNTE	NRO	89	631967.09	4785132.03
30	GE 2.82-127 LNTE	NRO	89	632368.16	4785147.53
31	GE 2.82-127 LNTE	NRO	89	632752.13	4785244.07
32	GE 2.82-127 LNTE	NRO	89	633065.03	4785475.28
33	GE 2.82-127 LNTE	NRO	89	634384.20	4784787.03
34	GE 2.82-127 LNTE	NRO	89	635499.63	4786107.12
35	GE 2.82-127 LNTE	NRO	89	636144.00	4785240.54
36	GE 2.82-127 LNTE	Normal Operation	89	636379.33	4784569.58
37	GE 2.82-127 LNTE	Normal Operation	89	636800.42	4784526.87
38	GE 2.82-127 LNTE	NRO	89	637210.81	4784555.10
39	GE 2.82-127 LNTE	NRO	89	638002.25	4784683.77
40	GE 2.82-127 LNTE	NRO	89	638493.25	4784819.39
41	GE 2.82-127 LNTE	NRO	89	639076.36	4784549.06
42	GE 2.82-127 LNTE	NRO	89	639468.03	4784941.31
43	GE 2.82-127 LNTE	NRO	89	639609.91	4785391.80
44	GE 2.82-127 LNTE	NRO	89	640010.22	4785491.05
45	GE 2.82-127 LNTE	NRO	89	636000.43	4783889.12
46	GE 2.82-127 LNTE	NRO	89	636404.54	4783941.07
47	GE 2.82-127 LNTE	NRO	89	639304.23	4783204.57
48	GE 2.82-127 LNTE	Normal Operation	89	639343.08	4783825.76
49	GE 2.82-127 LNTE	NRO	89	641594.04	4783826.32
50	GE 2.82-127 LNTE	Normal Operation	89	644079.03	4783491.93
51	GE 2.82-127 LNTE	Normal Operation	89	645552.58	4783552.59
52	GE 2.82-127 LNTE	NRO	89	645911.63	4783731.97
53	GE 2.82-127 LNTE	NRO	89	634054.74	4781346.29
54	GE 2.82-127 LNTE	NRO	89	635480.30	4781511.91

Table A-1: Wind Turbine Array 20240718 with Operation Details

Wind Turbine ID	Wind Turbine Type	Operation	Hub Height (m)	Coordinates NAD 1983 UTM Zone 14N	
				X (m)	Y (m)
55	GE 2.82-127 LNTE	Normal Operation	89	637243.89	4781603.36
56	GE 2.82-127 LNTE	NRC	89	639265.07	4782106.59
57	GE 2.82-127 LNTE	NRC	89	641208.86	4781585.99
58	GE 2.82-127 LNTE	Normal Operation	89	641217.88	4782164.00
59	GE 2.82-127 LNTE	Normal Operation	89	645507.73	4782209.72
60	GE 2.82-127 LNTE	NRC	89	646484.15	4781843.65
61	GE 2.82-127 LNTE	NRC	89	633761.20	4780622.77
62	GE 2.82-127 LNTE	NRC	89	634911.63	4779957.92
63	GE 2.82-127 LNTE	Normal Operation	89	636306.04	4780390.22
64	GE 2.82-127 LNTE	NRC	89	637727.70	4780438.59
65	GE 2.82-127 LNTE	NRC	89	638137.62	4780437.15
66	GE 2.82-127 LNTE	NRC	89	638533.14	4779879.23
67	GE 2.82-127 LNTE	NRC	89	638928.44	4779943.23
68	GE 2.82-127 LNTE	Normal Operation	89	639373.10	4779894.71
69	GE 2.82-127 LNTE	Normal Operation	89	639699.85	4780572.33
70	GE 2.82-127 LNTE	NRC	89	640381.78	4779751.75
71	GE 2.82-127 LNTE	Normal Operation	89	634584.92	4777989.14
72	GE 2.82-127 LNTE	Normal Operation	89	634889.22	4778282.44
73	GE 2.82-127 LNTE	NRC	89	637736.63	4778432.45
74	GE 2.82-127 LNTE	Normal Operation	89	640246.60	4778259.89
75	GE 2.82-127 LNTE	NRC	89	640519.30	4778585.58
76	GE 2.82-127 LNTE	NRC	89	637780.27	4777600.33
77	GE 2.82-127 LNTE	NRC	89	638984.49	4777320.48
78	GE 2.82-127 LNTE	NRC	89	641864.14	4776573.01
79	GE 2.82-127 LNTE	Normal Operation	89	642203.22	4776853.84
80	GE 2.82-127 LNTE	Normal Operation	89	642688.61	4776954.68
81	GE 2.82-127 LNTE	NRC	89	634195.39	4773446.05
82	GE 2.82-127 LNTE	NRC	89	634911.31	4773507.14
83	GE 2.82-127 LNTE	Normal Operation	89	635527.44	4774327.11
84	GE 2.82-127 LNTE	Normal Operation	89	635827.02	4774764.82
85	GE 2.82-127 LNTE	NRC	89	637078.38	4775686.31
86	GE 2.82-127 LNTE	Normal Operation	89	638750.39	4775190.46
87	GE 2.82-127 LNTE	NRC	89	639021.38	4775925.58
88	GE 2.82-127 LNTE	Normal Operation	89	639594.22	4775794.01
89	GE 2.82-127 LNTE	NRC	89	642204.34	4775943.99
90	GE 2.82-127 LNTE	NRC	89	643913.50	4774539.88
91	GE 2.82-127 LNTE	NRC	89	639798.25	4773647.79
92	GE 2.82-127 LNTE	NRC	89	640539.29	4772651.54
93	GE 2.82-127 LNTE	Normal Operation	89	640549.99	4772077.99
94	GE 2.82-127 LNTE	NRC	89	641320.82	4772091.27
95	GE 2.82-127 LNTE	NRC	89	642657.37	4772890.81
96	GE 2.82-127 LNTE	Normal Operation	89	643094.88	4772737.68
97	GE 2.82-127 LNTE	Normal Operation	89	644592.03	4772162.15
Alt1	GE 2.82-127 LNTE	NRC	89	630138.44	4793174.10
Alt2	GE 2.82-127 LNTE	NRC	89	635831.80	4790150.35
Alt3	GE 2.82-127 LNTE	NRC	89	632401.94	4781384.68
Alt4	GE 2.82-127 LNTE	Normal Operation	89	630444.42	4791868.64
Alt5	GE 2.82-127 LNTE	Normal Operation	89	630052.51	4791681.77
Alt6	GE 2.82-127 LNTE	Normal Operation	89	631597.27	4783107.72
Alt7	GE 2.82-127 LNTE	Normal Operation	89	631580.07	4782288.69
Alt8	GE 2.82-127 LNTE	Normal Operation	89	631270.24	4782846.97
Alt9	GE 2.82-127 LNTE	Normal Operation	89	630753.25	4784275.19

Appendix B

Sound Level Modeling Results - Tabular

Table B-2: Project Only Sound Level Modeling Results and NEER Criteria Evaluation - Sorted by Receptor ID

Receptor ID	Coordinates NAD 1983 UTM Zone 14N		Participation	Modeled Project-Only Leq Sound Level (dBA)	NEER Sound Level Criterion (dBA)	Complies with NEER Sound Level Criterion?
	X (m)	Y (m)				
10	640535.59	4768594.52	Non-Participating	29	45	Yes
11	640435.54	4768610.97	Non-Participating	30	45	Yes
12	640530.73	4768618.73	Non-Participating	29	45	Yes
13	640456.70	4768621.58	Non-Participating	30	45	Yes
14	640482.30	4768628.04	Non-Participating	30	45	Yes
15	640509.04	4768627.27	Non-Participating	29	45	Yes
16	640231.93	4768699.13	Non-Participating	30	45	Yes
17	639882.53	4769270.47	Non-Participating	30	45	Yes
18	640019.94	4769377.65	Non-Participating	29	45	Yes
19	639808.35	4769392.82	Non-Participating	30	45	Yes
20	640064.23	4769420.37	Non-Participating	29	45	Yes
21	640004.86	4769452.29	Non-Participating	29	45	Yes
22	640063.28	4769462.12	Non-Participating	29	45	Yes
23	639833.87	4769429.21	Non-Participating	30	45	Yes
24	649628.93	4770581.57	Non-Participating	16	45	Yes
25	649579.33	4770739.40	Non-Participating	16	45	Yes
26	649720.93	4771035.97	Non-Participating	17	45	Yes
27	649672.10	4771404.97	Non-Participating	18	45	Yes
28	649698.42	4771412.74	Non-Participating	19	45	Yes
29	649715.04	4771499.77	Non-Participating	19	45	Yes
30	649674.66	4771496.99	Non-Participating	18	45	Yes
31	630451.73	4771134.05	Non-Participating	27	45	Yes
32	649687.10	4771563.16	Non-Participating	17	45	Yes
33	630174.90	4771167.67	Non-Participating	27	45	Yes
34	630221.27	4771181.53	Non-Participating	27	45	Yes
35	630365.23	4771183.45	Non-Participating	27	45	Yes
36	649711.87	4771609.29	Non-Participating	18	45	Yes
38	649710.91	4771626.58	Non-Participating	21	45	Yes
40	649681.44	4771605.00	Non-Participating	18	45	Yes
45	649704.64	4771667.78	Non-Participating	21	45	Yes
60	649708.27	4771719.37	Non-Participating	21	45	Yes
61	649251.53	4771725.86	Non-Participating	17	45	Yes
62	649501.62	4771736.19	Non-Participating	17	45	Yes
63	649280.70	4771737.11	Non-Participating	17	45	Yes
65	649525.58	4771738.28	Non-Participating	17	45	Yes
67	649345.65	4771727.23	Non-Participating	17	45	Yes
69	649572.01	4771738.26	Non-Participating	17	45	Yes
70	649387.40	4771736.72	Non-Participating	17	45	Yes
71	640178.29	4771537.19	Non-Participating	43	45	Yes
72	649659.68	4771763.99	Non-Participating	22	45	Yes
77	649701.82	4771778.89	Non-Participating	22	45	Yes
79	649659.34	4771803.88	Non-Participating	22	45	Yes
80	649655.40	4771907.31	Non-Participating	20	45	Yes
81	649698.91	4771924.46	Non-Participating	21	45	Yes
84	649687.41	4771946.34	Non-Participating	21	45	Yes
85	649700.15	4771971.72	Non-Participating	21	45	Yes
87	649488.52	4772031.21	Non-Participating	17	45	Yes
88	649510.19	4772039.51	Non-Participating	17	45	Yes
89	648608.56	4773225.56	Non-Participating	27	45	Yes
90	648579.24	4773230.88	Non-Participating	27	45	Yes
91	648707.95	4773245.14	Non-Participating	27	45	Yes
92	636328.66	4774612.53	Participating	45	50	Yes
93	647700.71	4776288.67	Non-Participating	28	45	Yes
94	647866.82	4776309.75	Non-Participating	28	45	Yes
95	630170.38	4775964.35	Non-Participating	30	45	Yes
96	630146.44	4775972.52	Non-Participating	30	45	Yes
97	647819.96	4776339.15	Non-Participating	28	45	Yes
98	647793.15	4776339.16	Non-Participating	29	45	Yes
99	647901.05	4776352.19	Non-Participating	26	45	Yes

Table B-2: Project Only Sound Level Modeling Results and NEER Criteria Evaluation - Sorted by Receptor ID

Receptor ID	Coordinates NAD 1983 UTM Zone 14N		Participation	Modeled Project-Only Leq Sound Level (dBA)	NEER Sound Level Criterion (dBA)	Complies with NEER Sound Level Criterion?
	X (m)	Y (m)				
100	647884.07	4776352.16	Non-Participating	27	45	Yes
101	647892.74	4776352.51	Non-Participating	27	45	Yes
102	647874.13	4776352.47	Non-Participating	29	45	Yes
103	647911.09	4776353.36	Non-Participating	26	45	Yes
104	647863.62	4776357.98	Non-Participating	29	45	Yes
105	647812.88	4776358.68	Non-Participating	29	45	Yes
106	647760.79	4776353.51	Non-Participating	29	45	Yes
107	647736.46	4776354.39	Non-Participating	29	45	Yes
108	647836.36	4776364.72	Non-Participating	29	45	Yes
109	630167.07	4775997.66	Non-Participating	30	45	Yes
110	647848.59	4776366.15	Non-Participating	29	45	Yes
111	647740.95	4776377.52	Non-Participating	29	45	Yes
112	647808.59	4776404.37	Non-Participating	29	45	Yes
113	643002.17	4781127.00	Non-Participating	37	45	Yes
114	643056.09	4781134.20	Non-Participating	37	45	Yes
234	634784.24	4768513.77	Non-Participating	28	45	Yes
236	638848.29	4768923.79	Non-Participating	29	45	Yes
237	631328.93	4768847.99	Non-Participating	16	45	Yes
238	637047.88	4768987.35	Non-Participating	29	45	Yes
239	636451.86	4769025.59	Non-Participating	29	45	Yes
240	630797.98	4768929.38	Non-Participating	16	45	Yes
241	641472.91	4769256.40	Non-Participating	31	45	Yes
242	642105.46	4769401.95	Non-Participating	32	45	Yes
244	645446.79	4769600.40	Non-Participating	29	45	Yes
245	629030.95	4769236.61	Non-Participating	15	45	Yes
246	640535.75	4769642.45	Non-Participating	32	45	Yes
247	642914.30	4769829.58	Non-Participating	32	45	Yes
248	633064.33	4769697.73	Non-Participating	28	45	Yes
249	641012.63	4769921.95	Non-Participating	33	45	Yes
250	648081.23	4770080.76	Non-Participating	27	45	Yes
251	641610.08	4769970.92	Non-Participating	33	45	Yes
252	634207.18	4769909.46	Non-Participating	29	45	Yes
253	640045.42	4770021.02	Non-Participating	32	45	Yes
254	631133.57	4769895.19	Non-Participating	27	45	Yes
255	644487.46	4770224.25	Non-Participating	33	45	Yes
256	646297.55	4770285.95	Non-Participating	22	45	Yes
257	632153.32	4770113.23	Non-Participating	28	45	Yes
259	640728.90	4770403.67	Non-Participating	35	45	Yes
260	630044.26	4770180.42	Non-Participating	26	45	Yes
261	641772.53	4770490.07	Non-Participating	35	45	Yes
263	628629.07	4770604.66	Non-Participating	16	45	Yes
264	635324.45	4770767.92	Non-Participating	31	45	Yes
265	642804.04	4770889.68	Non-Participating	36	45	Yes
266	645599.70	4771088.82	Non-Participating	34	45	Yes
267	638782.12	4770989.64	Non-Participating	33	45	Yes
269	636932.30	4771155.58	Non-Participating	32	45	Yes
270	644055.08	4771378.92	Non-Participating	39	45	Yes
271	633611.40	4771192.42	Non-Participating	31	45	Yes
272	641321.79	4771383.18	Non-Participating	41	45	Yes
273	647871.30	4771541.44	Non-Participating	28	45	Yes
274	647620.24	4771536.52	Non-Participating	27	45	Yes
275	636833.93	4771388.29	Non-Participating	33	45	Yes
276	632712.26	4771353.66	Non-Participating	30	45	Yes
277	634064.57	4771369.49	Non-Participating	32	45	Yes
278	639471.93	4771515.71	Non-Participating	38	45	Yes
279	630083.40	4771333.32	Non-Participating	27	45	Yes
281	643767.97	4771639.18	Non-Participating	40	45	Yes
282	642137.14	4771627.53	Non-Participating	40	45	Yes
283	640935.85	4771598.52	Non-Participating	45	45	Yes

Table B-2: Project Only Sound Level Modeling Results and NEER Criteria Evaluation - Sorted by Receptor ID

Receptor ID	Coordinates NAD 1983 UTM Zone 14N		Participation	Modeled Project-Only Leq Sound Level (dBA)	NEER Sound Level Criterion (dBA)	Complies with NEER Sound Level Criterion?
	X (m)	Y (m)				
284	630485.97	4771337.60	Non-Participating	28	45	Yes
285	646072.43	4771672.28	Non-Participating	34	45	Yes
286	646719.34	4771725.63	Non-Participating	31	45	Yes
287	637184.58	4771513.22	Non-Participating	33	45	Yes
288	641637.67	4771637.78	Non-Participating	43	45	Yes
290	647229.47	4771800.61	Non-Participating	30	45	Yes
291	647818.24	4771917.55	Non-Participating	27	45	Yes
292	643090.10	4772004.84	Non-Participating	42	45	Yes
294	645780.02	4772350.18	Non-Participating	35	45	Yes
295	638048.06	4772213.60	Non-Participating	32	45	Yes
296	646586.35	4772445.61	Non-Participating	32	45	Yes
297	636785.80	4772390.19	Non-Participating	35	45	Yes
298	642100.19	4772541.91	Non-Participating	43	45	Yes
299	646444.55	4772719.23	Non-Participating	32	45	Yes
300	630481.34	4772446.72	Non-Participating	29	45	Yes
301	631897.41	4772505.38	Non-Participating	31	45	Yes
302	633773.79	4772515.10	Non-Participating	37	45	Yes
304	647363.19	4772926.95	Non-Participating	30	45	Yes
305	645655.28	4772946.29	Non-Participating	34	45	Yes
306	629732.63	4772682.54	Non-Participating	28	45	Yes
307	637214.27	4772853.24	Non-Participating	35	45	Yes
308	631930.52	4772784.49	Non-Participating	31	45	Yes
309	644611.20	4773087.41	Non-Participating	39	45	Yes
310	629969.44	4772849.42	Non-Participating	28	45	Yes
311	629640.45	4772812.34	Non-Participating	28	45	Yes
312	642046.85	4773121.33	Non-Participating	42	45	Yes
313	644203.18	4773189.48	Participating	40	50	Yes
314	639650.79	4773121.97	Participating	43	50	Yes
315	633949.48	4773017.71	Non-Participating	43	45	Yes
316	630333.89	4773092.37	Non-Participating	29	45	Yes
317	641319.22	4773348.57	Non-Participating	40	45	Yes
318	646623.30	4773489.86	Non-Participating	32	45	Yes
319	649215.26	4773539.71	Non-Participating	26	45	Yes
320	648177.04	4773633.33	Non-Participating	27	45	Yes
321	632239.66	4773353.61	Non-Participating	32	45	Yes
322	643238.14	4773597.23	Non-Participating	42	45	Yes
323	630597.16	4773354.60	Non-Participating	29	45	Yes
324	636654.71	4773399.27	Non-Participating	38	45	Yes
325	645231.35	4773845.02	Non-Participating	34	45	Yes
326	631971.53	4773701.23	Non-Participating	31	45	Yes
327	638783.64	4773894.81	Non-Participating	40	45	Yes
328	636782.32	4773941.41	Non-Participating	39	45	Yes
330	643135.21	4774116.86	Non-Participating	40	45	Yes
331	644702.80	4774150.47	Non-Participating	38	45	Yes
332	641524.85	4774210.69	Non-Participating	38	45	Yes
333	637004.06	4774058.35	Non-Participating	38	45	Yes
334	632097.00	4774041.37	Non-Participating	32	45	Yes
335	634483.16	4774152.44	Non-Participating	42	45	Yes
336	633532.29	4774133.16	Non-Participating	38	45	Yes
337	629231.31	4774068.30	Non-Participating	28	45	Yes
338	648225.49	4774482.22	Non-Participating	29	45	Yes
339	642340.85	4774459.18	Non-Participating	38	45	Yes
340	648791.71	4774617.57	Non-Participating	28	45	Yes
341	640390.20	4774427.74	Participating	40	50	Yes
342	647927.05	4774635.04	Non-Participating	29	45	Yes
343	638382.75	4774448.04	Non-Participating	41	45	Yes
345	647502.83	4774707.34	Non-Participating	29	45	Yes
346	645771.13	4774714.87	Non-Participating	32	45	Yes
347	647057.94	4774852.59	Non-Participating	31	45	Yes

Table B-2: Project Only Sound Level Modeling Results and NEER Criteria Evaluation - Sorted by Receptor ID

Receptor ID	Coordinates NAD 1983 UTM Zone 14N		Participation	Modeled Project-Only Leq Sound Level (dBA)	NEER Sound Level Criterion (dBA)	Complies with NEER Sound Level Criterion?
	X (m)	Y (m)				
348	636886.48	4774627.44	Participating	41	50	Yes
349	634163.46	4774574.46	Non-Participating	39	45	Yes
350	631946.52	4774591.87	Non-Participating	32	45	Yes
352	636758.32	4774766.60	Non-Participating	42	45	Yes
353	649223.63	4775011.76	Non-Participating	18	45	Yes
354	642956.10	4774989.46	Non-Participating	39	45	Yes
355	628892.23	4774775.62	Non-Participating	28	45	Yes
356	632290.62	4774904.79	Non-Participating	33	45	Yes
357	636893.55	4774999.89	Participating	42	50	Yes
359	644911.04	4775289.96	Non-Participating	36	45	Yes
360	636250.93	4775370.13	Participating	43	50	Yes
361	631930.30	4775354.80	Non-Participating	32	45	Yes
362	627095.29	4775383.83	Non-Participating	27	45	Yes
364	640502.05	4775810.62	Non-Participating	42	45	Yes
365	635633.42	4775681.89	Non-Participating	41	45	Yes
366	637919.77	4775897.35	Participating	42	50	Yes
367	628053.11	4775704.58	Non-Participating	28	45	Yes
368	643109.77	4776068.82	Non-Participating	42	45	Yes
369	644681.69	4776161.59	Non-Participating	35	45	Yes
370	638459.18	4776038.88	Participating	44	50	Yes
371	630797.93	4775956.24	Non-Participating	30	45	Yes
372	633751.14	4776050.38	Non-Participating	36	45	Yes
373	644963.32	4776433.47	Non-Participating	34	45	Yes
374	630631.15	4776153.54	Non-Participating	30	45	Yes
375	648518.45	4776539.91	Non-Participating	27	45	Yes
376	640658.45	4776365.14	Non-Participating	41	45	Yes
377	630139.99	4776157.08	Non-Participating	30	45	Yes
378	646962.60	4776498.23	Non-Participating	31	45	Yes
380	636938.05	4776454.88	Non-Participating	40	45	Yes
381	633631.96	4776383.66	Non-Participating	36	45	Yes
382	638766.28	4776501.25	Participating	44	50	Yes
383	644555.08	4776670.80	Non-Participating	35	45	Yes
384	633060.80	4776655.49	Non-Participating	35	45	Yes
385	647735.47	4776949.57	Non-Participating	30	45	Yes
387	647113.45	4777171.33	Non-Participating	31	45	Yes
388	636432.50	4777035.42	Non-Participating	39	45	Yes
389	638115.25	4777125.28	Participating	43	50	Yes
390	647528.88	4777367.64	Non-Participating	28	45	Yes
391	649425.80	4777450.11	Non-Participating	27	45	Yes
392	633474.30	4777233.77	Non-Participating	38	45	Yes
393	639927.46	4777351.56	Non-Participating	42	45	Yes
394	631845.94	4777340.76	Non-Participating	33	45	Yes
395	641292.27	4777531.52	Non-Participating	42	45	Yes
396	647865.24	4777717.18	Non-Participating	30	45	Yes
397	644093.73	4777767.24	Non-Participating	36	45	Yes
398	630525.89	4777455.18	Non-Participating	32	45	Yes
400	636306.43	4777687.66	Non-Participating	39	45	Yes
401	648236.47	4778149.89	Non-Participating	29	45	Yes
402	633725.43	4777851.16	Non-Participating	41	45	Yes
403	637206.27	4778052.77	Participating	43	50	Yes
404	645559.50	4778492.34	Participating	32	50	Yes
405	648719.55	4778666.95	Non-Participating	28	45	Yes
406	647847.52	4778711.50	Non-Participating	30	45	Yes
407	646569.18	4778807.67	Non-Participating	32	45	Yes
408	641454.74	4778708.10	Participating	41	50	Yes
409	633681.52	4778645.61	Non-Participating	40	45	Yes
410	636848.63	4778771.83	Non-Participating	40	45	Yes
411	647870.39	4779039.01	Participating	27	50	Yes
412	630424.82	4778722.86	Non-Participating	33	45	Yes

Table B-2: Project Only Sound Level Modeling Results and NEER Criteria Evaluation - Sorted by Receptor ID

Receptor ID	Coordinates NAD 1983 UTM Zone 14N		Participation	Modeled Project-Only Leq Sound Level (dBA)	NEER Sound Level Criterion (dBA)	Complies with NEER Sound Level Criterion?
	X (m)	Y (m)				
413	636981.66	4778935.28	Participating	41	50	Yes
414	646146.60	4779132.30	Non-Participating	33	45	Yes
415	643420.18	4779104.20	Non-Participating	35	45	Yes
416	638179.96	4779051.35	Non-Participating	43	45	Yes
418	639823.48	4779168.95	Participating	45	50	Yes
419	644399.93	4779324.94	Non-Participating	33	45	Yes
420	648284.30	4779453.30	Non-Participating	28	45	Yes
422	635470.77	4779199.04	Non-Participating	42	45	Yes
423	629887.30	4779060.15	Non-Participating	32	45	Yes
424	628423.92	4779059.47	Non-Participating	30	45	Yes
425	637819.93	4779490.29	Non-Participating	43	45	Yes
426	634494.72	4779421.89	Participating	42	50	Yes
427	645029.96	4779669.95	Participating	33	50	Yes
428	635418.51	4779496.92	Non-Participating	42	45	Yes
429	647873.88	4779755.38	Non-Participating	30	45	Yes
430	631513.91	4779509.49	Non-Participating	35	45	Yes
432	633008.01	4779724.73	Non-Participating	38	45	Yes
433	637311.60	4779800.17	Non-Participating	43	45	Yes
434	627999.11	4779665.42	Non-Participating	30	45	Yes
435	641421.60	4779911.93	Non-Participating	40	45	Yes
436	648281.12	4780233.25	Non-Participating	31	45	Yes
437	633330.20	4780199.42	Non-Participating	42	45	Yes
438	630218.56	4780216.09	Non-Participating	34	45	Yes
439	636960.97	4780400.38	Non-Participating	45	45	Yes
440	645479.03	4780615.94	Participating	36	50	Yes
441	635292.68	4780688.32	Non-Participating	44	45	Yes
442	634546.91	4780701.45	Participating	43	50	Yes
443	648306.61	4780966.39	Non-Participating	31	45	Yes
444	640230.14	4780963.86	Non-Participating	44	45	Yes
446	628573.96	4780803.43	Non-Participating	32	45	Yes
447	632128.57	4780858.07	Non-Participating	42	45	Yes
448	631511.45	4780853.58	Non-Participating	39	45	Yes
450	638903.54	4780990.35	Non-Participating	44	45	Yes
451	636651.60	4780936.35	Non-Participating	45	45	Yes
741	648056.54	4777598.98	Non-Participating	26	45	Yes
743	647799.28	4776385.31	Non-Participating	29	45	Yes
744	645263.37	4776349.74	Non-Participating	34	45	Yes
745	630160.58	4775991.63	Non-Participating	30	45	Yes
746	629078.68	4776097.31	Non-Participating	29	45	Yes
747	629139.36	4775527.12	Non-Participating	29	45	Yes
748	638138.95	4775102.17	Participating	44	50	Yes
749	630559.24	4769085.35	Non-Participating	16	45	Yes
750	636816.05	4770471.25	Non-Participating	31	45	Yes
751	640010.56	4769446.26	Non-Participating	29	45	Yes
752	641271.52	4770155.65	Non-Participating	33	45	Yes
753	638425.05	4771041.10	Non-Participating	33	45	Yes
754	635305.85	4772856.46	Non-Participating	40	45	Yes
755	635624.03	4772890.19	Non-Participating	39	45	Yes
756	644162.65	4778094.81	Non-Participating	36	45	Yes

Table B-1: Project Only Sound Level Modeling Results and NEER Criteria Evaluation - Sorted by Receptor ID (receptors w/in 1.5-mile radius only)

Receptor ID	Coordinates NAD 1983 UTM Zone 14N		Participation	Modeled Project-Only Leq Sound Level (dBA)	NEER Sound Level Criterion (dBA)	Complies with NEER Sound Level Criterion?
	X (m)	Y (m)				
71	640178.29	4771537.19	Non-Participating	43	45	Yes
92	636328.66	4774612.53	Participating	45	50	Yes
114	643056.09	4781134.20	Non-Participating	37	45	Yes
249	641012.63	4769921.95	Non-Participating	33	45	Yes
251	641610.08	4769970.92	Non-Participating	33	45	Yes
253	640045.42	4770021.02	Non-Participating	32	45	Yes
255	644487.46	4770224.25	Non-Participating	33	45	Yes
259	640728.90	4770403.67	Non-Participating	35	45	Yes
261	641772.53	4770490.07	Non-Participating	35	45	Yes
265	642804.04	4770889.68	Non-Participating	36	45	Yes
266	645599.70	4771088.82	Non-Participating	34	45	Yes
267	638782.12	4770989.64	Non-Participating	33	45	Yes
270	644055.08	4771378.92	Non-Participating	39	45	Yes
271	633611.40	4771192.42	Non-Participating	31	45	Yes
272	641321.79	4771383.18	Non-Participating	41	45	Yes
277	634064.57	4771369.49	Non-Participating	32	45	Yes
278	639471.93	4771515.71	Non-Participating	38	45	Yes
281	643767.97	4771639.18	Non-Participating	40	45	Yes
282	642137.14	4771627.53	Non-Participating	40	45	Yes
283	640935.85	4771598.52	Participating	45	50	Yes
285	646072.43	4771672.28	Non-Participating	34	45	Yes
286	646719.34	4771725.63	Non-Participating	31	45	Yes
288	641637.67	4771637.78	Non-Participating	43	45	Yes
292	643090.10	4772004.84	Non-Participating	42	45	Yes
294	645780.02	4772350.18	Non-Participating	35	45	Yes
295	638048.06	4772213.60	Non-Participating	32	45	Yes
296	646586.35	4772445.61	Non-Participating	32	45	Yes
297	636785.80	4772390.19	Non-Participating	35	45	Yes
298	642100.19	4772541.91	Non-Participating	43	45	Yes
299	646444.55	4772719.23	Non-Participating	32	45	Yes
302	633773.79	4772515.10	Non-Participating	37	45	Yes
305	645655.28	4772946.29	Non-Participating	34	45	Yes
307	637214.27	4772853.24	Non-Participating	35	45	Yes
308	631930.52	4772784.49	Non-Participating	31	45	Yes
309	644611.20	4773087.41	Non-Participating	39	45	Yes
312	642046.85	4773121.33	Non-Participating	42	45	Yes
313	644203.18	4773189.48	Participating	40	50	Yes
314	639650.79	4773121.97	Participating	43	50	Yes
315	633949.48	4773017.71	Non-Participating	43	45	Yes
317	641319.22	4773348.57	Non-Participating	40	45	Yes
321	632239.66	4773353.61	Non-Participating	32	45	Yes
322	643238.14	4773597.23	Non-Participating	42	45	Yes
324	636654.71	4773399.27	Participating	38	50	Yes
325	645231.35	4773845.02	Non-Participating	34	45	Yes
326	631971.53	4773701.23	Non-Participating	31	45	Yes
327	638783.64	4773894.81	Non-Participating	40	45	Yes
328	636782.32	4773941.41	Non-Participating	39	45	Yes
330	643135.21	4774116.86	Non-Participating	40	45	Yes
331	644702.80	4774150.47	Non-Participating	38	45	Yes
332	641524.85	4774210.69	Non-Participating	38	45	Yes
333	637004.06	4774058.35	Non-Participating	38	45	Yes
334	632097.00	4774041.37	Non-Participating	32	45	Yes
335	634483.16	4774152.44	Non-Participating	42	45	Yes
336	633532.29	4774133.16	Non-Participating	38	45	Yes
339	642340.85	4774459.18	Non-Participating	38	45	Yes
341	640390.20	4774427.74	Participating	40	50	Yes
343	638382.75	4774448.04	Non-Participating	41	45	Yes
346	645771.13	4774714.87	Non-Participating	32	45	Yes
348	636886.48	4774627.44	Participating	41	50	Yes

Table B-1: Project Only Sound Level Modeling Results and NEER Criteria Evaluation - Sorted by Receptor ID (receptors w/in 1.5-mile radius only)

Receptor ID	Coordinates NAD 1983 UTM Zone 14N		Participation	Modeled Project-Only Leq Sound Level (dBA)	NEER Sound Level Criterion (dBA)	Complies with NEER Sound Level Criterion?
	X (m)	Y (m)				
349	634163.46	4774574.46	Non-Participating	39	45	Yes
352	636758.32	4774766.60	Non-Participating	42	45	Yes
354	642956.10	4774989.46	Non-Participating	39	45	Yes
357	636893.55	4774999.89	Participating	42	50	Yes
359	644911.04	4775289.96	Non-Participating	36	45	Yes
360	636250.93	4775370.13	Participating	43	50	Yes
364	640502.05	4775810.62	Non-Participating	42	45	Yes
365	635633.42	4775681.89	Non-Participating	41	45	Yes
366	637919.77	4775897.35	Participating	42	50	Yes
368	643109.77	4776068.82	Non-Participating	42	45	Yes
369	644681.69	4776161.59	Non-Participating	35	45	Yes
370	638459.18	4776038.88	Participating	44	50	Yes
372	633751.14	4776050.38	Non-Participating	36	45	Yes
373	644963.32	4776433.47	Non-Participating	34	45	Yes
376	640658.45	4776365.14	Non-Participating	41	45	Yes
380	636938.05	4776454.88	Non-Participating	40	45	Yes
381	633631.96	4776383.66	Non-Participating	36	45	Yes
382	638766.28	4776501.25	Participating	44	50	Yes
383	644555.08	4776670.80	Non-Participating	35	45	Yes
384	633060.80	4776655.49	Non-Participating	35	45	Yes
388	636432.50	4777035.42	Non-Participating	39	45	Yes
389	638115.25	4777125.28	Participating	43	50	Yes
392	633474.30	4777233.77	Non-Participating	38	45	Yes
393	639927.46	4777351.56	Non-Participating	42	45	Yes
395	641292.27	4777531.52	Non-Participating	42	45	Yes
397	644093.73	4777767.24	Non-Participating	36	45	Yes
400	636306.43	4777687.66	Non-Participating	39	45	Yes
402	633725.43	4777851.16	Non-Participating	41	45	Yes
403	637206.27	4778052.77	Participating	43	50	Yes
408	641454.74	4778708.10	Participating	41	50	Yes
409	633681.52	4778645.61	Non-Participating	40	45	Yes
410	636848.63	4778771.83	Non-Participating	40	45	Yes
413	636981.66	4778935.28	Participating	41	50	Yes
415	643420.18	4779104.20	Non-Participating	35	45	Yes
416	638179.96	4779051.35	Non-Participating	43	45	Yes
418	639823.48	4779168.95	Participating	45	50	Yes
422	635470.77	4779199.04	Non-Participating	42	45	Yes
425	637819.93	4779490.29	Non-Participating	43	45	Yes
426	634494.72	4779421.89	Participating	42	50	Yes
428	635418.51	4779496.92	Non-Participating	42	45	Yes
430	631513.91	4779509.49	Non-Participating	35	45	Yes
432	633008.01	4779724.73	Non-Participating	38	45	Yes
433	637311.60	4779800.17	Non-Participating	43	45	Yes
435	641421.60	4779911.93	Non-Participating	40	45	Yes
436	648281.12	4780233.25	Non-Participating	31	45	Yes
437	633330.20	4780199.42	Non-Participating	42	45	Yes
439	636960.97	4780400.38	Non-Participating	45	45	Yes
440	645479.03	4780615.94	Participating	36	50	Yes
441	635292.68	4780688.32	Non-Participating	44	45	Yes
442	634546.91	4780701.45	Participating	43	50	Yes
443	648306.61	4780966.39	Non-Participating	31	45	Yes
444	640230.14	4780963.86	Non-Participating	44	45	Yes
447	632128.57	4780858.07	Non-Participating	42	45	Yes
448	631511.45	4780853.58	Non-Participating	39	45	Yes
450	638903.54	4780990.35	Non-Participating	44	45	Yes
451	636651.60	4780936.35	Non-Participating	45	45	Yes
744	645263.37	4776349.74	Non-Participating	34	45	Yes
748	638138.95	4775102.17	Participating	44	50	Yes
752	641271.52	4770155.65	Non-Participating	33	45	Yes

Table B-1: Project Only Sound Level Modeling Results and NEER Criteria Evaluation - Sorted by Receptor ID (receptors w/in 1.5-mile radius only)

Receptor ID	Coordinates NAD 1983 UTM Zone 14N		Participation	Modeled Project-Only Leq Sound Level (dBA)	NEER Sound Level Criterion (dBA)	Complies with NEER Sound Level Criterion?
	X (m)	Y (m)				
753	638425.05	4771041.10	Non-Participating	33	45	Yes
754	635305.85	4772856.46	Non-Participating	40	45	Yes
755	635624.03	4772890.19	Non-Participating	39	45	Yes
756	644162.65	4778094.81	Non-Participating	36	45	Yes



SHADOW FLICKER ASSESSMENT REPORT

Swan Lake Wind Project Yankton County, South Dakota

Prepared for:

Swan Lake Wind, LLC
700 Universe Boulevard
Juno Beach, Florida 33408

Prepared by:



Epsilon Associates, Inc.
3 Mill & Main Place, Suite 250
Maynard, MA 01754

August 9, 2024

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1.0 EXECUTIVE SUMMARY

The Swan Lake Wind Project (Project) is a proposed wind power generation facility that will consist of 97 wind turbines in Yankton and Turner Counties, South Dakota. The proposed Project is being developed by Swan Lake Wind, LLC (Swan Lake Wind), an indirect, wholly-owned subsidiary of NextEra Energy Resources, LLC (NextEra Energy Resources or NEER). SWCA Environmental Consultants (SWCA), 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 the results of the shadow flicker modeling analysis.

Shadow flicker modeling was conservatively conducted for 106 General Electric (GE) wind turbines, which includes nine (9) alternate wind turbine locations. Thirty-seven (37) of the modeled wind turbines are within Yankton County and 69 are within Turner County.

Shadow flicker durations from the Project were modeled at residences to evaluate a criterion set forth by NEER. The maximum duration of expected annual shadow flicker at a non-participating home (#450) is 18 hours, 37 minutes. Therefore, all non-participating residences are below the annual 30-hour NEER threshold. The maximum expected annual duration of shadow flicker at a participating home in Yankton County is 43 hours, 2 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

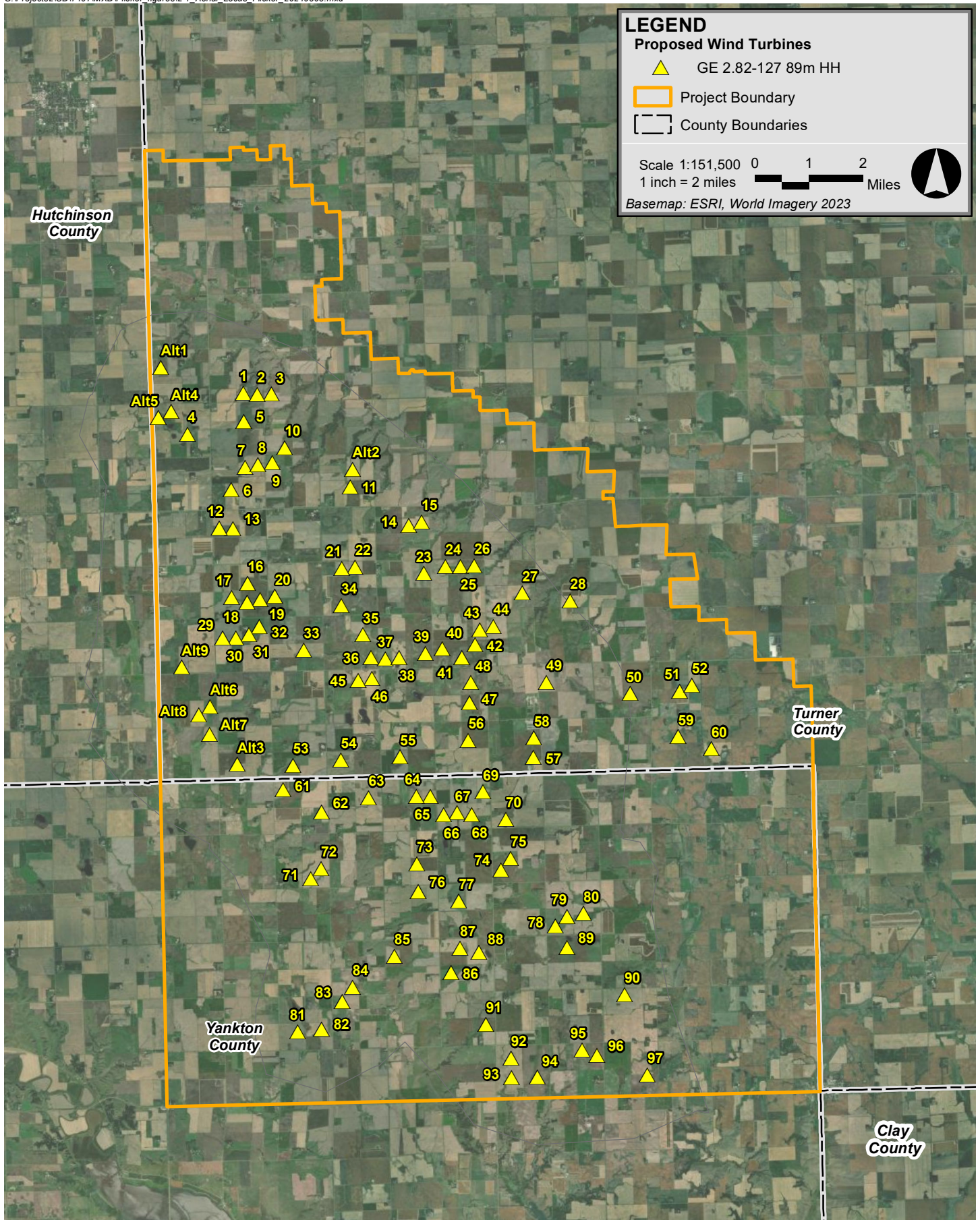
The Swan Lake Wind Project will consist of 97 General Electric (GE) 2.82-127 wind turbines at a hub height (HH) of 89 meters and a rotor diameter of 127 meters. There are 36 turbines proposed in Yankton County, South Dakota and 69 turbines proposed in Turner County, South Dakota. Figure 2-1 shows the locations of the 97 wind turbines and nine (9) alternate wind turbine locations over aerial imagery. The nine alternate wind turbines are all located in Turner County.

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.

The wind turbines were modeled with the WindPRO software package using information provided to Epsilon or that was publicly available. 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, <https://www.epilepsy.com/what-is-epilepsy/seizure-triggers/photosensitivity>. Accessed in August 2024.



Swan Lake Wind Project Turner and Yankton Counties, South Dakota

3.0 REGULATIONS & CRITERIA

3.1 Federal Regulations

There are no federal shadow flicker regulations applicable to this Project.

3.2 South Dakota State Regulations

There are no current state shadow flicker regulations applicable to this Project. The South Dakota Public Utilities Commission (SDPUC) as part of their orders granting permission to construct wind energy facilities, has included permit conditions with specific shadow flicker limits.

3.3 Yankton County Regulations

Yankton County has no shadow flicker regulations applicable to this Project.

3.4 NextEra Energy Resources Criteria

NextEra Energy Resources has instructed Epsilon to evaluate predicted shadow flicker durations against a threshold of 30 expected hours per year at non-participating residences in Yankton County.

4.0 SHADOW FLICKER MODELING

4.1 Modeling Methodology

Shadow flicker was modeled using a software package, WindPRO version 4.0. 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 could 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. Expected annual shadow flicker durations are presented in this report.

This analysis is for the wind turbine array dated July 18, 2024. Locations of the wind turbines are shown in Figure 4-1, and the coordinates are provided in Appendix A. In addition, the Project Boundary, dated May 10, 2024, is shown in Figure 4-1. All modeled wind turbines are GE 2.82-127 wind turbines with a 127.2-meter rotor diameter and a hub height of 89 meters; 37 of which are in Yankton County. The wind turbines have the following characteristics based on the technical data provided by SWCA or NEER:

		<u>GE 2.82-127</u>
◆ Rated Power	=	2,820 kW
◆ Hub Height	=	89 meters
◆ Rotor Diameter	=	127.2 meters
◆ Cut-in Wind Speed	=	3 m/s
◆ Cut-out Wind Speed	=	30 m/s
◆ Maximum 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 0.87 miles (1,400 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 June 18, 2024 dataset containing participation status information for property parcels in the vicinity of the Project was provided to Epsilon. Based on how the parcels were labeled within the file, they were separated into two categories, participating and non-participating. Participating parcels are shown on Figure 4-1. All other parcels are considered non-participating.

A modeling receptor dataset was provided to Epsilon with a date of May 28, 2024. These receptors, characterized as homes, were deduced to a dataset of homes within 1.5 miles of a proposed wind turbine and limited to those within Yankton County for this study, resulting in 285 receptors. Each modeling point was assumed to have a window facing all directions (“greenhouse” mode) which yields conservative results. Participation status for each modeling receptor, provided by SWCA, was assigned based on the data presented in Figure 4-1. All modeling receptors are identified in Figure 4-1 and are distinguished as either participating or non-participating. The model was set to limit calculations to 2,012 meters from a wind turbine, the equivalent of 1.25 miles. Consequently, shadow flicker at any of the 285 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.

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 August 2024.

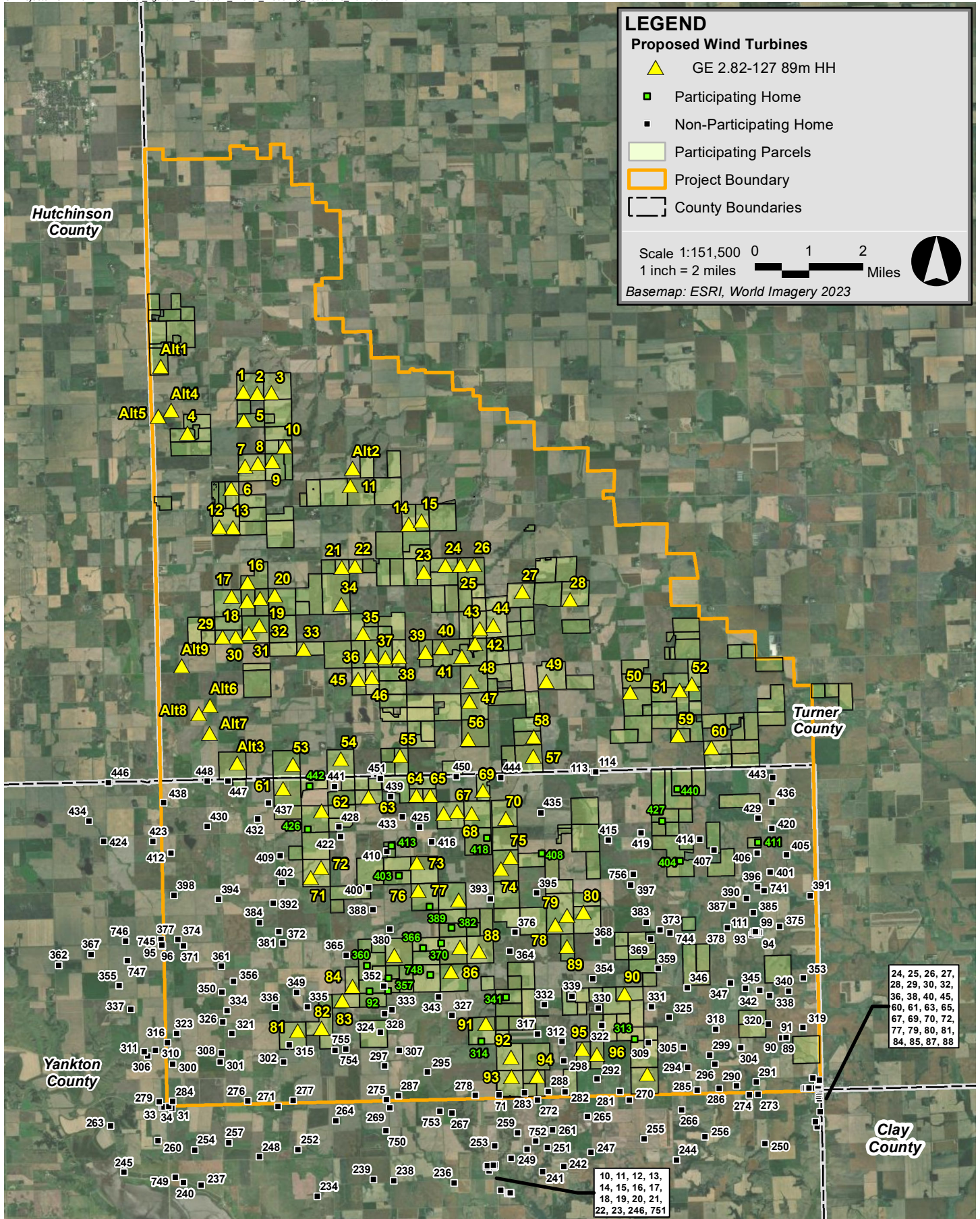
⁵ State of Connecticut CSC Wind Regulations (2014), available at https://eregulations.ct.gov/eRegsPortal/Browse/RCSA?id=Title_16Subtitle_16-50jSection_16-50j-94&content=shadow%20flicker/ Accessed in August 2024.

The terrain height contour elevations for the modeling domain were generated from elevation information in a GeoTIFF file (a.k.a. DEM or digital elevation model at a resolution of 1 meter) downloaded from the National Elevation Dataset (NED) developed by the U.S. Geological Survey. The contour interval in the shadow flicker model is 3 meters. 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 4-1 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 over four (4) years of scaled wind speed and direction was provided by NEER for an altitude of 89 meters. Epsilon used a complete 4-year subset of these 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 89% of the year. Table 4-2 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 December 2021.



Swan Lake Wind Project Turner and Yankton Counties, South Dakota

Table 4-1 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%

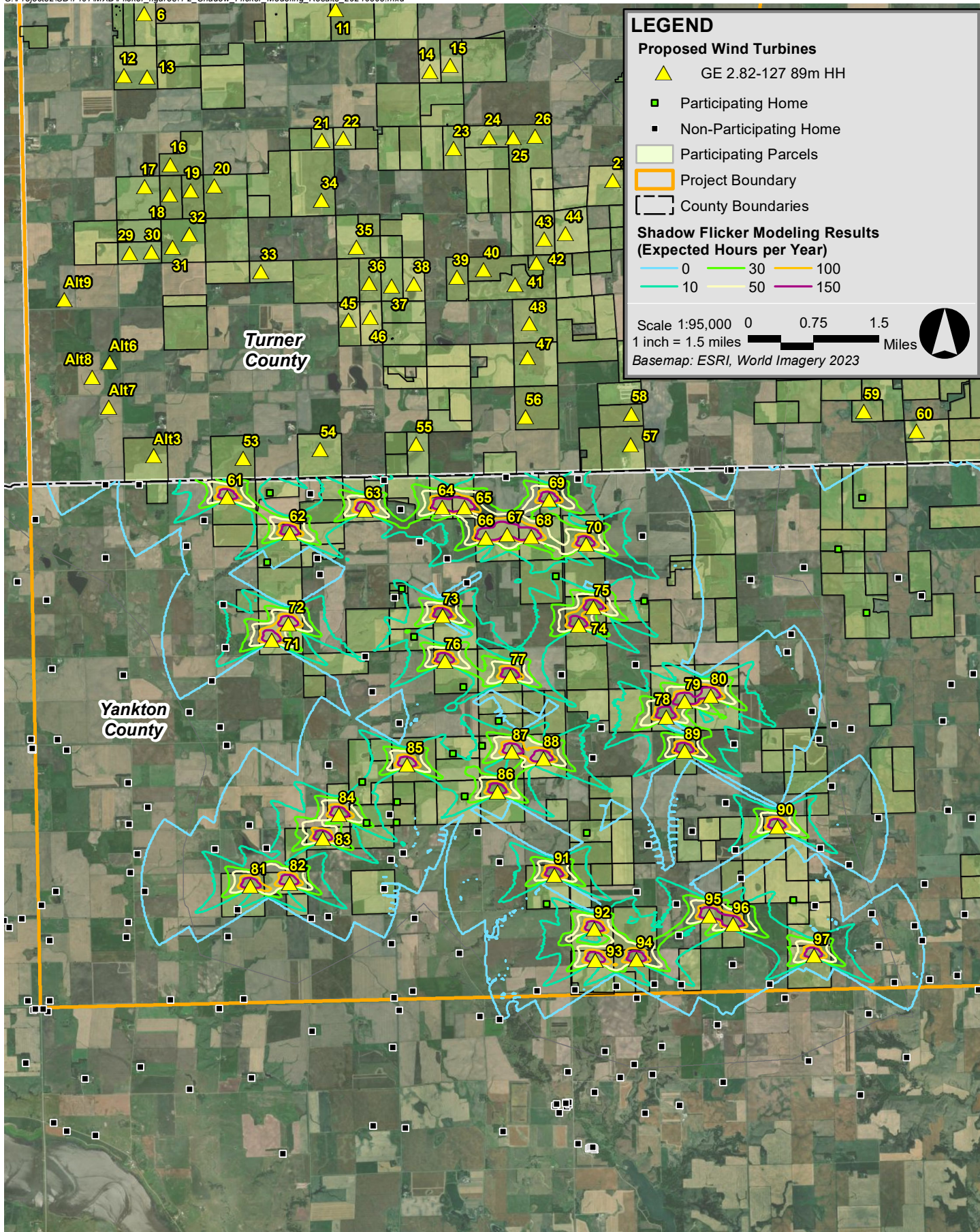
Table 4-2 Operational Hours per Wind Direction Sector

Wind Sector	Operational Hours
N	178
NNE	237
NE	237
ENE	276
E	383
ESE	518
SE	570
SSE	665
S	985
SSW	557
SW	409
WSW	262
W	359
WNW	612
NW	816
NNW	702
Annual	7,766

4.2 Results

Following the modeling methodology outlined in Section 4.1, WindPRO was used to calculate shadow flicker at the 285 discrete modeling receptor points in Yankton County and generate shadow flicker isolines based on the grid calculations. Table B-1 in Appendix B presents the modeling results by receptor.

The predicted expected annual shadow flicker durations range from 0 hours, 0 minutes per year to 43 hours, 2 minutes per year. The maximum calculated expected flicker duration is at a participating receptor (#92). The maximum modeled expected annual flicker duration at a non-participating receptor (#450) is 18 hours, 37 minutes. Two hundred and five (205) of the homes in Yankton County are predicted to experience no annual shadow flicker. Sixty-three (63) of the homes are predicted to experience some shadow flicker but less than 10 hours per year. The modeling results showed that 16 homes would be expected to have between 10 hours and 30 hours of shadow flicker per year. One (1) receptor (participating) is expected to have over 30 hours of flicker per year. Figure 4-2 displays the modeled flicker isolines (expected hours per year) over aerial imagery in relation to modeled wind turbines and modeling receptors.



Swan Lake Wind Project Turner and Yankton Counties, South Dakota

5.0 EVALUATION

NextEra Energy Resources has instructed Epsilon to evaluate predicted shadow flicker durations at non-participating residences in Yankton County against a threshold of 30 expected hours per year. Table B-1 in Appendix B presents an evaluation for all individual non-participating residences included in the model. The table shows the maximum duration of expected annual shadow flicker at a non-participating home (#450) to be 18 hours, 37 minutes. In conclusion, the predicted expected annual shadow flicker durations from the Swan Lake Wind Project are below the NEER criterion of 30 hours at all modeled non-participating residences in Yankton County meeting the requirements set forth by NEER under the modeled operation scenario.

6.0 CONCLUSIONS

A shadow flicker modeling assessment was conducted for the Swan Lake Wind Project that is proposed within Yankton and Turner Counties, South Dakota. This assessment is specific to Yankton County. The Project will consist of up to 97 wind turbines across Yankton and Turner Counties. The shadow flicker model included nine (9) alternate wind turbine locations, totaling 106 wind turbines in the model. Thirty-seven (37) of the modeled wind turbines are within Yankton County. The Project is anticipated to be composed of GE 2.82-127 wind turbines at a hub height of 89 meters.

Shadow flicker durations from the Project were modeled at residences to evaluate a criterion set forth by NextEra Energy Resources at non-participating residences.

The maximum duration of expected annual shadow flicker at a non-participating home (#450) is 18 hours, 37 minutes. Therefore, all non-participating residences are below the annual 30-hour NEER threshold, and the Project meets the requirements set forth by NEER under the modeled operation scenario.

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”).

Appendix A

Wind Turbine Coordinates

Table A-1: Wind Turbine Array 20240718

Wind Turbine ID	Wind Turbine Type	Hub Height (m)	Coordinates NAD 1983 UTM Zone 14N	
			X (m)	Y (m)
1	GE 2.82-127	89	632581.02	4792422.31
2	GE 2.82-127	89	632997.25	4792383.08
3	GE 2.82-127	89	633420.34	4792385.15
4	GE 2.82-127	89	630932.15	4791198.35
5	GE 2.82-127	89	632601.17	4791576.58
6	GE 2.82-127	89	632232.61	4789541.85
7	GE 2.82-127	89	632636.32	4790213.14
8	GE 2.82-127	89	633018.06	4790286.32
9	GE 2.82-127	89	633441.05	4790348.83
10	GE 2.82-127	89	633817.95	4790788.82
11	GE 2.82-127	89	635760.43	4789626.99
12	GE 2.82-127	89	631861.55	4788400.86
13	GE 2.82-127	89	632282.70	4788387.21
14	GE 2.82-127	89	637502.75	4788479.60
15	GE 2.82-127	89	637876.90	4788590.95
16	GE 2.82-127	89	632710.55	4786762.84
17	GE 2.82-127	89	632235.18	4786354.56
18	GE 2.82-127	89	632704.93	4786201.96
19	GE 2.82-127	89	633090.14	4786288.19
20	GE 2.82-127	89	633520.87	4786371.61
21	GE 2.82-127	89	635507.28	4787211.16
22	GE 2.82-127	89	635908.32	4787243.71
23	GE 2.82-127	89	637941.92	4787063.62
24	GE 2.82-127	89	638587.71	4787269.91
25	GE 2.82-127	89	639037.56	4787267.20
26	GE 2.82-127	89	639443.85	4787288.77
27	GE 2.82-127	89	640875.19	4786471.76
28	GE 2.82-127	89	642293.35	4786251.18
29	GE 2.82-127	89	631967.09	4785132.03
30	GE 2.82-127	89	632368.16	4785147.53
31	GE 2.82-127	89	632752.13	4785244.07
32	GE 2.82-127	89	633065.03	4785475.28
33	GE 2.82-127	89	634384.20	4784787.03
34	GE 2.82-127	89	635499.63	4786107.12
35	GE 2.82-127	89	636144.00	4785240.54
36	GE 2.82-127	89	636379.33	4784569.58
37	GE 2.82-127	89	636800.42	4784526.87
38	GE 2.82-127	89	637210.81	4784555.10
39	GE 2.82-127	89	638002.25	4784683.77
40	GE 2.82-127	89	638493.25	4784819.39
41	GE 2.82-127	89	639076.36	4784549.06
42	GE 2.82-127	89	639468.03	4784941.31
43	GE 2.82-127	89	639609.91	4785391.80
44	GE 2.82-127	89	640010.22	4785491.05
45	GE 2.82-127	89	636000.43	4783889.12

Table A-1: Wind Turbine Array 20240718

Wind Turbine ID	Wind Turbine Type	Hub Height (m)	Coordinates NAD 1983 UTM Zone 14N	
			X (m)	Y (m)
46	GE 2.82-127	89	636404.54	4783941.07
47	GE 2.82-127	89	639304.23	4783204.57
48	GE 2.82-127	89	639343.08	4783825.76
49	GE 2.82-127	89	641594.04	4783826.32
50	GE 2.82-127	89	644079.03	4783491.93
51	GE 2.82-127	89	645552.58	4783552.59
52	GE 2.82-127	89	645911.63	4783731.97
53	GE 2.82-127	89	634054.74	4781346.29
54	GE 2.82-127	89	635480.30	4781511.91
55	GE 2.82-127	89	637243.89	4781603.36
56	GE 2.82-127	89	639265.07	4782106.59
57	GE 2.82-127	89	641208.86	4781585.99
58	GE 2.82-127	89	641217.88	4782164.00
59	GE 2.82-127	89	645507.73	4782209.72
60	GE 2.82-127	89	646484.15	4781843.65
61	GE 2.82-127	89	633761.20	4780622.77
62	GE 2.82-127	89	634911.63	4779957.92
63	GE 2.82-127	89	636306.04	4780390.22
64	GE 2.82-127	89	637727.70	4780438.59
65	GE 2.82-127	89	638137.62	4780437.15
66	GE 2.82-127	89	638533.14	4779879.23
67	GE 2.82-127	89	638928.44	4779943.23
68	GE 2.82-127	89	639373.10	4779894.71
69	GE 2.82-127	89	639699.85	4780572.33
70	GE 2.82-127	89	640381.78	4779751.75
71	GE 2.82-127	89	634584.92	4777989.14
72	GE 2.82-127	89	634889.22	4778282.44
73	GE 2.82-127	89	637736.63	4778432.45
74	GE 2.82-127	89	640246.60	4778259.89
75	GE 2.82-127	89	640519.30	4778585.58
76	GE 2.82-127	89	637780.27	4777600.33
77	GE 2.82-127	89	638984.49	4777320.48
78	GE 2.82-127	89	641864.14	4776573.01
79	GE 2.82-127	89	642203.22	4776853.84
80	GE 2.82-127	89	642688.61	4776954.68
81	GE 2.82-127	89	634195.39	4773446.05
82	GE 2.82-127	89	634911.31	4773507.14
83	GE 2.82-127	89	635527.44	4774327.11
84	GE 2.82-127	89	635827.02	4774764.82
85	GE 2.82-127	89	637078.38	4775686.31
86	GE 2.82-127	89	638750.39	4775190.46
87	GE 2.82-127	89	639021.38	4775925.58
88	GE 2.82-127	89	639594.22	4775794.01
89	GE 2.82-127	89	642204.34	4775943.99
90	GE 2.82-127	89	643913.50	4774539.88

Table A-1: Wind Turbine Array 20240718

Wind Turbine ID	Wind Turbine Type	Hub Height (m)	Coordinates NAD 1983 UTM Zone 14N	
			X (m)	Y (m)
91	GE 2.82-127	89	639798.25	4773647.79
92	GE 2.82-127	89	640539.29	4772651.54
93	GE 2.82-127	89	640549.99	4772077.99
94	GE 2.82-127	89	641320.82	4772091.27
95	GE 2.82-127	89	642657.37	4772890.81
96	GE 2.82-127	89	643094.88	4772737.68
97	GE 2.82-127	89	644592.03	4772162.15
Alt1	GE 2.82-127	89	630138.44	4793174.10
Alt2	GE 2.82-127	89	635831.80	4790150.35
Alt3	GE 2.82-127	89	632401.94	4781384.68
Alt4	GE 2.82-127	89	630444.42	4791868.64
Alt5	GE 2.82-127	89	630052.51	4791681.77
Alt6	GE 2.82-127	89	631597.27	4783107.72
Alt7	GE 2.82-127	89	631580.07	4782288.69
Alt8	GE 2.82-127	89	631270.24	4782846.97
Alt9	GE 2.82-127	89	630753.25	4784275.19

Appendix B

Shadow Flicker Modeling Results: Modeling Receptors

Table B-2: Shadow Flicker Modeling Results and NEER Criteria Evaluation - Sorted by Receptor ID

Receptor ID	Coordinates NAD 1983 UTM Zone 14N		Participation	Expected Shadow Flicker Hours per Year (HH:MM/year)	NEER Shadow Flicker Criterion (Expected Hours/Year)	Complies with NEER Shadow Flicker Criterion?
	X (m)	Y (m)				
10	640535.59	4768594.52	Non-Participating	0:00	30	Yes
11	640435.54	4768610.97	Non-Participating	0:00	30	Yes
12	640530.73	4768618.73	Non-Participating	0:00	30	Yes
13	640456.70	4768621.58	Non-Participating	0:00	30	Yes
14	640482.30	4768628.04	Non-Participating	0:00	30	Yes
15	640509.04	4768627.27	Non-Participating	0:00	30	Yes
16	640231.93	4768699.13	Non-Participating	0:00	30	Yes
17	639882.53	4769270.47	Non-Participating	0:00	30	Yes
18	640019.94	4769377.65	Non-Participating	0:00	30	Yes
19	639808.35	4769392.82	Non-Participating	0:00	30	Yes
20	640064.23	4769420.37	Non-Participating	0:00	30	Yes
21	640004.86	4769452.29	Non-Participating	0:00	30	Yes
22	640063.28	4769462.12	Non-Participating	0:00	30	Yes
23	639833.87	4769429.21	Non-Participating	0:00	30	Yes
24	649628.93	4770581.57	Non-Participating	0:00	30	Yes
25	649579.33	4770739.40	Non-Participating	0:00	30	Yes
26	649720.93	4771035.97	Non-Participating	0:00	30	Yes
27	649672.10	4771404.97	Non-Participating	0:00	30	Yes
28	649698.42	4771412.74	Non-Participating	0:00	30	Yes
29	649715.04	4771499.77	Non-Participating	0:00	30	Yes
30	649674.66	4771496.99	Non-Participating	0:00	30	Yes
31	630451.73	4771134.05	Non-Participating	0:00	30	Yes
32	649687.10	4771563.16	Non-Participating	0:00	30	Yes
33	630174.90	4771167.67	Non-Participating	0:00	30	Yes
34	630221.27	4771181.53	Non-Participating	0:00	30	Yes
35	630365.23	4771183.45	Non-Participating	0:00	30	Yes
36	649711.87	4771609.29	Non-Participating	0:00	30	Yes
38	649710.91	4771626.58	Non-Participating	0:00	30	Yes
40	649681.44	4771605.00	Non-Participating	0:00	30	Yes
45	649704.64	4771667.78	Non-Participating	0:00	30	Yes
60	649708.27	4771719.37	Non-Participating	0:00	30	Yes
61	649251.53	4771725.86	Non-Participating	0:00	30	Yes
62	649501.62	4771736.19	Non-Participating	0:00	30	Yes
63	649280.70	4771737.11	Non-Participating	0:00	30	Yes
65	649525.58	4771738.28	Non-Participating	0:00	30	Yes
67	649345.65	4771727.23	Non-Participating	0:00	30	Yes
69	649572.01	4771738.26	Non-Participating	0:00	30	Yes
70	649387.40	4771736.72	Non-Participating	0:00	30	Yes
71	640178.29	4771537.19	Non-Participating	7:11	30	Yes
72	649659.68	4771763.99	Non-Participating	0:00	30	Yes
77	649701.82	4771778.89	Non-Participating	0:00	30	Yes
79	649659.34	4771803.88	Non-Participating	0:00	30	Yes
80	649655.40	4771907.31	Non-Participating	0:00	30	Yes
81	649698.91	4771924.46	Non-Participating	0:00	30	Yes
84	649687.41	4771946.34	Non-Participating	0:00	30	Yes
85	649700.15	4771971.72	Non-Participating	0:00	30	Yes
87	649488.52	4772031.21	Non-Participating	0:00	30	Yes
88	649510.19	4772039.51	Non-Participating	0:00	30	Yes
89	648608.56	4773225.56	Non-Participating	0:00	30	Yes
90	648579.24	4773230.88	Non-Participating	0:00	30	Yes
91	648707.95	4773245.14	Non-Participating	0:00	30	Yes
92	636328.66	4774612.53	Participating	43:02	N/A	N/A
93	647700.71	4776288.67	Non-Participating	0:00	30	Yes
94	647866.82	4776309.75	Non-Participating	0:00	30	Yes
95	630170.38	4775964.35	Non-Participating	0:00	30	Yes
96	630146.44	4775972.52	Non-Participating	0:00	30	Yes
97	647819.96	4776339.15	Non-Participating	0:00	30	Yes
98	647793.15	4776339.16	Non-Participating	0:00	30	Yes
99	647901.05	4776352.19	Non-Participating	0:00	30	Yes

Table B-2: Shadow Flicker Modeling Results and NEER Criteria Evaluation - Sorted by Receptor ID

Receptor ID	Coordinates NAD 1983 UTM Zone 14N		Participation	Expected Shadow Flicker Hours per Year (HH:MM/year)	NEER Shadow Flicker Criterion (Expected Hours/Year)	Complies with NEER Shadow Flicker Criterion?
	X (m)	Y (m)				
100	647884.07	4776352.16	Non-Participating	0:00	30	Yes
101	647892.74	4776352.51	Non-Participating	0:00	30	Yes
102	647874.13	4776352.47	Non-Participating	0:00	30	Yes
103	647911.09	4776353.36	Non-Participating	0:00	30	Yes
104	647863.62	4776357.98	Non-Participating	0:00	30	Yes
105	647812.88	4776358.68	Non-Participating	0:00	30	Yes
106	647760.79	4776353.51	Non-Participating	0:00	30	Yes
107	647736.46	4776354.39	Non-Participating	0:00	30	Yes
108	647836.36	4776364.72	Non-Participating	0:00	30	Yes
109	630167.07	4775997.66	Non-Participating	0:00	30	Yes
110	647848.59	4776366.15	Non-Participating	0:00	30	Yes
111	647740.95	4776377.52	Non-Participating	0:00	30	Yes
112	647808.59	4776404.37	Non-Participating	0:00	30	Yes
113	643002.17	4781127.00	Non-Participating	0:43	30	Yes
114	643056.09	4781134.20	Non-Participating	0:37	30	Yes
234	634784.24	4768513.77	Non-Participating	0:00	30	Yes
236	638848.29	4768923.79	Non-Participating	0:00	30	Yes
237	631328.93	4768847.99	Non-Participating	0:00	30	Yes
238	637047.88	4768987.35	Non-Participating	0:00	30	Yes
239	636451.86	4769025.59	Non-Participating	0:00	30	Yes
240	630797.98	4768929.38	Non-Participating	0:00	30	Yes
241	641472.91	4769256.40	Non-Participating	0:00	30	Yes
242	642105.46	4769401.95	Non-Participating	0:00	30	Yes
244	645446.79	4769600.40	Non-Participating	0:00	30	Yes
245	629030.95	4769236.61	Non-Participating	0:00	30	Yes
246	640535.75	4769642.45	Non-Participating	0:00	30	Yes
247	642914.30	4769829.58	Non-Participating	0:00	30	Yes
248	633064.33	4769697.73	Non-Participating	0:00	30	Yes
249	641012.63	4769921.95	Non-Participating	0:00	30	Yes
250	648081.23	4770080.76	Non-Participating	0:00	30	Yes
251	641610.08	4769970.92	Non-Participating	0:00	30	Yes
252	634207.18	4769909.46	Non-Participating	0:00	30	Yes
253	640045.42	4770021.02	Non-Participating	0:00	30	Yes
254	631133.57	4769895.19	Non-Participating	0:00	30	Yes
255	644487.46	4770224.25	Non-Participating	0:00	30	Yes
256	646297.55	4770285.95	Non-Participating	0:00	30	Yes
257	632153.32	4770113.23	Non-Participating	0:00	30	Yes
259	640728.90	4770403.67	Non-Participating	0:00	30	Yes
260	630044.26	4770180.42	Non-Participating	0:00	30	Yes
261	641772.53	4770490.07	Non-Participating	0:00	30	Yes
263	628629.07	4770604.66	Non-Participating	0:00	30	Yes
264	635324.45	4770767.92	Non-Participating	0:00	30	Yes
265	642804.04	4770889.68	Non-Participating	0:00	30	Yes
266	645599.70	4771088.82	Non-Participating	0:00	30	Yes
267	638782.12	4770989.64	Non-Participating	0:00	30	Yes
269	636932.30	4771155.58	Non-Participating	0:00	30	Yes
270	644055.08	4771378.92	Non-Participating	0:00	30	Yes
271	633611.40	4771192.42	Non-Participating	0:00	30	Yes
272	641321.79	4771383.18	Non-Participating	0:00	30	Yes
273	647871.30	4771541.44	Non-Participating	0:00	30	Yes
274	647620.24	4771536.52	Non-Participating	0:00	30	Yes
275	636833.93	4771388.29	Non-Participating	0:00	30	Yes
276	632712.26	4771353.66	Non-Participating	0:00	30	Yes
277	634064.57	4771369.49	Non-Participating	0:00	30	Yes
278	639471.93	4771515.71	Non-Participating	7:37	30	Yes
279	630083.40	4771333.32	Non-Participating	0:00	30	Yes
281	643767.97	4771639.18	Non-Participating	1:55	30	Yes
282	642137.14	4771627.53	Non-Participating	4:18	30	Yes
283	640935.85	4771598.52	Non-Participating	0:00	30	Yes

Table B-2: Shadow Flicker Modeling Results and NEER Criteria Evaluation - Sorted by Receptor ID

Receptor ID	Coordinates NAD 1983 UTM Zone 14N		Participation	Expected Shadow Flicker Hours per Year (HH:MM/year)	NEER Shadow Flicker Criterion (Expected Hours/Year)	Complies with NEER Shadow Flicker Criterion?
	X (m)	Y (m)				
284	630485.97	4771337.60	Non-Participating	0:00	30	Yes
285	646072.43	4771672.28	Non-Participating	2:33	30	Yes
286	646719.34	4771725.63	Non-Participating	0:00	30	Yes
287	637184.58	4771513.22	Non-Participating	0:00	30	Yes
288	641637.67	4771637.78	Non-Participating	6:51	30	Yes
290	647229.47	4771800.61	Non-Participating	0:00	30	Yes
291	647818.24	4771917.55	Non-Participating	0:00	30	Yes
292	643090.10	4772004.84	Non-Participating	1:31	30	Yes
294	645780.02	4772350.18	Non-Participating	2:43	30	Yes
295	638048.06	4772213.60	Non-Participating	0:00	30	Yes
296	646586.35	4772445.61	Non-Participating	0:00	30	Yes
297	636785.80	4772390.19	Non-Participating	0:00	30	Yes
298	642100.19	4772541.91	Non-Participating	13:24	30	Yes
299	646444.55	4772719.23	Non-Participating	0:48	30	Yes
300	630481.34	4772446.72	Non-Participating	0:00	30	Yes
301	631897.41	4772505.38	Non-Participating	0:00	30	Yes
302	633773.79	4772515.10	Non-Participating	0:00	30	Yes
304	647363.19	4772926.95	Non-Participating	0:00	30	Yes
305	645655.28	4772946.29	Non-Participating	5:00	30	Yes
306	629732.63	4772682.54	Non-Participating	0:00	30	Yes
307	637214.27	4772853.24	Non-Participating	0:00	30	Yes
308	631930.52	4772784.49	Non-Participating	0:00	30	Yes
309	644611.20	4773087.41	Non-Participating	1:44	30	Yes
310	629969.44	4772849.42	Non-Participating	0:00	30	Yes
311	629640.45	4772812.34	Non-Participating	0:00	30	Yes
312	642046.85	4773121.33	Non-Participating	13:28	30	Yes
313	644203.18	4773189.48	Participating	3:45	N/A	N/A
314	639650.79	4773121.97	Participating	5:41	N/A	N/A
315	633949.48	4773017.71	Non-Participating	8:52	30	Yes
316	630333.89	4773092.37	Non-Participating	0:00	30	Yes
317	641319.22	4773348.57	Non-Participating	6:39	30	Yes
318	646623.30	4773489.86	Non-Participating	0:00	30	Yes
319	649215.26	4773539.71	Non-Participating	0:00	30	Yes
320	648177.04	4773633.33	Non-Participating	0:00	30	Yes
321	632239.66	4773353.61	Non-Participating	0:37	30	Yes
322	643238.14	4773597.23	Non-Participating	0:00	30	Yes
323	630597.16	4773354.60	Non-Participating	0:00	30	Yes
324	636654.71	4773399.27	Non-Participating	0:25	30	Yes
325	645231.35	4773845.02	Non-Participating	3:48	30	Yes
326	631971.53	4773701.23	Non-Participating	0:00	30	Yes
327	638783.64	4773894.81	Non-Participating	3:51	30	Yes
328	636782.32	4773941.41	Non-Participating	3:03	30	Yes
330	643135.21	4774116.86	Non-Participating	8:29	30	Yes
331	644702.80	4774150.47	Non-Participating	11:03	30	Yes
332	641524.85	4774210.69	Non-Participating	0:23	30	Yes
333	637004.06	4774058.35	Non-Participating	1:22	30	Yes
334	632097.00	4774041.37	Non-Participating	0:00	30	Yes
335	634483.16	4774152.44	Non-Participating	7:03	30	Yes
336	633532.29	4774133.16	Non-Participating	2:15	30	Yes
337	629231.31	4774068.30	Non-Participating	0:00	30	Yes
338	648225.49	4774482.22	Non-Participating	0:00	30	Yes
339	642340.85	4774459.18	Non-Participating	0:43	30	Yes
340	648791.71	4774617.57	Non-Participating	0:00	30	Yes
341	640390.20	4774427.74	Participating	1:48	N/A	N/A
342	647927.05	4774635.04	Non-Participating	0:00	30	Yes
343	638382.75	4774448.04	Non-Participating	1:46	30	Yes
345	647502.83	4774707.34	Non-Participating	0:00	30	Yes
346	645771.13	4774714.87	Non-Participating	0:48	30	Yes
347	647057.94	4774852.59	Non-Participating	0:00	30	Yes

Table B-2: Shadow Flicker Modeling Results and NEER Criteria Evaluation - Sorted by Receptor ID

Receptor ID	Coordinates NAD 1983 UTM Zone 14N		Participation	Expected Shadow Flicker Hours per Year (HH:MM/year)	NEER Shadow Flicker Criterion (Expected Hours/Year)	Complies with NEER Shadow Flicker Criterion?
	X (m)	Y (m)				
348	636886.48	4774627.44	Participating	5:03	N/A	N/A
349	634163.46	4774574.46	Non-Participating	2:42	30	Yes
350	631946.52	4774591.87	Non-Participating	0:00	30	Yes
352	636758.32	4774766.60	Non-Participating	5:16	30	Yes
353	649223.63	4775011.76	Non-Participating	0:00	30	Yes
354	642956.10	4774989.46	Non-Participating	4:19	30	Yes
355	628892.23	4774775.62	Non-Participating	0:00	30	Yes
356	632290.62	4774904.79	Non-Participating	0:00	30	Yes
357	636893.55	4774999.89	Participating	3:47	N/A	N/A
359	644911.04	4775289.96	Non-Participating	5:40	30	Yes
360	636250.93	4775370.13	Participating	12:20	N/A	N/A
361	631930.30	4775354.80	Non-Participating	0:00	30	Yes
362	627095.29	4775383.83	Non-Participating	0:00	30	Yes
364	640502.05	4775810.62	Non-Participating	8:58	30	Yes
365	635633.42	4775681.89	Non-Participating	1:46	30	Yes
366	637919.77	4775897.35	Participating	12:49	N/A	N/A
367	628053.11	4775704.58	Non-Participating	0:00	30	Yes
368	643109.77	4776068.82	Non-Participating	8:47	30	Yes
369	644681.69	4776161.59	Non-Participating	0:00	30	Yes
370	638459.18	4776038.88	Participating	13:42	N/A	N/A
371	630797.93	4775956.24	Non-Participating	0:00	30	Yes
372	633751.14	4776050.38	Non-Participating	0:00	30	Yes
373	644963.32	4776433.47	Non-Participating	0:00	30	Yes
374	630631.15	4776153.54	Non-Participating	0:00	30	Yes
375	648518.45	4776539.91	Non-Participating	0:00	30	Yes
376	640658.45	4776365.14	Non-Participating	6:56	30	Yes
377	630139.99	4776157.08	Non-Participating	0:00	30	Yes
378	646962.60	4776498.23	Non-Participating	0:00	30	Yes
380	636938.05	4776454.88	Non-Participating	0:00	30	Yes
381	633631.96	4776383.66	Non-Participating	0:00	30	Yes
382	638766.28	4776501.25	Participating	4:38	N/A	N/A
383	644555.08	4776670.80	Non-Participating	0:52	30	Yes
384	633060.80	4776655.49	Non-Participating	0:00	30	Yes
385	647735.47	4776949.57	Non-Participating	0:00	30	Yes
387	647113.45	4777171.33	Non-Participating	0:00	30	Yes
388	636432.50	4777035.42	Non-Participating	3:23	30	Yes
389	638115.25	4777125.28	Participating	5:53	N/A	N/A
390	647528.88	4777367.64	Non-Participating	0:00	30	Yes
391	649425.80	4777450.11	Non-Participating	0:00	30	Yes
392	633474.30	4777233.77	Non-Participating	0:00	30	Yes
393	639927.46	4777351.56	Non-Participating	3:57	30	Yes
394	631845.94	4777340.76	Non-Participating	0:00	30	Yes
395	641292.27	4777531.52	Non-Participating	6:49	30	Yes
396	647865.24	4777717.18	Non-Participating	0:00	30	Yes
397	644093.73	4777767.24	Non-Participating	1:21	30	Yes
398	630525.89	4777455.18	Non-Participating	0:00	30	Yes
400	636306.43	4777687.66	Non-Participating	9:53	30	Yes
401	648236.47	4778149.89	Non-Participating	0:00	30	Yes
402	633725.43	4777851.16	Non-Participating	10:00	30	Yes
403	637206.27	4778052.77	Participating	18:29	N/A	N/A
404	645559.50	4778492.34	Participating	0:00	N/A	N/A
405	648719.55	4778666.95	Non-Participating	0:00	30	Yes
406	647847.52	4778711.50	Non-Participating	0:00	30	Yes
407	646569.18	4778807.67	Non-Participating	0:00	30	Yes
408	641454.74	4778708.10	Participating	6:19	N/A	N/A
409	633681.52	4778645.61	Non-Participating	11:36	30	Yes
410	636848.63	4778771.83	Non-Participating	5:54	30	Yes
411	647870.39	4779039.01	Participating	0:00	N/A	N/A
412	630424.82	4778722.86	Non-Participating	0:00	30	Yes

Table B-2: Shadow Flicker Modeling Results and NEER Criteria Evaluation - Sorted by Receptor ID

Receptor ID	Coordinates NAD 1983 UTM Zone 14N		Participation	Expected Shadow Flicker Hours per Year (HH:MM/year)	NEER Shadow Flicker Criterion (Expected Hours/Year)	Complies with NEER Shadow Flicker Criterion?
	X (m)	Y (m)				
413	636981.66	4778935.28	Participating	12:45	N/A	N/A
414	646146.60	4779132.30	Non-Participating	0:00	30	Yes
415	643420.18	4779104.20	Non-Participating	0:00	30	Yes
416	638179.96	4779051.35	Non-Participating	0:00	30	Yes
418	639823.48	4779168.95	Participating	9:57	N/A	N/A
419	644399.93	4779324.94	Non-Participating	0:00	30	Yes
420	648284.30	4779453.30	Non-Participating	0:00	30	Yes
422	635470.77	4779199.04	Non-Participating	0:00	30	Yes
423	629887.30	4779060.15	Non-Participating	0:00	30	Yes
424	628423.92	4779059.47	Non-Participating	0:00	30	Yes
425	637819.93	4779490.29	Non-Participating	14:10	30	Yes
426	634494.72	4779421.89	Participating	0:00	N/A	N/A
427	645029.96	4779669.95	Participating	0:00	N/A	N/A
428	635418.51	4779496.92	Non-Participating	0:00	30	Yes
429	647873.88	4779755.38	Non-Participating	0:00	30	Yes
430	631513.91	4779509.49	Non-Participating	0:00	30	Yes
432	633008.01	4779724.73	Non-Participating	0:49	30	Yes
433	637311.60	4779800.17	Non-Participating	3:28	30	Yes
434	627999.11	4779665.42	Non-Participating	0:00	30	Yes
435	641421.60	4779911.93	Non-Participating	4:13	30	Yes
436	648281.12	4780233.25	Non-Participating	0:00	30	Yes
437	633330.20	4780199.42	Non-Participating	1:10	30	Yes
438	630218.56	4780216.09	Non-Participating	0:00	30	Yes
439	636960.97	4780400.38	Non-Participating	18:12	30	Yes
440	645479.03	4780615.94	Participating	0:00	N/A	N/A
441	635292.68	4780688.32	Non-Participating	7:25	30	Yes
442	634546.91	4780701.45	Participating	6:06	N/A	N/A
443	648306.61	4780966.39	Non-Participating	0:00	30	Yes
444	640230.14	4780963.86	Non-Participating	17:08	30	Yes
446	628573.96	4780803.43	Non-Participating	0:00	30	Yes
447	632128.57	4780858.07	Non-Participating	1:49	30	Yes
448	631511.45	4780853.58	Non-Participating	3:40	30	Yes
450	638903.54	4780990.35	Non-Participating	18:37	30	Yes
451	636651.60	4780936.35	Non-Participating	11:21	30	Yes
741	648056.54	4777598.98	Non-Participating	0:00	30	Yes
743	647799.28	4776385.31	Non-Participating	0:00	30	Yes
744	645263.37	4776349.74	Non-Participating	0:00	30	Yes
745	630160.58	4775991.63	Non-Participating	0:00	30	Yes
746	629078.68	4776097.31	Non-Participating	0:00	30	Yes
747	629139.36	4775527.12	Non-Participating	0:00	30	Yes
748	638138.95	4775102.17	Participating	18:34	N/A	N/A
749	630559.24	4769085.35	Non-Participating	0:00	30	Yes
750	636816.05	4770471.25	Non-Participating	0:00	30	Yes
751	640010.56	4769446.26	Non-Participating	0:00	30	Yes
752	641271.52	4770155.65	Non-Participating	0:00	30	Yes
753	638425.05	4771041.10	Non-Participating	0:00	30	Yes
754	635305.85	4772856.46	Non-Participating	4:07	30	Yes
755	635624.03	4772890.19	Non-Participating	2:21	30	Yes
756	644162.65	4778094.81	Non-Participating	1:44	30	Yes

Table B-1: Shadow Flicker Modeling Results and NEER Criteria Evaluation - Sorted by Receptor ID (receptors w/in 1.5-mile radius only)

Receptor ID	Coordinates NAD 1983 UTM Zone 14N		Participation	Expected Shadow Flicker Hours per Year (HH:MM/year)	NEER Shadow Flicker Criterion (Expected Hours/Year)	Complies with NEER Shadow Flicker Criterion?
	X (m)	Y (m)				
71	640178.29	4771537.19	Non-Participating	7:11	30	Yes
92	636328.66	4774612.53	Participating	43:02	N/A	N/A
114	643056.09	4781134.20	Non-Participating	0:37	30	Yes
249	641012.63	4769921.95	Non-Participating	0:00	30	Yes
251	641610.08	4769970.92	Non-Participating	0:00	30	Yes
253	640045.42	4770021.02	Non-Participating	0:00	30	Yes
255	644487.46	4770224.25	Non-Participating	0:00	30	Yes
259	640728.90	4770403.67	Non-Participating	0:00	30	Yes
261	641772.53	4770490.07	Non-Participating	0:00	30	Yes
265	642804.04	4770889.68	Non-Participating	0:00	30	Yes
266	645599.70	4771088.82	Non-Participating	0:00	30	Yes
267	638782.12	4770989.64	Non-Participating	0:00	30	Yes
270	644055.08	4771378.92	Non-Participating	0:00	30	Yes
271	633611.40	4771192.42	Non-Participating	0:00	30	Yes
272	641321.79	4771383.18	Non-Participating	0:00	30	Yes
277	634064.57	4771369.49	Non-Participating	0:00	30	Yes
278	639471.93	4771515.71	Non-Participating	7:37	30	Yes
281	643767.97	4771639.18	Non-Participating	1:55	30	Yes
282	642137.14	4771627.53	Non-Participating	4:18	30	Yes
283	640935.85	4771598.52	Participating	0:00	N/A	N/A
285	646072.43	4771672.28	Non-Participating	2:33	30	Yes
286	646719.34	4771725.63	Non-Participating	0:00	30	Yes
288	641637.67	4771637.78	Non-Participating	6:51	30	Yes
292	643090.10	4772004.84	Non-Participating	1:31	30	Yes
294	645780.02	4772350.18	Non-Participating	2:43	30	Yes
295	638048.06	4772213.60	Non-Participating	0:00	30	Yes
296	646586.35	4772445.61	Non-Participating	0:00	30	Yes
297	636785.80	4772390.19	Non-Participating	0:00	30	Yes
298	642100.19	4772541.91	Non-Participating	13:24	30	Yes
299	646444.55	4772719.23	Non-Participating	0:48	30	Yes
302	633773.79	4772515.10	Non-Participating	0:00	30	Yes
305	645655.28	4772946.29	Non-Participating	5:00	30	Yes
307	637214.27	4772853.24	Non-Participating	0:00	30	Yes
308	631930.52	4772784.49	Non-Participating	0:00	30	Yes
309	644611.20	4773087.41	Non-Participating	1:44	30	Yes
312	642046.85	4773121.33	Non-Participating	13:28	30	Yes
313	644203.18	4773189.48	Participating	3:45	N/A	N/A
314	639650.79	4773121.97	Participating	5:41	N/A	N/A
315	633949.48	4773017.71	Non-Participating	8:52	30	Yes
317	641319.22	4773348.57	Non-Participating	6:39	30	Yes
321	632239.66	4773353.61	Non-Participating	0:37	30	Yes
322	643238.14	4773597.23	Non-Participating	0:00	30	Yes
324	636654.71	4773399.27	Participating	0:25	N/A	N/A
325	645231.35	4773845.02	Non-Participating	3:48	30	Yes
326	631971.53	4773701.23	Non-Participating	0:00	30	Yes
327	638783.64	4773894.81	Non-Participating	3:51	30	Yes
328	636782.32	4773941.41	Non-Participating	3:03	30	Yes
330	643135.21	4774116.86	Non-Participating	8:29	30	Yes
331	644702.80	4774150.47	Non-Participating	11:03	30	Yes
332	641524.85	4774210.69	Non-Participating	0:23	30	Yes
333	637004.06	4774058.35	Non-Participating	1:22	30	Yes
334	632097.00	4774041.37	Non-Participating	0:00	30	Yes
335	634483.16	4774152.44	Non-Participating	7:03	30	Yes
336	633532.29	4774133.16	Non-Participating	2:15	30	Yes
339	642340.85	4774459.18	Non-Participating	0:43	30	Yes

Table B-1: Shadow Flicker Modeling Results and NEER Criteria Evaluation - Sorted by Receptor ID (receptors w/in 1.5-mile radius only)

Receptor ID	Coordinates NAD 1983 UTM Zone 14N		Participation	Expected Shadow Flicker Hours per Year (HH:MM/year)	NEER Shadow Flicker Criterion (Expected Hours/Year)	Complies with NEER Shadow Flicker Criterion?
	X (m)	Y (m)				
341	640390.20	4774427.74	Participating	1:48	N/A	N/A
343	638382.75	4774448.04	Non-Participating	1:46	30	Yes
346	645771.13	4774714.87	Non-Participating	0:48	30	Yes
348	636886.48	4774627.44	Participating	5:03	N/A	N/A
349	634163.46	4774574.46	Non-Participating	2:42	30	Yes
352	636758.32	4774766.60	Non-Participating	5:16	30	Yes
354	642956.10	4774989.46	Non-Participating	4:19	30	Yes
357	636893.55	4774999.89	Participating	3:47	N/A	N/A
359	644911.04	4775289.96	Non-Participating	5:40	30	Yes
360	636250.93	4775370.13	Participating	12:20	N/A	N/A
364	640502.05	4775810.62	Non-Participating	8:58	30	Yes
365	635633.42	4775681.89	Non-Participating	1:46	30	Yes
366	637919.77	4775897.35	Participating	12:49	N/A	N/A
368	643109.77	4776068.82	Non-Participating	8:47	30	Yes
369	644681.69	4776161.59	Non-Participating	0:00	30	Yes
370	638459.18	4776038.88	Participating	13:42	N/A	N/A
372	633751.14	4776050.38	Non-Participating	0:00	30	Yes
373	644963.32	4776433.47	Non-Participating	0:00	30	Yes
376	640658.45	4776365.14	Non-Participating	6:56	30	Yes
380	636938.05	4776454.88	Non-Participating	0:00	30	Yes
381	633631.96	4776383.66	Non-Participating	0:00	30	Yes
382	638766.28	4776501.25	Participating	4:38	N/A	N/A
383	644555.08	4776670.80	Non-Participating	0:52	30	Yes
384	633060.80	4776655.49	Non-Participating	0:00	30	Yes
388	636432.50	4777035.42	Non-Participating	3:23	30	Yes
389	638115.25	4777125.28	Participating	5:53	N/A	N/A
392	633474.30	4777233.77	Non-Participating	0:00	30	Yes
393	639927.46	4777351.56	Non-Participating	3:57	30	Yes
395	641292.27	4777531.52	Non-Participating	6:49	30	Yes
397	644093.73	4777767.24	Non-Participating	1:21	30	Yes
400	636306.43	4777687.66	Non-Participating	9:53	30	Yes
402	633725.43	4777851.16	Non-Participating	10:00	30	Yes
403	637206.27	4778052.77	Participating	18:29	N/A	N/A
408	641454.74	4778708.10	Participating	6:19	N/A	N/A
409	633681.52	4778645.61	Non-Participating	11:36	30	Yes
410	636848.63	4778771.83	Non-Participating	5:54	30	Yes
413	636981.66	4778935.28	Participating	12:45	N/A	N/A
415	643420.18	4779104.20	Non-Participating	0:00	30	Yes
416	638179.96	4779051.35	Non-Participating	0:00	30	Yes
418	639823.48	4779168.95	Participating	9:57	N/A	N/A
422	635470.77	4779199.04	Non-Participating	0:00	30	Yes
425	637819.93	4779490.29	Non-Participating	14:10	30	Yes
426	634494.72	4779421.89	Participating	0:00	N/A	N/A
428	635418.51	4779496.92	Non-Participating	0:00	30	Yes
430	631513.91	4779509.49	Non-Participating	0:00	30	Yes
432	633008.01	4779724.73	Non-Participating	0:49	30	Yes
433	637311.60	4779800.17	Non-Participating	3:28	30	Yes
435	641421.60	4779911.93	Non-Participating	4:13	30	Yes
436	648281.12	4780233.25	Non-Participating	0:00	30	Yes
437	633330.20	4780199.42	Non-Participating	1:10	30	Yes
439	636960.97	4780400.38	Non-Participating	18:12	30	Yes
440	645479.03	4780615.94	Participating	0:00	N/A	N/A
441	635292.68	4780688.32	Non-Participating	7:25	30	Yes
442	634546.91	4780701.45	Participating	6:06	N/A	N/A
443	648306.61	4780966.39	Non-Participating	0:00	30	Yes

Table B-1: Shadow Flicker Modeling Results and NEER Criteria Evaluation - Sorted by Receptor ID (receptors w/in 1.5-mile radius only)

Receptor ID	Coordinates NAD 1983 UTM Zone 14N		Participation	Expected Shadow Flicker Hours per Year (HH:MM/year)	NEER Shadow Flicker Criterion (Expected Hours/Year)	Complies with NEER Shadow Flicker Criterion?
	X (m)	Y (m)				
444	640230.14	4780963.86	Non-Participating	17:08	30	Yes
447	632128.57	4780858.07	Non-Participating	1:49	30	Yes
448	631511.45	4780853.58	Non-Participating	3:40	30	Yes
450	638903.54	4780990.35	Non-Participating	18:37	30	Yes
451	636651.60	4780936.35	Non-Participating	11:21	30	Yes
744	645263.37	4776349.74	Non-Participating	0:00	30	Yes
748	638138.95	4775102.17	Participating	18:34	N/A	N/A
752	641271.52	4770155.65	Non-Participating	0:00	30	Yes
753	638425.05	4771041.10	Non-Participating	0:00	30	Yes
754	635305.85	4772856.46	Non-Participating	4:07	30	Yes
755	635624.03	4772890.19	Non-Participating	2:21	30	Yes
756	644162.65	4778094.81	Non-Participating	1:44	30	Yes