

Marble River Wind Farm

Wind Turbine Generator Shadow Flicker Analysis

Executive Summary

This report summarizes the assessment of potential shadow flicker effects on residents (i.e. receptors) within the vicinity the proposed Marble River Wind Farm in Clinton County, New York. Wind turbines, like other tall structures, will cast a shadow on the neighboring area when the sun is visible. For a resident living close to a wind turbine, the changing light intensity as the sun casts a shadow through the rotating blades may be annoying as the rotor blades chop the sunlight, causing a flickering (blinking) effect while the rotor is in motion. The change in intensity diminishes quickly and typically becomes imperceptible beyond 1,000 meters from the WTG.

The assessment of shadow flicker effects from the Marble River Wind Farm was conducted using the WindPRO Version 2.5 model. An initial screening of the WTGs and receptors was performed to determine the distance between each receptor and each WTG. Potential receptors that were beyond 1,000 meters of any WTG were omitted from the analysis because there would not be any perceptible effect at those receptors. Conversely, WTGs that were not within 1,000 meters of any potential receptor were omitted from the analysis because there would not be any perceptible effect created by those WTGs. A total of 87 WTGs and associated potential receptors were grouped into four clusters to facilitate modeling.

No standards exist in the U.S. or New York State for frequency or duration of shadow flicker from wind turbine projects, but impact thresholds of 30 hours per year are found in Germany and Australia. In the U.S., a more conservative threshold of 25 hours per year has typically been applied. Accordingly, a threshold of 25 hours of shadow flicker per year was used for this analysis. Based on the WindPRO modeling results, a total of 11 receptors would potentially experience shadow flicker more than 25 hours per year, with a maximum of 37 hours per year at one receptor. These 11 receptors are located in close proximity to several WTGs. Considering the mitigating circumstances that will reduce or eliminate shadow flicker effects (i.e., vegetation, orientation or absence of windows, etc.) it is recommended that each of these receptors be further evaluated to determine whether mitigating circumstances are present at these specific locations. A case-by-case evaluation would include, but not limited to determination of the nature of the receptor itself, i.e. is the receptor an inhabited residence or a generally vacant structure; an assessment of vegetation and intervening obstacles that may block the impact; and the orientation and location of windows relative to the WTGs.

Introduction

Marble River, LLC is currently developing a wind-powered electric generating project (Marble River Wind Farm) (i.e., the “Project”) in the Towns of Clinton and Ellenburg located in Clinton County, New York. The project may include up to 109-wind turbine generators (WTGs) constructed on approximately 18,500 acres of leased land in upstate New York. Each WTG would generate a nominal 2,000 kilowatts (kW) of electricity and the entire project would generate up to 218 megawatts (MW) of electricity. A comprehensive environmental assessment was prepared to assess the potential environment issues associated with the project in the “Draft Environmental Impact Statement for the Marble River Wind Farm – March 30, 2006.” This assessment of potential shadow flicker impacts was prepared to address changes to turbine layout that have occurred since completion of the DEIS, and to support the Supplemental Draft Environmental Impact Statement and Final Environmental Impact Statement for the proposed Project.

Shadow Flicker from Wind Turbines

Shadow flicker is caused by the direct rays of the sun shining through the rotating WTG blades and casting alternating shadows to produce a flickering or blinking effect. Shadow flicker can be predicted using a combination of meteorology and solar angle trigonometry to model scenarios when the wind is blowing at a sufficient velocity to spin the turbine blades and when the sun is fully shining (i.e., no clouds are present). Residents and other observers in the vicinity of the WTGs may experience shadow flicker when the wind is blowing parallel to their line of sight (i.e., causing the turbine blades to rotate perpendicular to their line of sight), when the sun is shining fully (i.e., there are no clouds or fog) when the sun is low in the sky (just above the horizon), and when there are no obstacles in the line of sight between the observer and the turbine blades (i.e., buildings, topography, vegetation, etc.). Shadow flicker is a transient phenomenon that is a function of time of day, the meteorological conditions (wind speed, wind direction, and sky cover), and distance without obstruction from the turbine blades to the observer. Therefore, the shadow flicker analysis considers the orientation of the sun, WTG, and receptors taking into account the frequency of the orientation of the WTG tower (based on the frequency of wind directions) and frequency of cloudiness, or conversely, amount of sunshine. Furthermore, the distance between the receptor and the WTG affects the intensity. Shadow flicker intensity diminishes rapidly as the turbine blades turn away from the line of sight perpendicular angle. The greatest intensity observed is immediately adjacent to the WTG; however, the affect significantly diminishes with increasing shadow length. This is due to diffraction of the shadow (caused by the sun’s light radiating from a disc rather than a point source) and the addition of ambient background light to diffuse the shadow. The change in intensity is essentially imperceptible at a distance of 1 kilometer (approximately 3,300 feet).

The WTG is anticipated to operate at approximately 17 revolutions per minute (rpm), and with three blades, represents an alternating shadow frequency of approximately 1 cycle per second (Hz). Research has suggested that brainwave frequency in a sensitive individual can shift towards the frequency of pulses of alternating light intensity that are in the 3 to 10 Hz range, and produce a mild hypnotic or trance-like state. This is consistent with the “Alpha” brainwave frequency, typically 8 to 12 Hz that is associated with an individual in a relaxed or meditative state. Essentially, the alpha waves can synchronize with the light intensity pulses resulting in a state of relaxation. However, the very low frequencies associated with WTG shadow flicker are considered harmless even to individuals with epilepsy. The Epilepsy Foundation has suggested that alternating light intensity with a frequency of less than 10 Hz are unlikely to trigger epileptic seizures. Therefore, while the very low frequency of alternating light intensity does not pose an adverse health risk, some sensitive individuals may perceive the alternating light intensity as an annoyance. As such, shadow flicker may be considered an adverse “quality of life” impact.

Figure 1 was prepared by Osten and Pahlke for the Article “Shadow Impact on the Surrounding of Wind Turbines – August 1998.” The figure represents the worst-case area around a wind turbine where an observer would be affected by shadows, with each spot representing the shadow of the highest point of the wind turbine (100 meters for this case). Note that the two parabolic edges of the shadow area represent the data from the summer and winter seasons. As the figure shows, the most significant impact is north of the turbine and within an area of approximately three times the top of a turbine blade. The impact then decreases as the observer moves further east and west of the turbine blades.

Modeling Methodology

The potential for shadow flicker effects was determined through a rigorous analytical study using the SHADOW module of the WindPRO 2.5 suite of modules. WindPRO is a Windows-based object-oriented software suite for the design and planning of both single WTGs and wind farms. WindPRO was developed by EMD International A/S, a Danish wind analysis and energy consulting company - EMD (Energi- og Miljødata). WindPRO is recognized by the industry as a leading tool for the analysis of wind power projects. The model incorporates a full range of WTG design characteristics as well as site topography, wind conditions and orientation of the WTGs. The SHADOW module incorporates the following into the flicker analysis:

- The position of the WTGs (geographical and elevation as x, y, z coordinates).
- The hub height and rotor diameter of the WTGs.
- The topography of the study area, input from U. S. Geological Survey (USGS) Digital Elevation Model (DEM) terrain data.
- The location, elevation and orientation of the receptor (typically nearest residences).

- Solar angle model to accurately calculate sunrise, sunset and solar angle of the sun during the day.
- Wind direction frequency, to determine the orientation of the WTGs
- Monthly sunshine frequency.

As discussed previously, the change in light intensity due to shadow flicker at a distance of 1 km is nearly imperceptible to the human eye. Therefore, an initial screening of the WTGs and receptors was performed to consider the absence of any potential shadow flicker effects due to the distance between potential receptors and WTGs. Potential receptors that were beyond 1 km of any WTG were omitted from the analysis because there would not be any perceptible effect at those receptors. Conversely, WTGs that were not within 1 km of any potential receptor were omitted from the analysis because there would not be any perceptible effect created by those WTGs. Based on this screening, a total of 87 WTGs and 348 associated potential receptors were identified for modeling. The various WTGs and potential receptors were further aggregated into four separate geographic “clusters” to facilitate development of isolines (contours of constant hours) of shadow flicker hours per year and to significantly reduce model run time. The results of this screening analysis are illustrated on Figure 2.

The locations of the 87 WTGs were incorporated into the shadow flicker analysis as discrete objects, along with the topographic data and locations of shadow flicker receptors (i.e., building structures where persons may experience the shadow flicker phenomena from one or more WTGs). The WTG specified in the shadow flicker model is a Gamesa G87 2.0 MW three-blade horizontal-axis wind turbine with a 78-meter hub height and an 87-meter rotor diameter. A total of 87 identical WTGs were positioned at the proposed turbine locations that are identified in Table 1. A base map of the study area was obtained from the U. S. Geological Survey (USGS) and the topography of the study area was obtained from 10-meter DEM topographic data for the surrounding area.

The shadow flicker analysis included the annual frequency of wind direction, as derived from project-specific meteorological data, as well as the monthly sunshine frequency, obtained from six years of hourly meteorological data obtained from Burlington International Airport. The wind frequency data provides a conservative estimate for the wind directions since it includes calms when shadow flicker would not occur. TRC developed a program to summarize the hourly cloud cover recorded at Burlington International Airport to obtain a frequency distribution of monthly sunshine values. The SHADOW module calculates the sun angle only between sunrise and sunset, and thus the sunshine frequency is based on the percentage of sky cover during daylight hours. Sunshine frequency for each hour is calculated as 1 minus the average sky cover (in tenths) by month. The average monthly sunshine frequency is the sum of the sunshine hours divided by the total possible hours of daylight for each month. Table 2 presents both the wind direction frequency and the monthly sunshine frequency used in the shadow flicker analysis.

Table 3 provides the complete list of potential receptors with addresses and with the receptor IDs corresponding to the figures provided with this analysis. The potential receptors were modeled conservatively by assigning the “green house mode” in the WindPRO model, which effectively assumes each receptor has windows that are always parallel to the plane of the wind turbine blades.

Shadow Flicker Results

The output from the shadow flicker calculations from WindPRO include both maps and tabulations of the number of hours per year, days per year and the maximum minutes per day the WTGs will result in shadow flicker at the indicated receptors. These values are calculated for the “worst case” based on the turbines facing each receptor during full sunlight, and the “expected” case, which is represented by the recorded meteorological conditions (i.e., the expected cases accounts for the wind direction frequency and the sunlight frequency from sunrise to sunset). Additionally, the module generates a contour plot denoting the isolines for shadow hours per year. Table 3 provides the WindPRO model results for each receptor. Attachment A presents printouts of the results from the WindPRO model including the main results and contour maps. It should be noted that the results of this analysis as shown by the contours and the individual receptor impacts will be conservative as the model assumes the observer has unrestricted views of the turbine blades at all times (i.e., there are no buildings or vegetation between the observer and the turbine shading the sun).

No standards exist in the U.S. or New York State for frequency or duration of shadow flicker from wind turbine projects, but impact thresholds of 30 hours per year are found in Germany and Australia. In the U. S. a more conservative threshold of 25 hours per year has typically been applied. Accordingly, a threshold of 25 hours of shadow flicker per year was used for this analysis, which is consistent with other wind power projects located in the U.S.

As indicated in Table 3 and Attachment A, 11 receptors were modeled to have potential shadow flicker hours greater than 25 hours per year, with the greatest potential shadow flicker of approximately 37 hours per year at an individual receptor. These locations are predominantly located along Route 189 between proposed WTG locations to the east and west, along Merchia Road near WTGs to the south, and at several individual receptors along Looby Road, Campbell Road, and Patnode Road. A map depicting these 11 receptor locations is provided as Figure 3.

Conclusion

The Marble River Wind Farm was rigorously examined to ascertain the potential for shadow flicker on the surrounding area and specifically building structures. Shadow flicker is a phenomenon that while generally recognized to not pose an adverse health effect, may cause an annoyance if experienced frequently by local residents and for extended periods of time. Considering the conservatism of the analysis and the large number of potential mitigating factors that can minimize or eliminate shadow flicker (intervening topography, vegetation – trees, windows facing away from WTGs, etc.), it is expected that the potential for shadow flicker on nearby residences is minimal and likely insignificant. However, a recommendation of this study is that the 11 receptors with modeled annual shadow flicker hours greater than 25 hours per year be further evaluated to determine if site-specific factors such as orientation and location of windows, obstructions such as barns or sheds, and vegetation would minimize or eliminate the modeled shadow flicker effects at those receptors.

Tables

Figures

Attachment A

WindPRO Model Output

Table 1: Wind Turbine Generator Locations

Turbine ID	UTM East (m)	UTM North (m)	Latitude	Longitude
WTG 161	583,180	4,968,863	44.8683	-73.947
WTG 157	582,317	4,968,920	44.8689	-73.9579
WTG 90	583,721	4,968,929	44.8689	-73.9402
WTG 200	582,284	4,969,192	44.8714	-73.9583
WTG 161A	583,214	4,969,246	44.8718	-73.9465
WTG 91	583,649	4,969,257	44.8718	-73.941
WTG 94	585,129	4,969,344	44.8724	-73.9223
WTG 95	585,087	4,969,609	44.8748	-73.9228
WTG 106-L	579,838	4,969,600	44.8753	-73.9892
WTG 107-L	579,680	4,969,780	44.877	-73.9912
WTG 93	582,284	4,970,100	44.8796	-73.9582
WTG 105-L	580,694	4,970,390	44.8824	-73.9783
WTG 109	584,893	4,970,431	44.8822	-73.9251
WTG 98	583,672	4,970,635	44.8842	-73.9405
WTG 102-L	581,243	4,970,715	44.8852	-73.9713
WTG 104-L	580,689	4,970,760	44.8857	-73.9783
WTG 97	583,668	4,970,880	44.8864	-73.9405
WTG 100-R	584,949	4,970,956	44.887	-73.9243
WTG 204	582,897	4,970,995	44.8876	-73.9503
WTG 96-S	583,511	4,971,140	44.8888	-73.9425
WTG 89-R	584,715	4,971,160	44.8888	-73.9272
WTG 67	583,680	4,971,581	44.8927	-73.9403
WTG 12	586,263	4,971,972	44.8959	-73.9075
WTG 202	585,803	4,971,996	44.8962	-73.9133
WTG 63	582,982	4,972,452	44.9007	-73.949
WTG 66	583,662	4,972,536	44.9013	-73.9403
WTG 64	585,342	4,972,631	44.902	-73.919
WTG 73-W	584,292	4,972,705	44.9028	-73.9323
WTG 63A	582,801	4,972,754	44.9034	-73.9512
WTG 62	583,468	4,972,834	44.904	-73.9427
WTG 60	585,189	4,973,158	44.9068	-73.9209
WTG 59	582,255	4,973,470	44.9099	-73.958
WTG 58	582,822	4,973,551	44.9106	-73.9508
WTG 206	583,765	4,973,619	44.9111	-73.9388
WTG 57	582,055	4,973,660	44.9116	-73.9605
WTG 56	584,524	4,973,743	44.9121	-73.9292
WTG 55	584,034	4,973,951	44.914	-73.9354
WTG 53	581,995	4,974,106	44.9157	-73.9612
WTG 75A-W	584,979	4,974,409	44.918	-73.9233
WTG 52	582,020	4,974,418	44.9185	-73.9608
WTG 51	584,913	4,974,768	44.9213	-73.9241
WTG 77	581,764	4,974,792	44.9219	-73.964
WTG 50	585,156	4,975,154	44.9247	-73.921
WTG 81	584,961	4,975,353	44.9265	-73.9234
WTG 48-W	584,067	4,975,370	44.9268	-73.9347
WTG 78	582,335	4,975,532	44.9285	-73.9566
WTG 47	585,010	4,975,744	44.93	-73.9227
WTG 45	581,889	4,975,869	44.9315	-73.9622

Table 1: Wind Turbine Generator Locations

Turbine ID	UTM East (m)	UTM North (m)	Latitude	Longitude
WTG 46	583,935	4,975,905	44.9316	-73.9363
WTG 44	583,130	4,976,076	44.9333	-73.9465
WTG 42	582,670	4,976,379	44.936	-73.9523
WTG 83	582,226	4,976,791	44.9398	-73.9578
WTG 85	582,873	4,976,896	44.9407	-73.9496
WTG 203	585,208	4,977,015	44.9415	-73.92
WTG 84	582,161	4,977,226	44.9437	-73.9586
WTG 202	585,104	4,977,308	44.9441	-73.9213
WTG 201	584,650	4,977,545	44.9463	-73.927
WTG 84A	582,000	4,977,637	44.9474	-73.9605
WTG 87	583,137	4,977,819	44.9489	-73.9461
WTG 36A	581,620	4,978,433	44.9546	-73.9652
WTG 135	590,092	4,978,534	44.9545	-73.8578
WTG 209	587,922	4,978,752	44.9568	-73.8853
WTG 31	581,116	4,979,155	44.9612	-73.9715
WTG 28	583,683	4,979,243	44.9617	-73.9389
WTG 208	581,926	4,979,376	44.9631	-73.9612
WTG 28A	584,468	4,979,494	44.9639	-73.929
WTG 134-S	589,903	4,979,722	44.9652	-73.86
WTG 172	581,513	4,979,722	44.9663	-73.9664
WTG 133	589,915	4,980,400	44.9713	-73.8597
WTG 21	584,724	4,980,373	44.9717	-73.9256
WTG 19	581,340	4,980,512	44.9734	-73.9684
WTG 15	583,569	4,980,589	44.9738	-73.9402
WTG 132	589,654	4,980,689	44.974	-73.863
WTG 15A	583,461	4,980,828	44.976	-73.9415
WTG 148	584,404	4,980,863	44.9762	-73.9295
WTG 10A	585,331	4,981,170	44.9788	-73.9177
WTG 148A	584,532	4,981,277	44.9799	-73.9278
WTG 11	583,460	4,981,354	44.9807	-73.9414
WTG 13	581,838	4,981,387	44.9812	-73.962
WTG 9A	584,679	4,981,623	44.983	-73.9259
WTG 175	584,828	4,982,048	44.9868	-73.924
WTG 5-A	585,629	4,982,227	44.9883	-73.9138
WTG 4-A	586,473	4,982,587	44.9915	-73.903
WTG 2-A	585,774	4,983,037	44.9956	-73.9118
WTG 207	586,431	4,983,073	44.9958	-73.9034
WTG 3-A	584,951	4,983,286	44.9979	-73.9222
WTG 1-A	585,700	4,983,358	44.9985	-73.9127

Note: All coordinates are in North American Datum of 1983.

Table 2: Sunshine and Wind Direction Frequencies

Sunshine probabilities		Operational hours		
Month	Frequency	Sectors	Hours	Percent
Jan	0.29	N	189	2.2%
Feb	0.37	NNE	217	2.5%
Mar	0.37	ENE	375	4.3%
Apr	0.33	E	724	8.3%
May	0.44	ESE	548	6.3%
Jun	0.47	SSE	302	3.4%
Jul	0.45	S	438	5.0%
Aug	0.46	SSW	720	8.2%
Sep	0.42	WSW	1823	20.8%
Oct	0.36	W	2412	27.5%
Nov	0.25	WNW	780	8.9%
Dec	0.28	NNW	232	2.6%
		Total	8,760	100%

Table 3: WindPRO Model Results

Parcel ID	No.	Address	Cluster	East [m]	North [m]	Z [m]	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Expected Shadow hours per year [h/year]	
36202	90	Whalen Rd	C1	580,529	4,978,811	323	14:34	42	0:26	5:28	
0	91	Unknown	C1	581,332	4,978,002	340	0:00	0	0:00	0:00	
17414	92	133 Jones Rd	C1	583,091	4,979,279	350	19:11	44	0:34	5:36	
17374	93	455 Merchia Rd	C1	580,696	4,979,347	323	54:16	134	0:44	15:00	
17405	94	154 Jones Rd	C1	583,144	4,979,462	350	21:54	48	0:35	5:11	
17366	95	229-231 Merchia Rd	C1	582,166	4,979,466	340	121:49	173	1:16	37:01	
17372	96	428-438 Merchia Rd	C1	580,867	4,979,461	325	93:03	163	0:55	18:16	
17366	97	229-231 Merchia Rd	C1	582,166	4,979,466	340	121:49	173	1:16	37:01	duplicate
17405	98	154 Jones Rd	C1	583,144	4,979,462	350	21:54	48	0:35	5:11	
17421	99	713 Rt 189	C1	584,069	4,979,597	347	91:11	150	0:48	21:33	
17369	100	306 Merchia Rd	C1	581,785	4,979,590	330	191:05	170	1:43	33:05	
36200	101	Merchia Rd	C1	580,581	4,979,585	321	43:52	110	0:32	7:36	
17391	102	724 Rt 189	C1	584,126	4,979,672	345	85:01	143	0:52	18:47	
17364	103	5 Merchia Rd	C1	582,173	4,979,665	340	83:25	126	0:57	18:33	
17401	104	725 Rt 189	C1	584,000	4,979,701	346	28:05	54	0:40	6:31	
17359	105	124 Merchia Rd	C1	583,146	4,979,802	344	5:42	26	0:17	0:46	
17392	106	748-750 Rt 189	C1	584,116	4,979,847	340	51:59	82	0:44	7:00	
17360	107	212 Jones Rd	C1	582,966	4,979,854	341	17:08	52	0:24	2:32	
17399	108	777 Rt 189	C1	584,011	4,980,065	333	22:20	68	0:28	8:01	
17393	109	780 Rt 189	C1	584,071	4,980,121	332	24:43	65	0:31	8:49	
17394	110	799 Rt 189	C1	583,967	4,980,219	330	12:51	38	0:27	4:00	
17395	111	844 Rt 189	C1	584,012	4,980,555	330	84:41	172	0:46	24:06	
17356	112	Jones Rd	C1	582,139	4,980,739	313	9:41	32	0:25	2:49	
17383	113	876 Rt 189	C1	583,988	4,980,782	326	122:25	191	1:16	36:06	duplicate
17383	114	876 Rt 189	C1	583,988	4,980,782	326	122:25	191	1:16	36:06	
17397	115	885 Rt 189	C1	583,903	4,980,872	323	143:09	201	1:23	36:28	
17382	116	Rt 189	C1	583,997	4,981,134	316	134:13	198	1:15	35:41	
17381	117	922 Rt 189	C1	583,941	4,981,143	315	118:49	204	1:14	31:14	
17380	118	975-963 Rt 189	C1	583,793	4,981,439	309	91:50	154	1:18	24:26	
17380	119	975-963 Rt 189	C1	583,793	4,981,439	309	91:50	154	1:18	24:26	duplicate
17265	120	65 Santamore Rd	C1	580,911	4,981,651	294	7:12	29	0:21	1:46	
17263	121	15 Santamore Rd	C1	581,214	4,981,801	290	19:47	55	0:28	3:10	
17263	122	15 Santamore Rd	C1	581,214	4,981,801	290	19:47	55	0:28	3:10	duplicate
0	123	Unknown	C1	581,332	4,978,002	340	0:00	0	0:00	0:00	
0	124	Unknown	C1	581,332	4,978,002	340	0:00	0	0:00	0:00	duplicate
17267	125	351 Frontier Rd	C1	581,305	4,981,926	290	13:42	40	0:25	1:53	
17243	126	352 Frontier Rd	C1	581,382	4,981,978	290	0:00	0	0:00	0:00	
17250	127	162 Frontier Rd	C1	582,583	4,982,035	289	18:14	56	0:23	3:59	
36590	128	133 Frontier Rd	C1	582,763	4,982,059	290	0:00	0	0:00	0:00	
17297	129	1048 Rt 189	C1	583,819	4,982,078	298	9:23	34	0:22	1:47	
0	130	Unknown	C1	581,332	4,978,002	340	0:00	0	0:00	0:00	
0	131	Unknown	C1	581,332	4,978,002	340	0:00	0	0:00	0:00	duplicate
17251	132	Frontier Rd	C1	581,988	4,982,181	284	0:00	0	0:00	0:00	
0	133	Unknown	C1	581,332	4,978,002	340	0:00	0	0:00	0:00	
17296	134	1067 Rt 189	C1	583,760	4,982,221	296	0:00	0	0:00	0:00	
17289	135	1079 Rt 189	C1	583,744	4,982,300	295	0:00	0	0:00	0:00	
17286	136	26 Frontier Rd	C1	583,560	4,982,318	292	0:00	0	0:00	0:00	
17298	137	32 Liberty Pole Rd	C1	584,016	4,982,331	300	9:42	32	0:24	2:21	
17298	138	32 Liberty Pole Rd	C1	584,016	4,982,331	300	9:42	32	0:24	2:21	duplicate
17309	139	136 Liberty Pole Rd	C1	584,781	4,982,454	295	9:06	31	0:23	2:15	

Table 3: WindPRO Model Results

Parcel ID	No.	Address	Cluster	East [m]	North [m]	Z [m]	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Expected Shadow hours per year [h/year]	
17300	140	121 Liberty Pole Rd	C1	584,664	4,982,483	292	7:00	27	0:21	1:44	
17303	141	178 Liberty Pole Rd	C1	585,123	4,982,509	300	24:59	55	0:36	5:02	
17310	142	211 Liberty Pole Rd	C1	585,342	4,982,551	303	81:20	80	1:20	12:48	
17311	143	238/239 Liberty Pole Rd	C1	585,529	4,982,589	310	27:18	100	0:25	6:34	
17310	144	211 Liberty Pole Rd	C1	585,342	4,982,551	303	81:20	80	1:20	12:48	duplicate
17311	145	238/239 Liberty Pole Rd	C1	585,529	4,982,589	310	27:18	100	0:25	6:34	duplicate
37070	146	404 Brandy Brook Rd	C2	587,004	4,971,501	374	0:00	0	0:00	0:00	
36197	147	399 Brandy Brook Rd	C2	586,915	4,971,502	377	0:00	0	0:00	0:00	
19819	148	410/412 Brandy Brook Rd	C2	586,987	4,971,544	375	1:19	13	0:08	0:22	
19819	149	410/412 Brandy Brook Rd	C2	586,987	4,971,544	375	1:19	13	0:08	0:22	duplicate
19817	150	439 Brandy Brook Rd	C2	586,858	4,971,728	380	41:06	83	0:34	12:03	
19820	151	452 Brandy Brook Rd	C2	586,933	4,971,865	377	17:33	45	0:31	5:01	
17843	152	466 Brandy Brook Rd	C2	586,914	4,971,965	378	16:37	42	0:31	4:49	
17848	153	476 Brandy Brook Rd	C2	586,918	4,972,032	378	15:28	38	0:31	4:43	
17796	154	487 Brandy Brook Rd	C2	586,807	4,972,109	380	21:09	45	0:36	6:22	
17842	155	488 Brandy Brook Rd	C2	586,876	4,972,137	379	16:42	41	0:32	4:57	
17838	156	508 Brandy Brook Rd	C2	586,836	4,972,257	379	18:52	46	0:32	5:26	
37341	157	515 Brandy Brook Rd	C2	586,747	4,972,319	380	36:20	92	0:36	8:47	
17844	158	516 Brandy Brook Rd	C2	586,838	4,972,328	378	19:49	49	0:31	4:57	
17845	159	524 Brandy Brook Rd	C2	586,831	4,972,377	378	22:29	58	0:31	5:00	
17850	160	538 Brandy Brook Rd	C2	586,809	4,972,493	376	25:45	62	0:29	5:33	
17840	161	550 Brandy Brook Rd	C2	586,810	4,972,583	374	3:42	20	0:13	0:47	
17851	162	6211 Rt 11	C2	586,896	4,972,696	371	0:00	0	0:00	0:00	
17837	163	6231 Rt 11	C2	586,789	4,972,731	373	0:00	0	0:00	0:00	
17852	164	6232 Rt 11	C2	586,810	4,972,789	372	0:00	0	0:00	0:00	
17853	165	6242 Rt 11	C2	586,734	4,972,805	375	0:00	0	0:00	0:00	
17763	166	250 Campbell Rd	C2	581,579	4,972,953	393	0:00	0	0:00	0:00	
17765	167	245 Campbell Rd	C2	581,532	4,972,956	393	0:00	0	0:00	0:00	
17793	168	Rt 11	C2	586,136	4,972,995	385	18:28	64	0:24	5:18	
17763	169	250 Campbell Rd	C2	581,579	4,972,953	393	0:00	0	0:00	0:00	
17766	170	251 Campbell Rd	C2	581,510	4,973,005	392	6:01	36	0:14	2:15	
17766	171	251 Campbell Rd	C2	581,510	4,973,005	392	6:01	36	0:14	2:15	duplicate
17737	172	261 Campbell Rd	C2	581,514	4,973,073	391	23:09	66	0:26	8:35	
17736	173	280 Campbell Rd	C2	581,474	4,973,097	390	24:36	81	0:25	8:59	
17746	174	327 Gagnier Rd	C2	582,911	4,973,112	400	53:33	170	0:33	11:43	
17747	175	Gagnier Rd	C2	582,689	4,973,113	398	10:33	34	0:25	2:33	
17791	176	6346 Rt 11	C2	586,043	4,973,145	388	26:45	94	0:25	6:29	
17740	177	444 Gagnier Rd	C2	582,070	4,973,122	391	29:32	89	0:26	8:43	
17736	178	280 Campbell Rd	C2	581,474	4,973,097	390	24:36	81	0:25	8:59	
17741	179	280 Campbell Rd	C2	581,700	4,973,188	390	35:51	70	0:36	13:15	
17736	180	280 Campbell Rd	C2	581,474	4,973,097	390	24:36	81	0:25	8:59	duplicate
17807	181	293 Gagnier Rd	C2	583,195	4,973,216	400	38:20	72	1:01	7:11	
17741	182	280 Campbell Rd	C2	581,700	4,973,188	390	35:51	70	0:36	13:15	duplicate
17807	183	293 Gagnier Rd	C2	583,195	4,973,216	400	38:20	72	1:01	7:11	duplicate
17807	184	293 Gagnier Rd	C2	583,195	4,973,216	400	38:20	72	1:01	7:11	duplicate
17807	185	293 Gagnier Rd	C2	583,195	4,973,216	400	38:20	72	1:01	7:11	duplicate
17807	186	293 Gagnier Rd	C2	583,195	4,973,216	400	38:20	72	1:01	7:11	duplicate
17805	187	293 Gagnier Rd	C2	584,386	4,973,320	410	40:32	104	0:32	11:27	
17798	188	105-103 Gagnier Rd	C2	584,619	4,973,328	410	29:45	88	0:34	7:50	
36301	189	166 Gagnier Rd	C2	584,142	4,973,362	410	21:20	70	0:25	4:39	

Table 3: WindPRO Model Results

Parcel ID	No.	Address	Cluster	East [m]	North [m]	Z [m]	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Expected Shadow hours per year [h/year]	
17791	190	6346 Rt 11	C2	586,043	4,973,145	388	26:45	94	0:25	6:29	
17785	191	Gagnier Rd	C2	584,793	4,973,429	410	48:58	92	0:44	8:03	
17771	192	317 Campbell Rd	C2	581,259	4,973,438	386	18:30	66	0:25	5:54	
17771	193	317 Campbell Rd	C2	581,259	4,973,438	386	18:30	66	0:25	5:54	duplicate
17787	194	6471 Rt 11	C2	585,195	4,973,527	407	22:02	58	0:30	6:29	
17739	195	362 Campbell Rd	C2	581,660	4,973,553	383	95:34	165	0:51	32:13	duplicate
17745	196	332 Campbell Rd	C2	581,516	4,973,607	382	37:18	87	0:38	10:53	
17786	197	6501 Rt 11	C2	585,011	4,973,709	408	31:15	58	0:42	9:02	
17738	198	345 Campbell Rd	C2	581,333	4,973,723	380	37:07	112	0:28	11:50	
17784	199	6523 Rt 11	C2	584,980	4,973,747	408	41:00	74	0:44	11:56	
17788	200	6514 Rt 11	C2	585,012	4,973,817	406	33:25	79	0:41	10:07	
17778	201	540 Patnode Rd	C2	583,162	4,973,825	400	99:25	188	0:48	23:58	
17784	202	6523 Rt 11	C2	584,980	4,973,747	408	41:00	74	0:44	11:56	
17739	203	362 Campbell Rd	C2	581,660	4,973,553	383	95:34	165	0:51	32:13	
17735	204	369 Campbell Rd	C2	581,358	4,973,857	380	50:11	142	0:31	15:20	
17735	205	369 Campbell Rd	C2	581,358	4,973,857	380	50:11	142	0:31	15:20	duplicate
17807	206	293 Gagnier Rd	C2	583,195	4,973,216	400	38:20	72	1:01	7:11	duplicate
17774	207	566 Patnode Rd	C2	583,123	4,974,016	398	25:47	79	0:28	5:13	
17782	208	6601 Rt 11	C2	584,542	4,974,161	403	63:14	153	0:38	19:48	
17775	209	586 Patnode Rd	C2	583,106	4,974,168	395	30:34	89	0:26	5:13	
17667	210	595 Patnode Rd	C2	583,025	4,974,229	393	19:03	56	0:23	2:50	
17669	211	426 Campbell Rd	C2	581,487	4,974,321	374	52:01	109	0:38	14:37	
17669	212	426 Campbell Rd	C2	581,487	4,974,321	374	52:01	109	0:38	14:37	duplicate
17779	213	22-20 Rt 189	C2	584,691	4,974,460	400	98:25	165	1:06	25:49	
17668	214	Patnode Rd	C2	582,953	4,974,451	390	5:44	27	0:20	1:44	
17780	215	6649 Rt 11	C2	584,281	4,974,465	400	48:27	119	0:31	16:45	
36872	216	60 Lamb Rd	C2	581,074	4,974,493	367	45:39	147	0:29	14:57	
17665	217	456 Campbell Rd	C2	581,398	4,974,523	370	39:15	101	0:32	7:59	
36873	218	43 Lamb Rd	C2	581,013	4,974,534	365	16:17	48	0:27	5:45	
17666	219	470 Campbell Rd	C2	581,425	4,974,559	370	50:38	122	0:33	9:22	
17703	220	646 Patnode Rd	C2	583,065	4,974,606	390	0:00	0	0:00	0:00	
17666	221	470 Campbell Rd	C2	581,425	4,974,559	370	50:38	122	0:33	9:22	
17701	222	640 Patnode Rd	C2	583,308	4,974,622	392	7:49	32	0:18	1:06	
17666	223	470 Campbell Rd	C2	581,425	4,974,559	370	50:38	122	0:33	9:22	
36872	224	60 Lamb Rd	C2	581,074	4,974,493	367	45:39	147	0:29	14:57	
17702	225	662 Patnode Rd	C2	583,098	4,974,739	390	0:00	0	0:00	0:00	
17659	226	470 Campbell Rd	C2	581,362	4,974,839	368	57:27	115	0:49	14:02	
17695	227	6747 Rt 11	C2	583,748	4,974,950	391	0:00	0	0:00	0:00	
36238	228	6750 Rt 11	C2	583,774	4,975,055	390	0:00	0	0:00	0:00	
36237	229	6766-6750 Rt 11	C2	583,678	4,975,136	390	4:34	20	0:17	1:44	
17664	230	Campbell Rd	C2	581,348	4,975,161	365	47:12	82	0:39	6:44	
36237	231	6766-6750 Rt 11	C2	583,678	4,975,136	390	4:34	20	0:17	1:44	
17662	232	544 Campbell Rd	C2	581,324	4,975,173	365	44:43	82	0:37	6:27	
17693	233	6801 Rt 11	C2	583,440	4,975,247	390	20:04	48	0:33	6:22	
17657	234	6985 Rt 11	C2	582,649	4,975,269	380	0:00	0	0:00	0:00	
36477	235	6825 Rt 11	C2	583,303	4,975,348	390	16:57	63	0:27	4:54	
17688	236	148 Rt 189	C2	584,564	4,975,391	397	87:16	115	1:28	24:20	
17681	237	157 Rt 189	C2	584,495	4,975,468	398	111:39	183	1:25	33:24	
36234	238	582 Campbell Rd	C2	581,300	4,975,463	362	0:00	0	0:00	0:00	
17699	239	764 Patnode Rd	C2	583,000	4,975,484	388	14:11	40	0:30	4:02	

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Parcel ID	No.	Address	Cluster	East [m]	North [m]	Z [m]	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Expected Shadow hours per year [h/year]	
17700	240	6848 Rt 11	C2	583,203	4,975,524	390	40:53	127	0:27	13:41	
17698	241	778 Patnode Rd	C2	583,064	4,975,550	390	22:23	80	0:27	7:22	
17698	242	778 Patnode Rd	C2	583,064	4,975,550	390	22:23	80	0:27	7:22	
17680	243	52 Nichols Rd	C2	583,414	4,975,728	390	57:24	130	0:38	17:25	
17680	244	52 Nichols Rd	C2	583,414	4,975,728	390	57:24	130	0:38	17:25	duplicate
17680	245	52 Nichols Rd	C2	583,414	4,975,728	390	57:24	130	0:38	17:25	duplicate
17682	246	206 Rt 189	C2	584,555	4,975,831	393	82:38	167	0:43	20:50	
17680	247	52 Nichols Rd	C2	583,414	4,975,728	390	57:24	130	0:38	17:25	
17658	248	6922 Rt 11	C2	582,776	4,975,878	380	80:02	173	0:41	22:12	
17683	249	228 Rt 189	C2	584,497	4,975,983	390	45:17	98	0:37	11:46	
17657	250	6985 Rt 11	C2	582,649	4,975,269	380	0:00	0	0:00	0:00	
17655	251	6977 Rt 11	C2	582,395	4,976,067	370	37:04	86	0:38	10:56	
17657	252	6985 Rt 11	C2	582,649	4,975,269	380	0:00	0	0:00	0:00	duplicate
17679	253	249 Rt 189	C2	584,398	4,976,144	380	48:28	103	0:39	11:10	
17678	254	Rt 189	C2	584,346	4,976,299	378	67:34	82	1:03	12:59	
17652	255	7026 Rt 11	C2	582,210	4,976,379	370	40:18	87	0:44	11:27	
17637	256	7173 Rt 11	C2	581,127	4,976,375	360	14:06	48	0:23	2:12	
17650	257	Rt 11	C2	581,176	4,976,381	360	19:45	68	0:25	3:02	
17637	258	7173 Rt 11	C2	581,127	4,976,375	360	14:06	48	0:23	2:12	
17651	259	7103 Rt 11	C2	581,642	4,976,421	361	4:40	23	0:15	1:45	
17649	260	7165 Rt 11	C2	581,168	4,976,422	360	23:01	70	0:24	3:30	
17487	261	7168 Rt 11	C2	581,147	4,976,495	358	16:53	52	0:23	2:30	
17485	262	7132 Rt 11	C2	581,407	4,976,520	360	12:09	41	0:25	4:14	
17484	263	7126 Rt 11	C2	581,458	4,976,521	360	15:02	47	0:26	5:19	
17482	264	535 Looby Rd	C2	581,802	4,976,554	362	35:16	82	0:38	12:09	
17480	265	525 Looby Rd	C2	581,799	4,976,630	361	77:06	129	0:47	26:58	
17675	266	103 Lagree Rd	C2	583,672	4,976,654	370	20:44	75	0:25	5:23	
17479	267	Lagree Rd	C2	582,040	4,976,684	361	31:00	95	0:30	8:24	
17685	268	2 Swamp Rd	C2	584,431	4,976,764	373	13:29	44	0:26	4:40	
17479	269	Lagree Rd	C2	582,040	4,976,684	361	31:00	95	0:30	8:24	
17517	270	114 Lagree Rd	C2	583,391	4,976,940	368	44:55	122	0:39	11:55	
17513	271	370 Rt 189	C2	584,408	4,977,039	370	31:07	91	0:29	10:28	
17516	272	403 Rt 189	C2	584,330	4,977,293	369	18:51	65	0:26	5:09	
17513	273	370 Rt 189	C2	584,408	4,977,039	370	31:07	91	0:29	10:28	duplicate
17513	274	370 Rt 189	C2	584,408	4,977,039	370	31:07	91	0:29	10:28	duplicate
17488	275	394 Looby Rd	C2	581,606	4,977,591	343	73:54	133	0:51	19:33	
17513	276	370 Rt 189	C2	584,408	4,977,039	370	31:07	91	0:29	10:28	duplicate
37381	277	Looby Rd	C2	581,602	4,977,780	344	50:40	102	0:47	10:52	
17514	278	472 Rt 189	C2	584,350	4,977,797	361	93:08	117	1:16	14:22	
17472	279	20 Whalen Rd	C2	581,590	4,977,877	343	36:41	66	0:43	7:19	
17472	280	20 Whalen Rd	C2	581,590	4,977,877	343	36:41	66	0:43	7:19	
0	281	Unknown	C2	581,332	4,978,002	340	15:27	44	0:28	2:58	
17473	282	36 Whalen Rd	C2	581,453	4,978,010	340	25:25	62	0:32	4:03	
17492	283	41 Whalen Rd	C2	581,390	4,978,017	340	19:32	51	0:29	3:18	
17478	284	283 Looby Rd	C2	582,143	4,978,063	350	0:00	0	0:00	0:00	
0	285	Unknown	C2	581,332	4,978,002	340	15:27	44	0:28	2:58	
17478	286	283 Looby Rd	C2	582,143	4,978,063	350	0:00	0	0:00	0:00	
17523	287	523 Rt 189	C2	584,213	4,978,178	360	0:00	0	0:00	0:00	
17518	288	191 Looby Rd	C2	582,811	4,978,206	358	36:48	76	0:38	5:48	
17522	289	Looby Rd	C2	583,768	4,978,213	360	17:14	50	0:29	4:02	

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Parcel ID	No.	Address	Cluster	East [m]	North [m]	Z [m]	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Expected Shadow hours per year [h/year]
17519	290	173 Looby Rd	C2	582,939	4,978,209	360	0:00	0	0:00	0:00
17474	291	37 Jones Rd	C2	581,949	4,978,257	346	29:25	51	0:43	8:22
17476	292	186 Looby Rd	C2	582,847	4,978,287	356	0:00	0	0:00	0:00
17570	293	540 Rt 189	C2	584,269	4,978,304	360	0:00	0	0:00	0:00
17474	294	37 Jones Rd	C2	581,949	4,978,257	346	29:25	51	0:43	8:22
17524	295	1 Looby Rd	C2	584,209	4,978,347	360	0:00	0	0:00	0:00
17525	296	15 Looby Rd	C2	584,105	4,978,365	360	0:00	0	0:00	0:00
17568	297	1331 Clinton Mills Rd	C2	584,375	4,978,382	360	0:00	0	0:00	0:00
17569	298	1329 Clinton Mills Rd	C2	584,397	4,978,392	360	0:00	0	0:00	0:00
17567	299	1323 Clinton Mills Rd	C2	584,431	4,978,397	360	0:00	0	0:00	0:00
17566	300	1313 Clinton Mills Rd	C2	584,503	4,978,402	360	0:00	0	0:00	0:00
17563	301	1301 Clinton Mills Rd	C2	584,592	4,978,406	360	0:00	0	0:00	0:00
17526	302	10 Looby Rd	C2	584,151	4,978,408	360	0:00	0	0:00	0:00
17564	303	1307 Clinton Mills Rd	C2	584,552	4,978,410	360	0:00	0	0:00	0:00
17562	304	1297 Clinton Mills Rd	C2	584,628	4,978,416	360	0:00	0	0:00	0:00
17559	305	1281 Clinton Mills Rd	C2	584,746	4,978,430	360	0:00	0	0:00	0:00
17573	306	1332 Clinton Mills Rd	C2	584,368	4,978,433	360	0:00	0	0:00	0:00
17574	307	1330 Clinton Mills Rd	C2	584,391	4,978,434	360	0:00	0	0:00	0:00
17575	308	1326 Clinton Mills Rd	C2	584,417	4,978,435	360	0:00	0	0:00	0:00
17576	309	1322 Clinton Mills Rd	C2	584,439	4,978,437	360	0:00	0	0:00	0:00
17560	310	1259 Clinton Mills Rd	C2	584,916	4,978,453	359	0:00	0	0:00	0:00
17577	311	1318 Clinton Mills Rd	C2	584,467	4,978,457	360	0:00	0	0:00	0:00
17552	312	1298 Clinton Mills Rd	C2	584,626	4,978,459	360	0:00	0	0:00	0:00
17579	313	1306 Clinton Mills Rd	C2	584,555	4,978,461	360	0:00	0	0:00	0:00
17572	314	556-560 Rt 189	C2	584,265	4,978,460	360	0:00	0	0:00	0:00
17558	315	1280 Clinton Mills Rd	C2	584,760	4,978,479	359	0:00	0	0:00	0:00
17551	316	6 Broad St	C2	584,588	4,978,486	360	0:00	0	0:00	0:00
17549	317	8 Smith St	C2	584,595	4,978,513	360	0:00	0	0:00	0:00
17580	318	11 Smith St	C2	584,548	4,978,524	360	0:00	0	0:00	0:00
17548	319	12 Smith St	C2	584,583	4,978,534	360	0:00	0	0:00	0:00
17581	320	13 Smith St	C2	584,545	4,978,545	360	0:00	0	0:00	0:00
17588	321	572 Rt 189	C2	584,286	4,978,547	360	0:00	0	0:00	0:00
17547	322	16 Smith St	C2	584,579	4,978,555	359	0:00	0	0:00	0:00
17528	323	Looby Rd	C2	584,200	4,978,571	359	0:00	0	0:00	0:00
17546	324	20 Smith St	C2	584,589	4,978,574	359	0:00	0	0:00	0:00
17589	325	576 Rt 189	C2	584,248	4,978,582	359	0:00	0	0:00	0:00
17546	326	20 Smith St	C2	584,589	4,978,574	359	0:00	0	0:00	0:00
17527	327	575 Rt 189	C2	584,194	4,978,587	359	0:00	0	0:00	0:00
17582	328	21 Smith St	C2	584,542	4,978,591	359	0:00	0	0:00	0:00
17557	329	16 Railroad St	C2	584,807	4,978,594	358	0:00	0	0:00	0:00
17500	330	Rt 189	C2	583,179	4,978,587	350	0:00	0	0:00	0:00
17583	331	23 Smith St	C2	584,539	4,978,611	359	0:00	0	0:00	0:00
17500	332	Rt 189	C2	583,179	4,978,587	350	0:00	0	0:00	0:00
17553	333	1260 Clinton Mills Rd	C2	584,941	4,978,621	358	0:00	0	0:00	0:00
17587	334	9 Summit Dr	C2	584,457	4,978,628	359	0:00	0	0:00	0:00
17584	335	25 Smith St	C2	584,530	4,978,634	359	0:00	0	0:00	0:00
17556	336	22 Railroad St	C2	584,803	4,978,638	358	0:00	0	0:00	0:00
17545	337	26 Smith St	C2	584,568	4,978,643	359	0:00	0	0:00	0:00
17585	338	27 Smith St	C2	584,522	4,978,649	359	0:00	0	0:00	0:00
17586	339	29 Smith St	C2	584,483	4,978,676	359	0:00	0	0:00	0:00

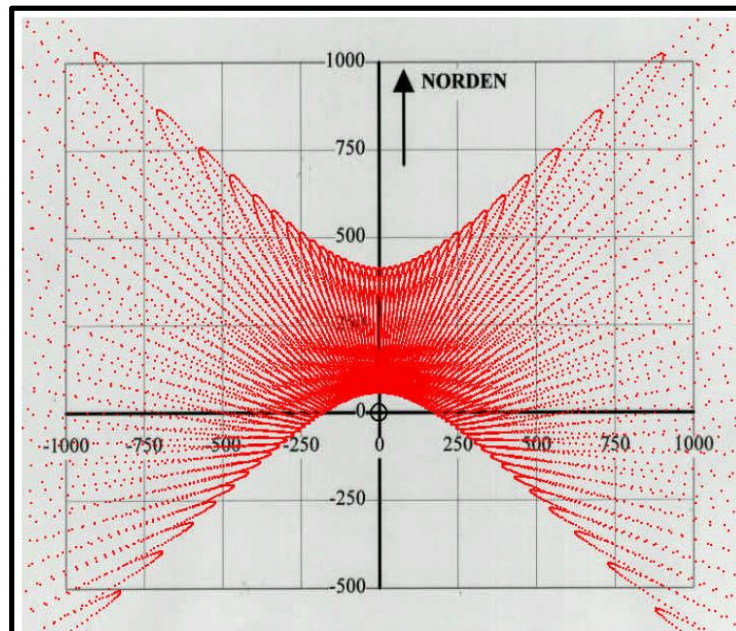
Table 3: WindPRO Model Results

Parcel ID	No.	Address	Cluster	East [m]	North [m]	Z [m]	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Expected Shadow hours per year [h/year]
17544	340	34 Smith St	C2	584,562	4,978,689	358	0:00	0	0:00	0:00
17532	341	592 Rt 189	C2	584,230	4,978,696	357	0:00	0	0:00	0:00
17534	342	30 Broad St	C2	584,313	4,978,708	357	0:00	0	0:00	0:00
17535	343	26 Broad St	C2	584,339	4,978,716	357	0:00	0	0:00	0:00
17536	344	22 Broad St	C2	584,361	4,978,720	357	0:00	0	0:00	0:00
17533	345	32 Broad St	C2	584,283	4,978,721	357	0:00	0	0:00	0:00
17537	346	18 Broad St	C2	584,398	4,978,724	357	0:00	0	0:00	0:00
17538	347	14 Broad St	C2	584,421	4,978,729	357	0:00	0	0:00	0:00
17539	348	12 Broad St	C2	584,443	4,978,733	358	0:00	0	0:00	0:00
17540	349	8 Broad St	C2	584,463	4,978,745	358	0:00	0	0:00	0:00
17541	350	2 Broad St	C2	584,520	4,978,746	358	0:00	0	0:00	0:00
17543	351	38 Smith St	C2	584,554	4,978,752	358	0:00	0	0:00	0:00
17508	352	Rt 189	C2	584,216	4,978,774	355	0:00	0	0:00	0:00
17509	353	603 Rt 189	C2	584,173	4,978,777	355	0:00	0	0:00	0:00
17507	354	618 Rt 189	C2	584,227	4,978,883	353	0:00	0	0:00	0:00
17503	355	623 Rt 189	C2	584,147	4,978,912	352	0:00	0	0:00	0:00
17504	356	629 Rt 189	C2	584,156	4,978,961	351	0:00	0	0:00	0:00
17506	357	632 Rt 189	C2	584,190	4,978,986	351	0:00	0	0:00	0:00
20079	358	Tacey Rd	C3	581,631	4,968,361	506	0:00	0	0:00	0:00
20076	359	550 Tacey Rd	C3	581,380	4,968,594	492	8:28	36	0:21	2:59
20069	360	314 Harrigan Rd	C3	579,508	4,968,791	464	0:00	0	0:00	0:00
20067	361	8305 Star Rd	C3	580,598	4,969,012	481	0:00	0	0:00	0:00
19798	362	8149 Star Rd	C3	580,547	4,969,290	475	17:51	88	0:24	5:03
20067	363	8305 Star Rd	C3	580,598	4,969,012	481	0:00	0	0:00	0:00
20067	364	8305 Star Rd	C3	580,598	4,969,012	481	0:00	0	0:00	0:00
19800	365	Star Rd	C3	580,214	4,969,319	467	0:00	0	0:00	0:00
37233	366	7960 Star Rd	C3	581,514	4,969,534	469	11:12	35	0:25	2:33
20083	367	7909 Star Rd	C3	582,332	4,969,569	471	7:01	29	0:21	1:41
20088	368	7891 Star Rd	C3	582,476	4,969,573	470	25:41	71	0:32	5:19
19796	369	7960 Star Rd	C3	581,955	4,969,573	470	40:17	68	0:43	5:27
19795	370	7942 Star Rd	C3	582,114	4,969,598	470	0:00	0	0:00	0:00
19793	371	7908 Star Rd	C3	582,346	4,969,623	470	7:28	31	0:22	1:40
20084	372	7837 Star Rd	C3	582,872	4,969,636	462	62:16	114	0:45	10:56
20145	373	7811 Star Rd	C3	583,058	4,969,662	455	45:19	127	0:45	9:20
19809	374	7777 Star Rd	C3	583,317	4,969,697	449	6:40	25	0:20	0:54
19797	375	30 Ryan Rd	C3	581,113	4,969,689	460	0:00	0	0:00	0:00
19859	376	7741 Star Rd	C3	583,570	4,969,705	441	24:18	52	0:35	5:04
19794	377	7864 Star Rd	C3	582,646	4,969,722	461	29:49	68	0:30	4:23
19857	378	7687 Star Rd	C3	583,978	4,969,759	430	13:30	52	0:23	3:02
19791	379	7750 Star Rd	C3	583,507	4,969,777	439	0:00	0	0:00	0:00
19860	380	7738 Star Rd	C3	583,590	4,969,788	439	0:00	0	0:00	0:00
19789	381	7764 Star Rd	C3	583,409	4,969,801	440	0:00	0	0:00	0:00
19861	382	7706 Star Rd	C3	583,840	4,969,836	430	23:25	62	0:26	5:03
19858	383	7682 Star Rd	C3	584,007	4,969,858	428	0:00	0	0:00	0:00
19855	384	7621 Star Rd	C3	584,460	4,969,868	422	39:21	106	0:30	7:15
19854	385	7605 Star Rd	C3	584,578	4,969,882	424	32:49	82	0:36	6:08
19853	386	7579/7599 Star Rd	C3	584,621	4,969,891	426	31:37	64	0:39	5:44
19856	387	7652 Star Rd	C3	584,181	4,969,894	424	8:37	42	0:21	2:03
19853	388	7579/7599 Star Rd	C3	584,621	4,969,891	426	31:37	64	0:39	5:44
19811	389	7622 Star Rd	C3	584,447	4,969,927	420	31:50	90	0:29	5:41

Table 3: WindPRO Model Results

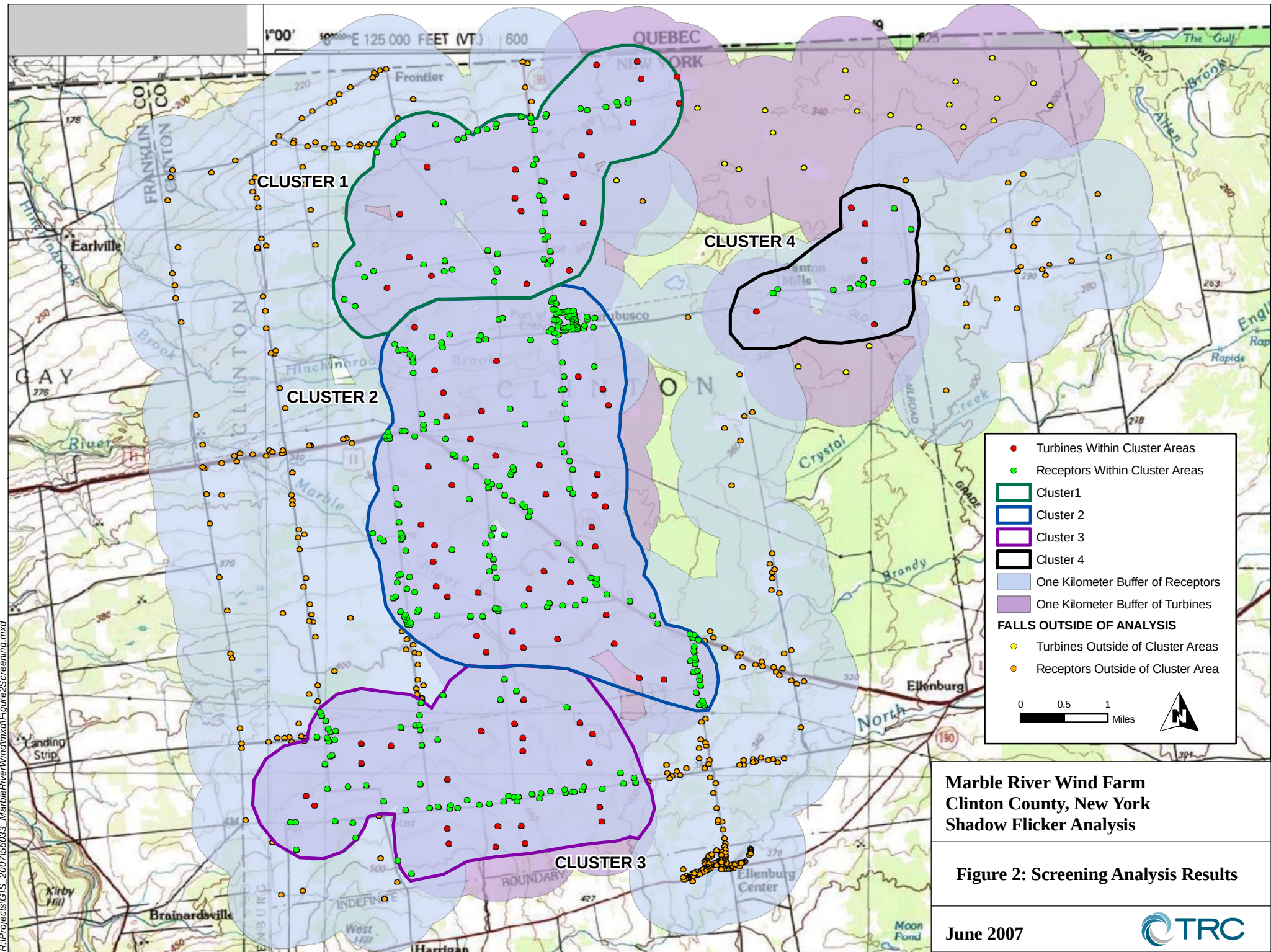
Parcel ID	No.	Address	Cluster	East [m]	North [m]	Z [m]	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Expected Shadow hours per year [h/year]
19808	390	197 Ryan Rd	C3	580,073	4,969,909	446	102:11	142	0:56	24:32
19852	391	7535 Star Rd	C3	585,138	4,969,945	425	0:00	0	0:00	0:00
19777	392	150 Ryan Rd	C3	580,450	4,969,955	451	26:45	80	0:30	7:08
19812	393	7576 Star Rd	C3	584,796	4,969,988	430	14:00	36	0:30	1:54
19778	394	94 Ryan Rd	C3	580,785	4,969,985	448	0:00	0	0:00	0:00
19796	395	7960 Star Rd	C3	581,955	4,969,573	470	40:17	68	0:43	5:27
19849	396	7471 Star Rd	C3	585,524	4,970,049	410	38:59	91	0:35	8:36
19848	397	7445 Star Rd	C3	585,753	4,970,074	401	32:38	108	0:26	8:32
19815	398	7446 Star Rd	C3	585,721	4,970,152	401	40:32	118	0:26	10:03
19814	399	Star Rd	C3	585,465	4,970,245	409	33:35	76	0:35	9:54
19768	400	259 Ryan Rd	C3	580,023	4,970,376	432	32:41	93	0:30	10:57
19776	401	Ryan Rd	C3	580,120	4,970,513	430	63:47	134	0:35	21:14
19772	402	280 Ryan Rd	C3	580,151	4,970,532	430	69:51	139	0:37	22:58
19784	403	157 Bohon Rd	C3	581,807	4,970,731	429	21:35	46	0:36	6:22
19763	404	312/316 Ryan Rd	C3	580,089	4,970,792	427	40:00	100	0:34	8:42
19771	405	217 No 5 Rd	C3	580,202	4,970,821	429	63:03	124	0:41	12:36
19786	406	168 Bohon Rd	C3	582,101	4,970,836	422	19:42	65	0:26	6:06
19770	407	322 Ryan Rd	C3	580,063	4,970,853	426	42:34	125	0:32	8:27
19765	408	259 Ryan Rd	C3	579,871	4,970,872	423	20:32	70	0:25	4:31
17875	409	340 Ryan Rd	C3	580,116	4,970,964	424	29:42	80	0:34	6:00
17864	410	216 No 5 Rd	C3	580,217	4,970,985	427	27:57	55	0:39	6:15
19783	411	195 Bohon Rd	C3	581,778	4,971,005	420	21:45	50	0:34	6:05
17875	412	340 Ryan Rd	C3	580,116	4,970,964	424	29:42	80	0:34	6:00
19781	413	49 No 5 Rd	C3	581,417	4,971,057	423	52:06	82	1:04	11:35
19785	414	13 No 5 Rd	C3	581,691	4,971,097	420	44:27	90	0:36	9:38
19780	415	207 Bohon Rd	C3	581,761	4,971,102	420	27:57	67	0:33	6:10
17875	416	340 Ryan Rd	C3	580,116	4,970,964	424	29:42	80	0:34	6:00
17886	417	387 Ryan Rd	C3	579,953	4,971,267	419	16:21	54	0:24	2:31
17890	418	19 Campbell Rd	C3	581,757	4,971,285	415	8:52	32	0:21	1:53
17886	419	387 Ryan Rd	C3	579,953	4,971,267	419	16:21	54	0:24	2:31
19813	420	Off Star Rd	C3	584,472	4,971,446	400	100:34	124	1:10	16:09
17892	421	48/58 Campbell Rd	C3	581,784	4,971,507	412	0:00	0	0:00	0:00
17895	422	Patnode Rd	C3	583,251	4,971,575	415	37:57	62	0:47	11:12
17893	423	Campbell Rd	C3	582,197	4,971,650	413	5:53	28	0:16	0:50
17800	424	Patnode Rd	C3	583,541	4,971,739	407	194:33	156	1:33	29:19
17804	425	288 Patnode Rd	C3	583,321	4,971,962	407	37:17	64	0:41	5:03
17435	426	140 Rogers Rd	C4	588,241	4,979,093	340	53:19	79	0:47	11:14
17436	427	142 Rogers Rd	C4	588,223	4,979,096	340	49:18	74	0:48	10:20
17427	428	656 Clinton Mills Rd	C4	589,331	4,979,165	335	13:46	46	0:22	2:04
17434	429	126 Rogers Rd	C4	588,313	4,979,176	340	28:52	58	0:37	6:08
37044	430	Clinton Mills Rd	C4	589,642	4,979,200	335	0:00	0	0:00	0:00
17432	431	584 Clinton Mills Rd	C4	589,888	4,979,247	334	0:00	0	0:00	0:00
17431	432	600 Clinton Mills Rd	C4	589,798	4,979,278	335	0:00	0	0:00	0:00
17458	433	562 Clinton Mills Rd	C4	590,071	4,979,295	333	0:00	0	0:00	0:00
17455	434	478 Clinton Mills Rd	C4	590,687	4,979,323	321	18:49	54	0:25	5:24
17430	435	614 Clinton Mills Rd	C4	589,887	4,979,384	338	0:00	0	0:00	0:00
17457	436	450 Clinton Mills Rd	C4	590,763	4,980,297	312	10:26	34	0:24	2:58
17429	437	187 Soucia Rd	C4	590,453	4,980,676	318	31:51	81	0:34	9:12

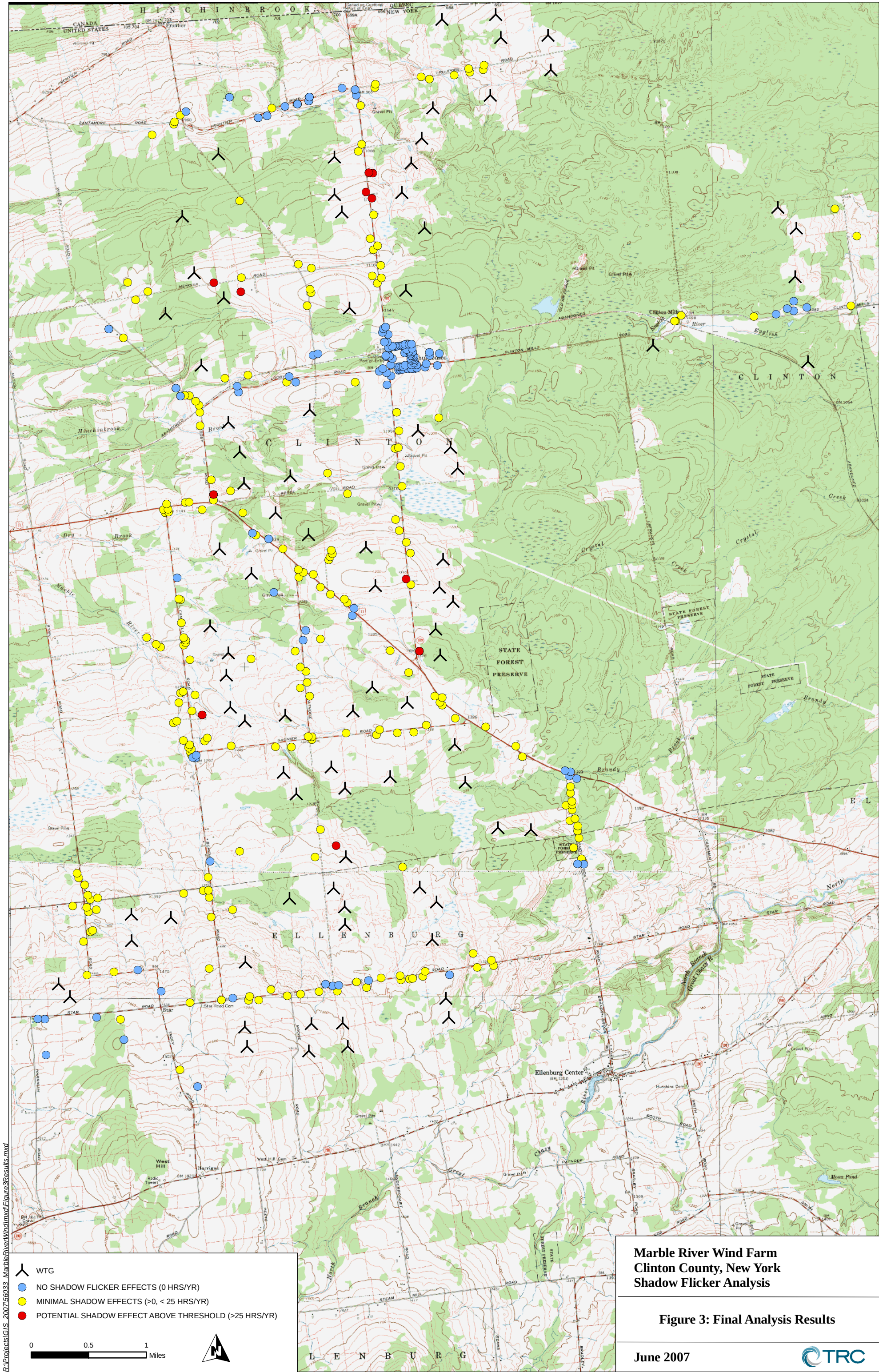
Figure 1: Hypothetical shadow impact from a wind turbine generator



Source: Osten and Pahlke, "Shadow Impact on the Surrounding of Wind Turbines," August 1998

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Project:
Marble River Wind Farm

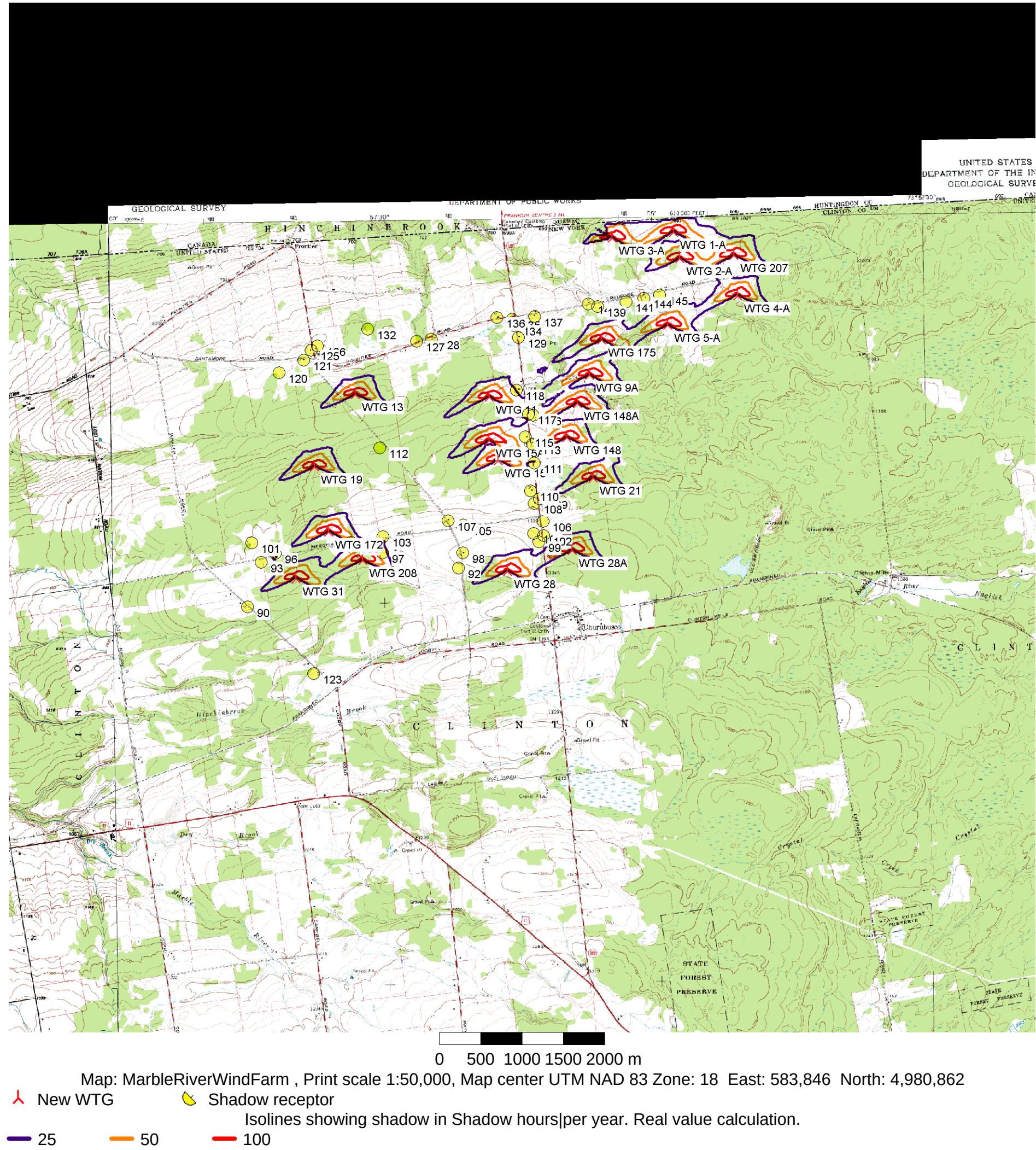
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Cluster 1

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Project:
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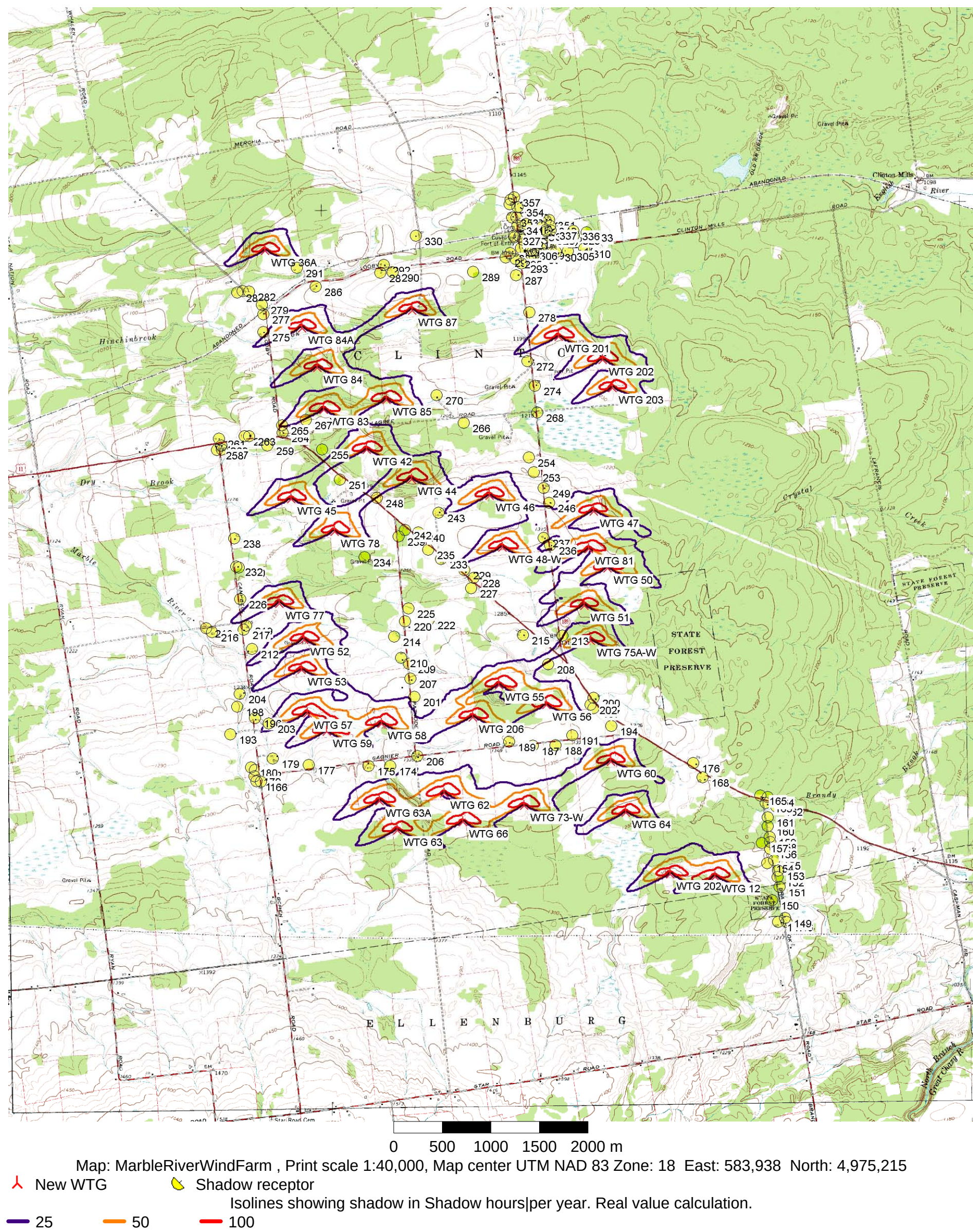
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Cluster 2

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Project:
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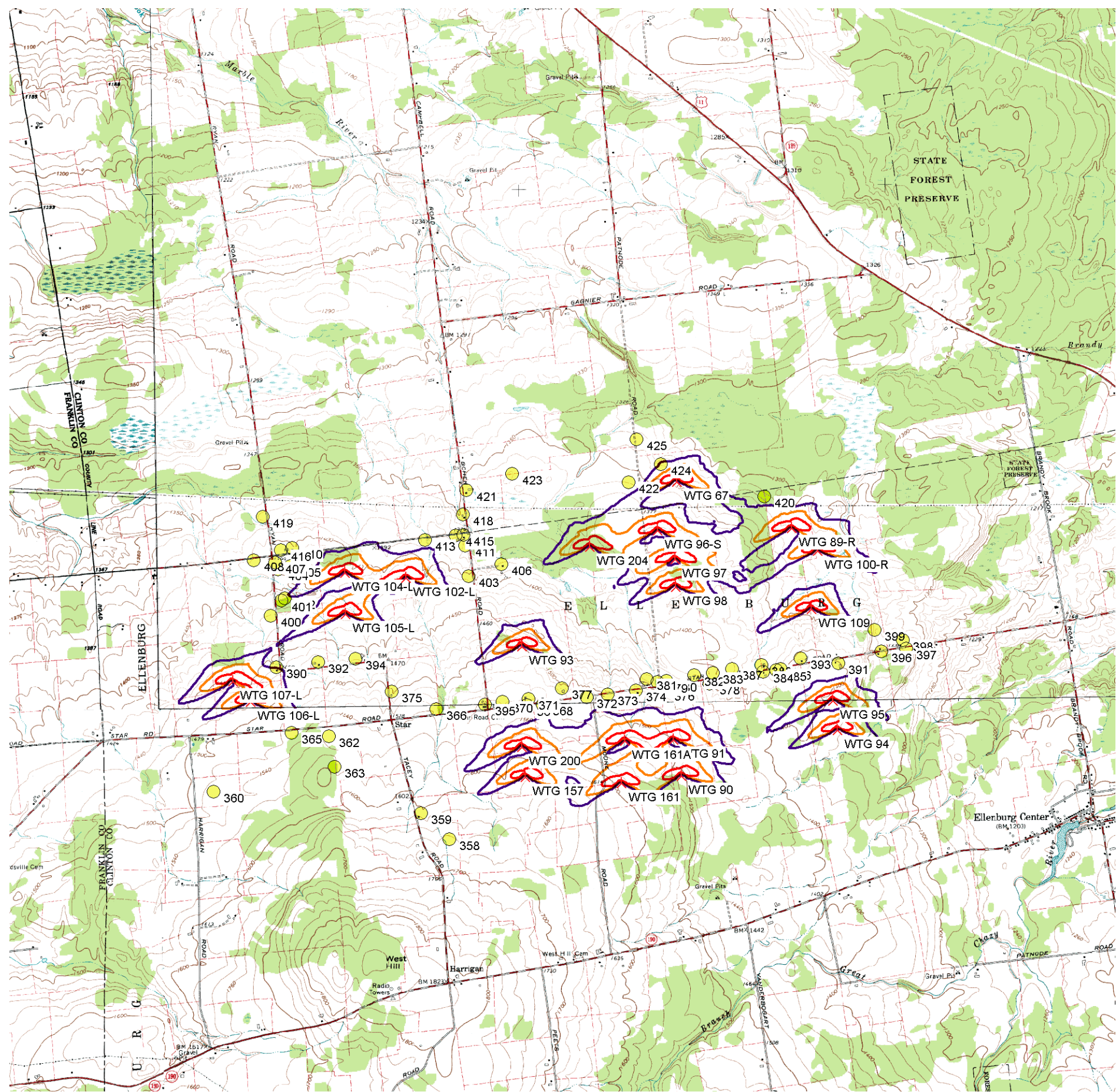
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Cluster 3

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Calculation: Marble River Wind Farm Cluster 3 File: MarbleRiverWindFarm.bmi



0

500

1000

1500

2000 m

Map: MarbleRiverWindFarm , Print scale 1:40,000, Map center UTM NAD 83 Zone: 18 East: 582,638 North: 4,970,115

New WTG

Shadow receptor

Isolines showing shadow in Shadow hours|per year. Real value calculation.

25

50

100

WindPRO is developed by EMD International A/S, Niels Jernesvej 10, DK-9220 Aalborg Ø, Tlf. +45 96 35 44 44, Fax +45 96 35 44 46, e-mail: windpro@emd.dk

Project:
Marble River Wind Farm

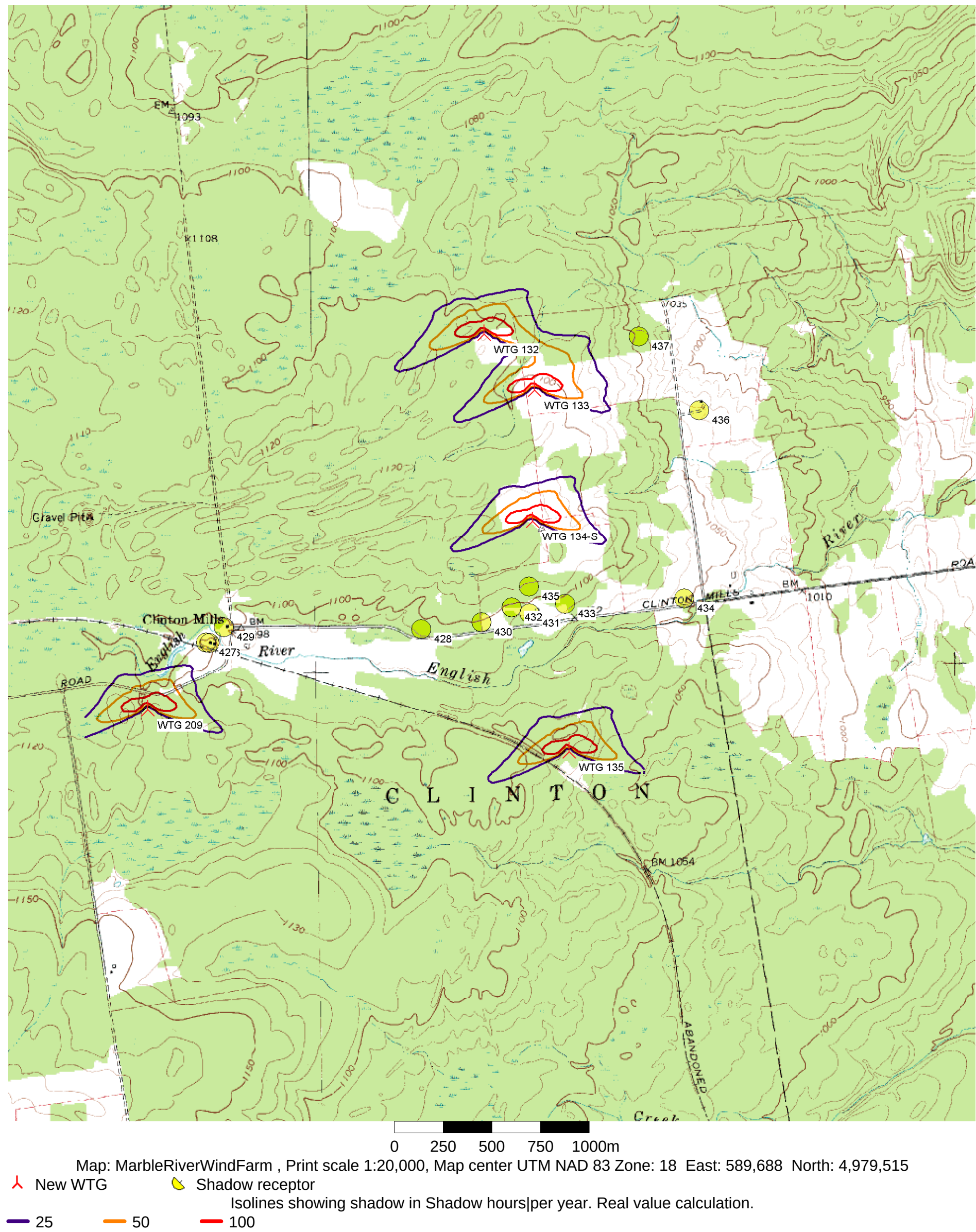
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Marble River Wind Farm
Cluster 4

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Calculation: Marble River Wind Farm Cluster 4 **File:** MarbleRiverWindFarm.bmi



Project:

Marble River Wind Farm

Description:

Marble River Wind Farm
Cluster 1

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5/31/2007 2:38 PM / 1

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TRC Environmental Corporation
1200 Wall Street West 2nd Floor
US-LYNDHURST NJ 07071
201 933 5541 x114

Calculated:

5/31/2007 9:19 AM/2.5.0.60

SHADOW - Main Result

Calculation: Marble River Wind Farm Cluster 1

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
 Minimum sun height over horizon for influence 3 °
 Day step for calculation 1 days
 Time step for calculation 1 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.29	0.37	0.37	0.33	0.44	0.47	0.45	0.46	0.42	0.36	0.25	0.28

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
189	217	375	724	548	302	438	720	1,823	2,412	780	232	8,760

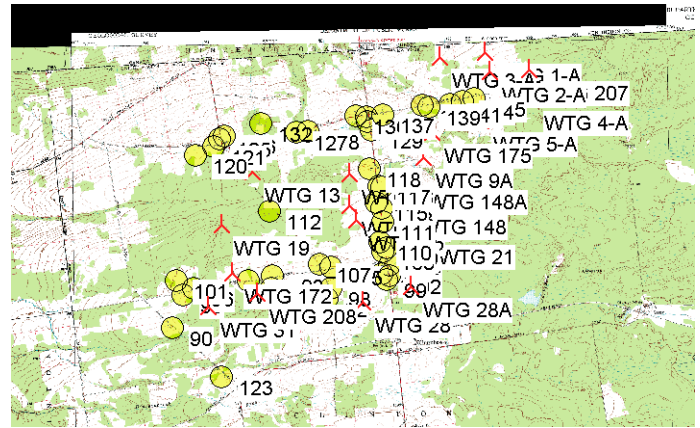
To avoid flicker from WTGs not visible a ZVI calculation is performed before the flicker calculation. The ZVI calculation is based on the following assumptions

Height contours used: Height Contours: MARBLE RIVER Contour 0.WPO (1)

Obstacles used in calculation

Eye height: 1.5 m

Grid resolution: 10 m



New WTG

Shadow receptor

WTGs

UTM NAD83 Zone: 18

	East	North	Z	Row data/Description	Valid	Manufact.	Type	Power [kW]	Diam. [m]	Height [m]	RPM [RPM]
WTG 11	583,460	4,981,354	307	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (78)	Yes	GAMESA	G87/2000	2,000	87.0	78.0	16.7
WTG 13	581,838	4,981,387	302	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (79)	Yes	GAMESA	G87/2000	2,000	87.0	78.0	16.7
WTG 148	584,404	4,980,863	326	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (75)	Yes	GAMESA	G87/2000	2,000	87.0	78.0	16.7
WTG 148A	584,532	4,981,276	320	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (77)	Yes	GAMESA	G87/2000	2,000	87.0	78.0	16.7
WTG 15	583,569	4,980,589	327	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (72)	Yes	GAMESA	G87/2000	2,000	87.0	78.0	16.7
WTG 15A	583,461	4,980,827	320	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (74)	Yes	GAMESA	G87/2000	2,000	87.0	78.0	16.7
WTG 172	581,513	4,979,722	330	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (68)	Yes	GAMESA	G87/2000	2,000	87.0	78.0	16.7
WTG 175	584,828	4,982,048	307	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (81)	Yes	GAMESA	G87/2000	2,000	87.0	78.0	16.7
WTG 19	581,340	4,980,512	316	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (71)	Yes	GAMESA	G87/2000	2,000	87.0	78.0	16.7
WTG 1-A	585,700	4,983,358	310	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (87)	Yes	GAMESA	G87/2000	2,000	87.0	78.0	16.7
WTG 207	586,431	4,983,073	321	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (85)	Yes	GAMESA	G87/2000	2,000	87.0	78.0	16.7
WTG 208	581,926	4,979,376	332	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (65)	Yes	GAMESA	G87/2000	2,000	87.0	78.0	16.7
WTG 21	584,724	4,980,373	330	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (70)	Yes	GAMESA	G87/2000	2,000	87.0	78.0	16.7
WTG 28	583,683	4,979,243	350	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (64)	Yes	GAMESA	G87/2000	2,000	87.0	78.0	16.7
WTG 28A	584,468	4,979,494	350	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (66)	Yes	GAMESA	G87/2000	2,000	87.0	78.0	16.7
WTG 2-A	585,774	4,983,036	314	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (84)	Yes	GAMESA	G87/2000	2,000	87.0	78.0	16.7
WTG 31	581,116	4,979,155	330	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (63)	Yes	GAMESA	G87/2000	2,000	87.0	78.0	16.7
WTG 3-A	584,951	4,983,285	294	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (86)	Yes	GAMESA	G87/2000	2,000	87.0	78.0	16.7
WTG 4-A	586,473	4,982,587	322	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (83)	Yes	GAMESA	G87/2000	2,000	87.0	78.0	16.7
WTG 5-A	585,629	4,982,226	310	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (82)	Yes	GAMESA	G87/2000	2,000	87.0	78.0	16.7
WTG 9A	584,679	4,981,623	312	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (80)	Yes	GAMESA	G87/2000	2,000	87.0	78.0	16.7

Shadow receptor-Input

UTM NAD83 Zone: 18

No.	Name	East	North	Z	Width [m]	Height [m]	Height a.g.l. [m]	Degrees from south cw [°]	Slope of window [°]	Direction mode
90	Whalen Rd C1	580,529	4,978,811	323	1.0	1.0	1.0	0.0	90.0	"Green house mode"
91	Unknown C1	581,332	4,978,002	340	1.0	1.0	1.0	0.0	90.0	"Green house mode"
92	133 Jones Rd C1	583,091	4,979,279	350	1.0	1.0	1.0	0.0	90.0	"Green house mode"
93	455 Merchia Rd C1	580,696	4,979,347	323	1.0	1.0	1.0	0.0	90.0	"Green house mode"
94	154 Jones Rd C1	583,144	4,979,462	350	1.0	1.0	1.0	0.0	90.0	"Green house mode"
95	229-231 Merchia Rd C1	582,166	4,979,466	340	1.0	1.0	1.0	0.0	90.0	"Green house mode"
96	428-438 Merchia Rd C1	580,867	4,979,461	325	1.0	1.0	1.0	0.0	90.0	"Green house mode"
97	229-231 Merchia Rd C1	582,166	4,979,466	340	1.0	1.0	1.0	0.0	90.0	"Green house mode"
98	154 Jones Rd C1	583,144	4,979,462	350	1.0	1.0	1.0	0.0	90.0	"Green house mode"

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Project:

Marble River Wind Farm

Description:

Marble River Wind Farm
Cluster 1

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5/31/2007 2:38 PM / 2

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1200 Wall Street West 2nd Floor
US-LYNDHURST NJ 07071
201 933 5541 x114

Calculated:

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SHADOW - Main Result**Calculation:** Marble River Wind Farm Cluster 1

...continued from previous page

UTM NAD83 Zone: 18

No.	Name	East	North	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
					[m]	[m]	[m]	[°]	[°]	
99	713 Rt 189 C1	584,069	4,979,597	347	1.0	1.0	1.0	0.0	90.0	"Green house mode"
100	306 Merchia Rd C1	581,785	4,979,590	330	1.0	1.0	1.0	0.0	90.0	"Green house mode"
101	Merchia Rd C1	580,581	4,979,585	321	1.0	1.0	1.0	0.0	90.0	"Green house mode"
102	724 Rt 189 C1	584,126	4,979,672	345	1.0	1.0	1.0	0.0	90.0	"Green house mode"
103	5 Merchia Rd C1	582,173	4,979,665	340	1.0	1.0	1.0	0.0	90.0	"Green house mode"
104	725 Rt 189 C1	584,000	4,979,701	346	1.0	1.0	1.0	0.0	90.0	"Green house mode"
105	124 Merchia Rd C1	583,146	4,979,802	344	1.0	1.0	1.0	0.0	90.0	"Green house mode"
106	748-750 Rt 189 C1	584,116	4,979,847	340	1.0	1.0	1.0	0.0	90.0	"Green house mode"
107	212 Jones Rd C1	582,966	4,979,854	341	1.0	1.0	1.0	0.0	90.0	"Green house mode"
108	777 Rt 189 C1	584,011	4,980,065	333	1.0	1.0	1.0	0.0	90.0	"Green house mode"
109	780 Rt 189 C1	584,071	4,980,121	332	1.0	1.0	1.0	0.0	90.0	"Green house mode"
110	799 Rt 189 C1	583,967	4,980,219	330	1.0	1.0	1.0	0.0	90.0	"Green house mode"
111	844 Rt 189 C1	584,012	4,980,555	330	1.0	1.0	1.0	0.0	90.0	"Green house mode"
112	Jones Rd C1	582,139	4,980,739	313	1.0	1.0	1.0	0.0	90.0	"Green house mode"
113	876 Rt 189 C1	583,988	4,980,782	326	1.0	1.0	1.0	0.0	90.0	"Green house mode"
114	876 Rt 189 C1	583,988	4,980,782	326	1.0	1.0	1.0	0.0	90.0	"Green house mode"
115	885 Rt 189 C1	583,903	4,980,872	323	1.0	1.0	1.0	0.0	90.0	"Green house mode"
116	Rt 189 C1	583,997	4,981,134	316	1.0	1.0	1.0	0.0	90.0	"Green house mode"
117	922 Rt 189 C1	583,941	4,981,143	315	1.0	1.0	1.0	0.0	90.0	"Green house mode"
118	975-963 Rt 189 C1	583,793	4,981,439	309	1.0	1.0	1.0	0.0	90.0	"Green house mode"
119	975-963 Rt 189 C1	583,793	4,981,439	309	1.0	1.0	1.0	0.0	90.0	"Green house mode"
120	65 Santamore Rd C1	580,911	4,981,651	294	1.0	1.0	1.0	0.0	90.0	"Green house mode"
121	15 Santamore Rd C1	581,214	4,981,801	290	1.0	1.0	1.0	0.0	90.0	"Green house mode"
122	15 Santamore Rd C1	581,214	4,981,801	290	1.0	1.0	1.0	0.0	90.0	"Green house mode"
123	Unknown C1	581,332	4,978,002	340	1.0	1.0	1.0	0.0	90.0	"Green house mode"
124	Unknown C1	581,332	4,978,002	340	1.0	1.0	1.0	0.0	90.0	"Green house mode"
125	351 Frontier Rd C1	581,305	4,981,926	290	1.0	1.0	1.0	0.0	90.0	"Green house mode"
126	352 Frontier Rd C1	581,382	4,981,978	290	1.0	1.0	1.0	0.0	90.0	"Green house mode"
127	162 Frontier Rd C1	582,583	4,982,035	289	1.0	1.0	1.0	0.0	90.0	"Green house mode"
128	133 Frontier Rd C1	582,763	4,982,059	290	1.0	1.0	1.0	0.0	90.0	"Green house mode"
129	1048 Rt 189 C1	583,819	4,982,078	298	1.0	1.0	1.0	0.0	90.0	"Green house mode"
130	Unknown C1	581,332	4,978,002	340	1.0	1.0	1.0	0.0	90.0	"Green house mode"
131	Unknown C1	581,332	4,978,002	340	1.0	1.0	1.0	0.0	90.0	"Green house mode"
132	Frontier Rd C1	581,988	4,982,181	284	1.0	1.0	1.0	0.0	90.0	"Green house mode"
133	Unknown C1	581,332	4,978,002	340	1.0	1.0	1.0	0.0	90.0	"Green house mode"
134	1067 Rt 189 C1	583,760	4,982,221	296	1.0	1.0	1.0	0.0	90.0	"Green house mode"
135	1079 Rt 189 C1	583,744	4,982,300	295	1.0	1.0	1.0	0.0	90.0	"Green house mode"
136	26 Frontier Rd C1	583,560	4,982,318	292	1.0	1.0	1.0	0.0	90.0	"Green house mode"
137	32 Liberty Pole Rd C1	584,016	4,982,331	300	1.0	1.0	1.0	0.0	90.0	"Green house mode"
138	32 Liberty Pole Rd C1	584,016	4,982,331	300	1.0	1.0	1.0	0.0	90.0	"Green house mode"
139	136 Liberty Pole Rd C1	584,781	4,982,454	295	1.0	1.0	1.0	0.0	90.0	"Green house mode"
140	121 Liberty Pole Rd C1	584,664	4,982,483	292	1.0	1.0	1.0	0.0	90.0	"Green house mode"
141	178 Liberty Pole Rd C1	585,123	4,982,509	300	1.0	1.0	1.0	0.0	90.0	"Green house mode"
142	211 Liberty Pole Rd C1	585,342	4,982,551	303	1.0	1.0	1.0	0.0	90.0	"Green house mode"
143	238/239 Liberty Pole Rd C1	585,529	4,982,589	310	1.0	1.0	1.0	0.0	90.0	"Green house mode"
144	211 Liberty Pole Rd C1	585,342	4,982,551	303	1.0	1.0	1.0	0.0	90.0	"Green house mode"
145	238/239 Liberty Pole Rd C1	585,529	4,982,589	310	1.0	1.0	1.0	0.0	90.0	"Green house mode"

Calculation Results

Shadow receptor

		Shadow, worst case			Shadow, expected values
No.	Name	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow hours per year [h/year]
90	Whalen Rd C1	14:34	42	0:26	5:28
91	Unknown C1	0:00	0	0:00	0:00
92	133 Jones Rd C1	19:11	44	0:34	5:36
93	455 Merchia Rd C1	54:16	134	0:44	15:00
94	154 Jones Rd C1	21:54	48	0:35	5:11

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Project:

Marble River Wind Farm

Description:

Marble River Wind Farm
Cluster 1

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201 933 5541 x114

Calculated:

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SHADOW - Main Result**Calculation:** Marble River Wind Farm Cluster 1

...continued from previous page

No.	Name	Shadow, worst case		Shadow, expected values	
		Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow hours per year [h/year]
95	229-231 Merchia Rd C1	121:49	173	1:16	37:01
96	428-438 Merchia Rd C1	93:03	163	0:55	18:16
97	229-231 Merchia Rd C1	121:49	173	1:16	37:01
98	154 Jones Rd C1	21:54	48	0:35	5:11
99	713 Rt 189 C1	91:11	150	0:48	21:33
100	306 Merchia Rd C1	191:05	170	1:43	33:05
101	Merchia Rd C1	43:52	110	0:32	7:36
102	724 Rt 189 C1	85:01	143	0:52	18:47
103	5 Merchia Rd C1	83:25	126	0:57	18:33
104	725 Rt 189 C1	28:05	54	0:40	6:31
105	124 Merchia Rd C1	5:42	26	0:17	0:46
106	748-750 Rt 189 C1	51:59	82	0:44	7:00
107	212 Jones Rd C1	17:08	52	0:24	2:32
108	777 Rt 189 C1	22:20	68	0:28	8:01
109	780 Rt 189 C1	24:43	65	0:31	8:49
110	799 Rt 189 C1	12:51	38	0:27	4:00
111	844 Rt 189 C1	84:41	172	0:46	24:06
112	Jones Rd C1	9:41	32	0:25	2:49
113	876 Rt 189 C1	122:25	191	1:16	36:06
114	876 Rt 189 C1	122:25	191	1:16	36:06
115	885 Rt 189 C1	143:09	201	1:23	36:28
116	Rt 189 C1	134:13	198	1:15	35:41
117	922 Rt 189 C1	118:49	204	1:14	31:14
118	975-963 Rt 189 C1	91:50	154	1:18	24:26
119	975-963 Rt 189 C1	91:50	154	1:18	24:26
120	65 Santamore Rd C1	7:12	29	0:21	1:46
121	15 Santamore Rd C1	19:47	55	0:28	3:10
122	15 Santamore Rd C1	19:47	55	0:28	3:10
123	Unknown C1	0:00	0	0:00	0:00
124	Unknown C1	0:00	0	0:00	0:00
125	351 Frontier Rd C1	13:42	40	0:25	1:53
126	352 Frontier Rd C1	0:00	0	0:00	0:00
127	162 Frontier Rd C1	18:14	56	0:23	3:59
128	133 Frontier Rd C1	0:00	0	0:00	0:00
129	1048 Rt 189 C1	9:23	34	0:22	1:47
130	Unknown C1	0:00	0	0:00	0:00
131	Unknown C1	0:00	0	0:00	0:00
132	Frontier Rd C1	0:00	0	0:00	0:00
133	Unknown C1	0:00	0	0:00	0:00
134	1067 Rt 189 C1	0:00	0	0:00	0:00
135	1079 Rt 189 C1	0:00	0	0:00	0:00
136	26 Frontier Rd C1	0:00	0	0:00	0:00
137	32 Liberty Pole Rd C1	9:42	32	0:24	2:21
138	32 Liberty Pole Rd C1	9:42	32	0:24	2:21
139	136 Liberty Pole Rd C1	9:06	31	0:23	2:15
140	121 Liberty Pole Rd C1	7:00	27	0:21	1:44
141	178 Liberty Pole Rd C1	24:59	55	0:36	5:02
142	211 Liberty Pole Rd C1	81:20	80	1:20	12:48
143	238/239 Liberty Pole Rd C1	27:18	100	0:25	6:34
144	211 Liberty Pole Rd C1	81:20	80	1:20	12:48
145	238/239 Liberty Pole Rd C1	27:18	100	0:25	6:34

Total amount of flickering on the shadow receptors caused by each WTG

No.	Name	Worst case [h/year]
WTG 11	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (78)	-1810:-33
WTG 13	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (79)	58:55
WTG 148	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (75)	138:48
WTG 148A	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (77)	52:52

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Project:

Marble River Wind Farm

Description:

Marble River Wind Farm
Cluster 1

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US-LYNDHURST NJ 07071
201 933 5541 x114

Calculated:

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SHADOW - Main Result**Calculation:** Marble River Wind Farm Cluster 1

...continued from previous page

No.	Name	Worst case [h/year]
WTG 15	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (72)	138:58
WTG 15A	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (74)	-1402:-43
WTG 172	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (68)	117:19
WTG 175	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (81)	52:46
WTG 19	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (71)	9:41
WTG 1-A	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (87)	0:00
WTG 207	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (85)	0:00
WTG 208	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (65)	297:47
WTG 21	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (70)	76:20
WTG 28	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (64)	117:27
WTG 28A	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (66)	147:28
WTG 2-A	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (84)	0:00
WTG 31	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (63)	162:19
WTG 3-A	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (86)	0:00
WTG 4-A	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (83)	7:31
WTG 5-A	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (82)	92:23
WTG 9A	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (80)	20:22

Project:

Marble River Wind Farm

Description:

Marble River Wind Farm
Cluster 2

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1200 Wall Street West 2nd Floor
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201 933 5541 x114

Calculated:

5/31/2007 2:29 PM/2.50.60

SHADOW - Main Result

Calculation: Marble River Wind Farm Cluster 2

Assumptions for shadow calculations

Maximum distance for influence	1,000 m
Minimum sun height over horizon for influence	3 °
Day step for calculation	1 days
Time step for calculation	1 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.29	0.37	0.37	0.33	0.44	0.47	0.45	0.46	0.42	0.36	0.25	0.28

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
189	217	375	724	548	302	438	720	1.823	2.412	780	232	8.760

To avoid flicker from WTGs not visible a ZVI calculation is performed before the

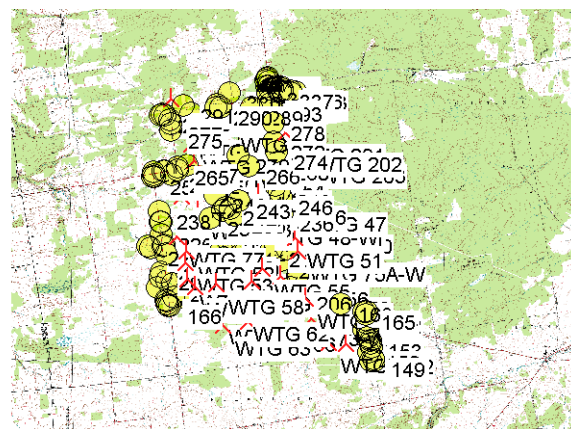
flicker calculation. The ZVI calculation is based on the following assumptions

Height contours used: Height Contours: MARBLE RIVER Contour 0.WPO (1)

Obstacles used in calculation

Eye height: 1.5 m

Grid resolution: 10 m



Scale 1:200,000

 New WTG

- Shadow receptor

WTGs

UTM NAD83 Zone: 18

East	North	Z	Row data/Description
			[m]

WTG type

[illegible]

Continued on next page...

Project:

Marble River Wind Farm

Description:

Marble River Wind Farm
Cluster 2

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1200 Wall Street West 2nd Floor
US-LYNDHURST NJ 07071
201 933 5541 x114

Calculated:

5/31/2007 2:29 PM/2.5.0.60

SHADOW - Main Result**Calculation:** Marble River Wind Farm Cluster 2

...continued from previous page

UTM NAD83 Zone: 18**WTG type**

East	North	Z	Row data/Description	Valid	Manufact.	Type	Power [kW]	Diam. [m]	Height [m]	RPM [RPM]
WTG 87	583,137	4,977,819	360 GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (59)	Yes	GAMESA	G87/2000	2,000	87.0	78.0	16.7

Shadow receptor-Input**UTM NAD83 Zone: 18**

No.	Name	East	North	Z	Width [m]	Height [m]	Height a.g.l. [m]	Degrees from south cw [°]	Slope of window [°]	Direction mode
146	404 Brandy Brook Rd C2	587,004	4,971,501	374	1.0	1.0	1.0	0.0	90.0	"Green house mode"
147	399 Brandy Brook Rd C2	586,915	4,971,502	377	1.0	1.0	1.0	0.0	90.0	"Green house mode"
148	410/412 Brandy Brook Rd C2	586,987	4,971,544	375	1.0	1.0	1.0	0.0	90.0	"Green house mode"
149	410/412 Brandy Brook Rd C2	586,987	4,971,544	375	1.0	1.0	1.0	0.0	90.0	"Green house mode"
150	439 Brandy Brook Rd C2	586,858	4,971,728	380	1.0	1.0	1.0	0.0	90.0	"Green house mode"
151	452 Brandy Brook Rd C2	586,933	4,971,865	377	1.0	1.0	1.0	0.0	90.0	"Green house mode"
152	466 Brandy Brook Rd C2	586,914	4,971,965	378	1.0	1.0	1.0	0.0	90.0	"Green house mode"
153	476 Brandy Brook Rd C2	586,918	4,972,032	378	1.0	1.0	1.0	0.0	90.0	"Green house mode"
154	487 Brandy Brook Rd C2	586,807	4,972,109	380	1.0	1.0	1.0	0.0	90.0	"Green house mode"
155	488 Brandy Brook Rd C2	586,876	4,972,137	379	1.0	1.0	1.0	0.0	90.0	"Green house mode"
156	508 Brandy Brook Rd C2	586,836	4,972,257	379	1.0	1.0	1.0	0.0	90.0	"Green house mode"
157	515 Brandy Brook Rd C2	586,747	4,972,319	380	1.0	1.0	1.0	0.0	90.0	"Green house mode"
158	516 Brandy Brook Rd C2	586,838	4,972,328	378	1.0	1.0	1.0	0.0	90.0	"Green house mode"
159	524 Brandy Brook Rd C2	586,831	4,972,377	378	1.0	1.0	1.0	0.0	90.0	"Green house mode"
160	538 Brandy Brook Rd C2	586,809	4,972,493	376	1.0	1.0	1.0	0.0	90.0	"Green house mode"
161	550 Brandy Brook Rd C2	586,810	4,972,583	374	1.0	1.0	1.0	0.0	90.0	"Green house mode"
162	6211 Rt 11 C2	586,896	4,972,696	371	1.0	1.0	1.0	0.0	90.0	"Green house mode"
163	6231 Rt 11 C2	586,789	4,972,731	373	1.0	1.0	1.0	0.0	90.0	"Green house mode"
164	6232 Rt 11 C2	586,810	4,972,789	372	1.0	1.0	1.0	0.0	90.0	"Green house mode"
165	6242 Rt 11 C2	586,734	4,972,805	375	1.0	1.0	1.0	0.0	90.0	"Green house mode"
166	250 Campbell Rd C2	581,579	4,972,953	393	1.0	1.0	1.0	0.0	90.0	"Green house mode"
167	245 Campbell Rd C2	581,532	4,972,956	393	1.0	1.0	1.0	0.0	90.0	"Green house mode"
168	Rt 11 C2	586,136	4,972,995	385	1.0	1.0	1.0	0.0	90.0	"Green house mode"
169	250 Campbell Rd C2	581,579	4,972,953	393	1.0	1.0	1.0	0.0	90.0	"Green house mode"
170	251 Campbell Rd C2	581,510	4,973,005	392	1.0	1.0	1.0	0.0	90.0	"Green house mode"
171	251 Campbell Rd C2	581,510	4,973,005	392	1.0	1.0	1.0	0.0	90.0	"Green house mode"
172	261 Campbell Rd C2	581,514	4,973,073	391	1.0	1.0	1.0	0.0	90.0	"Green house mode"
173	280 Campbell Rd C2	581,474	4,973,097	390	1.0	1.0	1.0	0.0	90.0	"Green house mode"
174	327 Gagnier Rd C2	582,911	4,973,112	400	1.0	1.0	1.0	0.0	90.0	"Green house mode"
175	Gagnier Rd C2	582,689	4,973,113	398	1.0	1.0	1.0	0.0	90.0	"Green house mode"
176	6346 Rt 11 C2	586,043	4,973,145	388	1.0	1.0	1.0	0.0	90.0	"Green house mode"
177	444 Gagnier Rd C2	582,070	4,973,122	391	1.0	1.0	1.0	0.0	90.0	"Green house mode"
178	280 Campbell Rd C2	581,474	4,973,097	390	1.0	1.0	1.0	0.0	90.0	"Green house mode"
179	280 Campbell Rd C2	581,700	4,973,188	390	1.0	1.0	1.0	0.0	90.0	"Green house mode"
180	280 Campbell Rd C2	581,474	4,973,097	390	1.0	1.0	1.0	0.0	90.0	"Green house mode"
181	293 Gagnier Rd C2	583,195	4,973,216	400	1.0	1.0	1.0	0.0	90.0	"Green house mode"
182	280 Campbell Rd C2	581,700	4,973,188	390	1.0	1.0	1.0	0.0	90.0	"Green house mode"
183	293 Gagnier Rd C2	583,195	4,973,216	400	1.0	1.0	1.0	0.0	90.0	"Green house mode"
184	293 Gagnier Rd C2	583,195	4,973,216	400	1.0	1.0	1.0	0.0	90.0	"Green house mode"
185	293 Gagnier Rd C2	583,195	4,973,216	400	1.0	1.0	1.0	0.0	90.0	"Green house mode"
186	293 Gagnier Rd C2	583,195	4,973,216	400	1.0	1.0	1.0	0.0	90.0	"Green house mode"
187	293 Gagnier Rd C2	584,386	4,973,320	410	1.0	1.0	1.0	0.0	90.0	"Green house mode"
188	105-103 Gagnier Rd C2	584,619	4,973,328	410	1.0	1.0	1.0	0.0	90.0	"Green house mode"
189	166 Gagnier Rd C2	584,142	4,973,362	410	1.0	1.0	1.0	0.0	90.0	"Green house mode"
190	6346 Rt 11 C2	586,043	4,973,145	388	1.0	1.0	1.0	0.0	90.0	"Green house mode"
191	Gagnier Rd C2	584,793	4,973,429	410	1.0	1.0	1.0	0.0	90.0	"Green house mode"
192	317 Campbell Rd C2	581,259	4,973,438	386	1.0	1.0	1.0	0.0	90.0	"Green house mode"
193	317 Campbell Rd C2	581,259	4,973,438	386	1.0	1.0	1.0	0.0	90.0	"Green house mode"
194	6471 Rt 11 C2	585,195	4,973,527	407	1.0	1.0	1.0	0.0	90.0	"Green house mode"
195	362 Campbell Rd C2	581,660	4,973,553	383	1.0	1.0	1.0	0.0	90.0	"Green house mode"
196	332 Campbell Rd C2	581,516	4,973,607	382	1.0	1.0	1.0	0.0	90.0	"Green house mode"
197	6501 Rt 11 C2	585,011	4,973,709	408	1.0	1.0	1.0	0.0	90.0	"Green house mode"

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Project:

Marble River Wind Farm

Description:

Marble River Wind Farm
Cluster 2

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5/31/2007 2:40 PM / 3

Licensed user:

TRC Environmental Corporation
1200 Wall Street West 2nd Floor
US-LYNDHURST NJ 07071
201 933 5541 x114

Calculated:

5/31/2007 2:29 PM/2.5.0.60

SHADOW - Main Result**Calculation:** Marble River Wind Farm Cluster 2

...continued from previous page

UTM NAD83 Zone: 18

No.	Name	East	North	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
				[m]	[m]	[m]	[m]	[°]	[°]	
198	345 Campbell Rd C2	581,333	4,973,723	380	1.0	1.0	1.0	0.0	90.0	"Green house mode"
199	6523 Rt 11 C2	584,980	4,973,747	408	1.0	1.0	1.0	0.0	90.0	"Green house mode"
200	6514 Rt 11 C2	585,012	4,973,817	406	1.0	1.0	1.0	0.0	90.0	"Green house mode"
201	540 Patnode Rd C2	583,162	4,973,825	400	1.0	1.0	1.0	0.0	90.0	"Green house mode"
202	6523 Rt 11 C2	584,980	4,973,747	408	1.0	1.0	1.0	0.0	90.0	"Green house mode"
203	362 Campbell Rd C2	581,660	4,973,553	383	1.0	1.0	1.0	0.0	90.0	"Green house mode"
204	369 Campbell Rd C2	581,358	4,973,857	380	1.0	1.0	1.0	0.0	90.0	"Green house mode"
205	369 Campbell Rd C2	581,358	4,973,857	380	1.0	1.0	1.0	0.0	90.0	"Green house mode"
206	293 Gagnier Rd C2	583,195	4,973,216	400	1.0	1.0	1.0	0.0	90.0	"Green house mode"
207	566 Patnode Rd C2	583,123	4,974,016	398	1.0	1.0	1.0	0.0	90.0	"Green house mode"
208	6601 Rt 11 C2	584,542	4,974,161	403	1.0	1.0	1.0	0.0	90.0	"Green house mode"
209	586 Patnode Rd C2	583,106	4,974,168	395	1.0	1.0	1.0	0.0	90.0	"Green house mode"
210	595 Patnode Rd C2	583,025	4,974,229	393	1.0	1.0	1.0	0.0	90.0	"Green house mode"
211	426 Campbell Rd C2	581,487	4,974,321	374	1.0	1.0	1.0	0.0	90.0	"Green house mode"
212	426 Campbell Rd C2	581,487	4,974,321	374	1.0	1.0	1.0	0.0	90.0	"Green house mode"
213	22-20 Rt 189 C2	584,691	4,974,460	400	1.0	1.0	1.0	0.0	90.0	"Green house mode"
214	Patnode Rd C2	582,953	4,974,451	390	1.0	1.0	1.0	0.0	90.0	"Green house mode"
215	6649 Rt 11 C2	584,281	4,974,465	400	1.0	1.0	1.0	0.0	90.0	"Green house mode"
216	60 Lamb Rd C2	581,074	4,974,493	367	1.0	1.0	1.0	0.0	90.0	"Green house mode"
217	456 Campbell Rd C2	581,398	4,974,523	370	1.0	1.0	1.0	0.0	90.0	"Green house mode"
218	43 Lamb Rd C2	581,013	4,974,534	365	1.0	1.0	1.0	0.0	90.0	"Green house mode"
219	470 Campbell Rd C2	581,425	4,974,559	370	1.0	1.0	1.0	0.0	90.0	"Green house mode"
220	646 Patnode Rd C2	583,065	4,974,606	390	1.0	1.0	1.0	0.0	90.0	"Green house mode"
221	470 Campbell Rd C2	581,425	4,974,559	370	1.0	1.0	1.0	0.0	90.0	"Green house mode"
222	640 Patnode Rd C2	583,308	4,974,622	392	1.0	1.0	1.0	0.0	90.0	"Green house mode"
223	470 Campbell Rd C2	581,425	4,974,559	370	1.0	1.0	1.0	0.0	90.0	"Green house mode"
224	60 Lamb Rd C2	581,074	4,974,493	367	1.0	1.0	1.0	0.0	90.0	"Green house mode"
225	662 Patnode Rd C2	583,098	4,974,739	390	1.0	1.0	1.0	0.0	90.0	"Green house mode"
226	470 Campbell Rd C2	581,362	4,974,839	368	1.0	1.0	1.0	0.0	90.0	"Green house mode"
227	6747 Rt 11 C2	583,748	4,974,950	391	1.0	1.0	1.0	0.0	90.0	"Green house mode"
228	6750 Rt 11 C2	583,774	4,975,055	390	1.0	1.0	1.0	0.0	90.0	"Green house mode"
229	6766-6750 Rt 11 C2	583,678	4,975,136	390	1.0	1.0	1.0	0.0	90.0	"Green house mode"
230	Campbell Rd C2	581,348	4,975,161	365	1.0	1.0	1.0	0.0	90.0	"Green house mode"
231	6766-6750 Rt 11 C2	583,678	4,975,136	390	1.0	1.0	1.0	0.0	90.0	"Green house mode"
232	544 Campbell Rd C2	581,324	4,975,173	365	1.0	1.0	1.0	0.0	90.0	"Green house mode"
233	6801 Rt 11 C2	583,440	4,975,247	390	1.0	1.0	1.0	0.0	90.0	"Green house mode"
234	6985 Rt 11 C2	582,649	4,975,269	380	1.0	1.0	1.0	0.0	90.0	"Green house mode"
235	6825 Rt 11 C2	583,303	4,975,348	390	1.0	1.0	1.0	0.0	90.0	"Green house mode"
236	148 Rt 189 C2	584,564	4,975,391	397	1.0	1.0	1.0	0.0	90.0	"Green house mode"
237	157 Rt 189 C2	584,495	4,975,468	398	1.0	1.0	1.0	0.0	90.0	"Green house mode"
238	582 Campbell Rd C2	581,300	4,975,463	362	1.0	1.0	1.0	0.0	90.0	"Green house mode"
239	764 Patnode Rd C2	583,000	4,975,484	388	1.0	1.0	1.0	0.0	90.0	"Green house mode"
240	6848 Rt 11 C2	583,203	4,975,524	390	1.0	1.0	1.0	0.0	90.0	"Green house mode"
241	778 Patnode Rd C2	583,064	4,975,550	390	1.0	1.0	1.0	0.0	90.0	"Green house mode"
242	778 Patnode Rd C2	583,064	4,975,550	390	1.0	1.0	1.0	0.0	90.0	"Green house mode"
243	52 Nichols Rd C2	583,414	4,975,728	390	1.0	1.0	1.0	0.0	90.0	"Green house mode"
244	52 Nichols Rd C2	583,414	4,975,728	390	1.0	1.0	1.0	0.0	90.0	"Green house mode"
245	52 Nichols Rd C2	583,414	4,975,728	390	1.0	1.0	1.0	0.0	90.0	"Green house mode"
246	206 Rt 189 C2	584,555	4,975,831	393	1.0	1.0	1.0	0.0	90.0	"Green house mode"
247	52 Nichols Rd C2	583,414	4,975,728	390	1.0	1.0	1.0	0.0	90.0	"Green house mode"
248	6922 Rt 11 C2	582,776	4,975,878	380	1.0	1.0	1.0	0.0	90.0	"Green house mode"
249	228 Rt 189 C2	584,497	4,975,983	390	1.0	1.0	1.0	0.0	90.0	"Green house mode"
250	6985 Rt 11 C2	582,649	4,975,269	380	1.0	1.0	1.0	0.0	90.0	"Green house mode"
251	6977 Rt 11 C2	582,395	4,976,067	370	1.0	1.0	1.0	0.0	90.0	"Green house mode"
252	6985 Rt 11 C2	582,649	4,975,269	380	1.0	1.0	1.0	0.0	90.0	"Green house mode"
253	249 Rt 189 C2	584,398	4,976,144	380	1.0	1.0	1.0	0.0	90.0	"Green house mode"
254	Rt 189 C2	584,346	4,976,299	378	1.0	1.0	1.0	0.0	90.0	"Green house mode"
255	7026 Rt 11 C2	582,210	4,976,379	370	1.0	1.0	1.0	0.0	90.0	"Green house mode"
256	7173 Rt 11 C2	581,127	4,976,375	360	1.0	1.0	1.0	0.0	90.0	"Green house mode"
257	Rt 11 C2	581,176	4,976,381	360	1.0	1.0	1.0	0.0	90.0	"Green house mode"

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Project:

Marble River Wind Farm

Description:

Marble River Wind Farm
Cluster 2

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5/31/2007 2:40 PM / 4

Licensed user:

TRC Environmental Corporation
1200 Wall Street West 2nd Floor
US-LYNDHURST NJ 07071
201 933 5541 x114

Calculated:

5/31/2007 2:29 PM/2.5.0.60

SHADOW - Main Result**Calculation:** Marble River Wind Farm Cluster 2

...continued from previous page

UTM NAD83 Zone: 18

No.	Name	East	North	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
				[m]	[m]	[m]	[m]	[°]	[°]	
258	7173 Rt 11 C2	581,127	4,976,375	360	1.0	1.0	1.0	0.0	90.0	"Green house mode"
259	7103 Rt 11 C2	581,642	4,976,421	361	1.0	1.0	1.0	0.0	90.0	"Green house mode"
260	7165 Rt 11 C2	581,168	4,976,422	360	1.0	1.0	1.0	0.0	90.0	"Green house mode"
261	7168 Rt 11 C2	581,147	4,976,495	358	1.0	1.0	1.0	0.0	90.0	"Green house mode"
262	7132 Rt 11 C2	581,407	4,976,520	360	1.0	1.0	1.0	0.0	90.0	"Green house mode"
263	7126 Rt 11 C2	581,458	4,976,521	360	1.0	1.0	1.0	0.0	90.0	"Green house mode"
264	535 Looby Rd C2	581,802	4,976,554	362	1.0	1.0	1.0	0.0	90.0	"Green house mode"
265	525 Looby Rd C2	581,799	4,976,630	361	1.0	1.0	1.0	0.0	90.0	"Green house mode"
266	103 Lagree Rd C2	583,672	4,976,654	370	1.0	1.0	1.0	0.0	90.0	"Green house mode"
267	Lagree Rd C2	582,040	4,976,684	361	1.0	1.0	1.0	0.0	90.0	"Green house mode"
268	2 Swamp Rd C2	584,431	4,976,764	373	1.0	1.0	1.0	0.0	90.0	"Green house mode"
269	Lagree Rd C2	582,040	4,976,684	361	1.0	1.0	1.0	0.0	90.0	"Green house mode"
270	114 Lagree Rd C2	583,391	4,976,940	368	1.0	1.0	1.0	0.0	90.0	"Green house mode"
271	370 Rt 189 C2	584,408	4,977,039	370	1.0	1.0	1.0	0.0	90.0	"Green house mode"
272	403 Rt 189 C2	584,330	4,977,293	369	1.0	1.0	1.0	0.0	90.0	"Green house mode"
273	370 Rt 189 C2	584,408	4,977,039	370	1.0	1.0	1.0	0.0	90.0	"Green house mode"
274	370 Rt 189 C2	584,408	4,977,039	370	1.0	1.0	1.0	0.0	90.0	"Green house mode"
275	394 Looby Rd C2	581,606	4,977,591	343	1.0	1.0	1.0	0.0	90.0	"Green house mode"
276	370 Rt 189 C2	584,408	4,977,039	370	1.0	1.0	1.0	0.0	90.0	"Green house mode"
277	Looby Rd C2	581,602	4,977,780	344	1.0	1.0	1.0	0.0	90.0	"Green house mode"
278	472 Rt 189 C2	584,350	4,977,797	361	1.0	1.0	1.0	0.0	90.0	"Green house mode"
279	20 Whalen Rd C2	581,590	4,977,877	343	1.0	1.0	1.0	0.0	90.0	"Green house mode"
280	20 Whalen Rd C2	581,590	4,977,877	343	1.0	1.0	1.0	0.0	90.0	"Green house mode"
281	C2	581,332	4,978,002	340	1.0	1.0	1.0	0.0	90.0	"Green house mode"
282	36 Whalen Rd C2	581,453	4,978,010	340	1.0	1.0	1.0	0.0	90.0	"Green house mode"
283	41 Whalen Rd C2	581,390	4,978,017	340	1.0	1.0	1.0	0.0	90.0	"Green house mode"
284	283 Looby Rd C2	582,143	4,978,063	350	1.0	1.0	1.0	0.0	90.0	"Green house mode"
285	C2	581,332	4,978,002	340	1.0	1.0	1.0	0.0	90.0	"Green house mode"
286	283 Looby Rd C2	582,143	4,978,063	350	1.0	1.0	1.0	0.0	90.0	"Green house mode"
287	523 Rt 189 C2	584,213	4,978,178	360	1.0	1.0	1.0	0.0	90.0	"Green house mode"
288	191 Looby Rd C2	582,811	4,978,206	358	1.0	1.0	1.0	0.0	90.0	"Green house mode"
289	Looby Rd C2	583,768	4,978,213	360	1.0	1.0	1.0	0.0	90.0	"Green house mode"
290	173 Looby Rd C2	582,939	4,978,209	360	1.0	1.0	1.0	0.0	90.0	"Green house mode"
291	37 Jones Rd C2	581,949	4,978,257	346	1.0	1.0	1.0	0.0	90.0	"Green house mode"
292	186 Looby Rd C2	582,847	4,978,287	356	1.0	1.0	1.0	0.0	90.0	"Green house mode"
293	540 Rt 189 C2	584,269	4,978,304	360	1.0	1.0	1.0	0.0	90.0	"Green house mode"
294	37 Jones Rd C2	581,949	4,978,257	346	1.0	1.0	1.0	0.0	90.0	"Green house mode"
295	1 Looby Rd C2	584,209	4,978,347	360	1.0	1.0	1.0	0.0	90.0	"Green house mode"
296	15 Looby Rd C2	584,105	4,978,365	360	1.0	1.0	1.0	0.0	90.0	"Green house mode"
297	1331 Clinton Mills Rd C2	584,375	4,978,382	360	1.0	1.0	1.0	0.0	90.0	"Green house mode"
298	1329 Clinton Mills Rd C2	584,397	4,978,392	360	1.0	1.0	1.0	0.0	90.0	"Green house mode"
299	1323 Clinton Mills Rd C2	584,431	4,978,397	360	1.0	1.0	1.0	0.0	90.0	"Green house mode"
300	1313 Clinton Mills Rd C2	584,503	4,978,402	360	1.0	1.0	1.0	0.0	90.0	"Green house mode"
301	1301 Clinton Mills Rd C2	584,592	4,978,406	360	1.0	1.0	1.0	0.0	90.0	"Green house mode"
302	10 Looby Rd C2	584,151	4,978,408	360	1.0	1.0	1.0	0.0	90.0	"Green house mode"
303	1307 Clinton Mills Rd C2	584,552	4,978,410	360	1.0	1.0	1.0	0.0	90.0	"Green house mode"
304	1297 Clinton Mills Rd C2	584,628	4,978,416	360	1.0	1.0	1.0	0.0	90.0	"Green house mode"
305	1281 Clinton Mills Rd C2	584,746	4,978,430	360	1.0	1.0	1.0	0.0	90.0	"Green house mode"
306	1332 Clinton Mills Rd C2	584,368	4,978,433	360	1.0	1.0	1.0	0.0	90.0	"Green house mode"
307	1330 Clinton Mills Rd C2	584,391	4,978,434	360	1.0	1.0	1.0	0.0	90.0	"Green house mode"
308	1326 Clinton Mills Rd C2	584,417	4,978,435	360	1.0	1.0	1.0	0.0	90.0	"Green house mode"
309	1322 Clinton Mills Rd C2	584,439	4,978,437	360	1.0	1.0	1.0	0.0	90.0	"Green house mode"
310	1259 Clinton Mills Rd C2	584,916	4,978,453	359	1.0	1.0	1.0	0.0	90.0	"Green house mode"
311	1318 Clinton Mills Rd C2	584,467	4,978,457	360	1.0	1.0	1.0	0.0	90.0	"Green house mode"
312	1298 Clinton Mills Rd C2	584,626	4,978,459	360	1.0	1.0	1.0	0.0	90.0	"Green house mode"
313	1306 Clinton Mills Rd C2	584,555	4,978,461	360	1.0	1.0	1.0	0.0	90.0	"Green house mode"
314	556-560 Rt 189 C2	584,265	4,978,460	360	1.0	1.0	1.0	0.0	90.0	"Green house mode"
315	1280 Clinton Mills Rd C2	584,760	4,978,479	359	1.0	1.0	1.0	0.0	90.0	"Green house mode"
316	6 Broad St C2	584,588	4,978,486	360	1.0	1.0	1.0	0.0	90.0	"Green house mode"
317	8 Smith St C2	584,595	4,978,513	360	1.0	1.0	1.0	0.0	90.0	"Green house mode"

Continued on next page...

Project:

Marble River Wind Farm

Description:

Marble River Wind Farm
Cluster 2

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5/31/2007 2:40 PM / 5

Licensed user:

TRC Environmental Corporation
1200 Wall Street West 2nd Floor
US-LYNDHURST NJ 07071
201 933 5541 x114

Calculated:

5/31/2007 2:29 PM/2.5.0.60

SHADOW - Main Result**Calculation:** Marble River Wind Farm Cluster 2

...continued from previous page

UTM NAD83 Zone: 18

No.	Name	East	North	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
				[m]	[m]	[m]	[m]	[°]	[°]	
318	11 Smith St C2	584,548	4,978,524	360	1.0	1.0	1.0	0.0	90.0	"Green house mode"
319	12 Smith St C2	584,583	4,978,534	360	1.0	1.0	1.0	0.0	90.0	"Green house mode"
320	13 Smith St C2	584,545	4,978,545	360	1.0	1.0	1.0	0.0	90.0	"Green house mode"
321	572 Rt 189 C2	584,286	4,978,547	360	1.0	1.0	1.0	0.0	90.0	"Green house mode"
322	16 Smith St C2	584,579	4,978,555	359	1.0	1.0	1.0	0.0	90.0	"Green house mode"
323	Looby Rd C2	584,200	4,978,571	359	1.0	1.0	1.0	0.0	90.0	"Green house mode"
324	20 Smith St C2	584,589	4,978,574	359	1.0	1.0	1.0	0.0	90.0	"Green house mode"
325	576 Rt 189 C2	584,248	4,978,582	359	1.0	1.0	1.0	0.0	90.0	"Green house mode"
326	20 Smith St C2	584,589	4,978,574	359	1.0	1.0	1.0	0.0	90.0	"Green house mode"
327	575 Rt 189 C2	584,194	4,978,587	359	1.0	1.0	1.0	0.0	90.0	"Green house mode"
328	21 Smith St C2	584,542	4,978,591	359	1.0	1.0	1.0	0.0	90.0	"Green house mode"
329	16 Railroad St C2	584,807	4,978,594	358	1.0	1.0	1.0	0.0	90.0	"Green house mode"
330	Rt 189 C2	583,179	4,978,587	350	1.0	1.0	1.0	0.0	90.0	"Green house mode"
331	23 Smith St C2	584,539	4,978,611	359	1.0	1.0	1.0	0.0	90.0	"Green house mode"
332	Rt 189 C2	583,179	4,978,587	350	1.0	1.0	1.0	0.0	90.0	"Green house mode"
333	1260 Clinton Mills Rd C2	584,941	4,978,621	358	1.0	1.0	1.0	0.0	90.0	"Green house mode"
334	9 Summit Dr C2	584,457	4,978,628	359	1.0	1.0	1.0	0.0	90.0	"Green house mode"
335	25 Smith St C2	584,530	4,978,634	359	1.0	1.0	1.0	0.0	90.0	"Green house mode"
336	22 Railroad St C2	584,803	4,978,638	358	1.0	1.0	1.0	0.0	90.0	"Green house mode"
337	26 Smith St C2	584,568	4,978,643	359	1.0	1.0	1.0	0.0	90.0	"Green house mode"
338	27 Smith St C2	584,522	4,978,649	359	1.0	1.0	1.0	0.0	90.0	"Green house mode"
339	29 Smith St C2	584,483	4,978,676	359	1.0	1.0	1.0	0.0	90.0	"Green house mode"
340	34 Smith St C2	584,562	4,978,689	358	1.0	1.0	1.0	0.0	90.0	"Green house mode"
341	592 Rt 189 C2	584,230	4,978,696	357	1.0	1.0	1.0	0.0	90.0	"Green house mode"
342	30 Broad St C2	584,313	4,978,708	357	1.0	1.0	1.0	0.0	90.0	"Green house mode"
343	26 Broad St C2	584,339	4,978,716	357	1.0	1.0	1.0	0.0	90.0	"Green house mode"
344	22 Broad St C2	584,361	4,978,720	357	1.0	1.0	1.0	0.0	90.0	"Green house mode"
345	32 Broad St C2	584,283	4,978,721	357	1.0	1.0	1.0	0.0	90.0	"Green house mode"
346	18 Broad St C2	584,398	4,978,724	357	1.0	1.0	1.0	0.0	90.0	"Green house mode"
347	14 Broad St C2	584,421	4,978,729	357	1.0	1.0	1.0	0.0	90.0	"Green house mode"
348	12 Broad St C2	584,443	4,978,733	358	1.0	1.0	1.0	0.0	90.0	"Green house mode"
349	8 Broad St C2	584,463	4,978,745	358	1.0	1.0	1.0	0.0	90.0	"Green house mode"
350	2 Broad St C2	584,520	4,978,746	358	1.0	1.0	1.0	0.0	90.0	"Green house mode"
351	38 Smith St C2	584,554	4,978,752	358	1.0	1.0	1.0	0.0	90.0	"Green house mode"
352	Rt 189 C2	584,216	4,978,774	355	1.0	1.0	1.0	0.0	90.0	"Green house mode"
353	603 Rt 189 C2	584,173	4,978,777	355	1.0	1.0	1.0	0.0	90.0	"Green house mode"
354	618 Rt 189 C2	584,227	4,978,883	353	1.0	1.0	1.0	0.0	90.0	"Green house mode"
355	623 Rt 189 C2	584,147	4,978,912	352	1.0	1.0	1.0	0.0	90.0	"Green house mode"
356	629 Rt 189 C2	584,156	4,978,961	351	1.0	1.0	1.0	0.0	90.0	"Green house mode"
357	632 Rt 189 C2	584,190	4,978,986	351	1.0	1.0	1.0	0.0	90.0	"Green house mode"

Calculation Results

Shadow receptor

Shadow, worst case**Shadow, expected values**

No.	Name	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow hours per year [h/year]
146	404 Brandy Brook Rd C2	0:00	0	0:00	0:00
147	399 Brandy Brook Rd C2	0:00	0	0:00	0:00
148	410/412 Brandy Brook Rd C2	1:19	13	0:08	0:22
149	410/412 Brandy Brook Rd C2	1:19	13	0:08	0:22
150	439 Brandy Brook Rd C2	41:06	83	0:34	12:03
151	452 Brandy Brook Rd C2	17:33	45	0:31	5:01
152	466 Brandy Brook Rd C2	16:37	42	0:31	4:49
153	476 Brandy Brook Rd C2	15:28	38	0:31	4:43
154	487 Brandy Brook Rd C2	21:09	45	0:36	6:22
155	488 Brandy Brook Rd C2	16:42	41	0:32	4:57
156	508 Brandy Brook Rd C2	18:52	46	0:32	5:26

Continued on next page...

Project:

Marble River Wind Farm

Description:

Marble River Wind Farm
Cluster 2

Printed/Page

5/31/2007 2:40 PM / 6

Licensed user:

TRC Environmental Corporation
1200 Wall Street West 2nd Floor
US-LYNDHURST NJ 07071
201 933 5541 x114

Calculated:

5/31/2007 2:29 PM/2.5.0.60

SHADOW - Main Result**Calculation:** Marble River Wind Farm Cluster 2

...continued from previous page

No.	Name	Shadow, worst case		Shadow, expected values	
		Shadow hours	Shadow days	Max shadow	Shadow hours
		per year [h/year]	per year [days/year]	hours per day [h/day]	per year [h/year]
157	515 Brandy Brook Rd C2	36:20	92	0:36	8:47
158	516 Brandy Brook Rd C2	19:49	49	0:31	4:57
159	524 Brandy Brook Rd C2	22:29	58	0:31	5:00
160	538 Brandy Brook Rd C2	25:45	62	0:29	5:33
161	550 Brandy Brook Rd C2	3:42	20	0:13	0:47
162	6211 Rt 11 C2	0:00	0	0:00	0:00
163	6231 Rt 11 C2	0:00	0	0:00	0:00
164	6232 Rt 11 C2	0:00	0	0:00	0:00
165	6242 Rt 11 C2	0:00	0	0:00	0:00
166	250 Campbell Rd C2	0:00	0	0:00	0:00
167	245 Campbell Rd C2	0:00	0	0:00	0:00
168	Rt 11 C2	18:28	64	0:24	5:18
169	250 Campbell Rd C2	0:00	0	0:00	0:00
170	251 Campbell Rd C2	6:01	36	0:14	2:15
171	251 Campbell Rd C2	6:01	36	0:14	2:15
172	261 Campbell Rd C2	23:09	66	0:26	8:35
173	280 Campbell Rd C2	24:36	81	0:25	8:59
174	327 Gagnier Rd C2	53:33	170	0:33	11:43
175	Gagnier Rd C2	10:33	34	0:25	2:33
176	6346 Rt 11 C2	26:45	94	0:25	6:29
177	444 Gagnier Rd C2	29:32	89	0:26	8:43
178	280 Campbell Rd C2	24:36	81	0:25	8:59
179	280 Campbell Rd C2	35:51	70	0:36	13:15
180	280 Campbell Rd C2	24:36	81	0:25	8:59
181	293 Gagnier Rd C2	38:20	72	1:01	7:11
182	280 Campbell Rd C2	35:51	70	0:36	13:15
183	293 Gagnier Rd C2	38:20	72	1:01	7:11
184	293 Gagnier Rd C2	38:20	72	1:01	7:11
185	293 Gagnier Rd C2	38:20	72	1:01	7:11
186	293 Gagnier Rd C2	38:20	72	1:01	7:11
187	293 Gagnier Rd C2	40:32	104	0:32	11:27
188	105-103 Gagnier Rd C2	29:45	88	0:34	7:50
189	166 Gagnier Rd C2	21:20	70	0:25	4:39
190	6346 Rt 11 C2	26:45	94	0:25	6:29
191	Gagnier Rd C2	48:58	92	0:44	8:03
192	317 Campbell Rd C2	18:30	66	0:25	5:54
193	317 Campbell Rd C2	18:30	66	0:25	5:54
194	6471 Rt 11 C2	22:02	58	0:30	6:29
195	362 Campbell Rd C2	95:34	165	0:51	32:13
196	332 Campbell Rd C2	37:18	87	0:38	10:53
197	6501 Rt 11 C2	31:15	58	0:42	9:02
198	345 Campbell Rd C2	37:07	112	0:28	11:50
199	6523 Rt 11 C2	41:00	74	0:44	11:56
200	6514 Rt 11 C2	33:25	79	0:41	10:07
201	540 Patnode Rd C2	99:25	188	0:48	23:58
202	6523 Rt 11 C2	41:00	74	0:44	11:56
203	362 Campbell Rd C2	95:34	165	0:51	32:13
204	369 Campbell Rd C2	50:11	142	0:31	15:20
205	369 Campbell Rd C2	50:11	142	0:31	15:20
206	293 Gagnier Rd C2	38:20	72	1:01	7:11
207	566 Patnode Rd C2	25:47	79	0:28	5:13
208	6601 Rt 11 C2	63:14	153	0:38	19:48
209	586 Patnode Rd C2	30:34	89	0:26	5:13
210	595 Patnode Rd C2	19:03	56	0:23	2:50
211	426 Campbell Rd C2	52:01	109	0:38	14:37
212	426 Campbell Rd C2	52:01	109	0:38	14:37
213	22-20 Rt 189 C2	98:25	165	1:06	25:49
214	Patnode Rd C2	5:44	27	0:20	1:44
215	6649 Rt 11 C2	48:27	119	0:31	16:45
216	60 Lamb Rd C2	45:39	147	0:29	14:57

Continued on next page...

Project:

Marble River Wind Farm

Description:

Marble River Wind Farm
Cluster 2

Printed/Page

5/31/2007 2:40 PM / 7

Licensed user:

TRC Environmental Corporation
1200 Wall Street West 2nd Floor
US-LYNDHURST NJ 07071
201 933 5541 x114

Calculated:

5/31/2007 2:29 PM/2.5.0.60

SHADOW - Main Result**Calculation:** Marble River Wind Farm Cluster 2

...continued from previous page

No.	Name	Shadow, worst case		Shadow, expected values	
		Shadow hours	Shadow days	Max shadow	Shadow hours
		per year	per year	hours per day	per year
		[h/year]	[days/year]	[h/day]	[h/year]
217	456 Campbell Rd C2	39:15	101	0:32	7:59
218	43 Lamb Rd C2	16:17	48	0:27	5:45
219	470 Campbell Rd C2	50:38	122	0:33	9:22
220	646 Patnode Rd C2	0:00	0	0:00	0:00
221	470 Campbell Rd C2	50:38	122	0:33	9:22
222	640 Patnode Rd C2	7:49	32	0:18	1:06
223	470 Campbell Rd C2	50:38	122	0:33	9:22
224	60 Lamb Rd C2	45:39	147	0:29	14:57
225	662 Patnode Rd C2	0:00	0	0:00	0:00
226	470 Campbell Rd C2	57:27	115	0:49	14:02
227	6747 Rt 11 C2	0:00	0	0:00	0:00
228	6750 Rt 11 C2	0:00	0	0:00	0:00
229	6766-6750 Rt 11 C2	4:34	20	0:17	1:44
230	Campbell Rd C2	47:12	82	0:39	6:44
231	6766-6750 Rt 11 C2	4:34	20	0:17	1:44
232	544 Campbell Rd C2	44:43	82	0:37	6:27
233	6801 Rt 11 C2	20:04	48	0:33	6:22
234	6985 Rt 11 C2	0:00	0	0:00	0:00
235	6825 Rt 11 C2	16:57	63	0:27	4:54
236	148 Rt 189 C2	87:16	115	1:28	24:20
237	157 Rt 189 C2	111:39	183	1:25	33:24
238	582 Campbell Rd C2	0:00	0	0:00	0:00
239	764 Patnode Rd C2	14:11	40	0:30	4:02
240	6848 Rt 11 C2	40:53	127	0:27	13:41
241	778 Patnode Rd C2	22:23	80	0:27	7:22
242	778 Patnode Rd C2	22:23	80	0:27	7:22
243	52 Nichols Rd C2	57:24	130	0:38	17:25
244	52 Nichols Rd C2	57:24	130	0:38	17:25
245	52 Nichols Rd C2	57:24	130	0:38	17:25
246	206 Rt 189 C2	82:38	167	0:43	20:50
247	52 Nichols Rd C2	57:24	130	0:38	17:25
248	6922 Rt 11 C2	80:02	173	0:41	22:12
249	228 Rt 189 C2	45:17	98	0:37	11:46
250	6985 Rt 11 C2	0:00	0	0:00	0:00
251	6977 Rt 11 C2	37:04	86	0:38	10:56
252	6985 Rt 11 C2	0:00	0	0:00	0:00
253	249 Rt 189 C2	48:28	103	0:39	11:10
254	Rt 189 C2	67:34	82	1:03	12:59
255	7026 Rt 11 C2	40:18	87	0:44	11:27
256	7173 Rt 11 C2	14:06	48	0:23	2:12
257	Rt 11 C2	19:45	68	0:25	3:02
258	7173 Rt 11 C2	14:06	48	0:23	2:12
259	7103 Rt 11 C2	4:40	23	0:15	1:45
260	7165 Rt 11 C2	23:01	70	0:24	3:30
261	7168 Rt 11 C2	16:53	52	0:23	2:30
262	7132 Rt 11 C2	12:09	41	0:25	4:14
263	7126 Rt 11 C2	15:02	47	0:26	5:19
264	535 Looby Rd C2	35:16	82	0:38	12:09
265	525 Looby Rd C2	77:06	129	0:47	26:58
266	103 Lagree Rd C2	20:44	75	0:25	5:23
267	Lagree Rd C2	31:00	95	0:30	8:24
268	2 Swamp Rd C2	13:29	44	0:26	4:40
269	Lagree Rd C2	31:00	95	0:30	8:24
270	114 Lagree Rd C2	44:55	122	0:39	11:55
271	370 Rt 189 C2	31:07	91	0:29	10:28
272	403 Rt 189 C2	18:51	65	0:26	5:09
273	370 Rt 189 C2	31:07	91	0:29	10:28
274	370 Rt 189 C2	31:07	91	0:29	10:28
275	394 Looby Rd C2	73:54	133	0:51	19:33
276	370 Rt 189 C2	31:07	91	0:29	10:28

Continued on next page...

Project:

Marble River Wind Farm

Description:

Marble River Wind Farm
Cluster 2

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5/31/2007 2:40 PM / 8

Licensed user:

TRC Environmental Corporation
1200 Wall Street West 2nd Floor
US-LYNDHURST NJ 07071
201 933 5541 x114

Calculated:

5/31/2007 2:29 PM/2.5.0.60

SHADOW - Main Result**Calculation:** Marble River Wind Farm Cluster 2

...continued from previous page

No.	Name	Shadow, worst case		Shadow, expected values	
		Shadow hours	Shadow days	Max shadow	Shadow hours
		per year	per year	hours per day	per year
		[h/year]	[days/year]	[h/day]	[h/year]
277	Looby Rd C2	50:40	102	0:47	10:52
278	472 Rt 189 C2	93:08	117	1:16	14:22
279	20 Whalen Rd C2	36:41	66	0:43	7:19
280	20 Whalen Rd C2	36:41	66	0:43	7:19
281	C2	15:27	44	0:28	2:58
282	36 Whalen Rd C2	25:25	62	0:32	4:03
283	41 Whalen Rd C2	19:32	51	0:29	3:18
284	283 Looby Rd C2	0:00	0	0:00	0:00
285	C2	15:27	44	0:28	2:58
286	283 Looby Rd C2	0:00	0	0:00	0:00
287	523 Rt 189 C2	0:00	0	0:00	0:00
288	191 Looby Rd C2	36:48	76	0:38	5:48
289	Looby Rd C2	17:14	50	0:29	4:02
290	173 Looby Rd C2	0:00	0	0:00	0:00
291	37 Jones Rd C2	29:25	51	0:43	8:22
292	186 Looby Rd C2	0:00	0	0:00	0:00
293	540 Rt 189 C2	0:00	0	0:00	0:00
294	37 Jones Rd C2	29:25	51	0:43	8:22
295	1 Looby Rd C2	0:00	0	0:00	0:00
296	15 Looby Rd C2	0:00	0	0:00	0:00
297	1331 Clinton Mills Rd C2	0:00	0	0:00	0:00
298	1329 Clinton Mills Rd C2	0:00	0	0:00	0:00
299	1323 Clinton Mills Rd C2	0:00	0	0:00	0:00
300	1313 Clinton Mills Rd C2	0:00	0	0:00	0:00
301	1301 Clinton Mills Rd C2	0:00	0	0:00	0:00
302	10 Looby Rd C2	0:00	0	0:00	0:00
303	1307 Clinton Mills Rd C2	0:00	0	0:00	0:00
304	1297 Clinton Mills Rd C2	0:00	0	0:00	0:00
305	1281 Clinton Mills Rd C2	0:00	0	0:00	0:00
306	1332 Clinton Mills Rd C2	0:00	0	0:00	0:00
307	1330 Clinton Mills Rd C2	0:00	0	0:00	0:00
308	1326 Clinton Mills Rd C2	0:00	0	0:00	0:00
309	1322 Clinton Mills Rd C2	0:00	0	0:00	0:00
310	1259 Clinton Mills Rd C2	0:00	0	0:00	0:00
311	1318 Clinton Mills Rd C2	0:00	0	0:00	0:00
312	1298 Clinton Mills Rd C2	0:00	0	0:00	0:00
313	1306 Clinton Mills Rd C2	0:00	0	0:00	0:00
314	556-560 Rt 189 C2	0:00	0	0:00	0:00
315	1280 Clinton Mills Rd C2	0:00	0	0:00	0:00
316	6 Broad St C2	0:00	0	0:00	0:00
317	8 Smith St C2	0:00	0	0:00	0:00
318	11 Smith St C2	0:00	0	0:00	0:00
319	12 Smith St C2	0:00	0	0:00	0:00
320	13 Smith St C2	0:00	0	0:00	0:00
321	572 Rt 189 C2	0:00	0	0:00	0:00
322	16 Smith St C2	0:00	0	0:00	0:00
323	Looby Rd C2	0:00	0	0:00	0:00
324	20 Smith St C2	0:00	0	0:00	0:00
325	576 Rt 189 C2	0:00	0	0:00	0:00
326	20 Smith St C2	0:00	0	0:00	0:00
327	575 Rt 189 C2	0:00	0	0:00	0:00
328	21 Smith St C2	0:00	0	0:00	0:00
329	16 Railroad St C2	0:00	0	0:00	0:00
330	Rt 189 C2	0:00	0	0:00	0:00
331	23 Smith St C2	0:00	0	0:00	0:00
332	Rt 189 C2	0:00	0	0:00	0:00
333	1260 Clinton Mills Rd C2	0:00	0	0:00	0:00
334	9 Summit Dr C2	0:00	0	0:00	0:00
335	25 Smith St C2	0:00	0	0:00	0:00
336	22 Railroad St C2	0:00	0	0:00	0:00

Continued on next page...

Project:

Marble River Wind Farm

Description:

Marble River Wind Farm
Cluster 2

Printed/Page

5/31/2007 2:40 PM / 9

Licensed user:

TRC Environmental Corporation
1200 Wall Street West 2nd Floor
US-LYNDHURST NJ 07071
201 933 5541 x114

Calculated:

5/31/2007 2:29 PM/2.5.0.60

SHADOW - Main Result**Calculation:** Marble River Wind Farm Cluster 2

...continued from previous page

No.	Name	Shadow, worst case		Shadow, expected values	
		Shadow hours	Shadow days	Max shadow	Shadow hours
		per year [h/year]	per year [days/year]	hours per day [h/day]	per year [h/year]
337	26 Smith St C2	0:00	0	0:00	0:00
338	27 Smith St C2	0:00	0	0:00	0:00
339	29 Smith St C2	0:00	0	0:00	0:00
340	34 Smith St C2	0:00	0	0:00	0:00
341	592 Rt 189 C2	0:00	0	0:00	0:00
342	30 Broad St C2	0:00	0	0:00	0:00
343	26 Broad St C2	0:00	0	0:00	0:00
344	22 Broad St C2	0:00	0	0:00	0:00
345	32 Broad St C2	0:00	0	0:00	0:00
346	18 Broad St C2	0:00	0	0:00	0:00
347	14 Broad St C2	0:00	0	0:00	0:00
348	12 Broad St C2	0:00	0	0:00	0:00
349	8 Broad St C2	0:00	0	0:00	0:00
350	2 Broad St C2	0:00	0	0:00	0:00
351	38 Smith St C2	0:00	0	0:00	0:00
352	Rt 189 C2	0:00	0	0:00	0:00
353	603 Rt 189 C2	0:00	0	0:00	0:00
354	618 Rt 189 C2	0:00	0	0:00	0:00
355	623 Rt 189 C2	0:00	0	0:00	0:00
356	629 Rt 189 C2	0:00	0	0:00	0:00
357	632 Rt 189 C2	0:00	0	0:00	0:00

Total amount of flickering on the shadow receptors caused by each WTG

No.	Name	Worst case [h/year]
WTG 12	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (23)	-306:-55
WTG 201	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (57)	79:00
WTG 202	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (56)	46:13
WTG 202	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (24)	7:11
WTG 203	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (54)	31:22
WTG 206	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (34)	-307:-23
WTG 36A	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (60)	-1026:-34
WTG 42	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (51)	85:55
WTG 44	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (50)	56:25
WTG 45	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (48)	72:49
WTG 46	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (49)	186:32
WTG 47	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (47)	132:24
WTG 48-W	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (45)	153:47
WTG 50	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (43)	25:16
WTG 51	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (41)	35:03
WTG 52	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (40)	85:05
WTG 53	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (38)	117:59
WTG 55	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (37)	93:01
WTG 56	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (36)	94:38
WTG 57	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (35)	132:44
WTG 58	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (33)	83:51
WTG 59	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (32)	100:56
WTG 60	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (31)	92:31
WTG 62	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (30)	70:44
WTG 63	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (25)	0:00
WTG 63A	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (29)	26:54
WTG 64	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (27)	27:16
WTG 66	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (26)	19:35
WTG 73-W	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (28)	0:00
WTG 75A-W	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (39)	112:08
WTG 77	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (42)	133:34
WTG 78	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (46)	74:29
WTG 81	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (44)	67:11
WTG 83	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (52)	94:50

Continued on next page...

Project:

Marble River Wind Farm

Description:

Marble River Wind Farm
Cluster 2

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5/31/2007 2:40 PM / 10

Licensed user:

TRC Environmental Corporation
1200 Wall Street West 2nd Floor
US-LYNDHURST NJ 07071
201 933 5541 x114

Calculated:

5/31/2007 2:29 PM/2.5.0.60

SHADOW - Main Result**Calculation:** Marble River Wind Farm Cluster 2

...continued from previous page

No.	Name	Worst case [h/year]
WTG 84	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (55)	36:19
WTG 84A	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (58)	154:30
WTG 85	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (53)	46:31
WTG 87	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (59)	44:24

Project:

Marble River Wind Farm

Description:

Marble River Wind Farm
Cluster 3

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5/31/2007 2:41 PM / 1

Licensed user:

TRC Environmental Corporation
1200 Wall Street West 2nd Floor
US-LYNDHURST NJ 07071
201 933 5541 x114

Calculated:

5/31/2007 10:49 AM/2.5.0.60

SHADOW - Main Result

Calculation: Marble River Wind Farm Cluster 3

Assumptions for shadow calculations

Maximum distance for influence	1,000 m
Minimum sun height over horizon for influence	3 °
Day step for calculation	1 days
Time step for calculation	1 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.29	0.37	0.37	0.33	0.44	0.47	0.45	0.46	0.42	0.36	0.25	0.28

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
189	217	375	724	548	302	438	720	1,823	2,412	780	232	8,760

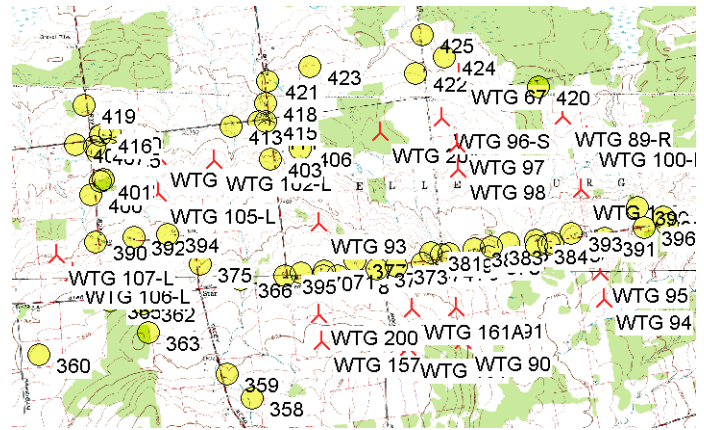
To avoid flicker from WTGs not visible a ZVI calculation is performed before the flicker calculation. The ZVI calculation is based on the following assumptions

Height contours used: Height Contours: MARBLE RIVER Contour 0.WPO (1)

Obstacles used in calculation

Eye height: 1.5 m

Grid resolution: 10 m



New WTG

Shadow receptor

WTGs

UTM NAD83 Zone: 18

	East	North	Z	Row data/Description	Valid	Manuf.	Type	Power [kW]	Diam. [m]	Height [m]	RPM [RPM]
WTG 100-R	584,949	4,970,956	401	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (18)	Yes	GAMESA	G87/2000	2,000	87.0	78.0	16.7
WTG 102-L	581,243	4,970,715	430	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (15)	Yes	GAMESA	G87/2000	2,000	87.0	78.0	16.7
WTG 104-L	580,689	4,970,760	430	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (16)	Yes	GAMESA	G87/2000	2,000	87.0	78.0	16.7
WTG 105-L	580,694	4,970,390	435	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (12)	Yes	GAMESA	G87/2000	2,000	87.0	78.0	16.7
WTG 106-L	579,838	4,969,600	451	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (9)	Yes	GAMESA	G87/2000	2,000	87.0	78.0	16.7
WTG 107-L	579,680	4,969,780	442	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (10)	Yes	GAMESA	G87/2000	2,000	87.0	78.0	16.7
WTG 109	584,893	4,970,431	410	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (13)	Yes	GAMESA	G87/2000	2,000	87.0	78.0	16.7
WTG 157	582,317	4,968,920	492	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (2)	Yes	GAMESA	G87/2000	2,000	87.0	78.0	16.7
WTG 161	583,180	4,968,863	484	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (1)	Yes	GAMESA	G87/2000	2,000	87.0	78.0	16.7
WTG 161A	583,214	4,969,246	466	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (5)	Yes	GAMESA	G87/2000	2,000	87.0	78.0	16.7
WTG 200	582,284	4,969,192	485	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (4)	Yes	GAMESA	G87/2000	2,000	87.0	78.0	16.7
WTG 204	582,897	4,970,995	420	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (19)	Yes	GAMESA	G87/2000	2,000	87.0	78.0	16.7
WTG 67	583,680	4,971,581	410	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (22)	Yes	GAMESA	G87/2000	2,000	87.0	78.0	16.7
WTG 89-R	584,715	4,971,160	400	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (21)	Yes	GAMESA	G87/2000	2,000	87.0	78.0	16.7
WTG 90	583,721	4,968,929	460	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (3)	Yes	GAMESA	G87/2000	2,000	87.0	78.0	16.7
WTG 91	583,649	4,969,257	456	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (6)	Yes	GAMESA	G87/2000	2,000	87.0	78.0	16.7
WTG 93	582,284	4,970,100	455	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (11)	Yes	GAMESA	G87/2000	2,000	87.0	78.0	16.7
WTG 94	585,129	4,969,344	417	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (7)	Yes	GAMESA	G87/2000	2,000	87.0	78.0	16.7
WTG 95	585,087	4,969,609	423	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (8)	Yes	GAMESA	G87/2000	2,000	87.0	78.0	16.7
WTG 96-S	583,511	4,971,140	420	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (20)	Yes	GAMESA	G87/2000	2,000	87.0	78.0	16.7
WTG 97	583,668	4,970,880	421	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (17)	Yes	GAMESA	G87/2000	2,000	87.0	78.0	16.7
WTG 98	583,672	4,970,635	424	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (14)	Yes	GAMESA	G87/2000	2,000	87.0	78.0	16.7

Shadow receptor-Input

UTM NAD83 Zone: 18

No.	Name	East	North	Z	Width [m]	Height [m]	Height a.g.l. [m]	Degrees from south cw [°]	Slope of window [°]	Direction mode
358	Tacey Rd C3	581,631	4,968,361	506	1.0	1.0	1.0	0.0	90.0	"Green house mode"
359	550 Tacey Rd C3	581,380	4,968,594	492	1.0	1.0	1.0	0.0	90.0	"Green house mode"
360	314 Harrigan Rd C3	579,508	4,968,791	464	1.0	1.0	1.0	0.0	90.0	"Green house mode"
361	8305 Star Rd C3	580,598	4,969,012	481	1.0	1.0	1.0	0.0	90.0	"Green house mode"
362	8149 Star Rd C3	580,547	4,969,290	475	1.0	1.0	1.0	0.0	90.0	"Green house mode"
363	8305 Star Rd C3	580,598	4,969,012	481	1.0	1.0	1.0	0.0	90.0	"Green house mode"
364	8305 Star Rd C3	580,598	4,969,012	481	1.0	1.0	1.0	0.0	90.0	"Green house mode"
365	Star Rd C3	580,214	4,969,319	467	1.0	1.0	1.0	0.0	90.0	"Green house mode"

Continued on next page...

Project:

Marble River Wind Farm

Description:

Marble River Wind Farm
Cluster 3

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5/31/2007 2:41 PM / 2

Licensed user:

TRC Environmental Corporation
1200 Wall Street West 2nd Floor
US-LYNDHURST NJ 07071
201 933 5541 x114

Calculated:

5/31/2007 10:49 AM/2.5.0.60

SHADOW - Main Result**Calculation:** Marble River Wind Farm Cluster 3

...continued from previous page

UTM NAD83 Zone: 18

No.	Name	East	North	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
				[m]	[m]	[m]	[m]	[°]	[°]	
366	7960 Star Rd C3	581,514	4,969,534	469	1.0	1.0	1.0	0.0	90.0	"Green house mode"
367	7909 Star Rd C3	582,332	4,969,569	471	1.0	1.0	1.0	0.0	90.0	"Green house mode"
368	7891 Star Rd C3	582,476	4,969,573	470	1.0	1.0	1.0	0.0	90.0	"Green house mode"
369	7960 Star Rd C3	581,955	4,969,573	470	1.0	1.0	1.0	0.0	90.0	"Green house mode"
370	7942 Star Rd C3	582,114	4,969,598	470	1.0	1.0	1.0	0.0	90.0	"Green house mode"
371	7908 Star Rd C3	582,346	4,969,623	470	1.0	1.0	1.0	0.0	90.0	"Green house mode"
372	7837 Star Rd C3	582,872	4,969,636	462	1.0	1.0	1.0	0.0	90.0	"Green house mode"
373	7811 Star Rd C3	583,058	4,969,662	455	1.0	1.0	1.0	0.0	90.0	"Green house mode"
374	7777 Star Rd C3	583,317	4,969,697	449	1.0	1.0	1.0	0.0	90.0	"Green house mode"
375	30 Ryan Rd C3	581,113	4,969,689	460	1.0	1.0	1.0	0.0	90.0	"Green house mode"
376	7741 Star Rd C3	583,570	4,969,705	441	1.0	1.0	1.0	0.0	90.0	"Green house mode"
377	7864 Star Rd C3	582,646	4,969,722	461	1.0	1.0	1.0	0.0	90.0	"Green house mode"
378	7687 Star Rd C3	583,978	4,969,759	430	1.0	1.0	1.0	0.0	90.0	"Green house mode"
379	7750 Star Rd C3	583,507	4,969,777	439	1.0	1.0	1.0	0.0	90.0	"Green house mode"
380	7738 Star Rd C3	583,590	4,969,788	439	1.0	1.0	1.0	0.0	90.0	"Green house mode"
381	7764 Star Rd C3	583,409	4,969,801	440	1.0	1.0	1.0	0.0	90.0	"Green house mode"
382	7706 Star Rd C3	583,840	4,969,836	430	1.0	1.0	1.0	0.0	90.0	"Green house mode"
383	7682 Star Rd C3	584,007	4,969,858	428	1.0	1.0	1.0	0.0	90.0	"Green house mode"
384	7621 Star Rd C3	584,460	4,969,868	422	1.0	1.0	1.0	0.0	90.0	"Green house mode"
385	7605 Star Rd C3	584,578	4,969,882	424	1.0	1.0	1.0	0.0	90.0	"Green house mode"
386	7579/7599 Star Rd C3	584,621	4,969,891	426	1.0	1.0	1.0	0.0	90.0	"Green house mode"
387	7652 Star Rd C3	584,181	4,969,894	424	1.0	1.0	1.0	0.0	90.0	"Green house mode"
388	7579/7599 Star Rd C3	584,621	4,969,891	426	1.0	1.0	1.0	0.0	90.0	"Green house mode"
389	7622 Star Rd C3	584,447	4,969,927	420	1.0	1.0	1.0	0.0	90.0	"Green house mode"
390	197 Ryan Rd C3	580,073	4,969,909	446	1.0	1.0	1.0	0.0	90.0	"Green house mode"
391	7535 Star Rd C3	585,138	4,969,945	425	1.0	1.0	1.0	0.0	90.0	"Green house mode"
392	150 Ryan Rd C3	580,450	4,969,955	451	1.0	1.0	1.0	0.0	90.0	"Green house mode"
393	7576 Star Rd C3	584,796	4,969,988	430	1.0	1.0	1.0	0.0	90.0	"Green house mode"
394	94 Ryan Rd C3	580,785	4,969,985	448	1.0	1.0	1.0	0.0	90.0	"Green house mode"
395	7960 Star Rd C3	581,955	4,969,573	470	1.0	1.0	1.0	0.0	90.0	"Green house mode"
396	7471 Star Rd C3	585,524	4,970,049	410	1.0	1.0	1.0	0.0	90.0	"Green house mode"
397	7445 Star Rd C3	585,753	4,970,074	401	1.0	1.0	1.0	0.0	90.0	"Green house mode"
398	7446 Star Rd C3	585,721	4,970,152	401	1.0	1.0	1.0	0.0	90.0	"Green house mode"
399	Star Rd C3	585,465	4,970,245	409	1.0	1.0	1.0	0.0	90.0	"Green house mode"
400	259 Ryan Rd C3	580,023	4,970,376	432	1.0	1.0	1.0	0.0	90.0	"Green house mode"
401	Ryan Rd C3	580,120	4,970,513	430	1.0	1.0	1.0	0.0	90.0	"Green house mode"
402	280 Ryan Rd C3	580,151	4,970,532	430	1.0	1.0	1.0	0.0	90.0	"Green house mode"
403	157 Bohon Rd C3	581,807	4,970,731	429	1.0	1.0	1.0	0.0	90.0	"Green house mode"
404	312/316 Ryan Rd C3	580,089	4,970,792	427	1.0	1.0	1.0	0.0	90.0	"Green house mode"
405	217 No 5 Rd C3	580,202	4,970,821	429	1.0	1.0	1.0	0.0	90.0	"Green house mode"
406	168 Bohon Rd C3	582,101	4,970,836	422	1.0	1.0	1.0	0.0	90.0	"Green house mode"
407	322 Ryan Rd C3	580,063	4,970,853	426	1.0	1.0	1.0	0.0	90.0	"Green house mode"
408	259 Ryan Rd C3	579,871	4,970,872	423	1.0	1.0	1.0	0.0	90.0	"Green house mode"
409	340 Ryan Rd C3	580,116	4,970,964	424	1.0	1.0	1.0	0.0	90.0	"Green house mode"
410	216 No 5 Rd C3	580,217	4,970,985	427	1.0	1.0	1.0	0.0	90.0	"Green house mode"
411	195 Bohon Rd C3	581,778	4,971,005	420	1.0	1.0	1.0	0.0	90.0	"Green house mode"
412	340 Ryan Rd C3	580,116	4,970,964	424	1.0	1.0	1.0	0.0	90.0	"Green house mode"
413	49 No 5 Rd C3	581,417	4,971,057	423	1.0	1.0	1.0	0.0	90.0	"Green house mode"
414	13 No 5 Rd C3	581,691	4,971,097	420	1.0	1.0	1.0	0.0	90.0	"Green house mode"
415	207 Bohon Rd C3	581,761	4,971,102	420	1.0	1.0	1.0	0.0	90.0	"Green house mode"
416	340 Ryan Rd C3	580,116	4,970,964	424	1.0	1.0	1.0	0.0	90.0	"Green house mode"
417	387 Ryan Rd C3	579,953	4,971,267	419	1.0	1.0	1.0	0.0	90.0	"Green house mode"
418	19 Campbell Rd C3	581,757	4,971,285	415	1.0	1.0	1.0	0.0	90.0	"Green house mode"
419	387 Ryan Rd C3	579,953	4,971,267	419	1.0	1.0	1.0	0.0	90.0	"Green house mode"
420	Off Star Rd C3	584,472	4,971,446	400	1.0	1.0	1.0	0.0	90.0	"Green house mode"
421	48/58 Campbell Rd C3	581,784	4,971,507	412	1.0	1.0	1.0	0.0	90.0	"Green house mode"
422	Patnode Rd C3	583,251	4,971,575	415	1.0	1.0	1.0	0.0	90.0	"Green house mode"
423	Campbell Rd C3	582,197	4,971,650	413	1.0	1.0	1.0	0.0	90.0	"Green house mode"
424	Patnode Rd C3	583,541	4,971,739	407	1.0	1.0	1.0	0.0	90.0	"Green house mode"
425	288 Patnode Rd C3	583,321	4,971,962	407	1.0	1.0	1.0	0.0	90.0	"Green house mode"

Project:

Marble River Wind Farm

Description:

Marble River Wind Farm
Cluster 3

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5/31/2007 2:41 PM / 3

Licensed user:

TRC Environmental Corporation
1200 Wall Street West 2nd Floor
US-LYNDHURST NJ 07071
201 933 5541 x114

Calculated:

5/31/2007 10:49 AM/2.5.0.60

SHADOW - Main Result

Calculation: Marble River Wind Farm Cluster 3

Calculation Results

Shadow receptor

No.	Name	Shadow, worst case		Max shadow hours per day [h/day]	Shadow, expected values
		Shadow hours per year [h/year]	Shadow days per year [days/year]		Shadow hours per year [h/year]
358	Tacey Rd C3	0:00	0	0:00	0:00
359	550 Tacey Rd C3	8:28	36	0:21	2:59
360	314 Harrigan Rd C3	0:00	0	0:00	0:00
361	8305 Star Rd C3	0:00	0	0:00	0:00
362	8149 Star Rd C3	17:51	88	0:24	5:03
363	8305 Star Rd C3	0:00	0	0:00	0:00
364	8305 Star Rd C3	0:00	0	0:00	0:00
365	Star Rd C3	0:00	0	0:00	0:00
366	7960 Star Rd C3	11:12	35	0:25	2:33
367	7909 Star Rd C3	7:01	29	0:21	1:41
368	7891 Star Rd C3	25:41	71	0:32	5:19
369	7960 Star Rd C3	40:17	68	0:43	5:27
370	7942 Star Rd C3	0:00	0	0:00	0:00
371	7908 Star Rd C3	7:28	31	0:22	1:40
372	7837 Star Rd C3	62:16	114	0:45	10:56
373	7811 Star Rd C3	45:19	127	0:45	9:20
374	7777 Star Rd C3	6:40	25	0:20	0:54
375	30 Ryan Rd C3	0:00	0	0:00	0:00
376	7741 Star Rd C3	24:18	52	0:35	5:04
377	7864 Star Rd C3	29:49	68	0:30	4:23
378	7687 Star Rd C3	13:30	52	0:23	3:02
379	7750 Star Rd C3	0:00	0	0:00	0:00
380	7738 Star Rd C3	0:00	0	0:00	0:00
381	7764 Star Rd C3	0:00	0	0:00	0:00
382	7706 Star Rd C3	23:25	62	0:26	5:03
383	7682 Star Rd C3	0:00	0	0:00	0:00
384	7621 Star Rd C3	39:21	106	0:30	7:15
385	7605 Star Rd C3	32:49	82	0:36	6:08
386	7579/7599 Star Rd C3	31:37	64	0:39	5:44
387	7652 Star Rd C3	8:37	42	0:21	2:03
388	7579/7599 Star Rd C3	31:37	64	0:39	5:44
389	7622 Star Rd C3	31:50	90	0:29	5:41
390	197 Ryan Rd C3	102:11	142	0:56	24:32
391	7535 Star Rd C3	0:00	0	0:00	0:00
392	150 Ryan Rd C3	26:45	80	0:30	7:08
393	7576 Star Rd C3	14:00	36	0:30	1:54
394	94 Ryan Rd C3	0:00	0	0:00	0:00
395	7960 Star Rd C3	40:17	68	0:43	5:27
396	7471 Star Rd C3	38:59	91	0:35	8:36
397	7445 Star Rd C3	32:38	108	0:26	8:32
398	7446 Star Rd C3	40:32	118	0:26	10:03
399	Star Rd C3	33:35	76	0:35	9:54
400	259 Ryan Rd C3	32:41	93	0:30	10:57
401	Ryan Rd C3	63:47	134	0:35	21:14
402	280 Ryan Rd C3	69:51	139	0:37	22:58
403	157 Bohon Rd C3	21:35	46	0:36	6:22
404	312/316 Ryan Rd C3	40:00	100	0:34	8:42
405	217 No 5 Rd C3	63:03	124	0:41	12:36
406	168 Bohon Rd C3	19:42	65	0:26	6:06
407	322 Ryan Rd C3	42:34	125	0:32	8:27
408	259 Ryan Rd C3	20:32	70	0:25	4:31
409	340 Ryan Rd C3	29:42	80	0:34	6:00
410	216 No 5 Rd C3	27:57	55	0:39	6:15
411	195 Bohon Rd C3	21:45	50	0:34	6:05
412	340 Ryan Rd C3	29:42	80	0:34	6:00
413	49 No 5 Rd C3	52:06	82	1:04	11:35
414	13 No 5 Rd C3	44:27	90	0:36	9:38

Continued on next page...

Project:

Marble River Wind Farm

Description:

Marble River Wind Farm
Cluster 3

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5/31/2007 2:41 PM / 4

Licensed user:

TRC Environmental Corporation
1200 Wall Street West 2nd Floor
US-LYNDHURST NJ 07071
201 933 5541 x114

Calculated:

5/31/2007 10:49 AM/2.5.0.60

SHADOW - Main Result**Calculation:** Marble River Wind Farm Cluster 3

...continued from previous page

No.	Name	Shadow, worst case		Shadow, expected values	
		Shadow hours	Shadow days	Max shadow	Shadow hours
		per year [h/year]	per year [days/year]	hours per day [h/day]	per year [h/year]
415	207 Bohon Rd C3	27:57	67	0:33	6:10
416	340 Ryan Rd C3	29:42	80	0:34	6:00
417	387 Ryan Rd C3	16:21	54	0:24	2:31
418	19 Campbell Rd C3	8:52	32	0:21	1:53
419	387 Ryan Rd C3	16:21	54	0:24	2:31
420	Off Star Rd C3	100:34	124	1:10	16:09
421	48/58 Campbell Rd C3	0:00	0	0:00	0:00
422	Patnode Rd C3	37:57	62	0:47	11:12
423	Campbell Rd C3	5:53	28	0:16	0:50
424	Patnode Rd C3	194:33	156	1:33	29:19
425	288 Patnode Rd C3	37:17	64	0:41	5:03

Total amount of flickering on the shadow receptors caused by each WTG

No.	Name	Worst case [h/year]
WTG 100-R	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (18)	13:44
WTG 102-L	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (15)	145:19
WTG 104-L	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (16)	175:52
WTG 105-L	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (12)	130:24
WTG 106-L	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (9)	-933:-38
WTG 107-L	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (10)	51:46
WTG 109	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (13)	44:21
WTG 157	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (2)	8:28
WTG 161	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (1)	0:00
WTG 161A	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (5)	136:31
WTG 200	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (4)	98:22
WTG 204	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (19)	16:57
WTG 67	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (22)	262:02
WTG 89-R	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (21)	70:06
WTG 90	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (3)	0:00
WTG 91	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (6)	44:12
WTG 93	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (11)	-38:-13
WTG 94	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (7)	32:23
WTG 95	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (8)	144:16
WTG 96-S	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (20)	0:00
WTG 97	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (17)	12:31
WTG 98	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (14)	0:00

Project:

Marble River Wind Farm

Description:

Marble River Wind Farm
Cluster 4

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5/31/2007 2:42 PM / 1

Licensed user:

TRC Environmental Corporation
1200 Wall Street West 2nd Floor
US-LYNDHURST NJ 07071
201 933 5541 x114

Calculated:

5/31/2007 9:32 AM/2.5.0.60

SHADOW - Main Result

Calculation: Marble River Wind Farm Cluster 4

Assumptions for shadow calculations

Maximum distance for influence 1,000 m
 Minimum sun height over horizon for influence 3 °
 Day step for calculation 1 days
 Time step for calculation 1 minutes

Sun shine probabilities (part of time from sun rise to sun set with sun shine)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.29	0.37	0.37	0.33	0.44	0.47	0.45	0.46	0.42	0.36	0.25	0.28

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
189	217	375	724	548	302	438	720	1,823	2,412	780	232	8,760

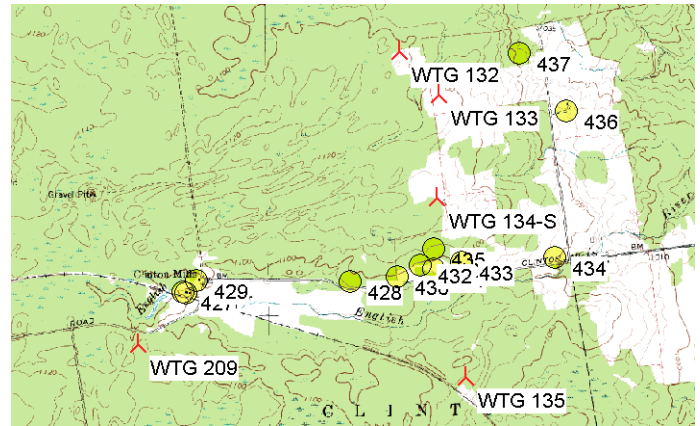
To avoid flicker from WTGs not visible a ZVI calculation is performed before the flicker calculation. The ZVI calculation is based on the following assumptions

Height contours used: Height Contours: MARBLE RIVER Contour 0.WPO (1)

Obstacles used in calculation

Eye height: 1.5 m

Grid resolution: 10 m



New WTG

Shadow receptor

WTGs

UTM NAD83 Zone: 18

	East	North	Z	Row data/Description	Valid	Manuf.	Type	Power [kW]	Diam. [m]	Height [m]	RPM [RPM]
WTG 132	589,654	4,980,689	332	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (73)	Yes	GAMESA	G87/2000	2,000	87.0	78.0	16.7
WTG 133	589,915	4,980,400	333	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (69)	Yes	GAMESA	G87/2000	2,000	87.0	78.0	16.7
WTG 134-S	589,903	4,979,722	340	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (67)	Yes	GAMESA	G87/2000	2,000	87.0	78.0	16.7
WTG 135	590,092	4,978,534	330	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (61)	Yes	GAMESA	G87/2000	2,000	87.0	78.0	16.7
WTG 209	587,922	4,978,751	340	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (62)	Yes	GAMESA	G87/2000	2,000	87.0	78.0	16.7

Shadow receptor-Input

UTM NAD83 Zone: 18

No.	Name	East	North	Z	Width [m]	Height [m]	Height a.g.l. [m]	Degrees from south cw [°]	Slope of window [°]	Direction mode
426	140 Rogers Rd C4	588,241	4,979,093	340	1.0	1.0	1.0	0.0	90.0	"Green house mode"
427	142 Rogers Rd C4	588,223	4,979,096	340	1.0	1.0	1.0	0.0	90.0	"Green house mode"
428	656 Clinton Mills Rd C4	589,331	4,979,165	335	1.0	1.0	1.0	0.0	90.0	"Green house mode"
429	126 Rogers Rd C4	588,313	4,979,176	340	1.0	1.0	1.0	0.0	90.0	"Green house mode"
430	Clinton Mills Rd C4	589,642	4,979,200	335	1.0	1.0	1.0	0.0	90.0	"Green house mode"
431	584 Clinton Mills Rd C4	589,888	4,979,247	334	1.0	1.0	1.0	0.0	90.0	"Green house mode"
432	600 Clinton Mills Rd C4	589,798	4,979,278	335	1.0	1.0	1.0	0.0	90.0	"Green house mode"
433	562 Clinton Mills Rd C4	590,071	4,979,295	333	1.0	1.0	1.0	0.0	90.0	"Green house mode"
434	478 Clinton Mills Rd C4	590,687	4,979,323	321	1.0	1.0	1.0	0.0	90.0	"Green house mode"
435	614 Clinton Mills Rd C4	589,887	4,979,384	338	1.0	1.0	1.0	0.0	90.0	"Green house mode"
436	450 Clinton Mills Rd C4	590,763	4,980,297	312	1.0	1.0	1.0	0.0	90.0	"Green house mode"
437	187 Soucia Rd C4	590,453	4,980,676	318	1.0	1.0	1.0	0.0	90.0	"Green house mode"

Calculation Results

Shadow receptor

Shadow, worst case

Shadow, expected values

No.	Name	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow hours per year [h/year]
426	140 Rogers Rd C4	53:19	79	0:47	11:14
427	142 Rogers Rd C4	49:18	74	0:48	10:20
428	656 Clinton Mills Rd C4	13:46	46	0:22	2:04
429	126 Rogers Rd C4	28:52	58	0:37	6:08
430	Clinton Mills Rd C4	0:00	0	0:00	0:00

Continued on next page...

Project:

Marble River Wind Farm

Description:

Marble River Wind Farm
Cluster 4

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5/31/2007 2:42 PM / 2

Licensed user:

TRC Environmental Corporation
1200 Wall Street West 2nd Floor
US-LYNDHURST NJ 07071
201 933 5541 x114

Calculated:

5/31/2007 9:32 AM/2.5.0.60

SHADOW - Main Result**Calculation:** Marble River Wind Farm Cluster 4

...continued from previous page

		Shadow, worst case			Shadow, expected values
No.	Name	Shadow hours	Shadow days	Max shadow	Shadow hours
		per year	per year	hours per day	per year
		[h/year]	[days/year]	[h/day]	[h/year]
431	584 Clinton Mills Rd C4	0:00	0	0:00	0:00
432	600 Clinton Mills Rd C4	0:00	0	0:00	0:00
433	562 Clinton Mills Rd C4	0:00	0	0:00	0:00
434	478 Clinton Mills Rd C4	18:49	54	0:25	5:24
435	614 Clinton Mills Rd C4	0:00	0	0:00	0:00
436	450 Clinton Mills Rd C4	10:26	34	0:24	2:58
437	187 Soucia Rd C4	31:51	81	0:34	9:12

Total amount of flickering on the shadow receptors caused by each WTG

No.	Name	Worst case [h/year]
WTG 132	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (73)	10:57
WTG 133	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (69)	31:20
WTG 134-S	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (67)	-1205:-10
WTG 135	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (61)	13:46
WTG 209	GAMESA G87/2000 2000 87.0 !O! hub: 78.0 m (62)	61:04

Table 1: Wind Turbine Generator Locations

Turbine ID	UTM East (m)	UTM North (m)	Latitude	Longitude
WTG 161	583,180	4,968,863	44.8683	-73.947
WTG 157	582,317	4,968,920	44.8689	-73.9579
WTG 90	583,721	4,968,929	44.8689	-73.9402
WTG 200	582,284	4,969,192	44.8714	-73.9583
WTG 161A	583,214	4,969,246	44.8718	-73.9465
WTG 91	583,649	4,969,257	44.8718	-73.941
WTG 94	585,129	4,969,344	44.8724	-73.9223
WTG 95	585,087	4,969,609	44.8748	-73.9228
WTG 106-L	579,838	4,969,600	44.8753	-73.9892
WTG 107-L	579,680	4,969,780	44.877	-73.9912
WTG 93	582,284	4,970,100	44.8796	-73.9582
WTG 105-L	580,694	4,970,390	44.8824	-73.9783
WTG 109	584,893	4,970,431	44.8822	-73.9251
WTG 98	583,672	4,970,635	44.8842	-73.9405
WTG 102-L	581,243	4,970,715	44.8852	-73.9713
WTG 104-L	580,689	4,970,760	44.8857	-73.9783
WTG 97	583,668	4,970,880	44.8864	-73.9405
WTG 100-R	584,949	4,970,956	44.887	-73.9243
WTG 204	582,897	4,970,995	44.8876	-73.9503
WTG 96-S	583,511	4,971,140	44.8888	-73.9425
WTG 89-R	584,715	4,971,160	44.8888	-73.9272
WTG 67	583,680	4,971,581	44.8927	-73.9403
WTG 12	586,263	4,971,972	44.8959	-73.9075
WTG 202	585,803	4,971,996	44.8962	-73.9133
WTG 63	582,982	4,972,452	44.9007	-73.949
WTG 66	583,662	4,972,536	44.9013	-73.9403
WTG 64	585,342	4,972,631	44.902	-73.919
WTG 73-W	584,292	4,972,705	44.9028	-73.9323
WTG 63A	582,801	4,972,754	44.9034	-73.9512
WTG 62	583,468	4,972,834	44.904	-73.9427
WTG 60	585,189	4,973,158	44.9068	-73.9209
WTG 59	582,255	4,973,470	44.9099	-73.958
WTG 58	582,822	4,973,551	44.9106	-73.9508
WTG 206	583,765	4,973,619	44.9111	-73.9388
WTG 57	582,055	4,973,660	44.9116	-73.9605
WTG 56	584,524	4,973,743	44.9121	-73.9292
WTG 55	584,034	4,973,951	44.914	-73.9354
WTG 53	581,995	4,974,106	44.9157	-73.9612
WTG 75A-W	584,979	4,974,409	44.918	-73.9233
WTG 52	582,020	4,974,418	44.9185	-73.9608
WTG 51	584,913	4,974,768	44.9213	-73.9241
WTG 77	581,764	4,974,792	44.9219	-73.964
WTG 50	585,156	4,975,154	44.9247	-73.921
WTG 81	584,961	4,975,353	44.9265	-73.9234
WTG 48-W	584,067	4,975,370	44.9268	-73.9347
WTG 78	582,335	4,975,532	44.9285	-73.9566
WTG 47	585,010	4,975,744	44.93	-73.9227
WTG 45	581,889	4,975,869	44.9315	-73.9622

Table 1: Wind Turbine Generator Locations

Turbine ID	UTM East (m)	UTM North (m)	Latitude	Longitude
WTG 46	583,935	4,975,905	44.9316	-73.9363
WTG 44	583,130	4,976,076	44.9333	-73.9465
WTG 42	582,670	4,976,379	44.936	-73.9523
WTG 83	582,226	4,976,791	44.9398	-73.9578
WTG 85	582,873	4,976,896	44.9407	-73.9496
WTG 203	585,208	4,977,015	44.9415	-73.92
WTG 84	582,161	4,977,226	44.9437	-73.9586
WTG 202	585,104	4,977,308	44.9441	-73.9213
WTG 201	584,650	4,977,545	44.9463	-73.927
WTG 84A	582,000	4,977,637	44.9474	-73.9605
WTG 87	583,137	4,977,819	44.9489	-73.9461
WTG 36A	581,620	4,978,433	44.9546	-73.9652
WTG 135	590,092	4,978,534	44.9545	-73.8578
WTG 209	587,922	4,978,752	44.9568	-73.8853
WTG 31	581,116	4,979,155	44.9612	-73.9715
WTG 28	583,683	4,979,243	44.9617	-73.9389
WTG 208	581,926	4,979,376	44.9631	-73.9612
WTG 28A	584,468	4,979,494	44.9639	-73.929
WTG 134-S	589,903	4,979,722	44.9652	-73.86
WTG 172	581,513	4,979,722	44.9663	-73.9664
WTG 133	589,915	4,980,400	44.9713	-73.8597
WTG 21	584,724	4,980,373	44.9717	-73.9256
WTG 19	581,340	4,980,512	44.9734	-73.9684
WTG 15	583,569	4,980,589	44.9738	-73.9402
WTG 132	589,654	4,980,689	44.974	-73.863
WTG 15A	583,461	4,980,828	44.976	-73.9415
WTG 148	584,404	4,980,863	44.9762	-73.9295
WTG 10A	585,331	4,981,170	44.9788	-73.9177
WTG 148A	584,532	4,981,277	44.9799	-73.9278
WTG 11	583,460	4,981,354	44.9807	-73.9414
WTG 13	581,838	4,981,387	44.9812	-73.962
WTG 9A	584,679	4,981,623	44.983	-73.9259
WTG 175	584,828	4,982,048	44.9868	-73.924
WTG 5-A	585,629	4,982,227	44.9883	-73.9138
WTG 4-A	586,473	4,982,587	44.9915	-73.903
WTG 2-A	585,774	4,983,037	44.9956	-73.9118
WTG 207	586,431	4,983,073	44.9958	-73.9034
WTG 3-A	584,951	4,983,286	44.9979	-73.9222
WTG 1-A	585,700	4,983,358	44.9985	-73.9127

Note: All coordinates are in North American Datum of 1983.

Table 2: Sunshine and Wind Direction Frequencies

Sunshine probabilities		Operational hours		
Month	Frequency	Sectors	Hours	Percent
Jan	0.29	N	189	2.2%
Feb	0.37	NNE	217	2.5%
Mar	0.37	ENE	375	4.3%
Apr	0.33	E	724	8.3%
May	0.44	ESE	548	6.3%
Jun	0.47	SSE	302	3.4%
Jul	0.45	S	438	5.0%
Aug	0.46	SSW	720	8.2%
Sep	0.42	WSW	1823	20.8%
Oct	0.36	W	2412	27.5%
Nov	0.25	WNW	780	8.9%
Dec	0.28	NNW	232	2.6%
		Total	8,760	100%

Table 3: WindPRO Model Results

Parcel ID	No.	Address	Cluster	East [m]	North [m]	Z [m]	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Expected Shadow hours per year [h/year]	
36202	90	Whalen Rd	C1	580,529	4,978,811	323	14:34	42	0:26	5:28	
0	91	Unknown	C1	581,332	4,978,002	340	0:00	0	0:00	0:00	
17414	92	133 Jones Rd	C1	583,091	4,979,279	350	19:11	44	0:34	5:36	
17374	93	455 Merchia Rd	C1	580,696	4,979,347	323	54:16	134	0:44	15:00	
17405	94	154 Jones Rd	C1	583,144	4,979,462	350	21:54	48	0:35	5:11	
17366	95	229-231 Merchia Rd	C1	582,166	4,979,466	340	121:49	173	1:16	37:01	
17372	96	428-438 Merchia Rd	C1	580,867	4,979,461	325	93:03	163	0:55	18:16	
17366	97	229-231 Merchia Rd	C1	582,166	4,979,466	340	121:49	173	1:16	37:01	duplicate
17405	98	154 Jones Rd	C1	583,144	4,979,462	350	21:54	48	0:35	5:11	
17421	99	713 Rt 189	C1	584,069	4,979,597	347	91:11	150	0:48	21:33	
17369	100	306 Merchia Rd	C1	581,785	4,979,590	330	191:05	170	1:43	33:05	
36200	101	Merchia Rd	C1	580,581	4,979,585	321	43:52	110	0:32	7:36	
17391	102	724 Rt 189	C1	584,126	4,979,672	345	85:01	143	0:52	18:47	
17364	103	5 Merchia Rd	C1	582,173	4,979,665	340	83:25	126	0:57	18:33	
17401	104	725 Rt 189	C1	584,000	4,979,701	346	28:05	54	0:40	6:31	
17359	105	124 Merchia Rd	C1	583,146	4,979,802	344	5:42	26	0:17	0:46	
17392	106	748-750 Rt 189	C1	584,116	4,979,847	340	51:59	82	0:44	7:00	
17360	107	212 Jones Rd	C1	582,966	4,979,854	341	17:08	52	0:24	2:32	
17399	108	777 Rt 189	C1	584,011	4,980,065	333	22:20	68	0:28	8:01	
17393	109	780 Rt 189	C1	584,071	4,980,121	332	24:43	65	0:31	8:49	
17394	110	799 Rt 189	C1	583,967	4,980,219	330	12:51	38	0:27	4:00	
17395	111	844 Rt 189	C1	584,012	4,980,555	330	84:41	172	0:46	24:06	
17356	112	Jones Rd	C1	582,139	4,980,739	313	9:41	32	0:25	2:49	
17383	113	876 Rt 189	C1	583,988	4,980,782	326	122:25	191	1:16	36:06	duplicate
17383	114	876 Rt 189	C1	583,988	4,980,782	326	122:25	191	1:16	36:06	
17397	115	885 Rt 189	C1	583,903	4,980,872	323	143:09	201	1:23	36:28	
17382	116	Rt 189	C1	583,997	4,981,134	316	134:13	198	1:15	35:41	
17381	117	922 Rt 189	C1	583,941	4,981,143	315	118:49	204	1:14	31:14	
17380	118	975-963 Rt 189	C1	583,793	4,981,439	309	91:50	154	1:18	24:26	
17380	119	975-963 Rt 189	C1	583,793	4,981,439	309	91:50	154	1:18	24:26	duplicate
17265	120	65 Santamore Rd	C1	580,911	4,981,651	294	7:12	29	0:21	1:46	
17263	121	15 Santamore Rd	C1	581,214	4,981,801	290	19:47	55	0:28	3:10	
17263	122	15 Santamore Rd	C1	581,214	4,981,801	290	19:47	55	0:28	3:10	duplicate
0	123	Unknown	C1	581,332	4,978,002	340	0:00	0	0:00	0:00	
0	124	Unknown	C1	581,332	4,978,002	340	0:00	0	0:00	0:00	duplicate
17267	125	351 Frontier Rd	C1	581,305	4,981,926	290	13:42	40	0:25	1:53	
17243	126	352 Frontier Rd	C1	581,382	4,981,978	290	0:00	0	0:00	0:00	
17250	127	162 Frontier Rd	C1	582,583	4,982,035	289	18:14	56	0:23	3:59	
36590	128	133 Frontier Rd	C1	582,763	4,982,059	290	0:00	0	0:00	0:00	
17297	129	1048 Rt 189	C1	583,819	4,982,078	298	9:23	34	0:22	1:47	
0	130	Unknown	C1	581,332	4,978,002	340	0:00	0	0:00	0:00	
0	131	Unknown	C1	581,332	4,978,002	340	0:00	0	0:00	0:00	duplicate
17251	132	Frontier Rd	C1	581,988	4,982,181	284	0:00	0	0:00	0:00	
0	133	Unknown	C1	581,332	4,978,002	340	0:00	0	0:00	0:00	
17296	134	1067 Rt 189	C1	583,760	4,982,221	296	0:00	0	0:00	0:00	
17289	135	1079 Rt 189	C1	583,744	4,982,300	295	0:00	0	0:00	0:00	
17286	136	26 Frontier Rd	C1	583,560	4,982,318	292	0:00	0	0:00	0:00	
17298	137	32 Liberty Pole Rd	C1	584,016	4,982,331	300	9:42	32	0:24	2:21	
17298	138	32 Liberty Pole Rd	C1	584,016	4,982,331	300	9:42	32	0:24	2:21	duplicate
17309	139	136 Liberty Pole Rd	C1	584,781	4,982,454	295	9:06	31	0:23	2:15	

Table 3: WindPRO Model Results

Parcel ID	No.	Address	Cluster	East [m]	North [m]	Z [m]	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Expected Shadow hours per year [h/year]	
17300	140	121 Liberty Pole Rd	C1	584,664	4,982,483	292	7:00	27	0:21	1:44	
17303	141	178 Liberty Pole Rd	C1	585,123	4,982,509	300	24:59	55	0:36	5:02	
17310	142	211 Liberty Pole Rd	C1	585,342	4,982,551	303	81:20	80	1:20	12:48	
17311	143	238/239 Liberty Pole Rd	C1	585,529	4,982,589	310	27:18	100	0:25	6:34	
17310	144	211 Liberty Pole Rd	C1	585,342	4,982,551	303	81:20	80	1:20	12:48	duplicate
17311	145	238/239 Liberty Pole Rd	C1	585,529	4,982,589	310	27:18	100	0:25	6:34	duplicate
37070	146	404 Brandy Brook Rd	C2	587,004	4,971,501	374	0:00	0	0:00	0:00	
36197	147	399 Brandy Brook Rd	C2	586,915	4,971,502	377	0:00	0	0:00	0:00	
19819	148	410/412 Brandy Brook Rd	C2	586,987	4,971,544	375	1:19	13	0:08	0:22	
19819	149	410/412 Brandy Brook Rd	C2	586,987	4,971,544	375	1:19	13	0:08	0:22	duplicate
19817	150	439 Brandy Brook Rd	C2	586,858	4,971,728	380	41:06	83	0:34	12:03	
19820	151	452 Brandy Brook Rd	C2	586,933	4,971,865	377	17:33	45	0:31	5:01	
17843	152	466 Brandy Brook Rd	C2	586,914	4,971,965	378	16:37	42	0:31	4:49	
17848	153	476 Brandy Brook Rd	C2	586,918	4,972,032	378	15:28	38	0:31	4:43	
17796	154	487 Brandy Brook Rd	C2	586,807	4,972,109	380	21:09	45	0:36	6:22	
17842	155	488 Brandy Brook Rd	C2	586,876	4,972,137	379	16:42	41	0:32	4:57	
17838	156	508 Brandy Brook Rd	C2	586,836	4,972,257	379	18:52	46	0:32	5:26	
37341	157	515 Brandy Brook Rd	C2	586,747	4,972,319	380	36:20	92	0:36	8:47	
17844	158	516 Brandy Brook Rd	C2	586,838	4,972,328	378	19:49	49	0:31	4:57	
17845	159	524 Brandy Brook Rd	C2	586,831	4,972,377	378	22:29	58	0:31	5:00	
17850	160	538 Brandy Brook Rd	C2	586,809	4,972,493	376	25:45	62	0:29	5:33	
17840	161	550 Brandy Brook Rd	C2	586,810	4,972,583	374	3:42	20	0:13	0:47	
17851	162	6211 Rt 11	C2	586,896	4,972,696	371	0:00	0	0:00	0:00	
17837	163	6231 Rt 11	C2	586,789	4,972,731	373	0:00	0	0:00	0:00	
17852	164	6232 Rt 11	C2	586,810	4,972,789	372	0:00	0	0:00	0:00	
17853	165	6242 Rt 11	C2	586,734	4,972,805	375	0:00	0	0:00	0:00	
17763	166	250 Campbell Rd	C2	581,579	4,972,953	393	0:00	0	0:00	0:00	
17765	167	245 Campbell Rd	C2	581,532	4,972,956	393	0:00	0	0:00	0:00	
17793	168	Rt 11	C2	586,136	4,972,995	385	18:28	64	0:24	5:18	
17763	169	250 Campbell Rd	C2	581,579	4,972,953	393	0:00	0	0:00	0:00	
17766	170	251 Campbell Rd	C2	581,510	4,973,005	392	6:01	36	0:14	2:15	
17766	171	251 Campbell Rd	C2	581,510	4,973,005	392	6:01	36	0:14	2:15	duplicate
17737	172	261 Campbell Rd	C2	581,514	4,973,073	391	23:09	66	0:26	8:35	
17736	173	280 Campbell Rd	C2	581,474	4,973,097	390	24:36	81	0:25	8:59	
17746	174	327 Gagnier Rd	C2	582,911	4,973,112	400	53:33	170	0:33	11:43	
17747	175	Gagnier Rd	C2	582,689	4,973,113	398	10:33	34	0:25	2:33	
17791	176	6346 Rt 11	C2	586,043	4,973,145	388	26:45	94	0:25	6:29	
17740	177	444 Gagnier Rd	C2	582,070	4,973,122	391	29:32	89	0:26	8:43	
17736	178	280 Campbell Rd	C2	581,474	4,973,097	390	24:36	81	0:25	8:59	
17741	179	280 Campbell Rd	C2	581,700	4,973,188	390	35:51	70	0:36	13:15	
17736	180	280 Campbell Rd	C2	581,474	4,973,097	390	24:36	81	0:25	8:59	duplicate
17807	181	293 Gagnier Rd	C2	583,195	4,973,216	400	38:20	72	1:01	7:11	
17741	182	280 Campbell Rd	C2	581,700	4,973,188	390	35:51	70	0:36	13:15	duplicate
17807	183	293 Gagnier Rd	C2	583,195	4,973,216	400	38:20	72	1:01	7:11	duplicate
17807	184	293 Gagnier Rd	C2	583,195	4,973,216	400	38:20	72	1:01	7:11	duplicate
17807	185	293 Gagnier Rd	C2	583,195	4,973,216	400	38:20	72	1:01	7:11	duplicate
17807	186	293 Gagnier Rd	C2	583,195	4,973,216	400	38:20	72	1:01	7:11	duplicate
17805	187	293 Gagnier Rd	C2	584,386	4,973,320	410	40:32	104	0:32	11:27	
17798	188	105-103 Gagnier Rd	C2	584,619	4,973,328	410	29:45	88	0:34	7:50	
36301	189	166 Gagnier Rd	C2	584,142	4,973,362	410	21:20	70	0:25	4:39	

Table 3: WindPRO Model Results

Parcel ID	No.	Address	Cluster	East [m]	North [m]	Z [m]	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Expected Shadow hours per year [h/year]	
17791	190	6346 Rt 11	C2	586,043	4,973,145	388	26:45	94	0:25	6:29	
17785	191	Gagnier Rd	C2	584,793	4,973,429	410	48:58	92	0:44	8:03	
17771	192	317 Campbell Rd	C2	581,259	4,973,438	386	18:30	66	0:25	5:54	
17771	193	317 Campbell Rd	C2	581,259	4,973,438	386	18:30	66	0:25	5:54	duplicate
17787	194	6471 Rt 11	C2	585,195	4,973,527	407	22:02	58	0:30	6:29	
17739	195	362 Campbell Rd	C2	581,660	4,973,553	383	95:34	165	0:51	32:13	duplicate
17745	196	332 Campbell Rd	C2	581,516	4,973,607	382	37:18	87	0:38	10:53	
17786	197	6501 Rt 11	C2	585,011	4,973,709	408	31:15	58	0:42	9:02	
17738	198	345 Campbell Rd	C2	581,333	4,973,723	380	37:07	112	0:28	11:50	
17784	199	6523 Rt 11	C2	584,980	4,973,747	408	41:00	74	0:44	11:56	
17788	200	6514 Rt 11	C2	585,012	4,973,817	406	33:25	79	0:41	10:07	
17778	201	540 Patnode Rd	C2	583,162	4,973,825	400	99:25	188	0:48	23:58	
17784	202	6523 Rt 11	C2	584,980	4,973,747	408	41:00	74	0:44	11:56	
17739	203	362 Campbell Rd	C2	581,660	4,973,553	383	95:34	165	0:51	32:13	
17735	204	369 Campbell Rd	C2	581,358	4,973,857	380	50:11	142	0:31	15:20	
17735	205	369 Campbell Rd	C2	581,358	4,973,857	380	50:11	142	0:31	15:20	duplicate
17807	206	293 Gagnier Rd	C2	583,195	4,973,216	400	38:20	72	1:01	7:11	duplicate
17774	207	566 Patnode Rd	C2	583,123	4,974,016	398	25:47	79	0:28	5:13	
17782	208	6601 Rt 11	C2	584,542	4,974,161	403	63:14	153	0:38	19:48	
17775	209	586 Patnode Rd	C2	583,106	4,974,168	395	30:34	89	0:26	5:13	
17667	210	595 Patnode Rd	C2	583,025	4,974,229	393	19:03	56	0:23	2:50	
17669	211	426 Campbell Rd	C2	581,487	4,974,321	374	52:01	109	0:38	14:37	
17669	212	426 Campbell Rd	C2	581,487	4,974,321	374	52:01	109	0:38	14:37	duplicate
17779	213	22-20 Rt 189	C2	584,691	4,974,460	400	98:25	165	1:06	25:49	
17668	214	Patnode Rd	C2	582,953	4,974,451	390	5:44	27	0:20	1:44	
17780	215	6649 Rt 11	C2	584,281	4,974,465	400	48:27	119	0:31	16:45	
36872	216	60 Lamb Rd	C2	581,074	4,974,493	367	45:39	147	0:29	14:57	
17665	217	456 Campbell Rd	C2	581,398	4,974,523	370	39:15	101	0:32	7:59	
36873	218	43 Lamb Rd	C2	581,013	4,974,534	365	16:17	48	0:27	5:45	
17666	219	470 Campbell Rd	C2	581,425	4,974,559	370	50:38	122	0:33	9:22	
17703	220	646 Patnode Rd	C2	583,065	4,974,606	390	0:00	0	0:00	0:00	
17666	221	470 Campbell Rd	C2	581,425	4,974,559	370	50:38	122	0:33	9:22	
17701	222	640 Patnode Rd	C2	583,308	4,974,622	392	7:49	32	0:18	1:06	
17666	223	470 Campbell Rd	C2	581,425	4,974,559	370	50:38	122	0:33	9:22	
36872	224	60 Lamb Rd	C2	581,074	4,974,493	367	45:39	147	0:29	14:57	
17702	225	662 Patnode Rd	C2	583,098	4,974,739	390	0:00	0	0:00	0:00	
17659	226	470 Campbell Rd	C2	581,362	4,974,839	368	57:27	115	0:49	14:02	
17695	227	6747 Rt 11	C2	583,748	4,974,950	391	0:00	0	0:00	0:00	
36238	228	6750 Rt 11	C2	583,774	4,975,055	390	0:00	0	0:00	0:00	
36237	229	6766-6750 Rt 11	C2	583,678	4,975,136	390	4:34	20	0:17	1:44	
17664	230	Campbell Rd	C2	581,348	4,975,161	365	47:12	82	0:39	6:44	
36237	231	6766-6750 Rt 11	C2	583,678	4,975,136	390	4:34	20	0:17	1:44	
17662	232	544 Campbell Rd	C2	581,324	4,975,173	365	44:43	82	0:37	6:27	
17693	233	6801 Rt 11	C2	583,440	4,975,247	390	20:04	48	0:33	6:22	
17657	234	6985 Rt 11	C2	582,649	4,975,269	380	0:00	0	0:00	0:00	
36477	235	6825 Rt 11	C2	583,303	4,975,348	390	16:57	63	0:27	4:54	
17688	236	148 Rt 189	C2	584,564	4,975,391	397	87:16	115	1:28	24:20	
17681	237	157 Rt 189	C2	584,495	4,975,468	398	111:39	183	1:25	33:24	
36234	238	582 Campbell Rd	C2	581,300	4,975,463	362	0:00	0	0:00	0:00	
17699	239	764 Patnode Rd	C2	583,000	4,975,484	388	14:11	40	0:30	4:02	

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17700	240	6848 Rt 11	C2	583,203	4,975,524	390	40:53	127	0:27	13:41	
17698	241	778 Patnode Rd	C2	583,064	4,975,550	390	22:23	80	0:27	7:22	
17698	242	778 Patnode Rd	C2	583,064	4,975,550	390	22:23	80	0:27	7:22	
17680	243	52 Nichols Rd	C2	583,414	4,975,728	390	57:24	130	0:38	17:25	
17680	244	52 Nichols Rd	C2	583,414	4,975,728	390	57:24	130	0:38	17:25	duplicate
17680	245	52 Nichols Rd	C2	583,414	4,975,728	390	57:24	130	0:38	17:25	duplicate
17682	246	206 Rt 189	C2	584,555	4,975,831	393	82:38	167	0:43	20:50	
17680	247	52 Nichols Rd	C2	583,414	4,975,728	390	57:24	130	0:38	17:25	
17658	248	6922 Rt 11	C2	582,776	4,975,878	380	80:02	173	0:41	22:12	
17683	249	228 Rt 189	C2	584,497	4,975,983	390	45:17	98	0:37	11:46	
17657	250	6985 Rt 11	C2	582,649	4,975,269	380	0:00	0	0:00	0:00	
17655	251	6977 Rt 11	C2	582,395	4,976,067	370	37:04	86	0:38	10:56	
17657	252	6985 Rt 11	C2	582,649	4,975,269	380	0:00	0	0:00	0:00	duplicate
17679	253	249 Rt 189	C2	584,398	4,976,144	380	48:28	103	0:39	11:10	
17678	254	Rt 189	C2	584,346	4,976,299	378	67:34	82	1:03	12:59	
17652	255	7026 Rt 11	C2	582,210	4,976,379	370	40:18	87	0:44	11:27	
17637	256	7173 Rt 11	C2	581,127	4,976,375	360	14:06	48	0:23	2:12	
17650	257	Rt 11	C2	581,176	4,976,381	360	19:45	68	0:25	3:02	
17637	258	7173 Rt 11	C2	581,127	4,976,375	360	14:06	48	0:23	2:12	
17651	259	7103 Rt 11	C2	581,642	4,976,421	361	4:40	23	0:15	1:45	
17649	260	7165 Rt 11	C2	581,168	4,976,422	360	23:01	70	0:24	3:30	
17487	261	7168 Rt 11	C2	581,147	4,976,495	358	16:53	52	0:23	2:30	
17485	262	7132 Rt 11	C2	581,407	4,976,520	360	12:09	41	0:25	4:14	
17484	263	7126 Rt 11	C2	581,458	4,976,521	360	15:02	47	0:26	5:19	
17482	264	535 Looby Rd	C2	581,802	4,976,554	362	35:16	82	0:38	12:09	
17480	265	525 Looby Rd	C2	581,799	4,976,630	361	77:06	129	0:47	26:58	
17675	266	103 Lagree Rd	C2	583,672	4,976,654	370	20:44	75	0:25	5:23	
17479	267	Lagree Rd	C2	582,040	4,976,684	361	31:00	95	0:30	8:24	
17685	268	2 Swamp Rd	C2	584,431	4,976,764	373	13:29	44	0:26	4:40	
17479	269	Lagree Rd	C2	582,040	4,976,684	361	31:00	95	0:30	8:24	
17517	270	114 Lagree Rd	C2	583,391	4,976,940	368	44:55	122	0:39	11:55	
17513	271	370 Rt 189	C2	584,408	4,977,039	370	31:07	91	0:29	10:28	
17516	272	403 Rt 189	C2	584,330	4,977,293	369	18:51	65	0:26	5:09	
17513	273	370 Rt 189	C2	584,408	4,977,039	370	31:07	91	0:29	10:28	duplicate
17513	274	370 Rt 189	C2	584,408	4,977,039	370	31:07	91	0:29	10:28	duplicate
17488	275	394 Looby Rd	C2	581,606	4,977,591	343	73:54	133	0:51	19:33	
17513	276	370 Rt 189	C2	584,408	4,977,039	370	31:07	91	0:29	10:28	duplicate
37381	277	Looby Rd	C2	581,602	4,977,780	344	50:40	102	0:47	10:52	
17514	278	472 Rt 189	C2	584,350	4,977,797	361	93:08	117	1:16	14:22	
17472	279	20 Whalen Rd	C2	581,590	4,977,877	343	36:41	66	0:43	7:19	
17472	280	20 Whalen Rd	C2	581,590	4,977,877	343	36:41	66	0:43	7:19	
0	281	Unknown	C2	581,332	4,978,002	340	15:27	44	0:28	2:58	
17473	282	36 Whalen Rd	C2	581,453	4,978,010	340	25:25	62	0:32	4:03	
17492	283	41 Whalen Rd	C2	581,390	4,978,017	340	19:32	51	0:29	3:18	
17478	284	283 Looby Rd	C2	582,143	4,978,063	350	0:00	0	0:00	0:00	
0	285	Unknown	C2	581,332	4,978,002	340	15:27	44	0:28	2:58	
17478	286	283 Looby Rd	C2	582,143	4,978,063	350	0:00	0	0:00	0:00	
17523	287	523 Rt 189	C2	584,213	4,978,178	360	0:00	0	0:00	0:00	
17518	288	191 Looby Rd	C2	582,811	4,978,206	358	36:48	76	0:38	5:48	
17522	289	Looby Rd	C2	583,768	4,978,213	360	17:14	50	0:29	4:02	

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Parcel ID	No.	Address	Cluster	East [m]	North [m]	Z [m]	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Expected Shadow hours per year [h/year]
17519	290	173 Looby Rd	C2	582,939	4,978,209	360	0:00	0	0:00	0:00
17474	291	37 Jones Rd	C2	581,949	4,978,257	346	29:25	51	0:43	8:22
17476	292	186 Looby Rd	C2	582,847	4,978,287	356	0:00	0	0:00	0:00
17570	293	540 Rt 189	C2	584,269	4,978,304	360	0:00	0	0:00	0:00
17474	294	37 Jones Rd	C2	581,949	4,978,257	346	29:25	51	0:43	8:22
17524	295	1 Looby Rd	C2	584,209	4,978,347	360	0:00	0	0:00	0:00
17525	296	15 Looby Rd	C2	584,105	4,978,365	360	0:00	0	0:00	0:00
17568	297	1331 Clinton Mills Rd	C2	584,375	4,978,382	360	0:00	0	0:00	0:00
17569	298	1329 Clinton Mills Rd	C2	584,397	4,978,392	360	0:00	0	0:00	0:00
17567	299	1323 Clinton Mills Rd	C2	584,431	4,978,397	360	0:00	0	0:00	0:00
17566	300	1313 Clinton Mills Rd	C2	584,503	4,978,402	360	0:00	0	0:00	0:00
17563	301	1301 Clinton Mills Rd	C2	584,592	4,978,406	360	0:00	0	0:00	0:00
17526	302	10 Looby Rd	C2	584,151	4,978,408	360	0:00	0	0:00	0:00
17564	303	1307 Clinton Mills Rd	C2	584,552	4,978,410	360	0:00	0	0:00	0:00
17562	304	1297 Clinton Mills Rd	C2	584,628	4,978,416	360	0:00	0	0:00	0:00
17559	305	1281 Clinton Mills Rd	C2	584,746	4,978,430	360	0:00	0	0:00	0:00
17573	306	1332 Clinton Mills Rd	C2	584,368	4,978,433	360	0:00	0	0:00	0:00
17574	307	1330 Clinton Mills Rd	C2	584,391	4,978,434	360	0:00	0	0:00	0:00
17575	308	1326 Clinton Mills Rd	C2	584,417	4,978,435	360	0:00	0	0:00	0:00
17576	309	1322 Clinton Mills Rd	C2	584,439	4,978,437	360	0:00	0	0:00	0:00
17560	310	1259 Clinton Mills Rd	C2	584,916	4,978,453	359	0:00	0	0:00	0:00
17577	311	1318 Clinton Mills Rd	C2	584,467	4,978,457	360	0:00	0	0:00	0:00
17552	312	1298 Clinton Mills Rd	C2	584,626	4,978,459	360	0:00	0	0:00	0:00
17579	313	1306 Clinton Mills Rd	C2	584,555	4,978,461	360	0:00	0	0:00	0:00
17572	314	556-560 Rt 189	C2	584,265	4,978,460	360	0:00	0	0:00	0:00
17558	315	1280 Clinton Mills Rd	C2	584,760	4,978,479	359	0:00	0	0:00	0:00
17551	316	6 Broad St	C2	584,588	4,978,486	360	0:00	0	0:00	0:00
17549	317	8 Smith St	C2	584,595	4,978,513	360	0:00	0	0:00	0:00
17580	318	11 Smith St	C2	584,548	4,978,524	360	0:00	0	0:00	0:00
17548	319	12 Smith St	C2	584,583	4,978,534	360	0:00	0	0:00	0:00
17581	320	13 Smith St	C2	584,545	4,978,545	360	0:00	0	0:00	0:00
17588	321	572 Rt 189	C2	584,286	4,978,547	360	0:00	0	0:00	0:00
17547	322	16 Smith St	C2	584,579	4,978,555	359	0:00	0	0:00	0:00
17528	323	Looby Rd	C2	584,200	4,978,571	359	0:00	0	0:00	0:00
17546	324	20 Smith St	C2	584,589	4,978,574	359	0:00	0	0:00	0:00
17589	325	576 Rt 189	C2	584,248	4,978,582	359	0:00	0	0:00	0:00
17546	326	20 Smith St	C2	584,589	4,978,574	359	0:00	0	0:00	0:00
17527	327	575 Rt 189	C2	584,194	4,978,587	359	0:00	0	0:00	0:00
17582	328	21 Smith St	C2	584,542	4,978,591	359	0:00	0	0:00	0:00
17557	329	16 Railroad St	C2	584,807	4,978,594	358	0:00	0	0:00	0:00
17500	330	Rt 189	C2	583,179	4,978,587	350	0:00	0	0:00	0:00
17583	331	23 Smith St	C2	584,539	4,978,611	359	0:00	0	0:00	0:00
17500	332	Rt 189	C2	583,179	4,978,587	350	0:00	0	0:00	0:00
17553	333	1260 Clinton Mills Rd	C2	584,941	4,978,621	358	0:00	0	0:00	0:00
17587	334	9 Summit Dr	C2	584,457	4,978,628	359	0:00	0	0:00	0:00
17584	335	25 Smith St	C2	584,530	4,978,634	359	0:00	0	0:00	0:00
17556	336	22 Railroad St	C2	584,803	4,978,638	358	0:00	0	0:00	0:00
17545	337	26 Smith St	C2	584,568	4,978,643	359	0:00	0	0:00	0:00
17585	338	27 Smith St	C2	584,522	4,978,649	359	0:00	0	0:00	0:00
17586	339	29 Smith St	C2	584,483	4,978,676	359	0:00	0	0:00	0:00

Table 3: WindPRO Model Results

Parcel ID	No.	Address	Cluster	East [m]	North [m]	Z [m]	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Expected Shadow hours per year [h/year]
17544	340	34 Smith St	C2	584,562	4,978,689	358	0:00	0	0:00	0:00
17532	341	592 Rt 189	C2	584,230	4,978,696	357	0:00	0	0:00	0:00
17534	342	30 Broad St	C2	584,313	4,978,708	357	0:00	0	0:00	0:00
17535	343	26 Broad St	C2	584,339	4,978,716	357	0:00	0	0:00	0:00
17536	344	22 Broad St	C2	584,361	4,978,720	357	0:00	0	0:00	0:00
17533	345	32 Broad St	C2	584,283	4,978,721	357	0:00	0	0:00	0:00
17537	346	18 Broad St	C2	584,398	4,978,724	357	0:00	0	0:00	0:00
17538	347	14 Broad St	C2	584,421	4,978,729	357	0:00	0	0:00	0:00
17539	348	12 Broad St	C2	584,443	4,978,733	358	0:00	0	0:00	0:00
17540	349	8 Broad St	C2	584,463	4,978,745	358	0:00	0	0:00	0:00
17541	350	2 Broad St	C2	584,520	4,978,746	358	0:00	0	0:00	0:00
17543	351	38 Smith St	C2	584,554	4,978,752	358	0:00	0	0:00	0:00
17508	352	Rt 189	C2	584,216	4,978,774	355	0:00	0	0:00	0:00
17509	353	603 Rt 189	C2	584,173	4,978,777	355	0:00	0	0:00	0:00
17507	354	618 Rt 189	C2	584,227	4,978,883	353	0:00	0	0:00	0:00
17503	355	623 Rt 189	C2	584,147	4,978,912	352	0:00	0	0:00	0:00
17504	356	629 Rt 189	C2	584,156	4,978,961	351	0:00	0	0:00	0:00
17506	357	632 Rt 189	C2	584,190	4,978,986	351	0:00	0	0:00	0:00
20079	358	Tacey Rd	C3	581,631	4,968,361	506	0:00	0	0:00	0:00
20076	359	550 Tacey Rd	C3	581,380	4,968,594	492	8:28	36	0:21	2:59
20069	360	314 Harrigan Rd	C3	579,508	4,968,791	464	0:00	0	0:00	0:00
20067	361	8305 Star Rd	C3	580,598	4,969,012	481	0:00	0	0:00	0:00
19798	362	8149 Star Rd	C3	580,547	4,969,290	475	17:51	88	0:24	5:03
20067	363	8305 Star Rd	C3	580,598	4,969,012	481	0:00	0	0:00	0:00
20067	364	8305 Star Rd	C3	580,598	4,969,012	481	0:00	0	0:00	0:00
19800	365	Star Rd	C3	580,214	4,969,319	467	0:00	0	0:00	0:00
37233	366	7960 Star Rd	C3	581,514	4,969,534	469	11:12	35	0:25	2:33
20083	367	7909 Star Rd	C3	582,332	4,969,569	471	7:01	29	0:21	1:41
20088	368	7891 Star Rd	C3	582,476	4,969,573	470	25:41	71	0:32	5:19
19796	369	7960 Star Rd	C3	581,955	4,969,573	470	40:17	68	0:43	5:27
19795	370	7942 Star Rd	C3	582,114	4,969,598	470	0:00	0	0:00	0:00
19793	371	7908 Star Rd	C3	582,346	4,969,623	470	7:28	31	0:22	1:40
20084	372	7837 Star Rd	C3	582,872	4,969,636	462	62:16	114	0:45	10:56
20145	373	7811 Star Rd	C3	583,058	4,969,662	455	45:19	127	0:45	9:20
19809	374	7777 Star Rd	C3	583,317	4,969,697	449	6:40	25	0:20	0:54
19797	375	30 Ryan Rd	C3	581,113	4,969,689	460	0:00	0	0:00	0:00
19859	376	7741 Star Rd	C3	583,570	4,969,705	441	24:18	52	0:35	5:04
19794	377	7864 Star Rd	C3	582,646	4,969,722	461	29:49	68	0:30	4:23
19857	378	7687 Star Rd	C3	583,978	4,969,759	430	13:30	52	0:23	3:02
19791	379	7750 Star Rd	C3	583,507	4,969,777	439	0:00	0	0:00	0:00
19860	380	7738 Star Rd	C3	583,590	4,969,788	439	0:00	0	0:00	0:00
19789	381	7764 Star Rd	C3	583,409	4,969,801	440	0:00	0	0:00	0:00
19861	382	7706 Star Rd	C3	583,840	4,969,836	430	23:25	62	0:26	5:03
19858	383	7682 Star Rd	C3	584,007	4,969,858	428	0:00	0	0:00	0:00
19855	384	7621 Star Rd	C3	584,460	4,969,868	422	39:21	106	0:30	7:15
19854	385	7605 Star Rd	C3	584,578	4,969,882	424	32:49	82	0:36	6:08
19853	386	7579/7599 Star Rd	C3	584,621	4,969,891	426	31:37	64	0:39	5:44
19856	387	7652 Star Rd	C3	584,181	4,969,894	424	8:37	42	0:21	2:03
19853	388	7579/7599 Star Rd	C3	584,621	4,969,891	426	31:37	64	0:39	5:44
19811	389	7622 Star Rd	C3	584,447	4,969,927	420	31:50	90	0:29	5:41

Table 3: WindPRO Model Results

Parcel ID	No.	Address	Cluster	East [m]	North [m]	Z [m]	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Expected Shadow hours per year [h/year]
19808	390	197 Ryan Rd	C3	580,073	4,969,909	446	102:11	142	0:56	24:32
19852	391	7535 Star Rd	C3	585,138	4,969,945	425	0:00	0	0:00	0:00
19777	392	150 Ryan Rd	C3	580,450	4,969,955	451	26:45	80	0:30	7:08
19812	393	7576 Star Rd	C3	584,796	4,969,988	430	14:00	36	0:30	1:54
19778	394	94 Ryan Rd	C3	580,785	4,969,985	448	0:00	0	0:00	0:00
19796	395	7960 Star Rd	C3	581,955	4,969,573	470	40:17	68	0:43	5:27
19849	396	7471 Star Rd	C3	585,524	4,970,049	410	38:59	91	0:35	8:36
19848	397	7445 Star Rd	C3	585,753	4,970,074	401	32:38	108	0:26	8:32
19815	398	7446 Star Rd	C3	585,721	4,970,152	401	40:32	118	0:26	10:03
19814	399	Star Rd	C3	585,465	4,970,245	409	33:35	76	0:35	9:54
19768	400	259 Ryan Rd	C3	580,023	4,970,376	432	32:41	93	0:30	10:57
19776	401	Ryan Rd	C3	580,120	4,970,513	430	63:47	134	0:35	21:14
19772	402	280 Ryan Rd	C3	580,151	4,970,532	430	69:51	139	0:37	22:58
19784	403	157 Bohon Rd	C3	581,807	4,970,731	429	21:35	46	0:36	6:22
19763	404	312/316 Ryan Rd	C3	580,089	4,970,792	427	40:00	100	0:34	8:42
19771	405	217 No 5 Rd	C3	580,202	4,970,821	429	63:03	124	0:41	12:36
19786	406	168 Bohon Rd	C3	582,101	4,970,836	422	19:42	65	0:26	6:06
19770	407	322 Ryan Rd	C3	580,063	4,970,853	426	42:34	125	0:32	8:27
19765	408	259 Ryan Rd	C3	579,871	4,970,872	423	20:32	70	0:25	4:31
17875	409	340 Ryan Rd	C3	580,116	4,970,964	424	29:42	80	0:34	6:00
17864	410	216 No 5 Rd	C3	580,217	4,970,985	427	27:57	55	0:39	6:15
19783	411	195 Bohon Rd	C3	581,778	4,971,005	420	21:45	50	0:34	6:05
17875	412	340 Ryan Rd	C3	580,116	4,970,964	424	29:42	80	0:34	6:00
19781	413	49 No 5 Rd	C3	581,417	4,971,057	423	52:06	82	1:04	11:35
19785	414	13 No 5 Rd	C3	581,691	4,971,097	420	44:27	90	0:36	9:38
19780	415	207 Bohon Rd	C3	581,761	4,971,102	420	27:57	67	0:33	6:10
17875	416	340 Ryan Rd	C3	580,116	4,970,964	424	29:42	80	0:34	6:00
17886	417	387 Ryan Rd	C3	579,953	4,971,267	419	16:21	54	0:24	2:31
17890	418	19 Campbell Rd	C3	581,757	4,971,285	415	8:52	32	0:21	1:53
17886	419	387 Ryan Rd	C3	579,953	4,971,267	419	16:21	54	0:24	2:31
19813	420	Off Star Rd	C3	584,472	4,971,446	400	100:34	124	1:10	16:09
17892	421	48/58 Campbell Rd	C3	581,784	4,971,507	412	0:00	0	0:00	0:00
17895	422	Patnode Rd	C3	583,251	4,971,575	415	37:57	62	0:47	11:12
17893	423	Campbell Rd	C3	582,197	4,971,650	413	5:53	28	0:16	0:50
17800	424	Patnode Rd	C3	583,541	4,971,739	407	194:33	156	1:33	29:19
17804	425	288 Patnode Rd	C3	583,321	4,971,962	407	37:17	64	0:41	5:03
17435	426	140 Rogers Rd	C4	588,241	4,979,093	340	53:19	79	0:47	11:14
17436	427	142 Rogers Rd	C4	588,223	4,979,096	340	49:18	74	0:48	10:20
17427	428	656 Clinton Mills Rd	C4	589,331	4,979,165	335	13:46	46	0:22	2:04
17434	429	126 Rogers Rd	C4	588,313	4,979,176	340	28:52	58	0:37	6:08
37044	430	Clinton Mills Rd	C4	589,642	4,979,200	335	0:00	0	0:00	0:00
17432	431	584 Clinton Mills Rd	C4	589,888	4,979,247	334	0:00	0	0:00	0:00
17431	432	600 Clinton Mills Rd	C4	589,798	4,979,278	335	0:00	0	0:00	0:00
17458	433	562 Clinton Mills Rd	C4	590,071	4,979,295	333	0:00	0	0:00	0:00
17455	434	478 Clinton Mills Rd	C4	590,687	4,979,323	321	18:49	54	0:25	5:24
17430	435	614 Clinton Mills Rd	C4	589,887	4,979,384	338	0:00	0	0:00	0:00
17457	436	450 Clinton Mills Rd	C4	590,763	4,980,297	312	10:26	34	0:24	2:58
17429	437	187 Soucia Rd	C4	590,453	4,980,676	318	31:51	81	0:34	9:12