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Memorandum

To: Henry Woltag
ConnectGen, LLC

From: Lindsay Donahoe
Jacob Runner

Date: September 13, 2021

Reference: Fountain Wind Farm
Updated Shadow Flicker Analysis

EDR Project No: 19255

Introduction

This memorandum report presents the findings of a shadow flicker analysis for the proposed Fountain Wind Farm (the Project) proposed by ConnectGen LLC (Client) in Shasta County, California (Figure 1). The layout evaluated in this analysis includes 48 Siemens Gamesa wind turbines on a 100-meter tower. The shadow flicker impact was evaluated at five receptors within 10 rotor diameters (1,700 meters) of the proposed wind turbines.

Shadow flicker refers to the shadows that a wind turbine casts over structures and observers at times of the day when the sun is directly behind the turbine rotor from an observer's position. During intervals of sunshine, operating wind turbine generators will cast a shadow on surrounding areas as the rotor blades pass in front of the sun, causing a flickering effect while the rotor is in motion. Shadow flicker is most pronounced in northern latitudes during winter months because of the lower angle of the sun in the winter sky. However, it is possible to encounter shadow flicker anywhere for brief periods after sunrise and before sunset (U.S. Department of the Interior, 2005). Shadow flicker does not occur when fog or clouds obscure the sun, or when turbines are not operating.

The distance between a wind turbine and a potential shadow-flicker receptor affects the intensity of the shadows cast by the blades, and therefore the intensity of flickering. Shadows cast close to a turbine will be more intense, distinct, and focused. This is because a greater proportion of the sun's disc is intermittently blocked by the turbine (BERR, 2009). Obstacles such as terrain, vegetation, and/or buildings occurring between residences and wind turbines can significantly reduce or eliminate shadow flicker effects. At distances beyond roughly 10 rotor diameters (approximately 1,700 meters based on the largest turbine model proposed for the Project [SG170]) shadow flicker effects are generally considered negligible (BERR, 2009; DECC, 2011; DOER, 2011).

For this reason, the shadow flicker analysis was run with a study area of 10 rotor diameters (1,700 meters).

The location and duration of shadow flicker can be predicted quite accurately using computer modeling programs and input data regarding turbine locations, turbine dimensions, receptor locations, local topography, and sunshine frequency. A conservative assumption that the turbines are in continuous operation is also applied. Shadow flicker effects predicted by the modeling exercise are expressed in terms of frequency (hours per year) at each receptor location.

Methods

This shadow flicker analysis evaluated the potential impact of 48 Siemens Gamesa SG170 turbines, each with a rotor diameter of 170 meters and a hub height of 100 meters (Figure 2).

WindPRO 3.4 software and the associated Shadow module was used to conduct the shadow flicker analysis. This software is a widely accepted modeling software package developed specifically for the design and evaluation of wind power projects. Input variables and assumptions used for shadow flicker modeling calculations for the proposed Project include:

- The latitude and longitude coordinates of 48 proposed wind turbine sites (provided by the Applicant).
- The latitude and longitude coordinates for five potential receptors located within the 10-rotor diameter Study Area.
- USGS 1:24,000 topographic mapping and USGS digital elevation model (DEM) data.
- The rotor diameter (170 meters) and hub height (100 meters) for the SG 170 turbine.
- Annual wind rose data (provided by the Applicant) to determine the approximate directional frequency of rotor orientation throughout the year (Table A1 of Attachment A).
- To account for the occurrence of cloudy conditions, the average monthly percent of available sunshine for the nearest National Oceanic and Atmospheric Administration (NOAA) weather station in Sacramento, California was used (Table A2 of Attachment A). Data were obtained from NOAA's "Comparative Climatic Data for the United States through 2015" (<http://www.ncdc.noaa.gov>).
- No allowance was made for wind being below or above generation speeds. Blades are assumed to be moving during all daylight hours when the sun's elevation is more than 3 degrees above the horizon. Shadow flicker is generally considered imperceptible when the sun is less than 3 degrees above the horizon due to the scattering effect of the atmosphere on low angle sunlight (DECC, 2011).

- In the preliminary analysis, the possible screening effect of trees and buildings adjacent to the receptors was not taken into consideration. In addition, the number and/or orientation of windows in residential receptors were not considered in the analysis.

Based on these variables and assumptions, *WindPRO* was used to calculate the theoretical number of hours per year that shadow flicker would occur at any given location in the vicinity of the Project. These predicted values represent a worst-case scenario. To more accurately calculate the amount of shadow flicker modeled to occur at non-participating receptors predicted to receive over 30-hours in the preliminary analysis, a desktop analysis was conducted to identify obstacles that could fully or partially block shadows at receptor sites. These data were then incorporated into the WindPro model and the analysis of predicted shadow flicker impacts at this receptor was evaluated. The following steps were undertaken as part of this desktop analysis:

1. Orthographic images were imported into the WindPro model (all images are geo-referenced).
2. Using digitizing tools in WindPro, geometric objects were drawn to represent different types of obstacles. Each object was assigned a width, length, and height to reflect the dimensions of the obstacle, as documented through client correspondence and orthographic images.
3. Porosity is then assigned to each obstacle. Low porosity factors (0, 0.2, etc.) were assigned to dense obstacles (such as buildings or stands of conifers) while higher porosity factors (0.5, 0.6, etc.) were assigned to obstacles with less density (such as widely spaced deciduous trees), see Table 1.

Table 1. Summary of Identified Obstacles at Non-Participating Receptors Predicted to Exceed 30 Hours¹

Receptor ID	Obstacle Types	Obstacle Location Relative to Receptor	Approximate Obstacle Dimensions (meters)	Assigned Porosity Factor
1	Large Stand of Mixed Trees	NW	12 x 60 x 146	0.3
	Large Stand of Mixed Trees	NNE	12 x 128 x 247	0.3
2	Deciduous Tree	W	12 x 8 x 7	0.4
	Open Hedge	N	8 x 30 x 5	0.7
57	Large Stand of Mixed Trees	NW	12 x 24 x 11	0.3

¹ The non-participating receptors identified in this table were identified based on the results of the conservative worst-case analysis modeling. See the Results section of this document for an identification of receptors predicted to receive over 30 hours of shadow flicker per year after the effects of screening were taken into consideration.

No consistent national, state, county, or local standards exist for allowable frequency or duration of shadow flicker from wind turbines at the proposed Project site. The National Association of Regulatory Utility Commissioners (NARUC) recommends a threshold of 30 hours of shadow flicker per year at occupied buildings (NARUC, 2012). Accordingly, a threshold of 30 hours of shadow flicker per year was applied to this Project.

Although shadow flicker has been alleged to cause or contribute to health effects, including seizures, modern wind turbines typically operate at a frequency lower than the typical threshold for photosensitive epilepsy sensitivity, and there is no evidence that wind turbines can trigger seizures (British Epilepsy Association, 2007; Ellenbogen et al., 2012; NHMRC, 2010; DECC, 2011).

Other health effects alleged to be caused by wind turbines are the symptoms associated with Wind Turbine Syndrome including insomnia, headaches, tinnitus, dizziness, nausea, panic attacks, and palpitations. Based on a detailed review of scientific literature and other reports, an expert panel found that, "there is limited scientific evidence of an association from prolonged shadow flicker (exceeding 30 minutes per day) and potential transitory cognitive and physical health effects" (Ellenbogen et al., 2012). Ellenbogen et al. (2012) also concluded, "there is no evidence for a set of health effects, from exposure to wind turbines that could be characterized as a 'Wind Turbine Syndrome.'" The primary concern with shadow flicker is the annoyance it can cause for adjacent homeowners.

The model calculations include the cumulative sum of shadow hours for all turbines. This omnidirectional approach reports total shadow flicker results at a receptor regardless of the presence or orientation of windows at the receptor (i.e., it assumes shadows from all directions can be perceived at a receptor, which may or may not be true). A receptor in the model is defined as a one square meter area, one meter above ground level; the actual dimensions of the receptor or window locations are not taken into consideration.

Results

Output from the model includes the following information:

- Calculated shadow flicker time (specific days, maximum hours per day, and total hours per year when shadow flicker is expected) at each of the receptors located in the Study Area.
- Tabulated and plotted time of day that receptors are predicted to receive shadow flicker (Attachment B).

- Shadow isolines, which are used to create maps showing turbine locations, receptors, and projected shadow flicker duration (hours per year; Figure 3).

A summary of the projected shadow flicker at each of the five receptors in the Study Area is presented below:

- 1 (20%) of the receptors may be affected 0-1 hour/year,
- 3 (60%) of the receptors may be affected 1-10 hours/year,
- 0 (0%) of the receptors may be affected 10-20 hours/year,
- 0 (0%) of the receptors may be affected 20-30 hours/year,
- 1 (20%) of the receptors may be affected for more than 30 hours/year.

As these results indicate, 80% of the receptors are predicted to receive less than 30 hours of shadow flicker per year, with 80% of the receptors also predicted to receive less than 10 hours of shadow flicker per year. At most receptor locations, shadow flicker will occur primarily in the early morning or late afternoon and will generally last less than 1 hour per day. The maximum daily duration of shadow flicker is 50 minutes (at participating receptor 58, see Attachment B).

The one receptor predicted to receive over 30 hours of shadow flicker per year is a participating receptor. Table 2 provides the results of the predicted shadow flicker for all receptors included in this analysis and Figure 4 provides a detailed map of these receptors. The times of day and duration of shadow flicker experienced by each receptor will vary throughout the calendar year based on the position of the sun in the sky and the direction of prevailing winds. See Attachment B for detailed calendars that illustrate the specific times of year and day that shadow flicker may occur at all receptors.

Table 2. Summary of Shadow Flicker Results

Receptor ID	Project Status	Predicted Annual Shadow Flicker (hh:mm)	Predicted Max Daily Shadow Flicker (hh:mm)	Predicted Shadow Flicker (days/year)
43	Non-Participating – Inholding	0:00	0:00	0
1	Non-Participating – Inholding	3:04	0:29	45
57	Non-Participating – Lammers Trust	5:08	0:23	40
2	Non-Participating – Lammers Trust	6:55	0:25	48
58	Participating – Leased Land	39:40	0:50	132

Conclusion

In summary, as a result of modeling the proposed Siemens Games SG 170 turbine model, *WindPRO* predicted that one receptor will receive more than 30 hours of shadow flicker per year; however, that one receptor is a Project participant. The primary concern with shadow flicker is the annoyance that it can cause for adjacent homeowners. A common finding is that annoyance is lower among residents who benefited economically from the wind turbines (i.e., project participants; Michaud et al., 2016). Based on this turbine layout and model selected, there are no non-participating receptors that are predicted to receive more than 30 hours/year of shadow flicker, the proposed threshold as described above.

References

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Department of Energy and Climate Change (DECC). 2011. *Update of UK Shadow Flicker Evidence Base: Final Report*. Parsons Brinckerhoff, London, UK, p. 5.

Ellenbogen, J. M., S. Grace, W. J. Heigher-Bernays, J. F. Manwell, D. A. Mills, K. A. Sullivan, M. G. Weisskopf. 2012. Wind Turbine Health Impact Study: Report of Independent Expert Panel. January 2012. Prepared for Massachusetts Department of Environmental Protection and Massachusetts Department of Public Health. Available at: <http://www.mass.gov/eea/docs/dep/energy/wind/turbine-impact-study.pdf>

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Michaud et. al. 2016. Estimating Annoyance to Calculated Wind Turbine Shadow Flicker is Improved when Variables Associated with Wind Turbine Noise Exposure are considered. *Journal of the Acoustical Society of America* 139, 1480.

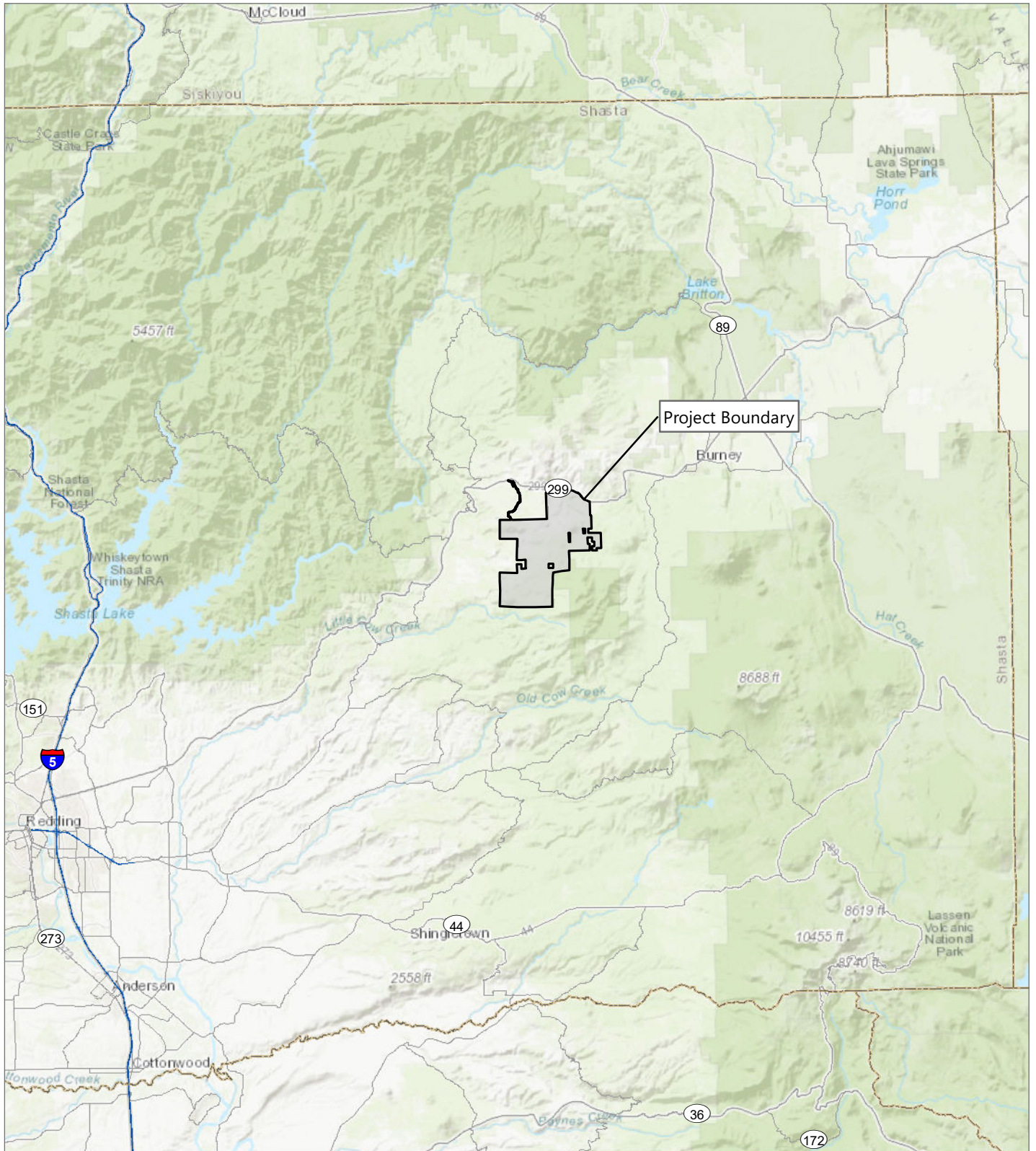
National Association of Regulatory Utility Commissioners (NARUC). 2012. *Wind Energy & Wind Park Siting and Zoning Best Practices and Guidance for States*. A report for the Minnesota Public Utilities Commission Funded by the U.S. Department of Energy. January 2012.

National Health and Medical Research Council (NHMRC). 2010. *Wind Turbines and Health: A Rapid Review of the Evidence*. Australian Government, July 2010.

U.S. Department of the Interior. 2005. *Final Programmatic Environmental Impact Statement on Wind Energy Development on BLM-Administered Lands in the Western United States*. Bureau of Land Management.

Figures

Figure 1. Regional Project Location



Fountain Wind
Shasta County, California

Shadow Flicker Analysis

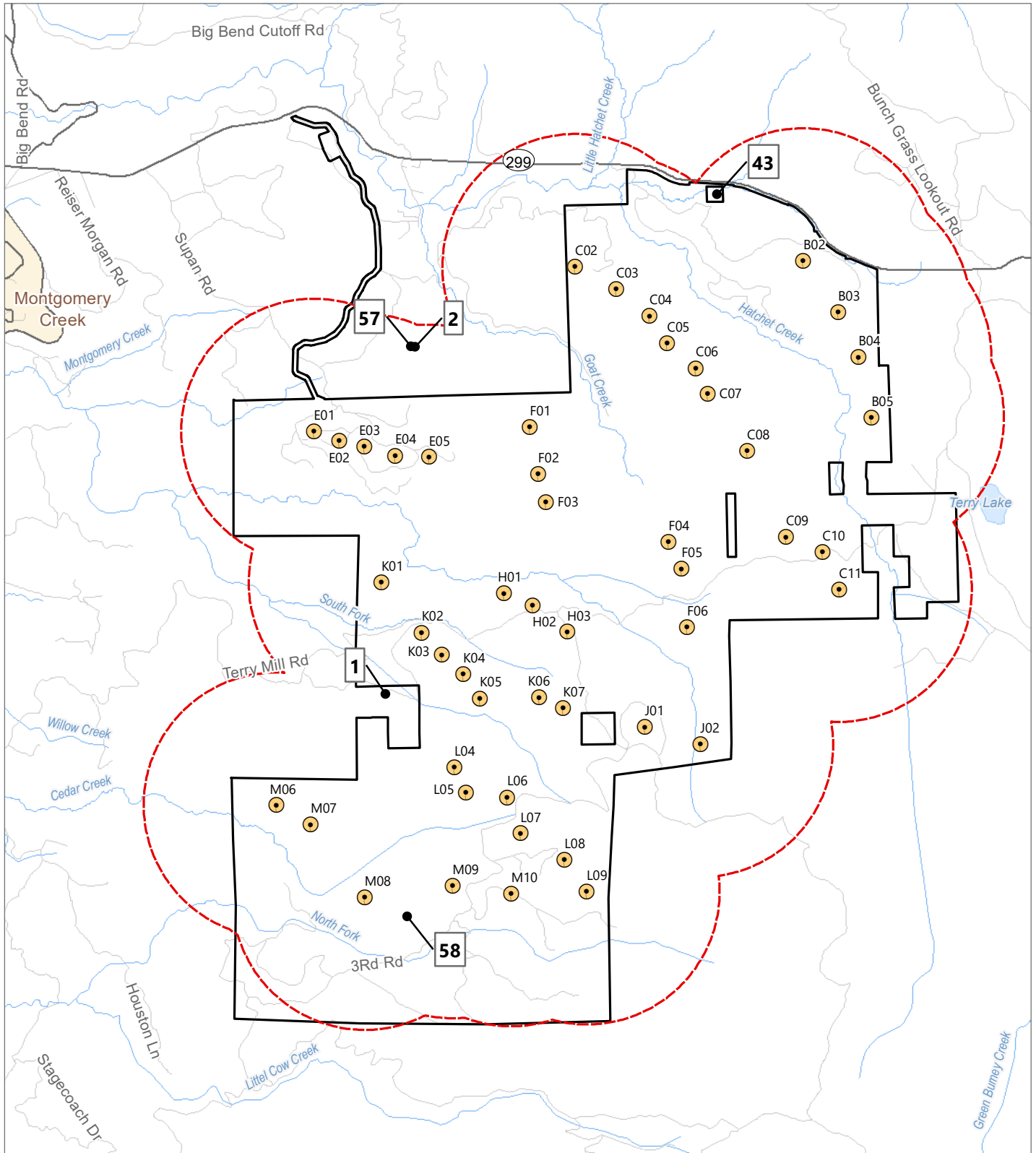
EDR



0 2.5 5 10
Miles

Prepared September 13, 2021
Basemap: ESRI ArcGIS Online "World Topographic Map" map service.

Figure 2. Proposed Turbine Layout



Fountain Wind
Shasta County, California

Shadow Flicker Analysis

- Receptor
- Wind Turbine
- ▭ Project Boundary
- ▭ 1,700-meter Study Area

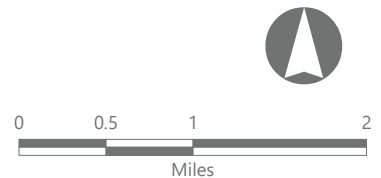
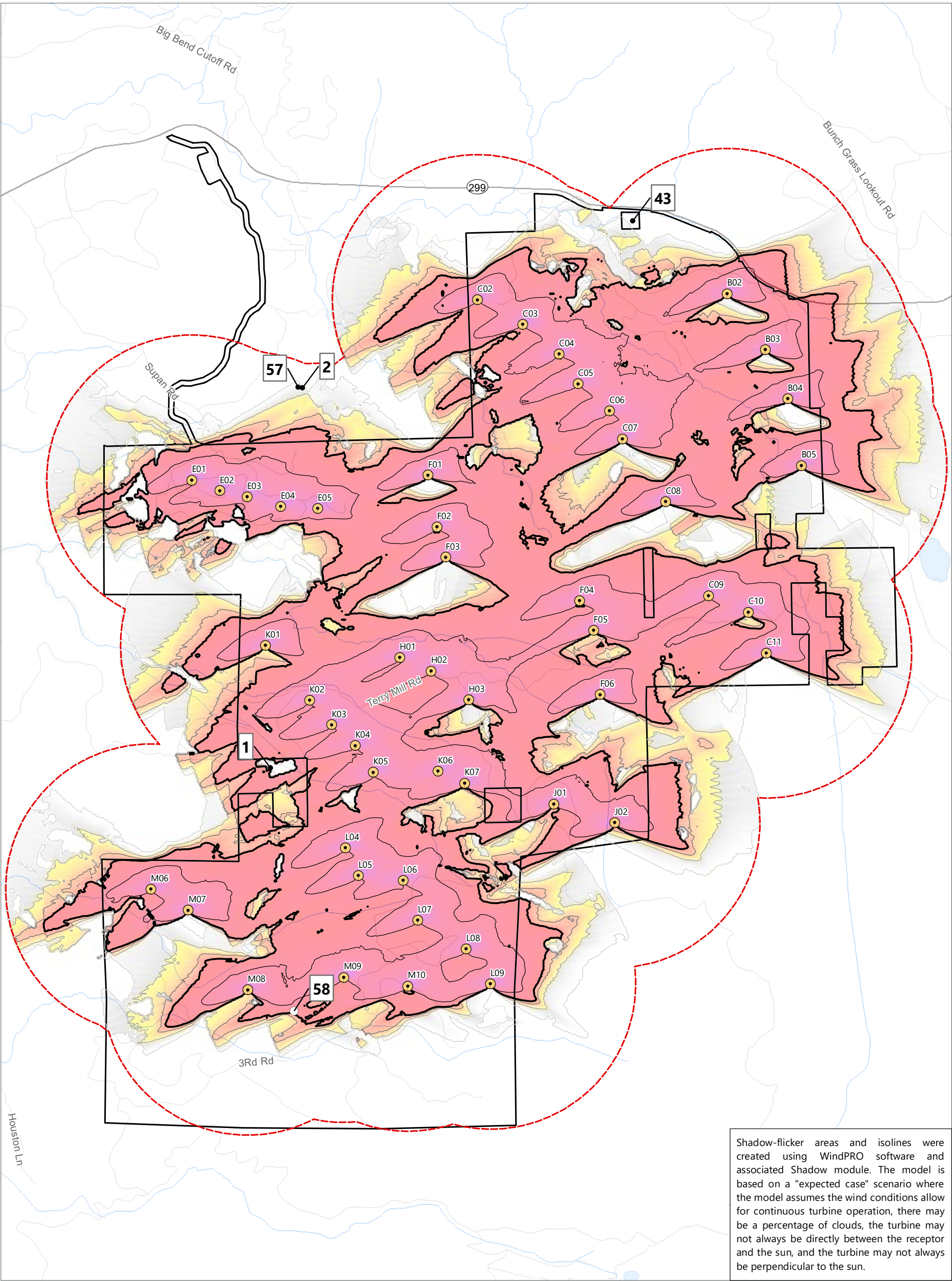


Figure 3. Projected Shadow Flicker

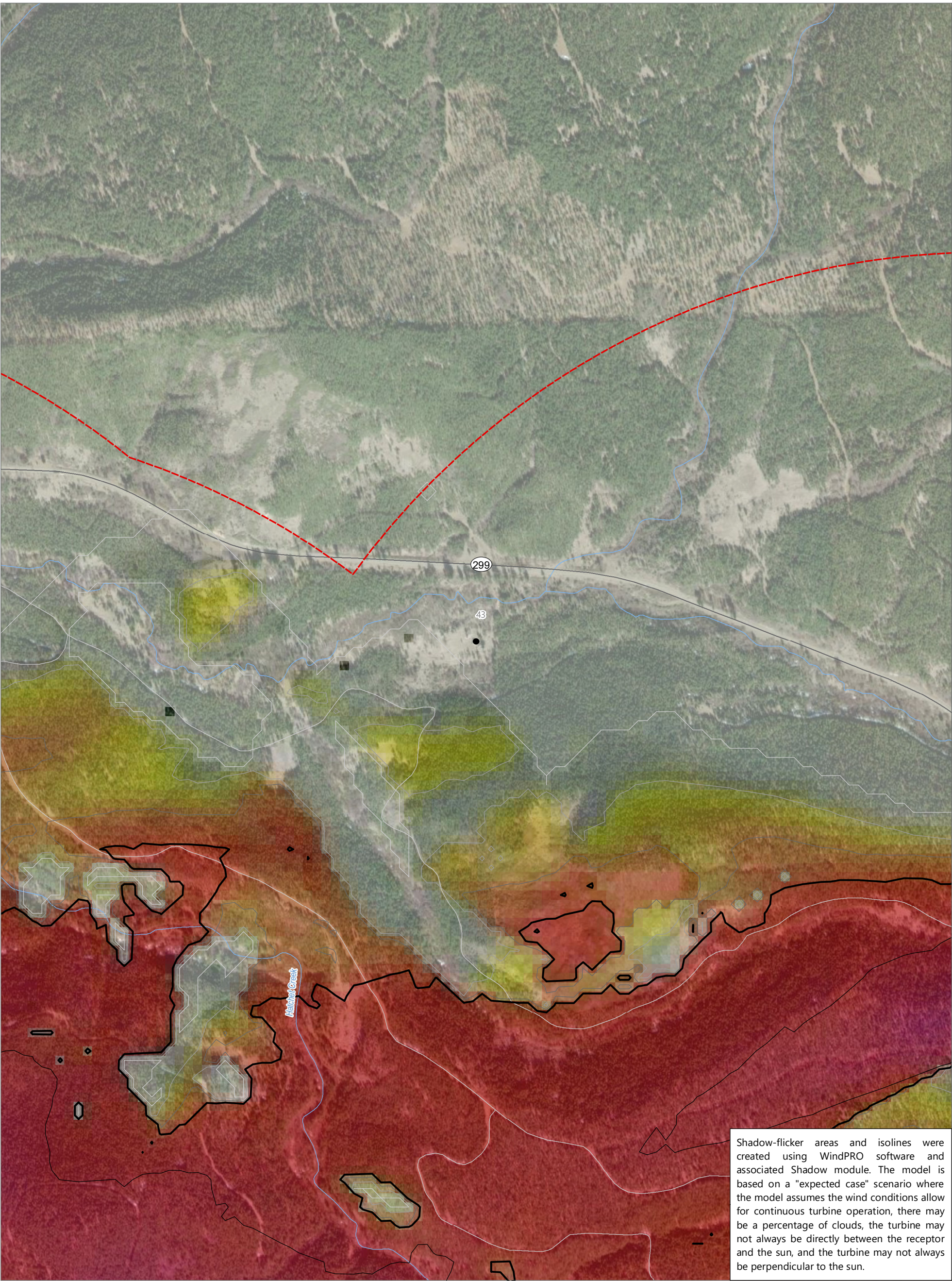


Fountain Wind
Shasta County, California

Shadow Flicker Analysis

- | | | |
|-------------------------------|------------------|-----------------------------|
| ● Receptor < 30 Hours/Year | Shadow Isolines | Shadow Flicker (hours/year) |
| ○ Participant > 30 Hours/Year | — 0 hours/year | □ < 1 |
| ● Wind Turbine | — 10 hours/year | □ 1 - 10 |
| □ Project Boundary | — 20 hours/year | □ 10 - 20 |
| □ 1,700-meter Study Area | — 30 hours/year | □ 20 - 30 |
| | — 100 hours/year | □ 30 - 100 |
| | | □ > 100 |





Fountain Wind
Shasta County, California

Shadow Flicker Analysis

- Receptor < 30 Hours/Year

○ Participant > 30 Hours/Year

⦿ Wind Turbine

▭ 1,700-meter Study Area

Shadow Isolines

— 0 hours/year

— 10 hours/year

— 20 hours/year

— 30 hours/year

— 100 hours/year

Shadow Flicker (hours/year)

< 1

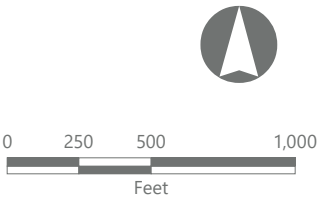
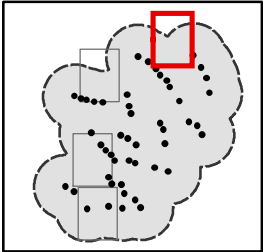
1 - 10

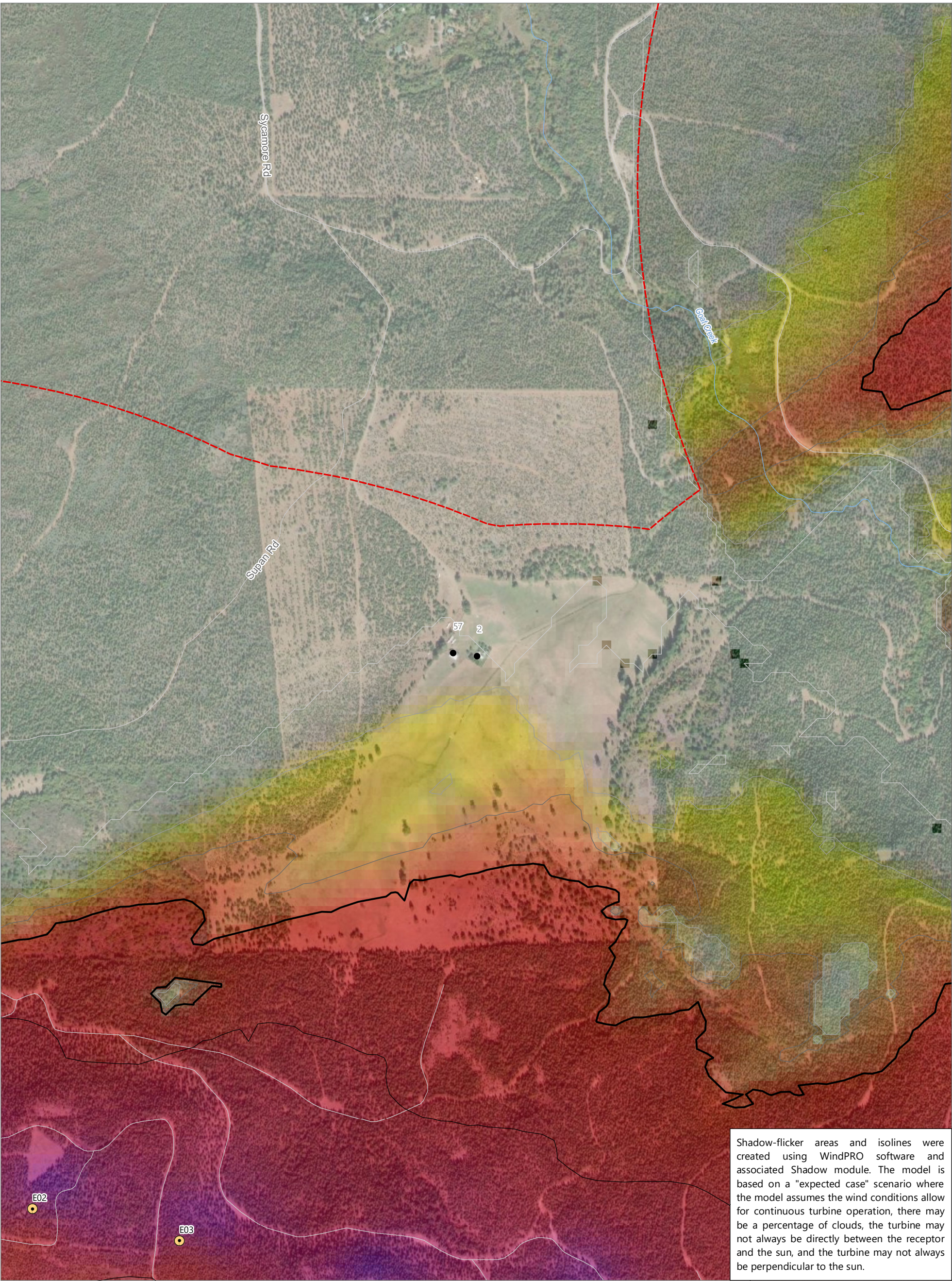
10 - 20

20 - 30

30 - 100

> 100

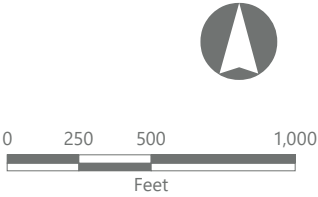
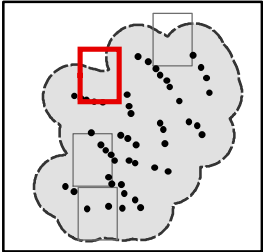


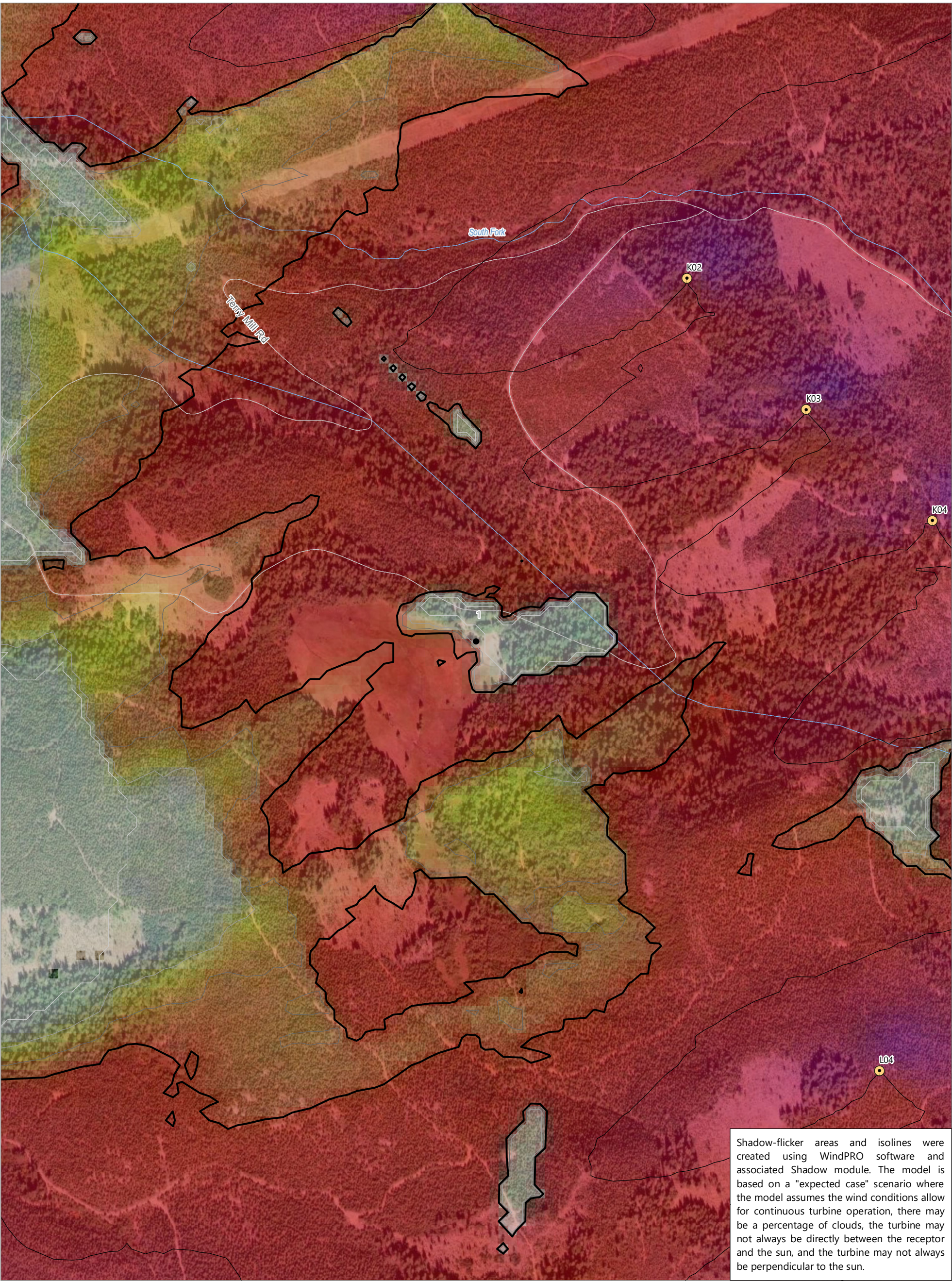


Fountain Wind
Shasta County, California

Shadow Flicker Analysis

- | | | |
|-------------------------------|------------------|-----------------------------|
| ● Receptor < 30 Hours/Year | Shadow Isolines | Shadow Flicker (hours/year) |
| ○ Participant > 30 Hours/Year | — 0 hours/year | □ < 1 |
| ● Wind Turbine | — 10 hours/year | □ 1 - 10 |
| □ 1,700-meter Study Area | — 20 hours/year | □ 10 - 20 |
| | — 30 hours/year | □ 20 - 30 |
| | — 100 hours/year | □ 30 - 100 |
| | | □ > 100 |



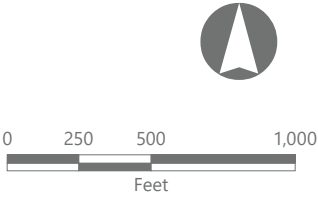
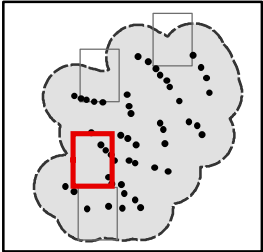


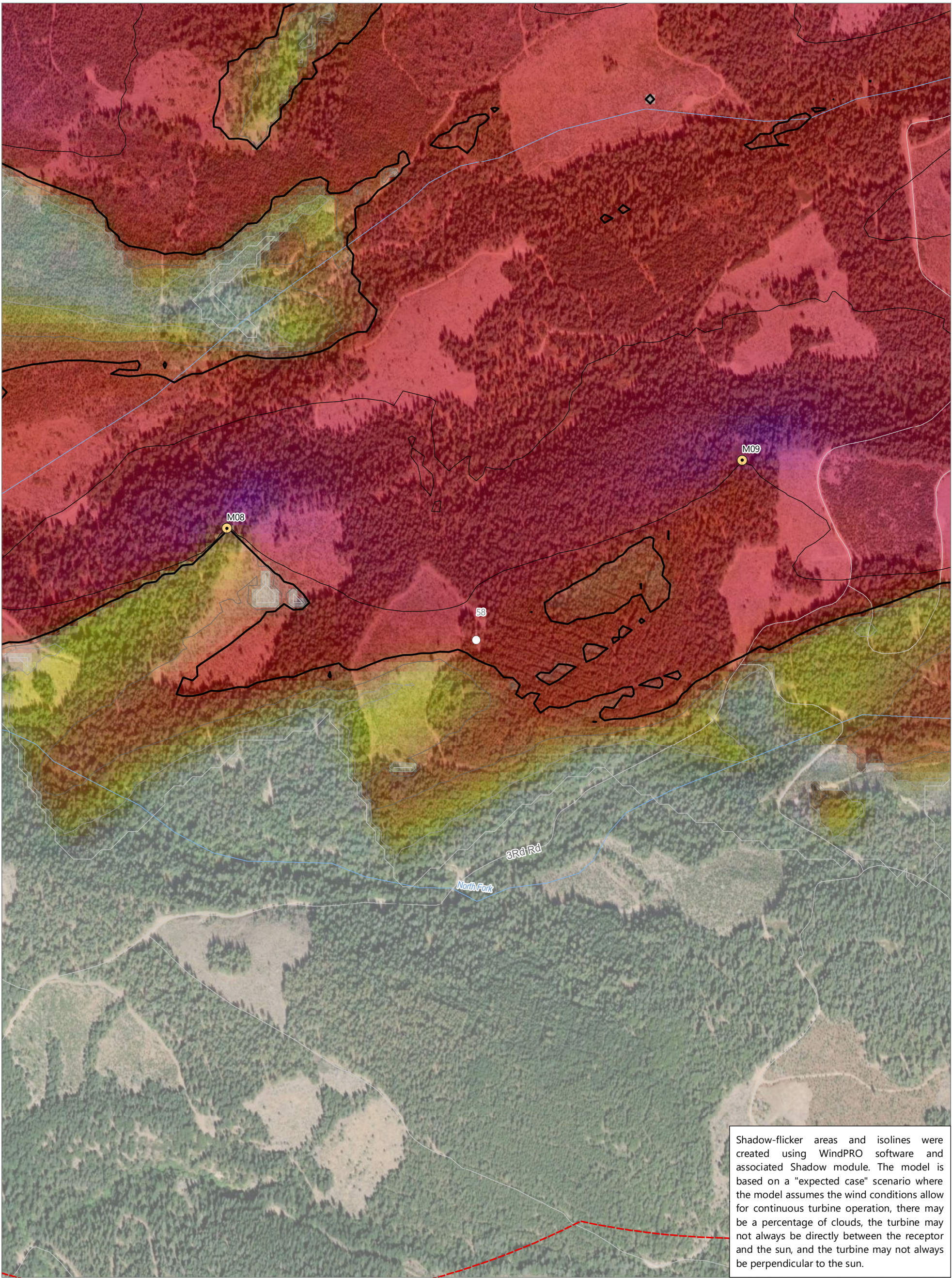
Fountain Wind

Shasta County, California

Shadow Flicker Analysis

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|-------------------------------|------------------|-----------------------------|
| ● Receptor < 30 Hours/Year | Shadow Isolines | Shadow Flicker (hours/year) |
| ○ Participant > 30 Hours/Year | — 0 hours/year | < 1 |
| ● Wind Turbine | — 10 hours/year | 1 - 10 |
| 1,700-meter Study Area | — 20 hours/year | 10 - 20 |
| | — 30 hours/year | 20 - 30 |
| | — 100 hours/year | 30 - 100 |
| | | > 100 |



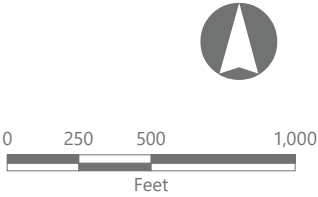
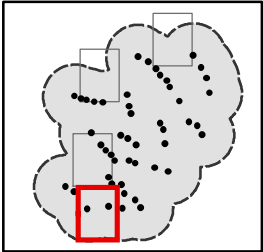


Shadow-flicker areas and isolines were created using WindPRO software and associated Shadow module. The model is based on a "expected case" scenario where the model assumes the wind conditions allow for continuous turbine operation, there may be a percentage of clouds, the turbine may not always be directly between the receptor and the sun, and the turbine may not always be perpendicular to the sun.

Fountain Wind
Shasta County, California

Shadow Flicker Analysis

- | | | |
|-------------------------------|------------------|-----------------------------|
| ● Receptor < 30 Hours/Year | Shadow Isolines | Shadow Flicker (hours/year) |
| ○ Participant > 30 Hours/Year | — 0 hours/year | □ < 1 |
| ● Wind Turbine | — 10 hours/year | □ 1 - 10 |
| □ 1,700-meter Study Area | — 20 hours/year | □ 10 - 20 |
| | — 30 hours/year | □ 20 - 30 |
| | — 100 hours/year | □ 30 - 100 |
| | | □ > 100 |



Attachment A

Wind Rose and Sunshine Data

Table A1. Wind Rose Data

SECTOR	N	NNE	NE	ENE	E	ESE	SE	SSE
Frequency	0.26	0.74	3.65	22.10	20.89	1.36	0.06	0.27
Hours of Operation	23	65	319	1,935	1,830	119	5	24

SECTOR	S	SSW	SW	WSW	W	WNW	NW	NNW
Frequency	3.88	16.34	20.16	8.68	1.13	0.22	0.12	0.15
Hours of Operation	340	1,432	1,766	761	99	19	10	13

Source: Wind rose data provided by ConnectGen LLC.

Table A2. Sunshine Probability Data¹

Month	JAN	FEB	MAR	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
Sunshine Probability ²	0.45	0.62	0.73	0.82	0.92	0.94	0.97	0.96	0.93	0.84	0.61	0.47

¹Source: NOAA Comparative Climatic Data for the United States through 2015 – Sacramento, California Weather Station.

²Defined by NOAA as the total time that sunshine reaches the surface of the earth, expressed as the percentage of the maximum amount possible from sunrise to sunset with clear sky conditions.

Attachment B

WindPRO Results and Calendar

SHADOW - Main Result

Assumptions for shadow calculations

Maximum distance for influence	1,700 m
Minimum sun height over horizon for influence	3 °
Day step for calculation	1 days
Time step for calculation	1 minutes

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.45	0.62	0.73	0.82	0.92	0.94	0.97	0.96	0.93	0.84	0.61	0.47

Operational time

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW
23	65	319	1,935	1,830	119	5	24	340	1,432	1,766	761

W	WNW	NW	NNW	Sum
99	19	10	13	8,760

A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:

Height contours used: Height Contours: 5m_contour.wpo (2)

Obstacles used in calculation

Eye height for map: 1.5 m

Grid resolution: 1.0 m

All coordinates are in

UTM (north)-NAD83 (US+CA) Zone: 10

WTGs

	Easting	Northing	Z	Row data/Description	WTG type		Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	RPM [RPM]
					Valid	Manufact.					
			[m]								
B02	602,115	4,523,201	1,331.9	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 10...	Yes	Siemens Gamesa	SG 6.0-170-6,200	6,200	170.0	100.0	8.8
B03	602,563	4,522,545	1,353.9	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 10...	Yes	Siemens Gamesa	SG 6.0-170-6,200	6,200	170.0	100.0	8.8
B04	602,825	4,521,968	1,380.0	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 10...	Yes	Siemens Gamesa	SG 6.0-170-6,200	6,200	170.0	100.0	8.8
B05	602,986	4,521,188	1,420.5	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 10...	Yes	Siemens Gamesa	SG 6.0-170-6,200	6,200	170.0	100.0	8.8
C02	599,188	4,523,128	1,328.7	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 10...	Yes	Siemens Gamesa	SG 6.0-170-6,200	6,200	170.0	100.0	8.8
C03	599,717	4,522,840	1,375.4	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 10...	Yes	Siemens Gamesa	SG 6.0-170-6,200	6,200	170.0	100.0	8.8
C04	600,145	4,522,493	1,399.2	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 10...	Yes	Siemens Gamesa	SG 6.0-170-6,200	6,200	170.0	100.0	8.8
C05	600,368	4,522,142	1,388.9	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 10...	Yes	Siemens Gamesa	SG 6.0-170-6,200	6,200	170.0	100.0	8.8
C06	600,734	4,521,827	1,440.0	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 10...	Yes	Siemens Gamesa	SG 6.0-170-6,200	6,200	170.0	100.0	8.8
C07	600,889	4,521,501	1,448.6	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 10...	Yes	Siemens Gamesa	SG 6.0-170-6,200	6,200	170.0	100.0	8.8
C08	601,394	4,520,764	1,527.3	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 10...	Yes	Siemens Gamesa	SG 6.0-170-6,200	6,200	170.0	100.0	8.8
C09	601,894	4,519,662	1,405.0	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 10...	Yes	Siemens Gamesa	SG 6.0-170-6,200	6,200	170.0	100.0	8.8
C10	602,361	4,519,469	1,403.6	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 10...	Yes	Siemens Gamesa	SG 6.0-170-6,200	6,200	170.0	100.0	8.8
C11	602,574	4,518,992	1,389.6	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 10...	Yes	Siemens Gamesa	SG 6.0-170-6,200	6,200	170.0	100.0	8.8
E01	595,840	4,521,016	1,265.6	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 10...	Yes	Siemens Gamesa	SG 6.0-170-6,200	6,200	170.0	100.0	8.8
E02	596,169	4,520,891	1,248.3	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 10...	Yes	Siemens Gamesa	SG 6.0-170-6,200	6,200	170.0	100.0	8.8
E03	596,489	4,520,822	1,285.0	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 10...	Yes	Siemens Gamesa	SG 6.0-170-6,200	6,200	170.0	100.0	8.8
E04	596,884	4,520,707	1,259.3	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 10...	Yes	Siemens Gamesa	SG 6.0-170-6,200	6,200	170.0	100.0	8.8
E05	597,316	4,520,684	1,243.8	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 10...	Yes	Siemens Gamesa	SG 6.0-170-6,200	6,200	170.0	100.0	8.8
F01	598,609	4,521,073	1,434.0	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 10...	Yes	Siemens Gamesa	SG 6.0-170-6,200	6,200	170.0	100.0	8.8
F02	598,714	4,520,467	1,415.0	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 10...	Yes	Siemens Gamesa	SG 6.0-170-6,200	6,200	170.0	100.0	8.8
F03	598,816	4,520,113	1,404.3	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 10...	Yes	Siemens Gamesa	SG 6.0-170-6,200	6,200	170.0	100.0	8.8
F04	600,386	4,519,601	1,438.0	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 10...	Yes	Siemens Gamesa	SG 6.0-170-6,200	6,200	170.0	100.0	8.8
F05	600,550	4,519,255	1,413.9	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 10...	Yes	Siemens Gamesa	SG 6.0-170-6,200	6,200	170.0	100.0	8.8
F06	600,623	4,518,503	1,415.0	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 10...	Yes	Siemens Gamesa	SG 6.0-170-6,200	6,200	170.0	100.0	8.8
H01	598,277	4,518,937	1,379.8	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 10...	Yes	Siemens Gamesa	SG 6.0-170-6,200	6,200	170.0	100.0	8.8
H02	598,646	4,518,781	1,411.7	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 10...	Yes	Siemens Gamesa	SG 6.0-170-6,200	6,200	170.0	100.0	8.8
H03	599,087	4,518,444	1,441.3	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 10...	Yes	Siemens Gamesa	SG 6.0-170-6,200	6,200	170.0	100.0	8.8
J01	600,082	4,517,223	1,548.1	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 10...	Yes	Siemens Gamesa	SG 6.0-170-6,200	6,200	170.0	100.0	8.8
J02	600,796	4,517,003	1,573.4	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 10...	Yes	Siemens Gamesa	SG 6.0-170-6,200	6,200	170.0	100.0	8.8
K01	596,706	4,519,081	1,307.0	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 10...	Yes	Siemens Gamesa	SG 6.0-170-6,200	6,200	170.0	100.0	8.8
K02	597,220	4,518,436	1,358.6	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 10...	Yes	Siemens Gamesa	SG 6.0-170-6,200	6,200	170.0	100.0	8.8
K03	597,480	4,518,150	1,380.0	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 10...	Yes	Siemens Gamesa	SG 6.0-170-6,200	6,200	170.0	100.0	8.8
K04	597,755	4,517,908	1,383.4	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 10...	Yes	Siemens Gamesa	SG 6.0-170-6,200	6,200	170.0	100.0	8.8
K05	597,969	4,517,594	1,374.2	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 10...	Yes	Siemens Gamesa	SG 6.0-170-6,200	6,200	170.0	100.0	8.8
K06	598,726	4,517,606	1,467.9	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 10...	Yes	Siemens Gamesa	SG 6.0-170-6,200	6,200	170.0	100.0	8.8

To be continued on next page...

SHADOW - Main Result

...continued from previous page

	Easting	Northing	Z	Row data/Description	WTG type		Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	RPM
					Valid	Manufact.					
			[m]								[RPM]
K07	599,038	4,517,467	1,507.8	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 10...	Yes	Siemens Gamesa	SG 6.0-170-6,200	6,200	170.0	100.0	8.8
L04	597,640	4,516,708	1,461.3	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 10...	Yes	Siemens Gamesa	SG 6.0-170-6,200	6,200	170.0	100.0	8.8
L05	597,793	4,516,383	1,448.0	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 10...	Yes	Siemens Gamesa	SG 6.0-170-6,200	6,200	170.0	100.0	8.8
L06	598,317	4,516,327	1,446.5	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 10...	Yes	Siemens Gamesa	SG 6.0-170-6,200	6,200	170.0	100.0	8.8
L07	598,490	4,515,860	1,498.6	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 10...	Yes	Siemens Gamesa	SG 6.0-170-6,200	6,200	170.0	100.0	8.8
L08	599,054	4,515,524	1,579.5	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 10...	Yes	Siemens Gamesa	SG 6.0-170-6,200	6,200	170.0	100.0	8.8
L09	599,341	4,515,113	1,621.1	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 10...	Yes	Siemens Gamesa	SG 6.0-170-6,200	6,200	170.0	100.0	8.8
M06	595,359	4,516,224	1,316.0	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 10...	Yes	Siemens Gamesa	SG 6.0-170-6,200	6,200	170.0	100.0	8.8
M07	595,799	4,515,977	1,343.6	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 10...	Yes	Siemens Gamesa	SG 6.0-170-6,200	6,200	170.0	100.0	8.8
M08	596,495	4,515,043	1,365.7	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 10...	Yes	Siemens Gamesa	SG 6.0-170-6,200	6,200	170.0	100.0	8.8
M09	597,621	4,515,192	1,422.1	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 10...	Yes	Siemens Gamesa	SG 6.0-170-6,200	6,200	170.0	100.0	8.8
M10	598,373	4,515,089	1,510.2	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 10...	Yes	Siemens Gamesa	SG 6.0-170-6,200	6,200	170.0	100.0	8.8

Shadow receptor-Input

No.	Easting	Northing	Z	Width	Height	Elevation a.g.l.	Slope of window	Direction mode	Eye height (ZVI) a.g.l.
			[m]	[m]	[m]	[m]	[°]		[m]
1	596,761	4,517,643	1,313.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0
2	597,139	4,522,095	1,193.8	1.0	1.0	1.0	90.0	"Green house mode"	2.0
43	601,007	4,524,052	1,253.2	1.0	1.0	1.0	90.0	"Green house mode"	2.0
57	597,086	4,522,102	1,193.5	1.0	1.0	1.0	90.0	"Green house mode"	2.0
58	597,040	4,514,798	1,418.9	1.0	1.0	1.0	90.0	"Green house mode"	2.0

Calculation Results

Shadow receptor

No.	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]	
1	17:39	45	0:29	3:04	
2	16:34	48	0:25	6:55	
43	0:00	0	0:00	0:00	
57	12:21	40	0:23	5:08	
58	79:44	132	0:50	39:40	

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

No.	Name	Worst case [h/year]	Expected [h/year]
B02	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 100.0 m (TOT: 185.0 m) (158)	0:00	0:00
B03	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 100.0 m (TOT: 185.0 m) (157)	0:00	0:00
B04	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 100.0 m (TOT: 185.0 m) (153)	0:00	0:00
B05	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 100.0 m (TOT: 185.0 m) (151)	0:00	0:00
C02	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 100.0 m (TOT: 185.0 m) (187)	0:00	0:00
C03	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 100.0 m (TOT: 185.0 m) (186)	0:00	0:00
C04	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 100.0 m (TOT: 185.0 m) (159)	0:00	0:00
C05	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 100.0 m (TOT: 185.0 m) (156)	0:00	0:00
C06	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 100.0 m (TOT: 185.0 m) (155)	0:00	0:00
C07	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 100.0 m (TOT: 185.0 m) (154)	0:00	0:00
C08	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 100.0 m (TOT: 185.0 m) (152)	0:00	0:00
C09	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 100.0 m (TOT: 185.0 m) (148)	0:00	0:00
C10	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 100.0 m (TOT: 185.0 m) (147)	0:00	0:00
C11	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 100.0 m (TOT: 185.0 m) (146)	0:00	0:00
E01	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 100.0 m (TOT: 185.0 m) (185)	18:34	7:45
E02	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 100.0 m (TOT: 185.0 m) (184)	0:00	0:00
E03	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 100.0 m (TOT: 185.0 m) (183)	0:00	0:00
E04	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 100.0 m (TOT: 185.0 m) (182)	0:00	0:00
E05	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 100.0 m (TOT: 185.0 m) (181)	0:00	0:00
F01	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 100.0 m (TOT: 185.0 m) (180)	0:00	0:00
F02	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 100.0 m (TOT: 185.0 m) (179)	0:00	0:00
F03	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 100.0 m (TOT: 185.0 m) (178)	0:00	0:00
F04	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 100.0 m (TOT: 185.0 m) (150)	0:00	0:00

To be continued on next page...

SHADOW - Main Result

...continued from previous page

No.	Name	Worst case [h/year]	Expected [h/year]
F05	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 100.0 m (TOT: 185.0 m) (149)	0:00	0:00
F06	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 100.0 m (TOT: 185.0 m) (145)	0:00	0:00
H01	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 100.0 m (TOT: 185.0 m) (176)	0:00	0:00
H02	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 100.0 m (TOT: 185.0 m) (171)	0:00	0:00
H03	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 100.0 m (TOT: 185.0 m) (170)	0:00	0:00
J01	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 100.0 m (TOT: 185.0 m) (144)	0:00	0:00
J02	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 100.0 m (TOT: 185.0 m) (143)	0:00	0:00
K01	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 100.0 m (TOT: 185.0 m) (177)	0:00	0:00
K02	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 100.0 m (TOT: 185.0 m) (175)	0:00	0:00
K03	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 100.0 m (TOT: 185.0 m) (174)	0:00	0:00
K04	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 100.0 m (TOT: 185.0 m) (173)	0:00	0:00
K05	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 100.0 m (TOT: 185.0 m) (172)	0:00	0:00
K06	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 100.0 m (TOT: 185.0 m) (169)	0:00	0:00
K07	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 100.0 m (TOT: 185.0 m) (164)	0:00	0:00
L04	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 100.0 m (TOT: 185.0 m) (166)	17:39	3:04
L05	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 100.0 m (TOT: 185.0 m) (165)	0:00	0:00
L06	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 100.0 m (TOT: 185.0 m) (162)	0:00	0:00
L07	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 100.0 m (TOT: 185.0 m) (161)	0:00	0:00
L08	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 100.0 m (TOT: 185.0 m) (160)	0:00	0:00
L09	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 100.0 m (TOT: 185.0 m) (140)	0:00	0:00
M06	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 100.0 m (TOT: 185.0 m) (168)	0:00	0:00
M07	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 100.0 m (TOT: 185.0 m) (167)	0:00	0:00
M08	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 100.0 m (TOT: 185.0 m) (142)	62:17	27:25
M09	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 100.0 m (TOT: 185.0 m) (163)	0:00	0:00
M10	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 100.0 m (TOT: 185.0 m) (141)	17:27	12:06

Total times in Receptor wise and WTG wise tables can differ, as a WTG can lead to flicker at 2 or more receptors simultaneously and/or receptors may receive flicker from 2 or more WTGs simultaneously.

Project:

Fountain Wind

Licensed user:

EDR

217 Montgomery St., Suite 1000
US-SYRACUSE, NY 13202
(315) 471 0688

Calculated:

9/3/2021 5:20 PM/3.4.415

SHADOW - Calendar

Shadow receptor: 1 - Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 0.0° (148)

Assumptions for shadow calculations

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.45	0.62	0.73	0.82	0.92	0.94	0.97	0.96	0.93	0.84	0.61	0.47

Operational time

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
23	65	319	1,935	1,830	119	5	24	340	1,432	1,766	761	99	19	10	13	8,760

	January		February		March	April	May	June	July	August	September	October	November	December		
1	07:32		08:48 (L04)	07:19	06:43	06:53	06:07	05:39	05:40	06:04	06:34	07:04	06:38		07:12	08:40 (L04)
	16:50	27	09:15 (L04)	17:24	17:57	19:31	20:03	20:32	20:43	20:25	19:43	18:53	18:06		16:41	13 08:53 (L04)
2	07:32		08:49 (L04)	07:18	06:41	06:51	06:06	05:39	05:40	06:05	06:35	07:05	06:39		07:13	08:39 (L04)
	16:51	26	09:15 (L04)	17:25	17:59	19:32	20:04	20:33	20:43	20:24	19:41	18:51	17:05		16:41	16 08:55 (L04)
3	07:33		08:50 (L04)	07:17	06:40	06:49	06:05	05:38	05:41	06:06	06:36	07:06	06:40		07:14	08:38 (L04)
	16:51	25	09:15 (L04)	17:26	18:00	19:33	20:05	20:34	20:43	20:23	19:40	18:49	17:04		16:41	18 08:56 (L04)
4	07:33		08:50 (L04)	07:16	06:38	06:48	06:03	05:38	05:41	06:07	06:37	07:07	06:41		07:15	08:38 (L04)
	16:52	25	09:15 (L04)	17:27	18:01	19:34	20:06	20:34	20:43	20:22	19:38	18:48	17:02		16:41	20 08:58 (L04)
5	07:33		08:51 (L04)	07:15	06:37	06:46	06:02	05:37	05:42	06:08	06:38	07:08	06:42		07:16	08:38 (L04)
	16:53	24	09:15 (L04)	17:28	18:02	19:35	20:07	20:35	20:43	20:21	19:36	18:46	17:01		16:40	21 08:59 (L04)
6	07:33		08:51 (L04)	07:14	06:35	06:44	06:01	05:37	05:43	06:09	06:39	07:09	06:44		07:17	08:37 (L04)
	16:54	23	09:14 (L04)	17:30	18:03	19:36	20:08	20:36	20:43	20:20	19:35	18:44	17:00		16:40	23 09:00 (L04)
7	07:32		08:53 (L04)	07:13	06:34	06:43	06:00	05:37	05:43	06:10	06:40	07:10	06:45		07:18	08:37 (L04)
	16:55	21	09:14 (L04)	17:31	18:04	19:37	20:09	20:36	20:42	20:19	19:33	18:43	16:59		16:40	24 09:01 (L04)
8	07:32		08:54 (L04)	07:11	07:32	06:41	05:59	05:37	05:44	06:10	06:41	07:11	06:46		07:19	08:38 (L04)
	16:56	20	09:14 (L04)	17:32	19:05	19:38	20:10	20:37	20:42	20:17	19:31	18:41	16:58		16:40	24 09:02 (L04)
9	07:32		08:55 (L04)	07:10	07:30	06:40	05:58	05:36	05:44	06:11	06:42	07:12	06:47		07:20	08:38 (L04)
	16:57	18	09:13 (L04)	17:33	19:06	19:40	20:11	20:37	20:42	20:16	19:30	18:40	16:57		16:40	25 09:03 (L04)
10	07:32		08:57 (L04)	07:09	07:29	06:38	05:56	05:36	05:45	06:12	06:43	07:13	06:48		07:21	08:38 (L04)
	16:58	16	09:13 (L04)	17:35	19:08	19:41	20:12	20:38	20:41	20:15	19:28	18:38	16:56		16:40	26 09:04 (L04)
11	07:32		08:58 (L04)	07:08	07:27	06:36	05:55	05:36	05:46	06:13	06:44	07:14	06:50		07:22	08:38 (L04)
	16:59	13	09:11 (L04)	17:36	19:09	19:42	20:13	20:39	20:41	20:14	19:26	18:36	16:55		16:40	27 09:05 (L04)
12	07:31		09:00 (L04)	07:07	07:26	06:35	05:54	05:36	05:47	06:14	06:45	07:15	06:51		07:22	08:39 (L04)
	17:00	10	09:10 (L04)	17:37	19:10	19:43	20:14	20:39	20:41	20:12	19:25	18:35	16:54		16:40	26 09:05 (L04)
13	07:31		09:05 (L04)	07:05	07:24	06:33	05:53	05:36	05:47	06:15	06:46	07:16	06:52		07:23	08:38 (L04)
	17:01	2	09:07 (L04)	17:38	19:11	19:44	20:15	20:40	20:40	20:11	19:23	18:33	16:53		16:40	27 09:05 (L04)
14	07:31			07:04	07:22	06:32	05:52	05:36	05:48	06:16	06:47	07:17	06:53		07:24	08:39 (L04)
	17:02			17:40	19:12	19:45	20:16	20:40	20:40	20:10	19:21	18:32	16:52		16:41	27 09:06 (L04)
15	07:30			07:03	07:21	06:30	05:51	05:36	05:49	06:17	06:48	07:19	06:54		07:25	08:39 (L04)
	17:03			17:41	19:13	19:46	20:17	20:41	20:39	20:08	19:20	18:30	16:51		16:41	28 09:07 (L04)
16	07:30			07:02	07:19	06:29	05:50	05:36	05:50	06:18	06:49	07:20	06:55		07:25	08:40 (L04)
	17:04			17:42	19:14	19:47	20:18	20:41	20:38	20:07	19:18	18:29	16:50		16:41	28 09:08 (L04)
17	07:30			07:00	07:17	06:27	05:49	05:36	05:50	06:19	06:50	07:21	06:57		07:26	08:40 (L04)
	17:06			17:43	19:15	19:48	20:19	20:41	20:38	20:06	19:16	18:27	16:49		16:41	28 09:08 (L04)
18	07:29			06:59	07:16	06:26	05:48	05:36	05:51	06:20	06:51	07:22	06:58		07:27	08:40 (L04)
	17:07			17:44	19:16	19:49	20:20	20:42	20:37	20:04	19:15	18:25	16:49		16:42	29 09:09 (L04)
19	07:29			06:58	07:14	06:24	05:48	05:36	05:52	06:21	06:52	07:23	06:59		07:27	08:40 (L04)
	17:08			17:46	19:17	19:50	20:21	20:42	20:37	20:03	19:13	18:24	16:48		16:42	29 09:09 (L04)
20	07:28			06:56	07:12	06:23	05:47	05:36	05:53	06:22	06:53	07:24	07:00		07:28	08:41 (L04)
	17:09			17:47	19:18	19:51	20:22	20:42	20:36	20:01	19:11	18:23	16:47		16:42	29 09:10 (L04)
21	07:27			06:55	07:11	06:21	05:46	05:36	05:54	06:23	06:54	07:25	07:01		07:28	08:42 (L04)
	17:10			17:48	19:19	19:52	20:23	20:43	20:35	20:00	19:10	18:21	16:46		16:43	29 09:11 (L04)
22	07:27			06:53	07:09	06:20	05:45	05:37	05:55	06:24	06:55	07:26	07:02		07:29	08:42 (L04)
	17:11			17:49	19:21	19:53	20:24	20:43	20:34	19:58	19:08	18:20	16:46		16:43	29 09:11 (L04)
23	07:26			06:52	07:07	06:18	05:44	05:37	05:55	06:25	06:56	07:27	07:04		07:29	08:42 (L04)
	17:13			17:50	19:22	19:54	20:24	20:43	20:34	19:57	19:06	18:18	16:45		16:44	29 09:11 (L04)
24	07:25			06:50	07:06	06:17	05:44	05:37	05:56	06:26	06:57	07:29	07:05		07:30	08:43 (L04)
	17:14			17:52	19:23	19:55	20:25	20:43	20:33	19:55	19:04	18:17	16:45		16:44	29 09:12 (L04)
25	07:25			06:49	07:04	06:15	05:43	05:37	05:57	06:27	06:58	07:30	07:06		07:30	08:43 (L04)
	17:15			17:53	19:24	19:56	20:26	20:43	20:32	19:54	19:03	18:15	16:44		16:45	29 09:12 (L04)
26	07:24			06:47	07:02	06:14	05:42	05:38	05:58	06:28	06:59	07:31	07:07		07:31	08:44 (L04)
	17:16			17:54	19:25	19:57	20:27	20:43	20:31	19:52	19:01	18:14	16:43		16:45	29 09:13 (L04)
27	07:23			06:46	07:01	06:13	05:42	05:38	05:59	06:29	07:00	07:32	07:08		07:31	08:45 (L04)
	17:17			17:55	19:26	19:58	20:28	20:43	20:30	19:51	18:59	18:13	16:43		16:46	28 09:13 (L04)
28	07:22			06:44	06:59	06:11	05:41	05:38	06:00	06:30	07:01	07:33	07:09		07:31	08:45 (L04)
	17:19			17:56	19:27	19:59	20:29	20:44	20:29	19:49	18:58	18:11	16:43		16:47	28 09:13 (L04)
29	07:22				06:57	06:10	05:40	05:39	06:01	06:31	07:02	07:34	07:10		07:32	08:45 (L04)
	17:20				19:28	20:01	20:30	20:44	20:28	19:48	18:56	18:10	16:42		16:47	28 09:13 (L04)
30	07:21				06:56	06:09	05:40	05:39	06:02	06:32	07:03	07:35	07:11		07:32	08:46 (L04)
	17:21				19:29	20:02	20:30	20:43	20:27	19:46	18:54	18:09	16:42	9	08:42 (L04)	16:48 27 09:13 (L04)
31	07:20				06:54		05:39		06:03	06:33		07:37			07:32	08:47 (L04)
	17:22				19:30		20:31		20:26	19:44		18:07			16:49 27 09:14 (L04)	
Potential sun hours	298			297	369	398	448	451	458	428	375	346	299		288	
Total, worst case	250												9		800	
Sun reduction	0.45												0.61		0.47	
Oper. time red.	1.00												1.00		1.00	
Wind dir. red.	0.37												0.37		0.37	
Total reduction	0.17												0.23		0.18	
Total, real	42												2		141	

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker	(WTG causing flicker first time)
	Sun set (hh:mm)	Minutes with flicker	Last time (hh:mm) with flicker
			(WTG causing flicker last time)

Project:

Fountain Wind

Licensed user:

EDR

217 Montgomery St., Suite 1000
US-SYRACUSE, NY 13202
(315) 471 0688

Calculated:

9/3/2021 5:20 PM/3.4.415

SHADOW - Calendar

Shadow receptor: 2 - Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 0.0° (149)

Assumptions for shadow calculations

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.45	0.62	0.73	0.82	0.92	0.94	0.97	0.96	0.93	0.84	0.61	0.47

Operational time

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
23	65	319	1,935	1,830	119	5	24	340	1,432	1,766	761	99	19	10	13	8,760

	January		February		March	April	May	June	July	August	September	October	November	December		
1	07:32	15:50 (E01)	07:19	06:43	06:52	06:07	05:39	05:40	06:04	06:34	07:04	06:38		07:12	15:40 (E01)	
	16:50	23	16:13 (E01)	17:23	17:57	19:31	20:03	20:32	20:44	20:25	19:43	18:06		16:41	15	15:55 (E01)
2	07:33	15:51 (E01)	07:18	06:41	06:51	06:06	05:38	05:40	06:05	06:35	07:05	06:39		07:13	15:40 (E01)	
	16:50	23	16:14 (E01)	17:25	17:58	19:32	20:04	20:33	20:43	20:24	19:41	18:51	17:05	16:41	17	15:57 (E01)
3	07:33	15:51 (E01)	07:17	06:40	06:49	06:05	05:38	05:41	06:06	06:36	07:06	06:40		07:14	15:40 (E01)	
	16:51	23	16:14 (E01)	17:26	18:00	19:33	20:05	20:34	20:43	20:23	19:40	18:49	17:04	16:41	18	15:58 (E01)
4	07:33	15:52 (E01)	07:16	06:38	06:48	06:03	05:38	05:41	06:06	06:37	07:07	06:41		07:15	15:40 (E01)	
	16:52	22	16:14 (E01)	17:27	18:01	19:34	20:06	20:34	20:43	20:22	19:38	18:48	17:02	16:41	19	15:59 (E01)
5	07:33	15:53 (E01)	07:15	06:37	06:46	06:02	05:37	05:42	06:07	06:38	07:08	06:43		07:16	15:40 (E01)	
	16:53	21	16:14 (E01)	17:28	18:02	19:35	20:07	20:35	20:43	20:21	19:36	18:46	17:01	16:40	20	16:00 (E01)
6	07:33	15:54 (E01)	07:14	06:35	06:44	06:01	05:37	05:42	06:08	06:39	07:09	06:44		07:17	15:40 (E01)	
	16:54	21	16:15 (E01)	17:30	18:03	19:36	20:08	20:36	20:43	20:20	19:35	18:44	17:00	16:40	21	16:01 (E01)
7	07:33	15:54 (E01)	07:13	06:34	06:43	06:00	05:37	05:43	06:09	06:40	07:10	06:45		07:18	15:40 (E01)	
	16:55	20	16:14 (E01)	17:31	18:04	19:37	20:09	20:36	20:42	20:19	19:33	18:43	16:59	16:40	21	16:01 (E01)
8	07:32	15:55 (E01)	07:11	07:32	06:41	05:59	05:36	05:44	06:10	06:41	07:11	06:46		07:19	15:39 (E01)	
	16:56	19	16:14 (E01)	17:32	19:05	19:38	20:10	20:37	20:42	20:17	19:31	18:41	16:58	16:40	22	16:01 (E01)
9	07:32	15:56 (E01)	07:10	07:30	06:39	05:57	05:36	05:44	06:11	06:42	07:12	06:47		07:20	15:39 (E01)	
	16:57	18	16:14 (E01)	17:33	19:06	19:40	20:11	20:38	20:42	20:16	19:30	18:39	16:57	16:40	23	16:02 (E01)
10	07:32	15:57 (E01)	07:09	07:29	06:38	05:56	05:36	05:45	06:12	06:43	07:13	06:48		07:21	15:40 (E01)	
	16:58	17	16:14 (E01)	17:35	19:07	19:41	20:12	20:38	20:41	20:15	19:28	18:38	16:56	16:40	23	16:03 (E01)
11	07:32	15:58 (E01)	07:08	07:27	06:36	05:55	05:36	05:46	06:13	06:44	07:14	06:50		07:22	15:40 (E01)	
	16:59	15	16:13 (E01)	17:36	19:09	19:42	20:13	20:39	20:41	20:14	19:26	18:36	16:55	16:40	23	16:03 (E01)
12	07:32	15:59 (E01)	07:07	07:26	06:35	05:54	05:36	05:46	06:14	06:45	07:15	06:51		07:23	15:41 (E01)	
	17:00	14	16:13 (E01)	17:37	19:10	19:43	20:14	20:39	20:41	20:12	19:25	18:35	16:54	16:40	23	16:04 (E01)
13	07:31	16:01 (E01)	07:05	07:24	06:33	05:53	05:36	05:47	06:15	06:46	07:16	06:52		07:23	15:41 (E01)	
	17:01	11	16:12 (E01)	17:38	19:11	19:44	20:15	20:40	20:40	20:11	19:23	18:33	16:53	16:40	24	16:05 (E01)
14	07:31	16:03 (E01)	07:04	07:22	06:32	05:52	05:36	05:48	06:16	06:47	07:17	06:53		07:24	15:41 (E01)	
	17:02	7	16:10 (E01)	17:40	19:12	19:45	20:16	20:40	20:40	20:10	19:21	18:32	16:52	16:40	24	16:05 (E01)
15	07:31	07:03	07:21	06:30	05:51	05:36	05:49	06:17	06:48	07:19	07:19	06:54		07:25	15:41 (E01)	
	17:03		17:41	19:13	19:46	20:17	20:41	20:39	20:08	19:20	18:30	16:51		16:41	25	16:06 (E01)
16	07:30	07:02	07:19	06:28	05:50	05:36	05:49	06:18	06:49	07:20	07:20	06:56		07:26	15:42 (E01)	
	17:04		17:42	19:14	19:47	20:18	20:41	20:39	20:07	19:18	18:28	16:50		16:41	24	16:06 (E01)
17	07:30	07:00	07:17	06:27	05:49	05:36	05:50	06:19	06:50	07:21	07:21	06:57		07:26	15:42 (E01)	
	17:05		17:43	19:15	19:48	20:19	20:41	20:38	20:06	19:16	18:27	16:49		16:41	24	16:06 (E01)
18	07:29	06:59	07:16	06:25	05:48	05:36	05:51	06:20	06:51	07:22	07:22	06:58		07:27	15:43 (E01)	
	17:07		17:44	19:16	19:49	20:20	20:42	20:37	20:04	19:15	18:25	16:49		16:41	24	16:07 (E01)
19	07:29	06:58	07:14	06:24	05:47	05:36	05:52	06:21	06:52	07:23	07:23	06:59		07:27	15:43 (E01)	
	17:08		17:46	19:17	19:50	20:21	20:42	20:37	20:03	19:13	18:24	16:48		16:42	25	16:08 (E01)
20	07:28	06:56	07:12	06:22	05:47	05:36	05:53	06:22	06:53	07:24	07:24	07:00		07:28	15:43 (E01)	
	17:09		17:47	19:18	19:51	20:22	20:42	20:36	20:01	19:11	18:22	16:47		16:42	25	16:08 (E01)
21	07:28	06:55	07:11	06:21	05:46	05:36	05:54	06:23	06:54	07:25	07:25	07:01		07:29	15:44 (E01)	
	17:10		17:48	19:19	19:52	20:23	20:43	20:35	20:00	19:10	18:21	16:46		16:43	25	16:09 (E01)
22	07:27	06:53	07:09	06:20	05:45	05:36	05:54	06:24	06:55	07:26	07:26	07:03		07:29	15:44 (E01)	
	17:11		17:49	19:21	19:53	20:24	20:43	20:35	19:58	19:08	18:20	16:46		16:43	25	16:09 (E01)
23	07:26	06:52	07:07	06:18	05:44	05:37	05:55	06:25	06:56	07:27	07:27	07:04		07:30	15:45 (E01)	
	17:12		17:50	19:22	19:54	20:25	20:43	20:34	19:57	19:06	18:18	16:45		16:43	25	16:10 (E01)
24	07:26	06:50	07:06	06:17	05:43	05:37	05:56	06:26	06:57	07:29	07:29	07:05		07:30	15:45 (E01)	
	17:14		17:51	19:23	19:55	20:25	20:43	20:33	19:55	19:04	18:17	16:44		16:44	25	16:10 (E01)
25	07:25	06:49	07:04	06:15	05:43	05:37	05:57	06:27	06:58	07:30	07:30	07:06		07:30	15:46 (E01)	
	17:15		17:53	19:24	19:56	20:26	20:43	20:32	19:54	19:03	18:15	16:44		16:45	24	16:10 (E01)
26	07:24	06:48	07:02	06:14	05:42	05:38	05:58	06:28	06:59	07:31	07:31	07:07		07:31	15:47 (E01)	
	17:16		17:54	19:25	19:57	20:27	20:44	20:31	19:52	19:01	18:14	16:43		16:45	24	16:11 (E01)
27	07:23	06:46	07:01	06:12	05:41	05:38	05:59	06:29	07:00	07:32	07:32	07:08		07:31	15:47 (E01)	
	17:17		17:55	19:26	19:58	20:28	20:44	20:30	19:51	18:59	18:13	16:43		16:46	24	16:11 (E01)
28	07:22	06:44	06:59	06:11	05:41	05:38	06:00	06:30	07:01	07:33	07:33	07:09		07:31	15:47 (E01)	
	17:18		17:56	19:27	20:00	20:29	20:44	20:29	19:49	18:58	18:11	16:42	7	15:43 (E01)	07:31	
29	07:22		06:57	06:10	05:40	05:39	06:01	06:31	07:02	07:34	07:34	07:10		15:41 (E01)	07:32	
	17:20		19:28	20:01	20:30	20:44	20:28	19:48	18:56	18:10	16:42	11	15:52 (E01)	16:47	24	16:12 (E01)
30	07:21		06:56	06:08	05:40	05:39	06:02	06:32	07:03	07:35	07:35	07:11		15:40 (E01)	07:32	
	17:21		19:29	20:02	20:31	20:44	20:27	19:46	18:54	18:09	16:42	14	15:54 (E01)	16:48	24	16:13 (E01)
31	07:20		06:54		05:39	06:03	06:33			07:37				07:32	15:49 (E01)	
	17:22		19:30		20:31	20:26	19:44			18:07				16:49	24	16:13 (E01)
Potential sun hours	298		297	369	398	448	451	458	428	375	346	298		288		
Total, worst case	254															708
Sun reduction	0.45												0.61			0.47
Oper. time red.	1.00												1.00			1.00
Wind dir. red.	0.89												0.89			0.89
Total reduction	0.40												0.54			0.42
Total, real	102												17			297

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker	(WTG causing flicker first time)
	Sun set (hh:mm)	Minutes with flicker	Last time (hh:mm) with flicker
			(WTG causing flicker last time)

Project:

Fountain Wind

Licensed user:

EDR

217 Montgomery St., Suite 1000
US-SYRACUSE, NY 13202
(315) 471 0688

Calculated:

9/3/2021 5:20 PM/3.4.415

SHADOW - Calendar

Shadow receptor: 43 - Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 0.0° (150)

Assumptions for shadow calculations

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.45	0.62	0.73	0.82	0.92	0.94	0.97	0.96	0.93	0.84	0.61	0.47

Operational time

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
23	65	319	1,935	1,830	119	5	24	340	1,432	1,766	761	99	19	10	13	8,760

	January	February	March	April	May	June	July	August	September	October	November	December
1	07:32	07:19	06:43	06:52	06:07	05:39	05:39	06:03	06:34	07:04	06:38	07:12
	16:49	17:23	17:57	19:31	20:03	20:32	20:43	20:25	19:43	18:52	18:06	16:41
2	07:32	07:18	06:41	06:51	06:06	05:38	05:40	06:04	06:35	07:05	06:39	07:13
	16:50	17:24	17:58	19:32	20:04	20:33	20:43	20:24	19:41	18:51	17:05	16:41
3	07:32	07:17	06:40	06:49	06:04	05:38	05:40	06:05	06:36	07:06	06:40	07:14
	16:51	17:26	17:59	19:33	20:05	20:33	20:43	20:23	19:39	18:49	17:03	16:41
4	07:33	07:16	06:38	06:47	06:03	05:37	05:41	06:06	06:37	07:07	06:41	07:15
	16:52	17:27	18:01	19:34	20:06	20:34	20:43	20:22	19:38	18:47	17:02	16:40
5	07:33	07:15	06:37	06:46	06:02	05:37	05:42	06:07	06:38	07:08	06:42	07:16
	16:53	17:28	18:02	19:35	20:07	20:35	20:43	20:21	19:36	18:46	17:01	16:40
6	07:32	07:14	06:35	06:44	06:01	05:37	05:42	06:08	06:39	07:09	06:44	07:17
	16:54	17:29	18:03	19:36	20:08	20:36	20:43	20:20	19:35	18:44	17:00	16:40
7	07:32	07:12	06:33	06:42	05:59	05:36	05:43	06:09	06:40	07:10	06:45	07:18
	16:55	17:31	18:04	19:37	20:09	20:36	20:42	20:18	19:33	18:43	16:59	16:40
8	07:32	07:11	07:32	06:41	05:58	05:36	05:43	06:10	06:41	07:11	06:46	07:19
	16:56	17:32	19:05	19:38	20:10	20:37	20:42	20:17	19:31	18:41	16:58	16:40
9	07:32	07:10	07:30	06:39	05:57	05:36	05:44	06:11	06:42	07:12	06:47	07:20
	16:57	17:33	19:06	19:39	20:11	20:37	20:42	20:16	19:30	18:39	16:57	16:40
10	07:32	07:09	07:29	06:38	05:56	05:36	05:45	06:12	06:43	07:13	06:48	07:21
	16:58	17:34	19:07	19:40	20:12	20:38	20:41	20:15	19:28	18:38	16:56	16:40
11	07:32	07:08	07:27	06:36	05:55	05:36	05:45	06:13	06:44	07:14	06:49	07:22
	16:59	17:36	19:08	19:41	20:13	20:39	20:41	20:13	19:26	18:36	16:55	16:40
12	07:31	07:07	07:25	06:34	05:54	05:36	05:46	06:14	06:45	07:15	06:51	07:22
	17:00	17:37	19:09	19:43	20:14	20:39	20:41	20:12	19:25	18:35	16:54	16:40
13	07:31	07:05	07:24	06:33	05:53	05:35	05:47	06:15	06:46	07:16	06:52	07:23
	17:01	17:38	19:11	19:44	20:15	20:40	20:40	20:11	19:23	18:33	16:53	16:40
14	07:31	07:04	07:22	06:31	05:52	05:35	05:48	06:16	06:47	07:17	06:53	07:24
	17:02	17:39	19:12	19:45	20:16	20:40	20:40	20:10	19:21	18:31	16:52	16:40
15	07:30	07:03	07:20	06:30	05:51	05:35	05:48	06:17	06:48	07:18	06:54	07:25
	17:03	17:41	19:13	19:46	20:17	20:40	20:39	20:08	19:20	18:30	16:51	16:40
16	07:30	07:01	07:19	06:28	05:50	05:35	05:49	06:18	06:49	07:19	06:55	07:25
	17:04	17:42	19:14	19:47	20:18	20:41	20:38	20:07	19:18	18:28	16:50	16:41
17	07:30	07:00	07:17	06:27	05:49	05:35	05:50	06:19	06:50	07:21	06:57	07:26
	17:05	17:43	19:15	19:48	20:19	20:41	20:38	20:05	19:16	18:27	16:49	16:41
18	07:29	06:59	07:16	06:25	05:48	05:36	05:51	06:20	06:51	07:22	06:58	07:27
	17:06	17:44	19:16	19:49	20:20	20:42	20:37	20:04	19:14	18:25	16:48	16:41
19	07:29	06:57	07:14	06:24	05:47	05:36	05:52	06:21	06:52	07:23	06:59	07:27
	17:08	17:45	19:17	19:50	20:21	20:42	20:37	20:03	19:13	18:24	16:48	16:41
20	07:28	06:56	07:12	06:22	05:46	05:36	05:52	06:22	06:53	07:24	07:00	07:28
	17:09	17:47	19:18	19:51	20:22	20:42	20:36	20:01	19:11	18:22	16:47	16:42
21	07:27	06:55	07:11	06:21	05:46	05:36	05:53	06:23	06:54	07:25	07:01	07:28
	17:10	17:48	19:19	19:52	20:23	20:43	20:35	20:00	19:09	18:21	16:46	16:42
22	07:27	06:53	07:09	06:19	05:45	05:36	05:54	06:24	06:55	07:26	07:02	07:29
	17:11	17:49	19:20	19:53	20:24	20:43	20:34	19:58	19:08	18:19	16:45	16:43
23	07:26	06:52	07:07	06:18	05:44	05:36	05:55	06:25	06:56	07:27	07:04	07:29
	17:12	17:50	19:21	19:54	20:24	20:43	20:34	19:57	19:06	18:18	16:45	16:43
24	07:25	06:50	07:06	06:16	05:43	05:37	05:56	06:26	06:57	07:28	07:05	07:30
	17:13	17:51	19:22	19:55	20:25	20:43	20:33	19:55	19:04	18:16	16:44	16:44
25	07:25	06:49	07:04	06:15	05:43	05:37	05:57	06:27	06:58	07:30	07:06	07:30
	17:15	17:52	19:24	19:56	20:26	20:43	20:32	19:54	19:03	18:15	16:44	16:44
26	07:24	06:47	07:02	06:14	05:42	05:37	05:58	06:28	06:59	07:31	07:07	07:31
	17:16	17:54	19:25	19:57	20:27	20:43	20:31	19:52	19:01	18:14	16:43	16:45
27	07:23	06:46	07:01	06:12	05:41	05:38	05:59	06:29	07:00	07:32	07:08	07:31
	17:17	17:55	19:26	19:58	20:28	20:43	20:30	19:51	18:59	18:12	16:43	16:46
28	07:22	06:44	06:59	06:11	05:41	05:38	06:00	06:30	07:01	07:33	07:09	07:31
	17:18	17:56	19:27	19:59	20:29	20:44	20:29	19:49	18:57	18:11	16:42	16:46
29	07:21		06:57	06:10	05:40	05:39	06:01	06:31	07:02	07:34	07:10	07:32
	17:19		19:28	20:00	20:30	20:44	20:28	19:47	18:56	18:10	16:42	16:47
30	07:21		06:56	06:08	05:40	05:39	06:01	06:32	07:03	07:35	07:11	07:32
	17:21		19:29	20:01	20:30	20:43	20:27	19:46	18:54	18:08	16:41	16:48
31	07:20		06:54		05:39		06:02	06:33		07:36		07:32
	17:22		19:30		20:31		20:26	19:44		18:07		16:48
Potential sun hours	298	297	369	398	448	452	458	428	375	346	298	288
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	(WTG causing flicker first time)	(WTG causing flicker last time)
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Project:

Fountain Wind

Licensed user:

EDR

217 Montgomery St., Suite 1000
US-SYRACUSE, NY 13202
(315) 471 0688

Calculated:

9/3/2021 5:20 PM/3.4.415

SHADOW - Calendar

Shadow receptor: 57 - Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 0.0° (151)

Assumptions for shadow calculations

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.45	0.62	0.73	0.82	0.92	0.94	0.97	0.96	0.93	0.84	0.61	0.47

Operational time

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
23	65	319	1,935	1,830	119	5	24	340	1,432	1,766	761	99	19	10	13	8,760

	January		February	March	April	May	June	July	August	September	October	November	December	
07:32	15:47 (E01)	07:19	06:43	06:52	06:07	05:39	05:40	06:04	06:34	07:04	06:38	07:12		
16:50	20	16:07 (E01)	17:23	17:57	19:31	20:03	20:32	20:44	20:25	19:43	18:53	18:06	16:41	
07:33	15:47 (E01)	07:18	06:41	06:51	06:06	05:38	05:40	06:05	06:35	07:05	06:39	07:13	15:41 (E01)	
16:50	20	16:07 (E01)	17:25	17:58	19:32	20:04	20:33	20:43	20:24	19:41	18:51	17:05	16:41	5 15:46 (E01)
07:33	15:48 (E01)	07:17	06:40	06:49	06:05	05:38	05:41	06:06	06:36	07:06	06:40	07:14	15:39 (E01)	
16:51	19	16:07 (E01)	17:26	18:00	19:33	20:05	20:34	20:43	20:23	19:40	18:49	17:04	16:41	10 15:49 (E01)
07:33	15:49 (E01)	07:16	06:38	06:48	06:03	05:38	05:41	06:06	06:37	07:07	06:41	07:15	15:38 (E01)	
16:52	18	16:07 (E01)	17:27	18:01	19:34	20:06	20:34	20:43	20:22	19:38	18:48	17:02	16:41	12 15:50 (E01)
07:33	15:50 (E01)	07:15	06:37	06:46	06:02	05:37	05:42	06:07	06:38	07:08	06:43	07:16	15:38 (E01)	
16:53	17	16:07 (E01)	17:28	18:02	19:35	20:07	20:35	20:43	20:21	19:36	18:46	17:01	16:40	14 15:52 (E01)
07:33	15:51 (E01)	07:14	06:35	06:44	06:01	05:37	05:42	06:08	06:39	07:09	06:44	07:17	15:38 (E01)	
16:54	16	16:07 (E01)	17:30	18:03	19:36	20:08	20:36	20:43	20:20	19:35	18:44	17:00	16:40	15 15:53 (E01)
07:33	15:52 (E01)	07:13	06:34	06:43	06:00	05:37	05:43	06:09	06:40	07:10	06:45	07:18	15:37 (E01)	
16:55	14	16:06 (E01)	17:31	18:04	19:37	20:09	20:36	20:42	20:19	19:33	18:43	16:59	16:40	17 15:54 (E01)
07:32	15:53 (E01)	07:11	07:32	06:41	05:59	05:36	05:44	06:10	06:41	07:11	06:46	07:19	15:36 (E01)	
16:56	13	16:06 (E01)	17:32	19:05	19:38	20:10	20:37	20:42	20:17	19:31	18:41	16:58	16:40	18 15:54 (E01)
07:32	15:55 (E01)	07:10	07:30	06:39	05:57	05:36	05:44	06:11	06:42	07:12	06:47	07:20	15:36 (E01)	
16:57	10	16:05 (E01)	17:33	19:06	19:40	20:11	20:38	20:42	20:16	19:30	18:39	16:57	16:40	19 15:55 (E01)
07:32	15:58 (E01)	07:09	07:29	06:38	05:56	05:36	05:45	06:12	06:43	07:13	06:48	07:21	15:37 (E01)	
16:58	6	16:04 (E01)	17:35	19:07	19:41	20:12	20:38	20:41	20:15	19:28	18:38	16:56	16:40	19 15:56 (E01)
07:32	17:36	07:08	07:27	06:36	05:55	05:36	05:46	06:13	06:44	07:14	06:50	07:22	15:37 (E01)	
16:59	17:36	19:09	19:42	20:13	20:39	20:41	20:14	19:26	18:36	16:55	16:40	20	15:57 (E01)	
07:32	17:00	07:07	07:26	06:35	05:54	05:36	05:46	06:14	06:45	07:15	06:51	07:23	15:37 (E01)	
17:00	17:37	19:10	19:43	20:14	20:39	20:41	20:12	19:25	18:35	16:54	16:40	21	15:58 (E01)	
07:31	17:01	07:05	07:24	06:33	05:53	05:36	05:47	06:15	06:46	07:16	06:52	07:23	15:38 (E01)	
17:01	17:38	19:11	19:44	20:15	20:40	20:40	20:11	19:23	18:33	16:53	16:40	21	15:59 (E01)	
07:31	17:02	07:04	07:22	06:32	05:52	05:36	05:48	06:16	06:47	07:17	06:53	07:24	15:37 (E01)	
17:02	17:40	19:12	19:45	20:16	20:40	20:40	20:10	19:21	18:32	16:52	16:40	22	15:59 (E01)	
07:31	17:03	07:03	07:21	06:30	05:51	05:36	05:49	06:17	06:48	07:19	06:54	07:25	15:38 (E01)	
17:03	17:41	19:13	19:46	20:17	20:41	20:39	20:08	19:20	18:30	16:51	16:41	21	15:59 (E01)	
07:30	17:04	07:02	07:19	06:28	05:50	05:36	05:49	06:18	06:49	07:20	06:56	07:26	15:38 (E01)	
17:04	17:42	19:14	19:47	20:18	20:41	20:39	20:07	19:18	18:28	16:50	16:41	22	16:00 (E01)	
07:30	17:05	07:00	07:17	06:27	05:49	05:36	05:50	06:19	06:50	07:21	06:57	07:26	15:38 (E01)	
17:05	17:43	19:15	19:48	20:19	20:41	20:38	20:06	19:16	18:27	16:49	16:41	22	16:00 (E01)	
07:29	17:07	06:59	07:16	06:25	05:48	05:36	05:51	06:20	06:51	07:22	06:58	07:27	15:39 (E01)	
17:07	17:44	19:16	19:49	20:20	20:42	20:37	20:04	19:15	18:25	16:49	16:41	22	16:01 (E01)	
07:29	17:08	06:58	07:14	06:24	05:47	05:36	05:52	06:21	06:52	07:23	06:59	07:27	15:40 (E01)	
17:08	17:46	19:17	19:50	20:21	20:42	20:37	20:03	19:13	18:24	16:48	16:42	22	16:02 (E01)	
07:28	17:09	06:56	07:12	06:22	05:47	05:36	05:53	06:22	06:53	07:24	07:00	07:28	15:39 (E01)	
17:09	17:47	19:18	19:51	20:22	20:42	20:36	20:01	19:11	18:22	16:47	16:42	23	16:02 (E01)	
07:28	17:10	06:55	07:11	06:21	05:46	05:36	05:54	06:23	06:54	07:25	07:01	07:29	15:40 (E01)	
17:10	17:48	19:19	19:52	20:23	20:43	20:35	20:00	19:10	18:21	16:46	16:43	23	16:03 (E01)	
07:27	17:11	06:53	07:09	06:20	05:45	05:36	05:54	06:24	06:55	07:26	07:03	07:29	15:40 (E01)	
17:11	17:49	19:21	19:53	20:24	20:43	20:35	19:58	19:08	18:20	16:46	16:43	23	16:03 (E01)	
07:26	17:12	06:52	07:07	06:18	05:44	05:37	05:55	06:25	06:56	07:27	07:04	07:30	15:41 (E01)	
17:12	17:50	19:22	19:54	20:25	20:43	20:34	19:57	19:06	18:18	16:45	16:43	23	16:04 (E01)	
07:26	17:14	06:50	07:06	06:17	05:43	05:37	05:56	06:26	06:57	07:29	07:05	07:30	15:42 (E01)	
17:14	17:51	19:23	19:55	20:25	20:43	20:33	19:55	19:04	18:17	16:44	16:44	22	16:04 (E01)	
07:25	17:15	06:49	07:04	06:15	05:43	05:37	05:57	06:27	06:58	07:30	07:06	07:30	15:42 (E01)	
17:15	17:53	19:24	19:56	20:26	20:43	20:32	19:54	19:03	18:15	16:44	16:45	22	16:04 (E01)	
07:24	17:16	06:48	07:02	06:14	05:42	05:38	05:58	06:28	06:59	07:31	07:07	07:31	15:43 (E01)	
17:16	17:54	19:25	19:57	20:27	20:44	20:31	19:52	19:01	18:14	16:43	16:45	22	16:05 (E01)	
07:23	17:17	06:46	07:01	06:12	05:41	05:38	05:59	06:29	07:00	07:32	07:08	07:31	15:43 (E01)	
17:17	17:55	19:26	19:58	20:28	20:44	20:30	19:51	18:59	18:13	16:43	16:46	22	16:05 (E01)	
07:22	17:18	06:45	06:59	06:11	05:41	05:38	06:00	06:30	07:01	07:33	07:09	07:31	15:44 (E01)	
17:18	17:56	19:27	20:00	20:29	20:44	20:29	19:49	18:58	18:11	16:42	16:46	21	16:05 (E01)	
07:22	17:20	06:57	06:10	05:40	05:39	06:01	06:31	07:02	07:34	07:10	07:32	15:44 (E01)		
17:20	17:21	19:28	20:01	20:30	20:44	20:28	19:48	18:56	18:10	16:42	16:47	22	16:06 (E01)	
07:21	17:21	06:56	06:08	05:40	05:39	06:02	06:32	07:03	07:35	07:11	07:32	15:45 (E01)		
17:21	17:22	19:29	20:02	20:31	20:44	20:27	19:46	18:54	18:09	16:42	16:48	22	16:07 (E01)	
07:20	17:22	06:54	05:39	05:39	06:03	06:33	07:03	07:37	07:37	07:37	07:32	15:46 (E01)		
298		297	369	398	448	451	458	428	375	346	298	288		
153														588
0.45														0.47
1.00														1.00
0.89														0.89
0.40														0.42
61														247

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker	Last time (hh:mm) with flicker	(WTG causing flicker first time)	(WTG causing flicker last time)
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Project:

Fountain Wind

Licensed user:

EDR
217 Montgomery St., Suite 1000
US-SYRACUSE, NY 13202
(315) 471 0688

Calculated:

9/3/2021 5:20 PM/3.4.415

SHADOW - Calendar

Shadow receptor: 58 - Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 0.0° (152)

Assumptions for shadow calculations

Sunshine probability S/S0 (Sun hours/Possible sun hours) []

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
0.45 0.62 0.73 0.82 0.92 0.94 0.97 0.96 0.93 0.84 0.61 0.47

Operational time

N NNE NE ENE E ESE SE SSE S SSW SW WSW W WNW NW NNW Sum
23 65 319 1,935 1,830 119 5 24 340 1,432 1,766 761 99 19 10 13 8,760

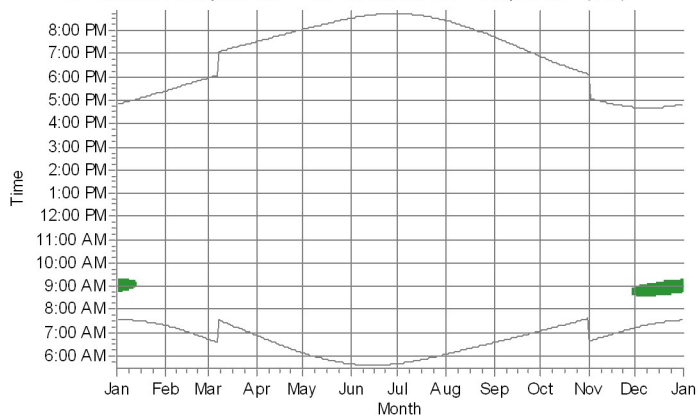
	January	February	March	April	May	June	July	August	September	October	November	December
1	07:32 16:50	07:19 17:24	06:43 17:57	06:53 19:31	06:07 20:03	06:44 (M10) 19:40 (M08)	05:39 20:08 (M08)	05:40 20:18 (M08)	06:04 20:25	19:36 (M08) 20:01 (M08)	06:34 19:43	07:04 18:53
2	07:32 16:51	07:18 17:25	06:41 17:59	06:51 19:32	06:06 20:04	06:45 (M10) 19:42 (M08)	05:39 20:08 (M08)	05:40 20:18 (M08)	06:05 20:24	19:36 (M08) 20:00 (M08)	06:35 19:41	07:05 18:51
3	07:32 16:52	07:17 17:26	06:40 18:00	06:49 19:33	06:05 20:05	06:44 (M10) 19:42 (M08)	05:38 20:09 (M08)	05:41 20:18 (M08)	06:06 20:23	19:37 (M08) 19:59 (M08)	06:36 19:40	07:06 18:49
4	07:32 16:52	07:16 17:27	06:38 18:01	06:48 19:34	06:03 20:06	06:45 (M10) 19:43 (M08)	05:38 20:09 (M08)	05:41 20:18 (M08)	06:07 20:22	19:31 (M08) 19:58 (M08)	06:37 19:38	07:07 18:48
5	07:32 16:53	07:15 17:29	06:37 18:02	06:46 19:35	06:02 20:07	06:46 (M10) 19:44 (M08)	05:37 20:10 (M08)	05:42 20:17 (M08)	06:08 20:21	19:30 (M08) 19:57 (M08)	06:38 19:36	07:08 18:46
6	07:32 16:54	07:14 17:30	06:35 18:03	06:44 19:36	06:01 20:08	06:47 (M10) 19:45 (M08)	05:37 20:11 (M08)	05:43 20:17 (M08)	06:09 20:20	19:31 (M08) 19:56 (M08)	06:39 19:35	07:09 18:44
7	07:32 16:55	07:12 17:31	06:34 18:04	06:43 19:37	06:00 20:09	06:49 (M10) 19:46 (M08)	05:37 20:12 (M08)	05:43 20:17 (M08)	06:10 20:18	19:30 (M08) 19:55 (M08)	06:40 19:33	07:10 18:43
8	07:32 16:56	07:11 17:32	06:41 18:05	06:41 19:38	05:59 20:10	06:51 (M10) 19:47 (M08)	05:37 20:12 (M08)	05:44 20:17 (M08)	06:11 20:17	19:31 (M08) 19:53 (M08)	06:41 19:31	07:11 18:41
9	07:32 16:57	07:10 17:33	06:40 18:06	06:40 19:39	05:58 20:11	06:54 (M10) 19:48 (M08)	05:36 20:12 (M08)	05:45 20:17 (M08)	06:12 20:16	19:31 (M08) 19:52 (M08)	06:42 19:30	07:12 18:40
10	07:32 16:58	07:09 17:35	06:38 18:08	06:38 19:41	05:56 20:12	19:27 (M08) 19:49 (M08)	05:36 20:13 (M08)	05:45 20:18 (M08)	06:12 20:15	19:31 (M08) 19:51 (M08)	06:43 19:28	07:13 18:38
11	07:32 16:59	07:08 17:36	06:37 18:09	06:36 19:42	05:55 20:13	19:26 (M08) 19:50 (M08)	05:36 20:14 (M08)	05:46 20:19 (M08)	06:13 20:14	19:31 (M08) 19:50 (M08)	06:44 19:26	07:14 18:36
12	07:31 17:00	07:07 17:37	06:36 18:10	06:35 19:43	05:54 20:14	19:26 (M08) 19:51 (M08)	05:36 20:14 (M08)	05:47 20:16 (M08)	06:14 20:12	19:32 (M08) 19:49 (M08)	06:45 19:25	07:15 18:35
13	07:31 17:01	07:05 17:38	06:34 18:11	06:33 19:44	05:53 20:15	19:25 (M08) 19:52 (M08)	05:36 20:15 (M08)	05:47 20:16 (M08)	06:15 20:11	19:31 (M08) 19:51 (M08)	06:46 19:23	07:16 18:33
14	07:31 17:02	07:04 17:40	06:32 18:12	06:32 19:45	05:52 20:16	19:25 (M08) 19:53 (M08)	05:36 20:15 (M08)	05:48 20:17 (M08)	06:16 20:10	19:31 (M08) 19:52 (M08)	06:47 19:21	07:17 18:32
15	07:30 17:03	07:03 17:41	06:30 18:13	06:30 19:46	05:51 20:17	19:24 (M08) 19:54 (M08)	05:36 20:16 (M08)	05:49 20:18 (M08)	06:17 20:08	19:32 (M08) 19:53 (M08)	06:48 19:20	07:18 18:30
16	07:30 17:05	07:02 17:42	06:29 18:14	06:29 19:47	05:50 20:18	19:24 (M08) 19:55 (M08)	05:36 20:17 (M08)	05:50 20:18 (M08)	06:18 20:07	19:32 (M08) 19:54 (M08)	06:49 19:18	07:20 18:29
17	07:30 17:06	07:00 17:43	06:27 18:15	06:27 19:48	05:49 20:19	19:23 (M08) 19:56 (M08)	05:36 20:18 (M08)	05:50 20:19 (M08)	06:19 20:05	19:31 (M08) 19:55 (M08)	06:50 19:16	07:21 18:27
18	07:29 17:07	06:59 17:44	06:26 18:16	06:26 19:49	05:48 20:20	06:53 (M10) 07:08 (M10)	05:49 20:19 (M08)	05:51 20:20 (M08)	06:20 20:04	19:32 (M08) 19:56 (M08)	06:51 19:15	07:22 18:26
19	07:29 17:08	06:57 17:46	06:24 18:17	06:24 19:50	05:48 20:21	06:51 (M10) 07:09 (M10)	05:48 20:20 (M08)	05:52 20:21 (M08)	06:21 20:03	19:32 (M08) 19:57 (M08)	06:52 19:13	07:23 18:24
20	07:28 17:09	06:56 17:47	06:23 18:18	06:23 19:51	05:47 20:22	06:49 (M10) 07:11 (M10)	05:47 20:21 (M08)	05:53 20:22 (M08)	06:22 20:01	19:33 (M08) 19:58 (M08)	06:52 19:11	07:24 18:23
21	07:27 17:10	06:55 17:48	06:21 18:19	06:21 19:52	05:46 20:23	06:47 (M10) 07:11 (M10)	05:46 20:22 (M08)	05:54 20:23 (M08)	06:23 20:00	19:33 (M08) 19:59 (M08)	06:54 19:10	07:25 18:21
22	07:27 17:11	06:53 17:49	06:19 18:21	06:20 19:53	05:45 20:24	06:47 (M10) 07:12 (M10)	05:45 20:23 (M08)	05:55 20:24 (M08)	06:24 19:58	19:33 (M08) 19:58 (M08)	06:55 19:08	07:26 18:20
23	07:26 17:13	06:52 17:50	06:18 18:22	06:18 19:54	05:44 20:25	06:46 (M10) 07:13 (M10)	05:44 20:24 (M08)	05:55 20:25 (M08)	06:25 19:57	19:33 (M08) 19:57 (M08)	06:56 19:06	07:27 18:18
24	07:25 17:14	06:50 17:52	06:17 18:23	06:17 19:55	05:44 20:26	06:45 (M10) 07:14 (M10)	05:44 20:25 (M08)	05:56 20:26 (M08)	06:26 19:55	19:33 (M08) 19:58 (M08)	06:57 19:04	07:28 18:17
25	07:25 17:15	06:49 17:53	06:15 18:24	06:15 19:56	05:43 20:27	06:45 (M10) 07:15 (M10)	05:43 20:26 (M08)	05:57 20:27 (M08)	06:27 19:54	19:33 (M08) 20:07 (M08)	06:58 19:03	07:30 18:15
26	07:24 17:16	06:47 17:54	06:14 18:25	06:14 19:57	05:42 20:28	06:44 (M10) 07:16 (M10)	05:38 20:27 (M08)	05:58 20:28 (M08)	06:28 19:52	19:34 (M08) 20:08 (M08)	06:59 19:01	07:31 18:14
27	07:23 17:17	06:46 17:55	06:13 18:26	06:13 19:58	05:42 20:29	06:44 (M10) 07:17 (M10)	05:38 20:28 (M08)	05:59 20:29 (M08)	06:29 19:51	19:34 (M08) 20:06 (M08)	07:00 19:00	07:32 18:13
28	07:22 17:19	06:44 17:56	06:11 18:27	06:11 19:59	05:41 20:30	06:44 (M10) 07:18 (M10)	05:39 20:29 (M08)	06:00 20:30 (M08)	06:30 19:49	19:35 (M08) 20:05 (M08)	07:01 19:01	07:33 18:11
29	07:21 17:20	06:57 17:58	06:10 18:28	06:10 19:59	05:41 20:31	06:43 (M10) 07:19 (M10)	05:41 20:30 (M08)	06:01 20:31 (M08)	06:31 19:48	19:36 (M08) 20:06 (M08)	07:02 19:02	07:34 18:10
30	07:21 17:21	06:56 17:59	06:09 18:29	06:09 19:59	05:40 20:32	06:44 (M10) 07:20 (M10)	05:40 20:31 (M08)	06:02 20:32 (M08)	06:32 19:46	19:36 (M08) 20:07 (M08)	07:03 19:03	07:35 18:09
31	07:20 17:22	06:54 18:00	06:08 18:30	06:08 19:30	05:39 20:31	06:44 (M10) 20:07 (M08)	05:39 20:32 (M08)	06:03 20:33 (M08)	06:33 19:44	19:35 (M08) 20:08 (M08)	07:04 19:04	07:36 18:07
Potential sun hours	298	297	369	398	447	451	458	428	375	346	299	288
Total, worst case				338	1063	1436	1241	706				
Sun reduction				0.82	0.92	0.94	0.97	0.96				
Oper. time red.				1.00	1.00	1.00	1.00	1.00				
Wind dir. red.				0.76	0.52	0.47	0.47	0.69				
Total reduction				0.63	0.48	0.44	0.45	0.66				
Total, real				213	507	631	562	468				

Table layout: For each day in each month the following matrix apply

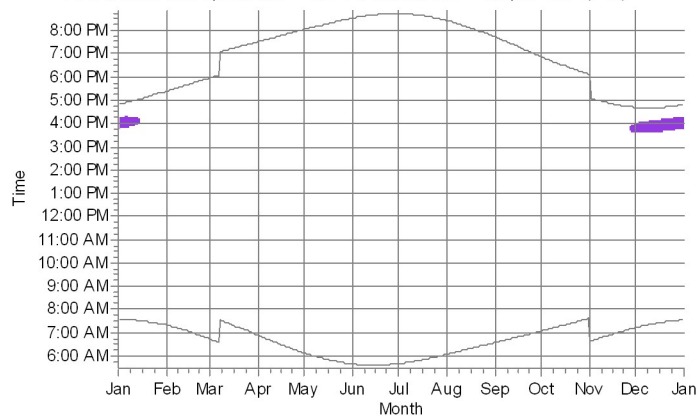
Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker	(WTG causing flicker first time)
	Sun set (hh:mm)	Last time (hh:mm) with flicker	(WTG causing flicker last time)
	Minutes with flicker		

SHADOW - Calendar, graphical

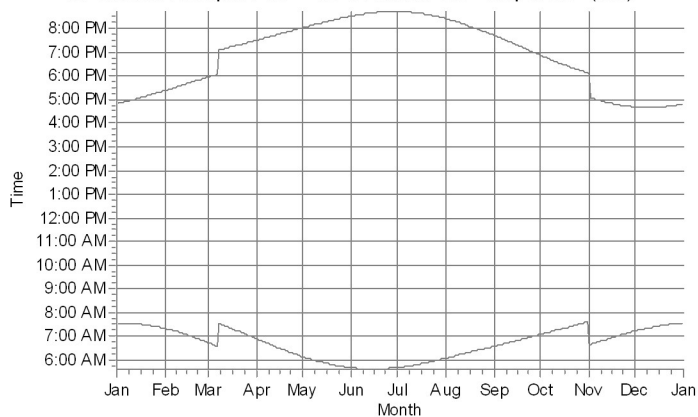
1: Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 0.0° (148)



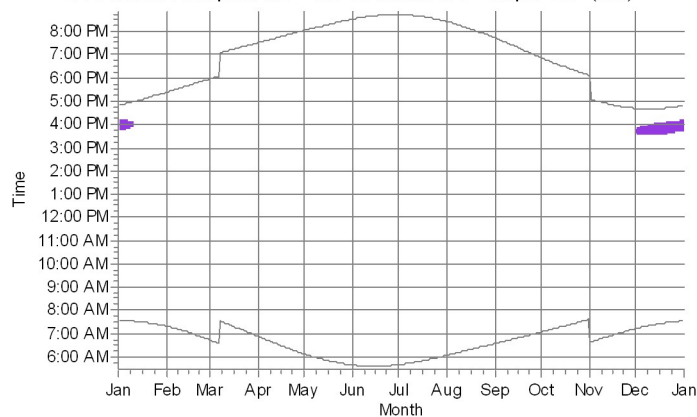
2: Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 0.0° (149)



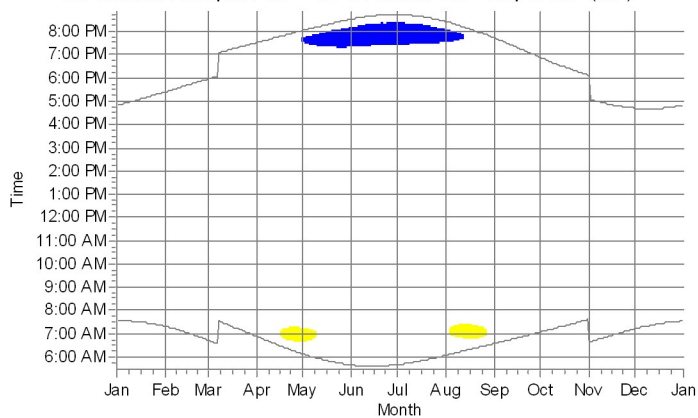
43: Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 0.0° (150)



57: Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 0.0° (151)



58: Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 0.0° (152)



WTGs

M10: Siemens Gamesa SG 6.0-170 6200 170.0 IOI hub: 100.0 m (TOT: 185.0 m) (141)
M08: Siemens Gamesa SG 6.0-170 6200 170.0 IOI hub: 100.0 m (TOT: 185.0 m) (142)

L04: Siemens Gamesa SG 6.0-170 6200 170.0 IOI hub: 100.0 m (TOT: 185.0 m) (146)
E01: Siemens Gamesa SG 6.0-170 6200 170.0 IOI hub: 100.0 m (TOT: 185.0 m) (185)