Large Filing Separator Sheet

Case Number: 09-980-EL-BGN

File Date: 1/13/10

Section: 7

Number of Pages: 152

Description of Document: Application

BERR, 2008). Therefore, the analysis presented herein is expected to be an inclusive (and conservative) projection of the shadow flicker effects of the proposed Timber Road Wind Farm.

The model calculation includes the cumulative sum of shadow hours for all turbines. This omni-directional approach reports total shadow-flicker results at a receptor regardless of the presence or orientation of windows at the receptor residence (i.e., it assumes shadows from all directions can be perceived at a residence, 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 house are not taken into consideration.

4.0 RESULTS

Output from the model includes the following information:

- Calculated shadow-flicker time (hours per year) at receptors within 1,000 meters.
- Tabulated and plotted time of day that receptors receive shadow flicker.
- Map showing turbine locations, identified shadow-flicker receptors, and projected shadow-flicker time (hours per year).

Each inventoried structure was evaluated to determine projected shadow flicker. Of the 193 structures identified within 1,000 meters of any turbine and evaluated in this study:

- 90 (47%) will not be affected at all,
- 4 (2%) will be affected less than 1 hour/year,
- 35 (18%) will be affected 1-5 hours/year,
- 16 (8%) will be affected 5-10 hours/year,
- 26 (13%) will be affected 10-20 hours/year,
- 11 (6%) will be affected 20-30 hours/year,
- 11 (6%) will be affected 30-47 hours/year, and
- none will be affected more than 47 hours/year.

5.0 DISCUSSION

Section 4906-17-08(A)(6) of the Ohio Administrative Code (OAC) requires the Applicant to "evaluate and describe the potential impact from shadow flicker at adjacent residential structures and primary roads..." With respect to primary roads[1], the shadow flicker maps in Attachment B depict the expected shadow flicker at all areas (including roads) in the vicinity of the proposed Facility. However, the model results generated by WindPRO assume a stationary object, which remains fixed 24 hours/day, 365 days/year. Therefore, because primary road users are mobile (typically in a motorized vehicle traveling at a relatively high speed), any Facility-related shadow flicker experienced by such users would be a tiny fraction of that experienced by a stationary object. Furthermore, most vehicle operators are already accustomed to shadow flicker while driving, since shadows cast from nearby objects (e.g., trees, roadside/overhead signage, etc.) will "flicker" across the windows of a moving vehicle.

As described above, this analysis focuses on receptors within 1,000 meters of proposed turbine sites, since shadow flicker effects are essentially undetectable beyond that distance (U.S. Department of Interior, 2005; BERR, 2008). This is because shadow flicker intensity diminishes as the distance between receptors and turbines increases. There are no schools, hospitals, libraries, golf courses, parks, registered historic sites, scenic byways, or scenic rivers within 1,000 meters of any turbine site (EDR, 2009). Therefore, no shadow flicker affects are anticipated to any of these visually sensitive resources.

The shadow flicker assumptions applied to the model for this Facility are conservative, and as such, the analysis is expected to over-predict the actual impacts. Trees and nearby buildings (such as barns) could significantly reduce or eliminate shadow flicker impacts at these receptor locations. In addition, many of the modeled shadow flicker hours are expected to be of low intensity. Table 1 summarizes the predicted shadow flicker data for each receptor calculated to experience greater than 10 hours/year.

[1] The term "primary roads" is not defined in OAC 4906-17. However, the Interactive Electric Maps available at the PUCO website (http://www.puco.ohio.gov/PUCO/GIS/) depict "major roads" and "secondary roads", and as portrayed, "major roads" include interstates, US highways, and state highways. Assuming primary roads and major roads are defined the same, primary roads in the vicinity of the Facility include US Highway 24 and State Routes 49, 111, and 500.

Table 1. Shadow Flicker Summary for Receptors Projected to Experience >10 hours/year

Receptor ID	Possible shadow Flicker Days (days/year)	Maximum Flicker Hours per Day (h:mm/day)	Predicted Shadow Flicker (hh:mm/year)
FA	62	0:45	10:09
BI	64	0:27	10:17
CJ	104	0:37	10:27
EM	96	0:30	10:49
ED	125	0:49	11:17
FI	53	0:40	11:34
AB	133	0:32	11:38
AC	110	0:39	11:47
EP	78	0:23	11:54
AM	96	0:37	12:05
AL	106	0:52	12:50
CV	111	0:22	13:06
EL	102	0:28	13:28
FB	83	0:45	14:09
BJ	76	0:27	14:26
CL	142	0:30	14:35
AN	113	0:42	14:54
W	103	0:59	15:28
AK	117	0:48	15:46
V	110	0:56	15:48
X	90	1:01	16:16
AA	105	0:59	17:29
FD	178	0:27	17:52
CI	133	0:44	18:08
CA	133	0:54	18:27
S	185	0:41	19:57
T	183	0:35	21:02
O	146	0:51	21:35
EE	157	0:31	22:11
CF	186	0:30	22:31
EJ	202	0:32	23:04
CW	142	0:51	23:11
CP	150	0:54	24:59
EH	178	0:45	26:09
EI	223	0:33	26:48
AE	179	0:46	26:51
FC	197	0:33	29:34
EG	161	0:52	30:32
CB	225	0:46	31:46
CC	214	0:52	31:57
P	149	0:59	32:16

Receptor ID	Possible shadow Flicker Days (days/year)	Maximum Flicker Hours per Day (h:mm/day)	Predicted Shadow Flicker (hh:mm/year)
CE	189	0:44	33:05
CD	196	0:57	33:06
CN	204	0:56	33:20
U	206	0:39	35:46
CO	231	0:52	40:27
EF	190	0:48	40:28
CM	284	0:52	46:02

No existing national, state, county, or local standards exist for frequency or duration of shadow flicker from wind turbines at the Facility site. However, international regulations, studies, and guidelines from Europe and Australia have suggested 30 hours of shadow flicker per year as the threshold of significant impact, or the point at which shadow flicker is commonly perceived as an annoyance. For example, a court in Germany ruled that the maximum allowable flicker would be 30 hours per year (Klepinger, 2007). In Austria, Dobesch and Kury (2001) recommended that shadow flicker should not exceed 30 hours per year. Guidelines for wind power development in the State of Victoria, Australia specify that shadow flicker may not exceed 30 hours per year at any dwelling in the surrounding area (Sustainable Energy Authority Victoria, 2003).

Accordingly, a threshold of 30 hours of shadow flicker per year was used in this analysis to evaluate potential shadow flicker impacts to area residences from the proposed Facility. As indicated above, 11 receptors out of 193 (6%) are predicted to exceed that threshold. It should be noted that of these 11 receptors, one is a Project participants and the Applicant is currently discussing neighbor agreements with the remaining ten non-participant homeowners. Table 2 summarizes the shadow flicker anticipated at the 11 affected receptors. Also refer to Attachment C, which contains graphical calendars produced by WindPRO that illustrate the times of year and day when receptors are anticipated to receive shadow flicker effects.

Table 2. Shadow Flicker Summary for Receptors Projected to Experience >30 hours/year

Receptor ID	Project Status	Predicted Shadow Flicker (hh:mm/year)	Turbines Contributing Shadow Flicker	Approximate Times of Day Receptor Potentially Affected by Flicker[1]
EG	Non-participant	30:32	D8, D9, D10, E7, E8	7-9 AM, 4:45-9 PM
CB	Non-participant	31:46	C5, C6, C7, D7, D8	6:30-9:15 AM, 4:15-8:15 PM
CC	Non-participant	31:57	C5, C6, C7, D7, D8	6:30-9:15 AM, 4:15-8:15 PM
P	Non-participant	32:16	E1, E2, E3, F1, F2	7-9:15 AM, 5:45-9 PM
CE	Non-participant	33:05	C5, C6, C7, D7, D8	7-9 AM, 4-8:30 PM
CD	Non-participant	33:06	C5, C6, C7, D7, D8	6:30-9 AM, 4:15-8:15 PM
CN	Non-participant	33:20	D5, D6, D7, E4, E5, E6	6:45-9 AM, 4-8 PM
U	Non-participant	35:46	D3, D4, E3, E4	6:30-8:45 AM, 4-8:30 PM
CO	Non-participant	40:27	D4, D5, D6, E4, E5, E6	7-9 AM, 4:15-8:45 PM
EF	Non-participant	40:28	D8, D9, D10, E7, E8	6:15-9 AM, 5:30-8:30 PM
CM	Participant	46:02	D5, D6, D7, E4, E5, E6	6:30-9 AM, 4-8:30 PM

[1] 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. The times of day presented here represent the full range of times during which each receptor could potentially experience shadow flicker throughout the year; however, no receptors will experience shadow flicker every day during all those hours. See Attachment C for graphical calendars that illustrate the specific times of year and day that each receptor will experience shadow flicker.

Although shadow flicker at ten non-participating receptors exceeds the nominal 30 hours per year threshold, these calculations do not take into account the screening effects associated with existing site-specific conditions such as vegetation and/or buildings. It is also important to note that only 23-32 turbines will be constructed at the proposed Facility, as stated above. Since 35 turbines were evaluated in the WindPRO analysis, the constructed Facility and associated shadow flicker impacts will be significantly smaller in comparison. Attachment D provides aerial photographs of the 11 receptors listed in Table 2, and these images indicate that existing trees and/or structures will reduce some of the anticipated shadow flicker at most of these receptors. Furthermore, the analysis presented herein assumes that there are windows on every side of the identified structures. If necessary, mitigation measures could include vegetative planting/screening or window treatments.

6.0 REFERENCES

British Epilepsy Association. 2007. *Photosensitive Epilepsy.* Epilepsy Action, Yeadon Leeds, UK.

Department for Business Enterprise & Regulatory Reform (BERR). Accessed online in January 2009 at http://www.berr.gov.uk/whatwedo/energy/sources/renewables/planning/onshore-wind/

Dobesch and Kury. 2001. *Basic Meteorological Concepts and Recommendations for the Exploration of Wind Energy in the Atmospheric Boundary Layer.* Central Institute for Meteorology and Geodymanics (ZAMG), Vienna, Austria.

Environmental Design & Research, Landscape Architecture, Planning, Environmental Services, Engineering and Surveying, P.C. (EDR). 2009. *Visual Impact Assessment, Timber Road Wind Farm.* Prepared for Horizon Wind Energy. October 2009.

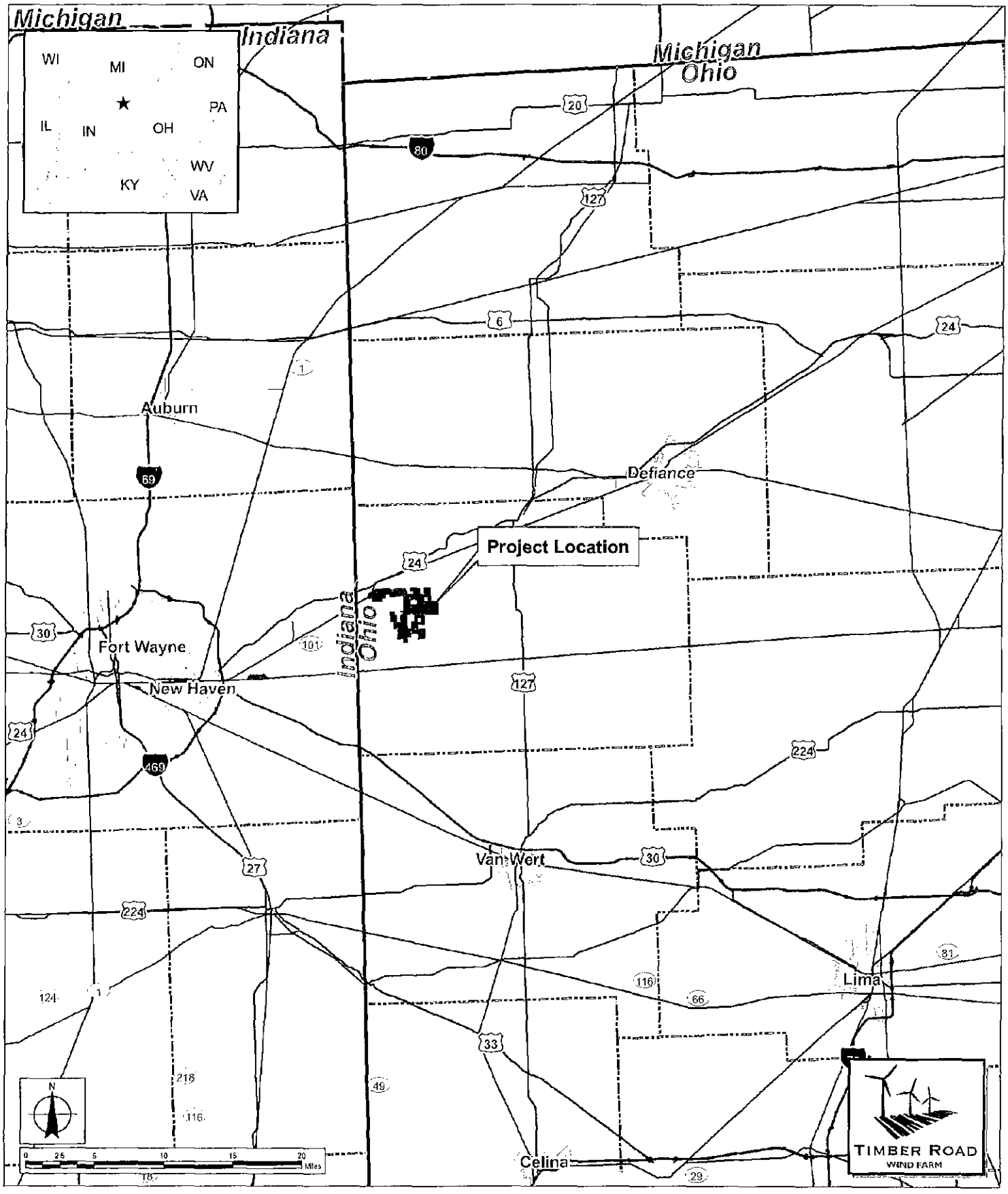
Gipe, P.B. 1995. *Wind Energy Comes Alive.* John Wiley & Sons, Inc. New York, NY.

Klepinger, Michael. 2007. *Michigan Land Use Guidelines for Siting Wind Energy Systems.* Michigan State Extension Bulletin, February.

Sustainable Energy Authority Victoria. 2003. *Policy Planning and Guidelines for Development of Wind Energy Facilities in Victoria.* Sustainable Energy Authority Victoria, Melbourne Victoria, Australia.

U.S. Department of 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



■ Timber Road Wind Farm

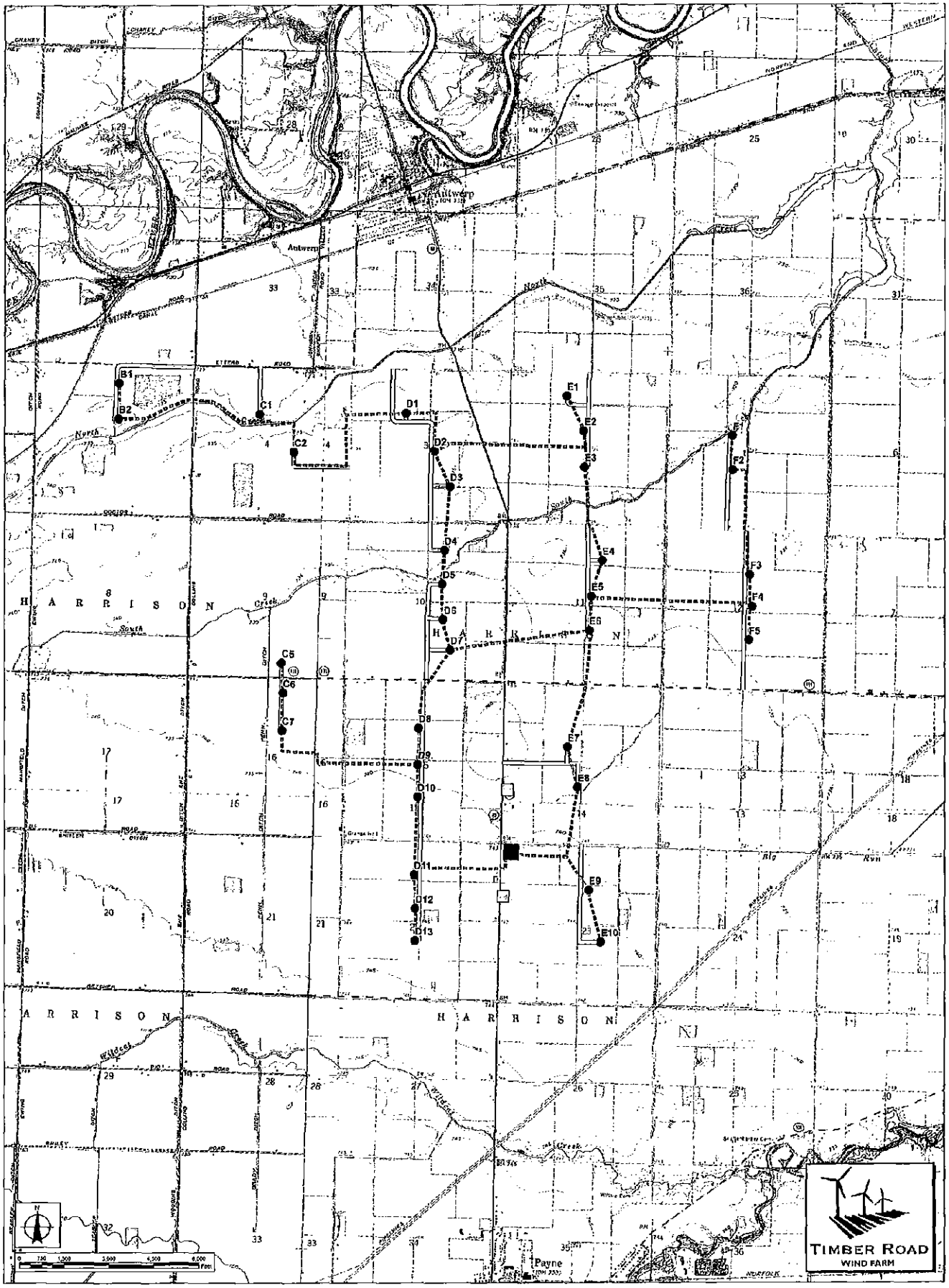
Harrison Township - Paulding County, Ohio

Figure 1: Regional Project Location

December 2009

Notes:
Base Map: ESRI StreetMap North America 2008.

EDR



Timber Road Wind Farm

Harrison Township - Paulding County, Ohio

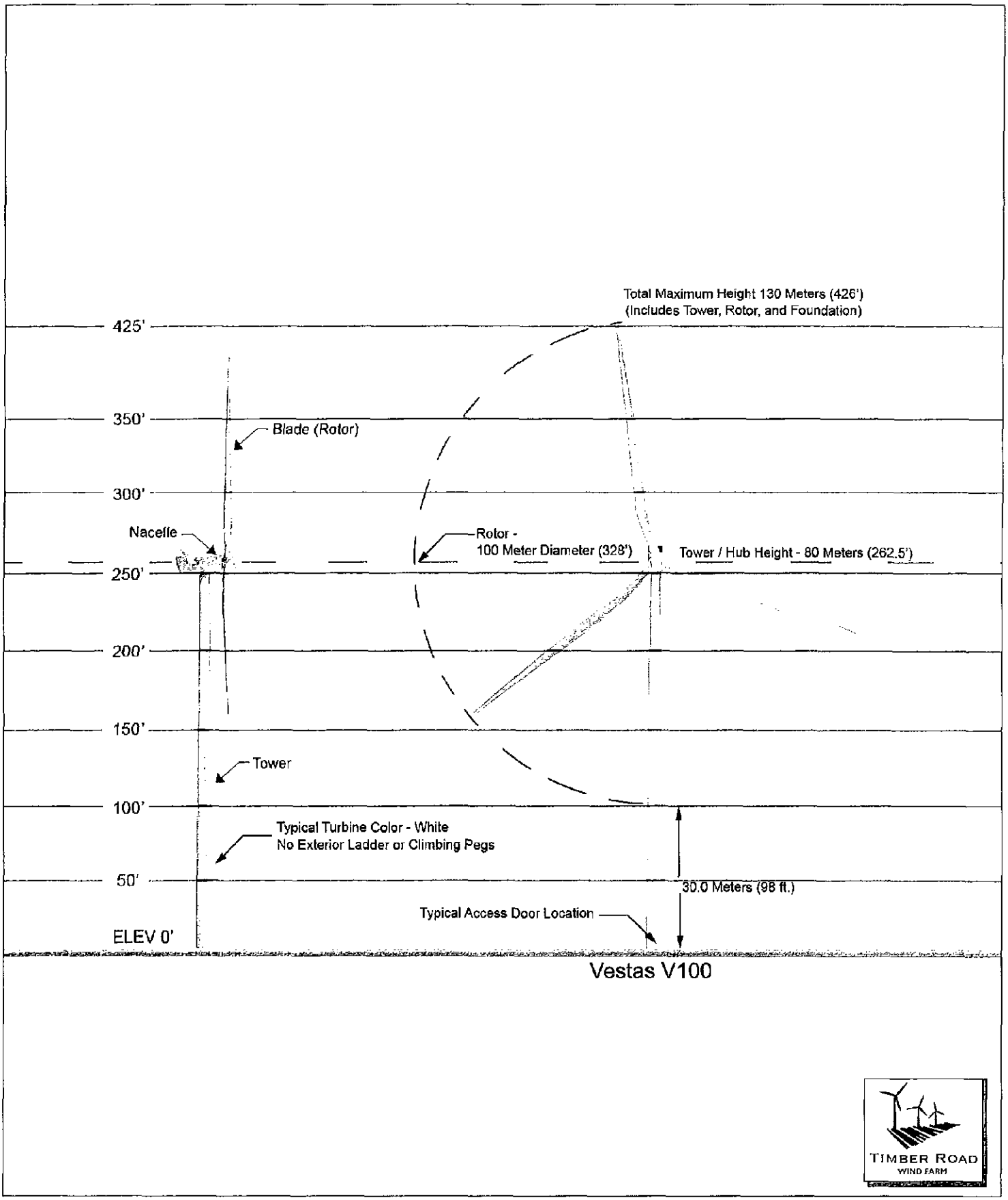
Figure 2: Proposed Project Layout

Wind Turbine
O&M Facility
Electrical Collection System
Access Road
Project Substation

December 2009

Notes:
Base Map: USGS 1:24,000 Antwerp, Grabill, Maples, Paulding, Payne, Woodburn North, and Woodburn South quadrangles.

EDR



■ Timber Road Wind Farm

Harrison Township - Paulding County, Ohio

Figure 3: Computer Model of Proposed Turbine
Vestas V100

December 2009

EDR

Attachment A

Wind Rose & Sunshine Data

Table 1. Wind Rose Data (frequency [%] of time wind comes from a given direction).

Windrose Data (used to determine hours of operation)								
Sector	**N**	**NNE**	**NE**	**ENE**	**E**	**ESE**	**SE**	**SSE**
Frequency	3.3	3.5	5.8	6.3	6.3	4.2	3.7	3.5
Hours of Operation	283	315	506	548	548	367	324	298

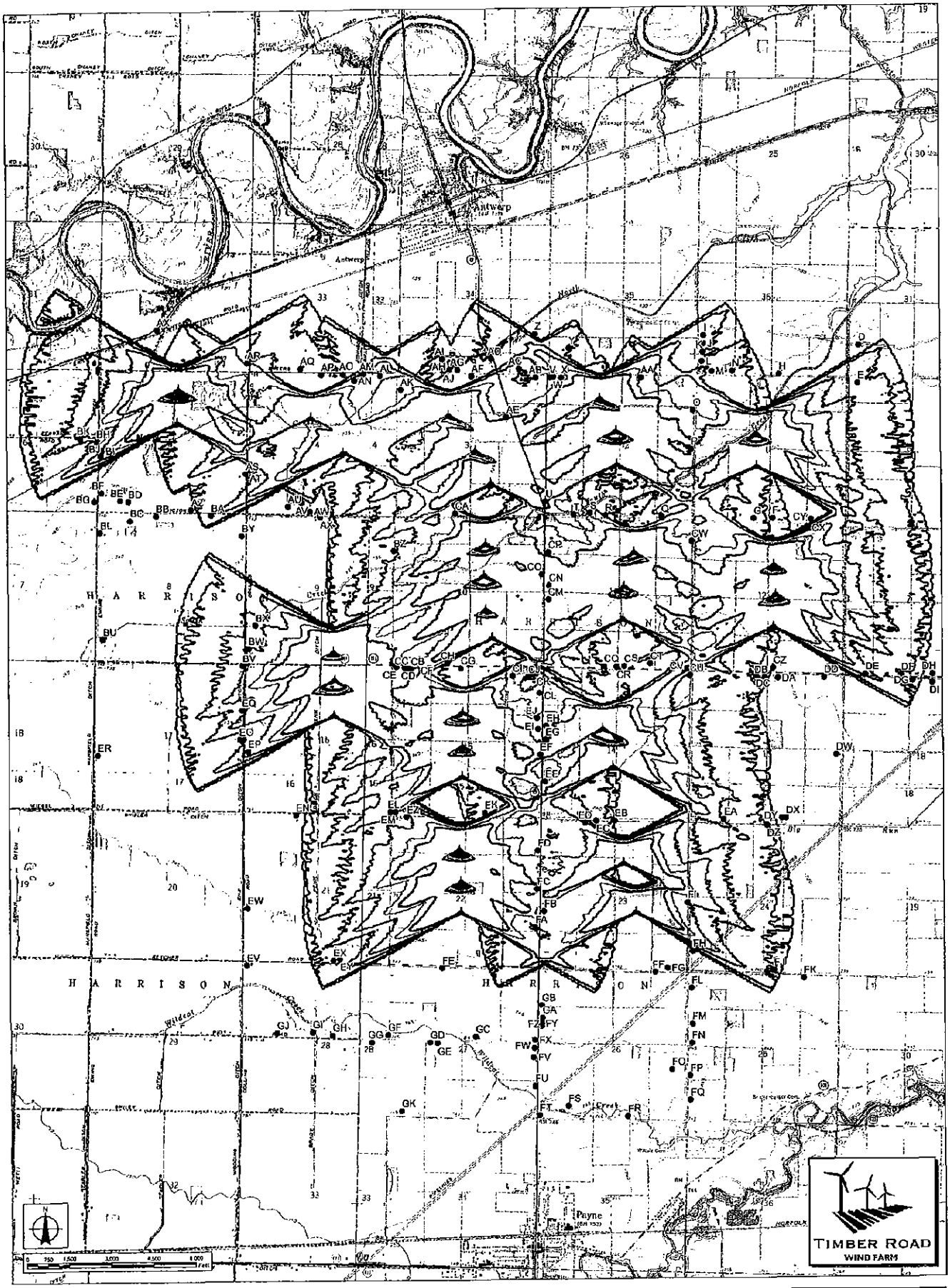
Sector	**S**	**SSW**	**SW**	**WSW**	**W**	**WNW**	**NW**	**NNW**	**Total**
Frequency	3.9	7.4	10.9	9.5	11.3	8.4	6.5	5.5	100
Hours of Operation	341	652	958	835	993	736	571	484	8760

Table 2. Sunshine Probability Data.

Sunshine Probability												
Month	JAN	FEB	MAR	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
% of Sunshine	.504	.504	.583	.66	.673	.771	.749	.747	.684	.546	.394	.337

Attachment B

Projected Shadow Flicker Map



Timber Road Wind Farm

Harrison Township - Paulding County, Ohio

Attachment B: Shadow Flicker Contours

December 2009

Receptors

Wind Turbine

Shadow Hours/Year

- 6
- 12
- 18
- 24
- 30

Notes:
Base Map: USGS 1:24,000 Antwerp, Grabill, Maples, Paulding, Payne, Woodburn North, and Woodburn South quadrangles.

EDR

Attachment C

WindPRO Overview Report
WindPRO Graphical Calendars
WindPRO Tabular Calendars

Project:
paulding 1 shadow flicker study [5-rev1]

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Calculated:
12/15/2009 11:10 PM/2.6.0.235

SHADOW - Main Result

Calculation: Timber Road Windfarm Shadow Flicker Analysis

Assumptions for shadow calculations

Maximum distance for influence
Calculate only when more than 20 % of sun is covered by the blade
Please look in WTG table

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)

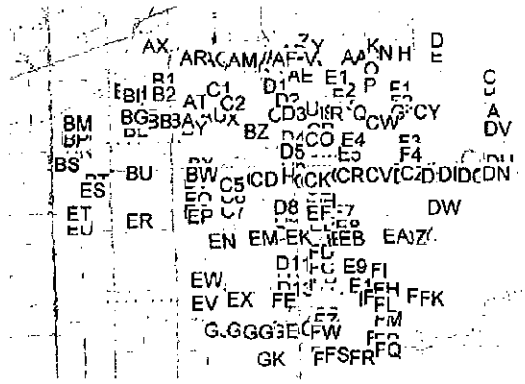
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.51	0.50	0.58	0.66	0.67	0.77	0.75	0.75	0.68	0.55	0.39	0.34

Operational time

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW
283	315	506	548	548	367	324	298	341	652	958	835

W	WNW	NW	NNW	Sum
993	736	571	484	8,759

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: paulding 1 - 1 ft contours.WPO (1)
Obstacles not used in calculation
Eye height: 1.5 m
Grid resolution: 10 m



Scale 1:200,000
New WTG Shadow receptor

WTGs

	UTM NAD27Ex Zone: 16 East	North	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Shadow data Calculation distance	RPM
	UTM NAD27Ex Zone: 16		[m]					[kW]	[m]	[m]	[m]	[RPM]
E1	691,257	4,559,072	731.0	VESTAS V100 1800 100.0 !O! h...	Yes	VESTAS	V100-1,800	1,800	100.0	80.0	1,702	14.9
E2	691,447	4,558,729	728.8	VESTAS V100 1800 100.0 !O! h...	Yes	VESTAS	V100-1,800	1,800	100.0	80.0	1,702	14.9
E3	691,470	4,558,367	729.0	VESTAS V100 1800 100.0 !O! h...	Yes	VESTAS	V100-1,800	1,800	100.0	80.0	1,702	14.9
E4	691,703	4,557,418	728.7	VESTAS V100 1800 100.0 !O! h...	Yes	VESTAS	V100-1,800	1,800	100.0	80.0	1,702	14.9
E5	691,611	4,557,051	731.2	VESTAS V100 1800 100.0 !O! h...	Yes	VESTAS	V100-1,800	1,800	100.0	80.0	1,702	14.9
E6	691,610	4,556,701	732.1	VESTAS V100 1800 100.0 !O! h...	Yes	VESTAS	V100-1,800	1,800	100.0	80.0	1,702	14.9
E7	691,446	4,555,494	734.0	VESTAS V100 1800 100.0 !O! h...	Yes	VESTAS	V100-1,800	1,800	100.0	80.0	1,702	14.9
E8	691,571	4,555,092	735.6	VESTAS V100 1800 100.0 !O! h...	Yes	VESTAS	V100-1,800	1,800	100.0	80.0	1,702	14.9
E9	691,740	4,554,053	739.0	VESTAS V100 1800 100.0 !O! h...	Yes	VESTAS	V100-1,800	1,800	100.0	80.0	1,702	14.9
B1	686,677	4,558,974	736.4	VESTAS V100 1800 100.0 !O! h...	Yes	VESTAS	V100-1,800	1,800	100.0	80.0	1,702	14.9
B2	686,684	4,558,612	734.9	VESTAS V100 1800 100.0 !O! h...	Yes	VESTAS	V100-1,800	1,800	100.0	80.0	1,702	14.9
C1	688,123	4,558,731	734.3	VESTAS V100 1800 100.0 !O! h...	Yes	VESTAS	V100-1,800	1,800	100.0	80.0	1,702	14.9
C2	688,494	4,558,365	736.0	VESTAS V100 1800 100.0 !O! h...	Yes	VESTAS	V100-1,800	1,800	100.0	80.0	1,702	14.9
C5	688,480	4,556,207	733.8	VESTAS V100 1800 100.0 !O! h...	Yes	VESTAS	V100-1,800	1,800	100.0	80.0	1,702	14.9
C6	688,511	4,555,900	734.0	VESTAS V100 1800 100.0 !O! h...	Yes	VESTAS	V100-1,800	1,800	100.0	80.0	1,702	14.9
C7	688,521	4,555,515	739.0	VESTAS V100 1800 100.0 !O! h...	Yes	VESTAS	V100-1,800	1,800	100.0	80.0	1,702	14.9
D1	689,619	4,558,618	734.8	VESTAS V100 1800 100.0 !O! h...	Yes	VESTAS	V100-1,800	1,800	100.0	80.0	1,702	14.9
D10	689,941	4,554,911	739.0	VESTAS V100 1800 100.0 !O! h...	Yes	VESTAS	V100-1,800	1,800	100.0	80.0	1,702	14.9
D11	689,948	4,554,117	740.7	VESTAS V100 1800 100.0 !O! h...	Yes	VESTAS	V100-1,800	1,800	100.0	80.0	1,702	14.9
D12	689,980	4,553,777	741.8	VESTAS V100 1800 100.0 !O! h...	Yes	VESTAS	V100-1,800	1,800	100.0	80.0	1,702	14.9
D13	689,991	4,553,444	742.6	VESTAS V100 1800 100.0 !O! h...	Yes	VESTAS	V100-1,800	1,800	100.0	80.0	1,702	14.9
D2	689,927	4,558,449	734.0	VESTAS V100 1800 100.0 !O! h...	Yes	VESTAS	V100-1,800	1,800	100.0	80.0	1,702	14.9
D3	690,111	4,558,099	734.6	VESTAS V100 1800 100.0 !O! h...	Yes	VESTAS	V100-1,800	1,800	100.0	80.0	1,702	14.9
D4	690,085	4,557,443	735.0	VESTAS V100 1800 100.0 !O! h...	Yes	VESTAS	V100-1,800	1,800	100.0	80.0	1,702	14.9
D5	690,083	4,557,099	734.1	VESTAS V100 1800 100.0 !O! h...	Yes	VESTAS	V100-1,800	1,800	100.0	80.0	1,702	14.9
D6	690,111	4,556,735	734.9	VESTAS V100 1800 100.0 !O! h...	Yes	VESTAS	V100-1,800	1,800	100.0	80.0	1,702	14.9
D7	690,197	4,556,429	735.0	VESTAS V100 1800 100.0 !O! h...	Yes	VESTAS	V100-1,800	1,800	100.0	80.0	1,702	14.9
D8	689,918	4,555,611	735.0	VESTAS V100 1800 100.0 !O! h...	Yes	VESTAS	V100-1,800	1,800	100.0	80.0	1,702	14.9
D9	689,930	4,555,239	738.0	VESTAS V100 1800 100.0 !O! h...	Yes	VESTAS	V100-1,800	1,800	100.0	80.0	1,702	14.9
E10	691,891	4,553,526	739.0	VESTAS V100 1800 100.0 !O! h...	Yes	VESTAS	V100-1,800	1,800	100.0	80.0	1,702	14.9
F1	692,969	4,558,756	724.4	VESTAS V100 1800 100.0 !O! h...	Yes	VESTAS	V100-1,800	1,800	100.0	80.0	1,702	14.9
F2	692,985	4,558,410	728.9	VESTAS V100 1800 100.0 !O! h...	Yes	VESTAS	V100-1,800	1,800	100.0	80.0	1,702	14.9

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Project:
paulding 1 shadow flicker study [5-rev1]

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SHADOW - Main Result

Calculation: Timber Road Windfarm Shadow Flicker Analysis

...continued from previous page

	UTM NAD27Ex Zone: 16 East	North	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Shadow data Calculation distance	RPM
	UTM NAD27Ex Zone: 16		[m]					[kW]	[m]	[m]	[m]	[RPM]
F3	693,219	4,557,346	730.0	VESTAS V100 1800 100.0 !O! h...	Yes	VESTAS	V100-1,800	1,800	100.0	80.0	1,702	14.9
F4	693,255	4,557,026	730.0	VESTAS V100 1800 100.0 !O! h...	Yes	VESTAS	V100-1,800	1,800	100.0	80.0	1,702	14.9
F5	693,242	4,556,680	733.0	VESTAS V100 1800 100.0 !O! h...	Yes	VESTAS	V100-1,800	1,800	100.0	80.0	1,702	14.9

Shadow receptor-Input

No.	UTM NAD27Ex Zone: 16 East	North	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
			[m]	[m]	[m]	[m]	[°]	[°]	
A	695,551	4,557,870	729.1	1.0	1.0	1.0	0.0	90.0	"Green house mode"
B	695,441	4,558,517	729.1	1.0	1.0	1.0	0.0	90.0	"Green house mode"
C	695,440	4,558,796	729.4	1.0	1.0	1.0	0.0	90.0	"Green house mode"
D	694,030	4,559,754	730.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
E	694,041	4,559,349	727.3	1.0	1.0	1.0	0.0	90.0	"Green house mode"
F	693,184	4,557,847	729.1	1.0	1.0	1.0	0.0	90.0	"Green house mode"
G	692,978	4,557,838	730.2	1.0	1.0	1.0	0.0	90.0	"Green house mode"
H	693,184	4,559,403	726.7	1.0	1.0	1.0	0.0	90.0	"Green house mode"
I	692,347	4,559,788	732.8	1.0	1.0	1.0	0.0	90.0	"Green house mode"
J	692,347	4,559,701	732.7	1.0	1.0	1.0	0.0	90.0	"Green house mode"
K	692,344	4,559,604	732.9	1.0	1.0	1.0	0.0	90.0	"Green house mode"
L	692,341	4,559,508	732.4	1.0	1.0	1.0	0.0	90.0	"Green house mode"
M	692,455	4,559,408	732.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
N	692,678	4,559,420	731.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"
O	692,274	4,558,976	729.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
P	692,275	4,558,560	729.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
Q	691,979	4,557,815	726.8	1.0	1.0	1.0	0.0	90.0	"Green house mode"
R	691,371	4,557,805	728.1	1.0	1.0	1.0	0.0	90.0	"Green house mode"
S	691,202	4,557,822	726.7	1.0	1.0	1.0	0.0	90.0	"Green house mode"
T	691,026	4,557,795	725.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
U	690,713	4,557,928	734.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
V	690,698	4,559,265	734.2	1.0	1.0	1.0	0.0	90.0	"Green house mode"
W	690,738	4,559,274	734.1	1.0	1.0	1.0	0.0	90.0	"Green house mode"
X	690,825	4,559,271	734.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
Y	690,891	4,559,588	731.1	1.0	1.0	1.0	0.0	90.0	"Green house mode"
Z	690,514	4,559,725	734.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"
AA	691,690	4,559,306	731.5	1.0	1.0	1.0	0.0	90.0	"Green house mode"
AB	690,546	4,559,259	734.5	1.0	1.0	1.0	0.0	90.0	"Green house mode"
AC	690,360	4,559,344	735.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
AD	690,054	4,559,436	735.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
AE	690,251	4,558,814	734.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
AF	689,850	4,559,245	729.1	1.0	1.0	1.0	0.0	90.0	"Green house mode"
AG	689,692	4,559,307	726.8	1.0	1.0	1.0	0.0	90.0	"Green house mode"
AH	689,608	4,559,309	731.2	1.0	1.0	1.0	0.0	90.0	"Green house mode"
AI	689,521	4,559,413	725.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
AJ	689,533	4,559,292	733.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"
AK	689,087	4,559,065	732.3	1.0	1.0	1.0	0.0	90.0	"Green house mode"
AL	688,856	4,559,203	729.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
AM	688,671	4,559,210	734.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
AN	688,576	4,559,136	734.8	1.0	1.0	1.0	0.0	90.0	"Green house mode"
AO	688,450	4,559,206	735.3	1.0	1.0	1.0	0.0	90.0	"Green house mode"
AP	688,217	4,559,188	736.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
AQ	687,988	4,559,246	736.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
AR	687,407	4,559,277	736.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"
AS	687,447	4,558,080	733.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"
AT	687,490	4,558,123	733.7	1.0	1.0	1.0	0.0	90.0	"Green house mode"
AU	687,920	4,557,751	734.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
AV	688,065	4,557,799	734.4	1.0	1.0	1.0	0.0	90.0	"Green house mode"

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Project:
paulding 1 shadow flicker study [5-rev1]

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Calculated:
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SHADOW - Main Result

Calculation: Timber Road Windfarm Shadow Flicker Analysis

...continued from previous page

UTM NAD27Ex Zone: 16

No.	East	North	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
			[m]	[m]	[m]	[m]	[°]	[°]	
AW	688,161	4,557,712	735.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"
AX	686,413	4,559,595	729.1	1.0	1.0	1.0	0.0	90.0	"Green house mode"
AX	688,274	4,557,652	739.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
AZ	686,875	4,557,672	734.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
BA	687,094	4,557,612	733.7	1.0	1.0	1.0	0.0	90.0	"Green house mode"
BB	686,500	4,557,588	736.4	1.0	1.0	1.0	0.0	90.0	"Green house mode"
BC	686,219	4,557,522	736.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"
BD	686,190	4,557,728	736.7	1.0	1.0	1.0	0.0	90.0	"Green house mode"
BE	686,101	4,557,737	738.4	1.0	1.0	1.0	0.0	90.0	"Green house mode"
BF	685,893	4,557,808	737.4	1.0	1.0	1.0	0.0	90.0	"Green house mode"
BG	685,823	4,557,714	736.9	1.0	1.0	1.0	0.0	90.0	"Green house mode"
BH	685,818	4,558,364	739.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
BI	685,875	4,558,270	738.2	1.0	1.0	1.0	0.0	90.0	"Green house mode"
BJ	685,868	4,558,207	736.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
BK	685,640	4,558,387	735.3	1.0	1.0	1.0	0.0	90.0	"Green house mode"
BL	685,901	4,557,374	739.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
BM	684,299	4,557,523	741.5	1.0	1.0	1.0	0.0	90.0	"Green house mode"
BN	684,349	4,557,333	743.8	1.0	1.0	1.0	0.0	90.0	"Green house mode"
BO	684,309	4,557,153	741.7	1.0	1.0	1.0	0.0	90.0	"Green house mode"
BP	684,307	4,557,103	741.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
BQ	684,237	4,557,142	740.9	1.0	1.0	1.0	0.0	90.0	"Green house mode"
BR	684,389	4,556,812	738.1	1.0	1.0	1.0	0.0	90.0	"Green house mode"
BS	684,085	4,556,445	735.7	1.0	1.0	1.0	0.0	90.0	"Green house mode"
BT	684,888	4,555,994	736.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
BU	685,980	4,556,226	736.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
BV	687,506	4,556,002	737.7	1.0	1.0	1.0	0.0	90.0	"Green house mode"
BW	687,563	4,556,190	735.9	1.0	1.0	1.0	0.0	90.0	"Green house mode"
BX	687,625	4,556,449	734.4	1.0	1.0	1.0	0.0	90.0	"Green house mode"
BY	687,439	4,557,407	734.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
BZ	689,089	4,557,313	736.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
CA	689,738	4,557,753	733.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"
CB	689,334	4,556,046	737.4	1.0	1.0	1.0	0.0	90.0	"Green house mode"
CC	689,306	4,556,053	737.5	1.0	1.0	1.0	0.0	90.0	"Green house mode"
CD	689,266	4,556,056	737.7	1.0	1.0	1.0	0.0	90.0	"Green house mode"
CE	689,175	4,556,061	738.5	1.0	1.0	1.0	0.0	90.0	"Green house mode"
CF	689,431	4,556,121	736.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
CG	689,873	4,556,080	734.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
CH	689,728	4,556,132	734.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
CI	690,440	4,556,018	735.7	1.0	1.0	1.0	0.0	90.0	"Green house mode"
CJ	690,610	4,556,014	737.8	1.0	1.0	1.0	0.0	90.0	"Green house mode"
CK	690,697	4,556,055	735.9	1.0	1.0	1.0	0.0	90.0	"Green house mode"
CL	690,743	4,555,849	739.8	1.0	1.0	1.0	0.0	90.0	"Green house mode"
CM	690,788	4,556,864	734.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
CN	690,794	4,557,017	731.8	1.0	1.0	1.0	0.0	90.0	"Green house mode"
CO	690,712	4,557,130	730.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"
CP	690,768	4,557,372	729.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
CQ	691,427	4,556,169	734.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
CR	691,564	4,556,170	734.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
CS	691,646	4,556,178	734.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
CT	691,928	4,556,218	732.1	1.0	1.0	1.0	0.0	90.0	"Green house mode"
CU	692,364	4,556,103	734.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
CV	692,335	4,556,184	730.7	1.0	1.0	1.0	0.0	90.0	"Green house mode"
CW	692,320	4,557,559	729.5	1.0	1.0	1.0	0.0	90.0	"Green house mode"
CX	693,569	4,557,753	732.9	1.0	1.0	1.0	0.0	90.0	"Green house mode"
CY	693,600	4,557,849	731.2	1.0	1.0	1.0	0.0	90.0	"Green house mode"
CZ	693,263	4,556,223	734.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
DA	693,319	4,556,117	734.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
DB	693,172	4,556,122	734.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"

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Calculated:
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SHADOW - Main Result

Calculation: Timber Road Windfarm Shadow Flicker Analysis

...continued from previous page

UTM NAD27Ex Zone: 16

No.	East	North	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
			[m]	[m]	[m]	[m]	[°]	[°]	
DC	693,079	4,556,137	733.8	1.0	1.0	1.0	0.0	90.0	"Green house mode"
DD	693,821	4,556,147	729.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
DE	694,264	4,556,200	733.5	1.0	1.0	1.0	0.0	90.0	"Green house mode"
DF	694,652	4,556,215	736.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"
DG	694,779	4,556,161	729.7	1.0	1.0	1.0	0.0	90.0	"Green house mode"
DH	694,992	4,556,234	738.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
DI	694,994	4,556,144	729.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
DJ	695,391	4,556,135	728.9	1.0	1.0	1.0	0.0	90.0	"Green house mode"
DK	695,384	4,556,240	736.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
DL	695,404	4,556,240	736.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
DM	695,407	4,556,277	736.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
DN	695,433	4,556,239	735.9	1.0	1.0	1.0	0.0	90.0	"Green house mode"
DO	695,479	4,556,241	735.9	1.0	1.0	1.0	0.0	90.0	"Green house mode"
DP	695,505	4,556,242	736.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
DQ	695,544	4,556,254	737.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
DR	695,548	4,556,276	736.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
DS	695,549	4,556,300	735.5	1.0	1.0	1.0	0.0	90.0	"Green house mode"
DT	695,547	4,556,327	734.8	1.0	1.0	1.0	0.0	90.0	"Green house mode"
DU	695,533	4,556,540	732.8	1.0	1.0	1.0	0.0	90.0	"Green house mode"
DV	695,473	4,557,424	729.5	1.0	1.0	1.0	0.0	90.0	"Green house mode"
DW	693,981	4,555,318	735.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
DX	693,475	4,554,604	730.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
DY	693,429	4,554,603	730.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
DZ	693,272	4,554,519	734.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
EA	692,801	4,554,562	734.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
EB	691,617	4,554,498	736.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
EC	691,418	4,554,488	735.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
ED	691,299	4,554,461	734.3	1.0	1.0	1.0	0.0	90.0	"Green house mode"
EE	690,845	4,554,887	739.3	1.0	1.0	1.0	0.0	90.0	"Green house mode"
EF	690,776	4,555,178	739.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"
EG	690,834	4,555,343	740.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
EH	690,833	4,555,494	740.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
EI	690,746	4,555,452	740.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
EJ	690,730	4,555,572	740.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
EK	690,204	4,554,521	739.4	1.0	1.0	1.0	0.0	90.0	"Green house mode"
EL	689,180	4,554,485	738.1	1.0	1.0	1.0	0.0	90.0	"Green house mode"
EM	689,232	4,554,490	739.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
EN	688,158	4,554,407	739.2	1.0	1.0	1.0	0.0	90.0	"Green house mode"
EO	687,510	4,555,199	739.3	1.0	1.0	1.0	0.0	90.0	"Green house mode"
EP	687,608	4,555,073	739.3	1.0	1.0	1.0	0.0	90.0	"Green house mode"
EQ	687,524	4,555,518	736.1	1.0	1.0	1.0	0.0	90.0	"Green house mode"
ER	685,983	4,554,961	746.4	1.0	1.0	1.0	0.0	90.0	"Green house mode"
ES	684,766	4,555,755	738.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
ET	684,417	4,555,126	747.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
EU	684,414	4,554,741	739.8	1.0	1.0	1.0	0.0	90.0	"Green house mode"
EV	687,699	4,552,762	744.8	1.0	1.0	1.0	0.0	90.0	"Green house mode"
EW	687,674	4,553,381	744.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
EX	688,635	4,552,860	744.4	1.0	1.0	1.0	0.0	90.0	"Green house mode"
EY	688,702	4,552,874	744.5	1.0	1.0	1.0	0.0	90.0	"Green house mode"
EZ	689,358	4,554,438	739.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
FA	690,809	4,553,310	738.9	1.0	1.0	1.0	0.0	90.0	"Green house mode"
FB	690,894	4,553,490	736.9	1.0	1.0	1.0	0.0	90.0	"Green house mode"
FC	690,808	4,553,725	736.8	1.0	1.0	1.0	0.0	90.0	"Green house mode"
FD	690,802	4,554,137	735.5	1.0	1.0	1.0	0.0	90.0	"Green house mode"
FE	689,818	4,552,822	744.7	1.0	1.0	1.0	0.0	90.0	"Green house mode"
FF	692,132	4,552,879	737.8	1.0	1.0	1.0	0.0	90.0	"Green house mode"
FG	692,261	4,552,929	734.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"
FH	692,529	4,553,125	739.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"

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Project:
paulding 1 shadow flicker study [5-rev1]

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Calculated:
12/15/2009 11:10 PM/2.6.0.235

SHADOW - Main Result

Calculation: Timber Road Windfarm Shadow Flicker Analysis

...continued from previous page

UTM NAD27Ex Zone: 16

No.	East	North	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
			[m]	[m]	[m]	[m]	[°]	[°]	
FI	692,447	4,553,648	736.3	1.0	1.0	1.0	0.0	90.0	"Green house mode"
FJ	693,417	4,552,956	739.1	1.0	1.0	1.0	0.0	90.0	"Green house mode"
FK	693,743	4,552,886	733.8	1.0	1.0	1.0	0.0	90.0	"Green house mode"
FL	692,535	4,552,726	735.9	1.0	1.0	1.0	0.0	90.0	"Green house mode"
FM	692,560	4,552,335	735.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
FN	692,562	4,552,130	738.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
FO	692,360	4,551,837	744.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
FP	692,561	4,551,778	745.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
FQ	692,578	4,551,523	744.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
FR	691,905	4,551,318	740.1	1.0	1.0	1.0	0.0	90.0	"Green house mode"
FS	691,254	4,551,400	745.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
FT	690,950	4,551,283	743.4	1.0	1.0	1.0	0.0	90.0	"Green house mode"
FU	690,884	4,551,595	745.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
FV	690,854	4,551,902	745.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
FW	690,855	4,552,000	745.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
FX	690,856	4,552,090	745.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
FY	690,921	4,552,244	744.8	1.0	1.0	1.0	0.0	90.0	"Green house mode"
FZ	690,947	4,552,294	744.1	1.0	1.0	1.0	0.0	90.0	"Green house mode"
GA	690,933	4,552,332	743.6	1.0	1.0	1.0	0.0	90.0	"Green house mode"
GB	690,919	4,552,465	741.9	1.0	1.0	1.0	0.0	90.0	"Green house mode"
GC	690,209	4,552,100	745.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
GD	689,718	4,552,014	741.8	1.0	1.0	1.0	0.0	90.0	"Green house mode"
GE	689,800	4,552,009	740.9	1.0	1.0	1.0	0.0	90.0	"Green house mode"
GF	689,257	4,552,072	744.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
GG	689,084	4,551,985	742.9	1.0	1.0	1.0	0.0	90.0	"Green house mode"
GH	688,657	4,552,044	746.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
GI	688,441	4,552,069	743.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"
GJ	688,055	4,552,042	744.8	1.0	1.0	1.0	0.0	90.0	"Green house mode"
GK	689,449	4,551,263	744.0	1.0	1.0	1.0	0.0	90.0	"Green house mode"

Calculation Results

Shadow receptor

No.	Shadow, worst case: Shadow hours per year [h/year]	Shadow, worst case: Shadow days per year [days/year]	Shadow, worst case: Max shadow hours per day [h/day]	Shadow, expected values: Shadow hours per year [h/year]
A	0:00	0	0:00	0:00
B	0:00	0	0:00	0:00
C	0:00	0	0:00	0:00
D	0:00	0	0:00	0:00
E	5:29	32	0:16	1:46
F	1:44	16	0:09	0:39
G	7:50	67	0:13	3:00
H	0:00	0	0:00	0:00
I	6:25	41	0:16	2:02
J	5:27	33	0:16	1:45
K	5:10	30	0:16	1:43
L	5:06	28	0:17	1:55
M	12:29	76	0:17	4:12
N	5:33	44	0:12	1:57
O	66:53	146	0:51	21:35
P	72:46	149	0:59	32:16
Q	16:41	125	0:15	6:12
R	23:04	138	0:21	8:07
S	64:51	185	0:41	19:57
T	62:40	183	0:35	21:02
U	90:16	206	0:39	35:46

Continued on next page...

Project:
paulding 1 shadow flicker study [5-rev1]

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SHADOW - Main Result

Calculation: Timber Road Windfarm Shadow Flicker Analysis

...continued from previous page

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]
V	53:40	110	0:56	15:48
W	52:31	103	0:59	15:28
X	53:24	90	1:01	16:16
Y	3:44	28	0:12	1:12
Z	0:00	0	0:00	0:00
AA	52:35	105	0:59	17:29
AB	36:15	133	0:32	11:38
AC	38:36	110	0:39	11:47
AD	6:12	46	0:15	1:56
AE	73:31	179	0:46	26:51
AF	7:29	66	0:12	2:35
AG	9:43	63	0:14	2:54
AH	3:04	31	0:09	1:09
AI	2:40	20	0:12	0:51
AJ	2:07	18	0:10	0:48
AK	54:49	117	0:48	15:46
AL	45:47	106	0:52	12:50
AM	42:39	96	0:37	12:05
AN	50:56	113	0:42	14:54
AO	6:32	47	0:16	2:03
AP	5:26	46	0:13	2:02
AQ	6:53	55	0:14	2:28
AR	33:04	90	0:34	9:25
AS	7:33	32	0:21	3:47
AT	8:18	34	0:22	4:08
AU	0:00	0	0:00	0:00
AV	0:00	0	0:00	0:00
AW	0:00	0	0:00	0:00
AX	0:00	0	0:00	0:00
AX	0:00	0	0:00	0:00
AZ	0:00	0	0:00	0:00
BA	7:39	57	0:10	4:08
BB	0:00	0	0:00	0:00
BC	0:00	0	0:00	0:00
BD	0:00	0	0:00	0:00
BE	0:00	0	0:00	0:00
BF	0:00	0	0:00	0:00
BG	0:00	0	0:00	0:00
BH	11:52	40	0:26	5:59
BI	19:59	64	0:27	10:17
BJ	26:55	76	0:27	14:26
BK	17:00	82	0:20	8:55
BL	0:00	0	0:00	0:00
BM	0:00	0	0:00	0:00
BN	0:00	0	0:00	0:00
BO	0:00	0	0:00	0:00
BP	0:00	0	0:00	0:00
BQ	0:00	0	0:00	0:00
BR	0:00	0	0:00	0:00
BS	0:00	0	0:00	0:00
BT	0:00	0	0:00	0:00
BU	0:00	0	0:00	0:00
BV	22:25	98	0:22	8:48
BW	30:49	112	0:25	9:37
BX	27:06	107	0:26	7:45
BY	0:00	0	0:00	0:00
BZ	23:10	105	0:22	8:22
CA	70:21	133	0:54	18:27

Continued on next page...

Project:
paulding 1 shadow flicker study [5-rev1]

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SHADOW - Main Result

Calculation: Timber Road Windfarm Shadow Flicker Analysis

...continued from previous page

	Shadow, worst case			Shadow, expected values
No.	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]
CB	89:45	225	0:46	31:46
CC	92:23	214	0:52	31:57
CD	96:31	196	0:57	33:06
CE	92:22	189	0:44	33:05
CF	51:09	186	0:30	22:31
CG	9:42	63	0:19	3:56
CH	14:35	89	0:15	6:09
CI	57:36	133	0:44	18:08
CJ	36:31	104	0:37	10:27
CK	30:58	94	0:26	8:10
CL	47:33	142	0:30	14:35
CM	114:30	284	0:52	46:02
CN	78:57	204	0:56	33:20
CO	100:48	231	0:52	40:27
CP	63:06	150	0:54	24:59
CQ	12:02	83	0:15	5:20
CR	6:13	49	0:12	2:48
CS	6:19	60	0:11	2:57
CT	5:14	52	0:13	2:43
CU	11:17	55	0:21	3:34
CV	31:45	111	0:22	13:06
CW	68:28	142	0:51	23:11
CX	14:38	36	0:31	3:43
CY	0:00	0	0:00	0:00
CZ	0:00	0	0:00	0:00
DA	0:00	0	0:00	0:00
DB	1:56	22	0:08	0:52
DC	2:43	26	0:09	1:13
DD	0:00	0	0:00	0:00
DE	15:16	62	0:20	7:06
DF	2:48	24	0:10	1:16
DG	2:22	22	0:09	1:04
DH	0:00	0	0:00	0:00
DI	0:00	0	0:00	0:00
DJ	0:00	0	0:00	0:00
DK	0:00	0	0:00	0:00
DL	0:00	0	0:00	0:00
DM	0:00	0	0:00	0:00
DN	0:00	0	0:00	0:00
DO	0:00	0	0:00	0:00
DP	0:00	0	0:00	0:00
DQ	0:00	0	0:00	0:00
DR	0:00	0	0:00	0:00
DS	0:00	0	0:00	0:00
DT	0:00	0	0:00	0:00
DU	0:00	0	0:00	0:00
DV	0:00	0	0:00	0:00
DW	0:00	0	0:00	0:00
DX	0:00	0	0:00	0:00
DY	0:00	0	0:00	0:00
DZ	6:28	63	0:10	2:00
EA	14:25	79	0:19	5:57
EB	0:00	0	0:00	0:00
EC	11:19	102	0:11	4:49
ED	42:19	125	0:49	11:17
EE	48:09	157	0:31	22:11
EF	84:34	190	0:48	40:28
EG	70:52	161	0:52	30:32

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Project:
paulding 1 shadow flicker study [5-rev1]

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SHADOW - Main Result

Calculation: Timber Road Windfarm Shadow Flicker Analysis

...continued from previous page

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]
EH	69:37	178	0:45	26:09
EI	69:01	223	0:33	26:48
EJ	64:46	202	0:32	23:04
EK	4:55	42	0:11	2:12
EL	32:36	102	0:28	13:28
EM	29:33	96	0:30	10:49
EN	0:00	0	0:00	0:00
EO	8:24	36	0:21	4:15
EP	22:20	78	0:23	11:54
EQ	17:35	72	0:23	8:25
ER	0:00	0	0:00	0:00
ES	0:00	0	0:00	0:00
ET	0:00	0	0:00	0:00
EU	0:00	0	0:00	0:00
EV	0:00	0	0:00	0:00
EW	0:00	0	0:00	0:00
EX	3:39	28	0:11	1:52
EY	4:28	32	0:12	2:17
EZ	29:04	66	0:36	8:00
FA	21:29	62	0:45	10:09
FB	31:22	83	0:45	14:09
FC	65:28	197	0:33	29:34
FD	49:37	178	0:27	17:52
FE	0:00	0	0:00	0:00
FF	0:00	0	0:00	0:00
FG	0:00	0	0:00	0:00
FH	0:00	0	0:00	0:00
FI	27:15	53	0:40	11:34
FJ	2:19	23	0:09	1:02
FK	0:00	0	0:00	0:00
FL	0:00	0	0:00	0:00
FM	0:00	0	0:00	0:00
FN	0:00	0	0:00	0:00
FO	0:00	0	0:00	0:00
FP	0:00	0	0:00	0:00
FQ	0:00	0	0:00	0:00
FR	0:00	0	0:00	0:00
FS	0:00	0	0:00	0:00
FT	0:00	0	0:00	0:00
FU	0:00	0	0:00	0:00
FV	0:00	0	0:00	0:00
FW	0:00	0	0:00	0:00
FX	0:00	0	0:00	0:00
FY	0:00	0	0:00	0:00
FZ	0:00	0	0:00	0:00
GA	0:00	0	0:00	0:00
GB	0:00	0	0:00	0:00
GC	0:00	0	0:00	0:00
GD	0:00	0	0:00	0:00
GE	0:00	0	0:00	0:00
GF	0:00	0	0:00	0:00
GG	0:00	0	0:00	0:00
GH	0:00	0	0:00	0:00
GI	0:00	0	0:00	0:00
GJ	0:00	0	0:00	0:00
GK	0:00	0	0:00	0:00

Project:
paulding 1 shadow flicker study [5-rev1]

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SHADOW - Main Result

Calculation: Timber Road Windfarm Shadow Flicker Analysis

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

No.	Name	Worst case [h/year]
E1	VESTAS V100 1800 100.0 !O! hub: 80.0 m (57)	160:25
E2	VESTAS V100 1800 100.0 !O! hub: 80.0 m (56)	81:15
E3	VESTAS V100 1800 100.0 !O! hub: 80.0 m (55)	49:48
E4	VESTAS V100 1800 100.0 !O! hub: 80.0 m (43)	129:05
E5	VESTAS V100 1800 100.0 !O! hub: 80.0 m (62)	75:21
E6	VESTAS V100 1800 100.0 !O! hub: 80.0 m (61)	43:49
E7	VESTAS V100 1800 100.0 !O! hub: 80.0 m (44)	181:10
E8	VESTAS V100 1800 100.0 !O! hub: 80.0 m (45)	83:21
E9	VESTAS V100 1800 100.0 !O! hub: 80.0 m (67)	57:20
B1	VESTAS V100 1800 100.0 !O! hub: 80.0 m (53)	29:14
B2	VESTAS V100 1800 100.0 !O! hub: 80.0 m (52)	59:50
C1	VESTAS V100 1800 100.0 !O! hub: 80.0 m (39)	89:56
C2	VESTAS V100 1800 100.0 !O! hub: 80.0 m (38)	36:26
C5	VESTAS V100 1800 100.0 !O! hub: 80.0 m (66)	58:13
C6	VESTAS V100 1800 100.0 !O! hub: 80.0 m (37)	64:44
C7	VESTAS V100 1800 100.0 !O! hub: 80.0 m (36)	110:04
D1	VESTAS V100 1800 100.0 !O! hub: 80.0 m (54)	107:04
D10	VESTAS V100 1800 100.0 !O! hub: 80.0 m (49)	81:08
D11	VESTAS V100 1800 100.0 !O! hub: 80.0 m (48)	74:52
D12	VESTAS V100 1800 100.0 !O! hub: 80.0 m (47)	42:18
D13	VESTAS V100 1800 100.0 !O! hub: 80.0 m (46)	54:35
D2	VESTAS V100 1800 100.0 !O! hub: 80.0 m (40)	71:45
D3	VESTAS V100 1800 100.0 !O! hub: 80.0 m (69)	43:06
D4	VESTAS V100 1800 100.0 !O! hub: 80.0 m (70)	156:26
D5	VESTAS V100 1800 100.0 !O! hub: 80.0 m (65)	120:14
D6	VESTAS V100 1800 100.0 !O! hub: 80.0 m (64)	82:09
D7	VESTAS V100 1800 100.0 !O! hub: 80.0 m (63)	78:46
D8	VESTAS V100 1800 100.0 !O! hub: 80.0 m (51)	175:11
D9	VESTAS V100 1800 100.0 !O! hub: 80.0 m (50)	84:01
E10	VESTAS V100 1800 100.0 !O! hub: 80.0 m (68)	61:32
F1	VESTAS V100 1800 100.0 !O! hub: 80.0 m (41)	46:16
F2	VESTAS V100 1800 100.0 !O! hub: 80.0 m (42)	39:38
F3	VESTAS V100 1800 100.0 !O! hub: 80.0 m (60)	28:02
F4	VESTAS V100 1800 100.0 !O! hub: 80.0 m (59)	15:27
F5	VESTAS V100 1800 100.0 !O! hub: 80.0 m (58)	39:05

Project:
paulding 1 shadow flicker study [5-rev1]

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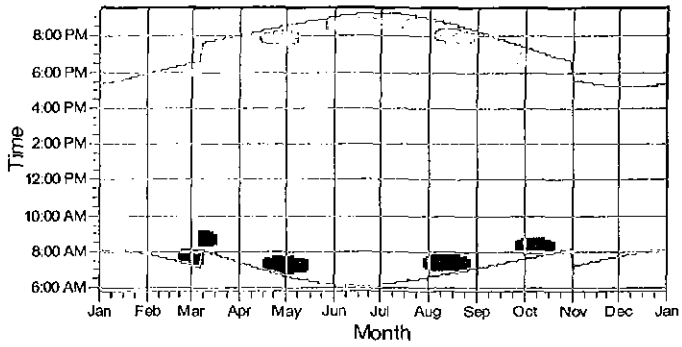
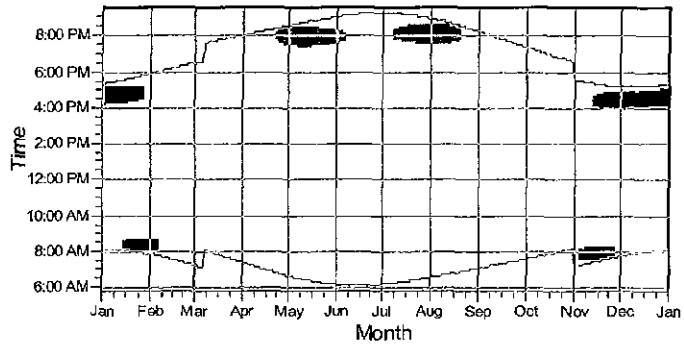
SHADOW - Calendar, graphical

Calculation: Timber Road Windfarm Shadow Flicker Analysis

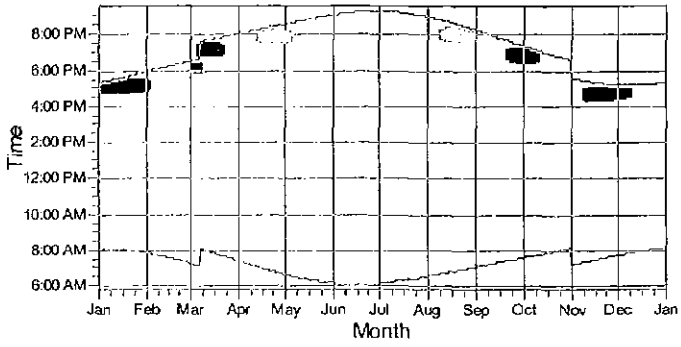
P: Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 0.0° (595)



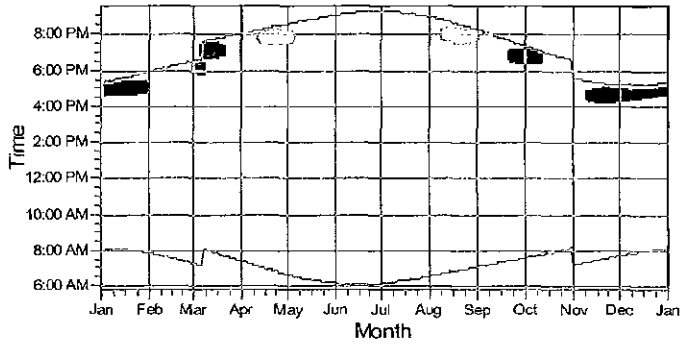
U: Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 0.0° (600)



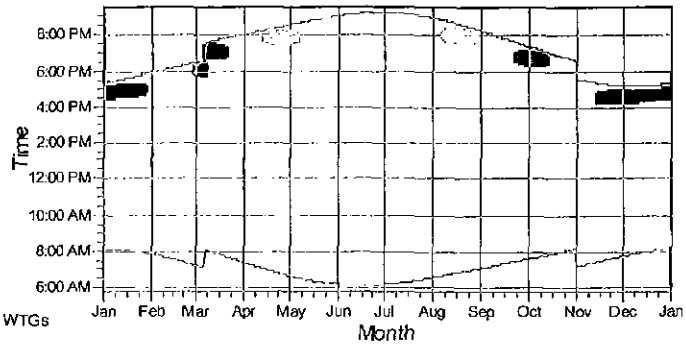
CB: Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 0.0° (659)



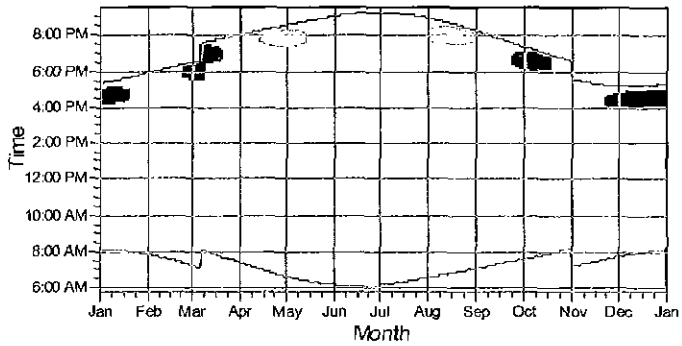
CC: Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 0.0° (660)



CD: Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 0.0° (661)



CE: Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 0.0° (662)



WTGs

- C7: VESTAS V100 1800 100.0 !O! hub: 80.0 m (36)
- C6: VESTAS V100 1800 100.0 !O! hub: 80.0 m (37)
- F1: VESTAS V100 1800 100.0 !O! hub: 80.0 m (41)
- F2: VESTAS V100 1800 100.0 !O! hub: 80.0 m (42)
- E4: VESTAS V100 1800 100.0 !O! hub: 80.0 m (43)
- D8: VESTAS V100 1800 100.0 !O! hub: 80.0 m (51)
- E3: VESTAS V100 1800 100.0 !O! hub: 80.0 m (55)
- E2: VESTAS V100 1800 100.0 !O! hub: 80.0 m (56)
- E1: VESTAS V100 1800 100.0 !O! hub: 80.0 m (57)
- D7: VESTAS V100 1800 100.0 !O! hub: 80.0 m (63)
- C5: VESTAS V100 1800 100.0 !O! hub: 80.0 m (66)
- D3: VESTAS V100 1800 100.0 !O! hub: 80.0 m (69)
- D4: VESTAS V100 1800 100.0 !O! hub: 80.0 m (70)

Project:
paulding 1 shadow flicker study [5-rev1]

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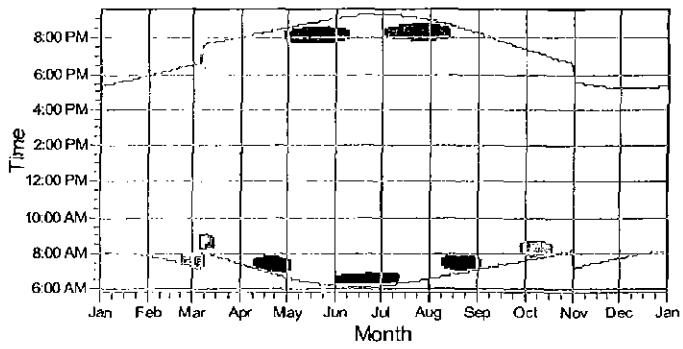
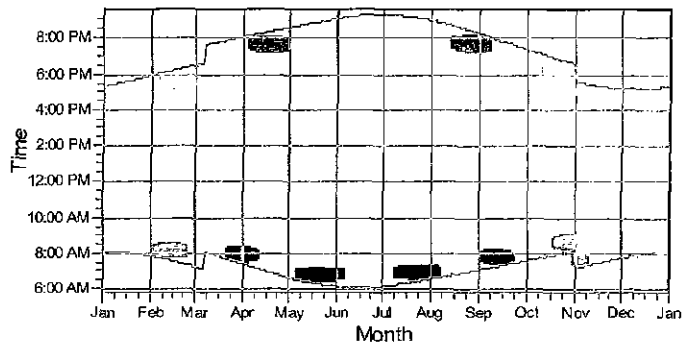
SHADOW - Calendar, graphical

Calculation: Timber Road Windfarm Shadow Flicker Analysis

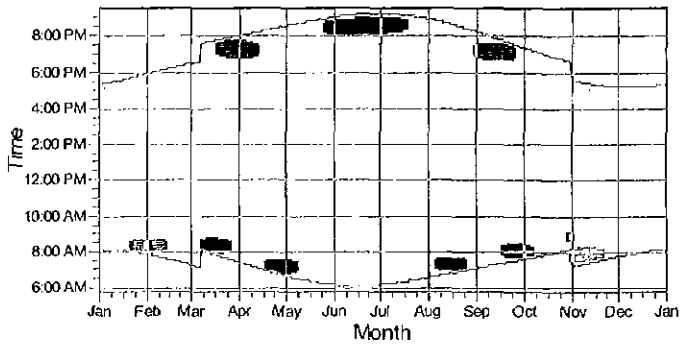
CM: Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 0.0° (670)



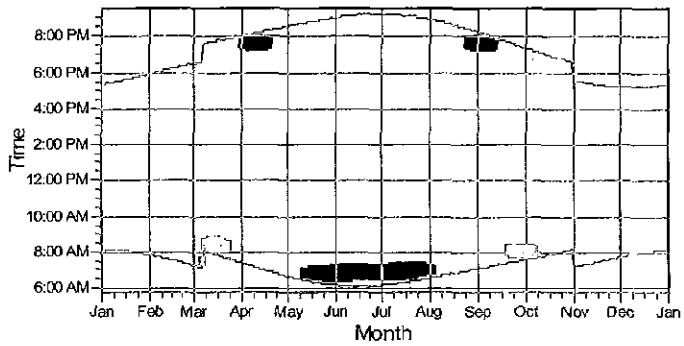
CN: Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 0.0° (671)



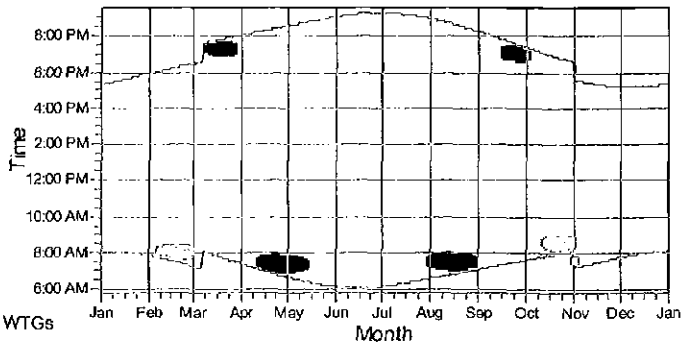
CO: Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 0.0° (672)



EF: Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 0.0° (715)



EG: Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 0.0° (716)



WTGs

- E4: VESTAS V100 1800 100.0 !O! hub: 80.0 m (43)
- E7: VESTAS V100 1800 100.0 !O! hub: 80.0 m (44)
- E8: VESTAS V100 1800 100.0 !O! hub: 80.0 m (45)
- D10: VESTAS V100 1800 100.0 !O! hub: 80.0 m (49)
- D9: VESTAS V100 1800 100.0 !O! hub: 80.0 m (50)
- D8: VESTAS V100 1800 100.0 !O! hub: 80.0 m (51)
- E6: VESTAS V100 1800 100.0 !O! hub: 80.0 m (61)
- E5: VESTAS V100 1800 100.0 !O! hub: 80.0 m (62)
- D7: VESTAS V100 1800 100.0 !O! hub: 80.0 m (63)
- D6: VESTAS V100 1800 100.0 !O! hub: 80.0 m (64)
- D5: VESTAS V100 1800 100.0 !O! hub: 80.0 m (65)
- D4: VESTAS V100 1800 100.0 !O! hub: 80.0 m (70)

Project:

paulding 1 shadow flicker study [5-rev1]

Printed/Page
12/21/2009 11:32 AM / 1

Licensed user:
EDR
217 Montgomery St.
US-SYRACUSE, NY 13202
(315) 471 0688

Calculated:
12/15/2009 11:10 PM/2.6.0.235

SHADOW - Calendar

Calculation: Timber Road Windfarm Shadow Flicker Analysis **Shadow receptor:** P - Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 0.0° (595)

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
0.51	0.50	0.58	0.66	0.67	0.77	0.75	0.75	0.68	0.55	0.39	0.34

Operational time

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
283	315	506	548	548	367	324	298	341	652	958	835	993	736	571	484	8,759

	January	February	March	April	May	June
1	08:05 / 17:21	07:51 / 17:55	07:15 / 18:29 40	07:34 (F2) / 18:07 (E3)	07:24 / 20:03	06:38 / 20:35 57	06:59 (F1) / 20:08 (E2)	06:09 / 21:04 7	20:33 (E1) / 20:40 (E1)
2	08:05 / 17:22	07:50 / 17:57	07:13 / 18:31 44	07:33 (F2) / 18:09 (E3)	07:22 / 20:04	06:37 / 20:36 56	06:58 (F1) / 20:05 (E2)	06:09 / 21:05 8	20:33 (E1) / 20:41 (E1)
3	08:05 / 17:23	07:49 / 17:58	07:12 / 18:32 49	07:31 (F2) / 18:10 (E3)	07:21 / 20:05	06:35 / 20:37 53	06:59 (F1) / 20:04 (E2)	06:08 / 21:06 9	20:32 (E1) / 20:41 (E1)
4	08:05 / 17:23	07:48 / 17:59	07:10 / 18:33 53	07:30 (F2) / 18:12 (E3)	07:19 / 20:06	06:34 / 20:38 48	06:59 (F1) / 20:02 (E2)	06:08 / 21:07 10	20:32 (E1) / 20:42 (E1)
5	08:05 / 17:24	07:47 / 18:00	07:09 / 18:34 56	07:28 (F2) / 18:13 (E3)	07:17 / 20:07	06:33 / 20:39 45	07:00 (F1) / 20:01 (E2)	06:08 / 21:07 11	20:32 (E1) / 20:43 (E1)
6	08:05 / 17:25	07:46 / 18:02	07:07 / 18:35 57	07:28 (F2) / 18:13 (E3)	07:16 / 20:08	06:32 / 20:40 39	07:00 (F1) / 19:59 (E2)	06:07 / 21:08 12	20:31 (E1) / 20:43 (E1)
7	08:05 / 17:26	07:45 / 18:03	07:05 / 18:36 59	07:28 (F2) / 18:15 (E3)	07:14 / 20:09	06:31 / 20:41 28	07:01 (F1) / 07:29 (F1)	06:07 / 21:09 12	20:32 (E1) / 20:44 (E1)
8	08:05 / 17:27	07:44 / 18:04	08:04 / 19:38 59	08:28 (F2) / 19:16 (E3)	07:12 / 20:10	06:29 / 20:42 28	07:01 (F1) / 07:27 (F1)	06:07 / 21:09 13	20:32 (E1) / 20:45 (E1)
9	08:05 / 17:28	07:42 / 18:05	08:02 / 19:39 57	08:28 (F2) / 19:15 (E3)	07:11 / 20:11	06:28 / 20:43 24	07:02 (F1) / 07:26 (F1)	06:07 / 21:10 13	20:32 (E1) / 20:45 (E1)
10	08:04 / 17:29	07:41 / 18:07	08:01 / 19:40 55	08:29 (F2) / 19:15 (E3)	07:09 / 20:12	06:27 / 20:44 22	07:03 (F1) / 07:25 (F1)	06:06 / 21:11 14	20:32 (E1) / 20:46 (E1)
11	08:04 / 17:30	07:40 / 18:08	07:59 / 19:41 51	08:29 (F2) / 19:13 (E3)	07:08 / 20:13	06:26 / 20:45 18	07:05 (F1) / 07:23 (F1)	06:06 / 21:11 14	20:32 (E1) / 20:46 (E1)
12	08:04 / 17:31	07:39 / 18:09	07:57 / 19:42 47	08:30 (F2) / 19:12 (E3)	07:06 / 20:14	06:25 / 20:46 15	07:06 (F1) / 07:21 (F1)	06:06 / 21:12 14	20:32 (E1) / 20:46 (E1)
13	08:04 / 17:33	07:38 / 18:10	07:56 / 19:43 41	08:32 (F2) / 19:11 (E3)	07:04 / 20:15	06:24 / 20:47 10	07:09 (F1) / 07:19 (F1)	06:06 / 21:12 15	20:32 (E1) / 20:47 (E1)
14	08:03 / 17:34	07:36 / 18:12	07:54 / 19:44 34	08:33 (F2) / 19:09 (E3)	07:03 / 20:17	06:23 / 20:48		06:06 / 21:13 15	20:32 (E1) / 20:47 (E1)
15	08:03 / 17:35	07:35 / 18:13	07:52 / 19:45 22	08:36 (F2) / 19:05 (E3)	07:01 / 20:18	06:22 / 20:49		06:06 / 21:13 16	20:32 (E1) / 20:48 (E1)
16	08:03 / 17:36	07:34 / 18:14	07:51 / 19:46	07:00 / 20:19 6	19:52 (E2) / 19:58 (E2)	06:21 / 20:50		06:06 / 21:13 16	20:32 (E1) / 20:48 (E1)
17	08:02 / 17:37	07:32 / 18:15	07:49 / 19:48	06:58 / 20:20 9	19:49 (E2) / 19:58 (E2)	06:20 / 20:51		06:06 / 21:14 15	20:33 (E1) / 20:48 (E1)
18	08:02 / 17:38	07:31 / 18:16	07:47 / 19:49	06:57 / 20:21 20	07:16 (F1) / 20:00 (E2)	06:19 / 20:52		06:06 / 21:14 15	20:34 (E1) / 20:49 (E1)
19	08:01 / 17:39	07:30 / 18:18	07:46 / 19:50	06:55 / 20:22 27	07:14 (F1) / 20:00 (E2)	06:18 / 20:53		06:06 / 21:15 16	20:34 (E1) / 20:50 (E1)
20	08:00 / 17:41	07:28 / 18:19	07:44 / 19:51	06:54 / 20:23 33	07:13 (F1) / 20:02 (E2)	06:17 / 20:54		06:06 / 21:15 16	20:34 (E1) / 20:50 (E1)
21	08:00 / 17:42	07:27 / 18:20	07:42 / 19:52	06:52 / 20:24 37	07:11 (F1) / 20:02 (E2)	06:16 / 20:55		06:07 / 21:15 16	20:34 (E1) / 20:50 (E1)
22	07:59 / 17:43	07:25 / 18:21	07:41 / 19:53	06:51 / 20:25 42	07:10 (F1) / 20:04 (E2)	06:16 / 20:56		06:07 / 21:15 16	20:34 (E1) / 20:50 (E1)
23	07:59 / 17:44	07:24 / 18:22 3	07:44 (F2) / 07:47 (F2)	07:39 / 19:54 / 20:26 45	06:49 / 20:04 (E2)	07:08 (F1) / 20:04 (E2)	06:15 / 20:57	06:07 / 21:16 16	20:35 (E1) / 20:51 (E1)
24	07:58 / 17:45	07:22 / 18:24 11	07:42 (F2) / 07:53 (F2)	07:37 / 19:55 / 20:27 48	06:48 / 20:05 (E2)	07:07 (F1) / 20:05 (E2)	06:14 / 20:58	06:07 / 21:16 15	20:35 (E1) / 20:50 (E1)
25	07:57 / 17:47	07:21 / 18:25 15	07:40 (F2) / 07:55 (F2)	07:36 / 19:56 / 20:28 52	06:46 / 20:07 (E2)	07:06 (F1) / 20:07 (E2)	06:13 / 20:59	06:08 / 21:16 15	20:35 (E1) / 20:50 (E1)
26	07:56 / 17:48	07:19 / 18:26 21	07:39 (F2) / 18:04 (E3)	07:34 / 19:57 / 20:29 55	06:45 / 20:07 (E2)	07:04 (F1) / 20:07 (E2)	06:13 / 21:00	06:08 / 21:16 15	20:35 (E1) / 20:50 (E1)
27	07:56 / 17:49	07:18 / 18:27 30	07:37 (F2) / 18:05 (E3)	07:32 / 19:58 / 20:30 56	06:43 / 20:08 (E2)	07:03 (F1) / 21:00	06:12	06:08 / 21:16 16	20:35 (E1) / 20:51 (E1)
28	07:55 / 17:50	07:16 / 18:26 35	07:36 (F2) / 18:07 (E3)	07:31 / 19:59 / 20:31 57	06:42 / 20:08 (E2)	07:02 (F1) / 21:01	06:11 / 20:35 (E1) 2	06:09 / 21:16 15	20:35 (E1) / 20:50 (E1)
29	07:54 / 17:52		07:29 / 20:00	06:41 / 20:33 58	07:00 (F1) / 20:07 (E2)	06:11 / 21:02	20:37 (E1) / 20:38 (E1) 4	06:09 / 21:16 15	20:36 (E1) / 20:51 (E1)
30	07:53 / 17:53		07:27 / 20:00	06:39 / 20:34 59	06:59 (F1) / 20:07 (E2)	06:10 / 21:03	20:34 (E1) / 20:38 (E1) 5	06:10 / 21:16 14	20:36 (E1) / 20:50 (E1)
31	07:52 / 17:54		07:26 / 20:02			06:10 / 21:04	20:33 (E1) / 20:39 (E1) 6		
Potential sun hours	297	297	370	399		448		452	
Total, worst case		115	724	604		458		414	
Sun reduction		0.50	0.58	0.66		0.67		0.77	
Oper. time red.		1.00	1.00	1.00		1.00		1.00	
Wind dir. red.		0.66	0.68	0.68		0.69		0.61	
Total reduction		0.33	0.39	0.45		0.47		0.47	
Total, real		38	286	272		214		195	

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)

Project:
paulding 1 shadow flicker study [5-rev1]

Licensed user:
EDR
217 Montgomery St.
US-SYRACUSE, NY 13202
(315) 471 0688

Calculated:
12/15/2009 11:10 PM/2.6.0.235

SHADOW - Calendar

Calculation: Timber Road Windfarm Shadow Flicker Analysis **Shadow receptor:** P - Shadow Receptor: 1.0 x 1.0 Azimuth: 0.0° Slope: 0.0° (595)

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
0.51	0.50	0.58	0.66	0.67	0.77	0.75	0.75	0.68	0.55	0.39	0.34

Operational time

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
283	315	506	548	548	367	324	298	341	652	958	835	993	736	571	484	8,759

July			August			September			October			November	December
1 | 06:10		20:37 (E1) | 06:34		07:16 (F1) | 07:05			07:35		08:10 (F2) | 07:10		07:45
| 21:16	14	20:51 (E1) | 20:58	17	07:33 (F1) | 20:15			19:22	45	16:51 (E3) | 17:36		17:12
2 | 06:11		20:36 (E1) | 06:35		07:15 (F1) | 07:06			07:36		08:08 (F2) | 07:11		07:46
| 21:16	14	20:50 (E1) | 20:57	19	07:34 (F1) | 20:13			19:21	50	16:52 (E3) | 17:35		17:11
3 | 06:11		20:37 (E1) | 06:36		07:13 (F1) | 07:07			07:37		08:07 (F2) | 07:12		07:47
| 21:16	14	20:51 (E1) | 20:56	23	07:35 (F1) | 20:12			19:19	53	16:52 (E3) | 17:33		17:11
4 | 06:12		20:37 (E1) | 06:37		07:12 (F1) | 07:08			07:38		08:06 (F2) | 07:13		07:48
| 21:16	13	20:50 (E1) | 20:54	25	07:37 (F1) | 20:10			19:17	55	16:52 (E3) | 17:32		17:11
5 | 06:12		20:38 (E1) | 06:38		07:11 (F1) | 07:09			07:39		08:05 (F2) | 07:14		07:49
| 21:15	12	20:50 (E1) | 20:53	27	07:38 (F1) | 20:08			19:16	57	16:52 (E3) | 17:31		17:11
6 | 06:13		20:38 (E1) | 06:39		07:11 (F1) | 07:10			07:40		08:04 (F2) | 07:16		07:50
| 21:15	11	20:49 (E1) | 20:52	30	20:05 (E2) | 20:07			19:14	58	16:51 (E3) | 17:30		17:11
7 | 06:13		20:38 (E1) | 06:40		07:10 (F1) | 07:11			07:42		08:04 (F2) | 07:17		07:51
| 21:15	12	20:50 (E1) | 20:51	40	20:09 (E2) | 20:05			19:13	57	16:50 (E3) | 17:29		17:10
8 | 06:14		20:38 (E1) | 06:41		07:09 (F1) | 07:12			07:43		08:04 (F2) | 07:18		07:51
| 21:15	11	20:49 (E1) | 20:50	46	20:11 (E2) | 20:03			19:11	56	16:49 (E3) | 17:28		17:10
9 | 06:15		20:39 (E1) | 06:42		07:09 (F1) | 07:13			07:44		08:04 (F2) | 07:19		07:52
| 21:14	10	20:49 (E1) | 20:48	50	20:13 (E2) | 20:02			19:09	55	16:47 (E3) | 17:27		17:10
10 | 06:15		20:40 (E1) | 06:43		07:08 (F1) | 07:14			07:45		08:05 (F2) | 07:20		07:53
| 21:14	9	20:49 (E1) | 20:47	53	20:14 (E2) | 20:00			19:08	50	16:45 (E3) | 17:26		17:10
11 | 06:16		20:40 (E1) | 06:44		07:08 (F1) | 07:15			07:46		08:06 (F2) | 07:22		07:54
| 21:14	8	20:48 (E1) | 20:46	55	20:15 (E2) | 19:57			19:06	47	16:44 (E3) | 17:25		17:11
12 | 06:17		20:41 (E1) | 06:45		07:07 (F1) | 07:16			07:47		08:07 (F2) | 07:23		07:55
| 21:13	7	20:48 (E1) | 20:45	57	20:14 (E2) | 19:55			19:04	42	16:42 (E3) | 17:24		17:11
13 | 06:18		20:42 (E1) | 06:46		07:07 (F1) | 07:17			07:48		08:08 (F2) | 07:24		07:56
| 21:13	5	20:47 (E1) | 20:43	59	20:15 (E2) | 19:53			19:03	38	16:40 (E3) | 17:23		17:11
14 | 06:18		20:43 (E1) | 06:47		07:08 (F1) | 07:18			07:49		08:09 (F2) | 07:25		07:56
| 21:12	4	20:47 (E1) | 20:42	58	20:15 (E2) | 19:51			19:01	33	16:39 (E3) | 17:22		17:11
15 | 06:19		20:43 (E1) | 06:48		07:09 (F1) | 07:19			07:50		08:10 (F2) | 07:26		07:57
| 21:12	3	20:46 (E1) | 20:41	57	20:15 (E2) | 19:50			19:00	27	16:37 (E3) | 17:21		17:11
16 | 06:20		20:45 (E1) | 06:49		07:10 (F1) | 07:20			07:51		08:11 (F2) | 07:28		07:58
| 21:11	2	20:47 (E1) | 20:39	57	20:16 (E2) | 19:48			18:58	17	08:28 (F2) | 17:20		17:12
17 | 06:21		| 06:50		07:11 (F1) | 07:21			07:52		08:13 (F2) | 07:29		07:59
| 21:10		| 20:38	54	20:14 (E2) | 19:46			18:57	13	08:26 (F2) | 17:19		17:12
18 | 06:21		| 06:51		07:12 (F1) | 07:22			07:53		08:14 (F2) | 07:30		07:59
| 21:10		| 20:36	51	20:12 (E2) | 19:45			18:55	9	08:23 (F2) | 17:18		17:12
19 | 06:22		| 06:52		07:13 (F1) | 07:23			07:55		| 07:31		08:00
| 21:09		| 20:35	48	20:11 (E2) | 19:43			18:54		| 17:18		17:13
20 | 06:23		| 06:53		07:14 (F1) | 07:24			07:56		| 07:32		08:00
| 21:08		| 20:33	45	20:10 (E2) | 19:41			18:52		| 17:17		17:13
21 | 06:24		| 06:54		07:15 (F1) | 07:25			07:57		| 07:33		08:01
| 21:08		| 20:32	41	20:08 (E2) | 19:39			18:51		| 17:16		17:13
22 | 06:25		| 06:55		07:16 (F1) | 07:26			07:58		| 07:35		08:01
| 21:07		| 20:30	36	20:07 (E2) | 19:38			18:49		| 17:16		17:14
23 | 06:26		| 06:56		07:17 (F1) | 07:27			07:59		| 07:36		08:02
| 21:06		| 20:29	31	20:05 (E2) | 19:36			18:48		| 17:15		17:14
24 | 06:27		| 06:57		07:18 (F1) | 07:28			08:00		| 07:37		08:02
| 21:05		| 20:27	26	20:04 (E2) | 19:34			18:46		| 17:15		17:15
25 | 06:28		| 06:58		07:19 (F1) | 07:29			08:01		| 07:38		08:03
| 21:04		| 20:26	19	20:02 (E2) | 19:33			18:45		| 17:14		17:16
26 | 06:28		| 06:59		19:52 (E2) | 07:30			08:03		| 07:39		08:03
| 21:04		| 20:24	9	20:01 (E2) | 19:31			18:44		| 17:14		17:16
27 | 06:29		| 07:00		19:54 (E2) | 07:31			08:04		| 07:40		08:04
| 21:03		| 20:23	5	19:59 (E2) | 19:29			18:42		| 17:13		17:17
28 | 06:30		| 07:01		| 07:32		08:19 (F2) | 08:05		| 07:41		08:04
| 21:02		| 20:21		| 19:28	15	18:45 (E3) | 18:41		| 17:13		17:18
29 | 06:31		| 07:02		| 07:33		08:15 (F2) | 08:06		| 07:42		08:04
| 21:01		| 20:20		| 19:26	30	18:48 (E3) | 18:40		| 17:12		17:18
30 | 06:32		07:22 (F1) | 07:03		| 07:34		08:12 (F2) | 08:07		| 07:44		08:04
| 21:00	5	07:27 (F1) | 20:18		| 19:24	39	18:50 (E3) | 18:38		| 17:12		17:19
31 | 06:33		07:18 (F1) | 07:04					08:08				08:05
| 20:59	13	07:31 (F1) | 20:16					18:37				17:20
Potential sun hours | *459*		| *428*		| *375*			*345*		*297*		*287*
Total, worst case | 167		| 1038		| 84			762				
Sun reduction | 0.75		| 0.75		| 0.68			0.55				
Oper. time red. | 1.00		| 1.00		| 1.00			1.00				
Wind dir. red. | 0.62		| 0.69		| 0.68			0.67				
Total reduction | *0.47*		| *0.51*		| *0.47*			*0.37*				
Total, real | 78		| 534		| 39			281				

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:
paulding 1 shadow flicker study [5-rev1]

Licensed user:
EDR
217 Montgomery St.
US-SYRACUSE, NY 13202
(315) 471 0688

Calculated:
12/15/2009 11:10 PM/2.6.0.235

SHADOW - Calendar

Calculation: Timber Road Windfarm Shadow Flicker Analysis **Shadow receptor:** U - Shadow Receptor: 1.0 x 1.0 Azimuth: 0.0° Slope: 0.0° (600)

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.51	0.50	0.58	0.66	0.67	0.77	0.75	0.75	0.68	0.55	0.39	0.34

Operational time

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
283	315	506	548	548	367	324	298	341	652	958	835	993	736	571	484	8,759

	January			February			March	April		May			June		
1	08:05		16:26 (D4)	07:51		08:14 (E4)	07:15	07:24		06:38		19:44 (D3)	06:09		06:31 (E3)
	17:21	28	16:54 (D4)	17:55	18	08:32 (E4)	18:30	20:03		20:35	29	20:13 (D3)	21:05	23	20:07 (D3)
2	08:05		16:27 (D4)	07:50		08:14 (E4)	07:13	07:22		06:37		19:44 (D3)	06:09		06:31 (E3)
	17:22	28	16:55 (D4)	17:57	16	08:30 (E4)	18:31	20:04		20:36	30	20:14 (D3)	21:05	21	20:06 (D3)
3	08:05		16:27 (D4)	07:49		08:15 (E4)	07:12	07:21		06:36		19:42 (D3)	06:09		06:30 (E3)
	17:23	29	16:56 (D4)	17:58	14	08:29 (E4)	18:32	20:05		20:37	32	20:14 (D3)	21:06	17	20:03 (D3)
4	08:05		16:27 (D4)	07:48		08:18 (E4)	07:10	07:19		06:34		19:41 (D3)	06:08		06:30 (E3)
	17:24	30	16:57 (D4)	17:59	9	08:27 (E4)	18:33	20:06		20:38	34	20:15 (D3)	21:07	13	06:43 (E3)
5	08:05		16:28 (D4)	07:47			07:09	07:17		06:33		19:41 (D3)	06:08		06:30 (E3)
	17:24	30	16:58 (D4)	18:00			18:34	20:07		20:39	36	20:17 (D3)	21:07	14	06:44 (E3)
6	08:05		16:28 (D4)	07:46			07:07	07:16		06:32		19:41 (D3)	06:07		06:29 (E3)
	17:25	31	16:59 (D4)	18:02			18:35	20:08		20:40	37	20:18 (D3)	21:08	15	06:44 (E3)
7	08:05		16:29 (D4)	07:45			07:05	07:14		06:31		19:41 (D3)	06:07		06:29 (E3)
	17:26	31	17:00 (D4)	18:03			18:36	20:09		20:41	37	20:18 (D3)	21:09	16	06:45 (E3)
8	08:05		16:29 (D4)	07:44			08:04	07:12		06:29		19:40 (D3)	06:07		06:29 (E3)
	17:27	32	17:01 (D4)	18:04			19:38	20:10		20:42	38	20:18 (D3)	21:09	16	06:45 (E3)
9	08:05		16:30 (D4)	07:43			08:02	07:11		06:28		19:39 (D3)	06:07		06:29 (E3)
	17:28	31	17:01 (D4)	18:05			19:39	20:11		20:43	39	20:18 (D3)	21:10	17	06:46 (E3)
10	08:05		16:30 (D4)	07:41			08:01	07:09		06:27		19:39 (D3)	06:07		06:29 (E3)
	17:29	31	17:01 (D4)	18:07			19:40	20:12		20:44	39	20:18 (D3)	21:11	17	06:46 (E3)
11	08:04		16:30 (D4)	07:40			07:59	07:08		06:26		19:39 (D3)	06:06		06:28 (E3)
	17:30	32	17:02 (D4)	18:08			19:41	20:13		20:45	39	20:18 (D3)	21:11	18	06:46 (E3)
12	08:04		16:31 (D4)	07:39			07:57	07:06		06:25		19:39 (D3)	06:06		06:28 (E3)
	17:32	31	17:02 (D4)	18:09			19:42	20:14		20:46	39	20:18 (D3)	21:12	18	06:46 (E3)
13	08:04		16:31 (D4)	07:38			07:56	07:04		06:24		19:39 (D3)	06:06		06:28 (E3)
	17:33	31	17:02 (D4)	18:10			19:43	20:16		20:47	39	20:18 (D3)	21:12	19	06:47 (E3)
14	08:03		16:32 (D4)	07:36			07:54	07:03		06:23		19:40 (D3)	06:06		06:28 (E3)
	17:34	31	17:03 (D4)	18:12			19:44	20:17		20:48	37	20:17 (D3)	21:13	19	06:47 (E3)
15	08:03		16:32 (D4)	07:35			07:52	07:01		06:22		19:40 (D3)	06:06		06:28 (E3)
	17:35	30	17:02 (D4)	18:13			19:45	20:18		20:49	37	20:17 (D3)	21:13	19	06:47 (E3)
16	08:03		16:33 (D4)	07:34			07:51	07:00		06:21		19:41 (D3)	06:06		06:28 (E3)
	17:36	30	17:03 (D4)	18:14			19:47	20:19		20:50	37	20:18 (D3)	21:14	19	06:47 (E3)
17	08:02		08:23 (E4)	07:32			07:49	06:58		06:20		19:41 (D3)	06:06		06:28 (E3)
	17:37	30	17:02 (D4)	18:15			19:48	20:20		20:51	36	20:17 (D3)	21:14	20	06:48 (E3)
18	08:02		08:23 (E4)	07:31			07:47	06:57		06:19		19:41 (D3)	06:06		06:28 (E3)
	17:38	31	17:03 (D4)	18:17			19:49	20:21		20:52	36	20:17 (D3)	21:14	20	06:48 (E3)
19	08:01		08:22 (E4)	07:30			07:46	06:55		06:18		19:42 (D3)	06:06		06:28 (E3)
	17:39	32	17:02 (D4)	18:18			19:50	20:22		20:53	34	20:16 (D3)	21:15	20	06:49 (E3)
20	08:01		08:22 (E4)	07:28			07:44	06:54		06:17		19:42 (D3)	06:07		06:28 (E3)
	17:41	33	17:03 (D4)	18:19			19:51	20:23		20:54	34	20:16 (D3)	21:15	20	06:49 (E3)
21	08:00		08:21 (E4)	07:27			07:42	06:52		06:17		19:42 (D3)	06:07		06:29 (E3)
	17:42	33	17:02 (D4)	18:20			19:52	20:24		20:55	33	20:15 (D3)	21:15	20	06:49 (E3)
22	07:59		08:20 (E4)	07:25			07:41	06:51		06:16		19:44 (D3)	06:07		06:29 (E3)
	17:43	33	17:01 (D4)	18:21			19:53	20:25		20:56	31	20:15 (D3)	21:15	20	06:49 (E3)
23	07:59		08:19 (E4)	07:24			07:39	06:49		06:15		19:44 (D3)	06:07		06:30 (E3)
	17:44	32	17:00 (D4)	18:23			19:54	20:26		20:57	30	20:14 (D3)	21:16	20	06:50 (E3)
24	07:58		08:19 (E4)	07:22			07:37	06:48		06:14		19:45 (D3)	06:07		06:30 (E3)
	17:45	30	17:00 (D4)	18:24			19:55	20:27		20:58	28	20:13 (D3)	21:16	20	06:50 (E3)
25	07:57		08:18 (E4)	07:21			07:36	06:46	19:59 (D3)	06:13		19:46 (D3)	06:08		06:30 (E3)
	17:47	30	16:59 (D4)	18:25			19:56	20:28	3 20:02 (D3)	20:59	28	20:14 (D3)	21:16	20	06:50 (E3)
26	07:56		08:17 (E4)	07:19			07:34	06:45	19:53 (D3)	06:13		19:46 (D3)	06:08		06:31 (E3)
	17:48	25	16:56 (D4)	18:26			19:57	20:29	14 20:07 (D3)	21:00	26	20:12 (D3)	21:16	20	06:51 (E3)
27	07:56		08:16 (E4)	07:18			07:32	06:44	19:50 (D3)	06:12		19:47 (D3)	06:08		06:31 (E3)
	17:49	16	08:32 (E4)	18:27			19:58	20:30	18 20:08 (D3)	21:00	24	20:11 (D3)	21:16	19	06:50 (E3)
28	07:55		08:15 (E4)	07:16			07:31	06:42	19:49 (D3)	06:12		06:33 (E3)	06:09		06:31 (E3)
	17:50	17	08:32 (E4)	18:28			19:59	20:32	21 20:10 (D3)	21:01	25	20:11 (D3)	21:16	19	06:50 (E3)
29	07:54		08:14 (E4)				07:29	06:41	19:46 (D3)	06:11		06:32 (E3)	06:09		06:32 (E3)
	17:52	18	08:32 (E4)				20:01	20:33	24 20:10 (D3)	21:02	26	20:10 (D3)	21:16	19	06:51 (E3)
30	07:53		08:13 (E4)				07:27	06:39	19:45 (D3)	06:10		06:32 (E3)	06:10		06:32 (E3)
	17:53	19	08:32 (E4)				20:01	20:34	26 20:11 (D3)	21:03	25	20:09 (D3)	21:16	18	06:50 (E3)
31	07:52		08:13 (E4)				07:26			06:10		06:31 (E3)			
	17:54	19	08:32 (E4)				20:02			21:04	25	20:08 (D3)			
Potential sun hours	297			297			370	399		448			452		
Total, worst case		884			57				106		1020			556	
Sun reduction		0.51			0.50				0.66		0.67			0.77	
Oper. time red.		1.00			1.00				1.00		1.00			1.00	
Wind dir. red.		0.69			0.61				0.64		0.64			0.71	
Total reduction		0.35			0.31				0.43		0.44			0.55	
Total, real		313			18				45		444			307	

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:
paulding 1 shadow flicker study [5-rev1]

Printed/Page
12/21/2009 11:32 AM / 4
Licensed user:
EDR
217 Montgomery St.
US-SYRACUSE, NY 13202
(315) 471 0688

Calculated:
12/15/2009 11:10 PM/2.6.0.235

SHADOW - Calendar

Calculation: Timber Road Windfarm Shadow Flicker Analysis **Shadow receptor:** U - Shadow Receptor: 1.0 x 1.0 Azimuth: 0.0° Slope: 0.0° (600)

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
0.51	0.50	0.58	0.66	0.67	0.77	0.75	0.75	0.68	0.55	0.39	0.34

Operational time

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
283	315	506	548	548	367	324	298	341	652	958	835	993	736	571	484	8,759

	July			August			September	October	November			December		
1	06:10		06:33 (E3)	06:34		19:50 (D3)	07:05	07:35	07:10			07:45		16:13 (D4)
	21:16	18	06:51 (E3)	20:58	38	20:28 (D3)	20:15	19:23	17:36			17:12	31	16:44 (D4)
2	06:11		06:33 (E3)	06:35		19:50 (D3)	07:06	07:36	07:11			07:46		16:13 (D4)
	21:16	18	06:51 (E3)	20:57	38	20:28 (D3)	20:13	19:21	17:35			17:11	31	16:44 (D4)
3	06:11		06:34 (E3)	06:36		19:50 (D3)	07:07	07:37	07:12			07:47		16:13 (D4)
	21:16	17	06:51 (E3)	20:56	38	20:28 (D3)	20:12	19:19	17:33			17:11	31	16:44 (D4)
4	06:12		06:34 (E3)	06:37		19:50 (D3)	07:08	07:38	07:13			07:48		16:13 (D4)
	21:16	16	06:50 (E3)	20:54	38	20:28 (D3)	20:10	19:18	17:32			17:11	32	16:45 (D4)
5	06:12		06:35 (E3)	06:38		19:50 (D3)	07:09	07:39	07:14			07:49		16:14 (D4)
	21:16	16	06:51 (E3)	20:53	38	20:28 (D3)	20:08	19:16	17:31			17:11	31	16:45 (D4)
6	06:13		06:35 (E3)	06:39		19:50 (D3)	07:10	07:41	07:16		07:52 (E4)	07:50		16:14 (D4)
	21:15	15	06:50 (E3)	20:52	38	20:28 (D3)	20:07	19:14	17:30	2	07:54 (E4)	17:11	31	16:45 (D4)
7	06:13		06:36 (E3)	06:40		19:51 (D3)	07:11	07:42	07:17		07:48 (E4)	07:51		16:15 (D4)
	21:15	14	06:50 (E3)	20:51	36	20:27 (D3)	20:05	19:13	17:29	10	07:56 (E4)	17:11	30	16:45 (D4)
8	06:14		06:37 (E3)	06:41		19:51 (D3)	07:12	07:43	07:18		07:48 (E4)	07:52		16:15 (D4)
	21:15	14	06:51 (E3)	20:50	35	20:26 (D3)	20:03	19:11	17:28	14	08:00 (E4)	17:11	30	16:45 (D4)
9	06:15		06:37 (E3)	06:42		19:51 (D3)	07:13	07:44	07:19		07:45 (E4)	07:52		16:16 (D4)
	21:14	13	06:50 (E3)	20:48	34	20:25 (D3)	20:02	19:09	17:27	16	08:01 (E4)	17:11	29	16:46 (D4)
10	06:15		06:38 (E3)	06:43		19:52 (D3)	07:14	07:45	07:20		07:45 (E4)	07:53		16:17 (D4)
	21:14	20	20:12 (D3)	20:47	31	20:23 (D3)	20:00	19:08	17:26	18	08:03 (E4)	17:11	28	16:45 (D4)
11	06:16		06:39 (E3)	06:44		19:52 (D3)	07:15	07:46	07:22		07:44 (E4)	07:54		16:17 (D4)
	21:14	23	20:15 (D3)	20:46	30	20:22 (D3)	19:57	19:06	17:25	19	08:03 (E4)	17:11	28	16:45 (D4)
12	06:17		06:39 (E3)	06:45		19:53 (D3)	07:16	07:47	07:23		07:45 (E4)	07:55		16:17 (D4)
	21:13	23	20:15 (D3)	20:45	28	20:21 (D3)	19:55	19:05	17:24	19	08:04 (E4)	17:11	28	16:45 (D4)
13	06:18		06:40 (E3)	06:46		19:54 (D3)	07:17	07:48	07:24		07:46 (E4)	07:56		16:18 (D4)
	21:13	25	20:17 (D3)	20:43	26	20:20 (D3)	19:53	19:03	17:23	18	08:04 (E4)	17:11	27	16:45 (D4)
14	06:18		06:41 (E3)	06:47		19:54 (D3)	07:18	07:49	07:25		07:48 (E4)	07:57		16:18 (D4)
	21:12	26	20:19 (D3)	20:42	24	20:18 (D3)	19:52	19:01	17:22	17	08:05 (E4)	17:11	27	16:45 (D4)
15	06:19		06:41 (E3)	06:48		19:56 (D3)	07:19	07:50	07:26		07:49 (E4)	07:57		16:19 (D4)
	21:12	26	20:19 (D3)	20:41	20	20:16 (D3)	19:50	19:00	17:21	16	08:05 (E4)	17:11	27	16:46 (D4)
16	06:20		06:42 (E3)	06:49		19:58 (D3)	07:20	07:51	07:28		07:50 (E4)	07:58		16:19 (D4)
	21:11	25	20:20 (D3)	20:39	17	20:15 (D3)	19:48	18:58	17:20	25	16:29 (D4)	17:12	26	16:45 (D4)
17	06:21		19:56 (D3)	06:50		20:00 (D3)	07:21	07:52	07:29		07:51 (E4)	07:59		16:20 (D4)
	21:10	25	20:21 (D3)	20:38	13	20:13 (D3)	19:46	18:57	17:19	30	16:32 (D4)	17:12	26	16:46 (D4)
18	06:22		19:56 (D3)	06:51			07:22	07:54	07:30		07:53 (E4)	07:59		16:21 (D4)
	21:10	26	20:22 (D3)	20:36			19:45	18:55	17:19	30	16:34 (D4)	17:12	26	16:47 (D4)
19	06:22		19:55 (D3)	06:52			07:23	07:55	07:31		07:54 (E4)	08:00		16:21 (D4)
	21:09	29	20:24 (D3)	20:35			19:43	18:54	17:18	32	16:35 (D4)	17:13	25	16:46 (D4)
20	06:23		19:54 (D3)	06:53			07:24	07:56	07:32		07:55 (E4)	08:00		16:22 (D4)
	21:08	29	20:23 (D3)	20:33			19:41	18:52	17:17	33	16:36 (D4)	17:13	25	16:47 (D4)
21	06:24		19:53 (D3)	06:54			07:25	07:57	07:34		07:56 (E4)	08:01		16:22 (D4)
	21:08	31	20:24 (D3)	20:32			19:40	18:51	17:16	32	16:37 (D4)	17:13	25	16:47 (D4)
22	06:25		19:53 (D3)	06:55			07:26	07:58	07:35		07:58 (E4)	08:02		16:23 (D4)
	21:07	32	20:25 (D3)	20:31			19:38	18:49	17:16	33	16:39 (D4)	17:14	25	16:48 (D4)
23	06:26		19:53 (D3)	06:56			07:27	07:59	07:36		07:59 (E4)	08:02		16:23 (D4)
	21:06	33	20:26 (D3)	20:29			19:36	18:48	17:15	32	16:39 (D4)	17:15	25	16:48 (D4)
24	06:27		19:52 (D3)	06:57			07:28	08:00	07:37		08:00 (E4)	08:02		16:24 (D4)
	21:05	34	20:26 (D3)	20:27			19:34	18:46	17:15	31	16:40 (D4)	17:15	25	16:49 (D4)
25	06:28		19:52 (D3)	06:58			07:29	08:02	07:38		08:01 (E4)	08:03		16:24 (D4)
	21:05	35	20:27 (D3)	20:26			19:33	18:45	17:14	30	16:40 (D4)	17:16	26	16:50 (D4)
26	06:29		19:52 (D3)	06:59			07:30	08:03	07:39		16:11 (D4)	08:03		16:24 (D4)
	21:04	35	20:28 (D3)	20:24			19:31	18:44	17:14	30	16:41 (D4)	17:16	26	16:50 (D4)
27	06:29		19:52 (D3)	07:00			07:31	08:04	07:40		16:12 (D4)	08:04		16:25 (D4)
	21:03	36	20:28 (D3)	20:23			19:29	18:42	17:13	30	16:42 (D4)	17:17	26	16:51 (D4)
28	06:30		19:50 (D3)	07:01			07:32	08:05	07:41		16:12 (D4)	08:04		16:25 (D4)
	21:02	37	20:27 (D3)	20:21			19:28	18:41	17:13	31	16:43 (D4)	17:18	27	16:52 (D4)
29	06:31		19:50 (D3)	07:02			07:33	08:06	07:43		16:12 (D4)	08:04		16:25 (D4)
	21:01	38	20:28 (D3)	20:20			19:26	18:40	17:12	31	16:43 (D4)	17:18	27	16:52 (D4)
30	06:32		19:50 (D3)	07:03			07:34	08:07	07:44		16:12 (D4)	08:04		16:26 (D4)
	21:00	38	20:28 (D3)	20:18			19:24	18:38	17:12	31	16:43 (D4)	17:19	27	16:53 (D4)
31	06:33		19:50 (D3)	07:04				08:09				08:05		16:26 (D4)
	20:59	38	20:28 (D3)	20:17				18:37				17:20	27	16:53 (D4)
Potential sun hours	459			428			375	345	297			287		
Total, worst case		806			522					610			855	
Sun reduction		0.75			0.75					0.39			0.34	
Oper. time red.		1.00			1.00					1.00			1.00	
Wind dir. red.		0.66			0.64					0.67			0.71	
Total reduction		0.50			0.48					0.27			0.24	
Total, real		400			252					162			206	

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:
paulding 1 shadow flicker study [5-rev1]

Printed/Page
12/21/2009 11:32 AM / 5

Licensed user:
EDR
217 Montgomery St.
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Calculated:
12/15/2009 11:10 PM/2.6.0.235

SHADOW - Calendar

Calculation: Timber Road Windfarm Shadow Flicker Analysis **Shadow receptor:** CB - Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 0.0° (659)

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
0.51	0.50	0.58	0.66	0.67	0.77	0.75	0.75	0.68	0.55	0.39	0.34

Operational time

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
283	315	506	548	548	367	324	298	341	652	958	835	993	736	571	484	8,759

	January			February			March			April			May			June		
1	08:05		08:30 (D8)	07:51		17:05 (C7)	07:15			07:24			06:38		19:45 (C5)	06:10		06:40 (D7)
	17:21	35	09:05 (D8)	17:55	10	17:15 (C7)	18:30			20:03			20:35	16	20:01 (C5)	21:05	18	06:58 (D7)
2	08:05		08:31 (D8)	07:50			07:13			07:22			06:37		19:47 (C5)	06:09		06:41 (D7)
	17:22	34	09:05 (D8)	17:57			18:31			20:04			20:36	12	19:59 (C5)	21:05	17	06:58 (D7)
3	08:05		08:31 (D8)	07:49			07:12			07:21			06:36		19:50 (C5)	06:09		06:41 (D7)
	17:23	35	09:06 (D8)	17:58			18:32			20:05			20:37	5	19:55 (C5)	21:06	16	06:57 (D7)
4	08:05		08:32 (D8)	07:48			07:10		18:11 (C6)	07:19			06:34			06:08		06:43 (D7)
	17:24	36	16:58 (C7)	17:59			18:33	2	18:13 (C6)	20:06			20:38			21:07	14	06:57 (D7)
5	08:05		08:33 (D8)	07:47			07:09		18:06 (C6)	07:17			06:33			06:08		06:44 (D7)
	17:25	35	16:58 (C7)	18:01			18:34	7	18:13 (C6)	20:07			20:39			21:07	12	06:56 (D7)
6	08:05		08:33 (D8)	07:46			07:07		18:03 (C6)	07:16			06:32			06:08		06:44 (D7)
	17:26	38	16:59 (C7)	18:02			18:35	10	18:13 (C6)	20:08			20:40			21:08	11	06:55 (D7)
7	08:05		08:34 (D8)	07:45			07:06		18:02 (C6)	07:14			06:31			06:07		06:46 (D7)
	17:27	38	17:00 (C7)	18:03			18:37	13	18:15 (C6)	20:09			20:41			21:09	8	06:54 (D7)
8	08:05		08:35 (D8)	07:44			08:04		19:00 (C6)	07:13			06:30		06:50 (D7)	06:07		06:48 (D7)
	17:28	40	17:02 (C7)	18:04			19:38	16	19:16 (C6)	20:10			20:42	4	06:54 (D7)	21:09	5	06:53 (D7)
9	08:05		08:35 (D8)	07:43			08:02		19:00 (C6)	07:11			06:28		06:49 (D7)	06:07		
	17:29	42	17:03 (C7)	18:06			19:39	18	19:18 (C6)	20:11			20:43	7	06:56 (D7)	21:10		
10	08:05		08:35 (D8)	07:41			08:01		18:58 (C6)	07:09			06:27		06:47 (D7)	06:07		
	17:30	42	17:03 (C7)	18:07			19:40	21	19:19 (C6)	20:12			20:44	9	06:56 (D7)	21:11		
11	08:04		08:36 (D8)	07:40			07:59		18:57 (C6)	07:08			06:26		06:46 (D7)	06:07		
	17:31	43	17:05 (C7)	18:08			19:41	22	19:19 (C6)	20:13			20:45	11	06:57 (D7)	21:11		
12	08:04		08:37 (D8)	07:39			07:57		18:57 (C6)	07:06			06:25		06:45 (D7)	06:06		
	17:32	44	17:06 (C7)	18:09			19:42	24	19:21 (C6)	20:14			20:46	13	06:58 (D7)	21:12		
13	08:04		08:37 (D8)	07:38			07:56		18:57 (C6)	07:05			06:24		06:44 (D7)	06:06		
	17:33	45	17:07 (C7)	18:10			19:43	25	19:22 (C6)	20:16			20:47	15	06:59 (D7)	21:12		
14	08:03		08:39 (D8)	07:36			07:54		18:56 (C6)	07:03		19:50 (C5)	06:23		06:43 (D7)	06:06		
	17:34	44	17:08 (C7)	18:12			19:44	27	19:23 (C6)	20:17	6	19:56 (C5)	20:48	16	06:59 (D7)	21:13		
15	08:03		08:39 (D8)	07:35			07:52		18:57 (C6)	07:01		19:47 (C5)	06:22		06:43 (D7)	06:06		
	17:35	45	17:09 (C7)	18:13			19:45	27	19:24 (C6)	20:18	9	19:56 (C5)	20:49	18	07:01 (D7)	21:13		
16	08:03		08:40 (D8)	07:34			07:51		18:57 (C6)	07:00		19:46 (C5)	06:21		06:42 (D7)	06:06		
	17:36	46	17:11 (C7)	18:14			19:47	26	19:23 (C6)	20:19	12	19:58 (C5)	20:50	19	07:01 (D7)	21:14		
17	08:02		08:41 (D8)	07:32			07:49		18:57 (C6)	06:58		19:44 (C5)	06:20		06:41 (D7)	06:06		
	17:37	44	17:11 (C7)	18:15			19:48	24	19:21 (C6)	20:20	14	19:58 (C5)	20:51	20	07:01 (D7)	21:14		
18	08:02		08:43 (D8)	07:31			07:47		18:59 (C6)	06:57		19:43 (C5)	06:19		06:40 (D7)	06:06		
	17:38	43	17:13 (C7)	18:17			19:49	22	19:21 (C6)	20:21	17	20:00 (C5)	20:52	21	07:01 (D7)	21:14		
19	08:01		08:43 (D8)	07:30			07:46		19:00 (C6)	06:55		19:42 (C5)	06:18		06:39 (D7)	06:06		
	17:40	44	17:14 (C7)	18:18			19:50	19	19:19 (C6)	20:22	18	20:00 (C5)	20:53	22	07:01 (D7)	21:15		
20	08:01		08:45 (D8)	07:28			07:44		19:01 (C6)	06:54		19:42 (C5)	06:17		06:38 (D7)	06:07		
	17:41	43	17:16 (C7)	18:19			19:51	15	19:16 (C6)	20:23	20	20:02 (C5)	20:54	23	07:01 (D7)	21:15		
21	08:00		08:47 (D8)	07:27			07:42		19:04 (C6)	06:52		19:41 (C5)	06:17		06:38 (D7)	06:07		
	17:42	41	17:17 (C7)	18:20			19:52	9	19:13 (C6)	20:24	21	20:02 (C5)	20:55	23	07:01 (D7)	21:15		
22	07:59		08:48 (D8)	07:25			07:41			06:51		19:41 (C5)	06:16		06:37 (D7)	06:07		
	17:43	39	17:18 (C7)	18:21			19:53			20:25	22	20:03 (C5)	20:56	24	07:01 (D7)	21:15		
23	07:59		08:52 (D8)	07:24			07:39			06:49		19:41 (C5)	06:15		06:36 (D7)	06:07		
	17:44	34	17:20 (C7)	18:23			19:54			20:26	24	20:05 (C5)	20:57	25	07:01 (D7)	21:16		
24	07:58		16:56 (C7)	07:23			07:37			06:48		19:40 (C5)	06:14		06:35 (D7)	06:08		
	17:46	24	17:20 (C7)	18:24			19:55			20:27	25	20:05 (C5)	20:58	25	07:00 (D7)	21:16		
25	07:57		16:56 (C7)	07:21			07:36			06:46		19:41 (C5)	06:14		06:36 (D7)	06:08		
	17:47	24	17:20 (C7)	18:25			19:56			20:28	26	20:07 (C5)	20:59	25	07:01 (D7)	21:16		
26	07:56		16:56 (C7)	07:20			07:34			06:45		19:40 (C5)	06:13		06:36 (D7)	06:08		
	17:48	24	17:20 (C7)	18:26			19:57			20:29	26	20:06 (C5)	21:00	24	07:00 (D7)	21:16		
27	07:56		16:57 (C7)	07:18			07:32			06:44		19:41 (C5)	06:12		06:37 (D7)	06:09		
	17:49	22	17:19 (C7)	18:27			19:58			20:30	25	20:06 (C5)	21:00	23	07:00 (D7)	21:16		
28	07:55		16:58 (C7)	07:17			07:31			06:42		19:42 (C5)	06:12		06:36 (D7)	06:09		
	17:51	21	17:19 (C7)	18:28			20:00			20:32	23	20:05 (C5)	21:01	22	07:00 (D7)	21:16		
29	07:54		16:59 (C7)				07:29			06:41		19:42 (C5)	06:11		06:35 (D7)	06:09		
	17:52	19	17:18 (C7)				20:00			20:33	21	20:03 (C5)	21:02	21	07:00 (D7)	21:16		
30	07:53		17:01 (C7)				07:27			06:40		19:43 (C5)	06:11		06:35 (D7)	06:10		
	17:53	17	17:18 (C7)				20:01			20:34	19	20:02 (C5)	21:03	20	06:59 (D7)	21:16		
31	07:52		17:03 (C7)				07:26						06:10		06:40 (D7)			
	17:54	14	17:17 (C7)				20:02						21:04	19	06:59 (D7)			
Potential sun hours	297			297			370			399			448			452		
Total, worst case		1095			10			327			328			482			101	
Sun reduction		0.51			0.50			0.58			0.66			0.67			0.77	
Oper. time red.		1.00			1.00			1.00			1.00			1.00			1.00	
Wind dir. red.		0.63			0.71			0.70			0.65			0.72			0.72	
Total reduction		0.32			0.35			0.40			0.42			0.47			0.55	
Total, real		347			4			132			139			226			55	

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:
paulding 1 shadow flicker study [5-rev1]

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

Calculated:
12/15/2009 11:10 PM/2.6.0.235

SHADOW - Calendar

Calculation: Timber Road Windfarm Shadow Flicker Analysis **Shadow receptor:** CB - Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 0.0° (659)

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
0.51	0.50	0.58	0.66	0.67	0.77	0.75	0.75	0.68	0.55	0.39	0.34

Operational time

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
283	315	506	548	548	367	324	298	341	652	958	835	993	736	571	484	8,759

July			August			September			October			November			December		
1	06:10			06:34		06:56 (D7)	07:05			07:35		18:36 (C6)	07:10			07:45		08:18 (D8)
	21:16			20:58	13	07:09 (D7)	20:15			19:23	24	19:00 (C6)	17:36			17:12	43	16:47 (C7)
2	06:11			06:35		06:57 (D7)	07:06			07:36		18:36 (C6)	07:11			07:46		08:18 (D8)
	21:16			20:57	11	07:08 (D7)	20:13			19:21	23	18:59 (C6)	17:35			17:11	42	16:46 (C7)
3	06:11			06:36		06:58 (D7)	07:07			07:37		18:36 (C6)	07:12			07:47		08:19 (D8)
	21:16			20:56	8	07:06 (D7)	20:12			19:19	21	18:57 (C6)	17:34			17:11	41	16:46 (C7)
4	06:12		06:54 (D7)	06:37		06:59 (D7)	07:08			07:39		18:36 (C6)	07:13			07:48		08:19 (D8)
	21:16	3	06:57 (D7)	20:54	6	07:05 (D7)	20:10			19:18	19	18:55 (C6)	17:32			17:11	40	16:46 (C7)
5	06:12		06:52 (D7)	06:38		07:00 (D7)	07:09			07:40		18:36 (C6)	07:15			07:49		08:19 (D8)
	21:16	5	07:00 (D7)	20:53	3	07:03 (D7)	20:08			19:16	17	18:53 (C6)	17:31			17:11	38	16:45 (C7)
6	06:13		06:51 (D7)	06:39			07:10			07:41		18:37 (C6)	07:16			07:50		08:19 (D8)
	21:15	10	07:01 (D7)	20:52			20:07			19:14	15	18:52 (C6)	17:30			17:11	38	16:45 (C7)
7	06:14		06:50 (D7)	06:40			07:11			07:42		18:39 (C6)	07:17			07:51		08:20 (D8)
	21:15	12	07:02 (D7)	20:51			20:05			19:13	12	18:51 (C6)	17:29			17:11	36	16:45 (C7)
8	06:14		06:50 (D7)	06:41			07:12			07:43		18:40 (C6)	07:18			07:52		08:20 (D8)
	21:15	13	07:03 (D7)	20:50			20:03			19:11	9	18:49 (C6)	17:28			17:11	36	16:46 (C7)
9	06:15		06:49 (D7)	06:42			07:13			07:44		18:43 (C6)	07:19			07:52		08:20 (D8)
	21:14	15	07:04 (D7)	20:49			20:02			19:09	4	18:47 (C6)	17:27			17:11	35	08:55 (D8)
10	06:16		06:49 (D7)	06:43		19:58 (C5)	07:14			07:45			07:21		16:36 (C7)	07:53		08:21 (D8)
	21:14	16	07:05 (D7)	20:47	8	20:06 (C5)	20:00			19:08			17:26	10	16:46 (C7)	17:11	34	08:55 (D8)
11	06:16		06:49 (D7)	06:44		19:55 (C5)	07:15			07:46			07:22		16:34 (C7)	07:54		08:22 (D8)
	21:14	17	07:06 (D7)	20:46	13	20:03 (C5)	19:57			19:06			17:25	14	16:48 (C7)	17:11	34	08:56 (D8)
12	06:17		06:47 (D7)	06:45		19:53 (C5)	07:16			07:47			07:23		16:32 (C7)	07:55		08:21 (D8)
	21:13	19	07:06 (D7)	20:45	17	20:10 (C5)	19:55			19:05			17:24	17	16:49 (C7)	17:11	35	08:56 (D8)
13	06:18		06:47 (D7)	06:46		19:52 (C5)	07:17			07:48			07:24		16:31 (C7)	07:56		08:22 (D8)
	21:13	20	07:07 (D7)	20:43	19	20:11 (C5)	19:53			19:03			17:23	19	16:50 (C7)	17:11	34	08:56 (D8)
14	06:18		06:47 (D7)	06:47		19:50 (C5)	07:18			07:49			07:25		16:31 (C7)	07:57		08:22 (D8)
	21:12	21	07:08 (D7)	20:42	22	20:12 (C5)	19:52			19:01			17:22	21	16:52 (C7)	17:11	35	08:57 (D8)
15	06:19		06:47 (D7)	06:48		19:49 (C5)	07:19			07:50			07:26		16:30 (C7)	07:57		08:23 (D8)
	21:12	22	07:09 (D7)	20:41	24	20:13 (C5)	19:50			19:00			17:21	22	16:52 (C7)	17:11	35	08:58 (D8)
16	06:20		06:46 (D7)	06:49		19:48 (C5)	07:20			07:51			07:28		16:29 (C7)	07:58		08:23 (D8)
	21:11	23	07:09 (D7)	20:39	24	20:12 (C5)	19:48			18:58			17:20	24	16:53 (C7)	17:12	34	08:57 (D8)
17	06:21		06:46 (D7)	06:50		19:47 (C5)	07:21			07:52			07:29		16:29 (C7)	07:59		08:24 (D8)
	21:11	23	07:09 (D7)	20:38	26	20:13 (C5)	19:46			18:57			17:19	24	16:53 (C7)	17:12	34	08:58 (D8)
18	06:22		06:46 (D7)	06:51		19:46 (C5)	07:22			07:54			07:30		16:30 (C7)	07:59		08:25 (D8)
	21:10	24	07:10 (D7)	20:36	26	20:12 (C5)	19:45			18:55			17:19	24	16:54 (C7)	17:12	34	08:59 (D8)
19	06:22		06:46 (D7)	06:52		19:46 (C5)	07:23			07:55			07:31		08:26 (D8)	08:00		08:24 (D8)
	21:09	25	07:11 (D7)	20:35	25	20:11 (C5)	19:43			18:54			17:18	34	16:54 (C7)	17:13	35	08:59 (D8)
20	06:23		06:46 (D7)	06:53		19:46 (C5)	07:24			07:56			07:32		08:23 (D8)	08:00		08:25 (D8)
	21:09	25	07:11 (D7)	20:34	23	20:09 (C5)	19:41			18:52			17:17	39	16:53 (C7)	17:13	35	09:00 (D8)
21	06:24		06:46 (D7)	06:54		19:46 (C5)	07:25			07:57			07:34		08:22 (D8)	08:01		08:25 (D8)
	21:08	24	07:10 (D7)	20:32	22	20:08 (C5)	19:40			18:51			17:17	41	16:52 (C7)	17:14	35	09:00 (D8)
22	06:25		06:47 (D7)	06:55		19:46 (C5)	07:26		18:50 (C6)	07:58			07:35		08:21 (D8)	08:02		08:26 (D8)
	21:07	24	07:11 (D7)	20:31	21	20:07 (C5)	19:38	6	18:56 (C6)	18:49			17:16	43	16:52 (C7)	17:14	35	09:01 (D8)
23	06:26		06:48 (D7)	06:56		19:46 (C5)	07:27		18:46 (C6)	07:59			07:36		08:20 (D8)	08:02		08:26 (D8)
	21:06	23	07:11 (D7)	20:29	19	20:05 (C5)	19:36	14	19:00 (C6)	18:46			17:15	44	16:51 (C7)	17:15	35	09:01 (D8)
24	06:27		06:49 (D7)	06:57		19:46 (C5)	07:28		18:44 (C6)	08:00			07:37		08:20 (D8)	08:03		08:27 (D8)
	21:05	22	07:11 (D7)	20:28	16	20:04 (C5)	19:35	18	19:02 (C6)	18:47			17:15	43	16:50 (C7)	17:15	35	09:02 (D8)
25	06:28		06:50 (D7)	06:58		19:46 (C5)	07:29		18:42 (C6)	08:02			07:38		08:19 (D8)	08:03		08:28 (D8)
	21:05	21	07:11 (D7)	20:26	16	20:02 (C5)	19:33	21	19:03 (C6)	18:45			17:14	44	16:49 (C7)	17:16	34	09:02 (D8)
26	06:29		06:51 (D7)	06:59		19:47 (C5)	07:30		18:40 (C6)	08:03			07:39		08:18 (D8)	08:03		08:28 (D8)
	21:04	21	07:12 (D7)	20:24	14	20:01 (C5)	19:31	23	19:03 (C6)	18:44			17:14	46	16:49 (C7)	17:16	34	09:02 (D8)
27	06:30		06:52 (D7)	07:00		19:48 (C5)	07:31		18:39 (C6)	08:04			07:40		08:19 (D8)	08:04		08:29 (D8)
	21:03	20	07:12 (D7)	20:23	11	19:59 (C5)	19:29	25	19:04 (C6)	18:42			17:13	46	16:49 (C7)	17:17	34	09:03 (D8)
28	06:31		06:53 (D7)	07:01		19:49 (C5)	07:32		18:38 (C6)	08:05			07:41		08:19 (D8)	08:04		08:29 (D8)
	21:02	18	07:11 (D7)	20:21	9	19:58 (C5)	19:28	26	19:04 (C6)	18:41			17:13	44	16:48 (C7)	17:18	35	09:04 (D8)
29	06:31		06:53 (D7)	07:02		19:52 (C5)	07:33		18:37 (C6)	08:06			07:43		08:19 (D8)	08:04		08:29 (D8)
	21:01	17	07:10 (D7)	20:20	4	19:56 (C5)	19:26	27	19:04 (C6)	18:40			17:12	44	16:48 (C7)	17:18	35	09:04 (D8)
30	06:32		06:54 (D7)	07:03			07:34		18:36 (C6)	08:07			07:44		08:18 (D8)	08:04		08:30 (D8)
	21:00	16	07:10 (D7)	20:18			19:24	26	19:02 (C6)	18:39			17:12	44	16:47 (C7)	17:19	34	09:04 (D8)
31	06:33		06:55 (D7)	07:04						08:09						08:05		08:30 (D8)
	20:59	14	07:09 (D7)	20:17						18:37						17:20	34	09:04 (D8)
Potential sun hours	459			428			375			345			297			287		
Total, worst case		516			402			186			144			688			1108	
Sun reduction		0.75			0.75			0.68			0.55			0.39			0.34	
Oper. time red.		1.00			1.00			1.00			1.00			1.00			1.00	
Wind dir. red.		0.72			0.66			0.70			0.70			0.86			0.59	
Total reduction		0.53			0.48			0.47			0.38			0.25			0.19	
Total, real		274			195			88			55			174			215	

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:
paulding 1 shadow flicker study [5-rev1]

Printed/Page
12/21/2009 11:32 AM / 7
Licensed user:
EDR
217 Montgomery St.
US-SYRACUSE, NY 13202
(315) 471 0688

Calculated:
12/15/2009 11:10 PM/2.6.0.235

SHADOW - Calendar

Calculation: Timber Road Windfarm Shadow Flicker Analysis **Shadow receptor:** CC - Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 0.0° (660)

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
0.51	0.50	0.58	0.66	0.67	0.77	0.75	0.75	0.68	0.55	0.39	0.34

Operational time

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
283	315	506	548	548	367	324	298	341	652	958	835	993	736	671	484	8,759

	January			February		March			April			May			June	
1	08:05		08:28 (D8)	07:51		07:15			07:24			06:36		19:43 (C5)	06:10	
	17:21	41	16:54 (C7)	17:55		18:30			20:03			20:35	18	20:01 (C5)	21:05	
2	08:05		08:28 (D8)	07:50		07:13			07:22			06:37		19:45 (C5)	06:09	
	17:22	42	16:55 (C7)	17:57		18:31			20:04			20:36	14	19:59 (C5)	21:05	
3	08:05		08:29 (D8)	07:49		07:12		18:05 (C6)	07:21			06:36		19:47 (C5)	06:09	
	17:23	43	16:56 (C7)	17:58		18:32	5	18:10 (C6)	20:05			20:37	9	19:56 (C5)	21:06	
4	08:05		08:29 (D8)	07:48		07:10		18:02 (C6)	07:19			06:34			06:08	
	17:24	44	16:57 (C7)	17:59		18:33	10	18:12 (C6)	20:06			20:38			21:07	
5	08:05		08:30 (D8)	07:47		07:09		18:00 (C6)	07:17			06:33		05:53 (D7)	06:08	
	17:25	45	16:58 (C7)	18:01		18:34	13	18:13 (C6)	20:07			20:39	3	05:56 (D7)	21:07	
6	08:05		08:30 (D8)	07:46		07:07		17:58 (C6)	07:16			06:32		05:52 (D7)	06:08	
	17:26	45	16:59 (C7)	18:02		18:35	15	18:13 (C6)	20:08			20:40	6	05:58 (D7)	21:08	
7	08:05		08:31 (D8)	07:45		07:06		17:57 (C6)	07:14			06:31		05:51 (D7)	06:07	
	17:27	46	17:00 (C7)	18:03		18:37	18	18:15 (C6)	20:09			20:41	8	05:59 (D7)	21:09	
8	08:05		08:32 (D8)	07:44		08:04		18:56 (C6)	07:13			06:30		05:50 (D7)	06:07	
	17:28	47	17:02 (C7)	18:04		19:38	20	19:16 (C6)	20:10			20:42	11	07:01 (D7)	21:09	
9	08:05		08:32 (D8)	07:43		08:02		18:56 (C6)	07:11			06:28		05:49 (D7)	06:07	
	17:29	49	17:03 (C7)	18:06		19:39	22	19:18 (C6)	20:11			20:43	13	07:02 (D7)	21:10	
10	08:05		08:32 (D8)	07:41		08:01		18:55 (C6)	07:09			06:27		05:47 (D7)	06:07	
	17:30	48	17:03 (C7)	18:07		19:40	24	19:19 (C6)	20:12			20:44	14	07:01 (D7)	21:11	
11	08:04		08:33 (D8)	07:40		07:59		18:54 (C6)	07:08			06:26		05:46 (D7)	06:07	
	17:31	50	17:05 (C7)	18:08		19:41	25	19:19 (C6)	20:13			20:45	16	07:02 (D7)	21:11	
12	08:04		08:34 (D8)	07:39		07:57		18:54 (C6)	07:06			06:25		05:45 (D7)	06:06	
	17:32	49	17:06 (C7)	18:09		19:42	27	19:21 (C6)	20:14			20:46	17	07:02 (D7)	21:12	
13	08:04		08:34 (D8)	07:38		07:56		18:54 (C6)	07:05		19:54 (C5)	06:24		05:44 (D7)	06:05	
	17:33	51	17:07 (C7)	18:10		19:43	28	19:22 (C6)	20:16	2	19:56 (C5)	20:47	18	07:02 (D7)	21:12	
14	08:03		08:35 (D8)	07:36		07:54		18:54 (C6)	07:03		19:49 (C5)	06:23		05:43 (D7)	06:05	
	17:34	50	17:08 (C7)	18:12		19:44	27	19:21 (C6)	20:17	7	19:56 (C5)	20:48	20	07:03 (D7)	21:13	
15	08:03		08:35 (D8)	07:35		07:52		18:55 (C6)	07:01		19:46 (C5)	06:22		05:43 (D7)	06:05	
	17:35	52	17:09 (C7)	18:13		19:45	26	19:21 (C6)	20:18	10	19:56 (C5)	20:49	21	07:04 (D7)	21:13	
16	08:03		08:37 (D8)	07:34		07:51		18:55 (C6)	07:00		19:45 (C5)	06:21		05:42 (D7)	06:05	
	17:36	51	17:11 (C7)	18:14		19:47	25	19:20 (C6)	20:19	13	19:58 (C5)	20:50	21	07:03 (D7)	21:14	
17	08:02		08:37 (D8)	07:32		07:49		18:56 (C6)	06:58		19:43 (C5)	06:20		05:41 (D7)	06:05	
	17:37	50	17:11 (C7)	18:15		19:48	22	19:18 (C6)	20:20	15	19:58 (C5)	20:51	22	07:03 (D7)	21:14	
18	08:02		08:39 (D8)	07:31		07:47		18:57 (C6)	06:57		19:42 (C5)	06:19		05:40 (D7)	06:05	
	17:38	50	17:13 (C7)	18:17		19:49	20	19:17 (C6)	20:21	18	20:00 (C5)	20:52	23	07:03 (D7)	21:14	
19	08:01		08:39 (D8)	07:30		07:46		18:59 (C6)	06:55		19:41 (C5)	06:18		05:39 (D7)	06:05	
	17:40	50	17:14 (C7)	18:18		19:50	15	19:14 (C6)	20:22	19	20:00 (C5)	20:53	24	07:03 (D7)	21:15	
20	08:01		08:41 (D8)	07:28		07:44		19:01 (C6)	06:54		19:41 (C6)	06:17		05:38 (D7)	06:07	
	17:41	49	17:16 (C7)	18:19		19:51	9	19:10 (C6)	20:23	21	20:02 (C5)	20:54	24	07:02 (D7)	21:15	
21	08:00		08:42 (D8)	07:27		07:42			06:52		19:39 (C5)	06:17		05:39 (D7)	06:07	
	17:42	46	17:15 (C7)	18:20		19:52			20:24	23	20:02 (C5)	20:55	24	07:03 (D7)	21:15	
22	07:59		08:43 (D8)	07:25		07:41			06:51		19:40 (C5)	06:16		05:40 (D7)	06:07	
	17:43	43	17:15 (C7)	18:21		19:53			20:25	23	20:03 (C5)	20:56	22	07:02 (D7)	21:15	
23	07:59		08:46 (D8)	07:24		07:39			06:49		19:40 (C5)	06:15		05:40 (D7)	06:07	
	17:44	38	17:16 (C7)	18:23		19:54			20:26	25	20:05 (C5)	20:57	21	07:01 (D7)	21:16	
24	07:58		08:49 (D8)	07:23		07:37			06:48		19:39 (C5)	06:14		05:40 (D7)	06:08	
	17:46	32	17:15 (C7)	18:24		19:55			20:27	26	20:05 (C5)	20:58	21	07:01 (D7)	21:16	
25	07:57		16:53 (C7)	07:21		07:36			06:46		19:39 (C5)	06:14		05:41 (D7)	06:08	
	17:47	22	17:15 (C7)	18:25		19:56			20:28	28	20:07 (C6)	20:59	20	07:01 (D7)	21:16	
26	07:56		16:54 (C7)	07:20		07:34			06:45		19:39 (C5)	06:13		05:42 (D7)	06:08	
	17:48	20	17:14 (C7)	18:26		19:57			20:29	27	20:06 (C5)	21:00	18	07:00 (D7)	21:16	
27	07:56		16:55 (C7)	07:18		07:32			06:44		19:40 (C5)	06:12		05:43 (D7)	06:09	
	17:49	18	17:13 (C7)	18:27		19:58			20:30	25	20:05 (C5)	21:00	17	07:00 (D7)	21:16	
28	07:55		16:57 (C7)	07:17		07:31			06:42		19:41 (C5)	06:12		05:44 (D7)	06:09	
	17:51	15	17:12 (C7)	18:29		20:00			20:32	24	20:05 (C5)	21:01	15	05:59 (D7)	21:16	
29	07:54		16:59 (C7)			07:29			06:41		19:41 (C5)	06:11		05:46 (D7)	06:09	
	17:52	11	17:10 (C7)			20:00			20:33	22	20:03 (C5)	21:02	12	06:58 (D7)	21:16	
30	07:53		17:03 (C7)			07:27			06:40		19:42 (C5)	06:11		05:46 (D7)	06:10	
	17:53	5	17:08 (C7)			20:01			20:34	20	20:02 (C5)	21:03	10	05:56 (D7)	21:16	
31	07:52					07:26						06:10		05:49 (D7)		
	17:54					20:02						21:04	6	05:55 (D7)		
Potential sun hours	297			297		370			399			448			462	
Total, worst case		1202					351			348			488			
Sun reduction		0.51					0.58			0.66			0.67			
Oper. time red.		1.00					1.00			1.00			1.00			
Wind dir. red.		0.64					0.70			0.65			0.71			
Total reduction		0.32					0.41			0.42			0.47			
Total, real		385					142			148			232			

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:
paulding 1 shadow flicker study [5-rev1]

Printed/Page
12/21/2009 11:32 AM / 8

Licensed user:
EDR
217 Montgomery St.
US-SYRACUSE, NY 13202
(315) 471 0688

Calculated:
12/15/2009 11:10 PM/2.6.0.235

SHADOW - Calendar

Calculation: Timber Road Windfarm Shadow Flicker Analysis **Shadow receptor:** CC - Shadow Receptor: 1.0 x 1.0 Azimuth: 0.0° Slope: 0.0° (660)

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
0.51	0.50	0.58	0.66	0.67	0.77	0.75	0.75	0.68	0.55	0.39	0.34

Operational time

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
283	315	506	548	548	367	324	298	341	652	958	835	993	736	571	484	8,759

	July			August			September			October			November			December		
1	06:10			06:34		06:56 (D7)	07:05			07:35		18:33 (C6)	07:10			07:45		08:15 (D8)
	21:16			20:58	17	07:13 (D7)	20:15			19:23	27	19:00 (C6)	17:36			17:12	50	16:47 (C7)
2	06:11			06:35		06:57 (D7)	07:06			07:36		18:33 (C6)	07:11			07:46		08:15 (D8)
	21:16			20:57	16	07:12 (D7)	20:13			19:21	26	18:59 (C6)	17:35			17:11	48	16:48 (C7)
3	06:11			06:36		06:58 (D7)	07:07			07:37		18:32 (C6)	07:12			07:47		08:15 (D8)
	21:16			20:56	14	07:12 (D7)	20:12			19:19	25	18:57 (C6)	17:34			17:11	49	16:46 (C7)
4	06:12			06:37		06:59 (D7)	07:08			07:39		18:32 (C6)	07:13			07:48		08:16 (D8)
	21:16			20:54	12	07:11 (D7)	20:10			19:18	23	18:55 (C6)	17:32			17:11	47	16:46 (C7)
5	06:12			06:38		07:00 (D7)	07:09			07:40		18:32 (C6)	07:15			07:49		08:16 (D8)
	21:16			20:53	10	07:10 (D7)	20:08			19:16	21	18:53 (C6)	17:31			17:11	46	16:45 (C7)
6	06:13			06:39		07:01 (D7)	07:10			07:41		18:32 (C6)	07:16			07:50		08:16 (D8)
	21:15			20:52	8	07:09 (D7)	20:07			19:14	20	18:52 (C6)	17:30			17:11	45	16:45 (C7)
7	06:14			06:40		07:02 (D7)	07:11			07:42		18:34 (C6)	07:17			07:51		08:17 (D8)
	21:15			20:51	5	07:07 (D7)	20:05			19:13	17	18:51 (C6)	17:29			17:11	45	16:45 (C7)
8	06:14			06:41		07:03 (D7)	07:12			07:43		18:35 (C6)	07:18			07:52		08:17 (D8)
	21:15			20:50	2	07:05 (D7)	20:03			19:11	14	18:49 (C6)	17:28			17:11	44	16:45 (C7)
9	06:15			06:42			07:13			07:44		18:36 (C6)	07:19			07:52		08:18 (D8)
	21:14			20:49			20:02			19:09	11	18:47 (C6)	17:27			17:11	43	16:45 (C7)
10	06:16			06:43		19:56 (C5)	07:14			07:45		18:38 (C6)	07:21			07:53		08:18 (D8)
	21:14			20:47	11	20:07 (C5)	20:00			19:08	8	18:46 (C6)	17:26			17:11	42	16:45 (C7)
11	06:16			06:44		19:53 (C5)	07:15			07:46		18:41 (C6)	07:22			07:54		08:19 (D8)
	21:14			20:46	16	20:09 (C5)	19:57			19:06	3	18:44 (C6)	17:25			17:11	42	16:46 (C7)
12	06:17		06:57 (D7)	06:45		19:52 (C5)	07:16			07:47			07:23		16:34 (C7)	07:55		08:18 (D8)
	21:13	4	07:01 (D7)	20:45	18	20:10 (C5)	19:55			19:05			17:24	5	16:39 (C7)	17:11	42	16:45 (C7)
13	06:18		06:55 (D7)	06:46		19:50 (C5)	07:17			07:48			07:24		16:30 (C7)	07:56		08:19 (D8)
	21:13	9	07:04 (D7)	20:43	21	20:11 (C5)	19:53			19:03			17:23	12	16:42 (C7)	17:11	40	16:45 (C7)
14	06:18		06:54 (D7)	06:47		19:49 (C5)	07:18			07:49			07:25		16:29 (C7)	07:57		08:20 (D8)
	21:12	12	07:06 (D7)	20:42	23	20:12 (C5)	19:52			19:01			17:22	16	16:45 (C7)	17:11	38	16:45 (C7)
15	06:19		06:54 (D7)	06:48		19:48 (C5)	07:19			07:50			07:26		16:28 (C7)	07:57		08:21 (D8)
	21:12	13	07:07 (D7)	20:41	25	20:13 (C5)	19:50			19:00			17:21	18	16:46 (C7)	17:11	38	16:46 (C7)
16	06:20		06:52 (D7)	06:49		19:46 (C5)	07:20			07:51			07:28		16:27 (C7)	07:58		08:21 (D8)
	21:11	16	07:08 (D7)	20:39	26	20:12 (C5)	19:48			18:58			17:20	20	16:47 (C7)	17:12	36	16:45 (C7)
17	06:21		06:52 (D7)	06:50		19:46 (C5)	07:21			07:53			07:29		16:26 (C7)	07:59		08:22 (D8)
	21:11	17	07:09 (D7)	20:38	27	20:13 (C5)	19:46			18:57			17:19	22	16:48 (C7)	17:12	36	16:46 (C7)
18	06:22		06:51 (D7)	06:51		19:45 (C5)	07:22			07:54			07:30		08:23 (D8)	07:59		08:23 (D8)
	21:10	19	07:10 (D7)	20:36	27	20:12 (C5)	19:45			18:56			17:19	32	16:49 (C7)	17:12	36	16:47 (C7)
19	06:22		06:51 (D7)	06:52		19:45 (C5)	07:23			07:55			07:31		08:20 (D8)	08:00		08:23 (D8)
	21:09	20	07:11 (D7)	20:35	26	20:11 (C5)	19:43			18:54			17:18	38	16:50 (C7)	17:13	36	16:47 (C7)
20	06:23		06:50 (D7)	06:53		19:44 (C5)	07:24			07:56			07:32		08:18 (D8)	08:00		08:24 (D8)
	21:09	22	07:12 (D7)	20:34	25	20:09 (C5)	19:41			18:52			17:17	43	16:50 (C7)	17:13	35	16:47 (C7)
21	06:24		06:49 (D7)	06:54		19:44 (C5)	07:25			07:57			07:34		08:17 (D8)	08:01		08:24 (D8)
	21:08	22	07:11 (D7)	20:32	24	20:08 (C5)	19:40			18:51			17:17	46	16:50 (C7)	17:14	35	16:47 (C7)
22	06:25		06:49 (D7)	06:55		19:44 (C5)	07:26			07:58			07:35		08:17 (D8)	08:02		08:25 (D8)
	21:07	23	07:12 (D7)	20:31	23	20:07 (C5)	19:38			18:49			17:16	49	16:52 (C7)	17:14	35	16:48 (C7)
23	06:26		06:49 (D7)	06:56		19:44 (C5)	07:27		18:47 (C6)	07:59			07:36		08:16 (D8)	08:02		08:25 (D8)
	21:06	24	07:13 (D7)	20:29	21	20:05 (C5)	19:36	6	18:53 (C6)	18:48			17:15	50	16:51 (C7)	17:15	35	16:48 (C7)
24	06:27		06:49 (D7)	06:57		19:45 (C5)	07:28		18:43 (C6)	08:00			07:37		08:16 (D8)	08:03		08:26 (D8)
	21:05	24	07:13 (D7)	20:28	19	20:04 (C5)	19:35	14	18:57 (C6)	18:47			17:15	50	16:50 (C7)	17:15	35	16:49 (C7)
25	06:28		06:50 (D7)	06:58		19:45 (C5)	07:29		18:40 (C6)	08:02			07:38		08:15 (D8)	08:03		08:26 (D8)
	21:05	23	07:13 (D7)	20:26	17	20:02 (C5)	19:33	19	18:59 (C6)	18:45			17:14	50	16:49 (C7)	17:16	36	16:50 (C7)
26	06:29		06:51 (D7)	06:59		19:46 (C5)	07:30		18:38 (C6)	08:03			07:39		08:15 (D8)	08:03		08:26 (D8)
	21:04	23	07:14 (D7)	20:24	15	20:01 (C5)	19:31	22	19:00 (C6)	18:44			17:14	51	16:49 (C7)	17:16	36	16:50 (C7)
27	06:30		06:52 (D7)	07:00		19:47 (C5)	07:31		18:37 (C6)	08:04			07:40		08:15 (D8)	08:04		08:27 (D8)
	21:03	22	07:14 (D7)	20:23	12	19:59 (C5)	19:29	24	19:01 (C6)	18:42			17:13	52	16:49 (C7)	17:17	36	16:51 (C7)
28	06:31		06:53 (D7)	07:01		19:48 (C5)	07:32		18:36 (C6)	08:05			07:41		08:15 (D8)	08:04		08:27 (D8)
	21:02	21	07:14 (D7)	20:21	10	19:58 (C5)	19:28	25	19:01 (C6)	18:41			17:13	50	16:48 (C7)	17:18	38	16:52 (C7)
29	06:31		06:53 (D7)	07:02		19:50 (C5)	07:33		18:35 (C6)	08:06			07:43		08:15 (D8)	08:04		08:27 (D8)
	21:01	20	07:13 (D7)	20:20	6	19:56 (C5)	19:26	27	19:02 (C6)	18:40			17:12	51	16:48 (C7)	17:18	38	16:52 (C7)
30	06:32		06:54 (D7)	07:03		19:54 (C5)	07:34		18:34 (C6)	08:07			07:44		08:15 (D8)	08:04		08:27 (D8)
	21:00	19	07:13 (D7)	20:18	2	19:56 (C5)	19:24	28	19:02 (C6)	18:39			17:12	49	16:47 (C7)	17:19	40	16:53 (C7)
31	06:33		06:55 (D7)	07:04						08:09						08:05		08:27 (D8)
	20:59	18	07:13 (D7)	20:17						18:37						17:20	40	16:53 (C7)
Potential sun hours	459			428			375			345			297			287		
Total, worst case		371			477			165			195			704			1242	
Sun reduction		0.75			0.75			0.68			0.55			0.39			0.34	
Oper. time red.		1.00			1.00			1.00			1.00			1.00			1.00	
Wind dir. red.		*0.72*			*0.66*			*0.70*			*0.70*			*0.65*			*0.60*	
Total reduction		0.53			0.49			0.48			0.38			0.25			0.20	
Total, real		198			233			78			74			178			249	

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)

Project:
paulding 1 shadow flicker study [5-rev1]

Licensed user:
EDR
217 Montgomery St.
US-SYRACUSE, NY 13202
(315) 471 0888

Calculated:
12/15/2009 11:10 PM/2.6.0.235

SHADOW - Calendar

Calculation: Timber Road Windfarm Shadow Flicker Analysis **Shadow receptor:** CD - Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 0.0° (661)

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
0.51	0.50	0.58	0.66	0.67	0.77	0.75	0.75	0.68	0.55	0.39	0.34

Operational time

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
283	315	506	548	548	367	324	298	341	652	958	835	993	736	571	484	8,759

January			February	March			April			May			June	
1	08:05		08:27 (D8)	07:51	07:15		18:04 (C6)	07:24		06:38		19:41 (C5)	06:10	
	17:21	44	16:54 (C7)	17:55	18:30	3	18:07 (C6)	20:03		20:35	23	20:04 (C5)	21:05	
2	08:05		08:27 (D8)	07:50	07:13		18:01 (C6)	07:22		06:37		06:57 (D7)	06:09	
	17:22	45	16:55 (C7)	17:57	18:31	8	18:09 (C6)	20:04		20:36	23	20:03 (C5)	21:05	
3	08:05		08:27 (D8)	07:49	07:12		17:58 (C6)	07:21		06:36		06:55 (D7)	06:09	
	17:23	47	16:56 (C7)	17:58	18:32	12	18:10 (C6)	20:05		20:37	23	20:01 (C5)	21:06	
4	08:05		08:27 (D8)	07:48	07:10		17:56 (C6)	07:19		06:34		06:54 (D7)	06:08	
	17:24	47	16:57 (C7)	17:59	18:33	16	18:12 (C6)	20:06		20:38	22	19:59 (C5)	21:07	
5	08:05		08:27 (D8)	07:47	07:09		17:55 (C6)	07:17		06:33		06:53 (D7)	06:08	
	17:25	49	16:58 (C7)	18:01	18:34	18	18:13 (C6)	20:07		20:39	19	19:57 (C5)	21:07	
6	08:05		08:27 (D8)	07:46	07:07		17:53 (C6)	07:16		06:32		06:52 (D7)	06:08	
	17:26	51	16:59 (C7)	18:02	18:35	20	18:13 (C6)	20:08		20:40	11	07:03 (D7)	21:08	
7	08:05		08:27 (D8)	07:45	07:06		17:53 (C6)	07:14		06:31		06:51 (D7)	06:07	
	17:27	51	17:00 (C7)	18:03	18:37	22	18:15 (C6)	20:09		20:41	13	07:04 (D7)	21:09	
8	08:05		08:27 (D8)	07:44	08:04		18:52 (C6)	07:13		06:30		06:50 (D7)	06:07	
	17:28	54	17:02 (C7)	18:04	19:38	24	19:16 (C6)	20:10		20:42	15	07:05 (D7)	21:09	
9	08:05		08:27 (D8)	07:43	08:02		18:52 (C6)	07:11		06:28		06:49 (D7)	06:07	
	17:29	54	17:03 (C7)	18:06	19:39	26	19:18 (C6)	20:11		20:43	16	07:05 (D7)	21:10	
10	08:05		08:27 (D8)	07:41	08:01		18:51 (C6)	07:09		06:27		06:47 (D7)	06:07	
	17:30	54	17:03 (C7)	18:07	19:40	28	19:19 (C6)	20:12		20:44	17	07:04 (D7)	21:11	
11	08:04		08:27 (D8)	07:40	07:59		18:50 (C6)	07:08		06:26		06:46 (D7)	06:07	
	17:31	57	17:05 (C7)	18:08	19:41	29	19:19 (C6)	20:13		20:45	19	07:05 (D7)	21:11	
12	08:04		08:28 (D8)	07:39	07:57		18:51 (C6)	07:06		06:25		06:45 (D7)	06:06	
	17:32	56	17:06 (C7)	18:09	19:42	30	19:21 (C6)	20:14		20:46	20	07:05 (D7)	21:12	
13	08:04		08:28 (D8)	07:38	07:56		18:51 (C6)	07:05		06:24		06:44 (D7)	06:06	
	17:33	57	17:07 (C7)	18:10	19:43	29	19:20 (C6)	20:16		20:47	21	07:05 (D7)	21:12	
14	08:03		08:29 (D8)	07:36	07:54		18:51 (C6)	07:03	19:51 (C5)	06:23		06:43 (D7)	06:06	
	17:34	57	17:08 (C7)	18:12	19:44	28	19:19 (C6)	20:17	5 19:56 (C5)	20:48	21	07:04 (D7)	21:13	
15	08:03		08:29 (D8)	07:35	07:52		18:52 (C6)	07:01	19:47 (C5)	06:22		06:43 (D7)	06:06	
	17:35	57	17:08 (C7)	18:13	19:45	26	19:18 (C6)	20:18	9 19:56 (C5)	20:49	22	07:05 (D7)	21:13	
16	08:03		08:30 (D8)	07:34	07:51		18:52 (C6)	07:00	19:46 (C5)	06:21		06:42 (D7)	06:06	
	17:36	57	17:09 (C7)	18:14	19:47	25	19:17 (C6)	20:19	12 19:58 (C5)	20:50	23	07:05 (D7)	21:14	
17	08:02		08:30 (D8)	07:32	07:49		18:53 (C6)	06:58	19:43 (C5)	06:20		06:42 (D7)	06:06	
	17:37	55	17:09 (C7)	18:15	19:48	22	19:15 (C6)	20:20	15 19:58 (C5)	20:51	22	07:04 (D7)	21:14	
18	08:02		08:31 (D8)	07:31	07:48		18:55 (C6)	06:57	19:43 (C5)	06:19		06:42 (D7)	06:06	
	17:38	54	17:09 (C7)	18:17	19:49	18	19:13 (C6)	20:21	17 20:00 (C5)	20:52	22	07:04 (D7)	21:14	
19	08:01		08:32 (D8)	07:30	07:46		18:57 (C6)	06:55	19:41 (C5)	06:18		06:43 (D7)	06:06	
	17:40	52	17:09 (C7)	18:18	19:50	13	19:10 (C6)	20:22	19 20:00 (C5)	20:53	20	07:03 (D7)	21:15	
20	08:01		08:33 (D8)	07:28	07:44			06:54	19:40 (C5)	06:17		06:43 (D7)	06:07	
	17:41	51	17:09 (C7)	18:19	19:51			20:23	22 20:02 (C5)	20:54	19	07:02 (D7)	21:15	
21	08:00		08:34 (D8)	07:27	07:42			06:52	19:39 (C5)	06:17		06:45 (D7)	06:07	
	17:42	48	17:09 (C7)	18:20	19:52			20:24	23 20:02 (C5)	20:55	17	07:02 (D7)	21:15	
22	07:59		08:35 (D8)	07:25	07:41			06:51	19:39 (C5)	06:16		06:46 (D7)	06:07	
	17:43	44	17:08 (C7)	18:21	19:53			20:26	24 20:03 (C5)	20:56	15	07:01 (D7)	21:15	
23	07:59		08:37 (D8)	07:24	07:39			06:49	19:39 (C5)	06:15		06:47 (D7)	06:07	
	17:44	40	17:08 (C7)	18:23	19:54			20:26	26 20:05 (C5)	20:57	12	06:59 (D7)	21:16	
24	07:58		08:38 (D8)	07:23	07:37			06:48	19:38 (C5)	06:14		06:48 (D7)	06:08	
	17:46	36	17:07 (C7)	18:24	19:55			20:27	27 20:05 (C5)	20:58	10	06:58 (D7)	21:16	
25	07:57		08:39 (D8)	07:21	07:36			06:46	19:39 (C5)	06:14		06:51 (D7)	06:08	
	17:47	32	17:06 (C7)	18:25	19:56			20:28	28 20:07 (C5)	20:59	5	06:56 (D7)	21:16	
26	07:56		08:41 (D8)	07:20	07:34			06:45	19:38 (C5)	06:13			06:08	
	17:48	24	17:04 (C7)	18:26	19:57			20:29	29 20:07 (C5)	21:00			21:16	
27	07:56		08:45 (D8)	07:18	07:32			06:44	19:38 (C5)	06:12			06:09	
	17:49	7	17:00 (C7)	18:27	19:58			20:30	29 20:07 (C5)	21:00			21:16	
28	07:55			07:17	07:31			06:42	19:39 (C5)	06:12			06:09	
	17:51			18:29	20:00			20:32	28 20:07 (C5)	21:01			21:16	
29	07:54				07:29			06:41	19:39 (C5)	06:11			06:09	
	17:52				20:00			20:33	26 20:05 (C5)	21:02			21:16	
30	07:53				07:27			06:40	19:40 (C5)	06:11			06:10	
	17:53				20:01			20:34	25 20:05 (C5)	21:03			21:16	
31	07:52				07:26					06:10				
	17:54				20:02					21:04				
Potential sun hours	297			297	370			399		448			452	
Total, worst case		1280				397			364		450			
Sun reduction		0.51				0.58			0.86		0.67			
Oper. time red.		1.00				1.00			1.00		1.00			
Wind dir. red.		0.64				0.71			0.65		0.71			
Total reduction		0.32				0.41			0.43		0.47			
Total, real		412				162			155		212			

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)*

Project:
paulding 1 shadow flicker study [5-rev1]

Licensed user:
EDR
217 Montgomery St.
US-SYRACUSE, NY 13202
(315) 471 0688

Calculated:
12/15/2009 11:10 PM/2.6.0.235

SHADOW - Calendar

Calculation: Timber Road Windfarm Shadow Flicker Analysis **Shadow receptor:** CD - Shadow Receptor: 1.0 x 1.0 Azimuth: 0.0° Slope: 0.0° (661)

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
0.51	0.50	0.58	0.66	0.67	0.77	0.75	0.75	0.68	0.55	0.39	0.34

Operational time

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
283	315	506	548	548	367	324	298	341	652	958	835	993	736	571	464	8,759

July			August			September			October			November			December		
1	06:10			06:34		06:56 (D7)	07:05			07:35		18:30 (C6)	07:10			07:45		08:09 (D8)
	21:16			20:58	19	07:15 (D7)	20:15			19:23	29	18:59 (C6)	17:38			17:12	57	16:47 (C7)
2	06:11			06:35		06:57 (D7)	07:06			07:36		18:29 (C6)	07:11			07:46		08:10 (D8)
	21:16			20:57	18	07:15 (D7)	20:13			19:21	30	18:59 (C6)	17:35			17:12	54	16:46 (C7)
3	06:11			06:36		06:58 (D7)	07:07			07:37		18:29 (C6)	07:12			07:47		08:10 (D8)
	21:16			20:56	17	07:15 (D7)	20:12			19:19	28	18:57 (C6)	17:34			17:11	55	16:46 (C7)
4	06:12			06:37		06:59 (D7)	07:08			07:39		18:28 (C6)	07:13			07:48		08:11 (D8)
	21:16			20:54	16	07:15 (D7)	20:10			19:18	27	18:55 (C6)	17:32			17:11	54	16:46 (C7)
5	06:12			06:38		07:00 (D7)	07:09			07:40		18:28 (C6)	07:15			07:49		08:12 (D8)
	21:16			20:53	14	07:14 (D7)	20:08			19:16	25	18:53 (C6)	17:31			17:11	51	16:45 (C7)
6	06:13			06:39		07:01 (D7)	07:10			07:41		18:28 (C6)	07:16			07:50		08:13 (D8)
	21:15			20:52	13	07:14 (D7)	20:07			19:14	24	18:52 (C6)	17:30			17:11	50	16:45 (C7)
7	06:14			06:40		07:02 (D7)	07:11			07:42		18:29 (C6)	07:17			07:51		08:14 (D8)
	21:15			20:51	13	20:03 (C5)	20:05			19:13	22	18:51 (C6)	17:29			17:11	49	16:45 (C7)
8	06:14			06:41		07:03 (D7)	07:12			07:43		18:30 (C6)	07:18			07:52		08:15 (D8)
	21:15			20:50	20	20:07 (C5)	20:03			19:11	19	18:49 (C6)	17:28			17:11	47	16:45 (C7)
9	06:15			06:42		07:04 (D7)	07:13			07:44		18:31 (C6)	07:19			07:52		08:16 (D8)
	21:14			20:49	22	20:09 (C5)	20:02			19:09	16	18:47 (C6)	17:27			17:11	47	16:45 (C7)
10	06:16			06:43		07:05 (D7)	07:14			07:45		18:32 (C6)	07:21			07:53		08:17 (D8)
	21:14			20:47	22	20:11 (C5)	20:00			19:08	14	18:46 (C6)	17:26			17:11	45	16:45 (C7)
11	06:16			06:44		19:50 (C5)	07:15			07:46		18:33 (C6)	07:22			07:54		08:18 (D8)
	21:14			20:46	22	20:12 (C5)	19:57			19:06	11	18:44 (C6)	17:25			17:11	45	16:46 (C7)
12	06:17			06:45		19:49 (C5)	07:16			07:47		18:35 (C6)	07:23			07:55		08:18 (D8)
	21:13			20:45	24	20:13 (C5)	19:55			19:05	7	18:42 (C6)	17:24			17:11	43	16:45 (C7)
13	06:18			06:46		19:48 (C5)	07:17			07:48			07:24			07:56		08:19 (D8)
	21:13			20:43	26	20:14 (C5)	19:53			19:03			17:23			17:11	42	16:45 (C7)
14	06:18			06:47		19:47 (C5)	07:18			07:49			07:25			07:57		08:20 (D8)
	21:12			20:42	27	20:14 (C5)	19:52			19:01			17:22			17:11	42	16:45 (C7)
15	06:19			06:48		19:47 (C5)	07:19			07:50			07:27		08:18 (D8)	07:57		08:21 (D8)
	21:12			20:41	28	20:15 (C5)	19:50			19:00			17:21	9	16:33 (C7)	17:11	41	16:46 (C7)
16	06:20			06:49		19:45 (C5)	07:20			07:51			07:28		08:14 (D8)	07:58		08:21 (D8)
	21:11			20:39	29	20:14 (C5)	19:48			18:58			17:20	24	16:37 (C7)	17:12	40	16:45 (C7)
17	06:21			06:50		19:45 (C5)	07:21			07:53			07:29		08:12 (D8)	07:59		08:22 (D8)
	21:11			20:38	29	20:14 (C5)	19:46			18:57			17:19	32	16:39 (C7)	17:12	40	16:46 (C7)
18	06:22			06:51		19:44 (C5)	07:22			07:54			07:30		08:12 (D8)	07:59		08:23 (D8)
	21:10			20:36	28	20:12 (C5)	19:45			18:55			17:19	36	16:41 (C7)	17:12	39	16:47 (C7)
19	06:22		06:59 (D7)	06:52		19:44 (C5)	07:23			07:55			07:31		08:11 (D8)	08:00		08:23 (D8)
	21:09	8	07:07 (D7)	20:35	27	20:11 (C5)	19:43			18:54			17:18	40	16:42 (C7)	17:13	39	16:47 (C7)
20	06:23		06:58 (D7)	06:53		19:44 (C5)	07:24			07:56			07:32		08:10 (D8)	08:01		08:24 (D8)
	21:09	11	07:09 (D7)	20:34	25	20:09 (C5)	19:41			18:52			17:17	44	16:43 (C7)	17:13	38	16:47 (C7)
21	06:24		06:56 (D7)	06:54		19:44 (C5)	07:25			07:57			07:34		08:09 (D8)	08:01		08:24 (D8)
	21:08	14	07:10 (D7)	20:32	24	20:08 (C5)	19:40			18:51			17:17	48	16:44 (C7)	17:14	38	16:47 (C7)
22	06:25		06:55 (D7)	06:55		19:44 (C5)	07:26			07:58			07:35		08:09 (D8)	08:02		08:25 (D8)
	21:07	16	07:11 (D7)	20:31	23	20:07 (C5)	19:38			18:49			17:16	50	16:45 (C7)	17:14	38	16:48 (C7)
23	06:26		06:54 (D7)	06:56		19:44 (C5)	07:27			07:59			07:36		08:09 (D8)	08:02		08:25 (D8)
	21:06	18	07:12 (D7)	20:29	21	20:05 (C5)	19:36			18:48			17:15	52	16:46 (C7)	17:15	38	16:48 (C7)
24	06:27		06:54 (D7)	06:57		19:45 (C5)	07:28		18:42 (C6)	08:00			07:37		08:09 (D8)	08:03		08:26 (D8)
	21:05	19	07:13 (D7)	20:28	19	20:04 (C5)	19:35	10	18:52 (C6)	18:47			17:15	53	16:46 (C7)	17:15	38	16:49 (C7)
25	06:28		06:53 (D7)	06:58		19:45 (C5)	07:29		18:39 (C6)	08:02			07:38		08:08 (D8)	08:03		08:26 (D8)
	21:05	21	07:14 (D7)	20:26	17	20:02 (C5)	19:33	16	18:55 (C6)	18:45			17:14	55	16:47 (C7)	17:16	39	16:50 (C7)
26	06:29		06:53 (D7)	06:59		19:46 (C5)	07:30		18:36 (C6)	08:03			07:39		08:08 (D8)	08:03		08:26 (D8)
	21:04	*21*	*07:14 (D7)*	*20:24*	15	*20:01 (C5)*	*19:31*	*21*	*18:57 (C6)*	*18:44*			*17:14*	*56*	*16:47 (C7)*	*17:16*	*40*	*16:50 (C7)*
27	06:30		06:53 (D7)	07:00		19:48 (C5)	07:31		18:34 (C6)	08:04			07:40		08:09 (D8)	08:04		08:27 (D8)
	21:03	22	07:15 (D7)	20:23	11	19:59 (C5)	19:29	24	18:58 (C6)	18:42			17:13	56	16:48 (C7)	17:17	40	16:51 (C7)
28	06:31		06:53 (D7)	07:01		19:49 (C5)	07:32		18:33 (C6)	08:05			07:41		08:09 (D8)	08:04		08:27 (D8)
	21:02	22	07:15 (D7)	20:21	9	19:58 (C5)	19:28	25	18:58 (C6)	18:41			17:13	57	16:48 (C7)	17:18	41	16:52 (C7)
29	06:31		06:53 (D7)	07:02		19:52 (C5)	07:33		18:32 (C6)	08:06			07:43		08:09 (D8)	08:04		08:27 (D8)
	21:01	22	07:15 (D7)	20:20	4	19:56 (C5)	19:26	27	18:59 (C6)	18:40			17:12	57	16:48 (C7)	17:18	41	16:52 (C7)
30	06:32		06:54 (D7)	07:03			07:34		18:31 (C6)	08:07			07:44		08:09 (D8)	08:04		08:27 (D8)
	21:00	21	07:15 (D7)	20:18			19:24	28	18:59 (C6)	18:39			17:12	56	16:47 (C7)	17:19	42	16:53 (C7)
31	06:33		06:55 (D7)	07:04						08:09						08:05		08:27 (D8)
	20:59	20	07:15 (D7)	20:17						18:37						17:20	42	16:53 (C7)
Potential sun hours	459			428			375			345			297			287		
Total, worst case		235			582			151			252			725			1365	
Sun reduction		0.75			0.75			0.68			0.55			0.39			0.34	
Oper. time red.		1.00			1.00			1.00			1.00			1.00			1.00	
Wind dir. red.		0.72			0.67			0.71			0.71			0.64			0.63	
Total reduction		0.53			0.49			0.48			0.38			0.25			0.21	
Total, real		126			287			72			96			181			285	

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)

Project:
paulding 1 shadow flicker study [5-rev1]

Printed/Page
12/21/2009 11:32 AM / 11

Licensed user:
EDR
217 Montgomery St.
US-SYRACUSE, NY 13202
(315) 471 0688

Calculated:
12/15/2009 11:10 PM/2.6.0.235

SHADOW - Calendar

Calculation: Timber Road Windfarm Shadow Flicker Analysis **Shadow receptor:** CE - Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 0.0° (662)

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
0.51	0.50	0.58	0.66	0.67	0.77	0.75	0.75	0.68	0.55	0.39	0.34

Operational time

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
283	315	506	548	548	367	324	298	341	652	958	835	993	736	571	484	8,759

	January			February			March			April			May			June		
1	08:05		08:27 (D8)	07:51		08:37 (D8)	07:15		17:47 (C6)	07:24			06:38		06:58 (D7)	06:10		
	17:21	38	16:50 (C7)	17:56	2	08:39 (D8)	18:30	20	18:07 (C6)	20:03			20:35	42	20:09 (C5)	21:05		
2	08:05		08:27 (D8)	07:50			07:13		17:46 (C6)	07:22			06:37		06:57 (D7)	06:09		
	17:22	38	16:50 (C7)	17:57			18:31	23	18:09 (C6)	20:04			20:36	43	20:09 (C5)	21:05		
3	08:05		08:27 (D8)	07:49			07:12		17:45 (C6)	07:21			06:36		06:55 (D7)	06:09		
	17:23	39	16:50 (C7)	17:58			18:32	25	18:10 (C6)	20:05			20:37	43	20:07 (C5)	21:06		
4	08:05		08:27 (D8)	07:48			07:10		17:45 (C6)	07:19			06:34		06:54 (D7)	06:08		
	17:24	40	16:51 (C7)	17:59			18:33	27	18:12 (C6)	20:06			20:38	44	20:07 (C5)	21:07		
5	08:05		08:27 (D8)	07:47			07:09		17:44 (C6)	07:17			06:33		06:53 (D7)	06:08		
	17:25	40	16:51 (C7)	18:01			18:34	29	18:13 (C6)	20:07			20:39	43	20:08 (C5)	21:07		
6	08:05		08:27 (D8)	07:46			07:07		17:43 (C6)	07:16			06:32		06:52 (D7)	06:08		
	17:26	40	16:51 (C7)	18:02			18:35	30	18:13 (C6)	20:08			20:40	42	20:05 (C5)	21:08		
7	08:05		08:27 (D8)	07:45			07:06		17:43 (C6)	07:14			06:31		06:51 (D7)	06:07		
	17:27	42	16:52 (C7)	18:03			18:37	32	18:15 (C6)	20:09			20:41	41	20:04 (C5)	21:09		
8	08:05		08:27 (D8)	07:44			08:04		18:42 (C6)	07:13			06:30		06:50 (D7)	06:07		
	17:28	42	16:52 (C7)	18:04			19:38	34	19:16 (C6)	20:10			20:42	40	20:03 (C5)	21:09		
9	08:05		08:27 (D8)	07:43			08:02		18:43 (C6)	07:11			06:28		06:49 (D7)	06:07		
	17:29	42	16:52 (C7)	18:06			19:39	33	19:16 (C6)	20:11			20:43	37	20:02 (C5)	21:10		
10	08:05		08:26 (D8)	07:41			08:01		18:42 (C6)	07:09			06:27		06:47 (D7)	06:07		
	17:30	43	16:52 (C7)	18:07			19:40	33	19:15 (C6)	20:12			20:44	34	19:59 (C5)	21:11		
11	08:04		08:26 (D8)	07:40			07:59		18:42 (C6)	07:08			06:26		06:46 (D7)	06:07		
	17:31	42	16:52 (C7)	18:08			19:41	32	19:14 (C6)	20:13			20:45	26	19:56 (C5)	21:11		
12	08:04		08:26 (D8)	07:39			07:57		18:43 (C6)	07:06			06:25		06:45 (D7)	06:06		
	17:32	42	16:52 (C7)	18:09			19:42	31	19:14 (C6)	20:14			20:46	16	07:05 (D7)	21:12		
13	08:04		08:25 (D8)	07:38			07:56		18:44 (C6)	07:05			06:24		06:50 (D7)	06:06		
	17:33	42	16:51 (C7)	18:10			19:43	29	19:13 (C6)	20:16			20:47	14	07:04 (D7)	21:12		
14	08:03		08:25 (D8)	07:36			07:54		18:44 (C6)	07:03			06:23		06:51 (D7)	06:06		
	17:34	41	16:51 (C7)	18:12			19:44	27	19:11 (C6)	20:17			20:48	12	07:03 (D7)	21:13		
15	08:03		08:24 (D8)	07:35			07:52		18:46 (C6)	07:01			06:22		06:54 (D7)	06:06		
	17:35	40	16:50 (C7)	18:13			19:45	24	19:10 (C6)	20:18			20:49	8	07:02 (D7)	21:13		
16	08:03		08:24 (D8)	07:34			07:51		18:47 (C6)	07:00		19:50 (C5)	06:21			06:06		
	17:36	39	16:50 (C7)	18:14			19:47	21	19:08 (C6)	20:19	8	19:58 (C5)	20:50			21:14		
17	08:02		08:23 (D8)	07:32			07:49		18:48 (C6)	06:58		19:47 (C5)	06:20			06:06		
	17:37	37	16:48 (C7)	18:15			19:48	17	19:05 (C6)	20:20	11	19:58 (C5)	20:51			21:14		
18	08:02		08:23 (D8)	07:31			07:48		18:52 (C6)	06:57		19:45 (C5)	06:19			06:06		
	17:38	32	16:46 (C7)	18:17			19:49	10	19:02 (C6)	20:21	15	20:00 (C5)	20:52			21:14		
19	08:01		08:22 (D8)	07:30			07:46			06:55		19:43 (C5)	06:18			06:06		
	17:40	27	08:49 (D8)	18:18			19:50			20:22	17	20:00 (C5)	20:53			21:15		
20	08:01		08:22 (D8)	07:28			07:44			06:54		19:42 (C5)	06:17			06:07		
	17:41	27	08:49 (D8)	18:19			19:51			20:23	20	20:02 (C5)	20:54			21:15		
21	08:00		08:21 (D8)	07:27			07:42			06:52		19:41 (C5)	06:17			06:07		
	17:42	28	08:49 (D8)	18:20			19:52			20:24	22	20:03 (C5)	20:55			21:15		
22	07:59		08:22 (D8)	07:25			07:41			06:51		19:39 (C5)	06:16			06:07		
	17:43	27	08:49 (D8)	18:21			19:53			20:25	24	20:03 (C5)	20:56			21:15		
23	07:59		08:23 (D8)	07:24			07:39			06:49		19:39 (C5)	06:15			06:07		
	17:44	27	08:50 (D8)	18:23			19:54			20:26	26	20:05 (C5)	20:57			21:16		
24	07:58		08:23 (D8)	07:23			07:37			06:48		19:38 (C5)	06:14			06:08		
	17:46	26	08:49 (D8)	18:24			19:55			20:27	27	20:05 (C5)	20:58			21:16		
25	07:57		08:24 (D8)	07:21		17:58 (C6)	07:36			06:46		19:38 (C5)	06:14			06:08		
	17:47	25	08:49 (D8)	18:25	5	18:03 (C6)	19:56			20:28	29	20:07 (C5)	20:59			21:16		
26	07:56		08:24 (D8)	07:20		17:53 (C6)	07:34			06:45		19:37 (C5)	06:13			06:08		
	17:48	25	08:49 (D8)	18:26	11	18:04 (C6)	19:57			20:29	30	20:07 (C5)	21:00			21:16		
27	07:56		08:25 (D8)	07:18		17:51 (C6)	07:32			06:44		19:37 (C5)	06:12			06:09		
	17:49	23	08:48 (D8)	18:27	15	18:05 (C6)	19:58			20:30	31	20:08 (C5)	21:00			21:16		
28	07:55		08:26 (D8)	07:17		17:49 (C8)	07:31			06:42		07:02 (D7)	06:12			06:09		
	17:51	21	08:47 (D8)	18:29	18	18:07 (C6)	20:00			20:32	36	20:10 (C5)	21:01			21:16		
29	07:54		08:27 (D8)				07:29			06:41		07:00 (D7)	06:11			06:09		
	17:52	19	08:46 (D8)				20:00			20:33	39	20:09 (C5)	21:02			21:16		
30	07:53		08:30 (D8)				07:27			06:40		06:59 (D7)	06:11			06:10		
	17:53	16	08:46 (D8)				20:01			20:34	40	20:09 (C5)	21:03			21:16		
31	07:52		08:32 (D8)				07:26						06:10					
	17:54	12	08:44 (D8)				20:02						21:04					
Potential sun hours	297			297			370			399			448			452		
Total, worst case		1022			51			477			375			485				
Sun reduction		0.51			0.50			0.58			0.66			0.67				
Oper. time red.		1.00			1.00			1.00			1.00			1.00				
Wind dir. red.		0.64			0.71			0.71			0.65			0.68				
Total reduction		0.32			0.35			0.41			0.43			0.46				
Total, real		332			18			197			161			222				

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:
paulding 1 shadow flicker study [5-rev1]

Licensed user:
EDR
217 Montgomery St.
US-SYRACUSE, NY 13202
(315) 471 0688

Calculated:
12/15/2009 11:10 PM/2.6.0.235

SHADOW - Calendar

Calculation: Timber Road Windfarm Shadow Flicker Analysis **Shadow receptor:** CE - Shadow Receptor: 1.0 x 1.0 Azimuth: 0.0° Slope: 0.0° (662)

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
0.51	0.50	0.58	0.66	0.67	0.77	0.75	0.75	0.68	0.55	0.39	0.34

Operational time

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
283	315	506	548	548	367	324	298	341	652	958	835	993	736	571	484	8,759

July			August			September			October			November			December		
1	06:10		06:34		06:59 (D7)	07:05			07:35		18:22 (C6)	07:10			07:45		08:06 (D8)
	21:16		20:58	17	07:16 (D7)	20:15			19:23	31	18:53 (C6)	17:36			17:12	42	16:34 (C7)
2	06:11		06:35		06:58 (D7)	07:06			07:36		18:21 (C6)	07:11			07:46		08:09 (D8)
	21:16		20:57	30	20:08 (C5)	20:13			19:21	32	18:53 (C6)	17:35			17:12	42	16:35 (C7)
3	06:11		06:36		06:58 (D7)	07:07			07:37		18:20 (C6)	07:12			07:47		08:10 (D8)
	21:16		20:56	36	20:10 (C5)	20:12			19:19	33	18:53 (C6)	17:34			17:11	42	16:35 (C7)
4	06:12		06:37		06:59 (D7)	07:08			07:39		18:19 (C6)	07:13			07:48		08:11 (D8)
	21:16		20:55	38	20:12 (C5)	20:10			19:18	34	18:53 (C6)	17:32			17:11	42	16:36 (C7)
5	06:12		06:38		07:00 (D7)	07:09			07:40		18:19 (C6)	07:15			07:49		08:12 (D8)
	21:16		20:53	40	20:13 (C5)	20:08			19:16	34	18:53 (C6)	17:31			17:11	42	16:37 (C7)
6	06:13		06:39		07:01 (D7)	07:10			07:41		18:18 (C6)	07:16			07:50		08:13 (D8)
	21:15		20:52	42	20:14 (C5)	20:07			19:14	34	18:52 (C6)	17:30			17:11	40	16:37 (C7)
7	06:14		06:40		07:02 (D7)	07:11			07:42		18:19 (C6)	07:17			07:51		08:14 (D8)
	21:15		20:51	43	20:15 (C5)	20:06			19:13	32	18:51 (C6)	17:29			17:11	40	16:38 (C7)
8	06:14		06:41		07:03 (D7)	07:12			07:43		18:19 (C6)	07:18			07:52		08:15 (D8)
	21:15		20:50	44	20:16 (C5)	20:03			19:11	30	18:49 (C6)	17:28			17:11	40	16:39 (C7)
9	06:15		06:42		07:04 (D7)	07:13			07:44		18:19 (C6)	07:19			07:52		08:16 (D8)
	21:14		20:49	44	20:17 (C5)	20:02			19:09	28	18:47 (C6)	17:27			17:11	40	16:40 (C7)
10	06:16		06:43		07:05 (D7)	07:14			07:45		18:19 (C6)	07:21		08:07 (D8)	07:53		08:17 (D8)
	21:14		20:47	43	20:17 (C5)	20:00			19:08	27	18:46 (C6)	17:26	4	08:11 (D8)	17:11	38	16:40 (C7)
11	06:16		06:44		07:06 (D7)	07:15			07:46		18:20 (C6)	07:22		08:03 (D8)	07:54		08:18 (D8)
	21:14		20:46	43	20:18 (C5)	19:57			19:06	24	18:44 (C6)	17:25	12	08:15 (D8)	17:11	39	16:41 (C7)
12	06:17		06:45		07:07 (D7)	07:16			07:47		18:20 (C6)	07:23		08:01 (D8)	07:55		08:18 (D8)
	21:13		20:45	42	20:18 (C5)	19:55			19:05	22	18:42 (C6)	17:24	16	08:17 (D8)	17:11	37	16:41 (C7)
13	06:18		06:46		07:08 (D7)	07:17			07:48		18:21 (C6)	07:24		07:59 (D8)	07:56		08:19 (D8)
	21:13		20:43	41	20:18 (C5)	19:53			19:03	19	18:40 (C6)	17:23	19	08:18 (D8)	17:11	37	16:41 (C7)
14	06:18		06:47		07:09 (D7)	07:18			07:49		18:22 (C6)	07:25		07:59 (D8)	07:57		08:20 (D8)
	21:12		20:42	38	20:18 (C5)	19:52			19:01	17	18:39 (C6)	17:22	21	08:20 (D8)	17:11	36	16:42 (C7)
15	06:19		06:48		07:10 (D7)	07:19			07:50		18:24 (C6)	07:27		07:58 (D8)	07:57		08:21 (D8)
	21:12		20:41	34	20:17 (C5)	19:50			19:00	13	18:37 (C6)	17:21	23	08:21 (D8)	17:11	35	16:43 (C7)
16	06:20		06:49		19:43 (C5)	07:20			07:51		18:27 (C6)	07:28		07:57 (D8)	07:58		08:21 (D8)
	21:11		20:39	32	20:15 (C5)	19:48			18:58	9	18:36 (C6)	17:20	25	08:22 (D8)	17:12	35	16:43 (C7)
17	06:21		06:50		19:43 (C5)	07:21			07:53			07:29		07:57 (D8)	07:59		08:22 (D8)
	21:11		20:38	31	20:14 (C5)	19:46			18:57			17:19	25	08:22 (D8)	17:12	35	16:44 (C7)
18	06:22		06:51		19:43 (C5)	07:22			07:54			07:30		07:57 (D8)	07:59		08:23 (D8)
	21:10		20:36	29	20:12 (C5)	19:45			18:55			17:19	26	08:23 (D8)	17:12	34	16:44 (C7)
19	06:22		06:52		19:44 (C5)	07:23			07:55			07:31		07:57 (D8)	08:00		08:23 (D8)
	21:09		20:35	27	20:11 (C5)	19:43			18:54			17:18	27	08:24 (D8)	17:13	34	16:44 (C7)
20	06:23		06:53		19:44 (C5)	07:24			07:56			07:32		07:57 (D8)	08:01		08:24 (D8)
	21:09		20:34	25	20:09 (C5)	19:41			18:52			17:17	27	08:24 (D8)	17:13	33	16:45 (C7)
21	06:24		06:54		19:44 (C5)	07:25			07:57			07:34		07:56 (D8)	08:01		08:24 (D8)
	21:08		20:32	24	20:08 (C5)	19:40			18:51			17:17	28	08:24 (D8)	17:14	33	16:45 (C7)
22	06:25		06:55		19:45 (C5)	07:26			07:58			07:35		07:56 (D8)	08:02		08:25 (D8)
	21:07		20:31	22	20:07 (C5)	19:38			18:49			17:16	28	08:26 (D8)	17:14	33	16:46 (C7)
23	06:26		06:56		19:46 (C5)	07:27			07:59			07:36		07:59 (D8)	08:02		08:25 (D8)
	21:06		20:29	19	20:05 (C5)	19:36			18:48			17:15	27	08:26 (D8)	17:15	33	16:46 (C7)
24	06:27		06:57		19:47 (C5)	07:28			08:00			07:37		08:00 (D8)	08:03		08:26 (D8)
	21:05		20:28	17	20:04 (C5)	19:35			18:47			17:15	32	16:23 (C7)	17:15	33	16:47 (C7)
25	06:28		06:58		19:48 (C5)	07:29		18:37 (C6)	08:02			07:38		08:01 (D8)	08:03		08:26 (D8)
	21:05		20:26	14	20:02 (C5)	19:33	6	18:43 (C6)	18:45			17:14	36	16:26 (C7)	17:16	34	16:47 (C7)
26	06:29		06:59		19:50 (C5)	07:30		18:32 (C6)	08:03			07:39		08:02 (D8)	08:03		08:26 (D8)
	21:04		20:24	11	20:01 (C5)	19:31	15	18:47 (C6)	18:44			17:14	39	16:28 (C7)	17:16	34	16:47 (C7)
27	06:30		07:00		19:53 (C5)	07:31		18:29 (C6)	08:04			07:40		08:04 (D8)	08:04		08:27 (D8)
	21:03		20:23	6	19:59 (C5)	19:29	20	18:49 (C6)	18:42			17:13	40	16:30 (C7)	17:17	36	16:49 (C7)
28	06:31	07:06 (D7)	07:01			07:32		18:27 (C6)	08:05			07:41		08:05 (D8)	08:04		08:27 (D8)
	21:02	4 07:10 (D7)	20:21			19:28	23	18:50 (C6)	18:41			17:13	41	16:31 (C7)	17:18	35	16:49 (C7)
29	06:31	07:03 (D7)	07:02			07:33		18:25 (C6)	08:06			07:43		08:06 (D8)	08:04		08:27 (D8)
	21:01	9 07:12 (D7)	20:20			19:26	26	18:51 (C6)	18:40			17:12	41	16:32 (C7)	17:18	36	16:49 (C7)
30	06:32	07:01 (D7)	07:03			07:34		18:23 (C6)	08:07			07:44		08:07 (D8)	08:04		08:27 (D8)
	21:00	13 07:14 (D7)	20:18			19:24	29	18:52 (C6)	18:39			17:12	42	16:33 (C7)	17:19	36	16:49 (C7)
31	06:33	07:00 (D7)	07:04						08:09						08:05		08:27 (D8)
	20:59	15 07:15 (D7)	20:17						18:37						17:20	37	16:50 (C7)
Potential sun hours	459		428			375			345			297			287		
Total, worst case	41		832			119			419			579			1142		
Sun reduction	0.75		0.75			0.68			0.55			0.39			0.34		
Oper. time red.	1.00		1.00			1.00			1.00			1.00			1.00		
Wind dir. red.	0.72		0.67			0.71			0.71			0.61			0.68		
Total reduction	0.54		0.50			0.48			0.39			0.24			0.23		
Total, real	22		413			58			162			140			262		

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)

Project:
paulding 1 shadow flicker study [5-rev1]

Licensed user:
EDR
217 Montgomery St.
US-SYRACUSE, NY 13202
(315) 471 0688

Calculated:
12/15/2009 11:10 PM/2.6.0.235

SHADOW - Calendar

Calculation: Timber Road Windfarm Shadow Flicker Analysis **Shadow receptor:** CM - Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 0.0° (670)

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
0.51	0.50	0.58	0.66	0.67	0.77	0.75	0.75	0.68	0.55	0.39	0.34

Operational time

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
283	315	506	548	548	367	324	298	341	652	958	835	993	736	571	484	8,759

January			February			March			April			May			June		
1	08:05		16:30 (D7)	07:51		16:51 (D7)	07:15		07:34 (E6)	07:24			06:38		07:16 (E5)	06:09		20:01 (D5)
	17:21	24	16:54 (D7)	17:55	8	16:59 (D7)	18:30	19	07:53 (E6)	20:03			20:36	13	20:12 (D5)	21:04	20	20:21 (D5)
2	08:05		16:30 (D7)	07:50			07:13		07:33 (E6)	07:22			06:37		20:04 (D5)	06:09		20:03 (D5)
	17:22	25	16:55 (D7)	17:57			18:31	21	07:54 (E6)	20:04			20:36	10	20:14 (D5)	21:05	17	20:20 (D5)
3	08:05		16:31 (D7)	07:49			07:12		07:31 (E6)	07:21			06:36		20:01 (D5)	06:09		06:30 (E4)
	17:23	25	16:56 (D7)	17:58			18:32	23	07:54 (E6)	20:05			20:37	13	20:14 (D5)	21:06	18	20:19 (D5)
4	08:05		16:31 (D7)	07:48			07:10		07:30 (E6)	07:19			06:34		19:59 (D5)	06:08		06:30 (E4)
	17:24	26	16:57 (D7)	17:59			18:33	36	18:12 (D6)	20:06			20:38	16	20:16 (D5)	21:07	18	20:19 (D5)
5	08:05		16:31 (D7)	07:47			07:09		07:28 (E6)	07:17			06:33		19:58 (D5)	06:08		06:30 (E4)
	17:25	27	16:58 (D7)	18:00			18:34	42	18:13 (D6)	20:07			20:39	18	20:18 (D5)	21:07	16	20:18 (D5)
6	08:05		16:31 (D7)	07:46			07:07		07:26 (E6)	07:16			06:32		19:57 (D5)	06:08		06:29 (E4)
	17:25	28	16:59 (D7)	18:02			18:35	46	18:13 (D6)	20:08			20:40	21	20:18 (D5)	21:08	14	20:16 (D5)
7	08:05		16:32 (D7)	07:45			07:05		07:26 (E6)	07:14			06:31		19:56 (D5)	06:07		06:29 (E4)
	17:26	28	17:00 (D7)	18:03			18:36	49	18:15 (D6)	20:09			20:41	23	20:19 (D5)	21:09	12	20:15 (D5)
8	08:05		16:32 (D7)	07:44			08:04		08:26 (E6)	07:12			06:29		19:56 (D5)	06:07		06:29 (E4)
	17:27	30	17:02 (D7)	18:04			19:38	50	19:16 (D6)	20:10			20:42	24	20:20 (D5)	21:09	7	06:36 (E4)
9	08:05		16:33 (D7)	07:43			08:02		08:27 (E6)	07:11			06:28		19:54 (D5)	06:07		06:29 (E4)
	17:28	30	17:03 (D7)	18:05			19:39	52	19:18 (D6)	20:11			20:43	26	20:20 (D5)	21:10	7	06:36 (E4)
10	08:05		16:32 (D7)	07:41			08:01		08:28 (E6)	07:09			06:27		19:54 (D5)	06:07		06:29 (E4)
	17:29	31	17:03 (D7)	18:07			19:40	51	19:19 (D6)	20:12			20:44	27	20:21 (D5)	21:11	8	06:37 (E4)
11	08:04		16:33 (D7)	07:40			07:59		08:28 (E6)	07:08			06:26		19:53 (D5)	06:06		06:29 (E4)
	17:31	32	17:05 (D7)	18:08			19:41	50	19:19 (D6)	20:13			20:45	29	20:22 (D5)	21:11	9	06:38 (E4)
12	08:04		16:33 (D7)	07:39			07:57		08:30 (E6)	07:06		07:25 (E5)	06:25		19:53 (D5)	06:06		06:28 (E4)
	17:32	33	17:06 (D7)	18:09			19:42	49	19:21 (D6)	20:14	5	07:30 (E5)	20:46	30	20:23 (D5)	21:12	9	06:37 (E4)
13	08:04		16:33 (D7)	07:38			07:56		08:32 (E6)	07:04		07:23 (E5)	06:24		19:53 (D5)	06:06		06:28 (E4)
	17:33	33	17:06 (D7)	18:10			19:43	45	19:21 (D6)	20:15	9	07:32 (E5)	20:47	31	20:24 (D5)	21:12	10	06:38 (E4)
14	08:03		16:34 (D7)	07:36			07:54		18:47 (D6)	07:03		07:22 (E5)	06:23		19:53 (D5)	06:06		06:28 (E4)
	17:34	33	17:07 (D7)	18:12			19:44	34	19:21 (D6)	20:17	12	07:34 (E5)	20:48	32	20:25 (D5)	21:13	10	06:38 (E4)
15	08:03		16:33 (D7)	07:35			07:52		18:48 (D6)	07:01		07:20 (E5)	06:22		19:53 (D5)	06:06		06:28 (E4)
	17:35	34	17:07 (D7)	18:13			19:45	33	19:21 (D6)	20:18	15	07:35 (E5)	20:49	32	20:25 (D5)	21:13	10	06:38 (E4)
16	08:03		16:34 (D7)	07:34			07:51		18:47 (D6)	07:00		07:19 (E5)	06:21		19:54 (D5)	06:06		06:28 (E4)
	17:36	34	17:08 (D7)	18:14			19:47	33	19:20 (D6)	20:19	17	07:36 (E5)	20:50	32	20:26 (D5)	21:14	10	06:38 (E4)
17	08:02		16:34 (D7)	07:32			07:49		18:47 (D6)	06:58		07:17 (E5)	06:20		19:54 (D5)	06:06		06:29 (E4)
	17:37	34	17:08 (D7)	18:15			19:48	32	19:19 (D6)	20:20	19	07:36 (E5)	20:51	32	20:26 (D5)	21:14	11	06:40 (E4)
18	*08:02*		*16:35 (D7)*	*07:31*			*07:47*		*18:48 (D6)*	*06:57*		*07:18 (E5)*	*06:19*		*19:54 (D5)*	*06:06*		*06:29 (E4)*
	17:38	34	17:09 (D7)	18:17			19:49	31	19:19 (D6)	20:21	21	07:37 (E5)	20:52	32	20:26 (D5)	21:14	11	06:40 (E4)
19	08:01		16:35 (D7)	07:30			07:46		18:49 (D6)	06:55		07:14 (E5)	06:18		19:54 (D5)	06:06		06:29 (E4)
	17:40	33	17:09 (D7)	18:18			19:50	29	19:18 (D6)	20:22	23	07:37 (E5)	20:53	32	20:26 (D5)	21:15	11	06:40 (E4)
20	08:00		16:36 (D7)	07:28			07:44		18:49 (D6)	06:54		07:13 (E5)	06:17		19:54 (D5)	06:07		06:29 (E4)
	17:41	33	17:09 (D7)	18:19			19:51	27	19:16 (D6)	20:23	24	07:37 (E5)	20:54	31	20:25 (D5)	21:15	11	06:40 (E4)
21	08:00		16:36 (D7)	07:27			07:42		18:50 (D6)	06:52		07:11 (E5)	06:17		19:54 (D5)	06:07		06:29 (E4)
	17:42	33	17:09 (D7)	18:20			19:52	24	19:14 (D6)	20:24	25	07:38 (E5)	20:55	31	20:25 (D5)	21:15	11	06:40 (E4)
22	07:59		16:37 (D7)	07:25			07:41		18:52 (D6)	06:51		07:10 (E5)	06:16		19:55 (D5)	06:07		06:29 (E4)
	17:43	*32*	*17:09 (D7)*	*18:21*			*19:53*	*21*	*19:13 (D6)*	*20:25*	*27*	*07:37 (E5)*	*20:56*	*30*	*20:25 (D5)*	*21:15*	*11*	*06:40 (E4)*
23	07:59		16:37 (D7)	07:24			07:39		18:53 (D6)	06:49		07:09 (E5)	06:15		19:55 (D5)	06:07		06:30 (E4)
	17:44	31	17:08 (D7)	18:23			19:54	17	19:10 (D6)	20:26	28	07:37 (E5)	20:57	30	20:25 (D5)	21:16	11	06:41 (E4)
24	07:58		16:39 (D7)	07:22		07:42 (E6)	07:37		18:56 (D6)	06:48		07:09 (E5)	06:14		19:55 (D5)	06:07		06:30 (E4)
	17:45	30	17:09 (D7)	18:24	2	07:44 (E6)	19:55	10	19:06 (D6)	20:27	26	07:35 (E5)	20:58	29	20:24 (D5)	21:16	11	06:41 (E4)
25	07:57		16:39 (D7)	07:21		07:41 (E6)	07:36			06:46		07:09 (E5)	06:14		19:56 (D5)	06:08		06:30 (E4)
	17:47	29	17:08 (D7)	18:25	8	07:49 (E6)	19:56			20:28	26	07:35 (E5)	20:59	28	20:24 (D5)	21:16	11	06:41 (E4)
26	07:56		16:40 (D7)	07:19		07:39 (E6)	07:34			06:45		07:09 (E5)	06:13		19:57 (D5)	06:08		06:31 (E4)
	17:48	28	17:08 (D7)	18:26	11	07:50 (E6)	19:57			20:29	25	07:34 (E5)	21:00	27	20:24 (D5)	21:16	11	06:42 (E4)
27	*07:56*		*16:41 (D7)*	*07:18*		*07:37 (E6)*	*07:32*			*06:44*		*07:10 (E5)*	*06:12*		*19:57 (D5)*	*06:08*		*06:31 (E4)*
	17:49	26	17:07 (D7)	18:27	14	07:51 (E6)	19:58			20:30	23	07:33 (E5)	21:00	26	20:23 (D5)	21:16	10	06:41 (E4)
28	07:55		16:42 (D7)	07:16		07:36 (E6)	07:31			06:42		07:11 (E5)	06:12		19:58 (D5)	06:09		06:31 (E4)
	17:50	24	17:06 (D7)	18:28	17	07:53 (E6)	19:59			20:31	21	07:32 (E5)	21:01	25	20:23 (D5)	21:16	10	06:41 (E4)
29	07:54		16:44 (D7)				07:29			06:41		07:12 (E5)	06:11		19:58 (D5)	06:09		06:32 (E4)
	17:52	21	17:05 (D7)				20:01			20:33	18	07:30 (E5)	21:02	24	20:22 (D5)	21:16	10	06:42 (E4)
30	07:53		16:45 (D7)				07:27			06:39		07:14 (E5)	06:10		20:00 (D5)	06:10		06:32 (E4)
	17:53	19	17:04 (D7)				20:01			20:34	14	07:28 (E5)	21:03	22	20:22 (D5)	21:16	9	06:41 (E4)
31	07:52		16:47 (D7)				07:26						06:10		20:00 (D5)			
	17:54	*16*	*17:02 (D7)*				*20:02*						*21:04*	*21*	*20:21 (D5)*			
Potential sun hours	297			297			370			399			448			452		
Total, worst case		895			60			824			378			797			344	
Sun reduction		0.51			0.50			0.58			0.66			0.67			0.77	
Oper. time red.		1.00			1.00			1.00			1.00			1.00			1.00	
Wind dir. red.		0.71			0.66			0.69			0.71			0.64			0.69	
Total reduction		0.36			0.33			0.40			0.47			0.43			0.54	
Total, real		326			20			331			178			344			185	

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:
paulding 1 shadow flicker study [5-rev1]

Printed/Page
12/21/2009 11:32 AM / 14

Licensed user:
EDR
217 Montgomery St.
US-SYRACUSE, NY 13202
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Calculated:
12/15/2009 11:10 PM/2.6.0.235

SHADOW - Calendar

Calculation: Timber Road Windfarm Shadow Flicker Analysis **Shadow receptor:** CM - Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 0.0° (670)

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
0.51	0.50	0.58	0.66	0.67	0.77	0.75	0.75	0.68	0.55	0.39	0.34

Operational time

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
283	315	506	548	548	367	324	298	341	652	956	835	993	736	571	484	8,759

July			August			September			October			November			December		
1	06:10		06:33 (E4)	06:34		20:04 (D5)	07:05		07:35		08:10 (E6)	07:10			07:45		16:16 (D7)
	21:16	9	06:42 (E4)	20:58	29	20:33 (D5)	20:15		19:23	48	19:00 (D6)	17:36			17:12	32	16:47 (D7)
2	06:11		06:33 (E4)	06:35		20:04 (D5)	07:06		07:36		08:08 (E6)	07:11			07:46		16:15 (D7)
	21:16	8	06:41 (E4)	20:57	28	20:32 (D5)	20:13		19:21	50	18:59 (D6)	17:35			17:11	31	16:46 (D7)
3	06:11		06:34 (E4)	06:36		20:05 (D5)	07:07		07:37		08:08 (E6)	07:12			07:47		16:16 (D7)
	21:16	8	06:42 (E4)	20:56	26	20:31 (D5)	20:12		19:19	51	18:57 (D6)	17:33			17:11	30	16:46 (D7)
4	06:12		06:34 (E4)	06:37		20:05 (D5)	07:08		07:38		08:04 (E6)	07:13			07:48		16:16 (D7)
	21:16	7	06:41 (E4)	20:54	25	20:30 (D5)	20:10		19:18	52	18:55 (D6)	17:32			17:11	30	16:46 (D7)
5	06:12		06:35 (E4)	06:38		20:06 (D5)	07:09		07:39		08:03 (E6)	07:14			07:49		16:17 (D7)
	21:15	8	20:19 (D5)	20:53	23	20:29 (D5)	20:08		19:16	51	18:53 (D6)	17:31			17:11	28	16:45 (D7)
6	06:13		06:35 (E4)	06:39		20:06 (D5)	07:10		07:41		08:02 (E6)	07:16			07:50		16:17 (D7)
	21:15	13	20:22 (D5)	20:52	22	20:28 (D5)	20:07		19:14	51	18:52 (D6)	17:30			17:11	28	16:45 (D7)
7	06:13		06:36 (E4)	06:40		20:07 (D5)	07:11		07:42		08:01 (E6)	07:17			07:51		16:18 (D7)
	21:15	16	20:24 (D5)	20:51	20	20:27 (D5)	20:05		19:13	49	18:50 (D6)	17:29			17:11	27	16:45 (D7)
8	06:14		06:37 (E4)	06:41		20:08 (D5)	07:12		07:43		08:03 (E6)	07:18			07:51		16:19 (D7)
	21:15	17	20:25 (D5)	20:50	18	20:26 (D5)	20:03		19:11	44	18:49 (D6)	17:28			17:11	26	16:45 (D7)
9	06:15		06:37 (E4)	06:42		20:10 (D5)	07:13		07:44		08:04 (E6)	07:19			07:52		16:20 (D7)
	21:14	17	20:26 (D5)	20:48	15	20:25 (D5)	20:02		19:09	38	18:47 (D6)	17:27			17:11	25	16:45 (D7)
10	06:15		06:38 (E4)	06:43		20:11 (D5)	07:14		07:45		08:05 (E6)	07:20		16:21 (D7)	07:53		16:20 (D7)
	21:14	19	20:27 (D5)	20:47	12	20:23 (D5)	20:00		19:08	33	18:46 (D6)	17:26	9	16:30 (D7)	17:11	25	16:45 (D7)
11	06:16		20:10 (D5)	06:44		07:29 (E5)	07:15		07:46		08:06 (E6)	07:22		16:19 (D7)	07:54		16:21 (D7)
	21:14	19	20:29 (D5)	20:46	10	20:22 (D5)	19:57		19:06	22	08:28 (E6)	17:25	15	16:34 (D7)	17:11	24	16:45 (D7)
12	06:17		20:09 (D5)	06:45		07:24 (E5)	07:16		07:47		08:07 (E6)	07:23		16:17 (D7)	07:55		16:21 (D7)
	21:13	20	20:29 (D5)	20:45	12	07:36 (E5)	19:55		19:05	20	08:27 (E6)	17:24	19	16:38 (D7)	17:11	24	16:45 (D7)
13	06:18		20:08 (D5)	06:46		07:22 (E5)	07:17		07:48		08:08 (E6)	07:24		16:15 (D7)	07:56		16:22 (D7)
	21:13	22	20:30 (D5)	20:43	16	07:38 (E5)	19:53		19:03	18	08:26 (E6)	17:23	22	16:37 (D7)	17:11	23	16:45 (D7)
14	06:18		20:08 (D5)	06:47		07:19 (E5)	07:18		07:49		08:09 (E6)	07:25		16:15 (D7)	07:56		16:23 (D7)
	21:12	23	20:31 (D5)	20:42	19	07:38 (E5)	19:52		19:01	16	08:25 (E6)	17:22	24	16:39 (D7)	17:11	22	16:45 (D7)
15	06:19		20:08 (D5)	06:48		07:18 (E5)	07:19		07:50		08:10 (E6)	07:26		16:14 (D7)	07:57		16:24 (D7)
	21:12	24	20:32 (D5)	20:41	21	07:39 (E5)	19:50		19:00	13	08:23 (E6)	17:21	26	16:40 (D7)	17:11	22	16:46 (D7)
16	06:20		20:06 (D5)	06:49		07:17 (E5)	07:20		07:51		08:12 (E6)	07:28		16:13 (D7)	07:58		16:24 (D7)
	21:11	26	20:32 (D5)	20:39	23	07:40 (E5)	19:48		18:58	10	08:22 (E6)	17:20	28	16:41 (D7)	17:12	21	16:45 (D7)
17	06:21		20:06 (D5)	06:50		07:16 (E5)	07:21		07:52		08:13 (E6)	07:29		16:12 (D7)	07:59		16:25 (D7)
	21:10	27	20:33 (D5)	20:38	25	07:41 (E5)	19:46		18:57	6	08:19 (E6)	17:19	29	16:41 (D7)	17:12	21	16:46 (D7)
18	06:22		20:06 (D5)	06:51		07:15 (E5)	07:22		07:54			07:30		16:13 (D7)	07:59		16:25 (D7)
	21:10	28	20:34 (D5)	20:36	26	07:41 (E5)	19:45		18:55			17:19	30	16:43 (D7)	17:12	22	16:47 (D7)
19	06:22		20:06 (D5)	06:52		07:14 (E5)	07:23	18:45 (D8)	07:55			07:31		16:12 (D7)	08:00		16:25 (D7)
	21:09	28	20:34 (D5)	20:35	27	07:41 (E5)	19:43	6 18:51 (D6)	18:54			17:18	31	16:43 (D7)	17:13	21	16:46 (D7)
20	06:23		20:05 (D5)	06:53		07:14 (E5)	07:24	18:40 (D8)	07:56			07:32		16:12 (D7)	08:00		16:26 (D7)
	21:08	29	20:34 (D5)	20:33	27	07:41 (E5)	19:41	16 18:56 (D6)	18:52			17:17	32	16:44 (D7)	17:13	21	16:47 (D7)
21	06:24		20:04 (D5)	06:54		07:15 (E5)	07:25	18:38 (D8)	07:57			07:34		16:12 (D7)	08:01		16:26 (D7)
	21:08	31	20:35 (D5)	20:32	26	07:41 (E5)	19:40	20 18:58 (D6)	18:51			17:16	32	16:44 (D7)	17:14	21	16:47 (D7)
22	06:25		20:04 (D5)	06:55		07:16 (E5)	07:26	18:35 (D6)	07:58			07:35		16:12 (D7)	08:02		16:27 (D7)
	21:07	31	20:35 (D5)	20:30	25	07:41 (E5)	19:38	24 18:59 (D8)	18:49			17:16	33	16:45 (D7)	17:14	21	16:48 (D7)
23	06:26		20:04 (D5)	06:56		07:17 (E5)	07:27	18:34 (D6)	07:59			07:36		16:12 (D7)	08:02		16:27 (D7)
	21:06	32	20:36 (D5)	20:29	24	07:41 (E5)	19:36	26 19:00 (D6)	18:48			17:15	33	16:45 (D7)	17:15	21	16:48 (D7)
24	06:27		20:04 (D5)	06:57		07:18 (E5)	07:28	18:32 (D6)	08:00			07:37		16:12 (D7)	08:02		16:28 (D7)
	21:05	32	20:36 (D5)	20:27	22	07:40 (E5)	19:34	29 19:01 (D6)	18:47			17:15	34	16:46 (D7)	17:15	21	16:49 (D7)
25	06:28		20:04 (D5)	06:58		07:19 (E5)	07:29	18:31 (D6)	08:02			07:38		16:12 (D7)	08:03		16:28 (D7)
	21:04	32	20:36 (D5)	20:26	21	07:40 (E5)	19:33	30 19:01 (D6)	18:45			17:14	34	16:46 (D7)	17:16	22	16:50 (D7)
26	06:29		20:04 (D5)	06:59		07:20 (E5)	07:30	18:30 (D6)	08:03			07:39		16:12 (D7)	08:03		16:29 (D7)
	21:04	33	20:37 (D5)	20:24	19	07:39 (E5)	19:31	31 19:01 (D6)	18:44			17:14	34	16:46 (D7)	17:16	21	16:50 (D7)
27	06:30		20:04 (D5)	07:00		07:21 (E5)	07:31	18:29 (D6)	08:04			07:40		16:13 (D7)	08:04		16:30 (D7)
	21:03	33	20:37 (D5)	20:23	17	07:38 (E5)	19:29	32 19:01 (D6)	18:42			17:13	34	16:47 (D7)	17:17	21	16:51 (D7)
28	06:30		20:03 (D5)	07:01		07:22 (E5)	07:32	18:28 (D8)	08:05			07:41		16:14 (D7)	08:04		16:30 (D7)
	21:02	33	20:36 (D5)	20:21	15	07:37 (E5)	19:28	33 19:01 (D6)	18:41			17:13	33	16:47 (D7)	17:18	22	16:52 (D7)
29	06:31		20:03 (D5)	07:02		07:23 (E5)	07:33	18:26 (D6)	08:06			07:43		16:14 (D7)	08:04		16:30 (D7)
	21:01	33	20:36 (D5)	20:20	12	07:35 (E5)	19:26	33 19:01 (D6)	18:40			17:12	33	16:47 (D7)	17:18	22	16:52 (D7)
30	06:32		20:03 (D5)	07:03		07:24 (E5)	07:34	08:14 (E6)	08:07			07:44		16:14 (D7)	08:04		16:30 (D7)
	21:00	32	20:35 (D5)	20:18	9	07:33 (E5)	19:24	42 19:01 (D6)	18:38			17:12	33	16:47 (D7)	17:19	23	16:53 (D7)
31	06:33		20:04 (D5)	07:04		07:25 (E5)			08:09						08:05		16:30 (D7)
	20:59	30	20:34 (D5)	20:17	5	07:30 (E5)			18:37						17:20	23	16:53 (D7)
Potential sun hours	459			428			375		345			297			287		
Total, worst case		720			619			322		572			598			741	
Sun reduction		0.75			0.75			0.68		0.55			0.39			0.34	
Oper. time red.		1.00			1.00			1.00		1.00			1.00			1.00	
Wind dir. red.		0.64			0.68			0.70		0.67			0.71			0.71	
Total reduction		0.48			0.51			0.48		0.37			0.28			0.24	
Total, real		349			317			156		211			168			178	

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:
paulding 1 shadow flicker study [5-rev1]

Printed/Page
12/21/2009 11:32 AM / 15

Licensed user:
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217 Montgomery St.
US-SYRACUSE, NY 13202
(315) 471 0688

Calculated:
12/15/2009 11:10 PM/2.6.0.235

SHADOW - Calendar

Calculation: Timber Road Windfarm Shadow Flicker Analysis **Shadow receptor:** CN - Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 0.0° (671)

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
0.51	0.50	0.58	0.66	0.67	0.77	0.75	0.75	0.68	0.55	0.39	0.34

Operational time

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
283	315	506	548	548	367	324	298	341	652	958	835	993	736	571	484	8,759

	January	February		March		April		May		June	
1	08:05	07:51		07:15	17:31 (D6)	07:24	07:43 (E6)	06:38		06:09	06:42 (E4)
	17:21	17:55		18:30	10 17:41 (D6)	20:03	26 08:11 (E5)	20:35		21:04	13 06:55 (E4)
2	08:05	07:50		07:13		07:22	07:42 (E5)	06:37		06:09	06:44 (E4)
	17:22	17:57		18:31		20:04	28 08:10 (E5)	20:36		21:05	11 06:55 (E4)
3	08:05	07:49	08:09 (E6)	07:12		07:21	07:43 (E6)	06:36		06:09	06:45 (E4)
	17:23	17:58	3 08:12 (E6)	18:32		20:05	27 08:10 (E5)	20:37		21:06	8 06:53 (E4)
4	08:05	07:48	08:08 (E6)	07:10		07:19	07:43 (E5)	06:34		06:08	06:47 (E4)
	17:24	17:59	7 08:15 (E6)	18:33		20:06	26 08:09 (E5)	20:38		21:07	4 06:51 (E4)
5	08:05	07:47	08:07 (E6)	07:09		07:17	07:43 (E5)	06:33		06:08	
	17:25	18:00	10 08:17 (E6)	18:34		20:07	24 08:07 (E6)	20:39		21:07	
6	08:05	07:46	08:06 (E6)	07:07		07:16	07:45 (E5)	06:32		06:08	
	17:25	18:02	13 08:19 (E6)	18:35		20:08	31 19:48 (D5)	20:40		21:08	
7	08:05	07:45	08:05 (E6)	07:05		07:14	07:45 (E5)	06:31	06:51 (E4)	06:07	
	17:26	18:03	15 08:20 (E6)	18:36		20:09	32 19:48 (D5)	20:41	2 06:53 (E4)	21:09	
8	08:05	07:44	08:04 (E6)	08:04		07:12	07:47 (E5)	06:29	06:50 (E4)	06:07	
	17:27	18:04	25 17:41 (D6)	19:38		20:10	32 19:49 (D5)	20:42	5 06:55 (E4)	21:09	
9	08:05	07:43	08:03 (E6)	08:02		07:11	07:50 (E5)	06:28	06:48 (E4)	06:07	
	17:28	18:05	31 17:42 (D6)	19:39		20:11	30 19:51 (D5)	20:43	7 06:55 (E4)	21:10	
10	08:05	07:41	08:01 (E6)	08:01		07:09	19:28 (D5)	06:27	06:47 (E4)	06:07	
	17:29	18:07	37 17:43 (D6)	19:40		20:12	23 19:51 (D5)	20:44	9 06:56 (E4)	21:11	
11	08:04	07:40	08:00 (E6)	07:59		07:08	19:28 (D5)	06:26	06:46 (E4)	06:06	
	17:31	18:08	42 17:45 (D6)	19:41		20:13	25 19:53 (D5)	20:45	11 06:57 (E4)	21:11	
12	08:04	07:39	07:59 (E6)	07:57		07:06	19:26 (D5)	06:25	06:45 (E4)	06:06	
	17:32	18:09	45 17:46 (D6)	19:42		20:14	27 19:53 (D5)	20:46	13 06:58 (E4)	21:12	
13	08:04	07:38	07:57 (E6)	07:56		07:04	19:25 (D5)	06:24	06:44 (E4)	06:06	
	17:33	18:10	49 17:47 (D6)	19:43		20:15	29 19:54 (D5)	20:47	14 06:58 (E4)	21:12	
14	08:03	07:36	07:56 (E6)	07:54		07:03	19:25 (D5)	06:23	06:43 (E4)	06:06	
	17:34	18:12	53 17:49 (D6)	19:44		20:17	31 19:56 (D5)	20:48	16 06:59 (E4)	21:13	
15	08:03	07:35	07:56 (E6)	07:52		07:01	19:24 (D5)	06:22	06:42 (E4)	06:06	
	17:35	18:13	54 17:50 (D6)	19:45		20:18	32 19:56 (D5)	20:49	17 06:59 (E4)	21:13	
16	08:03	07:34	07:56 (E6)	07:51		07:00	19:24 (D5)	06:21	06:42 (E4)	06:06	
	17:36	18:14	55 17:51 (D6)	19:47		20:19	33 19:57 (D5)	20:50	18 07:00 (E4)	21:14	
17	08:02	07:32	07:57 (E6)	07:49		06:58	19:23 (D5)	06:20	06:41 (E4)	06:06	
	17:37	18:15	56 17:53 (D6)	19:48		20:20	33 19:56 (D5)	20:51	19 07:00 (E4)	21:14	
18	08:02	07:31	07:58 (E6)	07:47		06:57	19:24 (D5)	06:19	06:40 (E4)	06:06	
	17:38	18:17	54 17:53 (D6)	19:49		20:21	32 19:56 (D5)	20:52	20 07:00 (E4)	21:14	
19	08:01	07:30	07:58 (E6)	07:46		06:55	19:23 (D5)	06:18	06:39 (E4)	06:06	
	17:39	18:18	54 17:53 (D6)	19:50		20:22	32 19:55 (D5)	20:53	21 07:00 (E4)	21:15	
20	08:00	07:28	08:00 (E6)	07:44		06:54	19:24 (D5)	06:17	06:38 (E4)	06:07	
	17:41	18:19	60 17:53 (D6)	19:51		20:23	31 19:55 (D5)	20:54	22 07:00 (E4)	21:15	
21	08:00	07:27	08:01 (E6)	07:42		06:52	19:24 (D5)	06:17	06:37 (E4)	06:07	
	17:42	18:20	46 17:52 (D6)	19:52		20:24	30 19:54 (D5)	20:55	22 06:59 (E4)	21:15	
22	07:59	07:25	08:05 (E6)	07:41		06:51	19:24 (D5)	06:16	06:37 (E4)	06:07	
	17:43	18:21	38 17:52 (D6)	19:53		20:25	29 19:53 (D5)	20:56	23 07:00 (E4)	21:15	
23	07:59	07:24	17:22 (D6)	07:39	07:58 (E5)	06:49	19:26 (D5)	06:15	06:36 (E4)	06:07	
	17:44	18:23	29 17:51 (D6)	19:54	7 08:05 (E5)	20:26	27 19:53 (D5)	20:57	23 06:59 (E4)	21:16	
24	07:58	07:22	17:23 (D6)	07:37	07:56 (E5)	06:48	19:26 (D5)	06:14	06:36 (E4)	06:07	
	17:45	18:24	28 17:51 (D6)	19:55	12 08:08 (E5)	20:27	25 19:51 (D5)	20:58	23 06:59 (E4)	21:16	
25	07:57	07:21	17:24 (D6)	07:36	07:55 (E5)	06:46	19:27 (D5)	06:14	06:37 (E4)	06:08	
	17:47	18:25	26 17:50 (D6)	19:56	15 08:10 (E5)	20:28	23 19:50 (D5)	20:59	22 06:59 (E4)	21:16	
26	07:56	07:19	17:25 (D6)	07:34	07:53 (E5)	06:45	19:28 (D5)	06:13	06:38 (E4)	06:08	
	17:48	18:26	24 17:49 (D6)	19:57	17 08:10 (E5)	20:29	20 19:48 (D5)	21:00	20 06:58 (E4)	21:16	
27	07:56	07:18	17:26 (D6)	07:32	07:51 (E6)	06:44	19:30 (D5)	06:12	06:38 (E4)	06:08	
	17:49	18:27	21 17:47 (D6)	19:58	20 08:11 (E5)	20:30	16 19:46 (D5)	21:00	20 06:58 (E4)	21:16	
28	07:55	07:16	17:28 (D6)	07:31	07:50 (E6)	06:42	19:33 (D5)	06:12	06:39 (E4)	06:09	
	17:50	18:28	17 17:45 (D6)	19:59	22 08:12 (E5)	20:31	10 19:43 (D5)	21:01	19 06:58 (E4)	21:16	
29	07:54			07:29	07:48 (E5)	06:41		06:11		06:39 (E4)	06:09
	17:52			20:01	24 08:12 (E6)	20:33		21:02	18	06:57 (E4)	21:16
30	07:53			07:27	07:46 (E5)	06:39		06:10		06:41 (E4)	06:10
	17:53			20:01	25 08:11 (E5)	20:34		21:03	16	06:57 (E4)	21:16
31	07:52			07:26	07:45 (E5)			06:10		06:41 (E4)	
	17:54			20:02	27 08:12 (E5)			21:04	14	06:55 (E4)	
Potential sun hours	297	297		370		399		448		452	
Total, worst case		882		179		766		414		36	
Sun reduction		0.50		0.58		0.66		0.67		0.77	
Oper. time red.		1.00		1.00		1.00		1.00		1.00	
Wind dir. red.		0.68		0.70		0.68		0.72		0.72	
Total reduction		0.34		0.41		0.45		0.48		0.55	
Total, real		303		73		341		201		20	

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)

Project:
paulding 1 shadow flicker study [5-rev1]

Licensed user:
EDR
217 Montgomery St.
US-SYRACUSE, NY 13202
(315) 471 0688

Calculated:
12/15/2009 11:10 PM/2.6.0.235

SHADOW - Calendar

Calculation: Timber Road Windfarm Shadow Flicker Analysis **Shadow receptor:** CN - Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 0.0° (671)

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
0.51	0.50	0.58	0.66	0.67	0.77	0.75	0.75	0.68	0.55	0.39	0.34

Operational time

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
283	315	506	548	548	367	324	298	341	652	958	835	993	736	571	484	8,759

	July		August		September		October		November		December	
1	06:10		06:34	06:56 (E4)	07:05	19:27 (D5)	07:35		07:10	07:31 (E6)	07:45	
	21:16		20:58	12 07:08 (E4)	20:15	25 19:52 (D5)	19:23		17:36	36 17:13 (D6)	17:12	
2	06:11		06:35	06:57 (E4)	07:06	19:27 (D5)	07:36		07:11	07:32 (E6)	07:46	
	21:16		20:57	11 07:08 (E4)	20:13	23 19:50 (D5)	19:21		17:35	31 17:11 (D6)	17:11	
3	06:11		06:36	06:58 (E4)	07:07	07:48 (E5)	07:37		07:12	07:34 (E6)	07:47	
	21:16		20:56	9 07:07 (E4)	20:12	30 19:48 (D5)	19:19		17:33	24 17:11 (D6)	17:11	
4	06:12		06:37	06:59 (E4)	07:08	07:45 (E5)	07:38		07:13	07:35 (E6)	07:48	
	21:16		20:54	6 07:05 (E4)	20:10	32 19:47 (D5)	19:18		17:32	15 07:50 (E6)	17:11	
5	06:12		06:38	07:00 (E4)	07:09	07:42 (E5)	07:39		07:14	07:36 (E6)	07:49	
	21:15		20:53	4 07:04 (E4)	20:08	33 19:45 (D5)	19:16		17:31	13 07:49 (E6)	17:11	
6	06:13		06:39		07:10	07:41 (E5)	07:41		07:16	07:37 (E6)	07:50	
	21:15		20:52		20:07	31 19:44 (D5)	19:14		17:30	10 07:47 (E6)	17:11	
7	06:13		06:40		07:11	07:38 (E5)	07:42		07:17	07:39 (E6)	07:51	
	21:15		20:51		20:05	24 06:02 (E5)	19:13		17:29	7 07:46 (E6)	17:11	
8	06:14		06:41		07:12	07:37 (E5)	07:43		07:18	07:40 (E6)	07:51	
	21:15		20:50		20:03	26 06:03 (E5)	19:11		17:28	2 07:42 (E6)	17:11	
9	06:15	06:53 (E4)	06:42		07:13	07:36 (E5)	07:44		07:19		07:52	
	21:14	6 06:59 (E4)	20:48		20:02	27 06:03 (E5)	19:09		17:27		17:11	
10	06:15	06:52 (E4)	06:43		07:14	07:36 (E5)	07:45		07:20		07:53	
	21:14	9 07:01 (E4)	20:47		20:00	27 06:03 (E5)	19:08		17:26		17:11	
11	06:16	06:51 (E4)	06:44		07:15	07:35 (E5)	07:46		07:22		07:54	
	21:14	12 07:03 (E4)	20:46		19:57	28 06:03 (E5)	19:06		17:25		17:11	
12	06:17	06:50 (E4)	06:45		07:16	07:36 (E5)	07:47	18:08 (D6)	07:23		07:55	
	21:13	13 07:03 (E4)	20:45		19:55	27 06:03 (E5)	19:05	4 18:12 (D6)	17:24		17:11	
13	06:18	06:49 (E4)	06:46		07:17	07:37 (E5)	07:48	18:02 (D6)	07:24		07:56	
	21:13	15 07:04 (E4)	20:43		19:53	28 06:03 (E5)	19:03	14 18:16 (D6)	17:23		17:11	
14	06:18	06:49 (E4)	06:47		07:18	07:38 (E5)	07:49	18:00 (D6)	07:25		07:56	16:09 (D7)
	21:12	17 07:06 (E4)	20:42		19:52	24 06:02 (E5)	19:01	18 18:18 (D6)	17:22		17:11	4 16:13 (D7)
15	06:19	06:49 (E4)	06:48	19:39 (D5)	07:19	07:39 (E5)	07:50	17:58 (D6)	07:26		07:57	16:08 (D7)
	21:12	18 07:07 (E4)	20:41	12 19:51 (D5)	19:50	22 06:01 (E5)	19:00	22 18:20 (D6)	17:21		17:11	7 16:15 (D7)
16	06:20	06:47 (E4)	06:49	19:36 (D5)	07:20	07:40 (E5)	07:51	17:57 (D6)	07:28		07:58	16:07 (D7)
	21:11	20 07:07 (E4)	20:39	17 19:53 (D5)	19:48	20 06:00 (E5)	18:58	25 18:22 (D6)	17:20		17:12	9 16:16 (D7)
17	06:21	06:47 (E4)	06:50	19:34 (D5)	07:21	07:41 (E5)	07:52	17:55 (D6)	07:29		07:59	16:07 (D7)
	21:10	20 07:07 (E4)	20:38	21 19:55 (D5)	19:46	18 07:59 (E5)	18:57	27 18:22 (D6)	17:19		17:12	10 16:17 (D7)
18	06:22	06:47 (E4)	06:51	19:33 (D5)	07:22	07:42 (E5)	07:54	17:54 (D6)	07:30		07:59	16:06 (D7)
	21:10	21 07:08 (E4)	20:36	23 19:56 (D5)	19:45	15 07:57 (E6)	18:55	29 18:23 (D6)	17:19		17:12	10 16:18 (D7)
19	06:22	06:47 (E4)	06:52	19:31 (D5)	07:23	07:43 (E5)	07:55	17:53 (D6)	07:31		08:00	16:07 (D7)
	21:09	22 07:09 (E4)	20:35	26 19:57 (D5)	19:43	12 07:55 (E5)	18:54	30 18:23 (D6)	17:18		17:13	12 16:19 (D7)
20	06:23	06:46 (E4)	06:53	19:30 (D5)	07:24	07:44 (E5)	07:56	08:34 (E6)	07:32		08:00	16:08 (D7)
	21:08	23 07:09 (E4)	20:33	28 19:58 (D5)	19:41	9 07:53 (E5)	18:52	42 18:23 (D6)	17:17		17:13	12 16:20 (D7)
21	06:24	06:46 (E4)	06:54	19:29 (D5)	07:25	07:45 (E5)	07:57	08:31 (E6)	07:34		08:01	16:08 (D7)
	21:08	23 07:09 (E4)	20:32	29 19:58 (D5)	19:40	2 07:47 (E5)	18:51	47 18:23 (D6)	17:16		17:14	12 16:20 (D7)
22	06:25	06:47 (E4)	06:55	19:28 (D5)	07:26		07:58	08:30 (E6)	07:35		08:02	16:09 (D7)
	21:07	23 07:10 (E4)	20:30	31 19:59 (D5)	19:38		18:49	52 18:24 (D6)	17:16		17:14	12 16:21 (D7)
23	06:26	06:48 (E4)	06:56	19:28 (D5)	07:27		07:59	08:29 (E6)	07:36		08:02	16:09 (D7)
	21:06	22 07:10 (E4)	20:29	31 19:59 (D5)	19:36		18:48	54 18:24 (D6)	17:15		17:15	12 16:21 (D7)
24	06:27	06:49 (E4)	06:57	19:27 (D5)	07:28		08:00	08:28 (E6)	07:37		08:02	16:10 (D7)
	21:05	21 07:10 (E4)	20:27	32 19:59 (D5)	19:34		18:47	54 18:23 (D6)	17:15		17:15	12 16:22 (D7)
25	06:28	06:50 (E4)	06:58	19:27 (D5)	07:29		08:02	08:27 (E6)	07:38		08:03	16:11 (D7)
	21:04	21 07:11 (E4)	20:26	32 19:59 (D5)	19:33		18:45	56 18:22 (D6)	17:14		17:16	10 16:21 (D7)
26	06:29	06:51 (E4)	06:59	19:26 (D5)	07:30		08:03	08:26 (E6)	07:39		08:03	16:11 (D7)
	21:04	20 07:11 (E4)	20:24	33 19:59 (D5)	19:31		18:44	55 18:20 (D6)	17:14		17:16	10 16:21 (D7)
27	06:30	06:52 (E4)	07:00	19:26 (D5)	07:31		08:04	08:26 (E6)	07:40		08:04	16:13 (D7)
	21:03	19 07:11 (E4)	20:23	33 19:59 (D5)	19:29		18:42	54 18:20 (D6)	17:13		17:17	9 16:22 (D7)
28	06:30	06:52 (E4)	07:01	19:26 (D5)	07:32		08:05	08:26 (E6)	07:41		08:04	16:14 (D7)
	21:02	18 07:10 (E4)	20:21	32 19:58 (D5)	19:28		18:41	52 18:18 (D6)	17:13		17:18	8 16:22 (D7)
29	06:31	06:53 (E4)	07:02	19:26 (D5)	07:33		08:06	08:27 (E6)	07:43		08:04	16:15 (D7)
	21:01	16 07:09 (E4)	20:20	30 19:56 (D5)	19:26		18:40	48 18:16 (D6)	17:12		17:18	8 16:21 (D7)
30	06:32	06:54 (E4)	07:03	19:26 (D5)	07:34		08:07	08:28 (E6)	07:44		08:04	16:17 (D7)
	21:00	15 07:09 (E4)	20:18	29 19:55 (D5)	19:24		18:38	45 18:15 (D6)	17:12		17:19	2 16:19 (D7)
31	06:33	06:55 (E4)	07:04	19:26 (D5)			08:09	08:30 (E6)			08:05	
	20:59	14 07:09 (E4)	20:17	27 19:53 (D5)			18:37	40 18:14 (D6)			17:20	
Potential sun hours	459		428		375		345		297		287	
Total, worst case	408		508		481		768		138		157	
Sun reduction	0.75		0.75		0.68		0.55		0.39		0.34	
Oper. time red.	1.00		1.00		1.00		1.00		1.00		1.00	
Wind dir. red.	0.72		0.67		0.69		0.69		0.66		0.70	
Total reduction	0.54		0.50		0.47		0.38		0.26		0.24	
Total, real	220		256		227		288		35		37	

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:
paulding 1 shadow flicker study [5-rev1]

Licensed user:
EDR
217 Montgomery St.
US-SYRACUSE, NY 13202
(315) 471 0688

Calculated:
12/15/2009 11:10 PM/2.6.0.235

SHADOW - Calendar

Calculation: Timber Road Windfarm Shadow Flicker Analysis **Shadow receptor:** CO - Shadow Receptor: 1.0 x 1.0 Azimuth: 0.0° Slope: 0.0° (672)

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
0.51	0.50	0.58	0.66	0.67	0.77	0.75	0.75	0.68	0.55	0.39	0.34

Operational time

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
283	315	506	548	548	367	324	298	341	652	958	835	993	736	571	484	8,759

	January			February			March			April			May			June		
1	08:05			07:51		08:11 (E6)	07:15			07:24		18:59 (D5)	06:38		06:59 (E4)	06:09		20:21 (D4)
	17:21			17:55	51	17:19 (D6)	18:30			20:03	36	19:35 (D5)	20:35	21	07:20 (E4)	21:05	19	20:40 (D4)
2	08:05			07:50		08:10 (E6)	07:13			07:22		18:59 (D5)	06:37		07:00 (E4)	06:09		20:21 (D4)
	17:22			17:57	51	17:16 (D6)	18:31			20:04	35	19:34 (D5)	20:36	19	07:19 (E4)	21:05	20	20:41 (D4)
3	08:05			07:49		08:09 (E6)	07:12			07:21		19:00 (D5)	06:36		07:00 (E4)	06:09		20:20 (D4)
	17:23			17:58	52	17:18 (D6)	18:32			20:05	34	19:34 (D5)	20:37	17	07:17 (E4)	21:06	21	20:41 (D4)
4	08:05			07:48		08:08 (E6)	07:10			07:19		19:00 (D5)	06:34		07:01 (E4)	06:08		20:20 (D4)
	17:24			17:59	51	17:17 (D6)	18:33			20:06	33	19:33 (D5)	20:38	15	07:16 (E4)	21:07	22	20:42 (D4)
5	08:05		16:54 (D6)	07:47		08:08 (E6)	07:09			07:17		19:00 (D5)	06:33		07:03 (E4)	06:08		20:20 (D4)
	17:25	2	16:56 (D6)	18:00	47	17:16 (D6)	18:34			20:07	32	19:32 (D5)	20:39	12	07:15 (E4)	21:07	23	20:43 (D4)
6	08:05		16:51 (D6)	07:46		08:09 (E6)	07:07			07:16		19:01 (D5)	06:32		07:06 (E4)	06:08		20:19 (D4)
	17:25	6	16:59 (D6)	18:02	44	17:15 (D6)	18:35			20:08	30	19:31 (D5)	20:40	6	07:12 (E4)	21:08	24	20:43 (D4)
7	08:05		16:50 (D6)	07:45		08:10 (E6)	07:05			07:14		19:02 (D5)	06:31			06:07		20:19 (D4)
	17:26	10	17:00 (D6)	18:03	40	17:14 (D6)	18:36			20:09	27	19:29 (D5)	20:41			21:09	25	20:44 (D4)
8	08:05		16:49 (D6)	07:44		08:11 (E6)	08:04			07:12		19:02 (D5)	06:29			06:07		20:19 (D4)
	17:27	13	17:02 (D6)	18:04	33	17:12 (D6)	19:38			20:10	25	19:27 (D5)	20:42			21:09	26	20:45 (D4)
9	08:05		16:49 (D6)	07:43		08:13 (E6)	08:02		08:22 (E5)	07:11		19:04 (D5)	06:28			06:07		20:19 (D4)
	17:28	14	17:03 (D6)	18:05	22	17:08 (D6)	19:39	6	08:28 (E5)	20:11	22	19:26 (D5)	20:43			21:10	26	20:45 (D4)
10	08:05		16:47 (D6)	07:41		08:14 (E6)	08:01		08:20 (E5)	07:09		19:06 (D5)	06:27			06:07		20:19 (D4)
	17:29	16	17:03 (D6)	18:07	13	08:27 (E6)	19:40	10	08:30 (E5)	20:12	16	19:22 (D5)	20:44			21:11	27	20:46 (D4)
11	08:04		16:47 (D6)	07:40		08:17 (E6)	07:59		08:18 (E5)	07:08		19:10 (D5)	06:26			06:06		20:19 (D4)
	17:31	18	17:05 (D6)	18:08	7	08:24 (E6)	19:41	13	08:31 (E5)	20:13	9	19:19 (D5)	20:45			21:11	28	20:47 (D4)
12	08:04		16:47 (D6)	07:39			07:57		08:17 (E5)	07:06			06:25			06:06		20:18 (D4)
	17:32	19	17:06 (D6)	18:09			19:42	15	08:32 (E5)	20:14			20:46			21:12	28	20:46 (D4)
13	08:04		16:46 (D6)	07:38			07:56		08:15 (E5)	07:04			06:24			06:06		20:18 (D4)
	17:33	21	17:07 (D6)	18:10			19:43	18	08:33 (E5)	20:16			20:47			21:12	29	20:47 (D4)
14	08:03		16:46 (D6)	07:36			07:54		08:13 (E5)	07:03			06:23			06:06		20:18 (D4)
	17:34	22	17:08 (D6)	18:12			19:44	20	08:33 (E5)	20:17			20:48			21:13	29	20:47 (D4)
15	08:03		16:45 (D6)	07:35			07:52		08:12 (E5)	07:01			06:22			06:06		20:18 (D4)
	17:35	24	17:09 (D6)	18:13			19:45	21	08:33 (E5)	20:18			20:49			21:13	30	20:48 (D4)
16	08:03		16:45 (D6)	07:34			07:51		08:10 (E5)	07:00			05:21			06:06		20:18 (D4)
	17:36	25	17:10 (D6)	18:14			19:47	23	08:33 (E5)	20:19			20:50			21:14	30	20:48 (D4)
17	08:02		16:45 (D6)	07:32			07:49		08:08 (E6)	06:58			06:20			06:06		20:19 (D4)
	17:37	28	17:11 (D6)	18:15			19:48	24	08:32 (E5)	20:20			20:51			21:14	30	20:49 (D4)
18	08:02		16:45 (D6)	07:31			07:47		08:07 (E5)	06:57			06:19			06:06		20:19 (D4)
	17:38	28	17:13 (D6)	18:17			19:49	25	08:32 (E5)	20:21			20:52			21:14	30	20:49 (D4)
19	08:01		16:45 (D6)	07:30			07:46		08:07 (E5)	06:55		07:14 (E4)	06:18			06:06		20:19 (D4)
	17:39	29	17:14 (D6)	18:18			19:50	32	19:25 (D5)	20:22	2	07:16 (E4)	20:53			21:15	31	20:50 (D4)
20	08:01		16:45 (D6)	07:28			07:44		08:07 (E5)	06:54		07:13 (E4)	06:17			06:07		20:19 (D4)
	17:41	31	17:16 (D6)	18:19			19:51	40	19:29 (D5)	20:23	5	07:18 (E4)	20:54			21:15	31	20:50 (D4)
21	08:00		16:45 (D6)	07:27			07:42		08:08 (E5)	06:52		07:11 (E4)	06:17			06:07		20:19 (D4)
	17:42	32	17:17 (D6)	18:20			19:52	41	19:30 (D5)	20:24	8	07:19 (E4)	20:55			21:15	31	20:50 (D4)
22	07:59		16:45 (D6)	07:25			07:41		08:09 (E5)	06:51		07:10 (E4)	06:16			06:07		20:19 (D4)
	17:43	32	17:17 (D6)	18:21			19:53	43	19:32 (D5)	20:25	10	07:20 (E4)	20:56			21:15	31	20:50 (D4)
23	07:59		08:19 (E6)	07:24			07:39		08:10 (E5)	06:49		07:09 (E4)	06:15			06:07		20:20 (D4)
	17:44	37	17:18 (D6)	18:23			19:54	43	19:33 (D5)	20:26	12	07:21 (E4)	20:57			21:16	31	20:51 (D4)
24	07:58		08:19 (E6)	07:22			07:37		08:13 (E5)	06:48		07:07 (E4)	06:14			06:07		20:20 (D4)
	17:45	40	17:19 (D6)	18:24			19:55	37	19:33 (D5)	20:27	14	07:21 (E4)	20:58			21:16	30	20:50 (D4)
25	07:57		08:18 (E6)	07:21			07:36		19:03 (D5)	06:46		07:06 (E4)	06:14			06:08		20:20 (D4)
	17:47	42	17:19 (D6)	18:25			19:56	32	19:35 (D5)	20:28	16	07:22 (E4)	20:59			21:16	30	20:50 (D4)
26	07:56		08:17 (E6)	07:19			07:34		19:02 (D5)	06:45		07:04 (E4)	06:13			06:08		20:21 (D4)
	17:48	44	17:19 (D6)	18:26			19:57	34	19:36 (D5)	20:29	17	07:21 (E4)	21:00			21:16	30	20:51 (D4)
27	07:56		08:16 (E6)	07:18			07:32		19:01 (D5)	06:44		07:03 (E4)	06:12		20:27 (D4)	06:08		20:21 (D4)
	17:49	46	17:19 (D6)	18:27			19:58	35	19:36 (D5)	20:30	18	07:21 (E4)	21:00	7	20:34 (D4)	21:16	30	20:51 (D4)
28	07:55		08:15 (E6)	07:16			07:31		19:01 (D5)	06:42		07:02 (E4)	06:12		20:26 (D4)	06:09		20:21 (D4)
	17:50	47	17:19 (D6)	18:28			19:59	36	19:37 (D5)	20:31	19	07:21 (E4)	21:01	12	20:37 (D4)	21:16	29	20:50 (D4)
29	07:54		08:14 (E6)				07:29		19:00 (D5)	06:41		07:00 (E4)	06:11		20:23 (D4)	06:09		20:22 (D4)
	17:52	49	17:19 (D6)				20:01	36	19:36 (D5)	20:33	20	07:20 (E4)	21:02	14	20:37 (D4)	21:16	29	20:51 (D4)
30	07:53		08:13 (E6)				07:27		18:59 (D5)	06:39		06:59 (E4)	06:10		20:23 (D4)	06:10		20:22 (D4)
	17:53	50	17:19 (D6)				20:01	37	19:36 (D5)	20:34	21	07:20 (E4)	21:03	16	20:39 (D4)	21:16	28	20:50 (D4)
31	07:52		08:12 (E6)				07:26		19:00 (D5)				06:10		20:21 (D4)			
	17:54	51	17:19 (D6)				20:02	36	19:36 (D5)				21:04	18	20:39 (D4)			
Potential sun hours	297			297			370			399			448			452		
Total, worst case		776			411			657			461			157			828	
Sun reduction		0.51			0.50			0.58			0.66			0.67			0.77	
Oper. time red.		1.00			1.00			1.00			1.00			1.00			1.00	
Wind dir. red.		0.70			0.66			0.69			0.70			0.67			0.61	
Total reduction		0.36			0.34			0.40			0.47			0.45			0.47	
Total, real		277			138			265			215			71			392	

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:
paulding 1 shadow flicker study [5-rev1]

Licensed user:
EDR
217 Montgomery St.
US-SYRACUSE, NY 13202
(315) 471 0688

Calculated:
12/15/2009 11:10 PM/2.6.0.235

SHADOW - Calendar

Calculation: Timber Road Windfarm Shadow Flicker Analysis **Shadow receptor:** CO - Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 0.0° (672)

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
0.51	0.50	0.58	0.66	0.67	0.77	0.75	0.75	0.68	0.55	0.39	0.34

Operational time

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
283	315	506	548	548	367	324	298	341	652	958	835	993	736	571	484	8,759

	July			August			September			October			November			December		
1	06:10		20:23 (D4)	06:34			07:05		19:09 (D5)	07:35		07:55 (E5)	07:10		07:43 (E6)	07:45		16:29 (D6)
	21:16	28	20:51 (D4)	20:58			20:15	9	19:18 (D5)	19:23	16	08:11 (E5)	17:36	14	07:57 (E6)	17:12	18	16:47 (D6)
2	06:11		20:23 (D4)	06:35			07:06		19:05 (D5)	07:36		07:56 (E5)	07:11		07:41 (E6)	07:46		16:30 (D6)
	21:16	27	20:50 (D4)	20:57			20:13	16	19:21 (D5)	19:21	14	08:10 (E5)	17:35	25	16:38 (D6)	17:11	16	16:46 (D6)
3	06:11		20:24 (D4)	06:35			07:07		19:02 (D5)	07:37		07:57 (E5)	07:12		07:41 (E6)	07:47		16:32 (D6)
	21:16	27	20:51 (D4)	20:56			20:12	21	19:23 (D5)	19:19	11	08:08 (E5)	17:33	34	16:42 (D6)	17:11	14	16:46 (D6)
4	06:12		20:24 (D4)	06:37			07:08		19:00 (D5)	07:38		07:58 (E5)	07:13		07:40 (E6)	07:48		16:33 (D6)
	21:16	26	20:50 (D4)	20:54			20:10	25	19:25 (D5)	19:18	8	08:06 (E5)	17:32	40	16:44 (D6)	17:11	13	16:46 (D6)
5	06:12		20:25 (D4)	06:36			07:09		18:59 (D5)	07:39		07:59 (E5)	07:14		07:39 (E6)	07:49		16:35 (D6)
	21:16	25	20:50 (D4)	20:53			20:08	27	19:26 (D5)	19:16	3	08:02 (E5)	17:31	44	16:45 (D6)	17:11	10	16:45 (D6)
6	06:13		20:25 (D4)	06:39			07:10		18:57 (D5)	07:41			07:16		07:38 (E6)	07:50		16:37 (D6)
	21:15	24	20:49 (D4)	20:52			20:07	30	19:27 (D5)	19:14			17:30	48	16:46 (D6)	17:11	8	16:45 (D6)
7	06:13		20:26 (D4)	06:40		07:14 (E4)	07:11		18:55 (D5)	07:42			07:17		07:39 (E6)	07:51		16:40 (D6)
	21:15	24	20:50 (D4)	20:51	9	07:23 (E4)	20:05	32	19:27 (D5)	19:13			17:29	50	16:48 (D6)	17:11	3	16:43 (D6)
8	06:14		20:27 (D4)	06:41		07:12 (E4)	07:12		18:54 (D5)	07:43			07:18		07:40 (E6)	07:52		
	21:15	23	20:50 (D4)	20:50	13	07:25 (E4)	20:03	33	19:27 (D5)	19:11			17:28	51	16:49 (D6)	17:11		
9	06:15		20:27 (D4)	06:42		07:10 (E4)	07:13		18:53 (D5)	07:44			07:19		07:41 (E6)	07:52		
	21:14	22	20:49 (D4)	20:48	16	07:28 (E4)	20:02	34	19:27 (D5)	19:09			17:27	51	16:49 (D6)	17:11		
10	06:15		20:28 (D4)	06:43		07:09 (E4)	07:14		18:52 (D5)	07:45			07:20		07:42 (E6)	07:53		
	21:14	21	20:49 (D4)	20:47	18	07:27 (E4)	20:00	35	19:27 (D5)	19:08			17:26	52	16:50 (D6)	17:11		
11	06:16		20:29 (D4)	06:44		07:08 (E4)	07:15		18:51 (D5)	07:46			07:22		07:44 (E6)	07:54		
	21:14	20	20:49 (D4)	20:46	20	07:28 (E4)	19:57	36	19:27 (D5)	19:06			17:25	51	16:51 (D6)	17:11		
12	06:17		20:29 (D4)	06:45		07:08 (E4)	07:16		18:51 (D5)	07:47			07:23		07:45 (E6)	07:55		
	21:13	18	20:47 (D4)	20:45	21	07:29 (E4)	19:55	36	19:27 (D5)	19:05			17:24	50	16:51 (D6)	17:11		
13	06:18		20:30 (D4)	06:46		07:08 (E4)	07:17		18:50 (D5)	07:48			07:24		07:46 (E6)	07:56		
	21:13	17	20:47 (D4)	20:43	21	07:29 (E4)	19:53	37	19:27 (D5)	19:03			17:23	49	16:51 (D6)	17:11		
14	06:18		20:32 (D4)	06:47		07:08 (E4)	07:18		18:50 (D5)	07:49			07:25		07:48 (E6)	07:56		
	21:12	15	20:47 (D4)	20:42	20	07:28 (E4)	19:52	36	19:26 (D5)	19:01			17:22	47	16:52 (D6)	17:11		
15	06:19		20:34 (D4)	06:48		07:09 (E4)	07:19		18:50 (D5)	07:50			07:26		07:49 (E6)	07:57		
	21:12	13	20:47 (D4)	20:41	19	07:28 (E4)	19:50	36	19:26 (D5)	19:00			17:21	46	16:52 (D6)	17:11		
16	06:20		20:35 (D4)	06:49		07:10 (E4)	07:20		18:50 (D5)	07:51			07:28		07:50 (E6)	07:58		
	21:11	10	20:45 (D4)	20:39	18	07:28 (E4)	19:48	35	19:25 (D5)	18:58			17:20	44	16:52 (D6)	17:12		
17	06:21			06:50		07:11 (E4)	07:21		18:50 (D5)	07:52			07:29		07:51 (E6)	07:59		
	21:10			20:38	17	07:28 (E4)	19:46	34	19:24 (D5)	18:57			17:19	42	16:52 (D6)	17:12		
18	06:22			06:51		07:12 (E4)	07:22		18:50 (D5)	07:54			07:30		07:53 (E6)	07:59		
	21:10			20:36	15	07:27 (E4)	19:45	33	19:23 (D5)	18:56			17:19	40	16:53 (D6)	17:12		
19	06:22			06:52		07:13 (E4)	07:23		08:01 (E5)	07:55			07:31		07:54 (E6)	08:00		
	21:09			20:35	14	07:27 (E4)	19:43	37	19:21 (D5)	18:54			17:18	37	16:53 (D6)	17:13		
20	06:23			06:53		07:14 (E4)	07:24		07:57 (E5)	07:56			07:32		16:20 (D6)	08:00		
	21:08			20:33	12	07:26 (E4)	19:41	41	19:19 (D5)	18:52			17:17	32	16:52 (D6)	17:13		
21	06:24			06:54		07:15 (E4)	07:25		07:55 (E5)	07:57			07:34		16:20 (D6)	08:01		
	21:08			20:32	10	07:25 (E4)	19:40	42	19:18 (D5)	18:51			17:16	32	16:52 (D6)	17:14		
22	06:25			06:55		07:16 (E4)	07:26		07:53 (E5)	07:56			07:35		16:21 (D6)	08:02		
	21:07			20:31	7	07:23 (E4)	19:38	43	19:16 (D5)	18:49			17:16	31	16:52 (D6)	17:14		
23	06:26			06:56		07:17 (E4)	07:27		07:52 (E5)	07:59			07:36		16:22 (D6)	08:02		
	21:06			20:29	4	07:21 (E4)	19:36	40	19:14 (D5)	18:48			17:15	29	16:51 (D6)	17:15		
24	06:27			06:57			07:28		07:51 (E5)	08:00			07:37		16:22 (D6)	08:02		
	21:05			20:27			19:34	36	19:11 (D5)	18:47			17:15	28	16:50 (D6)	17:15		
25	06:28			06:58			07:29		07:50 (E5)	08:02			07:38		16:23 (D6)	08:03		
	21:05			20:26			19:33	25	08:15 (E5)	18:45			17:14	26	16:49 (D6)	17:16		
26	06:29			06:59			07:30		07:50 (E5)	08:03			07:39		16:24 (D6)	08:03		
	21:04			20:24			19:31	25	08:15 (E5)	18:44			17:14	25	16:49 (D6)	17:16		
27	06:30			07:00			07:31		07:51 (E5)	08:04			07:40		16:25 (D6)	08:04		
	21:03			20:23			19:29	23	08:14 (E5)	18:42			17:13	24	16:49 (D6)	17:17		
28	06:30			07:01			07:32		07:52 (E5)	08:05			07:41		16:26 (D6)	08:04		
	21:02			20:21			19:28	22	08:14 (E5)	18:41			17:13	22	16:48 (D6)	17:18		
29	06:31			07:02			07:33		07:53 (E5)	08:06			07:43		16:27 (D6)	08:04		
	21:01			20:20			19:26	20	08:13 (E5)	18:40			17:12	21	16:48 (D6)	17:18		
30	06:32			07:03			07:34		07:54 (E5)	08:07			07:44		16:28 (D6)	08:04		
	21:00			20:18			19:24	18	08:12 (E5)	18:38			17:12	19	16:47 (D6)	17:19		
31	06:33			07:04						08:09		08:46 (E6)				08:05		
	20:59			20:17						18:37	9	08:55 (E6)				17:20		
Potential sun hours	459			428			375			345			297			287		
Total, worst case		340			254			917			61			1104			82	
Sun reduction		0.75			0.75			0.68			0.55			0.39			0.34	
Oper. time red.		1.00			1.00			1.00			1.00			1.00			1.00	
Wind dir. red.		0.61			0.72			0.69			0.67			0.68			0.71	
Total reduction		0.46			0.54			0.47			0.37			0.27			0.24	
Total, real		157			136			436			22			299			20	

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)

Project:
paulding 1 shadow flicker study [5-rev1]

Licensed user:
EDR
217 Montgomery St.
US-SYRACUSE, NY 13202
(315) 471 0688

Calculated:
12/15/2009 11:10 PM/2.6.0.235

SHADOW - Calendar

Calculation: Timber Road Windfarm Shadow Flicker Analysis **Shadow receptor:** EF - Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 0.0° (715)

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
0.51	0.50	0.58	0.66	0.67	0.77	0.75	0.75	0.68	0.55	0.39	0.34

Operational time

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
283	315	505	548	546	387	324	298	341	652	958	835	993	736	571	484	8,759

	January	February	March	April	May	June
1	08:05	07:51	07:15	17:40 (D10) 07:24	19:37 (D9) 06:38	06:09
	17:21	17:55	18:30 25	18:05 (D10) 20:03 5	19:42 (D9) 20:35	21:04 43 20:40 (D8)
2	08:05	07:50	07:13	17:41 (D10) 07:22	19:33 (D9) 06:37	06:09 06:32 (E7)
	17:22	17:57	18:31 24	18:05 (D10) 20:04 10	19:43 (D9) 20:36	21:05 44 20:41 (D8)
3	08:05	07:49	07:12	17:41 (D10) 07:21	19:32 (D9) 06:36	06:09 06:32 (E7)
	17:23	17:58	18:32 22	18:03 (D10) 20:05 13	19:45 (D9) 20:37	21:06 45 20:41 (D8)
4	08:05	07:48	07:10	17:43 (D10) 07:19	19:30 (D9) 06:34	06:08 06:33 (E7)
	17:24	17:59	18:33 19	18:02 (D10) 20:06 15	19:45 (D9) 20:38	21:07 45 20:42 (D8)
5	08:05	07:47	07:09	17:44 (D10) 07:17	19:28 (D9) 06:33	06:08 06:33 (E7)
	17:25	18:00	18:34 16	18:00 (D10) 20:07 18	19:46 (D9) 20:39	21:07 47 20:43 (D8)
6	08:05	07:46	07:07	07:26 (E8) 07:16	19:28 (D9) 06:32	06:08 06:33 (E7)
	17:26	18:02	18:35 14	17:56 (D10) 20:08 20	19:48 (D9) 20:40	21:08 46 20:43 (D8)
7	08:05	07:45	07:05	07:25 (E8) 07:14	19:27 (D9) 06:31	06:07 06:33 (E7)
	17:26	18:03	18:36 9	07:34 (E8) 20:09 21	19:48 (D9) 20:41	21:09 47 20:44 (D8)
8	08:05	07:44	08:04	08:23 (E8) 07:12	19:26 (D9) 06:30	06:07 06:34 (E7)
	17:27	18:04	19:38 13	08:35 (E8) 20:10 23	19:49 (D9) 20:42	21:09 47 20:45 (D8)
9	08:05	07:42	08:02	08:22 (E8) 07:11	19:26 (D9) 06:28	06:07 06:34 (E7)
	17:28	18:05	19:39 15	08:37 (E8) 20:11 25	19:51 (D9) 20:43	21:10 48 20:45 (D8)
10	08:04	07:41	08:01	08:20 (E8) 07:09	19:25 (D9) 06:27	06:07 06:35 (E7)
	17:30	18:07	19:40 18	08:38 (E8) 20:12 26	19:51 (D9) 20:44	21:11 47 20:46 (D8)
11	08:04	07:40	07:59	08:18 (E8) 07:08	19:26 (D9) 06:26	06:46 (E7) 06:06 06:35 (E7)
	17:31	18:08	19:41 20	08:38 (E8) 20:13 27	19:53 (D9) 20:45 7	06:53 (E7) 21:11 48 20:47 (D8)
12	08:04	07:39	07:57	08:17 (E8) 07:06	19:26 (D9) 06:25	06:45 (E7) 06:06 06:35 (E7)
	17:32	18:09	19:42 22	08:39 (E8) 20:14 26	19:52 (D9) 20:46 10	06:55 (E7) 21:12 47 20:46 (D8)
13	08:04	07:38	07:56	08:15 (E8) 07:04	19:25 (D9) 06:24	06:44 (E7) 06:06 06:35 (E7)
	17:33	18:10	19:43 24	08:39 (E8) 20:15 26	19:51 (D9) 20:47 13	06:57 (E7) 21:12 48 20:47 (D8)
14	08:03	07:36	07:54	08:13 (E8) 07:03	19:27 (D9) 06:23	06:43 (E7) 06:06 06:35 (E7)
	17:34	18:12	19:44 26	08:39 (E8) 20:17 23	19:50 (D9) 20:48 15	06:58 (E7) 21:13 48 20:47 (D8)
15	08:03	07:35	07:52	08:12 (E8) 07:01	19:27 (D9) 06:22	06:42 (E7) 06:06 06:36 (E7)
	17:35	18:13	19:45 27	08:39 (E8) 20:18 21	19:48 (D9) 20:49 17	06:59 (E7) 21:13 47 20:47 (D8)
16	08:02	07:34	07:51	08:10 (E8) 07:00	19:28 (D9) 06:21	06:42 (E7) 06:06 06:36 (E7)
	17:36	18:14	19:47 28	08:38 (E8) 20:19 19	19:47 (D9) 20:50 19	07:01 (E7) 21:13 48 20:48 (D8)
17	08:02	07:32	17:52 (D10) 07:49	08:09 (E8) 06:58	19:29 (D9) 06:20	06:41 (E7) 06:06 06:37 (E7)
	17:37	18:15 2	17:54 (D10) 19:48 28	08:37 (E8) 20:20 16	19:45 (D9) 20:51 20	07:01 (E7) 21:14 48 20:49 (D8)
18	08:02	07:31	17:48 (D10) 07:47	08:10 (E8) 06:57	19:32 (D9) 06:19	06:40 (E7) 06:06 06:37 (E7)
	17:38	18:17 6	17:54 (D10) 19:49 27	08:37 (E8) 20:21 10	19:42 (D9) 20:52 22	07:02 (E7) 21:14 48 20:49 (D8)
19	08:01	07:30	17:45 (D10) 07:46	08:10 (E8) 06:55	06:18	06:39 (E7) 06:06 06:38 (E7)
	17:40	18:18 10	17:55 (D10) 19:50 26	08:36 (E8) 20:22	20:53 23	07:02 (E7) 21:15 47 20:49 (D8)
20	08:00	07:28	17:44 (D10) 07:44	08:11 (E8) 06:54	06:17	06:38 (E7) 06:07 06:38 (E7)
	17:41	18:19 13	17:57 (D10) 19:51 23	08:34 (E8) 20:23	20:54 24	07:02 (E7) 21:15 48 20:50 (D8)
21	08:00	07:27	17:42 (D10) 07:42	08:11 (E8) 06:52	06:17	06:37 (E7) 06:07 06:38 (E7)
	17:42	18:20 15	17:57 (D10) 19:52 21	08:32 (E8) 20:24	20:55 26	07:03 (E7) 21:15 48 20:50 (D8)
22	07:59	07:25	17:42 (D10) 07:41	08:13 (E8) 06:51	06:16	06:37 (E7) 06:07 06:38 (E7)
	17:43	18:21 17	17:59 (D10) 19:53 18	08:31 (E8) 20:25	20:56 27	07:04 (E7) 21:15 48 20:50 (D8)
23	07:59	07:24	17:41 (D10) 07:39	08:15 (E8) 06:49	06:15	06:36 (E7) 06:07 06:39 (E7)
	17:44	18:23 19	18:00 (D10) 19:54 13	08:28 (E8) 20:26	20:57 28	07:04 (E7) 21:16 47 20:50 (D8)
24	07:58	07:22	17:40 (D10) 07:37	06:48	06:14	06:35 (E7) 06:07 06:39 (E7)
	17:46	18:24 22	18:02 (D10) 19:55	20:27	20:58 29	07:04 (E7) 21:16 48 20:50 (D8)
25	07:57	07:21	17:40 (D10) 07:36	06:46	06:14	06:35 (E7) 06:08 06:38 (E7)
	17:47	18:25 22	18:02 (D10) 19:56	20:28	20:59 29	07:04 (E7) 21:16 48 20:50 (D8)
26	07:56	07:19	17:40 (D10) 07:34	06:45	06:13	06:34 (E7) 06:08 06:39 (E7)
	17:48	18:26 24	18:04 (D10) 19:57	20:29	20:59 30	07:04 (E7) 21:16 48 20:51 (D8)
27	07:56	07:18	17:39 (D10) 07:32	06:44	06:12	06:34 (E7) 06:08 06:39 (E7)
	17:49	18:27 26	18:05 (D10) 19:58	20:30	21:00 34	20:37 (D8) 21:16 48 20:51 (D8)
28	07:55	07:16	17:40 (D10) 07:31	06:42	06:12	06:33 (E7) 06:09 06:39 (E7)
	17:50	18:28 26	18:06 (D10) 19:59	20:31	21:01 37	20:37 (D8) 21:16 47 20:50 (D8)
29	07:54		07:29	06:41	06:11	06:32 (E7) 06:09 06:39 (E7)
	17:52		20:01	20:33	21:02 38	20:37 (D8) 21:16 48 20:51 (D8)
30	07:53		07:27	06:40	06:10	06:32 (E7) 06:10 06:39 (E7)
	17:53		20:01	20:34	21:03 41	20:39 (D8) 21:16 47 20:50 (D8)
31	07:52		07:26		06:10	06:32 (E7)
	17:54		20:02		21:04 43	20:40 (D8)
Potential sun hours	297	297	370	399	448	452
Total, worst case		202	478	344	532	1413
Sun reduction		0.50	0.58	0.66	0.67	0.77
Oper. time red.		1.00	1.00	1.00	1.00	1.00
Wind dir. red.		0.72	0.68	0.68	0.71	0.68
Total reduction		0.36	0.40	0.45	0.48	0.53
Total, real		73	190	154	256	743

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)

Project:

paulding 1 shadow flicker study [5-rev1]

Printed/Page
12/21/2009 11:32 AM / 20
Licensed user:
EDR
217 Montgomery St.
US-SYRACUSE, NY 13202
(315) 471 0688

Calculated:
12/15/2009 11:10 PM/2.6.0.235

SHADOW - Calendar

Calculation: Timber Road Windfarm Shadow Flicker Analysis **Shadow receptor:** EF - Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 0.0° (715)

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
0.51	0.50	0.58	0.66	0.67	0.77	0.75	0.75	0.68	0.55	0.39	0.34

Operational time

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
283	315	506	548	548	367	324	298	341	652	958	835	993	736	571	484	8,759

	July		August		September		October		November	December
1	06:10		06:40 (E7)	06:34	06:56 (E7)	07:05	19:25 (D9)	07:35	07:55 (E8)	07:10	07:45
	21:16	47	20:51 (D8)	20:58	9 07:05 (E7)	20:15	27 18:52 (D9)	19:23	23 08:18 (E8)	17:36	17:12
2	06:11		06:39 (E7)	06:35	06:57 (E7)	07:06	19:24 (D9)	07:36	07:56 (E8)	07:11	07:46
	21:16	47	20:50 (D8)	20:57	5 07:02 (E7)	20:13	28 19:50 (D9)	19:21	21 08:17 (E8)	17:35	17:11
3	06:11		06:40 (E7)	06:36		07:07	19:24 (D9)	07:37	07:57 (E8)	07:12	07:47
	21:16	48	20:51 (D8)	20:56		20:12	25 19:49 (D9)	19:19	19 08:16 (E8)	17:33	17:11
4	06:12		06:39 (E7)	06:37		07:08	19:24 (D9)	07:38	07:58 (E8)	07:13	07:48
	21:16	48	20:50 (D8)	20:54		20:10	23 19:47 (D9)	19:18	17 08:15 (E8)	17:32	17:11
5	06:12		06:40 (E7)	06:38		07:09	19:24 (D9)	07:39	07:59 (E8)	07:14	07:49
	21:15	46	20:50 (D8)	20:53		20:08	21 19:45 (D9)	19:16	14 08:13 (E8)	17:31	17:11
6	06:13		06:39 (E7)	06:39		07:10	19:24 (D9)	07:41	08:00 (E8)	07:16	07:50
	21:15	46	20:49 (D8)	20:52		20:07	20 19:44 (D9)	19:14	11 08:11 (E8)	17:30	17:11
7	06:14		06:40 (E7)	06:40		07:11	19:23 (D9)	07:42	08:01 (E8)	07:17	07:51
	21:15	45	20:49 (D8)	20:51		20:05	18 19:41 (D9)	19:13	12 18:30 (D10)	17:29	17:11
8	06:14		06:40 (E7)	06:41		07:12	19:24 (D9)	07:43	18:21 (D10)	07:18	07:51
	21:15	46	20:50 (D8)	20:50		20:03	16 19:40 (D9)	19:11	13 18:34 (D10)	17:28	17:11
9	06:15		06:39 (E7)	06:42		07:13	19:25 (D9)	07:44	18:19 (D10)	07:19	07:52
	21:14	46	20:49 (D8)	20:48		20:02	13 19:38 (D9)	19:09	17 18:36 (D10)	17:27	17:11
10	06:16		06:40 (E7)	06:43		07:14	19:26 (D9)	07:45	18:17 (D10)	07:20	07:53
	21:14	45	20:49 (D8)	20:47		20:00	10 19:36 (D9)	19:08	20 18:37 (D10)	17:26	17:11
11	06:16		06:40 (E7)	06:44		07:15	19:28 (D9)	07:46	18:15 (D10)	07:22	07:54
	21:14	43	20:48 (D8)	20:46		19:57	7 19:35 (D9)	19:06	23 18:38 (D10)	17:25	17:11
12	06:17		06:40 (E7)	06:45		07:16		07:47	18:14 (D10)	07:23	07:55
	21:13	42	20:47 (D8)	20:45		19:55		19:05	24 18:38 (D10)	17:24	17:11
13	06:18		06:40 (E7)	06:46		07:17		07:48	18:13 (D10)	07:24	07:56
	21:13	41	20:47 (D8)	20:43		19:53		19:03	26 18:39 (D10)	17:23	17:11
14	06:18		06:41 (E7)	06:47		07:18		07:49	18:12 (D10)	07:25	07:56
	21:12	40	20:47 (D8)	20:42		19:52		19:01	27 18:39 (D10)	17:22	17:11
15	06:19		06:42 (E7)	06:48		07:19		07:50	18:12 (D10)	07:26	07:57
	21:12	38	20:47 (D8)	20:41		19:50		19:00	25 18:37 (D10)	17:21	17:11
16	06:20		06:42 (E7)	06:49		07:20		07:51	18:12 (D10)	07:28	07:58
	21:11	34	20:45 (D8)	20:39		19:48		18:58	24 18:36 (D10)	17:20	17:12
17	06:21		06:43 (E7)	06:50		07:21		07:52	18:12 (D10)	07:29	07:59
	21:10	33	20:45 (D8)	20:38		19:46		18:57	22 18:34 (D10)	17:19	17:12
18	06:22		06:44 (E7)	06:51		07:22		07:54	18:12 (D10)	07:30	07:59
	21:10	30	07:14 (E7)	20:36		19:45		18:55	21 18:33 (D10)	17:19	17:12
19	06:22		06:45 (E7)	06:52		07:23		07:55	18:12 (D10)	07:31	08:00
	21:09	29	07:14 (E7)	20:35		19:43		18:54	19 18:31 (D10)	17:18	17:13
20	06:23		06:46 (E7)	06:53		07:24	08:02 (E8)	07:56	18:13 (D10)	07:32	08:00
	21:08	28	07:14 (E7)	20:33		19:41	12 08:14 (E8)	18:52	16 18:29 (D10)	17:17	17:13
21	06:24		06:46 (E7)	06:54		07:25	07:59 (E8)	07:57	18:13 (D10)	07:33	08:01
	21:08	27	07:13 (E7)	20:32		19:40	17 08:16 (E8)	18:51	15 18:28 (D10)	17:17	17:14
22	06:25		06:47 (E7)	06:55		07:26	07:57 (E8)	07:58	18:15 (D10)	07:35	08:01
	21:07	26	07:13 (E7)	20:30		19:38	20 08:17 (E8)	18:49	12 18:27 (D10)	17:16	17:14
23	06:26		06:48 (E7)	06:56		07:27	07:55 (E8)	07:59	18:16 (D10)	07:36	08:02
	21:06	25	07:13 (E7)	20:29		19:36	23 08:18 (E8)	18:48	9 18:25 (D10)	17:15	17:15
24	06:27		06:49 (E7)	06:57		07:28	07:54 (E8)	08:00	18:19 (D10)	07:37	08:02
	21:05	24	07:13 (E7)	20:27		19:34	25 08:19 (E8)	18:47	5 18:24 (D10)	17:15	17:15
25	06:28		06:50 (E7)	06:58	19:35 (D9)	07:29	07:53 (E8)	08:01		07:38	08:03
	21:04	23	07:13 (E7)	20:26	11 19:46 (D9)	19:33	27 08:20 (E8)	18:45		17:14	17:16
26	06:29		06:51 (E7)	06:59	19:32 (D9)	07:30	07:52 (E8)	08:03		07:39	08:03
	21:04	21	07:12 (E7)	20:24	16 19:48 (D9)	19:31	28 08:20 (E8)	18:44		17:14	17:16
27	06:30		06:52 (E7)	07:00	19:30 (D9)	07:31	07:51 (E8)	08:04		07:40	08:04
	21:03	20	07:12 (E7)	20:23	19 19:49 (D9)	19:29	29 08:20 (E8)	18:42		17:13	17:17
28	06:30		06:53 (E7)	07:01	19:29 (D9)	07:32	07:52 (E8)	08:05		07:41	08:04
	21:02	18	07:11 (E7)	20:21	21 19:50 (D9)	19:28	28 08:20 (E8)	18:41		17:13	17:16
29	06:31		06:53 (E7)	07:02	19:27 (D9)	07:33	07:53 (E8)	08:06		07:42	08:04
	21:01	16	07:09 (E7)	20:20	24 19:51 (D9)	19:26	26 08:19 (E8)	18:40		17:12	17:16
30	06:32		06:54 (E7)	07:03	19:26 (D9)	07:34	07:54 (E8)	08:07		07:44	08:04
	21:00	14	07:08 (E7)	20:18	25 19:51 (D9)	19:24	25 08:19 (E8)	18:38		17:12	17:19
31	06:33		06:55 (E7)	07:04	19:26 (D9)			08:08			08:05
	20:59	12	07:07 (E7)	20:17	26 19:52 (D9)			18:37			17:20
Potential sun hours	459		428		375		345		297	288	
Total, worst case	1048		156		466		435				
Sun reduction	0.75		0.75		0.68		0.55				
Oper. time red.	1.00		1.00		1.00		1.00				
Wind dir. red.	0.70		0.68		0.67		0.71				
Total reduction	0.52		0.51		0.46		0.39				
Total, real	550		80		215		168				

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)

Project:
paulding 1 shadow flicker study [5-rev1]

Printed/Page
12/21/2009 11:32 AM / 21

Licensed user:
EDR
217 Montgomery St.
US-SYRACUSE, NY 13202
(315) 471 0688

Calculated:
12/15/2009 11:10 PM/2.6.0.235

SHADOW - Calendar

Calculation: Timber Road Windfarm Shadow Flicker Analysis **Shadow receptor:** EG - Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 0.0° (716)

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
0.51	0.50	0.58	0.66	0.67	0.77	0.75	0.75	0.68	0.55	0.39	0.34

Operational time

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
283	315	506	548	548	367	324	298	341	652	958	835	993	736	571	484	8,759

	January		February		March		April		May		June	
1	08:05		07:51		17:23 (D10)	07:15			07:24		06:38	07:05 (E7)	06:09	
	17:21		17:55	8	17:31 (D10)	18:30			20:03		20:35	50 20:13 (D8)	21:04	
2	08:05		07:50		17:22 (D10)	07:13			07:22		06:37	07:06 (E7)	06:09	
	17:22		17:57	10	17:32 (D10)	18:31			20:04		20:36	50 20:14 (D8)	21:05	
3	08:05		07:49		17:22 (D10)	07:12			07:21		06:36	07:05 (E7)	06:09	
	17:23		17:58	12	17:34 (D10)	18:32			20:05		20:37	51 20:14 (D8)	21:06	
4	08:05		07:48		17:21 (D10)	07:10			07:19		06:34	07:06 (E7)	06:08	
	17:24		17:59	14	17:35 (D10)	18:33			20:06		20:38	51 20:15 (D8)	21:07	
5	08:05		07:47		17:21 (D10)	07:09			07:17		06:33	07:07 (E7)	06:08	
	17:25		18:00	15	17:36 (D10)	18:34			20:07		20:39	50 20:16 (D8)	21:07	
6	08:05		07:46		17:21 (D10)	07:07			07:16		06:32	07:08 (E7)	06:08	
	17:26		18:02	17	17:38 (D10)	18:35			20:08		20:40	49 20:18 (D8)	21:08	
7	08:05		07:45		17:21 (D10)	07:05			07:14		06:31	07:09 (E7)	06:07	
	17:26		18:03	18	17:39 (D10)	18:36			20:09		20:41	48 20:19 (D8)	21:09	
8	08:05		07:44		08:04 (E8)	08:04			07:12		06:30	07:10 (E7)	06:07	
	17:27		18:04	24	17:41 (D10)	19:38			20:10		20:42	47 20:20 (D8)	21:09	
9	08:05		07:42		08:02 (E8)	08:02			07:11		06:28	07:11 (E7)	06:07	
	17:28		18:05	30	17:42 (D10)	19:39			20:11		20:43	44 20:20 (D8)	21:10	
10	08:04		07:41		08:01 (E8)	08:01			07:09		06:27	07:12 (E7)	06:07	
	17:30		18:07	33	17:43 (D10)	19:40			20:12		20:44	41 20:20 (D8)	21:11	
11	08:04		07:40		08:00 (E8)	07:59		19:18 (D9)	07:08		06:26	07:15 (E7)	06:06	
	17:31		18:08	36	17:44 (D10)	19:41	2	19:20 (D9)	20:13		20:45	34 20:19 (D8)	21:11	
12	08:04		07:39		07:59 (E8)	07:57		19:15 (D9)	07:06		06:25	07:19 (E7)	06:06	
	17:32		18:09	39	17:44 (D10)	19:42	6	19:21 (D9)	20:14		20:46	24 20:18 (D8)	21:12	
13	08:04		07:38		07:57 (E8)	07:56		19:12 (D9)	07:04	07:25 (E7)	06:24	19:59 (D8)	06:06	
	17:33		18:10	39	17:43 (D10)	19:43	10	19:22 (D9)	20:15	2 07:27 (E7)	20:47	18 20:17 (D8)	21:12	
14	08:03		07:36		07:56 (E8)	07:54		19:10 (D9)	07:03	07:22 (E7)	06:23	20:00 (D8)	06:06	
	17:34		18:12	39	17:42 (D10)	19:44	13	19:23 (D9)	20:17	12 07:34 (E7)	20:48	16 20:16 (D8)	21:13	
15	08:03		07:35		07:55 (E8)	07:52		19:09 (D9)	07:01	07:20 (E7)	06:22	20:02 (D8)	06:06	
	17:35		18:13	38	17:41 (D10)	19:45	16	19:25 (D9)	20:18	16 07:38 (E7)	20:49	13 20:16 (D8)	21:13	
16	08:03		07:34		07:53 (E8)	07:51		19:08 (D9)	07:00	07:19 (E7)	06:21	20:05 (D8)	06:06	
	17:36		18:14	35	17:38 (D10)	19:47	17	19:25 (D9)	20:19	19 07:38 (E7)	20:50	8 20:13 (D8)	21:13	
17	08:02		07:32		07:52 (E8)	07:49		19:07 (D9)	06:58	07:17 (E7)	06:20		06:06	
	17:37		18:15	26	08:18 (E8)	19:48	19	19:26 (D9)	20:20	22 07:39 (E7)	20:51		21:14	
18	08:02		07:31		07:51 (E8)	07:47		19:07 (D9)	06:57	07:16 (E7)	06:19		06:06	
	17:38		18:17	28	08:19 (E8)	19:49	21	19:28 (D9)	20:21	24 07:40 (E7)	20:52		21:14	
19	08:01		07:30		07:49 (E8)	07:46		19:07 (D9)	06:55	07:14 (E7)	06:18		06:06	
	17:40		18:18	29	08:18 (E8)	19:50	22	19:29 (D9)	20:22	26 07:40 (E7)	20:53		21:15	
20	08:00		07:28		07:49 (E8)	07:44		19:06 (D9)	06:54	07:13 (E7)	06:17		06:07	
	17:41		18:19	29	08:18 (E8)	19:51	23	19:29 (D9)	20:23	28 07:41 (E7)	20:54		21:15	
21	08:00		07:27		07:48 (E8)	07:42		19:06 (D9)	06:52	07:11 (E7)	06:17		06:07	
	17:42		18:20	30	08:18 (E8)	19:52	24	19:30 (D9)	20:24	30 07:41 (E7)	20:55		21:15	
22	07:59		07:25		07:49 (E8)	07:41		19:07 (D9)	06:51	07:10 (E7)	06:16		06:07	
	17:43		18:21	28	08:17 (E8)	19:53	23	19:30 (D9)	20:25	32 07:42 (E7)	20:56		21:15	
23	07:59		07:24		07:49 (E8)	07:39		19:07 (D9)	06:49	07:09 (E7)	06:15		06:07	
	17:44		18:23	27	08:16 (E8)	19:54	22	19:29 (D9)	20:26	34 07:43 (E7)	20:57		21:16	
24	07:58		07:22		07:50 (E8)	07:37		19:08 (D9)	06:48	07:07 (E7)	06:14		06:07	
	17:46		18:24	26	08:16 (E8)	19:55	19	19:27 (D9)	20:27	35 07:42 (E7)	20:58		21:16	
25	07:57		07:21		07:51 (E8)	07:36		19:10 (D9)	06:46	07:06 (E7)	06:14		06:08	
	17:47		18:25	23	08:14 (E8)	19:56	16	19:26 (D9)	20:28	38 07:42 (E7)	20:59		21:16	
26	07:56		07:19		07:52 (E8)	07:34		19:11 (D9)	06:45	07:04 (E7)	06:13		06:08	
	17:48		18:26	21	08:13 (E8)	19:57	12	19:23 (D9)	20:29	40 20:07 (D8)	20:59		21:16	
27	07:56		07:18		07:54 (E8)	07:32			06:44	07:04 (E7)	06:12		06:08	
	17:49		18:27	16	08:10 (E8)	19:58			20:30	43 20:08 (D8)	21:00		21:16	
28	07:55		07:16		07:57 (E8)	07:31			06:42	07:05 (E7)	06:12		06:09	
	17:50		18:28	11	08:08 (E8)	19:59			20:31	46 20:10 (D8)	21:01		21:16	
29	07:54					07:29			06:41	07:04 (E7)	06:11		06:09	
	17:52					20:01			20:33	48 20:10 (D8)	21:02		21:16	
30	07:53	17:26 (D10)				07:27			06:40	07:04 (E7)	06:10		06:10	
	17:53	2 17:28 (D10)				20:01			20:34	49 20:11 (D8)	21:03		21:16	
31	07:52	17:24 (D10)				07:26					06:10			
	17:54	5 17:29 (D10)				20:02					21:04			
Potential sun hours	297		297			370			399		448		452	
Total, worst case		7		701		265		542		594				
Sun reduction		0.51		0.50		0.58		0.66		0.67				
Oper. time red.		1.00		1.00		1.00		1.00		1.00				
Wind dir. red.		0.72		0.67		0.70		0.71		0.68				
Total reduction		0.37		0.34		0.41		0.47		0.45				
Total, real		3		236		108		252		270				

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:
paulding 1 shadow flicker study [5-rev1]

Licensed user:
EDR
217 Montgomery St.
US-SYRACUSE, NY 13202
(315) 471 0688

Calculated:
12/15/2009 11:10 PM/2.6.0.235

SHADOW - Calendar

Calculation: Timber Road Windfarm Shadow Flicker Analysis **Shadow receptor:** EG - Shadow Receptor: 1.0 × 1.0 Azimuth: 0.0° Slope: 0.0° (716)

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
0.51	0.50	0.58	0.66	0.67	0.77	0.75	0.75	0.68	0.55	0.39	0.34

Operational time

N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
283	315	506	548	548	367	324	298	341	652	958	835	993	736	571	484	8,759

	July		August		September		October		November		December
1	06:10		06:34	07:27 (E7)	07:05		07:35	16:52 (D9)	07:10	07:31 (E8)	07:45
	21:16		20:58 29	20:29 (D8)	20:15		19:23 8	19:00 (D9)	17:36 33	17:13 (D10)	17:12
2	06:11		06:35	07:24 (E7)	07:06		07:36	18:55 (D9)	07:11	07:32 (E8)	07:46
	21:16		20:57 37	20:30 (D8)	20:13		19:21 4	18:59 (D9)	17:35 29	17:11 (D10)	17:11
3	06:11		06:36	07:22 (E7)	07:07		07:37		07:12	07:33 (E8)	07:47
	21:16		20:56 42	20:30 (D8)	20:12		19:19		17:33 23	17:10 (D10)	17:11
4	06:12		06:37	07:21 (E7)	07:08		07:38		07:13	16:51 (D10)	07:48
	21:16		20:54 45	20:30 (D8)	20:10		19:18		17:32 18	17:09 (D10)	17:11
5	06:12		06:38	07:19 (E7)	07:09		07:39		07:14	16:51 (D10)	07:49
	21:15		20:53 47	20:29 (D8)	20:08		19:16		17:31 17	17:08 (D10)	17:11
6	06:13		06:39	07:18 (E7)	07:10		07:41		07:16	16:51 (D10)	07:50
	21:15		20:52 49	20:28 (D8)	20:07		19:14		17:30 15	17:06 (D10)	17:11
7	06:14		06:40	07:17 (E7)	07:11		07:42		07:17	16:52 (D10)	07:51
	21:15		20:51 50	20:27 (D8)	20:05		19:13		17:29 14	17:06 (D10)	17:11
8	06:14		06:41	07:16 (E7)	07:12		07:43		07:18	16:53 (D10)	07:51
	21:15		20:50 51	20:26 (D8)	20:03		19:11		17:28 11	17:04 (D10)	17:11
9	06:15		06:42	07:15 (E7)	07:13		07:44		07:19	16:53 (D10)	07:52
	21:14		20:48 52	20:25 (D8)	20:02		19:09		17:27 10	17:03 (D10)	17:11
10	06:16		06:43	07:15 (E7)	07:14		07:45		07:20	16:54 (D10)	07:53
	21:14		20:47 50	20:23 (D8)	20:00		19:08		17:26 8	17:02 (D10)	17:11
11	06:16		06:44	07:14 (E7)	07:15		07:46		07:22	16:56 (D10)	07:54
	21:14		20:46 50	20:22 (D8)	19:57		19:06		17:25 5	17:01 (D10)	17:11
12	06:17		06:45	07:14 (E7)	07:16		07:47		07:23	16:58 (D10)	07:55
	21:13		20:45 49	20:21 (D8)	19:55		19:05		17:24 2	17:00 (D10)	17:11
13	06:18		06:46	07:13 (E7)	07:17		07:48	08:33 (E8)	07:24		07:56
	21:13		20:43 49	20:20 (D8)	19:53		19:03 4	08:37 (E8)	17:23		17:11
14	06:18		06:47	07:13 (E7)	07:18		07:49	08:28 (E8)	07:25		07:56
	21:12		20:42 47	20:18 (D8)	19:52		19:01 14	08:42 (E8)	17:22		17:11
15	06:19		06:48	07:11 (E7)	07:19		07:50	08:25 (E8)	07:26		07:57
	21:12		20:41 46	20:16 (D8)	19:50		19:00 19	08:44 (E8)	17:21		17:11
16	06:20		06:49	07:11 (E7)	07:20		07:51	08:24 (E8)	07:28		07:58
	21:11		20:39 43	20:15 (D8)	19:48		18:58 22	08:46 (E8)	17:20		17:12
17	06:21		06:50	07:11 (E7)	07:21	19:00 (D9)	07:52	08:23 (E8)	07:29		07:59
	21:10		20:38 39	20:14 (D8)	19:46 10	19:10 (D9)	18:57 24	08:47 (E8)	17:19		17:12
18	06:22		06:51	07:12 (E7)	07:22	18:57 (D9)	07:54	08:21 (E8)	07:30		07:59
	21:10		20:36 36	07:48 (E7)	19:45 15	19:12 (D9)	18:55 27	08:48 (E8)	17:19		17:12
19	06:22		06:52	07:13 (E7)	07:23	18:55 (D9)	07:55	08:20 (E8)	07:31		08:00
	21:09		20:35 35	07:48 (E7)	19:43 19	19:14 (D9)	18:54 28	08:48 (E8)	17:18		17:13
20	06:23		06:53	07:14 (E7)	07:24	18:54 (D9)	07:56	08:19 (E8)	07:32		08:00
	21:08		20:33 33	07:47 (E7)	19:41 21	19:15 (D9)	18:52 29	08:48 (E8)	17:17		17:13
21	06:24		06:54	07:15 (E7)	07:25	18:52 (D9)	07:57	08:19 (E8)	07:33		08:01
	21:08		20:32 32	07:47 (E7)	19:40 23	19:15 (D9)	18:51 29	08:48 (E8)	17:17		17:14
22	06:25		06:55	07:16 (E7)	07:26	18:51 (D9)	07:58	08:19 (E8)	07:35		08:01
	21:07		20:30 30	07:46 (E7)	19:38 25	19:16 (D9)	18:49 30	08:49 (E8)	17:16		17:14
23	06:26		06:56	07:17 (E7)	07:27	18:51 (D9)	07:59	08:20 (E8)	07:36		08:02
	21:06		20:29 28	07:45 (E7)	19:36 23	19:14 (D9)	18:48 29	08:49 (E8)	17:15		17:15
24	06:27		06:57	07:18 (E7)	07:28	18:50 (D9)	08:00	08:21 (E8)	07:37		08:02
	21:05		20:27 26	07:44 (E7)	19:34 23	19:13 (D9)	18:47 28	08:49 (E8)	17:15		17:15
25	06:28		06:58	07:19 (E7)	07:29	18:50 (D9)	08:01	08:22 (E8)	07:38		08:03
	21:04		20:26 24	07:43 (E7)	19:33 21	19:11 (D9)	18:45 28	18:04 (D10)	17:14		17:16
26	06:29		06:59	07:20 (E7)	07:30	18:49 (D9)	08:03	08:23 (E8)	07:39		08:03
	21:04		20:24 21	07:41 (E7)	19:31 20	19:09 (D9)	18:44 35	18:08 (D10)	17:14		17:16
27	06:30	20:17 (D8)	07:00	07:21 (E7)	07:31	18:49 (D9)	08:04	08:25 (E8)	07:40		08:04
	21:03 5	20:22 (D8)	20:23 19	07:40 (E7)	19:29 18	19:07 (D9)	18:42 39	18:11 (D10)	17:13		17:17
28	06:30	20:13 (D8)	07:01	07:22 (E7)	07:32	18:50 (D9)	08:05	08:26 (E8)	07:41		08:04
	21:02 11	20:24 (D8)	20:21 15	07:37 (E7)	19:28 16	19:06 (D9)	18:41 39	18:12 (D10)	17:13		17:18
29	06:31	20:12 (D8)	07:02	07:23 (E7)	07:33	18:50 (D9)	08:06	08:27 (E8)	07:42		08:04
	21:01 14	20:26 (D8)	20:20 11	07:34 (E7)	19:26 14	19:04 (D9)	18:40 39	18:12 (D10)	17:12		17:18
30	06:32	20:11 (D8)	07:03		07:34	18:51 (D9)	08:07	08:28 (E8)	07:44		08:04
	21:00 16	20:27 (D8)	20:18		19:24 11	19:02 (D9)	18:38 38	18:13 (D10)	17:12		17:19
31	06:33	20:10 (D8)	07:04				08:08	08:30 (E8)			08:05
	20:59 18	20:28 (D8)	20:17				18:37 37	18:14 (D10)			17:20
Potential sun hours	459		428		375		345		297		288
Total, worst case	64		1085		259		550		185		
Sun reduction	0.75		0.75		0.68		0.55		0.39		
Oper. time red.	1.00		1.00		1.00		1.00		1.00		
Wind dir. red.	0.64		0.69		0.70		0.65		0.71		
Total reduction	0.48		0.52		0.48		0.36		0.28		
Total, real	31		561		124		198		52		

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)

Attachment D

Select Receptor Orthoimagery

Timber Road Wind Farm

Harrison Township - Paulding County, Ohio

Attachment D: Shadow Flicker Receptors Over 30 Hours

Sheet 1 of 5

December 2009

Notes:
Base Map: 1 ft. Orthoimagery, Year 2006.

Timber Road Wind Farm

Harrison Township - Paulding County, Ohio

Attachment D: Shadow Flicker Receptors Over 30 Hours

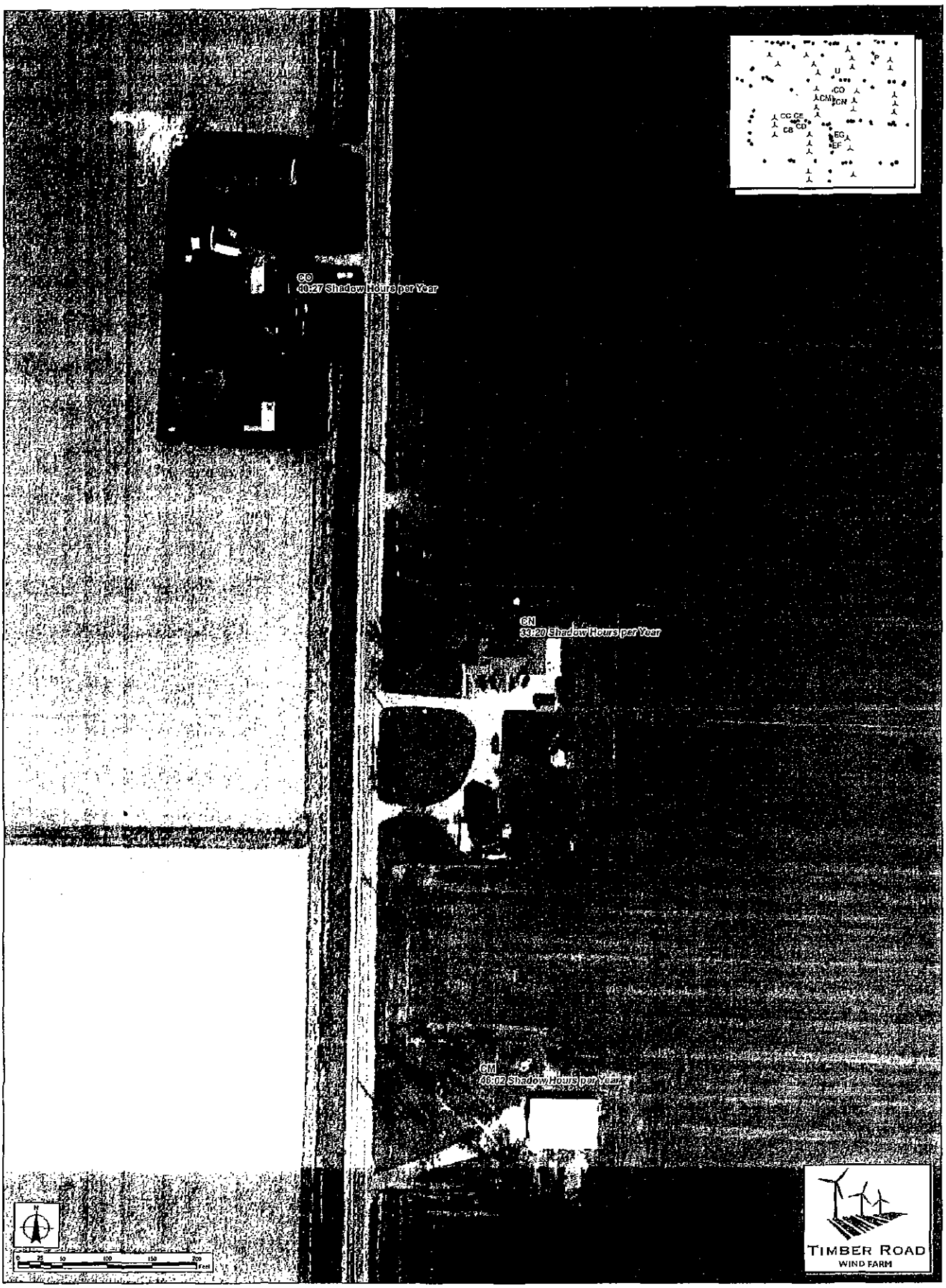
● Receptors

Sheet 2 of 5

December 2009

Notes:
Base Map: 1 ft. Orthoimagery. Year 2006.

EDR



Timber Road Wind Farm

Harrison Township - Paulding County, Ohio

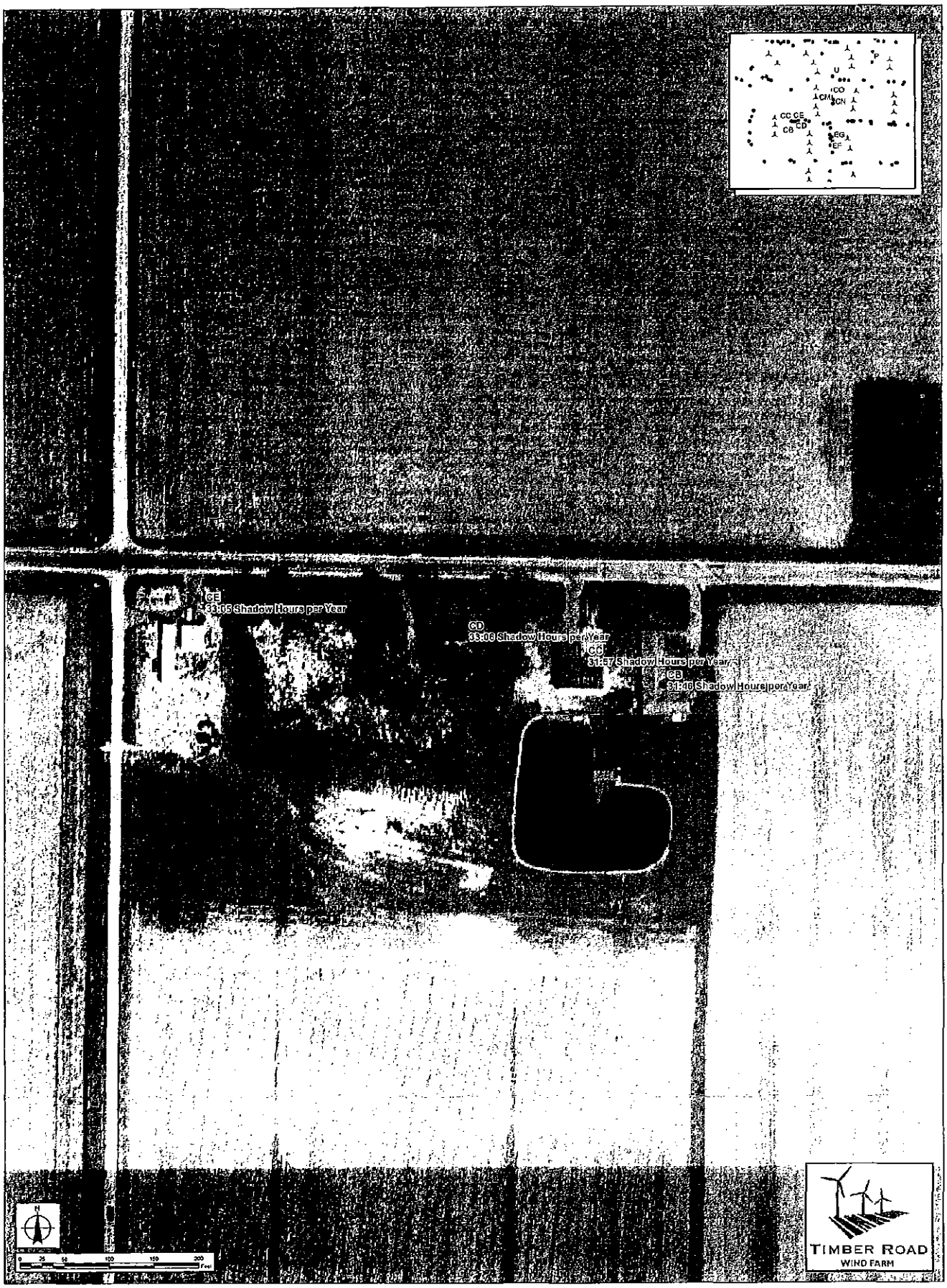
Attachment D: Shadow Flicker Receptors Over 30 Hours

Sheet 3 of 5

December 2009

● Receptors

Notes:
Base Map: 1 ft. Orthoimagery: Year 2006.



Timber Road Wind Farm

Harrison Township - Paulding County, Ohio

Attachment D: Shadow Flicker Receptors Over 30 Hours

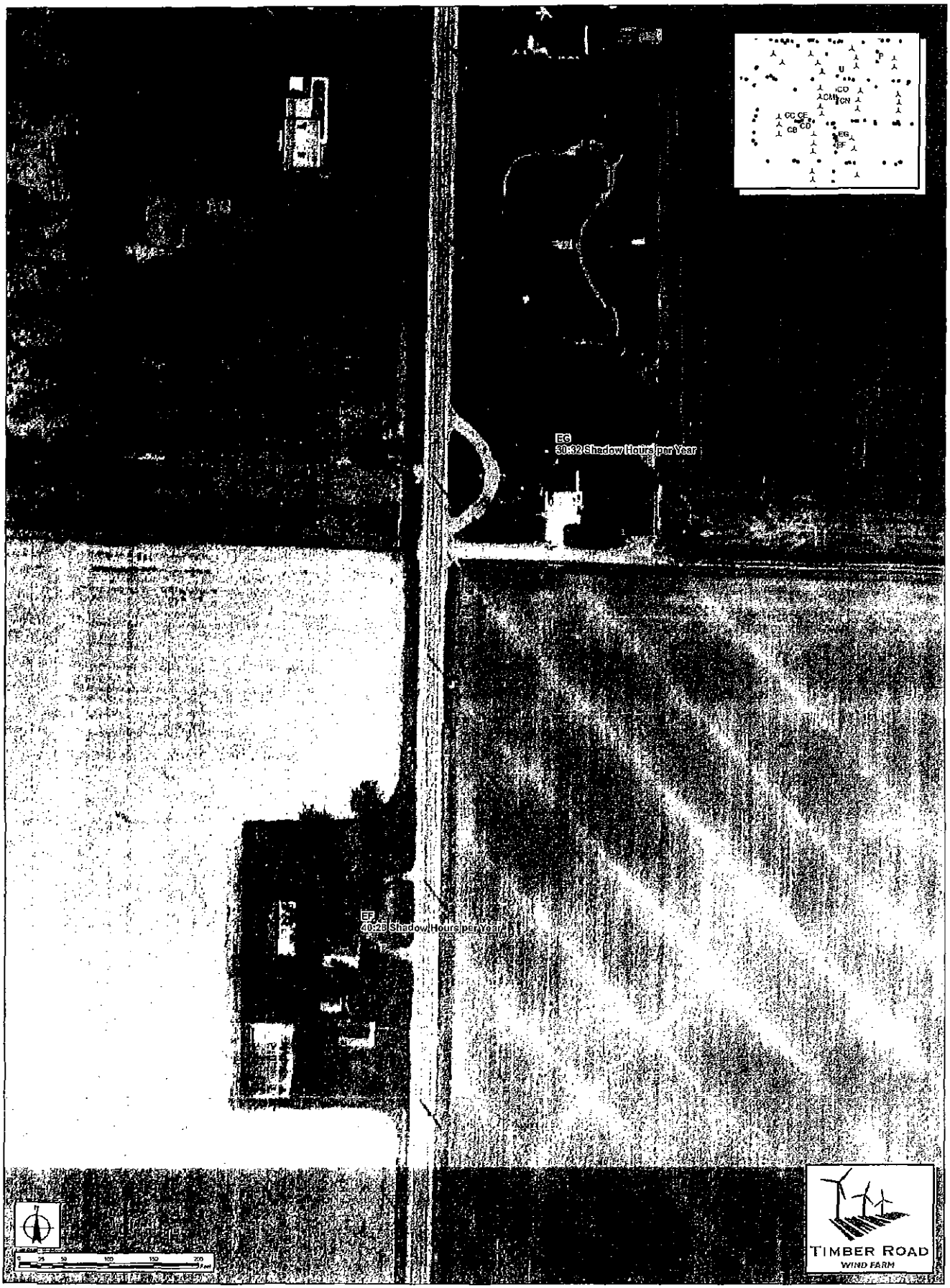
● Receptors

Sheet 4 of 5

December 2009

Notes:
Base Map: 1 ft. Orthoimagery, Year 2006.

EDR



Timber Road Wind Farm

Harrison Township - Paulding County, Ohio

Attachment D: Shadow Flicker Receptors Over 30 Hours

Receptors

Sheet 5 of 5

December 2009

Notes:
Base Map: 6 ft. Orthoimagery, Year 2006.

EDR

EXHIBIT O

Cultural Resources Report

OHIO POWER SITING BOARD REPORT FOR THE CULTURAL IMPACT OF THE TIMBER ROAD WIND FARM PROJECT

Harrison Township
Paulding County, Ohio

(JFNew Project No. 0905048)

Prepared For:

Horizon Wind Energy

Paulding Wind Farm LLC
808 Travis Street, Suite 700
Houston, Texas 77002

Prepared By:

JFNew

708 Roosevelt Road
Walkerton, Indiana 46574
www.jfnew.com

Amy C. Favret
J. Ryan Duddleson

Submitted by
J. Ryan Duddleson
Principal Investigator

November 10, 2009

Ohio Power Siting Board Report for the Cultural Impact of the Timber Road Wind Farm Project, Paulding County, Ohio

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Abstract

In response to a request from Horizon Wind Energy, LLC., JFNew conducted a cultural resources records check for the proposed Timber Road Wind Farm Wind Power Project in Paulding County, Ohio. The proposed project occurs in a rural setting in Harrison Township, Paulding County and includes construction of numerous wind turbines, access roads and power lines.

JFNew staff conducted the cultural resources records check at the Ohio Historic Preservation Office. The records check examined a study area consisting of an 8-km (5-mi) radius around the Timber Road Wind Farm wind resource area consistent with Ohio Power Siting Board (OPSB) guidelines. Research revealed that the Timber Road Wind Farm wind resource area has not been subjected to previous investigation. The nearest cultural resource management surveys include three archaeological reports associated with improvements to U.S. 24, north of the current project limits. Records show additional survey work in the study area, but these projects are located between 4.8 and 8 km (3 to 5 mi) outside the project limits.

The Ohio Archaeological Inventory lists 58 archaeological sites in the study area; however, none of these sites meet the eligibility requirements for listing in the National Register of Historic Places (NRHP). A total of 57 historic structures are recorded within the study area. One NRHP listed structure and two structures that are eligible for listing in the NRHP are located north of the Timber Road Wind Farm wind resource area, in the Village of Antwerp. Twelve cemeteries are recorded within the study area. In total, three archaeological sites, two historic structures, and one cemetery have been recorded within the Timber Road Wind Farm wind resource area.

Ohio Department of Natural Resources (ODNR) records show no state parks, state forests, or wildlife areas within 8 km (5 mi) of the proposed facility. The ODNR lists the Maumee River as a Scenic River within the study area. A portion of the river flows approximately 800 m (0.5 mile) northwest of the Timber Road Wind Farm wind resource area.

Municipal recreation areas associated with the villages of Antwerp (Antwerp Community Park) and Payne (Payne Community Park, Riverside Park, School Park) are also located within the 8-km (5-mi) study area. These recreation areas, however, are located further than one mile from the project limits.

The Applicant anticipates that all project components can be placed to avoid known cultural resources within the project limits. JFNew has begun Phase I cultural resource reconnaissance survey to assess the effects of the proposed project on cultural resources. The Phase I includes archaeological reconnaissance to identify archaeological resources that may be subject to direct project effects and history/architectural reconnaissance to identify cultural resources that may be subject to indirect project effects. The results of the Phase I reconnaissance are being compiled at the time of this writing and a complete report of investigations will be provided at a future date.

1. INTRODUCTION

In response to a request from Horizon Wind Energy, LLC (Horizon) JFNew conducted a records check for the proposed Timber Road Wind Farm Project in Harrison Township, Paulding County, Ohio. Results of the records check are presented in this report pursuant to Ohio Power Siting Board (OPSB) Requirements. The project is located in Harrison Township, Paulding County (Figure 1). The proposed improvement involves construction of numerous wind turbines, access roads and power lines in the Timber Road Wind Farm wind resource area. The project is located in a rural setting in Harrison Township dominated by open agricultural fields (Photographs 1 and 2).

JFNew conducted a records search on July 14, 2009 at the Ohio Historic Preservation Office (OHPO) in Columbus, Ohio. Research focused on an 8-km (5-mi) radius (study area) around the current project limits (Timber Road Wind Farm wind resource area), consistent with OPSB guidelines. The purpose of this report is to respond to the requirements of Rule 4906-17-08(D) of the Ohio Administrative Code.

2. REQUIREMENTS OF RULE 4906-17-08(D) OF THE OHIO ADMINISTRATIVE CODE

(1) The Applicant shall indicate, on the 1:24,000 map referenced in paragraph(C)(1)(a) of this rule, any registered landmarks of historic, religious, archaeological, scenic, natural, or other cultural significance within five miles of the proposed facility.

Research was conducted at the OHPO in Columbus, Ohio, consulting the following resources:

- Ohio Archaeological Inventory (OAI)
- Cultural Resource Management Reports
- Ohio Historic Inventory (OHI)
- National Register of Historic Places (NRHP)
- Determination of Eligibility Files (DOE)
- National Historic Landmarks List

Records reviewed at the OHPO revealed a total of 58 archaeological sites and 57 historic structures within the 8-km (5-mi) study area (Figure 1). Two (2) archaeological sites occur within or adjacent to the Timber Road Wind Farm wind resource area: 33-Pa-143 (a lithic scatter) and 33-Pa-176 (Elmtree School) (Figure 1). These sites do not meet eligibility criteria for inclusion on the NRHP.

Records on file at the OHPO indicate the Timber Road Wind Farm wind resource area has not been systematically surveyed for cultural resources. The nearest surveys are related to the proposed improvements to U.S. Highway 24, approximately 600 m (0.3 mi) north of the project boundary (Cameron and Johnson 2004; Schneider et al. 2001).

The Ohio Historic Inventory (OHI) lists 57 historic structures within the study area. The vast majority of the historic structures identified are in the Village of

Antwerp, to the north of the current project limits (Figure 2; Table 1). Three (3) historic structures are within or adjacent to the current project limits. Two of the structures are farmsteads, and one is a granary.

A total of 12 cemeteries are mapped within the 8-km (5-mi) radius study area. This includes one cemetery, the Ludwig Plot, within the current project limits and one unmarked grave, located approximately 400 m (1320 ft) south of the project limits along State Highway 49 (Figure 2). The remaining cemeteries are well outside the current project limits (4.8 to 8 km [3 to 5 mi]).

The NRHP lists one property within the study area, the Antwerp Norfolk and Western Depot (#80003205), located on West Water Street in the Village of Antwerp. The Determination of Eligibility (DOE) files list two additional properties (one structure) within in the study area, also located in the Village of Antwerp. No historic districts are located within the study area.

No National Historic Landmarks are located within the study area. The available records do not list any other registered scenic or natural resources within the study area.

This information has been provided to the Applicant for use in creating the required maps.

(2) The Applicant shall estimate the impact of the proposed facility on the preservation and continued meaningfulness of these landmarks and describe plans to mitigate any adverse impact.

The cultural resources records review revealed few previously recorded cultural resources within the project limits. These include two archaeological sites, three historic structures, and one cemetery. None of these resources appear to meet the eligibility criteria for listing in the NRHP. The Applicant anticipates that all project components including wind turbines, access roads, a substation and underground lines can be located to avoid previously identified cultural resources within the project limits.

The literature review indicated that the project limits have not been systematically surveyed for the presence of cultural resources. Based on the prehistoric context of the area, unidentified prehistoric archaeological sites may be located in or near the Timber Road Wind Farm wind resource area and may represent a range of site types and time periods. Unidentified archaeological sites in lowland areas may occur along slight topographic features and ridges. Common prehistoric site types range in from isolated artifacts reflective of a single episode in the past, small short term occupations, resource extraction, or other activity specific sites, to large occupation sites, and can range in date from the Paleoindian period to the Protohistoric Period.

Based on the historic context of the area, any unidentified historic archaeological sites are likely to be related to agricultural and/or rural domestic activity associated with the historic development of Paulding County. Some common site

types that may be represented include farmsteads or other residential sites, churches, or historic dump and debris discard areas.

Records at the OHPO list 57 historic structures within five (5) miles of the project limits. These include one (1) NRHP property and two (2) DOE properties.

Based on the results of the records check, the proposed facility is not likely to have direct impacts on known cultural resources within the study area and therefore no specific mitigation plans have been developed at this time. The Applicant, however, recognizes that the Timber Road Wind Farm wind resource area has not been systematically surveyed for cultural resources.

Because the proposed turbines would not physically alter any registered landmarks, potential impacts to the NRHP and DOE structures are likely limited to indirect, visual effects. Wind turbines may be visible at a distance along the horizon, in the viewshed from the Village of Antwerp, however, specific locations of turbines are not known at this time (Photographs 3-6 show representative views from the Village of Antwerp). JFNew has begun a Phase I cultural resource reconnaissance survey (Phase I), to assess the effects of the proposed project on these cultural resources. The Phase I work includes archaeological reconnaissance survey within the areas of direct effects and history/architecture survey to assess the indirect effects of the proposed project on cultural resources (NRHP and DOE structures) outside the Timber Road Wind Farm wind resource area, but within the study area. Cultural resources identified within the Timber Road Wind Farm wind resource area during the Phase I investigation will be documented and avoided. If avoidance is not possible a Phase II investigation will take place to assess the significance of cultural resources within the Timber Road Wind Farm wind resource area.

The results of the Phase I archaeological reconnaissance and history/architecture investigation for the Timber Road Wind Farm wind resource area are being compiled at the time of this writing and a complete report of investigations will be provided at a future date.

(3) Landmarks to be considered for purposes of paragraphs (D)(1) and (D)(2) of this rule are those districts, sites, buildings, structures, and objects which are recognized by, registered with, or identified as eligible for registration by the national registry of natural landmarks, the Ohio historical society, or the Ohio department of natural resources.

Landmarks considered in the JFNew Cultural Resources Records Check include those districts, sites, buildings, structures and objects which are recognized by, registered with or identified as eligible for listing in the National Registry of Natural Landmarks, the Ohio Historical Society or the Ohio Department of Natural Resources (ODNR).

(4) The Applicant shall indicate, on the 1:24,000 map referenced in paragraph (C)(1)(a) of this rule, existing and formally adopted land and water recreation areas within five miles of the proposed facility.

The Timber Road Wind Farm wind resource area is located in a portion of Paulding County that is almost exclusively agricultural fields. As such, there are no Ohio municipal golf courses or other large land recreation areas within five miles of the proposed facility. Review of ODNR records show no state parks, state forests, or wildlife areas within five miles of the proposed facility. The Maumee River, an ODNR listed Scenic River, flows north of the current project limits, approximately 800 m (0.5 mi) northwest of the northern limits of the Timber Road Wind Farm wind resource area at its closest point (Figure 1). The scenic portion of the Maumee River originates at the Ohio-Indiana state line travelling through the portions of Paulding and Defiance Counties and extends 43 miles to the U.S. 24 Bridge, west of Defiance. Other municipal recreation areas are associated with the villages of Antwerp (Antwerp Community Park) and Payne (Payne Community Park, Riverside Park, School Park).

Table 3 Existing Land and Water Recreation Areas within 5 miles of the Proposed Facility

Recreation Area	Type
Maumee River	Scenic River
Antwerp Community Park	Municipal Park
Payne Community Park	Municipal Park
Riverside Park	Municipal Park
School Park	Municipal Park

(5) The Applicant shall describe the identified recreational areas within one mile of the proposed project area in terms of their proximity to population centers, uniqueness, topography, vegetation, hydrology, and wildlife; estimate the impact of the proposed facility on the identified recreational areas; and describe plans to avoid, minimize, or mitigate any adverse impact.

Review of records show no state parks, state forests, or wildlife areas within one mile of the proposed facility. Further, no municipal recreation areas are located within one mile of the Timber Road Wind Farm wind resource area. The Maumee River, a registered Scenic River, is located north of the Timber Road Wind Farm wind resource area, its closest point located approximately 800 m (0.5 mi) northwest of the northern project limits. The Maumee River was designated a State Scenic River in 1974. The scenic portion of the river begins at the Ohio-Indiana border, traveling 43 miles northeast toward the Town of Defiance. The river flows through a healthy forested corridor characterized by relatively high valley walls compared to the broad level floodplain comprising the surrounding terrain (Ohio Department of Natural Resources – Division of Natural Areas and Preserves 2009). The Maumee River watershed as a whole drains over 5,000 square miles

Because the proposed turbines would not physically alter any recreational areas, including the Maumee River, potential impacts to the scenic portion of the Maumee River are likely limited to indirect, visual effects. Wind turbines may be visible at a distance along the horizon, in the viewshed from river, however,

specific locations of turbines are not known at this time (Photographs 7 and 8 show views toward the project setting from north of the river).

The Applicant has initiated a Phase I history/architecture survey to assess the indirect effects of the proposed project on the scenic portion of the Maumee River as well as the additional cultural resources (NRHP and DOE structures) outside the Timber Road Wind Farm wind resource area, but within the study area. Cultural resources identified within the Timber Road Wind Farm wind resource area during the Phase I investigation will be documented and avoided. If avoidance is not possible a Phase II investigation will take place to assess the significance of cultural resources within the Timber Road Wind Farm wind resource area. The results of the Phase I work are being compiled at the time of this writing. A complete report of investigations will be provided at a future date.

(6) The applicant shall describe measures that will be taken to minimize any adverse visual impacts created by the facility, including, but not limited to, project area location, lighting, and facility coloration. In no event shall these measures conflict with relevant safety requirements.

As described in Section 4906-13-07(D)(2) of this application, no adverse visual impacts to archaeological or historical landmarks are anticipated from construction and operation of the facility. The applicant has initiated a Phase I cultural reconnaissance survey, the results of of which are being complied at the time of this writing. The Phase I survey includes archaeological reconnaissance to assess the direct effects of the proposed project and history/architecture reconnaissance to assess the indirect effects of the proposed project. A complete report of investigations for the Phase I survey will be provided at a future date. No specific mitigation measures are proposed at this time.

3. SUMMARY AND CONCLUSION

Horizon Wind Energy, LLC contracted JFNew to conduct a cultural resource records check for the proposed Timber Road Wind Farm Project in Paulding County, Ohio. A review of records took place at the OHPO on July 14, 2009.

A total of 57 historic structures are within the study area, with the vast majority located in the Village of Antwerp, to the north of the current project limits (Figure 2, Table 2). Three historic structures area located within the Timber Road Wind Farm wind resource area: two are farmsteads, and one is a granary.

The Antwerp Norfolk and Western Depot (#80003205), an NRHP Listed structure, and two additional NRHP eligible structures are located north of the current project limits, in the Village on Antwerp.

One cemetery (Ludwig Plot) is located within the current project limits, and one unmarked grave is located to the south of the Timber Road Wind Farm wind resource area.

The records check indicated that a total of 58 archaeological sites occur within the study area. Of the 58 sites within the study area, two (2) previously recorded archaeological resources are located within or adjacent to the Timber Road Wind Farm wind resource area.

ODNR Records show no state parks, state forests, or wildlife areas within five miles of the proposed facility. Municipal parks in the communities of Antwerp and Payne are also located within the 8-km (5-mi) radius of the project. None of these features, however, are located within 1 mile of the project limits. ODNR records list the Maumee River as a Scenic River located approximately 800 m (0.5 mile) north of the Timber Road Wind Farm wind resource area.

The proposed project is not expected to directly impact known cultural resources within the study area. However, the Timber Road Wind Farm wind resource area has not been systematically surveyed for cultural resources. The Applicant has initiated a Phase I archaeological reconnaissance and history/architecture survey to assess the effects of the proposed project on cultural resources located within the project limits and study area. The results of the Phase I survey are being compiled at the time of this writing. A complete report of investigations will be provided at a future date.

4. REFERENCES CITED

Baker, Stanley W., Amy Tooehy and Richard Bratt
1997 *A Preliminary Reconnaissance Survey of the Delaware Bend Area and an Assessment of Archaeological Resources Impacted by the DEF-CR-134-2.414 (PID 15741) Bridge Replacement Project in Delaware Township, Defiance County, Ohio.* Copy on file at the Ohio Historic Preservation Office, Columbus, Ohio.

Baker Stanley W.
2000 *Letter Report: Summary of Cultural Resources Field Review in Auglaize Township, Paulding County, Ohio (PAU-637-17.17[PID 19400]).* Copy on File at the Ohio Historic Preservation Office, Columbus, OH.

Beamer, Herb, Deborah Dobson-Brown and William M. Hunter
1993 *Literature review and reconnaissance Survey for the County Road 42 Bridge Replacement and Road Realignment in Noble Township, Defiance County, Ohio.* Copy on file at the Ohio Historic Preservation Office, Columbus, OH.

Breetzke, David
2005 *Phase I Cultural Resource Report for Nextel Communications Tower OH-4328B in Carryall Township, Paulding County, Ohio.* Copy on file at the Ohio Historic Preservation Office, Columbus, Ohio.

Cameron Erica L. and Maura Johnson
2004 *Addendum Report: Phase I Cultural Resource Survey of the PAU/DEF-24-0.00/0.00 (PID 18904) Improvements in Noble, Delaware, and Defiance Townships, Defiance County, and Emerald, Crane, Carryall, and Harrison*

Townships, Paulding County, Ohio. Prepared for Parsons Brinckerhoff Ohio, Inc. Copy on file at the Ohio Historic Preservation Office, Columbus, Ohio.

Duddleson, J. Ryan and Amy C. Favret
2009 *Cultural Resources Records Check for the Timber Road Wind Farm Project, Paulding County, Ohio.* Prepared for Horizon Wind Energy, LLC. Copy on file at JFNew, Walkerton, IN.

Jackson, Kenneth E.
1990 *A Phase I and II Archaeological Reconnaissance of Proposed Natural Gas Transmission Facilities in Allen, Hardin, Marion and Paulding Counties, Ohio.* Copy on file at the Ohio Historic Preservation Office, Columbus, Ohio.

Keneer, Craig, S.
2000 *Phase I Cultural Resource Management Survey of the Proposed American Tower Cell Tower Site (Site AEPOH-152) in Hicksville Township, Defiance County, Ohio.* Copy on file at the Ohio Historic Preservation Office, Columbus, Ohio.

McDaniel, Gary, and John Wright
1990 *Phase I and II Cultural Resources Survey: 10 Acre Development Tract Near Hicksville in Hicksville Township, Defiance County, Ohio.* Copy on file at the Ohio Historic Preservation Office, Columbus, Ohio.

Nass, John P.
1979 *Preliminary Reconnaissance Archaeological Survey of O.D.O.T. Bridge Project DEF. 2.5.07, P.F. 449.* Copy on file at the Ohio Historic Preservation Office, Columbus, Ohio.

Ohio Department of Natural Resources – Division of Natural Areas and Preserves
2009 *ODNR Division of Natural Areas and Preserves - Maumee State Scenic River.* ODNR Division of Natural Areas and Preserves. http://www.dnr.state.oh.us/dnap/sr/maumee/tabid/1863/Default.aspx. September 2009.

Schneider, Andrew M. and Erica L. Cameron
2002a *Addendum Report: Phase I Archaeological Reconnaissance of the PAU/DEF-24-0.00/0.00 (PID 18904) Improvements in Defiance Township, Defiance County, Ohio.* Copy on file at the Ohio Historic Preservation Office, Columbus, Ohio.

2002b *Phase I Archaeological Survey of the Proposed Integrity Defiance Auto Body Project Section 29, Defiance Township, Defiance County, Ohio.* Copy on file at the Ohio Historic Preservation Office, Columbus, Ohio.

2004 *Phase I Archaeological Reconnaissance for Community Memorial Hospital Hicksville Township, Section 16, Defiance County, Ohio.* Copy on file at the Ohio Historic Preservation Office, Columbus, Ohio.

Schneider, Andrew M., Jason M. Koralewski, Erica L. Cameron

2001 *Phase I Archaeological Report of the PAU/DEF-24-0.00/0.00 PID 18904 Improvements in Noble, Delaware and Defiance Townships, Defiance County and Emerald, Crane, Carryall and Harrison Townships, Paulding County, Ohio.* Prepared for Parsons Brinckerhoff Ohio, Inc. Copy on file at the Ohio Historic Preservation Office, Columbus, Ohio.

Schweikart, John and Joan Randall
2002 *Phase I Cultural Resources Investigations of the PAU-CR 144-3.00 (PID 23090) Road Widening and Culvert Extension in Harrison Township, Paulding County, Ohio.* Prepared for the Ohio Department of Transportation, Office of Environmental Services, Cultural Resources Section. Copy on file at the Ohio Historic Preservation Office, Columbus, Ohio.

Watkins, Jason
2002 *Phase I Cultural Resources Investigations for the Proposed Intersection Improvement to State Route 111 and State Route 637 (PAU-111-23.26; PID 23174) in Auglaize Township, Paulding County, Ohio.* Copy on file at the Ohio Historic Preservation Office, Columbus, Ohio.

Weller Von Molsdorff, Ryan J.
1997 *Phase I Cultural Resource Investigations for the Proposed PAU CR 105-4.82 Bridge and Road Replacement and Realignment in Crane Township, Paulding County, Ohio.* Copy on file at the Ohio Historic Preservation Office, Columbus, Ohio.

1998 *Phase I Cultural Resource Management Investigation for a Proposed 25.5 HA (63 A) Industrial Park, in Hicksville Township, Defiance County, Ohio.* Copy on file at the Ohio Historic Preservation Office, Columbus, Ohio.

1999 *Phase I Cultural Resource Management Investigation Conducted for the Proposed 21 ha (52 a) Waste Water Treatment Plant and Force Main in Defiance Township, Defiance County, Ohio.* Copy on file at the Ohio Historic Preservation Office, Columbus, Ohio.

2000 *A Phase I Addendum Survey for the Proposed DEF-CR 134-2.414 (PID 15741) Bridge Replacement, Road Realignment, and Park Area in Delaware Township, Defiance County, Ohio.* Copy on file at the Ohio Historic Preservation Office, Columbus, Ohio.

2001 *Phase I Cultural Resources Management Investigations for the Proposed Construction of a 19.6 HA (56 A) Ethanol Plant in Mark Township, Defiance County, Ohio.* Copy on file at the Ohio Historic Preservation Office, Columbus, Ohio.

2006 *Phase I Archaeological Survey for a 2.67 ha (6.6 ac) Senior Housing Development in Defiance Township, Defiance County, Ohio.* Copy on file at the Ohio Historic Preservation Office, Columbus, Ohio.

2008 *An Archaeological Survey for the DEF-CR-153-0.00 Project (PID 83268) in Noble Township, Defiance County, Ohio.* Copy on file at the Ohio Historic Preservation Office, Columbus, Ohio.

Weller, Ryan J., and Matthew C. Haines
2003 *A Phase I Archaeological Survey for a 28.3 HA (70 ac) Water Reservoir in Defiance Township, Defiance County, Ohio.* Copy on file at the Ohio Historic Preservation Office, Columbus, Ohio.

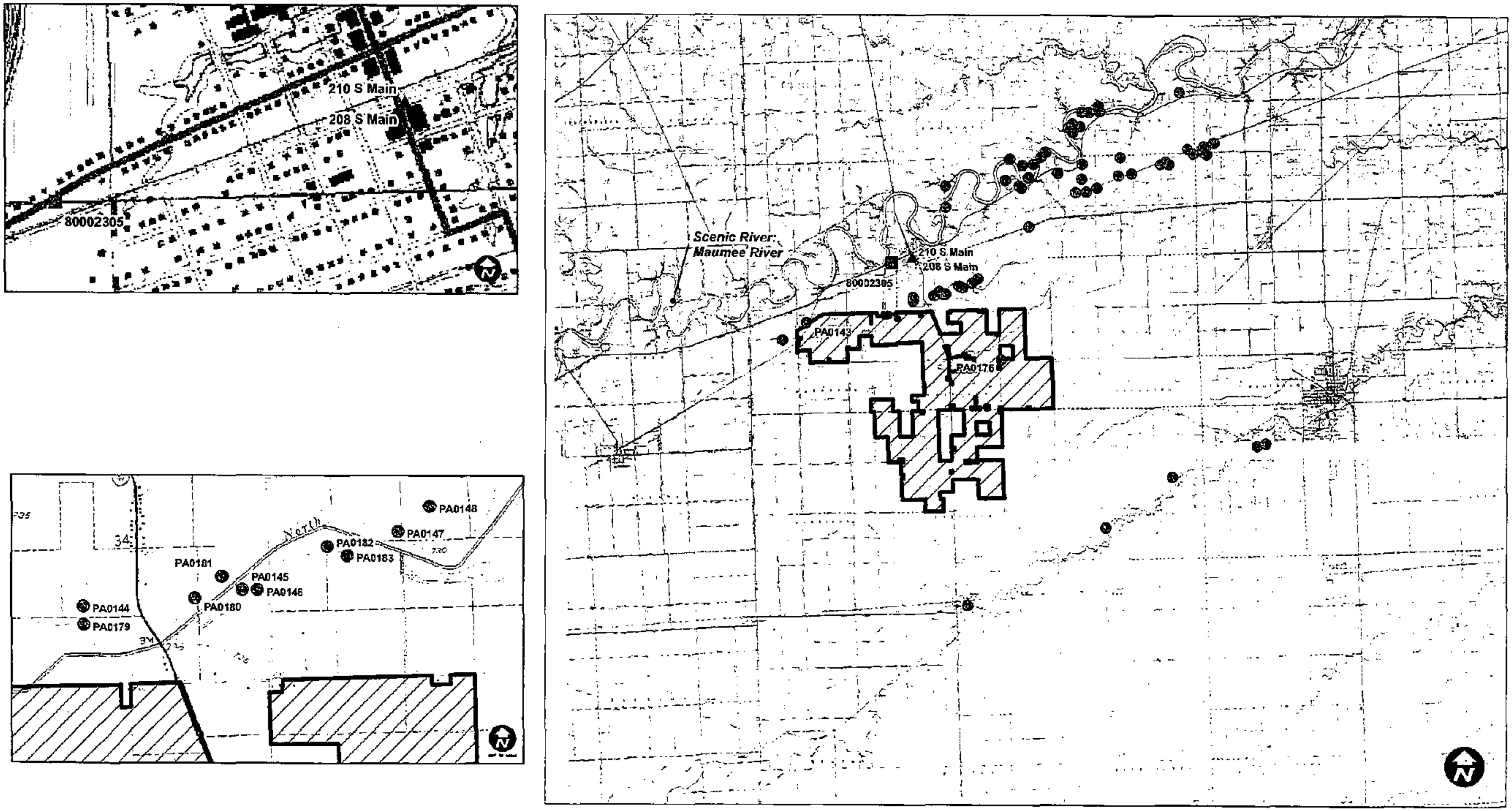


Figure 1: OAI Site Location Map
Timber Road Wind Farm
Paulding Wind Farm LLC
Paulding County, Ohio

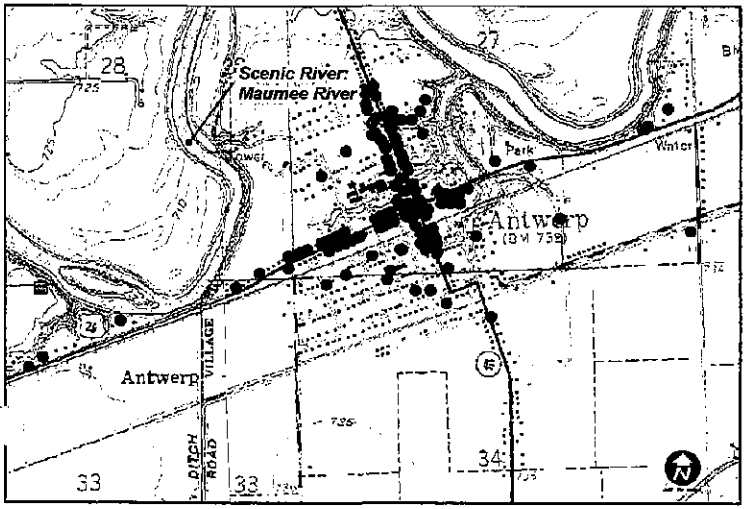
Woodburn North, Woodburn South, Payne, and Antwerp Quads

October 2009
JFNew File No. 0905048.00

Projected Coordinate System: NAD 83, UTM Zone 16 North

NOTE: See Table 1 for list of OAI Sites

JFNew



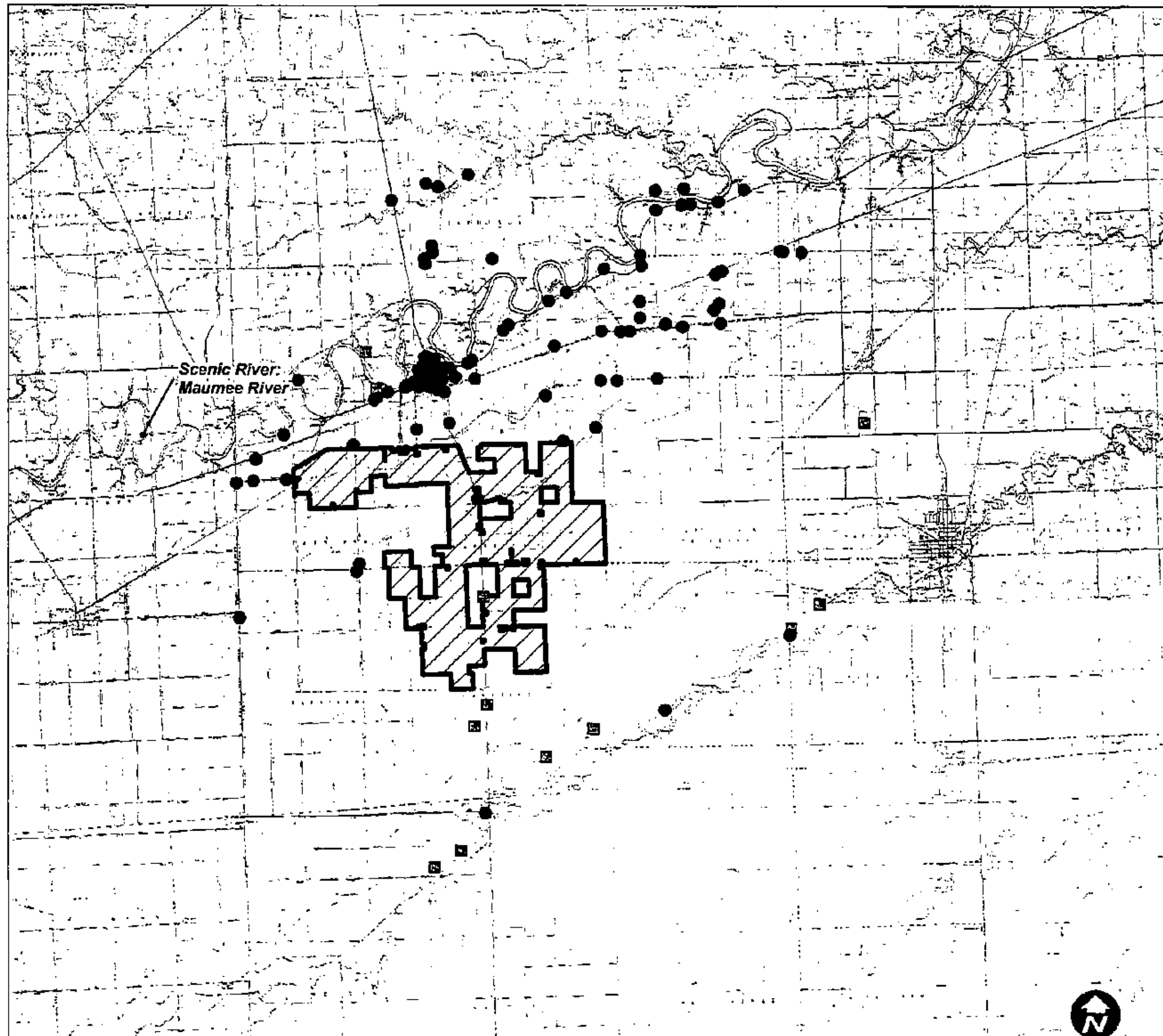


Figure 2: OHI Site Location Map
Pauldng I Project
Paulding Wind Farm LLC
Paulding County, Ohio
Woodburn North, Woodburn South, Payne, and Antwerp Quads
October 2009
JFNew File No. 0905048.00

Projected Coordinate System: NAD_1983_UTM_Zone_16N

0 2,500 5,000 10,000 Feet

- ● OHI Sites
- ■ Approximate Cemetery Location
- ▨ Paulding I Wind Resource Area

NOTE: See Table 2 for list of OHI Sites

JFNew

Table 1 - Previously Recorded Archaeological Sites in the Study Area

OAI_NUMBER	UTM_ZONE	UTM_EAST	UTM_NORTH	AFFILIATION	NADB1	QUADRANGLE NAME
PA0042	16	697870	4553990	Prehistoric	0	Payne
PA0057	16	692646	4564173	Prehistoric	0	Antwerp
PA0058	16	690594	4563298	Prehistoric and Historic	0	Antwerp
PA0105	16	700594	4555001	Prehistoric	0	Latty
PA0106	16	700864	4555081	Prehistoric	0	Latty
PA0142	16	685360	4558360	Historic	15200	Woodburn Nort h (Ind.)
PA0143	16	686130	4558930	Prehistoric	15200	Woodburn Nort h (Ind.)
PA0144	16	689570	4559740	Prehistoric	15200	Antwerp
PA0145	16	690510	4559840	Prehistoric	15200	Antwerp
PA0146	16	690600	4559840	Historic	15200	Antwerp
PA0147	16	691440	4560190	Prehistoric and Historic	15200	Antwerp
PA0153	16	693260	4562010	Historic	15200	Antwerp
PA0154	16	694730	4563100	Prehistoric and Historic	15200	Antwerp
PA0155	16	694940	4564010	Prehistoric and Historic	15200	Antwerp
PA0156	16	695080	4563120	Historic	15200	Antwerp
PA0157	16	695420	4563250	Historic	15200	Antwerp
PA0158	16	696530	4563720	Historic	15200	Antwerp
PA0159	16	697440	4564000	Prehistoric	15200	Antwerp
PA0160	16	697630	4564090	Prehistoric	15200	Antwerp
PA0161	16	697730	4564011	Prehistoric	15200	Antwerp
PA0162	16	698970	4564330	Prehistoric and Historic	15200	Antwerp
PA0163	16	698890	4564580	Prehistoric and Historic	15200	Antwerp
PA0164	16	698960	4564570	Prehistoric	15200	Antwerp
PA0165	16	699220	4564700	Prehistoric	15200	Paulding
PA0176	16	692380	4557740	Historic	15121	Antwerp
PA0177	16	695470	4565870	Prehistoric	14789	Antwerp
PA0178	16	695714	4552363	Prehistoric and Historic	16190	Payne
PA0179	16	689570	4559630	Prehistoric		Antwerp
PA0180	16	690230	4559790	Prehistoric		Antwerp
PA0181	16	690390	4559920	Prehistoric		Antwerp
PA0182	16	691020	4560100	Prehistoric		Antwerp
PA0183	16	691140	4560045	Prehistoric		Antwerp
PA0184	16	698340	4564495	Historic		Antwerp
PA0185	16	698840	4564420	Prehistoric		Antwerp
PA0188	16	692500	4563490	Prehistoric		Antwerp
PA0189	16	693015	4563250	Prehistoric		Antwerp
PA0190	16	693385	4564010	Prehistoric		Antwerp
PA0191	16	693775	4564385	Prehistoric		Antwerp
PA0192	16	690605	4562620	Prehistoric		Antwerp
PA0193	16	695510	4565700	Prehistoric		Antwerp
PA0194	16	696160	4564240	Prehistoric		Antwerp
PA0196	16	698065	4566315	Prehistoric		Antwerp
PA0198	16	694920	4563530	Prehistoric		Antwerp
PA0199	16	694155	4563720	Prehistoric		Antwerp
PA0201	16	692935	4563320	Prehistoric		Antwerp
PA0203	16	693235	4563585	Prehistoric		Antwerp
PA0204	16	693625	4564230	Prehistoric		Antwerp
PA0206	16	695167	4565670	Prehistoric and Historic		Antwerp

Table 1 - Previously Recorded Archaeological Sites in the Study Area

OAI_NUMBER	UTM_ZONE	UTM_EAST	UTM_NORTH	AFFILIATION	NADB1	QUADRANGLE NAME
PA0209	16	693045	4563970	Prehistoric		Antwerp
PA0211	16	698525	4564350	Prehistoric		Antwerp
PA0212	16	696105	4563650	Prehistoric		Antwerp
PA0213	16	694650	4565025	Prehistoric		Paulding
PA0214	16	694500	4565170	Prehistoric		Antwerp
PA0215	16	694880	4565210	Prehistoric		Antwerp
PA0216	16	694635	4565300	Prehistoric		Antwerp
PA0217	16	694930	4565680	Prehistoric		Antwerp
PA0218	16	694930	4565680	Prehistoric		Antwerp
PA0223	16	691340	4549850	Historic		Payne

Table 2 - Previously Recorded Historic Structures within the Study Area

OHI_NUMBER	UTM_ZONE	UTM_EAST	UTM_NORTH	Present Name	Other Name	Address	Style	Class	Historic Use 1	Historic Use 2	Date
PAU0003205	16	698898	4554298	Hines Dist School No 1		SEC SR 500 & CR 87	Vernacular		School		1900
PAU0005008	16	690888	4549587	St John the Baptist Cath Church	Payne Cath Church	203 W Townline St	Late Gothic Revival	Dominant Style	Church/Religious Structure		1905
PAU0007501	16	688420	4565730	Regina Donnell House	John Dunderman House	SR 49 btw CR 220 & CR 230	Vernacular		Single Dwelling	Barn	1890
PAU0007701	16	690415	4566410	RL Carr House	Josiah Lybarger House	SEC CR 45 & CR 220	Vernacular		Single Dwelling	Barn	1870
PAU0007801	16	691040	4564200		Nicholas Harmann House	TR 204 btw CR 45 & TR 53	Vernacular		Single Dwelling		1900
PAU0007901	16	689300	4564060	Raymond Dunderman House	Rose & David Barnett House	NWC SR 49 & CR 204	Vernacular		Single Dwelling	Barn	1880
PAU0008001	16	685570	4559560	Everett Wann House	WA Ewing House	Riverside Dr near SR 24	Vernacular		Single Dwelling		1880
PAU0008101	16	692450	4560600	Raymond Schmunk House	Peter Schmunch House	NEC TR 162 & TR 51	Vernacular		Single Dwelling	Barn	1900
PAU0010002	16	696060	4562420	Kenneth Klender House	Fred Inselman House	8404 County Road 180	Vernacular	Element Present	Single Dwelling		1880
PAU0010102	16	696890	4562880	Dorothy Chester House	Thomas Chester House	15051 Township Rd 180	Not Discernable from OHI Form		Single Dwelling	Barn	1900
PAU0010202	16	697030	4563880	Chester School		TR 83 near Norfolk & Western RR	Vernacular		School		1900
PAU0010302	16	696040	4565630	Knoxdale Depot	Toledo Wabash & Western RR	SR 24 E of TR 73	Vernacular		Rail Related		1880
PAU0010402	16	695340	4566000	Bethel United Methodist Church		TR 192 at CR 73	Vernacular		Church/Religious Structure		1900
PAU0010502	16	696100	4566060	Clair & Martha Forrest House	George W Forder House	TR 192 E of CR 73	Italianate	Element Present	Single Dwelling	Barn	1880
PAU0010802	16	695400	4561060	Brideg Stone		SWC CR 176 & TR 71			Rail Related		1892
PAU0011902	16	698700	4564410			CR 206 E of CR 87	Vernacular		Church/Religious Structure		1890
PAU0012401	16	693899	4561003	Six Mile Reservoir	Wabash & Erie Canal Reservoir				Canal Related		1840
PAU0012701	16	689285	4564200	Antwerp Local School		302 W Archer DR	Neo-Classical Revival	Element Present	School		1911
PAU0017601	16	689320	4566170	Lucas House	B & P Hallock House	502 N Main St	Bungalow	Element Present	Single Dwelling		1925
PAU0020101	16	685950	4561010	Seslar Garage		212 S Main St	Vernacular		Service Station		1912

Table 2 - Previously Recorded Historic Structures within the Study Area

OHI_NUMBER	UTM_ZONE	UTM_EAST	UTM_NORTH	Present Name	Other Name	Address	Style	Class	Historic Use 1	Historic Use 2	Date
PAU0020801	16	689630	4566085	Herzer House	P & H Michelson House	404 S Main St	Craftsman/ Arts and Crafts	Element Present	Single Dwelling		1915
PAU0021201	16	689465	4564540	Carrie Filler House	N Smith House	106 Mervin St	Bungalow	Element Present	Single Dwelling		1925
PAU0023501	16	689485	4564365		Ellen Snook House	103 E Woodcox St	Vernacular		Single Dwelling		1915
PAU0024102	16	694935	4563080		Gordon-Meade-Gevin House	SWC RR tracks & TR 69 (Knox Rd)	No academic style - Vernacular		Single Dwelling		c. 1892
PAU0024501	16	692915	4559405		Corn Crib	Etters Rd			Corn Crib		
PAU0024601	16	693770	4559765	Thomas Farmstead	Strasburger-Tolen Farmstead	13507 TR 61					
PAU0025201	16	692680	4561908	Donald English Farmstead	McGuire-Harrman	6395 CR 180 (Canal Rd & Wabash Rd)	No academic style - Vernacular		Single Dwelling		c.1870-1892
PAU0025502	16	694331	4560995		Sunday-Burroughs Farmstead	7292 CR 176	No academic style - Vernacular		Single Dwelling		1909
PAU0025602	16	699196	4564385	Stuart Farmstead	Meyers-Soloman Farmstead	10372 CR 206			Single Dwelling		1892-1910
PAU0025702	16	694429	4562288			7370 CR 180 (Canal Rd) (Wabash Rd)	No academic style - Vernacular		Single Dwelling		c.1920-50
PAU0025802	16	693915	4562305	Phil Bauer Farmstead	Lero Farmstead	7065 CR 180 (Canal Rd)	No academic style - Vernacular		Single Dwelling		1947
PAU0025902	16	695618	4562497	Tom & Linda Wilheim House	McMichael House	8123 CR 180 (Canal Rd)	No academic style - Vernacular		Single Dwelling		c.1939-1950
PAU0026002	16	698619	4564428		Kopp Farmstead	10017 CR 206	No academic style - Vernacular		Single Dwelling		c.1870-1892
PAU0026502	16	697060	4562523	J Lust House		14862 TR 83	No academic style - Vernacular		Single Dwelling		c.1892-1905
PAU0026602	16	694942	4562654			14985 TR 69 (Knox Rd)	No academic style - Vernacular		Single Dwelling		c.1920-50
PAU0026802	16	697022	4563044		Barn	15311 TR 83			Barn		
PAU0026902	16	696930	4563815	Gallup Farmstead	Hughes Farmstead	15661 TR 83	No academic style - Vernacular		Single Dwelling		1850-1892
PAU0027002	16	697095	4563899	Klender Farmstead	Halelit-Chester Farmstead	15700 TR 83	No academic style - Vernacular		Single Dwelling		c.1850-1892

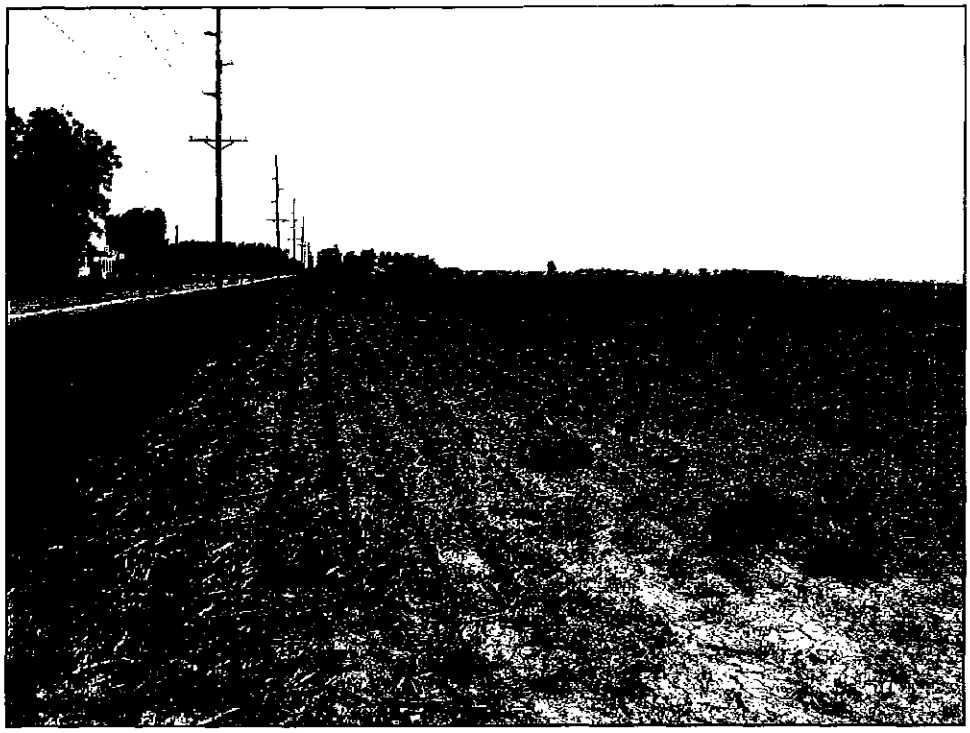
Table 2 - Previously Recorded Historic Structures within the Study Area

OHI_NUMBER	UTM_ZONE	UTM_EAST	UTM_NORTH	Present Name	Other Name	Address	Style	Class	Historic Use 1	Historic Use 2	Date
PAU0027602	16	694667	4562301		Harris House	CR 180 - .4 mi W of TR 61 - on Sside of Rd	No academic style - Vernacular		Single Dwelling		c.1920-40
PAU0029204	16	684413	4554733	Keible Farmstead	Graves-Litzenburg Farmstead	10238 State Line Rd (Rd 1)	No academic style - Vernacular		Single Dwelling		c.1905-1930
PAU0029504	16	684327	4558293	Doctors Farmstead	Rice Farmstead	12582 State Line Rd (Rd 1)	No academic style - Vernacular		Single Dwelling		c.1860-1892
PAU0029804	16	684774	4558344	Smith Farmstead	Jacob Shuler Farmstead	1302 TR 150 (Rice Rd)	No academic style - Vernacular		Single Dwelling		c.1880-1910
PAU0030004	16	685638	4558377	Ferrarre Farmstead	Charles Ferrarre Farmstead	14409 TR 150	Craftsman/ Arts and Crafts	Element	Single Dwelling		c.1927
PAU0030102	16	694945	4564309			7761 US 24	No academic style - Vernacular		Single Dwelling		c.1892-1910
PAU0033201	16	694979	4564026	Russell Coon Farmstead		15502 TR 69 (Knox Rd)	No academic style - Vernacular		Single Dwelling		1880-1920
PAU0033302	16	695360	4565490	R L Sauerbeck House		16708 CR 73	No academic style - Vernacular		School		c.1860-1890
PAU0035501	16	691325	4562317	Schroeder Assc Inc	Langham	5554 US 24			COMMERCIAL		pre 1950
PAU0035601	16	693000	4563323	Kimberly Brown House	Wilson House	6511 US 24	No academic style - Vernacular		Single Dwelling		c. 1892
PAU0035901	16	692528	4563095	Carr Farmstead	Banks Farmstead	6227 US 24	Queen Anne	Element	Single Dwelling		c. 1880-1910
PAU0036101	16	691470	4562460			Nside of US 24 - .25 mi W of CR 43	No academic style - Vernacular		Single Dwelling		c. 1910-30
PAU0036602	16	693984	4563940	Lloyd House	Banks Farmstead	7089 US 24	No academic style - Vernacular		Single Dwelling		c. 1892-1910
PAU0036702	16	696030	4565620	Richhart House	Ashton	8446 US 24	No academic style - Vernacular		Single Dwelling		c. 1892-1920
PAU0036802	16	697000	4565720	Francis Rhoades Farmstead		9061 US 24	No academic style - Vernacular		Single Dwelling		c. 1900
PAU0036902	16	697670	4566030	Douglas Smith House		9435 US 24	No academic style - Vernacular		Single Dwelling		c. 1965-1999
PAU0037002	16	696275	4565648	Crib Barn		US 24			Barn		

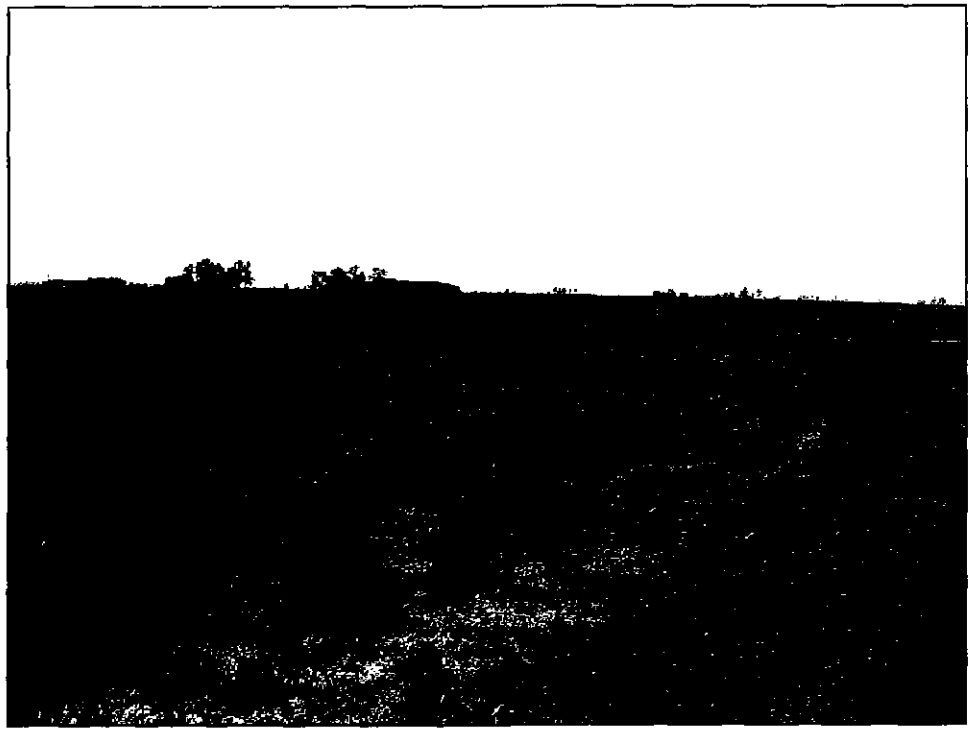
Table 2 - Previously Recorded Historic Structures within the Study Area

OHI_NUMBER	UTM_ZONE	UTM_EAST	UTM_NORTH	Present Name	Other Name	Address	Style	Class	Historic Use 1	Historic Use 2	Date
PAU0038004	16	684840	4558918		Wann Farmstead	1358 US 24	No academic style - Vernacular		Single Dwelling		c. 1890-1920
PAU0038205	16	695617	4552318	Reville Farmstead	Hardesty Farmstead	CR 71 at SR 500	Vernacular		Single Dwelling	Barn	1855

Appendix A - Photographs



Photograph 1: General overview of project setting.



Photograph 2: General overview of project setting.

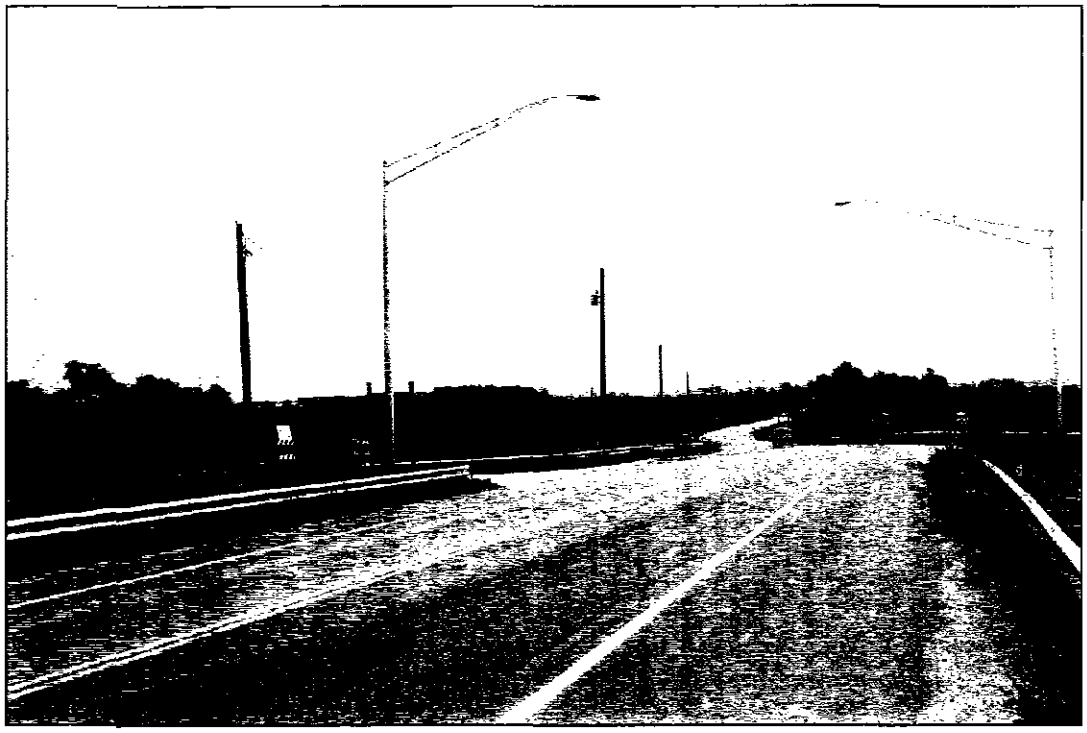
Photographs **Timber Road Wind Farm** **Horizon Wind Energy, LLC.** **Paulding County, Ohio**	JFNew # 0905048	JFNew 708 Roosevelt Road, Walkerton, IN 46574 Phone 574-586-3400 / Fax 574-586-3446 www.jfnew.com

Photograph 3: Representative view toward project setting from Antwerp.

Photograph 4: Representative view toward project setting from Antwerp.

Photographs **Timber Road Wind Farm** **Horizon Wind Energy, LLC.** **Paulding County, Ohio**	JFNew # 0905048	JFNew 708 Roosevelt Road, Walkerton, IN 46574 Phone 574-586-3400 / Fax 574-586-3446 www.jfnew.com

Photograph 5: Representative view toward project setting from Antwerp.



Photograph 6: Representative view toward project setting from Antwerp.

Photographs
Timber Road Wind Farm
Horizon Wind Energy, LLC.
Paulding County, Ohio

JFNew # 0905048

JFNew
708 Roosevelt Road, Walkerton, IN 46574
Phone 574-586-3400 / Fax 574-586-3446
www.jfnew.com

Photograph 7: Representative view toward project setting from north of Maumee River.

Photograph 8: Representative view toward project setting from north of Maumee river.

JFNew
708 Roosevelt Road, Walkerton, IN 46574
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www.jfnew.com

EXHIBIT P

Communication Studies

Off-Air Television Reception Analysis
AM/FM Radio Analysis
Microwave Path Analysis
Tower Structures Report
NTIA Correspondence

COMSEARCH

19700 Janelia Farms Blvd
Ashburn, VA 20147
703-726-5500

Off-Air TV Reception Analysis at the Timber Road Wind Farm Area in Paulding County, Ohio

Comsearch was contracted by Horizon Wind Energy to identify all of the off-air television stations within 100-mile radius of the center point of the proposed Timber Road Wind Farm area in Paulding County, Ohio. Off-air stations are television broadcasters that transmit signals that can be received directly on a television receiver from terrestrially located broadcast facilities. Comsearch examined the coverage of the off-air TV stations and the communities in the area that could potentially have degraded television reception because of the location of the wind turbines. The proposed wind energy turbine area boundaries and local communities are plotted in the map shown in Figure 1 of this memorandum. Table 1 lists the off-air television stations within 100 miles of the center point of the turbine area site. Table 2 lists all of the off-air television stations within 40 miles of the center point of the turbine area site. Figure 2 is a map overlay showing the location of the off-air television stations with respect to the wind energy turbine area.

Table 1 Off-Air TV Channels within 100 Miles of the Timber Road Wind Farm Area

ID	Location		Call Sign	Channel	Status	Service	Distance*
1	KALAMAZOO	MI	WGVK	5	STA	DS	93.42 mi
2	KALAMAZOO	MI	WGVK	5	STA	DS	93.42 mi
3	KALAMAZOO	MI	WGVK	5	LIC	DT	93.42 mi
4	TOLEDO	OH	WLMB	5	LIC	DT	56.42 mi
5	AUBURN	IN	W07CL	7	LIC	TX	20.93 mi
6	LIMA	OH	WLIO-DR	8	GRANT	DR	41.87 mi
7	LIMA	OH	WLIO	8	STA	DS	41.87 mi
8	LIMA	OH	WLIO	8	STA	DS	41.92 mi
9	LIMA	OH	WLIO	8	CP MOD	DT	41.91 mi
10	LIMA	OH	WLIO	8	APP	DS	41.91 mi
11	FINDLAY	OH	W09CG	9	LIC	TX	57.30 mi
12	FORT WAYNE	IN	WFWC-LD	10	CP	LD	21.00 mi
13	ONONDAGA	MI	WILX-TV	10	CP	DT	90.51 mi
14	ONONDAGA	MI	WILX-TV	10	APP	DT	90.51 mi
15	TOLEDO	OH	WTOL	11	CP MOD	DT	80.02 mi
16	ANGOLA	IN	WINM	12	LIC	DT	22.05 mi
17	TOLEDO	OH	WTVG	13	CP MOD	DT	78.80 mi
18	BATTLE CREEK	MI	WOBC-CA	14	LIC	CA	82.31 mi
19	BATTLE CREEK	MI	WOBC-CA	14	CP	DC	82.31 mi
20	BATTLE CREEK	MI	WOBC-CA	14	APP	DC	82.31 mi
21	SOUTH BEND	IN	WNDU-TV	16	LIC	TS	82.80 mi
22	CELINA	OH	W17AA	17	LIC	TX	42.19 mi
23	LIMA	OH	-	17	-	TA	41.31 mi
24	TOLEDO	OH	WTOL	17	STA	DS	80.02 mi
25	TOLEDO	OH	WTOL	17	LIC	DT	80.02 mi
26	CELINA	OH	W17AA	17	CP	LD	42.17 mi

27	CELINA	OH	W17AA	17	APP	LD	42.08 mi
28	ELKHART	IN	W18CF	18	LIC	TX	73.36 mi
29	ELKHART	IN	W18CF	18	CP	LD	73.36 mi
30	FORT WAYNE	IN	WISE-DR	18	APP	DR	23.03 mi
31	FORT WAYNE	IN	WISE-TV	18	APP	DT	23.03 mi
32	LIMA	OH	WLQP-LP	18	LIC	TX	44.72 mi
33	TOLEDO	OH	W22CO	18	CP	LD	76.50 mi
34	LIMA	OH	WLQP-LP	18	APP	LD	43.72 mi
35	FORT WAYNE	IN	WISE-TV	19	STA	DS	22.68 mi
36	FORT WAYNE	IN	WISE-TV	19	APP	DS	22.68 mi
37	FORT WAYNE	IN	WISE-TV	19	LIC	DT	22.68 mi
38	FORT WAYNE	IN	WISE-TV	19	APP	DS	22.68 mi
39	TOLEDO	OH	WTVG	19	LIC	DT	78.80 mi
40	SPRINGFIELD	OH	W20CL	20	LIC	TX	93.45 mi
41	FINDLAY	OH	NEW	20	APP	LD	43.72 mi
42	SOUTH BEND	IN	WSBT-TV	22	CP MOD	DT	83.31 mi
43	SOUTH BEND	IN	WSBT-TV	22	APP	DS	83.31 mi
44	JACKSON	MI	W24CG	22	APP	TX	89.27 mi
45	BUCYRUS	OH	WBKA-CA	22	LIC	CA	98.86 mi
46	FINDLAY	OH	WFND-LP	22	LIC	TX	57.30 mi
47	FINDLAY	OH	WFND-LP	22	CP	TX	47.31 mi
48	FINDLAY	OH	WFND-LP	22	APP	LD	57.30 mi
49	BUCYRUS	OH	WBKA-CA	22	APP	DC	93.17 mi
50	SOUTH BEND	IN	WMYS-LD	23	LIC	LD	81.77 mi
51	MUNCIE	IN	WIPB	23	CP MOD	DT	79.65 mi
52	MUNCIE	IN	WIPB	23	APP	DS	79.65 mi
53	LIMA	OH	W23DE-D	23	CP	TX	44.72 mi
54	LIMA	OH	W23DE-D	23	LIC	LD	44.72 mi
55	FORT WAYNE	IN	WPTA	24	LIC	DT	23.03 mi
56	SPRINGFIELD	OH	W24DG-D	24	CP	LD	93.45 mi
57	MARION	IN	WSOT-LP	25	LIC	TX	60.49 mi
58	SOUTH BEND	IN	WCWW-LP	25	LIC	TX	81.77 mi
59	LIMA	OH	WOHL-CA	25	LIC	CA	44.72 mi
60	LIMA	OH	WOHL-CA	25	APP	DC	44.72 mi
61	LIMA	OH	WOHL-CA	25	APP	CA	41.91 mi
62	MUNCIE	IN	WMUN-LP	26	LIC	TX	80.49 mi
63	AUBURN	IN	W26DH-D	26	CP	LD	20.93 mi
64	MUNCIE	IN	WMUN-LP	26	APP	LD	80.49 mi
65	KALAMAZOO	MI	W26BX	26	LIC	TX	74.95 mi
66	KALAMAZOO	MI	W26BX	26	CP	LD	75.00 mi
67	DEFIANCE	OH	WDFM-LP	26	STA	TX	15.19 mi
68	DEFIANCE	OH	WDFM-LP	26	LIC	TX	15.19 mi
69	MARION	IN	WSOT-LP	27	CP	TX	56.73 mi
70	SOUTH BEND	IN	WCWW-LD	27	LIC	LD	81.77 mi
71	MARION	IN	WSOT-LP	27	CP	LD	56.73 mi
72	ANN ARBOR	MI	WFHD-LP	27	LIC	TX	94.29 mi
73	ANN ARBOR	MI	WFHD-LP	27	CP	LD	94.29 mi
74	BOWLING GREEN	OH	WBGU-TV	27	CP MOD	DT	43.78 mi

75	BOWLING GREEN	OH	WBGU-TV	27	APP	DS	43.78 mi
76	ELKHART	IN	WSJV	28	CP	DX	82.20 mi
77	ELKHART	IN	WSJV	28	CP MOD	DT	82.20 mi
78	ELKHART	IN	WSJV	28	APP	DS	82.20 mi
79	DEFIANCE	OH	W52CO	28	APP	TX	15.19 mi
80	TOLEDO	OH	W28DH-D	28	CP	LD	65.29 mi
81	KOKOMO	IN	WTTK	29	APP	DS	84.02 mi
82	TOLEDO	OH	WGTE-TV	29	LIC	DT	77.12 mi
83	SOUTH BEND	IN	WSBT-TV	30	STA	DS	83.31 mi
84	FORT WAYNE	IN	WANE-DR	31	GRANT	DR	22.86 mi
85	FORT WAYNE	IN	WANE-TV	31	STA	DS	22.86 mi
86	FORT WAYNE	IN	WANE-TV	31	APP	DS	22.86 mi
87	FORT WAYNE	IN	WANE-TV	31	APP	DS	22.86 mi
88	FORT WAYNE	IN	WANE-TV	31	CP MOD	DT	22.86 mi
89	FORT WAYNE	IN	WANE-TV	31	APP	DS	22.86 mi
90	ANN ARBOR	MI	WPXD-TV	31	CP MOD	DT	92.19 mi
91	MARION	IN	WNDY-TV	32	LIC	DT	92.61 mi
92	TOLEDO	OH	W59DC	32	APP	TX	71.70 mi
93	KALAMAZOO	MI	WOKZ-LD	32	CP	LD	92.43 mi
94	MAPLEWOOD	OH	W63AH	32	APP	LD	62.04 mi
95	ANN ARBOR	MI	WPXD-TV	33	APP	DT	92.19 mi
96	LIMA	OH	W55CH	33	APP	TX	44.72 mi
97	ANN ARBOR	MI	WPXD-TV	33	LIC	DT	92.19 mi
98	SOUTH BEND	IN	WMYS-LP	34	APP	TX	81.77 mi
99	JACKSON	MI	WHTV	34	STA	DS	78.61 mi
100	TOLEDO	OH	WBTL-LP	34	LIC	TX	72.20 mi
101	SOUTH BEND	IN	WNIT	35	LIC	DT	81.89 mi
102	SOUTH BEND	IN	WNIT	35	APP	DT	81.89 mi
103	LIMA	OH	WOHL-CA	35	CP	DC	41.91 mi
104	LIMA	OH	WOHL-CA	35	APP	LD	41.91 mi
105	FORT WAYNE	IN	WFFT-TV	36	STA	DS	23.52 mi
106	FORT WAYNE	IN	WFFT-TV	36	CP MOD	DT	23.52 mi
107	KALAMAZOO	MI	WUHQ-LP	36	LIC	TX	91.43 mi
108	FORT WAYNE	IN	W38EA-D	38	LIC	LD	23.35 mi
109	LANSING	MI	WSYM-TV	38	STA	DS	91.92 mi
110	LANSING	MI	WSYM-TV	38	CP MOD	DT	91.92 mi
111	LIMA	OH	WLMO-LP	38	LIC	TX	44.72 mi
112	TOLEDO	OH	W38DH	38	LIC	TX	68.93 mi
113	LIMA	OH	WLMO-LP	38	APP	LD	43.72 mi
114	MARION	OH	WOCB-CD	39	LIC	CA	91.91 mi
115	MARION	OH	WOCB-CD	39	LIC	DC	92.06 mi
116	FORT WAYNE	IN	WFWA	40	LIC	DT	23.35 mi
117	FORT WAYNE	IN	WFWA	40	APP	DT	23.35 mi
118	SOUTH BEND	IN	WNDU-TV	42	LIC	DT	82.80 mi
119	SOUTH BEND	IN	WNDU-TV	42	CP	DT	82.82 mi
120	LIMA	OH	WTLW	44	CP MOD	DT	39.17 mi
121	LIMA	OH	WTLW	44	APP	DS	39.17 mi
122	FORT WAYNE	IN	WFWC-CA	45	LIC	CA	21.01 mi

123	LIMA	OH	WLQP-LP	45	APP	LD	41.91 mi
124	SOUTH BEND	IN	WHME-DR	46	APP	DR	80.05 mi
125	SOUTH BEND	IN	WHME-TV	46	APP	DT	80.05 mi
126	TOLEDO	OH	WUPW	46	LIC	DT	76.50 mi
127	TOLEDO	OH	WUPW	46	APP	DT	76.50 mi
128	LIMA	OH	WTLW	47	STA	DS	39.17 mi
129	LIMA	OH	WTLW	47	LIC	DT	39.17 mi
130	LIMA	OH	WLMO-LP	47	APP	LD	41.91 mi
131	SOUTH BEND	IN	WHME-TV	48	STA	DS	80.05 mi
132	SOUTH BEND	IN	WHME-TV	48	LIC	DT	80.05 mi
133	SOUTH BEND	IN	WHME-TV	48	APP	DT	80.05 mi
134	ANN ARBOR	MI	W48BZ	48	APP	TX	94.21 mi
135	BOWLING GREEN	OH	W50CD	48	APP	TX	43.78 mi
136	TOLEDO	OH	WMNT-CA	48	LIC	CA	72.52 mi
137	MARION	OH	WOCB-CD	48	APP	DC	69.38 mi
138	SOUTH BEND	IN	WBND-LD	49	LIC	LD	81.77 mi
139	BATTLE CREEK	MI	W21BS	49	APP	TX	82.31 mi
140	TOLEDO	OH	WNWO-TV	49	LIC	DT	80.95 mi
141	KOKOMO	IN	WKGK-LP	50	LIC	CA	86.56 mi
142	KOKOMO	IN	WKGK-LP	50	CP	DC	86.56 mi
143	KOKOMO	IN	WKGK-LP	50	APP	DC	84.66 mi
144	KALAMAZOO	MI	WOKZ-CA	50	LIC	CA	92.43 mi
145	TOLEDO	OH	NEW	50	APP	LD	72.20 mi
146	MARION	IN	WIWU-CD	51	LIC	CA	59.35 mi
147	MARION	IN	WIWU-CD	51	LIC	DC	59.35 mi
148	LANSING	MI	WLAJ	51	LIC	DT	89.27 mi
149	FINDLAY	OH	W09CG	51	APP	LD	57.30 mi
150	MUNCIE	IN	WIPB	52	STA	DS	79.65 mi
151	KOKOMO	IN	WTTK	54	STA	DS	84.02 mi
152	KOKOMO	IN	WTTK	54	APP	DS	84.02 mi
153	DEFIANCE	OH	NEW	56	APP	DN	43.78 mi
154	BOWLING GREEN	OH	WBGU-TV	56	STA	DS	43.78 mi
155	BOWLING GREEN	OH	WBGU-TV	56	LIC	DT	43.78 mi
156	SOUTH BEND	IN	WBND-LP	57	LIC	TX	81.77 mi
157	ONONDAGA	MI	WILX-TV	57	STA	DS	90.51 mi
158	ELKHART	IN	WSJV	58	STA	DS	82.20 mi
159	MAPLEWOOD, ETC.	OH	W63AH	63	LIC	TX	62.04 mi
160	SPRINGFIELD	OH	-	66	-	TA	97.01 mi
161	TOLEDO	OH	W22CO	68	LIC	TX	71.70 mi
162	SOUTH BEND	IN	WMYS-LP	69	LIC	TX	81.77 mi

IN-Indiana
OH-Ohio
MI-Michigan
ON-Ontario
DS-Digital Service Television, Temporary Operation, STA Operation
DT-Digital Television Broadcast Station
DR- Indicates Station has Applied for FCC Rule Making
DX- Digital Auxiliary Facility

Distance*-Measured from center point of wind turbine area

GRANT-Indicates Rule Making was granted by FCC
LP-Low Power Television Broadcast Station
TX-Translator Television Broadcast Station
CA-Low Power Full Service Channel
TA- Analog Allotment
TS-Analog Auxiliary Allotment
LIC – Licensed and operational station
CP – License approved construction permit granted
APP – License application, not yet operational
STA – Special transmit authorization, usually granted by FCC for temporary operation

The most likely TV stations that will produce off-air television coverage to the Paulding County, Ohio area will be those stations at a distance of 40 miles or less from the turbine area center point. These TV stations are listed in Table 2. There are 30 license records for television stations within 40 miles. Of these license records there are 14 that are providing television programming to the area. Five are full-power stations and one is a low-power digital channel and one is a low-power full service analog channel. There are also 5 full-power digital channels that are operating on a special transmit authority granted by the FCC providing programming. There are also 2 low power translators providing programming to the area. Translators are stations that re-broadcast TV signals from distant stations at low-power to a very limited local area. From the location of the TV stations relative to the wind turbine area certain channels may be degraded in those communities that are on the opposite side of the wind turbine area from the TV stations. But in no case will any community lose all of its now available TV channels because of the number of TV stations that presently surround the wind turbine area. If an area does suffer from an extreme loss of TV coverage two mitigation strategies to offset this is to offer either, cable television hookups, where a cable system is available, or direct broadcast satellite (DBS) TV reception systems. Based on the location of the proposed wind turbine area and the TV stations servicing the area it does not appear that there will be many communities where an extreme loss of TV coverage will occur.

Table 2 Off-Air TV Stations within 40 Miles of the Timber Road Wind Farm Area

ID	Location		Call Sign	Channel	Status	Service	Distance*
67	DEFIANCE	OH	WDFM-LP	26	STA	TX	15.19 mi
68	DEFIANCE	OH	WDFM-LP	26	LIC	TX	15.19 mi
79	DEFIANCE	OH	W52CO	28	APP	TX	15.19 mi
5	AUBURN	IN	W07CL	7	LIC	TX	20.93 mi
63	AUBURN	IN	W26DH-D	26	CP	LD	20.93 mi
12	FORT WAYNE	IN	WFWC-LD	10	CP	LD	21.00 mi
122	FORT WAYNE	IN	WFWC-CA	45	LIC	CA	21.01 mi
16	ANGOLA	IN	WINM	12	LIC	DT	22.05 mi
35	FORT WAYNE	IN	WISE-TV	19	STA	DS	22.68 mi
36	FORT WAYNE	IN	WISE-TV	19	APP	DS	22.68 mi
37	FORT WAYNE	IN	WISE-TV	19	LIC	DT	22.68 mi
38	FORT WAYNE	IN	WISE-TV	19	APP	DS	22.68 mi
84	FORT WAYNE	IN	WANE-DR	31	GRANT	DR	22.86 mi
85	FORT WAYNE	IN	WANE-TV	31	STA	DS	22.86 mi
86	FORT WAYNE	IN	WANE-TV	31	APP	DS	22.86 mi
87	FORT WAYNE	IN	WANE-TV	31	APP	DS	22.86 mi

88	FORT WAYNE	IN	WANE-TV	31	CP MOD	DT	22.86 mi
89	FORT WAYNE	IN	WANE-TV	31	APP	DS	22.86 mi
30	FORT WAYNE	IN	WISE-DR	18	APP	DR	23.03 mi
31	FORT WAYNE	IN	WISE-TV	18	APP	DT	23.03 mi
55	FORT WAYNE	IN	WPTA	24	LIC	DT	23.03 mi
108	FORT WAYNE	IN	W38EA-D	38	LIC	LD	23.35 mi
116	FORT WAYNE	IN	WFWA	40	LIC	DT	23.35 mi
117	FORT WAYNE	IN	WFWA	40	APP	DT	23.35 mi
105	FORT WAYNE	IN	WFFT-TV	36	STA	DS	23.52 mi
106	FORT WAYNE	IN	WFFT-TV	36	CP MOD	DT	23.52 mi
120	LIMA	OH	WTLW	44	CP MOD	DT	39.17 mi
121	LIMA	OH	WTLW	44	APP	DS	39.17 mi
128	LIMA	OH	WTLW	47	STA	DS	39.17 mi
129	LIMA	OH	WTLW	47	LIC	DT	39.17 mi

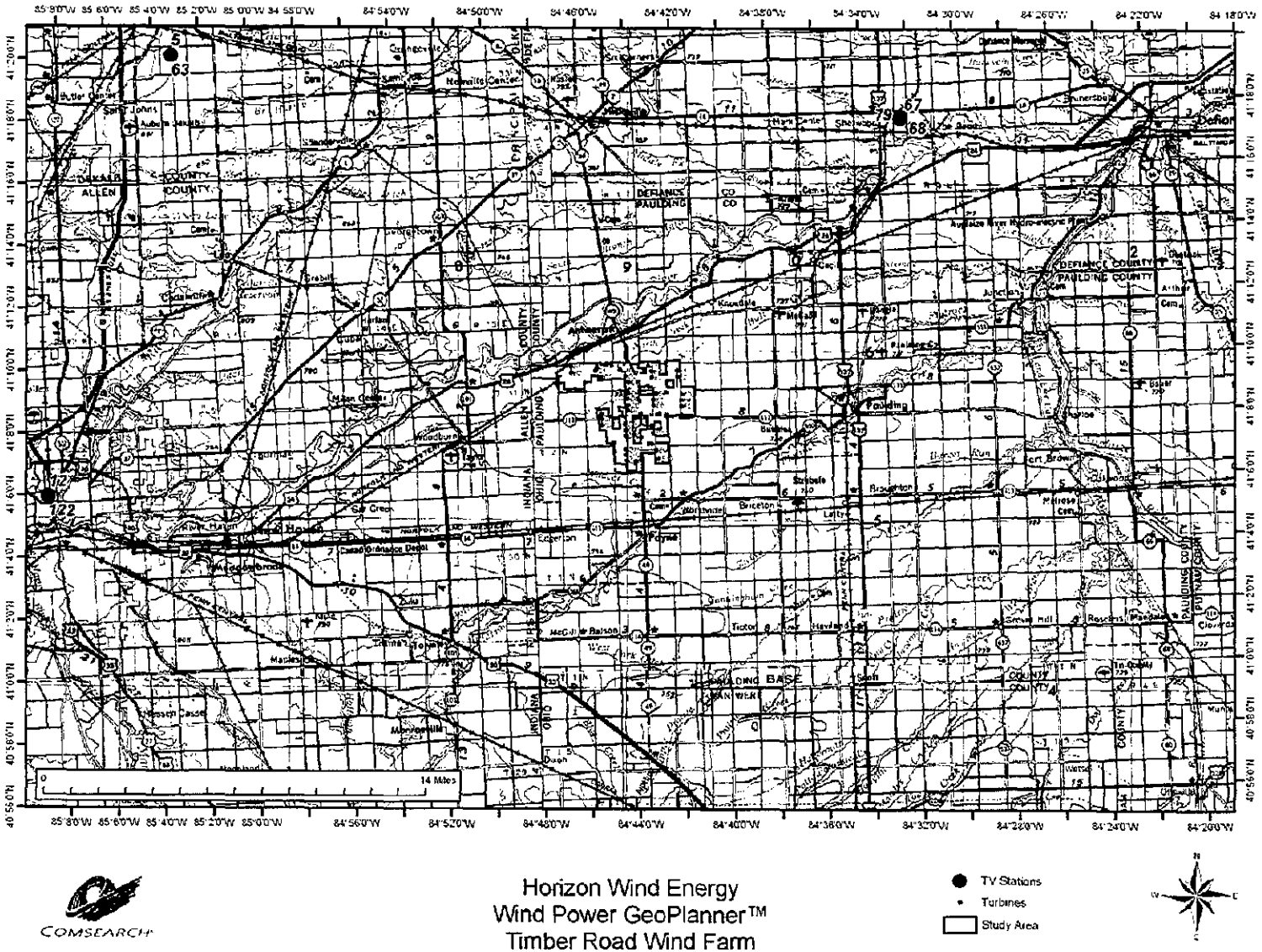


Figure 1 Timber Road Wind Farm Area Boundaries and Local Communities

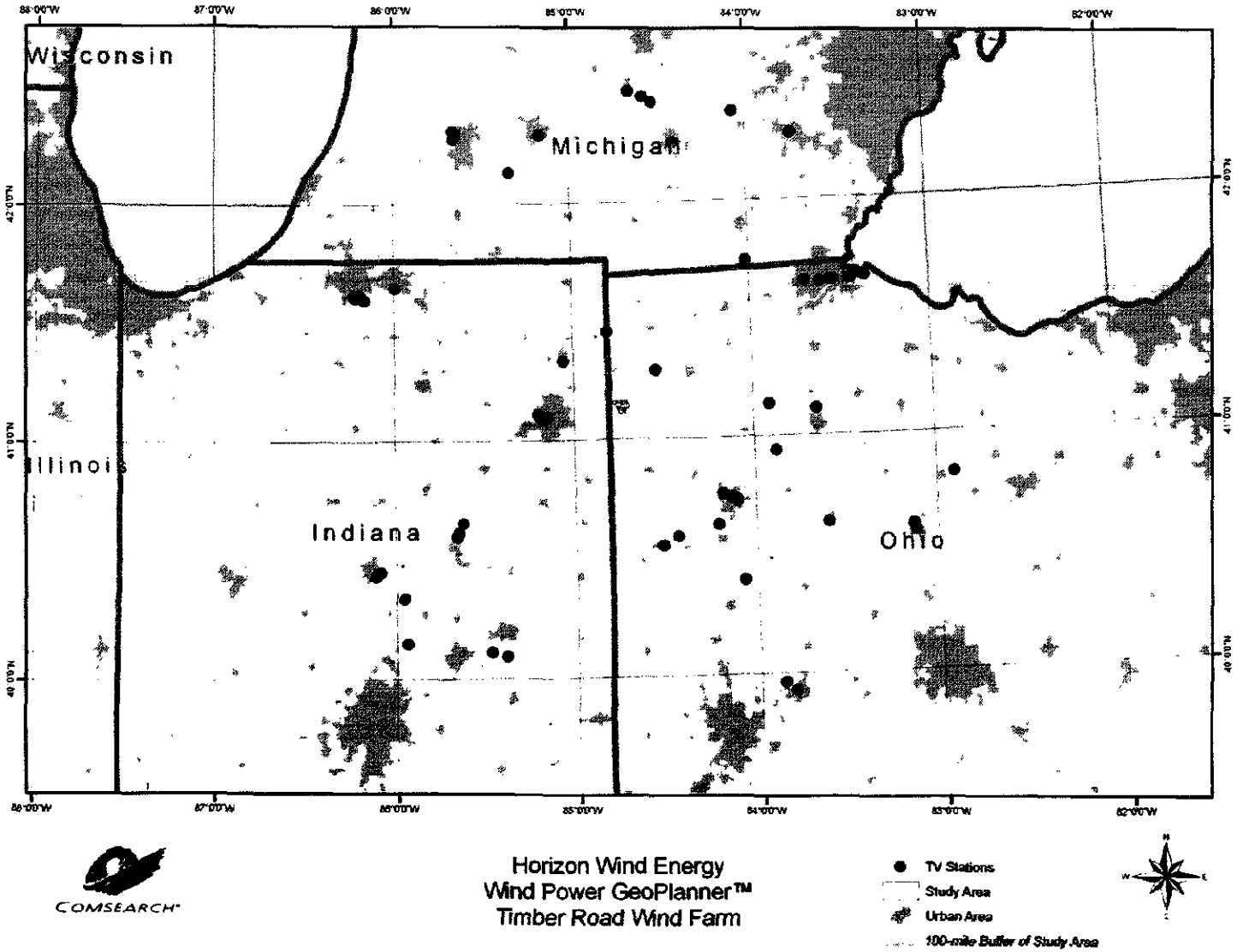


Figure 2 TV Stations within 100 Miles of Timber Road Wind Farm Area Center Point

COMSEARCH

19700 Janelia Farms Blvd
Ashburn, VA 20147
703-726-5500

Analysis of AM and FM Broadcast Station Operations in the Vicinity of the Timber Road Wind Farm Area in Paulding County, Ohio

Comsearch was contracted by Horizon Wind Energy to determine if there would be any degradation to the operational coverage of AM and FM Radio Broadcast Stations located in the vicinity of their proposed Timber Road Wind Farm area in Ohio.

Comsearch determined that there were two database records for AM stations within a search radius (20-miles) of the turbine area's center point. The two database records represent one station that is licensed to operate at two transmit power levels. For certain stations the FCC requires a lower transmit power after sundown. The separation distance of the AM station antenna from the planned center of the turbine area is approximately 17.56 miles. Table 1 lists the AM station in the vicinity of the turbine area. No degradation of AM broadcast coverage will occur due to the presence of the wind turbines as long as the separation distance to the nearest wind turbine is greater than 2 miles. Potential problems with broadcast coverage are only anticipated when AM broadcast stations with directive antennas are within 2 miles of turbine towers and AM broadcast stations with non-directive antennas are within 0.5 miles. The AM station antenna is at a distance of approximately 16.4 miles from the closest planned wind turbine. Therefore, no degradation of its coverage will occur. Figure 1 is a map that shows the location of the AM transmit antenna with respect to the wind turbine area.

Table 1 Location of AM Radio Stations in Vicinity of the Timber Road Wind Farm Study Area

Location		Call Sign	Status	Tx-ERP	Frequency	Distance*
FORT WAYNE	IN	WFCV	LIC	2.5 kW	1090 kHz	17.56 mi
FORT WAYNE	IN	WFCV	LIC	1.0 kW	1090 kHz	17.56 mi

IN = Indiana
kHz = kilohertz
kW = kilowatt
mi = mile
Tx-ERP= transmit effective radiated power
* Distance from wind turbine area center point to station antenna

Comsearch determined that there were ten FM station records within a 15 mile radius of the wind turbine area center point. Of the ten station records only 3 are licensed and operational. The station records are listed in Tables 2 of this report. All of the stations are located outside of the wind turbine area with the closest station being 8.57 miles from the center of the area and at a distance of approximately 7.1 miles from the closest planned wind turbine. FM stations' coverage, when they are at distances greater than 2.5 miles from wind turbines, are not subject to degradation. Therefore, no coverage degradation of any of the FM stations in the area of the Timber Road Wind Farm wind turbine area will occur.

Table 2 Location of FM Radio Stations in Vicinity of the Timber Road Wind Farm Area

ID	Location		Call Sign	Status	Tx-ERP	Frequency	Distance*
1	WOODBURN	IN	NEW	APP	0. kW	91.3 MHz	12.15 mi
2	GRABILL	IN	NEW	APP	0.25 kW	91.3 MHz	14.07 mi
3	LEO	IN	NEW	APP	11.7 kW	91.3 MHz	12.15 mi
4	NEW HAVEN	IN	NEW	APP	2.4 kW	91.3 MHz	7.68 mi
5	WOODBURN	IN	WBYR	LIC	50. kW	98.9 MHz	14.62 mi
6	PAULDING	OH	WKSD	LIC	3. kW	99.7 MHz	9.71 mi
7	PAULDING	OH	WKSD	USE	Na	99.7 MHz	8.57 mi
8	HICKSVILLE	OH	970205MD	USE	Na	106.7 MHz	13.12 mi
9	HICKSVILLE	OH	WFGA	LIC	2.85 kW	106.7 MHz	12.74 mi
10	NEW HAVEN	IN	WJFX	USE	Na	107.9 MHz	13.60 mi

IN = Indiana
OH = Ohio
MHz = kilohertz
kW = kilowatt
mi = mile
Tx-ERP= transmit effective radiated power

LIC = Licensed and Operational
APP = License Applied for but station Is Not Yet Operational
USE = Frequency Assigned Awaiting License
NEW = New Station Call Sign Not Assigned
Na = Not applicable
*Distance from wind turbine area center point to station antenna

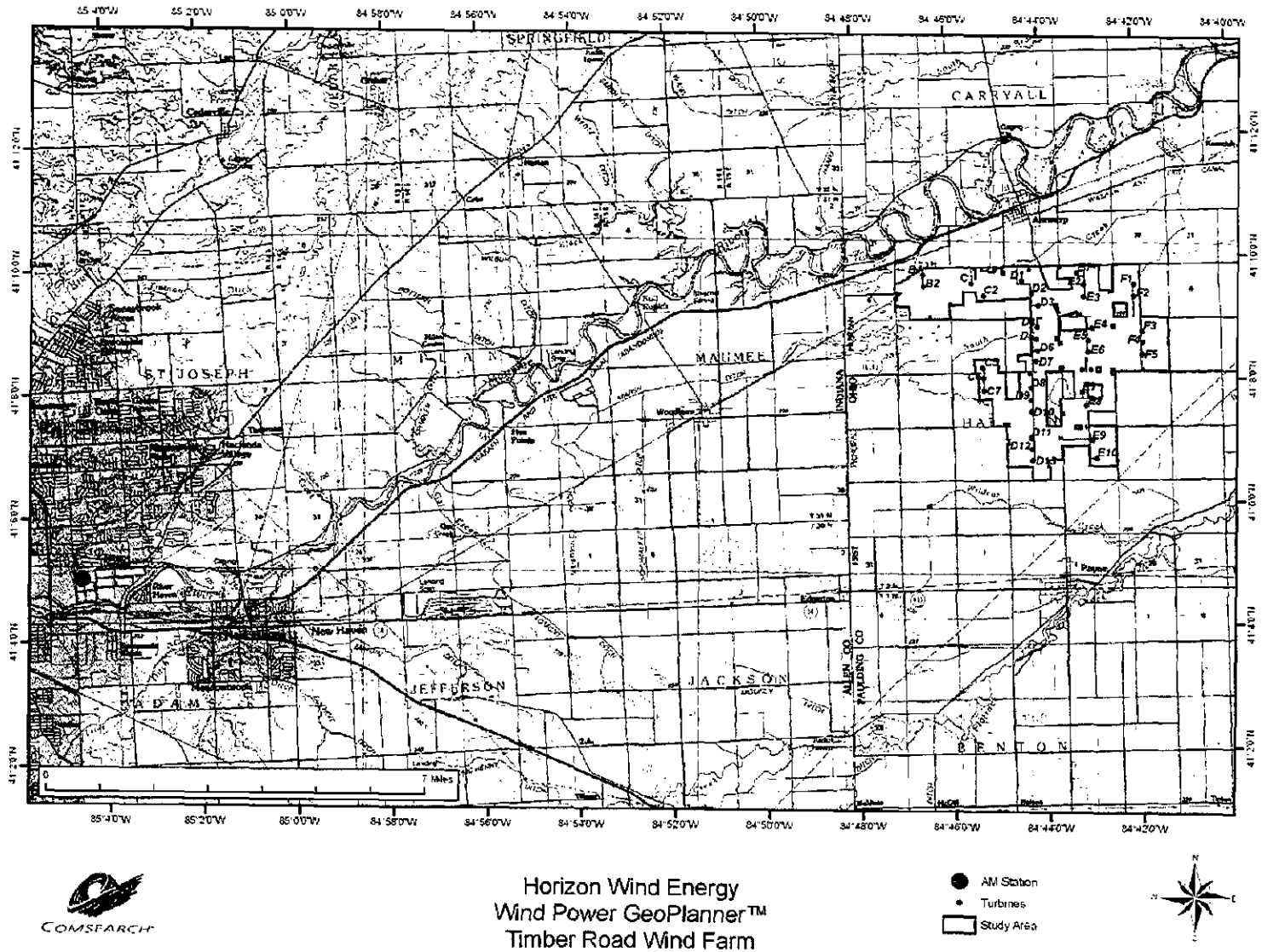


Figure 1 AM Stations in the Vicinity of the Timber Road Wind Farm Area

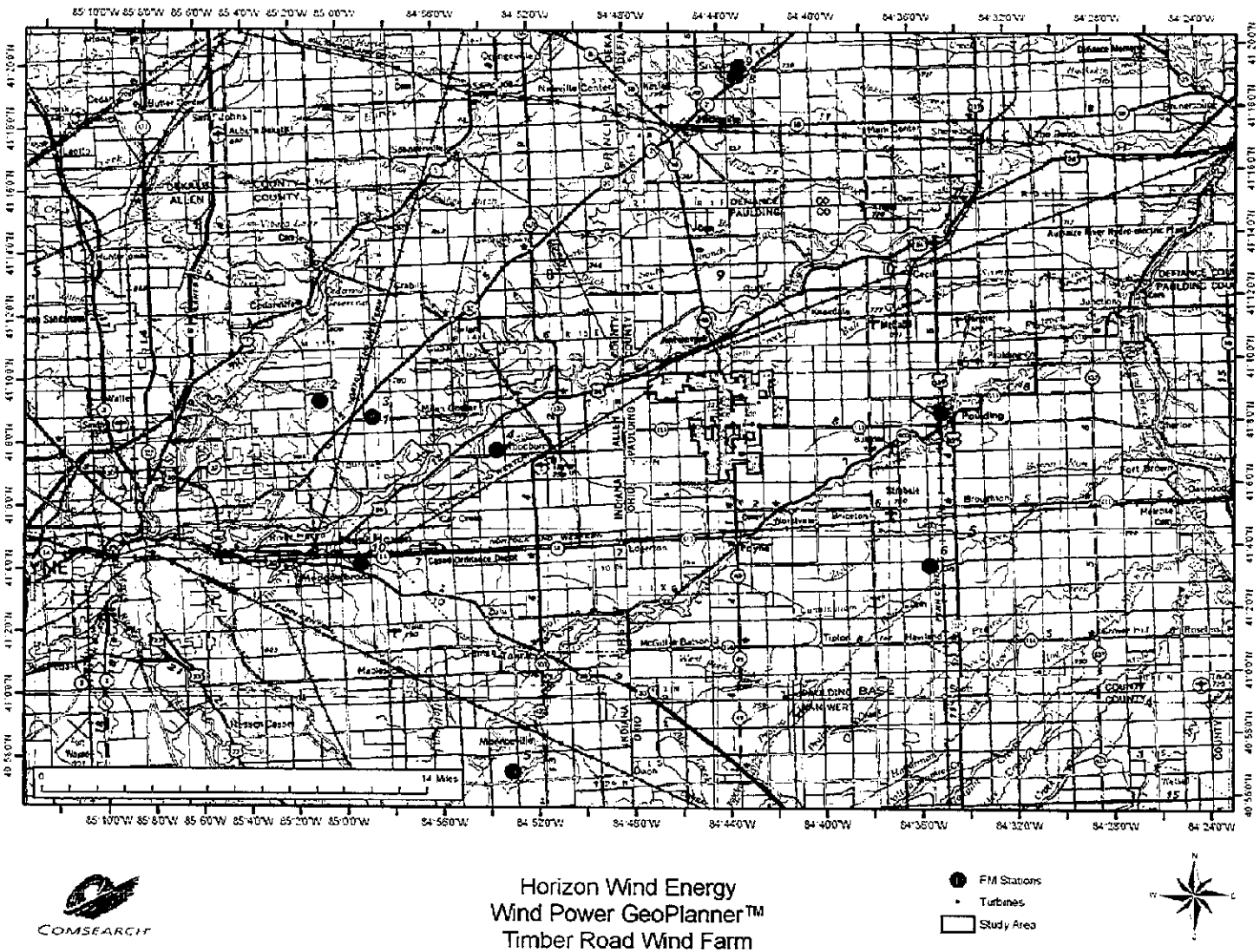
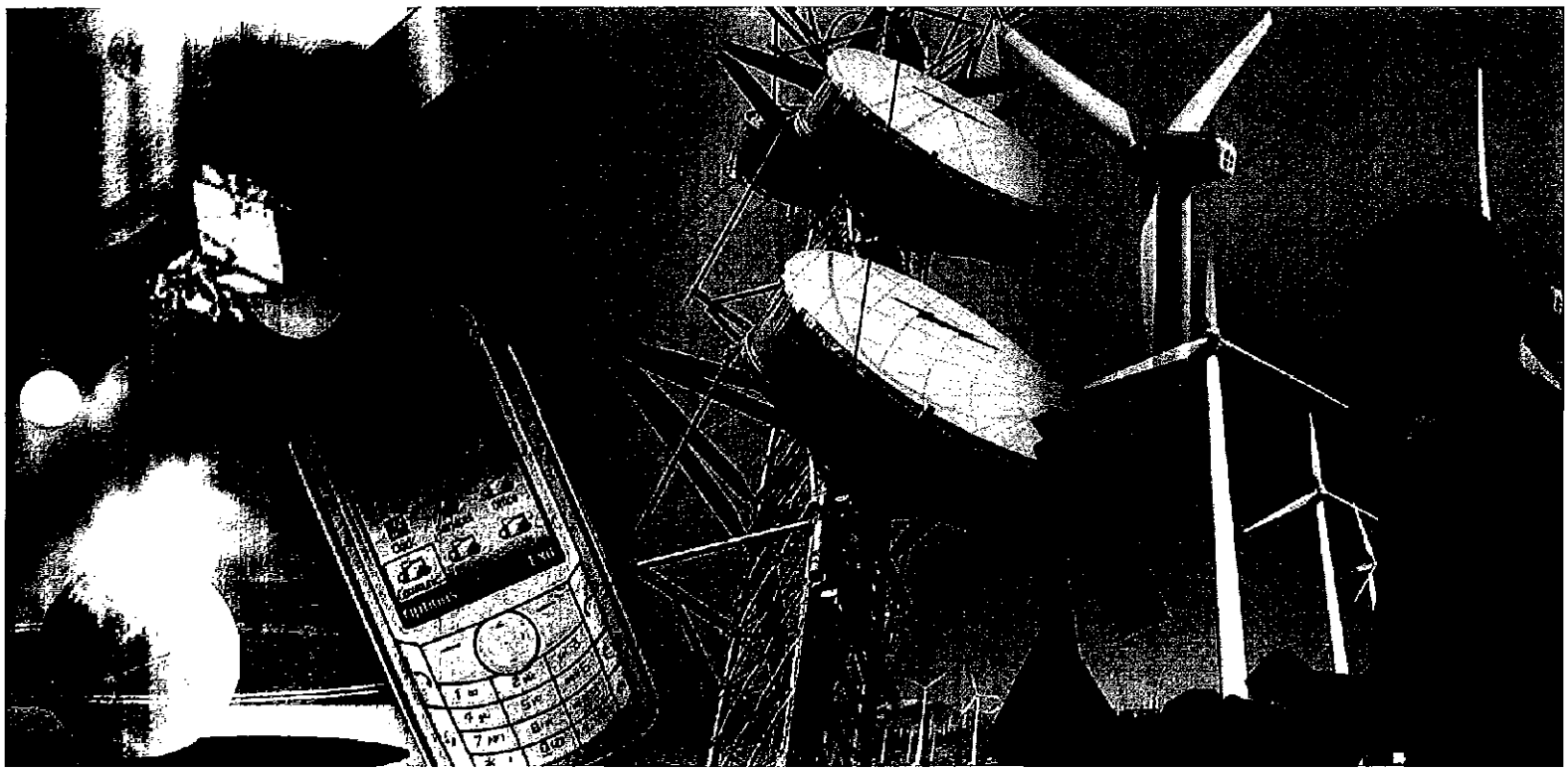


Figure 2 FM Stations in the Vicinity of the Timber Road Wind Farm Area

Wind Power GeoPlanner™

Licensed Microwave Report

Timber Road Wind Farm



Prepared on Behalf of
Horizon Wind Energy

October 6, 2009

COMSEARCH
A CommScope Company

Table of Contents

1. Introduction

The use of wind energy, one of the oldest forms of harnessing a natural energy source, is now one of the world's fastest growing alternative energy sources. The United States is committed to the use of wind energy, and over the next several years billions of dollars will be spent on wind power projects. However, as new wind turbine generators are installed around the country, it is important to note that they may pose an interference threat to existing microwave systems and broadcast stations licensed to operate in the United States.

Wind turbines can interfere with microwave paths by physically blocking the line-of-sight between two microwave transmitters. Additionally, wind turbines have the potential to cause blockage and reflections ("ghosting") to television reception. Blockage is caused by the physical presence of the turbines between the television station and the reception points. Ghosting is caused by multipath interference that occurs when a broadcast signal reflects off of a large reflective object—in this case a wind turbine—and arrives at a television receiver delayed in time from the signal that arrives via direct path.

Many states and other jurisdictions recognize the need for regulations addressing interference to radio signal transmissions from the wind turbine installations. Specifically, local planning authorities typically require project developers to ensure wind turbines will not cause interference. In some cases they require developers to notify the telecommunication operators in the area of the proposed wind turbine installation. Other factors prompting developers to undertake proactive investigation into potential interference include the need to prevent legal and regulatory problems and the desire to promote goodwill within the community—a good neighbor approach.

Comsearch has developed and maintains comprehensive technical databases containing information on licensed microwave networks throughout the United States. Microwave bands that may be affected by the installation of wind turbine facilities operate over a wide frequency range (900 MHz – 23 GHz). These systems are the telecommunication backbone of the country, providing long-distance and local telephone service, backhaul for cellular and personal communication service, data interconnects for mainframe computers and the Internet, network controls for utilities and railroads, and various video services.

This report focuses on the potential impact of wind turbines on licensed non-federal government microwave systems. Comsearch provides additional wind energy services, a description of which can be found at the end of this report.

2. Summary of Results

An overall summary of results appears below.

Project Information

Name: Timber Road Wind Farm

County: Paulding

State: Ohio

Number of Microwave Paths Analyzed	Number of Turbines	Number of Potential Obstructions
1	35	0

Methodology

Our obstruction analysis was performed using Comsearch's proprietary microwave database, which contains all non-government licensed paths from 0.9 - 23 GHz[1]. First, we determined all microwave paths that intersect the area of interest[2]. The area of interest was defined by the client and encompasses the planned turbine locations. Next, for each microwave path that intersected the project area, we calculated a Worst Case Fresnel Zone (WCFZ). The mid-point of a full microwave path is the location where the widest (or worst case) Fresnel zone occurs. Fresnel zones were calculated for each path using the following formula.

$$Rn \cong 17.3\sqrt{\frac{n}{F_{GHz}}\left(\frac{d_1 d_2}{d_1 + d_2}\right)}$$

Where,

R_n = Fresnel Zone radius at a specific point in the microwave path, meters
n = Fresnel Zone number, 1
F_{GHz} = Frequency of microwave system, GHz
d_1 = Distance from antenna 1 to a specific point in the microwave path, kilometers
d_2 = Distance from antenna 2 to a specific point in the microwave path, kilometers

For worst case Fresnel zone calculations, $d_1 = d_2$

[1] Please note that this analysis does not include unlicensed microwave paths or federal government paths that are not registered with the FCC.

[2] We use FCC-licensed coordinates to determine which paths intersect the area of interest. It is possible that as-built coordinates may differ slightly from those on the FCC license.

The calculated WCFZ radius, giving the linear path an area or swath, buffers each microwave path in the project area. See the Tables and Figures section for a summary of paths and WCFZ distances. In general, this is the two-dimensional area where the planned wind turbines should be avoided, if possible. A depiction of the WCFZ overlaid on topographic basemaps can be found in the Tables and Figures section, and is also included on the enclosed CD[3].

Discussion of Potential Obstructions
For this project, 35 turbines were considered in the analysis, each with a blade diameter of 100 meters and hub height of 80 meters.

None of the turbines were found to have a potential conflict with the incumbent microwave paths.

[3] The ESRI® shapefiles contained on the enclosed CD are in NAD 83 UTM Zone 16 projected coordinate system.

3. Tables and Figures

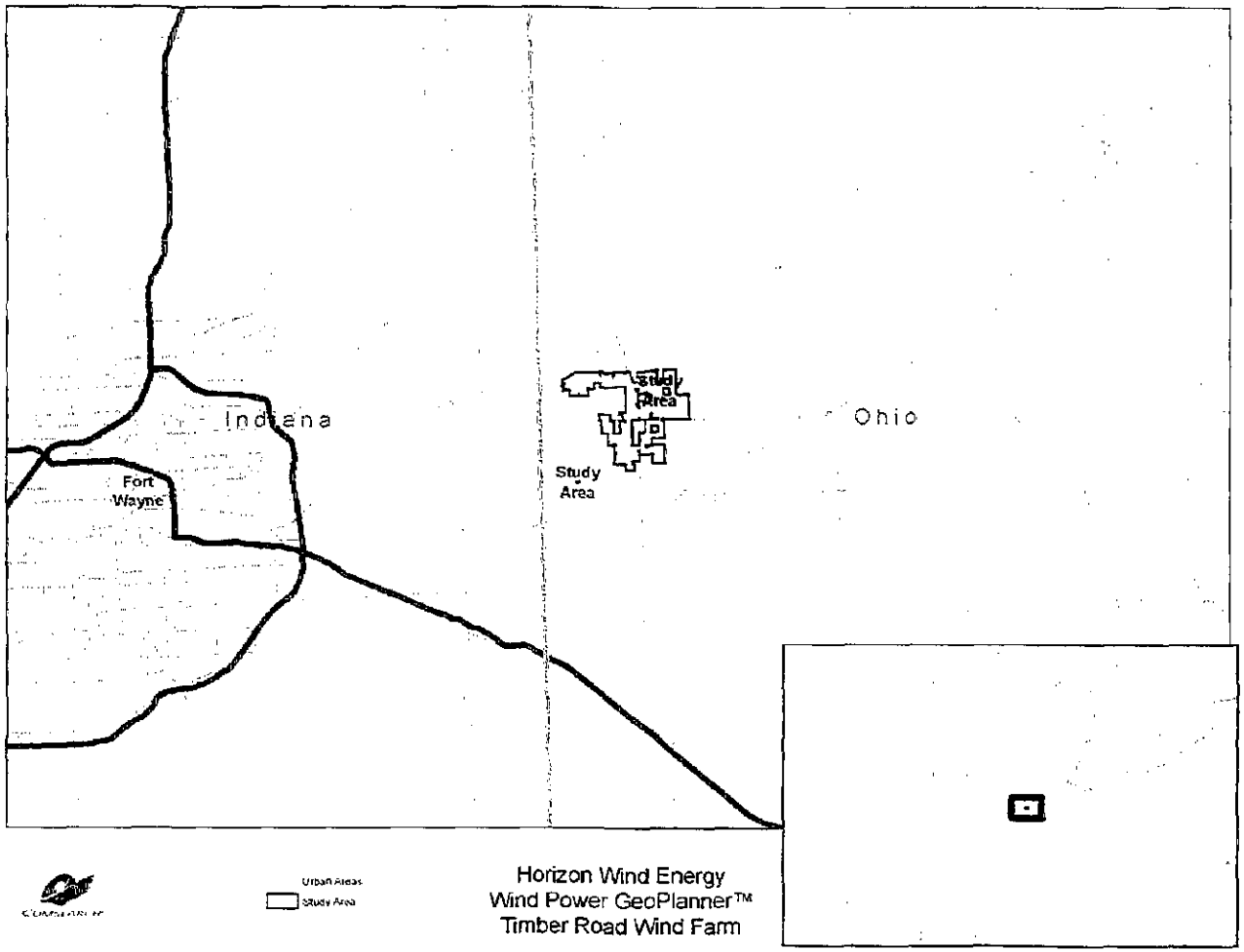


Figure 1: Area of Interest

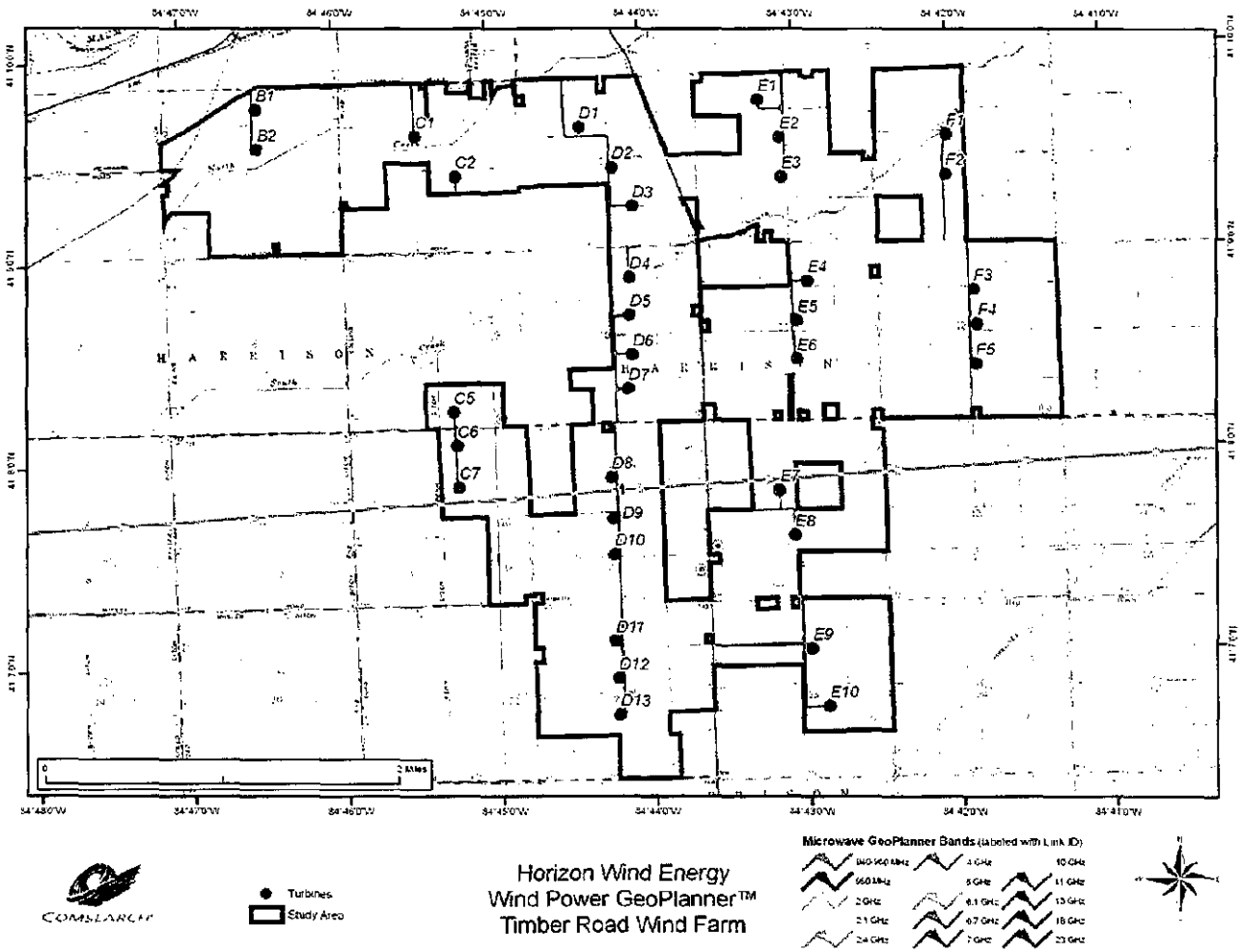


Figure 2: Microwave Paths that Intersect the Study Area

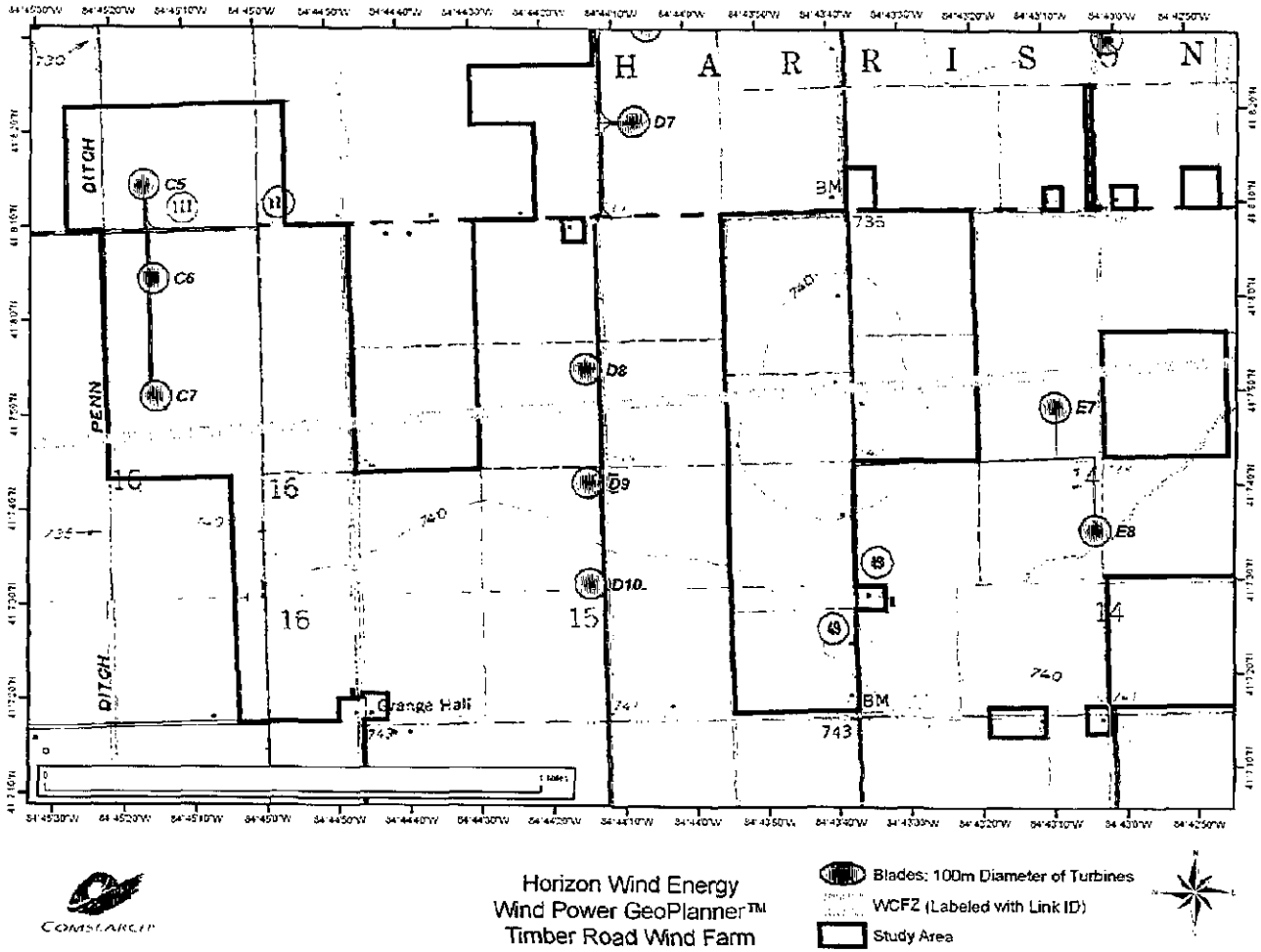


Figure 3: Microwave Paths with WCFZ Buffers

ID	Site Name 1	Site Name 2	Callsign 1	Callsign 2	Band	Licensee	WCFZ (m)
1	MILAN	PAULDING	WPQX475	WNEH649	Lower 6 GHz	INDIANA MICHIGAN POWER COMPANY	17.97

Table 1: Microwave Paths that Intersect the Area of Interest

(See enclosed mw_geopl.xls for more information and GP_dict_matrix_description.xls for detailed field descriptions)

4. Contact Us

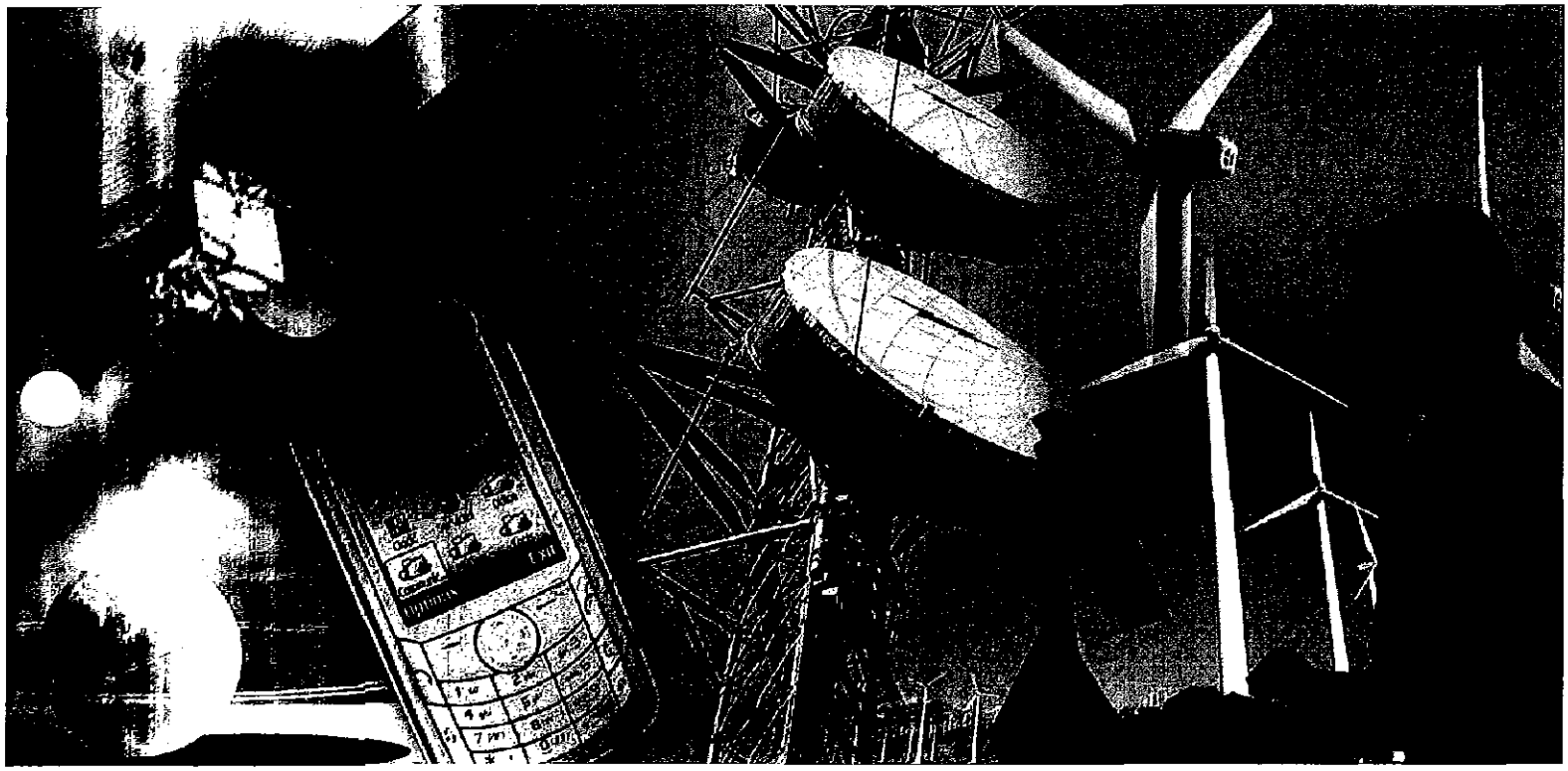
For questions or information regarding the Licensed Microwave Report, contact:

Contact person:	Denise Finney
Title:	Account Manager
Company:	Comsearch
Address:	19700 Janelia Farm Blvd., Ashburn, VA 20147
Telephone:	703-726-5650
Fax:	703-726-5595
Email:	dfinney@comsearch.com
Web site:	www.comsearch.com

Wind Power GeoPlanner™

Tower Structures Report

Timber Road Wind Farm



Prepared on Behalf of
Horizon Wind Energy

September 30, 2009

COMSEARCH
A CommScope Company

Table of Contents

1. Introduction

Comsearch compiles and provides information on communications towers identified within or near a defined area of interest related to proposed wind energy facilities. This information is useful in the planning stages of the wind energy facilities to identify the communication tower locations and owner-operator information. This data can be used in support of the wind energy facilities communications needs or to avoid any potential impact to the current communications services provided in that region.

2. Summary of Results

Methodology

Our tower structures report is derived from a variety of sources including the FCC's Antenna Structure Registration (ASR) database and the top ten nationwide tower owner databases. The data is imported into GIS software and the structures are geographically mapped with the wind energy area of interest defined by the customer. Each tower location on the map is identified with an ID number associated with detailed structure information provided in a data table.

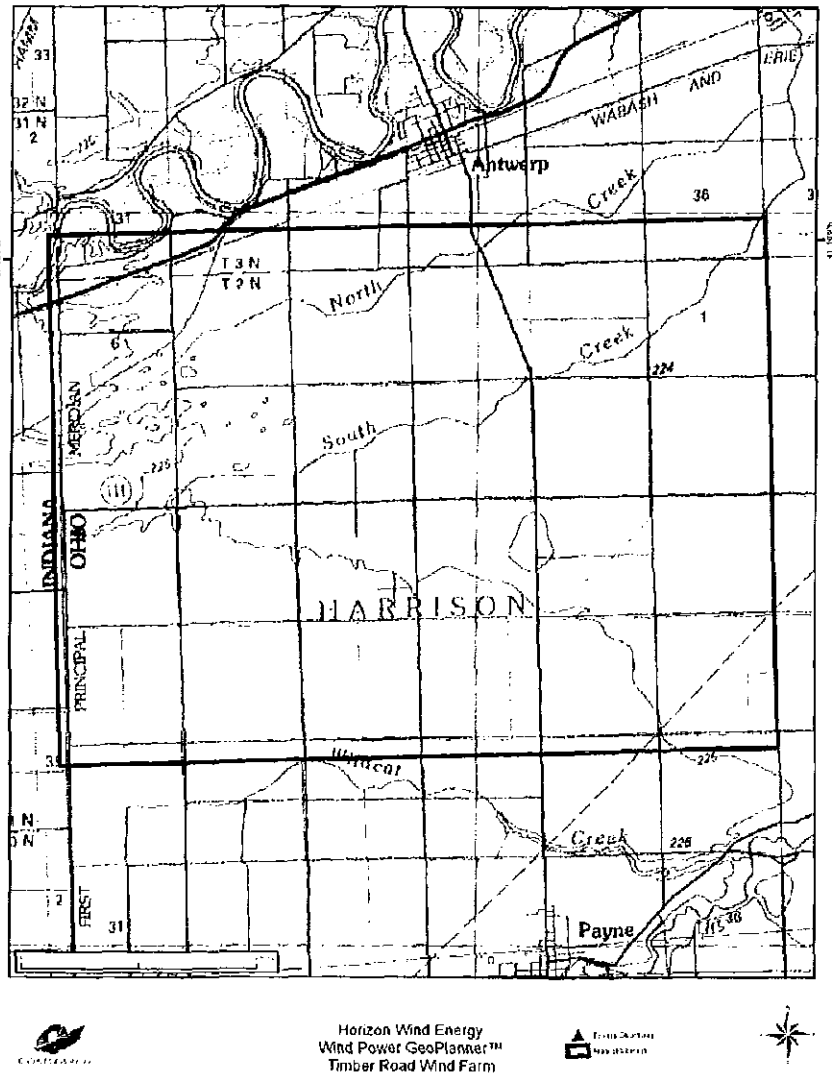


Figure 1: Tower structures near the Area of Interest

Results

Using the data sources described above, Figure 1 identifies no tower structures within the wind energy area of interest in Paulding County, Ohio. If towers existed, specific information about these structures would be provided in Table 1 including location coordinates, structure height above ground level, and owner-operator name.

Tower ID	ASR Number (if known)	Owner-Operator	Structure Height AGL (m)	City	ST	Latitude (NAD83)	Longitude (NAD83)
NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE

Table 1: Summary of Tower Structures

In planning the wind energy turbine locations, a conservative approach would dictate not locating any turbines in close proximity to tower structures to avoid any possible impact to the communications services provided by these towers. Additionally, any tower structures identified could be a potential benefit in support of communications network needs for the wind energy facility. An example would be the implementation of a Supervisory Control and Data Acquisition (SCADA) system that monitors and provides communications access to the wind energy facility.

3. Contact Us

For questions or information regarding the Tower Structures Report, contact:

Contact person:	Denise Finney
Title:	Account Manager
Company:	Comsearch
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Telephone:	703-726-5650
Fax:	703-726-5595
Email:	dfinney@comsearch.com
Web site:	www.comsearch.com

UNITED STATES DEPARTMENT OF COMMERCE
National Telecommunications and Information Administration
Washington, D.C. 20230

OCT 19 2009

Mr. Lester Polisky
Sr. Principal Engineer
COMSEARCH
19700 Janelia Farms Blvd.
Ashburn, VA 20147

Re: Paulding I Wind Project, in Paulding County, OH

Dear Mr. Polisky:

In response to your request on August 28, 2009, the National Telecommunications and Information Administration provided to the federal agencies represented in the Interdepartment Radio Advisory Committee (IRAC) the plans for the Paulding I Wind Project, in Paulding County, Ohio.

After a 45 day period of review, no federal agencies identified any concerns regarding blockage of their radio frequency transmissions.

While the IRAC agencies did not identify any concerns regarding radio frequency blockage, this does not eliminate the need for the wind energy facilities to meet any other requirements specified by law related to these agencies. For example, this review by the IRAC does not eliminate any need that may exist to coordinate with the Federal Aviation Administration concerning flight obstruction.

Thank you for the opportunity to review these proposals.

Sincerely,

Edward M. Davison
Deputy Associate Administrator
Office of Spectrum Management

EXHIBIT Q

Transportation Study

TRANSPORTATION STUDY

FOR

Timber Road Wind Farm

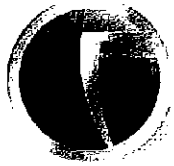
Paulding County, Ohio

Owner:

Paulding Wind Farm LLC
808 Travis Street
Suite 700
Houston, Texas 77002

Published: December 2009

Prepared By:



FISHERASSOCIATES

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TABLE OF CONTENTS

I. Introduction

Fisher Associates, P.E., L.S., P.C. (FA) has been contracted by Paulding Wind Farm LLC to complete a Transportation Study for the proposed Timber Road Wind Farm. The project is located in Harrison Township in Paulding County, Ohio as shown on the Site Location Map in Figure 1 and the Site Location Aerial Map in Figure 2. This report reviewed the existing local roadway conditions within the study area. The review revealed areas where modifications to the roadway system will be required to accommodate construction activities. Note that the proposed plan is only one potential improvement plan, though there may be others that could also be feasible.

A. Timber Road Project Delivery Route

All component delivery traffic is currently assumed to enter the study area from the south on State Route 49. Note that there is the potential that components could come from various sources and directions. Based on the data collected in this study, components arriving on alternate roadways such as the new Route 24 or from other directions will necessitate improvements similar to those contained herein.

Roadways outside the study area will be evaluated by the hauling company delivering the turbine components prior to construction. This will occur as part of the Special Hauling Permit process. A Special Hauling Permit is required for vehicles and/or loads that exceed the legal maximum dimensions or weights specified by Special Hauling Permit Section of the Ohio Department of Transportation. The *Legal Dimensions and Weight Limits for Highway Vehicles* is included in Appendix B.

B. Construction Vehicles

Construction traffic will consist of standard construction equipment and specialized hauling trucks to deliver the turbine components. Standard construction traffic consists of gravel/dump trucks, concrete trucks, excavation equipment, conventional semi-trailers, transport/tool vehicles and employee vehicles. These standard construction vehicles should not require physical modifications to the roadways to accommodate their presence.

Delivery of the wind turbine components will utilize Over-Size/Over-Weight (OS/OW) trucks to bring the components from the manufacturer to the study area. The OS/OW trucks are special hauling vehicles with unique lengths, widths, heights, and weights depending on the component being transported. These trucks require particular clearances due to their size and turning radii. The actual vehicles used to deliver the turbines varies dependent on the transportation contractor. For this study a minimum inside radius of 150 feet has been used to model intersection modification scenarios. A 150-foot radius is a conservative design standard used when developing improvements for wind power component delivery. The following is a summary of typical wind turbine components with corresponding truck configurations:

Wind Turbine Part	Approx. Component Weight (lbs.)	Comp. Length (ft)	Comp. Height / Dia. (ft)	Comp. Width (ft)	Truck Description	Overall Length (ft)	Overall Height (ft.)	Overall Width (ft.)	Est. Gross Vehicle Wt. (lbs.)
Rotor Blade	14,800	160.8	12.8	7.2	5-Axle Double Drop Stretch	180	14	11'-6"	45,000
Two Blade cage	33,100	141.4	9.7	12.8	5-Axle Double Drop Stretch	180	14	13'-0"	45,000
Base Tower	92,500	48.0	14.1	-	6-Axle Stretch	108	16	13'-6"	150,000
Lower Mid Tower	135,300	56.7	13.3 dia.	--	6-Axle Stretch	113	16	13'-6"	165,000
Mid Tower	105,150	56.8	13.2 dia.	--	6-Axle Stretch	113	16	13'-6"	135,000
Upper Mid Tower	87,000	64.7	13.2 dia.	--	6-Axle Stretch	113	16	13'-6"	120,000
Top Tower	62,600	80.7	13.2 dia.	--	6-Axle Stretch	113	16	13'-6"	95,000
Nacelle	165,400	34.1	13.3	13.1	11-Axle Low Profile	160	16	13'-6"	200,000
Hub Assembly	33,250	13.8	10.8	13.1	8-Axle Stretch	102	15	14'-0"	75,000

All truck configurations are based on previous projects. The truck configurations will need to be finalized after components and hauling company have been selected.

This report determines potential impacts to the existing traffic capacity / patterns and roadway features due to the anticipated construction/delivery traffic. For each impact, proposed mitigation methods are identified to address specific deficiencies due to the additional traffic created during construction and due to the requirements of the OS/OW vehicles.

II. Traffic

This section summarizes the existing conditions and potential impacts to the traffic flow along the delivery routes.

A. Traffic Flow and Capacity

A review of the State and County routes in the study area indicates that all appear to be operating below vehicle capacity. Detailed capacity analysis was not completed for this study; however, field observation of the transportation network did not reveal any locations where traffic flow and/or capacity appeared to create undue delay for the traveling public.

The following table presents the existing available traffic data along several of the roadways that are currently proposed for construction traffic. Note that data was not available for all roadways.

Roadway Name	Lanes	Travel Lane Widths	Shoulder Widths	Surface Type	AADT
SR 49	2	11'	1' (asphalt) 1' (gravel)	asphalt	2,300
SR 111 (east of SR 49)	2	11.5'	1' (asphalt) 1' (gravel)	asphalt	750
SR 111 (west of SR 49)	2	11'	1.5' (asphalt) 1' (gravel)	asphalt	1400
TR 144	2	9'	1.5' (gravel)	asphalt	80
TR 162	2	9'	1' (gravel)	asphalt/gravel	40
TR 33	2	9'	1' (gravel)	asphalt	40

* SR = State Route, CR = County Route, TR = Township Route
* AADT = Annual Average Daily Traffic.
* Traffic volumes for State routes obtained from the Ohio DOT Paulding County Annual Average Daily Traffic Report dated 2006.

1. During Construction

There will be approximately 10 OS/OW trucks required for each turbine. Depending on the turbine selected for the project, there will be approximately 23-32 turbines. For impact calculation purposes, this study assumes 32 turbines will be required. This equates to a total 320 OS/OW vehicle trips along with multiple standard construction equipment trips which could include the following:

- Gravel trucks with capacity of approximately 10 cubic yards (cy) per truck and an estimated gross weight of 75,000 pounds (lbs), for access road construction (currently the total length of the access roads is 58,000 feet long and 34 feet wide with gravel 15 inches deep; total of approximately 9,000 to 9,500 trips).
- Concrete trucks for construction of turbine foundations and transformer pads with capacity of approximately 10 cy per truck and an estimated gross weight of

96,000 lbs (total of approximately 40 trips per foundation depending on final design).

- Variety of conventional semi-trailers for delivery of reinforcing steel (two per turbine foundation) and small substation components and interconnection facility material (approximately 30 to 50 trucks).
- Pickup trucks for equipment and tools.
- Trucks and cars for transporting construction workers.

While OS/OW vehicles are traveling along study area and delivery route roadways, the existing traffic may experience minor delays as escort vehicles, flag persons, and/or temporary traffic signals slow or stop traffic to allow the safe passage of the OS/OW vehicles. As the existing traffic volumes are low, local traffic flow should not be significantly impacted by standard construction traffic or during OS/OW load transport.

2. Post Construction

The project will employ approximately 10 to 15 individuals, all of whom may drive separately to the Operation and Maintenance (O&M) building. Some of these personnel will need to visit each turbine location and return to the O&M building. Each turbine typically requires routine maintenance visits once every 3 months, but certain turbines or other project improvements may require periods of more frequent service visits should a problem arise. Such service visits typically involve 1 to 2 pick-up trucks.

Project personnel (or utility company personnel) may also need to service the project substation. Such servicing would likely be carried out on a similar quarterly basis (unless a problem arose) and would involve a similar number of maintenance vehicles.

Based on the preceding information, employee/maintenance traffic is not anticipated to have a significant impact on the local traffic patterns.

B. Projected Traffic Impacts & Proposed Mitigation

Traffic Flow and Capacity

Impact – During construction activities local traffic may experience minor delays due to slow moving vehicles and increased construction related traffic.

Mitigation – No areas appear to warrant immediate installation of measures to mitigate the minor delays that will be experienced by local traffic. The applicant should, in conjunction with the County, State, and local highway departments, establish a traffic/transportation notification protocol to respond to any locations that experience significant traffic flow or capacity issues. The following is a protocol that could be used for the project:

- Prior to construction the applicant will identify one or more construction managers as the primary traffic contact(s) for traffic/transportation concerns that may arise during the construction of the project.
- The Town, County, and State Highway departments will be notified of the primary traffic contact(s).
- All construction personnel will be instructed to watch for traffic/transportation concerns and to contact the primary traffic contact immediately following a traffic/transportation issue.
- The primary traffic contact will call the appropriate Town, County, or State Highway Department immediately following identification of a congestion problem.
- The applicant will consult with all town and county highway departments prior to construction to identify potential traffic congestion areas and to develop potential detours.
- If construction-related congestion occurs, the primary traffic contact will call the appropriate Town, County, or State Highway Department immediately and discuss the implementation of pre-determined detour routes.

III. Transportation Systems

The physical characteristics assessment completed as a part of the study included a review of the roadway widths, drainage structures, bridges, intersection geometry, overhead wires, and roadway alignments. Each bridge or drainage structure found in the field was inventoried for approximate location, type, size, approximate depth of cover over the structure, and roadway width at the structure. The structure and road data is included in Figure 3 – Figure 6.

Figure 7 presents the roadways currently proposed for construction traffic. This Construction Route appears to best accommodate construction traffic based on the factors listed above. The following discussion presents the factors and any impacts and mitigation that should be addressed prior to construction.

A. Existing Roadway Conditions

1. Surface Type

Figure 3 presents the Roadway Type and Width. As depicted, the roadways within the study area are primarily paved. Portions of Routes 33, 162, and 61 are stone/gravel/rubbilized pavement while Routes 152 and 134 are grass / dirt. The paved roads in the study area appear to be in good condition and adequate to accommodate construction activities. Note that only a small portion of the stone / gravel / rubbilized pavement section of Route 162 is being considered for construction traffic. This area appears adequate for construction at the time of this report. This roadway should be reviewed prior to construction to determine if additional gravel and compaction is necessary to accommodate the construction traffic.

2. Roadway Width

The approximate roadways widths are presented in Figure 3. A minimum width of 16-feet will be required to accommodate construction traffic. Within the study area, all roadways proposed for use by construction vehicles are 16 feet in width (or greater), with the exception of TR 134, which is a 12-foot wide grass road. The bridges in the study area are generally narrower than the roadways and over-width vehicles will likely need to cross the center line to traverse the bridges.

3. Intersections

As shown in the diagrams in Figures 8 - 13, all intersections being used by the OS/OW trucks will need improvements to accommodate the OS/OW vehicles. Figure 7 depicts the anticipated OS/OW travel routes. All turns at intersections will need improvements to accommodate the construction traffic. Note that the intersection of Route 49 and Route 134 is not included in the individual intersection improvements. Route 134 will need to be completely improved to access road standards for the project.

Figures 8 - 13 examine each intersection traveled and details the improvements necessary to accommodate the OS/OW vehicles. There does not appear to be significant construction challenges (steep grades, existing structures, significant clearing, etc.) with any of the proposed improvements. Note that the intersections will need to be re-evaluated during final engineering once topographic mapping and final truck configurations are available to determine the optimal solution for each intersection.

4. Weight

The project area roads are not posted with weight limits. There are also no reported structures along these roadways that have posted weight limits.

5. Vertical Curvature

The profile of project roadways will be adequate to accommodate construction traffic with one potential exception. The turns off-from, on-to, and directly over Route 49 may require profile adjustments to accommodate the OS/OW vehicles. The Route 49 intersections will need to be reviewed during final design (after topographic survey is collected) to determine if the OS/OW vehicles will bottom-out at Route 49.

6. Height

Based on the OS/OW truck configurations, any locations along the travel routes with a vertical clearance less than 16 feet will need to be adjusted to allow movement. The Existing Overhead Wire map, Figure 4, presents the location of overhead utilities along the study area roadways.

The applicant will coordinate and obtain permits from the utility companies in order to adjust the utility lines crossing the roadways. The actual heights and proposed modifications will be included in the route survey for the Special Hauling Permits from the State. These measurements and verifications will be performed at a later date by the company contracted to deliver project components.

B. Existing Drainage Structures / Bridges

Drainage structures with a span length of greater than 10 feet are considered bridges and referenced as such in this summary. Information regarding bridge structure type and history was obtained from the Ohio Department of Transportation Bridge Management System bridge inspection reports inventory for the SFNs indicated. Information regarding culverts was obtained through field inspection and evalution.

1. Bridges

There are five bridge structures that were reviewed for this study:

- SFN 6334709 – Township Route 33 over South Creek
- SFN 6334725 – Township Route 144 over South Creek
- SFN 6300324 – State Route 49 over South Creek
- SFN 6334806 – Township Route 51 over South Creek
- SFN 6330789 – Township Route 162 over South Creek

The locations of these bridges can be found in Figure 5. The bridges will all carry loads over water. The bridge reports were reviewed to determine if each could accommodate the OS/OW vehicles. The bridges are safe for legal loads, do not have posted weight restrictions, and also have sufficient horizontal and vertical clearances to accommodate the OS/OW trucks. During final design of the project improvements, and after the turbine manufacturer and haul company have been selected, the bridges that will be part of the delivery route will be reevaluated with the actual axle configuration and loadings to determine if improvements are necessary. Note that the State Route 49 bridge is currently the only bridge proposed to experience construction related traffic. The following is a summary of the current bridge conditions

SFN Number / Route	Sufficiency Rating	Bridge Roadway Width (ft)	Design Load/Year Rated	Operating Rating (tons)	Inventory Rating (tons)	Ohio % of Legal Load	General Appraisal
6334709 TR 33	62.8	19.5	Unknown 2009	35	21	100	5 Fair
6334725 TR 144	63.0	18.0	Unknown 1992	45	36	75	4 Poor
6300324 SR 49	99.5	40.0	HS20-44 1993	45	36	150	7 Good
6334806 TR 51	95.0	24.0	HS20-44 1991	45	36	150	7 Good
6330789 TR 162	95.0	28.0	HS20-44 1987	41	32	150	8 Very good

* The Sufficiency Rating is on a scale of 1 to 100 percent, where 100 percent would represent an entirely sufficient bridge and zero percent would represent an entirely insufficient bridge.

2. Culverts

The Culvert Type & Diameter and Culvert Minimum Cover & Condition maps, Figures 5 and 6, present the locations of the drainage structures apparent in the field. For the purposes of this study, it is assumed that any culvert with less than 2 feet of cover may be susceptible to damage during construction activities. These locations will be further analyzed during final engineering to determine if improvements are necessary prior to construction of the turbines.

C. Projected Physical Impacts & Proposed Mitigation

Roadway Type – Paved & Stone/Gravel

Impact – The paved and stone/gravel surface conditions generally appear adequate to accommodate construction activities. These roads should be monitored during construction for pot-holing and rubbilizing of the pavement to ensure they are safe for general construction and local roadway traffic. The amount, type, and weight of both general construction traffic (gravel/concrete trucks, semi-trailers, etc.) and OS/OW vehicles will likely damage the surface condition of the roadways in the study area.

Mitigation – After completion of construction activities, the applicant should repair the roadway surface to preconstruction conditions. A roadway condition video survey can be completed prior to construction to document the existing surface conditions. The applicant will need to repair the roadways using the appropriate treatment (oil & stone, hot or cold mix asphalt) to re-establish the preconstruction surface conditions.

Roadway Type – Grass

Impact – The grass roadways will not be adequate for construction traffic. The surface type will be too soft to accommodate the volume and weight of construction traffic.

Mitigation – The grass roadways will need to be replaced with gravel roadways. The gravel roadways will need to be similar to the turbine access roads being constructed for the project. Post-construction, and as approved by the local municipality, these roads can be left in place as an upgrade to better accommodate local traffic.

Roadway Width – Route 134

Impact – Route 134 will need to be widened to accommodate construction traffic. Note that the intersection with Route 49 is not identified as a specific intersection improvement. The entire road will need to be upgraded to access road standards for the project.

Mitigation – During reconstruction, the roadway should be widened to a minimum of 16-feet.

Intersections

Impact – All intersections used by OS/OW vehicles will need radius improvements to accommodate construction activities (Figures 8 - 13). The intersection impacts include:

- Clearing and grubbing of existing vegetation
- Relocating traffic signs, fences, and utility poles
- Grading of the terrain to accommodate the improvement
- Extension of existing drainage pipes and/or culverts
- Re-establishment of ditch line (if necessary)
- Construction of a suitable roadway surface to carry the construction traffic (based on the existing geotechnical conditions)

Mitigation – Each public roadway intersection will require a detailed engineering plan to quantify and provide a solution for the impacts listed above. The intersection radii will generally need to be improved to 150-feet. This study provided a preliminary engineering solution that can be completed, based on observed field conditions, to accommodate the OS/OW vehicles. See Figures 8 - 13 for the preliminary recommendations. After construction of the project, the applicant should coordinate with the State, County, and local highway departments to determine if the radii improvements will need to be returned to preconstruction conditions or left for future use by the Town.

Weight

Impact – Six drainage pipes/culverts along the construction route have been identified as having 2-feet or less of cover as shown in Figure 6. These culverts may be crushed or deformed by construction activities causing construction delays, delays to local motorists, and damage to construction vehicles and/or turbine components.

Mitigation – Each pipe should be evaluated during final design of the roadway improvements to determine if improvements will be necessary to accommodate the construction activities. Improvements may include:

- Additional cover over pipes,
- Reinforce pipes with bracing,
- Use bridge jumpers to clear pipes,
- Use bridge plates to distribute vehicle loading,
- Replace pipes prior to construction,
- Replace pipes during

Impact – The bridges in the project area are safe for legal axle loads and do not have posted weight restrictions. The State Route 49 bridge is the only bridge proposed to experience construction related traffic. This location has sufficient horizontal and vertical clearances to accommodate the OS/OW trucks.

Mitigation – Based on the bridge study findings, it does not appear that the State Route 49 bridge will require mitigation for weight concerns. The bridge has a 99.5 Sufficiency Rating and is rated for 150 percent of the Ohio Legal Load. The structures should be reviewed during final design of the project improvements to verify no additional mitigation will be required. Note that the Ohio Department of Transportation will be required to review and approve all bridges to be used for construction during the Special Hauling Permit application process.

Vertical Curvature

Impact – The Route 49 intersections within the study area may need minor profile adjustments to accommodate the OS/OW vehicles.

Mitigation – Gravel fill can be placed on the approaches to Route 49 to smooth out the transition onto the side roads. This work can be completed in conjunction with the turning radius improvements discussed above. Post-construction, the fill can be removed to restore the pre-construction conditions.

Height

Impact – Overhead wires that do not meet OS/OW vehicle clearances will need to be raised to accommodate OS/OW vehicles.

Mitigation – The applicant will be required to coordinate with the utility companies to obtain the necessary permits to raise wires. The utility companies will assist in the final solution at each location once final engineering plans and permit applications have been submitted. Solutions include permanently raising wires, temporarily raising wires for the duration of construction, or temporarily raising each wire as a vehicle passes under.

IV. Conclusion

This study has identified the transportation related impacts that may be experienced during construction of the Timber Road Wind Farm. Mitigation measures have been provided to accommodate the construction traffic and minimize impacts to the traveling public. Final engineering design will be required prior to construction activities to ensure all transportation related impacts have been addressed to the satisfaction of the State and the local highway departments.

APPENDIX A

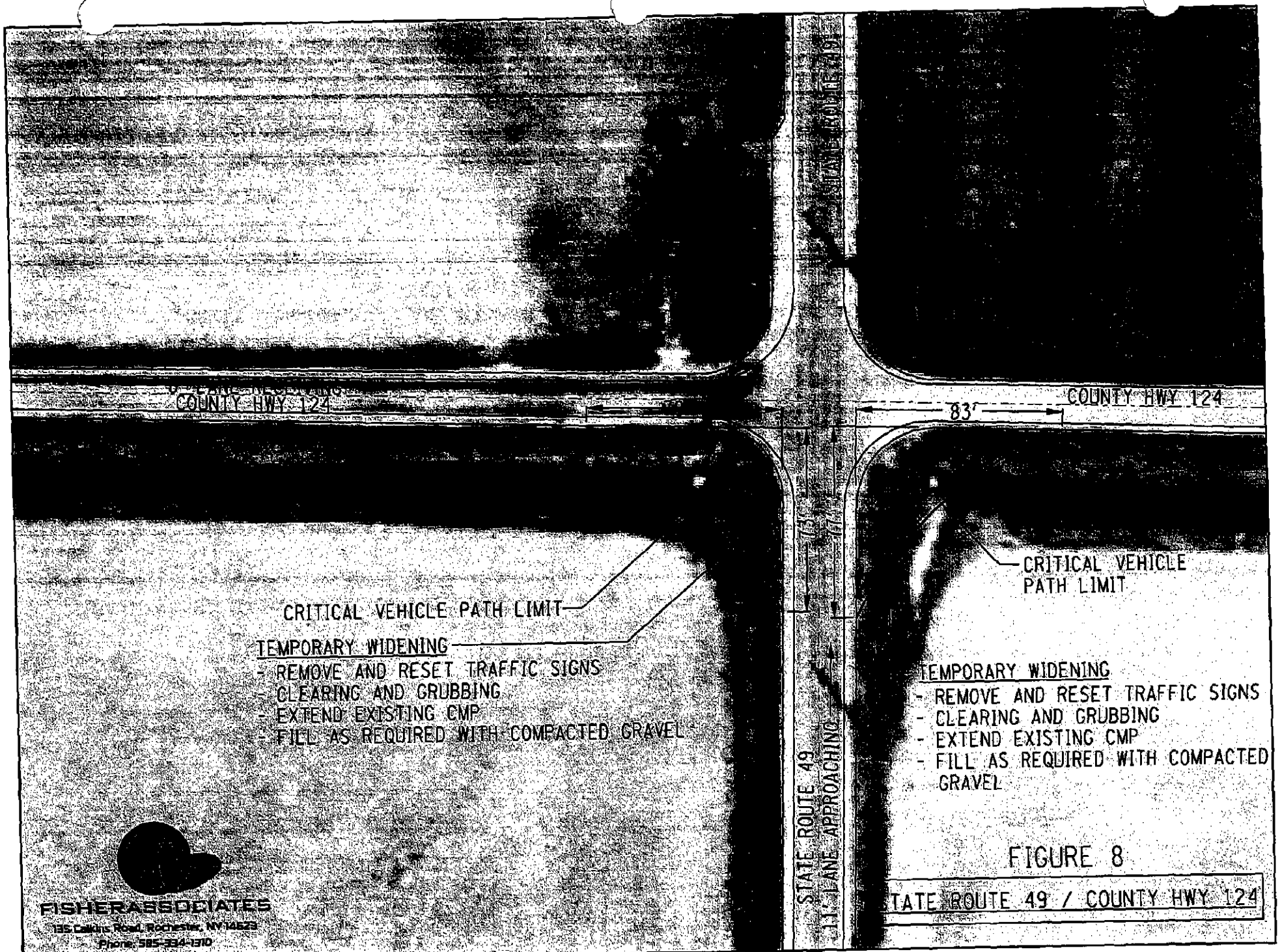
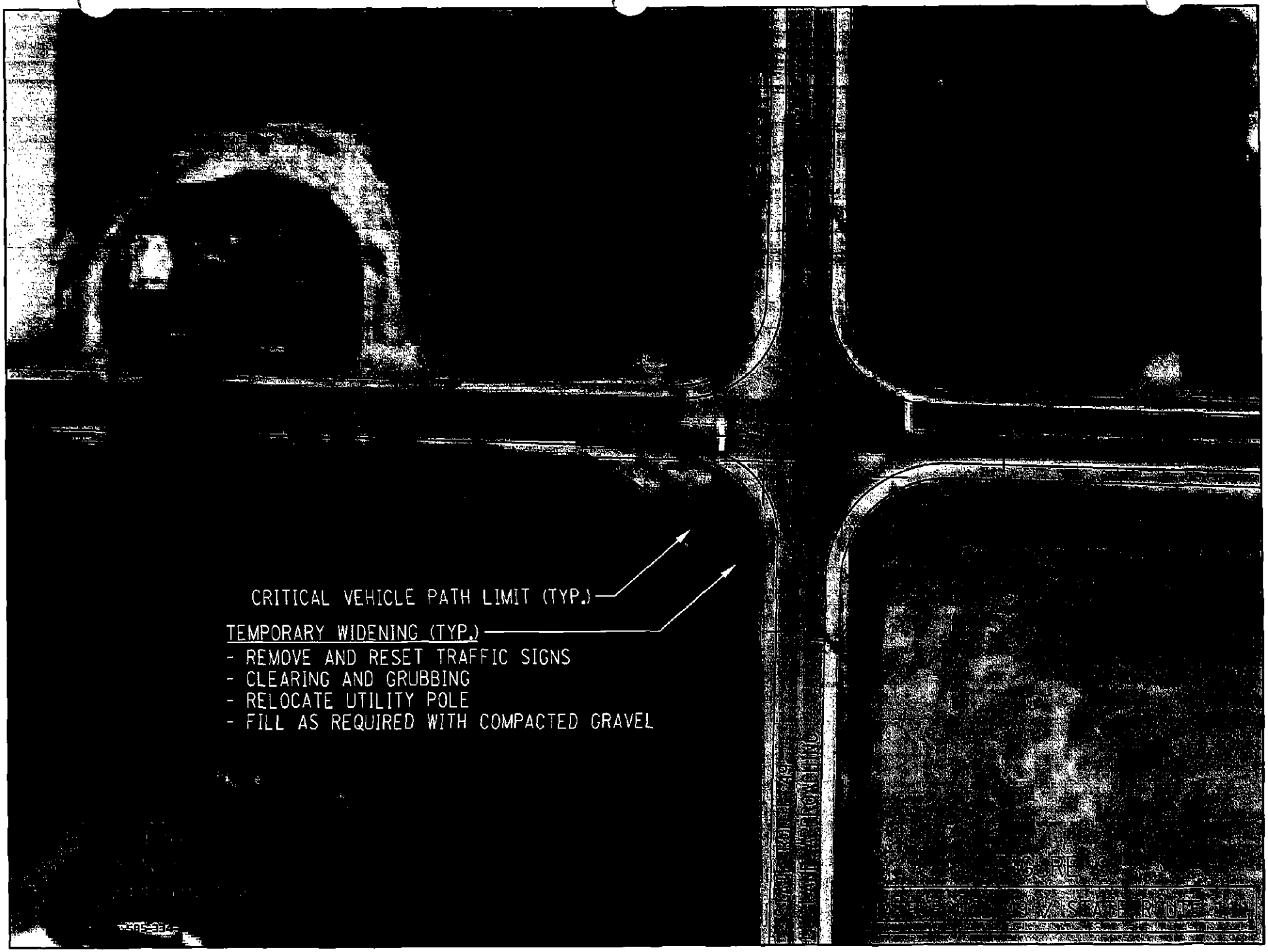
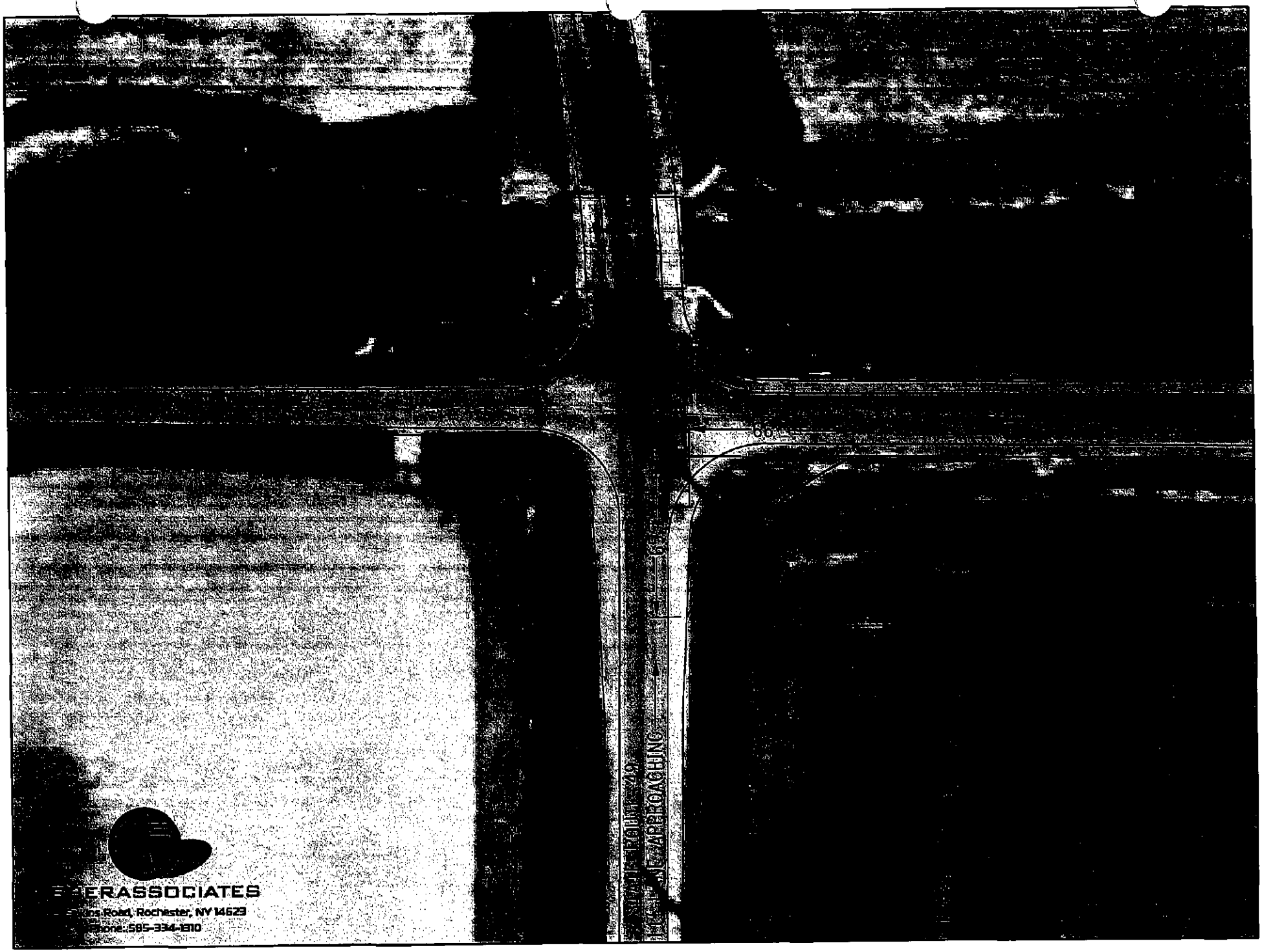


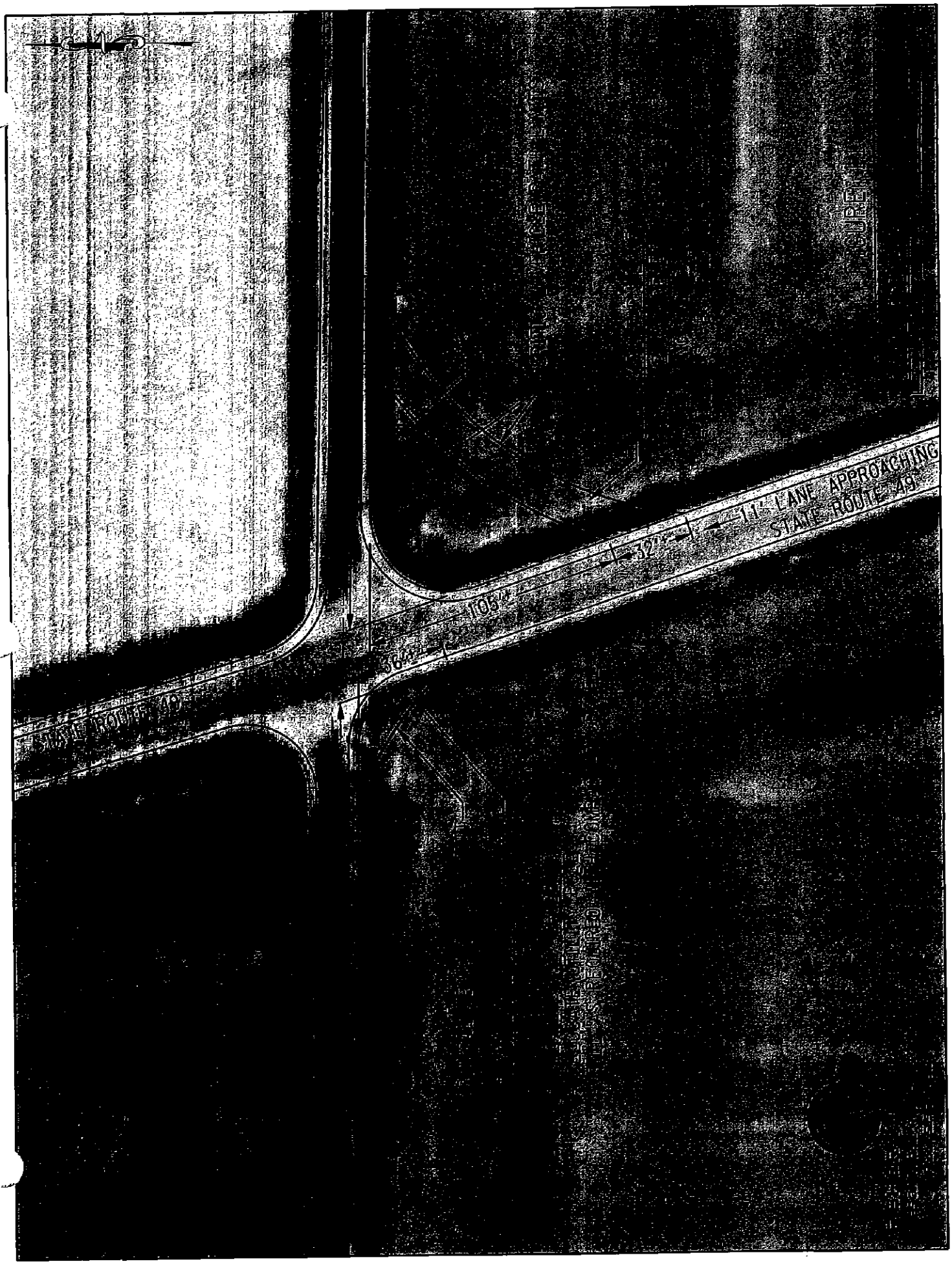
FIGURE 8

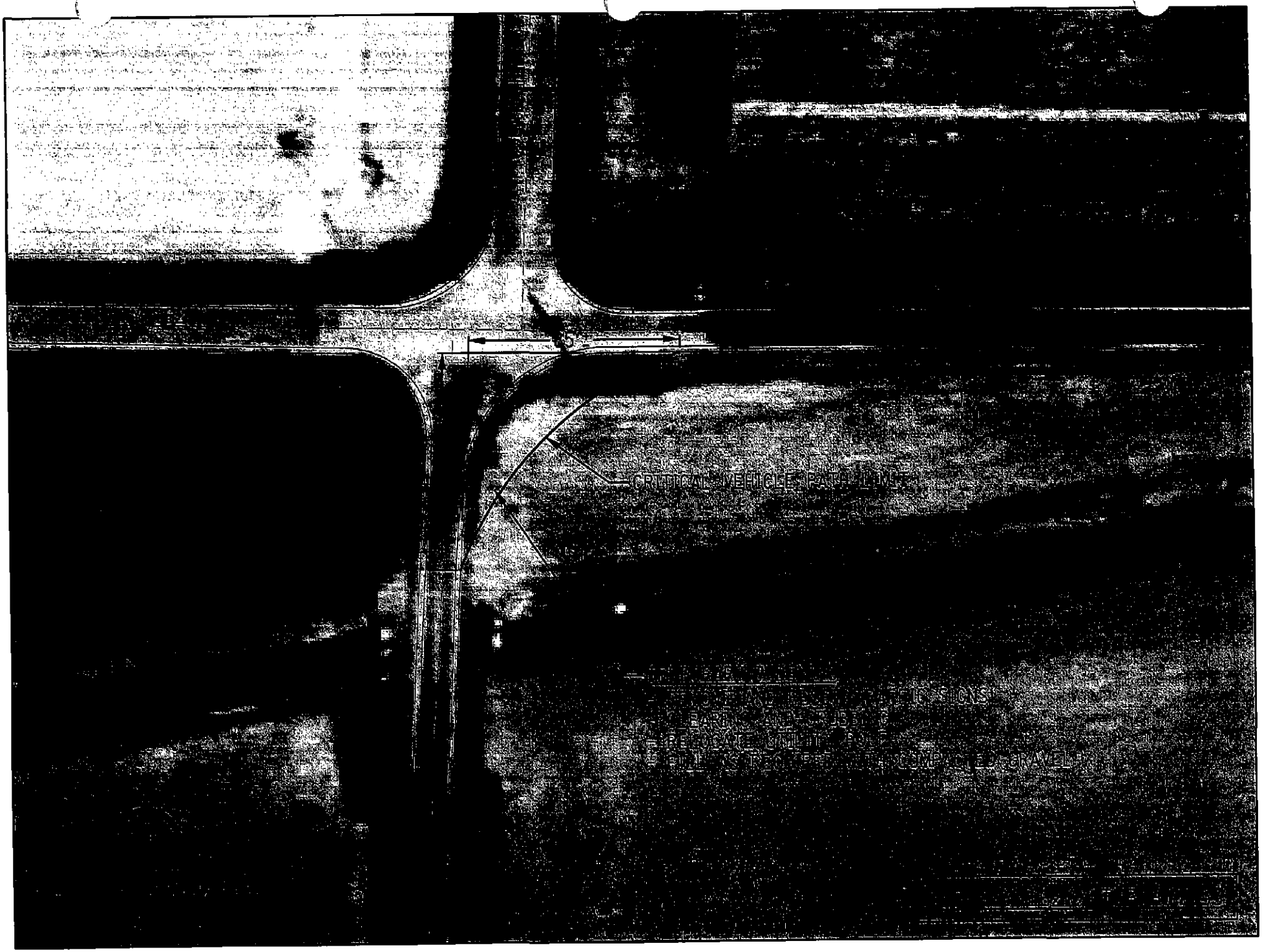
TATE ROUTE 49 / COUNTY HWY 124

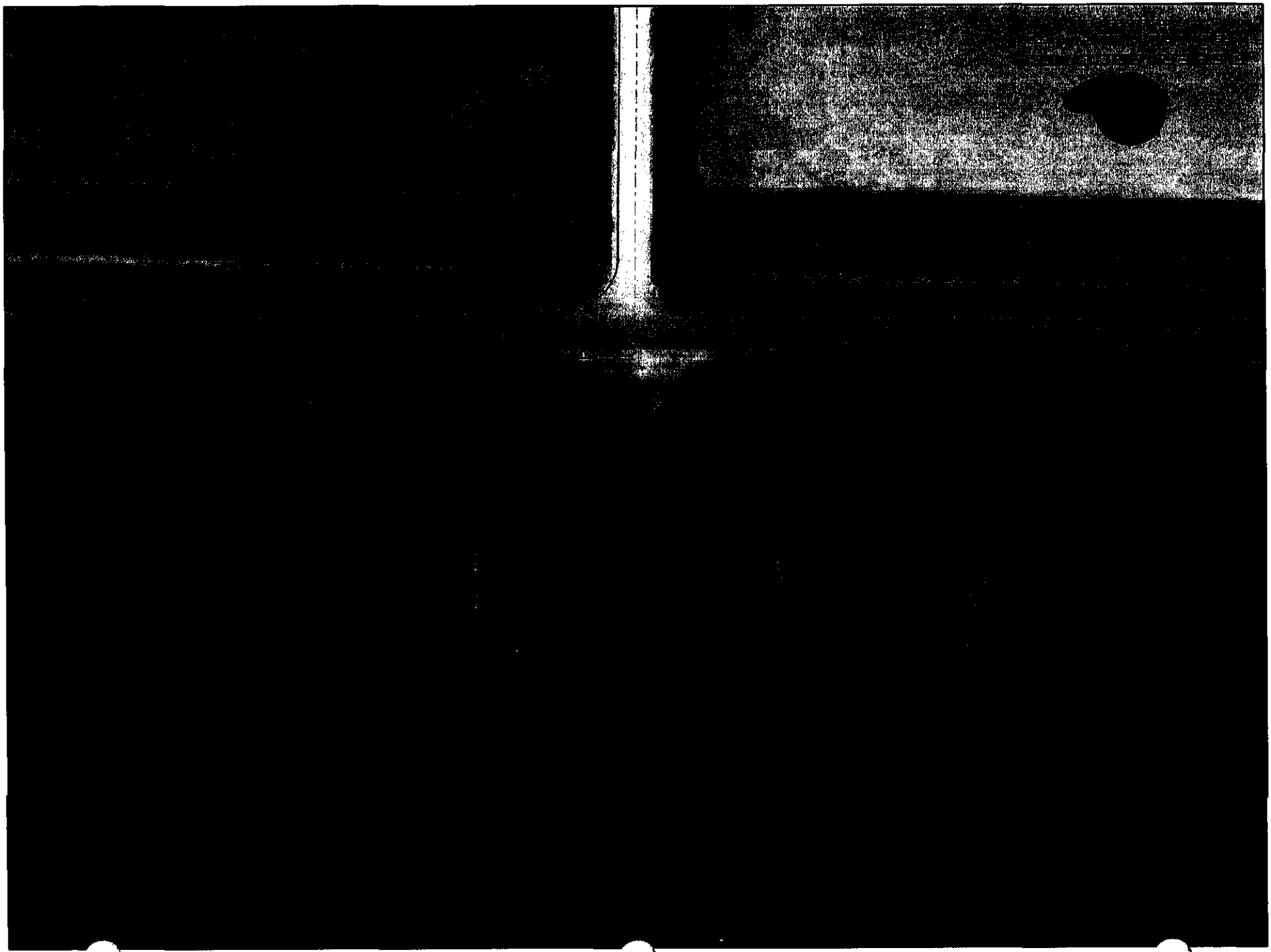
FISHERASSOCIATES
135 Calkins Road, Rochester, NY 14623
Phone: 585-334-1310

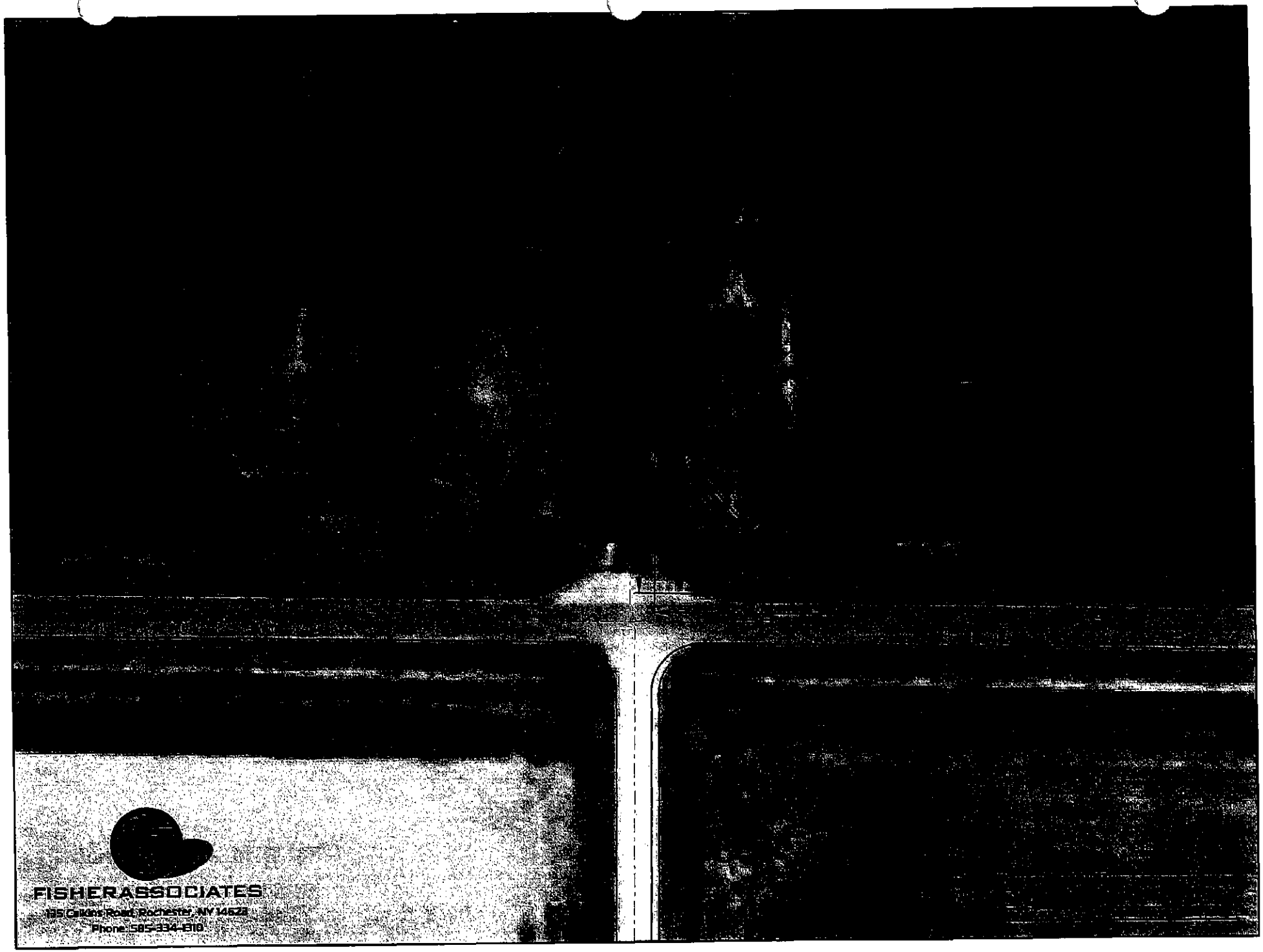

CRITICAL VEHICLE PATH LIMIT (TYP.)
TEMPORARY WIDENING (TYP.)
- REMOVE AND RESET TRAFFIC SIGNS
- CLEARING AND GRUBBING
- RELOCATE UTILITY POLE
- FILL AS REQUIRED WITH COMPACTED GRAVEL

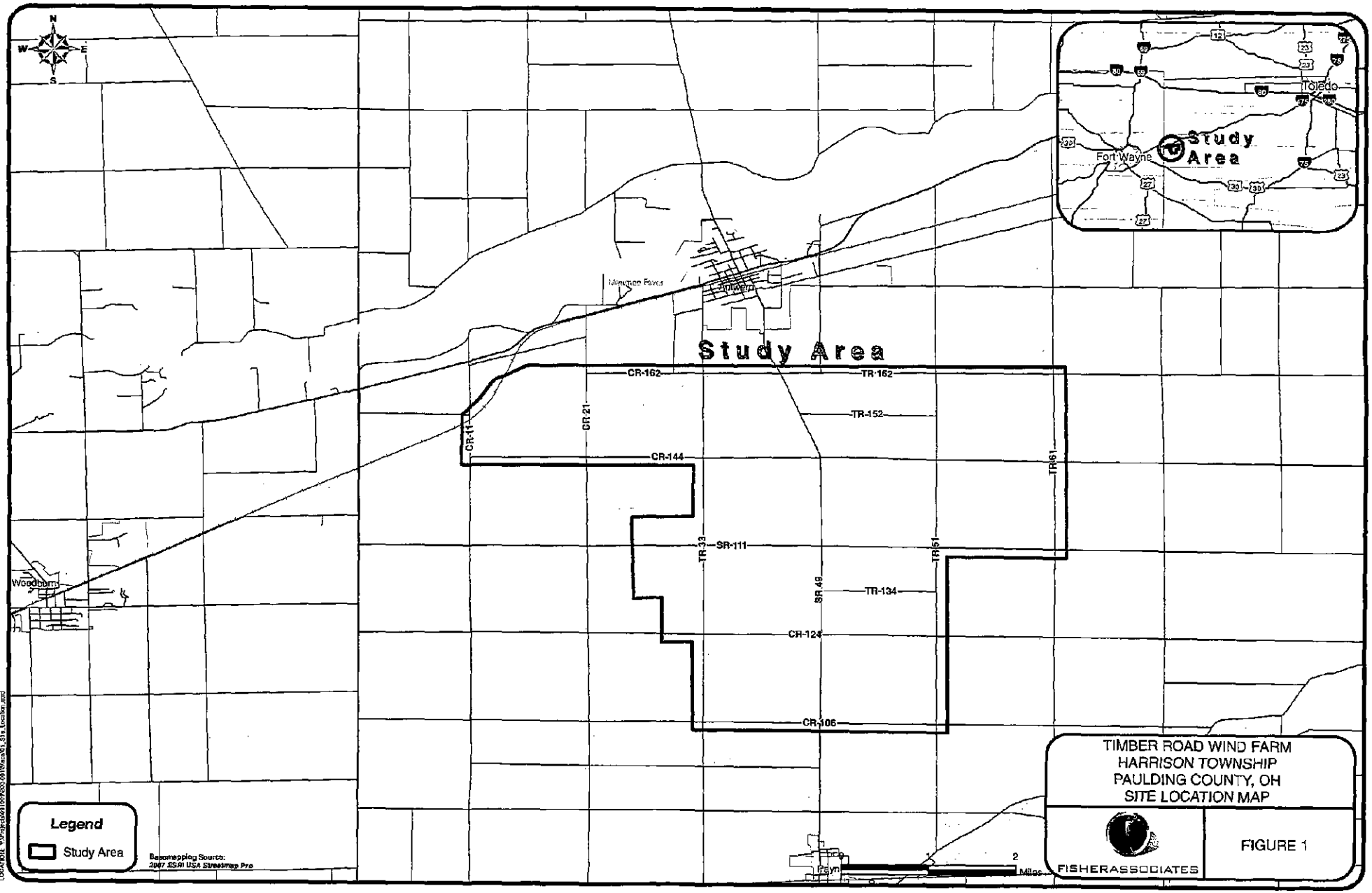

66'
66'
ERASSOCIATES
Road, Rochester, NY 14623
Phone: 585-334-1310

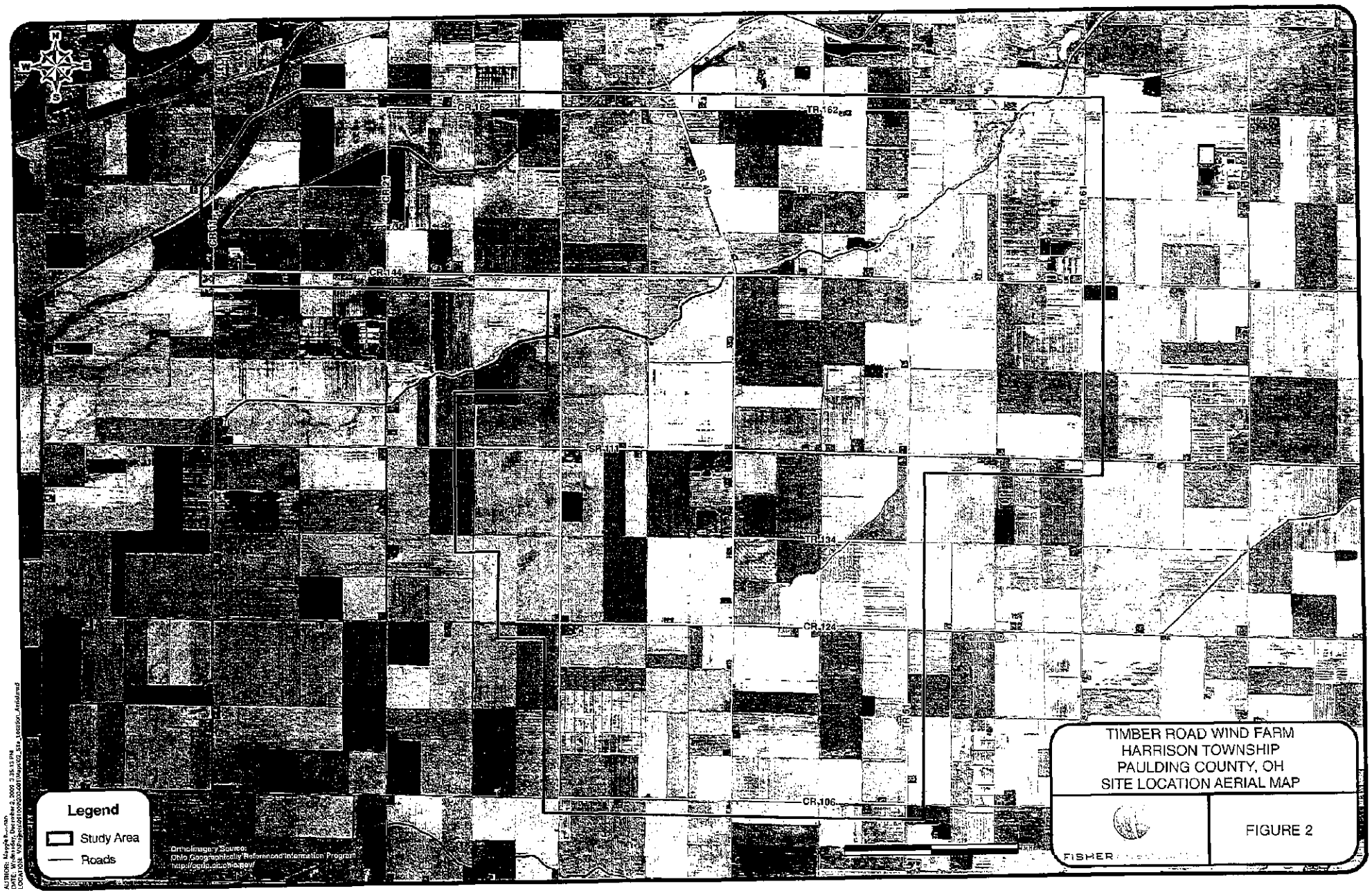

11' LANE APPROACHING
STATE ROUTE 49
32'
105'
36'

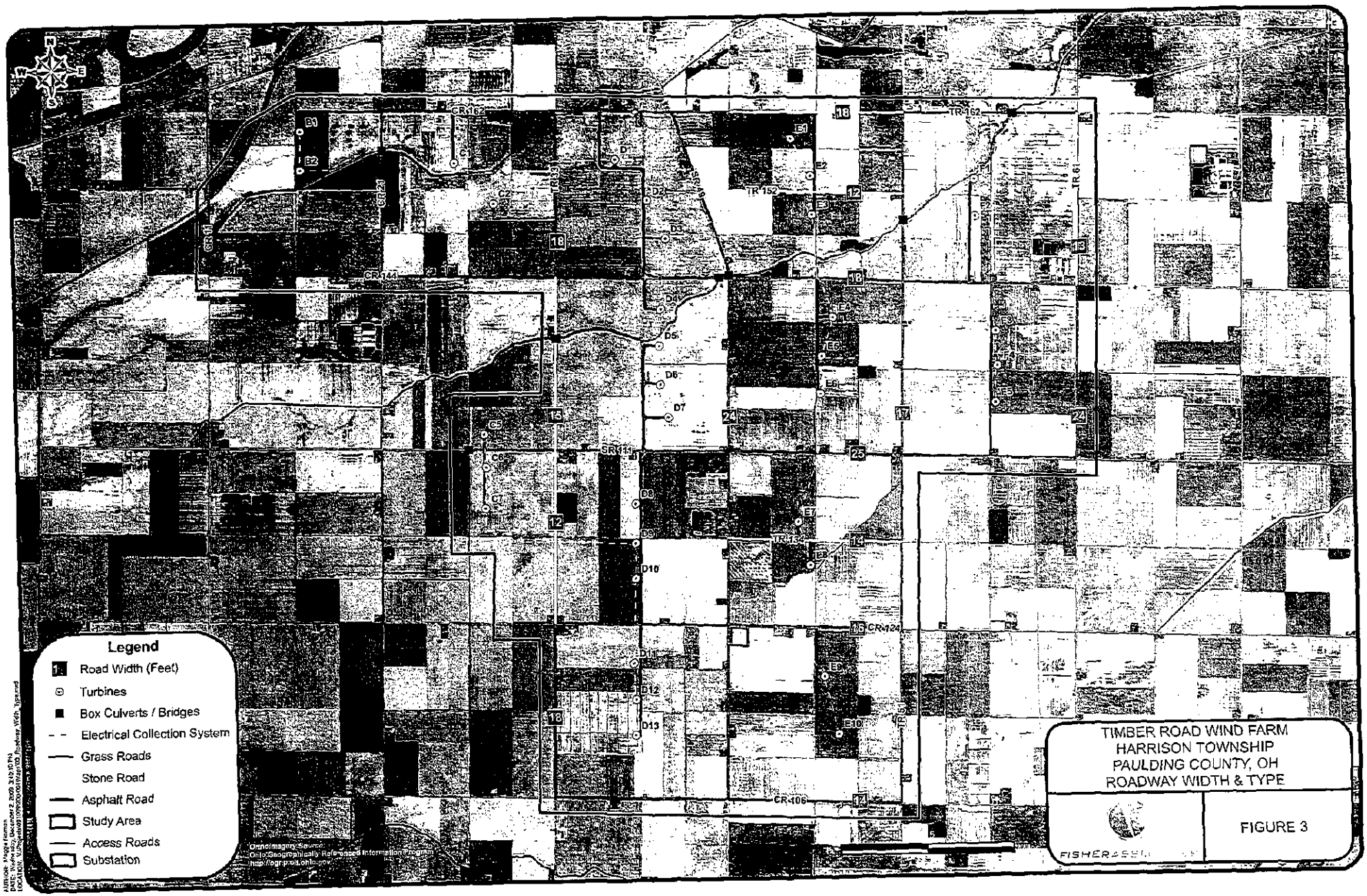

CRITICAL VEHICLE PATH LIMIT

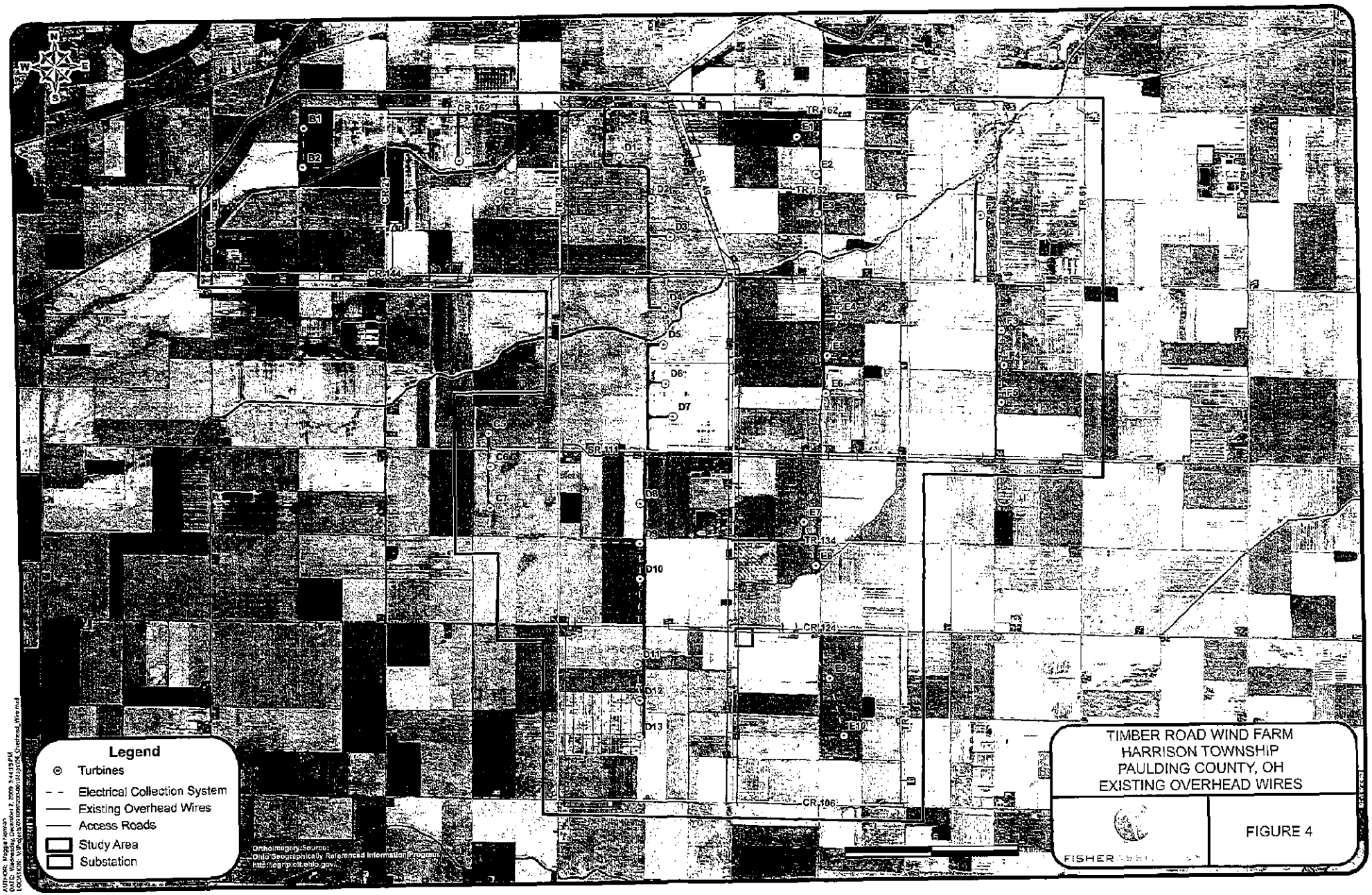


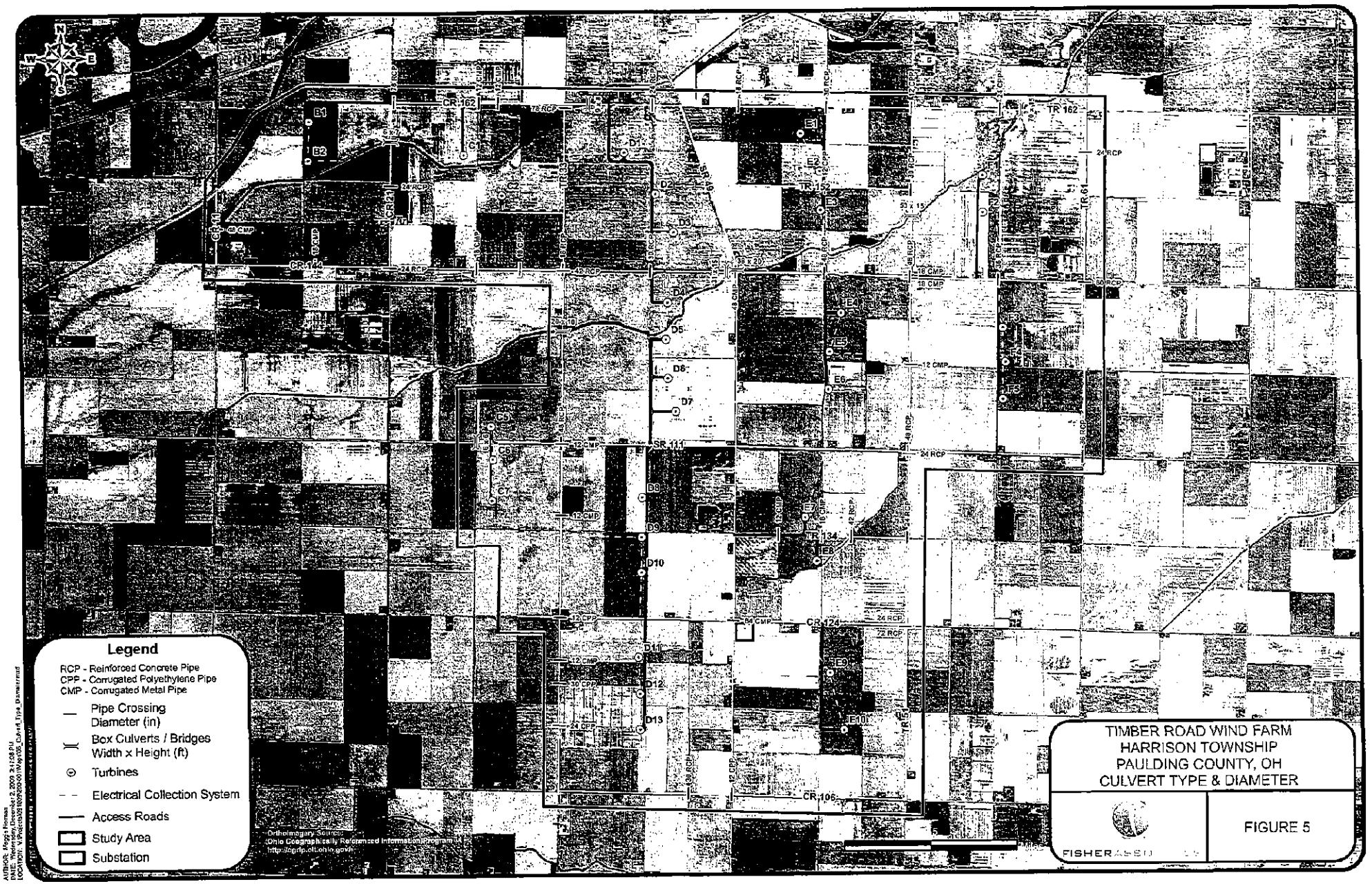

FISHERASSOCIATES
Phone: 585-334-8110

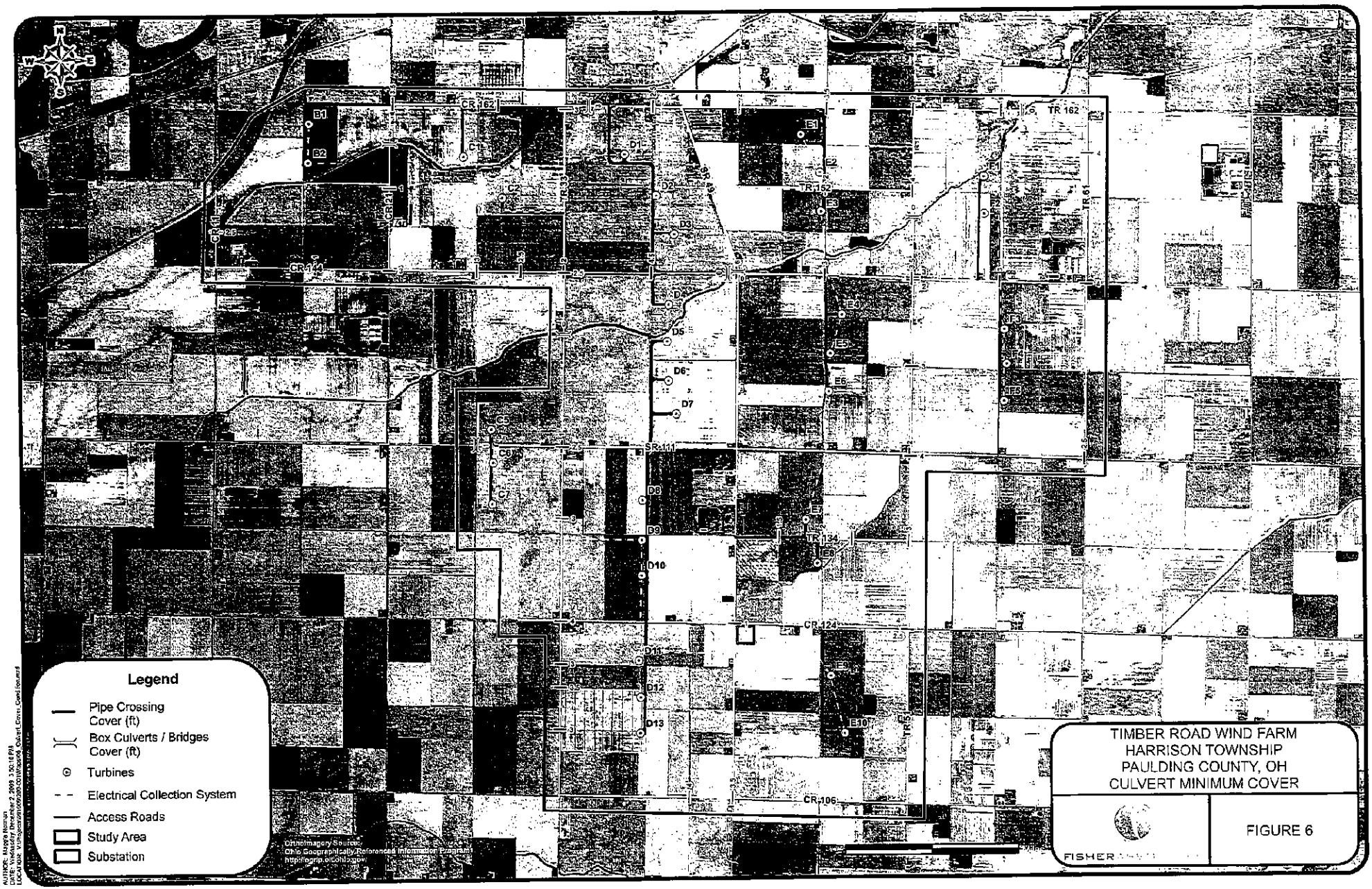

N
W
E
S
Study Area
Fort Wayne
Toledo
Study Area
CR-162
TR-162
TR-152
CR-21
CR-11
CR-144
TR-61
TR-33
SR-111
TR-61
SR 49
TR-134
CR-124
CR-106
Woodburn
Legend
Study Area
Basemapping Source:
2007 ESRI USA Streetmap Pro
0
1
2
Miles
TIMBER ROAD WIND FARM
HARRISON TOWNSHIP
PAULDING COUNTY, OH
SITE LOCATION MAP
FISHERASSOCIATES
FIGURE 1


N
W
E
S
CR-162
TR-162
SR-637
TR-152
CR-27
TR-133
CR-111
TR-61
CR-144
SR-111
TR-134
CR-124
CR-106
Legend
Study Area
Roads
Orthoimagery Source:
Ohio Geographically Referenced Information Program
http://gris.ohio.gov/
TIMBER ROAD WIND FARM
HARRISON TOWNSHIP
PAULDING COUNTY, OH
SITE LOCATION AERIAL MAP
FISHER
FIGURE 2


Legend
Road Width (Feet)
Turbines
Box Culverts / Bridges
Electrical Collection System
Grass Roads
Stone Road
Asphalt Road
Study Area
Access Roads
Substation
CR-162
TR-162
TR-152
TR-61
CR-144
SR-111
CR-124
CR-106
B1
B2
B3
B4
B5
B6
B7
B8
B9
B10
C1
C2
C3
C4
C5
C6
C7
C8
D1
D2
D3
D4
D5
D6
D7
D8
D9
D10
D11
D12
D13
E1
E2
E3
E4
E5
E6
E7
E8
E9
E10
TIMBER ROAD WIND FARM
HARRISON TOWNSHIP
PAULDING COUNTY, OH
ROADWAY WIDTH & TYPE
FIGURE 3
FISHERASSEL


N
W
E
S
CR 162
TR 162
CR 144
SR 49
SR 111
TR 134
CR 124
CR 106
TR 61
B1
B2
C1
C2
C3
C4
C5
C6
C7
D1
D2
D3
D4
D5
D6
D7
D8
D9
D10
D11
D12
D13
E1
E2
E3
E4
E5
E6
E7
E8
E9
E10
Legend
Turbines
Electrical Collection System
Existing Overhead Wires
Access Roads
Study Area
Substation
Orthoimagery Source:
Ohio Geographically Referenced Information Program
http://ogrip.oit.ohio.gov/
TIMBER ROAD WIND FARM
HARRISON TOWNSHIP
PAULDING COUNTY, OH
EXISTING OVERHEAD WIRES
FIGURE 4
FISHER


Legend
RCP - Reinforced Concrete Pipe
CPP - Corrugated Polyethylene Pipe
CMP - Corrugated Metal Pipe
Pipe Crossing Diameter (in)
Box Culverts / Bridges Width x Height (ft)
Turbines
Electrical Collection System
Access Roads
Study Area
Substation
Orthoimagery Source:
Ohio Geographically Referenced Information Program
http://ogrip.oit.ohio.gov/
CR 162
TR 162
CR 114
SR 111
TR 134
CR 124
CR 106
TR 152
TR 61
B1
B2
C1
C2
C3
C4
C5
C6
C7
C8
D1
D2
D3
D4
D5
D6
D7
D8
D9
D10
D11
D12
D13
E1
E2
E3
E4
E5
E6
E7
E8
E9
E10
F1
F2
F3
F4
F5
F6
TIMBER ROAD WIND FARM
HARRISON TOWNSHIP
PAULDING COUNTY, OH
CULVERT TYPE & DIAMETER
FISHER
FIGURE 5


Legend
Pipe Crossing Cover (ft)
Box Culverts / Bridges Cover (ft)
Turbines
Electrical Collection System
Access Roads
Study Area
Substation
CR 162
TR 162
CR 144
CR 124
CR 106
SR 111
TR 134
TR 61
B1
B2
C1
C2
C3
C4
C5
C6
C7
D1
D2
D3
D4
D5
D6
D7
D8
D9
D10
D11
D12
D13
E1
E2
E3
E4
E5
E6
E7
E8
E9
E10
F1
F2
F3
F4
F5
TIMBER ROAD WIND FARM
HARRISON TOWNSHIP
PAULDING COUNTY, OH
CULVERT MINIMUM COVER
FISHER
FIGURE 6

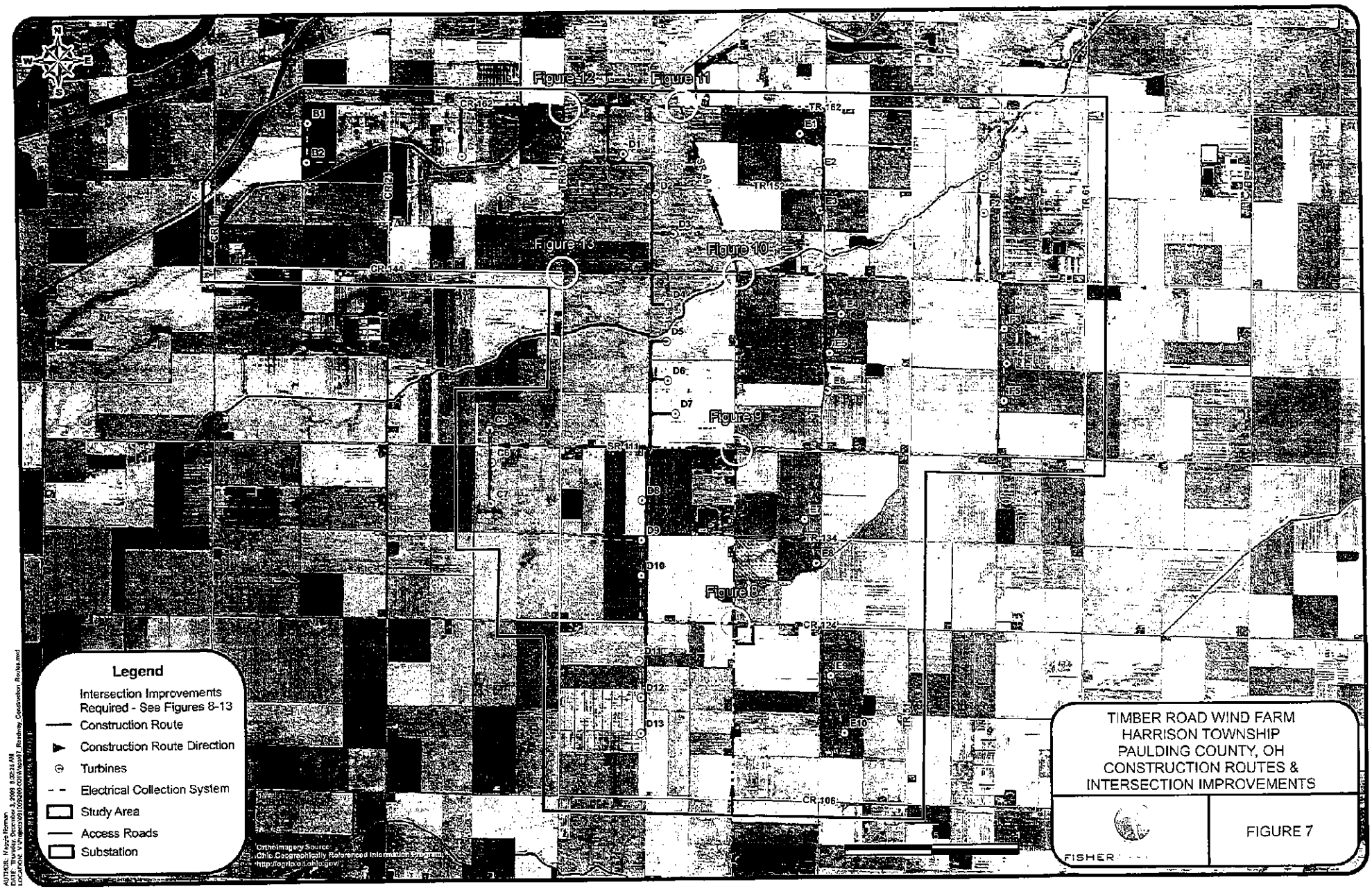


Figure 12
Figure 11
Figure 13
Figure 10
Figure 9
Figure 8
CR 162
TR 162
CR 21
TR 152
TR 61
CR 11
CR 144
SR 111
CR 124
TR 134
CR 106
B1
B2
E1
E2
E3
E4
E5
E6
E7
E8
E9
E10
F1
F2
F3
F4
F5
F6
D1
D2
D3
D4
D5
D6
D7
D8
D9
D10
D11
D12
D13
C1
C2
C3
C4
C5
C6
C7
Legend
Intersection Improvements Required - See Figures 8-13
Construction Route
Construction Route Direction
Turbines
Electrical Collection System
Study Area
Access Roads
Substation
Orthoimagery Source:
Ohio Geographically Referenced Information Program
http://logip.oit.ohio.gov/
TIMBER ROAD WIND FARM
HARRISON TOWNSHIP
PAULDING COUNTY, OH
CONSTRUCTION ROUTES &
INTERSECTION IMPROVEMENTS
FISHER
FIGURE 7

APPENDIX B

Ohio Department of Transportation
Office of Highway Management

Special Hauling Permit Section
(614) 351-2300
1610 West Broad Street
Columbus, OH 43223

www.dot.state.oh.us/permits/

LEGAL DIMENSION and WEIGHT LIMITS

for HIGHWAY VEHICLES

(As per Ohio Revised Code, Sections 5577.04, 5577.05)

PENALTIES for VIOLATION

(As per Ohio Revised Code, Section 5577.99)

Ted Strickland
Governor

Jolene M. Molitoris
Director

MAXIMUM OVERALL DIMENSIONS

(including any loads)

Width of municipal passenger bus	8'-8"
Width of passenger bus operated over freeways	8'-6"
Width of traction engine	11'-0"
Width of recreational vehicles	8'-6"
Width of all other vehicles	8'-6"
Length of muncipal passenger bus	66'-0"
Length of all other passenger bus type vehicles	45'-0"
Length of semitrailer used in a commercial tractor-semitrailer combination	53'-0"
Length of semitrailer or full trailer used in a commercial tractor-semitrailer-trailer combination	28'-6"
Length of saddlemount vehicle transporter operated on all Interstate, US and State routes	97'-0"
Length of saddlemount vehicle transporter operated on other roadways	75'-0"
Length of any other combination	65'-0"
Length of recreational vehicles	45'-0'
Length of all other vehicles	40'-0"
Length of automobile or boat transporter (plus load overhang of 3'-0" in front and 4'-0" in rear)	65'-0"
Length of stinger-steered automobile or boat transporter (plus load overhang of 3'-0" in front and 4'-0" in rear)	75'-0"
Height of all vehicles	13'-6"

Sec. 5577.05:

(A) No vehicle shall be operated upon the public highways, streets, bridges, and culverts within the state, whose dimensions exceed those specified in this section.

(B) No such vehicle shall have a width in excess of:

(1) 8'-8" for passenger bus type vehicles operated exclusively within municipal corporations;

(2) 8'-6", excluding such safety devices as are required by law, for passenger bus type vehicles operated over freeways, and such other state roads with minimum pavement widths of twenty-two feet, except those roads or portions thereof over which operation of 8'-6" buses is prohibited by order of the director of transportation;

(3) 11' for traction engines;

(4) 8'-6" for recreational vehicles, excluding safety devices and retracted awnings and other appurtenances of 6" or less in width and except that the director may prohibit the operation of 8'-6" recreational vehicles on designated state highways or portions of highways;

(5) 8'-6", including load, for all other vehicles, except that the director may prohibit the operation of 8'-6" vehicles on such state highways or portions thereof as the director designates.

(C) No such vehicle shall have a length in excess of:

(1) 66' for passenger bus type vehicles and articulated passenger bus type vehicles operated by a regional transit authority pursuant to sections 306.30 to 306.54 of the Revised Code;

(2) 45' for all other passenger bus type vehicles;

(3) 53' for any semitrailer when operated in a commercial tractor-semitrailer combination, with or without load, except that the director may prohibit the operation of any such commercial tractor-semitrailer combination on such state highways or portions thereof as the director designates.

(4) 28'-6" for any semitrailer or trailer when operated in a commercial tractor-semitrailer-trailer or commercial tractor-semitrailer-semitrailer combination, except that the director may prohibit the operation of any such commercial tractor-semitrailer-trailer or commercial tractor-semitrailer-semitrailer combination on such state highways or portions thereof as the director designates;

(5) (a) 97' for drive-away saddlemount vehicle transporter combinations and drive-away saddlemount with fullmount vehicle transporter combinations, when operated on all Interstate, US and State routes, including reasonable access travel on all other roadway for a distance not to exceed one road mile; not to exceed three saddlemounted vehicles, but which may include one fullmount.

(b) 75" for drive-away saddlemount vehicle transporter combinations and drive-away saddlemount with fullmount vehicle transporter combinations, when operated on all roadways not designated as an Interstate, US and State routes, other than roadways within one road mile of any Interstate, US and State routes, not to exceed three saddlemounted vehciles, but which may include one fullmount.

(6) 65' for any other combination of vehicles coupled together, with or without load, except as provided in divisions (C)(3) and (4), and in division (E) of this section;

(7) 45' for recreational vehicles;

(8) 40' for all other vehicles except trailers and semitrailers, with or without load.

MAXIMUM OVERALL DIMENSIONS (continued)

(D) No such vehicle shall have a height in excess of 13'-6", with or without load.

(E) An automobile transporter or boat transporter shall be allowed a length of 65' and a stinger-steered automobile transporter or stinger-steered boat transporter shall be allowed a length of 75', except that the load thereon may extend no more than 4' beyond the rear of such vehicles and may extend no more than 3' beyond the front of such vehicles, and except further that the director may prohibit the operation of a stinger-steered automobile transporter, stinger-steered boat transporter, or a B-train assembly on any state highway or portion thereof that the director designates.

(F) The widths prescribed in division (B) of this section shall not include side mirrors, turn signal lamps, marker lamps, handholds for cab entry and egress, flexible fender extensions, mud flaps, splash and spray suppressant devices, and load-induced tire bulge.

The width prescribed in division (B)(5) of this section shall not include automatic covering devices , tarp and tarp hardware, and tiedown assemblies, provided these safety devices do not extend more than three inches from each side of the vehicle.

The lengths prescribed in divisions (C)(2) to (7) of this section shall not include safety devices, bumpers attached to the front or rear of such bus or combination, B-train assembly used between the first and second semitrailer of a commercial tractor-semitrailer-semitrailer combination, energy conservation devices as provided in any regulations adopted by the secretary of the United States department of transportation, or any noncargo-carrying refrigeration equipment attached to the front of trailers and semitrailers. In special cases, vehicles whose dimensions exceed those prescribed by this section may operate in accordance with rules adopted by the director.

(G) This section does not apply to fire engines, fire trucks, or other vehicles or apparatus belonging to any municipal corporation or to the volunteer fire department of any municipal corporation or used by such department in the discharge of its functions. This section does not apply to vehicles and pole trailers used in the transportation of wooden and metal poles, nor to the transportation of pipes or well-drilling equipment, nor to farm machinery and equipment. The owner or operator of any vehicle, machinery, or equipment not specifically enumerated in this section but the dimensions of which exceed the dimensions provided by this section, when operating the same on the highways and streets of this state, shall comply with the rules of the director governing such movement, which the director may adopt. Sections 119.01 to 119.13 of the Revised Code apply to any rules the director adopts under this section, or the amendment or rescission thereof, and any person adversely affected shall have the same right of appeal as provided in those sections.

This section does not require the state, a municipal corporation, county, township, or any railroad or other private corporation to provide sufficient vertical clearance to permit the operation of such vehicle, or to make any changes in or about existing structures now crossing streets, roads, and other public thoroughfares in this state.

(H) As used in this section, "recreational vehicle" has the same meaning as in section 4501.01 of the Revised Code.

MAXIMUM WEIGHTS

Sec. 5577.04 Maximum axle load, wheel load, gross weights, for pneumatic tired vehicles.

(A) The maximum wheel load of any one wheel of any vehicle, trackless trolley, load, object, or structure operated or moved upon improved public highways, streets, bridges, or culverts shall not exceed six hundred fifty pounds per inch width of pneumatic tire, measured as prescribed by section 5577.03 of the Revised Code.

(B) The weight of vehicle and load imposed upon a road surface that is part of the interstate system by vehicles with pneumatic tires shall not exceed any of the following weight limitations:

(1) On any one axle, twenty thousand pounds;

(2) On any tandem axle, thirty-four thousand pounds;

(3) On any two or more consecutive axles, the maximum weight as determined by application of the formula provided in division (C) of this section.

(C) For purposes of division (B)(3) of this section, the maximum gross weight on any two or more consecutive axles shall be determined by application of the following formula:

$$W = 500((LN/N-1) + 12N + 36).$$

In this formula, W equals the overall gross weight on any group of two or more consecutive axles to the nearest five hundred pounds, L equals the distance in rounded whole feet between the extreme of any group of two or more consecutive axles, and N equals the number of axles in the group under consideration. However, two consecutive sets of tandem axles may carry a gross load of thirty-four thousand pounds each, provided the overall distance between the first and last axles of such consecutive sets of tandem axles is thirty-six feet or more.

(D) Except as provided in division (I) of this section, the weight of vehicle and load imposed upon a road surface that is not part of the interstate system by vehicles with pneumatic tires shall not exceed any of the following weight limitations:

(1) On any one axle, twenty thousand pounds;

(2) On any two successive axles:

(a) Spaced four feet or less apart, and weighed simultaneously, twenty-four thousand pounds;

(b) Spaced more than four feet apart, and weighed simultaneously, thirty-four thousand pounds, plus one thousand pounds per foot or fraction thereof, over four feet, not to exceed forty thousand pounds.

(3) On any three successive load-bearing axles designed to equalize the load between such axles and spaced so that each such axle of the three-axle group is more than four feet from the next axle in the three-axle group and so that the spacing between the first axle and the third axle of the three-axle group is no more than nine feet, and with such load-bearing three-axle group weighed simultaneously as a unit:

(a) Forty-eight thousand pounds, with the total weight of vehicle and load not exceeding thirty-eight thousand pounds plus an additional nine hundred pounds for each foot of spacing between the front axle and the rearmost axle of the vehicle;

(b) As an alternative to division (D)(3)(a) of this section, forty-two thousand five hundred pounds, if part of a six-axle vehicle combination with at least twenty feet of spacing between the front axle and rearmost axle, with the total weight of vehicle and load not exceeding fifty-four thousand pounds plus an additional six hundred pounds for each foot of spacing between the front axle and the rearmost axle of the vehicle.

(4) The total weight of vehicle and load utilizing any combination of axles, other than as provided for three-axle groups in division (D) of this section, shall not exceed thirty-eight thousand pounds plus an additional nine hundred pounds for each foot of spacing between the front axle and rearmost axle of the vehicle.

(E) Notwithstanding divisions (B) and (D) of this section, the maximum overall gross weight of vehicle and load imposed upon the road surface shall not exceed eighty thousand pounds.

(F) Notwithstanding any other provision of law, when a vehicle is towing another vehicle, such drawbar or other connection shall be of a length such as will limit the spacing between nearest axles of the respective vehicles to a distance not in excess of twelve feet and six inches.

(G) As used in division (B) of this section, "tandem axle" means two or more consecutive axles whose centers may be included between parallel transverse vertical planes spaced more than forty inches but not more than ninety-six inches apart, extending across the full width of the vehicle.

(H) This section does not apply to passenger bus type vehicles operated by a regional transit authority pursuant to sections 306.30 to 306.54 of the Revised Code.

(I) Either division (B) or (D) of this section applies to the weight of a vehicle and its load imposed upon any road surface that is not a part of the interstate system by vehicles with pneumatic tires. As between divisions (B) and (D) of this section, only the division that yields the highest total gross vehicle weight limit shall be applied to any such vehicle. Once that division is determined, only the limits contained in the subdivisions of that division shall apply to that vehicle.

FEDERAL BRIDGE FORMULA DEFINITIONS

The following definitions are used in conjunction with the federal bridge formula table.

GROSS WEIGHT: The weight of a vehicle combination without load plus the weight of any load thereon. The maximum overall gross weight of vehicle and load imposed upon the road surface shall not exceed eighty thousand pounds.

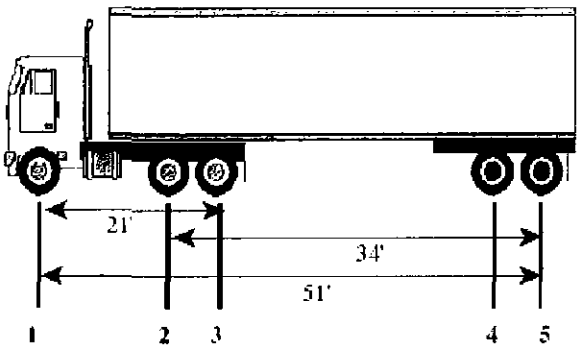
SINGLE AXLE WEIGHT: The total weight imposed upon the road surface by all wheels whose centers may be included between two parallel transverse vertical planes forty inches apart, extended across the full width of the vehicle. The maximum single axle weight shall not exceed twenty thousand pounds.

TANDEM AXLE WEIGHT: The total weight imposed upon the road surface by two or more consecutive axles whose centers may be included between parallel transverse vertical planes spaced more than forty inches but not more than ninety-six inches apart, extending across the full width of the vehicle. The maximum tandem axle weight shall not exceed thirty-four thousand pounds.

CONSECUTIVE AXLE WEIGHT: Any consecutive two or more axles may not exceed the weight as computed by the formula even though the single axles, tandem axles, and gross weights are within the legal requirements.

CHECKING A VEHICLE

This illustration of a tractor-semitrailer combination is used to illustrate a bridge formula check. Before beginning to check your vehicle, be sure that single axle 1 does not exceed 20,000 lbs., tandem axles 2-3 and 4-5 do not exceed 34,000 lbs. each and that the gross vehicle weight does not exceed 80,000 lbs. If these weight requirements are satisfactory, the following combinations should be checked as follows:



Axle 1 is 12,000 lbs.
Axle 2,3,4 and 5 are 17,000 lbs. each
and show a spacing violation

Check axles 1 through 3 using the illustration.
W (actual weight)
= 12,000 + 17,000 + 17,000 = 46,000 lbs.
N = 3 axles;
L = 21 feet
W = maximum

$$= 500 \left[\frac{L\,(N)}{(N-1)} + 12\,(N) + 36 \right]$$

$$= 500 \left[\frac{(1 \times 3)}{(3-1)} + (12 \times 3) + 36 \right]$$

= 51,500 lbs.

The actual weight of axles 1 through 3 of the illustrated combination is 46,000 lbs. so the bridge formula requirement is satisfied.

To use the Bridge Formula Table to obtain the maximum load allowed on axles 1 through 3, read down the left column (Distance in feet between ...axles) to L = 21 and across the number of axles to the right to N = 3 (axles).
Now check axles 1 through 5 using the illustration and table.
W (actual weight)
= 12,000 + 17,000 + 17,000
+ 17,000 + 17,000 = 80,000 lbs.
N = 5 axles; L = 51 feet
W maximum from the table for L of 51 feet and N of 5 (axles) = 80,000 lbs.
This axle spacing is satisfactory.

Now check axles 2 through 5 using the illustration and table.
W (actual weight)
= 17,000 + 17,000 + 17,000 + 17,000
= 68,000 lbs.
N = 4 axles; L = 34 feet
W maximum from the table for L = 34 feet and N = 4 (axles) = 64,500 lbs.
This means the illustration shows a violation; the actual weight of 68,000 lbs. exceeds the maximum allowable weight of 64,500 lbs. for the given axle spacing. To correct the situation, some load must be removed from the vehicle or the 34-foot axle spacing must be increased.

EXCEPTION TO FORMULA

There is one exception to the use of the formula and table: two consecutive sets of tandem axles may carry a gross load of 34,000 pounds each providing the overall distance between the first and last axles of such consecutive sets of tandem axles is 36 feet of more. For example, a 5-axle tractor-semitrailer may be used to haul a full 34,000 lbs. on the tandem of the tractor (axles 2 and 3) and the tandem of the trailer (axles 4 and 5) providing there is a spacing of 36 or more feet between axles 2 and 5. A spacing of 36 feet or more for axles 2 through 5 is satisfactory for an actual W of 68,000 lbs. even though the formula or table computes W maximum to be 66,000 to 67,500 lbs. for spacing of 36 to 38 feet.

FEDERAL BRIDGE FORMULA TABLE

Permissible Gross Loads for Vehicles in Regular Operation

Based on weight formula: **W = 500 [(L(N) / (N-1)) + 12(N) + 36]**

W = the maximum weight in pounds that can be carried on a group of two or more axles to the nearest 500 pounds

L = spacing in feet between the outer axles of any two or more consecutive axles

N = number of axles being considered

Distance in feet between the extremes of any group of 2 or more consecutive axles	Maximum load in pounds carried on any group of 2 or more consecutive axles					
	2 axles	3 axles	4 axles	5 axles	6 axles	7 axles
4	34,000	----------	----------	----------	----------	----------
5	34,000	----------	----------	----------	----------	----------
6	34,000	----------	----------	----------	----------	----------
7	34,000	----------	----------	----------	----------	----------
8 and less	34,000	34,000	----------	----------	----------	----------
More than 8	38,000	42,000	----------	----------	----------	----------
9	39,000	42,500	----------	----------	----------	----------
10	40,000	43,500	----------	----------	----------	----------
11	----------	44,000	----------	----------	----------	----------
12	----------	45,000	50,000	----------	----------	----------
13	----------	45,500	50,500	----------	----------	----------
14	----------	46,500	51,500	----------	----------	----------
15	----------	47,000	52,000	----------	----------	----------
16	----------	48,000	52,500	58,000	----------	----------
17	----------	48,500	53,500	58,500	----------	----------
18	----------	49,500	54,000	59,000	----------	----------
19	----------	50,000	54,500	60,000	----------	----------
20	----------	51,000	55,500	60,500	66,000	----------
21	----------	51,500	56,000	61,000	66,500	----------
22	----------	52,500	56,500	61,500	67,000	----------
23	----------	53,000	57,500	62,500	68,000	----------
24	----------	54,000	58,000	63,000	68,500	74,000
25	----------	54,500	58,500	63,500	69,000	74,500
26	----------	55,500	59,500	64,000	69,500	75,000
27	----------	56,000	60,000	65,000	70,000	75,500
28	----------	57,000	60,500	65,500	71,000	76,500
29	----------	57,500	61,500	66,000	71,500	77,000
30	----------	58,500	62,000	66,500	72,000	77,500
31	----------	59,000	62,500	67,500	72,500	78,000
32	----------	60,000	63,500	68,000	73,000	78,500
33	----------	----------	64,000	68,500	74,000	79,000
34	----------	----------	64,500	69,000	74,500	80,000
35	----------	----------	65,500	70,000	75,000	----------
36	----------	***Exception***	***66,000***	70,500	75,500	----------
37	----------	***23 U.S.C.***	***66,500***	71,000	76,000	----------
38	----------	***127***	***67,500***	71,500	77,000	----------
39	----------	----------	68,000	72,500	77,500	----------
40	----------	----------	68,500	73,000	78,000	----------
41	----------	----------	69,500	73,500	78,500	----------
42	----------	----------	70,000	74,000	79,000	----------
43	----------	----------	70,500	75,000	80,000	----------
44	----------	----------	71,500	75,500	----------	----------
45	----------	----------	72,000	76,000	----------	----------
46	----------	----------	72,500	76,500	----------	----------
47	----------	----------	73,500	77,500	----------	----------
48	----------	----------	74,000	78,000	----------	----------
49	----------	----------	74,500	78,500	----------	----------
50	----------	----------	75,500	79,000	----------	----------
51	----------	----------	76,000	80,000	----------	----------
52	----------	----------	76,500	----------	----------	----------
53	----------	----------	77,500	----------	----------	----------
54	----------	----------	78,000	----------	----------	----------
55	----------	----------	78,500	----------	----------	----------
56	----------	----------	79,500	----------	----------	----------
57	----------	----------	80,000	----------	----------	----------

Maximum Gross Weight allowed in State of Ohio is 80,000 pounds.

NON-INTERSTATE BRIDGE FORMULA

5577.04 *Ohio Revised Code*

Paragraph D

Maximum Allowable Load
for Various Distances
Center to Center of Extreme Axles (in feet)

Feet	Table A Pounds	Table B Pounds	Feet	Table A Pounds	Table B Pounds	Feet	Table A Pounds	Table B Pounds
3	24,000	X	18	54,200	X	34	68,600	74,400
4	24,000	X	19	55,100	X	35	69,500	75,000
4.5	35,000	X	20	56,000	66,000	36	70,400	75,600
5	35,000	X	21	56,900	66,600	37	71,300	76,200
6	36,000	X	22	57,800	67,200	38	72,200	76,800
7	37,000	X	23	58,700	67,800	39	73,100	77,400
8	38,000	X	24	59,600	68,400	40	74,000	78,000
9	39,000	X	25	60,500	69,000	41	74,900	78,600
10	40,000	X	26	61,400	69,600	42	75,800	79,200
11	47,900	X	27	62,300	70,200	43	76,700	79,800
12	48,800	X	28	63,200	70,800	44	77,600	80,000
13	49,700	X	29	64,100	71,400	45	78,500	80,000
14	50,600	X	30	65,000	72,000	46	79,400	80,000
15	51,500	X	31	65,900	72,600	47	80,000	80,000
16	52,400	X	32	66,800	73,200	48	80,000	80,000
17	53,300	X	33	67,700	73,800			

5577.15 APPLICATION OF SIZE AND WEIGHT PROVISIONS OF CHAPTER.

(A) The size and weight provisions of this chapter do not apply to a person who is engaged in the initial towing or removal of a wrecked or disabled motor vehicle from the site of an emergency on a public highway where the vehicle became wrecked or disabled to the nearest site where the vehicle can be brought into conformance with the requirements of this chapter or to the nearest qualified repair facility.

(B) Any subsequent towing of a wrecked or disabled vehicle shall comply with the size and weight provisions of this chapter.

(C) No court shall impose any penalty prescribed in section 5577.99 of the Revised Code or the civil liability established in section 5577.12 of the Revised Code upon a person towing or removing a vehicle in the manner described in division (A) of this section.

4511.04 EXCEPTION TO TRAFFIC RULES.

(A) Sections 4511.01 to 4511.18, 4511.20 to 4511.78, 4511.99, and 4513.01 to 4513.37 of the Revised Code do not apply to persons, teams, motor vehicles, and other equipment while actually engaged in work upon the surface of a highway within an area designated by traffic control devices, but apply to such persons and vehicles when traveling to or from such work.

(B) The driver of a highway maintenance vehicle owned by this state or any political subdivision of this state, while the driver is engaged in the performance of official duties upon a street or highway, provided the highway maintenance vehicle is equipped with flashing lights and such other markings as are required by law and such lights are in operation when the driver and vehicle are so engaged, shall be exempt from criminal prosecution for violations of sections 4511.22, 4511.25, 4511.26, 4511.27, 4511.28, 4511.30, 4511.31, 4511.33, 4511.35, 4511.66, 4513.02, and 5577.01 to 5577.09 of the Revised Code.

(C)(1) This section does not exempt a driver of a highway maintenance vehicle from civil liability arising from a violation of section 4511.22, 4511.25, 4511.26, 4511.27, 4511.28, 4511.30, 4511.31, 4511.33, 4511.35, 4511.66, or 4513.02 or sections 5577.01 to 5577.09 of the Revised Code.

(2) This section does not exempt the driver of a vehicle that is engaged in the transport of highway maintenance equipment from criminal liability for a violation of sections 5577.01 to 5577.09 of the Revised Code.

(D) As used in this section, "highway maintenance vehicle" means a vehicle used in snow and ice removal or road surface maintenance, including a snow plow, traffic line striper, road sweeper, mowing machine, asphalt distributing vehicle, or other such vehicle designed for use in specific highway maintenance activities.

SEC 5577.99 PENALTIES

(A) Whoever violates the weight provisions of sections 5577.01 to 5577.07 or the weight provisions in regard to highways under section 5577.04 of the Revised Code shall be fined eighty dollars for the first two thousand pounds, or fraction thereof, of overload; for overloads in excess of two thousand pounds, but not in excess of five thousand pounds, such person shall be fined one hundred dollars, and in addition thereto one dollar per one hundred pounds of overload; for overloads in excess of five thousand pounds, but not in excess of ten thousand pounds, such person shall be fined one hundred thirty dollars and in addition thereto two dollars per one hundred pounds of overload, or imprisoned not more than thirty days, or both. For all overloads in excess of ten thousand pounds such person shall be fined one hundred sixty dollars, and in addition thereto three dollars per one hundred pounds of overload, or imprisoned not more than thirty days, or both. Whoever violates the weight provisions of vehicle and load relating to gross load limits shall be fined not less than one hundred dollars. No penalty prescribed in this division shall be imposed on any vehicle combination if the overload on any axle does not exceed one thousand pounds, and if the immediately preceding or following axle, excepting the front axle of the vehicle combination, is underloaded by the same or a greater amount. For purposes of this division, two axles on one vehicle less than eight feet apart, shall be considered as one axle.

(B) Whoever violates the weight provisions of section 5577.071 or 5577.08 or the weight provisions in regard to bridges under section 5577.09, and whoever exceeds the carrying capacity specified under section 5591.42 of the Revised Code, shall be fined eighty dollars for the first two thousand pounds, or fraction thereof, of overload; for overloads in excess of two thousand pounds, but not in excess of five thousand pounds, the person shall be fined one hundred dollars, and in addition thereto one dollar per one hundred pounds of overload; for overloads in excess of five thousand pounds, but not in excess of ten thousand pounds, the person shall be fined one hundred thirty dollars, and in addition thereto two dollars per one hundred pounds of overload, or imprisoned not more than thirty days, or both. For all overloads in excess of ten thousand pounds, the person shall be fined one hundred sixty dollars, and in addition thereto three dollars per one hundred pounds of overload, or imprisoned not more than thirty days, or both.

Notwithstanding any other provision of the Revised Code that specifies a procedure for the distribution of fines, all fines collected pursuant to division (B) of this section shall be paid into the treasury of the county and credited to any fund for the maintenance and repair of roads, highways, bridges, or culverts.

(C) Whoever violates any other provision of sections 5577.01 to 5577.09 of the Revised Code is guilty of a minor misdemeanor on a first offense; on a second or subsequent offense, such person is guilty of a misdemeanor of the fourth degree.

(D) Whoever violates section 5577.10 of the Revised Code shall be fined not more than five thousand dollars or imprisoned for not less than thirty days nor more than six months, or both.

(E) Whoever violates section 5577.11 of the Revised Code shall be fined not more than twenty-five dollars.

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