South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
Response to Staff's First Data Request

Date: July 28, 2021

Data Request:
1-1) When is the final EA anticipated?

Responses:
The target for the completion of the Final EA is the end of 2021.

Response Prepared by:
Casey Willis

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL EL21-018
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Date: July 28, 2021

Data Request:
1-2) Refer to Page 1-2 of the Application. The Applicant states "North Bend Wind anticipates sharing the operations and maintenance facility with the Triple H Wind Project." Please identify and explain all facilities and items the North Bend Wind Project will share with the Triple H Wind Project.

Responses:
The only shared component between the two projects would be the operations and maintenance facility that is currently in use for the Triple H Wind Project. ENGIE plans to utilize this facility for the North Bend Wind Project as well.

Response Prepared by:
Casey Willis

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
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Date: July 28, 2021

Data Request:
1-3) Refer to Page 1-3 of the Application. The Applicant states "a CUP application was submitted to Hyde County on June 11, 2021, and a CUP is anticipated to be submitted to Hughes County by mid-June 2021. The decision is anticipated to be rendered by both counties by the end of August 2021." Please provide an update on the CUP processes in Hyde County and Hughes County, and submit the approved CUP when, and if, it becomes available.

Responses:
Hyde County has scheduled on the CUP application on August 10, 2021. Hughes County has yet to schedule a hearing date.

Response Prepared by:
Casey Willis

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
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Date: July 28, 2021

Data Request:

1-4) Refer to Page 2-3 of the Application. The Applicant states that a PPA will be a catalyst of the Project moving forward into construction and operation. Does this statement mean that the Applicant will not construct the facility without an executed PPA? Please explain and clarify

Responses:

A PPA has not been executed for the Project as of writing this response though ENGIE is actively submitting bids. The project will not be constructed and operated without the majority of the output being sold under a PPA.

Response Prepared by:

Casey Willis

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
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Date: July 28, 2021

Data Request:

1-5) Refer to Page 2-4 of the Application. The Applicant states "the construction and operation of a new renewable energy facility in a rural area will result in positive indirect economic impacts in addition to the direct landowner, tax, wage and donation benefits mentioned above the local level." Please describe the direct donation benefits from the project as the Applicant did not list any donation benefits in that section.

Responses:

Donations have not been made in conjunction with the North Bend Project as of writing this response. Donations were made locally in Hyde County in conjunction with the Triple H Wind Project. ENGIE typically provides donations to support local efforts or fundraising in conjunction with our projects at various points during the development phase, construction and/or operations.

Response Prepared by:

Casey Willis

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
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Date: July 28, 2021

Data Request:

1-6) Refer to Page 4-7 of the Application. The Applicant states "WAPA, the owner and operator of the 230-kV transmission line, will be responsible for the construction and operation of the switching station….. WAPA will construct a 230-kV interconnection facility connecting the collection substation and the interconnection switching station." Who owns the interconnection switching facility – WAPA or North Bend Wind Project, LLC? Who owns the 230-kV interconnection facility – WAPA or North Bend Wind Project, LLC? Please explain.

Responses:

WAPA will own the 230 kV interconnection facility. The use of the terms "switching facility" and "interconnection facility" are referencing the same thing. North Bend will own the project substation, which is proposed immediately adjacent and to the north of the 230 kV interconnection switchyard that will be owned/operated by WAPA.

Response Prepared by:

Casey Willis

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
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Date: July 28, 2021

Data Request:

1-7) Refer to Page 4-12 of the Application. The Applicant states "North Bend Wind will review and update the cost estimate of decommissioning and restoration for the Project every 5 years after Project commissioning." For the Triple H Wind Project, the Commission ordered that "beginning in year ten following commercial operation of the Project and each fifth year thereafter, the turbine owner shall submit to the Commission an estimated decommissioning date, if established, and estimated decommissioning costs and salvage values." Will the Applicant agree to review and update the cost estimate consistent with condition ordered for Triple H? If no, please explain.

Responses:

Yes, North Bend will comply with the obligations from the condition placed on Triple H as noted above.

Response Prepared by:

Casey Willis

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
Response to Staff's First Data Request

Date: July 28, 2021

Data Request:

1-8) Refer to the turbine spacing requirement in Hyde County and Hughes County identified in Table 5-1 of the Application.

a) Please provide the turbine spacing requirement for the GE 2.82-127 turbine model being considered for the Project.
b) Please identify the two proposed turbine locations which are spaced closest to the minimum turbine spacing allowed by the manufacturer and provide the distance between the two turbine locations.

Responses:

Minimum turbine spacing requirements for the GE 2.82-127 is three (3) rotor diameters, which equates to 381 meters or 1,250 feet. Turbines 63 and 64 are the closest spaced turbines for North Bend and are 447 meters or 1,466 feet from one another.

Response Prepared by:

Casey Willis

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
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Date: July 28, 2021

Data Request:

1-9) Refer to Table 5-1 of the Application, Hyde County Setback #3. The Applicant states that Hyde County requires the "distance from the exterior boundary of the proposed wind project shall be not less than 500 feet or 1.1 times the system height, whichever is greater, unless appropriate opt out has been obtained from all adjoining property owners."

a) Please define "the exterior boundary of the proposed wind project."
b) Please clarify what the exterior boundary of the proposed wind project needs to be at least 500 feet or 1.1 times the system height from?

Responses:

It is unclear exactly as to how the exterior boundary is defined. In both County ordinances, there is some level of overlap with what constitutes the exterior boundary setback and the requirement to have a 750 foot (or 1.4 times the tower height) setback from roads, section lines, highways, etc. In those instances, a setback was utilized following a 750 foot or 1.4 times the tower height setback. Property lines that do not have roads or highways and are not on section lines that are separate participating from non-participating properties utilized a 500 foot or 1.1 times the tower height setback per the County ordinances.

Response Prepared by:

Casey Willis

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
Response to Staff's First Data Request

Date: July 28, 2021

Data Request:
1-10) Please provide GIS shapefiles for the Project.

Responses:
Shapefiles are provided as an attachment to this response.

Response Prepared by:
Casey Willis

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
Response to Staff's First Data Request

Date: July 28, 2021

Data Request:

1-11) Please provide a map showing landowners, both participating and non-participating, in the project area.

Responses:

Please see the maps that are enclosed with this response.

Response Prepared by:

Casey Willis

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
Response to Staff's First Data Request

Date: July 28, 2021

Data Request:

1-12) Referring to section 2.1.2 of the Application, by what date does North Bend expect to obtain a PPA in order to achieve a COD of December 2022?

Responses:

A PPA would need to be executed in the next couple of months in order to support a December 2022 COD given long lead time orders of equipment. If that doesn't happen the project schedule will slip to a COD in 2023.

Response Prepared by:

Casey Willis

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
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Date: July 28, 2021

Data Request:

1-13) Referring to section 2.1.4 of the Application, will a delay or termination of the construction of the facility have an adverse impact on any of the demand drivers or the Southwest Power Pool? Please explain any response.

Responses:

Broadly speaking, with regard to the impact on the Southwest Power Pool as a whole, if the project were delayed or terminated the demand would likely be filled by another wind project in SPP. That could include another project in South Dakota or in an adjacent state that can sell into SPP.

Response Prepared by:

Casey Willis

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
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Response to Staff's First Data Request

Date: July 28, 2021

Data Request:

1-14) Please provide a copy of the Project's SPCC Plan as noted in section 4.2.4 of the Application.

Responses:

The SPCC Plan has not been generated for the North Bend Project as of writing this response. It is generally completed in conjunction with final engineering. When that is completed and is available it will be submitted to the docket.

Response Prepared by:

Casey Willis

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
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Date: July 28, 2021

Data Request:

1-15) Section 4.2.5 of the Application states: "Its [the O&M facility] location is provided on Figure 2 and 2a (Appendix A)." However, Figure 2 and 2a do not show the O&M facility location. Please explain this discrepancy.

Responses:

The statement noted is inaccurate in the application. There is not a separate O&M facility that is proposed for the North Bend Project. As noted in response to data request 1-12, North Bend is proposing to utilize the existing O&M facility that was constructed in conjunction with the Triple H Wind Project.

Response Prepared by:

Casey Willis

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
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Date: July 28, 2021

Data Request:

1-16) Section 4.2.7 of the Application indicates that the collector system will be buried to a minimum depth of 38 inches, however, section 4.4.4 of the Application indicates the collector lines will be buried at least 42 inches below grade. Please clarify what minimum depth the collector lines will be buried at.

Responses:

The references to 38 inches and 42 inches, were an oversight in the review of the application by the applicant. ENGIE's easements with the landowners guarantee a minimum depth of collection burial to 4 feet or 48 inches. We would meet the obligations of the easement for the burial depth.

Response Prepared by:

Casey Willis

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
Response to Staff's First Data Request

Date: July 28, 2021

Data Request:

1-17) Referring to sections 7.1.1.4 and 7.1.2 of the Application, will the project components impact any known economic mineral deposits that may not have yet applied for, or received, a permit from the SD Department of Agriculture and Natural Resources (SD DANR).

Responses:

ENGIE is not aware of any known mineral deposits where an applicant has an either plans for or filed permits with the SD Department of Agriculture and Natural Resources.

Response Prepared by:

Casey Willis

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
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Date: July 28, 2021

Data Request:

1-18) Will an aquifer be used as a source of potable water supply or process water? If yes, please provide the information required in ARSD 20:10:22:15(4).

Responses:

No. ENGIE has no plans to drill a water well. The use of water will be sourced from an existing well or other source during construction.

Response Prepared by:

Casey Willis

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
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Date: July 28, 2021

Data Request:

1-19) In section 9.1.1.1 of the Application, please clarify the appropriate acreage in the following sentence: "Based on WEST data, less than 50 percent (*.62 acres*) of the Project Area is mapped as grassland pasture and grassland herbaceous." {*emphasis added*}

Responses:

The total acres of grasslands (herbaceous and hay/pasture) should be 23,102.62 acres.

Response Prepared by:

Casey Willis

South Dakota Public Utilities Commission
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Date: July 28, 2021

Data Request:
1-20) Please explain the reason for the "No Fly Areas" shown on Figure 6 of Appendix C.

Responses:
When the field surveys were initially kicked off, our contractor who was completing the aerial survey efforts was contacted by the County Sheriff. The Sheriff had indicated there were a few landowners in these areas that were expressing concern about aircraft passing over their properties. Per the request, we ceased doing aerial overflights in the locations noted as no fly areas in Appendix C.

Response Prepared by:
Casey Willis

South Dakota Public Utilities Commission
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Date: July 28, 2021

Data Request:

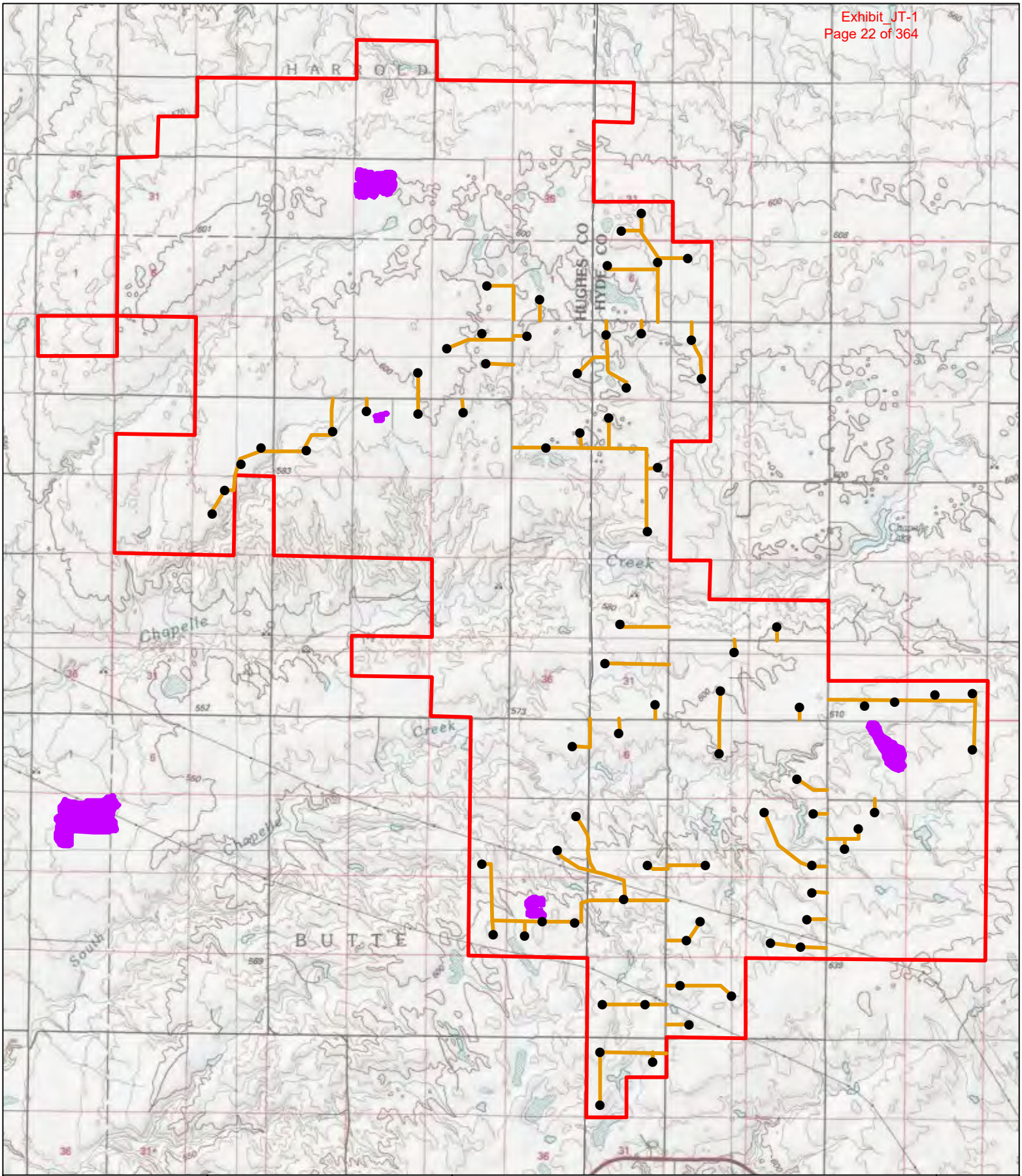
1-21) Referring to section 9.2.2.1 of the Application, are there any prairie dog towns within the project area that could be habitat for the swift fox or burrowing owl? If yes, please provide a map that delineates the boundaries of the prairie dog town.

Responses:

Enclosed is a map that notes where prairie dog colonies were identified within the North Bend Project area. There have been no swift fox or burrowing owls observed to date.

Response Prepared by:

Casey Willis





North Bend Wind Project

Black-tailed Prairie Dog Colonies

Data Source: ESRI USA Topo 2013
Coordinate System: UTM, NAD83, zn 14N
Map produced on 07/29/2021 by T. Thorn

0 1 2 mi
0 2 4 km

Map Features

- Project Boundary
- Black-tailed Prairie Dog Colonies
- Turbine Locations
- Access Roads

N
W E
S

WEST

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
Response to Staff's First Data Request

Date: July 28, 2021

Data Request:

1-22) Referring to section 9.2.3 of the Application, how will North Bend prevent damage or destruction of ground-nesting, grassland bird species' nests during construction of access roads and turbine pads if work will begin in the spring of 2022?

Responses:

Preconstruction surveys are typically done prior to the start of construction activities to avoid disturbance during the nesting season. Nests that are identified are then marked with a no disturbance buffer until the young fledge. ENGIE plans to complete a preconstruction survey for nesting birds in conjunction with the North Bend project.

Response Prepared by:

Casey Willis

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
Response to Staff's First Data Request

Date: July 28, 2021

Data Request:

1-23) Referring to section 11.3.3 of the Application, please provide North Bend's "process for documenting, investigating, and resolving Project-related sound complaints."

Responses:

If a noise concern is brought up during operation, the operations manager would document the concern that is raised and then evaluate the matter through the use of a third party acoustic consultant to validate whether the acoustic profile is in compliance with local standards. We fully anticipate operating in compliance with local standards as documented in the acoustic survey included in Appendix D of the application. But in the event that a location is not in compliance as documented by a third party acoustic consultant, operational changes to a particular turbine or turbines may be necessary in order to become compliant.

Response Prepared by:

Casey Willis

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
Response to Staff's First Data Request

Date: July 28, 2021

Data Request:

1-24) Referring to section 11.4.1 of the Application and Figure 1 in Appendix A, please clarify why the Titan Wind Project is not shown on the map as noted in Section 11.4.1.

Responses:

The Titan Wind Project is located just to the east of the extent of Figure 1 in Appendix A. It is located directly southeast of Ree Heights and just off the map.

Response Prepared by:

Casey Willis

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
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Date: July 28, 2021

Data Request:

1-25) Did the Acoustic Assessment (Appendix D) and Shadow Flicker Impact Analysis (Appendix E) include the Triple H turbines to account for cumulative impacts? If no, please provide updated modeling results that includes Triple H turbines.

Responses:

Attached are the updated studies that includes cumulative impacts in conjunction with the operating Triple H Wind Project.

Response Prepared by:

Casey Willis

To:	Casey Willis, ENGIE
From:	Tetra Tech, Inc.
Date:	July 2021
Subject:	North Bend Wind Project – Cumulative Acoustic Analysis Memo

Tetra Tech, Inc. (Tetra Tech) conducted an acoustic assessment on behalf of North Bend Wind Project, LLC (North Bend) for the proposed North Bend Wind Project (Project) under development in Hyde and Hughes Counties, South Dakota. An analysis was completed to evaluate the expected sound levels resulting from the Project wind turbines and substation. The acoustic assessment evaluated 78 potential wind turbine locations represented in the May 4, 2021 Project site layout although only 71 wind turbines are ultimately planned for construction. North Bend is considering the General Electric (GE) 2.82-127 wind turbine model with the Low Noise Trailing Edge (LNTE) blade technology option to be installed. The acoustic assessment was conducted according to the methodologies described in the June 2021 acoustic assessment report (*Acoustic Assessment for the North Bend Wind Project*).

Acoustic analyses for three different modeling scenarios were performed. Scenarios included wind turbine operation at cut-in wind speed, and maximum rotational speed under both moderate downwind and anomalous meteorological conditions for GE 2.82-127 wind turbines with LNTE. The Project substation, which included two 140 megavolt ampere (MVA) transformers, was also included in the acoustic analysis. CadnaA was used to assess received sound levels potentially occurring at 51 noise-sensitive receptors (NSRs; i.e. residences) identified within and near the Project area. The overall objective of this study was to determine the feasibility of the Project to operate in compliance with the Hyde County Zoning Ordinance 45 dBA noise limit and the Hughes County Zoning Ordinance 45 dBA noise limit.

Hyde County proposed regulations for wind energy facilities under Zoning Ordinance Section 9-104-A-18 as follows:

> *SECTION 9-104 Requirements for Siting Large Wind Energy Systems (LWES).*
>
> *A. Standards. A Large Wind Energy System shall be a Conditional Use in an Ag district subject to the following requirements:*
>
> *18. Noise. Noise level produced by the LWES shall not exceed forty-five (45) decibels of sound at the perimeter of occupied residences existing at the time the permit application is filed, unless a signed waiver or easement is obtained from the owner of the residence. The level, however, may be exceeded during short-term events such as utility outages or wind storms.*

Hughes County Ordinance 2020-05 amended Zoning Ordinance (No. 1997-03) Article 2 Section 2-117 regulations for wind energy facilities as follows:

> *SECTION 2-117.F Requirements for Siting Large Wind Energy Conversion Systems*
>
> *11. Noise. Noise level produced by the LWECS shall not exceed 45 dBA, average A-weighted sound pressure at the perimeter of occupied residences existing at the time the permit application is filed, unless a signed waiver or easement is obtained from the owner of the residence and recorded with the Register of Deeds.*

Acoustic modeling analyses per ISO 9613-2 and inclusive of a number of conservative assumptions were conducted, and sound levels resulting from the Project at all identified NSRs were assessed against the 45 dBA limit for Hyde and Hughes counties to determine whether compliance was achieved.

In order to assess compliance at NSRs inclusive of other contributing factors, a cumulative acoustic assessment was completed. Cumulative effects assessments consider the potential impact of the Project in the context of existing and future wind energy facilities, to ensure that any potential environmental impacts are not considered in isolation. The Project is located adjacent to the Triple H Wind Energy Project (Triple H), which includes 92 installed wind turbines. Due to its proximity, sound from Triple H turbines could contribute to sound levels received at NSRs within the Project area. To ensure combined impacts from the two projects would comply with Hyde and Hughes County requirements, a cumulative acoustic analysis was conducted for all 51 NSRs.

The Project is also located west of the South Dakota Wind Energy Center (SD WEC). However, since the Project and SD WEC would be separated by a distance greater than 5 km, cumulative effects would be minimal. Therefore, an assessment of cumulative impacts with the South Dakota Wind Energy Center is not warranted.

Cumulative Acoustic Modeling Methodology

The cumulative acoustic analysis was completed for the Project layout in combination with the Triple H wind energy facility. The cumulative analysis used the same modeling approach as presented in the *Acoustic Assessment for the North Bend Wind Project*. Operation of the Project's 78 potential wind turbine locations were evaluated in combination with the 92 wind turbines locations installed for Triple H. Substations for the Project and Triple H were also included in the cumulative assessment. Triple H has installed GE 2.72-116 wind turbines with LNTE blade technology at 90 meter hub height, as well as two 140 MVA transformers. The Triple H substation transformer specifications are similar to those specified for the Project and can be found in the *Acoustic Assessment for the North Bend Wind Project*. For the Triple H GE2.72-116 with LNTE wind turbines, Table 1 provides a summary of the sound power data correlated by wind speed at reference rotor hub height and Table 2 presents a summary of sound power by octave band center frequency during maximum rotational speed.

Table 1. Wind Turbine Broadband Sound Power Levels Correlated with Wind Speed

Wind Turbine	Hub Height (m)	Sound Power Level (dBA) at Reference Hub Height Wind Speed (m/s)						
		4	5	6	7	8	9	10
GE 2.72-116 LNTE	90.0	94.8	94.8	98.0	101.4	104.4	106.8	107.5

Source: GE 2018

Table 2. Wind Turbine Broadband Sound Power Level by Octave Band Frequency (10 m/s)

Wind Turbine	K-Factor	Octave Band Sound Power Level (dBA) by Frequency (Hz)									Broad band (dBA)
		31.5	63	125	250	500	1000	2000	4000	8000	
GE 2.72-116 LNTE	2.0	79.7	89.3	94.0	97.1	100.5	103.3	101.1	93.4	75.2	107.5

Source: GE 2018

Three cumulative modeling scenarios were evaluated for the purposes of this assessment. Acoustic modeling was completed for wind turbine operation for the following conditions thereby describing the full range of expected receive sound levels at receiver locations:

(1) Project GE 2.82-127 (LNTE) and Triple H GE 2.72-116 (LNTE) at initial cut-in wind speeds;

(2) Project GE 2.82-127 (LNTE) and Triple H GE 2.72-116 (LNTE) at maximum rotation; and

(3) Project GE 2.82-127 (LNTE) and Triple H GE 2.72-116 (LNTE) at maximum rotation during anomalous meteorological conditions.

Cumulative acoustic modeling was completed assuming all wind turbines were operating continuously and concurrently at the given operating condition.

Cumulative Acoustic Modeling Results

Sound contour plots displaying cumulative operational sound levels in color-coded isopleths are provided in Figures A-1 through A-3. The sound contours are graphical representations of the cumulative noise associated with the Project wind turbines and substation operating concurrently with Triple H wind turbines and substation at the given operating condition and show how operational noise would be distributed over the surrounding area. Figure A-1 displays broadband operational sound levels at the wind speeds during initial cut-in. Figure A-2 displays broadband operational sound levels at wind speeds sufficient to sustain wind turbine operation at maximum rotational speeds during moderate downwind propagation and Figure A-3 displays broadband operational sound levels at wind speeds sufficient to sustain wind turbine operation at maximum rotational speeds during anomalous meteorological conditions. As mentioned above, the resultant sound contour plots are independent of the existing acoustic environment, i.e., the plots and tabulated results represent Project-generated sound levels only. Table 3 presents the results of the cumulative acoustic modeling analysis and includes the NSR ID, Universal Transverse Mercator (UTM) coordinates, NSR status and the received sound levels at each NSR.

Cumulative acoustic modeling analyses per ISO 9613-2 and inclusive of a number of conservative assumptions demonstrate that received sound levels may be greater than 45 dBA at three NSRs. In comparison to the Project operating in isolation, cumulative noise impacts showed one additional exceedance of the Hyde County 45 dBA noise limit (NSR 29). While NSR 29 is not predicted to receive sound levels greater than 45 dBA with the Project operating in isolation, it may receive sound levels up to 46 dBA while the Project operates in conjunction with Triple H during anomalous meteorological conditions. No non-participating NSRs are predicted to receive sound levels that would exceed county thresholds. Both Hyde and Hughes county ordinances allow for levels above 45 dBA if a signed waiver or easement is obtained from the owner of the residence. It is expected that received sound levels at NSRs will be consistent with sound generated at similar wind energy projects successfully sited throughout the state of South Dakota employing the same or similar criteria.

Table 3. Cumulative Acoustic Modeling Results Summary

NSR ID	UTM Coordinates (meters)		Participation Status	Received Sound Levels (dBA)		
				Project GE 2.82-127 (LNTE) andTriple H GE 2.72-116 (LNTE)		
	Easting	Northing		Cut-in	Maximum Rotational	Anomalous Meteorological
1	451959	4905460	Non-Participant	22	33	36
2	451961	4905509	Non-Participant	22	34	36
3	451651	4906532	Non-Participant	26	38	40
4	451667	4906508	Non-Participant	26	37	39
5	452007	4912597	Non-Participant	32	44	45
6	456096	4911237	Non-Participant	24	36	38
7	454822	4907004	Participant	20	32	34
8	454834	4907004	Participant	20	32	34
9	456924	4903126	Non-Participant	12	23	26
10	456936	4903193	Non-Participant	13	24	27
11	458027	4909358	Non-Participant	14	26	28
12	456979	4911089	Participant	21	33	36
13	459894	4911262	Non-Participant	17	29	32

Table 3. Cumulative Acoustic Modeling Results Summary						
NSR ID	UTM Coordinates (meters)		Participation Status	Received Sound Levels (dBA)		
				Project GE 2.82-127 (LNTE) andTriple H GE 2.72-116 (LNTE)		
	Easting	Northing		Cut-in	Maximum Rotational	Anomalous Meteorological
14	456174	4911146	Non-Participant	24	36	38
15	446161	4905997	Non-Participant	27	40	41
16	441158	4903752	Non-Participant	13	25	28
17	435413	4904474	Non-Participant	5	16	19
18	437507	4925641	Non-Participant	13	25	28
19	440822	4926572	Non-Participant	15	27	30
20	444987	4923741	Participant	24	36	38
21	442558	4922500	Non-Participant	23	35	37
22	442678	4922259	Non-Participant	24	36	38
23	440697	4922015	Non-Participant	21	33	35
24	437557	4918479	Participant	21	33	35
25	440535	4919291	Participant	29	42	43
26	443100	4918873	Participant	35	48	48
27	445446	4917655	Participant	28	41	42
28	445621	4918665	Participant	32	45	45
29	445637	4918675	Participant	32	45	46
30	442663	4914508	Participant	21	32	35
31	442583	4914365	Participant	22	33	36
32	440462	4914037	Non-Participant	20	32	34
33	443049	4911871	Non-Participant	21	33	35
34	442769	4911900	Non-Participant	21	33	36
35	444336	4912677	Non-Participant	23	35	38
36	445432	4912472	Participant	26	38	40
37	445356	4911623	Participant	27	39	41
38	440290	4924270	Non-Participant	16	28	31
39	435597	4906544	Non-Participant	8	19	22
40	440884	4923291	Non-Participant	19	31	34
41	449222	4927447	Non-Participant	22	34	36
42	452104	4916108	Non-Participant	30	43	44
43	439796	4924263	Participant	13	25	27
44	442457	4925507	Participant	17	29	31
45	441883	4923945	Participant	20	32	34
46	446148	4922207	Participant	30	43	44
47	448547	4915128	Participant	29	42	43
48	448560	4915214	Participant	29	41	42
49	450247	4915029	Participant	32	45	45

Table 3. Cumulative Acoustic Modeling Results Summary

NSR ID	UTM Coordinates (meters)		Participation Status	Received Sound Levels (dBA)		
				Project GE 2.82-127 (LNTE) andTriple H GE 2.72-116 (LNTE)		
	Easting	Northing		Cut-in	Maximum Rotational	Anomalous Meteorological
50	445332	4915444	Participant	23	35	38
51	448812	4920035	Participant	34	47	48

Note: Predicted sound levels greater than the 45 dBA threshold criteria are identified in bold.

ENGIE

North Bend Wind Project

Figure A-1
Cumulative Analysis -
Received Sound Levels - Cut-in
Wind Turbine Rotational Speed

Hughes and Hyde Counties, SD

- Project Area
- North Bend Proposed Turbine
- Triple H Turbine
- Proposed Substation

Sensitive Receptor
- Participating
- Non-Participating

- County Boundary
- Highway/Major Road
- Local Road

Received Sound Level (dBA):
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- 65 - 70

N

0 0.5 1 2
Miles



TETRA TECH

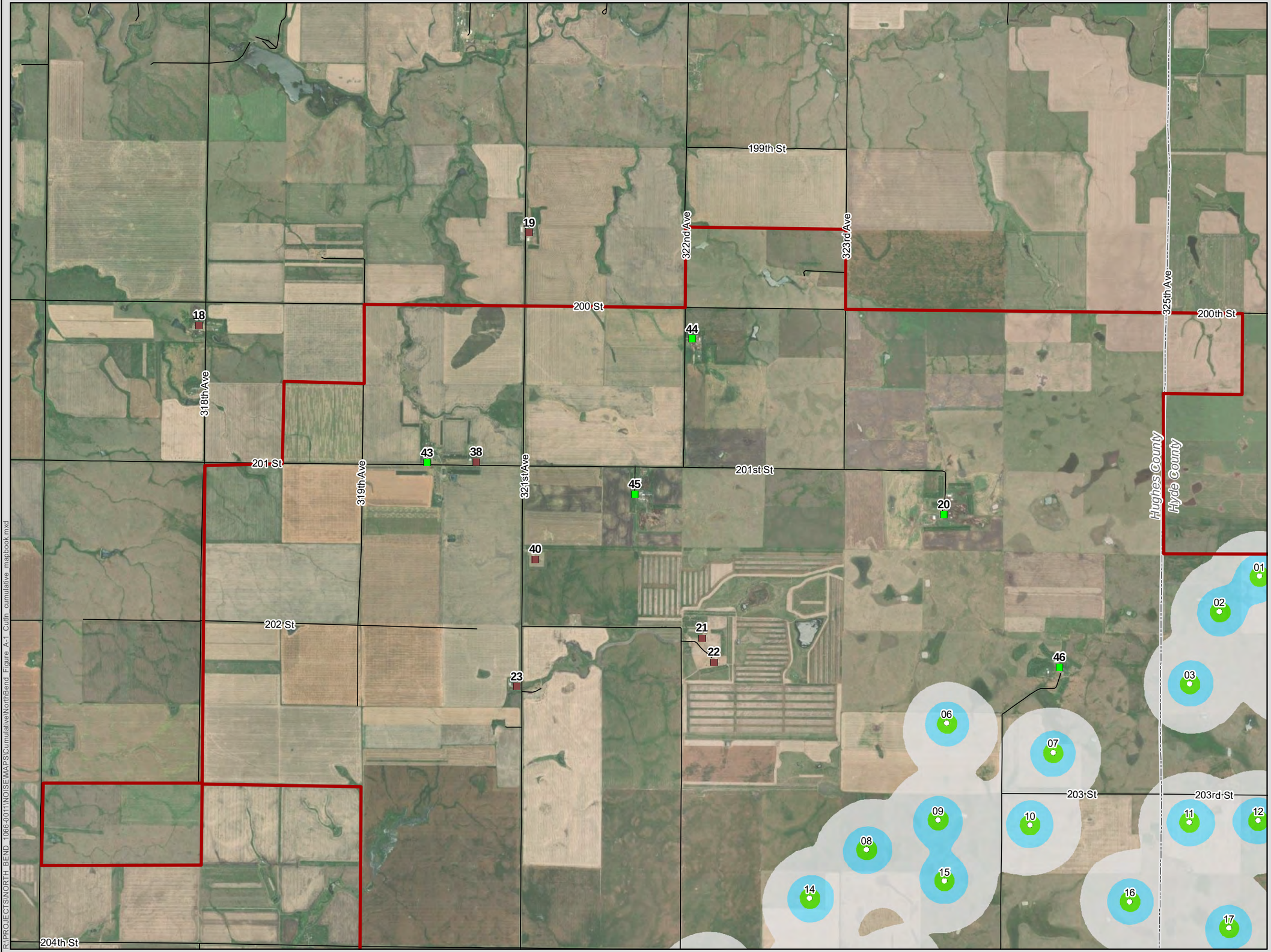
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ENGIE

North Bend Wind Project

Figure A-1A
Received Sound Levels - Cut-in
Wind Turbine Rotational Speed

Hughes and Hyde Counties, SD



- Project Area
- Proposed Turbine
- Proposed Substation

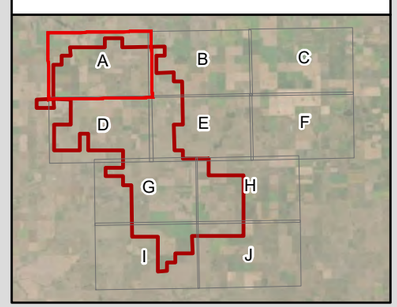
Sensitive Receptor
- Participating
- Non-Participating

- County Boundary
- Highway/Major Road
- Local Road

Received Sound Level (dBA):
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- 65 - 70

N

0 0.25 0.5 1
Miles



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North Bend Wind Project

Figure A-1B
Received Sound Levels - Cut-in
Wind Turbine Rotational Speed

Hughes and Hyde Counties, SD

- Project Area
- Proposed Turbine
- Proposed Substation

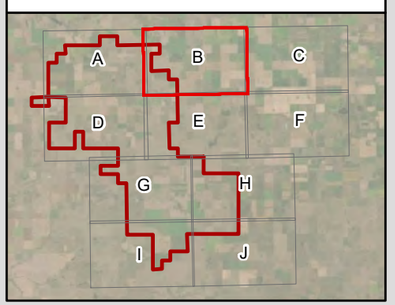
Sensitive Receptor
- Participating
- Non-Participating

- County Boundary
- Highway/Major Road
- Local Road

Received Sound Level (dBA):
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- 65 - 70

N

0 0.25 0.5 1
Miles



TETRA TECH

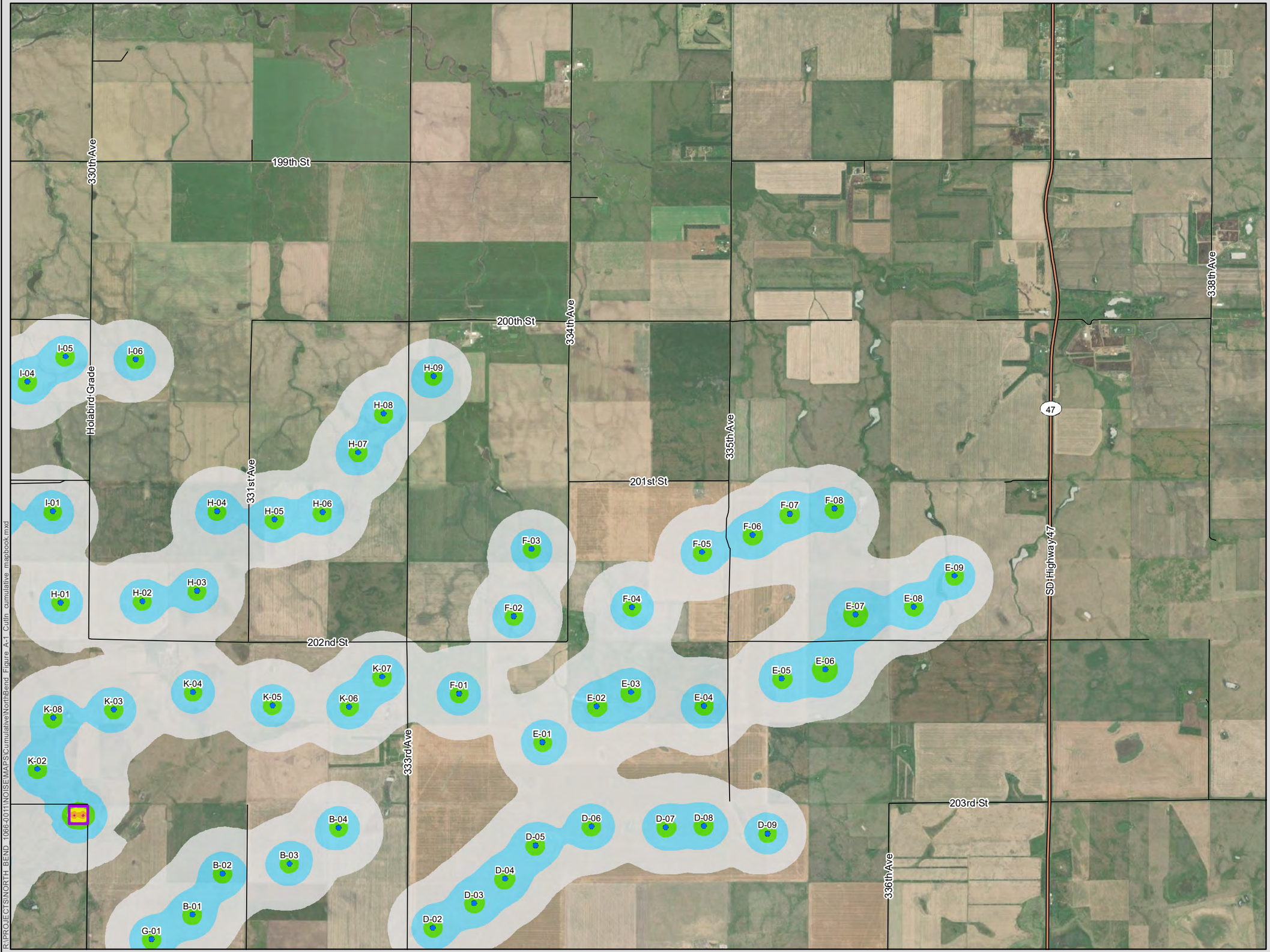
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North Bend Wind Project

Figure A-1C
Received Sound Levels - Cut-in
Wind Turbine Rotational Speed

Hughes and Hyde Counties, SD



- Project Area
- Proposed Turbine
- Proposed Substation

Sensitive Receptor

- Participating
- Non-Participating

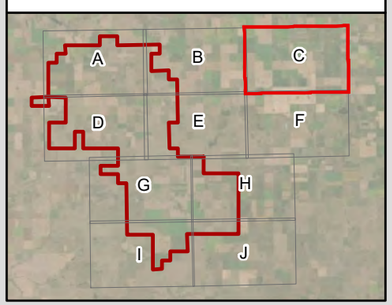
- County Boundary
- Highway/Major Road
- Local Road

Received Sound Level (dBA):

- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- 65 - 70

N

0 0.25 0.5 1
Miles



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North Bend Wind Project

Figure A-1D
Received Sound Levels - Cut-in
Wind Turbine Rotational Speed

Hughes and Hyde Counties, SD

- Project Area
- Proposed Turbine
- Proposed Substation

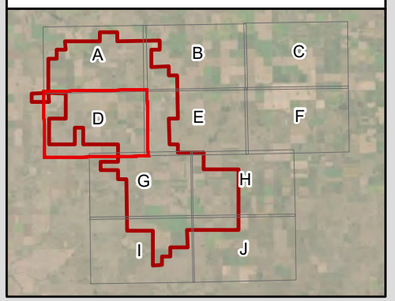
Sensitive Receptor
- Participating
- Non-Participating

- County Boundary
- Highway/Major Road
- Local Road

Received Sound Level (dBA):
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- 65 - 70

N

0 0.25 0.5 1
Miles



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North Bend Wind Project

Figure A-1E
Received Sound Levels - Cut-in
Wind Turbine Rotational Speed

Hughes and Hyde Counties, SD

- Project Area
- Proposed Turbine
- Proposed Substation

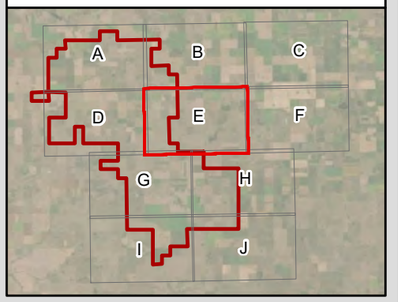
Sensitive Receptor
- Participating
- Non-Participating

- County Boundary
- Highway/Major Road
- Local Road

Received Sound Level (dBA):
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- 65 - 70

N

0 0.25 0.5 1
Miles



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North Bend Wind Project

Figure A-1F
Received Sound Levels - Cut-in
Wind Turbine Rotational Speed

Hughes and Hyde Counties, SD

- Project Area
- Proposed Turbine
- Proposed Substation

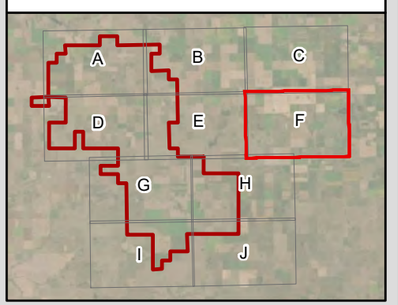
Sensitive Receptor
- Participating
- Non-Participating

- County Boundary
- Highway/Major Road
- Local Road

Received Sound Level (dBA):
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- 65 - 70

N

0 0.25 0.5 1
Miles



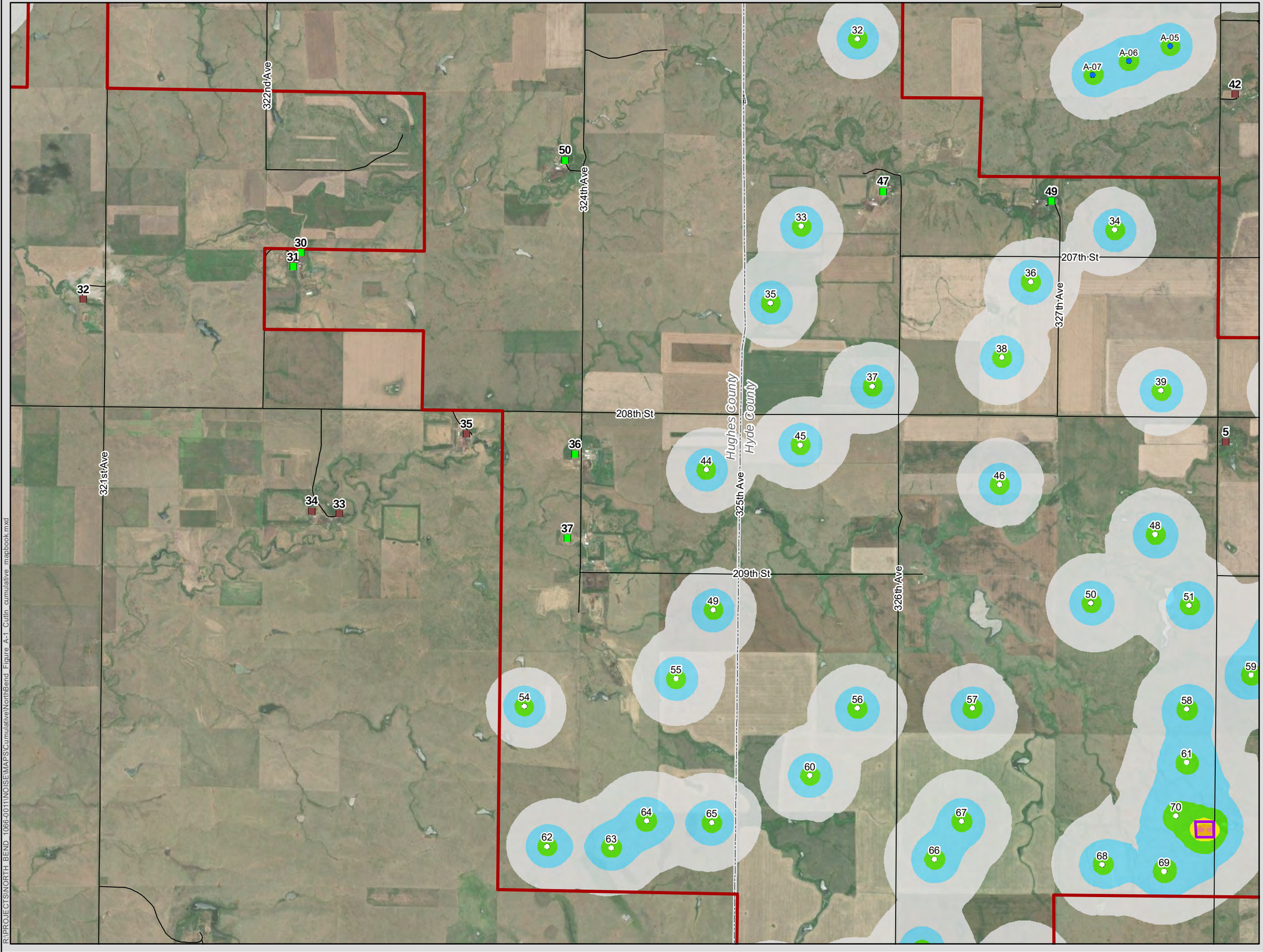
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North Bend Wind Project

Figure A-1G
Received Sound Levels - Cut-in
Wind Turbine Rotational Speed

Hughes and Hyde Counties, SD



- Project Area
- Proposed Turbine
- Proposed Substation

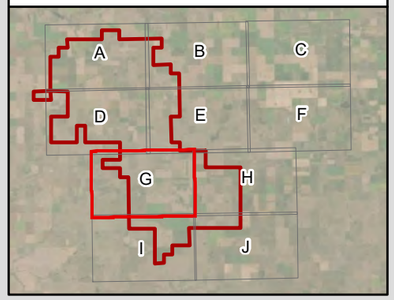
Sensitive Receptor
- Participating
- Non-Participating

- County Boundary
- Highway/Major Road
- Local Road

Received Sound Level (dBA):
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- 65 - 70

N

0 0.25 0.5 1
Miles



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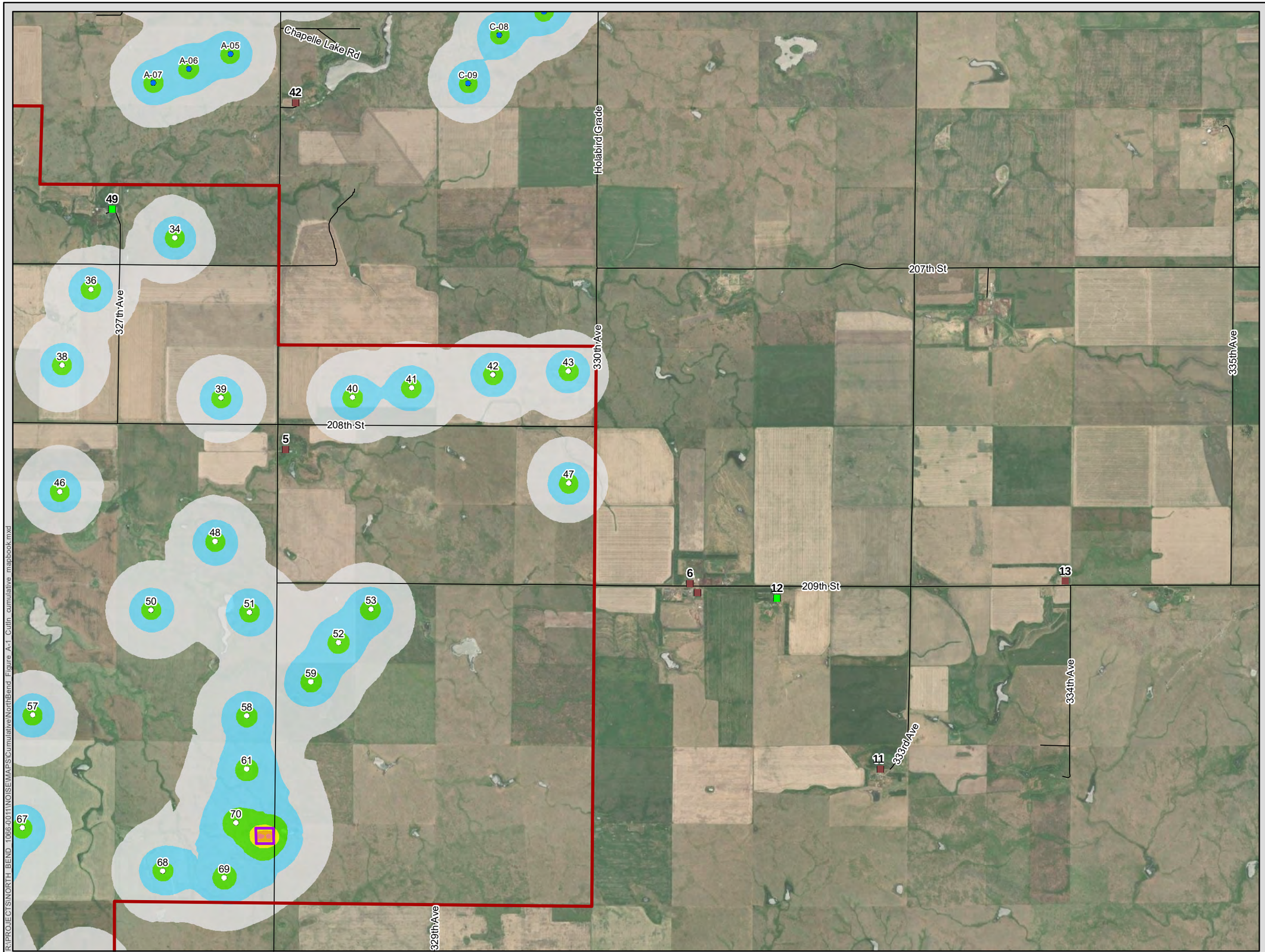
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North Bend Wind Project

Figure A-1H
Received Sound Levels - Cut-in
Wind Turbine Rotational Speed

Hughes and Hyde Counties, SD



- Project Area
- Proposed Turbine
- Proposed Substation

Sensitive Receptor

- Participating
- Non-Participating

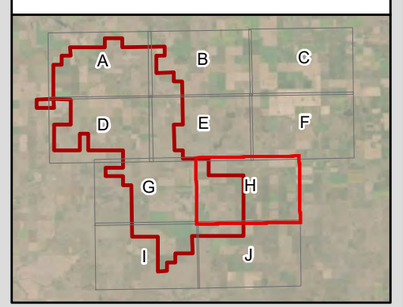
- County Boundary
- Highway/Major Road
- Local Road

Received Sound Level (dBA):

- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- 65 - 70

N

0 0.25 0.5 1
Miles



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North Bend Wind Project

Figure A-1I
Received Sound Levels - Cut-in
Wind Turbine Rotational Speed

Hughes and Hyde Counties, SD

- Project Area
- Proposed Turbine
- Proposed Substation

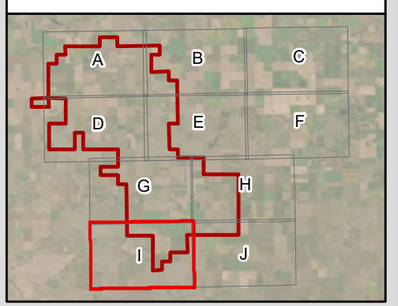
Sensitive Receptor
- Participating
- Non-Participating

- County Boundary
- Highway/Major Road
- Local Road

Received Sound Level (dBA):
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- 65 - 70

N

0 0.25 0.5 1
Miles



TETRA TECH

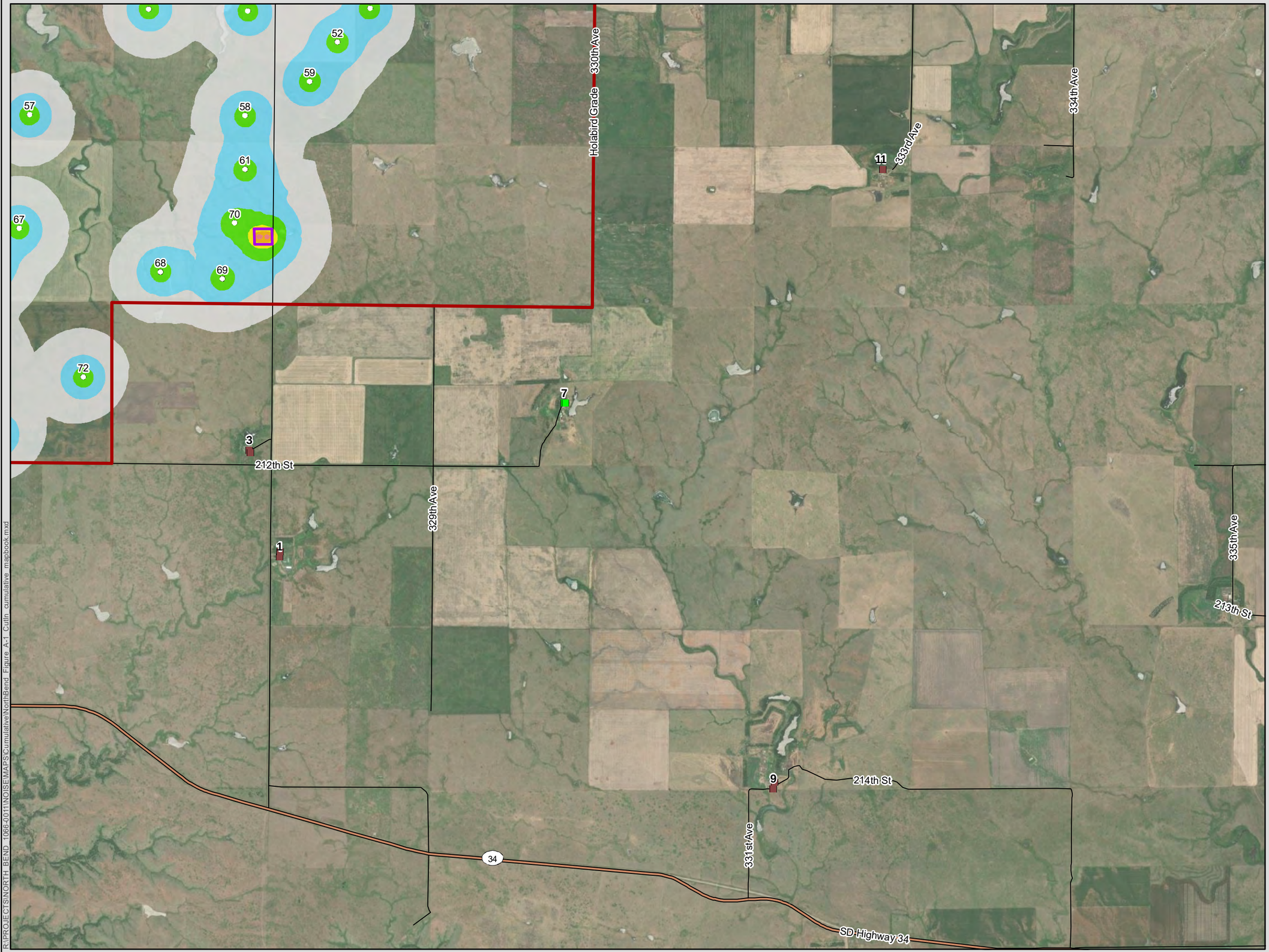
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North Bend Wind Project

Figure A-1J
Received Sound Levels - Cut-in
Wind Turbine Rotational Speed

Hughes and Hyde Counties, SD



- Project Area
- Proposed Turbine
- Proposed Substation

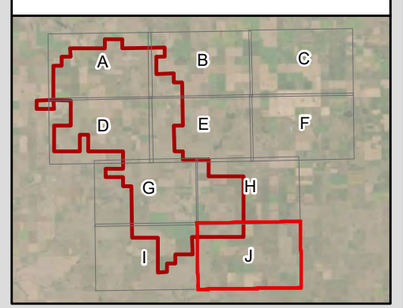
Sensitive Receptor
- Participating
- Non-Participating

- County Boundary
- Highway/Major Road
- Local Road

Received Sound Level (dBA):
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- 65 - 70

N

0 0.25 0.5 1
Miles



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North Bend Wind Project

Figure A-2
Cumulative Analysis -
Received Sound Levels - Maximum
Wind Turbine Rotational Speed

Hughes and Hyde Counties, SD

- Project Area
- North Bend Proposed Turbine
- Triple H Turbine
- Proposed Substation

Sensitive Receptor
- Participating
- Non-Participating

- County Boundary
- Highway/Major Road
- Local Road

Received Sound Level (dBA):
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- 65 - 70

N

0 0.5 1 2
Miles



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North Bend Wind Project

Figure A-2A
Received Sound Levels - Maximum
Wind Turbine Rotational Speed

Hughes and Hyde Counties, SD

- Project Area
- Proposed Turbine
- Proposed Substation

Sensitive Receptor
- Participating
- Non-Participating

- County Boundary
- Highway/Major Road
- Local Road

Received Sound Level (dBA):
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- 65 - 70

N

0 0.25 0.5 1
Miles

A B C
D E F
G H
I J

TETRA TECH

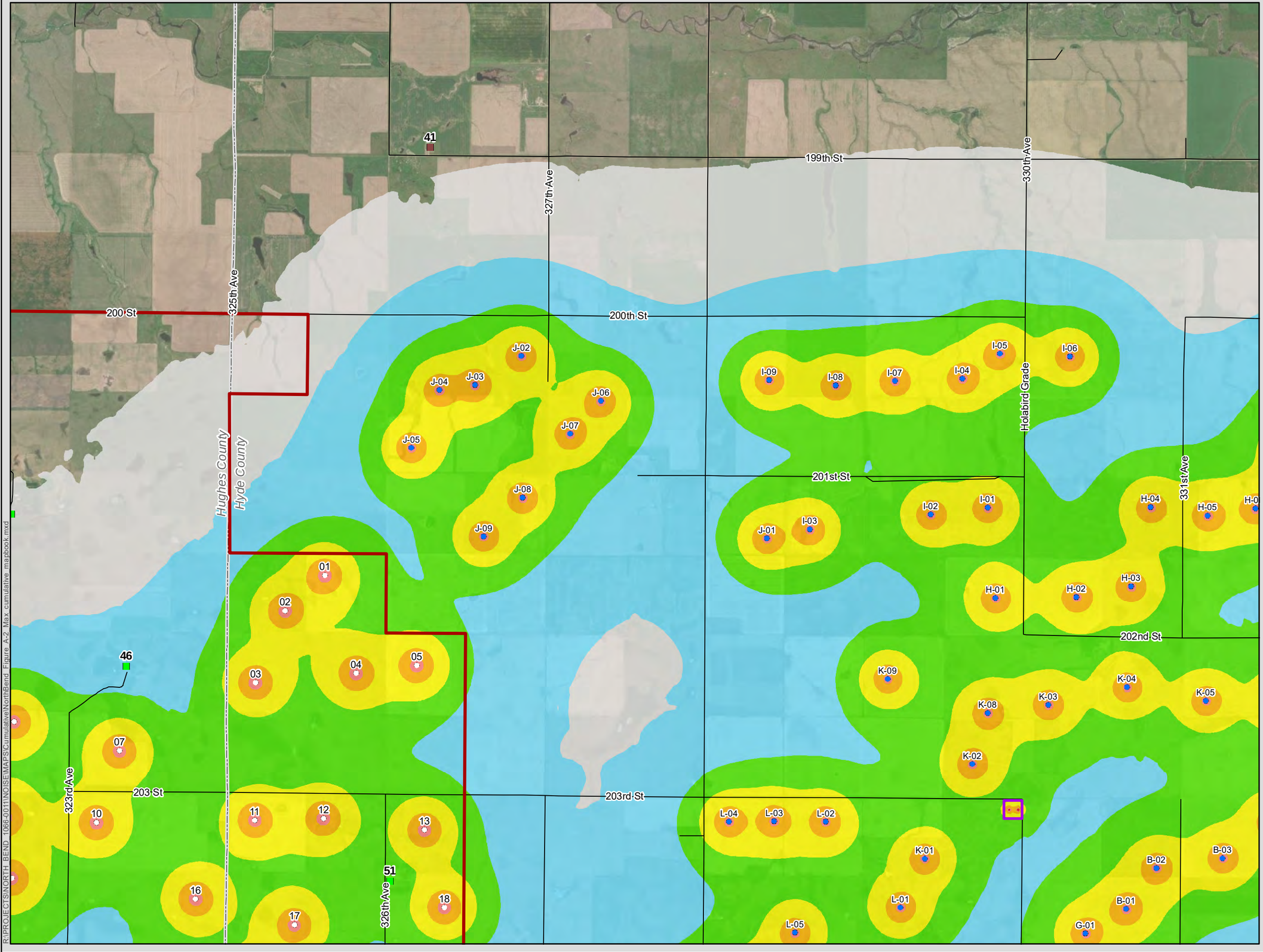
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North Bend Wind Project

Figure A-2B
Received Sound Levels - Maximum
Wind Turbine Rotational Speed

Hughes and Hyde Counties, SD

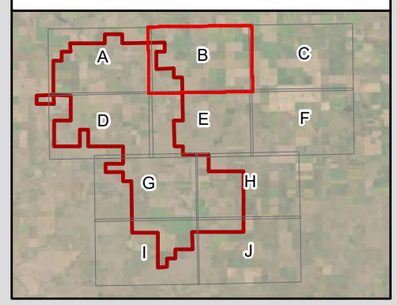


Project Area
Proposed Turbine
Proposed Substation
Sensitive Receptor
Participating
Non-Participating
County Boundary
Highway/Major Road
Local Road

Received Sound Level (dBA):
35 - 40
40 - 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70

N

0 0.25 0.5 1
Miles



TETRA TECH

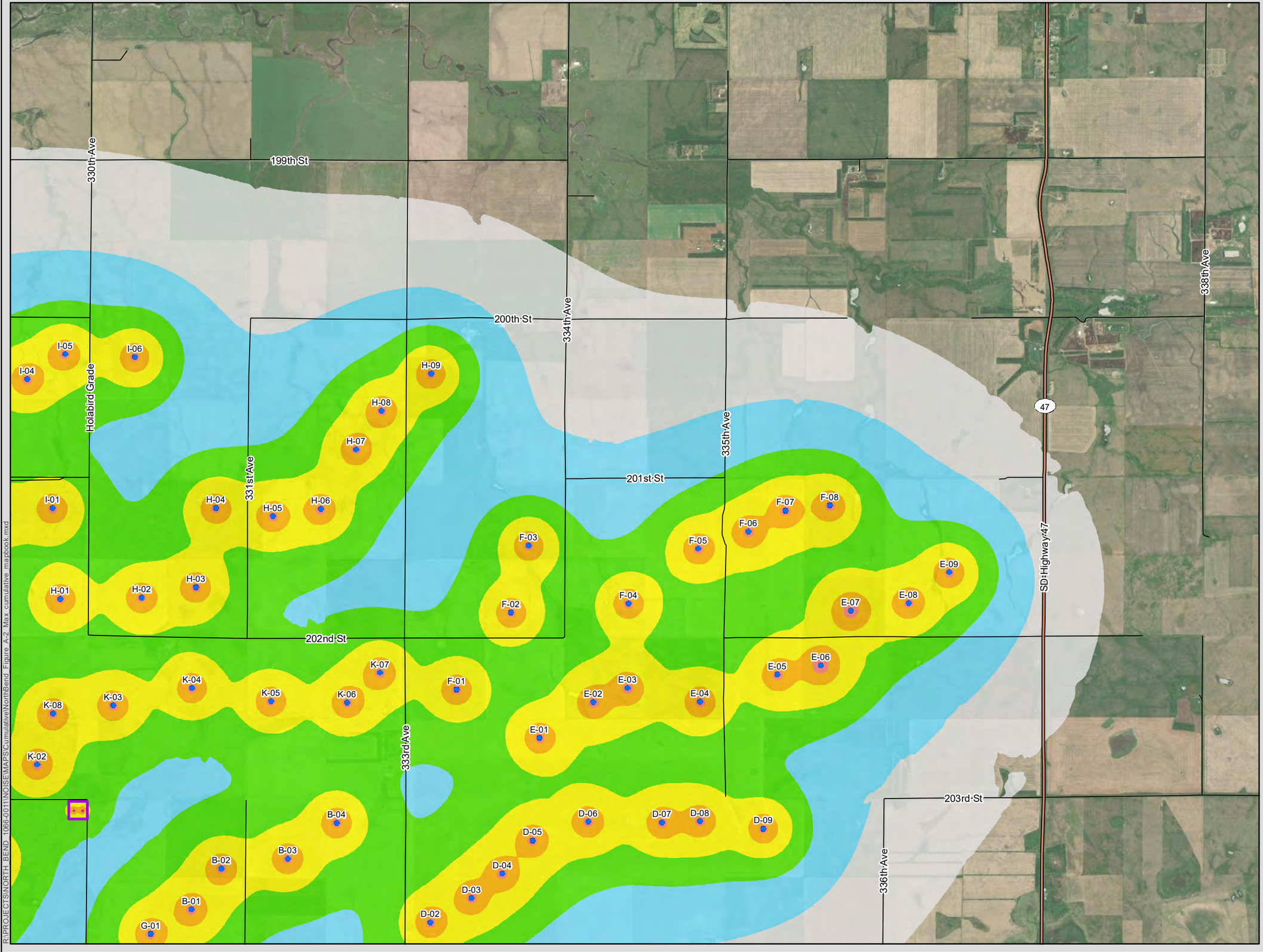
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North Bend Wind Project

Figure A-2C
Received Sound Levels - Maximum
Wind Turbine Rotational Speed

Hughes and Hyde Counties, SD



- Project Area
- Proposed Turbine
- Proposed Substation

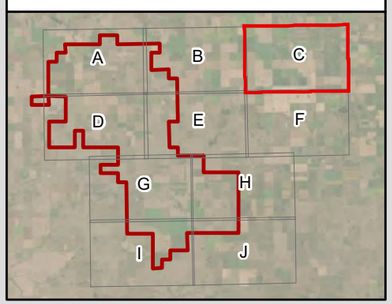
Sensitive Receptor
- Participating
- Non-Participating

- County Boundary
- Highway/Major Road
- Local Road

Received Sound Level (dBA):
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- 65 - 70

N

0 0.25 0.5 1
Miles



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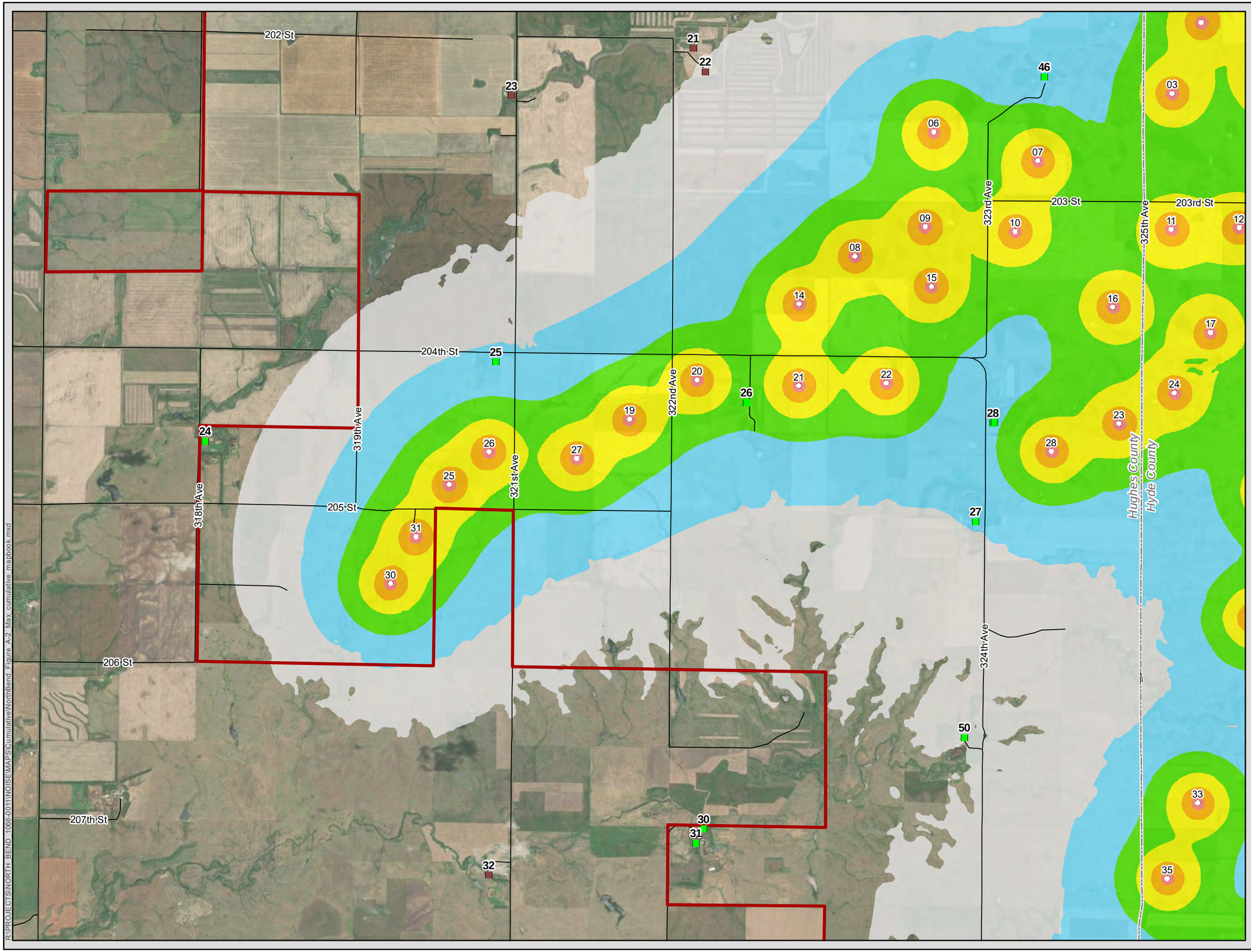
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North Bend Wind Project

Figure A-2D
Received Sound Levels - Maximum
Wind Turbine Rotational Speed

Hughes and Hyde Counties, SD



- Project Area
- Proposed Turbine
- Proposed Substation

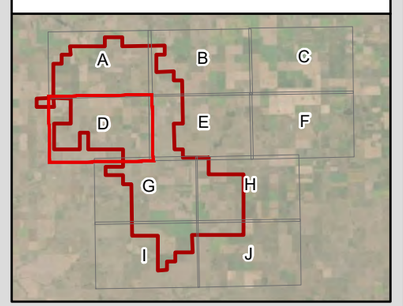
Sensitive Receptor
- Participating
- Non-Participating

- County Boundary
- Highway/Major Road
- Local Road

Received Sound Level (dBA):
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- 65 - 70

N

0 0.25 0.5 1
Miles



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North Bend Wind Project

Figure A-2E
Received Sound Levels - Maximum
Wind Turbine Rotational Speed

Hughes and Hyde Counties, SD

- Project Area
- Proposed Turbine
- Proposed Substation

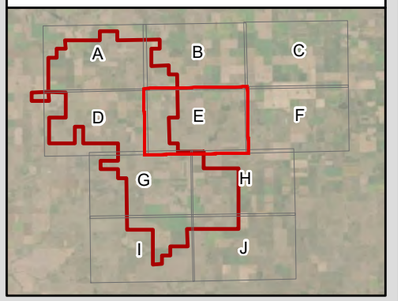
Sensitive Receptor
- Participating
- Non-Participating

- County Boundary
- Highway/Major Road
- Local Road

Received Sound Level (dBA):
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- 65 - 70

N

0 0.25 0.5 1
Miles



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North Bend Wind Project

Figure A-2F
Received Sound Levels - Maximum
Wind Turbine Rotational Speed

Hughes and Hyde Counties, SD

- Project Area
- Proposed Turbine
- Proposed Substation

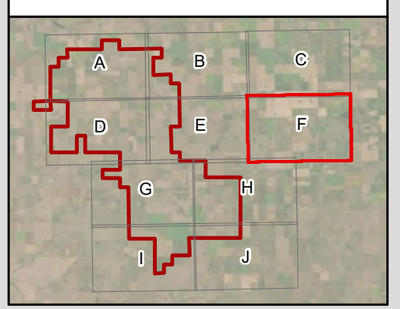
Sensitive Receptor
- Participating
- Non-Participating

- County Boundary
- Highway/Major Road
- Local Road

Received Sound Level (dBA):
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- 65 - 70

N

0 0.25 0.5 1
Miles



TETRA TECH

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North Bend Wind Project

Figure A-2G
Received Sound Levels - Maximum
Wind Turbine Rotational Speed

Hughes and Hyde Counties, SD

- Project Area
- Proposed Turbine
- Proposed Substation

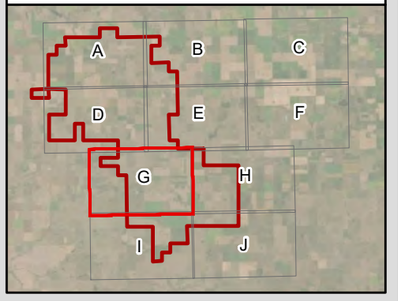
Sensitive Receptor
- Participating
- Non-Participating

- County Boundary
- Highway/Major Road
- Local Road

Received Sound Level (dBA):
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- 65 - 70

N

0 0.25 0.5 1
Miles



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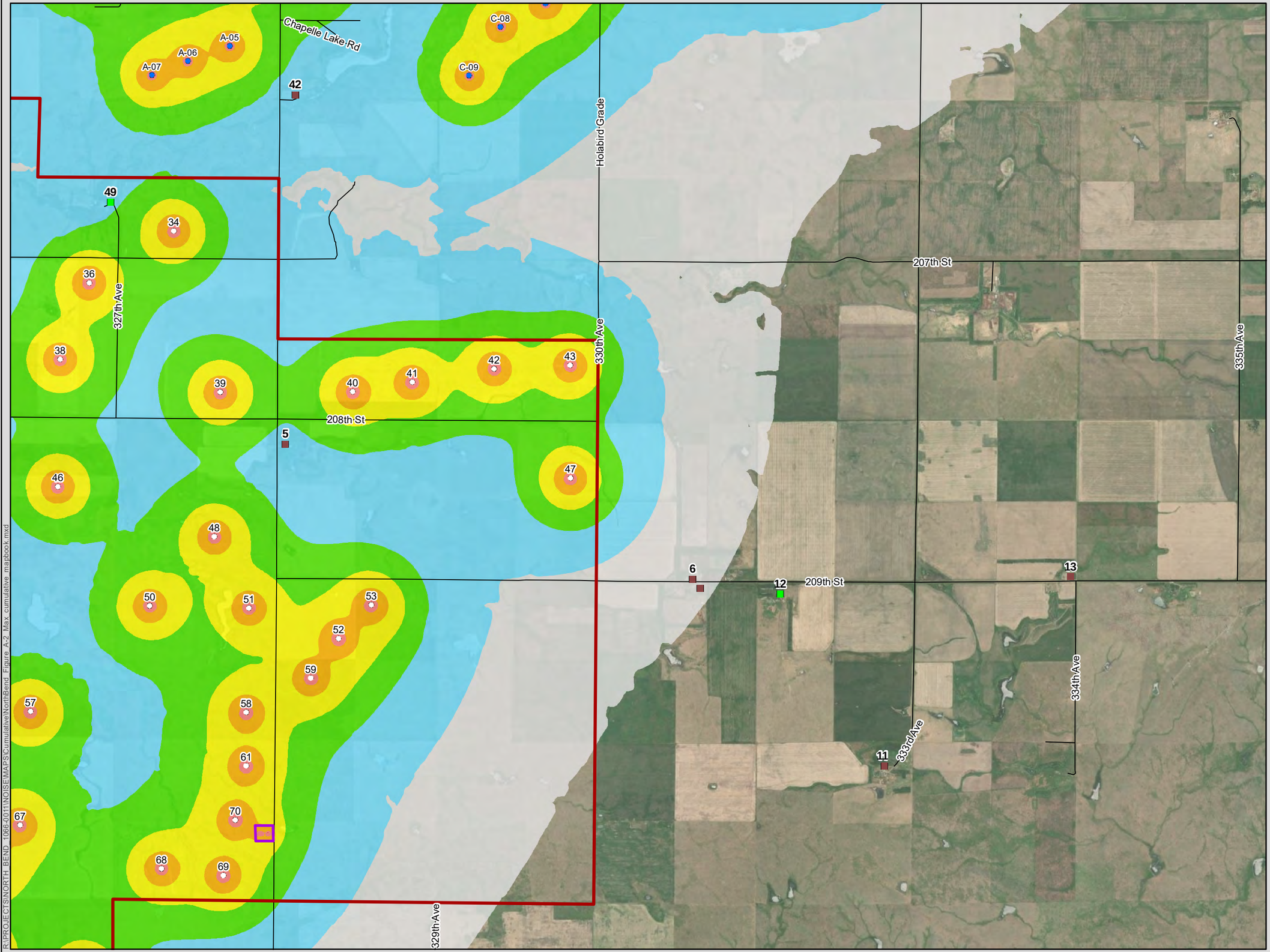
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North Bend Wind Project

Figure A-2H
Received Sound Levels - Maximum
Wind Turbine Rotational Speed

Hughes and Hyde Counties, SD

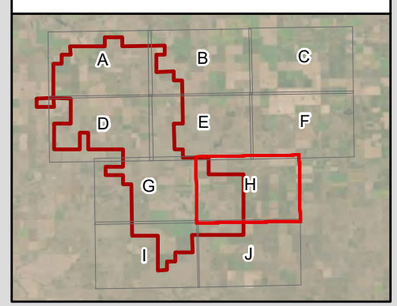


Project Area
Proposed Turbine
Proposed Substation
Sensitive Receptor
Participating
Non-Participating
County Boundary
Highway/Major Road
Local Road

Received Sound Level (dBA):
35 - 40
40 - 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70

N

0 0.25 0.5 1
Miles



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North Bend Wind Project

Figure A-2I
Received Sound Levels - Maximum
Wind Turbine Rotational Speed

Hughes and Hyde Counties, SD

- Project Area
- Proposed Turbine
- Proposed Substation

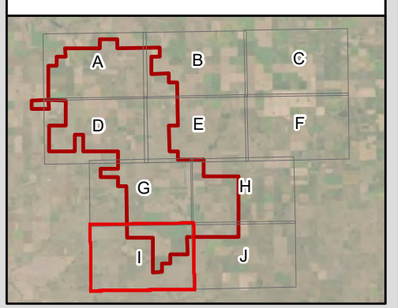
Sensitive Receptor
- Participating
- Non-Participating

- County Boundary
- Highway/Major Road
- Local Road

Received Sound Level (dBA):
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- 65 - 70

N

0 0.25 0.5 1
Miles



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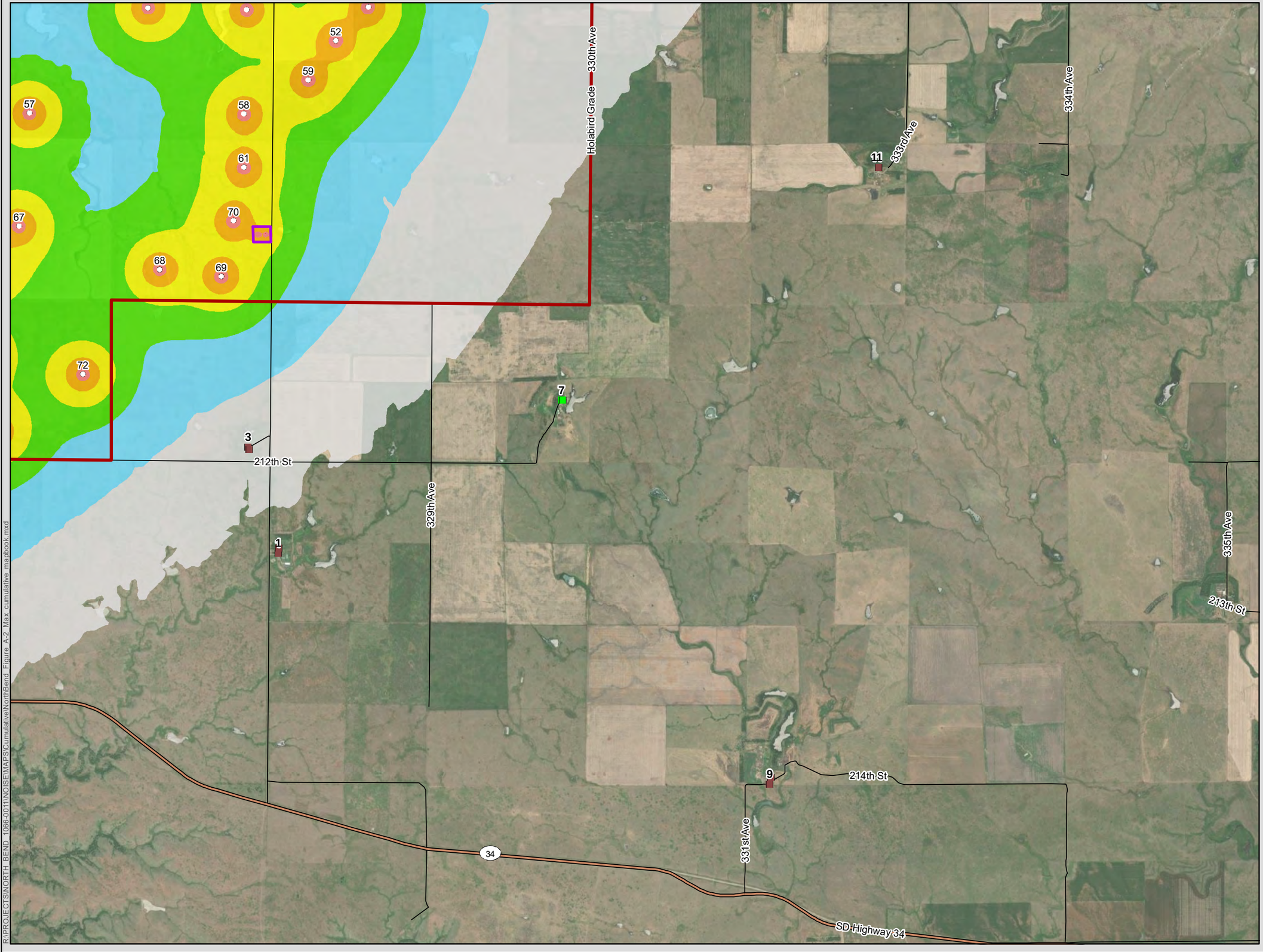
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North Bend Wind Project

Figure A-2J
Received Sound Levels - Maximum
Wind Turbine Rotational Speed

Hughes and Hyde Counties, SD

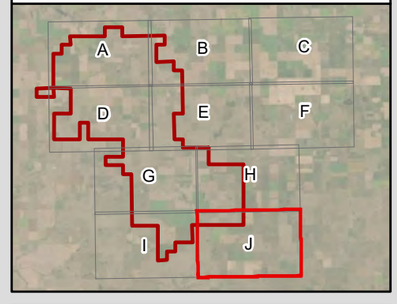


Project Area
Proposed Turbine
Proposed Substation
Sensitive Receptor
Participating
Non-Participating
County Boundary
Highway/Major Road
Local Road

Received Sound Level (dBA):
35 - 40
40 - 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70

N

0 0.25 0.5 1
Miles



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North Bend Wind Project

Figure A-3
Cumulative Analysis -
Received Sound Levels - Maximum
Wind Turbine Rotational Speed during
Anomalous Meteorological Conditions

Hughes and Hyde Counties, SD

- Project Area
- North Bend Proposed Turbine
- Triple H Turbine
- Proposed Substation

Sensitive Receptor
- Participating
- Non-Participating

- County Boundary
- Highway/Major Road
- Local Road

Received Sound Level (dBA):
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- 65 - 70

N

0 0.5 1 2
Miles



TETRA TECH

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North Bend Wind Project

Figure A-3A
Received Sound Levels - Maximum Wind Turbine Rotational Speed during Anomalous Meteorological Conditions

Hughes and Hyde Counties, SD

- Project Area
- Proposed Turbine
- Proposed Substation

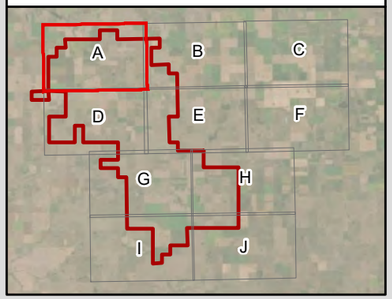
Sensitive Receptor
- Participating
- Non-Participating

- County Boundary
- Highway/Major Road
- Local Road

Received Sound Level (dBA):
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- 65 - 70

N

0 0.25 0.5 1
Miles



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North Bend Wind Project

Figure A-3B
Received Sound Levels - Maximum Wind Turbine Rotational Speed during Anomalous Meteorological Conditions

Hughes and Hyde Counties, SD

- Project Area
- Proposed Turbine
- Proposed Substation

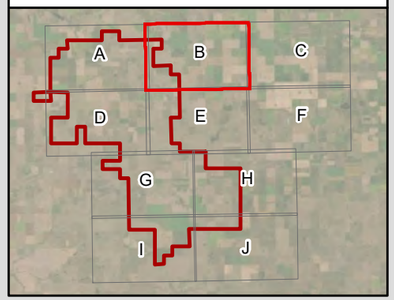
Sensitive Receptor
- Participating
- Non-Participating

- County Boundary
- Highway/Major Road
- Local Road

Received Sound Level (dBA):
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- 65 - 70

N

0 0.25 0.5 1
Miles



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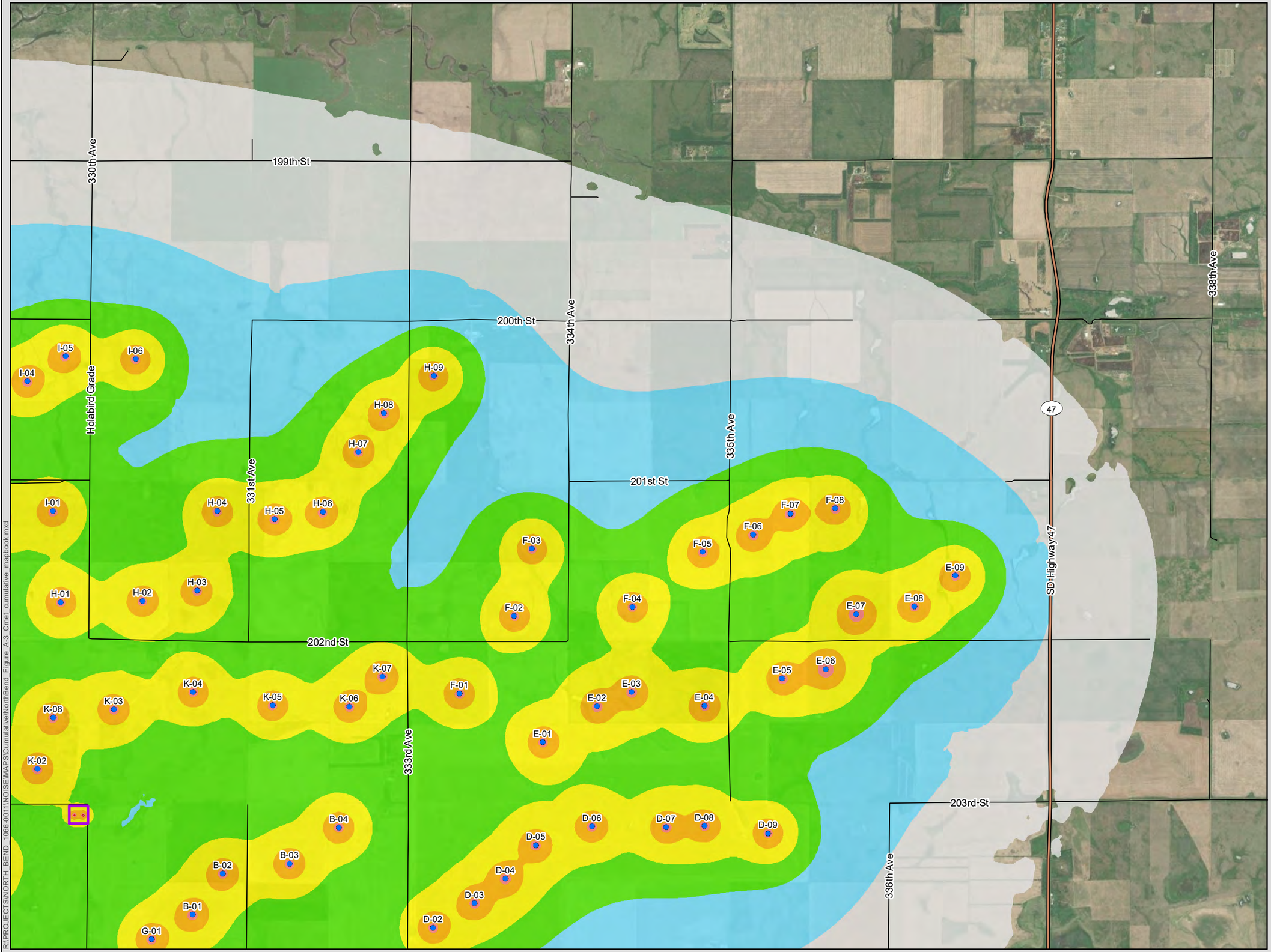
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North Bend Wind Project

Figure A-3C
Received Sound Levels - Maximum Wind Turbine Rotational Speed during Anomalous Meteorological Conditions

Hughes and Hyde Counties, SD



- Project Area
- Proposed Turbine
- Proposed Substation

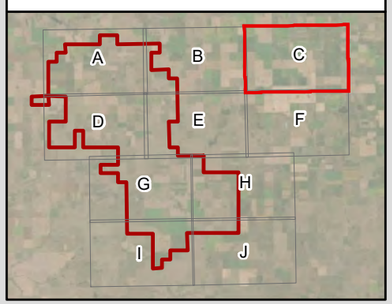
Sensitive Receptor
- Participating
- Non-Participating

- County Boundary
- Highway/Major Road
- Local Road

Received Sound Level (dBA):
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- 65 - 70

N

0 0.25 0.5 1
Miles



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North Bend Wind Project

Figure A-3D
Received Sound Levels - Maximum Wind Turbine Rotational Speed during Anomalous Meteorological Conditions

Hughes and Hyde Counties, SD

- Project Area
- Proposed Turbine
- Proposed Substation

Sensitive Receptor
- Participating
- Non-Participating

- County Boundary
- Highway/Major Road
- Local Road

Received Sound Level (dBA):
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- 65 - 70

N

0 0.25 0.5 1
Miles

A B C
D E F
G H
I J

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North Bend Wind Project

Figure A-3E
Received Sound Levels - Maximum Wind Turbine Rotational Speed during Anomalous Meteorological Conditions

Hughes and Hyde Counties, SD

- Project Area
- Proposed Turbine
- Proposed Substation

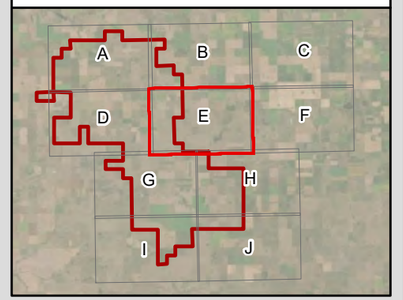
Sensitive Receptor
- Participating
- Non-Participating

- County Boundary
- Highway/Major Road
- Local Road

Received Sound Level (dBA):
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- 65 - 70

N

0 0.25 0.5 1
Miles



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North Bend Wind Project

Figure A-3F
Received Sound Levels - Maximum Wind Turbine Rotational Speed during Anomalous Meteorological Conditions

Hughes and Hyde Counties, SD

- Project Area
- Proposed Turbine
- Proposed Substation

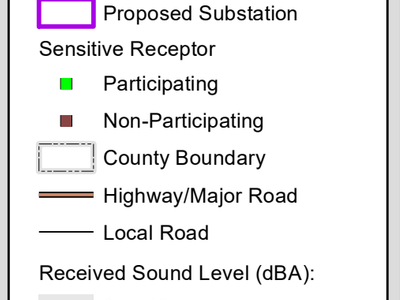
Sensitive Receptor
- Participating
- Non-Participating

- County Boundary
- Highway/Major Road
- Local Road

Received Sound Level (dBA):
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- 65 - 70

N

0 0.25 0.5 1
Miles



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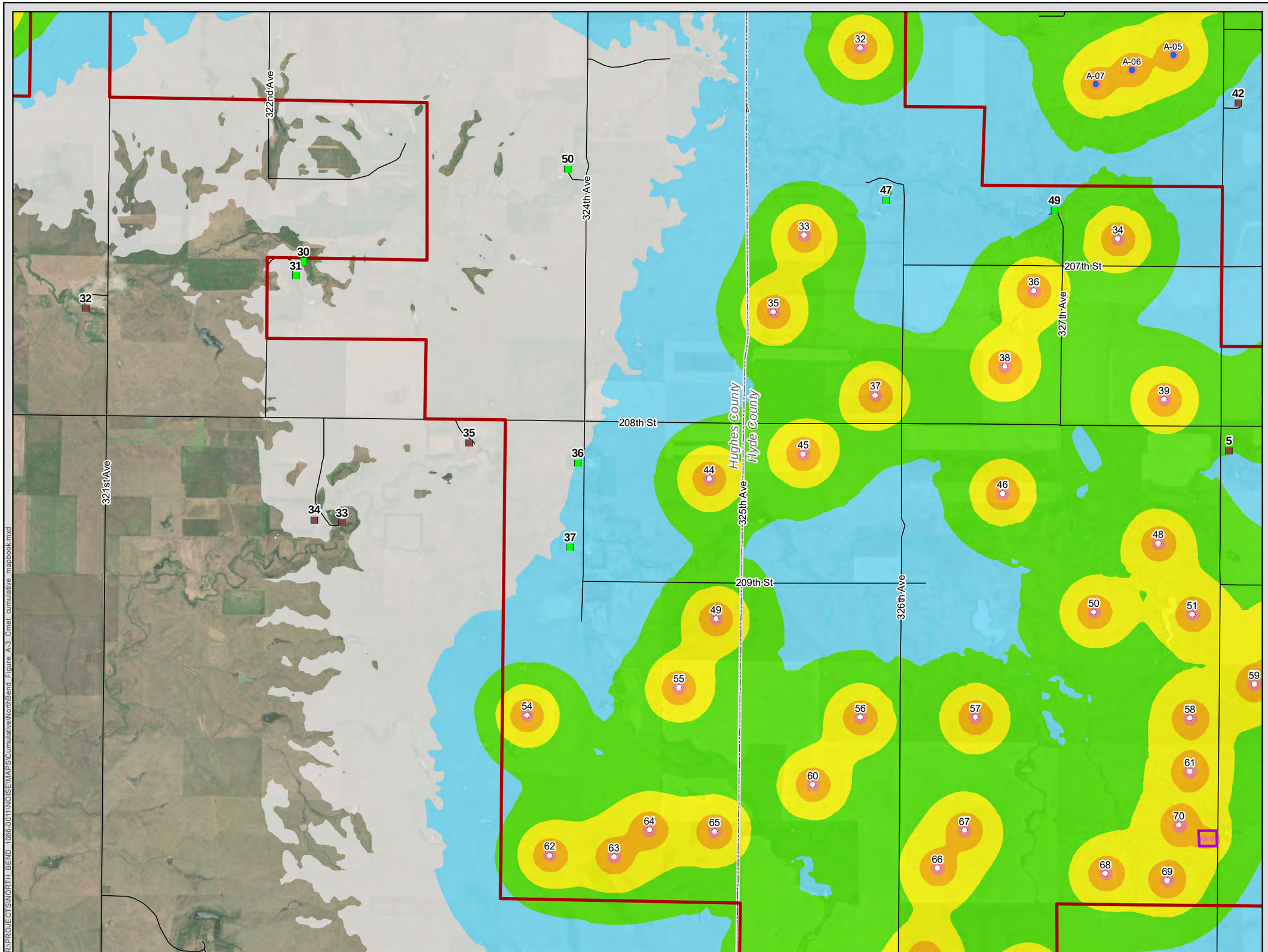
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North Bend Wind Project

Figure A-3G
Received Sound Levels - Maximum Wind Turbine Rotational Speed during Anomalous Meteorological Conditions

Hughes and Hyde Counties, SD



- Project Area
- Proposed Turbine
- Proposed Substation

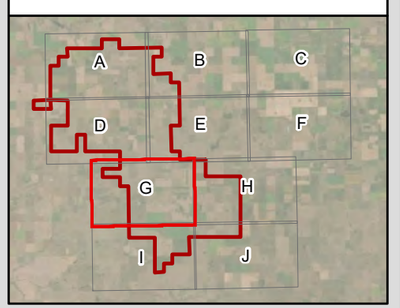
Sensitive Receptor
- Participating
- Non-Participating

- County Boundary
- Highway/Major Road
- Local Road

Received Sound Level (dBA):
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- 65 - 70

N

0 0.25 0.5 1
Miles



TETRA TECH

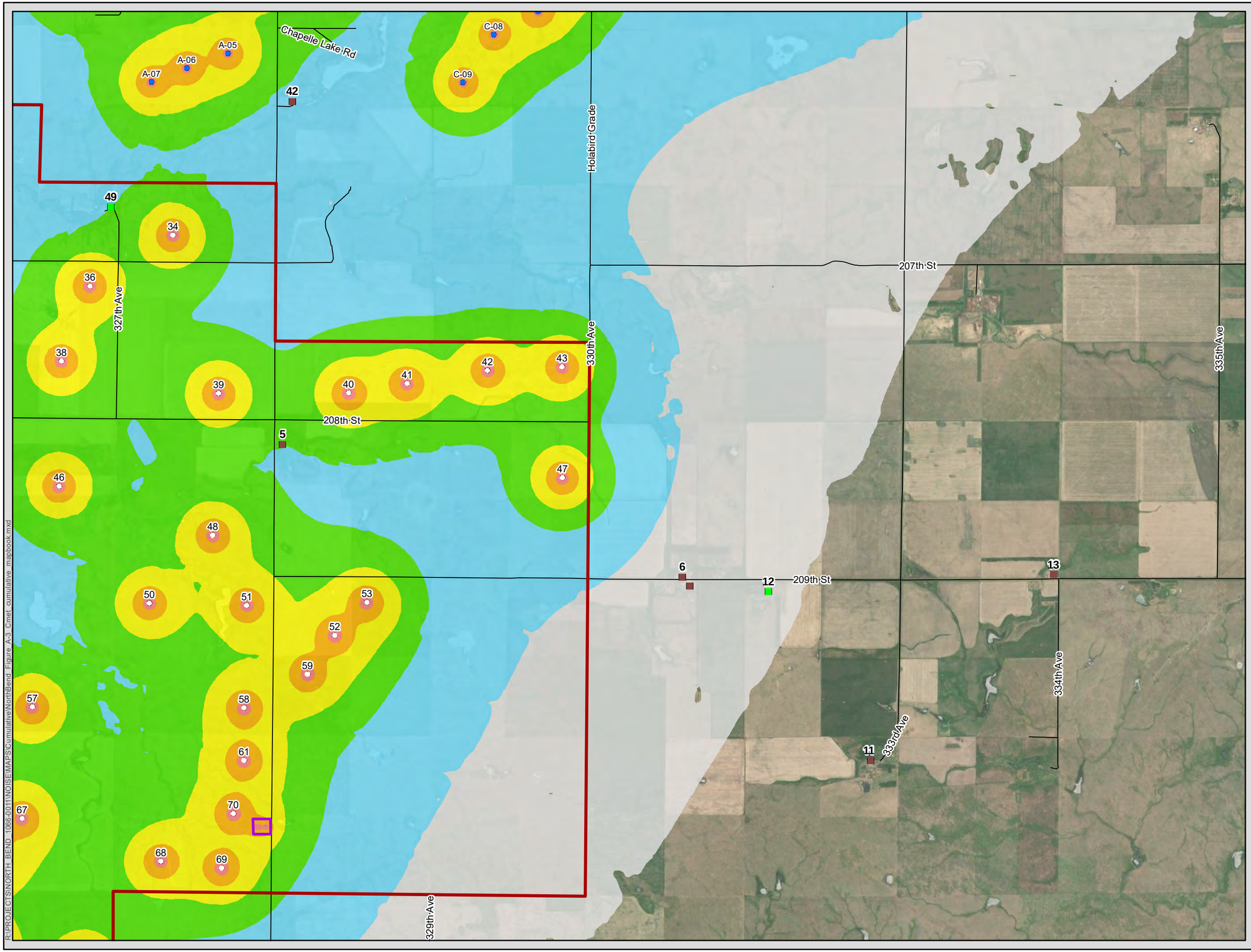
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North Bend Wind Project

Figure A-3H
Received Sound Levels - Maximum Wind Turbine Rotational Speed during Anomalous Meteorological Conditions

Hughes and Hyde Counties, SD

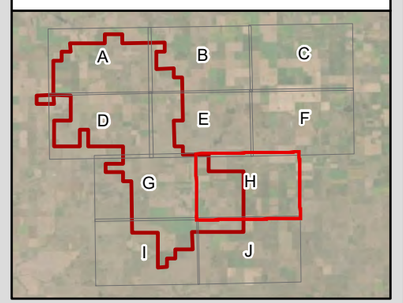


Project Area
Proposed Turbine
Proposed Substation
Sensitive Receptor
Participating
Non-Participating
County Boundary
Highway/Major Road
Local Road

Received Sound Level (dBA):
35 - 40
40 - 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70

N

0 0.25 0.5 1
Miles



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North Bend Wind Project

Figure A-3I
Received Sound Levels - Maximum Wind Turbine Rotational Speed during Anomalous Meteorological Conditions

Hughes and Hyde Counties, SD

- Project Area
- Proposed Turbine
- Proposed Substation

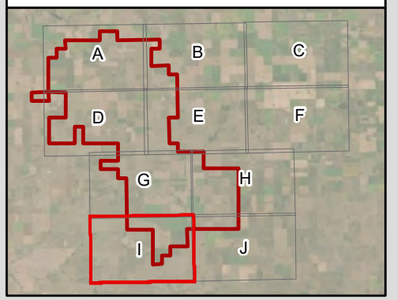
Sensitive Receptor
- Participating
- Non-Participating

- County Boundary
- Highway/Major Road
- Local Road

Received Sound Level (dBA):
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- 65 - 70

N

0 0.25 0.5 1
Miles



TETRA TECH

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North Bend Wind Project

Figure A-3J
Received Sound Levels - Maximum Wind Turbine Rotational Speed during Anomalous Meteorological Conditions

Hughes and Hyde Counties, SD

- Project Area
- Proposed Turbine
- Proposed Substation

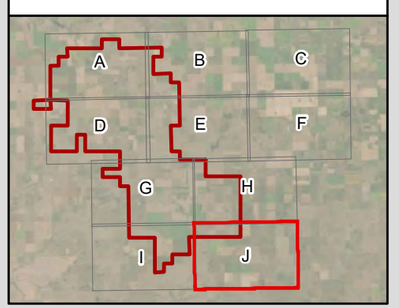
Sensitive Receptor
- Participating
- Non-Participating

- County Boundary
- Highway/Major Road
- Local Road

Received Sound Level (dBA):
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- 65 - 70

N

0 0.25 0.5 1
Miles



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To:	Casey Willis, ENGIE
From:	Tetra Tech, Inc.
Date:	July 2021
Subject:	North Bend Wind Project – Cumulative Shadow Flicker Analysis Memo

Tetra Tech conducted a shadow flicker impact assessment on behalf of North Bend Wind Project, LLC (North Bend) for the proposed North Bend Wind Project (the Project) located in Hyde and Hughes counties, South Dakota. The proposed Project has a maximum nameplate capacity of approximately 200 megawatts (MW) and includes up to 71 General Electric (GE) 2.82-127 wind turbines, each with 3 blades, a generating capacity of 2.82 MW, a rotor diameter of 127 meters, and an 89-meter-tall hub height.

The shadow flicker assessment was conducted using the WindPro model and according to the methodologies described in the June 2021 shadow flicker assessment report (*Shadow Flicker Impact Analysis for the North Bend Wind Project*). The analysis evaluated 78 potential turbine locations, though the Project would only construct up to 71 turbines. WindPro was used to assess shadow flicker potentially occurring at 51 residences identified within and near the Project area. The results of the June 2021 assessment demonstrated that shadow flicker impacts within the study area are expected to comply with requirements established by Hyde County Zoning Ordinance Section 9-104-A-20 shown below for all but one receptor location that is participating in the Project.

> *A Flicker Analysis shall include the duration and location of flicker potential for all receptors and road ways within a one (1) mile radius of each turbine within a project. The applicant shall provide a site map identifying the locations of shadow flicker that may be caused by the project and the expected durations of the flicker at these locations from sun-rise to sun-set over the course of a year. The analysis shall account for topography but not for obstacles such as accessory structures and trees. Flicker at any receptor shall not exceed thirty (30) hours per year within an established dwelling and forty (40) hours per year from any occupied structure.*

The Project is located adjacent to the Triple H Wind Energy Project (Triple H), which has been constructed and includes 92 turbine locations. Due to the proximity of Triple H to the Project, shadow flicker from Triple H turbines could contribute to shadow flicker impact at residences within the Project area. In order to ensure combined impacts from the two projects would comply with Hyde County requirements, a cumulative shadow flicker analysis was conducted for all 51 residences.

The Project is also adjacent to the South Dakota Wind Energy Center, located near the southwest corner of the Project area. However, since the Project does not contribute to shadow flicker impacts at the residences in this area, an assessment of cumulative impacts with the South Dakota Wind Energy Center is not warranted.

Cumulative Shadow Flicker Modeling Methodology

The cumulative shadow flicker analysis was completed using WindPro for the Project layout in combination with the as-built Triple H turbine layout. The cumulative analysis used the same modeling approach as presented in the *Shadow Flicker Impact Analysis for the North Bend Wind Project*. The Project's 78 potential turbine locations were evaluated in combination with Triple H's 92 turbine locations for a total of 170 wind turbines. The Triple H turbine model specifications are based on the General Electric (GE) 2.72-116 wind turbines, each with 3 blades, a generating capacity of 2.72 MW, a rotor diameter of 116 meters, and an 90-meter-tall hub height.

Cumulative Shadow Flicker Modeling Results

Table 1 presents the WindPro-predicted cumulative shadow flicker impacts for the top 10 worst-case impact receptors. Table 2 summarizes the cumulative shadow flicker impact prediction statistics. The predicted shadow flicker impact and participation status for all 51 receptors is presented in Table 3. Figure 1 shows the 170 modeled turbine locations, the 51 receptors, and the modeled shadow flicker impact areas. The maximum predicted cumulative shadow flicker impact at any occupied residence receptor is 79 hours and 44 minutes per year (Receptor 26). This is approximately 1.8 percent of the potential available daylight hours. Consistent with results of the shadow flicker modeling analysis for the North Bend Wind Project operating in isolation, the results of the cumulative shadow flicker analysis show that shadow flicker impact hours are less than the Hyde County Zoning Ordinance shadow flicker limit of 30 hours per year at all non-participating receptors.

Table 1. WindPro Top 10 Expected Shadow Flicker Impacts – Cumulative Analysis

Receptor ID	Receptor Type	Receptor Project Participation Status	Expected Shadow Flicker Hours per Year (Hours/Year)
26	Residential	Participant	79:44
51	Residential	Participant	27:14
29	Residential	Participant	26:28
28	Residential	Participant	25:51
49	Residential	Participant	13:59
15	Residential	Non-Participant	9:38
37	Residential	Participant	7:43
5	Residential	Non-Participant	6:59
47	Residential	Participant	6:34
48	Residential	Participant	6:25

Table 2. Statistical Summary of WindPro Expected Shadow Flicker Impacts – Number of Modeled Receptors – Cumulative Analysis

Cumulative Shadow Flicker Time (Expected)	Number of Modeled Receptors
Total	51
= 0 Hours	37
> 0 Hours ≤ 10 Hours	9
> 10 Hours ≤ 20 Hours	1
> 20 Hours ≤ 30 Hours	3
> 30 Hours	1

Table 3. Detailed Summary of WindPro Shadow Flicker Analysis Results – Cumulative Analysis

Receptor ID	UTM-E (m)	UTM-N (m)	WindPro Predicted Expected Shadow Flicker (Hours per Year)	Participation Status
1	451958.52	4905459.68	0:00	Non-Participant
2	451961.25	4905508.56	0:00	Non-Participant
3	451651.02	4906532.26	0:00	Non-Participant
4	451666.55	4906507.72	0:00	Non-Participant
5	452006.57	4912596.63	6:59	Non-Participant
6	456096.06	4911237.29	0:00	Non-Participant
7	454822.16	4907003.67	0:00	Participant
8	454834.31	4907004.11	0:00	Participant
9	456924.00	4903126.18	0:00	Non-Participant
10	456935.84	4903193.23	0:00	Non-Participant
11	458026.96	4909357.80	0:00	Non-Participant
12	456979.34	4911089.45	0:00	Participant
13	459894.21	4911262.03	0:00	Non-Participant
14	456174.50	4911145.59	0:00	Non-Participant
15	446161.47	4905997.12	9:38	Non-Participant
16	441158.23	4903751.87	0:00	Non-Participant
17	435412.60	4904474.20	0:00	Non-Participant
18	437506.50	4925640.83	0:00	Non-Participant
19	440821.77	4926572.35	0:00	Non-Participant
20	444986.74	4923741.15	0:00	Participant
21	442557.93	4922499.66	0:00	Non-Participant
22	442678.13	4922259.39	0:00	Non-Participant
23	440696.77	4922014.60	0:00	Non-Participant
24	437557.01	4918479.44	0:00	Participant
25	440534.66	4919290.67	2:07	Participant
26	443100.07	4918872.53	79:44	Participant
27	445445.63	4917654.54	0:00	Participant
28	445621.46	4918664.76	25:51	Participant
29	445636.78	4918674.61	26:28	Participant
30	442662.54	4914507.82	0:00	Participant
31	442582.52	4914365.18	0:00	Participant
32	440462.38	4914037.19	0:00	Non-Participant
33	443049.47	4911870.51	0:00	Non-Participant
34	442768.99	4911899.59	0:00	Non-Participant
35	444335.87	4912676.58	0:00	Non-Participant
36	445432.05	4912472.50	2:57	Participant

Receptor ID	UTM-E (m)	UTM-N (m)	WindPro Predicted Expected Shadow Flicker (Hours per Year)	Participation Status
37	445355.76	4911622.81	7:43	Participant
38	440289.85	4924270.07	0:00	Non-Participant
39	435597.42	4906544.14	0:00	Non-Participant
40	440884.50	4923291.30	0:00	Non-Participant
41	449222.28	4927447.00	0:00	Non-Participant
42	452103.97	4916107.54	8:03	Non-Participant
43	439795.82	4924263.47	0:00	Participant
44	442457.39	4925506.86	0:00	Participant
45	441883.41	4923945.14	0:00	Participant
46	446147.85	4922206.81	4:56	Participant
47	448546.99	4915127.89	6:34	Participant
48	448560.37	4915214.35	6:25	Participant
49	450247.17	4915028.55	13:59	Participant
50	445332.30	4915443.56	0:00	Participant
51	448812.30	4920034.63	27:14	Participant

Figure

ENGIE

North Bend Wind Project

Figure 1
Cumulative Analysis -
Expected Shadow Flicker
Impact Area

Hughes and Hyde Counties, SD

- Project Area
- North Bend Proposed Turbine
- Triple H Turbine

Sensitive Receptor
- Participating
- Non-Participating

- County Boundary
- Highway/Major Road
- Local Road

Shadow Flicker (Hours per Year)
- 0 - 15
- >15 - 30
- >30 - 50
- >50 - 100
- >100 - 200
- >200

N

0 0.5 1 2
Miles



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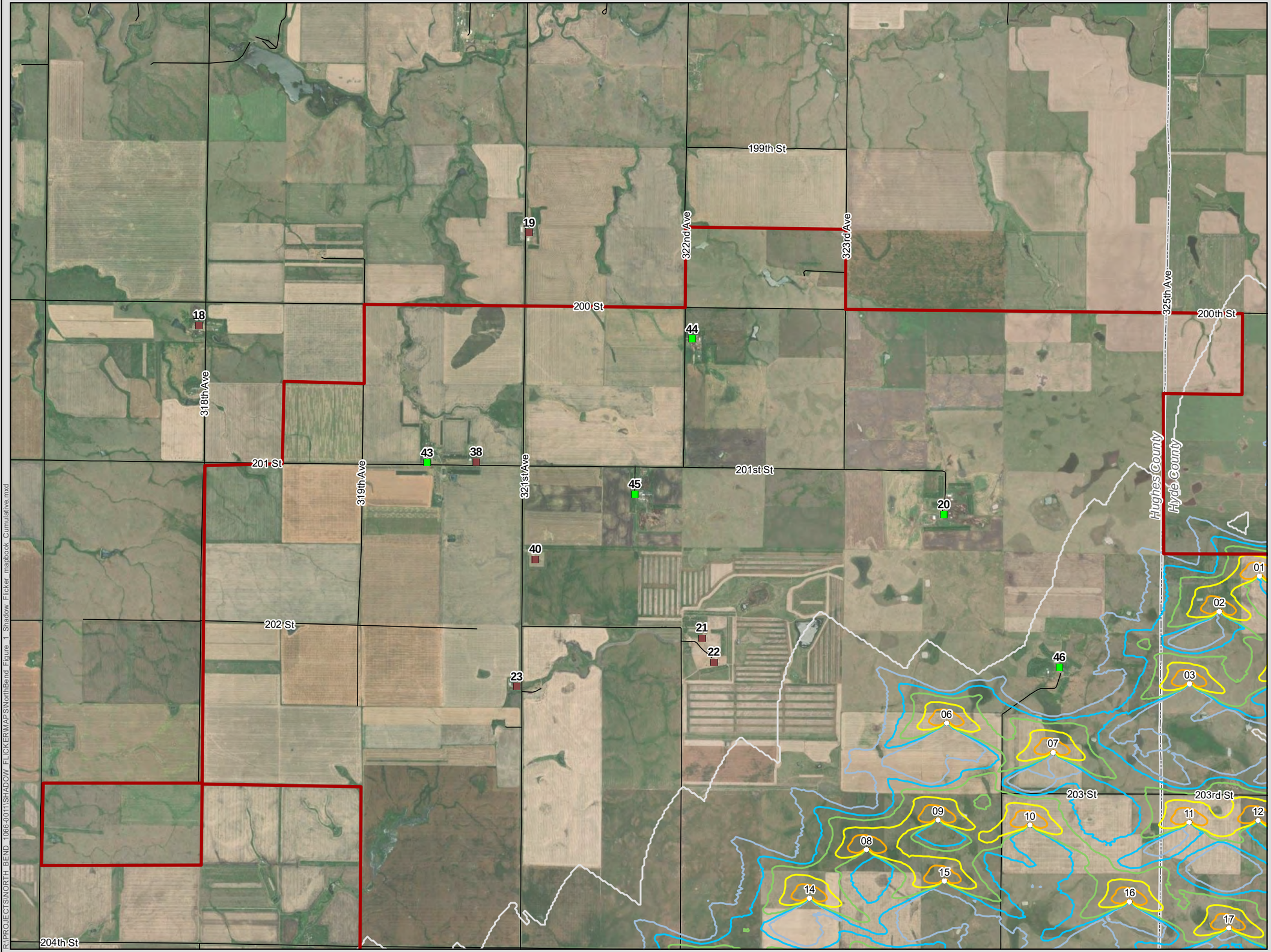
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North Bend Wind Project

Figure 1A
Cumulative Analysis -
Expected Shadow Flicker
Impact Area

Hughes and Hyde Counties, SD



- Project Area
- North Bend Proposed Turbine
- Triple H Turbine

Sensitive Receptor

- Participating
- Non-Participating

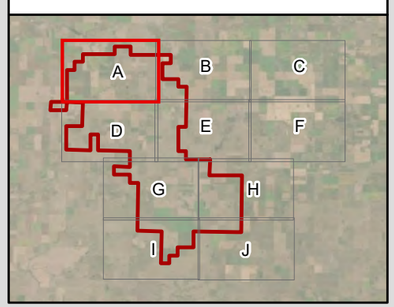
- County Boundary
- Highway/Major Road
- Local Road

Shadow Flicker (Hours per Year)

- 0 - 15
- >15 - 30
- >30 - 50
- >50 - 100
- >100 - 200
- >200

N

0 0.25 0.5 1
Miles



TETRA TECH

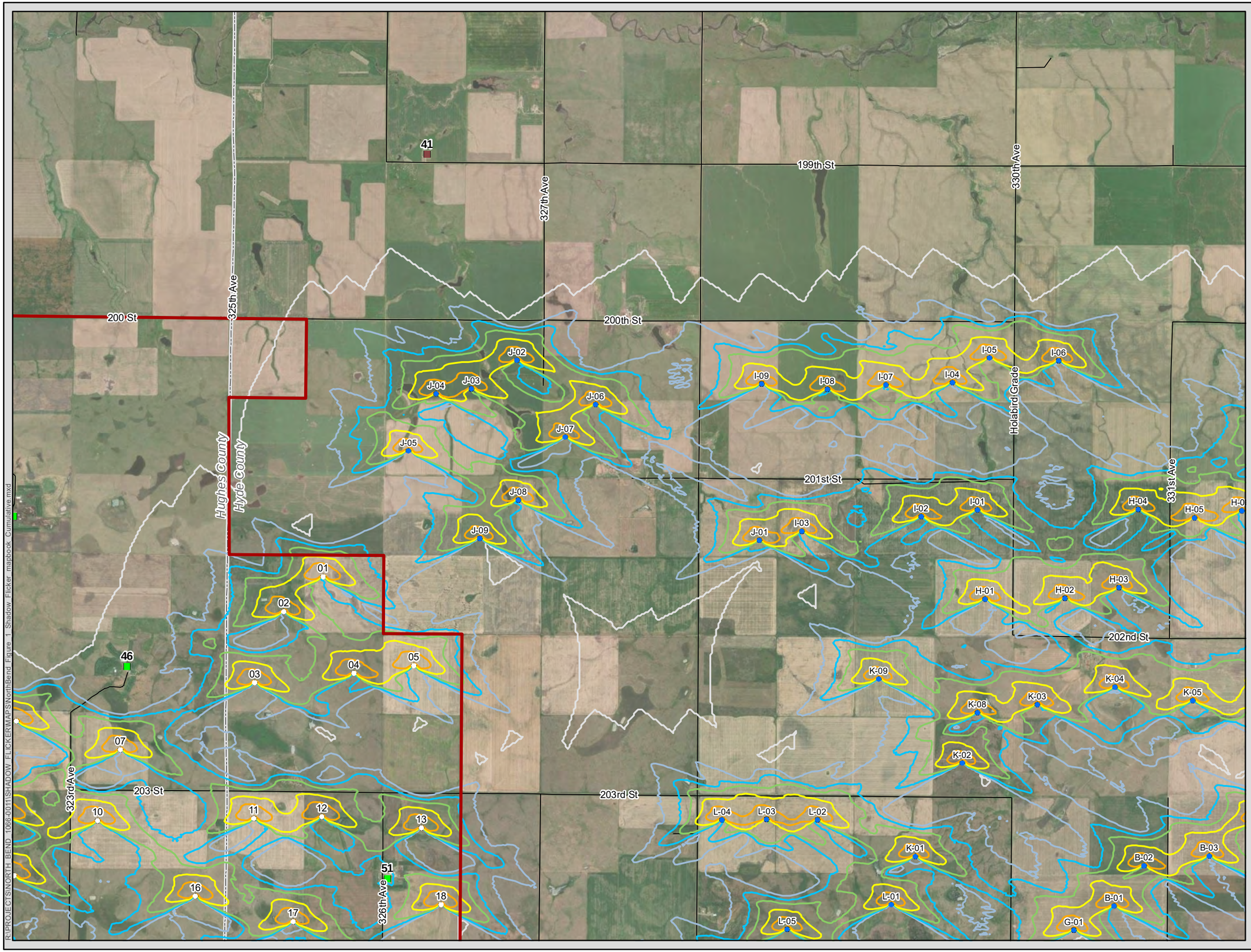
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North Bend Wind Project

Figure 1B
Cumulative Analysis -
Expected Shadow Flicker
Impact Area

Hughes and Hyde Counties, SD



Project Area
North Bend Proposed Turbine
Triple H Turbine

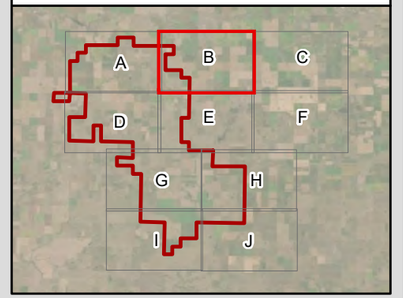
Sensitive Receptor
- Participating
- Non-Participating

County Boundary
Highway/Major Road
Local Road

Shadow Flicker (Hours per Year)
- 0 - 15
- >15 - 30
- >30 - 50
- >50 - 100
- >100 - 200
- >200

N

0 0.25 0.5 1
Miles



TETRA TECH

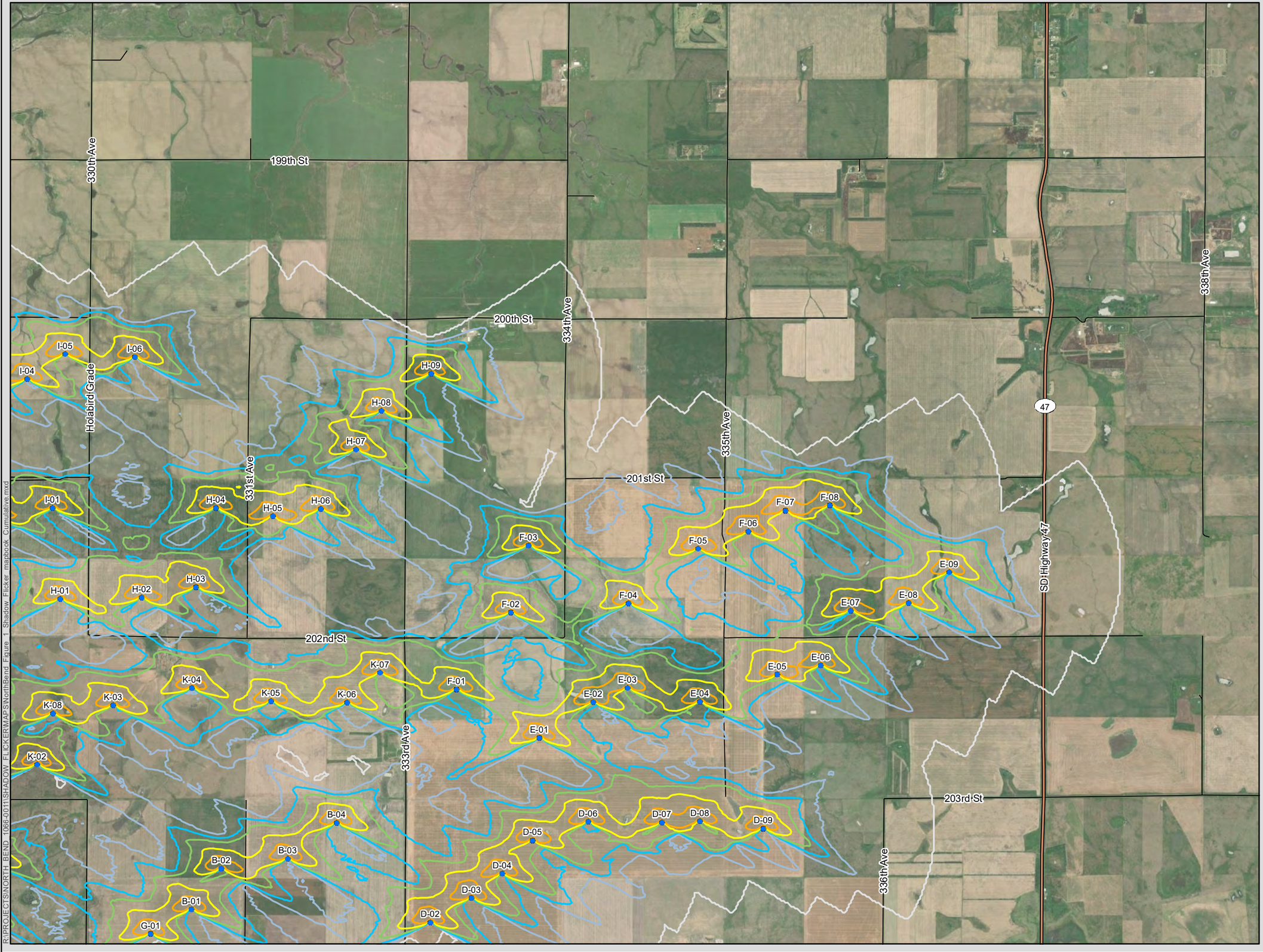
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ENGIE

North Bend Wind Project

Figure 1C
Cumulative Analysis -
Expected Shadow Flicker
Impact Area

Hughes and Hyde Counties, SD



- Project Area
- North Bend Proposed Turbine
- Triple H Turbine

Sensitive Receptor

- Participating
- Non-Participating

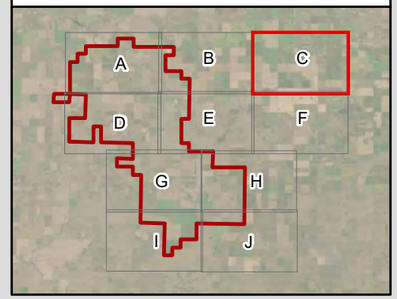
- County Boundary
- Highway/Major Road
- Local Road

Shadow Flicker (Hours per Year)

- 0 - 15
- >15 - 30
- >30 - 50
- >50 - 100
- >100 - 200
- >200

N

0 0.25 0.5 1
Miles



TETRA TECH

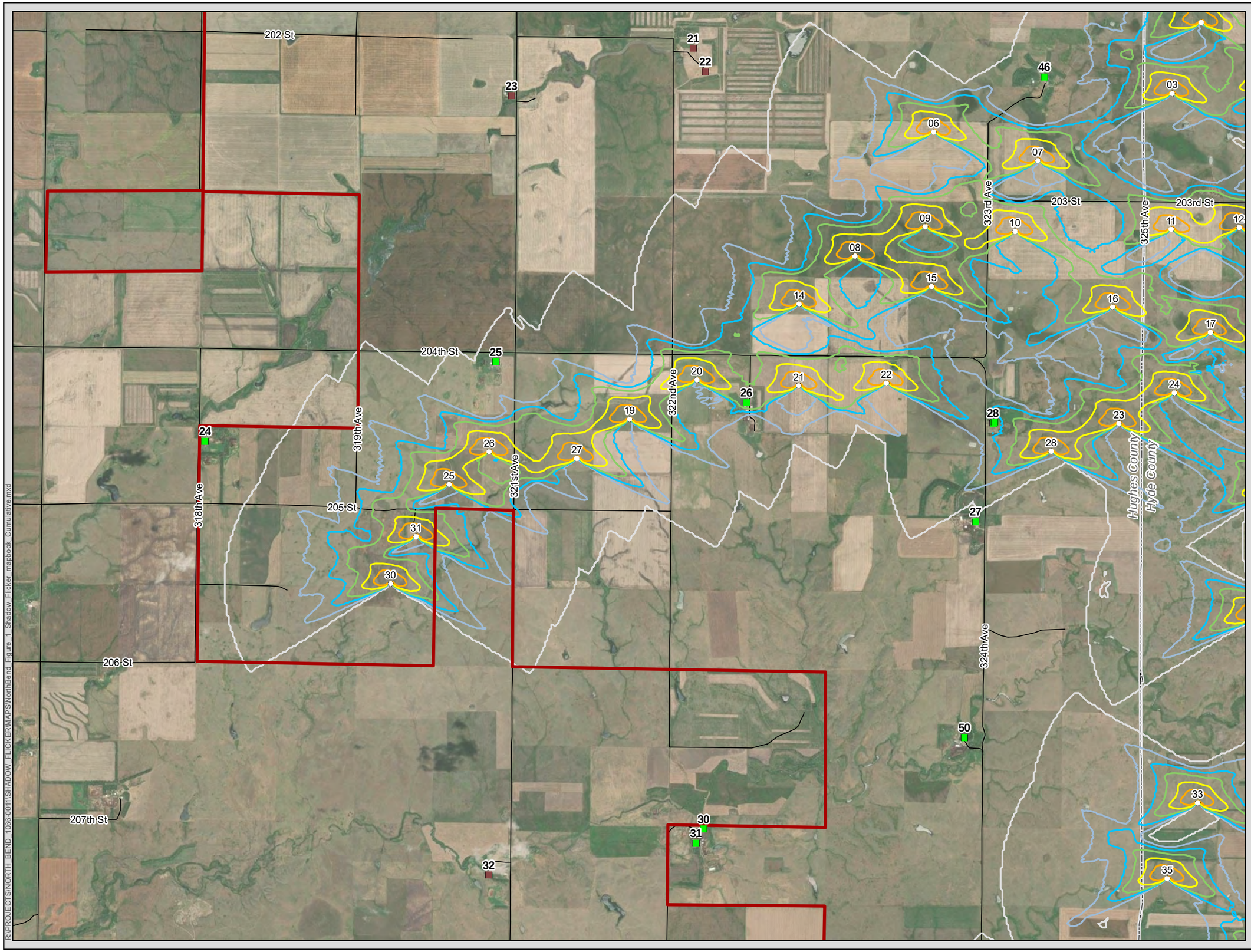
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ENGIE

North Bend Wind Project

Figure 1D
Cumulative Analysis -
Expected Shadow Flicker
Impact Area

Hughes and Hyde Counties, SD



- Project Area
- North Bend Proposed Turbine
- Triple H Turbine

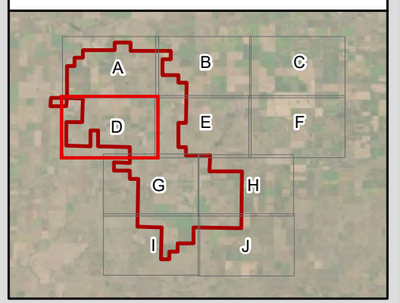
Sensitive Receptor
- Participating
- Non-Participating

- County Boundary
- Highway/Major Road
- Local Road

Shadow Flicker (Hours per Year)
- 0 - 15
- >15 - 30
- >30 - 50
- >50 - 100
- >100 - 200
- >200

N

0 0.25 0.5 1
Miles



TETRA TECH

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North Bend Wind Project

Figure 1E
Cumulative Analysis -
Expected Shadow Flicker
Impact Area

Hughes and Hyde Counties, SD

- Project Area
- North Bend Proposed Turbine
- Triple H Turbine

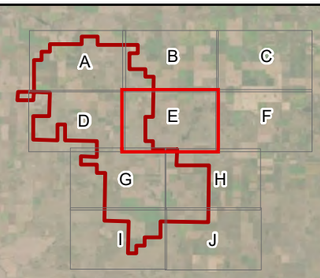
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- Participating
- Non-Participating

- County Boundary
- Highway/Major Road
- Local Road

Shadow Flicker (Hours per Year)
- 0 - 15
- >15 - 30
- >30 - 50
- >50 - 100
- >100 - 200
- >200

N

0 0.25 0.5 1
Miles



TETRA TECH

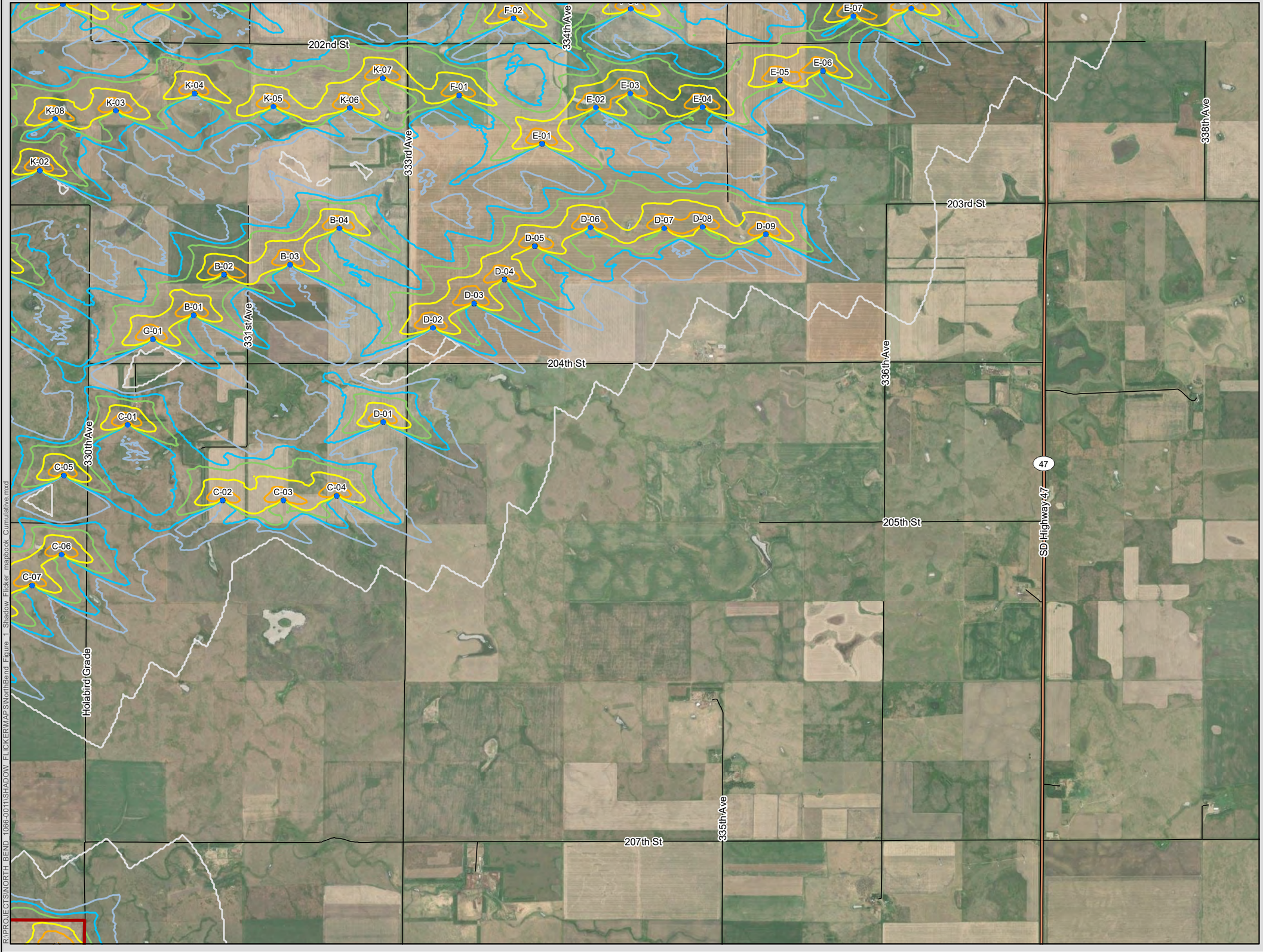
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North Bend Wind Project

Figure 1F
Cumulative Analysis -
Expected Shadow Flicker
Impact Area

Hughes and Hyde Counties, SD



- Project Area
- North Bend Proposed Turbine
- Triple H Turbine

Sensitive Receptor

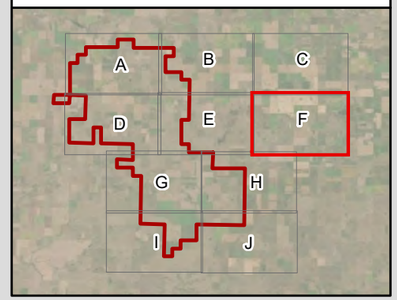
- Participating
- Non-Participating
- County Boundary
- Highway/Major Road
- Local Road

Shadow Flicker (Hours per Year)

- 0 - 15
- >15 - 30
- >30 - 50
- >50 - 100
- >100 - 200
- >200

N

0 0.25 0.5 1
Miles



TETRA TECH

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North Bend Wind Project

Figure 1G
Cumulative Analysis -
Expected Shadow Flicker
Impact Area

Hughes and Hyde Counties, SD

- Project Area
- North Bend Proposed Turbine
- Triple H Turbine

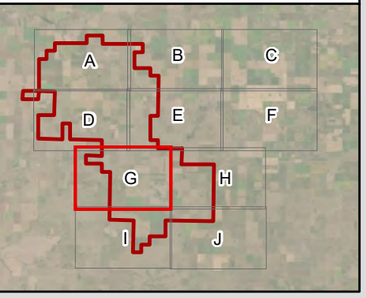
Sensitive Receptor
- Participating
- Non-Participating

- County Boundary
- Highway/Major Road
- Local Road

Shadow Flicker (Hours per Year)
- 0 - 15
- >15 - 30
- >30 - 50
- >50 - 100
- >100 - 200
- >200

N

0 0.25 0.5 1
Miles



TETRA TECH

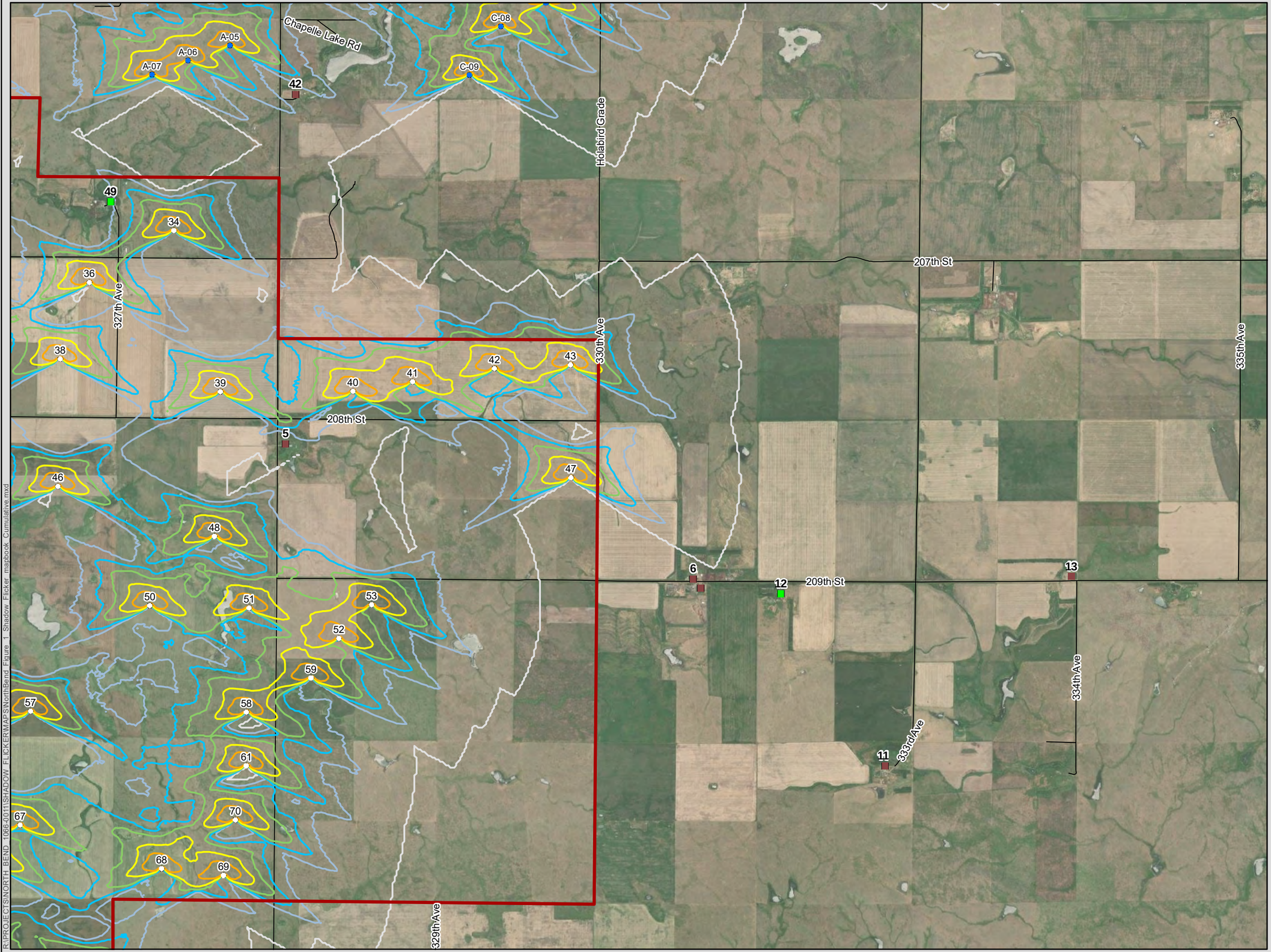
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North Bend Wind Project

Figure 1H
Cumulative Analysis -
Expected Shadow Flicker
Impact Area

Hughes and Hyde Counties, SD



Project Area
North Bend Proposed Turbine
Triple H Turbine

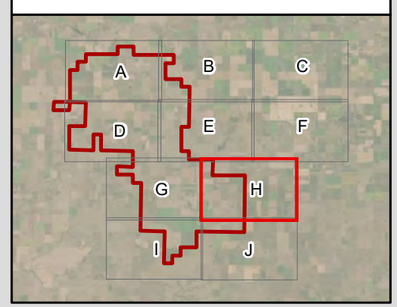
Sensitive Receptor
- Participating
- Non-Participating

County Boundary
Highway/Major Road
Local Road

Shadow Flicker (Hours per Year)
- 0 - 15
- >15 - 30
- >30 - 50
- >50 - 100
- >100 - 200
- >200

N

0 0.25 0.5 1
Miles



TETRA TECH

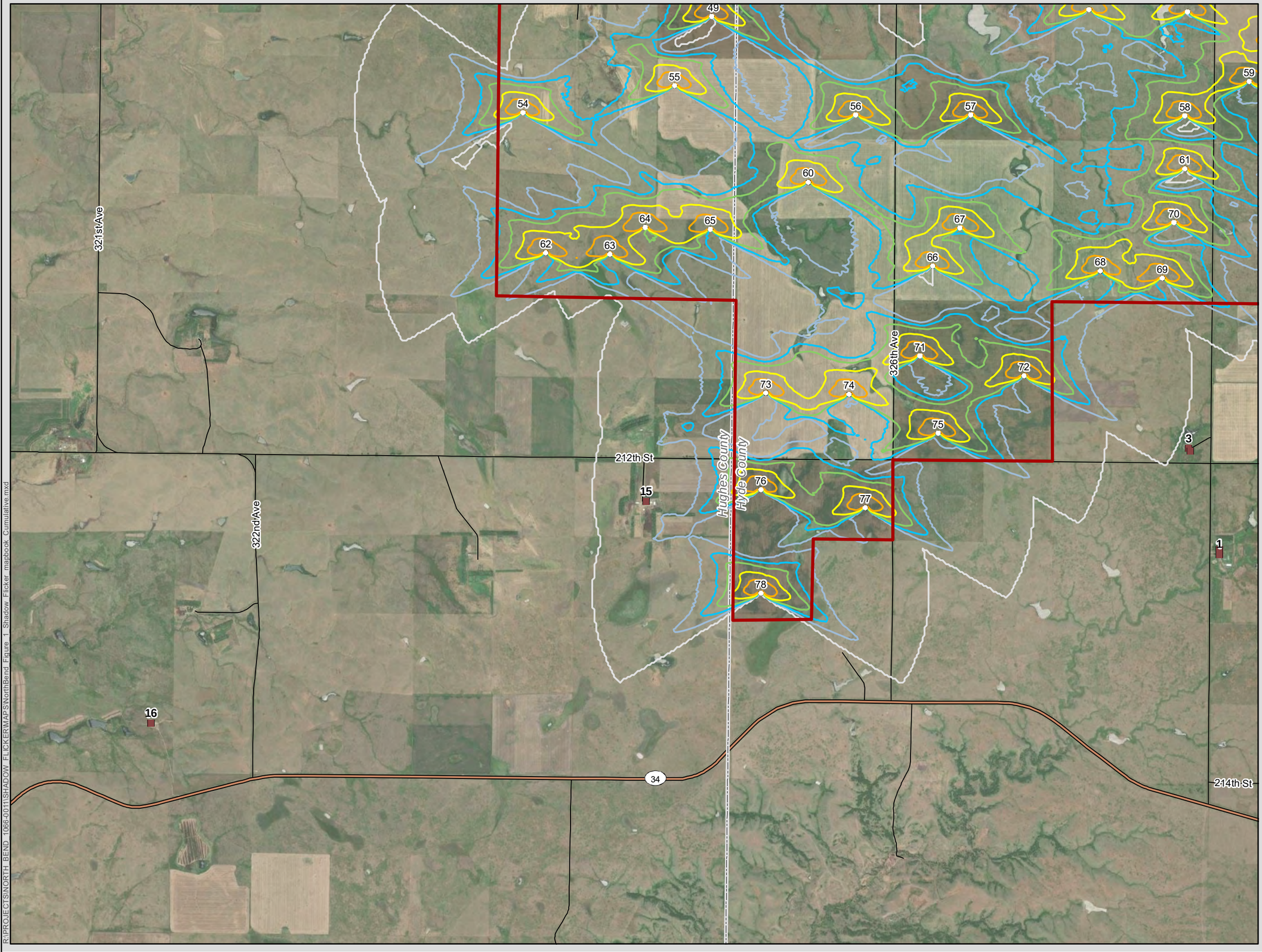
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North Bend Wind Project

Figure 1I
Cumulative Analysis -
Expected Shadow Flicker
Impact Area

Hughes and Hyde Counties, SD



- Project Area
- North Bend Proposed Turbine
- Triple H Turbine

Sensitive Receptor

- Participating
- Non-Participating

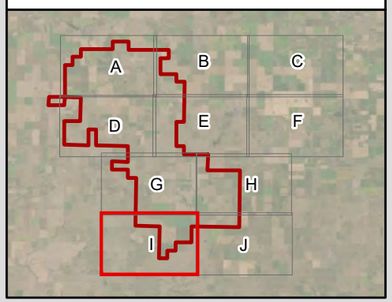
- County Boundary
- Highway/Major Road
- Local Road

Shadow Flicker (Hours per Year)

- 0 - 15
- >15 - 30
- >30 - 50
- >50 - 100
- >100 - 200
- >200

N

0 0.25 0.5 1
Miles



TETRA TECH

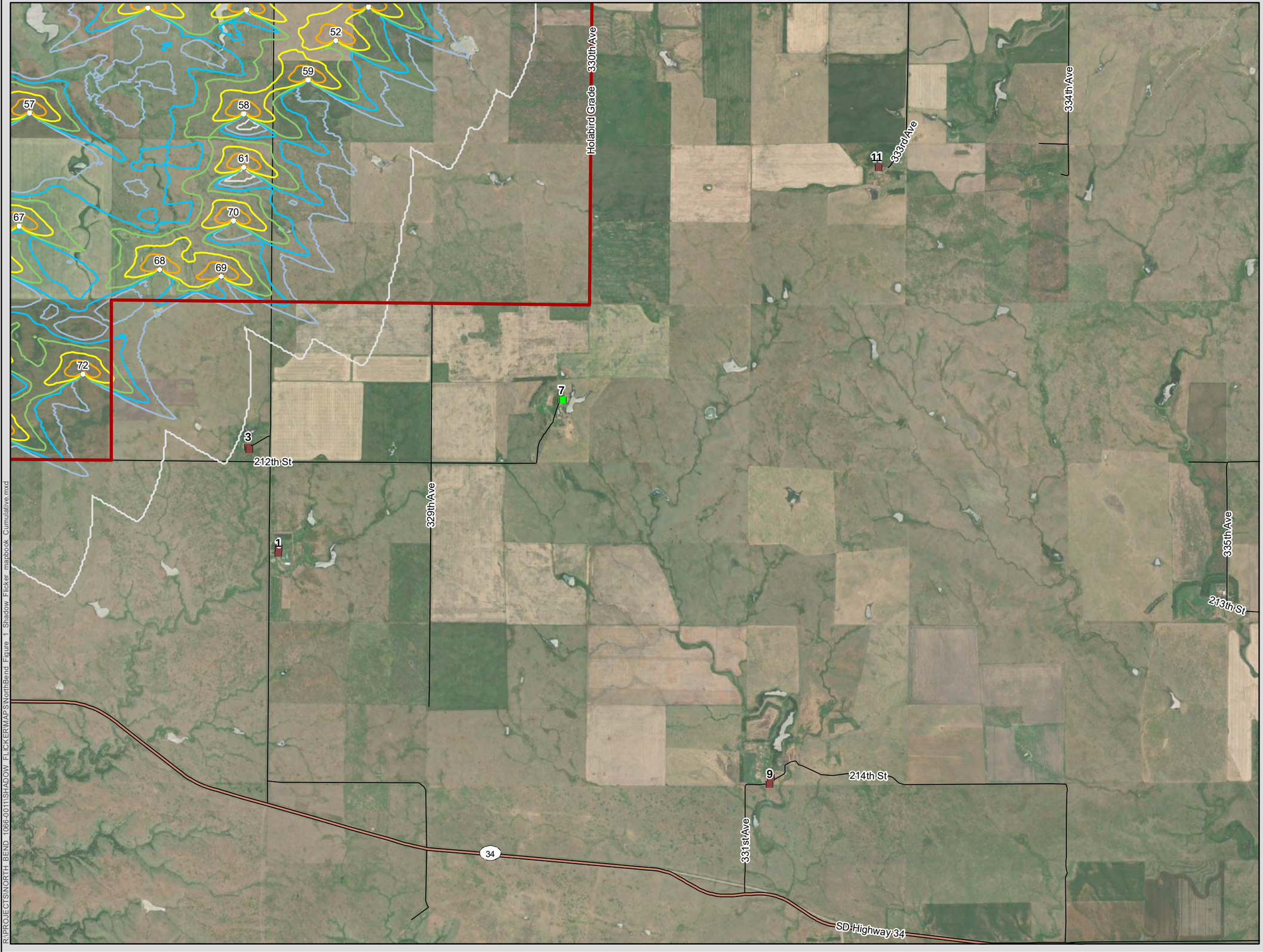
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ENGIE

North Bend Wind Project

Figure 1J
Cumulative Analysis -
Expected Shadow Flicker
Impact Area

Hughes and Hyde Counties, SD



- Project Area
- North Bend Proposed Turbine
- Triple H Turbine

Sensitive Receptor

- Participating
- Non-Participating

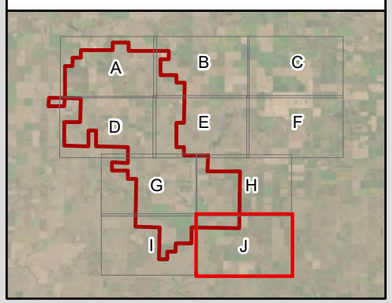
- County Boundary
- Highway/Major Road
- Local Road

Shadow Flicker (Hours per Year)

- 0 - 15
- >15 - 30
- >30 - 50
- >50 - 100
- >100 - 200
- >200

N

0 0.25 0.5 1
Miles



TETRA TECH

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South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
Response to Staff's Second Data Request

Date of Second Data Request: August 11, 2021

Data Request:

2-1) Refer to Page 19-1 of the Application. The Applicant states "a Decommissioning Plan and estimated cost analysis is being prepared for the Project and will be included as an addendum to this filing." Please provide the specific date the Applicant intends to file the decommissioning plan and cost estimate.

Responses:

The finalized decommissioning plan is being posted to the docket in conjunction with this response.

Response Prepared by:

Casey Willis

Decommissioning Plan and Reclamation Cost Estimate for the North Bend Wind Project Hyde and Hughes County, South Dakota

August 2021

PRESENTED TO

North Bend Wind Project, LLC

PRESENTED BY

Tetra Tech



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ATTACHMENT A. SUMMARY OF ESTIMATED COST OF DECOMMISSIONING PER TURBINE

ATTACHMENT B. DETAILED RECLAMATION COST ESTIMATES

1.0 INTRODUCTION

Tetra Tech was retained by North Bend Wind Project, LLC to prepare a decommissioning plan and cost analysis (Study) as part of an application for Energy Facility Permit from the South Dakota Public Utilities Commission (SDPUC) for the proposed North Bend Wind Project (Project). The scope of this Study is to review the Project details and develop a decommissioning plan and associated cost estimate for retiring the Project facilities at the end of its useful life.

2.0 PROJECT DESCRIPTION

The Project would be up to 200 megawatt (MW) and would be located entirely within Hyde and Hughes Counties in the Public Land Survey System townships of Butte, Chapelle, Harrold, Hollabird, Pleasant Valley, Pratt, and Webster, approximately 2 miles south of Harrold and 10 miles southwest of Highmore. The Project would be located on private and state held land within an area that encompasses approximately 46,391 acres (Project Area). The Project would utilize General Electric (GE) 2.82-MW wind turbine generators (WTGs). The current plan is to erect up to 71 GE 2.82-MW WTGs at the Project Area. Other major components for this Project include a Project substation, an interconnection switchyard, up to 200-foot 230-kilovolt (kV) interconnection transmission line, an aircraft detection lighting system (ADLS), one permanent meteorological tower, up to 32.2 miles of gravel access roads, and pad-mounted transformers at each WTG. The Project anticipates sharing the operations and maintenance (O&M) facility with the nearby Triple H Wind Project. These Project facilities are described in more detail below.

Decommissioning requirements are outlined under Section 9-106 of the Hyde County Zoning Ordinance and Section 2-117.F.14 of the Hughes County Zoning Ordinance. These ordinances specify "d*ecommissioning and site restoration includes dismantling and removal of all towers, turbine generators, transformers, overhead and underground cables, foundations, buildings and ancillary equipment to a depth of forty-two (42) inches; and removal of surface road material and restoration of the roads and turbine sites to substantially the same physical condition that existed immediately before construction of the LWECS...*". The following sections address these requirements.

2.1 WIND TURBINE GENERATORS

The Project would consist of no more than 71 GE 2.82-127 WTGs. The 2.82-MW turbines include 89-meter (292 feet), conical, tubular, steel towers. The rotor diameter is 127 meters (416.7 feet). All turbine components will be fully removed as part of decommissioning.

2.2 WIND TURBINE FOUNDATIONS

Each WTG would be supported by a cylindrical concrete pedestal on top of a sloped, octagonal or circular concrete spread footing, as is commonly used throughout the wind industry. The cylindrical concrete pedestal is proposed to be approximately 18 to 20 feet in diameter and 4 feet tall. Approximately 1 foot of the pedestal will extend above-grade. The sloped, octagonal concrete base beneath the pedestal would extend downward to a depth of 10 feet. The base of the foundation is expected to have a bottom diameter of approximately 75 feet. The total foundation depth would be approximately 10 feet below grade.

2.3 ACCESS ROADS

Each wind turbine would have an access road to allow for vehicle access to facilitate inspections and maintenance of the turbines and associated equipment during operation. The access roads would be 16 feet wide and would consist of crushed gravel overlying compacted subgrade. The Study accounts for removal of approximately 32.2

miles of new, private access roads. All public and county roads are assumed to remain in place after decommissioning.

2.4 COLLECTION SYSTEM

Each WTG generates three-phase electrical power that is transformed to 34.5-kV with an oil-filled, medium-voltage, pad-mounted transformer located adjacent to the base of the turbine. All such transformers will be removed as part of decommissioning.

The Project would include an underground 34.5-kV electrical power collection system that collects the electrical power from the wind turbines and routes it to the substation. A total of 62.9 miles of underground cable lines would be buried to a minimum below-grade depth of at least 48 inches as specified in easement agreements. Decommissioning requirements for Hyde and Hughes counties require any equipment, including cables (including both power and communication cabling) buried at a below-grade depth of less than 42 inches be removed when the Project is decommissioned in accordance with their ordinance requirements. However, all cables buried at or deeper than 48 inches below grade would be left in place when the Project is decommissioned, in accordance with easement agreements.

2.5 PROJECT SUBSTATION

Power from each wind turbine would be delivered via underground power collection cabling to an on-site Project substation, where it would be stepped up from 34.5-kV to 230-kV via a main power transformer. The plans also include two high-voltage circuit breakers, one dead-end structure, substation steel structures, medium-voltage circuit breakers, switching devices, perimeter fencing, auxiliary equipment, and a control enclosure. All above-grade equipment within the perimeter fence of the substation, equipment foundations to a below-grade depth of 48 inches, as well as underground cables to a depth of 48 inches, would be removed as part of decommissioning.

The interconnection switchyard station would be owned and operated by Western Area Power Administration as part of the Project. This switchyard is expected to include up to three 230-kV circuit breakers, three dead-end structures, substation steel structures, disconnect breakers, disconnect switches, bus conductors, auxiliary equipment, perimeter fencing, and a control enclosure, and is assumed to be decommissioned as a part of a separate project.

2.6 O&M BUILDING

While it is anticipated that some components of the nearby Triple H Wind Project O&M facility (i.e. storage, parking, fencing, etc.) will be shared with the Project, a separate building will be constructed to accommodate the needs of the North Bend Wind Project and their operations staff. This building is expected to be a pre-fabricated metal building built on a concrete slab-on-grade foundation with a footprint of approximately 5,000 square feet. This dedicated building has been included in this decommissioning plan and cost estimate.

2.7 AIRCRAFT DETECTION LIGHTING SYSTEM

The Project is planning to implement an aircraft detection lighting system (ADLS) as an additional mitigative measure available for wind turbine lighting. While an existing ADLS facility at the Triple H Wind Project could cover a portion of the North Bend Wind site, it was determined that a separate, standalone ADLS facility would be needed to order to provide sufficient coverage for the entire Project. ENGIE is working with the manufacturer on determining an appropriate location for the facility, which will require FAA approval.

The ADLS system consists of a tower up to 200 feet tall equipped with an 18-foot antenna mounted on the top of the tower. The size of the tower and its foundation is dependent on the surface location where it is proposed and the topography in proximity. In addition, an outdoor cabinet will be located at the base of the tower that contains

equipment associated with the system. Underground cabling will be installed from the ADLS location to its associated turbine at approximately 48 inches below grade. The ADLS unit is assumed to be decommissioned and removed as part of decommissioning.

2.8 METEOROLOGICAL TOWERS

One permanent meteorological tower would be installed as part of this Project. The tower would be a lattice-type tower that typically ranges in height from 80 to 90 meters and is supported by guy wires. The tower would be fully removed as part of decommissioning, including its supporting foundations down to 48 inches below grade.

3.0 ANTICIPATED LIFE OF NORTH BEND WIND PROJECT

Megawatt-scale wind turbine generators available on the market today have a life expectancy of more than 25 years. The tubular steel towers supporting the generators are robust and with basic routine maintenance would serve many years beyond the life expectancy of the generators.

As the Project WTGs approach the end of their expected life, technological advances should make available more efficient and cost-effective generators that would economically drive the replacement of the existing generators and thus prolong the economic life of the Project to an expected 30 years. Once the Project has met its design life, it will need to be decommissioned. The following sections provide a description of the decommissioning work and the estimated costs associated with that work.

4.0 DECOMMISSIONING PROCESS DESCRIPTION

All decommissioning and restoration activities will adhere to the requirements of appropriate governing authorities, and will be in accordance with all applicable federal, state, and local permits.

The decommissioning and restoration process comprises removal of all above-ground structures; removal of below-ground structures to a depth of 48 inches; restoration of topsoil, revegetation, and seeding; and a 2-year monitoring and remediation period.

Project-related above-ground structures include the WTGs, step-up (pad-mounted) transformers, meteorological tower, overhead electrical transmission lines, ADLS unit, and the substation. Below-ground structures include WTG foundations, collection system conduits/cable, foundations for the meteorological tower, ADLS and substation foundations, and drainage structures. The proposed high-voltage transmission line (230-kV line) and all facilities interior to the Project would be removed as a part of decommissioning . The Project O&M building would be shared with the nearby Triple H Wind Project and has been included in their decommissioning plan. Therefore, the Project O&M building is not included in this decommissioning plan and cost estimate.

It is assumed that the Project would incur costs for removal and disposal of the WTGs, wind turbine foundations, and other Project facilities, as well as costs for the restoration of the Project Area. Above-grade steel, aluminum, and copper equipment, however, is expected to have significant scrap value to a salvage contractor. All recyclable materials will be recycled to the extent possible, while all other non-recyclable waste materials will be disposed of in accordance with state and federal law.

The process of removing structures involves evaluating and categorizing all components and materials into categories of recondition and reuse, salvage, recycling, and disposal. In the interest of increased efficiency and minimal transportation impacts, components and material may be stored on-site in a pre-approved location until the bulk of similar components or materials are ready for transport. The components and material will be transported to the appropriate facilities for reconditioning (if possible), salvage, recycling, or disposal.

4.1 WTG REMOVALS

During the decommissioning process, access roads to turbines may be widened temporarily to sufficient width to accommodate movement of appropriately sized cranes or other machinery required for the disassembly and removal of the turbines. High-value components will be stripped. The remaining material will be reduced to shippable dimension and transported offsite for proper disposal. Control cabinets, electronic components, and internal cables will be removed. The blades, hub, and nacelle will be lowered to the ground for disassembly. The tower sections will also be lowered to the ground where they will be further disassembled into transportable sections. The blades, hub, nacelle, and tower sections will either be transported whole for reconditioning and reuse or disassembled into salvageable, recyclable, or disposable components. Each WTG area will be thoroughly cleaned and all debris removed.

Once removed, the wind turbine blades will be cut into manageably-sized sections, loaded onto a trailer, and hauled to a local landfill for disposal; the wind turbine blades are primarily constructed from a composite material that is assumed to have no salvage value at the time of decommissioning.

4.2 TURBINE ACCESS ROADS

All crushed rock surfacing will be removed from the Project's access roads. The removed crushed rock will be loaded into dump trucks and hauled offsite for disposal. Following the removal of crushed rock surfacing, the compacted subgrade will be de-compacted and a layer of topsoil will be added to replace the removed rock. The areas where crushed rock has been removed will be fine graded to provide suitable drainage. In right-of-way and non-agricultural areas, the ground will be seeded to prevent erosion.

4.3 WTG FOUNDATION REMOVAL

Topsoil will be removed from an area surrounding the foundation and stored for later replacement. Turbine foundations will be excavated to a depth sufficient to remove all anchor bolts, rebar, conduits, cable, and concrete to a depth of 48 inches below grade. After removal of all noted foundation materials, the hole will be filled with clean subgrade material of quality comparable to the immediate surrounding area. The subgrade material will be compacted to a density similar to surrounding subgrade material. All unexcavated areas compacted by equipment used in decommissioning shall be de-compacted in a manner to adequately restore the topsoil and subgrade material to the proper density consistent and compatible with the surrounding area. These areas will be thoroughly cleaned and all debris removed.

4.4 O&M BUILDING

The dedicated O&M building will be demolished/removed and disposed offsite as a part of the decommissioning plan.

4.5 UNDERGROUND ELECTRICAL COLLECTION SYSTEM

The cables and conduits will be removed to a depth of at least 48 inches below ground surface (bgs). All cable and conduit buried greater than 48 inches bgs will be left in place and abandoned. They contain no materials known to be harmful to the environment and will not interfere with future agricultural-related use of the area.

4.6 OVERHEAD TRANSMISSION LINE

The conductors will be removed and stored in a pre-approved location. Switches and other hardware will be removed and delivered to a processing company for recycling. The supporting transmission line structures will be removed and the concrete foundations removed to a depth of 48 inches bgs. The steel transmission structure

components will be stored in a pre-approved location. Stored conductors and other components will be later removed and transported to appropriate facilities for salvage or disposal. The area will be thoroughly cleaned and all debris removed.

4.7 SUBSTATION

Disassembly of the substation and associated switchyard will be completed and all material/equipment removed from the site. Steel, conductors, switches, transformers, etc. will be reconditioned and reused, sold as scrap, recycled, or disposed of appropriately depending on market value. Foundations and underground components will be removed to a depth of 48 inches and the excavation filled, contoured, and revegetated. All unexcavated areas compacted by equipment used in decommissioning shall be de-compacted in a manner to adequately restore the topsoil and subgrade material to the proper density consistent and compatible with the surrounding area. The area will be thoroughly cleaned and all debris removed.

4.8 AIRCRAFT DETECTION LIGHTING SYSTEM

Disassembly of the ADLS unit will be completed, and all material/equipment will be removed from the site. Steel, conductors, switches, transformers, etc. will be reconditioned and reused, sold as scrap, recycled, or disposed of appropriately, depending on market value. The foundation will be removed to a depth of 48 inches bgs, and the excavated area will be filled, contoured, and revegetated. The site surface gravel will be removed for disposal. All unexcavated areas compacted by equipment used in decommissioning shall be de-compacted in a manner to adequately restore the topsoil and subgrade material to the proper density consistent and compatible with the surrounding area. The area will be thoroughly cleaned, and all debris will be removed.

4.9 METEOROLOGICAL TOWER

One permanent meteorological tower will be disassembled at an appropriate time during the decommissioning activities so as not to interfere with the other ongoing work. This typically involves the use of a base crane to dismantle the mast, section by section, down to the foundation surface. The instrumentation and booms would be either removed before the sections are laid down or removed from the sections once on the ground.

The disassembly work includes the cost of labor, machinery, and tools to perform the dismantling tasks, including foundation removal to 48 inches below grade, and the loading of the dismantled material onto transport vehicles for removal from the site to an appropriate disposal, salvage, or rework facility.

5.0 SITE RESTORATION PROCESS DESCRIPTION

To the extent possible, topsoil will be removed prior to removal of structures from all work areas and stockpiled, clearly designated, and separated from other excavated material. Prior to topsoil replacement, all rocks 4 inches or greater will be removed from the surface of the subsoil. The topsoil will be de-compacted to match the density and consistency of the immediate surrounding area. The topsoil will be replaced to original depth, and original surface contours reestablished where possible. All rocks 4 inches or larger will be removed from the surface of the topsoil. Any topsoil deficiency and trench settling will be mitigated with imported topsoil consistent with the quality of the affected site.

All disturbed soil surfaces will be seeded with a seed mix agreed upon with the landowner(s) and/or applicable local, state, or federal agencies such as the U.S. Department of Agriculture. These areas will be restored to a condition and forage density similar to the original condition. In all areas, restoration will include, as reasonably required, leveling, terracing, mulching, and other necessary steps to prevent soil erosion, to ensure establishment of suitable grasses and forbs, and to control noxious weeds. Areas restored in agricultural fields will only be reseeded at request of the landowner. It is assumed that 50 percent of the access roads will be in agricultural areas.

6.0 ESTIMATED COST OF DECOMMISSIONING

At the time of retirement, the above-grade steel structures and turbine nacelles are assumed to have significant scrap value which would offset a portion of the cost to remove these items. However, the Project would also incur costs for removal and disposal of the wind turbine blades, foundations, and other Project facilities, along with the costs for the restoration of the site following the removal of salvageable equipment and disposal of other items.

The decommissioning cost estimate provided herein includes the costs to return the site to a condition compatible with the surrounding land and similar to the conditions that existed before development of the Project. Included in the estimate are the costs to decommission the power generating equipment associated with the Project, as well as the costs to retire the Project facilities, with all equipment and structures removed to a depth of 48 inches below grade. The following scenarios were considered when building the cost estimates:

- GE 2.82-MW model assuming salvage and no resale.
- GE 2.82-MW model assuming no salvage and no resale.

Cost estimates for the GE 2.82-MW model include 1) costs offset by the revenue that would be received for scrap value of steel, aluminum, and copper equipment (scrap credit) and 2) costs without scrap credit. No resale of the Project facilities for reuse is considered. Accordingly, they are “no resale” estimates.

The estimated decommissioning costs for the Project were prepared using available information from a variety of credible industry sources. As summarized in Attachment A, the current cost of decommissioning this Project is provided in Table 1 in 2021 dollars. The cost scenarios include no salvage value as well as a partial offset from the salvage value of the towers, turbine components, and electrical equipment.

Table 1. Decommissioning Cost by Model Scenario

Turbine Model Scenario	Estimate Cost per Turbine	Estimated Cost per MW
GE 2.82-MW model assuming salvage	$50,094	$17,765
GE 2.82-MW model without salvage	$161,408	$57,243

The detailed reclamation cost estimates are provided in Attachment B.

ATTACHMENT A. SUMMARY OF ESTIMATED COST OF DECOMMISSIONING PER TURBINE

SUMMARY OF ESTIMATED COST OF DECOMMISSIONING PER TURBINE

Decommissioning cost per MW (in current dollars)				
GE 2.82-127 MW Turbines with Salvage				
	Quantity	**Unit**	**Unit Price**	**Total**
Mob/Demob				
Equipment, facilities & personnel	1	lump sum	$ 911,610	
Site Facilities - rental	1	lump sum	$ 12,930	
				$ 924,540
Field Management				
$18,282.31/week	24	week	$ 438,776	$ 438,776
Substation & Switchyard Removal	1	lump sum	$ 205,905	$ 205,905
ADLS System Removal	1	lump sum	$ 13,644	$ 13,644
O&M Building Removal	1	lump sum	$ 24,625	$ 24,625
Met Tower Removal	1	lumpum	$ 3,843	$ 3,843
Removal of a Tower and Nacelle Units				
Construct/remove temporary crane pads ($7,747/WTG)	71	each	$ 550,009	
WTG Removal ($30,000/WTG)	71	each	$ 2,130,000	
WTG foundation removal	71	each	$ 692,621	
WTG Sizing & Loadout	71	each	$ 2,912,297	$ 6,284,927
Salvage				
(Net salvage value of $7,881,300 for scrap metal from transformer, WTG, transmission lines and poles, and pad mounted transformers)	1	each	$ 7,903,300	$ (7,903,300)
Pad mounted transformer removal				
$3,649/WTG	71	each	$ 259,054	$ 259,054
Site Restoration, Seeding and Re-vegetation				
(≈32.2 miles of access roadway, 8 acre substation & switchyard, and .5 acres/turbine site)	1	lump sum	$ 858,345	$ 858,345
Removal of Transmission Line				
(~200 ft of transmission line)	1	lump sum	$ 20,955	$ 20,955
Access Road Removal				
(≈32.2 miles of gravel road)				
16' wide and 6" depth		CY	$ 624,004	$ 624,004
Administrative & Project Management Tasks				
Home office, Project Management	1	lump sum	$ 482,931	
Contractor OH & fee (13%)	1	lump sum	$ 1,318,401	$ 1,801,332
Total Removal Cost for 71 Turbines (200.2 MW)	**1**	**lump sum**		**$ 3,556,650**
Removal Cost/WTG	**71**	**each**	*$ 50,094*	
Removal Cost/MW	200.2	each	*$ 17,765*	

Decommissioning cost per MW (in current dollars)				
GE 2.82-127 MW Turbines without Salvage				
	Quantity	**Unit**	**Unit Price**	**Total**
Mob/Demob				
Equipment, facilities & personnel	1	lump sum	$ 911,610	
Site Facilities - rental	1	lump sum	$ 12,930	
				$ 924,540
Field Management				
$18,282.31/week	24	week	$ 438,775	$ 438,775
Substation & Switchyard Removal				
	1	lump sum	$ 205,906	$ 205,906
ADLS System Removal	1	lump sum	$ 13,644	$ 13,644
O&M Building Removal	1	lump sum	$ 24,625	$ 24,625
Met Tower Removal	1	lump sum	$ 3,843	$ 3,843
Removal of a Tower and Nacelle Units				
Construct/remove temporary crane pads ($7,746.61/WTG)	71	each	$ 550,009	
WTG Removal ($30,000/WTG)	71	each	$ 2,130,000	
WTG foundation removal	71	each	$ 692,621	
WTG Sizing & Loadout	71	each	$ 2,912,297	$ 6,284,927
Salvage				
(*Not applicable*)	1	each	$ -	
				$ -
Pad mounted transformer removal				
$3,625/WTG	71	each	$ 259,054	
				$ 259,054
Site Restoration, Seeding and Re-vegetation				
(≈32.2 miles of access roadway, 8 acre substation & switchyard, and .5 acres/turbine site)	1	lump sum	$ 858,345	$ 858,345
Removal of Transmission Line				
(~200 ft of transmission line removed)	1	lump sum	$ 20,955	
				$ 20,955
Access Road Removal				
(≈32.2 miles of gravel road)		CY	$ 624,004	
16' wide and 6" depth				$ 624,004
Administrative & Project Management Tasks				
Home office, Project Management	1	lump sum	$ 482,931	
Contractor OH & fee (13%)	1	lump sum	$ 1,318,401	$ 1,801,332
Total Removal Cost for 71 Turbines (200.2 MW)	**1**	**lump sum**		**$ 11,459,950**
Removal Cost/WTG	**71**	**each**	*$ 161,408*	

Assumptions:

The scope of work and individual tasks were established using professional experience, in collaboration with Tetra Tech's engineering staff. The Project was broken into individual tasks that were each estimated separately to include labor requirements, equipment needs, and duration. Production rates were established using professional experience and published standards that include RS Means (www.rsmeans.com). Labor rates prevalent to the geographic area of the Project were obtained by referencing U.S. Department of Labor wage determinations. After the estimate was completed, typical average markups that are industry standard were applied for contingency, overhead, and fee. Estimating methods and assumptions specific to this estimate are as follows:

- Labor cost were developed by reviewing U.S. Department of Labor wage determinations and rates published by RS Means. An average rate was developed that includes base wage, fringe, and payroll tax liability. The final rate used in the estimate is an average of 40 hours standard (ST), and 10 hours overtime (OT) per week, assuming a 50-hour work week during decommissioning activities.
- Equipment (commonly referred to as yellow iron) rates used in the estimate are developed by reviewing rates published by RS Means, and historical vendor quotes. Rates include fuel, maintenance, and wear and tear of ground engaging components. Rates utilized assume the use of rental equipment, not owned.
- Mobilization and demobilization costs are estimated to be approximately 13 percent or less of the overall contractor's costs. This reflects the actual cost to mobilize equipment, facilities, and crew to the Project site. A substantial portion of this cost is for the crane and crew required for WTG removal. This amount does not include the front loading of cost from other tasks.
- Work was estimated on a unit cost basis, priced by task that follows the progression of work from start to finish. Unit costs are developed by including the labor, equipment, and production rate required for each individual task. RS Means and estimator's experience are utilized to establish the crew, equipment, and production for each individual task.
- Roads would be restored so that they become a part of the natural surroundings and are no longer recognizable to the greatest extent possible. Road gravel would be used to backfill foundation locations to within 6 inches of final grade. It is expected that the remaining road gravel will be accepted by local receivers with no additional disposal cost. Access roads located on agricultural land, assumed to be 20 percent of roads, will not be reseeded. On private lands, prior existing roads would be restored at the request of the current landowner.
- The O&M building is expected to be a pre-fabricated steel building constructed on a concrete slab on grade. The concrete slab is expected to be 5,000 sf in area and 18" thick with a grade beam (total expected concrete volume of 320 cy).
- All concrete foundations will be removed to a depth of 48 inches bgs. Gravel from road removal will be utilized to backfill to within 6 inches of final grade, and then completed with an additional 6 inches of topsoil. Concrete foundation removal will be accomplished with the use of excavators with concrete breakers. Processed concrete will be transported offsite under the same assumptions as road gravel.
- Underground electrical distribution cabling is assumed to be aluminum, at least 48 inches deep, and of low salvage value. As such, underground cable will be abandoned in place, with only the stubs to grade being removed down to 48 inches bgs.
- Oil from transformers and nacelles will be drained prior to removal, and the oil disposed of following state and federal regulations. Oil disposal cost is assumed to be $4 per gallon.
- To reduce the cost of loading and transport, WTG components, substation transformers, and equipment will be sized onsite utilizing shears and torch crews. Blades are assumed to have no scrap value and will

incur an estimated cost of $95 per ton for trucking and landfill fees. Remaining material is assumed to have a scrap value, with a cost of $65 per ton for trucking, and a credit of $216 per ton for scrap.

- WTG removal will require the construction and subsequent removal of temporary crane pads. Estimated cost of crane pads is based on an engineered design from a similar project.
- Final restoration will include the placement of 6 inches of topsoil on all disturbed areas, with a final seeding utilizing a mix of native grasses. It is assumed that 50 percent of the topsoil required for restoration is available onsite as a result of the original installation.
- The costs for temporary facilities have been included in the restoration cost. These include one office trailer, two Conex storage units, portolets, first aid supplies and utilities.
- Field management during construction activities has been added to the estimate. These costs include one Superintendent, one Health and Safety Representative and two Field Engineers. These positions are critical to the safe and successful execution of work.
- A contractor's home office, project management, overhead, and fee can vary widely by contractor. As such, averages were developed for the estimate and added as a percentage of total cost. These include 5 percent for home office and project management, and 13 percent for overhead and fee. Note that contractor contingency costs are not included. Several other miscellaneous costs have been approximated, including permits, engineering, signage, fencing, traffic control, utility disconnects, etc. In the context of the overall estimate, these are incidental costs that are covered in the estimate markups.

ATTACHMENT B. DETAILED RECLAMATION COST ESTIMATE

Estimate Summary
TETRA TECH EC, INC.
Job Code: ENGIE North Bend Wind
Description: Decommissioning Estimate

CBS Position Code	Quantity	UM	Cost Item Description	Days	Cost UM/Day	Source	Currency	Unit Cost	Total Cost
1	1.00	Lump Sum	NORTH BEND WIND RETIREMENT	827.31	0.00	Detail	U.S. Dollar	3,556,650.47	3,556,650.47
1.1	1.00	Lump Sum	Mob / Demob	5.00	0.20	Detail	U.S. Dollar	911,609.84	911,609.84
1.1.1	1.00	Lump Sum	Equipment Mob	0.00	0.00	Detail	U.S. Dollar	101,500.00	101,500.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
UERNTRLG	Rental Equip Transp-Large		10.00	Each	U.S. Dollar	10,000.00	100,000.00
UERNTRSM	Rental Equip Transp-Small		10.00	Each	U.S. Dollar	150.00	1,500.00

1.1.2	1.00	Lump Sum	Site Facilities	0.00	0.00	Detail	U.S. Dollar	2,200.00	2,200.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
UOCONMOB	Connex Box Mob		2.00	Each	U.S. Dollar	300.00	600.00
UOTRLTRN	Trailer Trnsp/Setup/Trdwn		2.00	Each	U.S. Dollar	800.00	1,600.00

1.1.3	3.00	Day	Crew Mob & Site Setup	3.00	1.00	Detail	U.S. Dollar	16,581.97	49,745.90

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
L060100	GENERAL LABORER	600.00	20.00	Each (hourly)	U.S. Dollar	45.44	27,266.58
L010101	OPERATOR	300.00	10.00	Each (hourly)	U.S. Dollar	56.75	17,026.01
L080940	TEAMSTER	120.00	4.00	Each (hourly)	U.S. Dollar	45.44	5,453.32

1.1.4	2.00	Day	Crew Demob & Site Cleanup	2.00	1.00	Detail	U.S. Dollar	16,581.97	33,163.93

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
L060100	GENERAL LABORER	400.00	20.00	Each (hourly)	U.S. Dollar	45.44	18,177.72
L010101	OPERATOR	200.00	10.00	Each (hourly)	U.S. Dollar	56.75	11,350.67
L080940	TEAMSTER	80.00	4.00	Each (hourly)	U.S. Dollar	45.44	3,635.54

1.1.5	1.00	Lump Sum	Mob-Erection Sub	0.00	0.00	Detail	U.S. Dollar	725,000.00	725,000.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
USERECTMOB	Sub-Erection Mobilization		1.00	Each	U.S. Dollar	725,000.00	725,000.00

Notes: **********
Historical pricing from past projects
****

1.2	6.00	Month	Site Facilities	0.00	0.00	Detail	U.S. Dollar	2,155.00	12,930.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
URCONNEX	Connex Box		12.00	Month	U.S. Dollar	150.00	1,800.00
UROFFTRL	Office Trailer -12x60		6.00	Month	U.S. Dollar	500.00	3,000.00
UO1STAID	1st Aid Supplies		6.00	Month	U.S. Dollar	300.00	1,800.00
UOOFFPHN	Monthly Office Phone		6.00	Month	U.S. Dollar	500.00	3,000.00
UOOFFSUP	Office Supplies($/prs/mo)		6.00	Month	U.S. Dollar	55.00	330.00
UINT	Internet		6.00	Month	U.S. Dollar	200.00	1,200.00
URPRTAJH	Port-a-John Unit(s) (4)		6.00	Month	U.S. Dollar	300.00	1,800.00

1.3	24.00	Week	Field Management	144.00	0.17	Detail	U.S. Dollar	18,282.31	438,775.52

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
L90FXX02	Field - Proj Superintendent	1,440.00	1.00	Each (hourly)	U.S. Dollar	83.18	119,782.08
RPUTRK05	F-250 4X4 3/4 TON PICKUP	5,760.00	4.00	Each (hourly)	U.S. Dollar	11.07	63,734.40
L90FEL00	Field - Engr. Tech	1,440.00	1.00	Each (hourly)	U.S. Dollar	39.57	56,986.59
L90FXX03	Field - SHSO	1,440.00	1.00	Each (hourly)	U.S. Dollar	89.26	128,540.02
L90FEJ00	Field - Asst. Engr.	1,440.00	1.00	Each (hourly)	U.S. Dollar	48.43	69,732.43

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CBS Position Code	Quantity	UM	Description	Cost Item Days	UM/Day	Cost Source	Currency	Unit Cost	Total Cost
1.4	1.00	Lump Sum	O&M Building Removal	6.48	0.15	Detail	U.S. Dollar	24,624.55	24,624.55
1.4.1	40.00	Ton	Structure Demo	2.00	20.00	Detail	U.S. Dollar	257.21	10,288.51

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
*REXCAV06A	Excav 100K w/ Bucket & Grapple	20.00	1.00	Each (hourly)	U.S. Dollar	124.54	2,490.70
*REXCAV06E	Excav 100K w/ Shear	20.00	1.00	Each (hourly)	U.S. Dollar	185.50	3,709.90
L010101	OPERATOR	40.00	2.00	Each (hourly)	U.S. Dollar	56.75	2,270.13
L060100	GENERAL LABORER	40.00	2.00	Each (hourly)	U.S. Dollar	45.44	1,817.77

1.4.2	320.00	Cubic Yard	Remove Foundations To Subgrade	4.48	71.43	Detail	U.S. Dollar	35.74	11,436.04
1.4.2.1	320.00	Cubic Yard	Excavate / Remove Foundation - Various Depth	1.28	250.00	Detail	U.S. Dollar	17.78	5,688.97

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
L060100	GENERAL LABORER	12.80	1.00	Each (hourly)	U.S. Dollar	45.44	581.69
L010101	OPERATOR	25.60	2.00	Each (hourly)	U.S. Dollar	56.75	1,452.89
*REXCAV06C	Excav 100K w/ Hammer	12.80	1.00	Each (hourly)	U.S. Dollar	160.97	2,060.35
*REXCAV06A	Excav 100K w/ Bucket & Grapple	12.80	1.00	Each (hourly)	U.S. Dollar	124.54	1,594.05

1.4.2.2	320.00	Cubic Yard	Concrete Transport Offsite	3.20	100.00	Detail	U.S. Dollar	17.96	5,747.07

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
RDUTRK06	CAT D350D, 18CY-24CY	32.00	1.00	Each (hourly)	U.S. Dollar	74.29	2,377.28
L080940	TEAMSTER	32.00	1.00	Each (hourly)	U.S. Dollar	45.44	1,454.22
L010101	OPERATOR	16.00	0.50	Each (hourly)	U.S. Dollar	56.75	908.05
RFELWH09	CAT 966F LOADER, 4.25CY	16.00	0.50	Each (hourly)	U.S. Dollar	62.97	1,007.52

1.4.3	2.00	Each	Trucking - Per Load	0.00	0.00	Detail	U.S. Dollar	1,375.00	2,750.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
USTRUCKING	Trucking Sub		2,750.00	Each	U.S. Dollar	1.00	2,750.00

Notes: **********
Assumption: 45,000 lbs per load
****

1.4.4	5.00	Ton	Disposal Cost	0.00	0.00	Detail	U.S. Dollar	30.00	150.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
USDISPOSAL	Disposal Fee's		150.00	Each	U.S. Dollar	1.00	150.00

Notes: **********
Assumption: 324,016 modules x 60.63 lbs each
****

1.5	1.00	Lump Sum	ADLS Tower / System Removal	2.55	0.39	Detail	U.S. Dollar	13,644.06	13,644.06
1.5.1	1.00	Each	ADLS Tower / System Removal	1.50	0.67	Detail	U.S. Dollar	8,681.25	8,681.25
1.5.1.1	1.00	Each	Cut / Lower Structure	1.00	1.00	Detail	U.S. Dollar	3,829.61	3,829.61

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
L060100	GENERAL LABORER	40.00	4.00	Each (hourly)	U.S. Dollar	45.44	1,817.77
L010101	OPERATOR	10.00	1.00	Each (hourly)	U.S. Dollar	56.75	567.53
*RXMISC14	MAN LIFT GAS 125ft	10.00	1.00	Each (hourly)	U.S. Dollar	53.52	535.20
*RXMISC23	GROVE RT 200 TON	10.00	1.00	Each (hourly)	U.S. Dollar	90.91	909.10

1.5.1.2	1.00	Each	Cut / Size Structure & Loadout	0.50	2.00	Detail	U.S. Dollar	2,101.65	2,101.65

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
L060100	GENERAL LABORER	30.00	6.00	Each (hourly)	U.S. Dollar	45.44	1,363.33
L010101	OPERATOR	5.00	1.00	Each (hourly)	U.S. Dollar	56.75	283.77
*RXMISC23	GROVE RT 200 TON	5.00	1.00	Each (hourly)	U.S. Dollar	90.91	454.55

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CBS Position Code	Quantity	UM	Description	Days	Cost UM/Day	Cost Source	Currency	Unit Cost	Total Cost
1.5.1.3	2.00	Each	Trucking - Per Load	0.00	0.00	Detail	U.S. Dollar	1,375.00	2,750.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
USTRUCKING	Trucking Sub		2,750.00	Each	U.S. Dollar	1.00	2,750.00

Notes: **********
Assume 20 ton per steel structure
****

1.5.2	1.00	Each	Remove Foundations To Subgrade	1.05	0.95	Detail	U.S. Dollar	4,962.81	4,962.81
1.5.2.1	1.00	Each	Excavate / Remove Foundation - Various Depth	1.00	1.00	Detail	U.S. Dollar	4,898.95	4,898.95

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
L060100	GENERAL LABORER	20.00	2.00	Each (hourly)	U.S. Dollar	45.44	908.89
L010101	OPERATOR	20.00	2.00	Each (hourly)	U.S. Dollar	56.75	1,135.07
*REXCAV06C	Excav 100K w/ Hammer	10.00	1.00	Each (hourly)	U.S. Dollar	160.97	1,609.65
*REXCAV06A	Excav 100K w/ Bucket & Grapple	10.00	1.00	Each (hourly)	U.S. Dollar	124.54	1,245.35

1.5.2.2	4.00	Cubic Yard	Concrete Transport Offsite	0.05	75.00	Detail	U.S. Dollar	15.96	63.86

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
RDUTRK06	CAT D350D, 18CY-24CY	0.53	1.00	Each (hourly)	U.S. Dollar	74.29	39.62
L080940	TEAMSTER	0.53	1.00	Each (hourly)	U.S. Dollar	45.44	24.24

1.6	1.00	Each	MET Tower Removal	0.71	1.42	Detail	U.S. Dollar	3,842.80	3,842.80
1.6.1	1.00	Each	Structure Demo	0.50	2.00	Detail	U.S. Dollar	2,572.13	2,572.13

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
*REXCAV06A	Excav 100K w/ Bucket & Grapple	5.00	1.00	Each (hourly)	U.S. Dollar	124.54	622.68
*REXCAV06E	Excav 100K w/ Shear	5.00	1.00	Each (hourly)	U.S. Dollar	185.50	927.48
L010101	OPERATOR	10.00	2.00	Each (hourly)	U.S. Dollar	56.75	567.53
L060100	GENERAL LABORER	10.00	2.00	Each (hourly)	U.S. Dollar	45.44	454.44

1.6.2	15.00	Cubic Yard	Remove Foundation	0.10	146.00	Detail	U.S. Dollar	48.47	727.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
L060100	GENERAL LABORER	2.05	2.00	Each (hourly)	U.S. Dollar	45.44	93.38
L010101	OPERATOR	3.08	3.00	Each (hourly)	U.S. Dollar	56.75	174.92
*REXCAV06C	Excav 100K w/ Hammer	2.05	2.00	Each (hourly)	U.S. Dollar	160.97	330.75
*REXCAV06A	Excav 100K w/ Bucket & Grapple	1.03	1.00	Each (hourly)	U.S. Dollar	124.54	127.95

1.6.3	15.00	Cubic Yard	Concrete Transport Offsite	0.10	146.67	Detail	U.S. Dollar	12.25	183.68

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
RDUTRK06	CAT D350D, 18CY-24CY	1.02	1.00	Each (hourly)	U.S. Dollar	74.29	75.98
L080940	TEAMSTER	1.02	1.00	Each (hourly)	U.S. Dollar	45.44	46.48
L010101	OPERATOR	0.51	0.50	Each (hourly)	U.S. Dollar	56.75	29.02
RFELWH09	CAT 966F LOADER, 4.25CY	0.51	0.50	Each (hourly)	U.S. Dollar	62.97	32.20

1.6.4	8.00	Ton	Scrap Trucking Cost	0.00	0.00	Detail	U.S. Dollar	45.00	360.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
USTRUCKING	Trucking Sub		360.00	Each	U.S. Dollar	1.00	360.00

1.7	1.00	Lump Sum	Substation & Switchyard Removal	22.27	0.04	Detail	U.S. Dollar	205,905.51	205,905.51
1.7.1	1.00	Day	Fence Removal	1.00	1.00	Detail	U.S. Dollar	1,354.33	1,354.33

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
L010101	OPERATOR	10.00	1.00	Each (hourly)	U.S. Dollar	56.75	567.53
L060100	GENERAL LABORER	10.00	1.00	Each (hourly)	U.S. Dollar	45.44	454.44

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CBS Position Code	Quantity	UM	Description	Cost Item Days	UM/Day	Cost Source	Currency	Unit Cost	Total Cost
RBACKH09	Deere 710J BACKHOE, 1.62CY		10.00	1.00	Each (hourly)		U.S. Dollar	33.24	332.35
1.7.2	1.00	Each	Transformer & Switchyard Equip Removal	3.50	0.29	Detail	U.S. Dollar	144,348.46	144,348.46
1.7.2.1	1.00	Each	Oil Removal & Disposal	2.00	0.50	Detail	U.S. Dollar	104,789.07	104,789.07
1.7.2.1.1	1.00	Each	Oil Removal	2.00	0.50	Detail	U.S. Dollar	2,039.07	2,039.07

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
L060100	GENERAL LABORER	40.00	2.00	Each (hourly)	U.S. Dollar	45.44	1,817.77
RPUTRK05	F-250 4X4 3/4 TON PICKUP	20.00	1.00	Each (hourly)	U.S. Dollar	11.07	221.30

1.7.2.1.2	25,000.00	Gallon	Oil Disposal	0.00	0.00	Detail	U.S. Dollar	4.00	100,000.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
USDISPOSAL	Disposal Fee's		100,000.00	Each	U.S. Dollar	1.00	100,000.00

1.7.2.1.3	2.00	Each	Trucking - Per Load	0.00	0.00	Detail	U.S. Dollar	1,375.00	2,750.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
USTRUCKING	Trucking Sub		2,750.00	Each	U.S. Dollar	1.00	2,750.00

1.7.2.2	150.00	Ton	Demo & Prepare For Shipment Offsite	1.50	100.00	Detail	U.S. Dollar	198.73	29,809.39

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
*RXMISC19	Material Handler	15.00	1.00	Each (hourly)	U.S. Dollar	98.82	1,482.23
*REXCAV06E	Excav 100K w/ Shear	30.00	2.00	Each (hourly)	U.S. Dollar	185.50	5,564.85
*REXCAV08	Excav 240K w/ Shear	30.00	2.00	Each (hourly)	U.S. Dollar	463.46	13,903.80
L010101	OPERATOR	60.00	4.00	Each (hourly)	U.S. Dollar	56.75	3,405.20
L060100	GENERAL LABORER	120.00	8.00	Each (hourly)	U.S. Dollar	45.44	5,453.32

1.7.2.3	150.00	Ton	Salvage & Recovery	0.00	0.00	Detail	U.S. Dollar	65.00	9,750.00
1.7.2.3.1	150.00	Ton	Scrap Trucking Cost	0.00	0.00	Detail	U.S. Dollar	65.00	9,750.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
USTRUCKING	Trucking Sub		9,750.00	Each	U.S. Dollar	1.00	9,750.00

1.7.3	1.00	Each	Remove Control Building	0.10	10.00	Detail	U.S. Dollar	2,637.29	2,637.29
1.7.3.1	10.00	Ton	Demo & Prepare For Shipment Offsite	0.10	100.00	Detail	U.S. Dollar	198.73	1,987.29

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
*RXMISC19	Material Handler	1.00	1.00	Each (hourly)	U.S. Dollar	98.82	98.82
*REXCAV06E	Excav 100K w/ Shear	2.00	2.00	Each (hourly)	U.S. Dollar	185.50	370.99
*REXCAV08	Excav 240K w/ Shear	2.00	2.00	Each (hourly)	U.S. Dollar	463.46	926.92
L010101	OPERATOR	4.00	4.00	Each (hourly)	U.S. Dollar	56.75	227.01
L060100	GENERAL LABORER	8.00	8.00	Each (hourly)	U.S. Dollar	45.44	363.55

1.7.3.2	10.00	Ton	Salvage & Recovery	0.00	0.00	Detail	U.S. Dollar	65.00	650.00
1.7.3.2.1	10.00	Ton	Scrap Trucking Cost	0.00	0.00	Detail	U.S. Dollar	65.00	650.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
USTRUCKING	Trucking Sub		650.00	Each	U.S. Dollar	1.00	650.00

1.7.4	2.00	Day	UG Utility & Ground Removal	2.00	1.00	Detail	U.S. Dollar	1,354.33	2,708.65

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
L010101	OPERATOR	20.00	1.00	Each (hourly)	U.S. Dollar	56.75	1,135.07
L060100	GENERAL LABORER	20.00	1.00	Each (hourly)	U.S. Dollar	45.44	908.89

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CBS Position Code	Quantity	UM	Description	Cost Item Days	UM/Day	Cost Source	Currency	Unit Cost	Total Cost
RBACKH09	Deere 710J BACKHOE, 1.62CY			20.00	1.00	Each (hourly)	U.S. Dollar	33.24	664.70
1.7.5	500.00	Cubic Yard	Remove Foundations To Subgrade	7.00	71.43	Detail	U.S. Dollar	35.74	17,868.82
1.7.5.1	500.00	Cubic Yard	Excavate / Remove Foundation - Various Depth	2.00	250.00	Detail	U.S. Dollar	17.78	8,889.02

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
L060100	GENERAL LABORER	20.00	1.00	Each (hourly)	U.S. Dollar	45.44	908.89
L010101	OPERATOR	40.00	2.00	Each (hourly)	U.S. Dollar	56.75	2,270.13
*REXCAV06C	Excav 100K w/ Hammer	20.00	1.00	Each (hourly)	U.S. Dollar	160.97	3,219.30
*REXCAV06A	Excav 100K w/ Bucket & Grapple	20.00	1.00	Each (hourly)	U.S. Dollar	124.54	2,490.70

1.7.5.2	500.00	Cubic Yard	Concrete Transport Offsite	5.00	100.00	Detail	U.S. Dollar	17.96	8,979.80

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
RDUTRK06	CAT D350D, 18CY-24CY	50.00	1.00	Each (hourly)	U.S. Dollar	74.29	3,714.50
L080940	TEAMSTER	50.00	1.00	Each (hourly)	U.S. Dollar	45.44	2,272.22
L010101	OPERATOR	25.00	0.50	Each (hourly)	U.S. Dollar	56.75	1,418.83
RFELWH09	CAT 966F LOADER, 4.25CY	25.00	0.50	Each (hourly)	U.S. Dollar	62.97	1,574.25

1.7.6	1.00	Lump Sum	Misc. Material Disposal	0.00	0.00	Detail	U.S. Dollar	1,675.00	1,675.00
1.7.6.1	1.00	Each	Trucking - Per Load	0.00	0.00	Detail	U.S. Dollar	1,375.00	1,375.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
USTRUCKING	Trucking Sub		1,375.00	Each	U.S. Dollar	1.00	1,375.00

1.7.6.2	10.00	Ton	Disposal Cost	0.00	0.00	Detail	U.S. Dollar	30.00	300.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
USDISPOSAL	Disposal Fee's		300.00	Each	U.S. Dollar	1.00	300.00

1.7.7	1.00	Lump Sum	Restore Yard	8.67	0.12	Detail	U.S. Dollar	35,312.96	35,312.96
1.7.7.1	4.00	Acre	Backfill / Regrade	2.00	2.00	Detail	U.S. Dollar	1,692.29	6,769.18

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
L060100	GENERAL LABORER	40.00	2.00	Each (hourly)	U.S. Dollar	45.44	1,817.77
L010101	OPERATOR	40.00	2.00	Each (hourly)	U.S. Dollar	56.75	2,270.13
REXCAV06B	Gradall - Excavator	20.00	1.00	Each (hourly)	U.S. Dollar	75.73	1,514.57
*RDOZER08	CAT D6 LGP Dozer	20.00	1.00	Each (hourly)	U.S. Dollar	58.34	1,166.70

1.7.7.2	2,000.00	Cubic Yard	Vegetative Cover	6.67	300.00	Detail	U.S. Dollar	12.74	25,483.78
1.7.7.2.1	1,000.00	Cubic Yard	Topsoil, Delivered	0.00	0.00	Detail	U.S. Dollar	10.00	10,000.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
IMSOIL	Topsoil		500.00	Cubic Yard	U.S. Dollar	20.00	10,000.00

Notes: **********
Assume that 50% of the topsoil required for restoration is bermed and stockpiled adjacent to the substation
****

1.7.7.2.2	2,000.00	Cubic Yard	Placement	6.67	300.00	Detail	U.S. Dollar	7.74	15,483.78

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
L010101	OPERATOR	133.33	2.00	Each (hourly)	U.S. Dollar	56.75	7,567.11
RDOZER08	CAT D6N XL	133.33	2.00	Each (hourly)	U.S. Dollar	59.38	7,916.67

1.7.7.3	4.00	Acre	Re-Seed With Native Vegetation	0.00	0.00	Detail	U.S. Dollar	765.00	3,060.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
USLANDSCAPE	Landscape Sub		4.00	Acre	U.S. Dollar	765.00	3,060.00

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CBS Position Code	Quantity	UM	Description	Cost Item Days	UM/Day	Cost Source	Currency	Unit Cost	Total Cost
1.8	1.00	Lump Sum	Transmission Line Removal	4.09	0.24	Detail	U.S. Dollar	20,955.44	20,955.44
1.8.1	2.00	Each	Structure Removal	2.00	1.00	Detail	U.S. Dollar	5,391.45	10,782.90
1.8.1.1	2.00	Each	Cut / Lower Structure	1.00	2.00	Detail	U.S. Dollar	1,914.80	3,829.61

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
L060100	GENERAL LABORER	40.00	4.00	Each (hourly)	U.S. Dollar	45.44	1,817.77
L010101	OPERATOR	10.00	1.00	Each (hourly)	U.S. Dollar	56.75	567.53
*RXMISC14	MAN LIFT GAS 125ft	10.00	1.00	Each (hourly)	U.S. Dollar	53.52	535.20
*RXMISC23	GROVE RT 200 TON	10.00	1.00	Each (hourly)	U.S. Dollar	90.91	909.10

1.8.1.2	2.00	Each	Cut / Size Structure & Loadout	1.00	2.00	Detail	U.S. Dollar	2,101.65	4,203.29

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
L060100	GENERAL LABORER	60.00	6.00	Each (hourly)	U.S. Dollar	45.44	2,726.66
L010101	OPERATOR	10.00	1.00	Each (hourly)	U.S. Dollar	56.75	567.53
*RXMISC23	GROVE RT 200 TON	10.00	1.00	Each (hourly)	U.S. Dollar	90.91	909.10

1.8.1.3	2.00	Each	Trucking - Per Load	0.00	0.00	Detail	U.S. Dollar	1,375.00	2,750.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
USTRUCKING	Trucking Sub		2,750.00	Each	U.S. Dollar	1.00	2,750.00

Notes: **********
Assume 9 ton per steel structure
****

1.8.2	2.00	Each	Remove Foundations To Subgrade	2.04	0.98	Detail	U.S. Dollar	4,924.73	9,849.45
1.8.2.1	2.00	Each	Excavate / Remove Foundation - Various Depth	2.00	1.00	Detail	U.S. Dollar	4,898.95	9,797.91

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
L060100	GENERAL LABORER	40.00	2.00	Each (hourly)	U.S. Dollar	45.44	1,817.77
L010101	OPERATOR	40.00	2.00	Each (hourly)	U.S. Dollar	56.75	2,270.13
*REXCAV06C	Excav 100K w/ Hammer	20.00	1.00	Each (hourly)	U.S. Dollar	160.97	3,219.30
*REXCAV06A	Excav 100K w/ Bucket & Grapple	20.00	1.00	Each (hourly)	U.S. Dollar	124.54	2,490.70

1.8.2.2	3.23	Cubic Yard	Concrete Transport Offsite	0.04	75.00	Detail	U.S. Dollar	15.96	51.55

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
RDUTRK06	CAT D350D, 18CY-24CY	0.43	1.00	Each (hourly)	U.S. Dollar	74.29	31.98
L080940	TEAMSTER	0.43	1.00	Each (hourly)	U.S. Dollar	45.44	19.56

1.8.3	0.05	Mile	Conductor Removal	0.05	1.00	Detail	U.S. Dollar	6,461.73	323.09
1.8.3.1	0.05	Mile	Cut / Lower Cable, Size & Loadout	0.05	1.00	Detail	U.S. Dollar	6,136.73	306.84

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
L060100	GENERAL LABORER	3.00	6.00	Each (hourly)	U.S. Dollar	45.44	136.33
L010101	OPERATOR	1.00	2.00	Each (hourly)	U.S. Dollar	56.75	56.75
*RXMISC14	MAN LIFT GAS 125ft	1.00	2.00	Each (hourly)	U.S. Dollar	53.52	53.52
RLIFTS05	JCB 508C, 8,000lbs FRKLFT	0.50	1.00	Each (hourly)	U.S. Dollar	21.65	10.82
*RXMISC19	Material Handler	0.50	1.00	Each (hourly)	U.S. Dollar	98.82	49.41

1.8.3.2	0.25	Ton	Salvage & Recovery	0.00	0.00	Detail	U.S. Dollar	65.00	16.25
1.8.3.2.1	0.25	Ton	Scrap Trucking Cost	0.00	0.00	Detail	U.S. Dollar	65.00	16.25

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
USTRUCKING	Trucking Sub		16.25	Each	U.S. Dollar	1.00	16.25

1.9	71.00	Each	Construct & Remove Temporary Crane Pads	94.67	0.75	Detail	U.S. Dollar	7,746.61	550,009.40

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CBS Position Code	Quantity	UM	Description	Cost Item Days	UM/Day	Cost Source	Currency	Unit Cost	Total Cost

Notes: **********
60' x 40' Temporary Crane Pad
****

1.9.1	7,100.00	Ton	Crane Pad 4" Stone 8" depth	35.50	200.00	Detail	U.S. Dollar	35.44	251,608.98

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
M4"STONE	4" Stone		7,100.00	Ton	U.S. Dollar	15.00	106,500.00
RDOZER06	CAT D5H XL	355.00	1.00	Each (hourly)	U.S. Dollar	43.56	15,462.03
RROLLR06	CP-563C 84" SMOOTH DRUM	355.00	1.00	Each (hourly)	U.S. Dollar	51.70	18,352.08
L010101	OPERATOR	710.00	2.00	Each (hourly)	U.S. Dollar	56.75	40,294.88
USSTONETRK	Sub-Trucking of Stone		7,100.00	Ton	U.S. Dollar	10.00	71,000.00

1.9.2	5,325.00	Ton	Crane Pad 2" Stone 6" depth	35.50	150.00	Detail	U.S. Dollar	38.92	207,233.98

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
USSTONETRK	Sub-Trucking of Stone		5,325.00	Ton	U.S. Dollar	10.00	53,250.00
L010101	OPERATOR	710.00	2.00	Each (hourly)	U.S. Dollar	56.75	40,294.88
RDOZER06	CAT D5H XL	355.00	1.00	Each (hourly)	U.S. Dollar	43.56	15,462.03
RROLLR06	CP-563C 84" SMOOTH DRUM	355.00	1.00	Each (hourly)	U.S. Dollar	51.70	18,352.08
M2"STONE	Material - 2" Stone		5,325.00	Ton	U.S. Dollar	15.00	79,875.00

1.9.3	71.00	Each	Remove stone after erection	23.67	3.00	Detail	U.S. Dollar	1,284.03	91,166.44

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
RDOZER06	CAT D5H XL	236.67	1.00	Each (hourly)	U.S. Dollar	43.56	10,308.02
RFELWH09	CAT 966F LOADER, 4.25CY	236.67	1.00	Each (hourly)	U.S. Dollar	62.97	14,902.90
L010101	OPERATOR	473.33	2.00	Each (hourly)	U.S. Dollar	56.75	26,863.25
L060100	GENERAL LABORER	236.67	1.00	Each (hourly)	U.S. Dollar	45.44	10,755.15
RDUTRK06	CAT D350D, 18CY-24CY	236.67	1.00	Each (hourly)	U.S. Dollar	74.29	17,581.97
L080940	TEAMSTER	236.67	1.00	Each (hourly)	U.S. Dollar	45.44	10,755.15

1.10	71.00	Each	WTG Removal	0.00	0.00	Detail	U.S. Dollar	30,000.00	2,130,000.00

1.10.1	71.00	Each	Remove Top,Nacell, Rotor	0.00	0.00	Detail	U.S. Dollar	20,000.00	1,420,000.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
USERECT1	Sub-Top, Nacelle, Rotor		71.00	Each	U.S. Dollar	20,000.00	1,420,000.00

1.10.2	71.00	Each	Remove Base & Mid	0.00	0.00	Detail	U.S. Dollar	10,000.00	710,000.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
USERECT	Erection Sub - Base/Mid		71.00	Each	U.S. Dollar	10,000.00	710,000.00

1.11	71.00	Each	WTG Sizing & Loadout - 2.8 MW, 89 m Tower	80.73	0.88	Detail	U.S. Dollar	41,018.27	2,912,297.09

1.11.1	71.00	Each	Oil Removal & Disposal	14.20	5.00	Detail	U.S. Dollar	386.08	27,412.01

1.11.1.1	71.00	Each	Oil Removal	14.20	5.00	Detail	U.S. Dollar	203.91	14,477.41

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
L060100	GENERAL LABORER	284.00	2.00	Each (hourly)	U.S. Dollar	45.44	12,906.18
RPUTRK05	F-250 4X4 3/4 TON PICKUP	142.00	1.00	Each (hourly)	U.S. Dollar	11.07	1,571.23

1.11.1.2	2,840.00	Gallon	Oil Disposal	0.00	0.00	Detail	U.S. Dollar	4.00	11,360.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
USDISPOSAL	Disposal Fee's		11,360.00	Each	U.S. Dollar	1.00	11,360.00

1.11.1.3	1.15	Each	Trucking - Per Load	0.00	0.00	Detail	U.S. Dollar	1,375.00	1,574.60

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CBS Position Code	Quantity	UM	Description	Days	Cost UM/Day	Cost Source	Currency	Unit Cost	Total Cost
			Cost Item						

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
USTRUCKING	Trucking Sub		1,574.60	Each	U.S. Dollar	1.00	1,574.60

1.11.2	11,573.00	Ton	Demo & Prepare For Shipment Offsite - Top, Mid & Base	40.47	286.00	Detail	U.S. Dollar	69.49	804,158.73

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
*RXMISC19	Material Handler	404.65	1.00	Each (hourly)	U.S. Dollar	98.82	39,985.52
*REXCAV06E	Excav 100K w/ Shear	809.30	2.00	Each (hourly)	U.S. Dollar	185.50	150,121.23
*REXCAV08	Excav 240K w/ Shear	809.30	2.00	Each (hourly)	U.S. Dollar	463.46	375,078.50
L010101	OPERATOR	1,618.60	4.00	Each (hourly)	U.S. Dollar	56.75	91,861.05
L060100	GENERAL LABORER	3,237.20	8.00	Each (hourly)	U.S. Dollar	45.44	147,112.42

1.11.3	2,272.00	Ton	Demo & Prepare For Shipment Offsite - Hub	7.94	286.00	Detail	U.S. Dollar	69.49	157,871.65

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
*RXMISC19	Material Handler	79.44	1.00	Each (hourly)	U.S. Dollar	98.82	7,849.92
*REXCAV06E	Excav 100K w/ Shear	158.88	2.00	Each (hourly)	U.S. Dollar	185.50	29,471.65
*REXCAV08	Excav 240K w/ Shear	158.88	2.00	Each (hourly)	U.S. Dollar	463.46	73,635.04
L010101	OPERATOR	317.76	4.00	Each (hourly)	U.S. Dollar	56.75	18,034.07
L060100	GENERAL LABORER	635.52	8.00	Each (hourly)	U.S. Dollar	45.44	28,880.96

1.11.4	4,970.00	Ton	Demo & Prepare For Shipment Offsite - Nacelle	17.38	286.00	Detail	U.S. Dollar	69.49	345,344.24

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
*RXMISC19	Material Handler	173.78	1.00	Each (hourly)	U.S. Dollar	98.82	17,171.70
*REXCAV06E	Excav 100K w/ Shear	347.55	2.00	Each (hourly)	U.S. Dollar	185.50	64,469.24
*REXCAV08	Excav 240K w/ Shear	347.55	2.00	Each (hourly)	U.S. Dollar	463.46	161,076.66
L010101	OPERATOR	695.10	4.00	Each (hourly)	U.S. Dollar	56.75	39,449.53
L060100	GENERAL LABORER	1,390.21	8.00	Each (hourly)	U.S. Dollar	45.44	63,177.11

1.11.5	213.00	Ton	Demo & Prepare For Shipment Offsite - Down Tower Assembly	0.74	286.00	Detail	U.S. Dollar	69.49	14,800.47

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
*RXMISC19	Material Handler	7.45	1.00	Each (hourly)	U.S. Dollar	98.82	735.93
*REXCAV06E	Excav 100K w/ Shear	14.90	2.00	Each (hourly)	U.S. Dollar	185.50	2,762.97
*REXCAV08	Excav 240K w/ Shear	14.90	2.00	Each (hourly)	U.S. Dollar	463.46	6,903.29
L010101	OPERATOR	29.79	4.00	Each (hourly)	U.S. Dollar	56.75	1,690.69
L060100	GENERAL LABORER	59.58	8.00	Each (hourly)	U.S. Dollar	45.44	2,707.59

1.11.6	71.00	Each	Salvage & Recovery	0.00	0.00	Detail	U.S. Dollar	17,355.00	1,232,205.00

1.11.6.1	18,957.00	Ton	Scrap Trucking Cost	0.00	0.00	Detail	U.S. Dollar	65.00	1,232,205.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
USTRUCKING	Trucking Sub		1,232,205.00	Each	U.S. Dollar	1.00	1,232,205.00

1.11.7	3,479.00	Ton	Blade T&D	0.00	0.00	Detail	U.S. Dollar	95.00	330,505.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
USTRUCKING	Trucking Sub		226,135.00	Each	U.S. Dollar	1.00	226,135.00
USDISPOSAL	Disposal Fee's		104,370.00	Each	U.S. Dollar	1.00	104,370.00

1.12	71.00	Each	WTG Foundation Removal	156.04	0.46	Detail	U.S. Dollar	9,755.22	692,620.91

1.12.1	1,065.00	Cubic Yard	Remove 13' x 3' Cylindrical Pedestal	7.10	150.00	Detail	U.S. Dollar	47.17	50,240.57

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
L060100	GENERAL LABORER	142.00	2.00	Each (hourly)	U.S. Dollar	45.44	6,453.09

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CBS Position Code	Quantity	UM	Description	Days	UM/Day	Cost Source	Currency	Unit Cost	Total Cost
			Cost Item						
L010101	OPERATOR		213.00	3.00	Each (hourly)		U.S. Dollar	56.75	12,088.46
*REXCAV06C	Excav 100K w/ Hammer		142.00	2.00	Each (hourly)		U.S. Dollar	160.97	22,857.03
*REXCAV06A	Excav 100K w/ Bucket & Grapple		71.00	1.00	Each (hourly)		U.S. Dollar	124.54	8,841.99
1.12.2	10,366.00	Cubic Yard	Remove Top 2' Of Octagonal Base	71.00	146.00	Detail	U.S. Dollar	48.47	502,405.69

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
L060100	GENERAL LABORER	1,420.00	2.00	Each (hourly)	U.S. Dollar	45.44	64,530.91
L010101	OPERATOR	2,130.00	3.00	Each (hourly)	U.S. Dollar	56.75	120,884.64
*REXCAV06C	Excav 100K w/ Hammer	1,420.00	2.00	Each (hourly)	U.S. Dollar	160.97	228,570.30
*REXCAV06A	Excav 100K w/ Bucket & Grapple	710.00	1.00	Each (hourly)	U.S. Dollar	124.54	88,419.85
1.12.3	11,431.00 Cubic Yard	Concrete Transport Offsite	77.94	146.67	Detail	U.S. Dollar	12.25	139,974.65

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
RDUTRK06	CAT D350D, 18CY-24CY	779.39	1.00	Each (hourly)	U.S. Dollar	74.29	57,900.61
L080940	TEAMSTER	779.39	1.00	Each (hourly)	U.S. Dollar	45.44	35,418.67
L010101	OPERATOR	389.69	0.50	Each (hourly)	U.S. Dollar	56.75	22,116.39
RFELWH09	CAT 966F LOADER, 4.25CY	389.69	0.50	Each (hourly)	U.S. Dollar	62.97	24,538.98
1.13	71.00 Each	Pad Mount Transformer Removal	18.74	3.79	Detail	U.S. Dollar	3,648.65	259,054.49
1.13.1	71.00 Each	Oil Removal & Disposal	14.20	5.00	Detail	U.S. Dollar	2,979.55	211,548.11
1.13.1.1	71.00 Each	Oil Removal	14.20	5.00	Detail	U.S. Dollar	113.02	8,024.32

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
L060100	GENERAL LABORER	142.00	1.00	Each (hourly)	U.S. Dollar	45.44	6,453.09
RPUTRK05	F-250 4X4 3/4 TON PICKUP	142.00	1.00	Each (hourly)	U.S. Dollar	11.07	1,571.23
1.13.1.2	49,700.00 Gallon	Oil Disposal	0.00	0.00	Detail	U.S. Dollar	4.00	198,800.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
USDISPOSAL	Disposal Fee's		198,800.00	Each	U.S. Dollar	1.00	198,800.00
1.13.1.3	3.44 Each	Trucking - Per Load	0.00	0.00	Detail	U.S. Dollar	1,375.00	4,723.79

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
USTRUCKING	Trucking Sub		4,723.79	Each	U.S. Dollar	1.00	4,723.79
1.13.2	71.00 Each	Remove & Loadout Transformer	3.55	20.00	Detail	U.S. Dollar	113.37	8,049.01

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
*REXCAV06A	Excav 100K w/ Bucket & Grapple	35.50	1.00	Each (hourly)	U.S. Dollar	124.54	4,420.99
L010101	OPERATOR	35.50	1.00	Each (hourly)	U.S. Dollar	56.75	2,014.74
L060100	GENERAL LABORER	35.50	1.00	Each (hourly)	U.S. Dollar	45.44	1,613.27
1.13.3	71.00 Each	Salvage & Recovery	0.00	0.00	Detail	U.S. Dollar	520.00	36,920.00
1.13.3.1	568.00 Ton	Scrap Trucking Cost	0.00	0.00	Detail	U.S. Dollar	65.00	36,920.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
USTRUCKING	Trucking Sub		36,920.00	Each	U.S. Dollar	1.00	36,920.00
1.13.4	71.00 Each	Remove Foundations To Subgrade	0.99	71.43	Detail	U.S. Dollar	35.74	2,537.37
1.13.4.1	71.00 Cubic Yard	Excavate / Remove Foundation - Various Depth	0.28	250.00	Detail	U.S. Dollar	17.78	1,262.24

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
L060100	GENERAL LABORER	2.84	1.00	Each (hourly)	U.S. Dollar	45.44	129.06

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CBS Position Code	Quantity	UM	Description	Days	UM/Day	Cost Source	Currency	Unit Cost	Total Cost
L010101	OPERATOR		5.68	2.00	Each (hourly)		U.S. Dollar	56.75	322.36
*REXCAV06C	Excav 100K w/ Hammer		2.84	1.00	Each (hourly)		U.S. Dollar	160.97	457.14
*REXCAV06A	Excav 100K w/ Bucket & Grapple		2.84	1.00	Each (hourly)		U.S. Dollar	124.54	353.68
1.13.4.2	71.00	Cubic Yard	Concrete Transport Offsite	0.71	100.00	Detail	U.S. Dollar	17.96	1,275.13

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
RDUTRK06	CAT D350D, 18CY-24CY	7.10	1.00	Each (hourly)	U.S. Dollar	74.29	527.46
L080940	TEAMSTER	7.10	1.00	Each (hourly)	U.S. Dollar	45.44	322.65
L010101	OPERATOR	3.55	0.50	Each (hourly)	U.S. Dollar	56.75	201.47
RFELWH09	CAT 966F LOADER, 4.25CY	3.55	0.50	Each (hourly)	U.S. Dollar	62.97	223.54

1.14	54,756.00	Cubic Yard	Access Road Removal	109.51	500.00	Detail	U.S. Dollar	11.40	624,003.65

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
L010101	OPERATOR	2,190.24	2.00	Each (hourly)	U.S. Dollar	56.75	124,303.46
L060100	GENERAL LABORER	2,190.24	2.00	Each (hourly)	U.S. Dollar	45.44	99,533.92
L080940	TEAMSTER	2,190.24	2.00	Each (hourly)	U.S. Dollar	45.44	99,533.92
RDUTRK06	CAT D350D, 18CY-24CY	2,190.24	2.00	Each (hourly)	U.S. Dollar	74.29	162,712.93
RFELWH09	CAT 966F LOADER, 4.25CY	2,190.24	2.00	Each (hourly)	U.S. Dollar	62.97	137,919.41

Notes: **********
35 miles x 16' wide x .5 foot depth
****

1.15	1.00	Lump Sum	Site Restoration	182.52	0.01	Detail	U.S. Dollar	858,344.93	858,344.93
1.15.1	54,756.00	Cubic Yard	Vegetative Cover	182.52	300.00	Detail	U.S. Dollar	12.74	697,694.93

Notes: **********
Assume that 50% of the topsoil is onsite and available for use
****

1.15.1.1	27,378.00	Cubic Yard	Topsoil, Delivered	0.00	0.00	Detail	U.S. Dollar	10.00	273,780.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
IMSOIL	Topsoil		13,689.00	Cubic Yard	U.S. Dollar	20.00	273,780.00

Notes: **********
Assume that 50% of the topsoil required for restoration
is bermed and stockpiled
****

1.15.1.2	54,756.00	Cubic Yard	Placement	182.52	300.00	Detail	U.S. Dollar	7.74	423,914.93

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
L010101	OPERATOR	3,650.40	2.00	Each (hourly)	U.S. Dollar	56.75	207,172.43
RDOZER08	CAT D6N XL	3,650.40	2.00	Each (hourly)	U.S. Dollar	59.38	216,742.50

1.15.2	210.00	Acre	Re-Seed With Native Vegetation - Roads & Areas Disturbed By Construction	0.00	0.00	Detail	U.S. Dollar	765.00	160,650.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
USLANDSCAPE	Landscape Sub		210.00	Acre	U.S. Dollar	765.00	160,650.00

Notes: **********
68 acres for roads, 2 acres per turbine
****

1.16	1.00	Lump Sum	Home Office, Project Management (5% Of Cost)	0.00	0.00	Detail	U.S. Dollar	482,930.90	482,930.90

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
USMARKUP5	5% Markup		9,658,618.00	Each	U.S. Dollar	0.05	482,930.90

1.17	1.00	Lump Sum	Contractor OH & Fee (13% Of Cost)	0.00	0.00	Detail	U.S. Dollar	1,318,401.37	1,318,401.37

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CBS Position Code	Quantity	UM	Description	Cost Item Days	UM/Day	Cost Source	Currency	Unit Cost	Total Cost
Resource Code	**Description**		**Hours**	**Quantity**	**UM**		**Currency**	**Unit Cost**	**Total Cost**
USMARKUP	13% Markup			10,141,549.00	Each		U.S. Dollar	0.13	1,318,401.37
1.18	1.00	Lump Sum	Scrap Metals Credit	0.00	0.00	Detail	U.S. Dollar	(7,903,300.00)	(7,903,300.00)
1.18.1	150.00	Ton	Scrap Metals Credit - Transformer & Switchyard	0.00	0.00	Detail	U.S. Dollar	(400.00)	(60,000.00)
Resource Code	**Description**		**Hours**	**Quantity**	**UM**		**Currency**	**Unit Cost**	**Total Cost**
UODCFERROUS	Ferrous Metal Scrap			150.00	Ton		U.S. Dollar	(400.00)	(60,000.00)
1.18.2	10.00	Ton	Scrap Metals Credit - Control Building	0.00	0.00	Detail	U.S. Dollar	(400.00)	(4,000.00)
Resource Code	**Description**		**Hours**	**Quantity**	**UM**		**Currency**	**Unit Cost**	**Total Cost**
UODCFERROUS	Ferrous Metal Scrap			10.00	Ton		U.S. Dollar	(400.00)	(4,000.00)
1.18.3	18,957.00	Ton	Scrap Metals Credit - WTG	0.00	0.00	Detail	U.S. Dollar	(400.00)	(7,582,800.00)
Resource Code	**Description**		**Hours**	**Quantity**	**UM**		**Currency**	**Unit Cost**	**Total Cost**
UODCFERROUS	Ferrous Metal Scrap			18,957.00	Ton		U.S. Dollar	(400.00)	(7,582,800.00)
1.18.4	568.00	Ton	Scrap Metals Credit - Pad Mount Transformer	0.00	0.00	Detail	U.S. Dollar	(400.00)	(227,200.00)
Resource Code	**Description**		**Hours**	**Quantity**	**UM**		**Currency**	**Unit Cost**	**Total Cost**
UODCFERROUS	Ferrous Metal Scrap			568.00	Ton		U.S. Dollar	(400.00)	(227,200.00)
1.18.5	18.00	Ton	Scrap Metals Credit - T Line Structure	0.00	0.00	Detail	U.S. Dollar	(400.00)	(7,200.00)
Resource Code	**Description**		**Hours**	**Quantity**	**UM**		**Currency**	**Unit Cost**	**Total Cost**
UODCFERROUS	Ferrous Metal Scrap			18.00	Ton		U.S. Dollar	(400.00)	(7,200.00)
1.18.6	0.25	Ton	Scrap Metals Credit - T Line	0.00	0.00	Detail	U.S. Dollar	(400.00)	(100.00)
Resource Code	**Description**		**Hours**	**Quantity**	**UM**		**Currency**	**Unit Cost**	**Total Cost**
UODCFERROUS	Ferrous Metal Scrap			0.25	Ton		U.S. Dollar	(400.00)	(100.00)
1.18.7	20.00	Ton	Scrap Metals Credit - ADLS	0.00	0.00	Detail	U.S. Dollar	(400.00)	(8,000.00)
Resource Code	**Description**		**Hours**	**Quantity**	**UM**		**Currency**	**Unit Cost**	**Total Cost**
UODCFERROUS	Ferrous Metal Scrap			20.00	Ton		U.S. Dollar	(400.00)	(8,000.00)
1.18.8	35.00	Ton	Scrap Metals Credit - O&M Building	0.00	0.00	Detail	U.S. Dollar	(400.00)	(14,000.00)
Resource Code	**Description**		**Hours**	**Quantity**	**UM**		**Currency**	**Unit Cost**	**Total Cost**
UODCFERROUS	Ferrous Metal Scrap			35.00	Ton		U.S. Dollar	(400.00)	(14,000.00)
Report Total:				827.31					3,556,650.47

Category	Total
Labor	1,854,615.47
Rented Equipment	2,141,168.09
Supplies	2,130.00
Materials	470,155.00
Subcontract	6,985,481.91
ODCs	6,400.00
Scrap Credit	(7,903,300.00)

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Estimate Summary
TETRA TECH EC, INC.
Job Code: ENGIE North Bend Wind
Description: Decommissioning Estimate

CBS Position Code	Quantity	UM	Description	Cost Item Days	Cost UM/Day	Cost Source	Currency	Unit Cost	Total Cost
1	1.00	Lump Sum	NORTH BEND WIND RETIREMENT	827.31	0.00	Detail	U.S. Dollar	11,459,950.47	11,459,950.47
1.1	1.00	Lump Sum	Mob / Demob	5.00	0.20	Detail	U.S. Dollar	911,609.84	911,609.84
1.1.1	1.00	Lump Sum	Equipment Mob	0.00	0.00	Detail	U.S. Dollar	101,500.00	101,500.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
UERNTRLG	Rental Equip Transp-Large		10.00	Each	U.S. Dollar	10,000.00	100,000.00
UERNTRSM	Rental Equip Transp-Small		10.00	Each	U.S. Dollar	150.00	1,500.00

1.1.2	1.00	Lump Sum	Site Facilities	0.00	0.00	Detail	U.S. Dollar	2,200.00	2,200.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
UOCONMOB	Connex Box Mob		2.00	Each	U.S. Dollar	300.00	600.00
UOTRLTRN	Trailer Trnsp/Setup/Trdwn		2.00	Each	U.S. Dollar	800.00	1,600.00

1.1.3	3.00	Day	Crew Mob & Site Setup	3.00	1.00	Detail	U.S. Dollar	16,581.97	49,745.90

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
L060100	GENERAL LABORER	600.00	20.00	Each (hourly)	U.S. Dollar	45.44	27,266.58
L010101	OPERATOR	300.00	10.00	Each (hourly)	U.S. Dollar	56.75	17,026.01
L080940	TEAMSTER	120.00	4.00	Each (hourly)	U.S. Dollar	45.44	5,453.32

1.1.4	2.00	Day	Crew Demob & Site Cleanup	2.00	1.00	Detail	U.S. Dollar	16,581.97	33,163.93

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
L060100	GENERAL LABORER	400.00	20.00	Each (hourly)	U.S. Dollar	45.44	18,177.72
L010101	OPERATOR	200.00	10.00	Each (hourly)	U.S. Dollar	56.75	11,350.67
L080940	TEAMSTER	80.00	4.00	Each (hourly)	U.S. Dollar	45.44	3,635.54

1.1.5	1.00	Lump Sum	Mob-Erection Sub	0.00	0.00	Detail	U.S. Dollar	725,000.00	725,000.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
USERECTMOB	Sub-Erection Mobilization		1.00	Each	U.S. Dollar	725,000.00	725,000.00

Notes: **********
Historical pricing from past projects
****

1.2	6.00	Month	Site Facilities	0.00	0.00	Detail	U.S. Dollar	2,155.00	12,930.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
URCONNEX	Connex Box		12.00	Month	U.S. Dollar	150.00	1,800.00
UROFFTRL	Office Trailer -12x60		6.00	Month	U.S. Dollar	500.00	3,000.00
UO1STAID	1st Aid Supplies		6.00	Month	U.S. Dollar	300.00	1,800.00
UOOFFPHN	Monthly Office Phone		6.00	Month	U.S. Dollar	500.00	3,000.00
UOOFFSUP	Office Supplies($/prs/mo)		6.00	Month	U.S. Dollar	55.00	330.00
UINT	Internet		6.00	Month	U.S. Dollar	200.00	1,200.00
URPRTAJH	Port-a-John Unit(s) (4)		6.00	Month	U.S. Dollar	300.00	1,800.00

1.3	24.00	Week	Field Management	144.00	0.17	Detail	U.S. Dollar	18,282.31	438,775.52

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
L90FXX02	Field - Proj Superintendent	1,440.00	1.00	Each (hourly)	U.S. Dollar	83.18	119,782.08
RPUTRK05	F-250 4X4 3/4 TON PICKUP	5,760.00	4.00	Each (hourly)	U.S. Dollar	11.07	63,734.40
L90FEL00	Field - Engr. Tech	1,440.00	1.00	Each (hourly)	U.S. Dollar	39.57	56,986.59
L90FXX03	Field - SHSO	1,440.00	1.00	Each (hourly)	U.S. Dollar	89.26	128,540.02
L90FEJ00	Field - Asst. Engr.	1,440.00	1.00	Each (hourly)	U.S. Dollar	48.43	69,732.43

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CBS Position Code	Quantity	UM	Description	Cost Item Days	UM/Day	Cost Source	Currency	Unit Cost	Total Cost
1.4	1.00	Lump Sum	O&M Building Removal	6.48	0.15	Detail	U.S. Dollar	24,624.55	24,624.55
1.4.1	40.00	Ton	Structure Demo	2.00	20.00	Detail	U.S. Dollar	257.21	10,288.51

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
*REXCAV06A	Excav 100K w/ Bucket & Grapple	20.00	1.00	Each (hourly)	U.S. Dollar	124.54	2,490.70
*REXCAV06E	Excav 100K w/ Shear	20.00	1.00	Each (hourly)	U.S. Dollar	185.50	3,709.90
L010101	OPERATOR	40.00	2.00	Each (hourly)	U.S. Dollar	56.75	2,270.13
L060100	GENERAL LABORER	40.00	2.00	Each (hourly)	U.S. Dollar	45.44	1,817.77

1.4.2	320.00	Cubic Yard	Remove Foundations To Subgrade	4.48	71.43	Detail	U.S. Dollar	35.74	11,436.04
1.4.2.1	320.00	Cubic Yard	Excavate / Remove Foundation - Various Depth	1.28	250.00	Detail	U.S. Dollar	17.78	5,688.97

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
L060100	GENERAL LABORER	12.80	1.00	Each (hourly)	U.S. Dollar	45.44	581.69
L010101	OPERATOR	25.60	2.00	Each (hourly)	U.S. Dollar	56.75	1,452.89
*REXCAV06C	Excav 100K w/ Hammer	12.80	1.00	Each (hourly)	U.S. Dollar	160.97	2,060.35
*REXCAV06A	Excav 100K w/ Bucket & Grapple	12.80	1.00	Each (hourly)	U.S. Dollar	124.54	1,594.05

1.4.2.2	320.00	Cubic Yard	Concrete Transport Offsite	3.20	100.00	Detail	U.S. Dollar	17.96	5,747.07

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
RDUTRK06	CAT D350D, 18CY-24CY	32.00	1.00	Each (hourly)	U.S. Dollar	74.29	2,377.28
L080940	TEAMSTER	32.00	1.00	Each (hourly)	U.S. Dollar	45.44	1,454.22
L010101	OPERATOR	16.00	0.50	Each (hourly)	U.S. Dollar	56.75	908.05
RFELWH09	CAT 966F LOADER, 4.25CY	16.00	0.50	Each (hourly)	U.S. Dollar	62.97	1,007.52

1.4.3	2.00	Each	Trucking - Per Load	0.00	0.00	Detail	U.S. Dollar	1,375.00	2,750.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
USTRUCKING	Trucking Sub		2,750.00	Each	U.S. Dollar	1.00	2,750.00

Notes: **********
Assumption: 45,000 lbs per load
****

1.4.4	5.00	Ton	Disposal Cost	0.00	0.00	Detail	U.S. Dollar	30.00	150.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
USDISPOSAL	Disposal Fee's		150.00	Each	U.S. Dollar	1.00	150.00

Notes: **********
Assumption: 324,016 modules x 60.63 lbs each
****

1.5	1.00	Lump Sum	ADLS Tower / System Removal	2.55	0.39	Detail	U.S. Dollar	13,644.06	13,644.06
1.5.1	1.00	Each	ADLS Tower / System Removal	1.50	0.67	Detail	U.S. Dollar	8,681.25	8,681.25
1.5.1.1	1.00	Each	Cut / Lower Structure	1.00	1.00	Detail	U.S. Dollar	3,829.61	3,829.61

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
L060100	GENERAL LABORER	40.00	4.00	Each (hourly)	U.S. Dollar	45.44	1,817.77
L010101	OPERATOR	10.00	1.00	Each (hourly)	U.S. Dollar	56.75	567.53
*RXMISC14	MAN LIFT GAS 125ft	10.00	1.00	Each (hourly)	U.S. Dollar	53.52	535.20
*RXMISC23	GROVE RT 200 TON	10.00	1.00	Each (hourly)	U.S. Dollar	90.91	909.10

1.5.1.2	1.00	Each	Cut / Size Structure & Loadout	0.50	2.00	Detail	U.S. Dollar	2,101.65	2,101.65

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
L060100	GENERAL LABORER	30.00	6.00	Each (hourly)	U.S. Dollar	45.44	1,363.33
L010101	OPERATOR	5.00	1.00	Each (hourly)	U.S. Dollar	56.75	283.77
*RXMISC23	GROVE RT 200 TON	5.00	1.00	Each (hourly)	U.S. Dollar	90.91	454.55

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CBS Position Code	Quantity	UM	Description	Days	Cost UM/Day	Cost Source	Currency	Unit Cost	Total Cost
1.5.1.3	2.00	Each	Trucking - Per Load	0.00	0.00	Detail	U.S. Dollar	1,375.00	2,750.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
USTRUCKING	Trucking Sub		2,750.00	Each	U.S. Dollar	1.00	2,750.00

Notes: **********
Assume 20 ton per steel structure
****

1.5.2	1.00	Each	Remove Foundations To Subgrade	1.05	0.95	Detail	U.S. Dollar	4,962.81	4,962.81
1.5.2.1	1.00	Each	Excavate / Remove Foundation - Various Depth	1.00	1.00	Detail	U.S. Dollar	4,898.95	4,898.95

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
L060100	GENERAL LABORER	20.00	2.00	Each (hourly)	U.S. Dollar	45.44	908.89
L010101	OPERATOR	20.00	2.00	Each (hourly)	U.S. Dollar	56.75	1,135.07
*REXCAV06C	Excav 100K w/ Hammer	10.00	1.00	Each (hourly)	U.S. Dollar	160.97	1,609.65
*REXCAV06A	Excav 100K w/ Bucket & Grapple	10.00	1.00	Each (hourly)	U.S. Dollar	124.54	1,245.35

1.5.2.2	4.00	Cubic Yard	Concrete Transport Offsite	0.05	75.00	Detail	U.S. Dollar	15.96	63.86

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
RDUTRK06	CAT D350D, 18CY-24CY	0.53	1.00	Each (hourly)	U.S. Dollar	74.29	39.62
L080940	TEAMSTER	0.53	1.00	Each (hourly)	U.S. Dollar	45.44	24.24

1.6	1.00	Each	MET Tower Removal	0.71	1.42	Detail	U.S. Dollar	3,842.80	3,842.80
1.6.1	1.00	Each	Structure Demo	0.50	2.00	Detail	U.S. Dollar	2,572.13	2,572.13

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
*REXCAV06A	Excav 100K w/ Bucket & Grapple	5.00	1.00	Each (hourly)	U.S. Dollar	124.54	622.68
*REXCAV06E	Excav 100K w/ Shear	5.00	1.00	Each (hourly)	U.S. Dollar	185.50	927.48
L010101	OPERATOR	10.00	2.00	Each (hourly)	U.S. Dollar	56.75	567.53
L060100	GENERAL LABORER	10.00	2.00	Each (hourly)	U.S. Dollar	45.44	454.44

1.6.2	15.00	Cubic Yard	Remove Foundation	0.10	146.00	Detail	U.S. Dollar	48.47	727.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
L060100	GENERAL LABORER	2.05	2.00	Each (hourly)	U.S. Dollar	45.44	93.38
L010101	OPERATOR	3.08	3.00	Each (hourly)	U.S. Dollar	56.75	174.92
*REXCAV06C	Excav 100K w/ Hammer	2.05	2.00	Each (hourly)	U.S. Dollar	160.97	330.75
*REXCAV06A	Excav 100K w/ Bucket & Grapple	1.03	1.00	Each (hourly)	U.S. Dollar	124.54	127.95

1.6.3	15.00	Cubic Yard	Concrete Transport Offsite	0.10	146.67	Detail	U.S. Dollar	12.25	183.68

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
RDUTRK06	CAT D350D, 18CY-24CY	1.02	1.00	Each (hourly)	U.S. Dollar	74.29	75.98
L080940	TEAMSTER	1.02	1.00	Each (hourly)	U.S. Dollar	45.44	46.48
L010101	OPERATOR	0.51	0.50	Each (hourly)	U.S. Dollar	56.75	29.02
RFELWH09	CAT 966F LOADER, 4.25CY	0.51	0.50	Each (hourly)	U.S. Dollar	62.97	32.20

1.6.4	8.00	Ton	Scrap Trucking Cost	0.00	0.00	Detail	U.S. Dollar	45.00	360.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
USTRUCKING	Trucking Sub		360.00	Each	U.S. Dollar	1.00	360.00

1.7	1.00	Lump Sum	Substation & Switchyard Removal	22.27	0.04	Detail	U.S. Dollar	205,905.51	205,905.51
1.7.1	1.00	Day	Fence Removal	1.00	1.00	Detail	U.S. Dollar	1,354.33	1,354.33

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
L010101	OPERATOR	10.00	1.00	Each (hourly)	U.S. Dollar	56.75	567.53
L060100	GENERAL LABORER	10.00	1.00	Each (hourly)	U.S. Dollar	45.44	454.44

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CBS Position Code	Quantity	UM	Description	Cost Item Days	UM/Day	Cost Source	Currency	Unit Cost	Total Cost
RBACKH09	Deere 710J BACKHOE, 1.62CY		10.00	1.00	Each (hourly)		U.S. Dollar	33.24	332.35
1.7.2	1.00	Each	Transformer & Switchyard Equip Removal	3.50	0.29	Detail	U.S. Dollar	144,348.46	144,348.46
1.7.2.1	1.00	Each	Oil Removal & Disposal	2.00	0.50	Detail	U.S. Dollar	104,789.07	104,789.07
1.7.2.1.1	1.00	Each	Oil Removal	2.00	0.50	Detail	U.S. Dollar	2,039.07	2,039.07

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
L060100	GENERAL LABORER	40.00	2.00	Each (hourly)	U.S. Dollar	45.44	1,817.77
RPUTRK05	F-250 4X4 3/4 TON PICKUP	20.00	1.00	Each (hourly)	U.S. Dollar	11.07	221.30

1.7.2.1.2	25,000.00	Gallon	Oil Disposal	0.00	0.00	Detail	U.S. Dollar	4.00	100,000.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
USDISPOSAL	Disposal Fee's		100,000.00	Each	U.S. Dollar	1.00	100,000.00

1.7.2.1.3	2.00	Each	Trucking - Per Load	0.00	0.00	Detail	U.S. Dollar	1,375.00	2,750.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
USTRUCKING	Trucking Sub		2,750.00	Each	U.S. Dollar	1.00	2,750.00

1.7.2.2	150.00	Ton	Demo & Prepare For Shipment Offsite	1.50	100.00	Detail	U.S. Dollar	198.73	29,809.39

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
*RXMISC19	Material Handler	15.00	1.00	Each (hourly)	U.S. Dollar	98.82	1,482.23
*REXCAV06E	Excav 100K w/ Shear	30.00	2.00	Each (hourly)	U.S. Dollar	185.50	5,564.85
*REXCAV08	Excav 240K w/ Shear	30.00	2.00	Each (hourly)	U.S. Dollar	463.46	13,903.80
L010101	OPERATOR	60.00	4.00	Each (hourly)	U.S. Dollar	56.75	3,405.20
L060100	GENERAL LABORER	120.00	8.00	Each (hourly)	U.S. Dollar	45.44	5,453.32

1.7.2.3	150.00	Ton	Salvage & Recovery	0.00	0.00	Detail	U.S. Dollar	65.00	9,750.00
1.7.2.3.1	150.00	Ton	Scrap Trucking Cost	0.00	0.00	Detail	U.S. Dollar	65.00	9,750.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
USTRUCKING	Trucking Sub		9,750.00	Each	U.S. Dollar	1.00	9,750.00

1.7.3	1.00	Each	Remove Control Building	0.10	10.00	Detail	U.S. Dollar	2,637.29	2,637.29
1.7.3.1	10.00	Ton	Demo & Prepare For Shipment Offsite	0.10	100.00	Detail	U.S. Dollar	198.73	1,987.29

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
*RXMISC19	Material Handler	1.00	1.00	Each (hourly)	U.S. Dollar	98.82	98.82
*REXCAV06E	Excav 100K w/ Shear	2.00	2.00	Each (hourly)	U.S. Dollar	185.50	370.99
*REXCAV08	Excav 240K w/ Shear	2.00	2.00	Each (hourly)	U.S. Dollar	463.46	926.92
L010101	OPERATOR	4.00	4.00	Each (hourly)	U.S. Dollar	56.75	227.01
L060100	GENERAL LABORER	8.00	8.00	Each (hourly)	U.S. Dollar	45.44	363.55

1.7.3.2	10.00	Ton	Salvage & Recovery	0.00	0.00	Detail	U.S. Dollar	65.00	650.00
1.7.3.2.1	10.00	Ton	Scrap Trucking Cost	0.00	0.00	Detail	U.S. Dollar	65.00	650.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
USTRUCKING	Trucking Sub		650.00	Each	U.S. Dollar	1.00	650.00

1.7.4	2.00	Day	UG Utility & Ground Removal	2.00	1.00	Detail	U.S. Dollar	1,354.33	2,708.65

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
L010101	OPERATOR	20.00	1.00	Each (hourly)	U.S. Dollar	56.75	1,135.07
L060100	GENERAL LABORER	20.00	1.00	Each (hourly)	U.S. Dollar	45.44	908.89

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CBS Position Code	Quantity	UM	Description	Cost Item Days	UM/Day	Cost Source	Currency	Unit Cost	Total Cost
RBACKH09	Deere 710J BACKHOE, 1.62CY		20.00	1.00	Each (hourly)		U.S. Dollar	33.24	664.70
1.7.5	500.00	Cubic Yard	Remove Foundations To Subgrade	7.00	71.43	Detail	U.S. Dollar	35.74	17,868.82
1.7.5.1	500.00	Cubic Yard	Excavate / Remove Foundation - Various Depth	2.00	250.00	Detail	U.S. Dollar	17.78	8,889.02

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
L060100	GENERAL LABORER	20.00	1.00	Each (hourly)	U.S. Dollar	45.44	908.89
L010101	OPERATOR	40.00	2.00	Each (hourly)	U.S. Dollar	56.75	2,270.13
*REXCAV06C	Excav 100K w/ Hammer	20.00	1.00	Each (hourly)	U.S. Dollar	160.97	3,219.30
*REXCAV06A	Excav 100K w/ Bucket & Grapple	20.00	1.00	Each (hourly)	U.S. Dollar	124.54	2,490.70

1.7.5.2	500.00	Cubic Yard	Concrete Transport Offsite	5.00	100.00	Detail	U.S. Dollar	17.96	8,979.80

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
RDUTRK06	CAT D350D, 18CY-24CY	50.00	1.00	Each (hourly)	U.S. Dollar	74.29	3,714.50
L080940	TEAMSTER	50.00	1.00	Each (hourly)	U.S. Dollar	45.44	2,272.22
L010101	OPERATOR	25.00	0.50	Each (hourly)	U.S. Dollar	56.75	1,418.83
RFELWH09	CAT 966F LOADER, 4.25CY	25.00	0.50	Each (hourly)	U.S. Dollar	62.97	1,574.25

1.7.6	1.00	Lump Sum	Misc. Material Disposal	0.00	0.00	Detail	U.S. Dollar	1,675.00	1,675.00
1.7.6.1	1.00	Each	Trucking - Per Load	0.00	0.00	Detail	U.S. Dollar	1,375.00	1,375.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
USTRUCKING	Trucking Sub		1,375.00	Each	U.S. Dollar	1.00	1,375.00

1.7.6.2	10.00	Ton	Disposal Cost	0.00	0.00	Detail	U.S. Dollar	30.00	300.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
USDISPOSAL	Disposal Fee's		300.00	Each	U.S. Dollar	1.00	300.00

1.7.7	1.00	Lump Sum	Restore Yard	8.67	0.12	Detail	U.S. Dollar	35,312.96	35,312.96
1.7.7.1	4.00	Acre	Backfill / Regrade	2.00	2.00	Detail	U.S. Dollar	1,692.29	6,769.18

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
L060100	GENERAL LABORER	40.00	2.00	Each (hourly)	U.S. Dollar	45.44	1,817.77
L010101	OPERATOR	40.00	2.00	Each (hourly)	U.S. Dollar	56.75	2,270.13
REXCAV06B	Gradall - Excavator	20.00	1.00	Each (hourly)	U.S. Dollar	75.73	1,514.57
*RDOZER08	CAT D6 LGP Dozer	20.00	1.00	Each (hourly)	U.S. Dollar	58.34	1,166.70

1.7.7.2	2,000.00	Cubic Yard	Vegetative Cover	6.67	300.00	Detail	U.S. Dollar	12.74	25,483.78
1.7.7.2.1	1,000.00	Cubic Yard	Topsoil, Delivered	0.00	0.00	Detail	U.S. Dollar	10.00	10,000.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
IMSOIL	Topsoil		500.00	Cubic Yard	U.S. Dollar	20.00	10,000.00

Notes: **********
Assume that 50% of the topsoil required for restoration is bermed and stockpiled adjacent to the substation
****

1.7.7.2.2	2,000.00	Cubic Yard	Placement	6.67	300.00	Detail	U.S. Dollar	7.74	15,483.78

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
L010101	OPERATOR	133.33	2.00	Each (hourly)	U.S. Dollar	56.75	7,567.11
RDOZER08	CAT D6N XL	133.33	2.00	Each (hourly)	U.S. Dollar	59.38	7,916.67

1.7.7.3	4.00	Acre	Re-Seed With Native Vegetation	0.00	0.00	Detail	U.S. Dollar	765.00	3,060.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
USLANDSCAPE	Landscape Sub		4.00	Acre	U.S. Dollar	765.00	3,060.00

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CBS Position Code	Quantity	UM	Description	Days	Cost UM/Day	Cost Source	Currency	Unit Cost	Total Cost
			Cost Item						
1.8	1.00	Lump Sum	Transmission Line Removal	4.09	0.24	Detail	U.S. Dollar	20,955.44	20,955.44
1.8.1	2.00	Each	Structure Removal	2.00	1.00	Detail	U.S. Dollar	5,391.45	10,782.90
1.8.1.1	2.00	Each	Cut / Lower Structure	1.00	2.00	Detail	U.S. Dollar	1,914.80	3,829.61

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
L060100	GENERAL LABORER	40.00	4.00	Each (hourly)	U.S. Dollar	45.44	1,817.77
L010101	OPERATOR	10.00	1.00	Each (hourly)	U.S. Dollar	56.75	567.53
*RXMISC14	MAN LIFT GAS 125ft	10.00	1.00	Each (hourly)	U.S. Dollar	53.52	535.20
*RXMISC23	GROVE RT 200 TON	10.00	1.00	Each (hourly)	U.S. Dollar	90.91	909.10

1.8.1.2	2.00	Each	Cut / Size Structure & Loadout	1.00	2.00	Detail	U.S. Dollar	2,101.65	4,203.29

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
L060100	GENERAL LABORER	60.00	6.00	Each (hourly)	U.S. Dollar	45.44	2,726.66
L010101	OPERATOR	10.00	1.00	Each (hourly)	U.S. Dollar	56.75	567.53
*RXMISC23	GROVE RT 200 TON	10.00	1.00	Each (hourly)	U.S. Dollar	90.91	909.10

1.8.1.3	2.00	Each	Trucking - Per Load	0.00	0.00	Detail	U.S. Dollar	1,375.00	2,750.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
USTRUCKING	Trucking Sub		2,750.00	Each	U.S. Dollar	1.00	2,750.00

Notes: **********
Assume 9 ton per steel structure
****

1.8.2	2.00	Each	Remove Foundations To Subgrade	2.04	0.98	Detail	U.S. Dollar	4,924.73	9,849.45
1.8.2.1	2.00	Each	Excavate / Remove Foundation - Various Depth	2.00	1.00	Detail	U.S. Dollar	4,898.95	9,797.91

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
L060100	GENERAL LABORER	40.00	2.00	Each (hourly)	U.S. Dollar	45.44	1,817.77
L010101	OPERATOR	40.00	2.00	Each (hourly)	U.S. Dollar	56.75	2,270.13
*REXCAV06C	Excav 100K w/ Hammer	20.00	1.00	Each (hourly)	U.S. Dollar	160.97	3,219.30
*REXCAV06A	Excav 100K w/ Bucket & Grapple	20.00	1.00	Each (hourly)	U.S. Dollar	124.54	2,490.70

1.8.2.2	3.23	Cubic Yard	Concrete Transport Offsite	0.04	75.00	Detail	U.S. Dollar	15.96	51.55

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
RDUTRK06	CAT D350D, 18CY-24CY	0.43	1.00	Each (hourly)	U.S. Dollar	74.29	31.98
L080940	TEAMSTER	0.43	1.00	Each (hourly)	U.S. Dollar	45.44	19.56

1.8.3	0.05	Mile	Conductor Removal	0.05	1.00	Detail	U.S. Dollar	6,461.73	323.09
1.8.3.1	0.05	Mile	Cut / Lower Cable, Size & Loadout	0.05	1.00	Detail	U.S. Dollar	6,136.73	306.84

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
L060100	GENERAL LABORER	3.00	6.00	Each (hourly)	U.S. Dollar	45.44	136.33
L010101	OPERATOR	1.00	2.00	Each (hourly)	U.S. Dollar	56.75	56.75
*RXMISC14	MAN LIFT GAS 125ft	1.00	2.00	Each (hourly)	U.S. Dollar	53.52	53.52
RLIFTS05	JCB 508C, 8,000lbs FRKLFT	0.50	1.00	Each (hourly)	U.S. Dollar	21.65	10.82
*RXMISC19	Material Handler	0.50	1.00	Each (hourly)	U.S. Dollar	98.82	49.41

1.8.3.2	0.25	Ton	Salvage & Recovery	0.00	0.00	Detail	U.S. Dollar	65.00	16.25
1.8.3.2.1	0.25	Ton	Scrap Trucking Cost	0.00	0.00	Detail	U.S. Dollar	65.00	16.25

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
USTRUCKING	Trucking Sub		16.25	Each	U.S. Dollar	1.00	16.25

1.9	71.00	Each	Construct & Remove Temporary Crane Pads	94.67	0.75	Detail	U.S. Dollar	7,746.61	550,009.40

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CBS Position Code	Quantity	UM	Description	Cost Item Days	UM/Day	Cost Source	Currency	Unit Cost	Total Cost

Notes: **********
60' x 40' Temporary Crane Pad
****

1.9.1	7,100.00	Ton	Crane Pad 4" Stone 8" depth	35.50	200.00	Detail	U.S. Dollar	35.44	251,608.98

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
M4"STONE	4" Stone		7,100.00	Ton	U.S. Dollar	15.00	106,500.00
RDOZER06	CAT D5H XL	355.00	1.00	Each (hourly)	U.S. Dollar	43.56	15,462.03
RROLLR06	CP-563C 84" SMOOTH DRUM	355.00	1.00	Each (hourly)	U.S. Dollar	51.70	18,352.08
L010101	OPERATOR	710.00	2.00	Each (hourly)	U.S. Dollar	56.75	40,294.88
USSTONETRK	Sub-Trucking of Stone		7,100.00	Ton	U.S. Dollar	10.00	71,000.00

1.9.2	5,325.00	Ton	Crane Pad 2" Stone 6" depth	35.50	150.00	Detail	U.S. Dollar	38.92	207,233.98

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
USSTONETRK	Sub-Trucking of Stone		5,325.00	Ton	U.S. Dollar	10.00	53,250.00
L010101	OPERATOR	710.00	2.00	Each (hourly)	U.S. Dollar	56.75	40,294.88
RDOZER06	CAT D5H XL	355.00	1.00	Each (hourly)	U.S. Dollar	43.56	15,462.03
RROLLR06	CP-563C 84" SMOOTH DRUM	355.00	1.00	Each (hourly)	U.S. Dollar	51.70	18,352.08
M2"STONE	Material - 2" Stone		5,325.00	Ton	U.S. Dollar	15.00	79,875.00

1.9.3	71.00	Each	Remove stone after erection	23.67	3.00	Detail	U.S. Dollar	1,284.03	91,166.44

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
RDOZER06	CAT D5H XL	236.67	1.00	Each (hourly)	U.S. Dollar	43.56	10,308.02
RFELWH09	CAT 966F LOADER, 4.25CY	236.67	1.00	Each (hourly)	U.S. Dollar	62.97	14,902.90
L010101	OPERATOR	473.33	2.00	Each (hourly)	U.S. Dollar	56.75	26,863.25
L060100	GENERAL LABORER	236.67	1.00	Each (hourly)	U.S. Dollar	45.44	10,755.15
RDUTRK06	CAT D350D, 18CY-24CY	236.67	1.00	Each (hourly)	U.S. Dollar	74.29	17,581.97
L080940	TEAMSTER	236.67	1.00	Each (hourly)	U.S. Dollar	45.44	10,755.15

1.10	71.00	Each	WTG Removal	0.00	0.00	Detail	U.S. Dollar	30,000.00	2,130,000.00

1.10.1	71.00	Each	Remove Top,Nacell, Rotor	0.00	0.00	Detail	U.S. Dollar	20,000.00	1,420,000.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
USERECT1	Sub-Top, Nacelle, Rotor		71.00	Each	U.S. Dollar	20,000.00	1,420,000.00

1.10.2	71.00	Each	Remove Base & Mid	0.00	0.00	Detail	U.S. Dollar	10,000.00	710,000.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
USERECT	Erection Sub - Base/Mid		71.00	Each	U.S. Dollar	10,000.00	710,000.00

1.11	71.00	Each	WTG Sizing & Loadout - 2.8 MW, 89 m Tower	80.73	0.88	Detail	U.S. Dollar	41,018.27	2,912,297.09

1.11.1	71.00	Each	Oil Removal & Disposal	14.20	5.00	Detail	U.S. Dollar	386.08	27,412.01

1.11.1.1	71.00	Each	Oil Removal	14.20	5.00	Detail	U.S. Dollar	203.91	14,477.41

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
L060100	GENERAL LABORER	284.00	2.00	Each (hourly)	U.S. Dollar	45.44	12,906.18
RPUTRK05	F-250 4X4 3/4 TON PICKUP	142.00	1.00	Each (hourly)	U.S. Dollar	11.07	1,571.23

1.11.1.2	2,840.00	Gallon	Oil Disposal	0.00	0.00	Detail	U.S. Dollar	4.00	11,360.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
USDISPOSAL	Disposal Fee's		11,360.00	Each	U.S. Dollar	1.00	11,360.00

1.11.1.3	1.15	Each	Trucking - Per Load	0.00	0.00	Detail	U.S. Dollar	1,375.00	1,574.60

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CBS Position Code	Quantity	UM	Description	Days	Cost UM/Day	Cost Source	Currency	Unit Cost	Total Cost
			Cost Item						

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
USTRUCKING	Trucking Sub		1,574.60	Each	U.S. Dollar	1.00	1,574.60

1.11.2	11,573.00	Ton	Demo & Prepare For Shipment Offsite - Top, Mid & Base	40.47	286.00	Detail	U.S. Dollar	69.49	804,158.73

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
*RXMISC19	Material Handler	404.65	1.00	Each (hourly)	U.S. Dollar	98.82	39,985.52
*REXCAV06E	Excav 100K w/ Shear	809.30	2.00	Each (hourly)	U.S. Dollar	185.50	150,121.23
*REXCAV08	Excav 240K w/ Shear	809.30	2.00	Each (hourly)	U.S. Dollar	463.46	375,078.50
L010101	OPERATOR	1,618.60	4.00	Each (hourly)	U.S. Dollar	56.75	91,861.05
L060100	GENERAL LABORER	3,237.20	8.00	Each (hourly)	U.S. Dollar	45.44	147,112.42

1.11.3	2,272.00	Ton	Demo & Prepare For Shipment Offsite - Hub	7.94	286.00	Detail	U.S. Dollar	69.49	157,871.65

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
*RXMISC19	Material Handler	79.44	1.00	Each (hourly)	U.S. Dollar	98.82	7,849.92
*REXCAV06E	Excav 100K w/ Shear	158.88	2.00	Each (hourly)	U.S. Dollar	185.50	29,471.65
*REXCAV08	Excav 240K w/ Shear	158.88	2.00	Each (hourly)	U.S. Dollar	463.46	73,635.04
L010101	OPERATOR	317.76	4.00	Each (hourly)	U.S. Dollar	56.75	18,034.07
L060100	GENERAL LABORER	635.52	8.00	Each (hourly)	U.S. Dollar	45.44	28,880.96

1.11.4	4,970.00	Ton	Demo & Prepare For Shipment Offsite - Nacelle	17.38	286.00	Detail	U.S. Dollar	69.49	345,344.24

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
*RXMISC19	Material Handler	173.78	1.00	Each (hourly)	U.S. Dollar	98.82	17,171.70
*REXCAV06E	Excav 100K w/ Shear	347.55	2.00	Each (hourly)	U.S. Dollar	185.50	64,469.24
*REXCAV08	Excav 240K w/ Shear	347.55	2.00	Each (hourly)	U.S. Dollar	463.46	161,076.66
L010101	OPERATOR	695.10	4.00	Each (hourly)	U.S. Dollar	56.75	39,449.53
L060100	GENERAL LABORER	1,390.21	8.00	Each (hourly)	U.S. Dollar	45.44	63,177.11

1.11.5	213.00	Ton	Demo & Prepare For Shipment Offsite - Down Tower Assembly	0.74	286.00	Detail	U.S. Dollar	69.49	14,800.47

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
*RXMISC19	Material Handler	7.45	1.00	Each (hourly)	U.S. Dollar	98.82	735.93
*REXCAV06E	Excav 100K w/ Shear	14.90	2.00	Each (hourly)	U.S. Dollar	185.50	2,762.97
*REXCAV08	Excav 240K w/ Shear	14.90	2.00	Each (hourly)	U.S. Dollar	463.46	6,903.29
L010101	OPERATOR	29.79	4.00	Each (hourly)	U.S. Dollar	56.75	1,690.69
L060100	GENERAL LABORER	59.58	8.00	Each (hourly)	U.S. Dollar	45.44	2,707.59

1.11.6	71.00	Each	Salvage & Recovery	0.00	0.00	Detail	U.S. Dollar	17,355.00	1,232,205.00

1.11.6.1	18,957.00	Ton	Scrap Trucking Cost	0.00	0.00	Detail	U.S. Dollar	65.00	1,232,205.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
USTRUCKING	Trucking Sub		1,232,205.00	Each	U.S. Dollar	1.00	1,232,205.00

1.11.7	3,479.00	Ton	Blade T&D	0.00	0.00	Detail	U.S. Dollar	95.00	330,505.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
USTRUCKING	Trucking Sub		226,135.00	Each	U.S. Dollar	1.00	226,135.00
USDISPOSAL	Disposal Fee's		104,370.00	Each	U.S. Dollar	1.00	104,370.00

1.12	71.00	Each	WTG Foundation Removal	156.04	0.46	Detail	U.S. Dollar	9,755.22	692,620.91

1.12.1	1,065.00	Cubic Yard	Remove 13' x 3' Cylindrical Pedestal	7.10	150.00	Detail	U.S. Dollar	47.17	50,240.57

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
L060100	GENERAL LABORER	142.00	2.00	Each (hourly)	U.S. Dollar	45.44	6,453.09

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CBS Position Code	Quantity	UM	Description	Days	UM/Day	Cost Source	Currency	Unit Cost	Total Cost
			Cost Item						
L010101	OPERATOR		213.00	3.00	Each (hourly)		U.S. Dollar	56.75	12,088.46
*REXCAV06C	Excav 100K w/ Hammer		142.00	2.00	Each (hourly)		U.S. Dollar	160.97	22,857.03
*REXCAV06A	Excav 100K w/ Bucket & Grapple		71.00	1.00	Each (hourly)		U.S. Dollar	124.54	8,841.99
1.12.2	10,366.00	Cubic Yard	Remove Top 2' Of Octagonal Base	71.00	146.00	Detail	U.S. Dollar	48.47	502,405.69

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
L060100	GENERAL LABORER	1,420.00	2.00	Each (hourly)	U.S. Dollar	45.44	64,530.91
L010101	OPERATOR	2,130.00	3.00	Each (hourly)	U.S. Dollar	56.75	120,884.64
*REXCAV06C	Excav 100K w/ Hammer	1,420.00	2.00	Each (hourly)	U.S. Dollar	160.97	228,570.30
*REXCAV06A	Excav 100K w/ Bucket & Grapple	710.00	1.00	Each (hourly)	U.S. Dollar	124.54	88,419.85
1.12.3	11,431.00	Cubic Yard	Concrete Transport Offsite	77.94	146.67	Detail	U.S. Dollar	12.25	139,974.65

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
RDUTRK06	CAT D350D, 18CY-24CY	779.39	1.00	Each (hourly)	U.S. Dollar	74.29	57,900.61
L080940	TEAMSTER	779.39	1.00	Each (hourly)	U.S. Dollar	45.44	35,418.67
L010101	OPERATOR	389.69	0.50	Each (hourly)	U.S. Dollar	56.75	22,116.39
RFELWH09	CAT 966F LOADER, 4.25CY	389.69	0.50	Each (hourly)	U.S. Dollar	62.97	24,538.98
1.13	71.00	Each	Pad Mount Transformer Removal	18.74	3.79	Detail	U.S. Dollar	3,648.65	259,054.49
1.13.1	71.00	Each	Oil Removal & Disposal	14.20	5.00	Detail	U.S. Dollar	2,979.55	211,548.11
1.13.1.1	71.00	Each	Oil Removal	14.20	5.00	Detail	U.S. Dollar	113.02	8,024.32

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
L060100	GENERAL LABORER	142.00	1.00	Each (hourly)	U.S. Dollar	45.44	6,453.09
RPUTRK05	F-250 4X4 3/4 TON PICKUP	142.00	1.00	Each (hourly)	U.S. Dollar	11.07	1,571.23
1.13.1.2	49,700.00	Gallon	Oil Disposal	0.00	0.00	Detail	U.S. Dollar	4.00	198,800.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
USDISPOSAL	Disposal Fee's		198,800.00	Each	U.S. Dollar	1.00	198,800.00
1.13.1.3	3.44	Each	Trucking - Per Load	0.00	0.00	Detail	U.S. Dollar	1,375.00	4,723.79

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
USTRUCKING	Trucking Sub		4,723.79	Each	U.S. Dollar	1.00	4,723.79
1.13.2	71.00	Each	Remove & Loadout Transformer	3.55	20.00	Detail	U.S. Dollar	113.37	8,049.01

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
*REXCAV06A	Excav 100K w/ Bucket & Grapple	35.50	1.00	Each (hourly)	U.S. Dollar	124.54	4,420.99
L010101	OPERATOR	35.50	1.00	Each (hourly)	U.S. Dollar	56.75	2,014.74
L060100	GENERAL LABORER	35.50	1.00	Each (hourly)	U.S. Dollar	45.44	1,613.27
1.13.3	71.00	Each	Salvage & Recovery	0.00	0.00	Detail	U.S. Dollar	520.00	36,920.00
1.13.3.1	568.00	Ton	Scrap Trucking Cost	0.00	0.00	Detail	U.S. Dollar	65.00	36,920.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
USTRUCKING	Trucking Sub		36,920.00	Each	U.S. Dollar	1.00	36,920.00
1.13.4	71.00	Each	Remove Foundations To Subgrade	0.99	71.43	Detail	U.S. Dollar	35.74	2,537.37
1.13.4.1	71.00	Cubic Yard	Excavate / Remove Foundation - Various Depth	0.28	250.00	Detail	U.S. Dollar	17.78	1,262.24

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
L060100	GENERAL LABORER	2.84	1.00	Each (hourly)	U.S. Dollar	45.44	129.06

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CBS Position Code	Quantity	UM	Description	Cost Item Days	UM/Day	Cost Source	Currency	Unit Cost	Total Cost
L010101	OPERATOR			5.68	2.00	Each (hourly)	U.S. Dollar	56.75	322.36
*REXCAV06C	Excav 100K w/ Hammer			2.84	1.00	Each (hourly)	U.S. Dollar	160.97	457.14
*REXCAV06A	Excav 100K w/ Bucket & Grapple			2.84	1.00	Each (hourly)	U.S. Dollar	124.54	353.68
1.13.4.2	71.00	Cubic Yard	Concrete Transport Offsite	0.71	100.00	Detail	U.S. Dollar	17.96	1,275.13

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
RDUTRK06	CAT D350D, 18CY-24CY	7.10	1.00	Each (hourly)	U.S. Dollar	74.29	527.46
L080940	TEAMSTER	7.10	1.00	Each (hourly)	U.S. Dollar	45.44	322.65
L010101	OPERATOR	3.55	0.50	Each (hourly)	U.S. Dollar	56.75	201.47
RFELWH09	CAT 966F LOADER, 4.25CY	3.55	0.50	Each (hourly)	U.S. Dollar	62.97	223.54

1.14	54,756.00	Cubic Yard	Access Road Removal	109.51	500.00	Detail	U.S. Dollar	11.40	624,003.65

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
L010101	OPERATOR	2,190.24	2.00	Each (hourly)	U.S. Dollar	56.75	124,303.46
L060100	GENERAL LABORER	2,190.24	2.00	Each (hourly)	U.S. Dollar	45.44	99,533.92
L080940	TEAMSTER	2,190.24	2.00	Each (hourly)	U.S. Dollar	45.44	99,533.92
RDUTRK06	CAT D350D, 18CY-24CY	2,190.24	2.00	Each (hourly)	U.S. Dollar	74.29	162,712.93
RFELWH09	CAT 966F LOADER, 4.25CY	2,190.24	2.00	Each (hourly)	U.S. Dollar	62.97	137,919.41

Notes: **********
35 miles x 16' wide x .5 foot depth
****

1.15	1.00	Lump Sum	Site Restoration	182.52	0.01	Detail	U.S. Dollar	858,344.93	858,344.93
1.15.1	54,756.00	Cubic Yard	Vegetative Cover	182.52	300.00	Detail	U.S. Dollar	12.74	697,694.93

Notes: **********
Assume that 50% of the topsoil is onsite and available for use
****

1.15.1.1	27,378.00	Cubic Yard	Topsoil, Delivered	0.00	0.00	Detail	U.S. Dollar	10.00	273,780.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
IMSOIL	Topsoil		13,689.00	Cubic Yard	U.S. Dollar	20.00	273,780.00

Notes: **********
Assume that 50% of the topsoil required for restoration
is bermed and stockpiled
****

1.15.1.2	54,756.00	Cubic Yard	Placement	182.52	300.00	Detail	U.S. Dollar	7.74	423,914.93

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
L010101	OPERATOR	3,650.40	2.00	Each (hourly)	U.S. Dollar	56.75	207,172.43
RDOZER08	CAT D6N XL	3,650.40	2.00	Each (hourly)	U.S. Dollar	59.38	216,742.50

1.15.2	210.00	Acre	Re-Seed With Native Vegetation - Roads & Areas Disturbed By Construction	0.00	0.00	Detail	U.S. Dollar	765.00	160,650.00

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
USLANDSCAPE	Landscape Sub		210.00	Acre	U.S. Dollar	765.00	160,650.00

Notes: **********
68 acres for roads, 2 acres per turbine
****

1.16	1.00	Lump Sum	Home Office, Project Management (5% Of Cost)	0.00	0.00	Detail	U.S. Dollar	482,930.90	482,930.90

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
USMARKUP5	5% Markup		9,658,618.00	Each	U.S. Dollar	0.05	482,930.90

1.17	1.00	Lump Sum	Contractor OH & Fee (13% Of Cost)	0.00	0.00	Detail	U.S. Dollar	1,318,401.37	1,318,401.37

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CBS Position Code	Quantity	UM	Description	Cost Item Days	Cost UM/Day	Source	Currency	Unit Cost	Total Cost

Resource Code	Description	Hours	Quantity	UM	Currency	Unit Cost	Total Cost
USMARKUP	13% Markup		10,141,549.00	Each	U.S. Dollar	0.13	1,318,401.37
Report Total:			827.31				11,459,950.47

Category	Total
Labor	1,854,615.47
Rented Equipment	2,141,168.09
Supplies	2,130.00
Materials	470,155.00
Subcontract	6,985,481.91
ODCs	6,400.00

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South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
Response to Staff's Second Data Request

Date of Second Data Request: August 11, 2021

Data Request:

2-2) Refer to the response to Staff data request 1-9. The Applicant states "it is unclear exactly as to how the exterior boundary is defined."

a) Please explain the steps the Applicant will take to ensure it complies with this ordinance if the Applicant is unclear with the requirement.
b) Does Hyde County review the project layout for compliance with the ordinance before it approves the Conditional Use Permit? Please explain.

Responses:

ENGIE has ensured compliance as we have utilized a more conservative distance (750 feet) which is larger than the exterior boundary standard (500 feet) that the counties have adopted.

ENGIE assumes that County staff reviews the details associated with all CUP applications that are submitted to the County to verify compliance with standards. Staff from both counties have made periodic inquiries about our CUP applications that were filed with both Hughes and Hyde Counties to clarify our filings.

Response Prepared by:

Casey Willis

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
Response to Staff's Second Data Request

Date of Second Data Request: August 11, 2021

Data Request:

2-3) Refer to the response to Staff data request 1-25, Cumulative Shadow Flicker Analysis_Memo.pdf.

a) The Applicant states there is one participant with expected shadow flicker hours per year of 79:44. Please provide the signed waiver from that participant to exceed 30 hours per year.
b) Please provide the shadow calendar for each receptor.

Responses:

There is a point of clarification needed here. Hyde County has a shadowflicker standard of 30 hours per year with the ability to exceed that with a waiver from the landowner. While the majority of the standards in the County ordinances between Hyde and Hughes County are identical, the one item that is different pertains to a shadowflicker standard. Hughes County updated and amended portions of their zoning ordinance in 2017 and again in 2020. Neither the original zoning ordinance nor the amendments that occurred in 2017 or 2020 included a shadowflicker standard. Subsequently a waiver is not required as the participant noted is within Hughes County.

While a waiver is not required per the County ordinance, ENGIE approached the landowner about the elevated predicted shadowflicker levels. The reason that the shadowflicker levels are a bit elevated is due to the fact that the home is centrally located between two turbines proposed on the same landowner's parcel. The method to reduce the shadowflicker levels would have involved eliminating either WTG 20 or 21 on the landowner's property. That option was presented to the landowner and the landowner did not want either turbine eliminated from the parcel.

Attached is a shadow calendar for each parcel.

Response Prepared by:
Casey Willis

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
TEST license
This license is only to be used for testing purposes

Ramos, Tiffanie / tiffanie.ramos@tetratech.com
Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 1 - Non-Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:15	07:58	07:17	07:21	06:31	05:58	05:58	06:25	07:01	07:36	07:15	07:54
	17:10	17:48	18:25	20:04	20:41	21:15	21:27	21:06	20:18	19:23	17:29	17:01
2	08:15	07:57	07:16	07:20	06:29	05:58	05:59	06:27	07:02	07:37	07:16	07:55
	17:11	17:49	18:26	20:05	20:42	21:15	21:27	21:04	20:16	19:21	17:28	17:01
3	08:15	07:56	07:14	07:18	06:28	05:57	05:59	06:28	07:03	07:38	07:18	07:56
	17:12	17:51	18:28	20:07	20:43	21:16	21:27	21:03	20:15	19:19	17:27	17:01
4	08:15	07:54	07:12	07:16	06:27	05:57	06:00	06:29	07:04	07:39	07:19	07:57
	17:13	17:52	18:29	20:08	20:45	21:17	21:26	21:02	20:13	19:17	17:25	17:00
5	08:15	07:53	07:10	07:14	06:25	05:56	06:01	06:30	07:06	07:41	07:20	07:58
	17:14	17:53	18:30	20:09	20:46	21:18	21:26	21:01	20:11	19:15	17:24	17:00
6	08:15	07:52	07:09	07:12	06:24	05:56	06:01	06:31	07:07	07:42	07:22	07:59
	17:15	17:55	18:31	20:10	20:47	21:19	21:26	20:59	20:09	19:14	17:23	17:00
7	08:15	07:51	07:07	07:11	06:23	05:56	06:02	06:32	07:08	07:43	07:23	08:00
	17:16	17:56	18:33	20:12	20:48	21:19	21:25	20:58	20:07	19:12	17:22	17:00
8	08:14	07:49	08:05	07:09	06:21	05:55	06:03	06:33	07:09	07:44	07:25	08:01
	17:17	17:58	18:34	20:13	20:49	21:20	21:25	20:57	20:06	19:10	17:20	17:00
9	08:14	07:48	08:03	07:07	06:20	05:55	06:03	06:34	07:10	07:46	07:26	08:02
	17:18	17:59	19:35	20:14	20:50	21:21	21:25	20:55	20:04	19:08	17:19	17:00
10	08:14	07:47	08:02	07:05	06:19	05:55	06:04	06:36	07:11	07:47	07:27	08:03
	17:19	18:00	19:37	20:15	20:52	21:21	21:24	20:54	20:02	19:06	17:18	17:00
11	08:14	07:45	08:00	07:03	06:17	05:55	06:05	06:37	07:12	07:48	07:29	08:04
	17:20	18:00	19:38	20:16	20:53	21:22	21:24	20:52	20:00	19:05	17:17	17:00
12	08:13	07:44	07:58	07:02	06:16	05:55	06:06	06:38	07:14	07:49	07:30	08:05
	17:21	18:02	19:39	20:18	20:54	21:22	21:23	20:51	19:58	19:03	17:16	17:00
13	08:13	07:43	07:56	07:00	06:15	05:54	06:07	06:39	07:15	07:50	07:31	08:06
	17:23	18:03	19:41	20:19	20:55	21:23	21:23	20:49	19:56	19:01	17:15	17:00
14	08:12	07:41	07:54	06:58	06:14	05:54	06:07	06:40	07:16	07:52	07:33	08:07
	17:24	18:05	19:42	20:20	20:56	21:24	21:22	20:48	19:54	18:58	17:14	17:00
15	08:12	07:40	07:53	06:56	06:13	05:54	06:08	06:41	07:17	07:53	07:34	08:07
	17:25	18:06	19:43	20:21	20:57	21:24	21:21	20:46	19:53	18:56	17:13	17:00
16	08:11	07:38	07:51	06:55	06:12	05:54	06:09	06:42	07:18	07:54	07:35	08:08
	17:26	18:07	19:44	20:23	20:58	21:24	21:21	20:45	19:51	18:54	17:12	17:01
17	08:11	07:37	07:49	06:53	06:11	05:54	06:10	06:44	07:19	07:56	07:37	08:09
	17:28	18:09	19:46	20:24	21:00	21:25	21:20	20:43	19:49	18:53	17:11	17:01
18	08:10	07:35	07:47	06:51	06:10	05:54	06:11	06:45	07:21	07:57	07:38	08:09
	17:29	18:10	19:47	20:25	21:01	21:25	21:19	20:42	19:47	18:51	17:10	17:01
19	08:09	07:34	07:45	06:50	06:09	05:54	06:12	06:46	07:22	07:58	07:39	08:10
	17:30	18:11	19:48	20:26	21:02	21:26	21:19	20:40	19:45	18:49	17:09	17:01
20	08:09	07:32	07:43	06:48	06:08	05:55	06:13	06:47	07:23	07:59	07:40	08:11
	17:31	18:13	19:49	20:27	21:03	21:26	21:18	20:39	19:43	18:48	17:08	17:02
21	08:08	07:30	07:42	06:46	06:07	05:55	06:14	06:48	07:24	08:01	07:42	08:11
	17:33	18:14	19:51	20:29	21:04	21:26	21:17	20:37	19:41	18:46	17:07	17:02
22	08:07	07:29	07:40	06:45	06:06	05:55	06:15	06:49	07:25	08:02	07:43	08:12
	17:34	18:16	19:52	20:30	21:05	21:26	21:16	20:35	19:40	18:44	17:07	17:03
23	08:07	07:27	07:38	06:43	06:05	05:55	06:16	06:51	07:26	08:03	07:44	08:12
	17:35	18:17	19:53	20:31	21:06	21:27	21:15	20:34	19:38	18:43	17:06	17:03
24	08:06	07:26	07:36	06:42	06:04	05:55	06:17	06:52	07:28	08:05	07:46	08:13
	17:37	18:18	19:54	20:32	21:07	21:27	21:14	20:32	19:36	18:41	17:05	17:04
25	08:05	07:24	07:34	06:40	06:03	05:56	06:18	06:53	07:29	08:06	07:47	08:13
	17:38	18:20	19:56	20:34	21:08	21:27	21:13	20:30	19:34	18:40	17:04	17:05
26	08:04	07:22	07:32	06:38	06:02	05:56	06:19	06:54	07:30	08:07	07:48	08:13
	17:39	18:21	19:57	20:35	21:09	21:27	21:12	20:29	19:32	18:38	17:04	17:05
27	08:03	07:21	07:31	06:37	06:02	05:57	06:20	06:55	07:31	08:08	07:49	08:14
	17:41	18:22	19:58	20:36	21:10	21:27	21:11	20:27	19:30	18:37	17:03	17:06
28	08:02	07:19	07:29	06:35	06:01	05:57	06:21	06:56	07:32	08:10	07:50	08:14
	17:42	18:24	19:59	20:37	21:11	21:27	21:10	20:25	19:28	18:35	17:03	17:07
29	08:01		07:27	06:34	06:00	05:57	06:22	06:57	07:33	08:11	07:52	08:14
	17:44		20:00	20:38	21:12	21:27	21:09	20:23	19:26	18:34	17:02	17:07
30	08:00		07:25	06:32	06:00	05:58	06:23	06:59	07:35	08:12	07:53	08:14
	17:45		20:02	20:40	21:13	21:27	21:08	20:22	19:25	18:32	17:02	17:08
31	07:59		07:23		05:59		06:24	07:00		08:14		08:15
	17:46		20:03		21:14		21:07	20:20		18:31		17:09
Potential sun hours	288	292	369	403	457	464	470	435	377	342	290	277
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

Day in month	Sun rise (hh:mm)		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:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
TEST license
This license is only to be used for testing purposes

Ramos, Tiffanie / tiffanie.ramos@tetratech.com
Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 2 - Non-Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:15	07:58	07:17	07:21	06:31	05:58	05:58	06:25	07:01	07:36	07:15	07:54
	17:10	17:48	18:25	20:04	20:41	21:15	21:27	21:06	20:18	19:23	17:29	17:01
2	08:15	07:57	07:16	07:20	06:29	05:58	05:59	06:27	07:02	07:37	07:16	07:55
	17:11	17:49	18:26	20:05	20:42	21:15	21:27	21:04	20:16	19:21	17:28	17:01
3	08:15	07:56	07:14	07:18	06:28	05:57	05:59	06:28	07:03	07:38	07:18	07:56
	17:12	17:51	18:28	20:07	20:43	21:16	21:27	21:03	20:15	19:19	17:27	17:01
4	08:15	07:54	07:12	07:16	06:27	05:57	06:00	06:29	07:04	07:39	07:19	07:57
	17:13	17:52	18:29	20:08	20:45	21:17	21:26	21:02	20:13	19:17	17:25	17:00
5	08:15	07:53	07:10	07:14	06:25	05:56	06:01	06:30	07:06	07:41	07:20	07:58
	17:14	17:53	18:30	20:09	20:46	21:18	21:26	21:01	20:11	19:15	17:24	17:00
6	08:15	07:52	07:09	07:12	06:24	05:56	06:01	06:31	07:07	07:42	07:22	07:59
	17:15	17:55	18:31	20:10	20:47	21:19	21:26	20:59	20:09	19:14	17:23	17:00
7	08:15	07:51	07:07	07:11	06:23	05:56	06:02	06:32	07:08	07:43	07:23	08:00
	17:16	17:56	18:33	20:12	20:48	21:19	21:25	20:58	20:07	19:12	17:22	17:00
8	08:14	07:49	08:05	07:09	06:21	05:55	06:03	06:33	07:09	07:44	07:25	08:01
	17:17	17:58	18:34	20:13	20:49	21:20	21:25	20:57	20:06	19:10	17:20	17:00
9	08:14	07:48	08:03	07:07	06:20	05:55	06:03	06:34	07:10	07:46	07:26	08:02
	17:18	17:59	19:35	20:14	20:50	21:21	21:25	20:55	20:04	19:08	17:19	17:00
10	08:14	07:47	08:02	07:05	06:19	05:55	06:04	06:36	07:11	07:47	07:27	08:03
	17:19	18:00	19:37	20:15	20:52	21:21	21:24	20:54	20:02	19:06	17:18	17:00
11	08:14	07:45	08:00	07:03	06:17	05:55	06:05	06:37	07:12	07:48	07:29	08:04
	17:20	18:00	19:38	20:16	20:53	21:22	21:24	20:52	20:00	19:05	17:17	17:00
12	08:13	07:44	07:58	07:02	06:16	05:55	06:06	06:38	07:14	07:49	07:30	08:05
	17:21	18:02	19:39	20:18	20:54	21:22	21:23	20:51	19:58	19:03	17:16	17:00
13	08:13	07:43	07:56	07:00	06:15	05:54	06:07	06:39	07:15	07:50	07:31	08:06
	17:23	18:03	19:41	20:19	20:55	21:23	21:23	20:49	19:56	19:01	17:15	17:00
14	08:12	07:41	07:54	06:58	06:14	05:54	06:07	06:40	07:16	07:52	07:33	08:07
	17:24	18:05	19:42	20:20	20:56	21:24	21:22	20:48	19:54	18:58	17:14	17:00
15	08:12	07:40	07:53	06:56	06:13	05:54	06:08	06:41	07:17	07:53	07:34	08:07
	17:25	18:06	19:43	20:21	20:57	21:24	21:21	20:46	19:53	18:56	17:13	17:00
16	08:11	07:38	07:51	06:55	06:12	05:54	06:09	06:42	07:18	07:54	07:35	08:08
	17:26	18:07	19:44	20:23	20:58	21:24	21:21	20:45	19:51	18:54	17:12	17:01
17	08:11	07:37	07:49	06:53	06:11	05:54	06:10	06:44	07:19	07:56	07:37	08:09
	17:28	18:09	19:46	20:24	21:00	21:25	21:20	20:43	19:49	18:53	17:11	17:01
18	08:10	07:35	07:47	06:51	06:10	05:54	06:11	06:45	07:21	07:57	07:38	08:09
	17:29	18:10	19:47	20:25	21:01	21:25	21:19	20:42	19:47	18:51	17:10	17:01
19	08:09	07:34	07:45	06:50	06:09	05:54	06:12	06:46	07:22	07:58	07:39	08:10
	17:30	18:11	19:48	20:26	21:02	21:26	21:19	20:40	19:45	18:49	17:09	17:01
20	08:09	07:32	07:43	06:48	06:08	05:55	06:13	06:47	07:23	07:59	07:40	08:11
	17:31	18:13	19:49	20:27	21:03	21:26	21:18	20:39	19:43	18:48	17:08	17:02
21	08:08	07:30	07:42	06:46	06:07	05:55	06:14	06:48	07:24	08:01	07:42	08:11
	17:33	18:14	19:51	20:29	21:04	21:26	21:17	20:37	19:41	18:46	17:07	17:02
22	08:07	07:29	07:40	06:45	06:06	05:55	06:15	06:49	07:25	08:02	07:43	08:12
	17:34	18:16	19:52	20:30	21:05	21:26	21:16	20:35	19:40	18:44	17:07	17:03
23	08:07	07:27	07:38	06:43	06:05	05:55	06:16	06:51	07:26	08:03	07:44	08:12
	17:35	18:17	19:53	20:31	21:06	21:27	21:15	20:34	19:38	18:43	17:06	17:03
24	08:06	07:26	07:36	06:42	06:04	05:55	06:17	06:52	07:28	08:05	07:46	08:13
	17:37	18:18	19:54	20:32	21:07	21:27	21:14	20:32	19:36	18:41	17:05	17:04
25	08:05	07:24	07:34	06:40	06:03	05:56	06:18	06:53	07:29	08:06	07:47	08:13
	17:38	18:20	19:56	20:34	21:08	21:27	21:13	20:30	19:34	18:40	17:04	17:05
26	08:04	07:22	07:32	06:38	06:02	05:56	06:19	06:54	07:30	08:07	07:48	08:13
	17:39	18:21	19:57	20:35	21:09	21:27	21:12	20:29	19:32	18:38	17:04	17:05
27	08:03	07:21	07:31	06:37	06:02	05:57	06:20	06:55	07:31	08:08	07:49	08:14
	17:41	18:22	19:58	20:36	21:10	21:27	21:11	20:27	19:30	18:37	17:03	17:06
28	08:02	07:19	07:29	06:35	06:01	05:57	06:21	06:56	07:32	08:10	07:50	08:14
	17:42	18:24	19:59	20:37	21:11	21:27	21:10	20:25	19:28	18:35	17:03	17:07
29	08:01		07:27	06:34	06:00	05:57	06:22	06:57	07:33	08:11	07:52	08:14
	17:44		20:00	20:38	21:12	21:27	21:09	20:23	19:26	18:34	17:02	17:07
30	08:00		07:25	06:32	06:00	05:58	06:23	06:59	07:35	08:12	07:53	08:15
	17:45		20:02	20:40	21:13	21:27	21:08	20:22	19:25	18:32	17:02	17:08
31	07:59		07:23		05:59		06:24	07:00		08:14		08:15
	17:46		20:03		21:14		21:07	20:20		18:31		17:09
Potential sun hours	288	292	369	403	457	464	470	435	377	342	290	277
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
TEST license
This license is only to be used for testing purposes

Ramos, Tiffanie / tiffanie.ramos@tetratech.com
Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 3 - Non-Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:15	07:58	07:17	07:21	06:31	05:58	05:58	06:25	07:01	07:36	07:15	07:54
	17:10	17:48	18:25	20:04	20:41	21:15	21:27	21:06	20:18	19:23	17:29	17:01
2	08:15	07:57	07:16	07:20	06:29	05:58	05:59	06:27	07:02	07:37	07:16	07:55
	17:11	17:49	18:26	20:05	20:42	21:15	21:27	21:04	20:16	19:21	17:28	17:01
3	08:15	07:56	07:14	07:18	06:28	05:57	05:59	06:28	07:03	07:38	07:18	07:56
	17:12	17:51	18:28	20:07	20:43	21:16	21:27	21:03	20:15	19:19	17:27	17:01
4	08:15	07:54	07:12	07:16	06:27	05:57	06:00	06:29	07:04	07:39	07:19	07:57
	17:13	17:52	18:29	20:08	20:45	21:17	21:26	21:02	20:13	19:17	17:25	17:00
5	08:15	07:53	07:10	07:14	06:25	05:56	06:01	06:30	07:06	07:41	07:21	07:58
	17:14	17:53	18:30	20:09	20:46	21:18	21:26	21:01	20:11	19:15	17:24	17:00
6	08:15	07:52	07:09	07:12	06:24	05:56	06:01	06:31	07:07	07:42	07:22	07:59
	17:15	17:55	18:31	20:10	20:47	21:19	21:26	20:59	20:09	19:14	17:23	17:00
7	08:15	07:51	07:07	07:11	06:23	05:56	06:02	06:32	07:08	07:43	07:23	08:00
	17:16	17:56	18:33	20:12	20:48	21:19	21:26	20:58	20:07	19:12	17:22	17:00
8	08:14	07:49	08:05	07:09	06:21	05:55	06:03	06:33	07:09	07:44	07:25	08:01
	17:17	17:58	18:34	20:13	20:49	21:20	21:25	20:57	20:06	19:10	17:20	17:00
9	08:14	07:48	08:03	07:07	06:20	05:55	06:03	06:34	07:10	07:46	07:26	08:02
	17:18	17:59	19:35	20:14	20:50	21:21	21:25	20:55	20:04	19:08	17:19	17:00
10	08:14	07:47	08:02	07:05	06:19	05:55	06:04	06:36	07:11	07:47	07:27	08:03
	17:19	18:00	19:37	20:15	20:52	21:21	21:24	20:54	20:02	19:06	17:18	17:00
11	08:14	07:45	08:00	07:03	06:17	05:55	06:05	06:37	07:12	07:48	07:29	08:04
	17:20	18:00	19:38	20:16	20:53	21:22	21:24	20:52	20:00	19:05	17:17	17:00
12	08:13	07:44	07:58	07:02	06:16	05:54	06:06	06:38	07:14	07:49	07:30	08:05
	17:21	18:02	19:39	20:18	20:54	21:23	21:23	20:51	19:58	19:03	17:16	17:00
13	08:13	07:43	07:56	07:00	06:15	05:54	06:07	06:39	07:15	07:51	07:31	08:06
	17:23	18:03	19:41	20:19	20:55	21:23	21:23	20:49	19:56	19:01	17:15	17:00
14	08:12	07:41	07:54	06:58	06:14	05:54	06:07	06:40	07:16	07:52	07:33	08:07
	17:24	18:05	19:42	20:20	20:56	21:24	21:22	20:48	19:54	18:58	17:14	17:00
15	08:12	07:40	07:53	06:57	06:13	05:54	06:08	06:41	07:17	07:53	07:34	08:07
	17:25	18:06	19:43	20:21	20:57	21:24	21:22	20:46	19:53	18:56	17:13	17:00
16	08:11	07:38	07:51	06:55	06:12	05:54	06:09	06:42	07:18	07:54	07:35	08:08
	17:26	18:07	19:44	20:23	20:59	21:25	21:21	20:45	19:51	18:54	17:12	17:00
17	08:11	07:37	07:49	06:53	06:11	05:54	06:10	06:44	07:19	07:56	07:37	08:09
	17:28	18:09	19:46	20:24	21:00	21:25	21:20	20:43	19:49	18:53	17:11	17:01
18	08:10	07:35	07:47	06:51	06:10	05:54	06:11	06:45	07:21	07:57	07:38	08:09
	17:29	18:10	19:47	20:25	21:01	21:25	21:19	20:42	19:47	18:51	17:10	17:01
19	08:10	07:34	07:45	06:50	06:08	05:54	06:12	06:46	07:22	07:58	07:39	08:10
	17:30	18:11	19:48	20:26	21:02	21:26	21:19	20:40	19:45	18:49	17:09	17:01
20	08:09	07:32	07:43	06:48	06:08	05:55	06:13	06:47	07:23	07:59	07:40	08:11
	17:31	18:13	19:49	20:28	21:03	21:26	21:18	20:39	19:43	18:48	17:08	17:02
21	08:08	07:31	07:42	06:46	06:07	05:55	06:14	06:48	07:24	08:01	07:42	08:11
	17:33	18:14	19:51	20:29	21:04	21:26	21:17	20:37	19:41	18:46	17:07	17:02
22	08:07	07:29	07:40	06:45	06:06	05:55	06:15	06:49	07:25	08:02	07:43	08:12
	17:34	18:16	19:52	20:30	21:05	21:26	21:16	20:35	19:40	18:44	17:07	17:03
23	08:07	07:27	07:38	06:43	06:05	05:55	06:16	06:51	07:26	08:03	07:44	08:12
	17:35	18:17	19:53	20:31	21:06	21:27	21:15	20:34	19:38	18:43	17:06	17:03
24	08:06	07:26	07:36	06:42	06:04	05:55	06:17	06:52	07:28	08:05	07:46	08:13
	17:37	18:18	19:54	20:32	21:07	21:27	21:14	20:32	19:36	18:41	17:05	17:04
25	08:05	07:24	07:34	06:40	06:03	05:56	06:18	06:53	07:29	08:06	07:47	08:13
	17:38	18:20	19:56	20:34	21:08	21:27	21:13	20:30	19:34	18:40	17:04	17:05
26	08:04	07:22	07:32	06:38	06:02	05:56	06:19	06:54	07:30	08:07	07:48	08:14
	17:39	18:21	19:57	20:35	21:09	21:27	21:12	20:29	19:32	18:38	17:04	17:05
27	08:03	07:21	07:31	06:37	06:02	05:56	06:20	06:55	07:31	08:09	07:49	08:14
	17:41	18:22	19:58	20:36	21:10	21:27	21:11	20:27	19:30	18:37	17:03	17:06
28	08:02	07:19	07:29	06:35	06:01	05:57	06:21	06:56	07:32	08:10	07:50	08:14
	17:42	18:24	19:59	20:37	21:11	21:27	21:10	20:25	19:28	18:35	17:03	17:07
29	08:01		07:27	06:34	06:00	05:57	06:22	06:57	07:33	08:11	07:52	08:14
	17:44		20:01	20:38	21:12	21:27	21:09	20:23	19:26	18:34	17:02	17:07
30	08:00		07:25	06:32	06:00	05:58	06:23	06:59	07:35	08:12	07:53	08:15
	17:45		20:02	20:40	21:13	21:27	21:08	20:22	19:25	18:32	17:02	17:08
31	07:59		07:23		05:59		06:24	07:00		08:14		08:15
	17:46		20:03		21:14		21:07	20:20		18:31		17:09
Potential sun hours	288	292	369	403	457	464	470	435	377	342	289	277
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
TEST license
This license is only to be used for testing purposes

Ramos, Tiffanie / tiffanie.ramos@tetratech.com
Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 4 - Non-Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:15	07:58	07:17	07:21	06:31	05:58	05:58	06:25	07:01	07:36	07:15	07:54
	17:10	17:48	18:25	20:04	20:41	21:15	21:27	21:06	20:18	19:23	17:29	17:01
2	08:15	07:57	07:16	07:20	06:29	05:58	05:59	06:27	07:02	07:37	07:16	07:55
	17:11	17:49	18:26	20:05	20:42	21:15	21:27	21:04	20:16	19:21	17:28	17:01
3	08:15	07:56	07:14	07:18	06:28	05:57	05:59	06:28	07:03	07:38	07:18	07:56
	17:12	17:51	18:28	20:07	20:43	21:16	21:27	21:03	20:15	19:19	17:27	17:01
4	08:15	07:54	07:12	07:16	06:27	05:57	06:00	06:29	07:04	07:39	07:19	07:57
	17:13	17:52	18:29	20:08	20:45	21:17	21:26	21:02	20:13	19:17	17:25	17:00
5	08:15	07:53	07:10	07:14	06:25	05:56	06:01	06:30	07:06	07:41	07:21	07:58
	17:14	17:53	18:30	20:09	20:46	21:18	21:26	21:01	20:11	19:15	17:24	17:00
6	08:15	07:52	07:09	07:12	06:24	05:56	06:01	06:31	07:07	07:42	07:22	07:59
	17:15	17:55	18:31	20:10	20:47	21:19	21:26	20:59	20:09	19:14	17:23	17:00
7	08:15	07:51	07:07	07:11	06:23	05:56	06:02	06:32	07:08	07:43	07:23	08:00
	17:16	17:56	18:33	20:12	20:48	21:19	21:26	20:58	20:07	19:12	17:22	17:00
8	08:14	07:49	08:05	07:09	06:21	05:55	06:03	06:33	07:09	07:44	07:25	08:01
	17:17	17:58	18:34	20:13	20:49	21:20	21:25	20:57	20:06	19:10	17:20	17:00
9	08:14	07:48	08:03	07:07	06:20	05:55	06:03	06:34	07:10	07:46	07:26	08:02
	17:18	17:59	19:35	20:14	20:50	21:21	21:25	20:55	20:04	19:08	17:19	17:00
10	08:14	07:47	08:02	07:05	06:19	05:55	06:04	06:36	07:11	07:47	07:27	08:03
	17:19	18:00	19:37	20:15	20:52	21:21	21:24	20:54	20:02	19:06	17:18	17:00
11	08:14	07:45	08:00	07:03	06:17	05:55	06:05	06:37	07:12	07:48	07:29	08:04
	17:20	18:00	19:38	20:16	20:53	21:22	21:24	20:52	20:00	19:05	17:17	17:00
12	08:13	07:44	07:58	07:02	06:16	05:54	06:06	06:38	07:14	07:49	07:30	08:05
	17:21	18:02	19:39	20:18	20:54	21:23	21:23	20:51	19:58	19:03	17:16	17:00
13	08:13	07:43	07:56	07:00	06:15	05:54	06:07	06:39	07:15	07:51	07:31	08:06
	17:23	18:03	19:41	20:19	20:55	21:23	21:23	20:49	19:56	19:01	17:15	17:00
14	08:12	07:41	07:54	06:58	06:14	05:54	06:07	06:40	07:16	07:52	07:33	08:07
	17:24	18:05	19:42	20:20	20:56	21:24	21:22	20:48	19:54	18:58	17:14	17:00
15	08:12	07:40	07:53	06:56	06:13	05:54	06:08	06:41	07:17	07:53	07:34	08:07
	17:25	18:06	19:43	20:21	20:57	21:24	21:22	20:46	19:53	18:56	17:13	17:00
16	08:11	07:38	07:51	06:55	06:12	05:54	06:09	06:42	07:18	07:54	07:35	08:08
	17:26	18:07	19:44	20:23	20:59	21:25	21:21	20:45	19:51	18:54	17:12	17:00
17	08:11	07:37	07:49	06:53	06:11	05:54	06:10	06:44	07:19	07:56	07:37	08:09
	17:28	18:09	19:46	20:24	21:00	21:25	21:20	20:43	19:49	18:53	17:11	17:01
18	08:10	07:35	07:47	06:51	06:10	05:54	06:11	06:45	07:21	07:57	07:38	08:09
	17:29	18:10	19:47	20:25	21:01	21:25	21:19	20:42	19:47	18:51	17:10	17:01
19	08:10	07:34	07:45	06:50	06:08	05:54	06:12	06:46	07:22	07:58	07:39	08:10
	17:30	18:11	19:48	20:26	21:02	21:26	21:19	20:40	19:45	18:49	17:09	17:01
20	08:09	07:32	07:43	06:48	06:08	05:55	06:13	06:47	07:23	07:59	07:40	08:11
	17:31	18:13	19:49	20:28	21:03	21:26	21:18	20:39	19:43	18:48	17:08	17:02
21	08:08	07:31	07:42	06:46	06:07	05:55	06:14	06:48	07:24	08:01	07:42	08:11
	17:33	18:14	19:51	20:29	21:04	21:26	21:17	20:37	19:41	18:46	17:07	17:02
22	08:07	07:29	07:40	06:45	06:06	05:55	06:15	06:49	07:25	08:02	07:43	08:12
	17:34	18:16	19:52	20:30	21:05	21:26	21:16	20:35	19:40	18:44	17:07	17:03
23	08:07	07:27	07:38	06:43	06:05	05:55	06:16	06:51	07:26	08:03	07:44	08:12
	17:35	18:17	19:53	20:31	21:06	21:27	21:15	20:34	19:38	18:43	17:06	17:03
24	08:06	07:26	07:36	06:42	06:04	05:55	06:17	06:52	07:28	08:05	07:46	08:13
	17:37	18:18	19:54	20:32	21:07	21:27	21:14	20:32	19:36	18:41	17:05	17:04
25	08:05	07:24	07:34	06:40	06:03	05:56	06:18	06:53	07:29	08:06	07:47	08:13
	17:38	18:20	19:56	20:34	21:08	21:27	21:13	20:30	19:34	18:40	17:04	17:05
26	08:04	07:22	07:32	06:38	06:02	05:56	06:19	06:54	07:30	08:07	07:48	08:14
	17:39	18:21	19:57	20:35	21:09	21:27	21:12	20:29	19:32	18:38	17:04	17:05
27	08:03	07:21	07:31	06:37	06:02	05:56	06:20	06:55	07:31	08:09	07:49	08:14
	17:41	18:22	19:58	20:36	21:10	21:27	21:11	20:27	19:30	18:37	17:03	17:06
28	08:02	07:19	07:29	06:35	06:01	05:57	06:21	06:56	07:32	08:10	07:50	08:14
	17:42	18:24	19:59	20:37	21:11	21:27	21:10	20:25	19:28	18:35	17:03	17:07
29	08:01		07:27	06:34	06:00	05:57	06:22	06:57	07:33	08:11	07:52	08:14
	17:44		20:01	20:38	21:12	21:27	21:09	20:23	19:26	18:34	17:02	17:07
30	08:00		07:25	06:32	06:00	05:58	06:23	06:59	07:35	08:12	07:53	08:15
	17:45		20:02	20:40	21:13	21:27	21:08	20:22	19:25	18:32	17:02	17:08
31	07:59		07:23		05:59		06:24	07:00		08:14		08:15
	17:46		20:03		21:14		21:07	20:20		18:31		17:09
Potential sun hours	288	292	369	403	457	464	470	435	377	342	289	277
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
TEST license
This license is only to be used for testing purposes

Ramos, Tiffanie / tiffanie.ramos@tetratech.com
Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 5 - Non-Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May		June		July		August	September	October	November	December
1	08:15	07:58	07:17	07:21	06:31		05:58		06:21 (41)		05:58	06:28 (41)	06:25	07:01	07:36	07:15	07:54
	17:10	17:48	18:25	20:04	20:41		21:15	19	06:40 (41)		21:27	15	06:43 (41)	21:06	20:18	19:23	17:29	17:01
2	08:15	07:57	07:16	07:20	06:29		05:58		06:21 (41)		05:59		06:28 (41)	06:26	07:02	07:37	07:17	07:55
	17:11	17:49	18:26	20:05	20:42		21:16	20	06:41 (41)		21:27	16	06:44 (41)	21:05	20:16	19:21	17:28	17:01
3	08:15	07:56	07:14	07:18	06:28		05:57		06:20 (41)		05:59		06:28 (41)	06:27	07:03	07:38	07:18	07:56
	17:12	17:50	18:27	20:07	20:43		21:16	20	06:40 (41)		21:27	16	06:44 (41)	21:03	20:15	19:19	17:27	17:01
4	08:15	07:55	07:12	07:16	06:26		05:57		06:20 (41)		06:00		06:28 (41)	06:29	07:04	07:39	07:19	07:57
	17:13	17:52	18:29	20:08	20:45		21:17	20	06:40 (41)		21:27	17	06:45 (41)	21:02	20:13	19:17	17:25	17:00
5	08:15	07:53	07:10	07:14	06:25		05:56		06:21 (41)		06:00		06:28 (41)	06:30	07:06	07:41	07:21	07:58
	17:14	17:53	18:30	20:09	20:46		21:18	20	06:41 (41)		21:26	18	06:46 (41)	21:01	20:11	19:15	17:24	17:00
6	08:15	07:52	07:09	07:12	06:24		05:56		06:21 (41)		06:01		06:27 (41)	06:31	07:07	07:42	07:22	08:00
	17:15	17:55	18:31	20:10	20:47		21:19	19	06:40 (41)		21:26	19	06:46 (41)	20:59	20:09	19:14	17:23	17:00
7	08:15	07:51	07:07	07:10	06:22		05:55		06:22 (41)		06:02		06:28 (41)	06:32	07:08	07:43	07:23	08:01
	17:16	17:56	18:33	20:12	20:48		21:20	18	06:40 (41)		21:26	19	06:47 (41)	20:58	20:07	19:12	17:21	17:00
8	08:15	07:50	08:05	07:09	06:21		05:55		06:23 (41)		06:03		06:28 (41)	06:33	07:09	07:44	07:25	08:02
	17:17	17:57	18:34	20:13	20:49		21:20	17	06:40 (41)		21:25	19	06:47 (41)	20:57	20:06	19:10	17:20	17:00
9	08:14	07:48	08:03	07:07	06:20		05:55		06:23 (41)		06:03		06:27 (41)	06:34	07:10	07:46	07:26	08:02
	17:18	17:59	19:35	20:14	20:51		21:21	17	06:40 (41)		21:25	20	06:47 (41)	20:55	20:04	19:08	17:19	17:00
10	08:14	07:47	08:02	07:05	06:18		05:55		06:23 (41)		06:04		06:28 (41)	06:35	07:11	07:47	07:27	08:03
	17:19	18:00	19:37	20:15	20:52		21:22	16	06:39 (41)		21:25	20	06:48 (41)	20:54	20:02	19:06	17:18	16:59
11	08:14	07:45	08:00	07:03	06:17		05:54		06:24 (41)		06:05		06:29 (41)	06:37	07:12	07:48	07:29	08:04
	17:20	18:00	19:38	20:17	20:53		21:22	15	06:39 (41)		21:24	19	06:48 (41)	20:53	20:00	19:05	17:17	17:00
12	08:13	07:44	07:58	07:02	06:16		05:54		06:24 (41)		06:06		06:30 (41)	06:38	07:14	07:49	07:30	08:05
	17:21	18:02	19:39	20:18	20:54		21:23	15	06:39 (41)		21:24	19	06:49 (41)	20:51	19:58	19:03	17:16	17:00
13	08:13	07:43	07:56	07:00	06:15		05:54		06:25 (41)		06:06		06:30 (41)	06:39	07:15	07:51	07:31	08:06
	17:22	18:03	19:40	20:19	20:55		21:23	14	06:39 (41)		21:23	18	06:48 (41)	20:50	19:56	19:01	17:14	17:00
14	08:13	07:41	07:54	06:58	06:14		05:54		06:25 (41)		06:07		06:31 (41)	06:40	07:16	07:52	07:33	08:07
	17:24	18:04	19:42	20:20	20:56		21:24	14	06:39 (41)		21:22	18	06:49 (41)	20:48	19:55	18:58	17:13	17:00
15	08:12	07:40	07:53	06:56	06:13		05:54		06:26 (41)		06:08		06:32 (41)	06:41	07:17	07:53	07:34	08:08
	17:25	18:06	19:43	20:21	20:58		21:24	13	06:39 (41)		21:22	17	06:49 (41)	20:47	19:53	18:56	17:12	17:00
16	08:12	07:38	07:51	06:55	06:11		06:33 (41)		05:54		06:26 (41)		06:09		06:33 (41)	06:42	07:18	07:54	07:35	08:08
	17:26	18:07	19:44	20:23	20:59	1	06:34 (41)		21:25	13	06:39 (41)		21:21	17	06:50 (41)	20:45	19:51	18:54	17:11	17:00
17	08:11	07:37	07:49	06:53	06:10		06:32 (41)		05:54		06:27 (41)		06:10		06:34 (41)	06:43	07:19	07:56	07:37	08:09
	17:27	18:09	19:46	20:24	21:00	4	06:36 (41)		21:25	12	06:39 (41)		21:20	16	06:50 (41)	20:43	19:49	18:53	17:11	17:01
18	08:10	07:35	07:47	06:51	06:09		06:31 (41)		05:54		06:27 (41)		06:11		06:35 (41)	06:45	07:21	07:57	07:38	08:10
	17:29	18:10	19:47	20:25	21:01	6	06:37 (41)		21:25	12	06:39 (41)		21:20	15	06:50 (41)	20:42	19:47	18:51	17:10	17:01
19	08:10	07:34	07:45	06:50	06:08		06:31 (41)		05:54		06:27 (41)		06:12		06:36 (41)	06:46	07:22	07:58	07:39	08:10
	17:30	18:11	19:48	20:26	21:02	7	06:38 (41)		21:26	12	06:39 (41)		21:19	14	06:50 (41)	20:40	19:45	18:49	17:09	17:01
20	08:09	07:32	07:43	06:48	06:07		06:30 (41)		05:54		06:27 (41)		06:13		06:37 (41)	06:47	07:23	07:59	07:41	08:11
	17:31	18:13	19:49	20:28	21:03	9	06:39 (41)		21:26	12	06:39 (41)		21:18	13	06:50 (41)	20:39	19:43	18:48	17:08	17:02
21	08:08	07:31	07:42	06:46	06:06		06:29 (41)		05:54		06:28 (41)		06:14		06:37 (41)	06:48	07:24	08:01	07:42	08:11
	17:33	18:14	19:51	20:29	21:04	10	06:39 (41)		21:26	12	06:40 (41)		21:17	12	06:49 (41)	20:37	19:41	18:46	17:07	17:02
22	08:08	07:29	07:40	06:45	06:05		06:28 (41)		05:55		06:28 (41)		06:15		06:38 (41)	06:49	07:25	08:02	07:43	08:12
	17:34	18:15	19:52	20:30	21:05	11	06:39 (41)		21:27	12	06:40 (41)		21:16	11	06:49 (41)	20:35	19:40	18:44	17:06	17:03
23	08:07	07:27	07:38	06:43	06:05		06:27 (41)		05:55		06:28 (41)		06:16		06:39 (41)	06:50	07:26	08:03	07:44	08:12
	17:35	18:17	19:53	20:31	21:06	13	06:40 (41)		21:27	12	06:40 (41)		21:15	10	06:49 (41)	20:34	19:38	18:43	17:06	17:03
24	08:06	07:26	07:36	06:41	06:04		06:26 (41)		05:55		06:28 (41)		06:17		06:40 (41)	06:52	07:28	08:05	07:46	08:13
	17:37	18:18	19:54	20:32	21:07	14	06:40 (41)		21:27	12	06:40 (41)		21:14	8	06:48 (41)	20:32	19:36	18:41	17:05	17:04
25	08:05	07:24	07:34	06:40	06:03		06:26 (41)		05:56		06:29 (41)		06:18		06:41 (41)	06:53	07:29	08:06	07:47	08:13
	17:38	18:19	19:56	20:34	21:08	15	06:41 (41)		21:27	12	06:41 (41)		21:13	7	06:48 (41)	20:30	19:34	18:40	17:04	17:04
26	08:04	07:22	07:32	06:38	06:02		06:25 (41)		05:56		06:28 (41)		06:19		06:42 (41)	06:54	07:30	08:07	07:48	08:14
	17:39	18:21	19:57	20:35	21:09	15	06:40 (41)		21:27	13	06:41 (41)		21:12	5	06:47 (41)	20:29	19:32	18:38	17:04	17:05
27	08:03	07:21	07:31	06:37	06:01		06:24 (41)		05:56		06:29 (41)		06:20		06:43 (41)	06:55	07:31	08:09	07:49	08:14
	17:41	18:22	19:58	20:36	21:10	16	06:40 (41)		21:27	13	06:42 (41)		21:11	3	06:46 (41)	20:27	19:30	18:37	17:03	17:06
28	08:02	07:19	07:29	06:35	06:01		06:24 (41)		05:57		06:29 (41)		06:21			06:56	07:32	08:10	07:51	08:14
	17:42	18:24	19:59	20:37	21:11	17	06:41 (41)		21:27	13	06:42 (41)		21:10			20:25	19:28	18:35	17:03	17:06
29	08:01		07:27	06:34	06:00		06:23 (41)		05:57		06:28 (41)		06:22			06:57	07:33	08:11	07:52	08:15
	17:43		20:01	20:39	21:12	18	06:41 (41)		21:27	14	06:42 (41)		21:09			20:24	19:26	18:34	17:02	17:07
30	08:00		07:25	06:32	05:59		06:22 (41)		05:58		06:29 (41)		06:23			06:59	07:35	08:13	07:53	08:15
	17:45		20:02	20:40	21:13	18	06:40 (41)		21:27	14	06:43 (41)		21:08			20:22	19:25	18:32	17:02	17:08
31	07:59		07:23		05:59		06:22 (41)						06:24			07:00		08:14		08:15
	17:46		20:03		21:14	19	06:41 (41)						21:07			20:20		18:31		17:09
Potential sun hours	288	292	369	403	458			464			470			435	377	342	289	276
Total, worst case						193			445			401						
Sun reduction						0.66			0.69			0.76						
Oper. time red.						0.98			0.98			0.98						
Wind dir. red.						0.58			0.58			0.58						
Total reduction						0.37			0.39			0.43						
Total, real						72			174			173						

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:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
TEST license
This license is only to be used for testing purposes

Ramos, Tiffanie / tiffanie.ramos@tetratech.com
Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 6 - Non-Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:15	07:58	07:17	07:21	06:31	05:58	05:58	06:25	07:01	07:36	07:15	07:54
	17:10	17:47	18:25	20:04	20:41	21:15	21:27	21:06	20:18	19:23	17:29	17:01
2	08:15	07:57	07:15	07:19	06:29	05:57	05:58	06:26	07:02	07:37	07:16	07:55
	17:11	17:49	18:26	20:05	20:42	21:15	21:27	21:04	20:16	19:21	17:28	17:01
3	08:15	07:55	07:14	07:18	06:28	05:57	05:59	06:27	07:03	07:38	07:18	07:56
	17:12	17:50	18:27	20:06	20:43	21:16	21:27	21:03	20:14	19:19	17:26	17:00
4	08:15	07:54	07:12	07:16	06:26	05:56	06:00	06:28	07:04	07:39	07:19	07:57
	17:12	17:52	18:29	20:08	20:44	21:17	21:26	21:02	20:13	19:17	17:25	17:00
5	08:15	07:53	07:10	07:14	06:25	05:56	06:00	06:30	07:05	07:40	07:20	07:58
	17:13	17:53	18:30	20:09	20:46	21:18	21:26	21:01	20:11	19:15	17:24	17:00
6	08:15	07:52	07:09	07:12	06:24	05:56	06:01	06:31	07:06	07:42	07:22	07:59
	17:14	17:54	18:31	20:10	20:47	21:19	21:26	20:59	20:09	19:13	17:22	17:00
7	08:15	07:51	07:07	07:10	06:22	05:55	06:02	06:32	07:08	07:43	07:23	08:00
	17:16	17:56	18:33	20:11	20:48	21:19	21:25	20:58	20:07	19:12	17:21	17:00
8	08:14	07:49	08:05	07:08	06:21	05:55	06:02	06:33	07:09	07:44	07:24	08:01
	17:17	17:57	18:34	20:13	20:49	21:20	21:25	20:57	20:05	19:10	17:20	16:59
9	08:14	07:48	08:03	07:07	06:20	05:55	06:03	06:34	07:10	07:45	07:26	08:02
	17:18	17:59	19:35	20:14	20:50	21:21	21:25	20:55	20:04	19:08	17:19	16:59
10	08:14	07:47	08:01	07:05	06:18	05:54	06:04	06:35	07:11	07:47	07:27	08:03
	17:19	18:00	19:36	20:15	20:52	21:21	21:24	20:54	20:02	19:06	17:18	16:59
11	08:13	07:45	08:00	07:03	06:17	05:54	06:05	06:36	07:12	07:48	07:28	08:04
	17:20	18:00	19:38	20:16	20:53	21:22	21:24	20:52	20:00	19:04	17:16	16:59
12	08:13	07:44	07:58	07:01	06:16	05:54	06:05	06:38	07:13	07:49	07:30	08:05
	17:21	18:01	19:39	20:18	20:54	21:22	21:23	20:51	19:58	19:03	17:15	16:59
13	08:13	07:42	07:56	07:00	06:15	05:54	06:06	06:39	07:15	07:50	07:31	08:06
	17:22	18:03	19:40	20:19	20:55	21:23	21:23	20:49	19:56	19:01	17:14	17:00
14	08:12	07:41	07:54	06:58	06:14	05:54	06:07	06:40	07:16	07:52	07:32	08:07
	17:23	18:04	19:42	20:20	20:56	21:24	21:22	20:48	19:54	18:57	17:13	17:00
15	08:12	07:40	07:52	06:56	06:12	05:54	06:08	06:41	07:17	07:53	07:34	08:07
	17:25	18:06	19:43	20:21	20:57	21:24	21:21	20:46	19:52	18:56	17:12	17:00
16	08:11	07:38	07:51	06:55	06:11	05:54	06:09	06:42	07:18	07:54	07:35	08:08
	17:26	18:07	19:44	20:22	20:58	21:24	21:21	20:45	19:51	18:54	17:11	17:00
17	08:11	07:37	07:49	06:53	06:10	05:54	06:10	06:43	07:19	07:55	07:36	08:09
	17:27	18:08	19:45	20:24	21:00	21:25	21:20	20:43	19:49	18:52	17:10	17:00
18	08:10	07:35	07:47	06:51	06:09	05:54	06:11	06:44	07:20	07:57	07:38	08:09
	17:28	18:10	19:47	20:25	21:01	21:25	21:19	20:42	19:47	18:51	17:09	17:01
19	08:09	07:34	07:45	06:49	06:08	05:54	06:12	06:46	07:22	07:58	07:39	08:10
	17:30	18:11	19:48	20:26	21:02	21:26	21:19	20:40	19:45	18:49	17:09	17:01
20	08:09	07:32	07:43	06:48	06:07	05:54	06:13	06:47	07:23	07:59	07:40	08:11
	17:31	18:12	19:49	20:27	21:03	21:26	21:18	20:38	19:43	18:47	17:08	17:01
21	08:08	07:30	07:41	06:46	06:06	05:54	06:14	06:48	07:24	08:01	07:42	08:11
	17:32	18:14	19:50	20:29	21:04	21:26	21:17	20:37	19:41	18:46	17:07	17:02
22	08:07	07:29	07:40	06:44	06:05	05:55	06:15	06:49	07:25	08:02	07:43	08:12
	17:34	18:15	19:52	20:30	21:05	21:26	21:16	20:35	19:39	18:44	17:06	17:02
23	08:06	07:27	07:38	06:43	06:04	05:55	06:16	06:50	07:26	08:03	07:44	08:12
	17:35	18:17	19:53	20:31	21:06	21:27	21:15	20:34	19:37	18:43	17:05	17:03
24	08:06	07:26	07:36	06:41	06:04	05:55	06:17	06:51	07:27	08:04	07:45	08:13
	17:36	18:18	19:54	20:32	21:07	21:27	21:14	20:32	19:36	18:41	17:05	17:04
25	08:05	07:24	07:34	06:40	06:03	05:55	06:18	06:53	07:29	08:06	07:47	08:13
	17:38	18:19	19:55	20:33	21:08	21:27	21:13	20:30	19:34	18:39	17:04	17:04
26	08:04	07:22	07:32	06:38	06:02	05:56	06:19	06:54	07:30	08:07	07:48	08:13
	17:39	18:21	19:57	20:35	21:09	21:27	21:12	20:28	19:32	18:38	17:04	17:05
27	08:03	07:21	07:30	06:37	06:01	05:56	06:20	06:55	07:31	08:08	07:49	08:14
	17:40	18:22	19:58	20:36	21:10	21:27	21:11	20:27	19:30	18:36	17:03	17:05
28	08:02	07:19	07:28	06:35	06:00	05:57	06:21	06:56	07:32	08:10	07:50	08:14
	17:42	18:23	19:59	20:37	21:11	21:27	21:10	20:25	19:28	18:35	17:02	17:06
29	08:01		07:27	06:34	06:00	05:57	06:22	06:57	07:33	08:11	07:52	08:14
	17:43		20:00	20:38	21:12	21:27	21:09	20:23	19:26	18:33	17:02	17:07
30	08:00		07:25	06:32	05:59	05:57	06:23	06:58	07:34	08:12	07:53	08:14
	17:45		20:02	20:40	21:13	21:27	21:08	20:22	19:24	18:32	17:01	17:08
31	07:59		07:23		05:59		06:24	07:00		08:14		08:15
	17:46		20:03		21:14		21:07	20:20		18:31		17:09
Potential sun hours	288	292	369	403	458	464	470	435	377	342	289	276
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
TEST license
This license is only to be used for testing purposes

Ramos, Tiffanie / tiffanie.ramos@tetratech.com
Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 7 - Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:15	07:58	07:17	07:21	06:31	05:58	05:58	06:25	07:01	07:36	07:15	07:54
	17:10	17:48	18:25	20:04	20:41	21:14	21:27	21:06	20:18	19:23	17:29	17:01
2	08:15	07:57	07:15	07:19	06:29	05:58	05:59	06:26	07:02	07:37	07:16	07:55
	17:11	17:49	18:26	20:05	20:42	21:15	21:27	21:04	20:16	19:21	17:28	17:01
3	08:15	07:55	07:14	07:18	06:28	05:57	05:59	06:27	07:03	07:38	07:18	07:56
	17:12	17:50	18:27	20:07	20:43	21:16	21:26	21:03	20:14	19:19	17:27	17:01
4	08:15	07:54	07:12	07:16	06:26	05:57	06:00	06:29	07:04	07:39	07:19	07:57
	17:13	17:52	18:29	20:08	20:44	21:17	21:26	21:02	20:13	19:17	17:25	17:00
5	08:15	07:53	07:10	07:14	06:25	05:56	06:00	06:30	07:05	07:41	07:20	07:58
	17:14	17:53	18:30	20:09	20:46	21:18	21:26	21:01	20:11	19:15	17:24	17:00
6	08:15	07:52	07:09	07:12	06:24	05:56	06:01	06:31	07:07	07:42	07:22	07:59
	17:15	17:55	18:31	20:10	20:47	21:18	21:26	20:59	20:09	19:13	17:23	17:00
7	08:14	07:51	07:07	07:10	06:22	05:56	06:02	06:32	07:08	07:43	07:23	08:00
	17:16	17:56	18:33	20:11	20:48	21:19	21:25	20:58	20:07	19:12	17:21	17:00
8	08:14	07:49	08:05	07:09	06:21	05:55	06:03	06:33	07:09	07:44	07:24	08:01
	17:17	17:57	18:34	20:13	20:49	21:20	21:25	20:57	20:05	19:10	17:20	17:00
9	08:14	07:48	08:03	07:07	06:20	05:55	06:03	06:34	07:10	07:45	07:26	08:02
	17:18	17:59	19:35	20:14	20:50	21:21	21:25	20:55	20:04	19:08	17:19	17:00
10	08:14	07:47	08:01	07:05	06:18	05:55	06:04	06:35	07:11	07:47	07:27	08:03
	17:19	18:00	19:37	20:15	20:52	21:21	21:24	20:54	20:02	19:06	17:18	17:00
11	08:13	07:45	08:00	07:03	06:17	05:54	06:05	06:37	07:12	07:48	07:28	08:04
	17:20	18:00	19:38	20:16	20:53	21:22	21:24	20:52	20:00	19:05	17:17	17:00
12	08:13	07:44	07:58	07:02	06:16	05:54	06:06	06:38	07:13	07:49	07:30	08:05
	17:21	18:02	19:39	20:18	20:54	21:22	21:23	20:51	19:58	19:03	17:16	17:00
13	08:13	07:42	07:56	07:00	06:15	05:54	06:06	06:39	07:15	07:50	07:31	08:06
	17:22	18:03	19:40	20:19	20:55	21:23	21:23	20:49	19:56	19:01	17:14	17:00
14	08:12	07:41	07:54	06:58	06:14	05:54	06:07	06:40	07:16	07:52	07:32	08:06
	17:24	18:04	19:42	20:20	20:56	21:23	21:22	20:48	19:54	18:58	17:13	17:00
15	08:12	07:40	07:52	06:56	06:13	05:54	06:08	06:41	07:17	07:53	07:34	08:07
	17:25	18:06	19:43	20:21	20:57	21:24	21:21	20:46	19:52	18:56	17:12	17:00
16	08:11	07:38	07:51	06:55	06:11	05:54	06:09	06:42	07:18	07:54	07:35	08:08
	17:26	18:07	19:44	20:22	20:58	21:24	21:21	20:45	19:51	18:54	17:11	17:00
17	08:11	07:37	07:49	06:53	06:10	05:54	06:10	06:43	07:19	07:55	07:36	08:09
	17:27	18:09	19:45	20:24	21:00	21:25	21:20	20:43	19:49	18:52	17:11	17:01
18	08:10	07:35	07:47	06:51	06:09	05:54	06:11	06:45	07:20	07:57	07:38	08:09
	17:29	18:10	19:47	20:25	21:01	21:25	21:19	20:42	19:47	18:51	17:10	17:01
19	08:09	07:34	07:45	06:50	06:08	05:54	06:12	06:46	07:22	07:58	07:39	08:10
	17:30	18:11	19:48	20:26	21:02	21:25	21:19	20:40	19:45	18:49	17:09	17:01
20	08:09	07:32	07:43	06:48	06:07	05:54	06:13	06:47	07:23	07:59	07:40	08:11
	17:31	18:13	19:49	20:27	21:03	21:26	21:18	20:38	19:43	18:47	17:08	17:02
21	08:08	07:30	07:41	06:46	06:06	05:55	06:14	06:48	07:24	08:01	07:42	08:11
	17:33	18:14	19:50	20:29	21:04	21:26	21:17	20:37	19:41	18:46	17:07	17:02
22	08:07	07:29	07:40	06:45	06:05	05:55	06:15	06:49	07:25	08:02	07:43	08:12
	17:34	18:15	19:52	20:30	21:05	21:26	21:16	20:35	19:39	18:44	17:06	17:03
23	08:06	07:27	07:38	06:43	06:05	05:55	06:16	06:50	07:26	08:03	07:44	08:12
	17:35	18:17	19:53	20:31	21:06	21:27	21:15	20:34	19:38	18:43	17:06	17:03
24	08:06	07:26	07:36	06:41	06:04	05:55	06:17	06:52	07:27	08:04	07:45	08:13
	17:37	18:18	19:54	20:32	21:07	21:27	21:14	20:32	19:36	18:41	17:05	17:04
25	08:05	07:24	07:34	06:40	06:03	05:56	06:18	06:53	07:29	08:06	07:47	08:13
	17:38	18:19	19:55	20:33	21:08	21:27	21:13	20:30	19:34	18:40	17:04	17:04
26	08:04	07:22	07:32	06:38	06:02	05:56	06:19	06:54	07:30	08:07	07:48	08:13
	17:39	18:21	19:57	20:35	21:09	21:27	21:12	20:28	19:32	18:38	17:04	17:05
27	08:03	07:21	07:30	06:37	06:01	05:56	06:20	06:55	07:31	08:08	07:49	08:14
	17:41	18:22	19:58	20:36	21:10	21:27	21:11	20:27	19:30	18:36	17:03	17:06
28	08:02	07:19	07:29	06:35	06:01	05:57	06:21	06:56	07:32	08:10	07:50	08:14
	17:42	18:23	19:59	20:37	21:11	21:27	21:10	20:25	19:28	18:35	17:03	17:06
29	08:01		07:27	06:34	06:00	05:57	06:22	06:57	07:33	08:11	07:51	08:14
	17:43		20:00	20:38	21:12	21:27	21:09	20:23	19:26	18:34	17:02	17:07
30	08:00		07:25	06:32	05:59	05:58	06:23	06:58	07:35	08:12	07:53	08:14
	17:45		20:02	20:40	21:13	21:27	21:08	20:22	19:24	18:32	17:02	17:08
31	07:59		07:23		05:59		06:24	07:00		08:14		08:15
	17:46		20:03		21:14		21:07	20:20		18:31		17:09
Potential sun hours	288	292	369	403	457	464	470	435	377	342	289	277
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
TEST license
This license is only to be used for testing purposes

Ramos, Tiffanie / tiffanie.ramos@tetratech.com
Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 8 - Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:15	07:58	07:17	07:21	06:31	05:58	05:58	06:25	07:01	07:36	07:15	07:54
	17:10	17:48	18:25	20:04	20:41	21:14	21:27	21:06	20:18	19:23	17:29	17:01
2	08:15	07:57	07:15	07:19	06:29	05:58	05:59	06:26	07:02	07:37	07:16	07:55
	17:11	17:49	18:26	20:05	20:42	21:15	21:27	21:04	20:16	19:21	17:28	17:01
3	08:15	07:55	07:14	07:18	06:28	05:57	05:59	06:27	07:03	07:38	07:18	07:56
	17:12	17:50	18:27	20:07	20:43	21:16	21:26	21:03	20:14	19:19	17:27	17:01
4	08:15	07:54	07:12	07:16	06:26	05:57	06:00	06:29	07:04	07:39	07:19	07:57
	17:13	17:52	18:29	20:08	20:44	21:17	21:26	21:02	20:13	19:17	17:25	17:00
5	08:15	07:53	07:10	07:14	06:25	05:56	06:00	06:30	07:05	07:41	07:20	07:58
	17:14	17:53	18:30	20:09	20:46	21:18	21:26	21:01	20:11	19:15	17:24	17:00
6	08:15	07:52	07:09	07:12	06:24	05:56	06:01	06:31	07:07	07:42	07:22	07:59
	17:15	17:55	18:31	20:10	20:47	21:18	21:26	20:59	20:09	19:13	17:23	17:00
7	08:14	07:51	07:07	07:10	06:22	05:56	06:02	06:32	07:08	07:43	07:23	08:00
	17:16	17:56	18:33	20:11	20:48	21:19	21:25	20:58	20:07	19:12	17:21	17:00
8	08:14	07:49	08:05	07:09	06:21	05:55	06:03	06:33	07:09	07:44	07:24	08:01
	17:17	17:57	18:34	20:13	20:49	21:20	21:25	20:57	20:05	19:10	17:20	17:00
9	08:14	07:48	08:03	07:07	06:20	05:55	06:03	06:34	07:10	07:45	07:26	08:02
	17:18	17:59	19:35	20:14	20:50	21:21	21:25	20:55	20:04	19:08	17:19	17:00
10	08:14	07:47	08:01	07:05	06:18	05:55	06:04	06:35	07:11	07:47	07:27	08:03
	17:19	18:00	19:37	20:15	20:52	21:21	21:24	20:54	20:02	19:06	17:18	17:00
11	08:13	07:45	08:00	07:03	06:17	05:54	06:05	06:37	07:12	07:48	07:28	08:04
	17:20	18:00	19:38	20:16	20:53	21:22	21:24	20:52	20:00	19:05	17:17	17:00
12	08:13	07:44	07:58	07:02	06:16	05:54	06:06	06:38	07:13	07:49	07:30	08:05
	17:21	18:02	19:39	20:18	20:54	21:22	21:23	20:51	19:58	19:03	17:16	17:00
13	08:13	07:42	07:56	07:00	06:15	05:54	06:06	06:39	07:15	07:50	07:31	08:06
	17:22	18:03	19:40	20:19	20:55	21:23	21:23	20:49	19:56	19:01	17:14	17:00
14	08:12	07:41	07:54	06:58	06:14	05:54	06:07	06:40	07:16	07:52	07:32	08:06
	17:24	18:04	19:42	20:20	20:56	21:23	21:22	20:48	19:54	18:58	17:13	17:00
15	08:12	07:40	07:52	06:56	06:13	05:54	06:08	06:41	07:17	07:53	07:34	08:07
	17:25	18:06	19:43	20:21	20:57	21:24	21:21	20:46	19:52	18:56	17:12	17:00
16	08:11	07:38	07:51	06:55	06:11	05:54	06:09	06:42	07:18	07:54	07:35	08:08
	17:26	18:07	19:44	20:22	20:58	21:24	21:21	20:45	19:51	18:54	17:11	17:00
17	08:11	07:37	07:49	06:53	06:10	05:54	06:10	06:43	07:19	07:55	07:36	08:09
	17:27	18:08	19:45	20:24	21:00	21:25	21:20	20:43	19:49	18:52	17:11	17:01
18	08:10	07:35	07:47	06:51	06:09	05:54	06:11	06:45	07:20	07:57	07:38	08:09
	17:29	18:10	19:47	20:25	21:01	21:25	21:19	20:42	19:47	18:51	17:10	17:01
19	08:09	07:34	07:45	06:50	06:08	05:54	06:12	06:46	07:22	07:58	07:39	08:10
	17:30	18:11	19:48	20:26	21:02	21:25	21:19	20:40	19:45	18:49	17:09	17:01
20	08:09	07:32	07:43	06:48	06:07	05:54	06:13	06:47	07:23	07:59	07:40	08:11
	17:31	18:13	19:49	20:27	21:03	21:26	21:18	20:38	19:43	18:47	17:08	17:02
21	08:08	07:30	07:41	06:46	06:06	05:55	06:14	06:48	07:24	08:01	07:42	08:11
	17:33	18:14	19:50	20:29	21:04	21:26	21:17	20:37	19:41	18:46	17:07	17:02
22	08:07	07:29	07:40	06:45	06:05	05:55	06:15	06:49	07:25	08:02	07:43	08:12
	17:34	18:15	19:52	20:30	21:05	21:26	21:16	20:35	19:39	18:44	17:06	17:03
23	08:06	07:27	07:38	06:43	06:05	05:55	06:16	06:50	07:26	08:03	07:44	08:12
	17:35	18:17	19:53	20:31	21:06	21:27	21:15	20:34	19:38	18:43	17:06	17:03
24	08:06	07:26	07:36	06:41	06:04	05:55	06:17	06:52	07:27	08:04	07:45	08:13
	17:37	18:18	19:54	20:32	21:07	21:27	21:14	20:32	19:36	18:41	17:05	17:04
25	08:05	07:24	07:34	06:40	06:03	05:56	06:18	06:53	07:29	08:06	07:47	08:13
	17:38	18:19	19:55	20:33	21:08	21:27	21:13	20:30	19:34	18:40	17:04	17:04
26	08:04	07:22	07:32	06:38	06:02	05:56	06:19	06:54	07:30	08:07	07:48	08:13
	17:39	18:21	19:57	20:35	21:09	21:27	21:12	20:28	19:32	18:38	17:04	17:05
27	08:03	07:21	07:30	06:37	06:01	05:56	06:20	06:55	07:31	08:08	07:49	08:14
	17:41	18:22	19:58	20:36	21:10	21:27	21:11	20:27	19:30	18:36	17:03	17:06
28	08:02	07:19	07:29	06:35	06:01	05:57	06:21	06:56	07:32	08:10	07:50	08:14
	17:42	18:23	19:59	20:37	21:11	21:27	21:10	20:25	19:28	18:35	17:03	17:06
29	08:01		07:27	06:34	06:00	05:57	06:22	06:57	07:33	08:11	07:51	08:14
	17:43		20:00	20:38	21:12	21:27	21:09	20:23	19:26	18:34	17:02	17:07
30	08:00		07:25	06:32	05:59	05:58	06:23	06:58	07:35	08:12	07:53	08:14
	17:45		20:02	20:40	21:13	21:27	21:08	20:22	19:24	18:32	17:02	17:08
31	07:59		07:23		05:59		06:24	07:00		08:14		08:15
	17:46		20:03		21:14		21:07	20:20		18:31		17:09
Potential sun hours	288	292	369	403	457	464	470	435	377	342	289	277
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
TEST license
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Ramos, Tiffanie / tiffanie.ramos@tetratech.com
Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 9 - Non-Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:15	07:58	07:17	07:21	06:31	05:58	05:58	06:25	07:01	07:36	07:15	07:54
	17:10	17:48	18:25	20:04	20:41	21:14	21:27	21:05	20:18	19:23	17:29	17:01
2	08:15	07:56	07:15	07:19	06:29	05:58	05:59	06:26	07:02	07:37	07:16	07:55
	17:11	17:49	18:26	20:05	20:42	21:15	21:26	21:04	20:16	19:21	17:28	17:01
3	08:15	07:55	07:14	07:18	06:28	05:57	05:59	06:27	07:03	07:38	07:18	07:56
	17:12	17:50	18:27	20:06	20:43	21:16	21:26	21:03	20:14	19:19	17:26	17:01
4	08:15	07:54	07:12	07:16	06:26	05:57	06:00	06:29	07:04	07:39	07:19	07:57
	17:13	17:52	18:29	20:08	20:44	21:17	21:26	21:02	20:13	19:17	17:25	17:00
5	08:15	07:53	07:10	07:14	06:25	05:56	06:01	06:30	07:05	07:40	07:20	07:58
	17:14	17:53	18:30	20:09	20:45	21:17	21:26	21:00	20:11	19:15	17:24	17:00
6	08:14	07:52	07:08	07:12	06:24	05:56	06:01	06:31	07:06	07:42	07:22	07:59
	17:15	17:55	18:31	20:10	20:47	21:18	21:25	20:59	20:09	19:13	17:23	17:00
7	08:14	07:50	07:07	07:10	06:22	05:56	06:02	06:32	07:08	07:43	07:23	08:00
	17:16	17:56	18:33	20:11	20:48	21:19	21:25	20:58	20:07	19:12	17:21	17:00
8	08:14	07:49	08:05	07:09	06:21	05:55	06:03	06:33	07:09	07:44	07:24	08:01
	17:17	17:57	18:34	20:13	20:49	21:20	21:25	20:56	20:05	19:10	17:20	17:00
9	08:14	07:48	08:03	07:07	06:20	05:55	06:03	06:34	07:10	07:45	07:26	08:02
	17:18	17:59	19:35	20:14	20:50	21:20	21:24	20:55	20:03	19:08	17:19	17:00
10	08:14	07:46	08:01	07:05	06:18	05:55	06:04	06:35	07:11	07:47	07:27	08:03
	17:19	18:00	19:36	20:15	20:51	21:21	21:24	20:54	20:02	19:06	17:18	17:00
11	08:13	07:45	08:00	07:03	06:17	05:55	06:05	06:36	07:12	07:48	07:28	08:04
	17:20	18:00	19:38	20:16	20:52	21:22	21:23	20:52	20:00	19:04	17:17	17:00
12	08:13	07:44	07:58	07:01	06:16	05:54	06:06	06:38	07:13	07:49	07:30	08:05
	17:21	18:02	19:39	20:17	20:54	21:22	21:23	20:51	19:58	19:03	17:16	17:00
13	08:12	07:42	07:56	07:00	06:15	05:54	06:06	06:39	07:15	07:50	07:31	08:05
	17:22	18:03	19:40	20:19	20:55	21:23	21:22	20:49	19:56	19:01	17:14	17:00
14	08:12	07:41	07:54	06:58	06:14	05:54	06:07	06:40	07:16	07:51	07:32	08:06
	17:24	18:04	19:42	20:20	20:56	21:23	21:22	20:48	19:54	18:57	17:13	17:00
15	08:12	07:39	07:52	06:56	06:13	05:54	06:08	06:41	07:17	07:53	07:34	08:07
	17:25	18:06	19:43	20:21	20:57	21:24	21:21	20:46	19:52	18:56	17:12	17:00
16	08:11	07:38	07:51	06:55	06:11	05:54	06:09	06:42	07:18	07:54	07:35	08:08
	17:26	18:07	19:44	20:22	20:58	21:24	21:21	20:45	19:50	18:54	17:11	17:00
17	08:10	07:36	07:49	06:53	06:10	05:54	06:10	06:43	07:19	07:55	07:36	08:08
	17:27	18:08	19:45	20:24	20:59	21:25	21:20	20:43	19:49	18:52	17:10	17:01
18	08:10	07:35	07:47	06:51	06:09	05:54	06:11	06:45	07:20	07:57	07:38	08:09
	17:29	18:10	19:47	20:25	21:00	21:25	21:19	20:41	19:47	18:51	17:10	17:01
19	08:09	07:33	07:45	06:50	06:08	05:54	06:12	06:46	07:21	07:58	07:39	08:10
	17:30	18:11	19:48	20:26	21:01	21:25	21:18	20:40	19:45	18:49	17:09	17:01
20	08:08	07:32	07:43	06:48	06:07	05:54	06:13	06:47	07:23	07:59	07:40	08:10
	17:31	18:13	19:49	20:27	21:03	21:26	21:17	20:38	19:43	18:47	17:08	17:02
21	08:08	07:30	07:41	06:46	06:06	05:55	06:14	06:48	07:24	08:00	07:41	08:11
	17:33	18:14	19:50	20:28	21:04	21:26	21:17	20:37	19:41	18:46	17:07	17:02
22	08:07	07:29	07:40	06:45	06:05	05:55	06:15	06:49	07:25	08:02	07:43	08:11
	17:34	18:15	19:52	20:30	21:05	21:26	21:16	20:35	19:39	18:44	17:06	17:03
23	08:06	07:27	07:38	06:43	06:05	05:55	06:16	06:50	07:26	08:03	07:44	08:12
	17:35	18:17	19:53	20:31	21:06	21:26	21:15	20:33	19:37	18:43	17:06	17:03
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25	08:05	07:24	07:34	06:40	06:03	05:56	06:18	06:53	07:28	08:06	07:46	08:13
	17:38	18:19	19:55	20:33	21:08	21:27	21:13	20:30	19:34	18:39	17:04	17:04
26	08:04	07:22	07:32	06:38	06:02	05:56	06:19	06:54	07:30	08:07	07:48	08:13
	17:39	18:21	19:57	20:35	21:09	21:27	21:12	20:28	19:32	18:38	17:04	17:05
27	08:03	07:20	07:30	06:37	06:01	05:56	06:20	06:55	07:31	08:08	07:49	08:13
	17:41	18:22	19:58	20:36	21:10	21:27	21:11	20:27	19:30	18:36	17:03	17:06
28	08:02	07:19	07:28	06:35	06:01	05:57	06:21	06:56	07:32	08:10	07:50	08:14
	17:42	18:23	19:59	20:37	21:11	21:27	21:10	20:25	19:28	18:35	17:03	17:06
29	08:01		07:27	06:34	06:00	05:57	06:22	06:57	07:33	08:11	07:51	08:14
	17:43		20:00	20:38	21:12	21:27	21:09	20:23	19:26	18:33	17:02	17:07
30	08:00		07:25	06:32	05:59	05:58	06:23	06:58	07:34	08:12	07:52	08:14
	17:45		20:01	20:39	21:12	21:27	21:08	20:21	19:24	18:32	17:02	17:08
31	07:59		07:23		05:59		06:24	07:00		08:13		08:14
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Project:
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Description:
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Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 10 - Non-Participant

Assumptions for shadow calculations

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Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:15	07:58	07:17	07:21	06:31	05:58	05:58	06:25	07:01	07:36	07:15	07:54
	17:10	17:48	18:25	20:04	20:41	21:14	21:27	21:05	20:18	19:23	17:29	17:01
2	08:15	07:56	07:15	07:19	06:29	05:58	05:59	06:26	07:02	07:37	07:16	07:55
	17:11	17:49	18:26	20:05	20:42	21:15	21:26	21:04	20:16	19:21	17:28	17:01
3	08:15	07:55	07:14	07:18	06:28	05:57	05:59	06:27	07:03	07:38	07:18	07:56
	17:12	17:50	18:27	20:06	20:43	21:16	21:26	21:03	20:14	19:19	17:26	17:01
4	08:15	07:54	07:12	07:16	06:26	05:57	06:00	06:29	07:04	07:39	07:19	07:57
	17:13	17:52	18:29	20:08	20:44	21:17	21:26	21:02	20:13	19:17	17:25	17:00
5	08:15	07:53	07:10	07:14	06:25	05:56	06:01	06:30	07:05	07:40	07:20	07:58
	17:14	17:53	18:30	20:09	20:45	21:17	21:26	21:00	20:11	19:15	17:24	17:00
6	08:14	07:52	07:08	07:12	06:24	05:56	06:01	06:31	07:06	07:42	07:22	07:59
	17:15	17:55	18:31	20:10	20:47	21:18	21:25	20:59	20:09	19:13	17:23	17:00
7	08:14	07:50	07:07	07:10	06:22	05:56	06:02	06:32	07:08	07:43	07:23	08:00
	17:16	17:56	18:33	20:11	20:48	21:19	21:25	20:58	20:07	19:12	17:21	17:00
8	08:14	07:49	08:05	07:09	06:21	05:55	06:03	06:33	07:09	07:44	07:24	08:01
	17:17	17:57	18:34	20:13	20:49	21:20	21:25	20:56	20:05	19:10	17:20	17:00
9	08:14	07:48	08:03	07:07	06:20	05:55	06:03	06:34	07:10	07:45	07:26	08:02
	17:18	17:59	19:35	20:14	20:50	21:20	21:24	20:55	20:03	19:08	17:19	17:00
10	08:14	07:46	08:01	07:05	06:18	05:55	06:04	06:35	07:11	07:47	07:27	08:03
	17:19	18:00	19:36	20:15	20:51	21:21	21:24	20:54	20:02	19:06	17:18	17:00
11	08:13	07:45	08:00	07:03	06:17	05:55	06:05	06:36	07:12	07:48	07:28	08:04
	17:20	18:00	19:38	20:16	20:52	21:22	21:23	20:52	20:00	19:04	17:17	17:00
12	08:13	07:44	07:58	07:01	06:16	05:54	06:06	06:38	07:13	07:49	07:30	08:05
	17:21	18:02	19:39	20:17	20:54	21:22	21:23	20:51	19:58	19:03	17:16	17:00
13	08:12	07:42	07:56	07:00	06:15	05:54	06:06	06:39	07:15	07:50	07:31	08:05
	17:22	18:03	19:40	20:19	20:55	21:23	21:22	20:49	19:56	19:01	17:14	17:00
14	08:12	07:41	07:54	06:58	06:14	05:54	06:07	06:40	07:16	07:51	07:32	08:06
	17:24	18:04	19:42	20:20	20:56	21:23	21:22	20:48	19:54	18:57	17:13	17:00
15	08:12	07:39	07:52	06:56	06:13	05:54	06:08	06:41	07:17	07:53	07:34	08:07
	17:25	18:06	19:43	20:21	20:57	21:24	21:21	20:46	19:52	18:56	17:12	17:00
16	08:11	07:38	07:51	06:55	06:11	05:54	06:09	06:42	07:18	07:54	07:35	08:08
	17:26	18:07	19:44	20:22	20:58	21:24	21:21	20:45	19:50	18:54	17:11	17:00
17	08:10	07:36	07:49	06:53	06:10	05:54	06:10	06:43	07:19	07:55	07:36	08:08
	17:27	18:08	19:45	20:24	20:59	21:25	21:20	20:43	19:49	18:52	17:10	17:01
18	08:10	07:35	07:47	06:51	06:09	05:54	06:11	06:45	07:20	07:57	07:38	08:09
	17:29	18:10	19:47	20:25	21:00	21:25	21:19	20:41	19:47	18:51	17:10	17:01
19	08:09	07:33	07:45	06:50	06:08	05:54	06:12	06:46	07:21	07:58	07:39	08:10
	17:30	18:11	19:48	20:26	21:01	21:25	21:18	20:40	19:45	18:49	17:09	17:01
20	08:08	07:32	07:43	06:48	06:07	05:54	06:13	06:47	07:23	07:59	07:40	08:10
	17:31	18:13	19:49	20:27	21:03	21:26	21:17	20:38	19:43	18:47	17:08	17:02
21	08:08	07:30	07:41	06:46	06:06	05:55	06:14	06:48	07:24	08:00	07:41	08:11
	17:33	18:14	19:50	20:28	21:04	21:26	21:17	20:37	19:41	18:46	17:07	17:02
22	08:07	07:29	07:40	06:45	06:05	05:55	06:15	06:49	07:25	08:02	07:43	08:11
	17:34	18:15	19:52	20:30	21:05	21:26	21:16	20:35	19:39	18:44	17:06	17:03
23	08:06	07:27	07:38	06:43	06:05	05:55	06:16	06:50	07:26	08:03	07:44	08:12
	17:35	18:17	19:53	20:31	21:06	21:26	21:15	20:33	19:37	18:43	17:06	17:03
24	08:05	07:25	07:36	06:41	06:04	05:55	06:17	06:51	07:27	08:04	07:45	08:12
	17:37	18:18	19:54	20:32	21:07	21:26	21:14	20:32	19:36	18:41	17:05	17:04
25	08:05	07:24	07:34	06:40	06:03	05:56	06:18	06:53	07:28	08:06	07:46	08:13
	17:38	18:19	19:55	20:33	21:08	21:27	21:13	20:30	19:34	18:39	17:04	17:04
26	08:04	07:22	07:32	06:38	06:02	05:56	06:19	06:54	07:30	08:07	07:48	08:13
	17:39	18:21	19:57	20:35	21:09	21:27	21:12	20:28	19:32	18:38	17:04	17:05
27	08:03	07:20	07:30	06:37	06:01	05:56	06:20	06:55	07:31	08:08	07:49	08:13
	17:41	18:22	19:58	20:36	21:10	21:27	21:11	20:27	19:30	18:36	17:03	17:06
28	08:02	07:19	07:28	06:35	06:01	05:57	06:21	06:56	07:32	08:10	07:50	08:14
	17:42	18:23	19:59	20:37	21:11	21:27	21:10	20:25	19:28	18:35	17:03	17:06
29	08:01		07:27	06:34	06:00	05:57	06:22	06:57	07:33	08:11	07:51	08:14
	17:43		20:00	20:38	21:12	21:27	21:09	20:23	19:26	18:33	17:02	17:07
30	08:00		07:25	06:32	05:59	05:58	06:23	06:58	07:34	08:12	07:52	08:14
	17:45		20:01	20:39	21:12	21:27	21:08	20:21	19:24	18:32	17:02	17:08
31	07:59		07:23		05:59		06:24	07:00		08:13		08:14
	17:46		20:03		21:13		21:06	20:20		18:31		17:09
Potential sun hours	288	292	369	403	457	464	470	435	377	342	290	277
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
TEST license
This license is only to be used for testing purposes

Ramos, Tiffanie / tiffanie.ramos@tetratech.com
Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 11 - Non-Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:15	07:58	07:17	07:21	06:31	05:58	05:58	06:25	07:01	07:36	07:15	07:54
	17:10	17:47	18:25	20:04	20:41	21:14	21:27	21:05	20:18	19:22	17:29	17:01
2	08:15	07:57	07:15	07:19	06:29	05:57	05:58	06:26	07:02	07:37	07:16	07:55
	17:11	17:49	18:26	20:05	20:42	21:15	21:27	21:04	20:16	19:21	17:28	17:01
3	08:15	07:55	07:14	07:17	06:28	05:57	05:59	06:27	07:03	07:38	07:18	07:56
	17:11	17:50	18:27	20:06	20:43	21:16	21:26	21:03	20:14	19:19	17:26	17:00
4	08:15	07:54	07:12	07:16	06:26	05:56	06:00	06:28	07:04	07:39	07:19	07:57
	17:12	17:52	18:29	20:08	20:44	21:17	21:26	21:02	20:13	19:17	17:25	17:00
5	08:15	07:53	07:10	07:14	06:25	05:56	06:00	06:29	07:05	07:40	07:20	07:58
	17:13	17:53	18:30	20:09	20:45	21:18	21:26	21:00	20:11	19:15	17:24	17:00
6	08:15	07:52	07:08	07:12	06:23	05:56	06:01	06:31	07:06	07:42	07:22	07:59
	17:14	17:54	18:31	20:10	20:47	21:18	21:26	20:59	20:09	19:13	17:22	17:00
7	08:14	07:50	07:07	07:10	06:22	05:55	06:02	06:32	07:08	07:43	07:23	08:00
	17:15	17:56	18:32	20:11	20:48	21:19	21:25	20:58	20:07	19:12	17:21	16:59
8	08:14	07:49	08:05	07:08	06:21	05:55	06:02	06:33	07:09	07:44	07:24	08:01
	17:17	17:57	18:34	20:13	20:49	21:20	21:25	20:56	20:05	19:10	17:20	16:59
9	08:14	07:48	08:03	07:07	06:20	05:55	06:03	06:34	07:10	07:45	07:26	08:02
	17:18	17:59	19:35	20:14	20:50	21:20	21:25	20:55	20:03	19:08	17:19	16:59
10	08:14	07:46	08:01	07:05	06:18	05:54	06:04	06:35	07:11	07:46	07:27	08:03
	17:19	18:00	19:36	20:15	20:51	21:21	21:24	20:54	20:02	19:06	17:18	16:59
11	08:13	07:45	08:00	07:03	06:17	05:54	06:05	06:36	07:12	07:48	07:28	08:04
	17:20	18:00	19:38	20:16	20:53	21:22	21:24	20:52	20:00	19:04	17:16	16:59
12	08:13	07:44	07:58	07:01	06:16	05:54	06:05	06:37	07:13	07:49	07:30	08:05
	17:21	18:01	19:39	20:17	20:54	21:22	21:23	20:51	19:58	19:03	17:15	16:59
13	08:13	07:42	07:56	07:00	06:15	05:54	06:06	06:39	07:14	07:50	07:31	08:06
	17:22	18:03	19:40	20:19	20:55	21:23	21:23	20:49	19:56	19:01	17:14	16:59
14	08:12	07:41	07:54	06:58	06:13	05:54	06:07	06:40	07:16	07:51	07:32	08:06
	17:23	18:04	19:41	20:20	20:56	21:23	21:22	20:48	19:54	18:57	17:13	17:00
15	08:12	07:39	07:52	06:56	06:12	05:54	06:08	06:41	07:17	07:53	07:34	08:07
	17:25	18:06	19:43	20:21	20:57	21:24	21:21	20:46	19:52	18:56	17:12	17:00
16	08:11	07:38	07:50	06:54	06:11	05:54	06:09	06:42	07:18	07:54	07:35	08:08
	17:26	18:07	19:44	20:22	20:58	21:24	21:21	20:45	19:50	18:54	17:11	17:00
17	08:11	07:36	07:49	06:53	06:10	05:54	06:10	06:43	07:19	07:55	07:36	08:09
	17:27	18:08	19:45	20:24	20:59	21:25	21:20	20:43	19:49	18:52	17:10	17:00
18	08:10	07:35	07:47	06:51	06:09	05:54	06:11	06:44	07:20	07:57	07:38	08:09
	17:28	18:10	19:47	20:25	21:01	21:25	21:19	20:42	19:47	18:51	17:09	17:01
19	08:09	07:33	07:45	06:49	06:08	05:54	06:12	06:46	07:21	07:58	07:39	08:10
	17:30	18:11	19:48	20:26	21:02	21:25	21:18	20:40	19:45	18:49	17:09	17:01
20	08:09	07:32	07:43	06:48	06:07	05:54	06:13	06:47	07:23	07:59	07:40	08:11
	17:31	18:12	19:49	20:27	21:03	21:26	21:18	20:38	19:43	18:47	17:08	17:01
21	08:08	07:30	07:41	06:46	06:06	05:54	06:13	06:48	07:24	08:00	07:41	08:11
	17:32	18:14	19:50	20:28	21:04	21:26	21:17	20:37	19:41	18:46	17:07	17:02
22	08:07	07:29	07:39	06:44	06:05	05:55	06:14	06:49	07:25	08:02	07:43	08:12
	17:34	18:15	19:52	20:30	21:05	21:26	21:16	20:35	19:39	18:44	17:06	17:02
23	08:06	07:27	07:38	06:43	06:04	05:55	06:15	06:50	07:26	08:03	07:44	08:12
	17:35	18:17	19:53	20:31	21:06	21:26	21:15	20:33	19:37	18:42	17:05	17:03
24	08:06	07:25	07:36	06:41	06:04	05:55	06:16	06:51	07:27	08:04	07:45	08:13
	17:36	18:18	19:54	20:32	21:07	21:27	21:14	20:32	19:35	18:41	17:05	17:03
25	08:05	07:24	07:34	06:40	06:03	05:55	06:18	06:52	07:28	08:06	07:47	08:13
	17:38	18:19	19:55	20:33	21:08	21:27	21:13	20:30	19:34	18:39	17:04	17:04
26	08:04	07:22	07:32	06:38	06:02	05:56	06:19	06:54	07:30	08:07	07:48	08:13
	17:39	18:21	19:56	20:35	21:09	21:27	21:12	20:28	19:32	18:38	17:03	17:05
27	08:03	07:20	07:30	06:37	06:01	05:56	06:20	06:55	07:31	08:08	07:49	08:14
	17:40	18:22	19:58	20:36	21:10	21:27	21:11	20:27	19:30	18:36	17:03	17:05
28	08:02	07:19	07:28	06:35	06:00	05:56	06:21	06:56	07:32	08:10	07:50	08:14
	17:42	18:23	19:59	20:37	21:11	21:27	21:10	20:25	19:28	18:35	17:02	17:06
29	08:01		07:27	06:33	06:00	05:57	06:22	06:57	07:33	08:11	07:51	08:14
	17:43		20:00	20:38	21:12	21:27	21:09	20:23	19:26	18:33	17:02	17:07
30	08:00		07:25	06:32	05:59	05:57	06:23	06:58	07:34	08:12	07:53	08:14
	17:45		20:01	20:39	21:13	21:27	21:08	20:21	19:24	18:32	17:01	17:08
31	07:59		07:23		05:59		06:24	06:59		08:14		08:14
	17:46		20:03		21:14		21:07	20:20		18:30		17:09
Potential sun hours	288	292	369	403	457	464	470	435	377	342	289	277
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
TEST license
This license is only to be used for testing purposes

Ramos, Tiffanie / tiffanie.ramos@tetratech.com
Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 12 - Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:15	07:58	07:17	07:21	06:31	05:58	05:58	06:25	07:01	07:36	07:15	07:54
	17:10	17:47	18:25	20:04	20:41	21:14	21:27	21:06	20:18	19:23	17:29	17:01
2	08:15	07:57	07:15	07:19	06:29	05:57	05:58	06:26	07:02	07:37	07:16	07:55
	17:11	17:49	18:26	20:05	20:42	21:15	21:27	21:04	20:16	19:21	17:28	17:01
3	08:15	07:55	07:14	07:17	06:28	05:57	05:59	06:27	07:03	07:38	07:18	07:56
	17:11	17:50	18:27	20:06	20:43	21:16	21:27	21:03	20:14	19:19	17:26	17:00
4	08:15	07:54	07:12	07:16	06:26	05:56	06:00	06:28	07:04	07:39	07:19	07:57
	17:12	17:52	18:29	20:08	20:44	21:17	21:26	21:02	20:13	19:17	17:25	17:00
5	08:15	07:53	07:10	07:14	06:25	05:56	06:00	06:29	07:05	07:40	07:20	07:58
	17:13	17:53	18:30	20:09	20:46	21:18	21:26	21:01	20:11	19:15	17:24	17:00
6	08:15	07:52	07:08	07:12	06:23	05:56	06:01	06:31	07:06	07:42	07:22	07:59
	17:14	17:54	18:31	20:10	20:47	21:18	21:26	20:59	20:09	19:13	17:22	17:00
7	08:14	07:51	07:07	07:10	06:22	05:55	06:02	06:32	07:08	07:43	07:23	08:00
	17:15	17:56	18:33	20:11	20:48	21:19	21:25	20:58	20:07	19:12	17:21	16:59
8	08:14	07:49	08:05	07:08	06:21	05:55	06:02	06:33	07:09	07:44	07:24	08:01
	17:17	17:57	18:34	20:13	20:49	21:20	21:25	20:56	20:05	19:10	17:20	16:59
9	08:14	07:48	08:03	07:07	06:20	05:55	06:03	06:34	07:10	07:45	07:26	08:02
	17:18	17:59	19:35	20:14	20:50	21:21	21:25	20:55	20:04	19:08	17:19	16:59
10	08:14	07:47	08:01	07:05	06:18	05:54	06:04	06:35	07:11	07:47	07:27	08:03
	17:19	18:00	19:36	20:15	20:52	21:21	21:24	20:54	20:02	19:06	17:18	16:59
11	08:13	07:45	08:00	07:03	06:17	05:54	06:05	06:36	07:12	07:48	07:28	08:04
	17:20	18:00	19:38	20:16	20:53	21:22	21:24	20:52	20:00	19:04	17:16	16:59
12	08:13	07:44	07:58	07:01	06:16	05:54	06:05	06:37	07:13	07:49	07:30	08:05
	17:21	18:01	19:39	20:17	20:54	21:22	21:23	20:51	19:58	19:03	17:15	16:59
13	08:13	07:42	07:56	07:00	06:15	05:54	06:06	06:39	07:15	07:50	07:31	08:06
	17:22	18:03	19:40	20:19	20:55	21:23	21:23	20:49	19:56	19:01	17:14	16:59
14	08:12	07:41	07:54	06:58	06:13	05:54	06:07	06:40	07:16	07:52	07:32	08:06
	17:23	18:04	19:42	20:20	20:56	21:23	21:22	20:48	19:54	18:57	17:13	17:00
15	08:12	07:40	07:52	06:56	06:12	05:54	06:08	06:41	07:17	07:53	07:34	08:07
	17:25	18:06	19:43	20:21	20:57	21:24	21:21	20:46	19:52	18:56	17:12	17:00
16	08:11	07:38	07:51	06:54	06:11	05:54	06:09	06:42	07:18	07:54	07:35	08:08
	17:26	18:07	19:44	20:22	20:58	21:24	21:21	20:45	19:51	18:54	17:11	17:00
17	08:11	07:37	07:49	06:53	06:10	05:54	06:10	06:43	07:19	07:55	07:36	08:09
	17:27	18:08	19:45	20:24	21:00	21:25	21:20	20:43	19:49	18:52	17:10	17:00
18	08:10	07:35	07:47	06:51	06:09	05:54	06:11	06:44	07:20	07:57	07:38	08:09
	17:28	18:10	19:47	20:25	21:01	21:25	21:19	20:42	19:47	18:51	17:09	17:01
19	08:09	07:33	07:45	06:49	06:08	05:54	06:12	06:46	07:21	07:58	07:39	08:10
	17:30	18:11	19:48	20:26	21:02	21:26	21:19	20:40	19:45	18:49	17:09	17:01
20	08:09	07:32	07:43	06:48	06:07	05:54	06:13	06:47	07:23	07:59	07:40	08:11
	17:31	18:12	19:49	20:27	21:03	21:26	21:18	20:38	19:43	18:47	17:08	17:01
21	08:08	07:30	07:41	06:46	06:06	05:54	06:13	06:48	07:24	08:00	07:42	08:11
	17:32	18:14	19:50	20:29	21:04	21:26	21:17	20:37	19:41	18:46	17:07	17:02
22	08:07	07:29	07:39	06:44	06:05	05:54	06:14	06:49	07:25	08:02	07:43	08:12
	17:34	18:15	19:52	20:30	21:05	21:26	21:16	20:35	19:39	18:44	17:06	17:02
23	08:06	07:27	07:38	06:43	06:04	05:55	06:15	06:50	07:26	08:03	07:44	08:12
	17:35	18:17	19:53	20:31	21:06	21:27	21:15	20:34	19:37	18:42	17:05	17:03
24	08:06	07:25	07:36	06:41	06:04	05:55	06:16	06:51	07:27	08:04	07:45	08:13
	17:36	18:18	19:54	20:32	21:07	21:27	21:14	20:32	19:36	18:41	17:05	17:03
25	08:05	07:24	07:34	06:40	06:03	05:55	06:18	06:53	07:28	08:06	07:47	08:13
	17:38	18:19	19:55	20:33	21:08	21:27	21:13	20:30	19:34	18:39	17:04	17:04
26	08:04	07:22	07:32	06:38	06:02	05:56	06:19	06:54	07:30	08:07	07:48	08:13
	17:39	18:21	19:57	20:35	21:09	21:27	21:12	20:28	19:32	18:38	17:03	17:05
27	08:03	07:21	07:30	06:37	06:01	05:56	06:20	06:55	07:31	08:08	07:49	08:14
	17:40	18:22	19:58	20:36	21:10	21:27	21:11	20:27	19:30	18:36	17:03	17:05
28	08:02	07:19	07:28	06:35	06:00	05:56	06:21	06:56	07:32	08:10	07:50	08:14
	17:42	18:23	19:59	20:37	21:11	21:27	21:10	20:25	19:28	18:35	17:02	17:06
29	08:01		07:27	06:33	06:00	05:57	06:22	06:57	07:33	08:11	07:51	08:14
	17:43		20:00	20:38	21:12	21:27	21:09	20:23	19:26	18:33	17:02	17:07
30	08:00		07:25	06:32	05:59	05:57	06:23	06:58	07:34	08:12	07:53	08:14
	17:45		20:01	20:40	21:13	21:27	21:08	20:22	19:24	18:32	17:01	17:08
31	07:59		07:23		05:58		06:24	06:59		08:14		08:15
	17:46		20:03		21:14		21:07	20:20		18:30		17:09
Potential sun hours	288	292	369	403	458	464	470	435	377	342	289	276
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
TEST license
This license is only to be used for testing purposes

Ramos, Tiffanie / tiffanie.ramos@tetratech.com
Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 13 - Non-Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:15	07:58	07:17	07:21	06:30	05:58	05:58	06:25	07:00	07:35	07:15	07:54
	17:09	17:47	18:24	20:04	20:41	21:14	21:27	21:05	20:18	19:22	17:29	17:01
2	08:15	07:56	07:15	07:19	06:29	05:57	05:58	06:26	07:02	07:37	07:16	07:55
	17:10	17:49	18:26	20:05	20:42	21:15	21:27	21:04	20:16	19:21	17:28	17:01
3	08:15	07:55	07:14	07:17	06:27	05:57	05:59	06:27	07:03	07:38	07:18	07:56
	17:11	17:50	18:27	20:06	20:43	21:16	21:26	21:03	20:14	19:19	17:26	17:00
4	08:15	07:54	07:12	07:16	06:26	05:56	05:59	06:28	07:04	07:39	07:19	07:57
	17:12	17:51	18:28	20:08	20:44	21:17	21:26	21:02	20:12	19:17	17:25	17:00
5	08:15	07:53	07:10	07:14	06:25	05:56	06:00	06:29	07:05	07:40	07:20	07:58
	17:13	17:53	18:30	20:09	20:45	21:18	21:26	21:00	20:11	19:15	17:24	17:00
6	08:14	07:52	07:08	07:12	06:23	05:55	06:01	06:30	07:06	07:42	07:22	07:59
	17:14	17:54	18:31	20:10	20:47	21:18	21:26	20:59	20:09	19:13	17:22	16:59
7	08:14	07:50	07:07	07:10	06:22	05:55	06:01	06:32	07:07	07:43	07:23	08:00
	17:15	17:56	18:32	20:11	20:48	21:19	21:25	20:58	20:07	19:11	17:21	16:59
8	08:14	07:49	08:05	07:08	06:21	05:55	06:02	06:33	07:09	07:44	07:24	08:01
	17:16	17:57	18:34	20:12	20:49	21:20	21:25	20:56	20:05	19:10	17:20	16:59
9	08:14	07:48	08:03	07:07	06:19	05:55	06:03	06:34	07:10	07:45	07:26	08:02
	17:17	17:58	19:35	20:14	20:50	21:20	21:25	20:55	20:03	19:08	17:19	16:59
10	08:14	07:46	08:01	07:05	06:18	05:54	06:04	06:35	07:11	07:46	07:27	08:03
	17:19	18:00	19:36	20:15	20:51	21:21	21:24	20:54	20:02	19:06	17:17	16:59
11	08:13	07:45	07:59	07:03	06:17	05:54	06:04	06:36	07:12	07:48	07:28	08:04
	17:20	18:00	19:38	20:16	20:53	21:22	21:24	20:52	20:00	19:04	17:16	16:59
12	08:13	07:44	07:58	07:01	06:16	05:54	06:05	06:37	07:13	07:49	07:30	08:05
	17:21	18:01	19:39	20:17	20:54	21:22	21:23	20:51	19:58	19:02	17:15	16:59
13	08:13	07:42	07:56	06:59	06:14	05:54	06:06	06:38	07:14	07:50	07:31	08:06
	17:22	18:03	19:40	20:19	20:55	21:23	21:23	20:49	19:56	19:01	17:14	16:59
14	08:12	07:41	07:54	06:58	06:13	05:54	06:07	06:40	07:16	07:51	07:32	08:06
	17:23	18:04	19:41	20:20	20:56	21:23	21:22	20:48	19:54	18:57	17:13	16:59
15	08:12	07:39	07:52	06:56	06:12	05:54	06:08	06:41	07:17	07:53	07:34	08:07
	17:25	18:05	19:43	20:21	20:57	21:24	21:21	20:46	19:52	18:56	17:12	17:00
16	08:11	07:38	07:50	06:54	06:11	05:54	06:09	06:42	07:18	07:54	07:35	08:08
	17:26	18:07	19:44	20:22	20:58	21:24	21:21	20:45	19:50	18:54	17:11	17:00
17	08:11	07:36	07:49	06:53	06:10	05:54	06:10	06:43	07:19	07:55	07:36	08:09
	17:27	18:08	19:45	20:23	20:59	21:25	21:20	20:43	19:49	18:52	17:10	17:00
18	08:10	07:35	07:47	06:51	06:09	05:54	06:10	06:44	07:20	07:56	07:38	08:09
	17:28	18:10	19:46	20:25	21:00	21:25	21:19	20:41	19:47	18:50	17:09	17:01
19	08:09	07:33	07:45	06:49	06:08	05:54	06:11	06:45	07:21	07:58	07:39	08:10
	17:30	18:11	19:48	20:26	21:02	21:25	21:18	20:40	19:45	18:49	17:08	17:01
20	08:09	07:32	07:43	06:48	06:07	05:54	06:12	06:47	07:22	07:59	07:40	08:10
	17:31	18:12	19:49	20:27	21:03	21:26	21:18	20:38	19:43	18:47	17:08	17:01
21	08:08	07:30	07:41	06:46	06:06	05:54	06:13	06:48	07:24	08:00	07:41	08:11
	17:32	18:14	19:50	20:28	21:04	21:26	21:17	20:37	19:41	18:46	17:07	17:02
22	08:07	07:29	07:39	06:44	06:05	05:54	06:14	06:49	07:25	08:02	07:43	08:12
	17:34	18:15	19:51	20:30	21:05	21:26	21:16	20:35	19:39	18:44	17:06	17:02
23	08:06	07:27	07:38	06:43	06:04	05:55	06:15	06:50	07:26	08:03	07:44	08:12
	17:35	18:16	19:53	20:31	21:06	21:26	21:15	20:33	19:37	18:42	17:05	17:03
24	08:05	07:25	07:36	06:41	06:03	05:55	06:16	06:51	07:27	08:04	07:45	08:12
	17:36	18:18	19:54	20:32	21:07	21:27	21:14	20:32	19:35	18:41	17:05	17:03
25	08:05	07:24	07:34	06:39	06:03	05:55	06:17	06:52	07:28	08:06	07:47	08:13
	17:38	18:19	19:55	20:33	21:08	21:27	21:13	20:30	19:34	18:39	17:04	17:04
26	08:04	07:22	07:32	06:38	06:02	05:56	06:18	06:54	07:30	08:07	07:48	08:13
	17:39	18:20	19:56	20:35	21:09	21:27	21:12	20:28	19:32	18:38	17:03	17:05
27	08:03	07:20	07:30	06:36	06:01	05:56	06:19	06:55	07:31	08:08	07:49	08:14
	17:40	18:22	19:58	20:36	21:10	21:27	21:11	20:27	19:30	18:36	17:03	17:05
28	08:02	07:19	07:28	06:35	06:00	05:56	06:21	06:56	07:32	08:09	07:50	08:14
	17:42	18:23	19:59	20:37	21:11	21:27	21:10	20:25	19:28	18:35	17:02	17:06
29	08:01		07:26	06:33	06:00	05:57	06:22	06:57	07:33	08:11	07:51	08:14
	17:43		20:00	20:38	21:12	21:27	21:09	20:23	19:26	18:33	17:02	17:07
30	08:00		07:25	06:32	05:59	05:57	06:23	06:58	07:34	08:12	07:53	08:14
	17:44		20:01	20:39	21:13	21:27	21:08	20:21	19:24	18:32	17:01	17:08
31	07:59		07:23		05:58		06:24	06:59		08:13		08:14
	17:46		20:03		21:13		21:07	20:20		18:30		17:08
Potential sun hours	288	292	369	403	458	464	470	435	377	342	289	276
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
TEST license
This license is only to be used for testing purposes

Ramos, Tiffanie / tiffanie.ramos@tetratech.com
Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 14 - Non-Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:15	07:58	07:17	07:21	06:31	05:58	05:58	06:25	07:01	07:36	07:15	07:54
	17:10	17:47	18:25	20:04	20:41	21:15	21:27	21:06	20:18	19:23	17:29	17:01
2	08:15	07:57	07:15	07:19	06:29	05:57	05:58	06:26	07:02	07:37	07:16	07:55
	17:11	17:49	18:26	20:05	20:42	21:15	21:27	21:04	20:16	19:21	17:28	17:01
3	08:15	07:55	07:14	07:18	06:28	05:57	05:59	06:27	07:03	07:38	07:18	07:56
	17:12	17:50	18:27	20:06	20:43	21:16	21:27	21:03	20:14	19:19	17:26	17:00
4	08:15	07:54	07:12	07:16	06:26	05:56	06:00	06:28	07:04	07:39	07:19	07:57
	17:12	17:52	18:29	20:08	20:44	21:17	21:26	21:02	20:13	19:17	17:25	17:00
5	08:15	07:53	07:10	07:14	06:25	05:56	06:00	06:30	07:05	07:40	07:20	07:58
	17:13	17:53	18:30	20:09	20:46	21:18	21:26	21:01	20:11	19:15	17:24	17:00
6	08:15	07:52	07:09	07:12	06:24	05:56	06:01	06:31	07:06	07:42	07:22	07:59
	17:14	17:54	18:31	20:10	20:47	21:19	21:26	20:59	20:09	19:13	17:22	17:00
7	08:15	07:51	07:07	07:10	06:22	05:55	06:02	06:32	07:08	07:43	07:23	08:00
	17:16	17:56	18:33	20:11	20:48	21:19	21:25	20:58	20:07	19:12	17:21	17:00
8	08:14	07:49	08:05	07:08	06:21	05:55	06:02	06:33	07:09	07:44	07:24	08:01
	17:17	17:57	18:34	20:13	20:49	21:20	21:25	20:57	20:05	19:10	17:20	16:59
9	08:14	07:48	08:03	07:07	06:20	05:55	06:03	06:34	07:10	07:45	07:26	08:02
	17:18	17:59	19:35	20:14	20:50	21:21	21:25	20:55	20:04	19:08	17:19	16:59
10	08:14	07:47	08:01	07:05	06:18	05:54	06:04	06:35	07:11	07:47	07:27	08:03
	17:19	18:00	19:36	20:15	20:52	21:21	21:24	20:54	20:02	19:06	17:18	16:59
11	08:13	07:45	08:00	07:03	06:17	05:54	06:05	06:36	07:12	07:48	07:28	08:04
	17:20	18:00	19:38	20:16	20:53	21:22	21:24	20:52	20:00	19:04	17:16	16:59
12	08:13	07:44	07:58	07:01	06:16	05:54	06:05	06:38	07:13	07:49	07:30	08:05
	17:21	18:01	19:39	20:18	20:54	21:22	21:23	20:51	19:58	19:03	17:15	16:59
13	08:13	07:42	07:56	07:00	06:15	05:54	06:06	06:39	07:15	07:50	07:31	08:06
	17:22	18:03	19:40	20:19	20:55	21:23	21:23	20:49	19:56	19:01	17:14	17:00
14	08:12	07:41	07:54	06:58	06:14	05:54	06:07	06:40	07:16	07:52	07:32	08:07
	17:23	18:04	19:42	20:20	20:56	21:24	21:22	20:48	19:54	18:57	17:13	17:00
15	08:12	07:40	07:52	06:56	06:12	05:54	06:08	06:41	07:17	07:53	07:34	08:07
	17:25	18:06	19:43	20:21	20:57	21:24	21:21	20:46	19:52	18:56	17:12	17:00
16	08:11	07:38	07:51	06:55	06:11	05:54	06:09	06:42	07:18	07:54	07:35	08:08
	17:26	18:07	19:44	20:22	20:58	21:24	21:21	20:45	19:51	18:54	17:11	17:00
17	08:11	07:37	07:49	06:53	06:10	05:54	06:10	06:43	07:19	07:55	07:36	08:09
	17:27	18:08	19:45	20:24	21:00	21:25	21:20	20:43	19:49	18:52	17:10	17:00
18	08:10	07:35	07:47	06:51	06:09	05:54	06:11	06:44	07:20	07:57	07:38	08:09
	17:28	18:10	19:47	20:25	21:01	21:25	21:19	20:42	19:47	18:51	17:09	17:01
19	08:09	07:33	07:45	06:49	06:08	05:54	06:12	06:46	07:21	07:58	07:39	08:10
	17:30	18:11	19:48	20:26	21:02	21:26	21:19	20:40	19:45	18:49	17:09	17:01
20	08:09	07:32	07:43	06:48	06:07	05:54	06:13	06:47	07:23	07:59	07:40	08:11
	17:31	18:12	19:49	20:27	21:03	21:26	21:18	20:38	19:43	18:47	17:08	17:01
21	08:08	07:30	07:41	06:46	06:06	05:54	06:14	06:48	07:24	08:00	07:42	08:11
	17:32	18:14	19:50	20:29	21:04	21:26	21:17	20:37	19:41	18:46	17:07	17:02
22	08:07	07:29	07:40	06:44	06:05	05:55	06:15	06:49	07:25	08:02	07:43	08:12
	17:34	18:15	19:52	20:30	21:05	21:26	21:16	20:35	19:39	18:44	17:06	17:02
23	08:06	07:27	07:38	06:43	06:04	05:55	06:16	06:50	07:26	08:03	07:44	08:12
	17:35	18:17	19:53	20:31	21:06	21:27	21:15	20:34	19:37	18:43	17:05	17:03
24	08:06	07:26	07:36	06:41	06:04	05:55	06:17	06:51	07:27	08:04	07:45	08:13
	17:36	18:18	19:54	20:32	21:07	21:27	21:14	20:32	19:36	18:41	17:05	17:04
25	08:05	07:24	07:34	06:40	06:03	05:55	06:18	06:53	07:29	08:06	07:47	08:13
	17:38	18:19	19:55	20:33	21:08	21:27	21:13	20:30	19:34	18:39	17:04	17:04
26	08:04	07:22	07:32	06:38	06:02	05:56	06:19	06:54	07:30	08:07	07:48	08:13
	17:39	18:21	19:57	20:35	21:09	21:27	21:12	20:28	19:32	18:38	17:04	17:05
27	08:03	07:21	07:30	06:37	06:01	05:56	06:20	06:55	07:31	08:08	07:49	08:14
	17:40	18:22	19:58	20:36	21:10	21:27	21:11	20:27	19:30	18:36	17:03	17:05
28	08:02	07:19	07:28	06:35	06:00	05:57	06:21	06:56	07:32	08:10	07:50	08:14
	17:42	18:23	19:59	20:37	21:11	21:27	21:10	20:25	19:28	18:35	17:02	17:06
29	08:01		07:27	06:34	06:00	05:57	06:22	06:57	07:33	08:11	07:52	08:14
	17:43		20:00	20:38	21:12	21:27	21:09	20:23	19:26	18:33	17:02	17:07
30	08:00		07:25	06:32	05:59	05:57	06:23	06:58	07:34	08:12	07:53	08:14
	17:45		20:02	20:40	21:13	21:27	21:08	20:22	19:24	18:32	17:01	17:08
31	07:59		07:23		05:59		06:24	07:00		08:14		08:15
	17:46		20:03		21:14		21:07	20:20		18:31		17:09
Potential sun hours	288	292	369	403	458	464	470	435	377	342	289	276
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
TEST license
This license is only to be used for testing purposes

Ramos, Tiffanie / tiffanie.ramos@tetratech.com
Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 15 - Non-Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	January			February	March	April			May	June
1	08:15		08:39 (78)	07:58	07:18	07:22			06:31	05:59
	17:10	18	08:57 (78)	17:48	18:25	20:04			20:41	21:15
2	08:15		08:39 (78)	07:57	07:16	07:20		07:40 (76)	06:30	05:58
	17:11	18	08:57 (78)	17:49	18:27	20:06	4	07:44 (76)	20:42	21:16
3	08:15		08:39 (78)	07:56	07:14	07:18		07:38 (76)	06:28	05:58
	17:12	18	08:57 (78)	17:51	18:28	20:07	9	07:47 (76)	20:44	21:17
4	08:15		08:39 (78)	07:55	07:12	07:16		07:36 (76)	06:27	05:57
	17:13	19	08:58 (78)	17:52	18:29	20:08	12	07:48 (76)	20:45	21:17
5	08:15		08:39 (78)	07:53	07:11	07:14		07:34 (76)	06:25	05:57
	17:14	19	08:58 (78)	17:54	18:30	20:09	15	07:49 (76)	20:46	21:18
6	08:15		08:39 (78)	07:52	07:09	07:13		07:33 (76)	06:24	05:56
	17:15	20	08:59 (78)	17:55	18:32	20:11	17	07:50 (76)	20:47	21:19
7	08:15		08:40 (78)	07:51	07:07	07:11		07:31 (76)	06:23	05:56
	17:16	19	08:59 (78)	17:56	18:33	20:12	19	07:50 (76)	20:48	21:20
8	08:15		08:40 (78)	07:50	08:05	07:09		07:29 (76)	06:21	05:56
	17:17	19	08:59 (78)	17:58	18:34	20:13	21	07:50 (76)	20:50	21:20
9	08:14		08:41 (78)	07:48	08:04	07:07		07:27 (76)	06:20	05:55
	17:18	18	08:59 (78)	17:59	19:36	20:14	23	07:50 (76)	20:51	21:21
10	08:14		08:42 (78)	07:47	08:02	07:05		07:26 (76)	06:19	05:55
	17:19	17	08:59 (78)	18:01	19:37	20:16	24	07:50 (76)	20:52	21:22
11	08:14		08:43 (78)	07:46	08:00	07:04		07:25 (76)	06:18	05:55
	17:21	15	08:58 (78)	18:01	19:38	20:17	24	07:49 (76)	20:53	21:22
12	08:13		08:44 (78)	07:44	07:58	07:02		07:24 (76)	06:16	05:55
	17:22	15	08:59 (78)	18:02	19:40	20:18	25	07:49 (76)	20:54	21:23
13	08:13		08:45 (78)	07:43	07:56	07:00		07:24 (76)	06:15	05:55
	17:23	13	08:58 (78)	18:03	19:41	20:19	23	07:47 (76)	20:55	21:23
14	08:13		08:47 (78)	07:41	07:55	06:59		07:25 (76)	06:14	05:55
	17:24	10	08:57 (78)	18:05	19:42	20:20	22	07:47 (76)	20:57	21:24
15	08:12		08:48 (78)	07:40	07:53	06:57		07:26 (76)	06:13	05:55
	17:25	8	08:56 (78)	18:06	19:43	20:22	20	07:46 (76)	20:58	21:24
16	08:12			07:38	07:51	06:55		07:27 (76)	06:12	05:55
	17:27			18:08	19:45	20:23	17	07:44 (76)	20:59	21:25
17	08:11			07:37	07:49	06:53		07:29 (76)	06:11	05:55
	17:28			18:09	19:46	20:24	13	07:42 (76)	21:00	21:25
18	08:10			07:35	07:47	06:52		07:31 (76)	06:10	05:55
	17:29			18:10	19:47	20:25	7	07:38 (76)	21:01	21:26
19	08:10			07:34	07:46	06:50			06:09	05:55
	17:30			18:12	19:48	20:27			21:02	21:26
20	08:09			07:32	07:44	06:48			06:08	05:55
	17:32			18:13	19:50	20:28			21:03	21:26
21	08:08			07:31	07:42	06:47			06:07	05:55
	17:33			18:14	19:51	20:29			21:04	21:26
22	08:08			07:29	07:40	06:45			06:06	05:55
	17:34			18:16	19:52	20:30			21:05	21:27
23	08:07			07:28	07:38	06:43			06:05	05:55
	17:36			18:17	19:53	20:31			21:06	21:27
24	08:06			07:26	07:36	06:42			06:04	05:56
	17:37			18:19	19:55	20:33			21:07	21:27
25	08:05			07:24	07:35	06:40			06:03	05:56
	17:38			18:20	19:56	20:34			21:08	21:27
26	08:04			07:23	07:33	06:39			06:03	05:56
	17:40			18:21	19:57	20:35			21:09	21:27
27	08:03			07:21	07:31	06:37			06:02	05:57
	17:41			18:23	19:58	20:36			21:10	21:27
28	08:02			07:19	07:29	06:36			06:01	05:57
	17:42			18:24	20:00	20:38			21:11	21:27
29	08:01				07:27	06:34			06:00	05:58
	17:44				20:01	20:39			21:12	21:27
30	08:00				07:25	06:33			06:00	05:58
	17:45				20:02	20:40			21:13	21:27
31	07:59				07:24				05:59	
	17:47				20:03				21:14	
Potential sun hours	288			292	369	403			457	464
Total, worst case		246					295			
Sun reduction		0.62					0.59			
Oper. time red.		0.98					0.98			
Wind dir. red.		0.75					0.66			
Total reduction		0.46					0.38			
Total, real		113					113			

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:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
TEST license
This license is only to be used for testing purposes

Ramos, Tiffanie / tiffanie.ramos@tetratech.com
Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 15 - Non-Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	July	August			September			October	November			December		
1	05:59	06:26			07:01		07:23 (76)	07:36	07:15			07:54		08:25 (78)
	21:27	21:06			20:18	25	07:48 (76)	19:23	17:30			17:02	15	08:40 (78)
2	05:59	06:27			07:02		07:24 (76)	07:37	07:17			07:55		08:24 (78)
	21:27	21:05			20:17	24	07:48 (76)	19:21	17:28			17:01	17	08:41 (78)
3	06:00	06:28			07:04		07:25 (76)	07:39	07:18			07:56		08:25 (78)
	21:27	21:03			20:15	23	07:48 (76)	19:19	17:27			17:01	18	08:43 (78)
4	06:00	06:29			07:05		07:26 (76)	07:40	07:19			07:58		08:25 (78)
	21:27	21:02			20:13	21	07:47 (76)	19:18	17:26			17:01	19	08:44 (78)
5	06:01	06:30			07:06		07:27 (76)	07:41	07:21			07:59		08:25 (78)
	21:26	21:01			20:11	19	07:46 (76)	19:16	17:24			17:01	19	08:44 (78)
6	06:02	06:31			07:07		07:28 (76)	07:42	07:22			08:00		08:25 (78)
	21:26	21:00			20:09	17	07:45 (76)	19:14	17:23			17:00	20	08:45 (78)
7	06:02	06:32			07:08		07:30 (76)	07:43	07:23			08:01		08:26 (78)
	21:26	20:58			20:08	15	07:45 (76)	19:12	17:22			17:00	19	08:45 (78)
8	06:03	06:34			07:09		07:31 (76)	07:45	07:25			08:02		08:27 (78)
	21:25	20:57			20:06	12	07:43 (76)	19:10	17:21			17:00	19	08:46 (78)
9	06:04	06:35			07:10		07:32 (76)	07:46	07:26			08:03		08:28 (78)
	21:25	20:56			20:04	9	07:41 (76)	19:09	17:19			17:00	18	08:46 (78)
10	06:04	06:36			07:12		07:33 (76)	07:47	07:27			08:03		08:29 (78)
	21:25	20:54			20:02	5	07:38 (76)	19:07	17:18			17:00	18	08:47 (78)
11	06:05	06:37			07:13			07:48	07:29			08:04		08:30 (78)
	21:24	20:53			20:00			19:05	17:17			17:00	18	08:48 (78)
12	06:06	06:38			07:14			07:50	07:30			08:05		08:31 (78)
	21:24	20:51			19:58			19:03	17:16			17:00	17	08:48 (78)
13	06:07	06:39			07:15			07:51	07:32			08:06		08:31 (78)
	21:23	20:50			19:57			19:01	17:15			17:00	17	08:48 (78)
14	06:08	06:40			07:16			07:52	07:33			08:07		08:32 (78)
	21:22	20:48			19:55			19:00	17:14			17:00	17	08:49 (78)
15	06:09	06:42			07:17			07:53	07:34			08:08		08:33 (78)
	21:22	20:47			19:53			18:56	17:13			17:01	16	08:49 (78)
16	06:09	06:43			07:19			07:55	07:35			08:08		08:34 (78)
	21:21	20:45			19:51			18:55	17:12			17:01	16	08:50 (78)
17	06:10	06:44			07:20			07:56	07:37			08:09		08:34 (78)
	21:20	20:44			19:49			18:53	17:11			17:01	16	08:50 (78)
18	06:11	06:45			07:21			07:57	07:38			08:10		08:35 (78)
	21:20	20:42			19:47			18:51	17:10			17:01	16	08:51 (78)
19	06:12	06:46			07:22			07:58	07:39			08:10		08:36 (78)
	21:19	20:40			19:45			18:50	17:09			17:02	16	08:52 (78)
20	06:13	06:47			07:23			08:00	07:41			08:11		08:36 (78)
	21:18	20:39			19:44			18:48	17:08			17:02	16	08:52 (78)
21	06:14	06:48			07:24			08:01	07:42			08:12		08:37 (78)
	21:17	20:37			19:42			18:46	17:08			17:03	15	08:52 (78)
22	06:15	06:50			07:26			08:02	07:43			08:12		08:37 (78)
	21:16	20:36			19:40			18:45	17:07			17:03	15	08:52 (78)
23	06:16	06:51			07:27			08:04	07:45			08:13		08:38 (78)
	21:15	20:34			19:38			18:43	17:06			17:04	15	08:53 (78)
24	06:17	06:52			07:28			08:05	07:46			08:13		08:38 (78)
	21:15	20:32			19:36			18:42	17:05			17:04	16	08:54 (78)
25	06:18	06:53		07:34 (76)	07:29			08:06	07:47			08:13		08:38 (78)
	21:14	20:31	8	07:42 (76)	19:34			18:40	17:05			17:05	16	08:54 (78)
26	06:19	06:54		07:30 (76)	07:30			08:07	07:48			08:14		08:39 (78)
	21:13	20:29	14	07:44 (76)	19:32			18:38	17:04			17:05	16	08:55 (78)
27	06:20	06:55		07:28 (76)	07:31			08:09	07:49		08:28 (78)	08:14		08:39 (78)
	21:12	20:27	18	07:46 (76)	19:30			18:37	17:04	7	08:35 (78)	17:06	16	08:55 (78)
28	06:21	06:57		07:28 (76)	07:33			08:10	07:51		08:27 (78)	08:14		08:39 (78)
	21:10	20:25	20	07:48 (76)	19:29			18:35	17:03	10	08:37 (78)	17:07	16	08:55 (78)
29	06:22	06:58		07:26 (76)	07:34			08:11	07:52		08:26 (78)	08:15		08:39 (78)
	21:09	20:24	22	07:48 (76)	19:27			18:34	17:03	13	08:39 (78)	17:08	17	08:56 (78)
30	06:24	06:59		07:25 (76)	07:35			08:13	07:53		08:25 (78)	08:15		08:39 (78)
	21:08	20:22	23	07:48 (76)	19:25			18:33	17:02	15	08:40 (78)	17:08	17	08:56 (78)
31	06:25	07:00		07:24 (76)				08:14				08:15		08:39 (78)
	21:07	20:20	25	07:49 (76)				18:31				17:09	17	08:56 (78)
Potential sun hours	470	435			377			342	290			277		
Total, worst case			130			170				45			523	
Sun reduction			0.74			0.69				0.51			0.51	
Oper. time red.			0.98			0.98				0.98			0.98	
Wind dir. red.			0.66			0.66				0.75			0.75	
Total reduction			0.48			0.45				0.38			0.38	
Total, real			62			76				17			198	

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:
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Description:
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Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 16 - Non-Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:15	07:58	07:18	07:22	06:31	05:59	05:59	06:26	07:02	07:36	07:16	07:54
	17:11	17:48	18:25	20:05	20:41	21:15	21:27	21:06	20:19	19:23	17:30	17:02
2	08:15	07:57	07:16	07:20	06:30	05:58	05:59	06:27	07:03	07:38	07:17	07:55
	17:12	17:50	18:27	20:06	20:43	21:16	21:27	21:05	20:17	19:21	17:29	17:02
3	08:15	07:56	07:14	07:18	06:29	05:58	06:00	06:28	07:04	07:39	07:18	07:57
	17:12	17:51	18:28	20:07	20:44	21:17	21:27	21:04	20:15	19:20	17:27	17:01
4	08:15	07:55	07:13	07:16	06:27	05:57	06:01	06:29	07:05	07:40	07:20	07:58
	17:13	17:53	18:29	20:08	20:45	21:18	21:27	21:02	20:13	19:18	17:26	17:01
5	08:15	07:54	07:11	07:15	06:26	05:57	06:01	06:30	07:06	07:41	07:21	07:59
	17:14	17:54	18:31	20:10	20:46	21:18	21:27	21:01	20:12	19:16	17:25	17:01
6	08:15	07:52	07:09	07:13	06:24	05:57	06:02	06:32	07:07	07:42	07:22	08:00
	17:15	17:55	18:32	20:11	20:47	21:19	21:26	21:00	20:10	19:14	17:23	17:01
7	08:15	07:51	07:07	07:11	06:23	05:56	06:03	06:33	07:08	07:44	07:24	08:01
	17:16	17:57	18:33	20:12	20:49	21:20	21:26	20:58	20:08	19:12	17:22	17:01
8	08:15	07:50	08:06	07:09	06:22	05:56	06:03	06:34	07:10	07:45	07:25	08:02
	17:18	17:58	18:35	20:13	20:50	21:20	21:26	20:57	20:06	19:11	17:21	17:00
9	08:15	07:49	08:04	07:08	06:21	05:56	06:04	06:35	07:11	07:46	07:26	08:03
	17:19	18:00	19:36	20:15	20:51	21:21	21:25	20:56	20:04	19:09	17:20	17:00
10	08:14	07:47	08:02	07:06	06:19	05:55	06:05	06:36	07:12	07:47	07:28	08:04
	17:20	18:00	19:37	20:16	20:52	21:22	21:25	20:54	20:02	19:07	17:19	17:00
11	08:14	07:46	08:00	07:04	06:18	05:55	06:06	06:37	07:13	07:49	07:29	08:05
	17:21	18:01	19:39	20:17	20:53	21:22	21:24	20:53	20:01	19:05	17:17	17:00
12	08:14	07:44	07:59	07:02	06:17	05:55	06:06	06:38	07:14	07:50	07:30	08:05
	17:22	18:02	19:40	20:18	20:54	21:23	21:24	20:51	19:59	19:03	17:16	17:00
13	08:13	07:43	07:57	07:01	06:16	05:55	06:07	06:40	07:15	07:51	07:32	08:06
	17:23	18:04	19:41	20:19	20:56	21:23	21:23	20:50	19:57	19:02	17:15	17:01
14	08:13	07:42	07:55	06:59	06:14	05:55	06:08	06:41	07:16	07:52	07:33	08:07
	17:24	18:05	19:42	20:21	20:57	21:24	21:23	20:48	19:55	19:00	17:14	17:01
15	08:12	07:40	07:53	06:57	06:13	05:55	06:09	06:42	07:18	07:54	07:34	08:08
	17:26	18:06	19:44	20:22	20:58	21:24	21:22	20:47	19:53	18:57	17:13	17:01
16	08:12	07:39	07:51	06:55	06:12	05:55	06:10	06:43	07:19	07:55	07:36	08:09
	17:27	18:08	19:45	20:23	20:59	21:25	21:21	20:45	19:51	18:55	17:12	17:01
17	08:11	07:37	07:49	06:54	06:11	05:55	06:11	06:44	07:20	07:56	07:37	08:09
	17:28	18:09	19:46	20:24	21:00	21:25	21:21	20:44	19:49	18:53	17:11	17:01
18	08:11	07:36	07:48	06:52	06:10	05:55	06:12	06:45	07:21	07:57	07:38	08:10
	17:29	18:11	19:47	20:26	21:01	21:26	21:20	20:42	19:48	18:52	17:10	17:02
19	08:10	07:34	07:46	06:50	06:09	05:55	06:13	06:46	07:22	07:59	07:40	08:11
	17:31	18:12	19:49	20:27	21:02	21:26	21:19	20:41	19:46	18:50	17:09	17:02
20	08:09	07:33	07:44	06:49	06:08	05:55	06:14	06:48	07:23	08:00	07:41	08:11
	17:32	18:13	19:50	20:28	21:03	21:26	21:18	20:39	19:44	18:48	17:09	17:02
21	08:09	07:31	07:42	06:47	06:07	05:55	06:15	06:49	07:25	08:01	07:42	08:12
	17:33	18:15	19:51	20:29	21:04	21:27	21:17	20:37	19:42	18:47	17:08	17:03
22	08:08	07:29	07:40	06:45	06:06	05:56	06:15	06:50	07:26	08:02	07:43	08:12
	17:35	18:16	19:52	20:30	21:05	21:27	21:17	20:36	19:40	18:45	17:07	17:03
23	08:07	07:28	07:38	06:44	06:05	05:56	06:16	06:51	07:27	08:04	07:45	08:13
	17:36	18:17	19:54	20:32	21:07	21:27	21:16	20:34	19:38	18:43	17:06	17:04
24	08:06	07:26	07:37	06:42	06:05	05:56	06:17	06:52	07:28	08:05	07:46	08:13
	17:37	18:19	19:55	20:33	21:08	21:27	21:15	20:33	19:36	18:42	17:06	17:05
25	08:05	07:25	07:35	06:41	06:04	05:56	06:19	06:53	07:29	08:06	07:47	08:14
	17:39	18:20	19:56	20:34	21:09	21:27	21:14	20:31	19:34	18:40	17:05	17:05
26	08:04	07:23	07:33	06:39	06:03	05:57	06:20	06:55	07:30	08:08	07:48	08:14
	17:40	18:21	19:57	20:35	21:10	21:27	21:13	20:29	19:33	18:39	17:04	17:06
27	08:04	07:21	07:31	06:37	06:02	05:57	06:21	06:56	07:32	08:09	07:50	08:14
	17:41	18:23	19:59	20:37	21:10	21:28	21:12	20:27	19:31	18:37	17:04	17:06
28	08:03	07:20	07:29	06:36	06:01	05:58	06:22	06:57	07:33	08:10	07:51	08:15
	17:43	18:24	20:00	20:38	21:11	21:28	21:11	20:26	19:29	18:36	17:03	17:07
29	08:02		07:27	06:34	06:01	05:58	06:23	06:58	07:34	08:12	07:52	08:15
	17:44		20:01	20:39	21:12	21:28	21:10	20:24	19:27	18:34	17:03	17:08
30	08:01		07:26	06:33	06:00	05:58	06:24	06:59	07:35	08:13	07:53	08:15
	17:46		20:02	20:40	21:13	21:27	21:08	20:22	19:25	18:33	17:02	17:09
31	07:59		07:24		06:00		06:25	07:00		08:14		08:15
	17:47		20:03		21:14		21:07	20:20		18:31		17:10
Potential sun hours	288	292	369	403	457	464	470	435	377	342	290	277
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
TEST license
This license is only to be used for testing purposes

Ramos, Tiffanie / tiffanie.ramos@tetratech.com
Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 17 - Non-Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:16	07:59	07:18	07:22	06:32	05:59	05:59	06:26	07:02	07:37	07:16	07:55
	17:11	17:49	18:26	20:05	20:42	21:15	21:28	21:06	20:19	19:24	17:30	17:02
2	08:16	07:58	07:16	07:20	06:30	05:59	06:00	06:27	07:03	07:38	07:17	07:56
	17:12	17:50	18:27	20:06	20:43	21:16	21:28	21:05	20:17	19:22	17:29	17:02
3	08:16	07:56	07:15	07:19	06:29	05:58	06:00	06:28	07:04	07:39	07:19	07:57
	17:13	17:51	18:28	20:07	20:44	21:17	21:27	21:04	20:15	19:20	17:28	17:02
4	08:16	07:55	07:13	07:17	06:27	05:58	06:01	06:30	07:05	07:40	07:20	07:58
	17:14	17:53	18:30	20:09	20:45	21:18	21:27	21:03	20:14	19:18	17:26	17:01
5	08:16	07:54	07:11	07:15	06:26	05:57	06:02	06:31	07:06	07:41	07:21	07:59
	17:15	17:54	18:31	20:10	20:47	21:19	21:27	21:01	20:12	19:16	17:25	17:01
6	08:16	07:53	07:10	07:13	06:25	05:57	06:02	06:32	07:08	07:43	07:23	08:00
	17:16	17:56	18:32	20:11	20:48	21:19	21:27	21:00	20:10	19:14	17:24	17:01
7	08:15	07:51	07:08	07:11	06:23	05:57	06:03	06:33	07:09	07:44	07:24	08:01
	17:17	17:57	18:34	20:12	20:49	21:20	21:26	20:59	20:08	19:13	17:22	17:01
8	08:15	07:50	08:06	07:10	06:22	05:56	06:04	06:34	07:10	07:45	07:25	08:02
	17:18	17:58	18:35	20:14	20:50	21:21	21:26	20:57	20:06	19:11	17:21	17:01
9	08:15	07:49	08:04	07:08	06:21	05:56	06:04	06:35	07:11	07:46	07:27	08:03
	17:19	18:00	19:36	20:15	20:51	21:21	21:26	20:56	20:05	19:09	17:20	17:01
10	08:15	07:48	08:02	07:06	06:20	05:56	06:05	06:36	07:12	07:48	07:28	08:04
	17:20	18:00	19:38	20:16	20:52	21:22	21:25	20:55	20:03	19:07	17:19	17:01
11	08:14	07:46	08:01	07:04	06:18	05:56	06:06	06:38	07:13	07:49	07:29	08:05
	17:21	18:01	19:39	20:17	20:54	21:23	21:25	20:53	20:01	19:06	17:18	17:01
12	08:14	07:45	07:59	07:03	06:17	05:55	06:07	06:39	07:14	07:50	07:31	08:06
	17:22	18:03	19:40	20:19	20:55	21:23	21:24	20:52	19:59	19:04	17:17	17:01
13	08:14	07:43	07:57	07:01	06:16	05:55	06:07	06:40	07:16	07:51	07:32	08:07
	17:24	18:04	19:41	20:20	20:56	21:24	21:24	20:50	19:57	19:02	17:16	17:01
14	08:13	07:42	07:55	06:59	06:15	05:55	06:08	06:41	07:17	07:53	07:33	08:07
	17:25	18:05	19:43	20:21	20:57	21:24	21:23	20:49	19:55	19:00	17:14	17:01
15	08:13	07:40	07:53	06:57	06:14	05:55	06:09	06:42	07:18	07:54	07:35	08:08
	17:26	18:07	19:44	20:22	20:58	21:25	21:22	20:47	19:53	18:57	17:13	17:01
16	08:12	07:39	07:52	06:56	06:12	05:55	06:10	06:43	07:19	07:55	07:36	08:09
	17:27	18:08	19:45	20:23	20:59	21:25	21:22	20:46	19:52	18:55	17:12	17:01
17	08:12	07:37	07:50	06:54	06:11	05:55	06:11	06:44	07:20	07:56	07:37	08:10
	17:28	18:10	19:46	20:25	21:00	21:26	21:21	20:44	19:50	18:53	17:12	17:02
18	08:11	07:36	07:48	06:52	06:10	05:55	06:12	06:46	07:21	07:58	07:39	08:10
	17:30	18:11	19:48	20:26	21:02	21:26	21:20	20:43	19:48	18:52	17:11	17:02
19	08:10	07:34	07:46	06:51	06:09	05:55	06:13	06:47	07:23	07:59	07:40	08:11
	17:31	18:12	19:49	20:27	21:03	21:26	21:19	20:41	19:46	18:50	17:10	17:02
20	08:10	07:33	07:44	06:49	06:08	05:55	06:14	06:48	07:24	08:00	07:41	08:11
	17:32	18:14	19:50	20:28	21:04	21:27	21:19	20:39	19:44	18:48	17:09	17:03
21	08:09	07:31	07:42	06:47	06:07	05:56	06:15	06:49	07:25	08:01	07:43	08:12
	17:34	18:15	19:51	20:30	21:05	21:27	21:18	20:38	19:42	18:47	17:08	17:03
22	08:08	07:30	07:41	06:46	06:07	05:56	06:16	06:50	07:26	08:03	07:44	08:13
	17:35	18:16	19:53	20:31	21:06	21:27	21:17	20:36	19:40	18:45	17:07	17:04
23	08:07	07:28	07:39	06:44	06:06	05:56	06:17	06:51	07:27	08:04	07:45	08:13
	17:36	18:18	19:54	20:32	21:07	21:27	21:16	20:34	19:38	18:44	17:07	17:04
24	08:07	07:26	07:37	06:42	06:05	05:56	06:18	06:53	07:28	08:05	07:46	08:13
	17:38	18:19	19:55	20:33	21:08	21:28	21:15	20:33	19:37	18:42	17:06	17:05
25	08:06	07:25	07:35	06:41	06:04	05:57	06:19	06:54	07:30	08:07	07:48	08:14
	17:39	18:20	19:56	20:34	21:09	21:28	21:14	20:31	19:35	18:41	17:05	17:05
26	08:05	07:23	07:33	06:39	06:03	05:57	06:20	06:55	07:31	08:08	07:49	08:14
	17:40	18:22	19:58	20:36	21:10	21:28	21:13	20:29	19:33	18:39	17:05	17:06
27	08:04	07:22	07:31	06:38	06:02	05:57	06:21	06:56	07:32	08:09	07:50	08:15
	17:42	18:23	19:59	20:37	21:11	21:28	21:12	20:28	19:31	18:38	17:04	17:07
28	08:03	07:20	07:30	06:36	06:02	05:58	06:22	06:57	07:33	08:11	07:51	08:15
	17:43	18:24	20:00	20:38	21:12	21:28	21:11	20:26	19:29	18:36	17:04	17:07
29	08:02		07:28	06:35	06:01	05:58	06:23	06:58	07:34	08:12	07:52	08:15
	17:44		20:01	20:39	21:13	21:28	21:10	20:24	19:27	18:35	17:03	17:08
30	08:01		07:26	06:33	06:00	05:59	06:24	06:59	07:35	08:13	07:54	08:15
	17:46		20:03	20:40	21:14	21:28	21:09	20:23	19:25	18:33	17:03	17:09
31	08:00		07:24		06:00		06:25	07:01		08:15		08:15
	17:47		20:04		21:14		21:08	20:21		18:32		17:10
Potential sun hours	288	292	369	403	457	464	470	435	377	342	290	277
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
TEST license
This license is only to be used for testing purposes

Ramos, Tiffanie / tiffanie.ramos@tetratech.com
Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 18 - Non-Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:16	07:59	07:18	07:22	06:31	05:58	05:58	06:26	07:01	07:37	07:16	07:55
	17:10	17:48	18:25	20:05	20:42	21:16	21:28	21:07	20:19	19:23	17:30	17:02
2	08:16	07:58	07:17	07:20	06:30	05:58	05:59	06:27	07:03	07:38	07:18	07:56
	17:11	17:49	18:27	20:06	20:43	21:17	21:28	21:06	20:17	19:22	17:28	17:01
3	08:16	07:57	07:15	07:18	06:28	05:57	06:00	06:28	07:04	07:39	07:19	07:57
	17:12	17:51	18:28	20:08	20:44	21:18	21:28	21:04	20:16	19:20	17:27	17:01
4	08:16	07:56	07:13	07:17	06:27	05:57	06:00	06:29	07:05	07:40	07:20	07:59
	17:13	17:52	18:29	20:09	20:46	21:18	21:28	21:03	20:14	19:18	17:26	17:01
5	08:16	07:54	07:11	07:15	06:26	05:57	06:01	06:30	07:06	07:41	07:22	08:00
	17:14	17:54	18:31	20:10	20:47	21:19	21:28	21:02	20:12	19:16	17:24	17:00
6	08:16	07:53	07:10	07:13	06:24	05:56	06:01	06:31	07:07	07:43	07:23	08:01
	17:15	17:55	18:32	20:11	20:48	21:20	21:27	21:01	20:10	19:14	17:23	17:00
7	08:16	07:52	07:08	07:11	06:23	05:56	06:02	06:32	07:08	07:44	07:24	08:02
	17:16	17:56	18:33	20:12	20:49	21:21	21:27	20:59	20:08	19:12	17:22	17:00
8	08:16	07:51	08:06	07:09	06:21	05:55	06:03	06:34	07:10	07:45	07:26	08:03
	17:17	17:58	18:35	20:14	20:50	21:21	21:27	20:58	20:06	19:11	17:21	17:00
9	08:15	07:49	08:04	07:08	06:20	05:55	06:04	06:35	07:11	07:46	07:27	08:04
	17:18	17:59	19:36	20:15	20:52	21:22	21:26	20:56	20:05	19:09	17:19	17:00
10	08:15	07:48	08:02	07:06	06:19	05:55	06:04	06:36	07:12	07:48	07:28	08:05
	17:19	18:01	19:37	20:16	20:53	21:23	21:26	20:55	20:03	19:07	17:18	17:00
11	08:15	07:46	08:01	07:04	06:18	05:55	06:05	06:37	07:13	07:49	07:30	08:05
	17:20	18:01	19:39	20:17	20:54	21:23	21:25	20:54	20:01	19:05	17:17	17:00
12	08:14	07:45	07:59	07:02	06:16	05:55	06:06	06:38	07:14	07:50	07:31	08:06
	17:22	18:02	19:40	20:19	20:55	21:24	21:25	20:52	19:59	19:03	17:16	17:00
13	08:14	07:44	07:57	07:00	06:15	05:54	06:07	06:39	07:15	07:51	07:32	08:07
	17:23	18:04	19:41	20:20	20:56	21:24	21:24	20:51	19:57	19:02	17:15	17:00
14	08:14	07:42	07:55	06:59	06:14	05:54	06:08	06:40	07:17	07:53	07:34	08:08
	17:24	18:05	19:42	20:21	20:57	21:25	21:23	20:49	19:55	19:00	17:14	17:00
15	08:13	07:41	07:53	06:57	06:13	05:54	06:08	06:42	07:18	07:54	07:35	08:09
	17:25	18:06	19:44	20:22	20:59	21:25	21:23	20:48	19:53	18:57	17:13	17:00
16	08:13	07:39	07:52	06:55	06:12	05:54	06:09	06:43	07:19	07:55	07:36	08:09
	17:26	18:08	19:45	20:24	21:00	21:26	21:22	20:46	19:52	18:55	17:12	17:01
17	08:12	07:38	07:50	06:54	06:11	05:54	06:10	06:44	07:20	07:56	07:38	08:10
	17:28	18:09	19:46	20:25	21:01	21:26	21:21	20:44	19:50	18:53	17:11	17:01
18	08:11	07:36	07:48	06:52	06:10	05:54	06:11	06:45	07:21	07:58	07:39	08:11
	17:29	18:10	19:48	20:26	21:02	21:27	21:21	20:43	19:48	18:51	17:10	17:01
19	08:11	07:35	07:46	06:50	06:09	05:54	06:12	06:46	07:22	07:59	07:40	08:11
	17:30	18:12	19:49	20:27	21:03	21:27	21:20	20:41	19:46	18:50	17:09	17:02
20	08:10	07:33	07:44	06:48	06:08	05:55	06:13	06:47	07:24	08:00	07:42	08:12
	17:32	18:13	19:50	20:29	21:04	21:27	21:19	20:40	19:44	18:48	17:08	17:02
21	08:09	07:31	07:42	06:47	06:07	05:55	06:14	06:49	07:25	08:02	07:43	08:13
	17:33	18:15	19:51	20:30	21:05	21:28	21:18	20:38	19:42	18:46	17:07	17:02
22	08:09	07:30	07:40	06:45	06:06	05:55	06:15	06:50	07:26	08:03	07:44	08:13
	17:34	18:16	19:53	20:31	21:06	21:28	21:17	20:36	19:40	18:45	17:07	17:03
23	08:08	07:28	07:39	06:44	06:05	05:55	06:16	06:51	07:27	08:04	07:46	08:14
	17:36	18:17	19:54	20:32	21:07	21:28	21:16	20:35	19:38	18:43	17:06	17:03
24	08:07	07:27	07:37	06:42	06:04	05:55	06:17	06:52	07:28	08:06	07:47	08:14
	17:37	18:19	19:55	20:33	21:08	21:28	21:16	20:33	19:37	18:42	17:05	17:04
25	08:06	07:25	07:35	06:40	06:03	05:56	06:18	06:53	07:29	08:07	07:48	08:14
	17:38	18:20	19:56	20:35	21:09	21:28	21:15	20:31	19:35	18:40	17:05	17:05
26	08:05	07:23	07:33	06:39	06:02	05:56	06:19	06:54	07:31	08:08	07:49	08:15
	17:40	18:21	19:58	20:36	21:10	21:28	21:14	20:30	19:33	18:39	17:04	17:05
27	08:04	07:22	07:31	06:37	06:02	05:57	06:20	06:56	07:32	08:10	07:50	08:15
	17:41	18:23	19:59	20:37	21:11	21:28	21:13	20:28	19:31	18:37	17:03	17:06
28	08:03	07:20	07:29	06:36	06:01	05:57	06:21	06:57	07:33	08:11	07:52	08:15
	17:42	18:24	20:00	20:38	21:12	21:28	21:11	20:26	19:29	18:36	17:03	17:07
29	08:02		07:28	06:34	06:00	05:57	06:22	06:58	07:34	08:12	07:53	08:16
	17:44		20:01	20:40	21:13	21:28	21:10	20:24	19:27	18:34	17:02	17:07
30	08:01		07:26	06:33	06:00	05:58	06:23	06:59	07:35	08:14	07:54	08:16
	17:45		20:03	20:41	21:14	21:28	21:09	20:23	19:25	18:33	17:02	17:08
31	08:00		07:24		05:59		06:25	07:00		08:15		08:16
	17:47		20:04		21:15		21:08	20:21		18:31		17:09
Potential sun hours	287	292	369	403	458	464	471	435	377	341	289	276
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
TEST license
This license is only to be used for testing purposes

Ramos, Tiffanie / tiffanie.ramos@tetratech.com
Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 19 - Non-Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:16	07:59	07:18	07:22	06:31	05:58	05:58	06:25	07:01	07:36	07:16	07:55
	17:10	17:48	18:25	20:05	20:42	21:16	21:28	21:07	20:19	19:23	17:30	17:01
2	08:16	07:58	07:16	07:20	06:30	05:58	05:59	06:27	07:02	07:38	07:17	07:56
	17:11	17:49	18:27	20:06	20:43	21:17	21:28	21:06	20:17	19:21	17:28	17:01
3	08:16	07:57	07:15	07:18	06:28	05:57	05:59	06:28	07:04	07:39	07:19	07:57
	17:12	17:51	18:28	20:07	20:44	21:17	21:28	21:04	20:15	19:20	17:27	17:01
4	08:16	07:55	07:13	07:16	06:27	05:57	06:00	06:29	07:05	07:40	07:20	07:58
	17:13	17:52	18:29	20:09	20:46	21:18	21:28	21:03	20:14	19:18	17:26	17:00
5	08:16	07:54	07:11	07:15	06:25	05:56	06:01	06:30	07:06	07:41	07:21	07:59
	17:14	17:53	18:31	20:10	20:47	21:19	21:27	21:02	20:12	19:16	17:24	17:00
6	08:16	07:53	07:09	07:13	06:24	05:56	06:01	06:31	07:07	07:43	07:23	08:01
	17:15	17:55	18:32	20:11	20:48	21:20	21:27	21:00	20:10	19:14	17:23	17:00
7	08:16	07:52	07:08	07:11	06:23	05:56	06:02	06:32	07:08	07:44	07:24	08:02
	17:16	17:56	18:33	20:12	20:49	21:21	21:27	20:59	20:08	19:12	17:22	17:00
8	08:16	07:50	08:06	07:09	06:21	05:55	06:03	06:33	07:09	07:45	07:26	08:03
	17:17	17:58	18:35	20:14	20:50	21:21	21:26	20:58	20:06	19:10	17:20	17:00
9	08:15	07:49	08:04	07:07	06:20	05:55	06:03	06:35	07:11	07:46	07:27	08:03
	17:18	17:59	19:36	20:15	20:52	21:22	21:26	20:56	20:04	19:09	17:19	17:00
10	08:15	07:48	08:02	07:06	06:19	05:55	06:04	06:36	07:12	07:47	07:28	08:04
	17:19	18:01	19:37	20:16	20:53	21:23	21:26	20:55	20:03	19:07	17:18	17:00
11	08:15	07:46	08:00	07:04	06:17	05:55	06:05	06:37	07:13	07:49	07:30	08:05
	17:20	18:01	19:38	20:17	20:54	21:23	21:25	20:53	20:01	19:05	17:17	17:00
12	08:14	07:45	07:59	07:02	06:16	05:54	06:06	06:38	07:14	07:50	07:31	08:06
	17:21	18:02	19:40	20:18	20:55	21:24	21:25	20:52	19:59	19:03	17:16	17:00
13	08:14	07:43	07:57	07:00	06:15	05:54	06:07	06:39	07:15	07:51	07:32	08:07
	17:23	18:03	19:41	20:20	20:56	21:24	21:24	20:50	19:57	19:02	17:15	17:00
14	08:13	07:42	07:55	06:59	06:14	05:54	06:07	06:40	07:16	07:53	07:34	08:08
	17:24	18:05	19:42	20:21	20:57	21:25	21:23	20:49	19:55	19:00	17:14	17:00
15	08:13	07:41	07:53	06:57	06:13	05:54	06:08	06:41	07:18	07:54	07:35	08:09
	17:25	18:06	19:44	20:22	20:58	21:25	21:23	20:47	19:53	18:56	17:13	17:00
16	08:12	07:39	07:51	06:55	06:12	05:54	06:09	06:43	07:19	07:55	07:36	08:09
	17:26	18:08	19:45	20:23	21:00	21:26	21:22	20:46	19:51	18:55	17:12	17:00
17	08:12	07:38	07:50	06:53	06:11	05:54	06:10	06:44	07:20	07:56	07:38	08:10
	17:28	18:09	19:46	20:25	21:01	21:26	21:21	20:44	19:50	18:53	17:11	17:01
18	08:11	07:36	07:48	06:52	06:10	05:54	06:11	06:45	07:21	07:58	07:39	08:11
	17:29	18:10	19:47	20:26	21:02	21:27	21:21	20:43	19:48	18:51	17:10	17:01
19	08:11	07:34	07:46	06:50	06:08	05:54	06:12	06:46	07:22	07:59	07:40	08:11
	17:30	18:12	19:49	20:27	21:03	21:27	21:20	20:41	19:46	18:50	17:09	17:01
20	08:10	07:33	07:44	06:48	06:07	05:54	06:13	06:47	07:23	08:00	07:42	08:12
	17:31	18:13	19:50	20:28	21:04	21:27	21:19	20:40	19:44	18:48	17:08	17:02
21	08:09	07:31	07:42	06:47	06:07	05:55	06:14	06:48	07:25	08:01	07:43	08:12
	17:33	18:14	19:51	20:30	21:05	21:27	21:18	20:38	19:42	18:46	17:07	17:02
22	08:08	07:30	07:40	06:45	06:06	05:55	06:15	06:50	07:26	08:03	07:44	08:13
	17:34	18:16	19:52	20:31	21:06	21:28	21:17	20:36	19:40	18:45	17:07	17:03
23	08:08	07:28	07:38	06:43	06:05	05:55	06:16	06:51	07:27	08:04	07:45	08:13
	17:35	18:17	19:54	20:32	21:07	21:28	21:16	20:35	19:38	18:43	17:06	17:03
24	08:07	07:26	07:37	06:42	06:04	05:55	06:17	06:52	07:28	08:05	07:47	08:14
	17:37	18:19	19:55	20:33	21:08	21:28	21:15	20:33	19:36	18:42	17:05	17:04
25	08:06	07:25	07:35	06:40	06:03	05:56	06:18	06:53	07:29	08:07	07:48	08:14
	17:38	18:20	19:56	20:35	21:09	21:28	21:14	20:31	19:34	18:40	17:04	17:04
26	08:05	07:23	07:33	06:39	06:02	05:56	06:19	06:54	07:30	08:08	07:49	08:15
	17:39	18:21	19:57	20:36	21:10	21:28	21:13	20:29	19:33	18:38	17:04	17:05
27	08:04	07:21	07:31	06:37	06:01	05:56	06:20	06:55	07:32	08:09	07:50	08:15
	17:41	18:23	19:59	20:37	21:11	21:28	21:12	20:28	19:31	18:37	17:03	17:06
28	08:03	07:20	07:29	06:36	06:01	05:57	06:21	06:57	07:33	08:11	07:52	08:15
	17:42	18:24	20:00	20:38	21:12	21:28	21:11	20:26	19:29	18:35	17:03	17:06
29	08:02		07:27	06:34	06:00	05:57	06:22	06:58	07:34	08:12	07:53	08:16
	17:44		20:01	20:39	21:13	21:28	21:10	20:24	19:27	18:34	17:02	17:07
30	08:01		07:26	06:33	05:59	05:58	06:23	06:59	07:35	08:13	07:54	08:16
	17:45		20:02	20:41	21:14	21:28	21:09	20:23	19:25	18:32	17:02	17:08
31	08:00		07:24		05:59		06:24	07:00		08:15		08:16
	17:46		20:04		21:15		21:08	20:21		18:31		17:09
Potential sun hours	287	292	369	403	458	464	471	435	377	341	289	276
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
TEST license
This license is only to be used for testing purposes

Ramos, Tiffanie / tiffanie.ramos@tetratech.com
Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 20 - Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:16	07:59	07:18	07:22	06:31	05:58	05:58	06:25	07:01	07:36	07:16	07:55
	17:10	17:48	18:25	20:05	20:42	21:16	21:28	21:06	20:19	19:23	17:29	17:01
2	08:16	07:57	07:16	07:20	06:29	05:58	05:59	06:26	07:02	07:37	07:17	07:56
	17:11	17:49	18:26	20:06	20:43	21:16	21:28	21:05	20:17	19:21	17:28	17:01
3	08:16	07:56	07:14	07:18	06:28	05:57	05:59	06:28	07:03	07:39	07:18	07:57
	17:12	17:51	18:28	20:07	20:44	21:17	21:28	21:04	20:15	19:19	17:27	17:01
4	08:16	07:55	07:13	07:16	06:27	05:57	06:00	06:29	07:05	07:40	07:20	07:58
	17:13	17:52	18:29	20:08	20:45	21:18	21:27	21:03	20:13	19:18	17:25	17:00
5	08:16	07:54	07:11	07:14	06:25	05:56	06:00	06:30	07:06	07:41	07:21	07:59
	17:14	17:53	18:30	20:10	20:46	21:19	21:27	21:01	20:12	19:16	17:24	17:00
6	08:16	07:53	07:09	07:13	06:24	05:56	06:01	06:31	07:07	07:42	07:23	08:00
	17:15	17:55	18:32	20:11	20:48	21:20	21:27	21:00	20:10	19:14	17:23	17:00
7	08:15	07:51	07:07	07:11	06:22	05:55	06:02	06:32	07:08	07:44	07:24	08:01
	17:16	17:56	18:33	20:12	20:49	21:20	21:26	20:59	20:08	19:12	17:22	17:00
8	08:15	07:50	08:06	07:09	06:21	05:55	06:02	06:33	07:09	07:45	07:25	08:02
	17:17	17:58	18:34	20:13	20:50	21:21	21:26	20:57	20:06	19:10	17:20	17:00
9	08:15	07:49	08:04	07:07	06:20	05:55	06:03	06:34	07:10	07:46	07:27	08:03
	17:18	17:59	19:36	20:15	20:51	21:22	21:26	20:56	20:04	19:08	17:19	17:00
10	08:15	07:47	08:02	07:05	06:19	05:55	06:04	06:36	07:12	07:47	07:28	08:04
	17:19	18:00	19:37	20:16	20:52	21:22	21:25	20:55	20:02	19:07	17:18	17:00
11	08:14	07:46	08:00	07:04	06:17	05:54	06:05	06:37	07:13	07:49	07:29	08:05
	17:20	18:00	19:38	20:17	20:54	21:23	21:25	20:53	20:01	19:05	17:17	17:00
12	08:14	07:45	07:58	07:02	06:16	05:54	06:06	06:38	07:14	07:50	07:31	08:06
	17:21	18:02	19:40	20:18	20:55	21:23	21:24	20:52	19:59	19:03	17:16	17:00
13	08:14	07:43	07:57	07:00	06:15	05:54	06:06	06:39	07:15	07:51	07:32	08:07
	17:22	18:03	19:41	20:19	20:56	21:24	21:24	20:50	19:57	19:01	17:15	17:00
14	08:13	07:42	07:55	06:58	06:14	05:54	06:07	06:40	07:16	07:52	07:33	08:08
	17:24	18:05	19:42	20:21	20:57	21:25	21:23	20:49	19:55	19:00	17:14	17:00
15	08:13	07:40	07:53	06:57	06:13	05:54	06:08	06:41	07:17	07:54	07:35	08:08
	17:25	18:06	19:43	20:22	20:58	21:25	21:22	20:47	19:53	18:56	17:13	17:00
16	08:12	07:39	07:51	06:55	06:12	05:54	06:09	06:42	07:19	07:55	07:36	08:09
	17:26	18:07	19:45	20:23	20:59	21:25	21:22	20:46	19:51	18:54	17:12	17:00
17	08:12	07:37	07:49	06:53	06:10	05:54	06:10	06:44	07:20	07:56	07:37	08:10
	17:27	18:09	19:46	20:24	21:00	21:26	21:21	20:44	19:49	18:53	17:11	17:01
18	08:11	07:36	07:47	06:51	06:09	05:54	06:11	06:45	07:21	07:57	07:39	08:10
	17:29	18:10	19:47	20:26	21:02	21:26	21:20	20:42	19:47	18:51	17:10	17:01
19	08:10	07:34	07:46	06:50	06:08	05:54	06:12	06:46	07:22	07:59	07:40	08:11
	17:30	18:12	19:48	20:27	21:03	21:27	21:20	20:41	19:46	18:49	17:09	17:01
20	08:10	07:33	07:44	06:48	06:07	05:54	06:13	06:47	07:23	08:00	07:41	08:12
	17:31	18:13	19:50	20:28	21:04	21:27	21:19	20:39	19:44	18:48	17:08	17:02
21	08:09	07:31	07:42	06:46	06:06	05:54	06:14	06:48	07:24	08:01	07:43	08:12
	17:33	18:14	19:51	20:29	21:05	21:27	21:18	20:38	19:42	18:46	17:07	17:02
22	08:08	07:29	07:40	06:45	06:05	05:55	06:15	06:49	07:26	08:03	07:44	08:13
	17:34	18:16	19:52	20:31	21:06	21:27	21:17	20:36	19:40	18:45	17:06	17:03
23	08:07	07:28	07:38	06:43	06:05	05:55	06:16	06:51	07:27	08:04	07:45	08:13
	17:35	18:17	19:53	20:32	21:07	21:28	21:16	20:34	19:38	18:43	17:06	17:03
24	08:07	07:26	07:36	06:42	06:04	05:55	06:17	06:52	07:28	08:05	07:46	08:14
	17:37	18:18	19:55	20:33	21:08	21:28	21:15	20:33	19:36	18:41	17:05	17:04
25	08:06	07:25	07:35	06:40	06:03	05:55	06:18	06:53	07:29	08:06	07:48	08:14
	17:38	18:20	19:56	20:34	21:09	21:28	21:14	20:31	19:34	18:40	17:04	17:04
26	08:05	07:23	07:33	06:38	06:02	05:56	06:19	06:54	07:30	08:08	07:49	08:14
	17:39	18:21	19:57	20:35	21:10	21:28	21:13	20:29	19:32	18:38	17:04	17:05
27	08:04	07:21	07:31	06:37	06:01	05:56	06:20	06:55	07:31	08:09	07:50	08:15
	17:41	18:22	19:58	20:37	21:11	21:28	21:12	20:28	19:31	18:37	17:03	17:06
28	08:03	07:20	07:29	06:35	06:01	05:57	06:21	06:56	07:33	08:10	07:51	08:15
	17:42	18:24	20:00	20:38	21:12	21:28	21:11	20:26	19:29	18:35	17:03	17:06
29	08:02		07:27	06:34	06:00	05:57	06:22	06:58	07:34	08:12	07:52	08:15
	17:43		20:01	20:39	21:13	21:28	21:10	20:24	19:27	18:34	17:02	17:07
30	08:01		07:25	06:32	05:59	05:58	06:23	06:59	07:35	08:13	07:54	08:15
	17:45		20:02	20:40	21:14	21:28	21:09	20:22	19:25	18:32	17:02	17:08
31	08:00		07:23		05:59		06:24	07:00		08:14		08:16
	17:46		20:03		21:15		21:08	20:21		18:31		17:09
Potential sun hours	287	292	369	403	458	464	470	435	377	341	289	276
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
TEST license
This license is only to be used for testing purposes

Ramos, Tiffanie / tiffanie.ramos@tetratech.com
Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 21 - Non-Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:16	07:59	07:18	07:22	06:31	05:58	05:58	06:25	07:01	07:36	07:16	07:55
	17:10	17:48	18:25	20:05	20:42	21:16	21:28	21:07	20:19	19:23	17:30	17:01
2	08:16	07:58	07:16	07:20	06:30	05:58	05:59	06:27	07:02	07:38	07:17	07:56
	17:11	17:49	18:27	20:06	20:43	21:16	21:28	21:05	20:17	19:21	17:28	17:01
3	08:16	07:56	07:15	07:18	06:28	05:57	05:59	06:28	07:04	07:39	07:19	07:57
	17:12	17:51	18:28	20:07	20:44	21:17	21:28	21:04	20:15	19:20	17:27	17:01
4	08:16	07:55	07:13	07:16	06:27	05:57	06:00	06:29	07:05	07:40	07:20	07:58
	17:13	17:52	18:29	20:08	20:45	21:18	21:27	21:03	20:13	19:18	17:26	17:00
5	08:16	07:54	07:11	07:14	06:25	05:56	06:01	06:30	07:06	07:41	07:21	07:59
	17:14	17:53	18:31	20:10	20:47	21:19	21:27	21:02	20:12	19:16	17:24	17:00
6	08:16	07:53	07:09	07:13	06:24	05:56	06:01	06:31	07:07	07:42	07:23	08:00
	17:15	17:55	18:32	20:11	20:48	21:20	21:27	21:00	20:10	19:14	17:23	17:00
7	08:16	07:51	07:08	07:11	06:23	05:56	06:02	06:32	07:08	07:44	07:24	08:01
	17:16	17:56	18:33	20:12	20:49	21:20	21:27	20:59	20:08	19:12	17:22	17:00
8	08:15	07:50	08:06	07:09	06:21	05:55	06:03	06:33	07:09	07:45	07:25	08:02
	17:17	17:58	18:34	20:13	20:50	21:21	21:26	20:57	20:06	19:10	17:20	17:00
9	08:15	07:49	08:04	07:07	06:20	05:55	06:03	06:35	07:11	07:46	07:27	08:03
	17:18	17:59	19:36	20:15	20:51	21:22	21:26	20:56	20:04	19:09	17:19	17:00
10	08:15	07:48	08:02	07:06	06:19	05:55	06:04	06:36	07:12	07:47	07:28	08:04
	17:19	18:01	19:37	20:16	20:53	21:22	21:25	20:55	20:02	19:07	17:18	17:00
11	08:15	07:46	08:00	07:04	06:17	05:55	06:05	06:37	07:13	07:49	07:29	08:05
	17:20	18:01	19:38	20:17	20:54	21:23	21:25	20:53	20:01	19:05	17:17	17:00
12	08:14	07:45	07:59	07:02	06:16	05:54	06:06	06:38	07:14	07:50	07:31	08:06
	17:21	18:02	19:40	20:18	20:55	21:24	21:24	20:52	19:59	19:03	17:16	17:00
13	08:14	07:43	07:57	07:00	06:15	05:54	06:07	06:39	07:15	07:51	07:32	08:07
	17:23	18:03	19:41	20:20	20:56	21:24	21:24	20:50	19:57	19:02	17:15	17:00
14	08:13	07:42	07:55	06:58	06:14	05:54	06:07	06:40	07:16	07:52	07:33	08:08
	17:24	18:05	19:42	20:21	20:57	21:25	21:23	20:49	19:55	19:00	17:14	17:00
15	08:13	07:40	07:53	06:57	06:13	05:54	06:08	06:41	07:17	07:54	07:35	08:08
	17:25	18:06	19:43	20:22	20:58	21:25	21:23	20:47	19:53	18:56	17:13	17:00
16	08:12	07:39	07:51	06:55	06:12	05:54	06:09	06:43	07:19	07:55	07:36	08:09
	17:26	18:08	19:45	20:23	20:59	21:26	21:22	20:46	19:51	18:55	17:12	17:00
17	08:12	07:37	07:49	06:53	06:11	05:54	06:10	06:44	07:20	07:56	07:37	08:10
	17:28	18:09	19:46	20:25	21:01	21:26	21:21	20:44	19:49	18:53	17:11	17:01
18	08:11	07:36	07:48	06:52	06:10	05:54	06:11	06:45	07:21	07:57	07:39	08:10
	17:29	18:10	19:47	20:26	21:02	21:26	21:20	20:43	19:48	18:51	17:10	17:01
19	08:10	07:34	07:46	06:50	06:09	05:54	06:12	06:46	07:22	07:59	07:40	08:11
	17:30	18:12	19:49	20:27	21:03	21:27	21:20	20:41	19:46	18:50	17:09	17:01
20	08:10	07:33	07:44	06:48	06:08	05:54	06:13	06:47	07:23	08:00	07:41	08:12
	17:31	18:13	19:50	20:28	21:04	21:27	21:19	20:39	19:44	18:48	17:08	17:02
21	08:09	07:31	07:42	06:47	06:07	05:55	06:14	06:48	07:24	08:01	07:43	08:12
	17:33	18:14	19:51	20:29	21:05	21:27	21:18	20:38	19:42	18:46	17:07	17:02
22	08:08	07:30	07:40	06:45	06:06	05:55	06:15	06:50	07:26	08:03	07:44	08:13
	17:34	18:16	19:52	20:31	21:06	21:27	21:17	20:36	19:40	18:45	17:07	17:03
23	08:07	07:28	07:38	06:43	06:05	05:55	06:16	06:51	07:27	08:04	07:45	08:13
	17:35	18:17	19:54	20:32	21:07	21:28	21:16	20:34	19:38	18:43	17:06	17:03
24	08:07	07:26	07:37	06:42	06:04	05:55	06:17	06:52	07:28	08:05	07:46	08:14
	17:37	18:18	19:55	20:33	21:08	21:28	21:15	20:33	19:36	18:41	17:05	17:04
25	08:06	07:25	07:35	06:40	06:03	05:56	06:18	06:53	07:29	08:07	07:48	08:14
	17:38	18:20	19:56	20:34	21:09	21:28	21:14	20:31	19:34	18:40	17:04	17:04
26	08:05	07:23	07:33	06:39	06:02	05:56	06:19	06:54	07:30	08:08	07:49	08:14
	17:40	18:21	19:57	20:36	21:10	21:28	21:13	20:29	19:33	18:38	17:04	17:05
27	08:04	07:21	07:31	06:37	06:02	05:56	06:20	06:55	07:32	08:09	07:50	08:15
	17:41	18:23	19:59	20:37	21:11	21:28	21:12	20:28	19:31	18:37	17:03	17:06
28	08:03	07:20	07:29	06:36	06:01	05:57	06:21	06:57	07:33	08:11	07:51	08:15
	17:42	18:24	20:00	20:38	21:12	21:28	21:11	20:26	19:29	18:35	17:03	17:07
29	08:02		07:27	06:34	06:00	05:57	06:22	06:58	07:34	08:12	07:53	08:15
	17:44		20:01	20:39	21:13	21:28	21:10	20:24	19:27	18:34	17:02	17:07
30	08:01		07:25	06:32	05:59	05:58	06:23	06:59	07:35	08:13	07:54	08:16
	17:45		20:02	20:40	21:14	21:28	21:09	20:22	19:25	18:32	17:02	17:08
31	08:00		07:24		05:59		06:24	07:00		08:15		08:16
	17:46		20:04		21:15		21:08	20:21		18:31		17:09
Potential sun hours	287	292	369	403	458	464	470	435	377	341	289	276
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
TEST license
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Ramos, Tiffanie / tiffanie.ramos@tetratech.com
Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 22 - Non-Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:16	07:59	07:18	07:22	06:31	05:58	05:58	06:25	07:01	07:36	07:16	07:55
	17:10	17:48	18:25	20:05	20:42	21:16	21:28	21:07	20:19	19:23	17:30	17:01
2	08:16	07:58	07:16	07:20	06:30	05:58	05:59	06:27	07:02	07:38	07:17	07:56
	17:11	17:49	18:27	20:06	20:43	21:16	21:28	21:05	20:17	19:21	17:28	17:01
3	08:16	07:56	07:15	07:18	06:28	05:57	05:59	06:28	07:04	07:39	07:19	07:57
	17:12	17:51	18:28	20:07	20:44	21:17	21:28	21:04	20:15	19:20	17:27	17:01
4	08:16	07:55	07:13	07:16	06:27	05:57	06:00	06:29	07:05	07:40	07:20	07:58
	17:13	17:52	18:29	20:08	20:45	21:18	21:27	21:03	20:13	19:18	17:26	17:00
5	08:16	07:54	07:11	07:14	06:25	05:56	06:01	06:30	07:06	07:41	07:21	07:59
	17:14	17:53	18:31	20:10	20:47	21:19	21:27	21:02	20:12	19:16	17:24	17:00
6	08:16	07:53	07:09	07:13	06:24	05:56	06:01	06:31	07:07	07:42	07:23	08:00
	17:15	17:55	18:32	20:11	20:48	21:20	21:27	21:00	20:10	19:14	17:23	17:00
7	08:16	07:51	07:08	07:11	06:23	05:56	06:02	06:32	07:08	07:44	07:24	08:01
	17:16	17:56	18:33	20:12	20:49	21:20	21:27	20:59	20:08	19:12	17:22	17:00
8	08:15	07:50	08:06	07:09	06:21	05:55	06:03	06:33	07:09	07:45	07:25	08:02
	17:17	17:58	18:34	20:13	20:50	21:21	21:26	20:57	20:06	19:10	17:20	17:00
9	08:15	07:49	08:04	07:07	06:20	05:55	06:03	06:35	07:11	07:46	07:27	08:03
	17:18	17:59	19:36	20:15	20:51	21:22	21:26	20:56	20:04	19:09	17:19	17:00
10	08:15	07:48	08:02	07:06	06:19	05:55	06:04	06:36	07:12	07:47	07:28	08:04
	17:19	18:01	19:37	20:16	20:53	21:22	21:25	20:55	20:02	19:07	17:18	17:00
11	08:15	07:46	08:00	07:04	06:17	05:55	06:05	06:37	07:13	07:49	07:29	08:05
	17:20	18:01	19:38	20:17	20:54	21:23	21:25	20:53	20:01	19:05	17:17	17:00
12	08:14	07:45	07:59	07:02	06:16	05:54	06:06	06:38	07:14	07:50	07:31	08:06
	17:21	18:02	19:40	20:18	20:55	21:24	21:24	20:52	19:59	19:03	17:16	17:00
13	08:14	07:43	07:57	07:00	06:15	05:54	06:07	06:39	07:15	07:51	07:32	08:07
	17:23	18:03	19:41	20:20	20:56	21:24	21:24	20:50	19:57	19:02	17:15	17:00
14	08:13	07:42	07:55	06:58	06:14	05:54	06:07	06:40	07:16	07:52	07:33	08:08
	17:24	18:05	19:42	20:21	20:57	21:25	21:23	20:49	19:55	19:00	17:14	17:00
15	08:13	07:40	07:53	06:57	06:13	05:54	06:08	06:41	07:17	07:54	07:35	08:08
	17:25	18:06	19:43	20:22	20:58	21:25	21:22	20:47	19:53	18:56	17:13	17:00
16	08:12	07:39	07:51	06:55	06:12	05:54	06:09	06:43	07:19	07:55	07:36	08:09
	17:26	18:08	19:45	20:23	20:59	21:26	21:22	20:46	19:51	18:55	17:12	17:00
17	08:12	07:37	07:49	06:53	06:11	05:54	06:10	06:44	07:20	07:56	07:37	08:10
	17:28	18:09	19:46	20:25	21:01	21:26	21:21	20:44	19:49	18:53	17:11	17:01
18	08:11	07:36	07:48	06:52	06:10	05:54	06:11	06:45	07:21	07:57	07:39	08:10
	17:29	18:10	19:47	20:26	21:02	21:26	21:20	20:43	19:48	18:51	17:10	17:01
19	08:10	07:34	07:46	06:50	06:09	05:54	06:12	06:46	07:22	07:59	07:40	08:11
	17:30	18:12	19:49	20:27	21:03	21:27	21:20	20:41	19:46	18:50	17:09	17:01
20	08:10	07:33	07:44	06:48	06:08	05:54	06:13	06:47	07:23	08:00	07:41	08:12
	17:31	18:13	19:50	20:28	21:04	21:27	21:19	20:39	19:44	18:48	17:08	17:02
21	08:09	07:31	07:42	06:47	06:07	05:55	06:14	06:48	07:24	08:01	07:43	08:12
	17:33	18:14	19:51	20:29	21:05	21:27	21:18	20:38	19:42	18:46	17:07	17:02
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	17:38	18:20	19:56	20:34	21:09	21:28	21:14	20:31	19:34	18:40	17:04	17:04
26	08:05	07:23	07:33	06:39	06:02	05:56	06:19	06:54	07:30	08:08	07:49	08:14
	17:40	18:21	19:57	20:36	21:10	21:28	21:13	20:29	19:33	18:38	17:04	17:05
27	08:04	07:21	07:31	06:37	06:02	05:56	06:20	06:55	07:32	08:09	07:50	08:15
	17:41	18:23	19:59	20:37	21:11	21:28	21:12	20:28	19:31	18:37	17:03	17:06
28	08:03	07:20	07:29	06:36	06:01	05:57	06:21	06:57	07:33	08:11	07:51	08:15
	17:42	18:24	20:00	20:38	21:12	21:28	21:11	20:26	19:29	18:35	17:03	17:07
29	08:02		07:27	06:34	06:00	05:57	06:22	06:58	07:34	08:12	07:53	08:15
	17:44		20:01	20:39	21:13	21:28	21:10	20:24	19:27	18:34	17:02	17:07
30	08:01		07:25	06:32	05:59	05:58	06:23	06:59	07:35	08:13	07:54	08:16
	17:45		20:02	20:40	21:14	21:28	21:09	20:22	19:25	18:32	17:02	17:08
31	08:00		07:24		05:59		06:24	07:00		08:15		08:16
	17:46		20:04		21:15		21:08	20:21		18:31		17:09
Potential sun hours	287	292	369	403	458	464	470	435	377	341	289	276
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
TEST license
This license is only to be used for testing purposes

Ramos, Tiffanie / tiffanie.ramos@tetratech.com
Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 23 - Non-Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:16	07:59	07:18	07:22	06:31	05:58	05:58	06:26	07:01	07:36	07:16	07:55
	17:10	17:48	18:25	20:05	20:42	21:16	21:28	21:07	20:19	19:23	17:30	17:02
2	08:16	07:58	07:16	07:20	06:30	05:58	05:59	06:27	07:02	07:38	07:17	07:56
	17:11	17:49	18:27	20:06	20:43	21:17	21:28	21:05	20:17	19:21	17:28	17:01
3	08:16	07:56	07:15	07:18	06:28	05:57	05:59	06:28	07:04	07:39	07:19	07:57
	17:12	17:51	18:28	20:07	20:44	21:17	21:28	21:04	20:15	19:20	17:27	17:01
4	08:16	07:55	07:13	07:16	06:27	05:57	06:00	06:29	07:05	07:40	07:20	07:58
	17:13	17:52	18:29	20:09	20:45	21:18	21:27	21:03	20:14	19:18	17:26	17:01
5	08:16	07:54	07:11	07:15	06:25	05:56	06:01	06:30	07:06	07:41	07:21	07:59
	17:14	17:54	18:31	20:10	20:47	21:19	21:27	21:02	20:12	19:16	17:24	17:00
6	08:16	07:53	07:09	07:13	06:24	05:56	06:01	06:31	07:07	07:43	07:23	08:00
	17:15	17:55	18:32	20:11	20:48	21:20	21:27	21:00	20:10	19:14	17:23	17:00
7	08:16	07:52	07:08	07:11	06:23	05:56	06:02	06:32	07:08	07:44	07:24	08:01
	17:16	17:56	18:33	20:12	20:49	21:20	21:27	20:59	20:08	19:12	17:22	17:00
8	08:15	07:50	08:06	07:09	06:21	05:55	06:03	06:33	07:09	07:45	07:25	08:02
	17:17	17:58	18:35	20:14	20:50	21:21	21:26	20:58	20:06	19:11	17:21	17:00
9	08:15	07:49	08:04	07:07	06:20	05:55	06:03	06:35	07:11	07:46	07:27	08:03
	17:18	17:59	19:36	20:15	20:51	21:22	21:26	20:56	20:04	19:09	17:19	17:00
10	08:15	07:48	08:02	07:06	06:19	05:55	06:04	06:36	07:12	07:47	07:28	08:04
	17:19	18:01	19:37	20:16	20:53	21:22	21:25	20:55	20:03	19:07	17:18	17:00
11	08:15	07:46	08:00	07:04	06:18	05:55	06:05	06:37	07:13	07:49	07:29	08:05
	17:20	18:01	19:38	20:17	20:54	21:23	21:25	20:53	20:01	19:05	17:17	17:00
12	08:14	07:45	07:59	07:02	06:16	05:55	06:06	06:38	07:14	07:50	07:31	08:06
	17:22	18:02	19:40	20:18	20:55	21:24	21:24	20:52	19:59	19:03	17:16	17:00
13	08:14	07:43	07:57	07:00	06:15	05:54	06:07	06:39	07:15	07:51	07:32	08:07
	17:23	18:03	19:41	20:20	20:56	21:24	21:24	20:50	19:57	19:02	17:15	17:00
14	08:13	07:42	07:55	06:59	06:14	05:54	06:08	06:40	07:16	07:52	07:33	08:08
	17:24	18:05	19:42	20:21	20:57	21:25	21:23	20:49	19:55	19:00	17:14	17:00
15	08:13	07:40	07:53	06:57	06:13	05:54	06:08	06:42	07:18	07:54	07:35	08:08
	17:25	18:06	19:44	20:22	20:58	21:25	21:23	20:47	19:53	18:56	17:13	17:00
16	08:12	07:39	07:51	06:55	06:12	05:54	06:09	06:43	07:19	07:55	07:36	08:09
	17:26	18:08	19:45	20:23	21:00	21:26	21:22	20:46	19:51	18:55	17:12	17:01
17	08:12	07:37	07:50	06:53	06:11	05:54	06:10	06:44	07:20	07:56	07:37	08:10
	17:28	18:09	19:46	20:25	21:01	21:26	21:21	20:44	19:50	18:53	17:11	17:01
18	08:11	07:36	07:48	06:52	06:10	05:54	06:11	06:45	07:21	07:58	07:39	08:11
	17:29	18:10	19:47	20:26	21:02	21:26	21:20	20:43	19:48	18:51	17:10	17:01
19	08:11	07:34	07:46	06:50	06:09	05:54	06:12	06:46	07:22	07:59	07:40	08:11
	17:30	18:12	19:49	20:27	21:03	21:27	21:20	20:41	19:46	18:50	17:09	17:02
20	08:10	07:33	07:44	06:48	06:08	05:55	06:13	06:47	07:23	08:00	07:41	08:12
	17:32	18:13	19:50	20:28	21:04	21:27	21:19	20:39	19:44	18:48	17:08	17:02
21	08:09	07:31	07:42	06:47	06:07	05:55	06:14	06:49	07:25	08:01	07:43	08:12
	17:33	18:15	19:51	20:30	21:05	21:27	21:18	20:38	19:42	18:46	17:07	17:02
22	08:08	07:30	07:40	06:45	06:06	05:55	06:15	06:50	07:26	08:03	07:44	08:13
	17:34	18:16	19:52	20:31	21:06	21:28	21:17	20:36	19:40	18:45	17:07	17:03
23	08:08	07:28	07:38	06:43	06:05	05:55	06:16	06:51	07:27	08:04	07:45	08:13
	17:36	18:17	19:54	20:32	21:07	21:28	21:16	20:34	19:38	18:43	17:06	17:03
24	08:07	07:26	07:37	06:42	06:04	05:55	06:17	06:52	07:28	08:05	07:47	08:14
	17:37	18:19	19:55	20:33	21:08	21:28	21:15	20:33	19:36	18:42	17:05	17:04
25	08:06	07:25	07:35	06:40	06:03	05:56	06:18	06:53	07:29	08:07	07:48	08:14
	17:38	18:20	19:56	20:34	21:09	21:28	21:14	20:31	19:34	18:40	17:05	17:05
26	08:05	07:23	07:33	06:39	06:02	05:56	06:19	06:54	07:30	08:08	07:49	08:15
	17:40	18:21	19:57	20:36	21:10	21:28	21:13	20:29	19:33	18:38	17:04	17:05
27	08:04	07:21	07:31	06:37	06:02	05:57	06:20	06:56	07:32	08:09	07:50	08:15
	17:41	18:23	19:59	20:37	21:11	21:28	21:12	20:28	19:31	18:37	17:03	17:06
28	08:03	07:20	07:29	06:36	06:01	05:57	06:21	06:57	07:33	08:11	07:51	08:15
	17:42	18:24	20:00	20:38	21:12	21:28	21:11	20:26	19:29	18:35	17:03	17:07
29	08:02		07:27	06:34	06:00	05:57	06:22	06:58	07:34	08:12	07:53	08:15
	17:44		20:01	20:39	21:13	21:28	21:10	20:24	19:27	18:34	17:02	17:07
30	08:01		07:26	06:33	06:00	05:58	06:23	06:59	07:35	08:13	07:54	08:16
	17:45		20:02	20:41	21:14	21:28	21:09	20:22	19:25	18:33	17:02	17:08
31	08:00		07:24		05:59		06:24	07:00		08:15		08:16
	17:47		20:04		21:15		21:08	20:21		18:31		17:09
Potential sun hours	287	292	369	403	458	464	470	435	377	341	289	276
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
TEST license
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Ramos, Tiffanie / tiffanie.ramos@tetratech.com
Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 24 - Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:16	07:59	07:18	07:22	06:31	05:59	05:59	06:26	07:02	07:37	07:16	07:55
	17:10	17:48	18:26	20:05	20:42	21:16	21:28	21:07	20:19	19:23	17:30	17:02
2	08:16	07:58	07:16	07:20	06:30	05:58	05:59	06:27	07:03	07:38	07:17	07:56
	17:11	17:50	18:27	20:06	20:43	21:17	21:28	21:05	20:17	19:22	17:29	17:01
3	08:16	07:57	07:15	07:18	06:28	05:58	06:00	06:28	07:04	07:39	07:19	07:57
	17:12	17:51	18:28	20:07	20:44	21:17	21:28	21:04	20:15	19:20	17:27	17:01
4	08:16	07:55	07:13	07:17	06:27	05:57	06:00	06:29	07:05	07:40	07:20	07:58
	17:13	17:52	18:29	20:09	20:46	21:18	21:28	21:03	20:14	19:18	17:26	17:01
5	08:16	07:54	07:11	07:15	06:26	05:57	06:01	06:30	07:06	07:41	07:21	07:59
	17:14	17:54	18:31	20:10	20:47	21:19	21:27	21:02	20:12	19:16	17:25	17:01
6	08:16	07:53	07:10	07:13	06:24	05:56	06:02	06:31	07:07	07:43	07:23	08:00
	17:15	17:55	18:32	20:11	20:48	21:20	21:27	21:00	20:10	19:14	17:23	17:00
7	08:16	07:52	07:08	07:11	06:23	05:56	06:02	06:33	07:08	07:44	07:24	08:01
	17:16	17:57	18:33	20:12	20:49	21:20	21:27	20:59	20:08	19:12	17:22	17:00
8	08:15	07:50	08:06	07:09	06:22	05:56	06:03	06:34	07:10	07:45	07:26	08:02
	17:17	17:58	18:35	20:14	20:50	21:21	21:26	20:58	20:06	19:11	17:21	17:00
9	08:15	07:49	08:04	07:08	06:20	05:55	06:04	06:35	07:11	07:46	07:27	08:03
	17:18	17:59	19:36	20:15	20:51	21:22	21:26	20:56	20:05	19:09	17:20	17:00
10	08:15	07:48	08:02	07:06	06:19	05:55	06:05	06:36	07:12	07:48	07:28	08:04
	17:20	18:01	19:37	20:16	20:53	21:22	21:25	20:55	20:03	19:07	17:18	17:00
11	08:15	07:46	08:01	07:04	06:18	05:55	06:05	06:37	07:13	07:49	07:30	08:05
	17:21	18:01	19:39	20:17	20:54	21:23	21:25	20:53	20:01	19:05	17:17	17:00
12	08:14	07:45	07:59	07:02	06:17	05:55	06:06	06:38	07:14	07:50	07:31	08:06
	17:22	18:02	19:40	20:19	20:55	21:24	21:24	20:52	19:59	19:04	17:16	17:00
13	08:14	07:44	07:57	07:01	06:15	05:55	06:07	06:39	07:15	07:51	07:32	08:07
	17:23	18:04	19:41	20:20	20:56	21:24	21:24	20:50	19:57	19:02	17:15	17:00
14	08:13	07:42	07:55	06:59	06:14	05:55	06:08	06:41	07:17	07:53	07:34	08:08
	17:24	18:05	19:42	20:21	20:57	21:25	21:23	20:49	19:55	19:00	17:14	17:00
15	08:13	07:41	07:53	06:57	06:13	05:55	06:09	06:42	07:18	07:54	07:35	08:08
	17:25	18:06	19:44	20:22	20:58	21:25	21:23	20:47	19:53	18:57	17:13	17:01
16	08:12	07:39	07:52	06:55	06:12	05:55	06:10	06:43	07:19	07:55	07:36	08:09
	17:27	18:08	19:45	20:23	21:00	21:26	21:22	20:46	19:52	18:55	17:12	17:01
17	08:12	07:38	07:50	06:54	06:11	05:55	06:10	06:44	07:20	07:56	07:38	08:10
	17:28	18:09	19:46	20:25	21:01	21:26	21:21	20:44	19:50	18:53	17:11	17:01
18	08:11	07:36	07:48	06:52	06:10	05:55	06:11	06:45	07:21	07:58	07:39	08:11
	17:29	18:11	19:48	20:26	21:02	21:26	21:21	20:43	19:48	18:52	17:10	17:01
19	08:11	07:35	07:46	06:50	06:09	05:55	06:12	06:46	07:22	07:59	07:40	08:11
	17:31	18:12	19:49	20:27	21:03	21:27	21:20	20:41	19:46	18:50	17:09	17:02
20	08:10	07:33	07:44	06:49	06:08	05:55	06:13	06:48	07:24	08:00	07:41	08:12
	17:32	18:13	19:50	20:28	21:04	21:27	21:19	20:40	19:44	18:48	17:08	17:02
21	08:09	07:31	07:42	06:47	06:07	05:55	06:14	06:49	07:25	08:02	07:43	08:12
	17:33	18:15	19:51	20:30	21:05	21:27	21:18	20:38	19:42	18:47	17:08	17:03
22	08:08	07:30	07:40	06:45	06:06	05:55	06:15	06:50	07:26	08:03	07:44	08:13
	17:34	18:16	19:53	20:31	21:06	21:28	21:17	20:36	19:40	18:45	17:07	17:03
23	08:08	07:28	07:39	06:44	06:05	05:55	06:16	06:51	07:27	08:04	07:45	08:13
	17:36	18:17	19:54	20:32	21:07	21:28	21:16	20:35	19:38	18:43	17:06	17:04
24	08:07	07:27	07:37	06:42	06:04	05:56	06:17	06:52	07:28	08:05	07:47	08:14
	17:37	18:19	19:55	20:33	21:08	21:28	21:15	20:33	19:37	18:42	17:05	17:04
25	08:06	07:25	07:35	06:40	06:03	05:56	06:18	06:53	07:29	08:07	07:48	08:14
	17:38	18:20	19:56	20:35	21:09	21:28	21:14	20:31	19:35	18:40	17:05	17:05
26	08:05	07:23	07:33	06:39	06:03	05:56	06:19	06:55	07:31	08:08	07:49	08:15
	17:40	18:21	19:58	20:36	21:10	21:28	21:13	20:30	19:33	18:39	17:04	17:05
27	08:04	07:22	07:31	06:37	06:02	05:57	06:20	06:56	07:32	08:09	07:50	08:15
	17:41	18:23	19:59	20:37	21:11	21:28	21:12	20:28	19:31	18:37	17:04	17:06
28	08:03	07:20	07:29	06:36	06:01	05:57	06:21	06:57	07:33	08:11	07:51	08:15
	17:43	18:24	20:00	20:38	21:12	21:28	21:11	20:26	19:29	18:36	17:03	17:07
29	08:02		07:28	06:34	06:01	05:58	06:23	06:58	07:34	08:12	07:53	08:15
	17:44		20:01	20:39	21:13	21:28	21:10	20:24	19:27	18:34	17:03	17:08
30	08:01		07:26	06:33	06:00	05:58	06:24	06:59	07:35	08:13	07:54	08:16
	17:45		20:03	20:41	21:14	21:28	21:09	20:23	19:25	18:33	17:02	17:08
31	08:00		07:24		05:59		06:25	07:00		08:15		08:16
	17:47		20:04		21:15		21:08	20:21		18:31		17:09
Potential sun hours	288	292	369	403	458	464	470	435	377	341	289	276
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

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Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 25 - Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
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Idle start wind speed: Cut in wind speed from power curve

	January	February		March	April	May	June	July	August	September	October		November		December
1	08:16	07:59		07:18	07:22	06:31	05:58	05:58	06:26	07:01	07:36		07:16	07:39 (19)	07:55
	17:10	17:48		18:25	20:05	20:42	21:16	21:28	21:07	20:19	19:23		17:30	9 07:48 (19)	17:02
2	08:16	07:58		07:16	07:20	06:30	05:58	05:59	06:27	07:03	07:38		07:17	07:40 (19)	07:56
	17:11	17:49		18:27	20:06	20:43	21:16	21:28	21:05	20:17	19:21		17:28	7 07:47 (19)	17:01
3	08:16	07:56		07:15	07:18	06:28	05:57	06:00	06:28	07:04	07:39		07:19	07:41 (19)	07:57
	17:12	17:51		18:28	20:07	20:44	21:17	21:28	21:04	20:15	19:20		17:27	5 07:46 (19)	17:01
4	08:16	07:55		07:13	07:16	06:27	05:57	06:00	06:29	07:05	07:40		07:20	07:43 (19)	07:58
	17:13	17:52		18:29	20:09	20:45	21:18	21:27	21:03	20:14	19:18		17:26	2 07:45 (19)	17:01
5	08:16	07:54		07:11	07:15	06:25	05:57	06:01	06:30	07:06	07:41		07:21		07:59
	17:14	17:54		18:31	20:10	20:47	21:19	21:27	21:02	20:12	19:16		17:24		17:00
6	08:16	07:53		07:09	07:13	06:24	05:56	06:01	06:31	07:07	07:43		07:23		08:00
	17:15	17:55		18:32	20:11	20:48	21:20	21:27	21:00	20:10	19:14		17:23		17:00
7	08:16	07:52	08:13 (19)	07:08	07:11	06:23	05:56	06:02	06:32	07:08	07:44		07:24		08:01
	17:16	17:56	2 08:15 (19)	18:33	20:12	20:49	21:20	21:27	20:59	20:08	19:12		17:22		17:00
8	08:15	07:50	08:12 (19)	08:06	07:09	06:21	05:56	06:03	06:34	07:09	07:45		07:25		08:02
	17:17	17:58	5 08:17 (19)	18:35	20:13	20:50	21:21	21:26	20:58	20:06	19:11		17:21		17:00
9	08:15	07:49	08:10 (19)	08:04	07:07	06:20	05:55	06:04	06:35	07:11	07:46		07:27		08:03
	17:18	17:59	7 08:17 (19)	19:36	20:15	20:51	21:22	21:26	20:56	20:04	19:09		17:19		17:00
10	08:15	07:48	08:09 (19)	08:02	07:06	06:19	05:55	06:04	06:36	07:12	07:47		07:28		08:04
	17:19	18:01	9 08:18 (19)	19:37	20:16	20:53	21:22	21:25	20:55	20:03	19:07		17:18		17:00
11	08:15	07:46	08:07 (19)	08:00	07:04	06:18	05:55	06:05	06:37	07:13	07:49		07:29		08:05
	17:20	18:01	11 08:18 (19)	19:38	20:17	20:54	21:23	21:25	20:53	20:01	19:05		17:17		17:00
12	08:14	07:45	08:06 (19)	07:59	07:02	06:16	05:55	06:06	06:38	07:14	07:50		07:31		08:06
	17:22	18:02	13 08:19 (19)	19:40	20:18	20:55	21:24	21:24	20:52	19:59	19:03		17:16		17:00
13	08:14	07:43	08:05 (19)	07:57	07:00	06:15	05:55	06:07	06:39	07:15	07:51		07:32		08:07
	17:23	18:03	14 08:19 (19)	19:41	20:20	20:56	21:24	21:24	20:50	19:57	19:02		17:15		17:00
14	08:13	07:42	08:03 (19)	07:55	06:59	06:14	05:54	06:08	06:40	07:16	07:52		07:33		08:08
	17:24	18:05	15 08:18 (19)	19:42	20:21	20:57	21:25	21:23	20:49	19:55	19:00		17:14		17:00
15	08:13	07:40	08:02 (19)	07:53	06:57	06:13	05:54	06:08	06:42	07:18	07:54		07:35		08:08
	17:25	18:06	16 08:18 (19)	19:44	20:22	20:58	21:25	21:23	20:47	19:53	18:56		17:13		17:00
16	08:12	07:39	08:00 (19)	07:51	06:55	06:12	05:54	06:09	06:43	07:19	07:55		07:36		08:09
	17:27	18:08	17 08:17 (19)	19:45	20:23	20:59	21:26	21:22	20:46	19:51	18:55		17:12		17:01
17	08:12	07:37	08:00 (19)	07:50	06:53	06:11	05:54	06:10	06:44	07:20	07:56		07:37		08:10
	17:28	18:09	16 08:16 (19)	19:46	20:25	21:01	21:26	21:21	20:44	19:50	18:53		17:11		17:01
18	08:11	07:36	08:02 (19)	07:48	06:52	06:10	05:54	06:11	06:45	07:21	07:58		07:39		08:10
	17:29	18:10	13 08:15 (19)	19:47	20:26	21:02	21:26	21:20	20:43	19:48	18:51		17:10		17:01
19	08:10	07:34	08:04 (19)	07:46	06:50	06:09	05:55	06:12	06:46	07:22	07:59		07:40		08:11
	17:30	18:12	8 08:12 (19)	19:49	20:27	21:03	21:27	21:20	20:41	19:46	18:50		17:09		17:02
20	08:10	07:33		07:44	06:48	06:08	05:55	06:13	06:47	07:23	08:00		07:41		08:12
	17:32	18:13		19:50	20:28	21:04	21:27	21:19	20:39	19:44	18:48		17:08		17:02
21	08:09	07:31		07:42	06:47	06:07	05:55	06:14	06:49	07:25	08:01		07:43		08:12
	17:33	18:15		19:51	20:29	21:05	21:27	21:18	20:38	19:42	18:46		17:08		17:02
22	08:08	07:30		07:40	06:45	06:06	05:55	06:15	06:50	07:26	08:03		07:44		08:13
	17:34	18:16		19:52	20:31	21:06	21:27	21:17	20:36	19:40	18:45		17:07		17:03
23	08:07	07:28		07:38	06:44	06:05	05:55	06:16	06:51	07:27	08:04		08:34 (19)	07:45	08:13
	17:36	18:17		19:54	20:32	21:07	21:28	21:16	20:34	19:38	18:43	9	08:43 (19)	17:06	17:03
24	08:07	07:26		07:37	06:42	06:04	05:56	06:17	06:52	07:28	08:05		08:31 (19)	07:46	08:14
	17:37	18:19		19:55	20:33	21:08	21:28	21:15	20:33	19:36	18:42	14	08:45 (19)	17:05	17:04
25	08:06	07:25		07:35	06:40	06:03	05:56	06:18	06:53	07:29	08:07		08:31 (19)	07:48	08:14
	17:38	18:20		19:56	20:34	21:09	21:28	21:14	20:31	19:34	18:40	16	08:47 (19)	17:05	17:05
26	08:05	07:23		07:33	06:39	06:02	05:56	06:19	06:54	07:30	08:08		08:30 (19)	07:49	08:14
	17:40	18:21		19:57	20:36	21:10	21:28	21:13	20:29	19:33	18:39	17	08:47 (19)	17:04	17:05
27	08:04	07:21		07:31	06:37	06:02	05:57	06:20	06:56	07:32	08:09		08:31 (19)	07:50	08:15
	17:41	18:23		19:59	20:37	21:11	21:28	21:12	20:28	19:31	18:37	16	08:47 (19)	17:03	17:06
28	08:03	07:20		07:29	06:36	06:01	05:57	06:21	06:57	07:33	08:11		08:33 (19)	07:51	08:15
	17:42	18:24		20:00	20:38	21:12	21:28	21:11	20:26	19:29	18:36	15	08:48 (19)	17:03	17:07
29	08:02			07:27	06:34	06:00	05:57	06:22	06:58	07:34	08:12		08:34 (19)	07:53	08:15
	17:44			20:01	20:39	21:13	21:28	21:10	20:24	19:27	18:34	14	08:48 (19)	17:02	17:07
30	08:01			07:26	06:33	06:00	05:58	06:23	06:59	07:35	08:13		08:36 (19)	07:54	08:16
	17:45			20:02	20:41	21:14	21:28	21:09	20:22	19:25	18:33	12	08:48 (19)	17:02	17:08
31	08:00			07:24		05:59		06:25	07:00		08:15		08:37 (19)		08:16
	17:47			20:04		21:15		21:08	20:21		18:31	11	08:48 (19)		17:09
Potential sun hours	288	292		369	403	458	464	470	435	377	341			289		276
Total, worst case			146									124			23	
Sun reduction			0.62									0.59			0.51	
Oper. time red.			0.98									0.98			0.98	
Wind dir. red.			0.74									0.74			0.74	
Total reduction			0.45									0.43			0.37	
Total, real			66									53			9	

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:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
TEST license
This license is only to be used for testing purposes

Ramos, Tiffanie / tiffanie.ramos@tetratech.com
Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 26 - Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	January	February	March		April		May		June	
1	08:16	07:59	07:18		07:22		06:31		06:52 (21)	05:58		06:46 (21)
	17:10	17:48	18:25		20:05		20:42	38	07:30 (21)	21:15	106	20:47 (20)
2	08:16	07:57	07:16		07:20		06:30		06:51 (21)	05:58		06:46 (21)
	17:11	17:49	18:27		20:06		20:43	40	07:31 (21)	21:16	105	20:47 (20)
3	08:16	07:56	07:14		07:18		06:28		06:49 (21)	05:57		06:47 (21)
	17:12	17:51	18:28		20:07		20:44	43	07:32 (21)	21:17	104	20:47 (20)
4	08:16	07:55	07:13		07:16		06:27		06:48 (21)	05:57		06:46 (21)
	17:13	17:52	18:29		20:08		20:45	45	07:33 (21)	21:18	105	20:47 (20)
5	08:16	07:54	07:11	18:08 (19)	07:14		06:25		06:47 (21)	05:56		06:47 (21)
	17:14	17:54	18:31	1 18:09 (19)	20:10		20:46	47	07:34 (21)	21:19	104	20:47 (20)
6	08:16	07:53	07:09	18:07 (19)	07:13	07:33 (22)	06:24		06:46 (21)	05:56		06:48 (21)
	17:15	17:55	18:32	4 18:11 (19)	20:11	1 07:34 (22)	20:48	48	07:34 (21)	21:19	103	20:48 (20)
7	08:15	07:51	07:07	18:05 (19)	07:11	07:31 (22)	06:23		06:45 (21)	05:56		06:48 (21)
	17:16	17:56	18:33	7 18:12 (19)	20:12	4 07:35 (22)	20:49	64	20:25 (20)	21:20	103	20:48 (20)
8	08:15	07:50	08:06	19:03 (19)	07:09	07:29 (22)	06:21		06:45 (21)	05:55		06:48 (21)
	17:17	17:58	18:34	10 19:13 (19)	20:13	7 07:36 (22)	20:50	69	20:26 (20)	21:21	103	20:48 (20)
9	08:15	07:49	08:04	19:02 (19)	07:07	07:27 (22)	06:20		06:45 (21)	05:55		06:49 (21)
	17:18	17:59	19:36	12 19:14 (19)	20:15	9 07:36 (22)	20:51	74	20:28 (20)	21:22	102	20:48 (20)
10	08:15	07:47	08:02	19:01 (19)	07:06	07:26 (22)	06:19		06:43 (21)	05:55		06:50 (21)
	17:19	18:01	19:37	14 19:15 (19)	20:16	11 07:37 (22)	20:52	78	20:28 (20)	21:22	102	20:49 (20)
11	08:14	07:46	08:00	19:01 (19)	07:04	07:24 (22)	06:18		06:43 (21)	05:55		06:50 (21)
	17:20	18:01	19:38	16 19:17 (19)	20:17	12 07:36 (22)	20:54	81	20:29 (20)	21:23	101	20:49 (20)
12	08:14	07:45	07:59	19:01 (19)	07:02	07:22 (22)	06:16		06:43 (21)	05:55		06:50 (21)
	17:22	18:02	19:40	18 19:19 (19)	20:18	14 07:36 (22)	20:55	84	20:30 (20)	21:23	101	20:49 (20)
13	08:14	07:43	07:57	19:01 (19)	07:00	07:20 (22)	06:15		06:43 (21)	05:54		06:50 (21)
	17:23	18:03	19:41	19 19:20 (19)	20:20	15 07:35 (22)	20:56	87	20:32 (20)	21:24	101	20:49 (20)
14	08:13	07:42	07:55	19:01 (19)	06:59	07:19 (22)	06:14		06:43 (21)	05:54		06:50 (21)
	17:24	18:05	19:42	20 19:21 (19)	20:21	16 07:35 (22)	20:57	90	20:33 (20)	21:24	100	20:49 (20)
15	08:13	07:40	07:53	19:01 (19)	06:57	07:17 (22)	06:13		06:43 (21)	05:54		06:51 (21)
	17:25	18:06	19:43	21 19:22 (19)	20:22	16 07:33 (22)	20:58	92	20:34 (20)	21:25	99	20:49 (20)
16	08:12	07:39	07:51	19:01 (19)	06:55	07:17 (22)	06:12		06:43 (21)	05:54		06:51 (21)
	17:26	18:08	19:45	20 19:21 (19)	20:23	15 07:32 (22)	20:59	94	20:35 (20)	21:25	100	20:49 (20)
17	08:12	07:37	07:49	19:03 (19)	06:53	07:18 (22)	06:11		06:42 (21)	05:54		06:51 (21)
	17:28	18:09	19:46	18 19:21 (19)	20:24	13 07:31 (22)	21:00	96	20:36 (20)	21:26	101	20:50 (20)
18	08:11	07:36	07:48	19:04 (19)	06:52	07:21 (22)	06:10		06:42 (21)	05:54		06:52 (21)
	17:29	18:10	19:47	15 19:19 (19)	20:26	6 07:27 (22)	21:02	98	20:37 (20)	21:26	100	20:50 (20)
19	08:10	07:34	07:46	19:07 (19)	06:50		06:09		06:42 (21)	05:54		06:53 (21)
	17:30	18:12	19:49	8 19:15 (19)	20:27		21:03	100	20:38 (20)	21:27	100	20:51 (20)
20	08:10	07:33	07:44		06:48		06:08		06:42 (21)	05:55		06:53 (21)
	17:32	18:13	19:50		20:28		21:04	101	20:39 (20)	21:27	99	20:51 (20)
21	08:09	07:31	07:42		06:47		06:07		06:42 (21)	05:55		06:53 (21)
	17:33	18:14	19:51		20:29		21:05	103	20:40 (20)	21:27	99	20:51 (20)
22	08:08	07:30	07:40		06:45		06:06		06:42 (21)	05:55		06:53 (21)
	17:34	18:16	19:52		20:31		21:06	102	20:40 (20)	21:27	99	20:51 (20)
23	08:07	07:28	07:38		06:43		06:05		06:42 (21)	05:55		06:53 (21)
	17:35	18:17	19:54		20:32		21:07	104	20:41 (20)	21:28	99	20:51 (20)
24	08:06	07:26	07:36		06:42		06:04		06:43 (21)	05:55		06:54 (21)
	17:37	18:19	19:55		20:33		21:08	105	20:43 (20)	21:28	100	20:52 (20)
25	08:06	07:25	07:35		06:40	07:06 (21)	06:03		06:43 (21)	05:56		06:53 (21)
	17:38	18:20	19:56		20:34	11 07:17 (21)	21:09	106	20:44 (20)	21:28	101	20:52 (20)
26	08:05	07:23	07:33		06:39	07:01 (21)	06:02		06:43 (21)	05:56		06:53 (21)
	17:40	18:21	19:57		20:35	20 07:21 (21)	21:10	106	20:44 (20)	21:28	101	20:52 (20)
27	08:04	07:21	07:31		06:37	06:59 (21)	06:02		06:44 (21)	05:56		06:54 (21)
	17:41	18:23	19:59		20:37	25 07:24 (21)	21:11	107	20:45 (20)	21:28	99	20:52 (20)
28	08:03	07:20	07:29		06:36	06:56 (21)	06:01		06:44 (21)	05:57		06:54 (21)
	17:42	18:24	20:00		20:38	30 07:26 (21)	21:12	106	20:45 (20)	21:28	99	20:52 (20)
29	08:02		07:27		06:34	06:55 (21)	06:00		06:44 (21)	05:57		06:54 (21)
	17:44		20:01		20:39	33 07:28 (21)	21:13	106	20:45 (20)	21:28	100	20:53 (20)
30	08:01		07:25		06:33	06:53 (21)	06:00		06:45 (21)	05:58		06:54 (21)
	17:45		20:02		20:40	35 07:28 (21)	21:14	106	20:46 (20)	21:28	101	20:53 (20)
31	08:00		07:24				05:59		06:45 (21)			
	17:46		20:03				21:15	105	20:46 (20)			
Potential sun hours	288	292	369		403		458			464		
Total, worst case				203		293		2625			3037	
Sun reduction				0.62		0.59		0.66			0.69	
Oper. time red.				0.98		0.98		0.98			0.98	
Wind dir. red.				0.64		0.62		0.66			0.68	
Total reduction				0.39		0.36		0.42			0.46	
Total, real				79		105		1113			1394	

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:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
TEST license
This license is only to be used for testing purposes

Ramos, Tiffanie / tiffanie.ramos@tetratech.com
Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 26 - Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	July			August			September			October			November	December
1	05:58		06:54 (21)	06:26		06:54 (21)	07:01		07:23 (22)	07:36		18:40 (19)	07:16	07:55
	21:28	101	20:53 (20)	21:06	83	20:40 (20)	20:19	12	07:35 (22)	19:23	18	18:58 (19)	17:30	17:02
2	05:59		06:54 (21)	06:27		06:54 (21)	07:02		07:24 (22)	07:38		18:40 (19)	07:17	07:56
	21:28	101	20:53 (20)	21:05	79	20:39 (20)	20:17	11	07:35 (22)	19:21	17	18:57 (19)	17:28	17:01
3	05:59		06:54 (21)	06:28		06:54 (21)	07:04		07:25 (22)	07:39		18:40 (19)	07:18	07:57
	21:27	103	20:54 (20)	21:04	77	20:38 (20)	20:15	9	07:34 (22)	19:20	15	18:55 (19)	17:27	17:01
4	06:00		06:54 (21)	06:29		06:54 (21)	07:05		07:26 (22)	07:40		18:39 (19)	07:20	07:58
	21:27	102	20:53 (20)	21:03	73	20:37 (20)	20:13	7	07:33 (22)	19:18	14	18:53 (19)	17:26	17:01
5	06:01		06:54 (21)	06:30		06:55 (21)	07:06		07:27 (22)	07:41		18:40 (19)	07:21	07:59
	21:27	104	20:54 (20)	21:01	67	20:35 (20)	20:12	4	07:31 (22)	19:16	10	18:50 (19)	17:24	17:00
6	06:01		06:54 (21)	06:31		06:55 (21)	07:07		07:29 (22)	07:42		18:40 (19)	07:23	08:00
	21:27	103	20:54 (20)	21:00	60	20:33 (20)	20:10	1	07:30 (22)	19:14	8	18:48 (19)	17:23	17:00
7	06:02		06:53 (21)	06:32		06:55 (21)	07:08			07:44		18:42 (19)	07:24	08:01
	21:26	104	20:54 (20)	20:59	48	07:43 (21)	20:08			19:12	5	18:47 (19)	17:22	17:00
8	06:03		06:54 (21)	06:33		06:56 (21)	07:09			07:45		18:43 (19)	07:25	08:02
	21:26	104	20:54 (20)	20:57	46	07:42 (21)	20:06			19:10	2	18:45 (19)	17:20	17:00
9	06:03		06:54 (21)	06:35		06:58 (21)	07:11			07:46			07:27	08:03
	21:26	105	20:55 (20)	20:56	44	07:42 (21)	20:04			19:09			17:19	17:00
10	06:04		06:53 (21)	06:36		06:59 (21)	07:12			07:47			07:28	08:04
	21:25	105	20:54 (20)	20:55	42	07:41 (21)	20:02			19:07			17:18	17:00
11	06:05		06:53 (21)	06:37		07:00 (21)	07:13			07:49			07:29	08:05
	21:25	106	20:54 (20)	20:53	40	07:40 (21)	20:01			19:05			17:17	17:00
12	06:06		06:53 (21)	06:38		07:01 (21)	07:14			07:50			07:31	08:06
	21:24	106	20:54 (20)	20:52	37	07:38 (21)	19:59			19:03			17:16	17:00
13	06:07		06:54 (21)	06:39		07:02 (21)	07:15			07:51			07:32	08:07
	21:24	106	20:55 (20)	20:50	35	07:37 (21)	19:57			19:02			17:15	17:00
14	06:08		06:54 (21)	06:40		07:03 (21)	07:16			07:52			07:33	08:07
	21:23	106	20:55 (20)	20:49	32	07:35 (21)	19:55			19:00			17:14	17:00
15	06:08		06:53 (21)	06:41		07:04 (21)	07:17			07:54			07:35	08:08
	21:22	106	20:54 (20)	20:47	29	07:33 (21)	19:53			18:56			17:13	17:00
16	06:09		06:53 (21)	06:43		07:06 (21)	07:19			07:55			07:36	08:09
	21:22	106	20:54 (20)	20:46	24	07:30 (21)	19:51			18:55			17:12	17:01
17	06:10		06:53 (21)	06:44		07:09 (21)	07:20			07:56			07:37	08:10
	21:21	106	20:54 (20)	20:44	18	07:27 (21)	19:49			18:53			17:11	17:01
18	06:11		06:53 (21)	06:45		07:14 (21)	07:21			07:57			07:39	08:10
	21:20	105	20:53 (20)	20:42	7	07:21 (21)	19:48			18:51			17:10	17:01
19	06:12		06:53 (21)	06:46			07:22			07:59			07:40	08:11
	21:19	105	20:53 (20)	20:41			19:46			18:50			17:09	17:01
20	06:13		06:53 (21)	06:47			07:23			08:00			07:41	08:12
	21:19	103	20:52 (20)	20:39			19:44			18:48			17:08	17:02
21	06:14		06:53 (21)	06:48			07:24			08:01			07:42	08:12
	21:18	103	20:51 (20)	20:38			19:42			18:46			17:07	17:02
22	06:15		06:53 (21)	06:50			07:26			08:03			07:44	08:13
	21:17	102	20:51 (20)	20:36			19:40			18:45			17:07	17:03
23	06:16		06:53 (21)	06:51			07:27			08:04			07:45	08:13
	21:16	101	20:50 (20)	20:34			19:38			18:43			17:06	17:03
24	06:17		06:53 (21)	06:52			07:28		18:52 (19)	08:05			07:46	08:14
	21:15	99	20:49 (20)	20:33			19:36	5	18:57 (19)	18:42			17:05	17:04
25	06:18		06:53 (21)	06:53		07:23 (22)	07:29		18:47 (19)	08:06			07:48	08:14
	21:14	98	20:48 (20)	20:31	8	07:31 (22)	19:34	13	19:00 (19)	18:40			17:05	17:05
26	06:19		06:53 (21)	06:54		07:20 (22)	07:30		18:45 (19)	08:08			07:49	08:14
	21:13	96	20:47 (20)	20:29	13	07:33 (22)	19:32	17	19:02 (19)	18:38			17:04	17:05
27	06:20		06:53 (21)	06:55		07:18 (22)	07:32		18:44 (19)	08:09			07:50	08:15
	21:12	94	20:46 (20)	20:28	16	07:34 (22)	19:31	20	19:04 (19)	18:37			17:03	17:06
28	06:21		06:53 (21)	06:57		07:19 (22)	07:33		18:43 (19)	08:10			07:51	08:15
	21:11	93	20:45 (20)	20:26	16	07:35 (22)	19:29	21	19:04 (19)	18:35			17:03	17:07
29	06:22		06:53 (21)	06:58		07:20 (22)	07:34		18:41 (19)	08:12			07:52	08:15
	21:10	91	20:44 (20)	20:24	16	07:36 (22)	19:27	21	19:02 (19)	18:34			17:02	17:07
30	06:23		06:53 (21)	06:59		07:21 (22)	07:35		18:40 (19)	08:13			07:54	08:15
	21:09	89	20:43 (20)	20:22	15	07:36 (22)	19:25	20	19:00 (19)	18:32			17:02	17:08
31	06:24		06:53 (21)	07:00		07:22 (22)				08:14				08:16
	21:08	87	20:42 (20)	20:21	14	07:36 (22)				18:31				17:09
Potential sun hours	470			435			377			341			289	276
Total, worst case		3140			939			161			89			
Sun reduction		0.76			0.74			0.69			0.59			
Oper. time red.		0.98			0.98			0.98			0.98			
Wind dir. red.		0.67			0.62			0.64			0.64			
Total reduction		0.50			0.45			0.43			0.37			
Total, real		1567			424			70			33			

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:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
TEST license
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Ramos, Tiffanie / tiffanie.ramos@tetratech.com
Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 27 - Participant
Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:16	07:58	07:18	07:22	06:31	05:58	05:58	06:25	07:01	07:36	07:16	07:55
	17:10	17:48	18:25	20:05	20:41	21:15	21:28	21:06	20:19	19:23	17:30	17:01
2	08:16	07:57	07:16	07:20	06:30	05:58	05:59	06:27	07:02	07:37	07:17	07:56
	17:11	17:49	18:26	20:06	20:43	21:16	21:27	21:05	20:17	19:21	17:28	17:01
3	08:16	07:56	07:14	07:18	06:28	05:57	05:59	06:28	07:03	07:39	07:18	07:57
	17:12	17:51	18:28	20:07	20:44	21:17	21:27	21:04	20:15	19:19	17:27	17:01
4	08:16	07:55	07:13	07:16	06:27	05:57	06:00	06:29	07:05	07:40	07:20	07:58
	17:13	17:52	18:29	20:08	20:45	21:18	21:27	21:03	20:13	19:18	17:25	17:00
5	08:16	07:54	07:11	07:14	06:25	05:56	06:01	06:30	07:06	07:41	07:21	07:59
	17:14	17:53	18:30	20:10	20:46	21:19	21:27	21:01	20:11	19:16	17:24	17:00
6	08:15	07:53	07:09	07:13	06:24	05:56	06:01	06:31	07:07	07:42	07:22	08:00
	17:15	17:55	18:32	20:11	20:48	21:19	21:27	21:00	20:10	19:14	17:23	17:00
7	08:15	07:51	07:07	07:11	06:23	05:56	06:02	06:32	07:08	07:43	07:24	08:01
	17:16	17:56	18:33	20:12	20:49	21:20	21:26	20:59	20:08	19:12	17:22	17:00
8	08:15	07:50	08:06	07:09	06:21	05:55	06:03	06:33	07:09	07:45	07:25	08:02
	17:17	17:58	18:34	20:13	20:50	21:21	21:26	20:57	20:06	19:10	17:20	17:00
9	08:15	07:49	08:04	07:07	06:20	05:55	06:03	06:34	07:10	07:46	07:26	08:03
	17:18	17:59	19:36	20:14	20:51	21:21	21:25	20:56	20:04	19:08	17:19	17:00
10	08:15	07:47	08:02	07:05	06:19	05:55	06:04	06:36	07:12	07:47	07:28	08:04
	17:19	18:00	19:37	20:16	20:52	21:22	21:25	20:54	20:02	19:07	17:18	17:00
11	08:14	07:46	08:00	07:04	06:17	05:55	06:05	06:37	07:13	07:48	07:29	08:05
	17:20	18:00	19:38	20:17	20:53	21:23	21:25	20:53	20:00	19:05	17:17	17:00
12	08:14	07:45	07:58	07:02	06:16	05:54	06:06	06:38	07:14	07:50	07:30	08:06
	17:21	18:02	19:40	20:18	20:55	21:23	21:24	20:52	19:59	19:03	17:16	17:00
13	08:13	07:43	07:57	07:00	06:15	05:54	06:07	06:39	07:15	07:51	07:32	08:06
	17:23	18:03	19:41	20:19	20:56	21:24	21:23	20:50	19:57	19:01	17:15	17:00
14	08:13	07:42	07:55	06:58	06:14	05:54	06:07	06:40	07:16	07:52	07:33	08:07
	17:24	18:05	19:42	20:21	20:57	21:24	21:23	20:49	19:55	19:00	17:14	17:00
15	08:13	07:40	07:53	06:57	06:13	05:54	06:08	06:41	07:17	07:53	07:34	08:08
	17:25	18:06	19:43	20:22	20:58	21:25	21:22	20:47	19:53	18:56	17:13	17:00
16	08:12	07:39	07:51	06:55	06:12	05:54	06:09	06:43	07:19	07:55	07:36	08:09
	17:26	18:07	19:45	20:23	20:59	21:25	21:22	20:45	19:51	18:55	17:12	17:00
17	08:11	07:37	07:49	06:53	06:11	05:54	06:10	06:44	07:20	07:56	07:37	08:10
	17:28	18:09	19:46	20:24	21:00	21:26	21:21	20:44	19:49	18:53	17:11	17:01
18	08:11	07:36	07:47	06:52	06:10	05:54	06:11	06:45	07:21	07:57	07:38	08:10
	17:29	18:10	19:47	20:26	21:01	21:26	21:20	20:42	19:47	18:51	17:10	17:01
19	08:10	07:34	07:46	06:50	06:08	05:54	06:12	06:46	07:22	07:59	07:40	08:11
	17:30	18:12	19:48	20:27	21:02	21:26	21:19	20:41	19:46	18:49	17:09	17:01
20	08:09	07:33	07:44	06:48	06:08	05:54	06:13	06:47	07:23	08:00	07:41	08:11
	17:31	18:13	19:50	20:28	21:04	21:27	21:18	20:39	19:44	18:48	17:08	17:02
21	08:09	07:31	07:42	06:47	06:07	05:55	06:14	06:48	07:24	08:01	07:42	08:12
	17:33	18:14	19:51	20:29	21:05	21:27	21:18	20:37	19:42	18:46	17:07	17:02
22	08:08	07:29	07:40	06:45	06:06	05:55	06:15	06:50	07:26	08:02	07:44	08:12
	17:34	18:16	19:52	20:30	21:06	21:27	21:17	20:36	19:40	18:45	17:07	17:03
23	08:07	07:28	07:38	06:43	06:05	05:55	06:16	06:51	07:27	08:04	07:45	08:13
	17:35	18:17	19:53	20:32	21:07	21:27	21:16	20:34	19:38	18:43	17:06	17:03
24	08:06	07:26	07:36	06:42	06:04	05:55	06:17	06:52	07:28	08:05	07:46	08:13
	17:37	18:18	19:55	20:33	21:08	21:28	21:15	20:33	19:36	18:41	17:05	17:04
25	08:05	07:24	07:35	06:40	06:03	05:56	06:18	06:53	07:29	08:06	07:47	08:14
	17:38	18:20	19:56	20:34	21:09	21:28	21:14	20:31	19:34	18:40	17:04	17:04
26	08:05	07:23	07:33	06:39	06:02	05:56	06:19	06:54	07:30	08:08	07:49	08:14
	17:39	18:21	19:57	20:35	21:10	21:28	21:13	20:29	19:32	18:38	17:04	17:05
27	08:04	07:21	07:31	06:37	06:02	05:56	06:20	06:55	07:31	08:09	07:50	08:15
	17:41	18:22	19:58	20:37	21:11	21:28	21:12	20:27	19:31	18:37	17:03	17:06
28	08:03	07:19	07:29	06:35	06:01	05:57	06:21	06:56	07:33	08:10	07:51	08:15
	17:42	18:24	20:00	20:38	21:12	21:28	21:11	20:26	19:29	18:35	17:03	17:07
29	08:02		07:27	06:34	06:00	05:57	06:22	06:58	07:34	08:12	07:52	08:15
	17:44		20:01	20:39	21:13	21:28	21:10	20:24	19:27	18:34	17:02	17:07
30	08:01		07:25	06:32	05:59	05:58	06:23	06:59	07:35	08:13	07:53	08:15
	17:45		20:02	20:40	21:14	21:28	21:09	20:22	19:25	18:32	17:02	17:08
31	08:00		07:23		05:59		06:24	07:00		08:14		08:15
	17:46		20:03		21:14		21:07	20:20		18:31		17:09
Potential sun hours	288	292	369	403	458	464	470	435	377	341	289	276
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
TEST license
This license is only to be used for testing purposes

Ramos, Tiffanie / tiffanie.ramos@tetratech.com
Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 28 - Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	January			February			March			April			May			June	
1	08:16			07:58		08:20 (28)	07:18		08:15 (28)	07:22		07:45 (23)	06:31		20:11 (22)	05:58	
	17:10			17:48	16	08:36 (28)	18:25	24	08:39 (28)	20:05	20	08:05 (23)	20:41	7	20:18 (22)	21:15	
2	08:16			07:57		08:19 (28)	07:16		08:18 (28)	07:20		07:46 (23)	06:29		20:10 (22)	05:58	
	17:11			17:49	20	08:39 (28)	18:26	19	08:37 (28)	20:06	18	08:04 (23)	20:43	10	20:20 (22)	21:16	
3	08:16			07:56		08:18 (28)	07:14		08:21 (28)	07:18		07:47 (23)	06:28		20:08 (22)	05:57	
	17:12			17:51	23	08:41 (28)	18:28	12	08:33 (28)	20:07	15	08:02 (23)	20:44	12	20:20 (22)	21:17	
4	08:16			07:55		08:17 (28)	07:13			07:16		07:49 (23)	06:27		20:08 (22)	05:57	
	17:13			17:52	26	08:43 (28)	18:29			20:08	10	07:59 (23)	20:45	14	20:22 (22)	21:18	
5	08:16			07:54		08:15 (28)	07:11			07:14			06:25		20:06 (22)	05:56	
	17:14			17:53	29	08:44 (28)	18:30			20:10			20:46	16	20:22 (22)	21:19	
6	08:15			07:53		08:14 (28)	07:09			07:13			06:24		20:06 (22)	05:56	
	17:15			17:55	32	08:46 (28)	18:32			20:11			20:48	18	20:24 (22)	21:19	
7	08:15			07:51		08:13 (28)	07:07			07:11			06:23		20:06 (22)	05:56	
	17:16			17:56	34	08:47 (28)	18:33			20:12			20:49	19	20:25 (22)	21:20	
8	08:15			07:50		08:11 (28)	08:06			07:09			06:21		20:06 (22)	05:55	
	17:17			17:58	37	08:48 (28)	18:34			20:13			20:50	20	20:26 (22)	21:21	
9	08:15			07:49		08:10 (28)	08:04			07:07			06:20		20:05 (22)	05:55	
	17:18			17:59	39	08:49 (28)	19:36			20:14			20:51	22	20:27 (22)	21:21	
10	08:15			07:47		08:09 (28)	08:02			07:05			06:19		20:05 (22)	05:55	
	17:19			18:00	41	08:50 (28)	19:37			20:16			20:52	23	20:28 (22)	21:22	
11	08:14			07:46		08:08 (28)	08:00			07:04			06:17		20:06 (22)	05:55	
	17:20			18:00	42	08:50 (28)	19:38			20:17			20:53	23	20:29 (22)	21:23	
12	08:14			07:45		08:08 (28)	07:58			07:02			06:16		20:06 (22)	05:54	
	17:21			18:02	43	08:51 (28)	19:40			20:18			20:55	24	20:30 (22)	21:23	
13	08:13			07:43		08:07 (28)	07:57			07:00			06:15		20:06 (22)	05:54	
	17:23			18:03	44	08:51 (28)	19:41			20:19			20:56	25	20:31 (22)	21:24	
14	08:13			07:42		08:07 (28)	07:55			06:58			06:14		20:07 (22)	05:54	
	17:24			18:05	44	08:51 (28)	19:42			20:21			20:57	24	20:31 (22)	21:24	
15	08:13			07:40		08:07 (28)	07:53			06:57			06:13		20:07 (22)	05:54	
	17:25			18:06	44	08:51 (28)	19:43			20:22			20:58	24	20:31 (22)	21:25	
16	08:12			07:39		08:07 (28)	07:51			06:55			06:12		20:08 (22)	05:54	
	17:26			18:07	45	08:52 (28)	19:45			20:23			20:59	22	20:30 (22)	21:25	
17	08:11			07:37		08:07 (28)	07:49			06:53			06:11		20:09 (22)	05:54	
	17:28			18:09	44	08:51 (28)	19:46			20:24			21:00	20	20:29 (22)	21:26	
18	08:11			07:36		08:07 (28)	07:47			06:52			06:09		20:09 (22)	05:54	
	17:29			18:10	45	08:52 (28)	19:47			20:26			21:01	20	20:29 (22)	21:26	
19	08:10			07:34		08:07 (28)	07:46			06:50			06:08		20:10 (22)	05:54	
	17:30			18:12	44	08:51 (28)	19:48			20:27			21:02	18	20:28 (22)	21:26	
20	08:09			07:33		08:07 (28)	07:44			06:48			06:07		20:11 (22)	05:54	
	17:31			18:13	43	08:50 (28)	19:50			20:28			21:04	16	20:27 (22)	21:27	
21	08:09			07:31		08:08 (28)	07:42			06:47			06:07		20:13 (22)	05:55	
	17:33			18:14	42	08:50 (28)	19:51			20:29			21:05	12	20:25 (22)	21:27	
22	08:08			07:29		08:08 (28)	07:40		08:00 (23)	06:45			06:06		20:14 (22)	05:55	
	17:34			18:16	41	08:49 (28)	19:52	3	08:03 (23)	20:30			21:06	9	20:23 (22)	21:27	
23	08:07			07:28		08:09 (28)	07:38		07:58 (23)	06:43			06:05			05:55	
	17:35			18:17	40	08:49 (28)	19:53	7	08:05 (23)	20:32			21:07			21:27	
24	08:06			07:26		08:09 (28)	07:36		07:56 (23)	06:42			06:04			05:55	
	17:37			18:18	39	08:48 (28)	19:55	10	08:06 (23)	20:33			21:08			21:28	
25	08:05			07:24		08:10 (28)	07:35		07:55 (23)	06:40			06:03			05:56	
	17:38			18:20	36	08:46 (28)	19:56	13	08:08 (23)	20:34			21:09			21:28	
26	08:05			07:23		08:11 (28)	07:33		07:53 (23)	06:39			06:02			05:56	
	17:39			18:21	35	08:46 (28)	19:57	15	08:08 (23)	20:35			21:10			21:28	
27	08:04			07:21		08:12 (28)	07:31		07:51 (23)	06:37			06:01			05:56	
	17:41			18:22	32	08:44 (28)	19:58	17	08:08 (23)	20:37			21:11			21:28	
28	08:03			07:19		08:13 (28)	07:29		07:49 (23)	06:35			06:01			05:57	
	17:42			18:24	29	08:42 (28)	20:00	19	08:08 (23)	20:38			21:12			21:28	
29	08:02						07:27		07:47 (23)	06:34		20:15 (22)	06:00			05:57	
	17:44						20:01	20	08:07 (23)	20:39	1	20:16 (22)	21:13			21:28	
30	08:01						07:25		07:45 (23)	06:32		20:12 (22)	05:59			05:58	
	17:45						20:02	21	08:06 (23)	20:40	5	20:17 (22)	21:14			21:28	
31	08:00		08:23 (28)				07:23		07:45 (23)				05:59				
	17:46	9	08:32 (28)				20:03	22	08:07 (23)				21:14				
Potential sun hours	288			292			369			403			458			464	
Total, worst case		9			1029			202			69			398			
Sun reduction		0.62			0.62			0.62			0.59			0.66			
Oper. time red.		0.98			0.98			0.98			0.98			0.98			
Wind dir. red.		0.75			0.75			0.70			0.69			0.73			
Total reduction		0.45			0.45			0.43			0.40			0.47			
Total, real		4			468			86			27			189			

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:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
TEST license
This license is only to be used for testing purposes

Ramos, Tiffanie / tiffanie.ramos@tetratech.com
Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 28 - Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	July			August			September			October			November			December
1	05:58			06:25		20:16 (22)	07:01			07:36			07:16		07:38 (28)	07:55
	21:28			21:06	24	20:40 (22)	20:19			19:23			17:30	40	08:18 (28)	17:01
2	05:59			06:27		20:16 (22)	07:02			07:37			07:17		07:40 (28)	07:56
	21:28			21:05	23	20:39 (22)	20:17			19:21			17:28	38	08:18 (28)	17:01
3	05:59			06:28		20:16 (22)	07:03			07:39			07:18		07:41 (28)	07:57
	21:27			21:04	22	20:38 (22)	20:15			19:19			17:27	36	08:17 (28)	17:01
4	06:00			06:29		20:16 (22)	07:05			07:40			07:20		07:43 (28)	07:58
	21:27			21:03	21	20:37 (22)	20:13			19:18			17:25	34	08:17 (28)	17:00
5	06:01			06:30		20:16 (22)	07:06			07:41			07:21		07:44 (28)	07:59
	21:27			21:01	19	20:35 (22)	20:11			19:16			17:24	31	08:15 (28)	17:00
6	06:01			06:31		20:16 (22)	07:07			07:42			07:22		07:46 (28)	08:00
	21:27			21:00	18	20:34 (22)	20:10			19:14			17:23	29	08:15 (28)	17:00
7	06:02			06:32		20:16 (22)	07:08			07:43			07:24		07:47 (28)	08:01
	21:26			20:59	17	20:33 (22)	20:08			19:12			17:22	26	08:13 (28)	17:00
8	06:03			06:33		20:16 (22)	07:09		07:44 (23)	07:45			07:25		07:48 (28)	08:02
	21:26			20:57	15	20:31 (22)	20:06	10	07:54 (23)	19:10			17:20	23	08:11 (28)	17:00
9	06:03			06:34		20:16 (22)	07:10		07:41 (23)	07:46			07:26		07:50 (28)	08:03
	21:25			20:56	14	20:30 (22)	20:04	15	07:56 (23)	19:08			17:19	20	08:10 (28)	17:00
10	06:04			06:36		20:17 (22)	07:12		07:39 (23)	07:47			07:28		07:51 (28)	08:04
	21:25			20:54	11	20:28 (22)	20:02	18	07:57 (23)	19:07			17:18	16	08:07 (28)	17:00
11	06:05			06:37		20:19 (22)	07:13		07:38 (23)	07:48		08:54 (28)	07:29		07:55 (28)	08:05
	21:25			20:53	9	20:28 (22)	20:00	19	07:57 (23)	19:05	15	09:09 (28)	17:17	9	08:04 (28)	17:00
12	06:06			06:38		20:20 (22)	07:14		07:36 (23)	07:50		08:50 (28)	07:30			08:06
	21:24			20:52	6	20:26 (22)	19:59	22	07:58 (23)	19:03	22	09:12 (28)	17:16			17:00
13	06:07			06:39		20:21 (22)	07:15		07:36 (23)	07:51		08:47 (28)	07:32			08:07
	21:23			20:50	4	20:25 (22)	19:57	22	07:58 (23)	19:01	27	09:14 (28)	17:15			17:00
14	06:07			06:40			07:16		07:37 (23)	07:52		08:46 (28)	07:33			08:07
	21:23			20:49			19:55	20	07:57 (23)	19:00	30	09:16 (28)	17:14			17:00
15	06:08			06:41			07:17		07:39 (23)	07:53		08:44 (28)	07:35			08:08
	21:22			20:47			19:53	19	07:58 (23)	18:56	33	09:17 (28)	17:13			17:00
16	06:09			06:43			07:19		07:40 (23)	07:55		08:42 (28)	07:36			08:09
	21:22			20:45			19:51	17	07:57 (23)	18:54	36	09:18 (28)	17:12			17:00
17	06:10			06:44			07:20		07:41 (23)	07:56		08:41 (28)	07:37			08:10
	21:21			20:44			19:49	15	07:56 (23)	18:53	37	09:18 (28)	17:11			17:01
18	06:11			06:45			07:21		07:42 (23)	07:57		08:40 (28)	07:38			08:10
	21:20			20:42			19:47	13	07:55 (23)	18:51	40	09:20 (28)	17:10			17:01
19	06:12			06:46			07:22		07:43 (23)	07:59		08:39 (28)	07:40			08:11
	21:19			20:41			19:45	11	07:54 (23)	18:49	41	09:20 (28)	17:09			17:01
20	06:13			06:47			07:23		07:44 (23)	08:00		08:39 (28)	07:41			08:11
	21:19			20:39			19:44	8	07:52 (23)	18:48	42	09:21 (28)	17:08			17:02
21	06:14		20:26 (22)	06:48			07:24		07:45 (23)	08:01		08:38 (28)	07:42			08:12
	21:18	6	20:32 (22)	20:38			19:42	4	07:49 (23)	18:46	43	09:21 (28)	17:07			17:02
22	06:15		20:24 (22)	06:49			07:26			08:02		08:37 (28)	07:44			08:13
	21:17	11	20:35 (22)	20:36			19:40			18:45	44	09:21 (28)	17:06			17:03
23	06:16		20:23 (22)	06:51			07:27			08:04		08:37 (28)	07:45			08:13
	21:16	13	20:36 (22)	20:34			19:38			18:43	45	09:22 (28)	17:06			17:03
24	06:17		20:21 (22)	06:52			07:28			08:05		08:37 (28)	07:46			08:13
	21:15	17	20:38 (22)	20:33			19:36			18:41	44	09:21 (28)	17:05			17:04
25	06:18		20:20 (22)	06:53			07:29			08:06		08:36 (28)	07:47			08:14
	21:14	19	20:39 (22)	20:31			19:34			18:40	45	09:21 (28)	17:04			17:04
26	06:19		20:20 (22)	06:54			07:30			08:08		08:37 (28)	07:49			08:14
	21:13	20	20:40 (22)	20:29			19:32			18:38	44	09:21 (28)	17:04			17:05
27	06:20		20:19 (22)	06:55			07:31			08:09		08:36 (28)	07:50			08:15
	21:12	21	20:40 (22)	20:27			19:31			18:37	45	09:21 (28)	17:03			17:06
28	06:21		20:18 (22)	06:56			07:33			08:10		08:37 (28)	07:51			08:15
	21:11	23	20:41 (22)	20:26			19:29			18:35	44	09:21 (28)	17:03			17:06
29	06:22		20:18 (22)	06:58			07:34			08:12		08:37 (28)	07:52			08:15
	21:10	23	20:41 (22)	20:24			19:27			18:34	43	09:20 (28)	17:02			17:07
30	06:23		20:17 (22)	06:59			07:35			08:13		08:37 (28)	07:53			08:15
	21:09	25	20:42 (22)	20:22			19:25			18:32	42	09:19 (28)	17:02			17:08
31	06:24		20:17 (22)	07:00						08:14		08:38 (28)				08:15
	21:07	25	20:42 (22)	20:20						18:31	42	09:20 (28)				17:09
Potential sun hours	470			435			377			341			289			276
Total, worst case		203			203			213			804			302		
Sun reduction		0.76			0.74			0.69			0.59			0.51		
Oper. time red.		0.98			0.98			0.98			0.98			0.98		
Wind dir. red.		0.73			0.73			0.68			0.75			0.75		
Total reduction		0.55			0.53			0.46			0.43			0.37		
Total, real		111			108			98			348			113		

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:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
TEST license
This license is only to be used for testing purposes

Ramos, Tiffanie / tiffanie.ramos@tetratech.com
Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 29 - Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	January			February			March			April			May			June		
1	08:16			07:58		08:20 (28)	07:18		08:25 (28)	07:22		07:47 (23)	06:31		20:07 (22)	05:58		
	17:10			17:48	27	08:47 (28)	18:25	13	08:38 (28)	20:05	19	08:06 (23)	20:41	11	20:18 (22)	21:15		
2	08:16			07:57		08:19 (28)	07:16			07:20		07:48 (23)	06:29		20:06 (22)	05:58		
	17:11			17:49	30	08:49 (28)	18:26			20:06	16	08:04 (23)	20:43	14	20:20 (22)	21:16		
3	08:16			07:56		08:18 (28)	07:14			07:18		07:50 (23)	06:28		20:05 (22)	05:57		
	17:12			17:51	32	08:50 (28)	18:28			20:07	12	08:02 (23)	20:44	15	20:20 (22)	21:17		
4	08:16			07:55		08:17 (28)	07:13			07:16		07:53 (23)	06:27		20:05 (22)	05:57		
	17:13			17:52	35	08:52 (28)	18:29			20:08	5	07:58 (23)	20:45	17	20:22 (22)	21:18		
5	08:16			07:54		08:15 (28)	07:11			07:14			06:25		20:04 (22)	05:56		
	17:14			17:53	37	08:52 (28)	18:30			20:10			20:46	18	20:22 (22)	21:19		
6	08:15			07:53		08:14 (28)	07:09			07:13			06:24		20:04 (22)	05:56		
	17:15			17:55	39	08:53 (28)	18:32			20:11			20:48	20	20:24 (22)	21:19		
7	08:15			07:51		08:13 (28)	07:07			07:11			06:23		20:04 (22)	05:56		
	17:16			17:56	41	08:54 (28)	18:33			20:12			20:49	21	20:25 (22)	21:20		
8	08:15			07:50		08:12 (28)	08:06			07:09			06:21		20:04 (22)	05:55		
	17:17			17:58	42	08:54 (28)	18:34			20:13			20:50	22	20:26 (22)	21:21		
9	08:15			07:49		08:12 (28)	08:04			07:07			06:20		20:03 (22)	05:55		
	17:18			17:59	43	08:55 (28)	19:36			20:14			20:51	24	20:27 (22)	21:21		
10	08:15			07:47		08:12 (28)	08:02			07:05			06:19		20:04 (22)	05:55		
	17:19			18:00	44	08:56 (28)	19:37			20:16			20:52	24	20:28 (22)	21:22		
11	08:14			07:46		08:11 (28)	08:00			07:04			06:17		20:04 (22)	05:55		
	17:20			18:00	45	08:56 (28)	19:38			20:17			20:53	25	20:29 (22)	21:23		
12	08:14			07:45		08:12 (28)	07:58			07:02			06:16		20:05 (22)	05:54		
	17:21			18:02	44	08:56 (28)	19:40			20:18			20:55	24	20:29 (22)	21:23		
13	08:13			07:43		08:11 (28)	07:57			07:00			06:15		20:05 (22)	05:54		
	17:23			18:03	45	08:56 (28)	19:41			20:19			20:56	23	20:28 (22)	21:24		
14	08:13			07:42		08:11 (28)	07:55			06:58			06:14		20:06 (22)	05:54		
	17:24			18:05	46	08:57 (28)	19:42			20:21			20:57	22	20:28 (22)	21:24		
15	08:13			07:40		08:11 (28)	07:53			06:57			06:13		20:07 (22)	05:54		
	17:25			18:06	45	08:56 (28)	19:43			20:22			20:58	20	20:27 (22)	21:25		
16	08:12			07:39		08:11 (28)	07:51			06:55			06:12		20:08 (22)	05:54		
	17:26			18:07	45	08:56 (28)	19:45			20:23			20:59	18	20:26 (22)	21:25		
17	08:11			07:37		08:11 (28)	07:49			06:53			06:11		20:09 (22)	05:54		
	17:28			18:09	45	08:56 (28)	19:46			20:24			21:00	16	20:25 (22)	21:26		
18	08:11			07:36		08:12 (28)	07:47			06:52			06:09		20:10 (22)	05:54		
	17:29			18:10	44	08:56 (28)	19:47			20:26			21:01	14	20:24 (22)	21:26		
19	08:10			07:34		08:12 (28)	07:46			06:50			06:08		20:12 (22)	05:54		
	17:30			18:12	43	08:55 (28)	19:48			20:27			21:02	10	20:22 (22)	21:26		
20	08:09			07:33		08:12 (28)	07:44			06:48			06:07		20:15 (22)	05:54		
	17:31			18:13	42	08:54 (28)	19:50			20:28			21:04	4	20:19 (22)	21:27		
21	08:09			07:31		08:13 (28)	07:42		08:02 (23)	06:47			06:07			05:55		
	17:33			18:14	41	08:54 (28)	19:51	2	08:04 (23)	20:29			21:05			21:27		
22	08:08			07:29		08:13 (28)	07:40		08:00 (23)	06:45			06:06			05:55		
	17:34			18:16	40	08:53 (28)	19:52	6	08:06 (23)	20:30			21:06			21:27		
23	08:07			07:28		08:15 (28)	07:38		07:58 (23)	06:43			06:05			05:55		
	17:35			18:17	37	08:52 (28)	19:53	10	08:08 (23)	20:32			21:07			21:27		
24	08:06			07:26		08:15 (28)	07:36		07:56 (23)	06:42			06:04			05:55		
	17:37			18:18	36	08:51 (28)	19:55	12	08:08 (23)	20:33			21:08			21:28		
25	08:05			07:24		08:16 (28)	07:35		07:55 (23)	06:40			06:03			05:56		
	17:38			18:20	33	08:49 (28)	19:56	15	08:10 (23)	20:34			21:09			21:28		
26	08:05			07:23		08:18 (28)	07:33		07:53 (23)	06:39			06:02			05:56		
	17:39			18:21	30	08:48 (28)	19:57	17	08:10 (23)	20:35			21:10			21:28		
27	08:04			07:21		08:20 (28)	07:31		07:51 (23)	06:37			06:01			05:56		
	17:41			18:22	25	08:45 (28)	19:58	19	08:10 (23)	20:37			21:11			21:28		
28	08:03		08:27 (28)	07:19		08:22 (28)	07:29		07:49 (23)	06:35		20:12 (22)	06:01			05:57		
	17:42	11	08:38 (28)	18:24	20	08:42 (28)	20:00	20	08:09 (23)	20:38	2	20:14 (22)	21:12			21:28		
29	08:02		08:24 (28)				07:27		07:47 (23)	06:34		20:10 (22)	06:00			05:57		
	17:44	17	08:41 (28)				20:01	22	08:09 (23)	20:39	6	20:16 (22)	21:13			21:28		
30	08:01		08:23 (28)				07:25		07:46 (23)	06:32		20:08 (22)	05:59			05:58		
	17:45	21	08:44 (28)				20:02	22	08:08 (23)	20:40	9	20:17 (22)	21:14			21:28		
31	08:00		08:21 (28)				07:23		07:47 (23)				05:59					
	17:46	24	08:45 (28)				20:03	21	08:08 (23)				21:14					
Potential sun hours	288			292			369			403			458			464		
Total, worst case		73			1076			179			69			362				
Sun reduction		0.62			0.62			0.62			0.59			0.66				
Oper. time red.		0.98			0.98			0.98			0.98			0.98				
Wind dir. red.		0.75			0.75			0.69			0.70			0.73				
Total reduction		0.46			0.46			0.42			0.40			0.47				
Total, real		33			491			75			28			171				

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:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
TEST license
This license is only to be used for testing purposes

Ramos, Tiffanie / tiffanie.ramos@tetratech.com
Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 29 - Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	July			August			September			October			November			December	
1	05:58			06:25			20:15 (22)	07:01			07:36			07:16			07:41 (28)	07:55
	21:28			21:06	24		20:39 (22)	20:19			19:23			17:30	44		08:25 (28)	17:01
2	05:59			06:27			20:15 (22)	07:02			07:37			07:17			07:42 (28)	07:56
	21:28			21:05	24		20:39 (22)	20:17			19:21			17:28	43		08:25 (28)	17:01
3	05:59			06:28			20:14 (22)	07:03			07:39			07:18			07:42 (28)	07:57
	21:27			21:04	24		20:38 (22)	20:15			19:19			17:27	42		08:24 (28)	17:01
4	06:00			06:29			20:14 (22)	07:05			07:40			07:20			07:43 (28)	07:58
	21:27			21:03	23		20:37 (22)	20:13			19:18			17:25	41		08:24 (28)	17:00
5	06:01			06:30			20:14 (22)	07:06			07:41			07:21			07:44 (28)	07:59
	21:27			21:01	21		20:35 (22)	20:11			19:16			17:24	39		08:23 (28)	17:00
6	06:01			06:31			20:13 (22)	07:07			07:42			07:22			07:46 (28)	08:00
	21:27			21:00	21		20:34 (22)	20:10			19:14			17:23	37		08:23 (28)	17:00
7	06:02			06:32			20:13 (22)	07:08			07:43			07:24			07:47 (28)	08:01
	21:26			20:59	20		20:33 (22)	20:08			19:12			17:22	34		08:21 (28)	17:00
8	06:03			06:33			20:13 (22)	07:09		07:48 (23)	07:45			07:25			07:48 (28)	08:02
	21:26			20:57	18		20:31 (22)	20:06	5	07:53 (23)	19:10			17:20	32		08:20 (28)	17:00
9	06:03			06:34			20:14 (22)	07:10		07:44 (23)	07:46			07:26			07:50 (28)	08:03
	21:25			20:56	16		20:30 (22)	20:04	12	07:56 (23)	19:08			17:19	29		08:19 (28)	17:00
10	06:04			06:36			20:14 (22)	07:12		07:42 (23)	07:47			07:28			07:51 (28)	08:04
	21:25			20:54	14		20:28 (22)	20:02	15	07:57 (23)	19:07			17:18	27		08:18 (28)	17:00
11	06:05			06:37			20:15 (22)	07:13		07:40 (23)	07:48			07:29			07:53 (28)	08:05
	21:25			20:53	13		20:28 (22)	20:00	18	07:58 (23)	19:05			17:17	24		08:17 (28)	17:00
12	06:06			06:38			20:16 (22)	07:14		07:38 (23)	07:50		09:03 (28)	07:30			07:54 (28)	08:06
	21:24			20:52	10		20:26 (22)	19:59	21	07:59 (23)	19:03	5	09:08 (28)	17:16	21		08:15 (28)	17:00
13	06:07			06:39			20:17 (22)	07:15		07:37 (23)	07:51		08:56 (28)	07:32			07:56 (28)	08:07
	21:23			20:50	8		20:25 (22)	19:57	22	07:59 (23)	19:01	17	09:13 (28)	17:15	17		08:13 (28)	17:00
14	06:07			06:40			20:18 (22)	07:16		07:37 (23)	07:52		08:54 (28)	07:33			07:59 (28)	08:07
	21:23			20:49	5		20:23 (22)	19:55	22	07:59 (23)	19:00	23	09:17 (28)	17:14	10		08:09 (28)	17:00
15	06:08			06:41			20:20 (22)	07:17		07:39 (23)	07:53		08:51 (28)	07:34				08:08
	21:22			20:47	2		20:22 (22)	19:53	20	07:59 (23)	18:56	27	09:18 (28)	17:13				17:00
16	06:09			06:43				07:19		07:40 (23)	07:55		08:49 (28)	07:36				08:09
	21:22			20:45				19:51	19	07:59 (23)	18:54	31	09:20 (28)	17:12				17:00
17	06:10			06:44				07:20		07:41 (23)	07:56		08:47 (28)	07:37				08:10
	21:21			20:44				19:49	17	07:58 (23)	18:53	34	09:21 (28)	17:11				17:01
18	06:11			06:45				07:21		07:42 (23)	07:57		08:46 (28)	07:38				08:10
	21:20			20:42				19:47	15	07:57 (23)	18:51	36	09:22 (28)	17:10				17:01
19	06:12			06:46				07:22		07:43 (23)	07:59		08:45 (28)	07:40				08:11
	21:19			20:41				19:45	13	07:56 (23)	18:49	38	09:23 (28)	17:09				17:01
20	06:13			06:47				07:23		07:44 (23)	08:00		08:45 (28)	07:41				08:11
	21:19			20:39				19:44	10	07:54 (23)	18:48	39	09:24 (28)	17:08				17:02
21	06:14			06:48				07:24		07:45 (23)	08:01		08:43 (28)	07:42				08:12
	21:18			20:38				19:42	7	07:52 (23)	18:46	42	09:25 (28)	17:07				17:02
22	06:15			06:49				07:26		07:47 (23)	08:02		08:42 (28)	07:44				08:13
	21:17			20:36				19:40	4	07:51 (23)	18:45	43	09:25 (28)	17:06				17:03
23	06:16			06:51				07:27			08:04		08:42 (28)	07:45				08:13
	21:16			20:34				19:38			18:43	44	09:26 (28)	17:06				17:03
24	06:17		20:24 (22)	06:52				07:28			08:05		08:41 (28)	07:46				08:13
	21:15	7	20:31 (22)	20:33				19:36			18:41	45	09:26 (28)	17:05				17:04
25	06:18		20:22 (22)	06:53				07:29			08:06		08:41 (28)	07:47				08:14
	21:14	11	20:33 (22)	20:31				19:34			18:40	44	09:25 (28)	17:04				17:04
26	06:19		20:20 (22)	06:54				07:30			08:08		08:41 (28)	07:49				08:14
	21:13	15	20:35 (22)	20:29				19:32			18:38	45	09:26 (28)	17:04				17:05
27	06:20		20:19 (22)	06:55				07:31			08:09		08:40 (28)	07:50				08:15
	21:12	17	20:36 (22)	20:27				19:31			18:37	46	09:26 (28)	17:03				17:06
28	06:21		20:18 (22)	06:56				07:33			08:10		08:41 (28)	07:51				08:15
	21:11	19	20:37 (22)	20:26				19:29			18:35	45	09:26 (28)	17:03				17:06
29	06:22		20:17 (22)	06:58				07:34			08:12		08:41 (28)	07:52				08:15
	21:10	21	20:38 (22)	20:24				19:27			18:34	45	09:26 (28)	17:02				17:07
30	06:23		20:16 (22)	06:59				07:35			08:13		08:40 (28)	07:53				08:15
	21:09	23	20:39 (22)	20:22				19:25			18:32	45	09:25 (28)	17:02				17:08
31	06:24		20:16 (22)	07:00							08:14		08:41 (28)					08:15
	21:07	23	20:39 (22)	20:20							18:31	44	09:25 (28)					17:09
Potential sun hours	470			435				377			341			289				276
Total, worst case		136			243				220			738			440			
Sun reduction		0.76			0.74				0.69			0.59			0.51			
Oper. time red.		0.98			0.98				0.98			0.98			0.98			
Wind dir. red.		0.73			0.73				0.68			0.75			0.75			
Total reduction		0.55			0.53				0.46			0.43			0.38			
Total, real		74			129				102			320			165			

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:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
TEST license
This license is only to be used for testing purposes

Ramos, Tiffanie / tiffanie.ramos@tetratech.com
Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 30 - Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:16	07:59	07:18	07:22	06:31	05:59	05:59	06:26	07:01	07:36	07:16	07:55
	17:10	17:48	18:25	20:05	20:42	21:15	21:28	21:06	20:19	19:23	17:30	17:02
2	08:16	07:57	07:16	07:20	06:30	05:58	05:59	06:27	07:02	07:38	07:17	07:56
	17:11	17:49	18:27	20:06	20:43	21:16	21:28	21:05	20:17	19:21	17:28	17:01
3	08:16	07:56	07:14	07:18	06:28	05:58	06:00	06:28	07:04	07:39	07:18	07:57
	17:12	17:51	18:28	20:07	20:44	21:17	21:27	21:04	20:15	19:20	17:27	17:01
4	08:16	07:55	07:13	07:16	06:27	05:57	06:00	06:29	07:05	07:40	07:20	07:58
	17:13	17:52	18:29	20:08	20:45	21:18	21:27	21:03	20:13	19:18	17:26	17:01
5	08:16	07:54	07:11	07:15	06:25	05:57	06:01	06:30	07:06	07:41	07:21	07:59
	17:14	17:54	18:31	20:10	20:46	21:19	21:27	21:01	20:12	19:16	17:24	17:00
6	08:15	07:53	07:09	07:13	06:24	05:56	06:02	06:31	07:07	07:42	07:22	08:00
	17:15	17:55	18:32	20:11	20:48	21:19	21:27	21:00	20:10	19:14	17:23	17:00
7	08:15	07:51	07:07	07:11	06:23	05:56	06:02	06:32	07:08	07:44	07:24	08:01
	17:16	17:56	18:33	20:12	20:49	21:20	21:26	20:59	20:08	19:12	17:22	17:00
8	08:15	07:50	08:06	07:09	06:21	05:56	06:03	06:34	07:09	07:45	07:25	08:02
	17:17	17:58	18:35	20:13	20:50	21:21	21:26	20:57	20:06	19:10	17:21	17:00
9	08:15	07:49	08:04	07:07	06:20	05:55	06:04	06:35	07:11	07:46	07:27	08:03
	17:18	17:59	19:36	20:15	20:51	21:21	21:25	20:56	20:04	19:09	17:19	17:00
10	08:15	07:47	08:02	07:06	06:19	05:55	06:04	06:36	07:12	07:47	07:28	08:04
	17:19	18:01	19:37	20:16	20:52	21:22	21:25	20:54	20:02	19:07	17:18	17:00
11	08:14	07:46	08:00	07:04	06:18	05:55	06:05	06:37	07:13	07:49	07:29	08:05
	17:21	18:01	19:38	20:17	20:53	21:23	21:25	20:53	20:01	19:05	17:17	17:00
12	08:14	07:45	07:59	07:02	06:16	05:55	06:06	06:38	07:14	07:50	07:31	08:06
	17:22	18:02	19:40	20:18	20:55	21:23	21:24	20:52	19:59	19:03	17:16	17:00
13	08:13	07:43	07:57	07:00	06:15	05:55	06:07	06:39	07:15	07:51	07:32	08:07
	17:23	18:03	19:41	20:19	20:56	21:24	21:23	20:50	19:57	19:02	17:15	17:00
14	08:13	07:42	07:55	06:59	06:14	05:54	06:08	06:40	07:16	07:52	07:33	08:07
	17:24	18:05	19:42	20:21	20:57	21:24	21:23	20:49	19:55	19:00	17:14	17:00
15	08:13	07:40	07:53	06:57	06:13	05:54	06:09	06:42	07:18	07:54	07:35	08:08
	17:25	18:06	19:43	20:22	20:58	21:25	21:22	20:47	19:53	18:56	17:13	17:00
16	08:12	07:39	07:51	06:55	06:12	05:54	06:09	06:43	07:19	07:55	07:36	08:09
	17:27	18:08	19:45	20:23	20:59	21:25	21:22	20:46	19:51	18:55	17:12	17:01
17	08:11	07:37	07:49	06:53	06:11	05:54	06:10	06:44	07:20	07:56	07:37	08:10
	17:28	18:09	19:46	20:24	21:00	21:26	21:21	20:44	19:49	18:53	17:11	17:01
18	08:11	07:36	07:48	06:52	06:10	05:54	06:11	06:45	07:21	07:57	07:39	08:10
	17:29	18:10	19:47	20:26	21:01	21:26	21:20	20:42	19:48	18:51	17:10	17:01
19	08:10	07:34	07:46	06:50	06:09	05:55	06:12	06:46	07:22	07:59	07:40	08:11
	17:30	18:12	19:49	20:27	21:03	21:26	21:19	20:41	19:46	18:50	17:09	17:02
20	08:10	07:33	07:44	06:48	06:08	05:55	06:13	06:47	07:23	08:00	07:41	08:11
	17:32	18:13	19:50	20:28	21:04	21:27	21:19	20:39	19:44	18:48	17:08	17:02
21	08:09	07:31	07:42	06:47	06:07	05:55	06:14	06:49	07:25	08:01	07:42	08:12
	17:33	18:15	19:51	20:29	21:05	21:27	21:18	20:38	19:42	18:46	17:08	17:03
22	08:08	07:29	07:40	06:45	06:06	05:55	06:15	06:50	07:26	08:03	07:44	08:13
	17:34	18:16	19:52	20:31	21:06	21:27	21:17	20:36	19:40	18:45	17:07	17:03
23	08:07	07:28	07:38	06:43	06:05	05:55	06:16	06:51	07:27	08:04	07:45	08:13
	17:36	18:17	19:54	20:32	21:07	21:27	21:16	20:34	19:38	18:43	17:06	17:04
24	08:06	07:26	07:37	06:42	06:04	05:56	06:17	06:52	07:28	08:05	07:46	08:13
	17:37	18:19	19:55	20:33	21:08	21:28	21:15	20:33	19:36	18:42	17:05	17:04
25	08:06	07:25	07:35	06:40	06:03	05:56	06:18	06:53	07:29	08:06	07:47	08:14
	17:38	18:20	19:56	20:34	21:09	21:28	21:14	20:31	19:34	18:40	17:05	17:05
26	08:05	07:23	07:33	06:39	06:03	05:56	06:19	06:54	07:30	08:08	07:49	08:14
	17:40	18:21	19:57	20:35	21:10	21:28	21:13	20:29	19:33	18:39	17:04	17:05
27	08:04	07:21	07:31	06:37	06:02	05:57	06:20	06:56	07:32	08:09	07:50	08:15
	17:41	18:23	19:59	20:37	21:11	21:28	21:12	20:28	19:31	18:37	17:04	17:06
28	08:03	07:20	07:29	06:36	06:01	05:57	06:21	06:57	07:33	08:10	07:51	08:15
	17:42	18:24	20:00	20:38	21:12	21:28	21:11	20:26	19:29	18:35	17:03	17:07
29	08:02		07:27	06:34	06:00	05:58	06:22	06:58	07:34	08:12	07:52	08:15
	17:44		20:01	20:39	21:13	21:28	21:10	20:24	19:27	18:34	17:03	17:08
30	08:01		07:25	06:33	06:00	05:58	06:23	06:59	07:35	08:13	07:53	08:15
	17:45		20:02	20:40	21:14	21:28	21:09	20:22	19:25	18:33	17:02	17:08
31	08:00		07:24		05:59		06:25	07:00		08:14		08:15
	17:47		20:03		21:14		21:08	20:21		18:31		17:09
Potential sun hours	288	292	369	403	458	464	470	435	377	342	289	276
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
TEST license
This license is only to be used for testing purposes

Ramos, Tiffanie / tiffanie.ramos@tetratech.com
Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 31 - Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:16	07:59	07:18	07:22	06:31	05:59	05:59	06:26	07:01	07:36	07:16	07:55
	17:10	17:48	18:25	20:05	20:42	21:15	21:28	21:06	20:19	19:23	17:30	17:02
2	08:16	07:57	07:16	07:20	06:30	05:58	05:59	06:27	07:02	07:38	07:17	07:56
	17:11	17:49	18:27	20:06	20:43	21:16	21:28	21:05	20:17	19:21	17:28	17:01
3	08:16	07:56	07:14	07:18	06:28	05:58	06:00	06:28	07:04	07:39	07:18	07:57
	17:12	17:51	18:28	20:07	20:44	21:17	21:27	21:04	20:15	19:20	17:27	17:01
4	08:16	07:55	07:13	07:16	06:27	05:57	06:00	06:29	07:05	07:40	07:20	07:58
	17:13	17:52	18:29	20:08	20:45	21:18	21:27	21:03	20:13	19:18	17:26	17:01
5	08:16	07:54	07:11	07:15	06:25	05:57	06:01	06:30	07:06	07:41	07:21	07:59
	17:14	17:54	18:31	20:10	20:46	21:19	21:27	21:01	20:12	19:16	17:24	17:00
6	08:15	07:53	07:09	07:13	06:24	05:56	06:02	06:31	07:07	07:42	07:22	08:00
	17:15	17:55	18:32	20:11	20:48	21:19	21:27	21:00	20:10	19:14	17:23	17:00
7	08:15	07:51	07:07	07:11	06:23	05:56	06:02	06:32	07:08	07:44	07:24	08:01
	17:16	17:56	18:33	20:12	20:49	21:20	21:26	20:59	20:08	19:12	17:22	17:00
8	08:15	07:50	08:06	07:09	06:21	05:56	06:03	06:34	07:09	07:45	07:25	08:02
	17:17	17:58	18:35	20:13	20:50	21:21	21:26	20:57	20:06	19:10	17:21	17:00
9	08:15	07:49	08:04	07:07	06:20	05:55	06:04	06:35	07:11	07:46	07:27	08:03
	17:18	17:59	19:36	20:15	20:51	21:21	21:25	20:56	20:04	19:09	17:19	17:00
10	08:15	07:47	08:02	07:06	06:19	05:55	06:04	06:36	07:12	07:47	07:28	08:04
	17:19	18:01	19:37	20:16	20:52	21:22	21:25	20:54	20:02	19:07	17:18	17:00
11	08:14	07:46	08:00	07:04	06:18	05:55	06:05	06:37	07:13	07:49	07:29	08:05
	17:21	18:01	19:38	20:17	20:53	21:23	21:25	20:53	20:01	19:05	17:17	17:00
12	08:14	07:45	07:59	07:02	06:16	05:55	06:06	06:38	07:14	07:50	07:31	08:06
	17:22	18:02	19:40	20:18	20:55	21:23	21:24	20:52	19:59	19:03	17:16	17:00
13	08:13	07:43	07:57	07:00	06:15	05:55	06:07	06:39	07:15	07:51	07:32	08:07
	17:23	18:03	19:41	20:19	20:56	21:24	21:23	20:50	19:57	19:02	17:15	17:00
14	08:13	07:42	07:55	06:59	06:14	05:54	06:08	06:40	07:16	07:52	07:33	08:07
	17:24	18:05	19:42	20:21	20:57	21:24	21:23	20:49	19:55	19:00	17:14	17:00
15	08:13	07:40	07:53	06:57	06:13	05:54	06:09	06:42	07:18	07:54	07:35	08:08
	17:25	18:06	19:44	20:22	20:58	21:25	21:22	20:47	19:53	18:56	17:13	17:00
16	08:12	07:39	07:51	06:55	06:12	05:54	06:09	06:43	07:19	07:55	07:36	08:09
	17:27	18:08	19:45	20:23	20:59	21:25	21:22	20:46	19:51	18:55	17:12	17:01
17	08:11	07:37	07:49	06:53	06:11	05:54	06:10	06:44	07:20	07:56	07:37	08:10
	17:28	18:09	19:46	20:24	21:00	21:26	21:21	20:44	19:49	18:53	17:11	17:01
18	08:11	07:36	07:48	06:52	06:10	05:55	06:11	06:45	07:21	07:57	07:39	08:10
	17:29	18:10	19:47	20:26	21:01	21:26	21:20	20:42	19:48	18:51	17:10	17:01
19	08:10	07:34	07:46	06:50	06:09	05:55	06:12	06:46	07:22	07:59	07:40	08:11
	17:30	18:12	19:49	20:27	21:03	21:26	21:19	20:41	19:46	18:50	17:09	17:02
20	08:10	07:33	07:44	06:48	06:08	05:55	06:13	06:47	07:23	08:00	07:41	08:11
	17:32	18:13	19:50	20:28	21:04	21:27	21:19	20:39	19:44	18:48	17:08	17:02
21	08:09	07:31	07:42	06:47	06:07	05:55	06:14	06:49	07:25	08:01	07:42	08:12
	17:33	18:15	19:51	20:29	21:05	21:27	21:18	20:38	19:42	18:46	17:08	17:03
22	08:08	07:29	07:40	06:45	06:06	05:55	06:15	06:50	07:26	08:03	07:44	08:13
	17:34	18:16	19:52	20:31	21:06	21:27	21:17	20:36	19:40	18:45	17:07	17:03
23	08:07	07:28	07:38	06:44	06:05	05:55	06:16	06:51	07:27	08:04	07:45	08:13
	17:36	18:17	19:54	20:32	21:07	21:27	21:16	20:34	19:38	18:43	17:06	17:04
24	08:06	07:26	07:37	06:42	06:04	05:56	06:17	06:52	07:28	08:05	07:46	08:13
	17:37	18:19	19:55	20:33	21:08	21:28	21:15	20:33	19:36	18:42	17:05	17:04
25	08:06	07:25	07:35	06:40	06:03	05:56	06:18	06:53	07:29	08:06	07:47	08:14
	17:38	18:20	19:56	20:34	21:09	21:28	21:14	20:31	19:34	18:40	17:05	17:05
26	08:05	07:23	07:33	06:39	06:03	05:56	06:19	06:54	07:30	08:08	07:49	08:14
	17:40	18:21	19:57	20:35	21:10	21:28	21:13	20:29	19:33	18:39	17:04	17:05
27	08:04	07:21	07:31	06:37	06:02	05:57	06:20	06:56	07:32	08:09	07:50	08:15
	17:41	18:23	19:59	20:37	21:11	21:28	21:12	20:28	19:31	18:37	17:04	17:06
28	08:03	07:20	07:29	06:36	06:01	05:57	06:21	06:57	07:33	08:10	07:51	08:15
	17:42	18:24	20:00	20:38	21:12	21:28	21:11	20:26	19:29	18:36	17:03	17:07
29	08:02		07:27	06:34	06:00	05:58	06:22	06:58	07:34	08:12	07:52	08:15
	17:44		20:01	20:39	21:13	21:28	21:10	20:24	19:27	18:34	17:03	17:08
30	08:01		07:25	06:33	06:00	05:58	06:23	06:59	07:35	08:13	07:53	08:15
	17:45		20:02	20:40	21:14	21:28	21:09	20:22	19:25	18:33	17:02	17:08
31	08:00		07:24		05:59		06:25	07:00		08:14		08:15
	17:47		20:03		21:14		21:08	20:21		18:31		17:09
Potential sun hours	288	292	369	403	458	464	470	435	377	342	289	276
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
TEST license
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Ramos, Tiffanie / tiffanie.ramos@tetratech.com
Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 32 - Non-Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:16	07:59	07:18	07:22	06:31	05:59	05:59	06:26	07:01	07:36	07:16	07:55
	17:10	17:48	18:25	20:05	20:42	21:15	21:28	21:06	20:19	19:23	17:30	17:02
2	08:16	07:57	07:16	07:20	06:30	05:58	05:59	06:27	07:03	07:38	07:17	07:56
	17:11	17:50	18:27	20:06	20:43	21:16	21:28	21:05	20:17	19:21	17:28	17:01
3	08:16	07:56	07:15	07:18	06:28	05:58	06:00	06:28	07:04	07:39	07:19	07:57
	17:12	17:51	18:28	20:07	20:44	21:17	21:27	21:04	20:15	19:20	17:27	17:01
4	08:16	07:55	07:13	07:16	06:27	05:57	06:00	06:29	07:05	07:40	07:20	07:58
	17:13	17:52	18:29	20:09	20:45	21:18	21:27	21:03	20:13	19:18	17:26	17:01
5	08:16	07:54	07:11	07:15	06:26	05:57	06:01	06:30	07:06	07:41	07:21	07:59
	17:14	17:54	18:31	20:10	20:46	21:19	21:27	21:01	20:12	19:16	17:24	17:01
6	08:16	07:53	07:09	07:13	06:24	05:56	06:02	06:31	07:07	07:43	07:23	08:00
	17:15	17:55	18:32	20:11	20:48	21:19	21:27	21:00	20:10	19:14	17:23	17:00
7	08:15	07:51	07:08	07:11	06:23	05:56	06:02	06:33	07:08	07:44	07:24	08:01
	17:16	17:57	18:33	20:12	20:49	21:20	21:26	20:59	20:08	19:12	17:22	17:00
8	08:15	07:50	08:06	07:09	06:22	05:56	06:03	06:34	07:10	07:45	07:25	08:02
	17:17	17:58	18:35	20:13	20:50	21:21	21:26	20:57	20:06	19:11	17:21	17:00
9	08:15	07:49	08:04	07:07	06:20	05:55	06:04	06:35	07:11	07:46	07:27	08:03
	17:18	17:59	19:36	20:15	20:51	21:22	21:26	20:56	20:04	19:09	17:20	17:00
10	08:15	07:47	08:02	07:06	06:19	05:55	06:05	06:36	07:12	07:47	07:28	08:04
	17:20	18:01	19:37	20:16	20:52	21:22	21:25	20:55	20:03	19:07	17:18	17:00
11	08:14	07:46	08:00	07:04	06:18	05:55	06:05	06:37	07:13	07:49	07:29	08:05
	17:21	18:01	19:38	20:17	20:54	21:23	21:25	20:53	20:01	19:05	17:17	17:00
12	08:14	07:45	07:59	07:02	06:17	05:55	06:06	06:38	07:14	07:50	07:31	08:06
	17:22	18:02	19:40	20:18	20:55	21:23	21:24	20:52	19:59	19:03	17:16	17:00
13	08:14	07:43	07:57	07:00	06:15	05:55	06:07	06:39	07:15	07:51	07:32	08:07
	17:23	18:04	19:41	20:20	20:56	21:24	21:24	20:50	19:57	19:02	17:15	17:00
14	08:13	07:42	07:55	06:59	06:14	05:55	06:08	06:41	07:16	07:52	07:33	08:07
	17:24	18:05	19:42	20:21	20:57	21:24	21:23	20:49	19:55	19:00	17:14	17:00
15	08:13	07:40	07:53	06:57	06:13	05:55	06:09	06:42	07:18	07:54	07:35	08:08
	17:25	18:06	19:44	20:22	20:58	21:25	21:22	20:47	19:53	18:56	17:13	17:01
16	08:12	07:39	07:51	06:55	06:12	05:55	06:10	06:43	07:19	07:55	07:36	08:09
	17:27	18:08	19:45	20:23	20:59	21:25	21:22	20:46	19:51	18:55	17:12	17:01
17	08:12	07:37	07:50	06:54	06:11	05:55	06:10	06:44	07:20	07:56	07:37	08:10
	17:28	18:09	19:46	20:25	21:00	21:26	21:21	20:44	19:49	18:53	17:11	17:01
18	08:11	07:36	07:48	06:52	06:10	05:55	06:11	06:45	07:21	07:57	07:39	08:10
	17:29	18:11	19:47	20:26	21:02	21:26	21:20	20:43	19:48	18:51	17:10	17:01
19	08:10	07:34	07:46	06:50	06:09	05:55	06:12	06:46	07:22	07:59	07:40	08:11
	17:30	18:12	19:49	20:27	21:03	21:26	21:19	20:41	19:46	18:50	17:09	17:02
20	08:10	07:33	07:44	06:49	06:08	05:55	06:13	06:47	07:23	08:00	07:41	08:12
	17:32	18:13	19:50	20:28	21:04	21:27	21:19	20:39	19:44	18:48	17:08	17:02
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22	08:08	07:30	07:40	06:45	06:06	05:55	06:15	06:50	07:26	08:03	07:44	08:13
	17:34	18:16	19:52	20:31	21:06	21:27	21:17	20:36	19:40	18:45	17:07	17:03
23	08:07	07:28	07:38	06:44	06:05	05:55	06:16	06:51	07:27	08:04	07:45	08:13
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25	08:06	07:25	07:35	06:40	06:03	05:56	06:18	06:53	07:29	08:07	07:48	08:14
	17:38	18:20	19:56	20:34	21:09	21:28	21:14	20:31	19:34	18:40	17:05	17:05
26	08:05	07:23	07:33	06:39	06:03	05:56	06:19	06:54	07:30	08:08	07:49	08:14
	17:40	18:21	19:57	20:36	21:10	21:28	21:13	20:29	19:33	18:39	17:04	17:05
27	08:04	07:21	07:31	06:37	06:02	05:57	06:20	06:56	07:32	08:09	07:50	08:15
	17:41	18:23	19:59	20:37	21:11	21:28	21:12	20:28	19:31	18:37	17:04	17:06
28	08:03	07:20	07:29	06:36	06:01	05:57	06:21	06:57	07:33	08:11	07:51	08:15
	17:43	18:24	20:00	20:38	21:12	21:28	21:11	20:26	19:29	18:36	17:03	17:07
29	08:02		07:27	06:34	06:00	05:58	06:23	06:58	07:34	08:12	07:52	08:15
	17:44		20:01	20:39	21:13	21:28	21:10	20:24	19:27	18:34	17:03	17:08
30	08:01		07:26	06:33	06:00	05:58	06:24	06:59	07:35	08:13	07:54	08:15
	17:45		20:02	20:40	21:14	21:28	21:09	20:22	19:25	18:33	17:02	17:08
31	08:00		07:24		05:59		06:25	07:00		08:15		08:16
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Total, real												

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Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

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Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 33 - Non-Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:15	07:58	07:18	07:22	06:31	05:59	05:59	06:26	07:01	07:36	07:16	07:55
	17:10	17:48	18:25	20:05	20:41	21:15	21:28	21:06	20:19	19:23	17:30	17:02
2	08:16	07:57	07:16	07:20	06:30	05:58	05:59	06:27	07:02	07:38	07:17	07:56
	17:11	17:49	18:27	20:06	20:43	21:16	21:27	21:05	20:17	19:21	17:28	17:01
3	08:16	07:56	07:14	07:18	06:28	05:58	06:00	06:28	07:04	07:39	07:18	07:57
	17:12	17:51	18:28	20:07	20:44	21:17	21:27	21:04	20:15	19:20	17:27	17:01
4	08:16	07:55	07:13	07:16	06:27	05:57	06:00	06:29	07:05	07:40	07:20	07:58
	17:13	17:52	18:29	20:08	20:45	21:18	21:27	21:03	20:13	19:18	17:26	17:01
5	08:15	07:54	07:11	07:15	06:26	05:57	06:01	06:30	07:06	07:41	07:21	07:59
	17:14	17:54	18:31	20:10	20:46	21:18	21:27	21:01	20:12	19:16	17:24	17:01
6	08:15	07:53	07:09	07:13	06:24	05:56	06:02	06:31	07:07	07:42	07:22	08:00
	17:15	17:55	18:32	20:11	20:47	21:19	21:26	21:00	20:10	19:14	17:23	17:00
7	08:15	07:51	07:07	07:11	06:23	05:56	06:02	06:32	07:08	07:44	07:24	08:01
	17:16	17:56	18:33	20:12	20:49	21:20	21:26	20:59	20:08	19:12	17:22	17:00
8	08:15	07:50	08:06	07:09	06:22	05:56	06:03	06:34	07:09	07:45	07:25	08:02
	17:17	17:58	18:34	20:13	20:50	21:21	21:26	20:57	20:06	19:10	17:21	17:00
9	08:15	07:49	08:04	07:07	06:20	05:55	06:04	06:35	07:11	07:46	07:26	08:03
	17:18	17:59	19:36	20:15	20:51	21:21	21:25	20:56	20:04	19:09	17:19	17:00
10	08:14	07:47	08:02	07:06	06:19	05:55	06:04	06:36	07:12	07:47	07:28	08:04
	17:19	18:01	19:37	20:16	20:52	21:22	21:25	20:54	20:02	19:07	17:18	17:00
11	08:14	07:46	08:00	07:04	06:18	05:55	06:05	06:37	07:13	07:49	07:29	08:05
	17:21	18:01	19:38	20:17	20:53	21:23	21:24	20:53	20:01	19:05	17:17	17:00
12	08:14	07:45	07:58	07:02	06:16	05:55	06:06	06:38	07:14	07:50	07:30	08:06
	17:22	18:02	19:40	20:18	20:55	21:23	21:24	20:52	19:59	19:03	17:16	17:00
13	08:13	07:43	07:57	07:00	06:15	05:55	06:07	06:39	07:15	07:51	07:32	08:06
	17:23	18:03	19:41	20:19	20:56	21:24	21:23	20:50	19:57	19:02	17:15	17:00
14	08:13	07:42	07:55	06:59	06:14	05:55	06:08	06:40	07:16	07:52	07:33	08:07
	17:24	18:05	19:42	20:21	20:57	21:24	21:23	20:49	19:55	19:00	17:14	17:00
15	08:12	07:40	07:53	06:57	06:13	05:54	06:09	06:42	07:18	07:54	07:34	08:08
	17:25	18:06	19:43	20:22	20:58	21:25	21:22	20:47	19:53	18:56	17:13	17:01
16	08:12	07:39	07:51	06:55	06:12	05:54	06:09	06:43	07:19	07:55	07:36	08:09
	17:27	18:08	19:45	20:23	20:59	21:25	21:21	20:45	19:51	18:55	17:12	17:01
17	08:11	07:37	07:49	06:53	06:11	05:55	06:10	06:44	07:20	07:56	07:37	08:09
	17:28	18:09	19:46	20:24	21:00	21:26	21:21	20:44	19:49	18:53	17:11	17:01
18	08:11	07:36	07:48	06:52	06:10	05:55	06:11	06:45	07:21	07:57	07:38	08:10
	17:29	18:10	19:47	20:26	21:01	21:26	21:20	20:42	19:47	18:51	17:10	17:01
19	08:10	07:34	07:46	06:50	06:09	05:55	06:12	06:46	07:22	07:59	07:40	08:11
	17:30	18:12	19:49	20:27	21:02	21:26	21:19	20:41	19:46	18:50	17:09	17:02
20	08:09	07:33	07:44	06:48	06:08	05:55	06:13	06:47	07:23	08:00	07:41	08:11
	17:32	18:13	19:50	20:28	21:04	21:27	21:18	20:39	19:44	18:48	17:08	17:02
21	08:09	07:31	07:42	06:47	06:07	05:55	06:14	06:49	07:24	08:01	07:42	08:12
	17:33	18:15	19:51	20:29	21:05	21:27	21:18	20:38	19:42	18:46	17:08	17:03
22	08:08	07:29	07:40	06:45	06:06	05:55	06:15	06:50	07:26	08:02	07:44	08:12
	17:34	18:16	19:52	20:30	21:06	21:27	21:17	20:36	19:40	18:45	17:07	17:03
23	08:07	07:28	07:38	06:44	06:05	05:55	06:16	06:51	07:27	08:04	07:45	08:13
	17:36	18:17	19:54	20:32	21:07	21:27	21:16	20:34	19:38	18:43	17:06	17:04
24	08:06	07:26	07:37	06:42	06:04	05:56	06:17	06:52	07:28	08:05	07:46	08:13
	17:37	18:19	19:55	20:33	21:08	21:27	21:15	20:33	19:36	18:42	17:05	17:04
25	08:05	07:25	07:35	06:40	06:03	05:56	06:18	06:53	07:29	08:06	07:47	08:14
	17:38	18:20	19:56	20:34	21:09	21:28	21:14	20:31	19:34	18:40	17:05	17:05
26	08:05	07:23	07:33	06:39	06:03	05:56	06:19	06:54	07:30	08:08	07:49	08:14
	17:40	18:21	19:57	20:35	21:10	21:28	21:13	20:29	19:32	18:39	17:04	17:05
27	08:04	07:21	07:31	06:37	06:02	05:57	06:20	06:56	07:32	08:09	07:50	08:14
	17:41	18:23	19:58	20:37	21:11	21:28	21:12	20:27	19:31	18:37	17:04	17:06
28	08:03	07:20	07:29	06:36	06:01	05:57	06:21	06:57	07:33	08:10	07:51	08:15
	17:42	18:24	20:00	20:38	21:12	21:28	21:11	20:26	19:29	18:36	17:03	17:07
29	08:02		07:27	06:34	06:00	05:58	06:22	06:58	07:34	08:12	07:52	08:15
	17:44		20:01	20:39	21:13	21:28	21:10	20:24	19:27	18:34	17:03	17:08
30	08:01		07:25	06:33	06:00	05:58	06:24	06:59	07:35	08:13	07:53	08:15
	17:45		20:02	20:40	21:13	21:28	21:09	20:22	19:25	18:33	17:02	17:08
31	08:00		07:24		05:59		06:25	07:00		08:14		08:15
	17:47		20:03		21:14		21:07	20:20		18:31		17:09
Potential sun hours	288	292	369	403	458	464	470	435	377	342	289	276
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
TEST license
This license is only to be used for testing purposes

Ramos, Tiffanie / tiffanie.ramos@tetratech.com
Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 34 - Non-Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:16	07:58	07:18	07:22	06:31	05:59	05:59	06:26	07:01	07:36	07:16	07:55
	17:10	17:48	18:25	20:05	20:41	21:15	21:28	21:06	20:19	19:23	17:30	17:02
2	08:16	07:57	07:16	07:20	06:30	05:58	05:59	06:27	07:02	07:38	07:17	07:56
	17:11	17:49	18:27	20:06	20:43	21:16	21:27	21:05	20:17	19:21	17:28	17:01
3	08:16	07:56	07:14	07:18	06:28	05:58	06:00	06:28	07:04	07:39	07:18	07:57
	17:12	17:51	18:28	20:07	20:44	21:17	21:27	21:04	20:15	19:20	17:27	17:01
4	08:16	07:55	07:13	07:16	06:27	05:57	06:00	06:29	07:05	07:40	07:20	07:58
	17:13	17:52	18:29	20:08	20:45	21:18	21:27	21:03	20:13	19:18	17:26	17:01
5	08:15	07:54	07:11	07:15	06:26	05:57	06:01	06:30	07:06	07:41	07:21	07:59
	17:14	17:54	18:31	20:10	20:46	21:18	21:27	21:01	20:12	19:16	17:24	17:01
6	08:15	07:53	07:09	07:13	06:24	05:56	06:02	06:31	07:07	07:42	07:22	08:00
	17:15	17:55	18:32	20:11	20:48	21:19	21:26	21:00	20:10	19:14	17:23	17:00
7	08:15	07:51	07:07	07:11	06:23	05:56	06:02	06:32	07:08	07:44	07:24	08:01
	17:16	17:56	18:33	20:12	20:49	21:20	21:26	20:59	20:08	19:12	17:22	17:00
8	08:15	07:50	08:06	07:09	06:22	05:56	06:03	06:34	07:09	07:45	07:25	08:02
	17:17	17:58	18:35	20:13	20:50	21:21	21:26	20:57	20:06	19:10	17:21	17:00
9	08:15	07:49	08:04	07:07	06:20	05:55	06:04	06:35	07:11	07:46	07:26	08:03
	17:18	17:59	19:36	20:15	20:51	21:21	21:25	20:56	20:04	19:09	17:19	17:00
10	08:15	07:47	08:02	07:06	06:19	05:55	06:04	06:36	07:12	07:47	07:28	08:04
	17:19	18:01	19:37	20:16	20:52	21:22	21:25	20:54	20:02	19:07	17:18	17:00
11	08:14	07:46	08:00	07:04	06:18	05:55	06:05	06:37	07:13	07:49	07:29	08:05
	17:21	18:01	19:38	20:17	20:53	21:23	21:24	20:53	20:01	19:05	17:17	17:00
12	08:14	07:45	07:58	07:02	06:17	05:55	06:06	06:38	07:14	07:50	07:30	08:06
	17:22	18:02	19:40	20:18	20:55	21:23	21:24	20:52	19:59	19:03	17:16	17:00
13	08:13	07:43	07:57	07:00	06:15	05:55	06:07	06:39	07:15	07:51	07:32	08:06
	17:23	18:03	19:41	20:19	20:56	21:24	21:23	20:50	19:57	19:02	17:15	17:00
14	08:13	07:42	07:55	06:59	06:14	05:55	06:08	06:40	07:16	07:52	07:33	08:07
	17:24	18:05	19:42	20:21	20:57	21:24	21:23	20:49	19:55	19:00	17:14	17:00
15	08:12	07:40	07:53	06:57	06:13	05:55	06:09	06:42	07:18	07:54	07:34	08:08
	17:25	18:06	19:43	20:22	20:58	21:25	21:22	20:47	19:53	18:56	17:13	17:01
16	08:12	07:39	07:51	06:55	06:12	05:54	06:09	06:43	07:19	07:55	07:36	08:09
	17:27	18:08	19:45	20:23	20:59	21:25	21:21	20:45	19:51	18:55	17:12	17:01
17	08:11	07:37	07:49	06:53	06:11	05:55	06:10	06:44	07:20	07:56	07:37	08:09
	17:28	18:09	19:46	20:24	21:00	21:26	21:21	20:44	19:49	18:53	17:11	17:01
18	08:11	07:36	07:48	06:52	06:10	05:55	06:11	06:45	07:21	07:57	07:38	08:10
	17:29	18:10	19:47	20:26	21:01	21:26	21:20	20:42	19:47	18:51	17:10	17:01
19	08:10	07:34	07:46	06:50	06:09	05:55	06:12	06:46	07:22	07:59	07:40	08:11
	17:30	18:12	19:49	20:27	21:02	21:26	21:19	20:41	19:46	18:50	17:09	17:02
20	08:09	07:33	07:44	06:48	06:08	05:55	06:13	06:47	07:23	08:00	07:41	08:11
	17:32	18:13	19:50	20:28	21:04	21:27	21:18	20:39	19:44	18:48	17:08	17:02
21	08:09	07:31	07:42	06:47	06:07	05:55	06:14	06:49	07:25	08:01	07:42	08:12
	17:33	18:15	19:51	20:29	21:05	21:27	21:18	20:38	19:42	18:46	17:08	17:03
22	08:08	07:29	07:40	06:45	06:06	05:55	06:15	06:50	07:26	08:02	07:44	08:12
	17:34	18:16	19:52	20:30	21:06	21:27	21:17	20:36	19:40	18:45	17:07	17:03
23	08:07	07:28	07:38	06:44	06:05	05:55	06:16	06:51	07:27	08:04	07:45	08:13
	17:36	18:17	19:54	20:32	21:07	21:27	21:16	20:34	19:38	18:43	17:06	17:04
24	08:06	07:26	07:37	06:42	06:04	05:56	06:17	06:52	07:28	08:05	07:46	08:13
	17:37	18:19	19:55	20:33	21:08	21:27	21:15	20:33	19:36	18:42	17:05	17:04
25	08:05	07:25	07:35	06:40	06:03	05:56	06:18	06:53	07:29	08:06	07:47	08:14
	17:38	18:20	19:56	20:34	21:09	21:28	21:14	20:31	19:34	18:40	17:05	17:05
26	08:05	07:23	07:33	06:39	06:03	05:56	06:19	06:54	07:30	08:08	07:49	08:14
	17:40	18:21	19:57	20:35	21:10	21:28	21:13	20:29	19:33	18:39	17:04	17:05
27	08:04	07:21	07:31	06:37	06:02	05:57	06:20	06:56	07:32	08:09	07:50	08:14
	17:41	18:23	19:59	20:37	21:11	21:28	21:12	20:27	19:31	18:37	17:04	17:06
28	08:03	07:20	07:29	06:36	06:01	05:57	06:21	06:57	07:33	08:10	07:51	08:15
	17:42	18:24	20:00	20:38	21:12	21:28	21:11	20:26	19:29	18:36	17:03	17:07
29	08:02		07:27	06:34	06:00	05:58	06:22	06:58	07:34	08:12	07:52	08:15
	17:44		20:01	20:39	21:13	21:28	21:10	20:24	19:27	18:34	17:03	17:08
30	08:01		07:25	06:33	06:00	05:58	06:24	06:59	07:35	08:13	07:53	08:15
	17:45		20:02	20:40	21:13	21:28	21:09	20:22	19:25	18:33	17:02	17:08
31	08:00		07:24		05:59		06:25	07:00		08:14		08:15
	17:47		20:03		21:14		21:07	20:20		18:31		17:09
Potential sun hours	288	292	369	403	458	464	470	435	377	342	289	276
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
TEST license
This license is only to be used for testing purposes

Ramos, Tiffanie / tiffanie.ramos@tetratech.com
Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 35 - Non-Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:15	07:58	07:18	07:22	06:31	05:59	05:58	06:26	07:01	07:36	07:16	07:54
	17:10	17:48	18:25	20:05	20:41	21:15	21:28	21:06	20:19	19:23	17:30	17:02
2	08:16	07:57	07:16	07:20	06:30	05:58	05:59	06:27	07:02	07:37	07:17	07:56
	17:11	17:49	18:27	20:06	20:43	21:16	21:27	21:05	20:17	19:21	17:28	17:01
3	08:16	07:56	07:14	07:18	06:28	05:57	06:00	06:28	07:04	07:39	07:18	07:57
	17:12	17:51	18:28	20:07	20:44	21:17	21:27	21:04	20:15	19:19	17:27	17:01
4	08:15	07:55	07:13	07:16	06:27	05:57	06:00	06:29	07:05	07:40	07:20	07:58
	17:13	17:52	18:29	20:08	20:45	21:18	21:27	21:02	20:13	19:18	17:26	17:01
5	08:15	07:54	07:11	07:14	06:25	05:57	06:01	06:30	07:06	07:41	07:21	07:59
	17:14	17:54	18:31	20:10	20:46	21:18	21:27	21:01	20:11	19:16	17:24	17:00
6	08:15	07:52	07:09	07:13	06:24	05:56	06:01	06:31	07:07	07:42	07:22	08:00
	17:15	17:55	18:32	20:11	20:47	21:19	21:26	21:00	20:10	19:14	17:23	17:00
7	08:15	07:51	07:07	07:11	06:23	05:56	06:02	06:32	07:08	07:44	07:24	08:01
	17:16	17:56	18:33	20:12	20:49	21:20	21:26	20:59	20:08	19:12	17:22	17:00
8	08:15	07:50	08:06	07:09	06:21	05:56	06:03	06:33	07:09	07:45	07:25	08:02
	17:17	17:58	18:34	20:13	20:50	21:21	21:26	20:57	20:06	19:10	17:21	17:00
9	08:15	07:49	08:04	07:07	06:20	05:55	06:04	06:35	07:11	07:46	07:26	08:03
	17:18	17:59	19:36	20:14	20:51	21:21	21:25	20:56	20:04	19:09	17:19	17:00
10	08:14	07:47	08:02	07:06	06:19	05:55	06:04	06:36	07:12	07:47	07:28	08:04
	17:19	18:01	19:37	20:16	20:52	21:22	21:25	20:54	20:02	19:07	17:18	17:00
11	08:14	07:46	08:00	07:04	06:18	05:55	06:05	06:37	07:13	07:48	07:29	08:05
	17:20	18:01	19:38	20:17	20:53	21:23	21:24	20:53	20:00	19:05	17:17	17:00
12	08:14	07:44	07:58	07:02	06:16	05:55	06:06	06:38	07:14	07:50	07:30	08:06
	17:22	18:02	19:40	20:18	20:55	21:23	21:24	20:51	19:59	19:03	17:16	17:00
13	08:13	07:43	07:57	07:00	06:15	05:55	06:07	06:39	07:15	07:51	07:32	08:06
	17:23	18:03	19:41	20:19	20:56	21:24	21:23	20:50	19:57	19:02	17:15	17:00
14	08:13	07:42	07:55	06:59	06:14	05:54	06:08	06:40	07:16	07:52	07:33	08:07
	17:24	18:05	19:42	20:21	20:57	21:24	21:23	20:48	19:55	19:00	17:14	17:00
15	08:12	07:40	07:53	06:57	06:13	05:54	06:08	06:42	07:17	07:53	07:34	08:08
	17:25	18:06	19:43	20:22	20:58	21:25	21:22	20:47	19:53	18:56	17:13	17:00
16	08:12	07:39	07:51	06:55	06:12	05:54	06:09	06:43	07:19	07:55	07:36	08:09
	17:27	18:08	19:45	20:23	20:59	21:25	21:21	20:45	19:51	18:55	17:12	17:01
17	08:11	07:37	07:49	06:53	06:11	05:54	06:10	06:44	07:20	07:56	07:37	08:09
	17:28	18:09	19:46	20:24	21:00	21:25	21:21	20:44	19:49	18:53	17:11	17:01
18	08:11	07:36	07:47	06:52	06:10	05:54	06:11	06:45	07:21	07:57	07:38	08:10
	17:29	18:10	19:47	20:26	21:01	21:26	21:20	20:42	19:47	18:51	17:10	17:01
19	08:10	07:34	07:46	06:50	06:09	05:55	06:12	06:46	07:22	07:59	07:40	08:11
	17:30	18:12	19:48	20:27	21:02	21:26	21:19	20:41	19:46	18:50	17:09	17:02
20	08:09	07:33	07:44	06:48	06:08	05:55	06:13	06:47	07:23	08:00	07:41	08:11
	17:32	18:13	19:50	20:28	21:03	21:27	21:18	20:39	19:44	18:48	17:08	17:02
21	08:09	07:31	07:42	06:47	06:07	05:55	06:14	06:48	07:24	08:01	07:42	08:12
	17:33	18:14	19:51	20:29	21:05	21:27	21:18	20:37	19:42	18:46	17:07	17:02
22	08:08	07:29	07:40	06:45	06:06	05:55	06:15	06:50	07:26	08:02	07:44	08:12
	17:34	18:16	19:52	20:30	21:06	21:27	21:17	20:36	19:40	18:45	17:07	17:03
23	08:07	07:28	07:38	06:43	06:05	05:55	06:16	06:51	07:27	08:04	07:45	08:13
	17:36	18:17	19:53	20:32	21:07	21:27	21:16	20:34	19:38	18:43	17:06	17:04
24	08:06	07:26	07:36	06:42	06:04	05:56	06:17	06:52	07:28	08:05	07:46	08:13
	17:37	18:19	19:55	20:33	21:08	21:27	21:15	20:32	19:36	18:42	17:05	17:04
25	08:05	07:24	07:35	06:40	06:03	05:56	06:18	06:53	07:29	08:06	07:47	08:14
	17:38	18:20	19:56	20:34	21:09	21:28	21:14	20:31	19:34	18:40	17:05	17:05
26	08:05	07:23	07:33	06:39	06:02	05:56	06:19	06:54	07:30	08:08	07:49	08:14
	17:40	18:21	19:57	20:35	21:10	21:28	21:13	20:29	19:32	18:38	17:04	17:05
27	08:04	07:21	07:31	06:37	06:02	05:57	06:20	06:55	07:31	08:09	07:50	08:14
	17:41	18:23	19:58	20:37	21:11	21:28	21:12	20:27	19:31	18:37	17:03	17:06
28	08:03	07:19	07:29	06:36	06:01	05:57	06:21	06:57	07:33	08:10	07:51	08:15
	17:42	18:24	20:00	20:38	21:12	21:28	21:11	20:26	19:29	18:35	17:03	17:07
29	08:02		07:27	06:34	06:00	05:58	06:22	06:58	07:34	08:12	07:52	08:15
	17:44		20:01	20:39	21:12	21:28	21:10	20:24	19:27	18:34	17:02	17:07
30	08:01		07:25	06:33	06:00	05:58	06:23	06:59	07:35	08:13	07:53	08:15
	17:45		20:02	20:40	21:13	21:28	21:09	20:22	19:25	18:33	17:02	17:08
31	07:59		07:24		05:59		06:25	07:00		08:14		08:15
	17:47		20:03		21:14		21:07	20:20		18:31		17:09
Potential sun hours	288	292	369	403	458	464	470	435	377	342	289	276
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
TEST license
This license is only to be used for testing purposes

Ramos, Tiffanie / tiffanie.ramos@tetratech.com
Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 36 - Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	January	February	March		April	May	June	July	August	September		October		November	December
1	08:15	07:58	07:18		07:22	06:31	05:58	05:58	06:26	07:01		07:36	07:57 (44)	07:16	07:54
	17:10	17:48	18:25		20:05	20:41	21:15	21:27	21:06	20:19		19:23	10 08:07 (44)	17:30	17:02
2	08:15	07:57	07:16		07:20	06:30	05:58	05:59	06:27	07:02		07:37	07:58 (44)	07:17	07:56
	17:11	17:49	18:26		20:06	20:43	21:16	21:27	21:05	20:17		19:21	7 08:05 (44)	17:28	17:01
3	08:15	07:56	07:14		07:18	06:28	05:57	06:00	06:28	07:04		07:39	08:00 (44)	07:18	07:57
	17:12	17:51	18:28		20:07	20:44	21:17	21:27	21:04	20:15		19:19	3 08:03 (44)	17:27	17:01
4	08:15	07:55	07:13		07:16	06:27	05:57	06:00	06:29	07:05		07:40		07:20	07:58
	17:13	17:52	18:29		20:08	20:45	21:18	21:27	21:02	20:13		19:18		17:26	17:01
5	08:15	07:54	07:11		07:14	06:25	05:57	06:01	06:30	07:06		07:41		07:21	07:59
	17:14	17:54	18:30		20:09	20:46	21:18	21:27	21:01	20:11		19:16		17:24	17:00
6	08:15	07:52	07:09		07:13	06:24	05:56	06:01	06:31	07:07		07:42		07:22	08:00
	17:15	17:55	18:32		20:11	20:47	21:19	21:26	21:00	20:10		19:14		17:23	17:00
7	08:15	07:51	07:07		07:11	06:23	05:56	06:02	06:32	07:08		07:43		07:24	08:01
	17:16	17:56	18:33		20:12	20:49	21:20	21:26	20:58	20:08		19:12		17:22	17:00
8	08:15	07:50	08:06		07:09	06:21	05:55	06:03	06:33	07:09		07:45		07:25	08:02
	17:17	17:58	18:34		20:13	20:50	21:21	21:26	20:57	20:06		19:10		17:20	17:00
9	08:15	07:49	08:04		07:07	06:20	05:55	06:04	06:35	07:10		07:46		07:26	08:03
	17:18	17:59	19:36		20:14	20:51	21:21	21:25	20:56	20:04		19:09		17:19	17:00
10	08:14	07:47	08:02	08:22 (44)	07:05	06:19	05:55	06:04	06:36	07:12		07:47		07:28	08:04
	17:19	18:01	19:37	1 08:23 (44)	20:16	20:52	21:22	21:25	20:54	20:02		19:07		17:18	17:00
11	08:14	07:46	08:00	08:20 (44)	07:04	06:18	05:55	06:05	06:37	07:13		07:48		07:29	08:05
	17:20	18:01	19:38	6 08:26 (44)	20:17	20:53	21:22	21:24	20:53	20:00		19:05		17:17	17:00
12	08:14	07:44	07:58	08:19 (44)	07:02	06:16	05:55	06:06	06:38	07:14		07:50		07:30	08:05
	17:22	18:02	19:40	9 08:28 (44)	20:18	20:54	21:23	21:24	20:51	19:59		19:03		17:16	17:00
13	08:13	07:43	07:57	08:17 (44)	07:00	06:15	05:54	06:07	06:39	07:15		07:51		07:32	08:06
	17:23	18:03	19:41	12 08:29 (44)	20:19	20:56	21:24	21:23	20:50	19:57		19:01		17:15	17:00
14	08:13	07:42	07:55	08:15 (44)	06:58	06:14	05:54	06:08	06:40	07:16		07:52		07:33	08:07
	17:24	18:05	19:42	14 08:29 (44)	20:21	20:57	21:24	21:23	20:48	19:55		19:00		17:14	17:00
15	08:12	07:40	07:53	08:13 (44)	06:57	06:13	05:54	06:08	06:41	07:17		07:53		07:34	08:08
	17:25	18:06	19:43	16 08:29 (44)	20:22	20:58	21:25	21:22	20:47	19:53		18:56		17:13	17:00
16	08:12	07:39	07:51	08:11 (44)	06:55	06:12	05:54	06:09	06:43	07:19		07:55		07:36	08:09
	17:26	18:08	19:45	18 08:29 (44)	20:23	20:59	21:25	21:21	20:45	19:51		18:55		17:12	17:01
17	08:11	07:37	07:49	08:09 (44)	06:53	06:11	05:54	06:10	06:44	07:20		07:56		07:37	08:09
	17:28	18:09	19:46	20 08:29 (44)	20:24	21:00	21:25	21:21	20:44	19:49		18:53		17:11	17:01
18	08:11	07:36	07:47	08:08 (44)	06:52	06:10	05:54	06:11	06:45	07:21		07:57		07:38	08:10
	17:29	18:10	19:47	21 08:29 (44)	20:25	21:01	21:26	21:20	20:42	19:47		18:51		17:10	17:01
19	08:10	07:34	07:46	08:07 (44)	06:50	06:09	05:55	06:12	06:46	07:22		07:58		07:40	08:11
	17:30	18:12	19:48	21 08:28 (44)	20:27	21:02	21:26	21:19	20:41	19:45		18:50		17:09	17:02
20	08:09	07:32	07:44	08:08 (44)	06:48	06:08	05:55	06:13	06:47	07:23	07:59 (44)	08:00		07:41	08:11
	17:32	18:13	19:50	19 08:27 (44)	20:28	21:03	21:26	21:18	20:39	19:44	7 08:06 (44)	18:48		17:08	17:02
21	08:09	07:31	07:42	08:08 (44)	06:47	06:07	05:55	06:14	06:48	07:24	07:55 (44)	08:01		07:42	08:12
	17:33	18:14	19:51	17 08:25 (44)	20:29	21:04	21:27	21:17	20:37	19:42	13 08:08 (44)	18:46		17:07	17:02
22	08:08	07:29	07:40	08:09 (44)	06:45	06:06	05:55	06:15	06:50	07:26	07:54 (44)	08:02		07:43	08:12
	17:34	18:16	19:52	14 08:23 (44)	20:30	21:06	21:27	21:17	20:36	19:40	16 08:10 (44)	18:45		17:07	17:03
23	08:07	07:28	07:38	08:11 (44)	06:43	06:05	05:55	06:16	06:51	07:27	07:52 (44)	08:04		07:45	08:13
	17:36	18:17	19:53	9 08:20 (44)	20:32	21:07	21:27	21:16	20:34	19:38	19 08:11 (44)	18:43		17:06	17:03
24	08:06	07:26	07:36		06:42	06:04	05:56	06:17	06:52	07:28	07:51 (44)	08:05		07:46	08:13
	17:37	18:18	19:55		20:33	21:08	21:27	21:15	20:32	19:36	20 08:11 (44)	18:41		17:05	17:04
25	08:05	07:24	07:35		06:40	06:03	05:56	06:18	06:53	07:29	07:50 (44)	08:06		07:47	08:14
	17:38	18:20	19:56		20:34	21:09	21:27	21:14	20:31	19:34	21 08:11 (44)	18:40		17:05	17:05
26	08:04	07:23	07:33		06:39	06:02	05:56	06:19	06:54	07:30	07:51 (44)	08:08		07:48	08:14
	17:40	18:21	19:57		20:35	21:10	21:28	21:13	20:29	19:32	20 08:11 (44)	18:38		17:04	17:05
27	08:04	07:21	07:31		06:37	06:02	05:57	06:20	06:55	07:31	07:52 (44)	08:09		07:50	08:14
	17:41	18:23	19:58		20:36	21:11	21:28	21:12	20:27	19:31	19 08:11 (44)	18:37		17:03	17:06
28	08:03	07:19	07:29		06:36	06:01	05:57	06:21	06:57	07:33	07:54 (44)	08:10		07:51	08:15
	17:42	18:24	20:00		20:38	21:11	21:28	21:11	20:26	19:29	17 08:11 (44)	18:35		17:03	17:07
29	08:02		07:27		06:34	06:00	05:57	06:22	06:58	07:34	07:55 (44)	08:12		07:52	08:15
	17:44		20:01		20:39	21:12	21:28	21:10	20:24	19:27	15 08:10 (44)	18:34		17:02	17:07
30	08:00		07:25		06:33	06:00	05:58	06:23	06:59	07:35	07:56 (44)	08:13		07:53	08:15
	17:45		20:02		20:40	21:13	21:28	21:08	20:22	19:25	13 08:09 (44)	18:32		17:02	17:08
31	07:59		07:24			05:59		06:24	07:00			08:14			08:15
	17:47		20:03			21:14		21:07	20:20			18:31			17:09
Potential sun hours	288	292	369		403	458	464	470	435	377		342		289	276
Total, worst case				197							180		20		
Sun reduction				0.62							0.69		0.59		
Oper. time red.				0.98							0.98		0.98		
Wind dir. red.				0.70							0.70		0.70		
Total reduction				0.43							0.47		0.41		
Total, real				84							85		8		

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:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
TEST license
This license is only to be used for testing purposes

Ramos, Tiffanie / tiffanie.ramos@tetratech.com
Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 37 - Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	January	February		March	April	May			June		
1	08:15	07:58		08:20 (49)	07:18	07:22	06:31		05:58		06:22 (44)
	17:10	17:48	2	08:22 (49)	18:25	20:05	20:41		21:15	17	06:39 (44)
2	08:15	07:57		08:19 (49)	07:16	07:20	06:30		05:58		06:21 (44)
	17:11	17:49	5	08:24 (49)	18:27	20:06	20:43		21:16	17	06:38 (44)
3	08:15	07:56		08:18 (49)	07:14	07:18	06:28		05:57		06:21 (44)
	17:12	17:51	7	08:25 (49)	18:28	20:07	20:44		21:17	17	06:38 (44)
4	08:15	07:55		08:16 (49)	07:13	07:16	06:27		05:57		06:20 (44)
	17:13	17:52	9	08:25 (49)	18:29	20:08	20:45		21:18	18	06:38 (44)
5	08:15	07:54		08:15 (49)	07:11	07:14	06:25		05:57		06:21 (44)
	17:14	17:54	11	08:26 (49)	18:30	20:09	20:46		21:18	17	06:38 (44)
6	08:15	07:52		08:14 (49)	07:09	07:13	06:24		05:56		06:21 (44)
	17:15	17:55	12	08:26 (49)	18:32	20:11	20:47		21:19	17	06:38 (44)
7	08:15	07:51		08:13 (49)	07:07	07:11	06:23		05:56		06:21 (44)
	17:16	17:56	14	08:27 (49)	18:33	20:12	20:49		21:20	16	06:37 (44)
8	08:15	07:50		08:11 (49)	08:06	07:09	06:21		05:56		06:22 (44)
	17:17	17:58	15	08:26 (49)	18:34	20:13	20:50		21:21	15	06:37 (44)
9	08:15	07:49		08:10 (49)	08:04	07:07	06:20		05:55		06:23 (44)
	17:18	17:59	16	08:26 (49)	19:36	20:14	20:51		21:21	14	06:37 (44)
10	08:14	07:47		08:09 (49)	08:02	07:05	06:19		05:55		06:24 (44)
	17:19	18:01	16	08:25 (49)	19:37	20:16	20:52		21:22	13	06:37 (44)
11	08:14	07:46		08:10 (49)	08:00	07:04	06:18		05:55		06:24 (44)
	17:20	18:01	15	08:25 (49)	19:38	20:17	20:53		21:22	13	06:37 (44)
12	08:14	07:44		08:12 (49)	07:58	07:02	06:16		05:55		06:24 (44)
	17:22	18:02	12	08:24 (49)	19:40	20:18	20:54		21:23	12	06:36 (44)
13	08:13	07:43		08:13 (49)	07:57	07:00	06:15		05:55		06:24 (44)
	17:23	18:03	8	08:21 (49)	19:41	20:19	20:56		21:24	12	06:36 (44)
14	08:13	07:42			07:55	06:58	06:14		05:54		06:25 (44)
	17:24	18:05			19:42	20:21	20:57		21:24	11	06:36 (44)
15	08:12	07:40			07:53	06:57	06:13		05:54		06:26 (44)
	17:25	18:06			19:43	20:22	20:58		21:25	10	06:36 (44)
16	08:12	07:39			07:51	06:55	06:12		05:54		06:26 (44)
	17:26	18:08			19:45	20:23	20:59		21:25	10	06:36 (44)
17	08:11	07:37			07:49	06:53	06:11		05:54		06:26 (44)
	17:28	18:09			19:46	20:24	21:00		21:25	10	06:36 (44)
18	08:11	07:36			07:47	06:52	06:10	06:32 (44)	05:54		06:28 (44)
	17:29	18:10			19:47	20:25	21:01	2 06:34 (44)	21:26	9	06:37 (44)
19	08:10	07:34			07:46	06:50	06:09	06:31 (44)	05:55		06:28 (44)
	17:30	18:12			19:48	20:27	21:02	4 06:35 (44)	21:26	9	06:37 (44)
20	08:09	07:32			07:44	06:48	06:08	06:30 (44)	05:55		06:28 (44)
	17:32	18:13			19:50	20:28	21:03	6 06:36 (44)	21:26	9	06:37 (44)
21	08:09	07:31			07:42	06:47	06:07	06:29 (44)	05:55		06:28 (44)
	17:33	18:14			19:51	20:29	21:04	7 06:36 (44)	21:27	9	06:37 (44)
22	08:08	07:29			07:40	06:45	06:06	06:28 (44)	05:55		06:28 (44)
	17:34	18:16			19:52	20:30	21:05	9 06:37 (44)	21:27	9	06:37 (44)
23	08:07	07:28			07:38	06:43	06:05	06:27 (44)	05:55		06:29 (44)
	17:36	18:17			19:53	20:32	21:07	10 06:37 (44)	21:27	9	06:38 (44)
24	08:06	07:26			07:36	06:42	06:04	06:27 (44)	05:56		06:29 (44)
	17:37	18:18			19:55	20:33	21:08	11 06:38 (44)	21:27	9	06:38 (44)
25	08:05	07:24			07:35	06:40	06:03	06:26 (44)	05:56		06:29 (44)
	17:38	18:20			19:56	20:34	21:09	12 06:38 (44)	21:27	9	06:38 (44)
26	08:04	07:23			07:33	06:39	06:02	06:25 (44)	05:56		06:28 (44)
	17:40	18:21			19:57	20:35	21:10	13 06:38 (44)	21:28	10	06:38 (44)
27	08:03	07:21			07:31	06:37	06:02	06:25 (44)	05:57		06:29 (44)
	17:41	18:23			19:58	20:36	21:11	14 06:39 (44)	21:28	10	06:39 (44)
28	08:03	07:19			07:29	06:36	06:01	06:24 (44)	05:57		06:28 (44)
	17:42	18:24			20:00	20:38	21:11	14 06:38 (44)	21:28	11	06:39 (44)
29	08:02				07:27	06:34	06:00	06:23 (44)	05:57		06:29 (44)
	17:44				20:01	20:39	21:12	15 06:38 (44)	21:28	11	06:40 (44)
30	08:00				07:25	06:33	06:00	06:23 (44)	05:58		06:28 (44)
	17:45				20:02	20:40	21:13	16 06:39 (44)	21:28	12	06:40 (44)
31	07:59				07:24		05:59	06:22 (44)			
	17:47				20:03		21:14	16 06:38 (44)			
Potential sun hours	288	292			369	403	458		464		
Total, worst case			142					149		365	
Sun reduction			0.62					0.66		0.69	
Oper. time red.			0.98					0.98		0.98	
Wind dir. red.			0.75					0.58		0.58	
Total reduction			0.46					0.38		0.40	
Total, real			65					56		144	

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:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
TEST license
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Ramos, Tiffanie / tiffanie.ramos@tetratech.com
Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 37 - Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	July			August	September	October			November			December
1	05:58		06:28 (44)	06:26	07:01	07:36			07:16		07:38 (49)	07:54
	21:27	13	06:41 (44)	21:06	20:19	19:23			17:30	17	07:55 (49)	17:02
2	05:59		06:28 (44)	06:27	07:02	07:37			07:17		07:40 (49)	07:56
	21:27	13	06:41 (44)	21:05	20:17	19:21			17:28	16	07:56 (49)	17:01
3	06:00		06:28 (44)	06:28	07:04	07:39			07:18		07:41 (49)	07:57
	21:27	14	06:42 (44)	21:04	20:15	19:19			17:27	15	07:56 (49)	17:01
4	06:00		06:27 (44)	06:29	07:05	07:40			07:20		07:42 (49)	07:58
	21:27	15	06:42 (44)	21:02	20:13	19:18			17:26	14	07:56 (49)	17:01
5	06:01		06:28 (44)	06:30	07:06	07:41			07:21		07:44 (49)	07:59
	21:27	15	06:43 (44)	21:01	20:11	19:16			17:24	12	07:56 (49)	17:00
6	06:01		06:28 (44)	06:31	07:07	07:42			07:22		07:45 (49)	08:00
	21:26	16	06:44 (44)	21:00	20:10	19:14			17:23	10	07:55 (49)	17:00
7	06:02		06:27 (44)	06:32	07:08	07:43			07:24		07:47 (49)	08:01
	21:26	17	06:44 (44)	20:58	20:08	19:12			17:22	9	07:56 (49)	17:00
8	06:03		06:27 (44)	06:33	07:09	07:45			07:25		07:48 (49)	08:02
	21:26	18	06:45 (44)	20:57	20:06	19:10			17:21	7	07:55 (49)	17:00
9	06:04		06:28 (44)	06:35	07:10	07:46			07:26		07:50 (49)	08:03
	21:25	17	06:45 (44)	20:56	20:04	19:09			17:19	4	07:54 (49)	17:00
10	06:04		06:28 (44)	06:36	07:12	07:47			07:28		07:51 (49)	08:04
	21:25	17	06:45 (44)	20:54	20:02	19:07			17:18	2	07:53 (49)	17:00
11	06:05		06:29 (44)	06:37	07:13	07:48			07:29			08:05
	21:24	17	06:46 (44)	20:53	20:00	19:05			17:17			17:00
12	06:06		06:30 (44)	06:38	07:14	07:50			07:30			08:05
	21:24	16	06:46 (44)	20:51	19:59	19:03			17:16			17:00
13	06:07		06:31 (44)	06:39	07:15	07:51			07:32			08:06
	21:23	16	06:47 (44)	20:50	19:57	19:01			17:15			17:00
14	06:08		06:32 (44)	06:40	07:16	07:52			07:33			08:07
	21:23	15	06:47 (44)	20:48	19:55	19:00			17:14			17:00
15	06:08		06:32 (44)	06:41	07:17	07:53			07:34			08:08
	21:22	15	06:47 (44)	20:47	19:53	18:56			17:13			17:00
16	06:09		06:33 (44)	06:43	07:19	07:55			07:36			08:09
	21:21	14	06:47 (44)	20:45	19:51	18:55			17:12			17:01
17	06:10		06:34 (44)	06:44	07:20	07:56			07:37			08:09
	21:21	13	06:47 (44)	20:44	19:49	18:53			17:11			17:01
18	06:11		06:35 (44)	06:45	07:21	07:57			07:38			08:10
	21:20	12	06:47 (44)	20:42	19:47	18:51			17:10			17:01
19	06:12		06:36 (44)	06:46	07:22	07:58			07:40			08:11
	21:19	11	06:47 (44)	20:41	19:45	18:50			17:09			17:02
20	06:13		06:37 (44)	06:47	07:23	08:00			07:41			08:11
	21:18	10	06:47 (44)	20:39	19:44	18:48			17:08			17:02
21	06:14		06:38 (44)	06:48	07:24	08:01			07:42			08:12
	21:17	9	06:47 (44)	20:37	19:42	18:46			17:07			17:02
22	06:15		06:39 (44)	06:50	07:26	08:02			07:43			08:12
	21:17	8	06:47 (44)	20:36	19:40	18:45			17:07			17:03
23	06:16		06:40 (44)	06:51	07:27	08:04			07:45			08:13
	21:16	7	06:47 (44)	20:34	19:38	18:43			17:06			17:03
24	06:17		06:41 (44)	06:52	07:28	08:05			07:46			08:13
	21:15	5	06:46 (44)	20:32	19:36	18:42			17:05			17:04
25	06:18		06:42 (44)	06:53	07:29	08:06			07:47			08:14
	21:14	3	06:45 (44)	20:31	19:34	18:40			17:05			17:05
26	06:19		06:43 (44)	06:54	07:30	08:08			07:48			08:14
	21:13	1	06:44 (44)	20:29	19:32	18:38			17:04			17:05
27	06:20			06:55	07:31	08:09			07:50			08:14
	21:12			20:27	19:31	18:37			17:03			17:06
28	06:21			06:57	07:33	08:10			07:51			08:15
	21:11			20:26	19:29	18:35			17:03			17:07
29	06:22			06:58	07:34	08:12		08:42 (49)	07:52			08:15
	21:10			20:24	19:27	18:34	9	08:51 (49)	17:02			17:07
30	06:23			06:59	07:35	08:13		08:40 (49)	07:53			08:15
	21:08			20:22	19:25	18:32	13	08:53 (49)	17:02			17:08
31	06:24			07:00		08:14		08:40 (49)				08:15
	21:07			20:20		18:31	14	08:54 (49)				17:09
Potential sun hours	470			435	377	342			289			276
Total, worst case		327					36			106		
Sun reduction		0.76					0.59			0.51		
Oper. time red.		0.98					0.98			0.98		
Wind dir. red.		0.58					0.75			0.75		
Total reduction		0.44					0.44			0.38		
Total, real		142					16			40		

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:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
TEST license
This license is only to be used for testing purposes

Ramos, Tiffanie / tiffanie.ramos@tetratech.com
Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 38 - Non-Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:16	07:59	07:18	07:22	06:31	05:58	05:58	06:26	07:01	07:36	07:16	07:55
	17:10	17:48	18:25	20:05	20:42	21:16	21:28	21:07	20:19	19:23	17:30	17:01
2	08:16	07:58	07:16	07:20	06:30	05:58	05:59	06:27	07:02	07:38	07:17	07:56
	17:11	17:49	18:27	20:06	20:43	21:17	21:28	21:05	20:17	19:21	17:28	17:01
3	08:16	07:57	07:15	07:18	06:28	05:57	05:59	06:28	07:04	07:39	07:19	07:57
	17:12	17:51	18:28	20:07	20:44	21:17	21:28	21:04	20:15	19:20	17:27	17:01
4	08:16	07:55	07:13	07:16	06:27	05:57	06:00	06:29	07:05	07:40	07:20	07:58
	17:13	17:52	18:29	20:09	20:46	21:18	21:28	21:03	20:14	19:18	17:26	17:01
5	08:16	07:54	07:11	07:15	06:25	05:56	06:01	06:30	07:06	07:41	07:21	07:59
	17:14	17:54	18:31	20:10	20:47	21:19	21:27	21:02	20:12	19:16	17:24	17:00
6	08:16	07:53	07:09	07:13	06:24	05:56	06:01	06:31	07:07	07:43	07:23	08:00
	17:15	17:55	18:32	20:11	20:48	21:20	21:27	21:00	20:10	19:14	17:23	17:00
7	08:16	07:52	07:08	07:11	06:23	05:56	06:02	06:32	07:08	07:44	07:24	08:01
	17:16	17:56	18:33	20:12	20:49	21:21	21:27	20:59	20:08	19:12	17:22	17:00
8	08:16	07:50	08:06	07:09	06:21	05:55	06:03	06:33	07:09	07:45	07:25	08:02
	17:17	17:58	18:35	20:14	20:50	21:21	21:26	20:58	20:06	19:11	17:21	17:00
9	08:15	07:49	08:04	07:07	06:20	05:55	06:03	06:35	07:11	07:46	07:27	08:03
	17:18	17:59	19:36	20:15	20:51	21:22	21:26	20:56	20:04	19:09	17:19	17:00
10	08:15	07:48	08:02	07:06	06:19	05:55	06:04	06:36	07:12	07:48	07:28	08:04
	17:19	18:01	19:37	20:16	20:53	21:23	21:25	20:55	20:03	19:07	17:18	17:00
11	08:15	07:46	08:00	07:04	06:18	05:55	06:05	06:37	07:13	07:49	07:30	08:05
	17:20	18:01	19:38	20:17	20:54	21:23	21:25	20:53	20:01	19:05	17:17	17:00
12	08:14	07:45	07:59	07:02	06:16	05:54	06:06	06:38	07:14	07:50	07:31	08:06
	17:22	18:02	19:40	20:18	20:55	21:24	21:24	20:52	19:59	19:03	17:16	17:00
13	08:14	07:43	07:57	07:00	06:15	05:54	06:07	06:39	07:15	07:51	07:32	08:07
	17:23	18:03	19:41	20:20	20:56	21:24	21:24	20:50	19:57	19:02	17:15	17:00
14	08:13	07:42	07:55	06:59	06:14	05:54	06:07	06:40	07:16	07:53	07:34	08:08
	17:24	18:05	19:42	20:21	20:57	21:25	21:23	20:49	19:55	19:00	17:14	17:00
15	08:13	07:41	07:53	06:57	06:13	05:54	06:08	06:42	07:18	07:54	07:35	08:09
	17:25	18:06	19:44	20:22	20:58	21:25	21:23	20:47	19:53	18:56	17:13	17:00
16	08:12	07:39	07:51	06:55	06:12	05:54	06:09	06:43	07:19	07:55	07:36	08:09
	17:26	18:08	19:45	20:23	21:00	21:26	21:22	20:46	19:51	18:55	17:12	17:00
17	08:12	07:38	07:50	06:53	06:11	05:54	06:10	06:44	07:20	07:56	07:38	08:10
	17:28	18:09	19:46	20:25	21:01	21:26	21:21	20:44	19:50	18:53	17:11	17:01
18	08:11	07:36	07:48	06:52	06:10	05:54	06:11	06:45	07:21	07:58	07:39	08:11
	17:29	18:10	19:47	20:26	21:02	21:26	21:21	20:43	19:48	18:51	17:10	17:01
19	08:11	07:34	07:46	06:50	06:09	05:54	06:12	06:46	07:22	07:59	07:40	08:11
	17:30	18:12	19:49	20:27	21:03	21:27	21:20	20:41	19:46	18:50	17:09	17:01
20	08:10	07:33	07:44	06:48	06:08	05:55	06:13	06:47	07:23	08:00	07:41	08:12
	17:32	18:13	19:50	20:28	21:04	21:27	21:19	20:39	19:44	18:48	17:08	17:02
21	08:09	07:31	07:42	06:47	06:07	05:55	06:14	06:48	07:25	08:01	07:43	08:12
	17:33	18:14	19:51	20:30	21:05	21:27	21:18	20:38	19:42	18:46	17:07	17:02
22	08:08	07:30	07:40	06:45	06:06	05:55	06:15	06:50	07:26	08:03	07:44	08:13
	17:34	18:16	19:52	20:31	21:06	21:28	21:17	20:36	19:40	18:45	17:07	17:03
23	08:08	07:28	07:38	06:43	06:05	05:55	06:16	06:51	07:27	08:04	07:45	08:13
	17:36	18:17	19:54	20:32	21:07	21:28	21:16	20:35	19:38	18:43	17:06	17:03
24	08:07	07:26	07:37	06:42	06:04	05:55	06:17	06:52	07:28	08:05	07:47	08:14
	17:37	18:19	19:55	20:33	21:08	21:28	21:15	20:33	19:36	18:42	17:05	17:04
25	08:06	07:25	07:35	06:40	06:03	05:56	06:18	06:53	07:29	08:07	07:48	08:14
	17:38	18:20	19:56	20:35	21:09	21:28	21:14	20:31	19:35	18:40	17:05	17:05
26	08:05	07:23	07:33	06:39	06:02	05:56	06:19	06:54	07:31	08:08	07:49	08:15
	17:40	18:21	19:57	20:36	21:10	21:28	21:13	20:29	19:33	18:38	17:04	17:05
27	08:04	07:21	07:31	06:37	06:02	05:56	06:20	06:55	07:32	08:09	07:50	08:15
	17:41	18:23	19:59	20:37	21:11	21:28	21:12	20:28	19:31	18:37	17:03	17:06
28	08:03	07:20	07:29	06:36	06:01	05:57	06:21	06:57	07:33	08:11	07:52	08:15
	17:42	18:24	20:00	20:38	21:12	21:28	21:11	20:26	19:29	18:35	17:03	17:07
29	08:02		07:27	06:34	06:00	05:57	06:22	06:58	07:34	08:12	07:53	08:15
	17:44		20:01	20:39	21:13	21:28	21:10	20:24	19:27	18:34	17:02	17:07
30	08:01		07:26	06:33	06:00	05:58	06:23	06:59	07:35	08:13	07:54	08:16
	17:45		20:02	20:41	21:14	21:28	21:09	20:23	19:25	18:33	17:02	17:08
31	08:00		07:24		05:59		06:24	07:00		08:15		08:16
	17:47		20:04		21:15		21:08	20:21		18:31		17:09
Potential sun hours	287	292	369	403	458	464	470	435	377	341	289	276
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
TEST license
This license is only to be used for testing purposes

Ramos, Tiffanie / tiffanie.ramos@tetratech.com
Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 39 - Non-Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:16	07:59	07:18	07:22	06:32	05:59	05:59	06:26	07:02	07:37	07:16	07:55
	17:11	17:49	18:26	20:05	20:42	21:15	21:28	21:06	20:19	19:24	17:30	17:02
2	08:16	07:58	07:16	07:20	06:30	05:59	06:00	06:27	07:03	07:38	07:17	07:56
	17:12	17:50	18:27	20:06	20:43	21:16	21:28	21:05	20:17	19:22	17:29	17:02
3	08:16	07:56	07:15	07:19	06:29	05:58	06:00	06:28	07:04	07:39	07:19	07:57
	17:13	17:51	18:28	20:07	20:44	21:17	21:27	21:04	20:15	19:20	17:27	17:02
4	08:16	07:55	07:13	07:17	06:27	05:58	06:01	06:30	07:05	07:40	07:20	07:58
	17:14	17:53	18:30	20:09	20:45	21:18	21:27	21:03	20:14	19:18	17:26	17:01
5	08:16	07:54	07:11	07:15	06:26	05:57	06:01	06:31	07:06	07:41	07:21	07:59
	17:15	17:54	18:31	20:10	20:47	21:19	21:27	21:01	20:12	19:16	17:25	17:01
6	08:16	07:53	07:10	07:13	06:25	05:57	06:02	06:32	07:08	07:43	07:23	08:00
	17:16	17:56	18:32	20:11	20:48	21:19	21:27	21:00	20:10	19:14	17:24	17:01
7	08:15	07:52	07:08	07:11	06:23	05:56	06:03	06:33	07:09	07:44	07:24	08:01
	17:17	17:57	18:34	20:12	20:49	21:20	21:26	20:59	20:08	19:13	17:22	17:01
8	08:15	07:50	08:06	07:10	06:22	05:56	06:04	06:34	07:10	07:45	07:25	08:02
	17:18	17:58	18:35	20:14	20:50	21:21	21:26	20:57	20:06	19:11	17:21	17:01
9	08:15	07:49	08:04	07:08	06:21	05:56	06:04	06:35	07:11	07:46	07:27	08:03
	17:19	18:00	19:36	20:15	20:51	21:21	21:26	20:56	20:05	19:09	17:20	17:01
10	08:15	07:48	08:02	07:06	06:19	05:56	06:05	06:36	07:12	07:48	07:28	08:04
	17:20	18:00	19:37	20:16	20:52	21:22	21:25	20:55	20:03	19:07	17:19	17:01
11	08:14	07:46	08:01	07:04	06:18	05:55	06:06	06:37	07:13	07:49	07:29	08:05
	17:21	18:01	19:39	20:17	20:54	21:23	21:25	20:53	20:01	19:05	17:18	17:01
12	08:14	07:45	07:59	07:03	06:17	05:55	06:07	06:39	07:14	07:50	07:31	08:06
	17:22	18:03	19:40	20:19	20:55	21:23	21:24	20:52	19:59	19:04	17:17	17:01
13	08:14	07:43	07:57	07:01	06:16	05:55	06:07	06:40	07:16	07:51	07:32	08:07
	17:23	18:04	19:41	20:20	20:56	21:24	21:24	20:50	19:57	19:02	17:15	17:01
14	08:13	07:42	07:55	06:59	06:15	05:55	06:08	06:41	07:17	07:53	07:33	08:07
	17:25	18:05	19:43	20:21	20:57	21:24	21:23	20:49	19:55	19:00	17:14	17:01
15	08:13	07:41	07:53	06:57	06:14	05:55	06:09	06:42	07:18	07:54	07:35	08:08
	17:26	18:07	19:44	20:22	20:58	21:25	21:22	20:47	19:53	18:57	17:13	17:01
16	08:12	07:39	07:52	06:56	06:12	05:55	06:10	06:43	07:19	07:55	07:36	08:09
	17:27	18:08	19:45	20:23	20:59	21:25	21:22	20:46	19:52	18:55	17:12	17:01
17	08:12	07:38	07:50	06:54	06:11	05:55	06:11	06:44	07:20	07:56	07:37	08:10
	17:28	18:09	19:46	20:25	21:00	21:26	21:21	20:44	19:50	18:53	17:11	17:02
18	08:11	07:36	07:48	06:52	06:10	05:55	06:12	06:46	07:21	07:58	07:39	08:10
	17:30	18:11	19:48	20:26	21:02	21:26	21:20	20:43	19:48	18:52	17:11	17:02
19	08:10	07:34	07:46	06:51	06:09	05:55	06:13	06:47	07:23	07:59	07:40	08:11
	17:31	18:12	19:49	20:27	21:03	21:26	21:19	20:41	19:46	18:50	17:10	17:02
20	08:10	07:33	07:44	06:49	06:08	05:55	06:14	06:48	07:24	08:00	07:41	08:12
	17:32	18:14	19:50	20:28	21:04	21:27	21:19	20:39	19:44	18:48	17:09	17:03
21	08:09	07:31	07:42	06:47	06:07	05:56	06:15	06:49	07:25	08:01	07:43	08:12
	17:34	18:15	19:51	20:30	21:05	21:27	21:18	20:38	19:42	18:47	17:08	17:03
22	08:08	07:30	07:41	06:46	06:06	05:56	06:16	06:50	07:26	08:03	07:44	08:13
	17:35	18:16	19:53	20:31	21:06	21:27	21:17	20:36	19:40	18:45	17:07	17:04
23	08:07	07:28	07:39	06:44	06:06	05:56	06:17	06:51	07:27	08:04	07:45	08:13
	17:36	18:18	19:54	20:32	21:07	21:27	21:16	20:35	19:38	18:44	17:07	17:04
24	08:07	07:27	07:37	06:42	06:05	05:56	06:18	06:52	07:28	08:05	07:46	08:14
	17:38	18:19	19:55	20:33	21:08	21:28	21:15	20:33	19:37	18:42	17:06	17:05
25	08:06	07:25	07:35	06:41	06:04	05:57	06:19	06:54	07:30	08:07	07:48	08:14
	17:39	18:20	19:56	20:34	21:09	21:28	21:14	20:31	19:35	18:41	17:05	17:05
26	08:05	07:23	07:33	06:39	06:03	05:57	06:20	06:55	07:31	08:08	07:49	08:14
	17:40	18:22	19:58	20:36	21:10	21:28	21:13	20:29	19:33	18:39	17:05	17:06
27	08:04	07:22	07:31	06:38	06:02	05:57	06:21	06:56	07:32	08:09	07:50	08:15
	17:42	18:23	19:59	20:37	21:11	21:28	21:12	20:28	19:31	18:37	17:04	17:07
28	08:03	07:20	07:30	06:36	06:02	05:58	06:22	06:57	07:33	08:11	07:51	08:15
	17:43	18:24	20:00	20:38	21:12	21:28	21:11	20:26	19:29	18:36	17:04	17:07
29	08:02		07:28	06:35	06:01	05:58	06:23	06:58	07:34	08:12	07:52	08:15
	17:44		20:01	20:39	21:13	21:28	21:10	20:24	19:27	18:35	17:03	17:08
30	08:01		07:26	06:33	06:00	05:59	06:24	06:59	07:35	08:13	07:54	08:15
	17:46		20:03	20:41	21:14	21:28	21:09	20:23	19:25	18:33	17:03	17:09
31	08:00		07:24		06:00		06:25	07:01		08:15		08:16
	17:47		20:04		21:15		21:08	20:21		18:32		17:10
Potential sun hours	288	292	369	403	457	464	470	435	377	342	290	277
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
TEST license
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Ramos, Tiffanie / tiffanie.ramos@tetratech.com
Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 40 - Non-Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:16	07:59	07:18	07:22	06:31	05:58	05:58	06:26	07:01	07:36	07:16	07:55
	17:10	17:48	18:25	20:05	20:42	21:16	21:28	21:07	20:19	19:23	17:30	17:01
2	08:16	07:58	07:16	07:20	06:30	05:58	05:59	06:27	07:02	07:38	07:17	07:56
	17:11	17:49	18:27	20:06	20:43	21:17	21:28	21:05	20:17	19:21	17:28	17:01
3	08:16	07:57	07:15	07:18	06:28	05:57	05:59	06:28	07:04	07:39	07:19	07:57
	17:12	17:51	18:28	20:07	20:44	21:17	21:28	21:04	20:15	19:20	17:27	17:01
4	08:16	07:55	07:13	07:16	06:27	05:57	06:00	06:29	07:05	07:40	07:20	07:58
	17:13	17:52	18:29	20:09	20:45	21:18	21:28	21:03	20:14	19:18	17:26	17:01
5	08:16	07:54	07:11	07:15	06:25	05:56	06:01	06:30	07:06	07:41	07:21	07:59
	17:14	17:54	18:31	20:10	20:47	21:19	21:27	21:02	20:12	19:16	17:24	17:00
6	08:16	07:53	07:09	07:13	06:24	05:56	06:01	06:31	07:07	07:43	07:23	08:00
	17:15	17:55	18:32	20:11	20:48	21:20	21:27	21:00	20:10	19:14	17:23	17:00
7	08:16	07:52	07:08	07:11	06:23	05:56	06:02	06:32	07:08	07:44	07:24	08:01
	17:16	17:56	18:33	20:12	20:49	21:20	21:27	20:59	20:08	19:12	17:22	17:00
8	08:15	07:50	08:06	07:09	06:21	05:55	06:03	06:33	07:09	07:45	07:25	08:02
	17:17	17:58	18:35	20:14	20:50	21:21	21:26	20:58	20:06	19:10	17:21	17:00
9	08:15	07:49	08:04	07:07	06:20	05:55	06:03	06:35	07:11	07:46	07:27	08:03
	17:18	17:59	19:36	20:15	20:51	21:22	21:26	20:56	20:04	19:09	17:19	17:00
10	08:15	07:48	08:02	07:06	06:19	05:55	06:04	06:36	07:12	07:47	07:28	08:04
	17:19	18:01	19:37	20:16	20:53	21:22	21:25	20:55	20:03	19:07	17:18	17:00
11	08:15	07:46	08:00	07:04	06:18	05:55	06:05	06:37	07:13	07:49	07:29	08:05
	17:20	18:01	19:38	20:17	20:54	21:23	21:25	20:53	20:01	19:05	17:17	17:00
12	08:14	07:45	07:59	07:02	06:16	05:54	06:06	06:38	07:14	07:50	07:31	08:06
	17:22	18:02	19:40	20:18	20:55	21:24	21:24	20:52	19:59	19:03	17:16	17:00
13	08:14	07:43	07:57	07:00	06:15	05:54	06:07	06:39	07:15	07:51	07:32	08:07
	17:23	18:03	19:41	20:20	20:56	21:24	21:24	20:50	19:57	19:02	17:15	17:00
14	08:13	07:42	07:55	06:59	06:14	05:54	06:07	06:40	07:16	07:52	07:34	08:08
	17:24	18:05	19:42	20:21	20:57	21:25	21:23	20:49	19:55	19:00	17:14	17:00
15	08:13	07:41	07:53	06:57	06:13	05:54	06:08	06:42	07:18	07:54	07:35	08:08
	17:25	18:06	19:44	20:22	20:58	21:25	21:23	20:47	19:53	18:56	17:13	17:00
16	08:12	07:39	07:51	06:55	06:12	05:54	06:09	06:43	07:19	07:55	07:36	08:09
	17:26	18:08	19:45	20:23	21:00	21:26	21:22	20:46	19:51	18:55	17:12	17:00
17	08:12	07:38	07:50	06:53	06:11	05:54	06:10	06:44	07:20	07:56	07:38	08:10
	17:28	18:09	19:46	20:25	21:01	21:26	21:21	20:44	19:50	18:53	17:11	17:01
18	08:11	07:36	07:48	06:52	06:10	05:54	06:11	06:45	07:21	07:58	07:39	08:11
	17:29	18:10	19:47	20:26	21:02	21:26	21:20	20:43	19:48	18:51	17:10	17:01
19	08:11	07:34	07:46	06:50	06:09	05:54	06:12	06:46	07:22	07:59	07:40	08:11
	17:30	18:12	19:49	20:27	21:03	21:27	21:20	20:41	19:46	18:50	17:09	17:01
20	08:10	07:33	07:44	06:48	06:08	05:55	06:13	06:47	07:23	08:00	07:41	08:12
	17:32	18:13	19:50	20:28	21:04	21:27	21:19	20:39	19:44	18:48	17:08	17:02
21	08:09	07:31	07:42	06:47	06:07	05:55	06:14	06:48	07:25	08:01	07:43	08:12
	17:33	18:14	19:51	20:30	21:05	21:27	21:18	20:38	19:42	18:46	17:07	17:02
22	08:08	07:30	07:40	06:45	06:06	05:55	06:15	06:50	07:26	08:03	07:44	08:13
	17:34	18:16	19:52	20:31	21:06	21:28	21:17	20:36	19:40	18:45	17:07	17:03
23	08:08	07:28	07:38	06:43	06:05	05:55	06:16	06:51	07:27	08:04	07:45	08:13
	17:35	18:17	19:54	20:32	21:07	21:28	21:16	20:35	19:38	18:43	17:06	17:03
24	08:07	07:26	07:37	06:42	06:04	05:55	06:17	06:52	07:28	08:05	07:47	08:14
	17:37	18:19	19:55	20:33	21:08	21:28	21:15	20:33	19:36	18:42	17:05	17:04
25	08:06	07:25	07:35	06:40	06:03	05:56	06:18	06:53	07:29	08:07	07:48	08:14
	17:38	18:20	19:56	20:34	21:09	21:28	21:14	20:31	19:34	18:40	17:05	17:05
26	08:05	07:23	07:33	06:39	06:02	05:56	06:19	06:54	07:30	08:08	07:49	08:15
	17:40	18:21	19:57	20:36	21:10	21:28	21:13	20:29	19:33	18:38	17:04	17:05
27	08:04	07:21	07:31	06:37	06:02	05:56	06:20	06:55	07:32	08:09	07:50	08:15
	17:41	18:23	19:59	20:37	21:11	21:28	21:12	20:28	19:31	18:37	17:03	17:06
28	08:03	07:20	07:29	06:36	06:01	05:57	06:21	06:57	07:33	08:11	07:51	08:15
	17:42	18:24	20:00	20:38	21:12	21:28	21:11	20:26	19:29	18:35	17:03	17:07
29	08:02		07:27	06:34	06:00	05:57	06:22	06:58	07:34	08:12	07:53	08:15
	17:44		20:01	20:39	21:13	21:28	21:10	20:24	19:27	18:34	17:02	17:07
30	08:01		07:26	06:33	06:00	05:58	06:23	06:59	07:35	08:13	07:54	08:16
	17:45		20:02	20:41	21:14	21:28	21:09	20:22	19:25	18:33	17:02	17:08
31	08:00		07:24		05:59		06:24	07:00		08:15		08:16
	17:47		20:04		21:15		21:08	20:21		18:31		17:09
Potential sun hours	287	292	369	403	458	464	470	435	377	341	289	276
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

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Ramos, Tiffanie / tiffanie.ramos@tetratech.com
Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 41 - Non-Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:16	07:58	07:18	07:21	06:31	05:58	05:58	06:25	07:01	07:36	07:16	07:55
	17:10	17:47	18:25	20:04	20:41	21:15	21:28	21:06	20:19	19:23	17:29	17:01
2	08:16	07:57	07:16	07:20	06:29	05:57	05:58	06:26	07:02	07:37	07:17	07:56
	17:10	17:49	18:26	20:06	20:43	21:16	21:28	21:05	20:17	19:21	17:28	17:01
3	08:16	07:56	07:14	07:18	06:28	05:57	05:59	06:27	07:03	07:38	07:18	07:57
	17:11	17:50	18:28	20:07	20:44	21:17	21:27	21:04	20:15	19:19	17:26	17:00
4	08:16	07:55	07:12	07:16	06:26	05:56	05:59	06:28	07:04	07:40	07:20	07:58
	17:12	17:52	18:29	20:08	20:45	21:18	21:27	21:03	20:13	19:17	17:25	17:00
5	08:16	07:54	07:11	07:14	06:25	05:56	06:00	06:29	07:06	07:41	07:21	07:59
	17:13	17:53	18:30	20:09	20:46	21:19	21:27	21:01	20:11	19:15	17:24	17:00
6	08:16	07:53	07:09	07:12	06:24	05:55	06:01	06:31	07:07	07:42	07:22	08:00
	17:14	17:54	18:31	20:11	20:48	21:19	21:27	21:00	20:10	19:14	17:22	17:00
7	08:15	07:51	07:07	07:10	06:22	05:55	06:01	06:32	07:08	07:43	07:24	08:01
	17:15	17:56	18:33	20:12	20:49	21:20	21:26	20:59	20:08	19:12	17:21	16:59
8	08:15	07:50	08:05	07:09	06:21	05:55	06:02	06:33	07:09	07:45	07:25	08:02
	17:16	17:57	18:34	20:13	20:50	21:21	21:26	20:57	20:06	19:10	17:20	16:59
9	08:15	07:49	08:04	07:07	06:20	05:55	06:03	06:34	07:10	07:46	07:26	08:03
	17:18	17:59	19:35	20:14	20:51	21:22	21:26	20:56	20:04	19:08	17:19	16:59
10	08:15	07:47	08:02	07:05	06:18	05:54	06:04	06:35	07:11	07:47	07:28	08:04
	17:19	18:00	19:37	20:16	20:52	21:22	21:25	20:54	20:02	19:06	17:18	16:59
11	08:14	07:46	08:00	07:03	06:17	05:54	06:04	06:36	07:12	07:48	07:29	08:05
	17:20	18:00	19:38	20:17	20:53	21:23	21:25	20:53	20:00	19:05	17:16	16:59
12	08:14	07:44	07:58	07:02	06:16	05:54	06:05	06:38	07:14	07:50	07:31	08:06
	17:21	18:01	19:39	20:18	20:55	21:23	21:24	20:52	19:58	19:03	17:15	16:59
13	08:14	07:43	07:56	07:00	06:15	05:54	06:06	06:39	07:15	07:51	07:32	08:07
	17:22	18:03	19:41	20:19	20:56	21:24	21:24	20:50	19:57	19:01	17:14	16:59
14	08:13	07:42	07:55	06:58	06:13	05:54	06:07	06:40	07:16	07:52	07:33	08:07
	17:23	18:04	19:42	20:21	20:57	21:24	21:23	20:49	19:55	18:58	17:13	17:00
15	08:13	07:40	07:53	06:56	06:12	05:54	06:08	06:41	07:17	07:53	07:35	08:08
	17:25	18:06	19:43	20:22	20:58	21:25	21:22	20:47	19:53	18:56	17:12	17:00
16	08:12	07:39	07:51	06:55	06:11	05:54	06:09	06:42	07:18	07:55	07:36	08:09
	17:26	18:07	19:44	20:23	20:59	21:25	21:22	20:45	19:51	18:54	17:11	17:00
17	08:11	07:37	07:49	06:53	06:10	05:54	06:10	06:43	07:19	07:56	07:37	08:10
	17:27	18:08	19:46	20:24	21:00	21:26	21:21	20:44	19:49	18:53	17:10	17:00
18	08:11	07:36	07:47	06:51	06:09	05:54	06:11	06:44	07:21	07:57	07:39	08:10
	17:28	18:10	19:47	20:25	21:01	21:26	21:20	20:42	19:47	18:51	17:09	17:01
19	08:10	07:34	07:45	06:50	06:08	05:54	06:11	06:46	07:22	07:58	07:40	08:11
	17:30	18:11	19:48	20:27	21:03	21:27	21:19	20:41	19:45	18:49	17:08	17:01
20	08:10	07:33	07:44	06:48	06:07	05:54	06:12	06:47	07:23	08:00	07:41	08:12
	17:31	18:13	19:49	20:28	21:04	21:27	21:19	20:39	19:43	18:48	17:08	17:01
21	08:09	07:31	07:42	06:46	06:06	05:54	06:13	06:48	07:24	08:01	07:42	08:12
	17:32	18:14	19:51	20:29	21:05	21:27	21:18	20:37	19:42	18:46	17:07	17:02
22	08:08	07:29	07:40	06:45	06:05	05:54	06:14	06:49	07:25	08:02	07:44	08:13
	17:34	18:15	19:52	20:30	21:06	21:27	21:17	20:36	19:40	18:44	17:06	17:02
23	08:07	07:28	07:38	06:43	06:04	05:55	06:15	06:50	07:27	08:04	07:45	08:13
	17:35	18:17	19:53	20:32	21:07	21:28	21:16	20:34	19:38	18:43	17:05	17:03
24	08:06	07:26	07:36	06:41	06:03	05:55	06:16	06:51	07:28	08:05	07:46	08:14
	17:36	18:18	19:54	20:33	21:08	21:28	21:15	20:32	19:36	18:41	17:05	17:03
25	08:06	07:24	07:34	06:40	06:03	05:55	06:17	06:53	07:29	08:06	07:47	08:14
	17:38	18:19	19:56	20:34	21:09	21:28	21:14	20:31	19:34	18:40	17:04	17:04
26	08:05	07:23	07:32	06:38	06:02	05:56	06:19	06:54	07:30	08:08	07:49	08:14
	17:39	18:21	19:57	20:35	21:10	21:28	21:13	20:29	19:32	18:38	17:03	17:05
27	08:04	07:21	07:31	06:37	06:01	05:56	06:20	06:55	07:31	08:09	07:50	08:15
	17:40	18:22	19:58	20:37	21:11	21:28	21:12	20:27	19:30	18:36	17:03	17:05
28	08:03	07:19	07:29	06:35	06:00	05:56	06:21	06:56	07:32	08:10	07:51	08:15
	17:42	18:24	19:59	20:38	21:12	21:28	21:11	20:26	19:28	18:35	17:02	17:06
29	08:02		07:27	06:34	06:00	05:57	06:22	06:57	07:34	08:12	07:52	08:15
	17:43		20:01	20:39	21:13	21:28	21:10	20:24	19:27	18:33	17:02	17:07
30	08:01		07:25	06:32	05:59	05:57	06:23	06:59	07:35	08:13	07:54	08:15
	17:45		20:02	20:40	21:14	21:28	21:09	20:22	19:25	18:32	17:01	17:08
31	08:00		07:23		05:58		06:24	07:00		08:14		08:16
	17:46		20:03		21:15		21:08	20:20		18:31		17:08
Potential sun hours	287	292	369	403	458	464	471	435	377	341	289	276
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
TEST license
This license is only to be used for testing purposes

Ramos, Tiffanie / tiffanie.ramos@tetratech.com
Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 42 - Non-Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:15	07:58	07:17	07:21	06:31	05:58	05:58	06:25	07:01	07:36	07:15	07:54
	17:10	17:47	18:25	20:04	20:41	21:15	21:27	21:06	20:18	19:23	17:29	17:01
2	08:15	07:57	07:16	07:19	06:29	05:57	05:59	06:26	07:02	07:37	07:17	07:55
	17:11	17:49	18:26	20:05	20:42	21:16	21:27	21:05	20:17	19:21	17:28	17:01
3	08:15	07:56	07:14	07:18	06:28	05:57	05:59	06:27	07:03	07:38	07:18	07:56
	17:12	17:50	18:27	20:07	20:44	21:17	21:27	21:03	20:15	19:19	17:26	17:00
4	08:15	07:55	07:12	07:16	06:26	05:57	06:00	06:28	07:04	07:39	07:19	07:58
	17:13	17:52	18:29	20:08	20:45	21:17	21:27	21:02	20:13	19:17	17:25	17:00
5	08:15	07:53	07:11	07:14	06:25	05:56	06:00	06:30	07:05	07:41	07:21	07:59
	17:14	17:53	18:30	20:09	20:46	21:18	21:26	21:01	20:11	19:15	17:24	17:00
6	08:15	07:52	07:09	07:12	06:24	05:56	06:01	06:31	07:07	07:42	07:22	08:00
	17:15	17:55	18:31	20:10	20:47	21:19	21:26	21:00	20:09	19:14	17:23	17:00
7	08:15	07:51	07:07	07:10	06:22	05:55	06:02	06:32	07:08	07:43	07:23	08:01
	17:16	17:56	18:33	20:12	20:48	21:20	21:26	20:58	20:07	19:12	17:21	17:00
8	08:15	07:50	08:05	07:09	06:21	05:55	06:02	06:33	07:09	07:44	07:25	08:02
	17:17	17:57	18:34	20:13	20:50	21:20	21:25	20:57	20:06	19:10	17:20	16:59
9	08:14	07:48	08:03	07:07	06:20	05:55	06:03	06:34	07:10	07:46	07:26	08:03
	17:18	17:59	19:35	20:14	20:51	21:21	21:25	20:55	20:04	19:08	17:19	16:59
10	08:14	07:47	08:02	07:05	06:18	05:55	06:04	06:35	07:11	07:47	07:27	08:03
	17:19	18:00	19:37	20:15	20:52	21:22	21:25	20:54	20:02	19:06	17:18	16:59
11	08:14	07:46	08:00	07:03	06:17	05:54	06:05	06:36	07:12	07:48	07:29	08:04
	17:20	18:00	19:38	20:17	20:53	21:22	21:24	20:53	20:00	19:05	17:17	16:59
12	08:13	07:44	07:58	07:02	06:16	05:54	06:05	06:38	07:14	07:49	07:30	08:05
	17:21	18:02	19:39	20:18	20:54	21:23	21:24	20:51	19:58	19:03	17:15	16:59
13	08:13	07:43	07:56	07:00	06:15	05:54	06:06	06:39	07:15	07:51	07:31	08:06
	17:22	18:03	19:40	20:19	20:55	21:23	21:23	20:50	19:56	19:01	17:14	17:00
14	08:13	07:41	07:54	06:58	06:14	05:54	06:07	06:40	07:16	07:52	07:33	08:07
	17:24	18:04	19:42	20:20	20:57	21:24	21:22	20:48	19:55	18:58	17:13	17:00
15	08:12	07:40	07:53	06:56	06:12	05:54	06:08	06:41	07:17	07:53	07:34	08:08
	17:25	18:06	19:43	20:21	20:58	21:24	21:22	20:47	19:53	18:56	17:12	17:00
16	08:12	07:38	07:51	06:55	06:11	05:54	06:09	06:42	07:18	07:54	07:35	08:08
	17:26	18:07	19:44	20:23	20:59	21:25	21:21	20:45	19:51	18:54	17:11	17:00
17	08:11	07:37	07:49	06:53	06:10	05:54	06:10	06:43	07:19	07:56	07:37	08:09
	17:27	18:09	19:46	20:24	21:00	21:25	21:20	20:44	19:49	18:52	17:10	17:00
18	08:10	07:35	07:47	06:51	06:09	05:54	06:11	06:45	07:21	07:57	07:38	08:10
	17:29	18:10	19:47	20:25	21:01	21:26	21:20	20:42	19:47	18:51	17:10	17:01
19	08:10	07:34	07:45	06:50	06:08	05:54	06:12	06:46	07:22	07:58	07:39	08:10
	17:30	18:11	19:48	20:26	21:02	21:26	21:19	20:40	19:45	18:49	17:09	17:01
20	08:09	07:32	07:43	06:48	06:07	05:54	06:13	06:47	07:23	07:59	07:41	08:11
	17:31	18:13	19:49	20:28	21:03	21:26	21:18	20:39	19:43	18:48	17:08	17:02
21	08:08	07:31	07:42	06:46	06:06	05:54	06:14	06:48	07:24	08:01	07:42	08:12
	17:32	18:14	19:51	20:29	21:04	21:27	21:17	20:37	19:41	18:46	17:07	17:02
22	08:08	07:29	07:40	06:45	06:05	05:55	06:15	06:49	07:25	08:02	07:43	08:12
	17:34	18:15	19:52	20:30	21:05	21:27	21:16	20:35	19:40	18:44	17:06	17:02
23	08:07	07:27	07:38	06:43	06:04	05:55	06:16	06:50	07:26	08:03	07:45	08:13
	17:35	18:17	19:53	20:31	21:06	21:27	21:15	20:34	19:38	18:43	17:06	17:03
24	08:06	07:26	07:36	06:41	06:04	05:55	06:17	06:52	07:28	08:05	07:46	08:13
	17:36	18:18	19:54	20:33	21:07	21:27	21:15	20:32	19:36	18:41	17:05	17:04
25	08:05	07:24	07:34	06:40	06:03	05:55	06:18	06:53	07:29	08:06	07:47	08:13
	17:38	18:19	19:56	20:34	21:08	21:27	21:14	20:30	19:34	18:40	17:04	17:04
26	08:04	07:22	07:32	06:38	06:02	05:56	06:19	06:54	07:30	08:07	07:48	08:14
	17:39	18:21	19:57	20:35	21:09	21:27	21:13	20:29	19:32	18:38	17:04	17:05
27	08:03	07:21	07:31	06:37	06:01	05:56	06:20	06:55	07:31	08:09	07:49	08:14
	17:41	18:22	19:58	20:36	21:10	21:27	21:12	20:27	19:30	18:36	17:03	17:06
28	08:02	07:19	07:29	06:35	06:01	05:57	06:21	06:56	07:32	08:10	07:51	08:14
	17:42	18:23	19:59	20:37	21:11	21:27	21:10	20:25	19:28	18:35	17:02	17:06
29	08:01		07:27	06:34	06:00	05:57	06:22	06:57	07:33	08:11	07:52	08:15
	17:43		20:01	20:39	21:12	21:27	21:09	20:24	19:26	18:34	17:02	17:07
30	08:00		07:25	06:32	05:59	05:57	06:23	06:58	07:35	08:13	07:53	08:15
	17:45		20:02	20:40	21:13	21:27	21:08	20:22	19:25	18:32	17:02	17:08
31	07:59		07:23		05:59		06:24	07:00		08:14		08:15
	17:46		20:03		21:14		21:07	20:20		18:31		17:09
Potential sun hours	288	292	369	403	458	464	470	435	377	341	289	276
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
TEST license
This license is only to be used for testing purposes

Ramos, Tiffanie / tiffanie.ramos@tetratech.com
Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 43 - Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:16	07:59	07:18	07:22	06:31	05:58	05:58	06:26	07:01	07:37	07:16	07:55
	17:10	17:48	18:25	20:05	20:42	21:16	21:28	21:07	20:19	19:23	17:30	17:02
2	08:16	07:58	07:16	07:20	06:30	05:58	05:59	06:27	07:03	07:38	07:17	07:56
	17:11	17:49	18:27	20:06	20:43	21:17	21:28	21:06	20:17	19:21	17:28	17:01
3	08:16	07:57	07:15	07:18	06:28	05:57	05:59	06:28	07:04	07:39	07:19	07:57
	17:12	17:51	18:28	20:07	20:44	21:17	21:28	21:04	20:15	19:20	17:27	17:01
4	08:16	07:55	07:13	07:16	06:27	05:57	06:00	06:29	07:05	07:40	07:20	07:58
	17:13	17:52	18:29	20:09	20:46	21:18	21:28	21:03	20:14	19:18	17:26	17:01
5	08:16	07:54	07:11	07:15	06:25	05:56	06:01	06:30	07:06	07:41	07:21	07:59
	17:14	17:54	18:31	20:10	20:47	21:19	21:27	21:02	20:12	19:16	17:24	17:00
6	08:16	07:53	07:09	07:13	06:24	05:56	06:01	06:31	07:07	07:43	07:23	08:00
	17:15	17:55	18:32	20:11	20:48	21:20	21:27	21:00	20:10	19:14	17:23	17:00
7	08:16	07:52	07:08	07:11	06:23	05:56	06:02	06:32	07:08	07:44	07:24	08:01
	17:16	17:56	18:33	20:12	20:49	21:21	21:27	20:59	20:08	19:12	17:22	17:00
8	08:16	07:50	08:06	07:09	06:21	05:55	06:03	06:33	07:09	07:45	07:26	08:02
	17:17	17:58	18:35	20:14	20:50	21:21	21:26	20:58	20:06	19:11	17:21	17:00
9	08:15	07:49	08:04	07:07	06:20	05:55	06:03	06:35	07:11	07:46	07:27	08:03
	17:18	17:59	19:36	20:15	20:52	21:22	21:26	20:56	20:04	19:09	17:19	17:00
10	08:15	07:48	08:02	07:06	06:19	05:55	06:04	06:36	07:12	07:48	07:28	08:04
	17:19	18:01	19:37	20:16	20:53	21:23	21:26	20:55	20:03	19:07	17:18	17:00
11	08:15	07:46	08:01	07:04	06:18	05:55	06:05	06:37	07:13	07:49	07:30	08:05
	17:20	18:01	19:38	20:17	20:54	21:23	21:25	20:53	20:01	19:05	17:17	17:00
12	08:14	07:45	07:59	07:02	06:16	05:54	06:06	06:38	07:14	07:50	07:31	08:06
	17:22	18:02	19:40	20:19	20:55	21:24	21:24	20:52	19:59	19:03	17:16	17:00
13	08:14	07:43	07:57	07:00	06:15	05:54	06:07	06:39	07:15	07:51	07:32	08:07
	17:23	18:03	19:41	20:20	20:56	21:24	21:24	20:50	19:57	19:02	17:15	17:00
14	08:13	07:42	07:55	06:59	06:14	05:54	06:07	06:40	07:16	07:53	07:34	08:08
	17:24	18:05	19:42	20:21	20:57	21:25	21:23	20:49	19:55	19:00	17:14	17:00
15	08:13	07:41	07:53	06:57	06:13	05:54	06:08	06:42	07:18	07:54	07:35	08:09
	17:25	18:06	19:44	20:22	20:58	21:25	21:23	20:47	19:53	18:56	17:13	17:00
16	08:12	07:39	07:51	06:55	06:12	05:54	06:09	06:43	07:19	07:55	07:36	08:09
	17:26	18:08	19:45	20:23	21:00	21:26	21:22	20:46	19:51	18:55	17:12	17:01
17	08:12	07:38	07:50	06:53	06:11	05:54	06:10	06:44	07:20	07:56	07:38	08:10
	17:28	18:09	19:46	20:25	21:01	21:26	21:21	20:44	19:50	18:53	17:11	17:01
18	08:11	07:36	07:48	06:52	06:10	05:54	06:11	06:45	07:21	07:58	07:39	08:11
	17:29	18:10	19:47	20:26	21:02	21:27	21:21	20:43	19:48	18:51	17:10	17:01
19	08:11	07:35	07:46	06:50	06:09	05:54	06:12	06:46	07:22	07:59	07:40	08:11
	17:30	18:12	19:49	20:27	21:03	21:27	21:20	20:41	19:46	18:50	17:09	17:01
20	08:10	07:33	07:44	06:48	06:08	05:55	06:13	06:47	07:23	08:00	07:42	08:12
	17:32	18:13	19:50	20:28	21:04	21:27	21:19	20:40	19:44	18:48	17:08	17:02
21	08:09	07:31	07:42	06:47	06:07	05:55	06:14	06:49	07:25	08:01	07:43	08:12
	17:33	18:15	19:51	20:30	21:05	21:27	21:18	20:38	19:42	18:46	17:07	17:02
22	08:08	07:30	07:40	06:45	06:06	05:55	06:15	06:50	07:26	08:03	07:44	08:13
	17:34	18:16	19:52	20:31	21:06	21:28	21:17	20:36	19:40	18:45	17:07	17:03
23	08:08	07:28	07:38	06:43	06:05	05:55	06:16	06:51	07:27	08:04	07:45	08:13
	17:36	18:17	19:54	20:32	21:07	21:28	21:16	20:35	19:38	18:43	17:06	17:03
24	08:07	07:26	07:37	06:42	06:04	05:55	06:17	06:52	07:28	08:05	07:47	08:14
	17:37	18:19	19:55	20:33	21:08	21:28	21:15	20:33	19:36	18:42	17:05	17:04
25	08:06	07:25	07:35	06:40	06:03	05:56	06:18	06:53	07:29	08:07	07:48	08:14
	17:38	18:20	19:56	20:35	21:09	21:28	21:14	20:31	19:35	18:40	17:05	17:05
26	08:05	07:23	07:33	06:39	06:02	05:56	06:19	06:54	07:31	08:08	07:49	08:15
	17:40	18:21	19:57	20:36	21:10	21:28	21:13	20:30	19:33	18:39	17:04	17:05
27	08:04	07:22	07:31	06:37	06:02	05:56	06:20	06:56	07:32	08:09	07:50	08:15
	17:41	18:23	19:59	20:37	21:11	21:28	21:12	20:28	19:31	18:37	17:03	17:06
28	08:03	07:20	07:29	06:36	06:01	05:57	06:21	06:57	07:33	08:11	07:52	08:15
	17:42	18:24	20:00	20:38	21:12	21:28	21:11	20:26	19:29	18:35	17:03	17:07
29	08:02		07:27	06:34	06:00	05:57	06:22	06:58	07:34	08:12	07:53	08:16
	17:44		20:01	20:39	21:13	21:28	21:10	20:24	19:27	18:34	17:02	17:07
30	08:01		07:26	06:33	06:00	05:58	06:23	06:59	07:35	08:13	07:54	08:16
	17:45		20:02	20:41	21:14	21:28	21:09	20:23	19:25	18:33	17:02	17:08
31	08:00		07:24		05:59		06:24	07:00		08:15		08:16
	17:47		20:04		21:15		21:08	20:21		18:31		17:09
Potential sun hours	287	292	369	403	458	464	470	435	377	341	289	276
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
TEST license
This license is only to be used for testing purposes

Ramos, Tiffanie / tiffanie.ramos@tetratech.com
Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 44 - Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:16	07:59	07:18	07:22	06:31	05:58	05:58	06:25	07:01	07:36	07:16	07:55
	17:10	17:48	18:25	20:05	20:42	21:16	21:28	21:07	20:19	19:23	17:30	17:01
2	08:16	07:58	07:16	07:20	06:30	05:58	05:59	06:27	07:02	07:38	07:17	07:56
	17:11	17:49	18:27	20:06	20:43	21:17	21:28	21:05	20:17	19:21	17:28	17:01
3	08:16	07:56	07:15	07:18	06:28	05:57	05:59	06:28	07:04	07:39	07:19	07:57
	17:12	17:51	18:28	20:07	20:44	21:17	21:28	21:04	20:15	19:20	17:27	17:01
4	08:16	07:55	07:13	07:16	06:27	05:57	06:00	06:29	07:05	07:40	07:20	07:58
	17:13	17:52	18:29	20:08	20:45	21:18	21:28	21:03	20:14	19:18	17:25	17:00
5	08:16	07:54	07:11	07:14	06:25	05:56	06:01	06:30	07:06	07:41	07:21	07:59
	17:14	17:53	18:31	20:10	20:47	21:19	21:27	21:02	20:12	19:16	17:24	17:00
6	08:16	07:53	07:09	07:13	06:24	05:56	06:01	06:31	07:07	07:42	07:23	08:00
	17:15	17:55	18:32	20:11	20:48	21:20	21:27	21:00	20:10	19:14	17:23	17:00
7	08:16	07:52	07:08	07:11	06:23	05:56	06:02	06:32	07:08	07:44	07:24	08:01
	17:16	17:56	18:33	20:12	20:49	21:20	21:27	20:59	20:08	19:12	17:22	17:00
8	08:15	07:50	08:06	07:09	06:21	05:55	06:03	06:33	07:09	07:45	07:25	08:02
	17:17	17:58	18:34	20:13	20:50	21:21	21:26	20:58	20:06	19:10	17:20	17:00
9	08:15	07:49	08:04	07:07	06:20	05:55	06:03	06:34	07:11	07:46	07:27	08:03
	17:18	17:59	19:36	20:15	20:51	21:22	21:26	20:56	20:04	19:09	17:19	17:00
10	08:15	07:48	08:02	07:05	06:19	05:55	06:04	06:36	07:12	07:47	07:28	08:04
	17:19	18:00	19:37	20:16	20:53	21:22	21:25	20:55	20:03	19:07	17:18	17:00
11	08:15	07:46	08:00	07:04	06:17	05:54	06:05	06:37	07:13	07:49	07:29	08:05
	17:20	18:00	19:38	20:17	20:54	21:23	21:25	20:53	20:01	19:05	17:17	17:00
12	08:14	07:45	07:59	07:02	06:16	05:54	06:06	06:38	07:14	07:50	07:31	08:06
	17:21	18:02	19:40	20:18	20:55	21:24	21:24	20:52	19:59	19:03	17:16	17:00
13	08:14	07:43	07:57	07:00	06:15	05:54	06:06	06:39	07:15	07:51	07:32	08:07
	17:23	18:03	19:41	20:20	20:56	21:24	21:24	20:50	19:57	19:01	17:15	17:00
14	08:13	07:42	07:55	06:58	06:14	05:54	06:07	06:40	07:16	07:52	07:33	08:08
	17:24	18:05	19:42	20:21	20:57	21:25	21:23	20:49	19:55	19:00	17:14	17:00
15	08:13	07:40	07:53	06:57	06:13	05:54	06:08	06:41	07:17	07:54	07:35	08:08
	17:25	18:06	19:43	20:22	20:58	21:25	21:23	20:47	19:53	18:56	17:13	17:00
16	08:12	07:39	07:51	06:55	06:12	05:54	06:09	06:43	07:19	07:55	07:36	08:09
	17:26	18:07	19:45	20:23	21:00	21:26	21:22	20:46	19:51	18:55	17:12	17:00
17	08:12	07:37	07:49	06:53	06:11	05:54	06:10	06:44	07:20	07:56	07:37	08:10
	17:28	18:09	19:46	20:25	21:01	21:26	21:21	20:44	19:49	18:53	17:11	17:01
18	08:11	07:36	07:48	06:52	06:09	05:54	06:11	06:45	07:21	07:57	07:39	08:11
	17:29	18:10	19:47	20:26	21:02	21:26	21:20	20:43	19:48	18:51	17:10	17:01
19	08:11	07:34	07:46	06:50	06:08	05:54	06:12	06:46	07:22	07:59	07:40	08:11
	17:30	18:12	19:49	20:27	21:03	21:27	21:20	20:41	19:46	18:50	17:09	17:01
20	08:10	07:33	07:44	06:48	06:07	05:54	06:13	06:47	07:23	08:00	07:41	08:12
	17:31	18:13	19:50	20:28	21:04	21:27	21:19	20:39	19:44	18:48	17:08	17:02
21	08:09	07:31	07:42	06:47	06:06	05:55	06:14	06:48	07:24	08:01	07:43	08:12
	17:33	18:14	19:51	20:29	21:05	21:27	21:18	20:38	19:42	18:46	17:07	17:02
22	08:08	07:30	07:40	06:45	06:06	05:55	06:15	06:50	07:26	08:03	07:44	08:13
	17:34	18:16	19:52	20:31	21:06	21:28	21:17	20:36	19:40	18:45	17:06	17:03
23	08:08	07:28	07:38	06:43	06:05	05:55	06:16	06:51	07:27	08:04	07:45	08:13
	17:35	18:17	19:54	20:32	21:07	21:28	21:16	20:34	19:38	18:43	17:06	17:03
24	08:07	07:26	07:37	06:42	06:04	05:55	06:17	06:52	07:28	08:05	07:47	08:14
	17:37	18:18	19:55	20:33	21:08	21:28	21:15	20:33	19:36	18:41	17:05	17:04
25	08:06	07:25	07:35	06:40	06:03	05:56	06:18	06:53	07:29	08:07	07:48	08:14
	17:38	18:20	19:56	20:34	21:09	21:28	21:14	20:31	19:34	18:40	17:04	17:04
26	08:05	07:23	07:33	06:39	06:02	05:56	06:19	06:54	07:30	08:08	07:49	08:15
	17:39	18:21	19:57	20:36	21:10	21:28	21:13	20:29	19:33	18:38	17:04	17:05
27	08:04	07:21	07:31	06:37	06:01	05:56	06:20	06:55	07:32	08:09	07:50	08:15
	17:41	18:23	19:59	20:37	21:11	21:28	21:12	20:28	19:31	18:37	17:03	17:06
28	08:03	07:20	07:29	06:35	06:01	05:57	06:21	06:57	07:33	08:11	07:51	08:15
	17:42	18:24	20:00	20:38	21:12	21:28	21:11	20:26	19:29	18:35	17:03	17:06
29	08:02		07:27	06:34	06:00	05:57	06:22	06:58	07:34	08:12	07:53	08:15
	17:44		20:01	20:39	21:13	21:28	21:10	20:24	19:27	18:34	17:02	17:07
30	08:01		07:25	06:32	05:59	05:58	06:23	06:59	07:35	08:13	07:54	08:16
	17:45		20:02	20:41	21:14	21:28	21:09	20:22	19:25	18:32	17:02	17:08
31	08:00		07:24		05:59		06:24	07:00		08:15		08:16
	17:46		20:04		21:15		21:08	20:21		18:31		17:09
Potential sun hours	287	292	369	403	458	464	471	435	377	341	289	276
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
TEST license
This license is only to be used for testing purposes

Ramos, Tiffanie / tiffanie.ramos@tetratech.com
Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 45 - Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:16	07:59	07:18	07:22	06:31	05:58	05:58	06:25	07:01	07:36	07:16	07:55
	17:10	17:48	18:25	20:05	20:42	21:16	21:28	21:07	20:19	19:23	17:30	17:01
2	08:16	07:58	07:16	07:20	06:30	05:58	05:59	06:27	07:02	07:38	07:17	07:56
	17:11	17:49	18:27	20:06	20:43	21:17	21:28	21:05	20:17	19:21	17:28	17:01
3	08:16	07:56	07:15	07:18	06:28	05:57	05:59	06:28	07:04	07:39	07:19	07:57
	17:12	17:51	18:28	20:07	20:44	21:17	21:28	21:04	20:15	19:20	17:27	17:01
4	08:16	07:55	07:13	07:16	06:27	05:57	06:00	06:29	07:05	07:40	07:20	07:58
	17:13	17:52	18:29	20:09	20:45	21:18	21:28	21:03	20:14	19:18	17:26	17:00
5	08:16	07:54	07:11	07:15	06:25	05:56	06:01	06:30	07:06	07:41	07:21	07:59
	17:14	17:53	18:31	20:10	20:47	21:19	21:27	21:02	20:12	19:16	17:24	17:00
6	08:16	07:53	07:09	07:13	06:24	05:56	06:01	06:31	07:07	07:42	07:23	08:00
	17:15	17:55	18:32	20:11	20:48	21:20	21:27	21:00	20:10	19:14	17:23	17:00
7	08:16	07:52	07:08	07:11	06:23	05:56	06:02	06:32	07:08	07:44	07:24	08:01
	17:16	17:56	18:33	20:12	20:49	21:20	21:27	20:59	20:08	19:12	17:22	17:00
8	08:15	07:50	08:06	07:09	06:21	05:55	06:03	06:33	07:09	07:45	07:25	08:02
	17:17	17:58	18:34	20:13	20:50	21:21	21:26	20:58	20:06	19:10	17:20	17:00
9	08:15	07:49	08:04	07:07	06:20	05:55	06:03	06:35	07:11	07:46	07:27	08:03
	17:18	17:59	19:36	20:15	20:51	21:22	21:26	20:56	20:04	19:09	17:19	17:00
10	08:15	07:48	08:02	07:06	06:19	05:55	06:04	06:36	07:12	07:47	07:28	08:04
	17:19	18:01	19:37	20:16	20:53	21:22	21:25	20:55	20:03	19:07	17:18	17:00
11	08:15	07:46	08:00	07:04	06:17	05:55	06:05	06:37	07:13	07:49	07:29	08:05
	17:20	18:01	19:38	20:17	20:54	21:23	21:25	20:53	20:01	19:05	17:17	17:00
12	08:14	07:45	07:59	07:02	06:16	05:54	06:06	06:38	07:14	07:50	07:31	08:06
	17:21	18:02	19:40	20:18	20:55	21:24	21:24	20:52	19:59	19:03	17:16	17:00
13	08:14	07:43	07:57	07:00	06:15	05:54	06:07	06:39	07:15	07:51	07:32	08:07
	17:23	18:03	19:41	20:20	20:56	21:24	21:24	20:50	19:57	19:02	17:15	17:00
14	08:13	07:42	07:55	06:59	06:14	05:54	06:07	06:40	07:16	07:52	07:33	08:08
	17:24	18:05	19:42	20:21	20:57	21:25	21:23	20:49	19:55	19:00	17:14	17:00
15	08:13	07:40	07:53	06:57	06:13	05:54	06:08	06:41	07:18	07:54	07:35	08:08
	17:25	18:06	19:44	20:22	20:58	21:25	21:23	20:47	19:53	18:56	17:13	17:00
16	08:12	07:39	07:51	06:55	06:12	05:54	06:09	06:43	07:19	07:55	07:36	08:09
	17:26	18:08	19:45	20:23	21:00	21:26	21:22	20:46	19:51	18:55	17:12	17:00
17	08:12	07:37	07:49	06:53	06:11	05:54	06:10	06:44	07:20	07:56	07:37	08:10
	17:28	18:09	19:46	20:25	21:01	21:26	21:21	20:44	19:49	18:53	17:11	17:01
18	08:11	07:36	07:48	06:52	06:10	05:54	06:11	06:45	07:21	07:58	07:39	08:11
	17:29	18:10	19:47	20:26	21:02	21:26	21:20	20:43	19:48	18:51	17:10	17:01
19	08:11	07:34	07:46	06:50	06:09	05:54	06:12	06:46	07:22	07:59	07:40	08:11
	17:30	18:12	19:49	20:27	21:03	21:27	21:20	20:41	19:46	18:50	17:09	17:01
20	08:10	07:33	07:44	06:48	06:08	05:54	06:13	06:47	07:23	08:00	07:41	08:12
	17:31	18:13	19:50	20:28	21:04	21:27	21:19	20:39	19:44	18:48	17:08	17:02
21	08:09	07:31	07:42	06:47	06:07	05:55	06:14	06:48	07:25	08:01	07:43	08:12
	17:33	18:14	19:51	20:29	21:05	21:27	21:18	20:38	19:42	18:46	17:07	17:02
22	08:08	07:30	07:40	06:45	06:06	05:55	06:15	06:50	07:26	08:03	07:44	08:13
	17:34	18:16	19:52	20:31	21:06	21:28	21:17	20:36	19:40	18:45	17:07	17:03
23	08:08	07:28	07:38	06:43	06:05	05:55	06:16	06:51	07:27	08:04	07:45	08:13
	17:35	18:17	19:54	20:32	21:07	21:28	21:16	20:34	19:38	18:43	17:06	17:03
24	08:07	07:26	07:37	06:42	06:04	05:55	06:17	06:52	07:28	08:05	07:47	08:14
	17:37	18:19	19:55	20:33	21:08	21:28	21:15	20:33	19:36	18:42	17:05	17:04
25	08:06	07:25	07:35	06:40	06:03	05:56	06:18	06:53	07:29	08:07	07:48	08:14
	17:38	18:20	19:56	20:34	21:09	21:28	21:14	20:31	19:34	18:40	17:04	17:04
26	08:05	07:23	07:33	06:39	06:02	05:56	06:19	06:54	07:30	08:08	07:49	08:15
	17:40	18:21	19:57	20:36	21:10	21:28	21:13	20:29	19:33	18:38	17:04	17:05
27	08:04	07:21	07:31	06:37	06:02	05:56	06:20	06:55	07:32	08:09	07:50	08:15
	17:41	18:23	19:59	20:37	21:11	21:28	21:12	20:28	19:31	18:37	17:03	17:06
28	08:03	07:20	07:29	06:36	06:01	05:57	06:21	06:57	07:33	08:11	07:51	08:15
	17:42	18:24	20:00	20:38	21:12	21:28	21:11	20:26	19:29	18:35	17:03	17:06
29	08:02		07:27	06:34	06:00	05:57	06:22	06:58	07:34	08:12	07:53	08:15
	17:44		20:01	20:39	21:13	21:28	21:10	20:24	19:27	18:34	17:02	17:07
30	08:01		07:25	06:33	05:59	05:58	06:23	06:59	07:35	08:13	07:54	08:16
	17:45		20:02	20:41	21:14	21:28	21:09	20:22	19:25	18:32	17:02	17:08
31	08:00		07:24		05:59		06:24	07:00		08:15		08:16
	17:46		20:04		21:15		21:08	20:21		18:31		17:09
Potential sun hours	287	292	369	403	458	464	470	435	377	341	289	276
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
TEST license
This license is only to be used for testing purposes

Ramos, Tiffanie / tiffanie.ramos@tetratech.com
Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 46 - Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	January		February		March		April	May	June
1	08:16		07:59		17:11 (06)	07:18		07:22	06:31	05:58
	17:10		17:48	11	17:22 (06)	18:25		20:05	20:42	21:15
2	08:16		07:57		17:11 (06)	07:16		07:20	06:29	05:58
	17:11		17:49	12	17:23 (06)	18:26		20:06	20:43	21:16
3	08:16		07:56		17:11 (06)	07:14		07:18	06:28	05:57
	17:12		17:50	14	17:25 (06)	18:28		20:07	20:44	21:17
4	08:16		07:55		17:11 (06)	07:13		07:16	06:27	05:57
	17:13		17:52	16	17:27 (06)	18:29		20:08	20:45	21:18
5	08:16		07:54		17:11 (06)	07:11		07:14	06:25	05:56
	17:14		17:53	17	17:28 (06)	18:30		20:10	20:46	21:19
6	08:16		07:53		17:11 (06)	07:09		07:12	06:24	05:56
	17:15		17:55	18	17:29 (06)	18:32		20:11	20:48	21:19
7	08:15		07:51		17:12 (06)	07:07		07:11	06:22	05:55
	17:16		17:56	19	17:31 (06)	18:33		20:12	20:49	21:20
8	08:15		07:50		17:12 (06)	08:06		07:09	06:21	05:55
	17:17		17:58	20	17:32 (06)	18:34		20:13	20:50	21:21
9	08:15		07:49		17:13 (06)	08:04	08:24 (03)	07:07	06:20	05:55
	17:18		17:59	21	17:34 (06)	19:36	2 08:26 (03)	20:14	20:51	21:22
10	08:15		07:47		17:15 (06)	08:02	08:22 (03)	07:05	06:19	05:55
	17:19		18:00	18	17:33 (06)	19:37	6 08:28 (03)	20:16	20:52	21:22
11	08:14		07:46		17:16 (06)	08:00	08:21 (03)	07:04	06:17	05:54
	17:20		18:00	15	17:31 (06)	19:38	8 08:29 (03)	20:17	20:54	21:23
12	08:14		07:45		17:18 (06)	07:58	08:19 (03)	07:02	06:16	05:54
	17:21		18:02	12	17:30 (06)	19:39	11 08:30 (03)	20:18	20:55	21:23
13	08:14		07:43		17:21 (06)	07:57	08:17 (03)	07:00	06:15	05:54
	17:22		18:03	5	17:26 (06)	19:41	13 08:30 (03)	20:19	20:56	21:24
14	08:13		07:42			07:55	08:15 (03)	06:58	06:14	05:54
	17:24		18:05			19:42	15 08:30 (03)	20:21	20:57	21:24
15	08:13		07:40			07:53	08:13 (03)	06:57	06:13	05:54
	17:25		18:06			19:43	17 08:30 (03)	20:22	20:58	21:25
16	08:12		07:39			07:51	08:11 (03)	06:55	06:11	05:54
	17:26		18:07			19:45	18 08:29 (03)	20:23	20:59	21:25
17	08:12		07:37			07:49	08:09 (03)	06:53	06:10	05:54
	17:27		18:09			19:46	19 08:28 (03)	20:24	21:00	21:26
18	08:11		07:36			07:47	08:08 (03)	06:51	06:09	05:54
	17:29		18:10			19:47	20 08:28 (03)	20:26	21:01	21:26
19	08:10		07:34			07:46	08:09 (03)	06:50	06:08	05:54
	17:30		18:11			19:48	18 08:27 (03)	20:27	21:03	21:26
20	08:10		07:33			07:44	08:10 (03)	06:48	06:07	05:54
	17:31		18:13			19:50	15 08:25 (03)	20:28	21:04	21:27
21	08:09		07:31			07:42	08:11 (03)	06:46	06:06	05:54
	17:33		18:14			19:51	11 08:22 (03)	20:29	21:05	21:27
22	08:08		07:29			07:40		06:45	06:05	05:55
	17:34		18:16			19:52		20:30	21:06	21:27
23	08:07		07:28			07:38		06:43	06:05	05:55
	17:35		18:17			19:53		20:32	21:07	21:27
24	08:06		07:26			07:36		06:42	06:04	05:55
	17:37		18:18			19:55		20:33	21:08	21:28
25	08:06		07:25			07:34		06:40	06:03	05:55
	17:38		18:20			19:56		20:34	21:09	21:28
26	08:05		07:23			07:33		06:38	06:02	05:56
	17:39		18:21			19:57		20:35	21:10	21:28
27	08:04		07:21			07:31		06:37	06:01	05:56
	17:41		18:22			19:58		20:37	21:11	21:28
28	08:03	17:13 (06)	07:19			07:29		06:35	06:01	05:57
	17:42	3 17:16 (06)	18:24			20:00		20:38	21:12	21:28
29	08:02	17:13 (06)				07:27		06:34	06:00	05:57
	17:43	5 17:18 (06)				20:01		20:39	21:13	21:28
30	08:01	17:12 (06)				07:25		06:32	05:59	05:58
	17:45	7 17:19 (06)				20:02		20:40	21:14	21:28
31	08:00	17:12 (06)				07:23			05:59	
	17:46	9 17:21 (06)				20:03			21:15	
Potential sun hours	287		292			369		403	458	464
Total, worst case	24		198			173				
Sun reduction	0.62		0.62			0.62				
Oper. time red.	0.98		0.98			0.98				
Wind dir. red.	0.58		0.58			0.70				
Total reduction	0.35		0.35			0.42				
Total, real	8		69			73				

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:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
TEST license
This license is only to be used for testing purposes

Ramos, Tiffanie / tiffanie.ramos@tetratech.com
Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 46 - Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	July	August	September		October		November		December
1	05:58	06:25	07:01		07:36		07:57 (03)	07:16	16:43 (06)	07:55
	21:28	21:06	20:19		19:23	12	08:09 (03)	17:29	19	17:02 (06)	17:01
2	05:59	06:26	07:02		07:37		07:58 (03)	07:17		16:43 (06)	07:56
	21:28	21:05	20:17		19:21	9	08:07 (03)	17:28	20	17:03 (06)	17:01
3	05:59	06:28	07:03		07:39		08:00 (03)	07:18		16:42 (06)	07:57
	21:27	21:04	20:15		19:19	7	08:07 (03)	17:27	20	17:02 (06)	17:01
4	06:00	06:29	07:05		07:40		08:01 (03)	07:20		16:42 (06)	07:58
	21:27	21:03	20:13		19:18	4	08:05 (03)	17:25	19	17:01 (06)	17:00
5	06:00	06:30	07:06		07:41			07:21		16:41 (06)	07:59
	21:27	21:01	20:11		19:16			17:24	18	16:59 (06)	17:00
6	06:01	06:31	07:07		07:42			07:22		16:42 (06)	08:00
	21:27	21:00	20:10		19:14			17:23	16	16:58 (06)	17:00
7	06:02	06:32	07:08		07:43			07:24		16:41 (06)	08:01
	21:26	20:59	20:08		19:12			17:21	15	16:56 (06)	17:00
8	06:02	06:33	07:09		07:45			07:25		16:42 (06)	08:02
	21:26	20:57	20:06		19:10			17:20	14	16:56 (06)	17:00
9	06:03	06:34	07:10		07:46			07:27		16:42 (06)	08:03
	21:26	20:56	20:04		19:08			17:19	12	16:54 (06)	17:00
10	06:04	06:35	07:12		07:47			07:28		16:42 (06)	08:04
	21:25	20:54	20:02		19:07			17:18	10	16:52 (06)	16:59
11	06:05	06:37	07:13		07:48			07:29		16:43 (06)	08:05
	21:25	20:53	20:00		19:05			17:17	9	16:52 (06)	17:00
12	06:06	06:38	07:14		07:50			07:31		16:43 (06)	08:06
	21:24	20:52	19:59		19:03			17:16	7	16:50 (06)	17:00
13	06:06	06:39	07:15		07:51			07:32		16:45 (06)	08:07
	21:24	20:50	19:57		19:01			17:15	4	16:49 (06)	17:00
14	06:07	06:40	07:16		07:52			07:33		16:45 (06)	08:07
	21:23	20:49	19:55		19:00			17:14	3	16:48 (06)	17:00
15	06:08	06:41	07:17		07:53			07:35			08:08
	21:22	20:47	19:53		18:56			17:12			17:00
16	06:09	06:42	07:18		07:55			07:36			08:09
	21:22	20:46	19:51		18:54			17:12			17:00
17	06:10	06:44	07:20		07:56			07:37			08:10
	21:21	20:44	19:49		18:53			17:11			17:01
18	06:11	06:45	07:21		07:57			07:39			08:10
	21:20	20:42	19:47		18:51			17:10			17:01
19	06:12	06:46	07:22		07:59			07:40			08:11
	21:19	20:41	19:45		18:49			17:09			17:01
20	06:13	06:47	07:23		08:00			07:41			08:12
	21:19	20:39	19:44		18:48			17:08			17:02
21	06:14	06:48	07:24		08:01			07:42			08:12
	21:18	20:38	19:42		18:46			17:07			17:02
22	06:15	06:49	07:25	07:58 (03)	08:02			07:44			08:13
	21:17	20:36	19:40	9	08:07 (03)	18:44			17:06			17:03
23	06:16	06:51	07:27	07:55 (03)	08:04			07:45			08:13
	21:16	20:34	19:38	14	08:09 (03)	18:43			17:06			17:03
24	06:17	06:52	07:28	07:53 (03)	08:05			07:46			08:14
	21:15	20:33	19:36	17	08:10 (03)	18:41			17:05			17:04
25	06:18	06:53	07:29	07:51 (03)	08:06			07:48			08:14
	21:14	20:31	19:34	19	08:10 (03)	18:40			17:04			17:04
26	06:19	06:54	07:30	07:51 (03)	08:08			07:49			08:14
	21:13	20:29	19:32	19	08:10 (03)	18:38			17:04			17:05
27	06:20	06:55	07:31	07:52 (03)	08:09			07:50			08:15
	21:12	20:27	19:30	18	08:10 (03)	18:37			17:03			17:06
28	06:21	06:56	07:33	07:54 (03)	08:10			07:51			08:15
	21:11	20:26	19:29	17	08:11 (03)	18:35			17:03			17:06
29	06:22	06:58	07:34	07:55 (03)	08:12		17:49 (06)	07:52			08:15
	21:10	20:24	19:27	16	08:11 (03)	18:34	8	17:57 (06)	17:02			17:07
30	06:23	06:59	07:35	07:56 (03)	08:13		17:47 (06)	07:54			08:15
	21:09	20:22	19:25	14	08:10 (03)	18:32	13	18:00 (06)	17:02			17:08
31	06:24	07:00			08:14		17:45 (06)				08:15
	21:08	20:20			18:31	16	18:01 (06)				17:09
Potential sun hours	470	435	377		341			289			276
Total, worst case				143		69			186		
Sun reduction				0.69		0.59			0.51		
Oper. time red.				0.98		0.98			0.98		
Wind dir. red.				0.70		0.64			0.58		
Total reduction				0.47		0.37			0.29		
Total, real				68		25			53		

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:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

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Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 47 - Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	January	February		March	April	May	June	July	August	September	October		November		December
1	08:15	07:58		07:18	07:22	06:31	05:58	05:58	06:25	07:01	07:36		07:15	16:42 (33)	07:54
	17:10	17:48		18:25	20:04	20:41	21:15	21:27	21:06	20:18	19:23		17:29	23 17:05 (33)	17:01
2	08:15	07:57		07:16	07:20	06:29	05:58	05:59	06:26	07:02	07:37		07:17	16:44 (33)	07:55
	17:11	17:49		18:26	20:06	20:42	21:16	21:27	21:05	20:17	19:21		17:28	20 17:04 (33)	17:01
3	08:15	07:56		07:14	07:18	06:28	05:57	05:59	06:28	07:03	07:38		07:18	16:44 (33)	07:57
	17:12	17:50		18:28	20:07	20:44	21:17	21:27	21:04	20:15	19:19		17:27	18 17:02 (33)	17:01
4	08:15	07:55		07:12	07:16	06:27	05:57	06:00	06:29	07:04	07:40		07:19	16:45 (33)	07:58
	17:13	17:52		18:29	20:08	20:45	21:18	21:27	21:02	20:13	19:17		17:25	15 17:00 (33)	17:00
5	08:15	07:54	17:20 (33)	07:11	07:14	06:25	05:56	06:01	06:30	07:06	07:41		07:21	16:48 (33)	07:59
	17:14	17:53	8 17:28 (33)	18:30	20:09	20:46	21:18	21:27	21:01	20:11	19:16		17:24	11 16:59 (33)	17:00
6	08:15	07:52	17:18 (33)	07:09	07:12	06:24	05:56	06:01	06:31	07:07	07:42		07:22	16:50 (33)	08:00
	17:15	17:55	12 17:30 (33)	18:32	20:11	20:47	21:19	21:26	21:00	20:09	19:14		17:23	8 16:58 (33)	17:00
7	08:15	07:51	17:16 (33)	07:07	07:11	06:22	05:56	06:02	06:32	07:08	07:43		07:24		08:01
	17:16	17:56	16 17:32 (33)	18:33	20:12	20:48	21:20	21:26	20:58	20:08	19:12		17:22		17:00
8	08:15	07:50	17:14 (33)	08:05	07:09	06:21	05:55	06:03	06:33	07:09	07:45		07:25		08:02
	17:17	17:58	18 17:32 (33)	18:34	20:13	20:50	21:20	21:26	20:57	20:06	19:10		17:20		17:00
9	08:15	07:48	17:14 (33)	08:04	07:07	06:20	05:55	06:03	06:34	07:10	07:46		07:26		08:03
	17:18	17:59	20 17:34 (33)	19:36	20:14	20:51	21:21	21:25	20:56	20:04	19:08		17:19		17:00
10	08:14	07:47	17:12 (33)	08:02	07:05	06:19	05:55	06:04	06:36	07:11	07:47		07:28		08:04
	17:19	18:00	23 17:35 (33)	19:37	20:16	20:52	21:22	21:25	20:54	20:02	19:07		17:18		17:00
11	08:14	07:46	17:12 (33)	08:00	07:04	06:17	05:55	06:05	06:37	07:13	07:48		07:29		08:05
	17:20	18:00	25 17:37 (33)	19:38	20:17	20:53	21:22	21:24	20:53	20:00	19:05		17:17		17:00
12	08:14	07:44	17:12 (33)	07:58	07:02	06:16	05:54	06:06	06:38	07:14	07:50		07:30		08:05
	17:21	18:02	27 17:39 (33)	19:39	20:18	20:54	21:23	21:24	20:51	19:58	19:03		17:16		17:00
13	08:13	07:43	17:11 (33)	07:56	07:00	06:15	05:54	06:06	06:39	07:15	07:51		07:32		08:06
	17:23	18:03	29 17:40 (33)	19:41	20:19	20:56	21:24	21:23	20:50	19:57	19:01		17:15		17:00
14	08:13	07:41	17:11 (33)	07:55	06:58	06:14	05:54	06:07	06:40	07:16	07:52	17:56 (33)	07:33		08:07
	17:24	18:05	31 17:42 (33)	19:42	20:20	20:57	21:24	21:23	20:48	19:55	19:00	4 18:00 (33)	17:14		17:00
15	08:12	07:40	17:10 (33)	07:53	06:57	06:13	05:54	06:08	06:41	07:17	07:53	17:51 (33)	07:34		08:08
	17:25	18:06	33 17:43 (33)	19:43	20:22	20:58	21:25	21:22	20:47	19:53	18:56	15 18:06 (33)	17:13		17:00
16	08:12	07:39	17:10 (33)	07:51	06:55	06:12	05:54	06:09	06:42	07:18	07:55	17:48 (33)	07:36		08:09
	17:26	18:07	34 17:44 (33)	19:44	20:23	20:59	21:25	21:21	20:45	19:51	18:54	20 18:08 (33)	17:12		17:00
17	08:11	07:37	17:10 (33)	07:49	06:53	06:10	05:54	06:10	06:44	07:20	07:56	17:46 (33)	07:37		08:09
	17:27	18:09	33 17:43 (33)	19:46	20:24	21:00	21:25	21:21	20:44	19:49	18:53	23 18:09 (33)	17:11		17:01
18	08:11	07:35	17:10 (33)	07:47	06:51	06:09	05:54	06:11	06:45	07:21	07:57	17:45 (33)	07:38		08:10
	17:29	18:10	32 17:42 (33)	19:47	20:25	21:01	21:26	21:20	20:42	19:47	18:51	26 18:11 (33)	17:10		17:01
19	08:10	07:34	17:10 (33)	07:45	06:50	06:08	05:54	06:12	06:46	07:22	07:58	17:43 (33)	07:40		08:11
	17:30	18:11	33 17:43 (33)	19:48	20:27	21:02	21:26	21:19	20:41	19:45	18:49	28 18:11 (33)	17:09		17:01
20	08:09	07:32	17:10 (33)	07:44	06:48	06:07	05:54	06:13	06:47	07:23	08:00	17:42 (33)	07:41		08:11
	17:31	18:13	32 17:42 (33)	19:50	20:28	21:03	21:26	21:18	20:39	19:43	18:48	29 18:11 (33)	17:08		17:02
21	08:09	07:31	17:12 (33)	07:42	06:46	06:06	05:55	06:14	06:48	07:24	08:01	17:42 (33)	07:42		08:12
	17:33	18:14	30 17:42 (33)	19:51	20:29	21:04	21:27	21:17	20:37	19:42	18:46	31 18:13 (33)	17:07		17:02
22	08:08	07:29	17:12 (33)	07:40	06:45	06:06	05:55	06:15	06:49	07:25	08:02	17:41 (33)	07:43		08:12
	17:34	18:16	29 17:41 (33)	19:52	20:30	21:05	21:27	21:17	20:36	19:40	18:44	32 18:13 (33)	17:06		17:03
23	08:07	07:28	17:12 (33)	07:38	06:43	06:05	05:55	06:16	06:51	07:27	08:04	17:40 (33)	07:45		08:13
	17:35	18:17	27 17:39 (33)	19:53	20:31	21:06	21:27	21:16	20:34	19:38	18:43	32 18:12 (33)	17:06		17:03
24	08:06	07:26	17:14 (33)	07:36	06:42	06:04	05:55	06:17	06:52	07:28	08:05	17:40 (33)	07:46		08:13
	17:37	18:18	25 17:39 (33)	19:55	20:33	21:07	21:27	21:15	20:32	19:36	18:41	33 18:13 (33)	17:05		17:04
25	08:05	07:24	17:15 (33)	07:34	06:40	06:03	05:56	06:18	06:53	07:29	08:06	17:40 (33)	07:47		08:14
	17:38	18:20	22 17:37 (33)	19:56	20:34	21:09	21:27	21:14	20:31	19:34	18:40	33 18:13 (33)	17:04		17:04
26	08:04	07:23	17:17 (33)	07:33	06:38	06:02	05:56	06:19	06:54	07:30	08:07	17:40 (33)	07:48		08:14
	17:39	18:21	17 17:34 (33)	19:57	20:35	21:09	21:28	21:13	20:29	19:32	18:38	33 18:13 (33)	17:04		17:05
27	08:03	07:21	17:20 (33)	07:31	06:37	06:01	05:56	06:20	06:55	07:31	08:09	17:40 (33)	07:50		08:14
	17:41	18:22	12 17:32 (33)	19:58	20:36	21:10	21:28	21:12	20:27	19:30	18:37	32 18:12 (33)	17:03		17:06
28	08:02	07:19		07:29	06:35	06:01	05:57	06:21	06:56	07:32	08:10	17:39 (33)	07:51		08:15
	17:42	18:24		19:59	20:38	21:11	21:28	21:11	20:25	19:28	18:35	31 18:10 (33)	17:03		17:06
29	08:01			07:27	06:34	06:00	05:57	06:22	06:58	07:34	08:11	17:40 (33)	07:52		08:15
	17:44			20:01	20:39	21:12	21:28	21:10	20:24	19:27	18:34	29 18:09 (33)	17:02		17:07
30	08:00			07:25	06:32	05:59	05:58	06:23	06:59	07:35	08:13	17:40 (33)	07:53		08:15
	17:45			20:02	20:40	21:13	21:27	21:08	20:22	19:25	18:32	27 18:07 (33)	17:02		17:08
31	07:59			07:23		05:59		06:24	07:00		08:14	17:42 (33)			08:15
	17:46			20:03		21:14		21:07	20:20		18:31	25 18:07 (33)			17:09
Potential sun hours	288	292		369	403	458	464	470	435	377	342		289		276
Total, worst case			568									483		95	
Sun reduction			0.62									0.59		0.51	
Oper. time red.			0.98									0.98		0.98	
Wind dir. red.			0.59									0.59		0.59	
Total reduction			0.36									0.34		0.29	
Total, real			202									164		28	

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:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
TEST license
This license is only to be used for testing purposes

Ramos, Tiffanie / tiffanie.ramos@tetratech.com
Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 48 - Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	January		February		March	April	May	June	July	August	September	October		November		December
1	08:15		07:58	16:58 (33)	07:18	07:22	06:31	05:58	05:58	06:25	07:01	07:36		07:15	16:26 (33)	07:54
	17:10		17:48	24 17:22 (33)	18:25	20:04	20:41	21:15	21:27	21:06	20:18	19:23		17:29	32 16:58 (33)	17:01
2	08:15		07:57	16:58 (33)	07:16	07:20	06:29	05:58	05:59	06:26	07:02	07:37		07:17	16:27 (33)	07:55
	17:11		17:49	26 17:24 (33)	18:26	20:06	20:42	21:16	21:27	21:05	20:17	19:21		17:28	31 16:58 (33)	17:01
3	08:15		07:56	16:58 (33)	07:14	07:18	06:28	05:57	05:59	06:28	07:03	07:38		07:18	16:26 (33)	07:57
	17:12		17:50	27 17:25 (33)	18:28	20:07	20:44	21:17	21:27	21:04	20:15	19:19		17:27	32 16:58 (33)	17:01
4	08:15		07:55	16:56 (33)	07:12	07:16	06:27	05:57	06:00	06:29	07:04	07:40		07:19	16:26 (33)	07:58
	17:13		17:52	30 17:26 (33)	18:29	20:08	20:45	21:18	21:27	21:02	20:13	19:17		17:25	31 16:57 (33)	17:00
5	08:15		07:54	16:56 (33)	07:11	07:14	06:25	05:56	06:01	06:30	07:06	07:41		07:21	16:27 (33)	07:59
	17:14		17:53	32 17:28 (33)	18:30	20:09	20:46	21:18	21:27	21:01	20:11	19:16		17:24	31 16:58 (33)	17:00
6	08:15		07:52	16:57 (33)	07:09	07:12	06:24	05:56	06:01	06:31	07:07	07:42		07:22	16:26 (33)	08:00
	17:15		17:55	31 17:28 (33)	18:32	20:11	20:47	21:19	21:26	21:00	20:09	19:14		17:23	31 16:57 (33)	17:00
7	08:15		07:51	16:57 (33)	07:07	07:11	06:22	05:56	06:02	06:32	07:08	07:43		07:24	16:27 (33)	08:01
	17:16		17:56	32 17:29 (33)	18:33	20:12	20:48	21:20	21:26	20:58	20:08	19:12		17:22	30 16:57 (33)	17:00
8	08:15		07:50	16:56 (33)	08:05	07:09	06:21	05:55	06:03	06:33	07:09	07:45		07:25	16:27 (33)	08:02
	17:17		17:58	32 17:28 (33)	18:34	20:13	20:50	21:20	21:26	20:57	20:06	19:10		17:20	28 16:55 (33)	17:00
9	08:15		07:48	16:57 (33)	08:04	07:07	06:20	05:55	06:03	06:34	07:10	07:46		07:26	16:29 (33)	08:03
	17:18		17:59	32 17:29 (33)	19:36	20:14	20:51	21:21	21:25	20:56	20:04	19:08		17:19	25 16:54 (33)	17:00
10	08:14		07:47	16:57 (33)	08:02	07:05	06:19	05:55	06:04	06:36	07:11	07:47		07:28	16:29 (33)	08:04
	17:19		18:00	31 17:28 (33)	19:37	20:16	20:52	21:22	21:25	20:54	20:02	19:07		17:18	24 16:53 (33)	17:00
11	08:14		07:46	16:57 (33)	08:00	07:04	06:17	05:55	06:05	06:37	07:13	07:48		07:29	16:31 (33)	08:05
	17:20		18:00	31 17:28 (33)	19:38	20:17	20:53	21:22	21:24	20:53	20:00	19:05		17:17	21 16:52 (33)	17:00
12	08:14		07:44	16:58 (33)	07:58	07:02	06:16	05:54	06:06	06:38	07:14	07:50		07:30	16:31 (33)	08:05
	17:21		18:02	30 17:28 (33)	19:39	20:18	20:54	21:23	21:24	20:51	19:58	19:03		17:16	19 16:50 (33)	17:00
13	08:13		07:43	16:58 (33)	07:56	07:00	06:15	05:54	06:06	06:39	07:15	07:51		07:32	16:32 (33)	08:06
	17:23		18:03	29 17:27 (33)	19:41	20:19	20:56	21:24	21:23	20:50	19:57	19:01		17:15	17 16:49 (33)	17:00
14	08:13		07:41	17:00 (33)	07:55	06:58	06:14	05:54	06:07	06:40	07:16	07:52		07:33	16:34 (33)	08:07
	17:24		18:05	27 17:27 (33)	19:42	20:20	20:57	21:24	21:23	20:48	19:55	19:00		17:14	14 16:48 (33)	17:00
15	08:12		07:40	17:00 (33)	07:53	06:57	06:13	05:54	06:08	06:41	07:17	07:53		07:34	16:36 (33)	08:08
	17:25		18:06	25 17:25 (33)	19:43	20:22	20:58	21:25	21:22	20:47	19:53	18:56		17:13	11 16:47 (33)	17:00
16	08:12		07:39	17:02 (33)	07:51	06:55	06:12	05:54	06:09	06:42	07:18	07:55		07:36	16:39 (33)	08:09
	17:26		18:07	22 17:24 (33)	19:44	20:23	20:59	21:25	21:21	20:45	19:51	18:54		17:12	7 16:46 (33)	17:00
17	08:11		07:37	17:03 (33)	07:49	06:53	06:10	05:54	06:10	06:44	07:20	07:56		07:37		08:09
	17:27		18:09	19 17:22 (33)	19:46	20:24	21:00	21:25	21:21	20:44	19:49	18:53		17:11		17:01
18	08:11		07:35	17:05 (33)	07:47	06:51	06:09	05:54	06:11	06:45	07:21	07:57		07:38		08:10
	17:29		18:10	15 17:20 (33)	19:47	20:25	21:01	21:26	21:20	20:42	19:47	18:51		17:10		17:01
19	08:10		07:34	17:10 (33)	07:45	06:50	06:08	05:54	06:12	06:46	07:22	07:58		07:40		08:11
	17:30		18:11	6 17:16 (33)	19:48	20:27	21:02	21:26	21:19	20:41	19:45	18:49		17:09		17:01
20	08:09		07:32		07:44	06:48	06:07	05:54	06:13	06:47	07:23	08:00		07:41		08:11
	17:31		18:13		19:50	20:28	21:03	21:26	21:18	20:39	19:43	18:48		17:08		17:02
21	08:09		07:31		07:42	06:46	06:06	05:55	06:14	06:48	07:24	08:01		07:42		08:12
	17:33		18:14		19:51	20:29	21:04	21:27	21:17	20:37	19:42	18:46		17:07		17:02
22	08:08		07:29		07:40	06:45	06:06	05:55	06:15	06:49	07:25	08:02		07:43		08:12
	17:34		18:16		19:52	20:30	21:05	21:27	21:17	20:36	19:40	18:44		17:06		17:03
23	08:07		07:28		07:38	06:43	06:05	05:55	06:16	06:51	07:27	08:04	17:38 (33)	07:45		08:13
	17:35		18:17		19:53	20:31	21:06	21:27	21:16	20:34	19:38	18:43	9 17:47 (33)	17:06		17:03
24	08:06		07:26		07:36	06:42	06:04	05:55	06:17	06:52	07:28	08:05	17:35 (33)	07:46		08:13
	17:37		18:18		19:54	20:33	21:08	21:27	21:15	20:32	19:36	18:41	16 17:51 (33)	17:05		17:04
25	08:05		07:24		07:34	06:40	06:03	05:56	06:18	06:53	07:29	08:06	17:32 (33)	07:47		08:14
	17:38		18:20		19:56	20:34	21:09	21:27	21:14	20:31	19:34	18:40	20 17:52 (33)	17:04		17:04
26	08:04	17:06 (33)	07:23		07:33	06:38	06:02	05:56	06:19	06:54	07:30	08:07	17:31 (33)	07:48		08:14
	17:39	7 17:13 (33)	18:21		19:57	20:35	21:09	21:28	21:13	20:29	19:32	18:38	23 17:54 (33)	17:04		17:05
27	08:03	17:04 (33)	07:21		07:31	06:37	06:01	05:56	06:20	06:55	07:31	08:09	17:30 (33)	07:50		08:14
	17:41	11 17:15 (33)	18:22		19:58	20:36	21:10	21:28	21:12	20:27	19:30	18:37	25 17:55 (33)	17:03		17:06
28	08:02	17:02 (33)	07:19		07:29	06:35	06:01	05:57	06:21	06:56	07:32	08:10	17:28 (33)	07:51		08:15
	17:42	14 17:16 (33)	18:24		19:59	20:38	21:11	21:28	21:11	20:25	19:28	18:35	27 17:55 (33)	17:03		17:06
29	08:01	17:00 (33)			07:27	06:34	06:00	05:57	06:22	06:58	07:34	08:11	17:28 (33)	07:52		08:15
	17:44	17 17:17 (33)			20:01	20:39	21:12	21:28	21:10	20:24	19:27	18:34	29 17:57 (33)	17:02		17:07
30	08:00	16:59 (33)			07:25	06:32	05:59	05:58	06:23	06:59	07:35	08:13	17:27 (33)	07:53		08:15
	17:45	20 17:19 (33)			20:02	20:40	21:13	21:27	21:08	20:22	19:25	18:32	30 17:57 (33)	17:02		17:08
31	07:59	16:59 (33)			07:23		05:59		06:24	07:00		08:14	17:27 (33)			08:15
	17:46	21 17:20 (33)			20:03		21:14		21:07	20:20		18:31	31 17:58 (33)			17:09
Potential sun hours	288		292		369	403	458	464	470	435	377	342		289		276
Total, worst case		90		501									210		384	
Sun reduction		0.62		0.62									0.59		0.51	
Oper. time red.		0.98		0.98									0.98		0.98	
Wind dir. red.		0.57		0.57									0.57		0.57	
Total reduction		0.35		0.35									0.33		0.29	
Total, real		31		174									70		110	

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:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
TEST license
This license is only to be used for testing purposes

Ramos, Tiffanie / tiffanie.ramos@tetratech.com
Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 49 - Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	January	February		March		April	May	June	July	August	September	October		November		December
1	08:15	07:58		07:18		08:08 (34)	07:21	06:31	05:58	05:58	06:25	07:01	07:36		07:15	07:42 (34)	07:54
	17:10	17:48		18:25	34	08:42 (34)	20:04	20:41	21:15	21:27	21:06	20:18	19:23		17:29	28 08:10 (34)	17:01
2	08:15	07:57		07:16		08:09 (34)	07:20	06:29	05:58	05:59	06:26	07:02	07:37		07:17	07:43 (34)	07:55
	17:11	17:49		18:26	31	08:40 (34)	20:06	20:42	21:16	21:27	21:05	20:17	19:21		17:28	25 08:08 (34)	17:01
3	08:15	07:56		07:14		08:11 (34)	07:18	06:28	05:57	05:59	06:27	07:03	07:38		07:18	07:45 (34)	07:56
	17:12	17:50		18:28	28	08:39 (34)	20:07	20:44	21:17	21:27	21:04	20:15	19:19		17:27	22 08:07 (34)	17:01
4	08:15	07:55		07:12		08:12 (34)	07:16	06:26	05:57	06:00	06:29	07:04	07:40		07:19	07:48 (34)	07:58
	17:13	17:52		18:29	24	08:36 (34)	20:08	20:45	21:17	21:27	21:02	20:13	19:17		17:25	16 08:04 (34)	17:00
5	08:15	07:53		07:11		08:14 (34)	07:14	06:25	05:56	06:00	06:30	07:06	07:41		07:21	07:52 (34)	07:59
	17:14	17:53		18:30	19	08:33 (34)	20:09	20:46	21:18	21:27	21:01	20:11	19:15		17:24	9 08:01 (34)	17:00
6	08:15	07:52		08:22 (34)		07:09	08:18 (34)	07:12	06:24	05:56	06:01	06:31	07:07	07:42		07:22		08:00
	17:15	17:55	10	08:32 (34)	11	18:32	08:29 (34)	20:10	20:47	21:19	21:26	21:00	20:09	19:14		17:23		17:00
7	08:15	07:51		08:17 (34)		07:07		07:11	06:22	05:55	06:02	06:32	07:08	07:43		08:58 (34)	07:23	08:01
	17:16	17:56	18	08:35 (34)		18:33		20:12	20:48	21:20	21:26	20:58	20:08	19:12	2	09:00 (34)	17:21	17:00
8	08:15	07:50		08:15 (34)		08:05		07:09	06:21	05:55	06:03	06:33	07:09	07:44		08:52 (34)	07:25	08:02
	17:17	17:57	23	08:38 (34)		18:34		20:13	20:50	21:20	21:26	20:57	20:06	19:10	16	09:08 (34)	17:20	17:00
9	08:15	07:48		08:14 (34)		08:04		07:07	06:20	05:55	06:03	06:34	07:10	07:46		08:48 (34)	07:26	08:03
	17:18	17:59	26	08:40 (34)		19:35		20:14	20:51	21:21	21:25	20:56	20:04	19:08	22	09:10 (34)	17:19	17:00
10	08:14	07:47		08:12 (34)		08:02		07:05	06:19	05:55	06:04	06:35	07:11	07:47		08:46 (34)	07:27	08:04
	17:19	18:00	29	08:41 (34)		19:37		20:15	20:52	21:22	21:25	20:54	20:02	19:06	26	09:12 (34)	17:18	17:00
11	08:14	07:46		08:11 (34)		08:00		07:03	06:17	05:54	06:05	06:37	07:13	07:48		08:44 (34)	07:29	08:04
	17:20	18:00	32	08:43 (34)		19:38		20:17	20:53	21:22	21:24	20:53	20:00	19:05	29	09:13 (34)	17:17	17:00
12	08:14	07:44		08:09 (34)		07:58		07:02	06:16	05:54	06:06	06:38	07:14	07:49		08:43 (34)	07:30	08:05
	17:21	18:02	34	08:43 (34)		19:39		20:18	20:54	21:23	21:24	20:51	19:58	19:03	32	09:15 (34)	17:16	17:00
13	08:13	07:43		08:09 (34)		07:56		07:00	06:15	05:54	06:06	06:39	07:15	07:51		08:41 (34)	07:32	08:06
	17:22	18:03	36	08:45 (34)		19:41		20:19	20:55	21:23	21:23	20:50	19:56	19:01	34	09:15 (34)	17:15	17:00
14	08:13	07:41		08:08 (34)		07:55		06:58	06:14	05:54	06:07	06:40	07:16	07:52		08:40 (34)	07:33	08:07
	17:24	18:04	37	08:45 (34)		19:42		20:20	20:57	21:24	21:23	20:48	19:55	18:58	36	09:16 (34)	17:13	17:00
15	08:12	07:40		08:07 (34)		07:53		06:56	06:13	05:54	06:08	06:41	07:17	07:53		08:39 (34)	07:34	08:08
	17:25	18:06	39	08:46 (34)		19:43		20:22	20:58	21:24	21:22	20:47	19:53	18:56	38	09:17 (34)	17:12	17:00
16	08:12	07:38		08:06 (34)		07:51		06:55	06:11	05:54	06:09	06:42	07:18	07:54		08:38 (34)	07:36	08:08
	17:26	18:07	40	08:46 (34)		19:44		20:23	20:59	21:25	21:21	20:45	19:51	18:54	39	09:17 (34)	17:11	17:00
17	08:11	07:37		08:06 (34)		07:49		06:53	06:10	05:54	06:10	06:44	07:19	07:56		08:37 (34)	07:37	08:09
	17:27	18:09	41	08:47 (34)		19:46		20:24	21:00	21:25	21:21	20:44	19:49	18:53	40	09:17 (34)	17:11	17:01
18	08:10	07:35		08:06 (34)		07:47		06:51	06:09	05:54	06:11	06:45	07:21	07:57		08:37 (34)	07:38	08:10
	17:29	18:10	41	08:47 (34)		19:47		20:25	21:01	21:26	21:20	20:42	19:47	18:51	41	09:18 (34)	17:10	17:01
19	08:10	07:34		08:06 (34)		07:45		06:50	06:08	05:54	06:12	06:46	07:22	07:58		08:37 (34)	07:39	08:10
	17:30	18:11	42	08:48 (34)		19:48		20:26	21:02	21:26	21:19	20:40	19:45	18:49	41	09:18 (34)	17:09	17:01
20	08:09	07:32		08:05 (34)		07:44		06:48	06:07	05:54	06:13	06:47	07:23	08:00		08:36 (34)	07:41	08:11
	17:31	18:13	42	08:47 (34)		19:49		20:28	21:03	21:26	21:18	20:39	19:43	18:48	42	09:18 (34)	17:08	17:02
21	08:08	07:31		08:06 (34)		07:42		06:46	06:06	05:54	06:14	06:48	07:24	08:01		08:36 (34)	07:42	08:12
	17:33	18:14	42	08:48 (34)		19:51		20:29	21:04	21:27	21:17	20:37	19:42	18:46	42	09:18 (34)	17:07	17:02
22	08:08	07:29		08:05 (34)		07:40		06:45	06:05	05:55	06:15	06:49	07:25	08:02		08:36 (34)	07:43	08:12
	17:34	18:15	42	08:47 (34)		19:52		20:30	21:05	21:27	21:16	20:36	19:40	18:44	42	09:18 (34)	17:06	17:03
23	08:07	07:27		08:05 (34)		07:38		06:43	06:05	05:55	06:16	06:50	07:26	08:03		08:36 (34)	07:45	08:13
	17:35	18:17	41	08:46 (34)		19:53		20:31	21:06	21:27	21:16	20:34	19:38	18:43	41	09:17 (34)	17:06	17:03
24	08:06	07:26		08:06 (34)		07:36		06:42	06:04	05:55	06:17	06:52	07:28	08:05		08:36 (34)	07:46	08:13
	17:37	18:18	41	08:47 (34)		19:54		20:33	21:07	21:27	21:15	20:32	19:36	18:41	41	09:17 (34)	17:05	17:04
25	08:05	07:24		08:06 (34)		07:34		06:40	06:03	05:56	06:18	06:53	07:29	08:06		08:36 (34)	07:47	08:13
	17:38	18:20	40	08:46 (34)		19:56		20:34	21:08	21:27	21:14	20:31	19:34	18:40	41	09:17 (34)	17:04	17:04
26	08:04	07:23		08:06 (34)		07:32		06:38	06:02	05:56	06:19	06:54	07:30	08:07		08:37 (34)	07:48	08:14
	17:39	18:21	39	08:45 (34)		19:57		20:35	21:09	21:27	21:13	20:29	19:32	18:38	40	09:17 (34)	17:04	17:05
27	08:03	07:21		08:07 (34)		07:31		06:37	06:01	05:56	06:20	06:55	07:31	08:09		08:37 (34)	07:50	08:14
	17:41	18:22	38	08:45 (34)		19:58		20:36	21:10	21:27	21:12	20:27	19:30	18:37	39	09:16 (34)	17:03	17:06
28	08:02	07:19		08:08 (34)		07:29		06:35	06:01	05:57	06:21	06:56	07:32	08:10		08:37 (34)	07:51	08:14
	17:42	18:24	35	08:43 (34)		19:59		20:38	21:11	21:27	21:11	20:25	19:28	18:35	37	09:14 (34)	17:03	17:06
29	08:01					07:27		06:34	06:00	05:57	06:22	06:57	07:34	08:11		08:39 (34)	07:52	08:15
	17:43					20:01		20:39	21:12	21:27	21:09	20:24	19:27	18:34	35	09:14 (34)	17:02	17:07
30	08:00					07:25		06:32	05:59	05:58	06:23	06:59	07:35	08:13		08:39 (34)	07:53	08:15
	17:45					20:02		20:40	21:13	21:27	21:08	20:22	19:25	18:32	34	09:13 (34)	17:02	17:08
31	07:59					07:23			05:59		06:24	07:00		08:14		08:41 (34)		08:15
	17:46					20:03			21:14		21:07	20:20		18:31	31	09:12 (34)		17:09
Potential sun hours	288	292		369		403	458	464	470	435	377	341		289			276	
Total, worst case			808		147								861		100			
Sun reduction			0.62		0.62								0.59		0.51			
Oper. time red.			0.98		0.98								0.98		0.98			
Wind dir. red.			0.74		0.74								0.74		0.74			
Total reduction			0.45		0.45								0.43		0.37			
Total, real			365		66								371		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:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
TEST license
This license is only to be used for testing purposes

Ramos, Tiffanie / tiffanie.ramos@tetratech.com
Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 50 - Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:15	07:58	07:18	07:22	06:31	05:58	05:58	06:25	07:01	07:36	07:16	07:55
	17:10	17:48	18:25	20:05	20:41	21:15	21:28	21:06	20:19	19:23	17:30	17:01
2	08:16	07:57	07:16	07:20	06:30	05:58	05:59	06:27	07:02	07:37	07:17	07:56
	17:11	17:49	18:26	20:06	20:43	21:16	21:27	21:05	20:17	19:21	17:28	17:01
3	08:16	07:56	07:14	07:18	06:28	05:57	05:59	06:28	07:03	07:39	07:18	07:57
	17:12	17:51	18:28	20:07	20:44	21:17	21:27	21:04	20:15	19:19	17:27	17:01
4	08:16	07:55	07:13	07:16	06:27	05:57	06:00	06:29	07:05	07:40	07:20	07:58
	17:13	17:52	18:29	20:08	20:45	21:18	21:27	21:02	20:13	19:18	17:26	17:01
5	08:15	07:54	07:11	07:14	06:25	05:56	06:01	06:30	07:06	07:41	07:21	07:59
	17:14	17:53	18:30	20:10	20:46	21:18	21:27	21:01	20:11	19:16	17:24	17:00
6	08:15	07:52	07:09	07:13	06:24	05:56	06:01	06:31	07:07	07:42	07:22	08:00
	17:15	17:55	18:32	20:11	20:47	21:19	21:26	21:00	20:10	19:14	17:23	17:00
7	08:15	07:51	07:07	07:11	06:23	05:56	06:02	06:32	07:08	07:43	07:24	08:01
	17:16	17:56	18:33	20:12	20:49	21:20	21:26	20:59	20:08	19:12	17:22	17:00
8	08:15	07:50	08:06	07:09	06:21	05:55	06:03	06:33	07:09	07:45	07:25	08:02
	17:17	17:58	18:34	20:13	20:50	21:21	21:26	20:57	20:06	19:10	17:20	17:00
9	08:15	07:49	08:04	07:07	06:20	05:55	06:03	06:35	07:10	07:46	07:26	08:03
	17:18	17:59	19:36	20:14	20:51	21:21	21:25	20:56	20:04	19:09	17:19	17:00
10	08:14	07:47	08:02	07:05	06:19	05:55	06:04	06:36	07:12	07:47	07:28	08:04
	17:19	18:00	19:37	20:16	20:52	21:22	21:25	20:54	20:02	19:07	17:18	17:00
11	08:14	07:46	08:00	07:04	06:18	05:55	06:05	06:37	07:13	07:48	07:29	08:05
	17:20	18:00	19:38	20:17	20:53	21:23	21:24	20:53	20:00	19:05	17:17	17:00
12	08:14	07:44	07:58	07:02	06:16	05:55	06:06	06:38	07:14	07:50	07:30	08:06
	17:22	18:02	19:40	20:18	20:55	21:23	21:24	20:51	19:59	19:03	17:16	17:00
13	08:13	07:43	07:57	07:00	06:15	05:54	06:07	06:39	07:15	07:51	07:32	08:06
	17:23	18:03	19:41	20:19	20:56	21:24	21:23	20:50	19:57	19:01	17:15	17:00
14	08:13	07:42	07:55	06:58	06:14	05:54	06:07	06:40	07:16	07:52	07:33	08:07
	17:24	18:05	19:42	20:21	20:57	21:24	21:23	20:48	19:55	19:00	17:14	17:00
15	08:12	07:40	07:53	06:57	06:13	05:54	06:08	06:41	07:17	07:53	07:34	08:08
	17:25	18:06	19:43	20:22	20:58	21:25	21:22	20:47	19:53	18:56	17:13	17:00
16	08:12	07:39	07:51	06:55	06:12	05:54	06:09	06:43	07:19	07:55	07:36	08:09
	17:26	18:07	19:45	20:23	20:59	21:25	21:21	20:45	19:51	18:55	17:12	17:01
17	08:11	07:37	07:49	06:53	06:11	05:54	06:10	06:44	07:20	07:56	07:37	08:09
	17:28	18:09	19:46	20:24	21:00	21:26	21:21	20:44	19:49	18:53	17:11	17:01
18	08:11	07:36	07:47	06:52	06:10	05:54	06:11	06:45	07:21	07:57	07:38	08:10
	17:29	18:10	19:47	20:26	21:01	21:26	21:20	20:42	19:47	18:51	17:10	17:01
19	08:10	07:34	07:46	06:50	06:09	05:54	06:12	06:46	07:22	07:59	07:40	08:11
	17:30	18:12	19:48	20:27	21:02	21:26	21:19	20:41	19:45	18:50	17:09	17:01
20	08:09	07:33	07:44	06:48	06:08	05:55	06:13	06:47	07:23	08:00	07:41	08:11
	17:31	18:13	19:50	20:28	21:03	21:27	21:18	20:39	19:44	18:48	17:08	17:02
21	08:09	07:31	07:42	06:47	06:07	05:55	06:14	06:48	07:24	08:01	07:42	08:12
	17:33	18:14	19:51	20:29	21:05	21:27	21:18	20:37	19:42	18:46	17:07	17:02
22	08:08	07:29	07:40	06:45	06:06	05:55	06:15	06:50	07:26	08:02	07:44	08:12
	17:34	18:16	19:52	20:30	21:06	21:27	21:17	20:36	19:40	18:45	17:07	17:03
23	08:07	07:28	07:38	06:43	06:05	05:55	06:16	06:51	07:27	08:04	07:45	08:13
	17:35	18:17	19:53	20:32	21:07	21:27	21:16	20:34	19:38	18:43	17:06	17:03
24	08:06	07:26	07:36	06:42	06:04	05:55	06:17	06:52	07:28	08:05	07:46	08:13
	17:37	18:18	19:55	20:33	21:08	21:27	21:15	20:32	19:36	18:41	17:05	17:04
25	08:05	07:24	07:35	06:40	06:03	05:56	06:18	06:53	07:29	08:06	07:47	08:14
	17:38	18:20	19:56	20:34	21:09	21:28	21:14	20:31	19:34	18:40	17:05	17:05
26	08:05	07:23	07:33	06:39	06:02	05:56	06:19	06:54	07:30	08:08	07:49	08:14
	17:40	18:21	19:57	20:35	21:10	21:28	21:13	20:29	19:32	18:38	17:04	17:05
27	08:04	07:21	07:31	06:37	06:02	05:56	06:20	06:55	07:31	08:09	07:50	08:14
	17:41	18:22	19:58	20:37	21:11	21:28	21:12	20:27	19:31	18:37	17:03	17:06
28	08:03	07:19	07:29	06:36	06:01	05:57	06:21	06:57	07:33	08:10	07:51	08:15
	17:42	18:24	20:00	20:38	21:12	21:28	21:11	20:26	19:29	18:35	17:03	17:07
29	08:02		07:27	06:34	06:00	05:57	06:22	06:58	07:34	08:12	07:52	08:15
	17:44		20:01	20:39	21:13	21:28	21:10	20:24	19:27	18:34	17:02	17:07
30	08:01		07:25	06:32	06:00	05:58	06:23	06:59	07:35	08:13	07:53	08:15
	17:45		20:02	20:40	21:13	21:28	21:09	20:22	19:25	18:32	17:02	17:08
31	08:00		07:23		05:59		06:24	07:00		08:14		08:15
	17:46		20:03		21:14		21:07	20:20		18:31		17:09
Potential sun hours	288	292	369	403	458	464	470	435	377	342	289	276
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
TEST license
This license is only to be used for testing purposes

Ramos, Tiffanie / tiffanie.ramos@tetratech.com
Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 51 - Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	January			February			March			April			May			June		
1	08:15			07:58		08:20 (18)	07:18		08:12 (18)	07:21			06:31			05:58		
	17:10			17:48	25	17:22 (17)	18:25	33	08:45 (18)	20:04			20:41			21:15		
2	08:16			07:57		08:19 (18)	07:16		08:13 (18)	07:20			06:29			05:58		
	17:11			17:49	31	17:23 (17)	18:26	30	08:43 (18)	20:06			20:43			21:16		
3	08:16			07:56		08:18 (18)	07:14		08:15 (18)	07:18			06:28			05:57		
	17:12			17:50	37	17:25 (17)	18:28	27	08:42 (18)	20:07			20:44			21:17		
4	08:16			07:55		08:17 (18)	07:12		08:17 (18)	07:16			06:26			05:57		
	17:13			17:52	43	17:27 (17)	18:29	22	08:39 (18)	20:08			20:45			21:18		
5	08:15			07:54		08:15 (18)	07:11		08:21 (18)	07:14			06:25			05:56		
	17:14			17:53	48	17:28 (17)	18:30	13	08:34 (18)	20:09			20:46			21:18		
6	08:15			07:52		08:14 (18)	07:09			07:12			06:24			05:56		
	17:15			17:55	51	17:29 (17)	18:32			20:11			20:47			21:19		
7	08:15			07:51		08:13 (18)	07:07			07:11			06:22			05:55		
	17:16			17:56	56	17:31 (17)	18:33			20:12			20:49			21:20		
8	08:15			07:50		08:11 (18)	08:05			07:09			06:21			05:55		
	17:17			17:57	60	17:32 (17)	18:34			20:13			20:50			21:21		
9	08:15			07:49		08:10 (18)	08:04			07:07			06:20		20:26 (11)	05:55		
	17:18			17:59	65	17:34 (17)	19:35			20:14			20:51	1	20:27 (11)	21:21		
10	08:14			07:47		08:08 (18)	08:02			07:05			06:18		20:25 (11)	05:55		
	17:19			18:00	69	17:35 (17)	19:37			20:16			20:52	3	20:28 (11)	21:22		
11	08:14			07:46		08:08 (18)	08:00			07:03			06:17		20:24 (11)	05:54		
	17:20			18:00	71	17:37 (17)	19:38			20:17			20:53	5	20:29 (11)	21:23		
12	08:14			07:44		08:08 (18)	07:58			07:02			06:16		20:24 (11)	05:54		
	17:21			18:02	74	17:39 (17)	19:39			20:18			20:54	6	20:30 (11)	21:23		
13	08:13			07:43		08:07 (18)	07:56			07:00			06:15		20:23 (11)	05:54		
	17:22			18:03	75	17:39 (17)	19:41			20:19			20:56	9	20:32 (11)	21:24		
14	08:13			07:42		08:07 (18)	07:55			06:58			06:14		20:23 (11)	05:54		
	17:24			18:04	75	17:39 (17)	19:42			20:20			20:57	10	20:33 (11)	21:24		
15	08:12			07:40		08:07 (18)	07:53			06:56			06:13		20:22 (11)	05:54		
	17:25			18:06	73	17:38 (17)	19:43			20:22			20:58	11	20:33 (11)	21:25		
16	08:12			07:39		08:07 (18)	07:51			06:55			06:11		20:21 (11)	05:54		
	17:26			18:07	71	17:37 (17)	19:44			20:23			20:59	13	20:34 (11)	21:25		
17	08:11			07:37		08:06 (18)	07:49			06:53			06:10		20:21 (11)	05:54		
	17:27			18:09	71	17:36 (17)	19:46			20:24			21:00	14	20:35 (11)	21:26		
18	08:11			07:36		08:07 (18)	07:47			06:51			06:09		20:21 (11)	05:54		
	17:29			18:10	67	17:35 (17)	19:47			20:25			21:01	15	20:36 (11)	21:26		
19	08:10			07:34		08:06 (18)	07:45			06:50			06:08		20:23 (11)	05:54		
	17:30			18:11	62	17:32 (17)	19:48			20:27			21:02	15	20:38 (11)	21:26		
20	08:09			07:32		08:06 (18)	07:44			06:48			06:07		20:23 (11)	05:54		
	17:31			18:13	57	17:29 (17)	19:49			20:28			21:03	16	20:39 (11)	21:27		
21	08:09			07:31		08:07 (18)	07:42			06:46			06:06		20:23 (11)	05:54		
	17:33			18:14	47	08:54 (18)	19:51			20:29			21:05	17	20:40 (11)	21:27		
22	08:08			07:29		08:07 (18)	07:40			06:45			06:05		20:23 (11)	05:55		
	17:34			18:15	46	08:53 (18)	19:52			20:30			21:06	17	20:40 (11)	21:27		
23	08:07			07:28		08:07 (18)	07:38			06:43			06:05		20:24 (11)	05:55		
	17:35			18:17	45	08:52 (18)	19:53			20:32			21:07	17	20:41 (11)	21:27		
24	08:06			07:26		08:08 (18)	07:36			06:41			06:04		20:24 (11)	05:55		
	17:37			18:18	44	08:52 (18)	19:54			20:33			21:08	17	20:41 (11)	21:27		
25	08:05			07:24		08:08 (18)	07:34			06:40			06:03		20:25 (11)	05:55		
	17:38			18:20	43	08:51 (18)	19:56			20:34			21:09	16	20:41 (11)	21:28		
26	08:04			07:23		08:08 (18)	07:33			06:38			06:02		20:26 (11)	05:56		
	17:39			18:21	42	08:50 (18)	19:57			20:35			21:10	14	20:40 (11)	21:28		
27	08:04			07:21		08:10 (18)	07:31			06:37			06:01		20:27 (11)	05:56		
	17:41			18:22	39	08:49 (18)	19:58			20:36			21:11	12	20:39 (11)	21:28		
28	08:03			07:19		08:11 (18)	07:29			06:35			06:01		20:29 (11)	05:57		
	17:42			18:24	36	08:47 (18)	19:59			20:38			21:12	10	20:39 (11)	21:28		
29	08:02						07:27			06:34			06:00		20:30 (11)	05:57		
	17:43						20:01			20:39			21:13	7	20:37 (11)	21:28		
30	08:01						07:25			06:32			05:59		20:32 (11)	05:58		
	17:45						20:02			20:40			21:13	2	20:34 (11)	21:28		
31	07:59		08:23 (18)				07:23						05:59					
	17:46	14	17:20 (17)				20:03						21:14					
Potential sun hours	288			292			369			403			458			464		
Total, worst case		14			1523			125						247				
Sun reduction		0.62			0.62			0.62						0.66				
Oper. time red.		0.98			0.98			0.98						0.98				
Wind dir. red.		0.72			0.71			0.75						0.74				
Total reduction		0.44			0.43			0.45						0.48				
Total, real		6			652			57						119				

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:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
TEST license
This license is only to be used for testing purposes

Ramos, Tiffanie / tiffanie.ramos@tetratech.com
Calculated:
5/24/2021 11:48 AM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker - Mast 4221Shadow receptor: 51 - Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,581

Idle start wind speed: Cut in wind speed from power curve

	July		August		September	October		November		December
1	05:58		06:25	20:34 (11)	07:01	07:36		07:16	07:38 (18)	07:54
	21:28		21:06	7 20:41 (11)	20:19	19:23		17:29	67 17:04 (17)	17:01
2	05:59		06:26	20:35 (11)	07:02	07:37		07:17	07:40 (18)	07:56
	21:27		21:05	4 20:39 (11)	20:17	19:21		17:28	64 17:04 (17)	17:01
3	05:59		06:27	20:36 (11)	07:03	07:38		07:18	07:41 (18)	07:57
	21:27		21:04	2 20:38 (11)	20:15	19:19		17:27	61 17:02 (17)	17:00
4	06:00		06:29		07:04	07:40		07:20	07:43 (18)	07:58
	21:27		21:02		20:13	19:17		17:25	57 17:01 (17)	17:00
5	06:00		06:30		07:06	07:41		07:21	07:44 (18)	07:59
	21:27		21:01		20:11	19:16		17:24	51 16:59 (17)	17:00
6	06:01		06:31		07:07	07:42		07:22	07:45 (18)	08:00
	21:26		21:00		20:09	19:14		17:23	46 16:57 (17)	17:00
7	06:02		06:32		07:08	07:43		07:24	07:47 (18)	08:01
	21:26		20:58		20:08	19:12		17:21	43 16:57 (17)	17:00
8	06:02		06:33		07:09	07:45	09:00 (18)	07:25	07:48 (18)	08:02
	21:26		20:57		20:06	19:10	7 09:07 (18)	17:20	37 16:55 (17)	17:00
9	06:03		06:34		07:10	07:46	08:54 (18)	07:26	07:50 (18)	08:03
	21:25		20:56		20:04	19:08	18 09:12 (18)	17:19	31 16:54 (17)	16:59
10	06:04		06:35		07:11	07:47	08:50 (18)	07:28	07:51 (18)	08:04
	21:25		20:54		20:02	19:07	24 09:14 (18)	17:18	24 16:52 (17)	16:59
11	06:05		06:37		07:13	07:48	08:48 (18)	07:29	07:55 (18)	08:05
	21:24		20:53		20:00	19:05	28 09:16 (18)	17:17	14 16:52 (17)	16:59
12	06:05		06:38		07:14	07:50	08:46 (18)	07:30		08:06
	21:24		20:51		19:58	19:03	32 09:18 (18)	17:16		17:00
13	06:06		06:39		07:15	07:51	08:44 (18)	07:32		08:06
	21:23		20:50		19:57	19:01	35 09:19 (18)	17:14		17:00
14	06:07	20:39 (11)	06:40		07:16	07:52	08:43 (18)	07:33		08:07
	21:23	5 20:44 (11)	20:48		19:55	18:58	37 09:20 (18)	17:13		17:00
15	06:08	20:37 (11)	06:41		07:17	07:53	08:42 (18)	07:34		08:08
	21:22	9 20:46 (11)	20:47		19:53	18:56	40 09:22 (18)	17:12		17:00
16	06:09	20:37 (11)	06:42		07:18	07:55	08:41 (18)	07:36		08:09
	21:21	11 20:48 (11)	20:45		19:51	18:54	41 09:22 (18)	17:11		17:00
17	06:10	20:36 (11)	06:43		07:20	07:56	08:39 (18)	07:37		08:09
	21:21	13 20:49 (11)	20:44		19:49	18:53	44 09:23 (18)	17:10		17:00
18	06:11	20:35 (11)	06:45		07:21	07:57	08:39 (18)	07:38		08:10
	21:20	15 20:50 (11)	20:42		19:47	18:51	45 09:24 (18)	17:10		17:01
19	06:12	20:35 (11)	06:46		07:22	07:58	08:38 (18)	07:40		08:11
	21:19	16 20:51 (11)	20:41		19:45	18:49	46 09:24 (18)	17:09		17:01
20	06:13	20:34 (11)	06:47		07:23	08:00	08:37 (18)	07:41		08:11
	21:18	18 20:52 (11)	20:39		19:43	18:48	47 09:24 (18)	17:08		17:02
21	06:14	20:33 (11)	06:48		07:24	08:01	08:37 (18)	07:42		08:12
	21:18	17 20:50 (11)	20:37		19:42	18:46	48 09:25 (18)	17:07		17:02
22	06:15	20:33 (11)	06:49		07:25	08:02	08:37 (18)	07:44		08:12
	21:17	17 20:50 (11)	20:36		19:40	18:44	58 18:01 (17)	17:06		17:03
23	06:16	20:32 (11)	06:50		07:27	08:04	08:36 (18)	07:45		08:13
	21:16	17 20:49 (11)	20:34		19:38	18:43	64 18:03 (17)	17:06		17:03
24	06:17	20:32 (11)	06:52		07:28	08:05	08:36 (18)	07:46		08:13
	21:15	16 20:48 (11)	20:32		19:36	18:41	69 18:05 (17)	17:05		17:04
25	06:18	20:32 (11)	06:53		07:29	08:06	08:36 (18)	07:47		08:14
	21:14	15 20:47 (11)	20:31		19:34	18:40	71 18:06 (17)	17:04		17:04
26	06:19	20:32 (11)	06:54		07:30	08:08	08:37 (18)	07:49		08:14
	21:13	14 20:46 (11)	20:29		19:32	18:38	72 18:07 (17)	17:04		17:05
27	06:20	20:32 (11)	06:55		07:31	08:09	08:36 (18)	07:50		08:14
	21:12	13 20:45 (11)	20:27		19:30	18:37	73 18:07 (17)	17:03		17:06
28	06:21	20:32 (11)	06:56		07:32	08:10	08:36 (18)	07:51		08:15
	21:11	12 20:44 (11)	20:26		19:28	18:35	73 18:07 (17)	17:03		17:06
29	06:22	20:32 (11)	06:57		07:34	08:12	08:37 (18)	07:52		08:15
	21:10	11 20:43 (11)	20:24		19:27	18:34	73 18:08 (17)	17:02		17:07
30	06:23	20:32 (11)	06:59		07:35	08:13	08:37 (18)	07:53		08:15
	21:08	10 20:42 (11)	20:22		19:25	18:32	72 18:07 (17)	17:02		17:08
31	06:24	20:34 (11)	07:00			08:14	08:38 (18)			08:15
	21:07	8 20:42 (11)	20:20			18:31	70 18:06 (17)			17:09
Potential sun hours	470		435		377	341		289		276
Total, worst case		237		13			1187		495	
Sun reduction		0.76		0.74			0.59		0.51	
Oper. time red.		0.98		0.98			0.98		0.98	
Wind dir. red.		0.74		0.74			0.72		0.69	
Total reduction		0.55		0.54			0.41		0.35	
Total, real		131		7			491		171	

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:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
Tetra Tech EC, Inc C/o Shin Ng
3475 E. Foothill Blvd
US-PASADENA, CA 91107
1 617 457 8405
Ted Guertin / ted.guertin@tetratech.com
Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 1 - Non-Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,582

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:15	07:58	07:17	07:21	06:31	05:58	05:58	06:25	07:01	07:36	07:15	07:54
	17:10	17:48	18:25	20:04	20:41	21:15	21:27	21:06	20:18	19:23	17:29	17:01
2	08:15	07:57	07:16	07:20	06:29	05:58	05:59	06:27	07:02	07:37	07:16	07:55
	17:11	17:49	18:26	20:05	20:42	21:15	21:27	21:04	20:16	19:21	17:28	17:01
3	08:15	07:56	07:14	07:18	06:28	05:57	05:59	06:28	07:03	07:38	07:18	07:56
	17:12	17:51	18:28	20:07	20:43	21:16	21:27	21:03	20:15	19:19	17:27	17:01
4	08:15	07:54	07:12	07:16	06:27	05:57	06:00	06:29	07:04	07:39	07:19	07:57
	17:13	17:52	18:29	20:08	20:45	21:17	21:26	21:02	20:13	19:17	17:25	17:00
5	08:15	07:53	07:10	07:14	06:25	05:56	06:01	06:30	07:06	07:41	07:20	07:58
	17:14	17:53	18:30	20:09	20:46	21:18	21:26	21:01	20:11	19:15	17:24	17:00
6	08:15	07:52	07:09	07:12	06:24	05:56	06:01	06:31	07:07	07:42	07:22	07:59
	17:15	17:55	18:31	20:10	20:47	21:19	21:26	20:59	20:09	19:14	17:23	17:00
7	08:15	07:51	07:07	07:11	06:23	05:56	06:02	06:32	07:08	07:43	07:23	08:00
	17:16	17:56	18:33	20:12	20:48	21:19	21:25	20:58	20:07	19:12	17:22	17:00
8	08:14	07:49	08:05	07:09	06:21	05:55	06:03	06:33	07:09	07:44	07:25	08:01
	17:17	17:58	18:34	20:13	20:49	21:20	21:25	20:57	20:06	19:10	17:20	17:00
9	08:14	07:48	08:03	07:07	06:20	05:55	06:03	06:34	07:10	07:46	07:26	08:02
	17:18	17:59	19:35	20:14	20:50	21:21	21:25	20:55	20:04	19:08	17:19	17:00
10	08:14	07:47	08:02	07:05	06:19	05:55	06:04	06:36	07:11	07:47	07:27	08:03
	17:19	18:00	19:37	20:15	20:52	21:21	21:24	20:54	20:02	19:06	17:18	17:00
11	08:14	07:45	08:00	07:03	06:17	05:55	06:05	06:37	07:12	07:48	07:29	08:04
	17:20	18:00	19:38	20:16	20:53	21:22	21:24	20:52	20:00	19:05	17:17	17:00
12	08:13	07:44	07:58	07:02	06:16	05:55	06:06	06:38	07:14	07:49	07:30	08:05
	17:21	18:02	19:39	20:18	20:54	21:22	21:23	20:51	19:58	19:03	17:16	17:00
13	08:13	07:43	07:56	07:00	06:15	05:54	06:07	06:39	07:15	07:50	07:31	08:06
	17:23	18:03	19:41	20:19	20:55	21:23	21:23	20:49	19:56	19:01	17:15	17:00
14	08:12	07:41	07:54	06:58	06:14	05:54	06:07	06:40	07:16	07:52	07:33	08:07
	17:24	18:05	19:42	20:20	20:56	21:24	21:22	20:48	19:54	18:58	17:14	17:00
15	08:12	07:40	07:53	06:56	06:13	05:54	06:08	06:41	07:17	07:53	07:34	08:07
	17:25	18:06	19:43	20:21	20:57	21:24	21:21	20:46	19:53	18:56	17:13	17:00
16	08:11	07:38	07:51	06:55	06:12	05:54	06:09	06:42	07:18	07:54	07:35	08:08
	17:26	18:07	19:44	20:23	20:58	21:24	21:21	20:45	19:51	18:54	17:12	17:01
17	08:11	07:37	07:49	06:53	06:11	05:54	06:10	06:44	07:19	07:56	07:37	08:09
	17:28	18:09	19:46	20:24	21:00	21:25	21:20	20:43	19:49	18:53	17:11	17:01
18	08:10	07:35	07:47	06:51	06:10	05:54	06:11	06:45	07:21	07:57	07:38	08:09
	17:29	18:10	19:47	20:25	21:01	21:25	21:19	20:42	19:47	18:51	17:10	17:01
19	08:09	07:34	07:45	06:50	06:09	05:54	06:12	06:46	07:22	07:58	07:39	08:10
	17:30	18:11	19:48	20:26	21:02	21:26	21:19	20:40	19:45	18:49	17:09	17:01
20	08:09	07:32	07:43	06:48	06:08	05:55	06:13	06:47	07:23	07:59	07:40	08:11
	17:31	18:13	19:49	20:27	21:03	21:26	21:18	20:39	19:43	18:48	17:08	17:02
21	08:08	07:30	07:42	06:46	06:07	05:55	06:14	06:48	07:24	08:01	07:42	08:11
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22	08:07	07:29	07:40	06:45	06:06	05:55	06:15	06:49	07:25	08:02	07:43	08:12
	17:34	18:16	19:52	20:30	21:05	21:26	21:16	20:35	19:40	18:44	17:07	17:03
23	08:07	07:27	07:38	06:43	06:05	05:55	06:16	06:51	07:26	08:03	07:44	08:12
	17:35	18:17	19:53	20:31	21:06	21:27	21:15	20:34	19:38	18:43	17:06	17:03
24	08:06	07:26	07:36	06:42	06:04	05:55	06:17	06:52	07:28	08:05	07:46	08:13
	17:37	18:18	19:54	20:32	21:07	21:27	21:14	20:32	19:36	18:41	17:05	17:04
25	08:05	07:24	07:34	06:40	06:03	05:56	06:18	06:53	07:29	08:06	07:47	08:13
	17:38	18:20	19:56	20:34	21:08	21:27	21:13	20:30	19:34	18:40	17:04	17:05
26	08:04	07:22	07:32	06:38	06:02	05:56	06:19	06:54	07:30	08:07	07:48	08:13
	17:39	18:21	19:57	20:35	21:09	21:27	21:12	20:29	19:32	18:38	17:04	17:05
27	08:03	07:21	07:31	06:37	06:02	05:57	06:20	06:55	07:31	08:08	07:49	08:14
	17:41	18:22	19:58	20:36	21:10	21:27	21:11	20:27	19:30	18:37	17:03	17:06
28	08:02	07:19	07:29	06:35	06:01	05:57	06:21	06:56	07:32	08:10	07:50	08:14
	17:42	18:24	19:59	20:37	21:11	21:27	21:10	20:25	19:28	18:35	17:03	17:07
29	08:01		07:27	06:34	06:00	05:57	06:22	06:57	07:33	08:11	07:52	08:14
	17:44		20:00	20:38	21:12	21:27	21:09	20:23	19:26	18:34	17:02	17:07
30	08:00		07:25	06:32	06:00	05:58	06:23	06:59	07:35	08:12	07:53	08:14
	17:45		20:02	20:40	21:13	21:27	21:08	20:22	19:25	18:32	17:02	17:08
31	07:59		07:23		05:59		06:24	07:00		08:14		08:15
	17:46		20:03		21:14		21:07	20:20		18:31		17:09
Potential sun hours	288	292	369	403	457	464	470	435	377	342	290	277
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

Day in month	Sun rise (hh:mm)		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:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
Tetra Tech EC, Inc C/o Shin Ng
3475 E. Foothill Blvd
US-PASADENA, CA 91107
1 617 457 8405
Ted Guertin / ted.guertin@tetratech.com
Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 2 - Non-Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,582

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:15	07:58	07:17	07:21	06:31	05:58	05:58	06:25	07:01	07:36	07:15	07:54
	17:10	17:48	18:25	20:04	20:41	21:15	21:27	21:06	20:18	19:23	17:29	17:01
2	08:15	07:57	07:16	07:20	06:29	05:58	05:59	06:27	07:02	07:37	07:16	07:55
	17:11	17:49	18:26	20:05	20:42	21:15	21:27	21:04	20:16	19:21	17:28	17:01
3	08:15	07:56	07:14	07:18	06:28	05:57	05:59	06:28	07:03	07:38	07:18	07:56
	17:12	17:51	18:28	20:07	20:43	21:16	21:27	21:03	20:15	19:19	17:27	17:01
4	08:15	07:54	07:12	07:16	06:27	05:57	06:00	06:29	07:04	07:39	07:19	07:57
	17:13	17:52	18:29	20:08	20:45	21:17	21:26	21:02	20:13	19:17	17:25	17:00
5	08:15	07:53	07:10	07:14	06:25	05:56	06:01	06:30	07:06	07:41	07:20	07:58
	17:14	17:53	18:30	20:09	20:46	21:18	21:26	21:01	20:11	19:15	17:24	17:00
6	08:15	07:52	07:09	07:12	06:24	05:56	06:01	06:31	07:07	07:42	07:22	07:59
	17:15	17:55	18:31	20:10	20:47	21:19	21:26	20:59	20:09	19:14	17:23	17:00
7	08:15	07:51	07:07	07:11	06:23	05:56	06:02	06:32	07:08	07:43	07:23	08:00
	17:16	17:56	18:33	20:12	20:48	21:19	21:25	20:58	20:07	19:12	17:22	17:00
8	08:14	07:49	08:05	07:09	06:21	05:55	06:03	06:33	07:09	07:44	07:25	08:01
	17:17	17:58	18:34	20:13	20:49	21:20	21:25	20:57	20:06	19:10	17:20	17:00
9	08:14	07:48	08:03	07:07	06:20	05:55	06:03	06:34	07:10	07:46	07:26	08:02
	17:18	17:59	19:35	20:14	20:50	21:21	21:25	20:55	20:04	19:08	17:19	17:00
10	08:14	07:47	08:02	07:05	06:19	05:55	06:04	06:36	07:11	07:47	07:27	08:03
	17:19	18:00	19:37	20:15	20:52	21:21	21:24	20:54	20:02	19:06	17:18	17:00
11	08:14	07:45	08:00	07:03	06:17	05:55	06:05	06:37	07:12	07:48	07:29	08:04
	17:20	18:00	19:38	20:16	20:53	21:22	21:24	20:52	20:00	19:05	17:17	17:00
12	08:13	07:44	07:58	07:02	06:16	05:55	06:06	06:38	07:14	07:49	07:30	08:05
	17:21	18:02	19:39	20:18	20:54	21:22	21:23	20:51	19:58	19:03	17:16	17:00
13	08:13	07:43	07:56	07:00	06:15	05:54	06:07	06:39	07:15	07:50	07:31	08:06
	17:23	18:03	19:41	20:19	20:55	21:23	21:23	20:49	19:56	19:01	17:15	17:00
14	08:12	07:41	07:54	06:58	06:14	05:54	06:07	06:40	07:16	07:52	07:33	08:07
	17:24	18:05	19:42	20:20	20:56	21:24	21:22	20:48	19:54	18:58	17:14	17:00
15	08:12	07:40	07:53	06:56	06:13	05:54	06:08	06:41	07:17	07:53	07:34	08:07
	17:25	18:06	19:43	20:21	20:57	21:24	21:21	20:46	19:53	18:56	17:13	17:00
16	08:11	07:38	07:51	06:55	06:12	05:54	06:09	06:42	07:18	07:54	07:35	08:08
	17:26	18:07	19:44	20:23	20:58	21:24	21:21	20:45	19:51	18:54	17:12	17:01
17	08:11	07:37	07:49	06:53	06:11	05:54	06:10	06:44	07:19	07:56	07:37	08:09
	17:28	18:09	19:46	20:24	21:00	21:25	21:20	20:43	19:49	18:53	17:11	17:01
18	08:10	07:35	07:47	06:51	06:10	05:54	06:11	06:45	07:21	07:57	07:38	08:09
	17:29	18:10	19:47	20:25	21:01	21:25	21:19	20:42	19:47	18:51	17:10	17:01
19	08:09	07:34	07:45	06:50	06:09	05:54	06:12	06:46	07:22	07:58	07:39	08:10
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20	08:09	07:32	07:43	06:48	06:08	05:55	06:13	06:47	07:23	07:59	07:40	08:11
	17:31	18:13	19:49	20:27	21:03	21:26	21:18	20:39	19:43	18:48	17:08	17:02
21	08:08	07:30	07:42	06:46	06:07	05:55	06:14	06:48	07:24	08:01	07:42	08:11
	17:33	18:14	19:51	20:29	21:04	21:26	21:17	20:37	19:41	18:46	17:07	17:02
22	08:07	07:29	07:40	06:45	06:06	05:55	06:15	06:49	07:25	08:02	07:43	08:12
	17:34	18:16	19:52	20:30	21:05	21:26	21:16	20:35	19:40	18:44	17:07	17:03
23	08:07	07:27	07:38	06:43	06:05	05:55	06:16	06:51	07:26	08:03	07:44	08:12
	17:35	18:17	19:53	20:31	21:06	21:27	21:15	20:34	19:38	18:43	17:06	17:03
24	08:06	07:26	07:36	06:42	06:04	05:55	06:17	06:52	07:28	08:05	07:46	08:13
	17:37	18:18	19:54	20:32	21:07	21:27	21:14	20:32	19:36	18:41	17:05	17:04
25	08:05	07:24	07:34	06:40	06:03	05:56	06:18	06:53	07:29	08:06	07:47	08:13
	17:38	18:20	19:56	20:34	21:08	21:27	21:13	20:30	19:34	18:40	17:04	17:05
26	08:04	07:22	07:32	06:38	06:02	05:56	06:19	06:54	07:30	08:07	07:48	08:13
	17:39	18:21	19:57	20:35	21:09	21:27	21:12	20:29	19:32	18:38	17:04	17:05
27	08:03	07:21	07:31	06:37	06:02	05:57	06:20	06:55	07:31	08:08	07:49	08:14
	17:41	18:22	19:58	20:36	21:10	21:27	21:11	20:27	19:30	18:37	17:03	17:06
28	08:02	07:19	07:29	06:35	06:01	05:57	06:21	06:56	07:32	08:10	07:50	08:14
	17:42	18:24	19:59	20:37	21:11	21:27	21:10	20:25	19:28	18:35	17:03	17:07
29	08:01		07:27	06:34	06:00	05:57	06:22	06:57	07:33	08:11	07:52	08:14
	17:44		20:00	20:38	21:12	21:27	21:09	20:23	19:26	18:34	17:02	17:07
30	08:00		07:25	06:32	06:00	05:58	06:23	06:59	07:35	08:12	07:53	08:15
	17:45		20:02	20:40	21:13	21:27	21:08	20:22	19:25	18:32	17:02	17:08
31	07:59		07:23		05:59		06:24	07:00		08:14		08:15
	17:46		20:03		21:14		21:07	20:20		18:31		17:09
Potential sun hours	288	292	369	403	457	464	470	435	377	342	290	277
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
Tetra Tech EC, Inc C/o Shin Ng
3475 E. Foothill Blvd
US-PASADENA, CA 91107
1 617 457 8405
Ted Guertin / ted.guertin@tetratech.com
Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 3 - Non-Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,582

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:15	07:58	07:17	07:21	06:31	05:58	05:58	06:25	07:01	07:36	07:15	07:54
	17:10	17:48	18:25	20:04	20:41	21:15	21:27	21:06	20:18	19:23	17:29	17:01
2	08:15	07:57	07:16	07:20	06:29	05:58	05:59	06:27	07:02	07:37	07:16	07:55
	17:11	17:49	18:26	20:05	20:42	21:15	21:27	21:04	20:16	19:21	17:28	17:01
3	08:15	07:56	07:14	07:18	06:28	05:57	05:59	06:28	07:03	07:38	07:18	07:56
	17:12	17:51	18:28	20:07	20:43	21:16	21:27	21:03	20:15	19:19	17:27	17:01
4	08:15	07:54	07:12	07:16	06:27	05:57	06:00	06:29	07:04	07:39	07:19	07:57
	17:13	17:52	18:29	20:08	20:45	21:17	21:26	21:02	20:13	19:17	17:25	17:00
5	08:15	07:53	07:10	07:14	06:25	05:56	06:01	06:30	07:06	07:41	07:21	07:58
	17:14	17:53	18:30	20:09	20:46	21:18	21:26	21:01	20:11	19:15	17:24	17:00
6	08:15	07:52	07:09	07:12	06:24	05:56	06:01	06:31	07:07	07:42	07:22	07:59
	17:15	17:55	18:31	20:10	20:47	21:19	21:26	20:59	20:09	19:14	17:23	17:00
7	08:15	07:51	07:07	07:11	06:23	05:56	06:02	06:32	07:08	07:43	07:23	08:00
	17:16	17:56	18:33	20:12	20:48	21:19	21:26	20:58	20:07	19:12	17:22	17:00
8	08:14	07:49	08:05	07:09	06:21	05:55	06:03	06:33	07:09	07:44	07:25	08:01
	17:17	17:58	18:34	20:13	20:49	21:20	21:25	20:57	20:06	19:10	17:20	17:00
9	08:14	07:48	08:03	07:07	06:20	05:55	06:03	06:34	07:10	07:46	07:26	08:02
	17:18	17:59	19:35	20:14	20:50	21:21	21:25	20:55	20:04	19:08	17:19	17:00
10	08:14	07:47	08:02	07:05	06:19	05:55	06:04	06:36	07:11	07:47	07:27	08:03
	17:19	18:00	19:37	20:15	20:52	21:21	21:24	20:54	20:02	19:06	17:18	17:00
11	08:14	07:45	08:00	07:03	06:17	05:55	06:05	06:37	07:12	07:48	07:29	08:04
	17:20	18:00	19:38	20:16	20:53	21:22	21:24	20:52	20:00	19:05	17:17	17:00
12	08:13	07:44	07:58	07:02	06:16	05:54	06:06	06:38	07:14	07:49	07:30	08:05
	17:21	18:02	19:39	20:18	20:54	21:23	21:23	20:51	19:58	19:03	17:16	17:00
13	08:13	07:43	07:56	07:00	06:15	05:54	06:07	06:39	07:15	07:51	07:31	08:06
	17:23	18:03	19:41	20:19	20:55	21:23	21:23	20:49	19:56	19:01	17:15	17:00
14	08:12	07:41	07:54	06:58	06:14	05:54	06:07	06:40	07:16	07:52	07:33	08:07
	17:24	18:05	19:42	20:20	20:56	21:24	21:22	20:48	19:54	18:58	17:14	17:00
15	08:12	07:40	07:53	06:57	06:13	05:54	06:08	06:41	07:17	07:53	07:34	08:07
	17:25	18:06	19:43	20:21	20:57	21:24	21:22	20:46	19:53	18:56	17:13	17:00
16	08:11	07:38	07:51	06:55	06:12	05:54	06:09	06:42	07:18	07:54	07:35	08:08
	17:26	18:07	19:44	20:23	20:59	21:25	21:21	20:45	19:51	18:54	17:12	17:00
17	08:11	07:37	07:49	06:53	06:11	05:54	06:10	06:44	07:19	07:56	07:37	08:09
	17:28	18:09	19:46	20:24	21:00	21:25	21:20	20:43	19:49	18:53	17:11	17:01
18	08:10	07:35	07:47	06:51	06:10	05:54	06:11	06:45	07:21	07:57	07:38	08:09
	17:29	18:10	19:47	20:25	21:01	21:25	21:19	20:42	19:47	18:51	17:10	17:01
19	08:10	07:34	07:45	06:50	06:08	05:54	06:12	06:46	07:22	07:58	07:39	08:10
	17:30	18:11	19:48	20:26	21:02	21:26	21:19	20:40	19:45	18:49	17:09	17:01
20	08:09	07:32	07:43	06:48	06:08	05:55	06:13	06:47	07:23	07:59	07:40	08:11
	17:31	18:13	19:49	20:28	21:03	21:26	21:18	20:39	19:43	18:48	17:08	17:02
21	08:08	07:31	07:42	06:46	06:07	05:55	06:14	06:48	07:24	08:01	07:42	08:11
	17:33	18:14	19:51	20:29	21:04	21:26	21:17	20:37	19:41	18:46	17:07	17:02
22	08:07	07:29	07:40	06:45	06:06	05:55	06:15	06:49	07:25	08:02	07:43	08:12
	17:34	18:16	19:52	20:30	21:05	21:26	21:16	20:35	19:40	18:44	17:07	17:03
23	08:07	07:27	07:38	06:43	06:05	05:55	06:16	06:51	07:26	08:03	07:44	08:12
	17:35	18:17	19:53	20:31	21:06	21:27	21:15	20:34	19:38	18:43	17:06	17:03
24	08:06	07:26	07:36	06:42	06:04	05:55	06:17	06:52	07:28	08:05	07:46	08:13
	17:37	18:18	19:54	20:32	21:07	21:27	21:14	20:32	19:36	18:41	17:05	17:04
25	08:05	07:24	07:34	06:40	06:03	05:56	06:18	06:53	07:29	08:06	07:47	08:13
	17:38	18:20	19:56	20:34	21:08	21:27	21:13	20:30	19:34	18:40	17:04	17:05
26	08:04	07:22	07:32	06:38	06:02	05:56	06:19	06:54	07:30	08:07	07:48	08:14
	17:39	18:21	19:57	20:35	21:09	21:27	21:12	20:29	19:32	18:38	17:04	17:05
27	08:03	07:21	07:31	06:37	06:02	05:56	06:20	06:55	07:31	08:09	07:49	08:14
	17:41	18:22	19:58	20:36	21:10	21:27	21:11	20:27	19:30	18:37	17:03	17:06
28	08:02	07:19	07:29	06:35	06:01	05:57	06:21	06:56	07:32	08:10	07:50	08:14
	17:42	18:24	19:59	20:37	21:11	21:27	21:10	20:25	19:28	18:35	17:03	17:07
29	08:01		07:27	06:34	06:00	05:57	06:22	06:57	07:33	08:11	07:52	08:14
	17:44		20:01	20:38	21:12	21:27	21:09	20:23	19:26	18:34	17:02	17:07
30	08:00		07:25	06:32	06:00	05:58	06:23	06:59	07:35	08:12	07:53	08:15
	17:45		20:02	20:40	21:13	21:27	21:08	20:22	19:25	18:32	17:02	17:08
31	07:59		07:23		05:59		06:24	07:00		08:14		08:15
	17:46		20:03		21:14		21:07	20:20		18:31		17:09
Potential sun hours	288	292	369	403	457	464	470	435	377	342	289	277
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
Tetra Tech EC, Inc C/o Shin Ng
3475 E. Foothill Blvd
US-PASADENA, CA 91107
1 617 457 8405
Ted Guertin / ted.guertin@tetratech.com
Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 4 - Non-Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,582

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:15	07:58	07:17	07:21	06:31	05:58	05:58	06:25	07:01	07:36	07:15	07:54
	17:10	17:48	18:25	20:04	20:41	21:15	21:27	21:06	20:18	19:23	17:29	17:01
2	08:15	07:57	07:16	07:20	06:29	05:58	05:59	06:27	07:02	07:37	07:16	07:55
	17:11	17:49	18:26	20:05	20:42	21:15	21:27	21:04	20:16	19:21	17:28	17:01
3	08:15	07:56	07:14	07:18	06:28	05:57	05:59	06:28	07:03	07:38	07:18	07:56
	17:12	17:51	18:28	20:07	20:43	21:16	21:27	21:03	20:15	19:19	17:27	17:01
4	08:15	07:54	07:12	07:16	06:27	05:57	06:00	06:29	07:04	07:39	07:19	07:57
	17:13	17:52	18:29	20:08	20:45	21:17	21:26	21:02	20:13	19:17	17:25	17:00
5	08:15	07:53	07:10	07:14	06:25	05:56	06:01	06:30	07:06	07:41	07:21	07:58
	17:14	17:53	18:30	20:09	20:46	21:18	21:26	21:01	20:11	19:15	17:24	17:00
6	08:15	07:52	07:09	07:12	06:24	05:56	06:01	06:31	07:07	07:42	07:22	07:59
	17:15	17:55	18:31	20:10	20:47	21:19	21:26	20:59	20:09	19:14	17:23	17:00
7	08:15	07:51	07:07	07:11	06:23	05:56	06:02	06:32	07:08	07:43	07:23	08:00
	17:16	17:56	18:33	20:12	20:48	21:19	21:26	20:58	20:07	19:12	17:22	17:00
8	08:14	07:49	08:05	07:09	06:21	05:55	06:03	06:33	07:09	07:44	07:25	08:01
	17:17	17:58	18:34	20:13	20:49	21:20	21:25	20:57	20:06	19:10	17:20	17:00
9	08:14	07:48	08:03	07:07	06:20	05:55	06:03	06:34	07:10	07:46	07:26	08:02
	17:18	17:59	19:35	20:14	20:50	21:21	21:25	20:55	20:04	19:08	17:19	17:00
10	08:14	07:47	08:02	07:05	06:19	05:55	06:04	06:36	07:11	07:47	07:27	08:03
	17:19	18:00	19:37	20:15	20:52	21:21	21:24	20:54	20:02	19:06	17:18	17:00
11	08:14	07:45	08:00	07:03	06:17	05:55	06:05	06:37	07:12	07:48	07:29	08:04
	17:20	18:00	19:38	20:16	20:53	21:22	21:24	20:52	20:00	19:05	17:17	17:00
12	08:13	07:44	07:58	07:02	06:16	05:54	06:06	06:38	07:14	07:49	07:30	08:05
	17:21	18:02	19:39	20:18	20:54	21:23	21:23	20:51	19:58	19:03	17:16	17:00
13	08:13	07:43	07:56	07:00	06:15	05:54	06:07	06:39	07:15	07:51	07:31	08:06
	17:23	18:03	19:41	20:19	20:55	21:23	21:23	20:49	19:56	19:01	17:15	17:00
14	08:12	07:41	07:54	06:58	06:14	05:54	06:07	06:40	07:16	07:52	07:33	08:07
	17:24	18:05	19:42	20:20	20:56	21:24	21:22	20:48	19:54	18:58	17:14	17:00
15	08:12	07:40	07:53	06:56	06:13	05:54	06:08	06:41	07:17	07:53	07:34	08:07
	17:25	18:06	19:43	20:21	20:57	21:24	21:22	20:46	19:53	18:56	17:13	17:00
16	08:11	07:38	07:51	06:55	06:12	05:54	06:09	06:42	07:18	07:54	07:35	08:08
	17:26	18:07	19:44	20:23	20:59	21:25	21:21	20:45	19:51	18:54	17:12	17:00
17	08:11	07:37	07:49	06:53	06:11	05:54	06:10	06:44	07:19	07:56	07:37	08:09
	17:28	18:09	19:46	20:24	21:00	21:25	21:20	20:43	19:49	18:53	17:11	17:01
18	08:10	07:35	07:47	06:51	06:10	05:54	06:11	06:45	07:21	07:57	07:38	08:09
	17:29	18:10	19:47	20:25	21:01	21:25	21:19	20:42	19:47	18:51	17:10	17:01
19	08:10	07:34	07:45	06:50	06:08	05:54	06:12	06:46	07:22	07:58	07:39	08:10
	17:30	18:11	19:48	20:26	21:02	21:26	21:19	20:40	19:45	18:49	17:09	17:01
20	08:09	07:32	07:43	06:48	06:08	05:55	06:13	06:47	07:23	07:59	07:40	08:11
	17:31	18:13	19:49	20:28	21:03	21:26	21:18	20:39	19:43	18:48	17:08	17:02
21	08:08	07:31	07:42	06:46	06:07	05:55	06:14	06:48	07:24	08:01	07:42	08:11
	17:33	18:14	19:51	20:29	21:04	21:26	21:17	20:37	19:41	18:46	17:07	17:02
22	08:07	07:29	07:40	06:45	06:06	05:55	06:15	06:49	07:25	08:02	07:43	08:12
	17:34	18:16	19:52	20:30	21:05	21:26	21:16	20:35	19:40	18:44	17:07	17:03
23	08:07	07:27	07:38	06:43	06:05	05:55	06:16	06:51	07:26	08:03	07:44	08:12
	17:35	18:17	19:53	20:31	21:06	21:27	21:15	20:34	19:38	18:43	17:06	17:03
24	08:06	07:26	07:36	06:42	06:04	05:55	06:17	06:52	07:28	08:05	07:46	08:13
	17:37	18:18	19:54	20:32	21:07	21:27	21:14	20:32	19:36	18:41	17:05	17:04
25	08:05	07:24	07:34	06:40	06:03	05:56	06:18	06:53	07:29	08:06	07:47	08:13
	17:38	18:20	19:56	20:34	21:08	21:27	21:13	20:30	19:34	18:40	17:04	17:05
26	08:04	07:22	07:32	06:38	06:02	05:56	06:19	06:54	07:30	08:07	07:48	08:14
	17:39	18:21	19:57	20:35	21:09	21:27	21:12	20:29	19:32	18:38	17:04	17:05
27	08:03	07:21	07:31	06:37	06:02	05:56	06:20	06:55	07:31	08:09	07:49	08:14
	17:41	18:22	19:58	20:36	21:10	21:27	21:11	20:27	19:30	18:37	17:03	17:06
28	08:02	07:19	07:29	06:35	06:01	05:57	06:21	06:56	07:32	08:10	07:50	08:14
	17:42	18:24	19:59	20:37	21:11	21:27	21:10	20:25	19:28	18:35	17:03	17:07
29	08:01		07:27	06:34	06:00	05:57	06:22	06:57	07:33	08:11	07:52	08:14
	17:44		20:01	20:38	21:12	21:27	21:09	20:23	19:26	18:34	17:02	17:07
30	08:00		07:25	06:32	06:00	05:58	06:23	06:59	07:35	08:12	07:53	08:15
	17:45		20:02	20:40	21:13	21:27	21:08	20:22	19:25	18:32	17:02	17:08
31	07:59		07:23		05:59		06:24	07:00		08:14		08:15
	17:46		20:03		21:14		21:07	20:20		18:31		17:09
Potential sun hours	288	292	369	403	457	464	470	435	377	342	289	277
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
Tetra Tech EC, Inc C/o Shin Ng
3475 E. Foothill Blvd
US-PASADENA, CA 91107
1 617 457 8405
Ted Guertin / ted.guertin@tetratech.com

Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 5 - Non-Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,582

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May		June		July		August	September	October	November	December
1	08:15	07:58	07:17	07:21	06:31		05:58	06:21 (41)	05:58	06:28 (41)	06:25	07:01	07:36	07:15	07:54
	17:10	17:48	18:25	20:04	20:41		21:15	19 06:40 (41)	21:27	15 06:43 (41)	21:06	20:18	19:23	17:29	17:01
2	08:15	07:57	07:16	07:20	06:29		05:58	06:21 (41)	05:59	06:28 (41)	06:26	07:02	07:37	07:17	07:55
	17:11	17:49	18:26	20:05	20:42		21:16	20 06:41 (41)	21:27	16 06:44 (41)	21:05	20:16	19:21	17:28	17:01
3	08:15	07:56	07:14	07:18	06:28		05:57	06:20 (41)	05:59	06:28 (41)	06:27	07:03	07:38	07:18	07:56
	17:12	17:50	18:27	20:07	20:43		21:16	20 06:40 (41)	21:27	16 06:44 (41)	21:03	20:15	19:19	17:27	17:01
4	08:15	07:55	07:12	07:16	06:26		05:57	06:20 (41)	06:00	06:28 (41)	06:29	07:04	07:39	07:19	07:57
	17:13	17:52	18:29	20:08	20:45		21:17	20 06:40 (41)	21:27	17 06:45 (41)	21:02	20:13	19:17	17:25	17:00
5	08:15	07:53	07:10	07:14	06:25		05:56	06:21 (41)	06:00	06:28 (41)	06:30	07:06	07:41	07:21	07:58
	17:14	17:53	18:30	20:09	20:46		21:18	20 06:41 (41)	21:26	18 06:46 (41)	21:01	20:11	19:15	17:24	17:00
6	08:15	07:52	07:09	07:12	06:24		05:56	06:21 (41)	06:01	06:27 (41)	06:31	07:07	07:42	07:22	08:00
	17:15	17:55	18:31	20:10	20:47		21:19	19 06:40 (41)	21:26	19 06:46 (41)	20:59	20:09	19:14	17:23	17:00
7	08:15	07:51	07:07	07:10	06:22		05:55	06:22 (41)	06:02	06:28 (41)	06:32	07:08	07:43	07:23	08:01
	17:16	17:56	18:33	20:12	20:48		21:20	18 06:40 (41)	21:26	19 06:47 (41)	20:58	20:07	19:12	17:21	17:00
8	08:15	07:50	08:05	07:09	06:21		05:55	06:23 (41)	06:03	06:28 (41)	06:33	07:09	07:44	07:25	08:02
	17:17	17:57	18:34	20:13	20:49		21:20	17 06:40 (41)	21:25	19 06:47 (41)	20:57	20:06	19:10	17:20	17:00
9	08:14	07:48	08:03	07:07	06:20		05:55	06:23 (41)	06:03	06:27 (41)	06:34	07:10	07:46	07:26	08:02
	17:18	17:59	19:35	20:14	20:51		21:21	17 06:40 (41)	21:25	20 06:47 (41)	20:55	20:04	19:08	17:19	17:00
10	08:14	07:47	08:02	07:05	06:18		05:55	06:23 (41)	06:04	06:28 (41)	06:35	07:11	07:47	07:27	08:03
	17:19	18:00	19:37	20:15	20:52		21:22	16 06:39 (41)	21:25	20 06:48 (41)	20:54	20:02	19:06	17:18	16:59
11	08:14	07:45	08:00	07:03	06:17		05:54	06:24 (41)	06:05	06:29 (41)	06:37	07:12	07:48	07:29	08:04
	17:20	18:00	19:38	20:17	20:53		21:22	15 06:39 (41)	21:24	19 06:48 (41)	20:53	20:00	19:05	17:17	17:00
12	08:13	07:44	07:58	07:02	06:16		05:54	06:24 (41)	06:06	06:30 (41)	06:38	07:14	07:49	07:30	08:05
	17:21	18:02	19:39	20:18	20:54		21:23	15 06:39 (41)	21:24	19 06:49 (41)	20:51	19:58	19:03	17:16	17:00
13	08:13	07:43	07:56	07:00	06:15		05:54	06:25 (41)	06:06	06:30 (41)	06:39	07:15	07:51	07:31	08:06
	17:22	18:03	19:40	20:19	20:55		21:23	14 06:39 (41)	21:23	18 06:48 (41)	20:50	19:56	19:01	17:14	17:00
14	08:13	07:41	07:54	06:58	06:14		05:54	06:25 (41)	06:07	06:31 (41)	06:40	07:16	07:52	07:33	08:07
	17:24	18:04	19:42	20:20	20:56		21:24	14 06:39 (41)	21:22	18 06:49 (41)	20:48	19:55	18:58	17:13	17:00
15	08:12	07:40	07:53	06:56	06:13		05:54	06:26 (41)	06:08	06:32 (41)	06:41	07:17	07:53	07:34	08:08
	17:25	18:06	19:43	20:21	20:58		21:24	13 06:39 (41)	21:22	17 06:49 (41)	20:47	19:53	18:56	17:12	17:00
16	08:12	07:38	07:51	06:55	06:11	06:33 (41)	05:54	06:26 (41)	06:09	06:33 (41)	06:42	07:18	07:54	07:35	08:08
	17:26	18:07	19:44	20:23	20:59	1 06:34 (41)	21:25	13 06:39 (41)	21:21	17 06:50 (41)	20:45	19:51	18:54	17:11	17:00
17	08:11	07:37	07:49	06:53	06:10	06:32 (41)	05:54	06:27 (41)	06:10	06:34 (41)	06:43	07:19	07:56	07:37	08:09
	17:27	18:09	19:46	20:24	21:00	4 06:36 (41)	21:25	12 06:39 (41)	21:20	16 06:50 (41)	20:43	19:49	18:53	17:11	17:01
18	08:10	07:35	07:47	06:51	06:09	06:31 (41)	05:54	06:27 (41)	06:11	06:35 (41)	06:45	07:21	07:57	07:38	08:10
	17:29	18:10	19:47	20:25	21:01	6 06:37 (41)	21:25	12 06:39 (41)	21:20	15 06:50 (41)	20:42	19:47	18:51	17:10	17:01
19	08:10	07:34	07:45	06:50	06:08	06:31 (41)	05:54	06:27 (41)	06:12	06:36 (41)	06:46	07:22	07:58	07:39	08:10
	17:30	18:11	19:48	20:26	21:02	7 06:38 (41)	21:26	12 06:39 (41)	21:19	14 06:50 (41)	20:40	19:45	18:49	17:09	17:01
20	08:09	07:32	07:43	06:48	06:07	06:30 (41)	05:54	06:27 (41)	06:13	06:37 (41)	06:47	07:23	07:59	07:41	08:11
	17:31	18:13	19:49	20:28	21:03	9 06:39 (41)	21:26	12 06:39 (41)	21:18	13 06:50 (41)	20:39	19:43	18:48	17:08	17:02
21	08:08	07:31	07:42	06:46	06:06	06:29 (41)	05:54	06:28 (41)	06:14	06:37 (41)	06:48	07:24	08:01	07:42	08:11
	17:33	18:14	19:51	20:29	21:04	10 06:39 (41)	21:26	12 06:40 (41)	21:17	12 06:49 (41)	20:37	19:41	18:46	17:07	17:02
22	08:08	07:29	07:40	06:45	06:05	06:28 (41)	05:55	06:28 (41)	06:15	06:38 (41)	06:49	07:25	08:02	07:43	08:12
	17:34	18:15	19:52	20:30	21:05	11 06:39 (41)	21:27	12 06:40 (41)	21:16	11 06:49 (41)	20:35	19:40	18:44	17:06	17:03
23	08:07	07:27	07:38	06:43	06:05	06:27 (41)	05:55	06:28 (41)	06:16	06:39 (41)	06:50	07:26	08:03	07:44	08:12
	17:35	18:17	19:53	20:31	21:06	13 06:40 (41)	21:27	12 06:40 (41)	21:15	10 06:49 (41)	20:34	19:38	18:43	17:06	17:03
24	08:06	07:26	07:36	06:41	06:04	06:26 (41)	05:55	06:28 (41)	06:17	06:40 (41)	06:52	07:28	08:05	07:46	08:13
	17:37	18:18	19:54	20:32	21:07	14 06:40 (41)	21:27	12 06:40 (41)	21:14	8 06:48 (41)	20:32	19:36	18:41	17:05	17:04
25	08:05	07:24	07:34	06:40	06:03	06:26 (41)	05:56	06:29 (41)	06:18	06:41 (41)	06:53	07:29	08:06	07:47	08:13
	17:38	18:19	19:56	20:34	21:08	15 06:41 (41)	21:27	12 06:41 (41)	21:13	7 06:48 (41)	20:30	19:34	18:40	17:04	17:04
26	08:04	07:22	07:32	06:38	06:02	06:25 (41)	05:56	06:28 (41)	06:19	06:42 (41)	06:54	07:30	08:07	07:48	08:14
	17:39	18:21	19:57	20:35	21:09	15 06:40 (41)	21:27	13 06:41 (41)	21:12	5 06:47 (41)	20:29	19:32	18:38	17:04	17:05
27	08:03	07:21	07:31	06:37	06:01	06:24 (41)	05:56	06:29 (41)	06:20	06:43 (41)	06:55	07:31	08:09	07:49	08:14
	17:41	18:22	19:58	20:36	21:10	16 06:40 (41)	21:27	13 06:42 (41)	21:11	3 06:46 (41)	20:27	19:30	18:37	17:03	17:06
28	08:02	07:19	07:29	06:35	06:01	06:24 (41)	05:57	06:29 (41)	06:21		06:56	07:32	08:10	07:51	08:14
	17:42	18:24	19:59	20:37	21:11	17 06:41 (41)	21:27	13 06:42 (41)	21:10		20:25	19:28	18:35	17:03	17:06
29	08:01		07:27	06:34	06:00	06:23 (41)	05:57	06:28 (41)	06:22		06:57	07:33	08:11	07:52	08:15
	17:43		20:01	20:39	21:12	18 06:41 (41)	21:27	14 06:42 (41)	21:09		20:24	19:26	18:34	17:02	17:07
30	08:00		07:25	06:32	05:59	06:22 (41)	05:58	06:29 (41)	06:23		06:59	07:35	08:13	07:53	08:15
	17:45		20:02	20:40	21:13	18 06:40 (41)	21:27	14 06:43 (41)	21:08		20:22	19:25	18:32	17:02	17:08
31	07:59		07:23		05:59	06:22 (41)			06:24		07:00		08:14		08:15
	17:46		20:03		21:14	19 06:41 (41)			21:07		20:20		18:31		17:09
Potential sun hours	288	292	369	403	458		464		470		435	377	342	289	276
Total, worst case					193		445		401						
Sun reduction					0.66		0.69		0.76						
Oper. time red.					0.98		0.98		0.98						
Wind dir. red.					0.58		0.58		0.58						
Total reduction					0.37		0.39		0.43						
Total, real					72		174		173						

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:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
Tetra Tech EC, Inc C/o Shin Ng
3475 E. Foothill Blvd
US-PASADENA, CA 91107
1 617 457 8405
Ted Guertin / ted.guertin@tetratech.com

Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 6 - Non-Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,582

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:15	07:58	07:17	07:21	06:31	05:58	05:58	06:25	07:01	07:36	07:15	07:54
	17:10	17:47	18:25	20:04	20:41	21:15	21:27	21:06	20:18	19:23	17:29	17:01
2	08:15	07:57	07:15	07:19	06:29	05:57	05:58	06:26	07:02	07:37	07:16	07:55
	17:11	17:49	18:26	20:05	20:42	21:15	21:27	21:04	20:16	19:21	17:28	17:01
3	08:15	07:55	07:14	07:18	06:28	05:57	05:59	06:27	07:03	07:38	07:18	07:56
	17:12	17:50	18:27	20:06	20:43	21:16	21:27	21:03	20:14	19:19	17:26	17:00
4	08:15	07:54	07:12	07:16	06:26	05:56	06:00	06:28	07:04	07:39	07:19	07:57
	17:12	17:52	18:29	20:08	20:44	21:17	21:26	21:02	20:13	19:17	17:25	17:00
5	08:15	07:53	07:10	07:14	06:25	05:56	06:00	06:30	07:05	07:40	07:20	07:58
	17:13	17:53	18:30	20:09	20:46	21:18	21:26	21:01	20:11	19:15	17:24	17:00
6	08:15	07:52	07:09	07:12	06:24	05:56	06:01	06:31	07:06	07:42	07:22	07:59
	17:14	17:54	18:31	20:10	20:47	21:19	21:26	20:59	20:09	19:13	17:22	17:00
7	08:15	07:51	07:07	07:10	06:22	05:55	06:02	06:32	07:08	07:43	07:23	08:00
	17:16	17:56	18:33	20:11	20:48	21:19	21:25	20:58	20:07	19:12	17:21	17:00
8	08:14	07:49	08:05	07:08	06:21	05:55	06:02	06:33	07:09	07:44	07:24	08:01
	17:17	17:57	18:34	20:13	20:49	21:20	21:25	20:57	20:05	19:10	17:20	16:59
9	08:14	07:48	08:03	07:07	06:20	05:55	06:03	06:34	07:10	07:45	07:26	08:02
	17:18	17:59	19:35	20:14	20:50	21:21	21:25	20:55	20:04	19:08	17:19	16:59
10	08:14	07:47	08:01	07:05	06:18	05:54	06:04	06:35	07:11	07:47	07:27	08:03
	17:19	18:00	19:36	20:15	20:52	21:21	21:24	20:54	20:02	19:06	17:18	16:59
11	08:13	07:45	08:00	07:03	06:17	05:54	06:05	06:36	07:12	07:48	07:28	08:04
	17:20	18:00	19:38	20:16	20:53	21:22	21:24	20:52	20:00	19:04	17:16	16:59
12	08:13	07:44	07:58	07:01	06:16	05:54	06:05	06:38	07:13	07:49	07:30	08:05
	17:21	18:01	19:39	20:18	20:54	21:22	21:23	20:51	19:58	19:03	17:15	16:59
13	08:13	07:42	07:56	07:00	06:15	05:54	06:06	06:39	07:15	07:50	07:31	08:06
	17:22	18:03	19:40	20:19	20:55	21:23	21:23	20:49	19:56	19:01	17:14	17:00
14	08:12	07:41	07:54	06:58	06:14	05:54	06:07	06:40	07:16	07:52	07:32	08:07
	17:23	18:04	19:42	20:20	20:56	21:24	21:22	20:48	19:54	18:57	17:13	17:00
15	08:12	07:40	07:52	06:56	06:12	05:54	06:08	06:41	07:17	07:53	07:34	08:07
	17:25	18:06	19:43	20:21	20:57	21:24	21:21	20:46	19:52	18:56	17:12	17:00
16	08:11	07:38	07:51	06:55	06:11	05:54	06:09	06:42	07:18	07:54	07:35	08:08
	17:26	18:07	19:44	20:22	20:58	21:24	21:21	20:45	19:51	18:54	17:11	17:00
17	08:11	07:37	07:49	06:53	06:10	05:54	06:10	06:43	07:19	07:55	07:36	08:09
	17:27	18:08	19:45	20:24	21:00	21:25	21:20	20:43	19:49	18:52	17:10	17:00
18	08:10	07:35	07:47	06:51	06:09	05:54	06:11	06:44	07:20	07:57	07:38	08:09
	17:28	18:10	19:47	20:25	21:01	21:25	21:19	20:42	19:47	18:51	17:09	17:01
19	08:09	07:34	07:45	06:49	06:08	05:54	06:12	06:46	07:22	07:58	07:39	08:10
	17:30	18:11	19:48	20:26	21:02	21:26	21:19	20:40	19:45	18:49	17:09	17:01
20	08:09	07:32	07:43	06:48	06:07	05:54	06:13	06:47	07:23	07:59	07:40	08:11
	17:31	18:12	19:49	20:27	21:03	21:26	21:18	20:38	19:43	18:47	17:08	17:01
21	08:08	07:30	07:41	06:46	06:06	05:54	06:14	06:48	07:24	08:01	07:42	08:11
	17:32	18:14	19:50	20:29	21:04	21:26	21:17	20:37	19:41	18:46	17:07	17:02
22	08:07	07:29	07:40	06:44	06:05	05:55	06:15	06:49	07:25	08:02	07:43	08:12
	17:34	18:15	19:52	20:30	21:05	21:26	21:16	20:35	19:39	18:44	17:06	17:02
23	08:06	07:27	07:38	06:43	06:04	05:55	06:16	06:50	07:26	08:03	07:44	08:12
	17:35	18:17	19:53	20:31	21:06	21:27	21:15	20:34	19:37	18:43	17:05	17:03
24	08:06	07:26	07:36	06:41	06:04	05:55	06:17	06:51	07:27	08:04	07:45	08:13
	17:36	18:18	19:54	20:32	21:07	21:27	21:14	20:32	19:36	18:41	17:05	17:04
25	08:05	07:24	07:34	06:40	06:03	05:55	06:18	06:53	07:29	08:06	07:47	08:13
	17:38	18:19	19:55	20:33	21:08	21:27	21:13	20:30	19:34	18:39	17:04	17:04
26	08:04	07:22	07:32	06:38	06:02	05:56	06:19	06:54	07:30	08:07	07:48	08:13
	17:39	18:21	19:57	20:35	21:09	21:27	21:12	20:28	19:32	18:38	17:04	17:05
27	08:03	07:21	07:30	06:37	06:01	05:56	06:20	06:55	07:31	08:08	07:49	08:14
	17:40	18:22	19:58	20:36	21:10	21:27	21:11	20:27	19:30	18:36	17:03	17:05
28	08:02	07:19	07:28	06:35	06:00	05:57	06:21	06:56	07:32	08:10	07:50	08:14
	17:42	18:23	19:59	20:37	21:11	21:27	21:10	20:25	19:28	18:35	17:02	17:06
29	08:01		07:27	06:34	06:00	05:57	06:22	06:57	07:33	08:11	07:52	08:14
	17:43		20:00	20:38	21:12	21:27	21:09	20:23	19:26	18:33	17:02	17:07
30	08:00		07:25	06:32	05:59	05:57	06:23	06:58	07:34	08:12	07:53	08:14
	17:45		20:02	20:40	21:13	21:27	21:08	20:22	19:24	18:32	17:01	17:08
31	07:59		07:23		05:59		06:24	07:00		08:14		08:15
	17:46		20:03		21:14		21:07	20:20		18:31		17:09
Potential sun hours	288	292	369	403	458	464	470	435	377	342	289	276
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
Tetra Tech EC, Inc C/o Shin Ng
3475 E. Foothill Blvd
US-PASADENA, CA 91107
1 617 457 8405
Ted Guertin / ted.guertin@tetratech.com

Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 7 - Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,582

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:15	07:58	07:17	07:21	06:31	05:58	05:58	06:25	07:01	07:36	07:15	07:54
	17:10	17:48	18:25	20:04	20:41	21:14	21:27	21:06	20:18	19:23	17:29	17:01
2	08:15	07:57	07:15	07:19	06:29	05:58	05:59	06:26	07:02	07:37	07:16	07:55
	17:11	17:49	18:26	20:05	20:42	21:15	21:27	21:04	20:16	19:21	17:28	17:01
3	08:15	07:55	07:14	07:18	06:28	05:57	05:59	06:27	07:03	07:38	07:18	07:56
	17:12	17:50	18:27	20:07	20:43	21:16	21:26	21:03	20:14	19:19	17:27	17:01
4	08:15	07:54	07:12	07:16	06:26	05:57	06:00	06:29	07:04	07:39	07:19	07:57
	17:13	17:52	18:29	20:08	20:44	21:17	21:26	21:02	20:13	19:17	17:25	17:00
5	08:15	07:53	07:10	07:14	06:25	05:56	06:00	06:30	07:05	07:41	07:20	07:58
	17:14	17:53	18:30	20:09	20:46	21:18	21:26	21:01	20:11	19:15	17:24	17:00
6	08:15	07:52	07:09	07:12	06:24	05:56	06:01	06:31	07:07	07:42	07:22	07:59
	17:15	17:55	18:31	20:10	20:47	21:18	21:26	20:59	20:09	19:13	17:23	17:00
7	08:14	07:51	07:07	07:10	06:22	05:56	06:02	06:32	07:08	07:43	07:23	08:00
	17:16	17:56	18:33	20:11	20:48	21:19	21:25	20:58	20:07	19:12	17:21	17:00
8	08:14	07:49	08:05	07:09	06:21	05:55	06:03	06:33	07:09	07:44	07:24	08:01
	17:17	17:57	18:34	20:13	20:49	21:20	21:25	20:57	20:05	19:10	17:20	17:00
9	08:14	07:48	08:03	07:07	06:20	05:55	06:03	06:34	07:10	07:45	07:26	08:02
	17:18	17:59	19:35	20:14	20:50	21:21	21:25	20:55	20:04	19:08	17:19	17:00
10	08:14	07:47	08:01	07:05	06:18	05:55	06:04	06:35	07:11	07:47	07:27	08:03
	17:19	18:00	19:37	20:15	20:52	21:21	21:24	20:54	20:02	19:06	17:18	17:00
11	08:13	07:45	08:00	07:03	06:17	05:54	06:05	06:37	07:12	07:48	07:28	08:04
	17:20	18:00	19:38	20:16	20:53	21:22	21:24	20:52	20:00	19:05	17:17	17:00
12	08:13	07:44	07:58	07:02	06:16	05:54	06:06	06:38	07:13	07:49	07:30	08:05
	17:21	18:02	19:39	20:18	20:54	21:22	21:23	20:51	19:58	19:03	17:16	17:00
13	08:13	07:42	07:56	07:00	06:15	05:54	06:06	06:39	07:15	07:50	07:31	08:06
	17:22	18:03	19:40	20:19	20:55	21:23	21:23	20:49	19:56	19:01	17:14	17:00
14	08:12	07:41	07:54	06:58	06:14	05:54	06:07	06:40	07:16	07:52	07:32	08:06
	17:24	18:04	19:42	20:20	20:56	21:23	21:22	20:48	19:54	18:58	17:13	17:00
15	08:12	07:40	07:52	06:56	06:13	05:54	06:08	06:41	07:17	07:53	07:34	08:07
	17:25	18:06	19:43	20:21	20:57	21:24	21:21	20:46	19:52	18:56	17:12	17:00
16	08:11	07:38	07:51	06:55	06:11	05:54	06:09	06:42	07:18	07:54	07:35	08:08
	17:26	18:07	19:44	20:22	20:58	21:24	21:21	20:45	19:51	18:54	17:11	17:00
17	08:11	07:37	07:49	06:53	06:10	05:54	06:10	06:43	07:19	07:55	07:36	08:09
	17:27	18:09	19:45	20:24	21:00	21:25	21:20	20:43	19:49	18:52	17:11	17:01
18	08:10	07:35	07:47	06:51	06:09	05:54	06:11	06:45	07:20	07:57	07:38	08:09
	17:29	18:10	19:47	20:25	21:01	21:25	21:19	20:42	19:47	18:51	17:10	17:01
19	08:09	07:34	07:45	06:50	06:08	05:54	06:12	06:46	07:22	07:58	07:39	08:10
	17:30	18:11	19:48	20:26	21:02	21:25	21:19	20:40	19:45	18:49	17:09	17:01
20	08:09	07:32	07:43	06:48	06:07	05:54	06:13	06:47	07:23	07:59	07:40	08:11
	17:31	18:13	19:49	20:27	21:03	21:26	21:18	20:38	19:43	18:47	17:08	17:02
21	08:08	07:30	07:41	06:46	06:06	05:55	06:14	06:48	07:24	08:01	07:42	08:11
	17:33	18:14	19:50	20:29	21:04	21:26	21:17	20:37	19:41	18:46	17:07	17:02
22	08:07	07:29	07:40	06:45	06:05	05:55	06:15	06:49	07:25	08:02	07:43	08:12
	17:34	18:15	19:52	20:30	21:05	21:26	21:16	20:35	19:39	18:44	17:06	17:03
23	08:06	07:27	07:38	06:43	06:05	05:55	06:16	06:50	07:26	08:03	07:44	08:12
	17:35	18:17	19:53	20:31	21:06	21:27	21:15	20:34	19:38	18:43	17:06	17:03
24	08:06	07:26	07:36	06:41	06:04	05:55	06:17	06:52	07:27	08:04	07:45	08:13
	17:37	18:18	19:54	20:32	21:07	21:27	21:14	20:32	19:36	18:41	17:05	17:04
25	08:05	07:24	07:34	06:40	06:03	05:56	06:18	06:53	07:29	08:06	07:47	08:13
	17:38	18:19	19:55	20:33	21:08	21:27	21:13	20:30	19:34	18:40	17:04	17:04
26	08:04	07:22	07:32	06:38	06:02	05:56	06:19	06:54	07:30	08:07	07:48	08:13
	17:39	18:21	19:57	20:35	21:09	21:27	21:12	20:28	19:32	18:38	17:04	17:05
27	08:03	07:21	07:30	06:37	06:01	05:56	06:20	06:55	07:31	08:08	07:49	08:14
	17:41	18:22	19:58	20:36	21:10	21:27	21:11	20:27	19:30	18:36	17:03	17:06
28	08:02	07:19	07:29	06:35	06:01	05:57	06:21	06:56	07:32	08:10	07:50	08:14
	17:42	18:23	19:59	20:37	21:11	21:27	21:10	20:25	19:28	18:35	17:03	17:06
29	08:01		07:27	06:34	06:00	05:57	06:22	06:57	07:33	08:11	07:51	08:14
	17:43		20:00	20:38	21:12	21:27	21:09	20:23	19:26	18:34	17:02	17:07
30	08:00		07:25	06:32	05:59	05:58	06:23	06:58	07:35	08:12	07:53	08:14
	17:45		20:02	20:40	21:13	21:27	21:08	20:22	19:24	18:32	17:02	17:08
31	07:59		07:23		05:59		06:24	07:00		08:14		08:15
	17:46		20:03		21:14		21:07	20:20		18:31		17:09
Potential sun hours	288	292	369	403	457	464	470	435	377	342	289	277
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
Tetra Tech EC, Inc C/o Shin Ng
3475 E. Foothill Blvd
US-PASADENA, CA 91107
1 617 457 8405
Ted Guertin / ted.guertin@tetratech.com

Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 8 - Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,582

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:15	07:58	07:17	07:21	06:31	05:58	05:58	06:25	07:01	07:36	07:15	07:54
	17:10	17:48	18:25	20:04	20:41	21:14	21:27	21:06	20:18	19:23	17:29	17:01
2	08:15	07:57	07:15	07:19	06:29	05:58	05:59	06:26	07:02	07:37	07:16	07:55
	17:11	17:49	18:26	20:05	20:42	21:15	21:27	21:04	20:16	19:21	17:28	17:01
3	08:15	07:55	07:14	07:18	06:28	05:57	05:59	06:27	07:03	07:38	07:18	07:56
	17:12	17:50	18:27	20:07	20:43	21:16	21:26	21:03	20:14	19:19	17:27	17:01
4	08:15	07:54	07:12	07:16	06:26	05:57	06:00	06:29	07:04	07:39	07:19	07:57
	17:13	17:52	18:29	20:08	20:44	21:17	21:26	21:02	20:13	19:17	17:25	17:00
5	08:15	07:53	07:10	07:14	06:25	05:56	06:00	06:30	07:05	07:41	07:20	07:58
	17:14	17:53	18:30	20:09	20:46	21:18	21:26	21:01	20:11	19:15	17:24	17:00
6	08:15	07:52	07:09	07:12	06:24	05:56	06:01	06:31	07:07	07:42	07:22	07:59
	17:15	17:55	18:31	20:10	20:47	21:18	21:26	20:59	20:09	19:13	17:23	17:00
7	08:14	07:51	07:07	07:10	06:22	05:56	06:02	06:32	07:08	07:43	07:23	08:00
	17:16	17:56	18:33	20:11	20:48	21:19	21:25	20:58	20:07	19:12	17:21	17:00
8	08:14	07:49	08:05	07:09	06:21	05:55	06:03	06:33	07:09	07:44	07:24	08:01
	17:17	17:57	18:34	20:13	20:49	21:20	21:25	20:57	20:05	19:10	17:20	17:00
9	08:14	07:48	08:03	07:07	06:20	05:55	06:03	06:34	07:10	07:45	07:26	08:02
	17:18	17:59	19:35	20:14	20:50	21:21	21:25	20:55	20:04	19:08	17:19	17:00
10	08:14	07:47	08:01	07:05	06:18	05:55	06:04	06:35	07:11	07:47	07:27	08:03
	17:19	18:00	19:37	20:15	20:52	21:21	21:24	20:54	20:02	19:06	17:18	17:00
11	08:13	07:45	08:00	07:03	06:17	05:54	06:05	06:37	07:12	07:48	07:28	08:04
	17:20	18:00	19:38	20:16	20:53	21:22	21:24	20:52	20:00	19:05	17:17	17:00
12	08:13	07:44	07:58	07:02	06:16	05:54	06:06	06:38	07:13	07:49	07:30	08:05
	17:21	18:02	19:39	20:18	20:54	21:22	21:23	20:51	19:58	19:03	17:16	17:00
13	08:13	07:42	07:56	07:00	06:15	05:54	06:06	06:39	07:15	07:50	07:31	08:06
	17:22	18:03	19:40	20:19	20:55	21:23	21:23	20:49	19:56	19:01	17:14	17:00
14	08:12	07:41	07:54	06:58	06:14	05:54	06:07	06:40	07:16	07:52	07:32	08:06
	17:24	18:04	19:42	20:20	20:56	21:23	21:22	20:48	19:54	18:58	17:13	17:00
15	08:12	07:40	07:52	06:56	06:13	05:54	06:08	06:41	07:17	07:53	07:34	08:07
	17:25	18:06	19:43	20:21	20:57	21:24	21:21	20:46	19:52	18:56	17:12	17:00
16	08:11	07:38	07:51	06:55	06:11	05:54	06:09	06:42	07:18	07:54	07:35	08:08
	17:26	18:07	19:44	20:22	20:58	21:24	21:21	20:45	19:51	18:54	17:11	17:00
17	08:11	07:37	07:49	06:53	06:10	05:54	06:10	06:43	07:19	07:55	07:36	08:09
	17:27	18:08	19:45	20:24	21:00	21:25	21:20	20:43	19:49	18:52	17:11	17:01
18	08:10	07:35	07:47	06:51	06:09	05:54	06:11	06:45	07:20	07:57	07:38	08:09
	17:29	18:10	19:47	20:25	21:01	21:25	21:19	20:42	19:47	18:51	17:10	17:01
19	08:09	07:34	07:45	06:50	06:08	05:54	06:12	06:46	07:22	07:58	07:39	08:10
	17:30	18:11	19:48	20:26	21:02	21:25	21:19	20:40	19:45	18:49	17:09	17:01
20	08:09	07:32	07:43	06:48	06:07	05:54	06:13	06:47	07:23	07:59	07:40	08:11
	17:31	18:13	19:49	20:27	21:03	21:26	21:18	20:38	19:43	18:47	17:08	17:02
21	08:08	07:30	07:41	06:46	06:06	05:55	06:14	06:48	07:24	08:01	07:42	08:11
	17:33	18:14	19:50	20:29	21:04	21:26	21:17	20:37	19:41	18:46	17:07	17:02
22	08:07	07:29	07:40	06:45	06:05	05:55	06:15	06:49	07:25	08:02	07:43	08:12
	17:34	18:15	19:52	20:30	21:05	21:26	21:16	20:35	19:39	18:44	17:06	17:03
23	08:06	07:27	07:38	06:43	06:05	05:55	06:16	06:50	07:26	08:03	07:44	08:12
	17:35	18:17	19:53	20:31	21:06	21:27	21:15	20:34	19:38	18:43	17:06	17:03
24	08:06	07:26	07:36	06:41	06:04	05:55	06:17	06:52	07:27	08:04	07:45	08:13
	17:37	18:18	19:54	20:32	21:07	21:27	21:14	20:32	19:36	18:41	17:05	17:04
25	08:05	07:24	07:34	06:40	06:03	05:56	06:18	06:53	07:29	08:06	07:47	08:13
	17:38	18:19	19:55	20:33	21:08	21:27	21:13	20:30	19:34	18:40	17:04	17:04
26	08:04	07:22	07:32	06:38	06:02	05:56	06:19	06:54	07:30	08:07	07:48	08:13
	17:39	18:21	19:57	20:35	21:09	21:27	21:12	20:28	19:32	18:38	17:04	17:05
27	08:03	07:21	07:30	06:37	06:01	05:56	06:20	06:55	07:31	08:08	07:49	08:14
	17:41	18:22	19:58	20:36	21:10	21:27	21:11	20:27	19:30	18:36	17:03	17:06
28	08:02	07:19	07:29	06:35	06:01	05:57	06:21	06:56	07:32	08:10	07:50	08:14
	17:42	18:23	19:59	20:37	21:11	21:27	21:10	20:25	19:28	18:35	17:03	17:06
29	08:01		07:27	06:34	06:00	05:57	06:22	06:57	07:33	08:11	07:51	08:14
	17:43		20:00	20:38	21:12	21:27	21:09	20:23	19:26	18:34	17:02	17:07
30	08:00		07:25	06:32	05:59	05:58	06:23	06:58	07:35	08:12	07:53	08:14
	17:45		20:02	20:40	21:13	21:27	21:08	20:22	19:24	18:32	17:02	17:08
31	07:59		07:23		05:59		06:24	07:00		08:14		08:15
	17:46		20:03		21:14		21:07	20:20		18:31		17:09
Potential sun hours	288	292	369	403	457	464	470	435	377	342	289	277
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
Tetra Tech EC, Inc C/o Shin Ng
3475 E. Foothill Blvd
US-PASADENA, CA 91107
1 617 457 8405
Ted Guertin / ted.guertin@tetratech.com
Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 9 - Non-Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,582

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:15	07:58	07:17	07:21	06:31	05:58	05:58	06:25	07:01	07:36	07:15	07:54
	17:10	17:48	18:25	20:04	20:41	21:14	21:27	21:05	20:18	19:23	17:29	17:01
2	08:15	07:56	07:15	07:19	06:29	05:58	05:59	06:26	07:02	07:37	07:16	07:55
	17:11	17:49	18:26	20:05	20:42	21:15	21:26	21:04	20:16	19:21	17:28	17:01
3	08:15	07:55	07:14	07:18	06:28	05:57	05:59	06:27	07:03	07:38	07:18	07:56
	17:12	17:50	18:27	20:06	20:43	21:16	21:26	21:03	20:14	19:19	17:26	17:01
4	08:15	07:54	07:12	07:16	06:26	05:57	06:00	06:29	07:04	07:39	07:19	07:57
	17:13	17:52	18:29	20:08	20:44	21:17	21:26	21:02	20:13	19:17	17:25	17:00
5	08:15	07:53	07:10	07:14	06:25	05:56	06:01	06:30	07:05	07:40	07:20	07:58
	17:14	17:53	18:30	20:09	20:45	21:17	21:26	21:00	20:11	19:15	17:24	17:00
6	08:14	07:52	07:08	07:12	06:24	05:56	06:01	06:31	07:06	07:42	07:22	07:59
	17:15	17:55	18:31	20:10	20:47	21:18	21:25	20:59	20:09	19:13	17:23	17:00
7	08:14	07:50	07:07	07:10	06:22	05:56	06:02	06:32	07:08	07:43	07:23	08:00
	17:16	17:56	18:33	20:11	20:48	21:19	21:25	20:58	20:07	19:12	17:21	17:00
8	08:14	07:49	08:05	07:09	06:21	05:55	06:03	06:33	07:09	07:44	07:24	08:01
	17:17	17:57	18:34	20:13	20:49	21:20	21:25	20:56	20:05	19:10	17:20	17:00
9	08:14	07:48	08:03	07:07	06:20	05:55	06:03	06:34	07:10	07:45	07:26	08:02
	17:18	17:59	19:35	20:14	20:50	21:20	21:24	20:55	20:03	19:08	17:19	17:00
10	08:14	07:46	08:01	07:05	06:18	05:55	06:04	06:35	07:11	07:47	07:27	08:03
	17:19	18:00	19:36	20:15	20:51	21:21	21:24	20:54	20:02	19:06	17:18	17:00
11	08:13	07:45	08:00	07:03	06:17	05:55	06:05	06:36	07:12	07:48	07:28	08:04
	17:20	18:00	19:38	20:16	20:52	21:22	21:23	20:52	20:00	19:04	17:17	17:00
12	08:13	07:44	07:58	07:01	06:16	05:54	06:06	06:38	07:13	07:49	07:30	08:05
	17:21	18:02	19:39	20:17	20:54	21:22	21:23	20:51	19:58	19:03	17:16	17:00
13	08:12	07:42	07:56	07:00	06:15	05:54	06:06	06:39	07:15	07:50	07:31	08:05
	17:22	18:03	19:40	20:19	20:55	21:23	21:22	20:49	19:56	19:01	17:14	17:00
14	08:12	07:41	07:54	06:58	06:14	05:54	06:07	06:40	07:16	07:51	07:32	08:06
	17:24	18:04	19:42	20:20	20:56	21:23	21:22	20:48	19:54	18:57	17:13	17:00
15	08:12	07:39	07:52	06:56	06:13	05:54	06:08	06:41	07:17	07:53	07:34	08:07
	17:25	18:06	19:43	20:21	20:57	21:24	21:21	20:46	19:52	18:56	17:12	17:00
16	08:11	07:38	07:51	06:55	06:11	05:54	06:09	06:42	07:18	07:54	07:35	08:08
	17:26	18:07	19:44	20:22	20:58	21:24	21:21	20:45	19:50	18:54	17:11	17:00
17	08:10	07:36	07:49	06:53	06:10	05:54	06:10	06:43	07:19	07:55	07:36	08:08
	17:27	18:08	19:45	20:24	20:59	21:25	21:20	20:43	19:49	18:52	17:10	17:01
18	08:10	07:35	07:47	06:51	06:09	05:54	06:11	06:45	07:20	07:57	07:38	08:09
	17:29	18:10	19:47	20:25	21:00	21:25	21:19	20:41	19:47	18:51	17:10	17:01
19	08:09	07:33	07:45	06:50	06:08	05:54	06:12	06:46	07:21	07:58	07:39	08:10
	17:30	18:11	19:48	20:26	21:01	21:25	21:18	20:40	19:45	18:49	17:09	17:01
20	08:08	07:32	07:43	06:48	06:07	05:54	06:13	06:47	07:23	07:59	07:40	08:10
	17:31	18:13	19:49	20:27	21:03	21:26	21:17	20:38	19:43	18:47	17:08	17:02
21	08:08	07:30	07:41	06:46	06:06	05:55	06:14	06:48	07:24	08:00	07:41	08:11
	17:33	18:14	19:50	20:28	21:04	21:26	21:17	20:37	19:41	18:46	17:07	17:02
22	08:07	07:29	07:40	06:45	06:05	05:55	06:15	06:49	07:25	08:02	07:43	08:11
	17:34	18:15	19:52	20:30	21:05	21:26	21:16	20:35	19:39	18:44	17:06	17:03
23	08:06	07:27	07:38	06:43	06:05	05:55	06:16	06:50	07:26	08:03	07:44	08:12
	17:35	18:17	19:53	20:31	21:06	21:26	21:15	20:33	19:37	18:43	17:06	17:03
24	08:05	07:25	07:36	06:41	06:04	05:55	06:17	06:51	07:27	08:04	07:45	08:12
	17:37	18:18	19:54	20:32	21:07	21:26	21:14	20:32	19:36	18:41	17:05	17:04
25	08:05	07:24	07:34	06:40	06:03	05:56	06:18	06:53	07:28	08:06	07:46	08:13
	17:38	18:19	19:55	20:33	21:08	21:27	21:13	20:30	19:34	18:39	17:04	17:04
26	08:04	07:22	07:32	06:38	06:02	05:56	06:19	06:54	07:30	08:07	07:48	08:13
	17:39	18:21	19:57	20:35	21:09	21:27	21:12	20:28	19:32	18:38	17:04	17:05
27	08:03	07:20	07:30	06:37	06:01	05:56	06:20	06:55	07:31	08:08	07:49	08:13
	17:41	18:22	19:58	20:36	21:10	21:27	21:11	20:27	19:30	18:36	17:03	17:06
28	08:02	07:19	07:28	06:35	06:01	05:57	06:21	06:56	07:32	08:10	07:50	08:14
	17:42	18:23	19:59	20:37	21:11	21:27	21:10	20:25	19:28	18:35	17:03	17:06
29	08:01		07:27	06:34	06:00	05:57	06:22	06:57	07:33	08:11	07:51	08:14
	17:43		20:00	20:38	21:12	21:27	21:09	20:23	19:26	18:33	17:02	17:07
30	08:00		07:25	06:32	05:59	05:58	06:23	06:58	07:34	08:12	07:52	08:14
	17:45		20:01	20:39	21:12	21:27	21:08	20:21	19:24	18:32	17:02	17:08
31	07:59		07:23		05:59		06:24	07:00		08:13		08:14
	17:46		20:03		21:13		21:06	20:20		18:31		17:09
Potential sun hours	288	292	369	403	457	464	470	435	377	342	290	277
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
Tetra Tech EC, Inc C/o Shin Ng
3475 E. Foothill Blvd
US-PASADENA, CA 91107
1 617 457 8405
Ted Guertin / ted.guertin@tetratech.com
Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 10 - Non-Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,582

Idle start wind speed: Cut in wind speed from power curve

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

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

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Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
Tetra Tech EC, Inc C/o Shin Ng
3475 E. Foothill Blvd
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1 617 457 8405
Ted Guertin / ted.guertin@tetratech.com
Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 11 - Non-Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,582

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:15	07:58	07:17	07:21	06:31	05:58	05:58	06:25	07:01	07:36	07:15	07:54
	17:10	17:47	18:25	20:04	20:41	21:14	21:27	21:05	20:18	19:22	17:29	17:01
2	08:15	07:57	07:15	07:19	06:29	05:57	05:58	06:26	07:02	07:37	07:16	07:55
	17:11	17:49	18:26	20:05	20:42	21:15	21:27	21:04	20:16	19:21	17:28	17:01
3	08:15	07:55	07:14	07:17	06:28	05:57	05:59	06:27	07:03	07:38	07:18	07:56
	17:11	17:50	18:27	20:06	20:43	21:16	21:26	21:03	20:14	19:19	17:26	17:00
4	08:15	07:54	07:12	07:16	06:26	05:56	06:00	06:28	07:04	07:39	07:19	07:57
	17:12	17:52	18:29	20:08	20:44	21:17	21:26	21:02	20:13	19:17	17:25	17:00
5	08:15	07:53	07:10	07:14	06:25	05:56	06:00	06:29	07:05	07:40	07:20	07:58
	17:13	17:53	18:30	20:09	20:45	21:18	21:26	21:00	20:11	19:15	17:24	17:00
6	08:15	07:52	07:08	07:12	06:23	05:56	06:01	06:31	07:06	07:42	07:22	07:59
	17:14	17:54	18:31	20:10	20:47	21:18	21:26	20:59	20:09	19:13	17:22	17:00
7	08:14	07:50	07:07	07:10	06:22	05:55	06:02	06:32	07:08	07:43	07:23	08:00
	17:15	17:56	18:32	20:11	20:48	21:19	21:25	20:58	20:07	19:12	17:21	16:59
8	08:14	07:49	08:05	07:08	06:21	05:55	06:02	06:33	07:09	07:44	07:24	08:01
	17:17	17:57	18:34	20:13	20:49	21:20	21:25	20:56	20:05	19:10	17:20	16:59
9	08:14	07:48	08:03	07:07	06:20	05:55	06:03	06:34	07:10	07:45	07:26	08:02
	17:18	17:59	19:35	20:14	20:50	21:20	21:25	20:55	20:03	19:08	17:19	16:59
10	08:14	07:46	08:01	07:05	06:18	05:54	06:04	06:35	07:11	07:46	07:27	08:03
	17:19	18:00	19:36	20:15	20:51	21:21	21:24	20:54	20:02	19:06	17:18	16:59
11	08:13	07:45	08:00	07:03	06:17	05:54	06:05	06:36	07:12	07:48	07:28	08:04
	17:20	18:00	19:38	20:16	20:53	21:22	21:24	20:52	20:00	19:04	17:16	16:59
12	08:13	07:44	07:58	07:01	06:16	05:54	06:05	06:37	07:13	07:49	07:30	08:05
	17:21	18:01	19:39	20:17	20:54	21:22	21:23	20:51	19:58	19:03	17:15	16:59
13	08:13	07:42	07:56	07:00	06:15	05:54	06:06	06:39	07:14	07:50	07:31	08:06
	17:22	18:03	19:40	20:19	20:55	21:23	21:23	20:49	19:56	19:01	17:14	16:59
14	08:12	07:41	07:54	06:58	06:13	05:54	06:07	06:40	07:16	07:51	07:32	08:06
	17:23	18:04	19:41	20:20	20:56	21:23	21:22	20:48	19:54	18:57	17:13	17:00
15	08:12	07:39	07:52	06:56	06:12	05:54	06:08	06:41	07:17	07:53	07:34	08:07
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17	08:11	07:36	07:49	06:53	06:10	05:54	06:10	06:43	07:19	07:55	07:36	08:09
	17:27	18:08	19:45	20:24	20:59	21:25	21:20	20:43	19:49	18:52	17:10	17:00
18	08:10	07:35	07:47	06:51	06:09	05:54	06:11	06:44	07:20	07:57	07:38	08:09
	17:28	18:10	19:47	20:25	21:01	21:25	21:19	20:42	19:47	18:51	17:09	17:01
19	08:09	07:33	07:45	06:49	06:08	05:54	06:12	06:46	07:21	07:58	07:39	08:10
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20	08:09	07:32	07:43	06:48	06:07	05:54	06:13	06:47	07:23	07:59	07:40	08:11
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24	08:06	07:25	07:36	06:41	06:04	05:55	06:16	06:51	07:27	08:04	07:45	08:13
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	17:38	18:19	19:55	20:33	21:08	21:27	21:13	20:30	19:34	18:39	17:04	17:04
26	08:04	07:22	07:32	06:38	06:02	05:56	06:19	06:54	07:30	08:07	07:48	08:13
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28	08:02	07:19	07:28	06:35	06:00	05:56	06:21	06:56	07:32	08:10	07:50	08:14
	17:42	18:23	19:59	20:37	21:11	21:27	21:10	20:25	19:28	18:35	17:02	17:06
29	08:01		07:27	06:33	06:00	05:57	06:22	06:57	07:33	08:11	07:51	08:14
	17:43		20:00	20:38	21:12	21:27	21:09	20:23	19:26	18:33	17:02	17:07
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Total, worst case												
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Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

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Ted Guertin / ted.guertin@tetratech.com
Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 12 - Participant

Assumptions for shadow calculations

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Idle start wind speed: Cut in wind speed from power curve

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1	08:15	07:58	07:17	07:21	06:31	05:58	05:58	06:25	07:01	07:36	07:15	07:54
	17:10	17:47	18:25	20:04	20:41	21:14	21:27	21:06	20:18	19:23	17:29	17:01
2	08:15	07:57	07:15	07:19	06:29	05:57	05:58	06:26	07:02	07:37	07:16	07:55
	17:11	17:49	18:26	20:05	20:42	21:15	21:27	21:04	20:16	19:21	17:28	17:01
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	17:12	17:52	18:29	20:08	20:44	21:17	21:26	21:02	20:13	19:17	17:25	17:00
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	17:13	17:53	18:30	20:09	20:46	21:18	21:26	21:01	20:11	19:15	17:24	17:00
6	08:15	07:52	07:08	07:12	06:23	05:56	06:01	06:31	07:06	07:42	07:22	07:59
	17:14	17:54	18:31	20:10	20:47	21:18	21:26	20:59	20:09	19:13	17:22	17:00
7	08:14	07:51	07:07	07:10	06:22	05:55	06:02	06:32	07:08	07:43	07:23	08:00
	17:15	17:56	18:33	20:11	20:48	21:19	21:25	20:58	20:07	19:12	17:21	16:59
8	08:14	07:49	08:05	07:08	06:21	05:55	06:02	06:33	07:09	07:44	07:24	08:01
	17:17	17:57	18:34	20:13	20:49	21:20	21:25	20:56	20:05	19:10	17:20	16:59
9	08:14	07:48	08:03	07:07	06:20	05:55	06:03	06:34	07:10	07:45	07:26	08:02
	17:18	17:59	19:35	20:14	20:50	21:21	21:25	20:55	20:04	19:08	17:19	16:59
10	08:14	07:47	08:01	07:05	06:18	05:54	06:04	06:35	07:11	07:47	07:27	08:03
	17:19	18:00	19:36	20:15	20:52	21:21	21:24	20:54	20:02	19:06	17:18	16:59
11	08:13	07:45	08:00	07:03	06:17	05:54	06:05	06:36	07:12	07:48	07:28	08:04
	17:20	18:00	19:38	20:16	20:53	21:22	21:24	20:52	20:00	19:04	17:16	16:59
12	08:13	07:44	07:58	07:01	06:16	05:54	06:05	06:37	07:13	07:49	07:30	08:05
	17:21	18:01	19:39	20:17	20:54	21:22	21:23	20:51	19:58	19:03	17:15	16:59
13	08:13	07:42	07:56	07:00	06:15	05:54	06:06	06:39	07:15	07:50	07:31	08:06
	17:22	18:03	19:40	20:19	20:55	21:23	21:23	20:49	19:56	19:01	17:14	16:59
14	08:12	07:41	07:54	06:58	06:13	05:54	06:07	06:40	07:16	07:52	07:32	08:06
	17:23	18:04	19:42	20:20	20:56	21:23	21:22	20:48	19:54	18:57	17:13	17:00
15	08:12	07:40	07:52	06:56	06:12	05:54	06:08	06:41	07:17	07:53	07:34	08:07
	17:25	18:06	19:43	20:21	20:57	21:24	21:21	20:46	19:52	18:56	17:12	17:00
16	08:11	07:38	07:51	06:54	06:11	05:54	06:09	06:42	07:18	07:54	07:35	08:08
	17:26	18:07	19:44	20:22	20:58	21:24	21:21	20:45	19:51	18:54	17:11	17:00
17	08:11	07:37	07:49	06:53	06:10	05:54	06:10	06:43	07:19	07:55	07:36	08:09
	17:27	18:08	19:45	20:24	21:00	21:25	21:20	20:43	19:49	18:52	17:10	17:00
18	08:10	07:35	07:47	06:51	06:09	05:54	06:11	06:44	07:20	07:57	07:38	08:09
	17:28	18:10	19:47	20:25	21:01	21:25	21:19	20:42	19:47	18:51	17:09	17:01
19	08:09	07:33	07:45	06:49	06:08	05:54	06:12	06:46	07:21	07:58	07:39	08:10
	17:30	18:11	19:48	20:26	21:02	21:26	21:19	20:40	19:45	18:49	17:09	17:01
20	08:09	07:32	07:43	06:48	06:07	05:54	06:13	06:47	07:23	07:59	07:40	08:11
	17:31	18:12	19:49	20:27	21:03	21:26	21:18	20:38	19:43	18:47	17:08	17:01
21	08:08	07:30	07:41	06:46	06:06	05:54	06:13	06:48	07:24	08:00	07:42	08:11
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22	08:07	07:29	07:39	06:44	06:05	05:54	06:14	06:49	07:25	08:02	07:43	08:12
	17:34	18:15	19:52	20:30	21:05	21:26	21:16	20:35	19:39	18:44	17:06	17:02
23	08:06	07:27	07:38	06:43	06:04	05:55	06:15	06:50	07:26	08:03	07:44	08:12
	17:35	18:17	19:53	20:31	21:06	21:27	21:15	20:34	19:37	18:42	17:05	17:03
24	08:06	07:25	07:36	06:41	06:04	05:55	06:16	06:51	07:27	08:04	07:45	08:13
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25	08:05	07:24	07:34	06:40	06:03	05:55	06:18	06:53	07:28	08:06	07:47	08:13
	17:38	18:19	19:55	20:33	21:08	21:27	21:13	20:30	19:34	18:39	17:04	17:04
26	08:04	07:22	07:32	06:38	06:02	05:56	06:19	06:54	07:30	08:07	07:48	08:13
	17:39	18:21	19:57	20:35	21:09	21:27	21:12	20:28	19:32	18:38	17:03	17:05
27	08:03	07:21	07:30	06:37	06:01	05:56	06:20	06:55	07:31	08:08	07:49	08:14
	17:40	18:22	19:58	20:36	21:10	21:27	21:11	20:27	19:30	18:36	17:03	17:05
28	08:02	07:19	07:28	06:35	06:00	05:56	06:21	06:56	07:32	08:10	07:50	08:14
	17:42	18:23	19:59	20:37	21:11	21:27	21:10	20:25	19:28	18:35	17:02	17:06
29	08:01		07:27	06:33	06:00	05:57	06:22	06:57	07:33	08:11	07:51	08:14
	17:43		20:00	20:38	21:12	21:27	21:09	20:23	19:26	18:33	17:02	17:07
30	08:00		07:25	06:32	05:59	05:57	06:23	06:58	07:34	08:12	07:53	08:14
	17:45		20:01	20:40	21:13	21:27	21:08	20:22	19:24	18:32	17:01	17:08
31	07:59		07:23		05:58		06:24	06:59		08:14		08:15
	17:46		20:03		21:14		21:07	20:20		18:30		17:09
Potential sun hours	288	292	369	403	458	464	470	435	377	342	289	276
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
Tetra Tech EC, Inc C/o Shin Ng
3475 E. Foothill Blvd
US-PASADENA, CA 91107
1 617 457 8405
Ted Guertin / ted.guertin@tetratech.com
Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 13 - Non-Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,582

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:15	07:58	07:17	07:21	06:30	05:58	05:58	06:25	07:00	07:35	07:15	07:54
	17:09	17:47	18:24	20:04	20:41	21:14	21:27	21:05	20:18	19:22	17:29	17:01
2	08:15	07:56	07:15	07:19	06:29	05:57	05:58	06:26	07:02	07:37	07:16	07:55
	17:10	17:49	18:26	20:05	20:42	21:15	21:27	21:04	20:16	19:21	17:28	17:01
3	08:15	07:55	07:14	07:17	06:27	05:57	05:59	06:27	07:03	07:38	07:18	07:56
	17:11	17:50	18:27	20:06	20:43	21:16	21:26	21:03	20:14	19:19	17:26	17:00
4	08:15	07:54	07:12	07:16	06:26	05:56	05:59	06:28	07:04	07:39	07:19	07:57
	17:12	17:51	18:28	20:08	20:44	21:17	21:26	21:02	20:12	19:17	17:25	17:00
5	08:15	07:53	07:10	07:14	06:25	05:56	06:00	06:29	07:05	07:40	07:20	07:58
	17:13	17:53	18:30	20:09	20:45	21:18	21:26	21:00	20:11	19:15	17:24	17:00
6	08:14	07:52	07:08	07:12	06:23	05:55	06:01	06:30	07:06	07:42	07:22	07:59
	17:14	17:54	18:31	20:10	20:47	21:18	21:26	20:59	20:09	19:13	17:22	16:59
7	08:14	07:50	07:07	07:10	06:22	05:55	06:01	06:32	07:07	07:43	07:23	08:00
	17:15	17:56	18:32	20:11	20:48	21:19	21:25	20:58	20:07	19:11	17:21	16:59
8	08:14	07:49	08:05	07:08	06:21	05:55	06:02	06:33	07:09	07:44	07:24	08:01
	17:16	17:57	18:34	20:12	20:49	21:20	21:25	20:56	20:05	19:10	17:20	16:59
9	08:14	07:48	08:03	07:07	06:19	05:55	06:03	06:34	07:10	07:45	07:26	08:02
	17:17	17:58	19:35	20:14	20:50	21:20	21:25	20:55	20:03	19:08	17:19	16:59
10	08:14	07:46	08:01	07:05	06:18	05:54	06:04	06:35	07:11	07:46	07:27	08:03
	17:19	18:00	19:36	20:15	20:51	21:21	21:24	20:54	20:02	19:06	17:17	16:59
11	08:13	07:45	07:59	07:03	06:17	05:54	06:04	06:36	07:12	07:48	07:28	08:04
	17:20	18:00	19:38	20:16	20:53	21:22	21:24	20:52	20:00	19:04	17:16	16:59
12	08:13	07:44	07:58	07:01	06:16	05:54	06:05	06:37	07:13	07:49	07:30	08:05
	17:21	18:01	19:39	20:17	20:54	21:22	21:23	20:51	19:58	19:02	17:15	16:59
13	08:13	07:42	07:56	06:59	06:14	05:54	06:06	06:38	07:14	07:50	07:31	08:06
	17:22	18:03	19:40	20:19	20:55	21:23	21:23	20:49	19:56	19:01	17:14	16:59
14	08:12	07:41	07:54	06:58	06:13	05:54	06:07	06:40	07:16	07:51	07:32	08:06
	17:23	18:04	19:41	20:20	20:56	21:23	21:22	20:48	19:54	18:57	17:13	16:59
15	08:12	07:39	07:52	06:56	06:12	05:54	06:08	06:41	07:17	07:53	07:34	08:07
	17:25	18:05	19:43	20:21	20:57	21:24	21:21	20:46	19:52	18:56	17:12	17:00
16	08:11	07:38	07:50	06:54	06:11	05:54	06:09	06:42	07:18	07:54	07:35	08:08
	17:26	18:07	19:44	20:22	20:58	21:24	21:21	20:45	19:50	18:54	17:11	17:00
17	08:11	07:36	07:49	06:53	06:10	05:54	06:10	06:43	07:19	07:55	07:36	08:09
	17:27	18:08	19:45	20:23	20:59	21:25	21:20	20:43	19:49	18:52	17:10	17:00
18	08:10	07:35	07:47	06:51	06:09	05:54	06:10	06:44	07:20	07:56	07:38	08:09
	17:28	18:10	19:46	20:25	21:00	21:25	21:19	20:41	19:47	18:50	17:09	17:01
19	08:09	07:33	07:45	06:49	06:08	05:54	06:11	06:45	07:21	07:58	07:39	08:10
	17:30	18:11	19:48	20:26	21:02	21:25	21:18	20:40	19:45	18:49	17:08	17:01
20	08:09	07:32	07:43	06:48	06:07	05:54	06:12	06:47	07:22	07:59	07:40	08:10
	17:31	18:12	19:49	20:27	21:03	21:26	21:18	20:38	19:43	18:47	17:08	17:01
21	08:08	07:30	07:41	06:46	06:06	05:54	06:13	06:48	07:24	08:00	07:41	08:11
	17:32	18:14	19:50	20:28	21:04	21:26	21:17	20:37	19:41	18:46	17:07	17:02
22	08:07	07:29	07:39	06:44	06:05	05:54	06:14	06:49	07:25	08:02	07:43	08:12
	17:34	18:15	19:51	20:30	21:05	21:26	21:16	20:35	19:39	18:44	17:06	17:02
23	08:06	07:27	07:38	06:43	06:04	05:55	06:15	06:50	07:26	08:03	07:44	08:12
	17:35	18:16	19:53	20:31	21:06	21:26	21:15	20:33	19:37	18:42	17:05	17:03
24	08:05	07:25	07:36	06:41	06:03	05:55	06:16	06:51	07:27	08:04	07:45	08:12
	17:36	18:18	19:54	20:32	21:07	21:27	21:14	20:32	19:35	18:41	17:05	17:03
25	08:05	07:24	07:34	06:39	06:03	05:55	06:17	06:52	07:28	08:06	07:47	08:13
	17:38	18:19	19:55	20:33	21:08	21:27	21:13	20:30	19:34	18:39	17:04	17:04
26	08:04	07:22	07:32	06:38	06:02	05:56	06:18	06:54	07:30	08:07	07:48	08:13
	17:39	18:20	19:56	20:35	21:09	21:27	21:12	20:28	19:32	18:38	17:03	17:05
27	08:03	07:20	07:30	06:36	06:01	05:56	06:19	06:55	07:31	08:08	07:49	08:14
	17:40	18:22	19:58	20:36	21:10	21:27	21:11	20:27	19:30	18:36	17:03	17:05
28	08:02	07:19	07:28	06:35	06:00	05:56	06:21	06:56	07:32	08:09	07:50	08:14
	17:42	18:23	19:59	20:37	21:11	21:27	21:10	20:25	19:28	18:35	17:02	17:06
29	08:01		07:26	06:33	06:00	05:57	06:22	06:57	07:33	08:11	07:51	08:14
	17:43		20:00	20:38	21:12	21:27	21:09	20:23	19:26	18:33	17:02	17:07
30	08:00		07:25	06:32	05:59	05:57	06:23	06:58	07:34	08:12	07:53	08:14
	17:44		20:01	20:39	21:13	21:27	21:08	20:21	19:24	18:32	17:01	17:08
31	07:59		07:23		05:58		06:24	06:59		08:13		08:14
	17:46		20:03		21:13		21:07	20:20		18:30		17:08
Potential sun hours	288	292	369	403	458	464	470	435	377	342	289	276
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
Tetra Tech EC, Inc C/o Shin Ng
3475 E. Foothill Blvd
US-PASADENA, CA 91107
1 617 457 8405
Ted Guertin / ted.guertin@tetratech.com
Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 14 - Non-Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,582

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:15	07:58	07:17	07:21	06:31	05:58	05:58	06:25	07:01	07:36	07:15	07:54
	17:10	17:47	18:25	20:04	20:41	21:15	21:27	21:06	20:18	19:23	17:29	17:01
2	08:15	07:57	07:15	07:19	06:29	05:57	05:58	06:26	07:02	07:37	07:16	07:55
	17:11	17:49	18:26	20:05	20:42	21:15	21:27	21:04	20:16	19:21	17:28	17:01
3	08:15	07:55	07:14	07:18	06:28	05:57	05:59	06:27	07:03	07:38	07:18	07:56
	17:12	17:50	18:27	20:06	20:43	21:16	21:27	21:03	20:14	19:19	17:26	17:00
4	08:15	07:54	07:12	07:16	06:26	05:56	06:00	06:28	07:04	07:39	07:19	07:57
	17:12	17:52	18:29	20:08	20:44	21:17	21:26	21:02	20:13	19:17	17:25	17:00
5	08:15	07:53	07:10	07:14	06:25	05:56	06:00	06:30	07:05	07:40	07:20	07:58
	17:13	17:53	18:30	20:09	20:46	21:18	21:26	21:01	20:11	19:15	17:24	17:00
6	08:15	07:52	07:09	07:12	06:24	05:56	06:01	06:31	07:06	07:42	07:22	07:59
	17:14	17:54	18:31	20:10	20:47	21:19	21:26	20:59	20:09	19:13	17:22	17:00
7	08:15	07:51	07:07	07:10	06:22	05:55	06:02	06:32	07:08	07:43	07:23	08:00
	17:16	17:56	18:33	20:11	20:48	21:19	21:25	20:58	20:07	19:12	17:21	17:00
8	08:14	07:49	08:05	07:08	06:21	05:55	06:02	06:33	07:09	07:44	07:24	08:01
	17:17	17:57	18:34	20:13	20:49	21:20	21:25	20:57	20:05	19:10	17:20	16:59
9	08:14	07:48	08:03	07:07	06:20	05:55	06:03	06:34	07:10	07:45	07:26	08:02
	17:18	17:59	19:35	20:14	20:50	21:21	21:25	20:55	20:04	19:08	17:19	16:59
10	08:14	07:47	08:01	07:05	06:18	05:54	06:04	06:35	07:11	07:47	07:27	08:03
	17:19	18:00	19:36	20:15	20:52	21:21	21:24	20:54	20:02	19:06	17:18	16:59
11	08:13	07:45	08:00	07:03	06:17	05:54	06:05	06:36	07:12	07:48	07:28	08:04
	17:20	18:00	19:38	20:16	20:53	21:22	21:24	20:52	20:00	19:04	17:16	16:59
12	08:13	07:44	07:58	07:01	06:16	05:54	06:05	06:38	07:13	07:49	07:30	08:05
	17:21	18:01	19:39	20:18	20:54	21:22	21:23	20:51	19:58	19:03	17:15	16:59
13	08:13	07:42	07:56	07:00	06:15	05:54	06:06	06:39	07:15	07:50	07:31	08:06
	17:22	18:03	19:40	20:19	20:55	21:23	21:23	20:49	19:56	19:01	17:14	17:00
14	08:12	07:41	07:54	06:58	06:14	05:54	06:07	06:40	07:16	07:52	07:32	08:07
	17:23	18:04	19:42	20:20	20:56	21:24	21:22	20:48	19:54	18:57	17:13	17:00
15	08:12	07:40	07:52	06:56	06:12	05:54	06:08	06:41	07:17	07:53	07:34	08:07
	17:25	18:06	19:43	20:21	20:57	21:24	21:21	20:46	19:52	18:56	17:12	17:00
16	08:11	07:38	07:51	06:55	06:11	05:54	06:09	06:42	07:18	07:54	07:35	08:08
	17:26	18:07	19:44	20:22	20:58	21:24	21:21	20:45	19:51	18:54	17:11	17:00
17	08:11	07:37	07:49	06:53	06:10	05:54	06:10	06:43	07:19	07:55	07:36	08:09
	17:27	18:08	19:45	20:24	21:00	21:25	21:20	20:43	19:49	18:52	17:10	17:00
18	08:10	07:35	07:47	06:51	06:09	05:54	06:11	06:44	07:20	07:57	07:38	08:09
	17:28	18:10	19:47	20:25	21:01	21:25	21:19	20:42	19:47	18:51	17:09	17:01
19	08:09	07:33	07:45	06:49	06:08	05:54	06:12	06:46	07:21	07:58	07:39	08:10
	17:30	18:11	19:48	20:26	21:02	21:26	21:19	20:40	19:45	18:49	17:09	17:01
20	08:09	07:32	07:43	06:48	06:07	05:54	06:13	06:47	07:23	07:59	07:40	08:11
	17:31	18:12	19:49	20:27	21:03	21:26	21:18	20:38	19:43	18:47	17:08	17:01
21	08:08	07:30	07:41	06:46	06:06	05:54	06:14	06:48	07:24	08:00	07:42	08:11
	17:32	18:14	19:50	20:29	21:04	21:26	21:17	20:37	19:41	18:46	17:07	17:02
22	08:07	07:29	07:40	06:44	06:05	05:55	06:15	06:49	07:25	08:02	07:43	08:12
	17:34	18:15	19:52	20:30	21:05	21:26	21:16	20:35	19:39	18:44	17:06	17:02
23	08:06	07:27	07:38	06:43	06:04	05:55	06:16	06:50	07:26	08:03	07:44	08:12
	17:35	18:17	19:53	20:31	21:06	21:27	21:15	20:34	19:37	18:43	17:05	17:03
24	08:06	07:26	07:36	06:41	06:04	05:55	06:17	06:51	07:27	08:04	07:45	08:13
	17:36	18:18	19:54	20:32	21:07	21:27	21:14	20:32	19:36	18:41	17:05	17:04
25	08:05	07:24	07:34	06:40	06:03	05:55	06:18	06:53	07:29	08:06	07:47	08:13
	17:38	18:19	19:55	20:33	21:08	21:27	21:13	20:30	19:34	18:39	17:04	17:04
26	08:04	07:22	07:32	06:38	06:02	05:56	06:19	06:54	07:30	08:07	07:48	08:13
	17:39	18:21	19:57	20:35	21:09	21:27	21:12	20:28	19:32	18:38	17:04	17:05
27	08:03	07:21	07:30	06:37	06:01	05:56	06:20	06:55	07:31	08:08	07:49	08:14
	17:40	18:22	19:58	20:36	21:10	21:27	21:11	20:27	19:30	18:36	17:03	17:05
28	08:02	07:19	07:28	06:35	06:00	05:57	06:21	06:56	07:32	08:10	07:50	08:14
	17:42	18:23	19:59	20:37	21:11	21:27	21:10	20:25	19:28	18:35	17:02	17:06
29	08:01		07:27	06:34	06:00	05:57	06:22	06:57	07:33	08:11	07:52	08:14
	17:43		20:00	20:38	21:12	21:27	21:09	20:23	19:26	18:33	17:02	17:07
30	08:00		07:25	06:32	05:59	05:57	06:23	06:58	07:34	08:12	07:53	08:14
	17:45		20:02	20:40	21:13	21:27	21:08	20:22	19:24	18:32	17:01	17:08
31	07:59		07:23		05:59		06:24	07:00		08:14		08:15
	17:46		20:03		21:14		21:07	20:20		18:31		17:09
Potential sun hours	288	292	369	403	458	464	470	435	377	342	289	276
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
Tetra Tech EC, Inc C/o Shin Ng
3475 E. Foothill Blvd
US-PASADENA, CA 91107
1 617 457 8405
Ted Guertin / ted.guertin@tetratech.com
Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 15 - Non-Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,582

Idle start wind speed: Cut in wind speed from power curve

	January		February	March	April		May	June	July	August		September		October	November		December	
1	08:15	08:39 (78)	07:58	07:18	07:22		06:31	05:59	05:59	06:26		07:01	07:23 (76)	07:36	07:15		07:54	08:25 (78)
	17:10 18	08:57 (78)	17:48	18:25	20:04		20:41	21:15	21:27	21:06		20:18 25	07:48 (76)	19:23	17:30		17:02 15	08:40 (78)
2	08:15	08:39 (78)	07:57	07:16	07:20	07:40 (76)	06:30	05:58	05:59	06:27		07:02	07:24 (76)	07:37	07:17		07:55	08:24 (78)
	17:11 18	08:57 (78)	17:49	18:27	20:06 4	07:44 (76)	20:42	21:16	21:27	21:05		20:17 24	07:48 (76)	19:21	17:28		17:01 17	08:41 (78)
3	08:15	08:39 (78)	07:56	07:14	07:18	07:38 (76)	06:28	05:58	06:00	06:28		07:04	07:25 (76)	07:39	07:18		07:56	08:25 (78)
	17:12 18	08:57 (78)	17:51	18:28	20:07 9	07:47 (76)	20:44	21:17	21:27	21:03		20:15 23	07:48 (76)	19:19	17:27		17:01 18	08:43 (78)
4	08:15	08:39 (78)	07:55	07:12	07:16	07:36 (76)	06:27	05:57	06:00	06:29		07:05	07:26 (76)	07:40	07:19		07:58	08:25 (78)
	17:13 19	08:58 (78)	17:52	18:29	20:08 12	07:48 (76)	20:45	21:17	21:27	21:02		20:13 21	07:47 (76)	19:18	17:26		17:01 19	08:44 (78)
5	08:15	08:39 (78)	07:53	07:11	07:14	07:34 (76)	06:25	05:57	06:01	06:30		07:06	07:27 (76)	07:41	07:21		07:59	08:25 (78)
	17:14 19	08:58 (78)	17:54	18:30	20:09 15	07:49 (76)	20:46	21:18	21:26	21:01		20:11 19	07:46 (76)	19:16	17:24		17:01 19	08:44 (78)
6	08:15	08:39 (78)	07:52	07:09	07:13	07:33 (76)	06:24	05:56	06:02	06:31		07:07	07:28 (76)	07:42	07:22		08:00	08:25 (78)
	17:15 20	08:59 (78)	17:55	18:32	20:11 17	07:50 (76)	20:47	21:19	21:26	21:00		20:09 17	07:45 (76)	19:14	17:23		17:00 20	08:45 (78)
7	08:15	08:40 (78)	07:51	07:07	07:11	07:31 (76)	06:23	05:56	06:02	06:32		07:08	07:30 (76)	07:43	07:23		08:01	08:26 (78)
	17:16 19	08:59 (78)	17:56	18:33	20:12 19	07:50 (76)	20:48	21:20	21:26	20:58		20:08 15	07:45 (76)	19:12	17:22		17:00 19	08:45 (78)
8	08:15	08:40 (78)	07:50	08:05	07:09	07:29 (76)	06:21	05:56	06:03	06:34		07:09	07:31 (76)	07:45	07:25		08:02	08:27 (78)
	17:17 19	08:59 (78)	17:58	18:34	20:13 21	07:50 (76)	20:50	21:20	21:25	20:57		20:06 12	07:43 (76)	19:10	17:21		17:00 19	08:46 (78)
9	08:14	08:41 (78)	07:48	08:04	07:07	07:27 (76)	06:20	05:55	06:04	06:35		07:10	07:32 (76)	07:46	07:26		08:03	08:28 (78)
	17:18 18	08:59 (78)	17:59	19:36	20:14 23	07:50 (76)	20:51	21:21	21:25	20:56		20:04 9	07:41 (76)	19:09	17:19		17:00 18	08:46 (78)
10	08:14	08:42 (78)	07:47	08:02	07:05	07:26 (76)	06:19	05:55	06:04	06:36		07:12	07:33 (76)	07:47	07:27		08:03	08:29 (78)
	17:19 17	08:59 (78)	18:01	19:37	20:16 24	07:50 (76)	20:52	21:22	21:25	20:54		20:02 5	07:38 (76)	19:07	17:18		17:00 18	08:47 (78)
11	08:14	08:43 (78)	07:46	08:00	07:04	07:25 (76)	06:18	05:55	06:05	06:37		07:13		07:48	07:29		08:04	08:30 (78)
	17:21 15	08:58 (78)	18:01	19:38	20:17 24	07:49 (76)	20:53	21:22	21:24	20:53		20:00		19:05	17:17		17:00 18	08:48 (78)
12	08:13	08:44 (78)	07:44	07:58	07:02	07:24 (76)	06:16	05:55	06:06	06:38		07:14		07:50	07:30		08:05	08:31 (78)
	17:22 15	08:59 (78)	18:02	19:40	20:18 25	07:49 (76)	20:54	21:23	21:24	20:51		19:58		19:03	17:16		17:00 17	08:48 (78)
13	08:13	08:45 (78)	07:43	07:56	07:00	07:24 (76)	06:15	05:55	06:07	06:39		07:15		07:51	07:32		08:06	08:31 (78)
	17:23 13	08:58 (78)	18:03	19:41	20:19 23	07:47 (76)	20:55	21:23	21:23	20:50		19:57		19:01	17:15		17:00 17	08:48 (78)
14	08:13	08:47 (78)	07:41	07:55	06:59	07:25 (76)	06:14	05:55	06:08	06:40		07:16		07:52	07:33		08:07	08:32 (78)
	17:24 10	08:57 (78)	18:05	19:42	20:20 22	07:47 (76)	20:57	21:24	21:22	20:48		19:55		19:00	17:14		17:00 17	08:49 (78)
15	08:12	08:48 (78)	07:40	07:53	06:57	07:26 (76)	06:13	05:55	06:09	06:42		07:17		07:53	07:34		08:08	08:33 (78)
	17:25 8	08:56 (78)	18:06	19:43	20:22 20	07:46 (76)	20:58	21:24	21:22	20:47		19:53		18:56	17:13		17:01 16	08:49 (78)
16	08:12		07:38	07:51	06:55	07:27 (76)	06:12	05:55	06:09	06:43		07:19		07:55	07:35		08:08	08:34 (78)
	17:27		18:08	19:45	20:23 17	07:44 (76)	20:59	21:25	21:21	20:45		19:51		18:55	17:12		17:01 16	08:50 (78)
17	08:11		07:37	07:49	06:53	07:29 (76)	06:11	05:55	06:10	06:44		07:20		07:56	07:37		08:09	08:34 (78)
	17:28		18:09	19:46	20:24 13	07:42 (76)	21:00	21:25	21:20	20:44		19:49		18:53	17:11		17:01 16	08:50 (78)
18	08:10		07:35	07:47	06:52	07:31 (76)	06:10	05:55	06:11	06:45		07:21		07:57	07:38		08:10	08:35 (78)
	17:29		18:10	19:47	20:25 7	07:38 (76)	21:01	21:26	21:20	20:42		19:47		18:51	17:10		17:01 16	08:51 (78)
19	08:10		07:34	07:46	06:50		06:09	05:55	06:12	06:46		07:22		07:58	07:39		08:10	08:36 (78)
	17:30		18:12	19:48	20:27		21:02	21:26	21:19	20:40		19:45		18:50	17:09		17:02 16	08:52 (78)
20	08:09		07:32	07:44	06:48		06:08	05:55	06:13	06:47		07:23		08:00	07:41		08:11	08:36 (78)
	17:32		18:13	19:50	20:28		21:03	21:26	21:18	20:39		19:44		18:48	17:08		17:02 16	08:52 (78)
21	08:08		07:31	07:42	06:47		06:07	05:55	06:14	06:48		07:24		08:01	07:42		08:12	08:37 (78)
	17:33		18:14	19:51	20:29		21:04	21:26	21:17	20:37		19:42		18:46	17:08		17:03 15	08:52 (78)
22	08:08		07:29	07:40	06:45		06:06	05:55	06:15	06:50		07:26		08:02	07:43		08:12	08:37 (78)
	17:34		18:16	19:52	20:30		21:05	21:27	21:16	20:36		19:40		18:45	17:07		17:03 15	08:52 (78)
23	08:07		07:28	07:38	06:43		06:05	05:55	06:16	06:51		07:27		08:04	07:45		08:13	08:38 (78)
	17:36		18:17	19:53	20:31		21:06	21:27	21:15	20:34		19:38		18:43	17:06		17:04 15	08:53 (78)
24	08:06		07:26	07:36	06:42		06:04	05:56	06:17	06:52		07:28		08:05	07:46		08:13	08:38 (78)
	17:37		18:19	19:55	20:33		21:07	21:27	21:15	20:32		19:36		18:42	17:05		17:04 16	08:54 (78)
25	08:05		07:24	07:35	06:40		06:03	05:56	06:18	06:53	07:34 (76)	07:29		08:06	07:47		08:13	08:38 (78)
	17:38		18:20	19:56	20:34		21:08	21:27	21:14	20:31 8	07:42 (76)	19:34		18:40	17:05		17:05 16	08:54 (78)
26	08:04		07:23	07:33	06:39		06:03	05:56	06:19	06:54	07:30 (76)	07:30		08:07	07:48		08:14	08:39 (78)
	17:40		18:21	19:57	20:35		21:09	21:27	21:13	20:29 14	07:44 (76)	19:32		18:38	17:04		17:05 16	08:55 (78)
27	08:03		07:21	07:31	06:37		06:02	05:57	06:20	06:55	07:28 (76)	07:31		08:09	07:49	08:28 (78)	08:14	08:39 (78)
	17:41		18:23	19:58	20:36		21:10	21:27	21:12	20:27 18	07:46 (76)	19:30		18:37	17:04 7	08:35 (78)	17:06 16	08:55 (78)
28	08:02		07:19	07:29	06:36		06:01	05:57	06:21	06:57	07:28 (76)	07:33		08:10	07:51	08:27 (78)	08:14	08:39 (78)
	17:42		18:24	20:00	20:38		21:11	21:27	21:10	20:25 20	07:48 (76)	19:29		18:35	17:03 10	08:37 (78)	17:07 16	08:55 (78)
29	08:01			07:27	06:34		06:00	05:58	06:22	06:58	07:26 (76)	07:34		08:11	07:52	08:26 (78)	08:15	08:39 (78)
	17:44			20:01	20:39		21:12	21:27	21:09	20:24 22	07:48 (76)	19:27		18:34	17:03 13	08:39 (78)	17:08 17	08:56 (78)
30	08:00			07:25	06:33		06:00	05:58	06:24	06:59	07:25 (76)	07:35		08:13	07:53	08:25 (78)	08:15	08:39 (78)
	17:45			20:02	20:40		21:13	21:27	21:08	20:22 23	07:48 (76)	19:25		18:33	17:02 15	08:40 (78)	17:08 17	08:56 (78)
31	07:59			07:24			05:59		06:25	07:00	07:24 (76)			08:14			08:15	08:39 (78)
	17:47			20:03			21:14		21:07	20:20 25	07:49 (76)			18:31			17:09 17	08:56 (78)
Potential sun hours	288		292	369	403		457	464	470	435		377		342	290		277	
Total, worst case		246				295					130		170			45		523
Sun reduction		0.62				0.59					0.74		0.69			0.51		0.51
Oper. time red.		0.98				0.98					0.98		0.98			0.98		0.98
Wind dir. red.		0.75				0.66					0.66		0.66			0.75		0.75
Total reduction		0.46				0.38					0.48		0.45			0.38		0.38
Total, real		113				113					62		76			17		198

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:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
Tetra Tech EC, Inc C/o Shin Ng
3475 E. Foothill Blvd
US-PASADENA, CA 91107
1 617 457 8405
Ted Guertin / ted.guertin@tetratech.com
Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 16 - Non-Participant
Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,582

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:15	07:58	07:18	07:22	06:31	05:59	05:59	06:26	07:02	07:36	07:16	07:54
	17:11	17:48	18:25	20:05	20:41	21:15	21:27	21:06	20:19	19:23	17:30	17:02
2	08:15	07:57	07:16	07:20	06:30	05:58	05:59	06:27	07:03	07:38	07:17	07:55
	17:12	17:50	18:27	20:06	20:43	21:16	21:27	21:05	20:17	19:21	17:29	17:02
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	17:13	17:53	18:29	20:08	20:45	21:18	21:27	21:02	20:13	19:18	17:26	17:01
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	17:14	17:54	18:31	20:10	20:46	21:18	21:27	21:01	20:12	19:16	17:25	17:01
6	08:15	07:52	07:09	07:13	06:24	05:57	06:02	06:32	07:07	07:42	07:22	08:00
	17:15	17:55	18:32	20:11	20:47	21:19	21:26	21:00	20:10	19:14	17:23	17:01
7	08:15	07:51	07:07	07:11	06:23	05:56	06:03	06:33	07:08	07:44	07:24	08:01
	17:16	17:57	18:33	20:12	20:49	21:20	21:26	20:58	20:08	19:12	17:22	17:01
8	08:15	07:50	08:06	07:09	06:22	05:56	06:03	06:34	07:10	07:45	07:25	08:02
	17:18	17:58	18:35	20:13	20:50	21:20	21:26	20:57	20:06	19:11	17:21	17:00
9	08:15	07:49	08:04	07:08	06:21	05:56	06:04	06:35	07:11	07:46	07:26	08:03
	17:19	18:00	19:36	20:15	20:51	21:21	21:25	20:56	20:04	19:09	17:20	17:00
10	08:14	07:47	08:02	07:06	06:19	05:55	06:05	06:36	07:12	07:47	07:28	08:04
	17:20	18:00	19:37	20:16	20:52	21:22	21:25	20:54	20:02	19:07	17:19	17:00
11	08:14	07:46	08:00	07:04	06:18	05:55	06:06	06:37	07:13	07:49	07:29	08:05
	17:21	18:01	19:39	20:17	20:53	21:22	21:24	20:53	20:01	19:05	17:17	17:00
12	08:14	07:44	07:59	07:02	06:17	05:55	06:06	06:38	07:14	07:50	07:30	08:05
	17:22	18:02	19:40	20:18	20:54	21:23	21:24	20:51	19:59	19:03	17:16	17:00
13	08:13	07:43	07:57	07:01	06:16	05:55	06:07	06:40	07:15	07:51	07:32	08:06
	17:23	18:04	19:41	20:19	20:56	21:23	21:23	20:50	19:57	19:02	17:15	17:01
14	08:13	07:42	07:55	06:59	06:14	05:55	06:08	06:41	07:16	07:52	07:33	08:07
	17:24	18:05	19:42	20:21	20:57	21:24	21:23	20:48	19:55	19:00	17:14	17:01
15	08:12	07:40	07:53	06:57	06:13	05:55	06:09	06:42	07:18	07:54	07:34	08:08
	17:26	18:06	19:44	20:22	20:58	21:24	21:22	20:47	19:53	18:57	17:13	17:01
16	08:12	07:39	07:51	06:55	06:12	05:55	06:10	06:43	07:19	07:55	07:36	08:09
	17:27	18:08	19:45	20:23	20:59	21:25	21:21	20:45	19:51	18:55	17:12	17:01
17	08:11	07:37	07:49	06:54	06:11	05:55	06:11	06:44	07:20	07:56	07:37	08:09
	17:28	18:09	19:46	20:24	21:00	21:25	21:21	20:44	19:49	18:53	17:11	17:01
18	08:11	07:36	07:48	06:52	06:10	05:55	06:12	06:45	07:21	07:57	07:38	08:10
	17:29	18:11	19:47	20:26	21:01	21:26	21:20	20:42	19:48	18:52	17:10	17:02
19	08:10	07:34	07:46	06:50	06:09	05:55	06:13	06:46	07:22	07:59	07:40	08:11
	17:31	18:12	19:49	20:27	21:02	21:26	21:19	20:41	19:46	18:50	17:09	17:02
20	08:09	07:33	07:44	06:49	06:08	05:55	06:14	06:48	07:23	08:00	07:41	08:11
	17:32	18:13	19:50	20:28	21:03	21:26	21:18	20:39	19:44	18:48	17:09	17:02
21	08:09	07:31	07:42	06:47	06:07	05:55	06:15	06:49	07:25	08:01	07:42	08:12
	17:33	18:15	19:51	20:29	21:04	21:27	21:17	20:37	19:42	18:47	17:08	17:03
22	08:08	07:29	07:40	06:45	06:06	05:56	06:15	06:50	07:26	08:02	07:43	08:12
	17:35	18:16	19:52	20:30	21:05	21:27	21:17	20:36	19:40	18:45	17:07	17:03
23	08:07	07:28	07:38	06:44	06:05	05:56	06:16	06:51	07:27	08:04	07:45	08:13
	17:36	18:17	19:54	20:32	21:07	21:27	21:16	20:34	19:38	18:43	17:06	17:04
24	08:06	07:26	07:37	06:42	06:05	05:56	06:17	06:52	07:28	08:05	07:46	08:13
	17:37	18:19	19:55	20:33	21:08	21:27	21:15	20:33	19:36	18:42	17:06	17:05
25	08:05	07:25	07:35	06:41	06:04	05:56	06:19	06:53	07:29	08:06	07:47	08:14
	17:39	18:20	19:56	20:34	21:09	21:27	21:14	20:31	19:34	18:40	17:05	17:05
26	08:04	07:23	07:33	06:39	06:03	05:57	06:20	06:55	07:30	08:08	07:48	08:14
	17:40	18:21	19:57	20:35	21:10	21:27	21:13	20:29	19:33	18:39	17:04	17:06
27	08:04	07:21	07:31	06:37	06:02	05:57	06:21	06:56	07:32	08:09	07:50	08:14
	17:41	18:23	19:59	20:37	21:10	21:28	21:12	20:27	19:31	18:37	17:04	17:06
28	08:03	07:20	07:29	06:36	06:01	05:58	06:22	06:57	07:33	08:10	07:51	08:15
	17:43	18:24	20:00	20:38	21:11	21:28	21:11	20:26	19:29	18:36	17:03	17:07
29	08:02		07:27	06:34	06:01	05:58	06:23	06:58	07:34	08:12	07:52	08:15
	17:44		20:01	20:39	21:12	21:28	21:10	20:24	19:27	18:34	17:03	17:08
30	08:01		07:26	06:33	06:00	05:58	06:24	06:59	07:35	08:13	07:53	08:15
	17:46		20:02	20:40	21:13	21:27	21:08	20:22	19:25	18:33	17:02	17:09
31	07:59		07:24		06:00		06:25	07:00		08:14		08:15
	17:47		20:03		21:14		21:07	20:20		18:31		17:10
Potential sun hours	288	292	369	403	457	464	470	435	377	342	290	277
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

Day in month	Sun rise (hh:mm)		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:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
Tetra Tech EC, Inc C/o Shin Ng
3475 E. Foothill Blvd
US-PASADENA, CA 91107
1 617 457 8405
Ted Guertin / ted.guertin@tetratech.com
Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 17 - Non-Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,582

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:16	07:59	07:18	07:22	06:32	05:59	05:59	06:26	07:02	07:37	07:16	07:55
	17:11	17:49	18:26	20:05	20:42	21:15	21:28	21:06	20:19	19:24	17:30	17:02
2	08:16	07:58	07:16	07:20	06:30	05:59	06:00	06:27	07:03	07:38	07:17	07:56
	17:12	17:50	18:27	20:06	20:43	21:16	21:28	21:05	20:17	19:22	17:29	17:02
3	08:16	07:56	07:15	07:19	06:29	05:58	06:00	06:28	07:04	07:39	07:19	07:57
	17:13	17:51	18:28	20:07	20:44	21:17	21:27	21:04	20:15	19:20	17:28	17:02
4	08:16	07:55	07:13	07:17	06:27	05:58	06:01	06:30	07:05	07:40	07:20	07:58
	17:14	17:53	18:30	20:09	20:45	21:18	21:27	21:03	20:14	19:18	17:26	17:01
5	08:16	07:54	07:11	07:15	06:26	05:57	06:02	06:31	07:06	07:41	07:21	07:59
	17:15	17:54	18:31	20:10	20:47	21:19	21:27	21:01	20:12	19:16	17:25	17:01
6	08:16	07:53	07:10	07:13	06:25	05:57	06:02	06:32	07:08	07:43	07:23	08:00
	17:16	17:56	18:32	20:11	20:48	21:19	21:27	21:00	20:10	19:14	17:24	17:01
7	08:15	07:51	07:08	07:11	06:23	05:57	06:03	06:33	07:09	07:44	07:24	08:01
	17:17	17:57	18:34	20:12	20:49	21:20	21:26	20:59	20:08	19:13	17:22	17:01
8	08:15	07:50	08:06	07:10	06:22	05:56	06:04	06:34	07:10	07:45	07:25	08:02
	17:18	17:58	18:35	20:14	20:50	21:21	21:26	20:57	20:06	19:11	17:21	17:01
9	08:15	07:49	08:04	07:08	06:21	05:56	06:04	06:35	07:11	07:46	07:27	08:03
	17:19	18:00	19:36	20:15	20:51	21:21	21:26	20:56	20:05	19:09	17:20	17:01
10	08:15	07:48	08:02	07:06	06:20	05:56	06:05	06:36	07:12	07:48	07:28	08:04
	17:20	18:00	19:38	20:16	20:52	21:22	21:25	20:55	20:03	19:07	17:19	17:01
11	08:14	07:46	08:01	07:04	06:18	05:56	06:06	06:38	07:13	07:49	07:29	08:05
	17:21	18:01	19:39	20:17	20:54	21:23	21:25	20:53	20:01	19:06	17:18	17:01
12	08:14	07:45	07:59	07:03	06:17	05:55	06:07	06:39	07:14	07:50	07:31	08:06
	17:22	18:03	19:40	20:19	20:55	21:23	21:24	20:52	19:59	19:04	17:17	17:01
13	08:14	07:43	07:57	07:01	06:16	05:55	06:07	06:40	07:16	07:51	07:32	08:07
	17:24	18:04	19:41	20:20	20:56	21:24	21:24	20:50	19:57	19:02	17:16	17:01
14	08:13	07:42	07:55	06:59	06:15	05:55	06:08	06:41	07:17	07:53	07:33	08:07
	17:25	18:05	19:43	20:21	20:57	21:24	21:23	20:49	19:55	19:00	17:14	17:01
15	08:13	07:40	07:53	06:57	06:14	05:55	06:09	06:42	07:18	07:54	07:35	08:08
	17:26	18:07	19:44	20:22	20:58	21:25	21:22	20:47	19:53	18:57	17:13	17:01
16	08:12	07:39	07:52	06:56	06:12	05:55	06:10	06:43	07:19	07:55	07:36	08:09
	17:27	18:08	19:45	20:23	20:59	21:25	21:22	20:46	19:52	18:55	17:12	17:01
17	08:12	07:37	07:50	06:54	06:11	05:55	06:11	06:44	07:20	07:56	07:37	08:10
	17:28	18:10	19:46	20:25	21:00	21:26	21:21	20:44	19:50	18:53	17:12	17:02
18	08:11	07:36	07:48	06:52	06:10	05:55	06:12	06:46	07:21	07:58	07:39	08:10
	17:30	18:11	19:48	20:26	21:02	21:26	21:20	20:43	19:48	18:52	17:11	17:02
19	08:10	07:34	07:46	06:51	06:09	05:55	06:13	06:47	07:23	07:59	07:40	08:11
	17:31	18:12	19:49	20:27	21:03	21:26	21:19	20:41	19:46	18:50	17:10	17:02
20	08:10	07:33	07:44	06:49	06:08	05:55	06:14	06:48	07:24	08:00	07:41	08:11
	17:32	18:14	19:50	20:28	21:04	21:27	21:19	20:39	19:44	18:48	17:09	17:03
21	08:09	07:31	07:42	06:47	06:07	05:56	06:15	06:49	07:25	08:01	07:43	08:12
	17:34	18:15	19:51	20:30	21:05	21:27	21:18	20:38	19:42	18:47	17:08	17:03
22	08:08	07:30	07:41	06:46	06:07	05:56	06:16	06:50	07:26	08:03	07:44	08:13
	17:35	18:16	19:53	20:31	21:06	21:27	21:17	20:36	19:40	18:45	17:07	17:04
23	08:07	07:28	07:39	06:44	06:06	05:56	06:17	06:51	07:27	08:04	07:45	08:13
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24	08:07	07:26	07:37	06:42	06:05	05:56	06:18	06:53	07:28	08:05	07:46	08:13
	17:38	18:19	19:55	20:33	21:08	21:28	21:15	20:33	19:37	18:42	17:06	17:05
25	08:06	07:25	07:35	06:41	06:04	05:57	06:19	06:54	07:30	08:07	07:48	08:14
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26	08:05	07:23	07:33	06:39	06:03	05:57	06:20	06:55	07:31	08:08	07:49	08:14
	17:40	18:22	19:58	20:36	21:10	21:28	21:13	20:29	19:33	18:39	17:05	17:06
27	08:04	07:22	07:31	06:38	06:02	05:57	06:21	06:56	07:32	08:09	07:50	08:15
	17:42	18:23	19:59	20:37	21:11	21:28	21:12	20:28	19:31	18:38	17:04	17:07
28	08:03	07:20	07:30	06:36	06:02	05:58	06:22	06:57	07:33	08:11	07:51	08:15
	17:43	18:24	20:00	20:38	21:12	21:28	21:11	20:26	19:29	18:36	17:04	17:07
29	08:02		07:28	06:35	06:01	05:58	06:23	06:58	07:34	08:12	07:52	08:15
	17:44		20:01	20:39	21:13	21:28	21:10	20:24	19:27	18:35	17:03	17:08
30	08:01		07:26	06:33	06:00	05:59	06:24	06:59	07:35	08:13	07:54	08:15
	17:46		20:03	20:40	21:14	21:28	21:09	20:23	19:25	18:33	17:03	17:09
31	08:00		07:24		06:00		06:25	07:01		08:15		08:15
	17:47		20:04		21:14		21:08	20:21		18:32		17:10
Potential sun hours	288	292	369	403	457	464	470	435	377	342	290	277
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

Day in month	Sun rise (hh:mm)		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:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
Tetra Tech EC, Inc C/o Shin Ng
3475 E. Foothill Blvd
US-PASADENA, CA 91107
1 617 457 8405
Ted Guertin / ted.guertin@tetratech.com
Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 18 - Non-Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,582

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:16	07:59	07:18	07:22	06:31	05:58	05:58	06:26	07:01	07:37	07:16	07:55
	17:10	17:48	18:25	20:05	20:42	21:16	21:28	21:07	20:19	19:23	17:30	17:02
2	08:16	07:58	07:17	07:20	06:30	05:58	05:59	06:27	07:03	07:38	07:18	07:56
	17:11	17:49	18:27	20:06	20:43	21:17	21:28	21:06	20:17	19:22	17:28	17:01
3	08:16	07:57	07:15	07:18	06:28	05:57	06:00	06:28	07:04	07:39	07:19	07:57
	17:12	17:51	18:28	20:08	20:44	21:18	21:28	21:04	20:16	19:20	17:27	17:01
4	08:16	07:56	07:13	07:17	06:27	05:57	06:00	06:29	07:05	07:40	07:20	07:59
	17:13	17:52	18:29	20:09	20:46	21:18	21:28	21:03	20:14	19:18	17:26	17:01
5	08:16	07:54	07:11	07:15	06:26	05:57	06:01	06:30	07:06	07:41	07:22	08:00
	17:14	17:54	18:31	20:10	20:47	21:19	21:28	21:02	20:12	19:16	17:24	17:00
6	08:16	07:53	07:10	07:13	06:24	05:56	06:01	06:31	07:07	07:43	07:23	08:01
	17:15	17:55	18:32	20:11	20:48	21:20	21:27	21:01	20:10	19:14	17:23	17:00
7	08:16	07:52	07:08	07:11	06:23	05:56	06:02	06:32	07:08	07:44	07:24	08:02
	17:16	17:56	18:33	20:12	20:49	21:21	21:27	20:59	20:08	19:12	17:22	17:00
8	08:16	07:51	08:06	07:09	06:21	05:55	06:03	06:34	07:10	07:45	07:26	08:03
	17:17	17:58	18:35	20:14	20:50	21:21	21:27	20:58	20:06	19:11	17:21	17:00
9	08:15	07:49	08:04	07:08	06:20	05:55	06:04	06:35	07:11	07:46	07:27	08:04
	17:18	17:59	19:36	20:15	20:52	21:22	21:26	20:56	20:05	19:09	17:19	17:00
10	08:15	07:48	08:02	07:06	06:19	05:55	06:04	06:36	07:12	07:48	07:28	08:05
	17:19	18:01	19:37	20:16	20:53	21:23	21:26	20:55	20:03	19:07	17:18	17:00
11	08:15	07:46	08:01	07:04	06:18	05:55	06:05	06:37	07:13	07:49	07:30	08:05
	17:20	18:01	19:39	20:17	20:54	21:23	21:25	20:54	20:01	19:05	17:17	17:00
12	08:14	07:45	07:59	07:02	06:16	05:55	06:06	06:38	07:14	07:50	07:31	08:06
	17:22	18:02	19:40	20:19	20:55	21:24	21:25	20:52	19:59	19:03	17:16	17:00
13	08:14	07:44	07:57	07:00	06:15	05:54	06:07	06:39	07:15	07:51	07:32	08:07
	17:23	18:04	19:41	20:20	20:56	21:24	21:24	20:51	19:57	19:02	17:15	17:00
14	08:14	07:42	07:55	06:59	06:14	05:54	06:08	06:40	07:17	07:53	07:34	08:08
	17:24	18:05	19:42	20:21	20:57	21:25	21:23	20:49	19:55	19:00	17:14	17:00
15	08:13	07:41	07:53	06:57	06:13	05:54	06:08	06:42	07:18	07:54	07:35	08:09
	17:25	18:06	19:44	20:22	20:59	21:25	21:23	20:48	19:53	18:57	17:13	17:00
16	08:13	07:39	07:52	06:55	06:12	05:54	06:09	06:43	07:19	07:55	07:36	08:09
	17:26	18:08	19:45	20:24	21:00	21:26	21:22	20:46	19:52	18:55	17:12	17:01
17	08:12	07:38	07:50	06:54	06:11	05:54	06:10	06:44	07:20	07:56	07:38	08:10
	17:28	18:09	19:46	20:25	21:01	21:26	21:21	20:44	19:50	18:53	17:11	17:01
18	08:11	07:36	07:48	06:52	06:10	05:54	06:11	06:45	07:21	07:58	07:39	08:11
	17:29	18:10	19:48	20:26	21:02	21:27	21:21	20:43	19:48	18:51	17:10	17:01
19	08:11	07:35	07:46	06:50	06:09	05:54	06:12	06:46	07:22	07:59	07:40	08:11
	17:30	18:12	19:49	20:27	21:03	21:27	21:20	20:41	19:46	18:50	17:09	17:02
20	08:10	07:33	07:44	06:48	06:08	05:55	06:13	06:47	07:24	08:00	07:42	08:12
	17:32	18:13	19:50	20:29	21:04	21:27	21:19	20:40	19:44	18:48	17:08	17:02
21	08:09	07:31	07:42	06:47	06:07	05:55	06:14	06:49	07:25	08:02	07:43	08:13
	17:33	18:15	19:51	20:30	21:05	21:28	21:18	20:38	19:42	18:46	17:07	17:02
22	08:09	07:30	07:40	06:45	06:06	05:55	06:15	06:50	07:26	08:03	07:44	08:13
	17:34	18:16	19:53	20:31	21:06	21:28	21:17	20:36	19:40	18:45	17:07	17:03
23	08:08	07:28	07:39	06:44	06:05	05:55	06:16	06:51	07:27	08:04	07:46	08:14
	17:36	18:17	19:54	20:32	21:07	21:28	21:16	20:35	19:38	18:43	17:06	17:03
24	08:07	07:27	07:37	06:42	06:04	05:55	06:17	06:52	07:28	08:06	07:47	08:14
	17:37	18:19	19:55	20:33	21:08	21:28	21:16	20:33	19:37	18:42	17:05	17:04
25	08:06	07:25	07:35	06:40	06:03	05:56	06:18	06:53	07:29	08:07	07:48	08:14
	17:38	18:20	19:56	20:35	21:09	21:28	21:15	20:31	19:35	18:40	17:05	17:05
26	08:05	07:23	07:33	06:39	06:02	05:56	06:19	06:54	07:31	08:08	07:49	08:15
	17:40	18:21	19:58	20:36	21:10	21:28	21:14	20:30	19:33	18:39	17:04	17:05
27	08:04	07:22	07:31	06:37	06:02	05:57	06:20	06:56	07:32	08:10	07:50	08:15
	17:41	18:23	19:59	20:37	21:11	21:28	21:13	20:28	19:31	18:37	17:03	17:06
28	08:03	07:20	07:29	06:36	06:01	05:57	06:21	06:57	07:33	08:11	07:52	08:15
	17:42	18:24	20:00	20:38	21:12	21:28	21:11	20:26	19:29	18:36	17:03	17:07
29	08:02		07:28	06:34	06:00	05:57	06:22	06:58	07:34	08:12	07:53	08:16
	17:44		20:01	20:40	21:13	21:28	21:10	20:24	19:27	18:34	17:02	17:07
30	08:01		07:26	06:33	06:00	05:58	06:23	06:59	07:35	08:14	07:54	08:16
	17:45		20:03	20:41	21:14	21:28	21:09	20:23	19:25	18:33	17:02	17:08
31	08:00		07:24		05:59		06:25	07:00		08:15		08:16
	17:47		20:04		21:15		21:08	20:21		18:31		17:09
Potential sun hours	287	292	369	403	458	464	471	435	377	341	289	276
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
Tetra Tech EC, Inc C/o Shin Ng
3475 E. Foothill Blvd
US-PASADENA, CA 91107
1 617 457 8405
Ted Guertin / ted.guertin@tetratech.com
Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 19 - Non-Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,582

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:16	07:59	07:18	07:22	06:31	05:58	05:58	06:25	07:01	07:36	07:16	07:55
	17:10	17:48	18:25	20:05	20:42	21:16	21:28	21:07	20:19	19:23	17:30	17:01
2	08:16	07:58	07:16	07:20	06:30	05:58	05:59	06:27	07:02	07:38	07:17	07:56
	17:11	17:49	18:27	20:06	20:43	21:17	21:28	21:06	20:17	19:21	17:28	17:01
3	08:16	07:57	07:15	07:18	06:28	05:57	05:59	06:28	07:04	07:39	07:19	07:57
	17:12	17:51	18:28	20:07	20:44	21:17	21:28	21:04	20:15	19:20	17:27	17:01
4	08:16	07:55	07:13	07:16	06:27	05:57	06:00	06:29	07:05	07:40	07:20	07:58
	17:13	17:52	18:29	20:09	20:46	21:18	21:28	21:03	20:14	19:18	17:26	17:00
5	08:16	07:54	07:11	07:15	06:25	05:56	06:01	06:30	07:06	07:41	07:21	07:59
	17:14	17:53	18:31	20:10	20:47	21:19	21:27	21:02	20:12	19:16	17:24	17:00
6	08:16	07:53	07:09	07:13	06:24	05:56	06:01	06:31	07:07	07:43	07:23	08:01
	17:15	17:55	18:32	20:11	20:48	21:20	21:27	21:00	20:10	19:14	17:23	17:00
7	08:16	07:52	07:08	07:11	06:23	05:56	06:02	06:32	07:08	07:44	07:24	08:02
	17:16	17:56	18:33	20:12	20:49	21:21	21:27	20:59	20:08	19:12	17:22	17:00
8	08:16	07:50	08:06	07:09	06:21	05:55	06:03	06:33	07:09	07:45	07:26	08:03
	17:17	17:58	18:35	20:14	20:50	21:21	21:26	20:58	20:06	19:10	17:20	17:00
9	08:15	07:49	08:04	07:07	06:20	05:55	06:03	06:35	07:11	07:46	07:27	08:03
	17:18	17:59	19:36	20:15	20:52	21:22	21:26	20:56	20:04	19:09	17:19	17:00
10	08:15	07:48	08:02	07:06	06:19	05:55	06:04	06:36	07:12	07:47	07:28	08:04
	17:19	18:01	19:37	20:16	20:53	21:23	21:26	20:55	20:03	19:07	17:18	17:00
11	08:15	07:46	08:00	07:04	06:17	05:55	06:05	06:37	07:13	07:49	07:30	08:05
	17:20	18:01	19:38	20:17	20:54	21:23	21:25	20:53	20:01	19:05	17:17	17:00
12	08:14	07:45	07:59	07:02	06:16	05:54	06:06	06:38	07:14	07:50	07:31	08:06
	17:21	18:02	19:40	20:18	20:55	21:24	21:25	20:52	19:59	19:03	17:16	17:00
13	08:14	07:43	07:57	07:00	06:15	05:54	06:07	06:39	07:15	07:51	07:32	08:07
	17:23	18:03	19:41	20:20	20:56	21:24	21:24	20:50	19:57	19:02	17:15	17:00
14	08:13	07:42	07:55	06:59	06:14	05:54	06:07	06:40	07:16	07:53	07:34	08:08
	17:24	18:05	19:42	20:21	20:57	21:25	21:23	20:49	19:55	19:00	17:14	17:00
15	08:13	07:41	07:53	06:57	06:13	05:54	06:08	06:41	07:18	07:54	07:35	08:09
	17:25	18:06	19:44	20:22	20:58	21:25	21:23	20:47	19:53	18:56	17:13	17:00
16	08:12	07:39	07:51	06:55	06:12	05:54	06:09	06:43	07:19	07:55	07:36	08:09
	17:26	18:08	19:45	20:23	21:00	21:26	21:22	20:46	19:51	18:55	17:12	17:00
17	08:12	07:38	07:50	06:53	06:11	05:54	06:10	06:44	07:20	07:56	07:38	08:10
	17:28	18:09	19:46	20:25	21:01	21:26	21:21	20:44	19:50	18:53	17:11	17:01
18	08:11	07:36	07:48	06:52	06:10	05:54	06:11	06:45	07:21	07:58	07:39	08:11
	17:29	18:10	19:47	20:26	21:02	21:27	21:21	20:43	19:48	18:51	17:10	17:01
19	08:11	07:34	07:46	06:50	06:08	05:54	06:12	06:46	07:22	07:59	07:40	08:11
	17:30	18:12	19:49	20:27	21:03	21:27	21:20	20:41	19:46	18:50	17:09	17:01
20	08:10	07:33	07:44	06:48	06:07	05:54	06:13	06:47	07:23	08:00	07:42	08:12
	17:31	18:13	19:50	20:28	21:04	21:27	21:19	20:40	19:44	18:48	17:08	17:02
21	08:09	07:31	07:42	06:47	06:07	05:55	06:14	06:48	07:25	08:01	07:43	08:12
	17:33	18:14	19:51	20:30	21:05	21:27	21:18	20:38	19:42	18:46	17:07	17:02
22	08:08	07:30	07:40	06:45	06:06	05:55	06:15	06:50	07:26	08:03	07:44	08:13
	17:34	18:16	19:52	20:31	21:06	21:28	21:17	20:36	19:40	18:45	17:07	17:03
23	08:08	07:28	07:38	06:43	06:05	05:55	06:16	06:51	07:27	08:04	07:45	08:13
	17:35	18:17	19:54	20:32	21:07	21:28	21:16	20:35	19:38	18:43	17:06	17:03
24	08:07	07:26	07:37	06:42	06:04	05:55	06:17	06:52	07:28	08:05	07:47	08:14
	17:37	18:19	19:55	20:33	21:08	21:28	21:15	20:33	19:36	18:42	17:05	17:04
25	08:06	07:25	07:35	06:40	06:03	05:56	06:18	06:53	07:29	08:07	07:48	08:14
	17:38	18:20	19:56	20:35	21:09	21:28	21:14	20:31	19:34	18:40	17:04	17:04
26	08:05	07:23	07:33	06:39	06:02	05:56	06:19	06:54	07:30	08:08	07:49	08:15
	17:39	18:21	19:57	20:36	21:10	21:28	21:13	20:29	19:33	18:38	17:04	17:05
27	08:04	07:21	07:31	06:37	06:01	05:56	06:20	06:55	07:32	08:09	07:50	08:15
	17:41	18:23	19:59	20:37	21:11	21:28	21:12	20:28	19:31	18:37	17:03	17:06
28	08:03	07:20	07:29	06:36	06:01	05:57	06:21	06:57	07:33	08:11	07:52	08:15
	17:42	18:24	20:00	20:38	21:12	21:28	21:11	20:26	19:29	18:35	17:03	17:06
29	08:02		07:27	06:34	06:00	05:57	06:22	06:58	07:34	08:12	07:53	08:16
	17:44		20:01	20:39	21:13	21:28	21:10	20:24	19:27	18:34	17:02	17:07
30	08:01		07:26	06:33	05:59	05:58	06:23	06:59	07:35	08:13	07:54	08:16
	17:45		20:02	20:41	21:14	21:28	21:09	20:23	19:25	18:32	17:02	17:08
31	08:00		07:24		05:59		06:24	07:00		08:15		08:16
	17:46		20:04		21:15		21:08	20:21		18:31		17:09
Potential sun hours	287	292	369	403	458	464	471	435	377	341	289	276
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
Tetra Tech EC, Inc C/o Shin Ng
3475 E. Foothill Blvd
US-PASADENA, CA 91107
1 617 457 8405
Ted Guertin / ted.guertin@tetratech.com
Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 20 - Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,582

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:16	07:59	07:18	07:22	06:31	05:58	05:58	06:25	07:01	07:36	07:16	07:55
	17:10	17:48	18:25	20:05	20:42	21:16	21:28	21:06	20:19	19:23	17:29	17:01
2	08:16	07:57	07:16	07:20	06:29	05:58	05:59	06:26	07:02	07:37	07:17	07:56
	17:11	17:49	18:26	20:06	20:43	21:16	21:28	21:05	20:17	19:21	17:28	17:01
3	08:16	07:56	07:14	07:18	06:28	05:57	05:59	06:28	07:03	07:39	07:18	07:57
	17:12	17:51	18:28	20:07	20:44	21:17	21:28	21:04	20:15	19:19	17:27	17:01
4	08:16	07:55	07:13	07:16	06:27	05:57	06:00	06:29	07:05	07:40	07:20	07:58
	17:13	17:52	18:29	20:08	20:45	21:18	21:27	21:03	20:13	19:18	17:25	17:00
5	08:16	07:54	07:11	07:14	06:25	05:56	06:00	06:30	07:06	07:41	07:21	07:59
	17:14	17:53	18:30	20:10	20:46	21:19	21:27	21:01	20:12	19:16	17:24	17:00
6	08:16	07:53	07:09	07:13	06:24	05:56	06:01	06:31	07:07	07:42	07:23	08:00
	17:15	17:55	18:32	20:11	20:48	21:20	21:27	21:00	20:10	19:14	17:23	17:00
7	08:15	07:51	07:07	07:11	06:22	05:55	06:02	06:32	07:08	07:44	07:24	08:01
	17:16	17:56	18:33	20:12	20:49	21:20	21:26	20:59	20:08	19:12	17:22	17:00
8	08:15	07:50	08:06	07:09	06:21	05:55	06:02	06:33	07:09	07:45	07:25	08:02
	17:17	17:58	18:34	20:13	20:50	21:21	21:26	20:57	20:06	19:10	17:20	17:00
9	08:15	07:49	08:04	07:07	06:20	05:55	06:03	06:34	07:10	07:46	07:27	08:03
	17:18	17:59	19:36	20:15	20:51	21:22	21:26	20:56	20:04	19:08	17:19	17:00
10	08:15	07:47	08:02	07:05	06:19	05:55	06:04	06:36	07:12	07:47	07:28	08:04
	17:19	18:00	19:37	20:16	20:52	21:22	21:25	20:55	20:02	19:07	17:18	17:00
11	08:14	07:46	08:00	07:04	06:17	05:54	06:05	06:37	07:13	07:49	07:29	08:05
	17:20	18:00	19:38	20:17	20:54	21:23	21:25	20:53	20:01	19:05	17:17	17:00
12	08:14	07:45	07:58	07:02	06:16	05:54	06:06	06:38	07:14	07:50	07:31	08:06
	17:21	18:02	19:40	20:18	20:55	21:23	21:24	20:52	19:59	19:03	17:16	17:00
13	08:14	07:43	07:57	07:00	06:15	05:54	06:06	06:39	07:15	07:51	07:32	08:07
	17:22	18:03	19:41	20:19	20:56	21:24	21:24	20:50	19:57	19:01	17:15	17:00
14	08:13	07:42	07:55	06:58	06:14	05:54	06:07	06:40	07:16	07:52	07:33	08:08
	17:24	18:05	19:42	20:21	20:57	21:25	21:23	20:49	19:55	19:00	17:14	17:00
15	08:13	07:40	07:53	06:57	06:13	05:54	06:08	06:41	07:17	07:54	07:35	08:08
	17:25	18:06	19:43	20:22	20:58	21:25	21:22	20:47	19:53	18:56	17:13	17:00
16	08:12	07:39	07:51	06:55	06:12	05:54	06:09	06:42	07:19	07:55	07:36	08:09
	17:26	18:07	19:45	20:23	20:59	21:25	21:22	20:46	19:51	18:54	17:12	17:00
17	08:12	07:37	07:49	06:53	06:10	05:54	06:10	06:44	07:20	07:56	07:37	08:10
	17:27	18:09	19:46	20:24	21:00	21:26	21:21	20:44	19:49	18:53	17:11	17:01
18	08:11	07:36	07:47	06:51	06:09	05:54	06:11	06:45	07:21	07:57	07:39	08:10
	17:29	18:10	19:47	20:26	21:02	21:26	21:20	20:42	19:47	18:51	17:10	17:01
19	08:10	07:34	07:46	06:50	06:08	05:54	06:12	06:46	07:22	07:59	07:40	08:11
	17:30	18:12	19:48	20:27	21:03	21:27	21:20	20:41	19:46	18:49	17:09	17:01
20	08:10	07:33	07:44	06:48	06:07	05:54	06:13	06:47	07:23	08:00	07:41	08:12
	17:31	18:13	19:50	20:28	21:04	21:27	21:19	20:39	19:44	18:48	17:08	17:02
21	08:09	07:31	07:42	06:46	06:06	05:54	06:14	06:48	07:24	08:01	07:43	08:12
	17:33	18:14	19:51	20:29	21:05	21:27	21:18	20:38	19:42	18:46	17:07	17:02
22	08:08	07:29	07:40	06:45	06:05	05:55	06:15	06:49	07:26	08:03	07:44	08:13
	17:34	18:16	19:52	20:31	21:06	21:27	21:17	20:36	19:40	18:45	17:06	17:03
23	08:07	07:28	07:38	06:43	06:05	05:55	06:16	06:51	07:27	08:04	07:45	08:13
	17:35	18:17	19:53	20:32	21:07	21:28	21:16	20:34	19:38	18:43	17:06	17:03
24	08:07	07:26	07:36	06:42	06:04	05:55	06:17	06:52	07:28	08:05	07:46	08:14
	17:37	18:18	19:55	20:33	21:08	21:28	21:15	20:33	19:36	18:41	17:05	17:04
25	08:06	07:25	07:35	06:40	06:03	05:55	06:18	06:53	07:29	08:06	07:48	08:14
	17:38	18:20	19:56	20:34	21:09	21:28	21:14	20:31	19:34	18:40	17:04	17:04
26	08:05	07:23	07:33	06:38	06:02	05:56	06:19	06:54	07:30	08:08	07:49	08:14
	17:39	18:21	19:57	20:35	21:10	21:28	21:13	20:29	19:32	18:38	17:04	17:05
27	08:04	07:21	07:31	06:37	06:01	05:56	06:20	06:55	07:31	08:09	07:50	08:15
	17:41	18:22	19:58	20:37	21:11	21:28	21:12	20:28	19:31	18:37	17:03	17:06
28	08:03	07:20	07:29	06:35	06:01	05:57	06:21	06:56	07:33	08:10	07:51	08:15
	17:42	18:24	20:00	20:38	21:12	21:28	21:11	20:26	19:29	18:35	17:03	17:06
29	08:02		07:27	06:34	06:00	05:57	06:22	06:58	07:34	08:12	07:52	08:15
	17:43		20:01	20:39	21:13	21:28	21:10	20:24	19:27	18:34	17:02	17:07
30	08:01		07:25	06:32	05:59	05:58	06:23	06:59	07:35	08:13	07:54	08:15
	17:45		20:02	20:40	21:14	21:28	21:09	20:22	19:25	18:32	17:02	17:08
31	08:00		07:23		05:59		06:24	07:00		08:14		08:16
	17:46		20:03		21:15		21:08	20:21		18:31		17:09
Potential sun hours	287	292	369	403	458	464	470	435	377	341	289	276
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
Tetra Tech EC, Inc C/o Shin Ng
3475 E. Foothill Blvd
US-PASADENA, CA 91107
1 617 457 8405
Ted Guertin / ted.guertin@tetratech.com
Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 21 - Non-Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,582

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:16	07:59	07:18	07:22	06:31	05:58	05:58	06:25	07:01	07:36	07:16	07:55
	17:10	17:48	18:25	20:05	20:42	21:16	21:28	21:07	20:19	19:23	17:30	17:01
2	08:16	07:58	07:16	07:20	06:30	05:58	05:59	06:27	07:02	07:38	07:17	07:56
	17:11	17:49	18:27	20:06	20:43	21:16	21:28	21:05	20:17	19:21	17:28	17:01
3	08:16	07:56	07:15	07:18	06:28	05:57	05:59	06:28	07:04	07:39	07:19	07:57
	17:12	17:51	18:28	20:07	20:44	21:17	21:28	21:04	20:15	19:20	17:27	17:01
4	08:16	07:55	07:13	07:16	06:27	05:57	06:00	06:29	07:05	07:40	07:20	07:58
	17:13	17:52	18:29	20:08	20:45	21:18	21:27	21:03	20:13	19:18	17:26	17:00
5	08:16	07:54	07:11	07:14	06:25	05:56	06:01	06:30	07:06	07:41	07:21	07:59
	17:14	17:53	18:31	20:10	20:47	21:19	21:27	21:02	20:12	19:16	17:24	17:00
6	08:16	07:53	07:09	07:13	06:24	05:56	06:01	06:31	07:07	07:42	07:23	08:00
	17:15	17:55	18:32	20:11	20:48	21:20	21:27	21:00	20:10	19:14	17:23	17:00
7	08:16	07:51	07:08	07:11	06:23	05:56	06:02	06:32	07:08	07:44	07:24	08:01
	17:16	17:56	18:33	20:12	20:49	21:20	21:27	20:59	20:08	19:12	17:22	17:00
8	08:15	07:50	08:06	07:09	06:21	05:55	06:03	06:33	07:09	07:45	07:25	08:02
	17:17	17:58	18:34	20:13	20:50	21:21	21:26	20:57	20:06	19:10	17:20	17:00
9	08:15	07:49	08:04	07:07	06:20	05:55	06:03	06:35	07:11	07:46	07:27	08:03
	17:18	17:59	19:36	20:15	20:51	21:22	21:26	20:56	20:04	19:09	17:19	17:00
10	08:15	07:48	08:02	07:06	06:19	05:55	06:04	06:36	07:12	07:47	07:28	08:04
	17:19	18:01	19:37	20:16	20:53	21:22	21:25	20:55	20:02	19:07	17:18	17:00
11	08:15	07:46	08:00	07:04	06:17	05:55	06:05	06:37	07:13	07:49	07:29	08:05
	17:20	18:01	19:38	20:17	20:54	21:23	21:25	20:53	20:01	19:05	17:17	17:00
12	08:14	07:45	07:59	07:02	06:16	05:54	06:06	06:38	07:14	07:50	07:31	08:06
	17:21	18:02	19:40	20:18	20:55	21:24	21:24	20:52	19:59	19:03	17:16	17:00
13	08:14	07:43	07:57	07:00	06:15	05:54	06:07	06:39	07:15	07:51	07:32	08:07
	17:23	18:03	19:41	20:20	20:56	21:24	21:24	20:50	19:57	19:02	17:15	17:00
14	08:13	07:42	07:55	06:58	06:14	05:54	06:07	06:40	07:16	07:52	07:33	08:08
	17:24	18:05	19:42	20:21	20:57	21:25	21:23	20:49	19:55	19:00	17:14	17:00
15	08:13	07:40	07:53	06:57	06:13	05:54	06:08	06:41	07:17	07:54	07:35	08:08
	17:25	18:06	19:43	20:22	20:58	21:25	21:23	20:47	19:53	18:56	17:13	17:00
16	08:12	07:39	07:51	06:55	06:12	05:54	06:09	06:43	07:19	07:55	07:36	08:09
	17:26	18:08	19:45	20:23	20:59	21:26	21:22	20:46	19:51	18:55	17:12	17:00
17	08:12	07:37	07:49	06:53	06:11	05:54	06:10	06:44	07:20	07:56	07:37	08:10
	17:28	18:09	19:46	20:25	21:01	21:26	21:21	20:44	19:49	18:53	17:11	17:01
18	08:11	07:36	07:48	06:52	06:10	05:54	06:11	06:45	07:21	07:57	07:39	08:10
	17:29	18:10	19:47	20:26	21:02	21:26	21:20	20:43	19:48	18:51	17:10	17:01
19	08:10	07:34	07:46	06:50	06:09	05:54	06:12	06:46	07:22	07:59	07:40	08:11
	17:30	18:12	19:49	20:27	21:03	21:27	21:20	20:41	19:46	18:50	17:09	17:01
20	08:10	07:33	07:44	06:48	06:08	05:54	06:13	06:47	07:23	08:00	07:41	08:12
	17:31	18:13	19:50	20:28	21:04	21:27	21:19	20:39	19:44	18:48	17:08	17:02
21	08:09	07:31	07:42	06:47	06:07	05:55	06:14	06:48	07:24	08:01	07:43	08:12
	17:33	18:14	19:51	20:29	21:05	21:27	21:18	20:38	19:42	18:46	17:07	17:02
22	08:08	07:30	07:40	06:45	06:06	05:55	06:15	06:50	07:26	08:03	07:44	08:13
	17:34	18:16	19:52	20:31	21:06	21:27	21:17	20:36	19:40	18:45	17:07	17:03
23	08:07	07:28	07:38	06:43	06:05	05:55	06:16	06:51	07:27	08:04	07:45	08:13
	17:35	18:17	19:54	20:32	21:07	21:28	21:16	20:34	19:38	18:43	17:06	17:03
24	08:07	07:26	07:37	06:42	06:04	05:55	06:17	06:52	07:28	08:05	07:46	08:14
	17:37	18:18	19:55	20:33	21:08	21:28	21:15	20:33	19:36	18:41	17:05	17:04
25	08:06	07:25	07:35	06:40	06:03	05:56	06:18	06:53	07:29	08:07	07:48	08:14
	17:38	18:20	19:56	20:34	21:09	21:28	21:14	20:31	19:34	18:40	17:04	17:04
26	08:05	07:23	07:33	06:39	06:02	05:56	06:19	06:54	07:30	08:08	07:49	08:14
	17:40	18:21	19:57	20:36	21:10	21:28	21:13	20:29	19:33	18:38	17:04	17:05
27	08:04	07:21	07:31	06:37	06:02	05:56	06:20	06:55	07:32	08:09	07:50	08:15
	17:41	18:23	19:59	20:37	21:11	21:28	21:12	20:28	19:31	18:37	17:03	17:06
28	08:03	07:20	07:29	06:36	06:01	05:57	06:21	06:57	07:33	08:11	07:51	08:15
	17:42	18:24	20:00	20:38	21:12	21:28	21:11	20:26	19:29	18:35	17:03	17:07
29	08:02		07:27	06:34	06:00	05:57	06:22	06:58	07:34	08:12	07:53	08:15
	17:44		20:01	20:39	21:13	21:28	21:10	20:24	19:27	18:34	17:02	17:07
30	08:01		07:25	06:32	05:59	05:58	06:23	06:59	07:35	08:13	07:54	08:16
	17:45		20:02	20:40	21:14	21:28	21:09	20:22	19:25	18:32	17:02	17:08
31	08:00		07:24		05:59		06:24	07:00		08:15		08:16
	17:46		20:04		21:15		21:08	20:21		18:31		17:09
Potential sun hours	287	292	369	403	458	464	470	435	377	341	289	276
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
Tetra Tech EC, Inc C/o Shin Ng
3475 E. Foothill Blvd
US-PASADENA, CA 91107
1 617 457 8405
Ted Guertin / ted.guertin@tetratech.com
Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 22 - Non-Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,582

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:16	07:59	07:18	07:22	06:31	05:58	05:58	06:25	07:01	07:36	07:16	07:55
	17:10	17:48	18:25	20:05	20:42	21:16	21:28	21:07	20:19	19:23	17:30	17:01
2	08:16	07:58	07:16	07:20	06:30	05:58	05:59	06:27	07:02	07:38	07:17	07:56
	17:11	17:49	18:27	20:06	20:43	21:16	21:28	21:05	20:17	19:21	17:28	17:01
3	08:16	07:56	07:15	07:18	06:28	05:57	05:59	06:28	07:04	07:39	07:19	07:57
	17:12	17:51	18:28	20:07	20:44	21:17	21:28	21:04	20:15	19:20	17:27	17:01
4	08:16	07:55	07:13	07:16	06:27	05:57	06:00	06:29	07:05	07:40	07:20	07:58
	17:13	17:52	18:29	20:08	20:45	21:18	21:27	21:03	20:13	19:18	17:26	17:00
5	08:16	07:54	07:11	07:14	06:25	05:56	06:01	06:30	07:06	07:41	07:21	07:59
	17:14	17:53	18:31	20:10	20:47	21:19	21:27	21:02	20:12	19:16	17:24	17:00
6	08:16	07:53	07:09	07:13	06:24	05:56	06:01	06:31	07:07	07:42	07:23	08:00
	17:15	17:55	18:32	20:11	20:48	21:20	21:27	21:00	20:10	19:14	17:23	17:00
7	08:16	07:51	07:08	07:11	06:23	05:56	06:02	06:32	07:08	07:44	07:24	08:01
	17:16	17:56	18:33	20:12	20:49	21:20	21:27	20:59	20:08	19:12	17:22	17:00
8	08:15	07:50	08:06	07:09	06:21	05:55	06:03	06:33	07:09	07:45	07:25	08:02
	17:17	17:58	18:34	20:13	20:50	21:21	21:26	20:57	20:06	19:10	17:20	17:00
9	08:15	07:49	08:04	07:07	06:20	05:55	06:03	06:35	07:11	07:46	07:27	08:03
	17:18	17:59	19:36	20:15	20:51	21:22	21:26	20:56	20:04	19:09	17:19	17:00
10	08:15	07:48	08:02	07:06	06:19	05:55	06:04	06:36	07:12	07:47	07:28	08:04
	17:19	18:01	19:37	20:16	20:53	21:22	21:25	20:55	20:02	19:07	17:18	17:00
11	08:15	07:46	08:00	07:04	06:17	05:55	06:05	06:37	07:13	07:49	07:29	08:05
	17:20	18:01	19:38	20:17	20:54	21:23	21:25	20:53	20:01	19:05	17:17	17:00
12	08:14	07:45	07:59	07:02	06:16	05:54	06:06	06:38	07:14	07:50	07:31	08:06
	17:21	18:02	19:40	20:18	20:55	21:24	21:24	20:52	19:59	19:03	17:16	17:00
13	08:14	07:43	07:57	07:00	06:15	05:54	06:07	06:39	07:15	07:51	07:32	08:07
	17:23	18:03	19:41	20:20	20:56	21:24	21:24	20:50	19:57	19:02	17:15	17:00
14	08:13	07:42	07:55	06:58	06:14	05:54	06:07	06:40	07:16	07:52	07:33	08:08
	17:24	18:05	19:42	20:21	20:57	21:25	21:23	20:49	19:55	19:00	17:14	17:00
15	08:13	07:40	07:53	06:57	06:13	05:54	06:08	06:41	07:17	07:54	07:35	08:08
	17:25	18:06	19:43	20:22	20:58	21:25	21:22	20:47	19:53	18:56	17:13	17:00
16	08:12	07:39	07:51	06:55	06:12	05:54	06:09	06:43	07:19	07:55	07:36	08:09
	17:26	18:08	19:45	20:23	20:59	21:26	21:22	20:46	19:51	18:55	17:12	17:00
17	08:12	07:37	07:49	06:53	06:11	05:54	06:10	06:44	07:20	07:56	07:37	08:10
	17:28	18:09	19:46	20:25	21:01	21:26	21:21	20:44	19:49	18:53	17:11	17:01
18	08:11	07:36	07:48	06:52	06:10	05:54	06:11	06:45	07:21	07:57	07:39	08:10
	17:29	18:10	19:47	20:26	21:02	21:26	21:20	20:43	19:48	18:51	17:10	17:01
19	08:10	07:34	07:46	06:50	06:09	05:54	06:12	06:46	07:22	07:59	07:40	08:11
	17:30	18:12	19:49	20:27	21:03	21:27	21:20	20:41	19:46	18:50	17:09	17:01
20	08:10	07:33	07:44	06:48	06:08	05:54	06:13	06:47	07:23	08:00	07:41	08:12
	17:31	18:13	19:50	20:28	21:04	21:27	21:19	20:39	19:44	18:48	17:08	17:02
21	08:09	07:31	07:42	06:47	06:07	05:55	06:14	06:48	07:24	08:01	07:43	08:12
	17:33	18:14	19:51	20:29	21:05	21:27	21:18	20:38	19:42	18:46	17:07	17:02
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	17:37	18:18	19:55	20:33	21:08	21:28	21:15	20:33	19:36	18:41	17:05	17:04
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	17:38	18:20	19:56	20:34	21:09	21:28	21:14	20:31	19:34	18:40	17:04	17:04
26	08:05	07:23	07:33	06:39	06:02	05:56	06:19	06:54	07:30	08:08	07:49	08:14
	17:40	18:21	19:57	20:36	21:10	21:28	21:13	20:29	19:33	18:38	17:04	17:05
27	08:04	07:21	07:31	06:37	06:02	05:56	06:20	06:55	07:32	08:09	07:50	08:15
	17:41	18:23	19:59	20:37	21:11	21:28	21:12	20:28	19:31	18:37	17:03	17:06
28	08:03	07:20	07:29	06:36	06:01	05:57	06:21	06:57	07:33	08:11	07:51	08:15
	17:42	18:24	20:00	20:38	21:12	21:28	21:11	20:26	19:29	18:35	17:03	17:07
29	08:02		07:27	06:34	06:00	05:57	06:22	06:58	07:34	08:12	07:53	08:15
	17:44		20:01	20:39	21:13	21:28	21:10	20:24	19:27	18:34	17:02	17:07
30	08:01		07:25	06:32	05:59	05:58	06:23	06:59	07:35	08:13	07:54	08:16
	17:45		20:02	20:40	21:14	21:28	21:09	20:22	19:25	18:32	17:02	17:08
31	08:00		07:24		05:59		06:24	07:00		08:15		08:16
	17:46		20:04		21:15		21:08	20:21		18:31		17:09
Potential sun hours	287	292	369	403	458	464	470	435	377	341	289	276
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

Day in month	Sun rise (hh:mm)		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:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
Tetra Tech EC, Inc C/o Shin Ng
3475 E. Foothill Blvd
US-PASADENA, CA 91107
1 617 457 8405
Ted Guertin / ted.guertin@tetratech.com
Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 23 - Non-Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,582

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:16	07:59	07:18	07:22	06:31	05:58	05:58	06:26	07:01	07:36	07:16	07:55
	17:10	17:48	18:25	20:05	20:42	21:16	21:28	21:07	20:19	19:23	17:30	17:02
2	08:16	07:58	07:16	07:20	06:30	05:58	05:59	06:27	07:02	07:38	07:17	07:56
	17:11	17:49	18:27	20:06	20:43	21:17	21:28	21:05	20:17	19:21	17:28	17:01
3	08:16	07:56	07:15	07:18	06:28	05:57	05:59	06:28	07:04	07:39	07:19	07:57
	17:12	17:51	18:28	20:07	20:44	21:17	21:28	21:04	20:15	19:20	17:27	17:01
4	08:16	07:55	07:13	07:16	06:27	05:57	06:00	06:29	07:05	07:40	07:20	07:58
	17:13	17:52	18:29	20:09	20:45	21:18	21:27	21:03	20:14	19:18	17:26	17:01
5	08:16	07:54	07:11	07:15	06:25	05:56	06:01	06:30	07:06	07:41	07:21	07:59
	17:14	17:54	18:31	20:10	20:47	21:19	21:27	21:02	20:12	19:16	17:24	17:00
6	08:16	07:53	07:09	07:13	06:24	05:56	06:01	06:31	07:07	07:43	07:23	08:00
	17:15	17:55	18:32	20:11	20:48	21:20	21:27	21:00	20:10	19:14	17:23	17:00
7	08:16	07:52	07:08	07:11	06:23	05:56	06:02	06:32	07:08	07:44	07:24	08:01
	17:16	17:56	18:33	20:12	20:49	21:20	21:27	20:59	20:08	19:12	17:22	17:00
8	08:15	07:50	08:06	07:09	06:21	05:55	06:03	06:33	07:09	07:45	07:25	08:02
	17:17	17:58	18:35	20:14	20:50	21:21	21:26	20:58	20:06	19:11	17:21	17:00
9	08:15	07:49	08:04	07:07	06:20	05:55	06:03	06:35	07:11	07:46	07:27	08:03
	17:18	17:59	19:36	20:15	20:51	21:22	21:26	20:56	20:04	19:09	17:19	17:00
10	08:15	07:48	08:02	07:06	06:19	05:55	06:04	06:36	07:12	07:47	07:28	08:04
	17:19	18:01	19:37	20:16	20:53	21:22	21:25	20:55	20:03	19:07	17:18	17:00
11	08:15	07:46	08:00	07:04	06:18	05:55	06:05	06:37	07:13	07:49	07:29	08:05
	17:20	18:01	19:38	20:17	20:54	21:23	21:25	20:53	20:01	19:05	17:17	17:00
12	08:14	07:45	07:59	07:02	06:16	05:55	06:06	06:38	07:14	07:50	07:31	08:06
	17:22	18:02	19:40	20:18	20:55	21:24	21:24	20:52	19:59	19:03	17:16	17:00
13	08:14	07:43	07:57	07:00	06:15	05:54	06:07	06:39	07:15	07:51	07:32	08:07
	17:23	18:03	19:41	20:20	20:56	21:24	21:24	20:50	19:57	19:02	17:15	17:00
14	08:13	07:42	07:55	06:59	06:14	05:54	06:08	06:40	07:16	07:52	07:33	08:08
	17:24	18:05	19:42	20:21	20:57	21:25	21:23	20:49	19:55	19:00	17:14	17:00
15	08:13	07:40	07:53	06:57	06:13	05:54	06:08	06:42	07:18	07:54	07:35	08:08
	17:25	18:06	19:44	20:22	20:58	21:25	21:23	20:47	19:53	18:56	17:13	17:00
16	08:12	07:39	07:51	06:55	06:12	05:54	06:09	06:43	07:19	07:55	07:36	08:09
	17:26	18:08	19:45	20:23	21:00	21:26	21:22	20:46	19:51	18:55	17:12	17:01
17	08:12	07:37	07:50	06:53	06:11	05:54	06:10	06:44	07:20	07:56	07:37	08:10
	17:28	18:09	19:46	20:25	21:01	21:26	21:21	20:44	19:50	18:53	17:11	17:01
18	08:11	07:36	07:48	06:52	06:10	05:54	06:11	06:45	07:21	07:58	07:39	08:11
	17:29	18:10	19:47	20:26	21:02	21:26	21:20	20:43	19:48	18:51	17:10	17:01
19	08:11	07:34	07:46	06:50	06:09	05:54	06:12	06:46	07:22	07:59	07:40	08:11
	17:30	18:12	19:49	20:27	21:03	21:27	21:20	20:41	19:46	18:50	17:09	17:02
20	08:10	07:33	07:44	06:48	06:08	05:55	06:13	06:47	07:23	08:00	07:41	08:12
	17:32	18:13	19:50	20:28	21:04	21:27	21:19	20:39	19:44	18:48	17:08	17:02
21	08:09	07:31	07:42	06:47	06:07	05:55	06:14	06:49	07:25	08:01	07:43	08:12
	17:33	18:15	19:51	20:30	21:05	21:27	21:18	20:38	19:42	18:46	17:07	17:02
22	08:08	07:30	07:40	06:45	06:06	05:55	06:15	06:50	07:26	08:03	07:44	08:13
	17:34	18:16	19:52	20:31	21:06	21:28	21:17	20:36	19:40	18:45	17:07	17:03
23	08:08	07:28	07:38	06:43	06:05	05:55	06:16	06:51	07:27	08:04	07:45	08:13
	17:36	18:17	19:54	20:32	21:07	21:28	21:16	20:34	19:38	18:43	17:06	17:03
24	08:07	07:26	07:37	06:42	06:04	05:55	06:17	06:52	07:28	08:05	07:47	08:14
	17:37	18:19	19:55	20:33	21:08	21:28	21:15	20:33	19:36	18:42	17:05	17:04
25	08:06	07:25	07:35	06:40	06:03	05:56	06:18	06:53	07:29	08:07	07:48	08:14
	17:38	18:20	19:56	20:34	21:09	21:28	21:14	20:31	19:34	18:40	17:05	17:05
26	08:05	07:23	07:33	06:39	06:02	05:56	06:19	06:54	07:30	08:08	07:49	08:15
	17:40	18:21	19:57	20:36	21:10	21:28	21:13	20:29	19:33	18:38	17:04	17:05
27	08:04	07:21	07:31	06:37	06:02	05:57	06:20	06:56	07:32	08:09	07:50	08:15
	17:41	18:23	19:59	20:37	21:11	21:28	21:12	20:28	19:31	18:37	17:03	17:06
28	08:03	07:20	07:29	06:36	06:01	05:57	06:21	06:57	07:33	08:11	07:51	08:15
	17:42	18:24	20:00	20:38	21:12	21:28	21:11	20:26	19:29	18:35	17:03	17:07
29	08:02		07:27	06:34	06:00	05:57	06:22	06:58	07:34	08:12	07:53	08:15
	17:44		20:01	20:39	21:13	21:28	21:10	20:24	19:27	18:34	17:02	17:07
30	08:01		07:26	06:33	06:00	05:58	06:23	06:59	07:35	08:13	07:54	08:16
	17:45		20:02	20:41	21:14	21:28	21:09	20:22	19:25	18:33	17:02	17:08
31	08:00		07:24		05:59		06:24	07:00		08:15		08:16
	17:47		20:04		21:15		21:08	20:21		18:31		17:09
Potential sun hours	287	292	369	403	458	464	470	435	377	341	289	276
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
Tetra Tech EC, Inc C/o Shin Ng
3475 E. Foothill Blvd
US-PASADENA, CA 91107
1 617 457 8405
Ted Guertin / ted.guertin@tetratech.com
Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 24 - Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,582

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:16	07:59	07:18	07:22	06:31	05:59	05:59	06:26	07:02	07:37	07:16	07:55
	17:10	17:48	18:26	20:05	20:42	21:16	21:28	21:07	20:19	19:23	17:30	17:02
2	08:16	07:58	07:16	07:20	06:30	05:58	05:59	06:27	07:03	07:38	07:17	07:56
	17:11	17:50	18:27	20:06	20:43	21:17	21:28	21:05	20:17	19:22	17:29	17:01
3	08:16	07:57	07:15	07:18	06:28	05:58	06:00	06:28	07:04	07:39	07:19	07:57
	17:12	17:51	18:28	20:07	20:44	21:17	21:28	21:04	20:15	19:20	17:27	17:01
4	08:16	07:55	07:13	07:17	06:27	05:57	06:00	06:29	07:05	07:40	07:20	07:58
	17:13	17:52	18:29	20:09	20:46	21:18	21:28	21:03	20:14	19:18	17:26	17:01
5	08:16	07:54	07:11	07:15	06:26	05:57	06:01	06:30	07:06	07:41	07:21	07:59
	17:14	17:54	18:31	20:10	20:47	21:19	21:27	21:02	20:12	19:16	17:25	17:01
6	08:16	07:53	07:10	07:13	06:24	05:56	06:02	06:31	07:07	07:43	07:23	08:00
	17:15	17:55	18:32	20:11	20:48	21:20	21:27	21:00	20:10	19:14	17:23	17:00
7	08:16	07:52	07:08	07:11	06:23	05:56	06:02	06:33	07:08	07:44	07:24	08:01
	17:16	17:57	18:33	20:12	20:49	21:20	21:27	20:59	20:08	19:12	17:22	17:00
8	08:15	07:50	08:06	07:09	06:22	05:56	06:03	06:34	07:10	07:45	07:26	08:02
	17:17	17:58	18:35	20:14	20:50	21:21	21:26	20:58	20:06	19:11	17:21	17:00
9	08:15	07:49	08:04	07:08	06:20	05:55	06:04	06:35	07:11	07:46	07:27	08:03
	17:18	17:59	19:36	20:15	20:51	21:22	21:26	20:56	20:05	19:09	17:20	17:00
10	08:15	07:48	08:02	07:06	06:19	05:55	06:05	06:36	07:12	07:48	07:28	08:04
	17:20	18:01	19:37	20:16	20:53	21:22	21:25	20:55	20:03	19:07	17:18	17:00
11	08:15	07:46	08:01	07:04	06:18	05:55	06:05	06:37	07:13	07:49	07:30	08:05
	17:21	18:01	19:39	20:17	20:54	21:23	21:25	20:53	20:01	19:05	17:17	17:00
12	08:14	07:45	07:59	07:02	06:17	05:55	06:06	06:38	07:14	07:50	07:31	08:06
	17:22	18:02	19:40	20:19	20:55	21:24	21:24	20:52	19:59	19:04	17:16	17:00
13	08:14	07:44	07:57	07:01	06:15	05:55	06:07	06:39	07:15	07:51	07:32	08:07
	17:23	18:04	19:41	20:20	20:56	21:24	21:24	20:50	19:57	19:02	17:15	17:00
14	08:13	07:42	07:55	06:59	06:14	05:55	06:08	06:41	07:17	07:53	07:34	08:08
	17:24	18:05	19:42	20:21	20:57	21:25	21:23	20:49	19:55	19:00	17:14	17:00
15	08:13	07:41	07:53	06:57	06:13	05:55	06:09	06:42	07:18	07:54	07:35	08:08
	17:25	18:06	19:44	20:22	20:58	21:25	21:23	20:47	19:53	18:57	17:13	17:01
16	08:12	07:39	07:52	06:55	06:12	05:55	06:10	06:43	07:19	07:55	07:36	08:09
	17:27	18:08	19:45	20:23	21:00	21:26	21:22	20:46	19:52	18:55	17:12	17:01
17	08:12	07:38	07:50	06:54	06:11	05:55	06:10	06:44	07:20	07:56	07:38	08:10
	17:28	18:09	19:46	20:25	21:01	21:26	21:21	20:44	19:50	18:53	17:11	17:01
18	08:11	07:36	07:48	06:52	06:10	05:55	06:11	06:45	07:21	07:58	07:39	08:11
	17:29	18:11	19:48	20:26	21:02	21:26	21:21	20:43	19:48	18:52	17:10	17:01
19	08:11	07:35	07:46	06:50	06:09	05:55	06:12	06:46	07:22	07:59	07:40	08:11
	17:31	18:12	19:49	20:27	21:03	21:27	21:20	20:41	19:46	18:50	17:09	17:02
20	08:10	07:33	07:44	06:49	06:08	05:55	06:13	06:48	07:24	08:00	07:41	08:12
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21	08:09	07:31	07:42	06:47	06:07	05:55	06:14	06:49	07:25	08:02	07:43	08:12
	17:33	18:15	19:51	20:30	21:05	21:27	21:18	20:38	19:42	18:47	17:08	17:03
22	08:08	07:30	07:40	06:45	06:06	05:55	06:15	06:50	07:26	08:03	07:44	08:13
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25	08:06	07:25	07:35	06:40	06:03	05:56	06:18	06:53	07:29	08:07	07:48	08:14
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26	08:05	07:23	07:33	06:39	06:03	05:56	06:19	06:55	07:31	08:08	07:49	08:15
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	17:41	18:23	19:59	20:37	21:11	21:28	21:12	20:28	19:31	18:37	17:04	17:06
28	08:03	07:20	07:29	06:36	06:01	05:57	06:21	06:57	07:33	08:11	07:51	08:15
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29	08:02		07:28	06:34	06:01	05:58	06:23	06:58	07:34	08:12	07:53	08:15
	17:44		20:01	20:39	21:13	21:28	21:10	20:24	19:27	18:34	17:03	17:08
30	08:01		07:26	06:33	06:00	05:58	06:24	06:59	07:35	08:13	07:54	08:16
	17:45		20:03	20:41	21:14	21:28	21:09	20:23	19:25	18:33	17:02	17:08
31	08:00		07:24		05:59		06:25	07:00		08:15		08:16
	17:47		20:04		21:15		21:08	20:21		18:31		17:09
Potential sun hours	288	292	369	403	458	464	470	435	377	341	289	276
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
Tetra Tech EC, Inc C/o Shin Ng
3475 E. Foothill Blvd
US-PASADENA, CA 91107
1 617 457 8405
Ted Guertin / ted.guertin@tetratech.com
Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 25 - Participant
Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,582

Idle start wind speed: Cut in wind speed from power curve

	January	February		March	April	May	June	July	August	September	October		November		December
1	08:16	07:59		07:18	07:22	06:31	05:58	05:58	06:26	07:01	07:36		07:16	07:39 (19)	07:55
	17:10	17:48		18:25	20:05	20:42	21:16	21:28	21:07	20:19	19:23		17:30	9 07:48 (19)	17:02
2	08:16	07:58		07:16	07:20	06:30	05:58	05:59	06:27	07:03	07:38		07:17	07:40 (19)	07:56
	17:11	17:49		18:27	20:06	20:43	21:16	21:28	21:05	20:17	19:21		17:28	7 07:47 (19)	17:01
3	08:16	07:56		07:15	07:18	06:28	05:57	06:00	06:28	07:04	07:39		07:19	07:41 (19)	07:57
	17:12	17:51		18:28	20:07	20:44	21:17	21:28	21:04	20:15	19:20		17:27	5 07:46 (19)	17:01
4	08:16	07:55		07:13	07:16	06:27	05:57	06:00	06:29	07:05	07:40		07:20	07:43 (19)	07:58
	17:13	17:52		18:29	20:09	20:45	21:18	21:27	21:03	20:14	19:18		17:26	2 07:45 (19)	17:01
5	08:16	07:54		07:11	07:15	06:25	05:57	06:01	06:30	07:06	07:41		07:21		07:59
	17:14	17:54		18:31	20:10	20:47	21:19	21:27	21:02	20:12	19:16		17:24		17:00
6	08:16	07:53		07:09	07:13	06:24	05:56	06:01	06:31	07:07	07:43		07:23		08:00
	17:15	17:55		18:32	20:11	20:48	21:20	21:27	21:00	20:10	19:14		17:23		17:00
7	08:16	07:52	08:13 (19)	07:08	07:11	06:23	05:56	06:02	06:32	07:08	07:44		07:24		08:01
	17:16	17:56	2 08:15 (19)	18:33	20:12	20:49	21:20	21:27	20:59	20:08	19:12		17:22		17:00
8	08:15	07:50	08:12 (19)	08:06	07:09	06:21	05:56	06:03	06:34	07:09	07:45		07:25		08:02
	17:17	17:58	5 08:17 (19)	18:35	20:13	20:50	21:21	21:26	20:58	20:06	19:11		17:21		17:00
9	08:15	07:49	08:10 (19)	08:04	07:07	06:20	05:55	06:04	06:35	07:11	07:46		07:27		08:03
	17:18	17:59	7 08:17 (19)	19:36	20:15	20:51	21:22	21:26	20:56	20:04	19:09		17:19		17:00
10	08:15	07:48	08:09 (19)	08:02	07:06	06:19	05:55	06:04	06:36	07:12	07:47		07:28		08:04
	17:19	18:01	9 08:18 (19)	19:37	20:16	20:53	21:22	21:25	20:55	20:03	19:07		17:18		17:00
11	08:15	07:46	08:07 (19)	08:00	07:04	06:18	05:55	06:05	06:37	07:13	07:49		07:29		08:05
	17:20	18:01	11 08:18 (19)	19:38	20:17	20:54	21:23	21:25	20:53	20:01	19:05		17:17		17:00
12	08:14	07:45	08:06 (19)	07:59	07:02	06:16	05:55	06:06	06:38	07:14	07:50		07:31		08:06
	17:22	18:02	13 08:19 (19)	19:40	20:18	20:55	21:24	21:24	20:52	19:59	19:03		17:16		17:00
13	08:14	07:43	08:05 (19)	07:57	07:00	06:15	05:55	06:07	06:39	07:15	07:51		07:32		08:07
	17:23	18:03	14 08:19 (19)	19:41	20:20	20:56	21:24	21:24	20:50	19:57	19:02		17:15		17:00
14	08:13	07:42	08:03 (19)	07:55	06:59	06:14	05:54	06:08	06:40	07:16	07:52		07:33		08:08
	17:24	18:05	15 08:18 (19)	19:42	20:21	20:57	21:25	21:23	20:49	19:55	19:00		17:14		17:00
15	08:13	07:40	08:02 (19)	07:53	06:57	06:13	05:54	06:08	06:42	07:18	07:54		07:35		08:08
	17:25	18:06	16 08:18 (19)	19:44	20:22	20:58	21:25	21:23	20:47	19:53	18:56		17:13		17:00
16	08:12	07:39	08:00 (19)	07:51	06:55	06:12	05:54	06:09	06:43	07:19	07:55		07:36		08:09
	17:27	18:08	17 08:17 (19)	19:45	20:23	20:59	21:26	21:22	20:46	19:51	18:55		17:12		17:01
17	08:12	07:37	08:00 (19)	07:50	06:53	06:11	05:54	06:10	06:44	07:20	07:56		07:37		08:10
	17:28	18:09	16 08:16 (19)	19:46	20:25	21:01	21:26	21:21	20:44	19:50	18:53		17:11		17:01
18	08:11	07:36	08:02 (19)	07:48	06:52	06:10	05:54	06:11	06:45	07:21	07:58		07:39		08:10
	17:29	18:10	13 08:15 (19)	19:47	20:26	21:02	21:26	21:20	20:43	19:48	18:51		17:10		17:01
19	08:10	07:34	08:04 (19)	07:46	06:50	06:09	05:55	06:12	06:46	07:22	07:59		07:40		08:11
	17:30	18:12	8 08:12 (19)	19:49	20:27	21:03	21:27	21:20	20:41	19:46	18:50		17:09		17:02
20	08:10	07:33		07:44	06:48	06:08	05:55	06:13	06:47	07:23	08:00		07:41		08:12
	17:32	18:13		19:50	20:28	21:04	21:27	21:19	20:39	19:44	18:48		17:08		17:02
21	08:09	07:31		07:42	06:47	06:07	05:55	06:14	06:49	07:25	08:01		07:43		08:12
	17:33	18:15		19:51	20:29	21:05	21:27	21:18	20:38	19:42	18:46		17:08		17:02
22	08:08	07:30		07:40	06:45	06:06	05:55	06:15	06:50	07:26	08:03		07:44		08:13
	17:34	18:16		19:52	20:31	21:06	21:27	21:17	20:36	19:40	18:45		17:07		17:03
23	08:07	07:28		07:38	06:44	06:05	05:55	06:16	06:51	07:27	08:04	08:34 (19)	07:45		08:13
	17:36	18:17		19:54	20:32	21:07	21:28	21:16	20:34	19:38	18:43	9 08:43 (19)	17:06		17:03
24	08:07	07:26		07:37	06:42	06:04	05:56	06:17	06:52	07:28	08:05	08:31 (19)	07:46		08:14
	17:37	18:19		19:55	20:33	21:08	21:28	21:15	20:33	19:36	18:42	14 08:45 (19)	17:05		17:04
25	08:06	07:25		07:35	06:40	06:03	05:56	06:18	06:53	07:29	08:07	08:31 (19)	07:48		08:14
	17:38	18:20		19:56	20:34	21:09	21:28	21:14	20:31	19:34	18:40	16 08:47 (19)	17:05		17:05
26	08:05	07:23		07:33	06:39	06:02	05:56	06:19	06:54	07:30	08:08	08:30 (19)	07:49		08:14
	17:40	18:21		19:57	20:36	21:10	21:28	21:13	20:29	19:33	18:39	17 08:47 (19)	17:04		17:05
27	08:04	07:21		07:31	06:37	06:02	05:57	06:20	06:56	07:32	08:09	08:31 (19)	07:50		08:15
	17:41	18:23		19:59	20:37	21:11	21:28	21:12	20:28	19:31	18:37	16 08:47 (19)	17:03		17:06
28	08:03	07:20		07:29	06:36	06:01	05:57	06:21	06:57	07:33	08:11	08:33 (19)	07:51		08:15
	17:42	18:24		20:00	20:38	21:12	21:28	21:11	20:26	19:29	18:36	15 08:48 (19)	17:03		17:07
29	08:02			07:27	06:34	06:00	05:57	06:22	06:58	07:34	08:12	08:34 (19)	07:53		08:15
	17:44			20:01	20:39	21:13	21:28	21:10	20:24	19:27	18:34	14 08:48 (19)	17:02		17:07
30	08:01			07:26	06:33	06:00	05:58	06:23	06:59	07:35	08:13	08:36 (19)	07:54		08:16
	17:45			20:02	20:41	21:14	21:28	21:09	20:22	19:25	18:33	12 08:48 (19)	17:02		17:08
31	08:00			07:24		05:59		06:25	07:00		08:15	08:37 (19)			08:16
	17:47			20:04		21:15		21:08	20:21		18:31	11 08:48 (19)			17:09
Potential sun hours	288	292		369	403	458	464	470	435	377	341		289		276
Total, worst case			146									124		23	
Sun reduction			0.62									0.59		0.51	
Oper. time red.			0.98									0.98		0.98	
Wind dir. red.			0.74									0.74		0.74	
Total reduction			0.45									0.43		0.37	
Total, real			66									53		9	

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:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
Tetra Tech EC, Inc C/o Shin Ng
3475 E. Foothill Blvd
US-PASADENA, CA 91107
1 617 457 8405
Ted Guertin / ted.guertin@tetratech.com

Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 26 - Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,582

Idle start wind speed: Cut in wind speed from power curve

	January		February		March			April			May			June		
1	08:16		07:59		07:18			07:22			06:31		06:52 (21)	05:58		06:46 (21)
	17:10		17:48		18:25			20:05			20:42	38	07:30 (21)	21:15	106	20:47 (20)
2	08:16		07:57		07:16			07:20			06:30		06:51 (21)	05:58		06:46 (21)
	17:11		17:49		18:27			20:06			20:43	40	07:31 (21)	21:16	105	20:47 (20)
3	08:16		07:56		07:14			07:18			06:28		06:49 (21)	05:57		06:47 (21)
	17:12		17:51		18:28			20:07			20:44	43	07:32 (21)	21:17	104	20:47 (20)
4	08:16		07:55		07:13			07:16			06:27		06:48 (21)	05:57		06:46 (21)
	17:13		17:52		18:29			20:08			20:45	45	07:33 (21)	21:18	105	20:47 (20)
5	08:16		07:54		07:11		18:08 (19)	07:14			06:25		06:47 (21)	05:56		06:47 (21)
	17:14		17:54		18:31	1	18:09 (19)	20:10			20:46	47	07:34 (21)	21:19	104	20:47 (20)
6	08:16		07:53		07:09		18:07 (19)	07:13		07:33 (22)	06:24		06:46 (21)	05:56		06:48 (21)
	17:15		17:55		18:32	4	18:11 (19)	20:11	1	07:34 (22)	20:48	48	07:34 (21)	21:19	103	20:48 (20)
7	08:15		07:51		07:07		18:05 (19)	07:11		07:31 (22)	06:23		06:45 (21)	05:56		06:48 (21)
	17:16		17:56		18:33	7	18:12 (19)	20:12	4	07:35 (22)	20:49	64	20:25 (20)	21:20	103	20:48 (20)
8	08:15		07:50		08:06		19:03 (19)	07:09		07:29 (22)	06:21		06:45 (21)	05:55		06:48 (21)
	17:17		17:58		18:34	10	19:13 (19)	20:13	7	07:36 (22)	20:50	69	20:26 (20)	21:21	103	20:48 (20)
9	08:15		07:49		08:04		19:02 (19)	07:07		07:27 (22)	06:20		06:45 (21)	05:55		06:49 (21)
	17:18		17:59		19:36	12	19:14 (19)	20:15	9	07:36 (22)	20:51	74	20:28 (20)	21:22	102	20:48 (20)
10	08:15		07:47		08:02		19:01 (19)	07:06		07:26 (22)	06:19		06:43 (21)	05:55		06:50 (21)
	17:19		18:01		19:37	14	19:15 (19)	20:16	11	07:37 (22)	20:52	78	20:28 (20)	21:22	102	20:49 (20)
11	08:14		07:46		08:00		19:01 (19)	07:04		07:24 (22)	06:18		06:43 (21)	05:55		06:50 (21)
	17:20		18:01		19:38	16	19:17 (19)	20:17	12	07:36 (22)	20:54	81	20:29 (20)	21:23	101	20:49 (20)
12	08:14		07:45		07:59		19:01 (19)	07:02		07:22 (22)	06:16		06:43 (21)	05:55		06:50 (21)
	17:22		18:02		19:40	18	19:19 (19)	20:18	14	07:36 (22)	20:55	84	20:30 (20)	21:23	101	20:49 (20)
13	08:14		07:43		07:57		19:01 (19)	07:00		07:20 (22)	06:15		06:43 (21)	05:54		06:50 (21)
	17:23		18:03		19:41	19	19:20 (19)	20:20	15	07:35 (22)	20:56	87	20:32 (20)	21:24	101	20:49 (20)
14	08:13		07:42		07:55		19:01 (19)	06:59		07:19 (22)	06:14		06:43 (21)	05:54		06:50 (21)
	17:24		18:05		19:42	20	19:21 (19)	20:21	16	07:35 (22)	20:57	90	20:33 (20)	21:24	100	20:49 (20)
15	08:13		07:40		07:53		19:01 (19)	06:57		07:17 (22)	06:13		06:43 (21)	05:54		06:51 (21)
	17:25		18:06		19:43	21	19:22 (19)	20:22	16	07:33 (22)	20:58	92	20:34 (20)	21:25	99	20:49 (20)
16	08:12		07:39		07:51		19:01 (19)	06:55		07:17 (22)	06:12		06:43 (21)	05:54		06:51 (21)
	17:26		18:08		19:45	20	19:21 (19)	20:23	15	07:32 (22)	20:59	94	20:35 (20)	21:25	100	20:49 (20)
17	08:12		07:37		07:49		19:03 (19)	06:53		07:18 (22)	06:11		06:42 (21)	05:54		06:51 (21)
	17:28		18:09		19:46	18	19:21 (19)	20:24	13	07:31 (22)	21:00	96	20:36 (20)	21:26	101	20:50 (20)
18	08:11		07:36		07:48		19:04 (19)	06:52		07:21 (22)	06:10		06:42 (21)	05:54		06:52 (21)
	17:29		18:10		19:47	15	19:19 (19)	20:26	6	07:27 (22)	21:02	98	20:37 (20)	21:26	100	20:50 (20)
19	08:10		07:34		07:46		19:07 (19)	06:50			06:09		06:42 (21)	05:54		06:53 (21)
	17:30		18:12		19:49	8	19:15 (19)	20:27			21:03	100	20:38 (20)	21:27	100	20:51 (20)
20	08:10		07:33		07:44			06:48			06:08		06:42 (21)	05:55		06:53 (21)
	17:32		18:13		19:50			20:28			21:04	101	20:39 (20)	21:27	99	20:51 (20)
21	08:09		07:31		07:42			06:47			06:07		06:42 (21)	05:55		06:53 (21)
	17:33		18:14		19:51			20:29			21:05	103	20:40 (20)	21:27	99	20:51 (20)
22	08:08		07:30		07:40			06:45			06:06		06:42 (21)	05:55		06:53 (21)
	17:34		18:16		19:52			20:31			21:06	102	20:40 (20)	21:27	99	20:51 (20)
23	08:07		07:28		07:38			06:43			06:05		06:42 (21)	05:55		06:53 (21)
	17:35		18:17		19:54			20:32			21:07	104	20:41 (20)	21:28	99	20:51 (20)
24	08:06		07:26		07:36			06:42			06:04		06:43 (21)	05:55		06:54 (21)
	17:37		18:19		19:55			20:33			21:08	105	20:43 (20)	21:28	100	20:52 (20)
25	08:06		07:25		07:35			06:40		07:06 (21)	06:03		06:43 (21)	05:56		06:53 (21)
	17:38		18:20		19:56			20:34	11	07:17 (21)	21:09	106	20:44 (20)	21:28	101	20:52 (20)
26	08:05		07:23		07:33			06:39		07:01 (21)	06:02		06:43 (21)	05:56		06:53 (21)
	17:40		18:21		19:57			20:35	20	07:21 (21)	21:10	106	20:44 (20)	21:28	101	20:52 (20)
27	08:04		07:21		07:31			06:37		06:59 (21)	06:02		06:44 (21)	05:56		06:54 (21)
	17:41		18:23		19:59			20:37	25	07:24 (21)	21:11	107	20:45 (20)	21:28	99	20:52 (20)
28	08:03		07:20		07:29			06:36		06:56 (21)	06:01		06:44 (21)	05:57		06:54 (21)
	17:42		18:24		20:00			20:38	30	07:26 (21)	21:12	106	20:45 (20)	21:28	99	20:52 (20)
29	08:02				07:27			06:34		06:55 (21)	06:00		06:44 (21)	05:57		06:54 (21)
	17:44				20:01			20:39	33	07:28 (21)	21:13	106	20:45 (20)	21:28	100	20:53 (20)
30	08:01				07:25			06:33		06:53 (21)	06:00		06:45 (21)	05:58		06:54 (21)
	17:45				20:02			20:40	35	07:28 (21)	21:14	106	20:46 (20)	21:28	101	20:53 (20)
31	08:00				07:24						05:59		06:45 (21)			
	17:46				20:03						21:15	105	20:46 (20)			
Potential sun hours	288		292		369			403			458			464		
Total, worst case						203			293			2625			3037	
Sun reduction						0.62			0.59			0.66			0.69	
Oper. time red.						0.98			0.98			0.98			0.98	
Wind dir. red.						0.64			0.62			0.66			0.68	
Total reduction						0.39			0.36			0.42			0.46	
Total, real						79			105			1113			1394	

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:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
Tetra Tech EC, Inc C/o Shin Ng
3475 E. Foothill Blvd
US-PASADENA, CA 91107
1 617 457 8405
Ted Guertin / ted.guertin@tetratech.com
Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 26 - Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,582

Idle start wind speed: Cut in wind speed from power curve

	July			August			September			October			November	December
1	05:58		06:54 (21)	06:26		06:54 (21)	07:01		07:23 (22)	07:36		18:40 (19)	07:16	07:55
	21:28	101	20:53 (20)	21:06	83	20:40 (20)	20:19	12	07:35 (22)	19:23	18	18:58 (19)	17:30	17:02
2	05:59		06:54 (21)	06:27		06:54 (21)	07:02		07:24 (22)	07:38		18:40 (19)	07:17	07:56
	21:28	101	20:53 (20)	21:05	79	20:39 (20)	20:17	11	07:35 (22)	19:21	17	18:57 (19)	17:28	17:01
3	05:59		06:54 (21)	06:28		06:54 (21)	07:04		07:25 (22)	07:39		18:40 (19)	07:18	07:57
	21:27	103	20:54 (20)	21:04	77	20:38 (20)	20:15	9	07:34 (22)	19:20	15	18:55 (19)	17:27	17:01
4	06:00		06:54 (21)	06:29		06:54 (21)	07:05		07:26 (22)	07:40		18:39 (19)	07:20	07:58
	21:27	102	20:53 (20)	21:03	73	20:37 (20)	20:13	7	07:33 (22)	19:18	14	18:53 (19)	17:26	17:01
5	06:01		06:54 (21)	06:30		06:55 (21)	07:06		07:27 (22)	07:41		18:40 (19)	07:21	07:59
	21:27	104	20:54 (20)	21:01	67	20:35 (20)	20:12	4	07:31 (22)	19:16	10	18:50 (19)	17:24	17:00
6	06:01		06:54 (21)	06:31		06:55 (21)	07:07		07:29 (22)	07:42		18:40 (19)	07:23	08:00
	21:27	103	20:54 (20)	21:00	60	20:33 (20)	20:10	1	07:30 (22)	19:14	8	18:48 (19)	17:23	17:00
7	06:02		06:53 (21)	06:32		06:55 (21)	07:08			07:44		18:42 (19)	07:24	08:01
	21:26	104	20:54 (20)	20:59	48	07:43 (21)	20:08			19:12	5	18:47 (19)	17:22	17:00
8	06:03		06:54 (21)	06:33		06:56 (21)	07:09			07:45		18:43 (19)	07:25	08:02
	21:26	104	20:54 (20)	20:57	46	07:42 (21)	20:06			19:10	2	18:45 (19)	17:20	17:00
9	06:03		06:54 (21)	06:35		06:58 (21)	07:11			07:46			07:27	08:03
	21:26	105	20:55 (20)	20:56	44	07:42 (21)	20:04			19:09			17:19	17:00
10	06:04		06:53 (21)	06:36		06:59 (21)	07:12			07:47			07:28	08:04
	21:25	105	20:54 (20)	20:55	42	07:41 (21)	20:02			19:07			17:18	17:00
11	06:05		06:53 (21)	06:37		07:00 (21)	07:13			07:49			07:29	08:05
	21:25	106	20:54 (20)	20:53	40	07:40 (21)	20:01			19:05			17:17	17:00
12	06:06		06:53 (21)	06:38		07:01 (21)	07:14			07:50			07:31	08:06
	21:24	106	20:54 (20)	20:52	37	07:38 (21)	19:59			19:03			17:16	17:00
13	06:07		06:54 (21)	06:39		07:02 (21)	07:15			07:51			07:32	08:07
	21:24	106	20:55 (20)	20:50	35	07:37 (21)	19:57			19:02			17:15	17:00
14	06:08		06:54 (21)	06:40		07:03 (21)	07:16			07:52			07:33	08:07
	21:23	106	20:55 (20)	20:49	32	07:35 (21)	19:55			19:00			17:14	17:00
15	06:08		06:53 (21)	06:41		07:04 (21)	07:17			07:54			07:35	08:08
	21:22	106	20:54 (20)	20:47	29	07:33 (21)	19:53			18:56			17:13	17:00
16	06:09		06:53 (21)	06:43		07:06 (21)	07:19			07:55			07:36	08:09
	21:22	106	20:54 (20)	20:46	24	07:30 (21)	19:51			18:55			17:12	17:01
17	06:10		06:53 (21)	06:44		07:09 (21)	07:20			07:56			07:37	08:10
	21:21	106	20:54 (20)	20:44	18	07:27 (21)	19:49			18:53			17:11	17:01
18	06:11		06:53 (21)	06:45		07:14 (21)	07:21			07:57			07:39	08:10
	21:20	105	20:53 (20)	20:42	7	07:21 (21)	19:48			18:51			17:10	17:01
19	06:12		06:53 (21)	06:46			07:22			07:59			07:40	08:11
	21:19	105	20:53 (20)	20:41			19:46			18:50			17:09	17:01
20	06:13		06:53 (21)	06:47			07:23			08:00			07:41	08:12
	21:19	103	20:52 (20)	20:39			19:44			18:48			17:08	17:02
21	06:14		06:53 (21)	06:48			07:24			08:01			07:42	08:12
	21:18	103	20:51 (20)	20:38			19:42			18:46			17:07	17:02
22	06:15		06:53 (21)	06:50			07:26			08:03			07:44	08:13
	21:17	102	20:51 (20)	20:36			19:40			18:45			17:07	17:03
23	06:16		06:53 (21)	06:51			07:27			08:04			07:45	08:13
	21:16	101	20:50 (20)	20:34			19:38			18:43			17:06	17:03
24	06:17		06:53 (21)	06:52			07:28		18:52 (19)	08:05			07:46	08:14
	21:15	99	20:49 (20)	20:33			19:36	5	18:57 (19)	18:42			17:05	17:04
25	06:18		06:53 (21)	06:53		07:23 (22)	07:29		18:47 (19)	08:06			07:48	08:14
	21:14	98	20:48 (20)	20:31	8	07:31 (22)	19:34	13	19:00 (19)	18:40			17:05	17:05
26	06:19		06:53 (21)	06:54		07:20 (22)	07:30		18:45 (19)	08:08			07:49	08:14
	21:13	96	20:47 (20)	20:29	13	07:33 (22)	19:32	17	19:02 (19)	18:38			17:04	17:05
27	06:20		06:53 (21)	06:55		07:18 (22)	07:32		18:44 (19)	08:09			07:50	08:15
	21:12	94	20:46 (20)	20:28	16	07:34 (22)	19:31	20	19:04 (19)	18:37			17:03	17:06
28	06:21		06:53 (21)	06:57		07:19 (22)	07:33		18:43 (19)	08:10			07:51	08:15
	21:11	93	20:45 (20)	20:26	16	07:35 (22)	19:29	21	19:04 (19)	18:35			17:03	17:07
29	06:22		06:53 (21)	06:58		07:20 (22)	07:34		18:41 (19)	08:12			07:52	08:15
	21:10	91	20:44 (20)	20:24	16	07:36 (22)	19:27	21	19:02 (19)	18:34			17:02	17:07
30	06:23		06:53 (21)	06:59		07:21 (22)	07:35		18:40 (19)	08:13			07:54	08:15
	21:09	89	20:43 (20)	20:22	15	07:36 (22)	19:25	20	19:00 (19)	18:32			17:02	17:08
31	06:24		06:53 (21)	07:00		07:22 (22)				08:14				08:16
	21:08	87	20:42 (20)	20:21	14	07:36 (22)				18:31				17:09
Potential sun hours	470			435			377			341			289	276
Total, worst case		3140			939			161			89			
Sun reduction		0.76			0.74			0.69			0.59			
Oper. time red.		0.98			0.98			0.98			0.98			
Wind dir. red.		0.67			0.62			0.64			0.64			
Total reduction		0.50			0.45			0.43			0.37			
Total, real		1567			424			70			33			

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:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
Tetra Tech EC, Inc C/o Shin Ng
3475 E. Foothill Blvd
US-PASADENA, CA 91107
1 617 457 8405
Ted Guertin / ted.guertin@tetratech.com
Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 27 - Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,582

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:16	07:58	07:18	07:22	06:31	05:58	05:58	06:25	07:01	07:36	07:16	07:55
	17:10	17:48	18:25	20:05	20:41	21:15	21:28	21:06	20:19	19:23	17:30	17:01
2	08:16	07:57	07:16	07:20	06:30	05:58	05:59	06:27	07:02	07:37	07:17	07:56
	17:11	17:49	18:26	20:06	20:43	21:16	21:27	21:05	20:17	19:21	17:28	17:01
3	08:16	07:56	07:14	07:18	06:28	05:57	05:59	06:28	07:03	07:39	07:18	07:57
	17:12	17:51	18:28	20:07	20:44	21:17	21:27	21:04	20:15	19:19	17:27	17:01
4	08:16	07:55	07:13	07:16	06:27	05:57	06:00	06:29	07:05	07:40	07:20	07:58
	17:13	17:52	18:29	20:08	20:45	21:18	21:27	21:03	20:13	19:18	17:25	17:00
5	08:16	07:54	07:11	07:14	06:25	05:56	06:01	06:30	07:06	07:41	07:21	07:59
	17:14	17:53	18:30	20:10	20:46	21:19	21:27	21:01	20:11	19:16	17:24	17:00
6	08:15	07:53	07:09	07:13	06:24	05:56	06:01	06:31	07:07	07:42	07:22	08:00
	17:15	17:55	18:32	20:11	20:48	21:19	21:27	21:00	20:10	19:14	17:23	17:00
7	08:15	07:51	07:07	07:11	06:23	05:56	06:02	06:32	07:08	07:43	07:24	08:01
	17:16	17:56	18:33	20:12	20:49	21:20	21:26	20:59	20:08	19:12	17:22	17:00
8	08:15	07:50	08:06	07:09	06:21	05:55	06:03	06:33	07:09	07:45	07:25	08:02
	17:17	17:58	18:34	20:13	20:50	21:21	21:26	20:57	20:06	19:10	17:20	17:00
9	08:15	07:49	08:04	07:07	06:20	05:55	06:03	06:34	07:10	07:46	07:26	08:03
	17:18	17:59	19:36	20:14	20:51	21:21	21:25	20:56	20:04	19:08	17:19	17:00
10	08:15	07:47	08:02	07:05	06:19	05:55	06:04	06:36	07:12	07:47	07:28	08:04
	17:19	18:00	19:37	20:16	20:52	21:22	21:25	20:54	20:02	19:07	17:18	17:00
11	08:14	07:46	08:00	07:04	06:17	05:55	06:05	06:37	07:13	07:48	07:29	08:05
	17:20	18:00	19:38	20:17	20:53	21:23	21:25	20:53	20:00	19:05	17:17	17:00
12	08:14	07:45	07:58	07:02	06:16	05:54	06:06	06:38	07:14	07:50	07:30	08:06
	17:21	18:02	19:40	20:18	20:55	21:23	21:24	20:52	19:59	19:03	17:16	17:00
13	08:13	07:43	07:57	07:00	06:15	05:54	06:07	06:39	07:15	07:51	07:32	08:06
	17:23	18:03	19:41	20:19	20:56	21:24	21:23	20:50	19:57	19:01	17:15	17:00
14	08:13	07:42	07:55	06:58	06:14	05:54	06:07	06:40	07:16	07:52	07:33	08:07
	17:24	18:05	19:42	20:21	20:57	21:24	21:23	20:49	19:55	19:00	17:14	17:00
15	08:13	07:40	07:53	06:57	06:13	05:54	06:08	06:41	07:17	07:53	07:34	08:08
	17:25	18:06	19:43	20:22	20:58	21:25	21:22	20:47	19:53	18:56	17:13	17:00
16	08:12	07:39	07:51	06:55	06:12	05:54	06:09	06:43	07:19	07:55	07:36	08:09
	17:26	18:07	19:45	20:23	20:59	21:25	21:22	20:45	19:51	18:55	17:12	17:00
17	08:11	07:37	07:49	06:53	06:11	05:54	06:10	06:44	07:20	07:56	07:37	08:10
	17:28	18:09	19:46	20:24	21:00	21:26	21:21	20:44	19:49	18:53	17:11	17:01
18	08:11	07:36	07:47	06:52	06:10	05:54	06:11	06:45	07:21	07:57	07:38	08:10
	17:29	18:10	19:47	20:26	21:01	21:26	21:20	20:42	19:47	18:51	17:10	17:01
19	08:10	07:34	07:46	06:50	06:08	05:54	06:12	06:46	07:22	07:59	07:40	08:11
	17:30	18:12	19:48	20:27	21:02	21:26	21:19	20:41	19:46	18:49	17:09	17:01
20	08:09	07:33	07:44	06:48	06:08	05:54	06:13	06:47	07:23	08:00	07:41	08:11
	17:31	18:13	19:50	20:28	21:04	21:27	21:18	20:39	19:44	18:48	17:08	17:02
21	08:09	07:31	07:42	06:47	06:07	05:55	06:14	06:48	07:24	08:01	07:42	08:12
	17:33	18:14	19:51	20:29	21:05	21:27	21:18	20:37	19:42	18:46	17:07	17:02
22	08:08	07:29	07:40	06:45	06:06	05:55	06:15	06:50	07:26	08:02	07:44	08:12
	17:34	18:16	19:52	20:30	21:06	21:27	21:17	20:36	19:40	18:45	17:07	17:03
23	08:07	07:28	07:38	06:43	06:05	05:55	06:16	06:51	07:27	08:04	07:45	08:13
	17:35	18:17	19:53	20:32	21:07	21:27	21:16	20:34	19:38	18:43	17:06	17:03
24	08:06	07:26	07:36	06:42	06:04	05:55	06:17	06:52	07:28	08:05	07:46	08:13
	17:37	18:18	19:55	20:33	21:08	21:28	21:15	20:33	19:36	18:41	17:05	17:04
25	08:05	07:24	07:35	06:40	06:03	05:56	06:18	06:53	07:29	08:06	07:47	08:14
	17:38	18:20	19:56	20:34	21:09	21:28	21:14	20:31	19:34	18:40	17:04	17:04
26	08:05	07:23	07:33	06:39	06:02	05:56	06:19	06:54	07:30	08:08	07:49	08:14
	17:39	18:21	19:57	20:35	21:10	21:28	21:13	20:29	19:32	18:38	17:04	17:05
27	08:04	07:21	07:31	06:37	06:02	05:56	06:20	06:55	07:31	08:09	07:50	08:15
	17:41	18:22	19:58	20:37	21:11	21:28	21:12	20:27	19:31	18:37	17:03	17:06
28	08:03	07:19	07:29	06:35	06:01	05:57	06:21	06:56	07:33	08:10	07:51	08:15
	17:42	18:24	20:00	20:38	21:12	21:28	21:11	20:26	19:29	18:35	17:03	17:07
29	08:02		07:27	06:34	06:00	05:57	06:22	06:58	07:34	08:12	07:52	08:15
	17:44		20:01	20:39	21:13	21:28	21:10	20:24	19:27	18:34	17:02	17:07
30	08:01		07:25	06:32	05:59	05:58	06:23	06:59	07:35	08:13	07:53	08:15
	17:45		20:02	20:40	21:14	21:28	21:09	20:22	19:25	18:32	17:02	17:08
31	08:00		07:23		05:59		06:24	07:00		08:14		08:15
	17:46		20:03		21:14		21:07	20:20		18:31		17:09
Potential sun hours	288	292	369	403	458	464	470	435	377	341	289	276
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
Tetra Tech EC, Inc C/o Shin Ng
3475 E. Foothill Blvd
US-PASADENA, CA 91107
1 617 457 8405
Ted Guertin / ted.guertin@tetratech.com
Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 28 - Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,582

Idle start wind speed: Cut in wind speed from power curve

	January			February			March			April			May			June	
1	08:16			07:58			08:20 (28)	07:18		08:15 (28)	07:22		07:45 (23)	06:31		20:11 (22)	05:58
	17:10			17:48	16		08:36 (28)	18:25	24	08:39 (28)	20:05	20	08:05 (23)	20:41	7	20:18 (22)	21:15
2	08:16			07:57			08:19 (28)	07:16		08:18 (28)	07:20		07:46 (23)	06:29		20:10 (22)	05:58
	17:11			17:49	20		08:39 (28)	18:26	19	08:37 (28)	20:06	18	08:04 (23)	20:43	10	20:20 (22)	21:16
3	08:16			07:56			08:18 (28)	07:14		08:21 (28)	07:18		07:47 (23)	06:28		20:08 (22)	05:57
	17:12			17:51	23		08:41 (28)	18:28	12	08:33 (28)	20:07	15	08:02 (23)	20:44	12	20:20 (22)	21:17
4	08:16			07:55			08:17 (28)	07:13			07:16		07:49 (23)	06:27		20:08 (22)	05:57
	17:13			17:52	26		08:43 (28)	18:29			20:08	10	07:59 (23)	20:45	14	20:22 (22)	21:18
5	08:16			07:54			08:15 (28)	07:11			07:14			06:25		20:06 (22)	05:56
	17:14			17:53	29		08:44 (28)	18:30			20:10			20:46	16	20:22 (22)	21:19
6	08:15			07:53			08:14 (28)	07:09			07:13			06:24		20:06 (22)	05:56
	17:15			17:55	32		08:46 (28)	18:32			20:11			20:48	18	20:24 (22)	21:19
7	08:15			07:51			08:13 (28)	07:07			07:11			06:23		20:06 (22)	05:56
	17:16			17:56	34		08:47 (28)	18:33			20:12			20:49	19	20:25 (22)	21:20
8	08:15			07:50			08:11 (28)	08:06			07:09			06:21		20:06 (22)	05:55
	17:17			17:58	37		08:48 (28)	18:34			20:13			20:50	20	20:26 (22)	21:21
9	08:15			07:49			08:10 (28)	08:04			07:07			06:20		20:05 (22)	05:55
	17:18			17:59	39		08:49 (28)	19:36			20:14			20:51	22	20:27 (22)	21:21
10	08:15			07:47			08:09 (28)	08:02			07:05			06:19		20:05 (22)	05:55
	17:19			18:00	41		08:50 (28)	19:37			20:16			20:52	23	20:28 (22)	21:22
11	08:14			07:46			08:08 (28)	08:00			07:04			06:17		20:06 (22)	05:55
	17:20			18:00	42		08:50 (28)	19:38			20:17			20:53	23	20:29 (22)	21:23
12	08:14			07:45			08:08 (28)	07:58			07:02			06:16		20:06 (22)	05:54
	17:21			18:02	43		08:51 (28)	19:40			20:18			20:55	24	20:30 (22)	21:23
13	08:13			07:43			08:07 (28)	07:57			07:00			06:15		20:06 (22)	05:54
	17:23			18:03	44		08:51 (28)	19:41			20:19			20:56	25	20:31 (22)	21:24
14	08:13			07:42			08:07 (28)	07:55			06:58			06:14		20:07 (22)	05:54
	17:24			18:05	44		08:51 (28)	19:42			20:21			20:57	24	20:31 (22)	21:24
15	08:13			07:40			08:07 (28)	07:53			06:57			06:13		20:07 (22)	05:54
	17:25			18:06	44		08:51 (28)	19:43			20:22			20:58	24	20:31 (22)	21:25
16	08:12			07:39			08:07 (28)	07:51			06:55			06:12		20:08 (22)	05:54
	17:26			18:07	45		08:52 (28)	19:45			20:23			20:59	22	20:30 (22)	21:25
17	08:11			07:37			08:07 (28)	07:49			06:53			06:11		20:09 (22)	05:54
	17:28			18:09	44		08:51 (28)	19:46			20:24			21:00	20	20:29 (22)	21:26
18	08:11			07:36			08:07 (28)	07:47			06:52			06:09		20:09 (22)	05:54
	17:29			18:10	45		08:52 (28)	19:47			20:26			21:01	20	20:29 (22)	21:26
19	08:10			07:34			08:07 (28)	07:46			06:50			06:08		20:10 (22)	05:54
	17:30			18:12	44		08:51 (28)	19:48			20:27			21:02	18	20:28 (22)	21:26
20	08:09			07:33			08:07 (28)	07:44			06:48			06:07		20:11 (22)	05:54
	17:31			18:13	43		08:50 (28)	19:50			20:28			21:04	16	20:27 (22)	21:27
21	08:09			07:31			08:08 (28)	07:42			06:47			06:07		20:13 (22)	05:55
	17:33			18:14	42		08:50 (28)	19:51			20:29			21:05	12	20:25 (22)	21:27
22	08:08			07:29			08:08 (28)	07:40		08:00 (23)	06:45			06:06		20:14 (22)	05:55
	17:34			18:16	41		08:49 (28)	19:52	3	08:03 (23)	20:30			21:06	9	20:23 (22)	21:27
23	08:07			07:28			08:09 (28)	07:38		07:58 (23)	06:43			06:05			05:55
	17:35			18:17	40		08:49 (28)	19:53	7	08:05 (23)	20:32			21:07			21:27
24	08:06			07:26			08:09 (28)	07:36		07:56 (23)	06:42			06:04			05:55
	17:37			18:18	39		08:48 (28)	19:55	10	08:06 (23)	20:33			21:08			21:28
25	08:05			07:24			08:10 (28)	07:35		07:55 (23)	06:40			06:03			05:56
	17:38			18:20	36		08:46 (28)	19:56	13	08:08 (23)	20:34			21:09			21:28
26	08:05			07:23			08:11 (28)	07:33		07:53 (23)	06:39			06:02			05:56
	17:39			18:21	35		08:46 (28)	19:57	15	08:08 (23)	20:35			21:10			21:28
27	08:04			07:21			08:12 (28)	07:31		07:51 (23)	06:37			06:01			05:56
	17:41			18:22	32		08:44 (28)	19:58	17	08:08 (23)	20:37			21:11			21:28
28	08:03			07:19			08:13 (28)	07:29		07:49 (23)	06:35			06:01			05:57
	17:42			18:24	29		08:42 (28)	20:00	19	08:08 (23)	20:38			21:12			21:28
29	08:02							07:27		07:47 (23)	06:34		20:15 (22)	06:00			05:57
	17:44							20:01	20	08:07 (23)	20:39	1	20:16 (22)	21:13			21:28
30	08:01							07:25		07:45 (23)	06:32		20:12 (22)	05:59			05:58
	17:45							20:02	21	08:06 (23)	20:40	5	20:17 (22)	21:14			21:28
31	08:00		08:23 (28)					07:23		07:45 (23)				05:59			
	17:46	9	08:32 (28)					20:03	22	08:07 (23)				21:14			
Potential sun hours	288			292				369			403			458			464
Total, worst case		9			1029				202			69			398		
Sun reduction		0.62			0.62				0.62			0.59			0.66		
Oper. time red.		0.98			0.98				0.98			0.98			0.98		
Wind dir. red.		0.75			0.75				0.70			0.69			0.73		
Total reduction		0.45			0.45				0.43			0.40			0.47		
Total, real		4			468				86			27			189		

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:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
Tetra Tech EC, Inc C/o Shin Ng
3475 E. Foothill Blvd
US-PASADENA, CA 91107
1 617 457 8405
Ted Guertin / ted.guertin@tetratech.com
Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 28 - Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,582

Idle start wind speed: Cut in wind speed from power curve

	July		August		September		October		November		December
1	05:58		06:25	20:16 (22)	07:01		07:36		07:16	07:38 (28)	07:55
	21:28		21:06 24	20:40 (22)	20:19		19:23		17:30 40	08:18 (28)	17:01
2	05:59		06:27	20:16 (22)	07:02		07:37		07:17	07:40 (28)	07:56
	21:28		21:05 23	20:39 (22)	20:17		19:21		17:28 38	08:18 (28)	17:01
3	05:59		06:28	20:16 (22)	07:03		07:39		07:18	07:41 (28)	07:57
	21:27		21:04 22	20:38 (22)	20:15		19:19		17:27 36	08:17 (28)	17:01
4	06:00		06:29	20:16 (22)	07:05		07:40		07:20	07:43 (28)	07:58
	21:27		21:03 21	20:37 (22)	20:13		19:18		17:25 34	08:17 (28)	17:00
5	06:01		06:30	20:16 (22)	07:06		07:41		07:21	07:44 (28)	07:59
	21:27		21:01 19	20:35 (22)	20:11		19:16		17:24 31	08:15 (28)	17:00
6	06:01		06:31	20:16 (22)	07:07		07:42		07:22	07:46 (28)	08:00
	21:27		21:00 18	20:34 (22)	20:10		19:14		17:23 29	08:15 (28)	17:00
7	06:02		06:32	20:16 (22)	07:08		07:43		07:24	07:47 (28)	08:01
	21:26		20:59 17	20:33 (22)	20:08		19:12		17:22 26	08:13 (28)	17:00
8	06:03		06:33	20:16 (22)	07:09	07:44 (23)	07:45		07:25	07:48 (28)	08:02
	21:26		20:57 15	20:31 (22)	20:06 10	07:54 (23)	19:10		17:20 23	08:11 (28)	17:00
9	06:03		06:34	20:16 (22)	07:10	07:41 (23)	07:46		07:26	07:50 (28)	08:03
	21:25		20:56 14	20:30 (22)	20:04 15	07:56 (23)	19:08		17:19 20	08:10 (28)	17:00
10	06:04		06:36	20:17 (22)	07:12	07:39 (23)	07:47		07:28	07:51 (28)	08:04
	21:25		20:54 11	20:28 (22)	20:02 18	07:57 (23)	19:07		17:18 16	08:07 (28)	17:00
11	06:05		06:37	20:19 (22)	07:13	07:38 (23)	07:48	08:54 (28)	07:29	07:55 (28)	08:05
	21:25		20:53 9	20:28 (22)	20:00 19	07:57 (23)	19:05 15	09:09 (28)	17:17 9	08:04 (28)	17:00
12	06:06		06:38	20:20 (22)	07:14	07:36 (23)	07:50	08:50 (28)	07:30		08:06
	21:24		20:52 6	20:26 (22)	19:59 22	07:58 (23)	19:03 22	09:12 (28)	17:16		17:00
13	06:07		06:39	20:21 (22)	07:15	07:36 (23)	07:51	08:47 (28)	07:32		08:07
	21:23		20:50 4	20:25 (22)	19:57 22	07:58 (23)	19:01 27	09:14 (28)	17:15		17:00
14	06:07		06:40		07:16	07:37 (23)	07:52	08:46 (28)	07:33		08:07
	21:23		20:49		19:55 20	07:57 (23)	19:00 30	09:16 (28)	17:14		17:00
15	06:08		06:41		07:17	07:39 (23)	07:53	08:44 (28)	07:35		08:08
	21:22		20:47		19:53 19	07:58 (23)	18:56 33	09:17 (28)	17:13		17:00
16	06:09		06:43		07:19	07:40 (23)	07:55	08:42 (28)	07:36		08:09
	21:22		20:45		19:51 17	07:57 (23)	18:54 36	09:18 (28)	17:12		17:00
17	06:10		06:44		07:20	07:41 (23)	07:56	08:41 (28)	07:37		08:10
	21:21		20:44		19:49 15	07:56 (23)	18:53 37	09:18 (28)	17:11		17:01
18	06:11		06:45		07:21	07:42 (23)	07:57	08:40 (28)	07:38		08:10
	21:20		20:42		19:47 13	07:55 (23)	18:51 40	09:20 (28)	17:10		17:01
19	06:12		06:46		07:22	07:43 (23)	07:59	08:39 (28)	07:40		08:11
	21:19		20:41		19:45 11	07:54 (23)	18:49 41	09:20 (28)	17:09		17:01
20	06:13		06:47		07:23	07:44 (23)	08:00	08:39 (28)	07:41		08:11
	21:19		20:39		19:44 8	07:52 (23)	18:48 42	09:21 (28)	17:08		17:02
21	06:14	20:26 (22)	06:48		07:24	07:45 (23)	08:01	08:38 (28)	07:42		08:12
	21:18 6	20:32 (22)	20:38		19:42 4	07:49 (23)	18:46 43	09:21 (28)	17:07		17:02
22	06:15	20:24 (22)	06:49		07:26		08:02	08:37 (28)	07:44		08:13
	21:17 11	20:35 (22)	20:36		19:40		18:45 44	09:21 (28)	17:06		17:03
23	06:16	20:23 (22)	06:51		07:27		08:04	08:37 (28)	07:45		08:13
	21:16 13	20:36 (22)	20:34		19:38		18:43 45	09:22 (28)	17:06		17:03
24	06:17	20:21 (22)	06:52		07:28		08:05	08:37 (28)	07:46		08:13
	21:15 17	20:38 (22)	20:33		19:36		18:41 44	09:21 (28)	17:05		17:04
25	06:18	20:20 (22)	06:53		07:29		08:06	08:36 (28)	07:47		08:14
	21:14 19	20:39 (22)	20:31		19:34		18:40 45	09:21 (28)	17:04		17:04
26	06:19	20:20 (22)	06:54		07:30		08:08	08:37 (28)	07:49		08:14
	21:13 20	20:40 (22)	20:29		19:32		18:38 44	09:21 (28)	17:04		17:05
27	06:20	20:19 (22)	06:55		07:31		08:09	08:36 (28)	07:50		08:15
	21:12 21	20:40 (22)	20:27		19:31		18:37 45	09:21 (28)	17:03		17:06
28	06:21	20:18 (22)	06:56		07:33		08:10	08:37 (28)	07:51		08:15
	21:11 23	20:41 (22)	20:26		19:29		18:35 44	09:21 (28)	17:03		17:06
29	06:22	20:18 (22)	06:58		07:34		08:12	08:37 (28)	07:52		08:15
	21:10 23	20:41 (22)	20:24		19:27		18:34 43	09:20 (28)	17:02		17:07
30	06:23	20:17 (22)	06:59		07:35		08:13	08:37 (28)	07:53		08:15
	21:09 25	20:42 (22)	20:22		19:25		18:32 42	09:19 (28)	17:02		17:08
31	06:24	20:17 (22)	07:00				08:14	08:38 (28)			08:15
	21:07 25	20:42 (22)	20:20				18:31 42	09:20 (28)			17:09
Potential sun hours	470		435		377		341		289		276
Total, worst case	203		203		213		804		302		
Sun reduction	0.76		0.74		0.69		0.59		0.51		
Oper. time red.	0.98		0.98		0.98		0.98		0.98		
Wind dir. red.	0.73		0.73		0.68		0.75		0.75		
Total reduction	0.55		0.53		0.46		0.43		0.37		
Total, real	111		108		98		348		113		

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:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
Tetra Tech EC, Inc C/o Shin Ng
3475 E. Foothill Blvd
US-PASADENA, CA 91107
1 617 457 8405
Ted Guertin / ted.guertin@tetratech.com
Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 29 - Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,582

Idle start wind speed: Cut in wind speed from power curve

	January			February			March			April			May			June	
1	08:16			07:58		08:20 (28)	07:18		08:25 (28)	07:22		07:47 (23)	06:31		20:07 (22)	05:58	
	17:10			17:48	27	08:47 (28)	18:25	13	08:38 (28)	20:05	19	08:06 (23)	20:41	11	20:18 (22)	21:15	
2	08:16			07:57		08:19 (28)	07:16			07:20		07:48 (23)	06:29		20:06 (22)	05:58	
	17:11			17:49	30	08:49 (28)	18:26			20:06	16	08:04 (23)	20:43	14	20:20 (22)	21:16	
3	08:16			07:56		08:18 (28)	07:14			07:18		07:50 (23)	06:28		20:05 (22)	05:57	
	17:12			17:51	32	08:50 (28)	18:28			20:07	12	08:02 (23)	20:44	15	20:20 (22)	21:17	
4	08:16			07:55		08:17 (28)	07:13			07:16		07:53 (23)	06:27		20:05 (22)	05:57	
	17:13			17:52	35	08:52 (28)	18:29			20:08	5	07:58 (23)	20:45	17	20:22 (22)	21:18	
5	08:16			07:54		08:15 (28)	07:11			07:14			06:25		20:04 (22)	05:56	
	17:14			17:53	37	08:52 (28)	18:30			20:10			20:46	18	20:22 (22)	21:19	
6	08:15			07:53		08:14 (28)	07:09			07:13			06:24		20:04 (22)	05:56	
	17:15			17:55	39	08:53 (28)	18:32			20:11			20:48	20	20:24 (22)	21:19	
7	08:15			07:51		08:13 (28)	07:07			07:11			06:23		20:04 (22)	05:56	
	17:16			17:56	41	08:54 (28)	18:33			20:12			20:49	21	20:25 (22)	21:20	
8	08:15			07:50		08:12 (28)	08:06			07:09			06:21		20:04 (22)	05:55	
	17:17			17:58	42	08:54 (28)	18:34			20:13			20:50	22	20:26 (22)	21:21	
9	08:15			07:49		08:12 (28)	08:04			07:07			06:20		20:03 (22)	05:55	
	17:18			17:59	43	08:55 (28)	19:36			20:14			20:51	24	20:27 (22)	21:21	
10	08:15			07:47		08:12 (28)	08:02			07:05			06:19		20:04 (22)	05:55	
	17:19			18:00	44	08:56 (28)	19:37			20:16			20:52	24	20:28 (22)	21:22	
11	08:14			07:46		08:11 (28)	08:00			07:04			06:17		20:04 (22)	05:55	
	17:20			18:00	45	08:56 (28)	19:38			20:17			20:53	25	20:29 (22)	21:23	
12	08:14			07:45		08:12 (28)	07:58			07:02			06:16		20:05 (22)	05:54	
	17:21			18:02	44	08:56 (28)	19:40			20:18			20:55	24	20:29 (22)	21:23	
13	08:13			07:43		08:11 (28)	07:57			07:00			06:15		20:05 (22)	05:54	
	17:23			18:03	45	08:56 (28)	19:41			20:19			20:56	23	20:28 (22)	21:24	
14	08:13			07:42		08:11 (28)	07:55			06:58			06:14		20:06 (22)	05:54	
	17:24			18:05	46	08:57 (28)	19:42			20:21			20:57	22	20:28 (22)	21:24	
15	08:13			07:40		08:11 (28)	07:53			06:57			06:13		20:07 (22)	05:54	
	17:25			18:06	45	08:56 (28)	19:43			20:22			20:58	20	20:27 (22)	21:25	
16	08:12			07:39		08:11 (28)	07:51			06:55			06:12		20:08 (22)	05:54	
	17:26			18:07	45	08:56 (28)	19:45			20:23			20:59	18	20:26 (22)	21:25	
17	08:11			07:37		08:11 (28)	07:49			06:53			06:11		20:09 (22)	05:54	
	17:28			18:09	45	08:56 (28)	19:46			20:24			21:00	16	20:25 (22)	21:26	
18	08:11			07:36		08:12 (28)	07:47			06:52			06:09		20:10 (22)	05:54	
	17:29			18:10	44	08:56 (28)	19:47			20:26			21:01	14	20:24 (22)	21:26	
19	08:10			07:34		08:12 (28)	07:46			06:50			06:08		20:12 (22)	05:54	
	17:30			18:12	43	08:55 (28)	19:48			20:27			21:02	10	20:22 (22)	21:26	
20	08:09			07:33		08:12 (28)	07:44			06:48			06:07		20:15 (22)	05:54	
	17:31			18:13	42	08:54 (28)	19:50			20:28			21:04	4	20:19 (22)	21:27	
21	08:09			07:31		08:13 (28)	07:42		08:02 (23)	06:47			06:07			05:55	
	17:33			18:14	41	08:54 (28)	19:51	2	08:04 (23)	20:29			21:05			21:27	
22	08:08			07:29		08:13 (28)	07:40		08:00 (23)	06:45			06:06			05:55	
	17:34			18:16	40	08:53 (28)	19:52	6	08:06 (23)	20:30			21:06			21:27	
23	08:07			07:28		08:15 (28)	07:38		07:58 (23)	06:43			06:05			05:55	
	17:35			18:17	37	08:52 (28)	19:53	10	08:08 (23)	20:32			21:07			21:27	
24	08:06			07:26		08:15 (28)	07:36		07:56 (23)	06:42			06:04			05:55	
	17:37			18:18	36	08:51 (28)	19:55	12	08:08 (23)	20:33			21:08			21:28	
25	08:05			07:24		08:16 (28)	07:35		07:55 (23)	06:40			06:03			05:56	
	17:38			18:20	33	08:49 (28)	19:56	15	08:10 (23)	20:34			21:09			21:28	
26	08:05			07:23		08:18 (28)	07:33		07:53 (23)	06:39			06:02			05:56	
	17:39			18:21	30	08:48 (28)	19:57	17	08:10 (23)	20:35			21:10			21:28	
27	08:04			07:21		08:20 (28)	07:31		07:51 (23)	06:37			06:01			05:56	
	17:41			18:22	25	08:45 (28)	19:58	19	08:10 (23)	20:37			21:11			21:28	
28	08:03		08:27 (28)	07:19		08:22 (28)	07:29		07:49 (23)	06:35		20:12 (22)	06:01			05:57	
	17:42	11	08:38 (28)	18:24	20	08:42 (28)	20:00	20	08:09 (23)	20:38	2	20:14 (22)	21:12			21:28	
29	08:02		08:24 (28)				07:27		07:47 (23)	06:34		20:10 (22)	06:00			05:57	
	17:44	17	08:41 (28)				20:01	22	08:09 (23)	20:39	6	20:16 (22)	21:13			21:28	
30	08:01		08:23 (28)				07:25		07:46 (23)	06:32		20:08 (22)	05:59			05:58	
	17:45	21	08:44 (28)				20:02	22	08:08 (23)	20:40	9	20:17 (22)	21:14			21:28	
31	08:00		08:21 (28)				07:23		07:47 (23)				05:59				
	17:46	24	08:45 (28)				20:03	21	08:08 (23)				21:14				
Potential sun hours	288			292			369			403			458			464	
Total, worst case		73			1076			179			69			362			
Sun reduction		0.62			0.62			0.62			0.59			0.66			
Oper. time red.		0.98			0.98			0.98			0.98			0.98			
Wind dir. red.		0.75			0.75			0.69			0.70			0.73			
Total reduction		0.46			0.46			0.42			0.40			0.47			
Total, real		33			491			75			28			171			

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:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
Tetra Tech EC, Inc C/o Shin Ng
3475 E. Foothill Blvd
US-PASADENA, CA 91107
1 617 457 8405
Ted Guertin / ted.guertin@tetratech.com
Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 29 - Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,582

Idle start wind speed: Cut in wind speed from power curve

	July		August		September		October		November		December
1	05:58		06:25	20:15 (22)	07:01		07:36		07:16	07:41 (28)	07:55
	21:28		21:06 24	20:39 (22)	20:19		19:23		17:30 44	08:25 (28)	17:01
2	05:59		06:27	20:15 (22)	07:02		07:37		07:17	07:42 (28)	07:56
	21:28		21:05 24	20:39 (22)	20:17		19:21		17:28 43	08:25 (28)	17:01
3	05:59		06:28	20:14 (22)	07:03		07:39		07:18	07:42 (28)	07:57
	21:27		21:04 24	20:38 (22)	20:15		19:19		17:27 42	08:24 (28)	17:01
4	06:00		06:29	20:14 (22)	07:05		07:40		07:20	07:43 (28)	07:58
	21:27		21:03 23	20:37 (22)	20:13		19:18		17:25 41	08:24 (28)	17:00
5	06:01		06:30	20:14 (22)	07:06		07:41		07:21	07:44 (28)	07:59
	21:27		21:01 21	20:35 (22)	20:11		19:16		17:24 39	08:23 (28)	17:00
6	06:01		06:31	20:13 (22)	07:07		07:42		07:22	07:46 (28)	08:00
	21:27		21:00 21	20:34 (22)	20:10		19:14		17:23 37	08:23 (28)	17:00
7	06:02		06:32	20:13 (22)	07:08		07:43		07:24	07:47 (28)	08:01
	21:26		20:59 20	20:33 (22)	20:08		19:12		17:22 34	08:21 (28)	17:00
8	06:03		06:33	20:13 (22)	07:09	07:48 (23)	07:45		07:25	07:48 (28)	08:02
	21:26		20:57 18	20:31 (22)	20:06 5	07:53 (23)	19:10		17:20 32	08:20 (28)	17:00
9	06:03		06:34	20:14 (22)	07:10	07:44 (23)	07:46		07:26	07:50 (28)	08:03
	21:25		20:56 16	20:30 (22)	20:04 12	07:56 (23)	19:08		17:19 29	08:19 (28)	17:00
10	06:04		06:36	20:14 (22)	07:12	07:42 (23)	07:47		07:28	07:51 (28)	08:04
	21:25		20:54 14	20:28 (22)	20:02 15	07:57 (23)	19:07		17:18 27	08:18 (28)	17:00
11	06:05		06:37	20:15 (22)	07:13	07:40 (23)	07:48		07:29	07:53 (28)	08:05
	21:25		20:53 13	20:28 (22)	20:00 18	07:58 (23)	19:05		17:17 24	08:17 (28)	17:00
12	06:06		06:38	20:16 (22)	07:14	07:38 (23)	07:50	09:03 (28)	07:30	07:54 (28)	08:06
	21:24		20:52 10	20:26 (22)	19:59 21	07:59 (23)	19:03 5	09:08 (28)	17:16 21	08:15 (28)	17:00
13	06:07		06:39	20:17 (22)	07:15	07:37 (23)	07:51	08:56 (28)	07:32	07:56 (28)	08:07
	21:23		20:50 8	20:25 (22)	19:57 22	07:59 (23)	19:01 17	09:13 (28)	17:15 17	08:13 (28)	17:00
14	06:07		06:40	20:18 (22)	07:16	07:37 (23)	07:52	08:54 (28)	07:33	07:59 (28)	08:07
	21:23		20:49 5	20:23 (22)	19:55 22	07:59 (23)	19:00 23	09:17 (28)	17:14 10	08:09 (28)	17:00
15	06:08		06:41	20:20 (22)	07:17	07:39 (23)	07:53	08:51 (28)	07:34		08:08
	21:22		20:47 2	20:22 (22)	19:53 20	07:59 (23)	18:56 27	09:18 (28)	17:13		17:00
16	06:09		06:43		07:19	07:40 (23)	07:55	08:49 (28)	07:36		08:09
	21:22		20:45		19:51 19	07:59 (23)	18:54 31	09:20 (28)	17:12		17:00
17	06:10		06:44		07:20	07:41 (23)	07:56	08:47 (28)	07:37		08:10
	21:21		20:44		19:49 17	07:58 (23)	18:53 34	09:21 (28)	17:11		17:01
18	06:11		06:45		07:21	07:42 (23)	07:57	08:46 (28)	07:38		08:10
	21:20		20:42		19:47 15	07:57 (23)	18:51 36	09:22 (28)	17:10		17:01
19	06:12		06:46		07:22	07:43 (23)	07:59	08:45 (28)	07:40		08:11
	21:19		20:41		19:45 13	07:56 (23)	18:49 38	09:23 (28)	17:09		17:01
20	06:13		06:47		07:23	07:44 (23)	08:00	08:45 (28)	07:41		08:11
	21:19		20:39		19:44 10	07:54 (23)	18:48 39	09:24 (28)	17:08		17:02
21	06:14		06:48		07:24	07:45 (23)	08:01	08:43 (28)	07:42		08:12
	21:18		20:38		19:42 7	07:52 (23)	18:46 42	09:25 (28)	17:07		17:02
22	06:15		06:49		07:26	07:47 (23)	08:02	08:42 (28)	07:44		08:13
	21:17		20:36		19:40 4	07:51 (23)	18:45 43	09:25 (28)	17:06		17:03
23	06:16		06:51		07:27		08:04	08:42 (28)	07:45		08:13
	21:16		20:34		19:38		18:43 44	09:26 (28)	17:06		17:03
24	06:17	20:24 (22)	06:52		07:28		08:05	08:41 (28)	07:46		08:13
	21:15 7	20:31 (22)	20:33		19:36		18:41 45	09:26 (28)	17:05		17:04
25	06:18	20:22 (22)	06:53		07:29		08:06	08:41 (28)	07:47		08:14
	21:14 11	20:33 (22)	20:31		19:34		18:40 44	09:25 (28)	17:04		17:04
26	06:19	20:20 (22)	06:54		07:30		08:08	08:41 (28)	07:49		08:14
	21:13 15	20:35 (22)	20:29		19:32		18:38 45	09:26 (28)	17:04		17:05
27	06:20	20:19 (22)	06:55		07:31		08:09	08:40 (28)	07:50		08:15
	21:12 17	20:36 (22)	20:27		19:31		18:37 46	09:26 (28)	17:03		17:06
28	06:21	20:18 (22)	06:56		07:33		08:10	08:41 (28)	07:51		08:15
	21:11 19	20:37 (22)	20:26		19:29		18:35 45	09:26 (28)	17:03		17:06
29	06:22	20:17 (22)	06:58		07:34		08:12	08:41 (28)	07:52		08:15
	21:10 21	20:38 (22)	20:24		19:27		18:34 45	09:26 (28)	17:02		17:07
30	06:23	20:16 (22)	06:59		07:35		08:13	08:40 (28)	07:53		08:15
	21:09 23	20:39 (22)	20:22		19:25		18:32 45	09:25 (28)	17:02		17:08
31	06:24	20:16 (22)	07:00				08:14	08:41 (28)			08:15
	21:07 23	20:39 (22)	20:20				18:31 44	09:25 (28)			17:09
Potential sun hours	470		435		377		341		289		276
Total, worst case	136		243		220		738		440		
Sun reduction	0.76		0.74		0.69		0.59		0.51		
Oper. time red.	0.98		0.98		0.98		0.98		0.98		
Wind dir. red.	0.73		0.73		0.68		0.75		0.75		
Total reduction	0.55		0.53		0.46		0.43		0.38		
Total, real	74		129		102		320		165		

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:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
Tetra Tech EC, Inc C/o Shin Ng
3475 E. Foothill Blvd
US-PASADENA, CA 91107
1 617 457 8405
Ted Guertin / ted.guertin@tetratech.com
Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 30 - Participant
Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,582

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:16	07:59	07:18	07:22	06:31	05:59	05:59	06:26	07:01	07:36	07:16	07:55
	17:10	17:48	18:25	20:05	20:42	21:15	21:28	21:06	20:19	19:23	17:30	17:02
2	08:16	07:57	07:16	07:20	06:30	05:58	05:59	06:27	07:02	07:38	07:17	07:56
	17:11	17:49	18:27	20:06	20:43	21:16	21:28	21:05	20:17	19:21	17:28	17:01
3	08:16	07:56	07:14	07:18	06:28	05:58	06:00	06:28	07:04	07:39	07:18	07:57
	17:12	17:51	18:28	20:07	20:44	21:17	21:27	21:04	20:15	19:20	17:27	17:01
4	08:16	07:55	07:13	07:16	06:27	05:57	06:00	06:29	07:05	07:40	07:20	07:58
	17:13	17:52	18:29	20:08	20:45	21:18	21:27	21:03	20:13	19:18	17:26	17:01
5	08:16	07:54	07:11	07:15	06:25	05:57	06:01	06:30	07:06	07:41	07:21	07:59
	17:14	17:54	18:31	20:10	20:46	21:19	21:27	21:01	20:12	19:16	17:24	17:00
6	08:15	07:53	07:09	07:13	06:24	05:56	06:02	06:31	07:07	07:42	07:22	08:00
	17:15	17:55	18:32	20:11	20:48	21:19	21:27	21:00	20:10	19:14	17:23	17:00
7	08:15	07:51	07:07	07:11	06:23	05:56	06:02	06:32	07:08	07:44	07:24	08:01
	17:16	17:56	18:33	20:12	20:49	21:20	21:26	20:59	20:08	19:12	17:22	17:00
8	08:15	07:50	08:06	07:09	06:21	05:56	06:03	06:34	07:09	07:45	07:25	08:02
	17:17	17:58	18:35	20:13	20:50	21:21	21:26	20:57	20:06	19:10	17:21	17:00
9	08:15	07:49	08:04	07:07	06:20	05:55	06:04	06:35	07:11	07:46	07:27	08:03
	17:18	17:59	19:36	20:15	20:51	21:21	21:25	20:56	20:04	19:09	17:19	17:00
10	08:15	07:47	08:02	07:06	06:19	05:55	06:04	06:36	07:12	07:47	07:28	08:04
	17:19	18:01	19:37	20:16	20:52	21:22	21:25	20:54	20:02	19:07	17:18	17:00
11	08:14	07:46	08:00	07:04	06:18	05:55	06:05	06:37	07:13	07:49	07:29	08:05
	17:21	18:01	19:38	20:17	20:53	21:23	21:25	20:53	20:01	19:05	17:17	17:00
12	08:14	07:45	07:59	07:02	06:16	05:55	06:06	06:38	07:14	07:50	07:31	08:06
	17:22	18:02	19:40	20:18	20:55	21:23	21:24	20:52	19:59	19:03	17:16	17:00
13	08:13	07:43	07:57	07:00	06:15	05:55	06:07	06:39	07:15	07:51	07:32	08:07
	17:23	18:03	19:41	20:19	20:56	21:24	21:23	20:50	19:57	19:02	17:15	17:00
14	08:13	07:42	07:55	06:59	06:14	05:54	06:08	06:40	07:16	07:52	07:33	08:07
	17:24	18:05	19:42	20:21	20:57	21:24	21:23	20:49	19:55	19:00	17:14	17:00
15	08:13	07:40	07:53	06:57	06:13	05:54	06:09	06:42	07:18	07:54	07:35	08:08
	17:25	18:06	19:43	20:22	20:58	21:25	21:22	20:47	19:53	18:56	17:13	17:00
16	08:12	07:39	07:51	06:55	06:12	05:54	06:09	06:43	07:19	07:55	07:36	08:09
	17:27	18:08	19:45	20:23	20:59	21:25	21:22	20:46	19:51	18:55	17:12	17:01
17	08:11	07:37	07:49	06:53	06:11	05:54	06:10	06:44	07:20	07:56	07:37	08:10
	17:28	18:09	19:46	20:24	21:00	21:26	21:21	20:44	19:49	18:53	17:11	17:01
18	08:11	07:36	07:48	06:52	06:10	05:54	06:11	06:45	07:21	07:57	07:39	08:10
	17:29	18:10	19:47	20:26	21:01	21:26	21:20	20:42	19:48	18:51	17:10	17:01
19	08:10	07:34	07:46	06:50	06:09	05:55	06:12	06:46	07:22	07:59	07:40	08:11
	17:30	18:12	19:49	20:27	21:03	21:26	21:19	20:41	19:46	18:50	17:09	17:02
20	08:10	07:33	07:44	06:48	06:08	05:55	06:13	06:47	07:23	08:00	07:41	08:11
	17:32	18:13	19:50	20:28	21:04	21:27	21:19	20:39	19:44	18:48	17:08	17:02
21	08:09	07:31	07:42	06:47	06:07	05:55	06:14	06:49	07:25	08:01	07:42	08:12
	17:33	18:15	19:51	20:29	21:05	21:27	21:18	20:38	19:42	18:46	17:08	17:03
22	08:08	07:29	07:40	06:45	06:06	05:55	06:15	06:50	07:26	08:03	07:44	08:13
	17:34	18:16	19:52	20:31	21:06	21:27	21:17	20:36	19:40	18:45	17:07	17:03
23	08:07	07:28	07:38	06:43	06:05	05:55	06:16	06:51	07:27	08:04	07:45	08:13
	17:36	18:17	19:54	20:32	21:07	21:27	21:16	20:34	19:38	18:43	17:06	17:04
24	08:06	07:26	07:37	06:42	06:04	05:56	06:17	06:52	07:28	08:05	07:46	08:13
	17:37	18:19	19:55	20:33	21:08	21:28	21:15	20:33	19:36	18:42	17:05	17:04
25	08:06	07:25	07:35	06:40	06:03	05:56	06:18	06:53	07:29	08:06	07:47	08:14
	17:38	18:20	19:56	20:34	21:09	21:28	21:14	20:31	19:34	18:40	17:05	17:05
26	08:05	07:23	07:33	06:39	06:03	05:56	06:19	06:54	07:30	08:08	07:49	08:14
	17:40	18:21	19:57	20:35	21:10	21:28	21:13	20:29	19:33	18:39	17:04	17:05
27	08:04	07:21	07:31	06:37	06:02	05:57	06:20	06:56	07:32	08:09	07:50	08:15
	17:41	18:23	19:59	20:37	21:11	21:28	21:12	20:28	19:31	18:37	17:04	17:06
28	08:03	07:20	07:29	06:36	06:01	05:57	06:21	06:57	07:33	08:10	07:51	08:15
	17:42	18:24	20:00	20:38	21:12	21:28	21:11	20:26	19:29	18:35	17:03	17:07
29	08:02		07:27	06:34	06:00	05:58	06:22	06:58	07:34	08:12	07:52	08:15
	17:44		20:01	20:39	21:13	21:28	21:10	20:24	19:27	18:34	17:03	17:08
30	08:01		07:25	06:33	06:00	05:58	06:23	06:59	07:35	08:13	07:53	08:15
	17:45		20:02	20:40	21:14	21:28	21:09	20:22	19:25	18:33	17:02	17:08
31	08:00		07:24		05:59		06:25	07:00		08:14		08:15
	17:47		20:03		21:14		21:08	20:21		18:31		17:09
Potential sun hours	288	292	369	403	458	464	470	435	377	342	289	276
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
Tetra Tech EC, Inc C/o Shin Ng
3475 E. Foothill Blvd
US-PASADENA, CA 91107
1 617 457 8405
Ted Guertin / ted.guertin@tetratech.com

Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 31 - Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,582

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:16	07:59	07:18	07:22	06:31	05:59	05:59	06:26	07:01	07:36	07:16	07:55
	17:10	17:48	18:25	20:05	20:42	21:15	21:28	21:06	20:19	19:23	17:30	17:02
2	08:16	07:57	07:16	07:20	06:30	05:58	05:59	06:27	07:02	07:38	07:17	07:56
	17:11	17:49	18:27	20:06	20:43	21:16	21:28	21:05	20:17	19:21	17:28	17:01
3	08:16	07:56	07:14	07:18	06:28	05:58	06:00	06:28	07:04	07:39	07:18	07:57
	17:12	17:51	18:28	20:07	20:44	21:17	21:27	21:04	20:15	19:20	17:27	17:01
4	08:16	07:55	07:13	07:16	06:27	05:57	06:00	06:29	07:05	07:40	07:20	07:58
	17:13	17:52	18:29	20:08	20:45	21:18	21:27	21:03	20:13	19:18	17:26	17:01
5	08:16	07:54	07:11	07:15	06:25	05:57	06:01	06:30	07:06	07:41	07:21	07:59
	17:14	17:54	18:31	20:10	20:46	21:19	21:27	21:01	20:12	19:16	17:24	17:00
6	08:15	07:53	07:09	07:13	06:24	05:56	06:02	06:31	07:07	07:42	07:22	08:00
	17:15	17:55	18:32	20:11	20:48	21:19	21:27	21:00	20:10	19:14	17:23	17:00
7	08:15	07:51	07:07	07:11	06:23	05:56	06:02	06:32	07:08	07:44	07:24	08:01
	17:16	17:56	18:33	20:12	20:49	21:20	21:26	20:59	20:08	19:12	17:22	17:00
8	08:15	07:50	08:06	07:09	06:21	05:56	06:03	06:34	07:09	07:45	07:25	08:02
	17:17	17:58	18:35	20:13	20:50	21:21	21:26	20:57	20:06	19:10	17:21	17:00
9	08:15	07:49	08:04	07:07	06:20	05:55	06:04	06:35	07:11	07:46	07:27	08:03
	17:18	17:59	19:36	20:15	20:51	21:21	21:25	20:56	20:04	19:09	17:19	17:00
10	08:15	07:47	08:02	07:06	06:19	05:55	06:04	06:36	07:12	07:47	07:28	08:04
	17:19	18:01	19:37	20:16	20:52	21:22	21:25	20:54	20:02	19:07	17:18	17:00
11	08:14	07:46	08:00	07:04	06:18	05:55	06:05	06:37	07:13	07:49	07:29	08:05
	17:21	18:01	19:38	20:17	20:53	21:23	21:25	20:53	20:01	19:05	17:17	17:00
12	08:14	07:45	07:59	07:02	06:16	05:55	06:06	06:38	07:14	07:50	07:31	08:06
	17:22	18:02	19:40	20:18	20:55	21:23	21:24	20:52	19:59	19:03	17:16	17:00
13	08:13	07:43	07:57	07:00	06:15	05:55	06:07	06:39	07:15	07:51	07:32	08:07
	17:23	18:03	19:41	20:19	20:56	21:24	21:23	20:50	19:57	19:02	17:15	17:00
14	08:13	07:42	07:55	06:59	06:14	05:54	06:08	06:40	07:16	07:52	07:33	08:07
	17:24	18:05	19:42	20:21	20:57	21:24	21:23	20:49	19:55	19:00	17:14	17:00
15	08:13	07:40	07:53	06:57	06:13	05:54	06:09	06:42	07:18	07:54	07:35	08:08
	17:25	18:06	19:44	20:22	20:58	21:25	21:22	20:47	19:53	18:56	17:13	17:00
16	08:12	07:39	07:51	06:55	06:12	05:54	06:09	06:43	07:19	07:55	07:36	08:09
	17:27	18:08	19:45	20:23	20:59	21:25	21:22	20:46	19:51	18:55	17:12	17:01
17	08:11	07:37	07:49	06:53	06:11	05:54	06:10	06:44	07:20	07:56	07:37	08:10
	17:28	18:09	19:46	20:24	21:00	21:26	21:21	20:44	19:49	18:53	17:11	17:01
18	08:11	07:36	07:48	06:52	06:10	05:55	06:11	06:45	07:21	07:57	07:39	08:10
	17:29	18:10	19:47	20:26	21:01	21:26	21:20	20:42	19:48	18:51	17:10	17:01
19	08:10	07:34	07:46	06:50	06:09	05:55	06:12	06:46	07:22	07:59	07:40	08:11
	17:30	18:12	19:49	20:27	21:03	21:26	21:19	20:41	19:46	18:50	17:09	17:02
20	08:10	07:33	07:44	06:48	06:08	05:55	06:13	06:47	07:23	08:00	07:41	08:11
	17:32	18:13	19:50	20:28	21:04	21:27	21:19	20:39	19:44	18:48	17:08	17:02
21	08:09	07:31	07:42	06:47	06:07	05:55	06:14	06:49	07:25	08:01	07:42	08:12
	17:33	18:15	19:51	20:29	21:05	21:27	21:18	20:38	19:42	18:46	17:08	17:03
22	08:08	07:29	07:40	06:45	06:06	05:55	06:15	06:50	07:26	08:03	07:44	08:13
	17:34	18:16	19:52	20:31	21:06	21:27	21:17	20:36	19:40	18:45	17:07	17:03
23	08:07	07:28	07:38	06:44	06:05	05:55	06:16	06:51	07:27	08:04	07:45	08:13
	17:36	18:17	19:54	20:32	21:07	21:27	21:16	20:34	19:38	18:43	17:06	17:04
24	08:06	07:26	07:37	06:42	06:04	05:56	06:17	06:52	07:28	08:05	07:46	08:13
	17:37	18:19	19:55	20:33	21:08	21:28	21:15	20:33	19:36	18:42	17:05	17:04
25	08:06	07:25	07:35	06:40	06:03	05:56	06:18	06:53	07:29	08:06	07:47	08:14
	17:38	18:20	19:56	20:34	21:09	21:28	21:14	20:31	19:34	18:40	17:05	17:05
26	08:05	07:23	07:33	06:39	06:03	05:56	06:19	06:54	07:30	08:08	07:49	08:14
	17:40	18:21	19:57	20:35	21:10	21:28	21:13	20:29	19:33	18:39	17:04	17:05
27	08:04	07:21	07:31	06:37	06:02	05:57	06:20	06:56	07:32	08:09	07:50	08:15
	17:41	18:23	19:59	20:37	21:11	21:28	21:12	20:28	19:31	18:37	17:04	17:06
28	08:03	07:20	07:29	06:36	06:01	05:57	06:21	06:57	07:33	08:10	07:51	08:15
	17:42	18:24	20:00	20:38	21:12	21:28	21:11	20:26	19:29	18:36	17:03	17:07
29	08:02		07:27	06:34	06:00	05:58	06:22	06:58	07:34	08:12	07:52	08:15
	17:44		20:01	20:39	21:13	21:28	21:10	20:24	19:27	18:34	17:03	17:08
30	08:01		07:25	06:33	06:00	05:58	06:23	06:59	07:35	08:13	07:53	08:15
	17:45		20:02	20:40	21:14	21:28	21:09	20:22	19:25	18:33	17:02	17:08
31	08:00		07:24		05:59		06:25	07:00		08:14		08:15
	17:47		20:03		21:14		21:08	20:21		18:31		17:09
Potential sun hours	288	292	369	403	458	464	470	435	377	342	289	276
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
Tetra Tech EC, Inc C/o Shin Ng
3475 E. Foothill Blvd
US-PASADENA, CA 91107
1 617 457 8405
Ted Guertin / ted.guertin@tetratech.com
Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 32 - Non-Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,582

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:16	07:59	07:18	07:22	06:31	05:59	05:59	06:26	07:01	07:36	07:16	07:55
	17:10	17:48	18:25	20:05	20:42	21:15	21:28	21:06	20:19	19:23	17:30	17:02
2	08:16	07:57	07:16	07:20	06:30	05:58	05:59	06:27	07:03	07:38	07:17	07:56
	17:11	17:50	18:27	20:06	20:43	21:16	21:28	21:05	20:17	19:21	17:28	17:01
3	08:16	07:56	07:15	07:18	06:28	05:58	06:00	06:28	07:04	07:39	07:19	07:57
	17:12	17:51	18:28	20:07	20:44	21:17	21:27	21:04	20:15	19:20	17:27	17:01
4	08:16	07:55	07:13	07:16	06:27	05:57	06:00	06:29	07:05	07:40	07:20	07:58
	17:13	17:52	18:29	20:09	20:45	21:18	21:27	21:03	20:13	19:18	17:26	17:01
5	08:16	07:54	07:11	07:15	06:26	05:57	06:01	06:30	07:06	07:41	07:21	07:59
	17:14	17:54	18:31	20:10	20:46	21:19	21:27	21:01	20:12	19:16	17:24	17:01
6	08:16	07:53	07:09	07:13	06:24	05:56	06:02	06:31	07:07	07:43	07:23	08:00
	17:15	17:55	18:32	20:11	20:48	21:19	21:27	21:00	20:10	19:14	17:23	17:00
7	08:15	07:51	07:08	07:11	06:23	05:56	06:02	06:33	07:08	07:44	07:24	08:01
	17:16	17:57	18:33	20:12	20:49	21:20	21:26	20:59	20:08	19:12	17:22	17:00
8	08:15	07:50	08:06	07:09	06:22	05:56	06:03	06:34	07:10	07:45	07:25	08:02
	17:17	17:58	18:35	20:13	20:50	21:21	21:26	20:57	20:06	19:11	17:21	17:00
9	08:15	07:49	08:04	07:07	06:20	05:55	06:04	06:35	07:11	07:46	07:27	08:03
	17:18	17:59	19:36	20:15	20:51	21:22	21:26	20:56	20:04	19:09	17:20	17:00
10	08:15	07:47	08:02	07:06	06:19	05:55	06:05	06:36	07:12	07:47	07:28	08:04
	17:20	18:01	19:37	20:16	20:52	21:22	21:25	20:55	20:03	19:07	17:18	17:00
11	08:14	07:46	08:00	07:04	06:18	05:55	06:05	06:37	07:13	07:49	07:29	08:05
	17:21	18:01	19:38	20:17	20:54	21:23	21:25	20:53	20:01	19:05	17:17	17:00
12	08:14	07:45	07:59	07:02	06:17	05:55	06:06	06:38	07:14	07:50	07:31	08:06
	17:22	18:02	19:40	20:18	20:55	21:23	21:24	20:52	19:59	19:03	17:16	17:00
13	08:14	07:43	07:57	07:00	06:15	05:55	06:07	06:39	07:15	07:51	07:32	08:07
	17:23	18:04	19:41	20:20	20:56	21:24	21:24	20:50	19:57	19:02	17:15	17:00
14	08:13	07:42	07:55	06:59	06:14	05:55	06:08	06:41	07:16	07:52	07:33	08:07
	17:24	18:05	19:42	20:21	20:57	21:24	21:23	20:49	19:55	19:00	17:14	17:00
15	08:13	07:40	07:53	06:57	06:13	05:55	06:09	06:42	07:18	07:54	07:35	08:08
	17:25	18:06	19:44	20:22	20:58	21:25	21:22	20:47	19:53	18:56	17:13	17:01
16	08:12	07:39	07:51	06:55	06:12	05:55	06:10	06:43	07:19	07:55	07:36	08:09
	17:27	18:08	19:45	20:23	20:59	21:25	21:22	20:46	19:51	18:55	17:12	17:01
17	08:12	07:37	07:50	06:54	06:11	05:55	06:10	06:44	07:20	07:56	07:37	08:10
	17:28	18:09	19:46	20:25	21:00	21:26	21:21	20:44	19:49	18:53	17:11	17:01
18	08:11	07:36	07:48	06:52	06:10	05:55	06:11	06:45	07:21	07:57	07:39	08:10
	17:29	18:11	19:47	20:26	21:02	21:26	21:20	20:43	19:48	18:51	17:10	17:01
19	08:10	07:34	07:46	06:50	06:09	05:55	06:12	06:46	07:22	07:59	07:40	08:11
	17:30	18:12	19:49	20:27	21:03	21:26	21:19	20:41	19:46	18:50	17:09	17:02
20	08:10	07:33	07:44	06:49	06:08	05:55	06:13	06:47	07:23	08:00	07:41	08:12
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	17:33	18:15	19:51	20:29	21:05	21:27	21:18	20:38	19:42	18:46	17:08	17:03
22	08:08	07:30	07:40	06:45	06:06	05:55	06:15	06:50	07:26	08:03	07:44	08:13
	17:34	18:16	19:52	20:31	21:06	21:27	21:17	20:36	19:40	18:45	17:07	17:03
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	17:36	18:17	19:54	20:32	21:07	21:27	21:16	20:34	19:38	18:43	17:06	17:04
24	08:07	07:26	07:37	06:42	06:04	05:56	06:17	06:52	07:28	08:05	07:46	08:14
	17:37	18:19	19:55	20:33	21:08	21:28	21:15	20:33	19:36	18:42	17:05	17:04
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26	08:05	07:23	07:33	06:39	06:03	05:56	06:19	06:54	07:30	08:08	07:49	08:14
	17:40	18:21	19:57	20:36	21:10	21:28	21:13	20:29	19:33	18:39	17:04	17:05
27	08:04	07:21	07:31	06:37	06:02	05:57	06:20	06:56	07:32	08:09	07:50	08:15
	17:41	18:23	19:59	20:37	21:11	21:28	21:12	20:28	19:31	18:37	17:04	17:06
28	08:03	07:20	07:29	06:36	06:01	05:57	06:21	06:57	07:33	08:11	07:51	08:15
	17:43	18:24	20:00	20:38	21:12	21:28	21:11	20:26	19:29	18:36	17:03	17:07
29	08:02		07:27	06:34	06:00	05:58	06:23	06:58	07:34	08:12	07:52	08:15
	17:44		20:01	20:39	21:13	21:28	21:10	20:24	19:27	18:34	17:03	17:08
30	08:01		07:26	06:33	06:00	05:58	06:24	06:59	07:35	08:13	07:54	08:15
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31	08:00		07:24		05:59		06:25	07:00		08:15		08:16
	17:47		20:04		21:15		21:08	20:21		18:31		17:09
Potential sun hours	288	292	369	403	458	464	470	435	377	342	289	276
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
Tetra Tech EC, Inc C/o Shin Ng
3475 E. Foothill Blvd
US-PASADENA, CA 91107
1 617 457 8405
Ted Guertin / ted.guertin@tetratech.com
Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 33 - Non-Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,582

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:15	07:58	07:18	07:22	06:31	05:59	05:59	06:26	07:01	07:36	07:16	07:55
	17:10	17:48	18:25	20:05	20:41	21:15	21:28	21:06	20:19	19:23	17:30	17:02
2	08:16	07:57	07:16	07:20	06:30	05:58	05:59	06:27	07:02	07:38	07:17	07:56
	17:11	17:49	18:27	20:06	20:43	21:16	21:27	21:05	20:17	19:21	17:28	17:01
3	08:16	07:56	07:14	07:18	06:28	05:58	06:00	06:28	07:04	07:39	07:18	07:57
	17:12	17:51	18:28	20:07	20:44	21:17	21:27	21:04	20:15	19:20	17:27	17:01
4	08:16	07:55	07:13	07:16	06:27	05:57	06:00	06:29	07:05	07:40	07:20	07:58
	17:13	17:52	18:29	20:08	20:45	21:18	21:27	21:03	20:13	19:18	17:26	17:01
5	08:15	07:54	07:11	07:15	06:26	05:57	06:01	06:30	07:06	07:41	07:21	07:59
	17:14	17:54	18:31	20:10	20:46	21:18	21:27	21:01	20:12	19:16	17:24	17:01
6	08:15	07:53	07:09	07:13	06:24	05:56	06:02	06:31	07:07	07:42	07:22	08:00
	17:15	17:55	18:32	20:11	20:47	21:19	21:26	21:00	20:10	19:14	17:23	17:00
7	08:15	07:51	07:07	07:11	06:23	05:56	06:02	06:32	07:08	07:44	07:24	08:01
	17:16	17:56	18:33	20:12	20:49	21:20	21:26	20:59	20:08	19:12	17:22	17:00
8	08:15	07:50	08:06	07:09	06:22	05:56	06:03	06:34	07:09	07:45	07:25	08:02
	17:17	17:58	18:34	20:13	20:50	21:21	21:26	20:57	20:06	19:10	17:21	17:00
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10	08:14	07:47	08:02	07:06	06:19	05:55	06:04	06:36	07:12	07:47	07:28	08:04
	17:19	18:01	19:37	20:16	20:52	21:22	21:25	20:54	20:02	19:07	17:18	17:00
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	17:21	18:01	19:38	20:17	20:53	21:23	21:24	20:53	20:01	19:05	17:17	17:00
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14	08:13	07:42	07:55	06:59	06:14	05:55	06:08	06:40	07:16	07:52	07:33	08:07
	17:24	18:05	19:42	20:21	20:57	21:24	21:23	20:49	19:55	19:00	17:14	17:00
15	08:12	07:40	07:53	06:57	06:13	05:54	06:09	06:42	07:18	07:54	07:34	08:08
	17:25	18:06	19:43	20:22	20:58	21:25	21:22	20:47	19:53	18:56	17:13	17:01
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	17:27	18:08	19:45	20:23	20:59	21:25	21:21	20:45	19:51	18:55	17:12	17:01
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	17:37	18:19	19:55	20:33	21:08	21:27	21:15	20:33	19:36	18:42	17:05	17:04
25	08:05	07:25	07:35	06:40	06:03	05:56	06:18	06:53	07:29	08:06	07:47	08:14
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26	08:05	07:23	07:33	06:39	06:03	05:56	06:19	06:54	07:30	08:08	07:49	08:14
	17:40	18:21	19:57	20:35	21:10	21:28	21:13	20:29	19:32	18:39	17:04	17:05
27	08:04	07:21	07:31	06:37	06:02	05:57	06:20	06:56	07:32	08:09	07:50	08:14
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	17:47		20:03		21:14		21:07	20:20		18:31		17:09
Potential sun hours	288	292	369	403	458	464	470	435	377	342	289	276
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
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Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 34 - Non-Participant
Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
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Idle start wind speed: Cut in wind speed from power curve

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	17:11	17:49	18:27	20:06	20:43	21:16	21:27	21:05	20:17	19:21	17:28	17:01
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	17:14	17:54	18:31	20:10	20:46	21:18	21:27	21:01	20:12	19:16	17:24	17:01
6	08:15	07:53	07:09	07:13	06:24	05:56	06:02	06:31	07:07	07:42	07:22	08:00
	17:15	17:55	18:32	20:11	20:48	21:19	21:26	21:00	20:10	19:14	17:23	17:00
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SHADOW - Calendar

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4	08:15	07:55	07:13	07:16	06:27	05:57	06:00	06:29	07:05	07:40	07:20	07:58
	17:13	17:52	18:29	20:08	20:45	21:18	21:27	21:02	20:13	19:18	17:26	17:01
5	08:15	07:54	07:11	07:14	06:25	05:57	06:01	06:30	07:06	07:41	07:21	07:59
	17:14	17:54	18:31	20:10	20:46	21:18	21:27	21:01	20:11	19:16	17:24	17:00
6	08:15	07:52	07:09	07:13	06:24	05:56	06:01	06:31	07:07	07:42	07:22	08:00
	17:15	17:55	18:32	20:11	20:47	21:19	21:26	21:00	20:10	19:14	17:23	17:00
7	08:15	07:51	07:07	07:11	06:23	05:56	06:02	06:32	07:08	07:44	07:24	08:01
	17:16	17:56	18:33	20:12	20:49	21:20	21:26	20:59	20:08	19:12	17:22	17:00
8	08:15	07:50	08:06	07:09	06:21	05:56	06:03	06:33	07:09	07:45	07:25	08:02
	17:17	17:58	18:34	20:13	20:50	21:21	21:26	20:57	20:06	19:10	17:21	17:00
9	08:15	07:49	08:04	07:07	06:20	05:55	06:04	06:35	07:11	07:46	07:26	08:03
	17:18	17:59	19:36	20:14	20:51	21:21	21:25	20:56	20:04	19:09	17:19	17:00
10	08:14	07:47	08:02	07:06	06:19	05:55	06:04	06:36	07:12	07:47	07:28	08:04
	17:19	18:01	19:37	20:16	20:52	21:22	21:25	20:54	20:02	19:07	17:18	17:00
11	08:14	07:46	08:00	07:04	06:18	05:55	06:05	06:37	07:13	07:48	07:29	08:05
	17:20	18:01	19:38	20:17	20:53	21:23	21:24	20:53	20:00	19:05	17:17	17:00
12	08:14	07:44	07:58	07:02	06:16	05:55	06:06	06:38	07:14	07:50	07:30	08:06
	17:22	18:02	19:40	20:18	20:55	21:23	21:24	20:51	19:59	19:03	17:16	17:00
13	08:13	07:43	07:57	07:00	06:15	05:55	06:07	06:39	07:15	07:51	07:32	08:06
	17:23	18:03	19:41	20:19	20:56	21:24	21:23	20:50	19:57	19:02	17:15	17:00
14	08:13	07:42	07:55	06:59	06:14	05:54	06:08	06:40	07:16	07:52	07:33	08:07
	17:24	18:05	19:42	20:21	20:57	21:24	21:23	20:48	19:55	19:00	17:14	17:00
15	08:12	07:40	07:53	06:57	06:13	05:54	06:08	06:42	07:17	07:53	07:34	08:08
	17:25	18:06	19:43	20:22	20:58	21:25	21:22	20:47	19:53	18:56	17:13	17:00
16	08:12	07:39	07:51	06:55	06:12	05:54	06:09	06:43	07:19	07:55	07:36	08:09
	17:27	18:08	19:45	20:23	20:59	21:25	21:21	20:45	19:51	18:55	17:12	17:01
17	08:11	07:37	07:49	06:53	06:11	05:54	06:10	06:44	07:20	07:56	07:37	08:09
	17:28	18:09	19:46	20:24	21:00	21:25	21:21	20:44	19:49	18:53	17:11	17:01
18	08:11	07:36	07:47	06:52	06:10	05:54	06:11	06:45	07:21	07:57	07:38	08:10
	17:29	18:10	19:47	20:26	21:01	21:26	21:20	20:42	19:47	18:51	17:10	17:01
19	08:10	07:34	07:46	06:50	06:09	05:55	06:12	06:46	07:22	07:59	07:40	08:11
	17:30	18:12	19:48	20:27	21:02	21:26	21:19	20:41	19:46	18:50	17:09	17:02
20	08:09	07:33	07:44	06:48	06:08	05:55	06:13	06:47	07:23	08:00	07:41	08:11
	17:32	18:13	19:50	20:28	21:03	21:27	21:18	20:39	19:44	18:48	17:08	17:02
21	08:09	07:31	07:42	06:47	06:07	05:55	06:14	06:48	07:24	08:01	07:42	08:12
	17:33	18:14	19:51	20:29	21:05	21:27	21:18	20:37	19:42	18:46	17:07	17:02
22	08:08	07:29	07:40	06:45	06:06	05:55	06:15	06:50	07:26	08:02	07:44	08:12
	17:34	18:16	19:52	20:30	21:06	21:27	21:17	20:36	19:40	18:45	17:07	17:03
23	08:07	07:28	07:38	06:43	06:05	05:55	06:16	06:51	07:27	08:04	07:45	08:13
	17:36	18:17	19:53	20:32	21:07	21:27	21:16	20:34	19:38	18:43	17:06	17:04
24	08:06	07:26	07:36	06:42	06:04	05:56	06:17	06:52	07:28	08:05	07:46	08:13
	17:37	18:19	19:55	20:33	21:08	21:27	21:15	20:32	19:36	18:42	17:05	17:04
25	08:05	07:24	07:35	06:40	06:03	05:56	06:18	06:53	07:29	08:06	07:47	08:14
	17:38	18:20	19:56	20:34	21:09	21:28	21:14	20:31	19:34	18:40	17:05	17:05
26	08:05	07:23	07:33	06:39	06:02	05:56	06:19	06:54	07:30	08:08	07:49	08:14
	17:40	18:21	19:57	20:35	21:10	21:28	21:13	20:29	19:32	18:38	17:04	17:05
27	08:04	07:21	07:31	06:37	06:02	05:57	06:20	06:55	07:31	08:09	07:50	08:14
	17:41	18:23	19:58	20:37	21:11	21:28	21:12	20:27	19:31	18:37	17:03	17:06
28	08:03	07:19	07:29	06:36	06:01	05:57	06:21	06:57	07:33	08:10	07:51	08:15
	17:42	18:24	20:00	20:38	21:12	21:28	21:11	20:26	19:29	18:35	17:03	17:07
29	08:02		07:27	06:34	06:00	05:58	06:22	06:58	07:34	08:12	07:52	08:15
	17:44		20:01	20:39	21:12	21:28	21:10	20:24	19:27	18:34	17:02	17:07
30	08:01		07:25	06:33	06:00	05:58	06:23	06:59	07:35	08:13	07:53	08:15
	17:45		20:02	20:40	21:13	21:28	21:09	20:22	19:25	18:33	17:02	17:08
31	07:59		07:24		05:59		06:25	07:00		08:14		08:15
	17:47		20:03		21:14		21:07	20:20		18:31		17:09
Potential sun hours	288	292	369	403	458	464	470	435	377	342	289	276
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
Tetra Tech EC, Inc C/o Shin Ng
3475 E. Foothill Blvd
US-PASADENA, CA 91107
1 617 457 8405
Ted Guertin / ted.guertin@tetratech.com

Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 36 - Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,582

Idle start wind speed: Cut in wind speed from power curve

	January	February	March		April	May	June	July	August	September		October		November	December
1	08:15	07:58	07:18		07:22	06:31	05:58	05:58	06:26	07:01		07:36	07:57 (44)	07:16	07:54
	17:10	17:48	18:25		20:05	20:41	21:15	21:27	21:06	20:19		19:23	10 08:07 (44)	17:30	17:02
2	08:15	07:57	07:16		07:20	06:30	05:58	05:59	06:27	07:02		07:37	07:58 (44)	07:17	07:56
	17:11	17:49	18:26		20:06	20:43	21:16	21:27	21:05	20:17		19:21	7 08:05 (44)	17:28	17:01
3	08:15	07:56	07:14		07:18	06:28	05:57	06:00	06:28	07:04		07:39	08:00 (44)	07:18	07:57
	17:12	17:51	18:28		20:07	20:44	21:17	21:27	21:04	20:15		19:19	3 08:03 (44)	17:27	17:01
4	08:15	07:55	07:13		07:16	06:27	05:57	06:00	06:29	07:05		07:40		07:20	07:58
	17:13	17:52	18:29		20:08	20:45	21:18	21:27	21:02	20:13		19:18		17:26	17:01
5	08:15	07:54	07:11		07:14	06:25	05:57	06:01	06:30	07:06		07:41		07:21	07:59
	17:14	17:54	18:30		20:09	20:46	21:18	21:27	21:01	20:11		19:16		17:24	17:00
6	08:15	07:52	07:09		07:13	06:24	05:56	06:01	06:31	07:07		07:42		07:22	08:00
	17:15	17:55	18:32		20:11	20:47	21:19	21:26	21:00	20:10		19:14		17:23	17:00
7	08:15	07:51	07:07		07:11	06:23	05:56	06:02	06:32	07:08		07:43		07:24	08:01
	17:16	17:56	18:33		20:12	20:49	21:20	21:26	20:58	20:08		19:12		17:22	17:00
8	08:15	07:50	08:06		07:09	06:21	05:55	06:03	06:33	07:09		07:45		07:25	08:02
	17:17	17:58	18:34		20:13	20:50	21:21	21:26	20:57	20:06		19:10		17:20	17:00
9	08:15	07:49	08:04		07:07	06:20	05:55	06:04	06:35	07:10		07:46		07:26	08:03
	17:18	17:59	19:36		20:14	20:51	21:21	21:25	20:56	20:04		19:09		17:19	17:00
10	08:14	07:47	08:02	08:22 (44)	07:05	06:19	05:55	06:04	06:36	07:12		07:47		07:28	08:04
	17:19	18:01	19:37	1 08:23 (44)	20:16	20:52	21:22	21:25	20:54	20:02		19:07		17:18	17:00
11	08:14	07:46	08:00	08:20 (44)	07:04	06:18	05:55	06:05	06:37	07:13		07:48		07:29	08:05
	17:20	18:01	19:38	6 08:26 (44)	20:17	20:53	21:22	21:24	20:53	20:00		19:05		17:17	17:00
12	08:14	07:44	07:58	08:19 (44)	07:02	06:16	05:55	06:06	06:38	07:14		07:50		07:30	08:05
	17:22	18:02	19:40	9 08:28 (44)	20:18	20:54	21:23	21:24	20:51	19:59		19:03		17:16	17:00
13	08:13	07:43	07:57	08:17 (44)	07:00	06:15	05:54	06:07	06:39	07:15		07:51		07:32	08:06
	17:23	18:03	19:41	12 08:29 (44)	20:19	20:56	21:24	21:23	20:50	19:57		19:01		17:15	17:00
14	08:13	07:42	07:55	08:15 (44)	06:58	06:14	05:54	06:08	06:40	07:16		07:52		07:33	08:07
	17:24	18:05	19:42	14 08:29 (44)	20:21	20:57	21:24	21:23	20:48	19:55		19:00		17:14	17:00
15	08:12	07:40	07:53	08:13 (44)	06:57	06:13	05:54	06:08	06:41	07:17		07:53		07:34	08:08
	17:25	18:06	19:43	16 08:29 (44)	20:22	20:58	21:25	21:22	20:47	19:53		18:56		17:13	17:00
16	08:12	07:39	07:51	08:11 (44)	06:55	06:12	05:54	06:09	06:43	07:19		07:55		07:36	08:09
	17:26	18:08	19:45	18 08:29 (44)	20:23	20:59	21:25	21:21	20:45	19:51		18:55		17:12	17:01
17	08:11	07:37	07:49	08:09 (44)	06:53	06:11	05:54	06:10	06:44	07:20		07:56		07:37	08:09
	17:28	18:09	19:46	20 08:29 (44)	20:24	21:00	21:25	21:21	20:44	19:49		18:53		17:11	17:01
18	08:11	07:36	07:47	08:08 (44)	06:52	06:10	05:54	06:11	06:45	07:21		07:57		07:38	08:10
	17:29	18:10	19:47	21 08:29 (44)	20:25	21:01	21:26	21:20	20:42	19:47		18:51		17:10	17:01
19	08:10	07:34	07:46	08:07 (44)	06:50	06:09	05:55	06:12	06:46	07:22		07:58		07:40	08:11
	17:30	18:12	19:48	21 08:28 (44)	20:27	21:02	21:26	21:19	20:41	19:45		18:50		17:09	17:02
20	08:09	07:32	07:44	08:08 (44)	06:48	06:08	05:55	06:13	06:47	07:23	07:59 (44)	08:00		07:41	08:11
	17:32	18:13	19:50	19 08:27 (44)	20:28	21:03	21:26	21:18	20:39	19:44	7 08:06 (44)	18:48		17:08	17:02
21	08:09	07:31	07:42	08:08 (44)	06:47	06:07	05:55	06:14	06:48	07:24	07:55 (44)	08:01		07:42	08:12
	17:33	18:14	19:51	17 08:25 (44)	20:29	21:04	21:27	21:17	20:37	19:42	13 08:08 (44)	18:46		17:07	17:02
22	08:08	07:29	07:40	08:09 (44)	06:45	06:06	05:55	06:15	06:50	07:26	07:54 (44)	08:02		07:43	08:12
	17:34	18:16	19:52	14 08:23 (44)	20:30	21:06	21:27	21:17	20:36	19:40	16 08:10 (44)	18:45		17:07	17:03
23	08:07	07:28	07:38	08:11 (44)	06:43	06:05	05:55	06:16	06:51	07:27	07:52 (44)	08:04		07:45	08:13
	17:36	18:17	19:53	9 08:20 (44)	20:32	21:07	21:27	21:16	20:34	19:38	19 08:11 (44)	18:43		17:06	17:03
24	08:06	07:26	07:36		06:42	06:04	05:56	06:17	06:52	07:28	07:51 (44)	08:05		07:46	08:13
	17:37	18:18	19:55		20:33	21:08	21:27	21:15	20:32	19:36	20 08:11 (44)	18:41		17:05	17:04
25	08:05	07:24	07:35		06:40	06:03	05:56	06:18	06:53	07:29	07:50 (44)	08:06		07:47	08:14
	17:38	18:20	19:56		20:34	21:09	21:27	21:14	20:31	19:34	21 08:11 (44)	18:40		17:05	17:05
26	08:04	07:23	07:33		06:39	06:02	05:56	06:19	06:54	07:30	07:51 (44)	08:08		07:48	08:14
	17:40	18:21	19:57		20:35	21:10	21:28	21:13	20:29	19:32	20 08:11 (44)	18:38		17:04	17:05
27	08:04	07:21	07:31		06:37	06:02	05:57	06:20	06:55	07:31	07:52 (44)	08:09		07:50	08:14
	17:41	18:23	19:58		20:36	21:11	21:28	21:12	20:27	19:31	19 08:11 (44)	18:37		17:03	17:06
28	08:03	07:19	07:29		06:36	06:01	05:57	06:21	06:57	07:33	07:54 (44)	08:10		07:51	08:15
	17:42	18:24	20:00		20:38	21:11	21:28	21:11	20:26	19:29	17 08:11 (44)	18:35		17:03	17:07
29	08:02		07:27		06:34	06:00	05:57	06:22	06:58	07:34	07:55 (44)	08:12		07:52	08:15
	17:44		20:01		20:39	21:12	21:28	21:10	20:24	19:27	15 08:10 (44)	18:34		17:02	17:07
30	08:00		07:25		06:33	06:00	05:58	06:23	06:59	07:35	07:56 (44)	08:13		07:53	08:15
	17:45		20:02		20:40	21:13	21:28	21:08	20:22	19:25	13 08:09 (44)	18:32		17:02	17:08
31	07:59		07:24			05:59		06:24	07:00			08:14			08:15
	17:47		20:03			21:14		21:07	20:20			18:31			17:09
Potential sun hours	288	292	369		403	458	464	470	435	377		342		289	276
Total, worst case				197							180		20		
Sun reduction				0.62							0.69		0.59		
Oper. time red.				0.98							0.98		0.98		
Wind dir. red.				0.70							0.70		0.70		
Total reduction				0.43							0.47		0.41		
Total, real				84							85		8		

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:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
Tetra Tech EC, Inc C/o Shin Ng
3475 E. Foothill Blvd
US-PASADENA, CA 91107
1 617 457 8405
Ted Guertin / ted.guertin@tetratech.com
Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 37 - Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,582

Idle start wind speed: Cut in wind speed from power curve

	January	February		March	April	May		June		July		August	September	October		November		December
1	08:15	07:58		08:20 (49)	07:18	07:22	06:31	05:58		06:22 (44)	05:58	06:28 (44)	06:26	07:01	07:36	07:16		07:38 (49)	07:54
	17:10	17:48	2	08:22 (49)	18:25	20:05	20:41	21:15	17	06:39 (44)	21:27	06:41 (44)	21:06	20:19	19:23	17:30	17	07:55 (49)	17:02
2	08:15	07:57		08:19 (49)	07:16	07:20	06:30	05:58		06:21 (44)	05:59	06:28 (44)	06:27	07:02	07:37	07:17		07:40 (49)	07:56
	17:11	17:49	5	08:24 (49)	18:27	20:06	20:43	21:16	17	06:38 (44)	21:27	06:41 (44)	21:05	20:17	19:21	17:28	16	07:56 (49)	17:01
3	08:15	07:56		08:18 (49)	07:14	07:18	06:28	05:57		06:21 (44)	06:00	06:28 (44)	06:28	07:04	07:39	07:18		07:41 (49)	07:57
	17:12	17:51	7	08:25 (49)	18:28	20:07	20:44	21:17	17	06:38 (44)	21:27	06:42 (44)	21:04	20:15	19:19	17:27	15	07:56 (49)	17:01
4	08:15	07:55		08:16 (49)	07:13	07:16	06:27	05:57		06:20 (44)	06:00	06:27 (44)	06:29	07:05	07:40	07:20		07:42 (49)	07:58
	17:13	17:52	9	08:25 (49)	18:29	20:08	20:45	21:18	18	06:38 (44)	21:27	06:42 (44)	21:02	20:13	19:18	17:26	14	07:56 (49)	17:01
5	08:15	07:54		08:15 (49)	07:11	07:14	06:25	05:57		06:21 (44)	06:01	06:28 (44)	06:30	07:06	07:41	07:21		07:44 (49)	07:59
	17:14	17:54	11	08:26 (49)	18:30	20:09	20:46	21:18	17	06:38 (44)	21:27	06:43 (44)	21:01	20:11	19:16	17:24	12	07:56 (49)	17:00
6	08:15	07:52		08:14 (49)	07:09	07:13	06:24	05:56		06:21 (44)	06:01	06:28 (44)	06:31	07:07	07:42	07:22		07:45 (49)	08:00
	17:15	17:55	12	08:26 (49)	18:32	20:11	20:47	21:19	17	06:38 (44)	21:26	06:44 (44)	21:00	20:10	19:14	17:23	10	07:55 (49)	17:00
7	08:15	07:51		08:13 (49)	07:07	07:11	06:23	05:56		06:21 (44)	06:02	06:27 (44)	06:32	07:08	07:43	07:24		07:47 (49)	08:01
	17:16	17:56	14	08:27 (49)	18:33	20:12	20:49	21:20	16	06:37 (44)	21:26	06:44 (44)	20:58	20:08	19:12	17:22	9	07:56 (49)	17:00
8	08:15	07:50		08:11 (49)	08:06	07:09	06:21	05:56		06:22 (44)	06:03	06:27 (44)	06:33	07:09	07:45	07:25		07:48 (49)	08:02
	17:17	17:58	15	08:26 (49)	18:34	20:13	20:50	21:21	15	06:37 (44)	21:26	06:45 (44)	20:57	20:06	19:10	17:21	7	07:55 (49)	17:00
9	08:15	07:49		08:10 (49)	08:04	07:07	06:20	05:55		06:23 (44)	06:04	06:28 (44)	06:35	07:10	07:46	07:26		07:50 (49)	08:03
	17:18	17:59	16	08:26 (49)	19:36	20:14	20:51	21:21	14	06:37 (44)	21:25	06:45 (44)	20:56	20:04	19:09	17:19	4	07:54 (49)	17:00
10	08:14	07:47		08:09 (49)	08:02	07:05	06:19	05:55		06:24 (44)	06:04	06:28 (44)	06:36	07:12	07:47	07:28		07:51 (49)	08:04
	17:19	18:01	16	08:25 (49)	19:37	20:16	20:52	21:22	13	06:37 (44)	21:25	06:45 (44)	20:54	20:02	19:07	17:18	2	07:53 (49)	17:00
11	08:14	07:46		08:10 (49)	08:00	07:04	06:18	05:55		06:24 (44)	06:05	06:29 (44)	06:37	07:13	07:48	07:29			08:05
	17:20	18:01	15	08:25 (49)	19:38	20:17	20:53	21:22	13	06:37 (44)	21:24	06:46 (44)	20:53	20:00	19:05	17:17			17:00
12	08:14	07:44		08:12 (49)	07:58	07:02	06:16	05:55		06:24 (44)	06:06	06:30 (44)	06:38	07:14	07:50	07:30			08:05
	17:22	18:02	12	08:24 (49)	19:40	20:18	20:54	21:23	12	06:36 (44)	21:24	06:46 (44)	20:51	19:59	19:03	17:16			17:00
13	08:13	07:43		08:13 (49)	07:57	07:00	06:15	05:55		06:24 (44)	06:07	06:31 (44)	06:39	07:15	07:51	07:32			08:06
	17:23	18:03	8	08:21 (49)	19:41	20:19	20:56	21:24	12	06:36 (44)	21:23	06:47 (44)	20:50	19:57	19:01	17:15			17:00
14	08:13	07:42			07:55	06:58	06:14	05:54		06:25 (44)	06:08	06:32 (44)	06:40	07:16	07:52	07:33			08:07
	17:24	18:05			19:42	20:21	20:57	21:24	11	06:36 (44)	21:23	06:47 (44)	20:48	19:55	19:00	17:14			17:00
15	08:12	07:40			07:53	06:57	06:13	05:54		06:26 (44)	06:08	06:32 (44)	06:41	07:17	07:53	07:34			08:08
	17:25	18:06			19:43	20:22	20:58	21:25	10	06:36 (44)	21:22	06:47 (44)	20:47	19:53	18:56	17:13			17:00
16	08:12	07:39			07:51	06:55	06:12	05:54		06:26 (44)	06:09	06:33 (44)	06:43	07:19	07:55	07:36			08:09
	17:26	18:08			19:45	20:23	20:59	21:25	10	06:36 (44)	21:21	06:47 (44)	20:45	19:51	18:55	17:12			17:01
17	08:11	07:37			07:49	06:53	06:11	05:54		06:26 (44)	06:10	06:34 (44)	06:44	07:20	07:56	07:37			08:09
	17:28	18:09			19:46	20:24	21:00	21:25	10	06:36 (44)	21:21	06:47 (44)	20:44	19:49	18:53	17:11			17:01
18	08:11	07:36			07:47	06:52	06:10	06:32 (44)	05:54	06:28 (44)	06:11	06:35 (44)	06:45	07:21	07:57	07:38			08:10
	17:29	18:10			19:47	20:25	21:01	2 06:34 (44)	21:26	9 06:37 (44)	21:20	12 06:47 (44)	20:42	19:47	18:51	17:10			17:01
19	08:10	07:34			07:46	06:50	06:09	06:31 (44)	05:55	06:28 (44)	06:12	06:36 (44)	06:46	07:22	07:58	07:40			08:11
	17:30	18:12			19:48	20:27	21:02	4 06:35 (44)	21:26	9 06:37 (44)	21:19	11 06:47 (44)	20:41	19:45	18:50	17:09			17:02
20	08:09	07:32			07:44	06:48	06:08	06:30 (44)	05:55	06:28 (44)	06:13	06:37 (44)	06:47	07:23	08:00	07:41			08:11
	17:32	18:13			19:50	20:28	21:03	6 06:36 (44)	21:26	9 06:37 (44)	21:18	10 06:47 (44)	20:39	19:44	18:48	17:08			17:02
21	08:09	07:31			07:42	06:47	06:07	06:29 (44)	05:55	06:28 (44)	06:14	06:38 (44)	06:48	07:24	08:01	07:42			08:12
	17:33	18:14			19:51	20:29	21:04	7 06:36 (44)	21:27	9 06:37 (44)	21:17	9 06:47 (44)	20:37	19:42	18:46	17:07			17:02
22	08:08	07:29			07:40	06:45	06:06	06:28 (44)	05:55	06:28 (44)	06:15	06:39 (44)	06:50	07:26	08:02	07:43			08:12
	17:34	18:16			19:52	20:30	21:05	9 06:37 (44)	21:27	9 06:37 (44)	21:17	8 06:47 (44)	20:36	19:40	18:45	17:07			17:03
23	08:07	07:28			07:38	06:43	06:05	06:27 (44)	05:55	06:29 (44)	06:16	06:40 (44)	06:51	07:27	08:04	07:45			08:13
	17:36	18:17			19:53	20:32	21:07	10 06:37 (44)	21:27	9 06:38 (44)	21:16	7 06:47 (44)	20:34	19:38	18:43	17:06			17:03
24	08:06	07:26			07:36	06:42	06:04	06:27 (44)	05:56	06:29 (44)	06:17	06:41 (44)	06:52	07:28	08:05	07:46			08:13
	17:37	18:18			19:55	20:33	21:08	11 06:38 (44)	21:27	9 06:38 (44)	21:15	5 06:46 (44)	20:32	19:36	18:42	17:05			17:04
25	08:05	07:24			07:35	06:40	06:03	06:26 (44)	05:56	06:29 (44)	06:18	06:42 (44)	06:53	07:29	08:06	07:47			08:14
	17:38	18:20			19:56	20:34	21:09	12 06:38 (44)	21:27	9 06:38 (44)	21:14	3 06:45 (44)	20:31	19:34	18:40	17:05			17:05
26	08:04	07:23			07:33	06:39	06:02	06:25 (44)	05:56	06:28 (44)	06:19	06:43 (44)	06:54	07:30	08:08	07:48			08:14
	17:40	18:21			19:57	20:35	21:10	13 06:38 (44)	21:28	10 06:38 (44)	21:13	1 06:44 (44)	20:29	19:32	18:38	17:04			17:05
27	08:03	07:21			07:31	06:37	06:02	06:25 (44)	05:57	06:29 (44)	06:20		06:55	07:31	08:09	07:50			08:14
	17:41	18:23			19:58	20:36	21:11	14 06:39 (44)	21:28	10 06:39 (44)	21:12		20:27	19:31	18:37	17:03			17:06
28	08:03	07:19			07:29	06:36	06:01	06:24 (44)	05:57	06:28 (44)	06:21		06:57	07:33	08:10	07:51			08:15
	17:42	18:24			20:00	20:38	21:11	14 06:38 (44)	21:28	11 06:39 (44)	21:11		20:26	19:29	18:35	17:03			17:07
29	08:02				07:27	06:34	06:00	06:23 (44)	05:57	06:29 (44)	06:22		06:58	07:34	08:12	08:42 (49)	07:52		08:15
	17:44				20:01	20:39	21:12	15 06:38 (44)	21:28	11 06:40 (44)	21:10		20:24	19:27	18:34	9 08:51 (49)	17:02		17:07
30	08:00				07:25	06:33	06:00	06:23 (44)	05:58	06:28 (44)	06:23		06:59	07:35	08:13	08:40 (49)	07:53		08:15
	17:45				20:02	20:40	21:13	16 06:39 (44)	21:28	12 06:40 (44)	21:08		20:22	19:25	18:32	13 08:53 (49)	17:02		17:08
31	07:59				07:24		05:59	06:22 (44)			06:24		07:00		08:14	08:40 (49)			08:15
	17:47				20:03		21:14	16 06:38 (44)			21:07		20:20		18:31	14 08:54 (49)			17:09
Potential sun hours	288	292		369	403	458		464		470		435	377	342		289			276
Total, worst case			142				149		365		327				36		106		
Sun reduction			0.62				0.66		0.69		0.76				0.59		0.51		
Oper. time red.			0.98				0.98		0.98		0.98				0.98		0.98		
Wind dir. red.			0.75				0.58		0.58		0.58				0.75		0.75		
Total reduction			0.46				0.38		0.40		0.44				0.44		0.38		
Total, real			65				56		144		142				16		40		

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:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
Tetra Tech EC, Inc C/o Shin Ng
3475 E. Foothill Blvd
US-PASADENA, CA 91107
1 617 457 8405
Ted Guertin / ted.guertin@tetratech.com
Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 38 - Non-Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,582

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:16	07:59	07:18	07:22	06:31	05:58	05:58	06:26	07:01	07:36	07:16	07:55
	17:10	17:48	18:25	20:05	20:42	21:16	21:28	21:07	20:19	19:23	17:30	17:01
2	08:16	07:58	07:16	07:20	06:30	05:58	05:59	06:27	07:02	07:38	07:17	07:56
	17:11	17:49	18:27	20:06	20:43	21:17	21:28	21:05	20:17	19:21	17:28	17:01
3	08:16	07:57	07:15	07:18	06:28	05:57	05:59	06:28	07:04	07:39	07:19	07:57
	17:12	17:51	18:28	20:07	20:44	21:17	21:28	21:04	20:15	19:20	17:27	17:01
4	08:16	07:55	07:13	07:16	06:27	05:57	06:00	06:29	07:05	07:40	07:20	07:58
	17:13	17:52	18:29	20:09	20:46	21:18	21:28	21:03	20:14	19:18	17:26	17:01
5	08:16	07:54	07:11	07:15	06:25	05:56	06:01	06:30	07:06	07:41	07:21	07:59
	17:14	17:54	18:31	20:10	20:47	21:19	21:27	21:02	20:12	19:16	17:24	17:00
6	08:16	07:53	07:09	07:13	06:24	05:56	06:01	06:31	07:07	07:43	07:23	08:00
	17:15	17:55	18:32	20:11	20:48	21:20	21:27	21:00	20:10	19:14	17:23	17:00
7	08:16	07:52	07:08	07:11	06:23	05:56	06:02	06:32	07:08	07:44	07:24	08:01
	17:16	17:56	18:33	20:12	20:49	21:21	21:27	20:59	20:08	19:12	17:22	17:00
8	08:16	07:50	08:06	07:09	06:21	05:55	06:03	06:33	07:09	07:45	07:25	08:02
	17:17	17:58	18:35	20:14	20:50	21:21	21:26	20:58	20:06	19:11	17:21	17:00
9	08:15	07:49	08:04	07:07	06:20	05:55	06:03	06:35	07:11	07:46	07:27	08:03
	17:18	17:59	19:36	20:15	20:51	21:22	21:26	20:56	20:04	19:09	17:19	17:00
10	08:15	07:48	08:02	07:06	06:19	05:55	06:04	06:36	07:12	07:48	07:28	08:04
	17:19	18:01	19:37	20:16	20:53	21:23	21:25	20:55	20:03	19:07	17:18	17:00
11	08:15	07:46	08:00	07:04	06:18	05:55	06:05	06:37	07:13	07:49	07:30	08:05
	17:20	18:01	19:38	20:17	20:54	21:23	21:25	20:53	20:01	19:05	17:17	17:00
12	08:14	07:45	07:59	07:02	06:16	05:54	06:06	06:38	07:14	07:50	07:31	08:06
	17:22	18:02	19:40	20:18	20:55	21:24	21:24	20:52	19:59	19:03	17:16	17:00
13	08:14	07:43	07:57	07:00	06:15	05:54	06:07	06:39	07:15	07:51	07:32	08:07
	17:23	18:03	19:41	20:20	20:56	21:24	21:24	20:50	19:57	19:02	17:15	17:00
14	08:13	07:42	07:55	06:59	06:14	05:54	06:07	06:40	07:16	07:53	07:34	08:08
	17:24	18:05	19:42	20:21	20:57	21:25	21:23	20:49	19:55	19:00	17:14	17:00
15	08:13	07:41	07:53	06:57	06:13	05:54	06:08	06:42	07:18	07:54	07:35	08:09
	17:25	18:06	19:44	20:22	20:58	21:25	21:23	20:47	19:53	18:56	17:13	17:00
16	08:12	07:39	07:51	06:55	06:12	05:54	06:09	06:43	07:19	07:55	07:36	08:09
	17:26	18:08	19:45	20:23	21:00	21:26	21:22	20:46	19:51	18:55	17:12	17:00
17	08:12	07:38	07:50	06:53	06:11	05:54	06:10	06:44	07:20	07:56	07:38	08:10
	17:28	18:09	19:46	20:25	21:01	21:26	21:21	20:44	19:50	18:53	17:11	17:01
18	08:11	07:36	07:48	06:52	06:10	05:54	06:11	06:45	07:21	07:58	07:39	08:11
	17:29	18:10	19:47	20:26	21:02	21:26	21:21	20:43	19:48	18:51	17:10	17:01
19	08:11	07:34	07:46	06:50	06:09	05:54	06:12	06:46	07:22	07:59	07:40	08:11
	17:30	18:12	19:49	20:27	21:03	21:27	21:20	20:41	19:46	18:50	17:09	17:01
20	08:10	07:33	07:44	06:48	06:08	05:55	06:13	06:47	07:23	08:00	07:41	08:12
	17:32	18:13	19:50	20:28	21:04	21:27	21:19	20:39	19:44	18:48	17:08	17:02
21	08:09	07:31	07:42	06:47	06:07	05:55	06:14	06:48	07:25	08:01	07:43	08:12
	17:33	18:14	19:51	20:30	21:05	21:27	21:18	20:38	19:42	18:46	17:07	17:02
22	08:08	07:30	07:40	06:45	06:06	05:55	06:15	06:50	07:26	08:03	07:44	08:13
	17:34	18:16	19:52	20:31	21:06	21:28	21:17	20:36	19:40	18:45	17:07	17:03
23	08:08	07:28	07:38	06:43	06:05	05:55	06:16	06:51	07:27	08:04	07:45	08:13
	17:36	18:17	19:54	20:32	21:07	21:28	21:16	20:35	19:38	18:43	17:06	17:03
24	08:07	07:26	07:37	06:42	06:04	05:55	06:17	06:52	07:28	08:05	07:47	08:14
	17:37	18:19	19:55	20:33	21:08	21:28	21:15	20:33	19:36	18:42	17:05	17:04
25	08:06	07:25	07:35	06:40	06:03	05:56	06:18	06:53	07:29	08:07	07:48	08:14
	17:38	18:20	19:56	20:35	21:09	21:28	21:14	20:31	19:35	18:40	17:05	17:05
26	08:05	07:23	07:33	06:39	06:02	05:56	06:19	06:54	07:31	08:08	07:49	08:15
	17:40	18:21	19:57	20:36	21:10	21:28	21:13	20:29	19:33	18:38	17:04	17:05
27	08:04	07:21	07:31	06:37	06:02	05:56	06:20	06:55	07:32	08:09	07:50	08:15
	17:41	18:23	19:59	20:37	21:11	21:28	21:12	20:28	19:31	18:37	17:03	17:06
28	08:03	07:20	07:29	06:36	06:01	05:57	06:21	06:57	07:33	08:11	07:52	08:15
	17:42	18:24	20:00	20:38	21:12	21:28	21:11	20:26	19:29	18:35	17:03	17:07
29	08:02		07:27	06:34	06:00	05:57	06:22	06:58	07:34	08:12	07:53	08:15
	17:44		20:01	20:39	21:13	21:28	21:10	20:24	19:27	18:34	17:02	17:07
30	08:01		07:26	06:33	06:00	05:58	06:23	06:59	07:35	08:13	07:54	08:16
	17:45		20:02	20:41	21:14	21:28	21:09	20:23	19:25	18:33	17:02	17:08
31	08:00		07:24		05:59		06:24	07:00		08:15		08:16
	17:47		20:04		21:15		21:08	20:21		18:31		17:09
Potential sun hours	287	292	369	403	458	464	470	435	377	341	289	276
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
Tetra Tech EC, Inc C/o Shin Ng
3475 E. Foothill Blvd
US-PASADENA, CA 91107
1 617 457 8405
Ted Guertin / ted.guertin@tetratech.com

Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 39 - Non-Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,582

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:16	07:59	07:18	07:22	06:32	05:59	05:59	06:26	07:02	07:37	07:16	07:55
	17:11	17:49	18:26	20:05	20:42	21:15	21:28	21:06	20:19	19:24	17:30	17:02
2	08:16	07:58	07:16	07:20	06:30	05:59	06:00	06:27	07:03	07:38	07:17	07:56
	17:12	17:50	18:27	20:06	20:43	21:16	21:28	21:05	20:17	19:22	17:29	17:02
3	08:16	07:56	07:15	07:19	06:29	05:58	06:00	06:28	07:04	07:39	07:19	07:57
	17:13	17:51	18:28	20:07	20:44	21:17	21:27	21:04	20:15	19:20	17:27	17:02
4	08:16	07:55	07:13	07:17	06:27	05:58	06:01	06:30	07:05	07:40	07:20	07:58
	17:14	17:53	18:30	20:09	20:45	21:18	21:27	21:03	20:14	19:18	17:26	17:01
5	08:16	07:54	07:11	07:15	06:26	05:57	06:01	06:31	07:06	07:41	07:21	07:59
	17:15	17:54	18:31	20:10	20:47	21:19	21:27	21:01	20:12	19:16	17:25	17:01
6	08:16	07:53	07:10	07:13	06:25	05:57	06:02	06:32	07:08	07:43	07:23	08:00
	17:16	17:56	18:32	20:11	20:48	21:19	21:27	21:00	20:10	19:14	17:24	17:01
7	08:15	07:52	07:08	07:11	06:23	05:56	06:03	06:33	07:09	07:44	07:24	08:01
	17:17	17:57	18:34	20:12	20:49	21:20	21:26	20:59	20:08	19:13	17:22	17:01
8	08:15	07:50	08:06	07:10	06:22	05:56	06:04	06:34	07:10	07:45	07:25	08:02
	17:18	17:58	18:35	20:14	20:50	21:21	21:26	20:57	20:06	19:11	17:21	17:01
9	08:15	07:49	08:04	07:08	06:21	05:56	06:04	06:35	07:11	07:46	07:27	08:03
	17:19	18:00	19:36	20:15	20:51	21:21	21:26	20:56	20:05	19:09	17:20	17:01
10	08:15	07:48	08:02	07:06	06:19	05:56	06:05	06:36	07:12	07:48	07:28	08:04
	17:20	18:00	19:37	20:16	20:52	21:22	21:25	20:55	20:03	19:07	17:19	17:01
11	08:14	07:46	08:01	07:04	06:18	05:55	06:06	06:37	07:13	07:49	07:29	08:05
	17:21	18:01	19:39	20:17	20:54	21:23	21:25	20:53	20:01	19:05	17:18	17:01
12	08:14	07:45	07:59	07:03	06:17	05:55	06:07	06:39	07:14	07:50	07:31	08:06
	17:22	18:03	19:40	20:19	20:55	21:23	21:24	20:52	19:59	19:04	17:17	17:01
13	08:14	07:43	07:57	07:01	06:16	05:55	06:07	06:40	07:16	07:51	07:32	08:07
	17:23	18:04	19:41	20:20	20:56	21:24	21:24	20:50	19:57	19:02	17:15	17:01
14	08:13	07:42	07:55	06:59	06:15	05:55	06:08	06:41	07:17	07:53	07:33	08:07
	17:25	18:05	19:43	20:21	20:57	21:24	21:23	20:49	19:55	19:00	17:14	17:01
15	08:13	07:41	07:53	06:57	06:14	05:55	06:09	06:42	07:18	07:54	07:35	08:08
	17:26	18:07	19:44	20:22	20:58	21:25	21:22	20:47	19:53	18:57	17:13	17:01
16	08:12	07:39	07:52	06:56	06:12	05:55	06:10	06:43	07:19	07:55	07:36	08:09
	17:27	18:08	19:45	20:23	20:59	21:25	21:22	20:46	19:52	18:55	17:12	17:01
17	08:12	07:38	07:50	06:54	06:11	05:55	06:11	06:44	07:20	07:56	07:37	08:10
	17:28	18:09	19:46	20:25	21:00	21:26	21:21	20:44	19:50	18:53	17:11	17:02
18	08:11	07:36	07:48	06:52	06:10	05:55	06:12	06:46	07:21	07:58	07:39	08:10
	17:30	18:11	19:48	20:26	21:02	21:26	21:20	20:43	19:48	18:52	17:11	17:02
19	08:10	07:34	07:46	06:51	06:09	05:55	06:13	06:47	07:23	07:59	07:40	08:11
	17:31	18:12	19:49	20:27	21:03	21:26	21:19	20:41	19:46	18:50	17:10	17:02
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	17:32	18:14	19:50	20:28	21:04	21:27	21:19	20:39	19:44	18:48	17:09	17:03
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	17:34	18:15	19:51	20:30	21:05	21:27	21:18	20:38	19:42	18:47	17:08	17:03
22	08:08	07:30	07:41	06:46	06:06	05:56	06:16	06:50	07:26	08:03	07:44	08:13
	17:35	18:16	19:53	20:31	21:06	21:27	21:17	20:36	19:40	18:45	17:07	17:04
23	08:07	07:28	07:39	06:44	06:06	05:56	06:17	06:51	07:27	08:04	07:45	08:13
	17:36	18:18	19:54	20:32	21:07	21:27	21:16	20:35	19:38	18:44	17:07	17:04
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	17:38	18:19	19:55	20:33	21:08	21:28	21:15	20:33	19:37	18:42	17:06	17:05
25	08:06	07:25	07:35	06:41	06:04	05:57	06:19	06:54	07:30	08:07	07:48	08:14
	17:39	18:20	19:56	20:34	21:09	21:28	21:14	20:31	19:35	18:41	17:05	17:05
26	08:05	07:23	07:33	06:39	06:03	05:57	06:20	06:55	07:31	08:08	07:49	08:14
	17:40	18:22	19:58	20:36	21:10	21:28	21:13	20:29	19:33	18:39	17:05	17:06
27	08:04	07:22	07:31	06:38	06:02	05:57	06:21	06:56	07:32	08:09	07:50	08:15
	17:42	18:23	19:59	20:37	21:11	21:28	21:12	20:28	19:31	18:37	17:04	17:07
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	17:44		20:01	20:39	21:13	21:28	21:10	20:24	19:27	18:35	17:03	17:08
30	08:01		07:26	06:33	06:00	05:59	06:24	06:59	07:35	08:13	07:54	08:15
	17:46		20:03	20:41	21:14	21:28	21:09	20:23	19:25	18:33	17:03	17:09
31	08:00		07:24		06:00		06:25	07:01		08:15		08:16
	17:47		20:04		21:15		21:08	20:21		18:32		17:10
Potential sun hours	288	292	369	403	457	464	470	435	377	342	290	277
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

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Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 40 - Non-Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,582

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
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	17:10	17:48	18:25	20:05	20:42	21:16	21:28	21:07	20:19	19:23	17:30	17:01
2	08:16	07:58	07:16	07:20	06:30	05:58	05:59	06:27	07:02	07:38	07:17	07:56
	17:11	17:49	18:27	20:06	20:43	21:17	21:28	21:05	20:17	19:21	17:28	17:01
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	17:12	17:51	18:28	20:07	20:44	21:17	21:28	21:04	20:15	19:20	17:27	17:01
4	08:16	07:55	07:13	07:16	06:27	05:57	06:00	06:29	07:05	07:40	07:20	07:58
	17:13	17:52	18:29	20:09	20:45	21:18	21:28	21:03	20:14	19:18	17:26	17:01
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	17:14	17:54	18:31	20:10	20:47	21:19	21:27	21:02	20:12	19:16	17:24	17:00
6	08:16	07:53	07:09	07:13	06:24	05:56	06:01	06:31	07:07	07:43	07:23	08:00
	17:15	17:55	18:32	20:11	20:48	21:20	21:27	21:00	20:10	19:14	17:23	17:00
7	08:16	07:52	07:08	07:11	06:23	05:56	06:02	06:32	07:08	07:44	07:24	08:01
	17:16	17:56	18:33	20:12	20:49	21:20	21:27	20:59	20:08	19:12	17:22	17:00
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	17:18	17:59	19:36	20:15	20:51	21:22	21:26	20:56	20:04	19:09	17:19	17:00
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	17:22	18:02	19:40	20:18	20:55	21:24	21:24	20:52	19:59	19:03	17:16	17:00
13	08:14	07:43	07:57	07:00	06:15	05:54	06:07	06:39	07:15	07:51	07:32	08:07
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	17:24	18:05	19:42	20:21	20:57	21:25	21:23	20:49	19:55	19:00	17:14	17:00
15	08:13	07:41	07:53	06:57	06:13	05:54	06:08	06:42	07:18	07:54	07:35	08:08
	17:25	18:06	19:44	20:22	20:58	21:25	21:23	20:47	19:53	18:56	17:13	17:00
16	08:12	07:39	07:51	06:55	06:12	05:54	06:09	06:43	07:19	07:55	07:36	08:09
	17:26	18:08	19:45	20:23	21:00	21:26	21:22	20:46	19:51	18:55	17:12	17:00
17	08:12	07:38	07:50	06:53	06:11	05:54	06:10	06:44	07:20	07:56	07:38	08:10
	17:28	18:09	19:46	20:25	21:01	21:26	21:21	20:44	19:50	18:53	17:11	17:01
18	08:11	07:36	07:48	06:52	06:10	05:54	06:11	06:45	07:21	07:58	07:39	08:11
	17:29	18:10	19:47	20:26	21:02	21:26	21:20	20:43	19:48	18:51	17:10	17:01
19	08:11	07:34	07:46	06:50	06:09	05:54	06:12	06:46	07:22	07:59	07:40	08:11
	17:30	18:12	19:49	20:27	21:03	21:27	21:20	20:41	19:46	18:50	17:09	17:01
20	08:10	07:33	07:44	06:48	06:08	05:55	06:13	06:47	07:23	08:00	07:41	08:12
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	17:38	18:20	19:56	20:34	21:09	21:28	21:14	20:31	19:34	18:40	17:05	17:05
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27	08:04	07:21	07:31	06:37	06:02	05:56	06:20	06:55	07:32	08:09	07:50	08:15
	17:41	18:23	19:59	20:37	21:11	21:28	21:12	20:28	19:31	18:37	17:03	17:06
28	08:03	07:20	07:29	06:36	06:01	05:57	06:21	06:57	07:33	08:11	07:51	08:15
	17:42	18:24	20:00	20:38	21:12	21:28	21:11	20:26	19:29	18:35	17:03	17:07
29	08:02		07:27	06:34	06:00	05:57	06:22	06:58	07:34	08:12	07:53	08:15
	17:44		20:01	20:39	21:13	21:28	21:10	20:24	19:27	18:34	17:02	17:07
30	08:01		07:26	06:33	06:00	05:58	06:23	06:59	07:35	08:13	07:54	08:16
	17:45		20:02	20:41	21:14	21:28	21:09	20:22	19:25	18:33	17:02	17:08
31	08:00		07:24		05:59		06:24	07:00		08:15		08:16
	17:47		20:04		21:15		21:08	20:21		18:31		17:09
Potential sun hours	287	292	369	403	458	464	470	435	377	341	289	276
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

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Description:
North Bend Wind - Shadow Flicker - Mast 4221

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Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 41 - Non-Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

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Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:16	07:58	07:18	07:21	06:31	05:58	05:58	06:25	07:01	07:36	07:16	07:55
	17:10	17:47	18:25	20:04	20:41	21:15	21:28	21:06	20:19	19:23	17:29	17:01
2	08:16	07:57	07:16	07:20	06:29	05:57	05:58	06:26	07:02	07:37	07:17	07:56
	17:10	17:49	18:26	20:06	20:43	21:16	21:28	21:05	20:17	19:21	17:28	17:01
3	08:16	07:56	07:14	07:18	06:28	05:57	05:59	06:27	07:03	07:38	07:18	07:57
	17:11	17:50	18:28	20:07	20:44	21:17	21:27	21:04	20:15	19:19	17:26	17:00
4	08:16	07:55	07:12	07:16	06:26	05:56	05:59	06:28	07:04	07:40	07:20	07:58
	17:12	17:52	18:29	20:08	20:45	21:18	21:27	21:03	20:13	19:17	17:25	17:00
5	08:16	07:54	07:11	07:14	06:25	05:56	06:00	06:29	07:06	07:41	07:21	07:59
	17:13	17:53	18:30	20:09	20:46	21:19	21:27	21:01	20:11	19:15	17:24	17:00
6	08:16	07:53	07:09	07:12	06:24	05:55	06:01	06:31	07:07	07:42	07:22	08:00
	17:14	17:54	18:31	20:11	20:48	21:19	21:27	21:00	20:10	19:14	17:22	17:00
7	08:15	07:51	07:07	07:10	06:22	05:55	06:01	06:32	07:08	07:43	07:24	08:01
	17:15	17:56	18:33	20:12	20:49	21:20	21:26	20:59	20:08	19:12	17:21	16:59
8	08:15	07:50	08:05	07:09	06:21	05:55	06:02	06:33	07:09	07:45	07:25	08:02
	17:16	17:57	18:34	20:13	20:50	21:21	21:26	20:57	20:06	19:10	17:20	16:59
9	08:15	07:49	08:04	07:07	06:20	05:55	06:03	06:34	07:10	07:46	07:26	08:03
	17:18	17:59	19:35	20:14	20:51	21:22	21:26	20:56	20:04	19:08	17:19	16:59
10	08:15	07:47	08:02	07:05	06:18	05:54	06:04	06:35	07:11	07:47	07:28	08:04
	17:19	18:00	19:37	20:16	20:52	21:22	21:25	20:54	20:02	19:06	17:18	16:59
11	08:14	07:46	08:00	07:03	06:17	05:54	06:04	06:36	07:12	07:48	07:29	08:05
	17:20	18:00	19:38	20:17	20:53	21:23	21:25	20:53	20:00	19:05	17:16	16:59
12	08:14	07:44	07:58	07:02	06:16	05:54	06:05	06:38	07:14	07:50	07:31	08:06
	17:21	18:01	19:39	20:18	20:55	21:23	21:24	20:52	19:58	19:03	17:15	16:59
13	08:14	07:43	07:56	07:00	06:15	05:54	06:06	06:39	07:15	07:51	07:32	08:07
	17:22	18:03	19:41	20:19	20:56	21:24	21:24	20:50	19:57	19:01	17:14	16:59
14	08:13	07:42	07:55	06:58	06:13	05:54	06:07	06:40	07:16	07:52	07:33	08:07
	17:23	18:04	19:42	20:21	20:57	21:24	21:23	20:49	19:55	18:58	17:13	17:00
15	08:13	07:40	07:53	06:56	06:12	05:54	06:08	06:41	07:17	07:53	07:35	08:08
	17:25	18:06	19:43	20:22	20:58	21:25	21:22	20:47	19:53	18:56	17:12	17:00
16	08:12	07:39	07:51	06:55	06:11	05:54	06:09	06:42	07:18	07:55	07:36	08:09
	17:26	18:07	19:44	20:23	20:59	21:25	21:22	20:45	19:51	18:54	17:11	17:00
17	08:11	07:37	07:49	06:53	06:10	05:54	06:10	06:43	07:19	07:56	07:37	08:10
	17:27	18:08	19:46	20:24	21:00	21:26	21:21	20:44	19:49	18:53	17:10	17:00
18	08:11	07:36	07:47	06:51	06:09	05:54	06:11	06:44	07:21	07:57	07:39	08:10
	17:28	18:10	19:47	20:25	21:01	21:26	21:20	20:42	19:47	18:51	17:09	17:01
19	08:10	07:34	07:45	06:50	06:08	05:54	06:11	06:46	07:22	07:58	07:40	08:11
	17:30	18:11	19:48	20:27	21:03	21:27	21:19	20:41	19:45	18:49	17:08	17:01
20	08:10	07:33	07:44	06:48	06:07	05:54	06:12	06:47	07:23	08:00	07:41	08:12
	17:31	18:13	19:49	20:28	21:04	21:27	21:19	20:39	19:43	18:48	17:08	17:01
21	08:09	07:31	07:42	06:46	06:06	05:54	06:13	06:48	07:24	08:01	07:42	08:12
	17:32	18:14	19:51	20:29	21:05	21:27	21:18	20:37	19:42	18:46	17:07	17:02
22	08:08	07:29	07:40	06:45	06:05	05:54	06:14	06:49	07:25	08:02	07:44	08:13
	17:34	18:15	19:52	20:30	21:06	21:27	21:17	20:36	19:40	18:44	17:06	17:02
23	08:07	07:28	07:38	06:43	06:04	05:55	06:15	06:50	07:27	08:04	07:45	08:13
	17:35	18:17	19:53	20:32	21:07	21:28	21:16	20:34	19:38	18:43	17:05	17:03
24	08:06	07:26	07:36	06:41	06:03	05:55	06:16	06:51	07:28	08:05	07:46	08:14
	17:36	18:18	19:54	20:33	21:08	21:28	21:15	20:32	19:36	18:41	17:05	17:03
25	08:06	07:24	07:34	06:40	06:03	05:55	06:17	06:53	07:29	08:06	07:47	08:14
	17:38	18:19	19:56	20:34	21:09	21:28	21:14	20:31	19:34	18:40	17:04	17:04
26	08:05	07:23	07:32	06:38	06:02	05:56	06:19	06:54	07:30	08:08	07:49	08:14
	17:39	18:21	19:57	20:35	21:10	21:28	21:13	20:29	19:32	18:38	17:03	17:05
27	08:04	07:21	07:31	06:37	06:01	05:56	06:20	06:55	07:31	08:09	07:50	08:15
	17:40	18:22	19:58	20:37	21:11	21:28	21:12	20:27	19:30	18:36	17:03	17:05
28	08:03	07:19	07:29	06:35	06:00	05:56	06:21	06:56	07:32	08:10	07:51	08:15
	17:42	18:24	19:59	20:38	21:12	21:28	21:11	20:26	19:28	18:35	17:02	17:06
29	08:02		07:27	06:34	06:00	05:57	06:22	06:57	07:34	08:12	07:52	08:15
	17:43		20:01	20:39	21:13	21:28	21:10	20:24	19:27	18:33	17:02	17:07
30	08:01		07:25	06:32	05:59	05:57	06:23	06:59	07:35	08:13	07:54	08:15
	17:45		20:02	20:40	21:14	21:28	21:09	20:22	19:25	18:32	17:01	17:08
31	08:00		07:23		05:58		06:24	07:00		08:14		08:16
	17:46		20:03		21:15		21:08	20:20		18:31		17:08
Potential sun hours	287	292	369	403	458	464	471	435	377	341	289	276
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
Tetra Tech EC, Inc C/o Shin Ng
3475 E. Foothill Blvd
US-PASADENA, CA 91107
1 617 457 8405
Ted Guertin / ted.guertin@tetratech.com
Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 42 - Non-Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,582

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April		May		June	July		August		September		October	November	December
1	08:15	07:58	07:17	07:21		06:31		19:56 (54)	05:58		06:25		20:09 (54)	07:01	19:38 (53)	07:36	07:15	07:54
	17:10	17:47	18:25	20:04		20:41	22	20:18 (54)	21:15		21:27		20:25 (54)	20:18	19:54 (53)	19:23	17:29	17:01
2	08:15	07:57	07:16	07:19		06:29		19:55 (54)	05:57		05:59		06:26	20:09 (54)	07:02	19:38 (53)	07:37	07:17	07:55
	17:11	17:49	18:26	20:05		20:42	24	20:19 (54)	21:16		21:27		21:05	18	20:27 (54)	20:17	14	19:52 (53)	19:21	17:28	17:01
3	08:15	07:56	07:14	07:18		06:28		19:55 (54)	05:57		05:59		06:27		20:08 (54)	07:03		19:37 (53)	07:38	07:18	07:56
	17:12	17:50	18:27	20:07		20:44	25	20:20 (54)	21:17		21:27		21:03	19	20:27 (54)	20:15	13	19:50 (53)	19:19	17:26	17:00
4	08:15	07:55	07:12	07:16		06:26		19:56 (54)	05:57		06:00		06:28		20:07 (54)	07:04		19:37 (53)	07:39	07:19	07:58
	17:13	17:52	18:29	20:08		20:45	24	20:20 (54)	21:17		21:27		21:02	21	20:28 (54)	20:13	11	19:48 (53)	19:17	17:25	17:00
5	08:15	07:53	07:11	07:14		06:25		19:55 (54)	05:56		06:00		06:30		20:06 (54)	07:05		19:38 (53)	07:41	07:21	07:59
	17:14	17:53	18:30	20:09	3	19:47 (53)	20:46	24	20:19 (54)	21:18		21:26		21:01	23	20:29 (54)	20:11	8	19:46 (53)	19:15	17:24	17:00
6	08:15	07:52	07:09	07:12		19:42 (53)	06:24		19:56 (54)	05:56		06:01		06:31		20:06 (54)	07:07		19:38 (53)	07:42	07:22	08:00
	17:15	17:55	18:31	20:10	6	19:48 (53)	20:47	23	20:19 (54)	21:19		21:26		21:00	23	20:29 (54)	20:09	7	19:45 (53)	19:14	17:23	17:00
7	08:15	07:51	07:07	07:10		19:42 (53)	06:22		19:56 (54)	05:55		06:02		06:32		20:05 (54)	07:08		19:39 (53)	07:43	07:23	08:01
	17:16	17:56	18:33	20:12	8	19:50 (53)	20:48	23	20:19 (54)	21:20		21:26		20:58	24	20:29 (54)	20:07	4	19:43 (53)	19:12	17:21	17:00
8	08:15	07:50	08:05	07:09		19:40 (53)	06:21		19:56 (54)	05:55		06:02		06:33		20:05 (54)	07:09			07:44	07:25	08:02
	17:17	17:57	18:34	20:13	11	19:51 (53)	20:50	22	20:18 (54)	21:20		21:25		20:57	24	20:29 (54)	20:06			19:10	17:20	16:59
9	08:14	07:48	08:03	07:07		19:39 (53)	06:20		19:57 (54)	05:55		06:03		06:34		20:04 (54)	07:10			07:46	07:26	08:03
	17:18	17:59	19:35	20:14	13	19:52 (53)	20:51	20	20:17 (54)	21:21		21:25		20:55	25	20:29 (54)	20:04			19:08	17:19	16:59
10	08:14	07:47	08:02	07:05		19:39 (53)	06:18		19:58 (54)	05:55		06:04		06:35		20:04 (54)	07:11			07:47	07:27	08:03
	17:19	18:00	19:37	20:15	14	19:53 (53)	20:52	19	20:17 (54)	21:22		21:25		20:54	24	20:28 (54)	20:02			19:06	17:18	16:59
11	08:14	07:46	08:00	07:03		19:38 (53)	06:17		19:59 (54)	05:54		06:05		06:36		20:04 (54)	07:12			07:48	07:29	08:04
	17:20	18:00	19:38	20:17	16	19:54 (53)	20:53	17	20:16 (54)	21:22		21:24		20:53	23	20:27 (54)	20:00			19:05	17:17	16:59
12	08:13	07:44	07:58	07:02		19:39 (53)	06:16		20:00 (54)	05:54		06:05		06:38		20:04 (54)	07:14			07:49	07:30	08:05
	17:21	18:02	19:39	20:18	17	19:56 (53)	20:54	15	20:15 (54)	21:23		21:24		20:51	21	20:25 (54)	19:58			19:03	17:15	16:59
13	08:13	07:43	07:56	07:00		19:39 (53)	06:15		20:02 (54)	05:54		06:06		06:39		20:05 (54)	07:15			07:51	07:31	08:06
	17:22	18:03	19:40	20:19	17	19:56 (53)	20:55	11	20:13 (54)	21:23		21:23		20:50	20	20:25 (54)	19:56			19:01	17:14	17:00
14	08:13	07:41	07:54	06:58		19:40 (53)	06:14		20:04 (54)	05:54		06:07		06:40		20:05 (54)	07:16			07:52	07:33	08:07
	17:24	18:04	19:42	20:20	14	19:54 (53)	20:57	5	20:09 (54)	21:24		21:22		20:48	18	20:23 (54)	19:55			18:58	17:13	17:00
15	08:12	07:40	07:53	06:56		19:42 (53)	06:12			05:54		06:08		06:41		20:06 (54)	07:17			07:53	07:34	08:08
	17:25	18:06	19:43	20:21	11	19:53 (53)	20:58			21:24		21:22		20:47	16	20:22 (54)	19:53			18:56	17:12	17:00
16	08:12	07:38	07:51	06:55		19:44 (53)	06:11			05:54		06:09		06:42		20:07 (54)	07:18			07:54	07:35	08:08
	17:26	18:07	19:44	20:23	6	19:50 (53)	20:59			21:25		21:21		20:45	13	20:20 (54)	19:51			18:54	17:11	17:00
17	08:11	07:37	07:49	06:53			06:10			05:54		06:10		06:43		20:08 (54)	07:19			07:56	07:37	08:09
	17:27	18:09	19:46	20:24			21:00			21:25		21:20		20:44	10	20:18 (54)	19:49			18:52	17:10	17:00
18	08:10	07:35	07:47	06:51			06:09			05:54		06:11		06:45		20:09 (54)	07:21			07:57	07:38	08:10
	17:29	18:10	19:47	20:25			21:01			21:26		21:20		20:42	8	20:17 (54)	19:47			18:51	17:10	17:01
19	08:10	07:34	07:45	06:50			06:08			05:54		06:12		06:46		20:13 (54)	07:22			07:58	07:39	08:10
	17:30	18:11	19:48	20:26			21:02			21:26		21:19		20:40	2	20:15 (54)	19:45			18:49	17:09	17:01
20	08:09	07:32	07:43	06:48			06:07			05:54		06:13		06:47			07:23			07:59	07:41	08:11
	17:31	18:13	19:49	20:28			21:03			21:26		21:18		20:39			19:43			18:48	17:08	17:02
21	08:08	07:31	07:42	06:46			06:06			05:54		06:14		06:48			07:24			08:01	07:42	08:12
	17:32	18:14	19:51	20:29			21:04			21:27		21:17		20:37			19:41			18:46	17:07	17:02
22	08:08	07:29	07:40	06:45			06:05			05:55		06:15		06:49			07:25			08:02	07:43	08:12
	17:34	18:15	19:52	20:30			21:05			21:27		21:16		20:35			19:40			18:44	17:06	17:02
23	08:07	07:27	07:38	06:43			06:04			05:55		06:16		06:50			07:26			08:03	07:45	08:13
	17:35	18:17	19:53	20:31			21:06			21:27		21:15		20:34			19:38			18:43	17:06	17:03
24	08:06	07:26	07:36	06:41		20:06 (54)	06:04			05:55		06:17		06:52			07:28			08:05	07:46	08:13
	17:36	18:18	19:54	20:33	4	20:10 (54)	21:07			21:27		21:15		20:32			19:36			18:41	17:05	17:04
25	08:05	07:24	07:34	06:40		20:02 (54)	06:03			05:55		06:18		06:53			07:29			08:06	07:47	08:13
	17:38	18:19	19:56	20:34	8	20:10 (54)	21:08			21:27		21:14		20:30			19:34			18:40	17:04	17:04
26	08:04	07:22	07:32	06:38		20:01 (54)	06:02			05:56		06:19		06:54			07:30			08:07	07:48	08:14
	17:39	18:21	19:57	20:35	11	20:12 (54)	21:09			21:27		21:13		20:29			19:32			18:38	17:04	17:05
27	08:03	07:21	07:31	06:37		19:59 (54)	06:01			05:56		06:20		06:55		19:45 (53)	07:31			08:09	07:49	08:14
	17:41	18:22	19:58	20:36	14	20:13 (54)	21:10			21:27		21:12		20:27	7	19:52 (53)	19:30			18:36	17:03	17:06
28	08:02	07:19	07:29	06:35		19:58 (54)	06:01			05:57		06:21		06:56		19:42 (53)	07:32			08:10	07:51	08:14
	17:42	18:23	19:59	20:37	16	20:14 (54)	21:11			21:27		21:10		20:25	12	19:54 (53)	19:28			18:35	17:02	17:06
29	08:01		07:27	06:34		19:57 (54)	06:00			05:57		06:22		06:57		19:41 (53)	07:33			08:11	07:52	08:15
	17:43		20:01	20:39	18	20:15 (54)	21:12			21:27		21:09		20:24	14	19:55 (53)	19:26			18:34	17:02	17:07
30	08:00		07:25	06:32		19:56 (54)	05:59			05:57		06:23	20:13 (54)	06:58		19:39 (53)	07:35			08:13	07:53	08:15
	17:45		20:02	20:40	21	20:17 (54)	21:13			21:27		21:08	8 20:21 (54)	20:22	17	19:56 (53)	19:25			18:32	17:02	17:08
31	07:59		07:23				05:59					06:24	20:11 (54)	07:00		19:38 (53)				08:14		08:15
	17:46		20:03				21:14					21:07	12 20:23 (54)	20:20	17	19:55 (53)				18:31		17:09
Potential sun hours	288	292	369	403			458		464	470			435			377			341	289	276
Total, worst case					228			274			20			415			73					
Sun reduction					0.59			0.66			0.76			0.74			0.69					
Oper. time red.					0.98			0.98			0.98			0.98			0.98					
Wind dir. red.					0.71			0.72			0.72			0.72			0.70					
Total reduction					0.41			0.47			0.54			0.52			0.48					
Total, real					94			128			11			216			35					

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:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
Tetra Tech EC, Inc C/o Shin Ng
3475 E. Foothill Blvd
US-PASADENA, CA 91107
1 617 457 8405
Ted Guertin / ted.guertin@tetratech.com
Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 43 - Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,582

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:16	07:59	07:18	07:22	06:31	05:58	05:58	06:26	07:01	07:37	07:16	07:55
	17:10	17:48	18:25	20:05	20:42	21:16	21:28	21:07	20:19	19:23	17:30	17:02
2	08:16	07:58	07:16	07:20	06:30	05:58	05:59	06:27	07:03	07:38	07:17	07:56
	17:11	17:49	18:27	20:06	20:43	21:17	21:28	21:06	20:17	19:21	17:28	17:01
3	08:16	07:57	07:15	07:18	06:28	05:57	05:59	06:28	07:04	07:39	07:19	07:57
	17:12	17:51	18:28	20:07	20:44	21:17	21:28	21:04	20:15	19:20	17:27	17:01
4	08:16	07:55	07:13	07:16	06:27	05:57	06:00	06:29	07:05	07:40	07:20	07:58
	17:13	17:52	18:29	20:09	20:46	21:18	21:28	21:03	20:14	19:18	17:26	17:01
5	08:16	07:54	07:11	07:15	06:25	05:56	06:01	06:30	07:06	07:41	07:21	07:59
	17:14	17:54	18:31	20:10	20:47	21:19	21:27	21:02	20:12	19:16	17:24	17:00
6	08:16	07:53	07:09	07:13	06:24	05:56	06:01	06:31	07:07	07:43	07:23	08:00
	17:15	17:55	18:32	20:11	20:48	21:20	21:27	21:00	20:10	19:14	17:23	17:00
7	08:16	07:52	07:08	07:11	06:23	05:56	06:02	06:32	07:08	07:44	07:24	08:01
	17:16	17:56	18:33	20:12	20:49	21:21	21:27	20:59	20:08	19:12	17:22	17:00
8	08:16	07:50	08:06	07:09	06:21	05:55	06:03	06:33	07:09	07:45	07:26	08:02
	17:17	17:58	18:35	20:14	20:50	21:21	21:26	20:58	20:06	19:11	17:21	17:00
9	08:15	07:49	08:04	07:07	06:20	05:55	06:03	06:35	07:11	07:46	07:27	08:03
	17:18	17:59	19:36	20:15	20:52	21:22	21:26	20:56	20:04	19:09	17:19	17:00
10	08:15	07:48	08:02	07:06	06:19	05:55	06:04	06:36	07:12	07:48	07:28	08:04
	17:19	18:01	19:37	20:16	20:53	21:23	21:26	20:55	20:03	19:07	17:18	17:00
11	08:15	07:46	08:01	07:04	06:18	05:55	06:05	06:37	07:13	07:49	07:30	08:05
	17:20	18:01	19:38	20:17	20:54	21:23	21:25	20:53	20:01	19:05	17:17	17:00
12	08:14	07:45	07:59	07:02	06:16	05:54	06:06	06:38	07:14	07:50	07:31	08:06
	17:22	18:02	19:40	20:19	20:55	21:24	21:24	20:52	19:59	19:03	17:16	17:00
13	08:14	07:43	07:57	07:00	06:15	05:54	06:07	06:39	07:15	07:51	07:32	08:07
	17:23	18:03	19:41	20:20	20:56	21:24	21:24	20:50	19:57	19:02	17:15	17:00
14	08:13	07:42	07:55	06:59	06:14	05:54	06:07	06:40	07:16	07:53	07:34	08:08
	17:24	18:05	19:42	20:21	20:57	21:25	21:23	20:49	19:55	19:00	17:14	17:00
15	08:13	07:41	07:53	06:57	06:13	05:54	06:08	06:42	07:18	07:54	07:35	08:09
	17:25	18:06	19:44	20:22	20:58	21:25	21:23	20:47	19:53	18:56	17:13	17:00
16	08:12	07:39	07:51	06:55	06:12	05:54	06:09	06:43	07:19	07:55	07:36	08:09
	17:26	18:08	19:45	20:23	21:00	21:26	21:22	20:46	19:51	18:55	17:12	17:01
17	08:12	07:38	07:50	06:53	06:11	05:54	06:10	06:44	07:20	07:56	07:38	08:10
	17:28	18:09	19:46	20:25	21:01	21:26	21:21	20:44	19:50	18:53	17:11	17:01
18	08:11	07:36	07:48	06:52	06:10	05:54	06:11	06:45	07:21	07:58	07:39	08:11
	17:29	18:10	19:47	20:26	21:02	21:27	21:21	20:43	19:48	18:51	17:10	17:01
19	08:11	07:35	07:46	06:50	06:09	05:54	06:12	06:46	07:22	07:59	07:40	08:11
	17:30	18:12	19:49	20:27	21:03	21:27	21:20	20:41	19:46	18:50	17:09	17:01
20	08:10	07:33	07:44	06:48	06:08	05:55	06:13	06:47	07:23	08:00	07:42	08:12
	17:32	18:13	19:50	20:28	21:04	21:27	21:19	20:40	19:44	18:48	17:08	17:02
21	08:09	07:31	07:42	06:47	06:07	05:55	06:14	06:49	07:25	08:01	07:43	08:12
	17:33	18:15	19:51	20:30	21:05	21:27	21:18	20:38	19:42	18:46	17:07	17:02
22	08:08	07:30	07:40	06:45	06:06	05:55	06:15	06:50	07:26	08:03	07:44	08:13
	17:34	18:16	19:52	20:31	21:06	21:28	21:17	20:36	19:40	18:45	17:07	17:03
23	08:08	07:28	07:38	06:43	06:05	05:55	06:16	06:51	07:27	08:04	07:45	08:13
	17:36	18:17	19:54	20:32	21:07	21:28	21:16	20:35	19:38	18:43	17:06	17:03
24	08:07	07:26	07:37	06:42	06:04	05:55	06:17	06:52	07:28	08:05	07:47	08:14
	17:37	18:19	19:55	20:33	21:08	21:28	21:15	20:33	19:36	18:42	17:05	17:04
25	08:06	07:25	07:35	06:40	06:03	05:56	06:18	06:53	07:29	08:07	07:48	08:14
	17:38	18:20	19:56	20:35	21:09	21:28	21:14	20:31	19:35	18:40	17:05	17:05
26	08:05	07:23	07:33	06:39	06:02	05:56	06:19	06:54	07:31	08:08	07:49	08:15
	17:40	18:21	19:57	20:36	21:10	21:28	21:13	20:30	19:33	18:39	17:04	17:05
27	08:04	07:22	07:31	06:37	06:02	05:56	06:20	06:56	07:32	08:09	07:50	08:15
	17:41	18:23	19:59	20:37	21:11	21:28	21:12	20:28	19:31	18:37	17:03	17:06
28	08:03	07:20	07:29	06:36	06:01	05:57	06:21	06:57	07:33	08:11	07:52	08:15
	17:42	18:24	20:00	20:38	21:12	21:28	21:11	20:26	19:29	18:35	17:03	17:07
29	08:02		07:27	06:34	06:00	05:57	06:22	06:58	07:34	08:12	07:53	08:16
	17:44		20:01	20:39	21:13	21:28	21:10	20:24	19:27	18:34	17:02	17:07
30	08:01		07:26	06:33	06:00	05:58	06:23	06:59	07:35	08:13	07:54	08:16
	17:45		20:02	20:41	21:14	21:28	21:09	20:23	19:25	18:33	17:02	17:08
31	08:00		07:24		05:59		06:24	07:00		08:15		08:16
	17:47		20:04		21:15		21:08	20:21		18:31		17:09
Potential sun hours	287	292	369	403	458	464	470	435	377	341	289	276
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
Tetra Tech EC, Inc C/o Shin Ng
3475 E. Foothill Blvd
US-PASADENA, CA 91107
1 617 457 8405
Ted Guertin / ted.guertin@tetratech.com
Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 44 - Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,582

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:16	07:59	07:18	07:22	06:31	05:58	05:58	06:25	07:01	07:36	07:16	07:55
	17:10	17:48	18:25	20:05	20:42	21:16	21:28	21:07	20:19	19:23	17:30	17:01
2	08:16	07:58	07:16	07:20	06:30	05:58	05:59	06:27	07:02	07:38	07:17	07:56
	17:11	17:49	18:27	20:06	20:43	21:17	21:28	21:05	20:17	19:21	17:28	17:01
3	08:16	07:56	07:15	07:18	06:28	05:57	05:59	06:28	07:04	07:39	07:19	07:57
	17:12	17:51	18:28	20:07	20:44	21:17	21:28	21:04	20:15	19:20	17:27	17:01
4	08:16	07:55	07:13	07:16	06:27	05:57	06:00	06:29	07:05	07:40	07:20	07:58
	17:13	17:52	18:29	20:08	20:45	21:18	21:28	21:03	20:14	19:18	17:25	17:00
5	08:16	07:54	07:11	07:14	06:25	05:56	06:01	06:30	07:06	07:41	07:21	07:59
	17:14	17:53	18:31	20:10	20:47	21:19	21:27	21:02	20:12	19:16	17:24	17:00
6	08:16	07:53	07:09	07:13	06:24	05:56	06:01	06:31	07:07	07:42	07:23	08:00
	17:15	17:55	18:32	20:11	20:48	21:20	21:27	21:00	20:10	19:14	17:23	17:00
7	08:16	07:52	07:08	07:11	06:23	05:56	06:02	06:32	07:08	07:44	07:24	08:01
	17:16	17:56	18:33	20:12	20:49	21:20	21:27	20:59	20:08	19:12	17:22	17:00
8	08:15	07:50	08:06	07:09	06:21	05:55	06:03	06:33	07:09	07:45	07:25	08:02
	17:17	17:58	18:34	20:13	20:50	21:21	21:26	20:58	20:06	19:10	17:20	17:00
9	08:15	07:49	08:04	07:07	06:20	05:55	06:03	06:34	07:11	07:46	07:27	08:03
	17:18	17:59	19:36	20:15	20:51	21:22	21:26	20:56	20:04	19:09	17:19	17:00
10	08:15	07:48	08:02	07:05	06:19	05:55	06:04	06:36	07:12	07:47	07:28	08:04
	17:19	18:00	19:37	20:16	20:53	21:22	21:25	20:55	20:03	19:07	17:18	17:00
11	08:15	07:46	08:00	07:04	06:17	05:54	06:05	06:37	07:13	07:49	07:29	08:05
	17:20	18:00	19:38	20:17	20:54	21:23	21:25	20:53	20:01	19:05	17:17	17:00
12	08:14	07:45	07:59	07:02	06:16	05:54	06:06	06:38	07:14	07:50	07:31	08:06
	17:21	18:02	19:40	20:18	20:55	21:24	21:24	20:52	19:59	19:03	17:16	17:00
13	08:14	07:43	07:57	07:00	06:15	05:54	06:06	06:39	07:15	07:51	07:32	08:07
	17:23	18:03	19:41	20:20	20:56	21:24	21:24	20:50	19:57	19:01	17:15	17:00
14	08:13	07:42	07:55	06:58	06:14	05:54	06:07	06:40	07:16	07:52	07:33	08:08
	17:24	18:05	19:42	20:21	20:57	21:25	21:23	20:49	19:55	19:00	17:14	17:00
15	08:13	07:40	07:53	06:57	06:13	05:54	06:08	06:41	07:17	07:54	07:35	08:08
	17:25	18:06	19:43	20:22	20:58	21:25	21:23	20:47	19:53	18:56	17:13	17:00
16	08:12	07:39	07:51	06:55	06:12	05:54	06:09	06:43	07:19	07:55	07:36	08:09
	17:26	18:07	19:45	20:23	21:00	21:26	21:22	20:46	19:51	18:55	17:12	17:00
17	08:12	07:37	07:49	06:53	06:11	05:54	06:10	06:44	07:20	07:56	07:37	08:10
	17:28	18:09	19:46	20:25	21:01	21:26	21:21	20:44	19:49	18:53	17:11	17:01
18	08:11	07:36	07:48	06:52	06:09	05:54	06:11	06:45	07:21	07:57	07:39	08:11
	17:29	18:10	19:47	20:26	21:02	21:26	21:20	20:43	19:48	18:51	17:10	17:01
19	08:11	07:34	07:46	06:50	06:08	05:54	06:12	06:46	07:22	07:59	07:40	08:11
	17:30	18:12	19:49	20:27	21:03	21:27	21:20	20:41	19:46	18:50	17:09	17:01
20	08:10	07:33	07:44	06:48	06:07	05:54	06:13	06:47	07:23	08:00	07:41	08:12
	17:31	18:13	19:50	20:28	21:04	21:27	21:19	20:39	19:44	18:48	17:08	17:02
21	08:09	07:31	07:42	06:47	06:06	05:55	06:14	06:48	07:24	08:01	07:43	08:12
	17:33	18:14	19:51	20:29	21:05	21:27	21:18	20:38	19:42	18:46	17:07	17:02
22	08:08	07:30	07:40	06:45	06:06	05:55	06:15	06:50	07:26	08:03	07:44	08:13
	17:34	18:16	19:52	20:31	21:06	21:28	21:17	20:36	19:40	18:45	17:06	17:03
23	08:08	07:28	07:38	06:43	06:05	05:55	06:16	06:51	07:27	08:04	07:45	08:13
	17:35	18:17	19:54	20:32	21:07	21:28	21:16	20:34	19:38	18:43	17:06	17:03
24	08:07	07:26	07:37	06:42	06:04	05:55	06:17	06:52	07:28	08:05	07:47	08:14
	17:37	18:18	19:55	20:33	21:08	21:28	21:15	20:33	19:36	18:41	17:05	17:04
25	08:06	07:25	07:35	06:40	06:03	05:56	06:18	06:53	07:29	08:07	07:48	08:14
	17:38	18:20	19:56	20:34	21:09	21:28	21:14	20:31	19:34	18:40	17:04	17:04
26	08:05	07:23	07:33	06:39	06:02	05:56	06:19	06:54	07:30	08:08	07:49	08:15
	17:39	18:21	19:57	20:36	21:10	21:28	21:13	20:29	19:33	18:38	17:04	17:05
27	08:04	07:21	07:31	06:37	06:01	05:56	06:20	06:55	07:32	08:09	07:50	08:15
	17:41	18:23	19:59	20:37	21:11	21:28	21:12	20:28	19:31	18:37	17:03	17:06
28	08:03	07:20	07:29	06:35	06:01	05:57	06:21	06:57	07:33	08:11	07:51	08:15
	17:42	18:24	20:00	20:38	21:12	21:28	21:11	20:26	19:29	18:35	17:03	17:06
29	08:02		07:27	06:34	06:00	05:57	06:22	06:58	07:34	08:12	07:53	08:15
	17:44		20:01	20:39	21:13	21:28	21:10	20:24	19:27	18:34	17:02	17:07
30	08:01		07:25	06:32	05:59	05:58	06:23	06:59	07:35	08:13	07:54	08:16
	17:45		20:02	20:41	21:14	21:28	21:09	20:22	19:25	18:32	17:02	17:08
31	08:00		07:24		05:59		06:24	07:00		08:15		08:16
	17:46		20:04		21:15		21:08	20:21		18:31		17:09
Potential sun hours	287	292	369	403	458	464	471	435	377	341	289	276
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
Tetra Tech EC, Inc C/o Shin Ng
3475 E. Foothill Blvd
US-PASADENA, CA 91107
1 617 457 8405
Ted Guertin / ted.guertin@tetratech.com
Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 45 - Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,582

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:16	07:59	07:18	07:22	06:31	05:58	05:58	06:25	07:01	07:36	07:16	07:55
	17:10	17:48	18:25	20:05	20:42	21:16	21:28	21:07	20:19	19:23	17:30	17:01
2	08:16	07:58	07:16	07:20	06:30	05:58	05:59	06:27	07:02	07:38	07:17	07:56
	17:11	17:49	18:27	20:06	20:43	21:17	21:28	21:05	20:17	19:21	17:28	17:01
3	08:16	07:56	07:15	07:18	06:28	05:57	05:59	06:28	07:04	07:39	07:19	07:57
	17:12	17:51	18:28	20:07	20:44	21:17	21:28	21:04	20:15	19:20	17:27	17:01
4	08:16	07:55	07:13	07:16	06:27	05:57	06:00	06:29	07:05	07:40	07:20	07:58
	17:13	17:52	18:29	20:09	20:45	21:18	21:28	21:03	20:14	19:18	17:26	17:00
5	08:16	07:54	07:11	07:15	06:25	05:56	06:01	06:30	07:06	07:41	07:21	07:59
	17:14	17:53	18:31	20:10	20:47	21:19	21:27	21:02	20:12	19:16	17:24	17:00
6	08:16	07:53	07:09	07:13	06:24	05:56	06:01	06:31	07:07	07:42	07:23	08:00
	17:15	17:55	18:32	20:11	20:48	21:20	21:27	21:00	20:10	19:14	17:23	17:00
7	08:16	07:52	07:08	07:11	06:23	05:56	06:02	06:32	07:08	07:44	07:24	08:01
	17:16	17:56	18:33	20:12	20:49	21:20	21:27	20:59	20:08	19:12	17:22	17:00
8	08:15	07:50	08:06	07:09	06:21	05:55	06:03	06:33	07:09	07:45	07:25	08:02
	17:17	17:58	18:34	20:13	20:50	21:21	21:26	20:58	20:06	19:10	17:20	17:00
9	08:15	07:49	08:04	07:07	06:20	05:55	06:03	06:35	07:11	07:46	07:27	08:03
	17:18	17:59	19:36	20:15	20:51	21:22	21:26	20:56	20:04	19:09	17:19	17:00
10	08:15	07:48	08:02	07:06	06:19	05:55	06:04	06:36	07:12	07:47	07:28	08:04
	17:19	18:01	19:37	20:16	20:53	21:22	21:25	20:55	20:03	19:07	17:18	17:00
11	08:15	07:46	08:00	07:04	06:17	05:55	06:05	06:37	07:13	07:49	07:29	08:05
	17:20	18:01	19:38	20:17	20:54	21:23	21:25	20:53	20:01	19:05	17:17	17:00
12	08:14	07:45	07:59	07:02	06:16	05:54	06:06	06:38	07:14	07:50	07:31	08:06
	17:21	18:02	19:40	20:18	20:55	21:24	21:24	20:52	19:59	19:03	17:16	17:00
13	08:14	07:43	07:57	07:00	06:15	05:54	06:07	06:39	07:15	07:51	07:32	08:07
	17:23	18:03	19:41	20:20	20:56	21:24	21:24	20:50	19:57	19:02	17:15	17:00
14	08:13	07:42	07:55	06:59	06:14	05:54	06:07	06:40	07:16	07:52	07:33	08:08
	17:24	18:05	19:42	20:21	20:57	21:25	21:23	20:49	19:55	19:00	17:14	17:00
15	08:13	07:40	07:53	06:57	06:13	05:54	06:08	06:41	07:18	07:54	07:35	08:08
	17:25	18:06	19:44	20:22	20:58	21:25	21:23	20:47	19:53	18:56	17:13	17:00
16	08:12	07:39	07:51	06:55	06:12	05:54	06:09	06:43	07:19	07:55	07:36	08:09
	17:26	18:08	19:45	20:23	21:00	21:26	21:22	20:46	19:51	18:55	17:12	17:00
17	08:12	07:37	07:49	06:53	06:11	05:54	06:10	06:44	07:20	07:56	07:37	08:10
	17:28	18:09	19:46	20:25	21:01	21:26	21:21	20:44	19:49	18:53	17:11	17:01
18	08:11	07:36	07:48	06:52	06:10	05:54	06:11	06:45	07:21	07:58	07:39	08:11
	17:29	18:10	19:47	20:26	21:02	21:26	21:20	20:43	19:48	18:51	17:10	17:01
19	08:11	07:34	07:46	06:50	06:09	05:54	06:12	06:46	07:22	07:59	07:40	08:11
	17:30	18:12	19:49	20:27	21:03	21:27	21:20	20:41	19:46	18:50	17:09	17:01
20	08:10	07:33	07:44	06:48	06:08	05:54	06:13	06:47	07:23	08:00	07:41	08:12
	17:31	18:13	19:50	20:28	21:04	21:27	21:19	20:39	19:44	18:48	17:08	17:02
21	08:09	07:31	07:42	06:47	06:07	05:55	06:14	06:48	07:25	08:01	07:43	08:12
	17:33	18:14	19:51	20:29	21:05	21:27	21:18	20:38	19:42	18:46	17:07	17:02
22	08:08	07:30	07:40	06:45	06:06	05:55	06:15	06:50	07:26	08:03	07:44	08:13
	17:34	18:16	19:52	20:31	21:06	21:28	21:17	20:36	19:40	18:45	17:07	17:03
23	08:08	07:28	07:38	06:43	06:05	05:55	06:16	06:51	07:27	08:04	07:45	08:13
	17:35	18:17	19:54	20:32	21:07	21:28	21:16	20:34	19:38	18:43	17:06	17:03
24	08:07	07:26	07:37	06:42	06:04	05:55	06:17	06:52	07:28	08:05	07:47	08:14
	17:37	18:19	19:55	20:33	21:08	21:28	21:15	20:33	19:36	18:42	17:05	17:04
25	08:06	07:25	07:35	06:40	06:03	05:56	06:18	06:53	07:29	08:07	07:48	08:14
	17:38	18:20	19:56	20:34	21:09	21:28	21:14	20:31	19:34	18:40	17:04	17:04
26	08:05	07:23	07:33	06:39	06:02	05:56	06:19	06:54	07:30	08:08	07:49	08:15
	17:40	18:21	19:57	20:36	21:10	21:28	21:13	20:29	19:33	18:38	17:04	17:05
27	08:04	07:21	07:31	06:37	06:02	05:56	06:20	06:55	07:32	08:09	07:50	08:15
	17:41	18:23	19:59	20:37	21:11	21:28	21:12	20:28	19:31	18:37	17:03	17:06
28	08:03	07:20	07:29	06:36	06:01	05:57	06:21	06:57	07:33	08:11	07:51	08:15
	17:42	18:24	20:00	20:38	21:12	21:28	21:11	20:26	19:29	18:35	17:03	17:06
29	08:02		07:27	06:34	06:00	05:57	06:22	06:58	07:34	08:12	07:53	08:15
	17:44		20:01	20:39	21:13	21:28	21:10	20:24	19:27	18:34	17:02	17:07
30	08:01		07:25	06:33	05:59	05:58	06:23	06:59	07:35	08:13	07:54	08:16
	17:45		20:02	20:41	21:14	21:28	21:09	20:22	19:25	18:32	17:02	17:08
31	08:00		07:24		05:59		06:24	07:00		08:15		08:16
	17:46		20:04		21:15		21:08	20:21		18:31		17:09
Potential sun hours	287	292	369	403	458	464	470	435	377	341	289	276
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
Tetra Tech EC, Inc C/o Shin Ng
3475 E. Foothill Blvd
US-PASADENA, CA 91107
1 617 457 8405
Ted Guertin / ted.guertin@tetratech.com
Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 46 - Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,582

Idle start wind speed: Cut in wind speed from power curve

	January		February		March		April	May	June	July	August	September		October		November		December
1	08:16		07:59		17:11 (06)	07:18		07:22	06:31	05:58	05:58	06:25	07:01		07:36		07:57 (03)	07:16	16:43 (06)	07:55
	17:10		17:48	11	17:22 (06)	18:25		20:05	20:42	21:15	21:28	21:06	20:19		19:23	12	08:09 (03)	17:29	17:02 (06)	17:01
2	08:16		07:57		17:11 (06)	07:16		07:20	06:29	05:58	05:59	06:26	07:02		07:37		07:58 (03)	07:17	16:43 (06)	07:56
	17:11		17:49	12	17:23 (06)	18:26		20:06	20:43	21:16	21:28	21:05	20:17		19:21	9	08:07 (03)	17:28	17:03 (06)	17:01
3	08:16		07:56		17:11 (06)	07:14		07:18	06:28	05:57	05:59	06:28	07:03		07:39		08:00 (03)	07:18	16:42 (06)	07:57
	17:12		17:50	14	17:25 (06)	18:28		20:07	20:44	21:17	21:27	21:04	20:15		19:19	7	08:07 (03)	17:27	17:02 (06)	17:01
4	08:16		07:55		17:11 (06)	07:13		07:16	06:27	05:57	06:00	06:29	07:05		07:40		08:01 (03)	07:20	16:42 (06)	07:58
	17:13		17:52	16	17:27 (06)	18:29		20:08	20:45	21:18	21:27	21:03	20:13		19:18	4	08:05 (03)	17:25	17:01 (06)	17:00
5	08:16		07:54		17:11 (06)	07:11		07:14	06:25	05:56	06:00	06:30	07:06		07:41			07:21	16:41 (06)	07:59
	17:14		17:53	17	17:28 (06)	18:30		20:10	20:46	21:19	21:27	21:01	20:11		19:16			17:24	16:59 (06)	17:00
6	08:16		07:53		17:11 (06)	07:09		07:12	06:24	05:56	06:01	06:31	07:07		07:42			07:22	16:42 (06)	08:00
	17:15		17:55	18	17:29 (06)	18:32		20:11	20:48	21:19	21:27	21:00	20:10		19:14			17:23	16:58 (06)	17:00
7	08:15		07:51		17:12 (06)	07:07		07:11	06:22	05:55	06:02	06:32	07:08		07:43			07:24	16:41 (06)	08:01
	17:16		17:56	19	17:31 (06)	18:33		20:12	20:49	21:20	21:26	20:59	20:08		19:12			17:21	16:56 (06)	17:00
8	08:15		07:50		17:12 (06)	08:06		07:09	06:21	05:55	06:02	06:33	07:09		07:45			07:25	16:42 (06)	08:02
	17:17		17:58	20	17:32 (06)	18:34		20:13	20:50	21:21	21:26	20:57	20:06		19:10			17:20	16:56 (06)	17:00
9	08:15		07:49		17:13 (06)	08:04	08:24 (03)	07:07	06:20	05:55	06:03	06:34	07:10		07:46			07:27	16:42 (06)	08:03
	17:18		17:59	21	17:34 (06)	19:36	2 08:26 (03)	20:14	20:51	21:22	21:26	20:56	20:04		19:08			17:19	12 16:54 (06)	17:00
10	08:15		07:47		17:15 (06)	08:02	08:22 (03)	07:05	06:19	05:55	06:04	06:35	07:12		07:47			07:28	16:42 (06)	08:04
	17:19		18:00	18	17:33 (06)	19:37	6 08:28 (03)	20:16	20:52	21:22	21:25	20:54	20:02		19:07			17:18	10 16:52 (06)	16:59
11	08:14		07:46		17:16 (06)	08:00	08:21 (03)	07:04	06:17	05:54	06:05	06:37	07:13		07:48			07:29	16:43 (06)	08:05
	17:20		18:00	15	17:31 (06)	19:38	8 08:29 (03)	20:17	20:54	21:23	21:25	20:53	20:00		19:05			17:17	9 16:52 (06)	17:00
12	08:14		07:45		17:18 (06)	07:58	08:19 (03)	07:02	06:16	05:54	06:06	06:38	07:14		07:50			07:31	16:43 (06)	08:06
	17:21		18:02	12	17:30 (06)	19:39	11 08:30 (03)	20:18	20:55	21:23	21:24	20:52	19:59		19:03			17:16	7 16:50 (06)	17:00
13	08:14		07:43		17:21 (06)	07:57	08:17 (03)	07:00	06:15	05:54	06:06	06:39	07:15		07:51			07:32	16:45 (06)	08:07
	17:22		18:03	5	17:26 (06)	19:41	13 08:30 (03)	20:19	20:56	21:24	21:24	20:50	19:57		19:01			17:15	4 16:49 (06)	17:00
14	08:13		07:42			07:55	08:15 (03)	06:58	06:14	05:54	06:07	06:40	07:16		07:52			07:33	16:45 (06)	08:07
	17:24		18:05			19:42	15 08:30 (03)	20:21	20:57	21:24	21:23	20:49	19:55		19:00			17:14	3 16:48 (06)	17:00
15	08:13		07:40			07:53	08:13 (03)	06:57	06:13	05:54	06:08	06:41	07:17		07:53			07:35		08:08
	17:25		18:06			19:43	17 08:30 (03)	20:22	20:58	21:25	21:22	20:47	19:53		18:56			17:12		17:00
16	08:12		07:39			07:51	08:11 (03)	06:55	06:11	05:54	06:09	06:42	07:18		07:55			07:36		08:09
	17:26		18:07			19:45	18 08:29 (03)	20:23	20:59	21:25	21:22	20:46	19:51		18:54			17:12		17:00
17	08:12		07:37			07:49	08:09 (03)	06:53	06:10	05:54	06:10	06:44	07:20		07:56			07:37		08:10
	17:27		18:09			19:46	19 08:28 (03)	20:24	21:00	21:26	21:21	20:44	19:49		18:53			17:11		17:01
18	08:11		07:36			07:47	08:08 (03)	06:51	06:09	05:54	06:11	06:45	07:21		07:57			07:39		08:10
	17:29		18:10			19:47	20 08:28 (03)	20:26	21:01	21:26	21:20	20:42	19:47		18:51			17:10		17:01
19	08:10		07:34			07:46	08:09 (03)	06:50	06:08	05:54	06:12	06:46	07:22		07:59			07:40		08:11
	17:30		18:11			19:48	18 08:27 (03)	20:27	21:03	21:26	21:19	20:41	19:45		18:49			17:09		17:01
20	08:10		07:33			07:44	08:10 (03)	06:48	06:07	05:54	06:13	06:47	07:23		08:00			07:41		08:12
	17:31		18:13			19:50	15 08:25 (03)	20:28	21:04	21:27	21:19	20:39	19:44		18:48			17:08		17:02
21	08:09		07:31			07:42	08:11 (03)	06:46	06:06	05:54	06:14	06:48	07:24		08:01			07:42		08:12
	17:33		18:14			19:51	11 08:22 (03)	20:29	21:05	21:27	21:18	20:38	19:42		18:46			17:07		17:02
22	08:08		07:29			07:40		06:45	06:05	05:55	06:15	06:49	07:25	07:58 (03)	08:02			07:44		08:13
	17:34		18:16			19:52		20:30	21:06	21:27	21:17	20:36	19:40	9 08:07 (03)	18:44			17:06		17:03
23	08:07		07:28			07:38		06:43	06:05	05:55	06:16	06:51	07:27	07:55 (03)	08:04			07:45		08:13
	17:35		18:17			19:53		20:32	21:07	21:27	21:16	20:34	19:38	14 08:09 (03)	18:43			17:06		17:03
24	08:06		07:26			07:36		06:42	06:04	05:55	06:17	06:52	07:28	07:53 (03)	08:05			07:46		08:14
	17:37		18:18			19:55		20:33	21:08	21:28	21:15	20:33	19:36	17 08:10 (03)	18:41			17:05		17:04
25	08:06		07:25			07:34		06:40	06:03	05:55	06:18	06:53	07:29	07:51 (03)	08:06			07:48		08:14
	17:38		18:20			19:56		20:34	21:09	21:28	21:14	20:31	19:34	19 08:10 (03)	18:40			17:04		17:04
26	08:05		07:23			07:33		06:38	06:02	05:56	06:19	06:54	07:30	07:51 (03)	08:08			07:49		08:14
	17:39		18:21			19:57		20:35	21:10	21:28	21:13	20:29	19:32	19 08:10 (03)	18:38			17:04		17:05
27	08:04		07:21			07:31		06:37	06:01	05:56	06:20	06:55	07:31	07:52 (03)	08:09			07:50		08:15
	17:41		18:22			19:58		20:37	21:11	21:28	21:12	20:27	19:30	18 08:10 (03)	18:37			17:03		17:06
28	08:03	17:13 (06)	07:19			07:29		06:35	06:01	05:57	06:21	06:56	07:33	07:54 (03)	08:10			07:51		08:15
	17:42	3 17:16 (06)	18:24			20:00		20:38	21:12	21:28	21:11	20:26	19:29	17 08:11 (03)	18:35			17:03		17:06
29	08:02	17:13 (06)				07:27		06:34	06:00	05:57	06:22	06:58	07:34	07:55 (03)	08:12		17:49 (06)	07:52		08:15
	17:43	5 17:18 (06)				20:01		20:39	21:13	21:28	21:10	20:24	19:27	16 08:11 (03)	18:34	8	17:57 (06)	17:02		17:07
30	08:01	17:12 (06)				07:25		06:32	05:59	05:58	06:23	06:59	07:35	07:56 (03)	08:13		17:47 (06)	07:54		08:15
	17:45	7 17:19 (06)				20:02		20:40	21:14	21:28	21:09	20:22	19:25	14 08:10 (03)	18:32	13	18:00 (06)	17:02		17:08
31	08:00	17:12 (06)				07:23			05:59		06:24	07:00			08:14		17:45 (06)			08:15
	17:46	9 17:21 (06)				20:03			21:15		21:08	20:20			18:31	16	18:01 (06)			17:09
Potential sun hours	287		292			369		403	458	464	470	435	377		341			289		276
Total, worst case		24		198			173							143		69			186	
Sun reduction		0.62		0.62			0.62							0.69		0.59			0.51	
Oper. time red.		0.98		0.98			0.98							0.98		0.98			0.98	
Wind dir. red.		0.58		0.58			0.70							0.70		0.64			0.58	
Total reduction		0.35		0.35			0.42							0.47		0.37			0.29	
Total, real		8		69			73							68		25			53	

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:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
Tetra Tech EC, Inc C/o Shin Ng
3475 E. Foothill Blvd
US-PASADENA, CA 91107
1 617 457 8405
Ted Guertin / ted.guertin@tetratech.com
Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 47 - Participant
Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,582

Idle start wind speed: Cut in wind speed from power curve

	January	February		March	April	May	June	July	August	September	October		November		December
1	08:15	07:58		07:18	07:22	06:31	05:58	05:58	06:25	07:01	07:36		07:15	16:42 (33)	07:54
	17:10	17:48		18:25	20:04	20:41	21:15	21:27	21:06	20:18	19:23		17:29	23 17:05 (33)	17:01
2	08:15	07:57		07:16	07:20	06:29	05:58	05:59	06:26	07:02	07:37		07:17	16:44 (33)	07:55
	17:11	17:49		18:26	20:06	20:42	21:16	21:27	21:05	20:17	19:21		17:28	20 17:04 (33)	17:01
3	08:15	07:56		07:14	07:18	06:28	05:57	05:59	06:28	07:03	07:38		07:18	16:44 (33)	07:57
	17:12	17:50		18:28	20:07	20:44	21:17	21:27	21:04	20:15	19:19		17:27	18 17:02 (33)	17:01
4	08:15	07:55		07:12	07:16	06:27	05:57	06:00	06:29	07:04	07:40		07:19	16:45 (33)	07:58
	17:13	17:52		18:29	20:08	20:45	21:18	21:27	21:02	20:13	19:17		17:25	15 17:00 (33)	17:00
5	08:15	07:54	17:20 (33)	07:11	07:14	06:25	05:56	06:01	06:30	07:06	07:41		07:21	16:48 (33)	07:59
	17:14	17:53	8 17:28 (33)	18:30	20:09	20:46	21:18	21:27	21:01	20:11	19:16		17:24	11 16:59 (33)	17:00
6	08:15	07:52	17:18 (33)	07:09	07:12	06:24	05:56	06:01	06:31	07:07	07:42		07:22	16:50 (33)	08:00
	17:15	17:55	12 17:30 (33)	18:32	20:11	20:47	21:19	21:26	21:00	20:09	19:14		17:23	8 16:58 (33)	17:00
7	08:15	07:51	17:16 (33)	07:07	07:11	06:22	05:56	06:02	06:32	07:08	07:43		07:24		08:01
	17:16	17:56	16 17:32 (33)	18:33	20:12	20:48	21:20	21:26	20:58	20:08	19:12		17:22		17:00
8	08:15	07:50	17:14 (33)	08:05	07:09	06:21	05:55	06:03	06:33	07:09	07:45		07:25		08:02
	17:17	17:58	18 17:32 (33)	18:34	20:13	20:50	21:20	21:26	20:57	20:06	19:10		17:20		17:00
9	08:15	07:48	17:14 (33)	08:04	07:07	06:20	05:55	06:03	06:34	07:10	07:46		07:26		08:03
	17:18	17:59	20 17:34 (33)	19:36	20:14	20:51	21:21	21:25	20:56	20:04	19:08		17:19		17:00
10	08:14	07:47	17:12 (33)	08:02	07:05	06:19	05:55	06:04	06:36	07:11	07:47		07:28		08:04
	17:19	18:00	23 17:35 (33)	19:37	20:16	20:52	21:22	21:25	20:54	20:02	19:07		17:18		17:00
11	08:14	07:46	17:12 (33)	08:00	07:04	06:17	05:55	06:05	06:37	07:13	07:48		07:29		08:05
	17:20	18:00	25 17:37 (33)	19:38	20:17	20:53	21:22	21:24	20:53	20:00	19:05		17:17		17:00
12	08:14	07:44	17:12 (33)	07:58	07:02	06:16	05:54	06:06	06:38	07:14	07:50		07:30		08:05
	17:21	18:02	27 17:39 (33)	19:39	20:18	20:54	21:23	21:24	20:51	19:58	19:03		17:16		17:00
13	08:13	07:43	17:11 (33)	07:56	07:00	06:15	05:54	06:06	06:39	07:15	07:51		07:32		08:06
	17:23	18:03	29 17:40 (33)	19:41	20:19	20:56	21:24	21:23	20:50	19:57	19:01		17:15		17:00
14	08:13	07:41	17:11 (33)	07:55	06:58	06:14	05:54	06:07	06:40	07:16	07:52	17:56 (33)	07:33		08:07
	17:24	18:05	31 17:42 (33)	19:42	20:20	20:57	21:24	21:23	20:48	19:55	19:00	4 18:00 (33)	17:14		17:00
15	08:12	07:40	17:10 (33)	07:53	06:57	06:13	05:54	06:08	06:41	07:17	07:53	17:51 (33)	07:34		08:08
	17:25	18:06	33 17:43 (33)	19:43	20:22	20:58	21:25	21:22	20:47	19:53	18:56	15 18:06 (33)	17:13		17:00
16	08:12	07:39	17:10 (33)	07:51	06:55	06:12	05:54	06:09	06:42	07:18	07:55	17:48 (33)	07:36		08:09
	17:26	18:07	34 17:44 (33)	19:44	20:23	20:59	21:25	21:21	20:45	19:51	18:54	20 18:08 (33)	17:12		17:00
17	08:11	07:37	17:10 (33)	07:49	06:53	06:10	05:54	06:10	06:44	07:20	07:56	17:46 (33)	07:37		08:09
	17:27	18:09	33 17:43 (33)	19:46	20:24	21:00	21:25	21:21	20:44	19:49	18:53	23 18:09 (33)	17:11		17:01
18	08:11	07:35	17:10 (33)	07:47	06:51	06:09	05:54	06:11	06:45	07:21	07:57	17:45 (33)	07:38		08:10
	17:29	18:10	32 17:42 (33)	19:47	20:25	21:01	21:26	21:20	20:42	19:47	18:51	26 18:11 (33)	17:10		17:01
19	08:10	07:34	17:10 (33)	07:45	06:50	06:08	05:54	06:12	06:46	07:22	07:58	17:43 (33)	07:40		08:11
	17:30	18:11	33 17:43 (33)	19:48	20:27	21:02	21:26	21:19	20:41	19:45	18:49	28 18:11 (33)	17:09		17:01
20	08:09	07:32	17:10 (33)	07:44	06:48	06:07	05:54	06:13	06:47	07:23	08:00	17:42 (33)	07:41		08:11
	17:31	18:13	32 17:42 (33)	19:50	20:28	21:03	21:26	21:18	20:39	19:43	18:48	29 18:11 (33)	17:08		17:02
21	08:09	07:31	17:12 (33)	07:42	06:46	06:06	05:55	06:14	06:48	07:24	08:01	17:42 (33)	07:42		08:12
	17:33	18:14	30 17:42 (33)	19:51	20:29	21:04	21:27	21:17	20:37	19:42	18:46	31 18:13 (33)	17:07		17:02
22	08:08	07:29	17:12 (33)	07:40	06:45	06:06	05:55	06:15	06:49	07:25	08:02	17:41 (33)	07:43		08:12
	17:34	18:16	29 17:41 (33)	19:52	20:30	21:05	21:27	21:17	20:36	19:40	18:44	32 18:13 (33)	17:06		17:03
23	08:07	07:28	17:12 (33)	07:38	06:43	06:05	05:55	06:16	06:51	07:27	08:04	17:40 (33)	07:45		08:13
	17:35	18:17	27 17:39 (33)	19:53	20:31	21:06	21:27	21:16	20:34	19:38	18:43	32 18:12 (33)	17:06		17:03
24	08:06	07:26	17:14 (33)	07:36	06:42	06:04	05:55	06:17	06:52	07:28	08:05	17:40 (33)	07:46		08:13
	17:37	18:18	25 17:39 (33)	19:55	20:33	21:07	21:27	21:15	20:32	19:36	18:41	33 18:13 (33)	17:05		17:04
25	08:05	07:24	17:15 (33)	07:34	06:40	06:03	05:56	06:18	06:53	07:29	08:06	17:40 (33)	07:47		08:14
	17:38	18:20	22 17:37 (33)	19:56	20:34	21:09	21:27	21:14	20:31	19:34	18:40	33 18:13 (33)	17:04		17:04
26	08:04	07:23	17:17 (33)	07:33	06:38	06:02	05:56	06:19	06:54	07:30	08:07	17:40 (33)	07:48		08:14
	17:39	18:21	17 17:34 (33)	19:57	20:35	21:09	21:28	21:13	20:29	19:32	18:38	33 18:13 (33)	17:04		17:05
27	08:03	07:21	17:20 (33)	07:31	06:37	06:01	05:56	06:20	06:55	07:31	08:09	17:40 (33)	07:50		08:14
	17:41	18:22	12 17:32 (33)	19:58	20:36	21:10	21:28	21:12	20:27	19:30	18:37	32 18:12 (33)	17:03		17:06
28	08:02	07:19		07:29	06:35	06:01	05:57	06:21	06:56	07:32	08:10	17:39 (33)	07:51		08:15
	17:42	18:24		19:59	20:38	21:11	21:28	21:11	20:25	19:28	18:35	31 18:10 (33)	17:03		17:06
29	08:01			07:27	06:34	06:00	05:57	06:22	06:58	07:34	08:11	17:40 (33)	07:52		08:15
	17:44			20:01	20:39	21:12	21:28	21:10	20:24	19:27	18:34	29 18:09 (33)	17:02		17:07
30	08:00			07:25	06:32	05:59	05:58	06:23	06:59	07:35	08:13	17:40 (33)	07:53		08:15
	17:45			20:02	20:40	21:13	21:27	21:08	20:22	19:25	18:32	27 18:07 (33)	17:02		17:08
31	07:59			07:23		05:59		06:24	07:00		08:14	17:42 (33)			08:15
	17:46			20:03		21:14		21:07	20:20		18:31	25 18:07 (33)			17:09
Potential sun hours	288	292		369	403	458	464	470	435	377	342		289		276
Total, worst case			568									483		95	
Sun reduction			0.62									0.59		0.51	
Oper. time red.			0.98									0.98		0.98	
Wind dir. red.			0.59									0.59		0.59	
Total reduction			0.36									0.34		0.29	
Total, real			202									164		28	

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:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
Tetra Tech EC, Inc C/o Shin Ng
3475 E. Foothill Blvd
US-PASADENA, CA 91107
1 617 457 8405
Ted Guertin / ted.guertin@tetratech.com
Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 48 - Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,582

Idle start wind speed: Cut in wind speed from power curve

	January		February		March	April	May	June	July	August	September	October		November		December
1	08:15		07:58		16:58 (33)	07:18	07:22	06:31	05:58	05:58	06:25	07:01	07:36			07:15		16:26 (33)	07:54
	17:10		17:48	24	17:22 (33)	18:25	20:04	20:41	21:15	21:27	21:06	20:18	19:23			17:29	32	16:58 (33)	17:01
2	08:15		07:57		16:58 (33)	07:16	07:20	06:29	05:58	05:59	06:26	07:02	07:37			07:17		16:27 (33)	07:55
	17:11		17:49	26	17:24 (33)	18:26	20:06	20:42	21:16	21:27	21:05	20:17	19:21			17:28	31	16:58 (33)	17:01
3	08:15		07:56		16:58 (33)	07:14	07:18	06:28	05:57	05:59	06:28	07:03	07:38			07:18		16:26 (33)	07:57
	17:12		17:50	27	17:25 (33)	18:28	20:07	20:44	21:17	21:27	21:04	20:15	19:19			17:27	32	16:58 (33)	17:01
4	08:15		07:55		16:56 (33)	07:12	07:16	06:27	05:57	06:00	06:29	07:04	07:40			07:19		16:26 (33)	07:58
	17:13		17:52	30	17:26 (33)	18:29	20:08	20:45	21:18	21:27	21:02	20:13	19:17			17:25	31	16:57 (33)	17:00
5	08:15		07:54		16:56 (33)	07:11	07:14	06:25	05:56	06:01	06:30	07:06	07:41			07:21		16:27 (33)	07:59
	17:14		17:53	32	17:28 (33)	18:30	20:09	20:46	21:18	21:27	21:01	20:11	19:16			17:24	31	16:58 (33)	17:00
6	08:15		07:52		16:57 (33)	07:09	07:12	06:24	05:56	06:01	06:31	07:07	07:42			07:22		16:26 (33)	08:00
	17:15		17:55	31	17:28 (33)	18:32	20:11	20:47	21:19	21:26	21:00	20:09	19:14			17:23	31	16:57 (33)	17:00
7	08:15		07:51		16:57 (33)	07:07	07:11	06:22	05:56	06:02	06:32	07:08	07:43			07:24		16:27 (33)	08:01
	17:16		17:56	32	17:29 (33)	18:33	20:12	20:48	21:20	21:26	20:58	20:08	19:12			17:22	30	16:57 (33)	17:00
8	08:15		07:50		16:56 (33)	08:05	07:09	06:21	05:55	06:03	06:33	07:09	07:45			07:25		16:27 (33)	08:02
	17:17		17:58	32	17:28 (33)	18:34	20:13	20:50	21:20	21:26	20:57	20:06	19:10			17:20	28	16:55 (33)	17:00
9	08:15		07:48		16:57 (33)	08:04	07:07	06:20	05:55	06:03	06:34	07:10	07:46			07:26		16:29 (33)	08:03
	17:18		17:59	32	17:29 (33)	19:36	20:14	20:51	21:21	21:25	20:56	20:04	19:08			17:19	25	16:54 (33)	17:00
10	08:14		07:47		16:57 (33)	08:02	07:05	06:19	05:55	06:04	06:36	07:11	07:47			07:28		16:29 (33)	08:04
	17:19		18:00	31	17:28 (33)	19:37	20:16	20:52	21:22	21:25	20:54	20:02	19:07			17:18	24	16:53 (33)	17:00
11	08:14		07:46		16:57 (33)	08:00	07:04	06:17	05:55	06:05	06:37	07:13	07:48			07:29		16:31 (33)	08:05
	17:20		18:00	31	17:28 (33)	19:38	20:17	20:53	21:22	21:24	20:53	20:00	19:05			17:17	21	16:52 (33)	17:00
12	08:14		07:44		16:58 (33)	07:58	07:02	06:16	05:54	06:06	06:38	07:14	07:50			07:30		16:31 (33)	08:05
	17:21		18:02	30	17:28 (33)	19:39	20:18	20:54	21:23	21:24	20:51	19:58	19:03			17:16	19	16:50 (33)	17:00
13	08:13		07:43		16:58 (33)	07:56	07:00	06:15	05:54	06:06	06:39	07:15	07:51			07:32		16:32 (33)	08:06
	17:23		18:03	29	17:27 (33)	19:41	20:19	20:56	21:24	21:23	20:50	19:57	19:01			17:15	17	16:49 (33)	17:00
14	08:13		07:41		17:00 (33)	07:55	06:58	06:14	05:54	06:07	06:40	07:16	07:52			07:33		16:34 (33)	08:07
	17:24		18:05	27	17:27 (33)	19:42	20:20	20:57	21:24	21:23	20:48	19:55	19:00			17:14	14	16:48 (33)	17:00
15	08:12		07:40		17:00 (33)	07:53	06:57	06:13	05:54	06:08	06:41	07:17	07:53			07:34		16:36 (33)	08:08
	17:25		18:06	25	17:25 (33)	19:43	20:22	20:58	21:25	21:22	20:47	19:53	18:56			17:13	11	16:47 (33)	17:00
16	08:12		07:39		17:02 (33)	07:51	06:55	06:12	05:54	06:09	06:42	07:18	07:55			07:36		16:39 (33)	08:09
	17:26		18:07	22	17:24 (33)	19:44	20:23	20:59	21:25	21:21	20:45	19:51	18:54			17:12	7	16:46 (33)	17:00
17	08:11		07:37		17:03 (33)	07:49	06:53	06:10	05:54	06:10	06:44	07:20	07:56			07:37			08:09
	17:27		18:09	19	17:22 (33)	19:46	20:24	21:00	21:25	21:21	20:44	19:49	18:53			17:11			17:01
18	08:11		07:35		17:05 (33)	07:47	06:51	06:09	05:54	06:11	06:45	07:21	07:57			07:38			08:10
	17:29		18:10	15	17:20 (33)	19:47	20:25	21:01	21:26	21:20	20:42	19:47	18:51			17:10			17:01
19	08:10		07:34		17:10 (33)	07:45	06:50	06:08	05:54	06:12	06:46	07:22	07:58			07:40			08:11
	17:30		18:11	6	17:16 (33)	19:48	20:27	21:02	21:26	21:19	20:41	19:45	18:49			17:09			17:01
20	08:09		07:32			07:44	06:48	06:07	05:54	06:13	06:47	07:23	08:00			07:41			08:11
	17:31		18:13			19:50	20:28	21:03	21:26	21:18	20:39	19:43	18:48			17:08			17:02
21	08:09		07:31			07:42	06:46	06:06	05:55	06:14	06:48	07:24	08:01			07:42			08:12
	17:33		18:14			19:51	20:29	21:04	21:27	21:17	20:37	19:42	18:46			17:07			17:02
22	08:08		07:29			07:40	06:45	06:06	05:55	06:15	06:49	07:25	08:02			07:43			08:12
	17:34		18:16			19:52	20:30	21:05	21:27	21:17	20:36	19:40	18:44			17:06			17:03
23	08:07		07:28			07:38	06:43	06:05	05:55	06:16	06:51	07:27	08:04		17:38 (33)	07:45			08:13
	17:35		18:17			19:53	20:31	21:06	21:27	21:16	20:34	19:38	18:43	9	17:47 (33)	17:06			17:03
24	08:06		07:26			07:36	06:42	06:04	05:55	06:17	06:52	07:28	08:05		17:35 (33)	07:46			08:13
	17:37		18:18			19:54	20:33	21:08	21:27	21:15	20:32	19:36	18:41	16	17:51 (33)	17:05			17:04
25	08:05		07:24			07:34	06:40	06:03	05:56	06:18	06:53	07:29	08:06		17:32 (33)	07:47			08:14
	17:38		18:20			19:56	20:34	21:09	21:27	21:14	20:31	19:34	18:40	20	17:52 (33)	17:04			17:04
26	08:04	17:06 (33)	07:23			07:33	06:38	06:02	05:56	06:19	06:54	07:30	08:07		17:31 (33)	07:48			08:14
	17:39	7 17:13 (33)	18:21			19:57	20:35	21:09	21:28	21:13	20:29	19:32	18:38	23	17:54 (33)	17:04			17:05
27	08:03	17:04 (33)	07:21			07:31	06:37	06:01	05:56	06:20	06:55	07:31	08:09		17:30 (33)	07:50			08:14
	17:41	11 17:15 (33)	18:22			19:58	20:36	21:10	21:28	21:12	20:27	19:30	18:37	25	17:55 (33)	17:03			17:06
28	08:02	17:02 (33)	07:19			07:29	06:35	06:01	05:57	06:21	06:56	07:32	08:10		17:28 (33)	07:51			08:15
	17:42	14 17:16 (33)	18:24			19:59	20:38	21:11	21:28	21:11	20:25	19:28	18:35	27	17:55 (33)	17:03			17:06
29	08:01	17:00 (33)				07:27	06:34	06:00	05:57	06:22	06:58	07:34	08:11		17:28 (33)	07:52			08:15
	17:44	17 17:17 (33)				20:01	20:39	21:12	21:28	21:10	20:24	19:27	18:34	29	17:57 (33)	17:02			17:07
30	08:00	16:59 (33)				07:25	06:32	05:59	05:58	06:23	06:59	07:35	08:13		17:27 (33)	07:53			08:15
	17:45	20 17:19 (33)				20:02	20:40	21:13	21:27	21:08	20:22	19:25	18:32	30	17:57 (33)	17:02			17:08
31	07:59	16:59 (33)				07:23		05:59		06:24	07:00		08:14		17:27 (33)				08:15
	17:46	21 17:20 (33)				20:03		21:14		21:07	20:20		18:31	31	17:58 (33)				17:09
Potential sun hours	288		292		369	403	458	464	470	435	377	342		289		276			
Total, worst case		90		501									210		384				
Sun reduction		0.62		0.62									0.59		0.51				
Oper. time red.		0.98		0.98									0.98		0.98				
Wind dir. red.		0.57		0.57									0.57		0.57				
Total reduction		0.35		0.35									0.33		0.29				
Total, real		31		175									70		110				

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:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
Tetra Tech EC, Inc C/o Shin Ng
3475 E. Foothill Blvd
US-PASADENA, CA 91107
1 617 457 8405
Ted Guertin / ted.guertin@tetratech.com
Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 49 - Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,582

Idle start wind speed: Cut in wind speed from power curve

	January	February		March		April	May	June	July	August	September	October		November		December
1	08:15	07:58		07:18		08:08 (34)	07:21	06:31	05:58	05:58	06:25	07:01	07:36		07:15		07:42 (34)	07:54
	17:10	17:48		18:25	34	08:42 (34)	20:04	20:41	21:15	21:27	21:06	20:18	19:23		17:29	28	08:10 (34)	17:01
2	08:15	07:57		07:16		08:09 (34)	07:20	06:29	05:58	05:59	06:26	07:02	07:37		07:17		07:43 (34)	07:55
	17:11	17:49		18:26	31	08:40 (34)	20:06	20:42	21:16	21:27	21:05	20:17	19:21		17:28	25	08:08 (34)	17:01
3	08:15	07:56		07:14		08:11 (34)	07:18	06:28	05:57	05:59	06:27	07:03	07:38		07:18		07:45 (34)	07:56
	17:12	17:50		18:28	28	08:39 (34)	20:07	20:44	21:17	21:27	21:04	20:15	19:19		17:27	22	08:07 (34)	17:01
4	08:15	07:55		07:12		08:12 (34)	07:16	06:26	05:57	06:00	06:29	07:04	07:40		07:19		07:48 (34)	07:58
	17:13	17:52		18:29	24	08:36 (34)	20:08	20:45	21:17	21:27	21:02	20:13	19:17		17:25	16	08:04 (34)	17:00
5	08:15	07:53		07:11		08:14 (34)	07:14	06:25	05:56	06:00	06:30	07:06	07:41		07:21		07:52 (34)	07:59
	17:14	17:53		18:30	19	08:33 (34)	20:09	20:46	21:18	21:27	21:01	20:11	19:15		17:24	9	08:01 (34)	17:00
6	08:15	07:52		07:09		08:18 (34)	07:12	06:24	05:56	06:01	06:31	07:07	07:42		07:22			08:00
	17:15	17:55	10	08:32 (34)		08:29 (34)	20:10	20:47	21:19	21:26	21:00	20:09	19:14		17:23			17:00
7	08:15	07:51		08:17 (34)			07:11	06:22	05:55	06:02	06:32	07:08	07:43		08:58 (34)		07:23	08:01
	17:16	17:56	18	08:35 (34)			20:12	20:48	21:20	21:26	20:58	20:08	19:12	2	09:00 (34)		17:21	17:00
8	08:15	07:50		08:15 (34)			07:09	06:21	05:55	06:03	06:33	07:09	07:44		08:52 (34)		07:25	08:02
	17:17	17:57	23	08:38 (34)			20:13	20:50	21:20	21:26	20:57	20:06	19:10	16	09:08 (34)		17:20	17:00
9	08:15	07:48		08:14 (34)			07:07	06:20	05:55	06:03	06:34	07:10	07:46		08:48 (34)		07:26	08:03
	17:18	17:59	26	08:40 (34)			20:14	20:51	21:21	21:25	20:56	20:04	19:08	22	09:10 (34)		17:19	17:00
10	08:14	07:47		08:12 (34)			07:05	06:19	05:55	06:04	06:35	07:11	07:47		08:46 (34)		07:27	08:04
	17:19	18:00	29	08:41 (34)			20:15	20:52	21:22	21:25	20:54	20:02	19:06	26	09:12 (34)		17:18	17:00
11	08:14	07:46		08:11 (34)			07:03	06:17	05:54	06:05	06:37	07:13	07:48		08:44 (34)		07:29	08:04
	17:20	18:00	32	08:43 (34)			20:17	20:53	21:22	21:24	20:53	20:00	19:05	29	09:13 (34)		17:17	17:00
12	08:14	07:44		08:09 (34)			07:02	06:16	05:54	06:06	06:38	07:14	07:49		08:43 (34)		07:30	08:05
	17:21	18:02	34	08:43 (34)			20:18	20:54	21:23	21:24	20:51	19:58	19:03	32	09:15 (34)		17:16	17:00
13	08:13	07:43		08:09 (34)			07:00	06:15	05:54	06:06	06:39	07:15	07:51		08:41 (34)		07:32	08:06
	17:22	18:03	36	08:45 (34)			20:19	20:55	21:23	21:23	20:50	19:56	19:01	34	09:15 (34)		17:15	17:00
14	08:13	07:41		08:08 (34)			06:58	06:14	05:54	06:07	06:40	07:16	07:52		08:40 (34)		07:33	08:07
	17:24	18:04	37	08:45 (34)			20:20	20:57	21:24	21:23	20:48	19:55	18:58	36	09:16 (34)		17:13	17:00
15	08:12	07:40		08:07 (34)			06:56	06:13	05:54	06:08	06:41	07:17	07:53		08:39 (34)		07:34	08:08
	17:25	18:06	39	08:46 (34)			20:22	20:58	21:24	21:22	20:47	19:53	18:56	38	09:17 (34)		17:12	17:00
16	08:12	07:38		08:06 (34)			06:55	06:11	05:54	06:09	06:42	07:18	07:54		08:38 (34)		07:36	08:08
	17:26	18:07	40	08:46 (34)			20:23	20:59	21:25	21:21	20:45	19:51	18:54	39	09:17 (34)		17:11	17:00
17	08:11	07:37		08:06 (34)			06:53	06:10	05:54	06:10	06:44	07:19	07:56		08:37 (34)		07:37	08:09
	17:27	18:09	41	08:47 (34)			20:24	21:00	21:25	21:21	20:44	19:49	18:53	40	09:17 (34)		17:11	17:01
18	08:10	07:35		08:06 (34)			06:51	06:09	05:54	06:11	06:45	07:21	07:57		08:37 (34)		07:38	08:10
	17:29	18:10	41	08:47 (34)			20:25	21:01	21:26	21:20	20:42	19:47	18:51	41	09:18 (34)		17:10	17:01
19	08:10	07:34		08:06 (34)			06:50	06:08	05:54	06:12	06:46	07:22	07:58		08:37 (34)		07:39	08:10
	17:30	18:11	42	08:48 (34)			20:26	21:02	21:26	21:19	20:40	19:45	18:49	41	09:18 (34)		17:09	17:01
20	08:09	07:32		08:05 (34)			06:48	06:07	05:54	06:13	06:47	07:23	08:00		08:36 (34)		07:41	08:11
	17:31	18:13	42	08:47 (34)			20:28	21:03	21:26	21:18	20:39	19:43	18:48	42	09:18 (34)		17:08	17:02
21	08:08	07:31		08:06 (34)			06:46	06:06	05:54	06:14	06:48	07:24	08:01		08:36 (34)		07:42	08:12
	17:33	18:14	42	08:48 (34)			20:29	21:04	21:27	21:17	20:37	19:42	18:46	42	09:18 (34)		17:07	17:02
22	08:08	07:29		08:05 (34)			06:45	06:05	05:55	06:15	06:49	07:25	08:02		08:36 (34)		07:43	08:12
	17:34	18:15	42	08:47 (34)			20:30	21:05	21:27	21:16	20:36	19:40	18:44	42	09:18 (34)		17:06	17:03
23	08:07	07:27		08:05 (34)			06:43	06:05	05:55	06:16	06:50	07:26	08:03		08:36 (34)		07:45	08:13
	17:35	18:17	41	08:46 (34)			20:31	21:06	21:27	21:16	20:34	19:38	18:43	41	09:17 (34)		17:06	17:03
24	08:06	07:26		08:06 (34)			06:42	06:04	05:55	06:17	06:52	07:28	08:05		08:36 (34)		07:46	08:13
	17:37	18:18	41	08:47 (34)			20:33	21:07	21:27	21:15	20:32	19:36	18:41	41	09:17 (34)		17:05	17:04
25	08:05	07:24		08:06 (34)			06:40	06:03	05:56	06:18	06:53	07:29	08:06		08:36 (34)		07:47	08:13
	17:38	18:20	40	08:46 (34)			20:34	21:08	21:27	21:14	20:31	19:34	18:40	41	09:17 (34)		17:04	17:04
26	08:04	07:23		08:06 (34)			06:38	06:02	05:56	06:19	06:54	07:30	08:07		08:37 (34)		07:48	08:14
	17:39	18:21	39	08:45 (34)			20:35	21:09	21:27	21:13	20:29	19:32	18:38	40	09:17 (34)		17:04	17:05
27	08:03	07:21		08:07 (34)			06:37	06:01	05:56	06:20	06:55	07:31	08:09		08:37 (34)		07:50	08:14
	17:41	18:22	38	08:45 (34)			20:36	21:10	21:27	21:12	20:27	19:30	18:37	39	09:16 (34)		17:03	17:06
28	08:02	07:19		08:08 (34)			06:35	06:01	05:57	06:21	06:56	07:32	08:10		08:37 (34)		07:51	08:14
	17:42	18:24	35	08:43 (34)			20:38	21:11	21:27	21:11	20:25	19:28	18:35	37	09:14 (34)		17:03	17:06
29	08:01						06:34	06:00	05:57	06:22	06:57	07:34	08:11		08:39 (34)		07:52	08:15
	17:43						20:39	21:12	21:27	21:09	20:24	19:27	18:34	35	09:14 (34)		17:02	17:07
30	08:00						06:32	05:59	05:58	06:23	06:59	07:35	08:13		08:39 (34)		07:53	08:15
	17:45						20:40	21:13	21:27	21:08	20:22	19:25	18:32	34	09:13 (34)		17:02	17:08
31	07:59							05:59		06:24	07:00		08:14		08:41 (34)			08:15
	17:46							21:14		21:07	20:20		18:31	31	09:12 (34)			17:09
Potential sun hours	288	292		369			403	458	464	470	435	377	341			289		276
Total, worst case			808		147									861			100	
Sun reduction			0.62		0.62									0.59			0.51	
Oper. time red.			0.98		0.98									0.98			0.98	
Wind dir. red.			0.74		0.74									0.74			0.74	
Total reduction			0.45		0.45									0.43			0.37	
Total, real			365		66									371			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:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
Tetra Tech EC, Inc C/o Shin Ng
3475 E. Foothill Blvd
US-PASADENA, CA 91107
1 617 457 8405
Ted Guertin / ted.guertin@tetratech.com
Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 50 - Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,582

Idle start wind speed: Cut in wind speed from power curve

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:15	07:58	07:18	07:22	06:31	05:58	05:58	06:25	07:01	07:36	07:16	07:55
	17:10	17:48	18:25	20:05	20:41	21:15	21:28	21:06	20:19	19:23	17:30	17:01
2	08:16	07:57	07:16	07:20	06:30	05:58	05:59	06:27	07:02	07:37	07:17	07:56
	17:11	17:49	18:26	20:06	20:43	21:16	21:27	21:05	20:17	19:21	17:28	17:01
3	08:16	07:56	07:14	07:18	06:28	05:57	05:59	06:28	07:03	07:39	07:18	07:57
	17:12	17:51	18:28	20:07	20:44	21:17	21:27	21:04	20:15	19:19	17:27	17:01
4	08:16	07:55	07:13	07:16	06:27	05:57	06:00	06:29	07:05	07:40	07:20	07:58
	17:13	17:52	18:29	20:08	20:45	21:18	21:27	21:02	20:13	19:18	17:26	17:01
5	08:15	07:54	07:11	07:14	06:25	05:56	06:01	06:30	07:06	07:41	07:21	07:59
	17:14	17:53	18:30	20:10	20:46	21:18	21:27	21:01	20:11	19:16	17:24	17:00
6	08:15	07:52	07:09	07:13	06:24	05:56	06:01	06:31	07:07	07:42	07:22	08:00
	17:15	17:55	18:32	20:11	20:47	21:19	21:26	21:00	20:10	19:14	17:23	17:00
7	08:15	07:51	07:07	07:11	06:23	05:56	06:02	06:32	07:08	07:43	07:24	08:01
	17:16	17:56	18:33	20:12	20:49	21:20	21:26	20:59	20:08	19:12	17:22	17:00
8	08:15	07:50	08:06	07:09	06:21	05:55	06:03	06:33	07:09	07:45	07:25	08:02
	17:17	17:58	18:34	20:13	20:50	21:21	21:26	20:57	20:06	19:10	17:20	17:00
9	08:15	07:49	08:04	07:07	06:20	05:55	06:03	06:35	07:10	07:46	07:26	08:03
	17:18	17:59	19:36	20:14	20:51	21:21	21:25	20:56	20:04	19:09	17:19	17:00
10	08:14	07:47	08:02	07:05	06:19	05:55	06:04	06:36	07:12	07:47	07:28	08:04
	17:19	18:00	19:37	20:16	20:52	21:22	21:25	20:54	20:02	19:07	17:18	17:00
11	08:14	07:46	08:00	07:04	06:18	05:55	06:05	06:37	07:13	07:48	07:29	08:05
	17:20	18:00	19:38	20:17	20:53	21:23	21:24	20:53	20:00	19:05	17:17	17:00
12	08:14	07:44	07:58	07:02	06:16	05:55	06:06	06:38	07:14	07:50	07:30	08:06
	17:22	18:02	19:40	20:18	20:55	21:23	21:24	20:51	19:59	19:03	17:16	17:00
13	08:13	07:43	07:57	07:00	06:15	05:54	06:07	06:39	07:15	07:51	07:32	08:06
	17:23	18:03	19:41	20:19	20:56	21:24	21:23	20:50	19:57	19:01	17:15	17:00
14	08:13	07:42	07:55	06:58	06:14	05:54	06:07	06:40	07:16	07:52	07:33	08:07
	17:24	18:05	19:42	20:21	20:57	21:24	21:23	20:48	19:55	19:00	17:14	17:00
15	08:12	07:40	07:53	06:57	06:13	05:54	06:08	06:41	07:17	07:53	07:34	08:08
	17:25	18:06	19:43	20:22	20:58	21:25	21:22	20:47	19:53	18:56	17:13	17:00
16	08:12	07:39	07:51	06:55	06:12	05:54	06:09	06:43	07:19	07:55	07:36	08:09
	17:26	18:07	19:45	20:23	20:59	21:25	21:21	20:45	19:51	18:55	17:12	17:01
17	08:11	07:37	07:49	06:53	06:11	05:54	06:10	06:44	07:20	07:56	07:37	08:09
	17:28	18:09	19:46	20:24	21:00	21:26	21:21	20:44	19:49	18:53	17:11	17:01
18	08:11	07:36	07:47	06:52	06:10	05:54	06:11	06:45	07:21	07:57	07:38	08:10
	17:29	18:10	19:47	20:26	21:01	21:26	21:20	20:42	19:47	18:51	17:10	17:01
19	08:10	07:34	07:46	06:50	06:09	05:54	06:12	06:46	07:22	07:59	07:40	08:11
	17:30	18:12	19:48	20:27	21:02	21:26	21:19	20:41	19:45	18:50	17:09	17:01
20	08:09	07:33	07:44	06:48	06:08	05:55	06:13	06:47	07:23	08:00	07:41	08:11
	17:31	18:13	19:50	20:28	21:03	21:27	21:18	20:39	19:44	18:48	17:08	17:02
21	08:09	07:31	07:42	06:47	06:07	05:55	06:14	06:48	07:24	08:01	07:42	08:12
	17:33	18:14	19:51	20:29	21:05	21:27	21:18	20:37	19:42	18:46	17:07	17:02
22	08:08	07:29	07:40	06:45	06:06	05:55	06:15	06:50	07:26	08:02	07:44	08:12
	17:34	18:16	19:52	20:30	21:06	21:27	21:17	20:36	19:40	18:45	17:07	17:03
23	08:07	07:28	07:38	06:43	06:05	05:55	06:16	06:51	07:27	08:04	07:45	08:13
	17:35	18:17	19:53	20:32	21:07	21:27	21:16	20:34	19:38	18:43	17:06	17:03
24	08:06	07:26	07:36	06:42	06:04	05:55	06:17	06:52	07:28	08:05	07:46	08:13
	17:37	18:18	19:55	20:33	21:08	21:27	21:15	20:32	19:36	18:41	17:05	17:04
25	08:05	07:24	07:35	06:40	06:03	05:56	06:18	06:53	07:29	08:06	07:47	08:14
	17:38	18:20	19:56	20:34	21:09	21:28	21:14	20:31	19:34	18:40	17:05	17:05
26	08:05	07:23	07:33	06:39	06:02	05:56	06:19	06:54	07:30	08:08	07:49	08:14
	17:40	18:21	19:57	20:35	21:10	21:28	21:13	20:29	19:32	18:38	17:04	17:05
27	08:04	07:21	07:31	06:37	06:02	05:56	06:20	06:55	07:31	08:09	07:50	08:14
	17:41	18:22	19:58	20:37	21:11	21:28	21:12	20:27	19:31	18:37	17:03	17:06
28	08:03	07:19	07:29	06:36	06:01	05:57	06:21	06:57	07:33	08:10	07:51	08:15
	17:42	18:24	20:00	20:38	21:12	21:28	21:11	20:26	19:29	18:35	17:03	17:07
29	08:02		07:27	06:34	06:00	05:57	06:22	06:58	07:34	08:12	07:52	08:15
	17:44		20:01	20:39	21:13	21:28	21:10	20:24	19:27	18:34	17:02	17:07
30	08:01		07:25	06:32	06:00	05:58	06:23	06:59	07:35	08:13	07:53	08:15
	17:45		20:02	20:40	21:13	21:28	21:09	20:22	19:25	18:32	17:02	17:08
31	08:00		07:23		05:59		06:24	07:00		08:14		08:15
	17:46		20:03		21:14		21:07	20:20		18:31		17:09
Potential sun hours	288	292	369	403	458	464	470	435	377	342	289	276
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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

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

Project:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
Tetra Tech EC, Inc C/o Shin Ng
3475 E. Foothill Blvd
US-PASADENA, CA 91107
1 617 457 8405
Ted Guertin / ted.guertin@tetratech.com
Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 51 - Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,582

Idle start wind speed: Cut in wind speed from power curve

	January			February			March			April			May			June		
1	08:15			07:58		08:20 (18)	07:18		08:12 (18)	07:21			06:31			05:58		
	17:10			17:48	25	17:22 (17)	18:25	33	08:45 (18)	20:04			20:41			21:15		
2	08:16			07:57		08:19 (18)	07:16		08:13 (18)	07:20			06:29			05:58		
	17:11			17:49	31	17:23 (17)	18:26	30	08:43 (18)	20:06			20:43			21:16		
3	08:16			07:56		08:18 (18)	07:14		08:15 (18)	07:18			06:28			05:57		
	17:12			17:50	37	17:25 (17)	18:28	27	08:42 (18)	20:07			20:44			21:17		
4	08:16			07:55		08:17 (18)	07:12		08:17 (18)	07:16			06:26			05:57		
	17:13			17:52	43	17:27 (17)	18:29	22	08:39 (18)	20:08			20:45			21:18		
5	08:15			07:54		08:15 (18)	07:11		08:21 (18)	07:14			06:25			05:56		
	17:14			17:53	48	17:28 (17)	18:30	13	08:34 (18)	20:09			20:46			21:18		
6	08:15			07:52		08:14 (18)	07:09			07:12			06:24			05:56		
	17:15			17:55	51	17:29 (17)	18:32			20:11			20:47			21:19		
7	08:15			07:51		08:13 (18)	07:07			07:11			06:22			05:55		
	17:16			17:56	56	17:31 (17)	18:33			20:12			20:49			21:20		
8	08:15			07:50		08:11 (18)	08:05			07:09			06:21			05:55		
	17:17			17:57	60	17:32 (17)	18:34			20:13			20:50			21:21		
9	08:15			07:49		08:10 (18)	08:04			07:07			06:20		20:26 (11)	05:55		
	17:18			17:59	65	17:34 (17)	19:35			20:14			20:51	1	20:27 (11)	21:21		
10	08:14			07:47		08:08 (18)	08:02			07:05			06:18		20:25 (11)	05:55		
	17:19			18:00	69	17:35 (17)	19:37			20:16			20:52	3	20:28 (11)	21:22		
11	08:14			07:46		08:08 (18)	08:00			07:03			06:17		20:24 (11)	05:54		
	17:20			18:00	71	17:37 (17)	19:38			20:17			20:53	5	20:29 (11)	21:23		
12	08:14			07:44		08:08 (18)	07:58			07:02			06:16		20:24 (11)	05:54		
	17:21			18:02	74	17:39 (17)	19:39			20:18			20:54	6	20:30 (11)	21:23		
13	08:13			07:43		08:07 (18)	07:56			07:00			06:15		20:23 (11)	05:54		
	17:22			18:03	75	17:39 (17)	19:41			20:19			20:56	9	20:32 (11)	21:24		
14	08:13			07:42		08:07 (18)	07:55			06:58			06:14		20:23 (11)	05:54		
	17:24			18:04	75	17:39 (17)	19:42			20:20			20:57	10	20:33 (11)	21:24		
15	08:12			07:40		08:07 (18)	07:53			06:56			06:13		20:22 (11)	05:54		
	17:25			18:06	73	17:38 (17)	19:43			20:22			20:58	11	20:33 (11)	21:25		
16	08:12			07:39		08:07 (18)	07:51			06:55			06:11		20:21 (11)	05:54		
	17:26			18:07	71	17:37 (17)	19:44			20:23			20:59	13	20:34 (11)	21:25		
17	08:11			07:37		08:06 (18)	07:49			06:53			06:10		20:21 (11)	05:54		
	17:27			18:09	71	17:36 (17)	19:46			20:24			21:00	14	20:35 (11)	21:26		
18	08:11			07:36		08:07 (18)	07:47			06:51			06:09		20:21 (11)	05:54		
	17:29			18:10	67	17:35 (17)	19:47			20:25			21:01	15	20:36 (11)	21:26		
19	08:10			07:34		08:06 (18)	07:45			06:50			06:08		20:23 (11)	05:54		
	17:30			18:11	62	17:32 (17)	19:48			20:27			21:02	15	20:38 (11)	21:26		
20	08:09			07:32		08:06 (18)	07:44			06:48			06:07		20:23 (11)	05:54		
	17:31			18:13	57	17:29 (17)	19:49			20:28			21:03	16	20:39 (11)	21:27		
21	08:09			07:31		08:07 (18)	07:42			06:46			06:06		20:23 (11)	05:54		
	17:33			18:14	47	08:54 (18)	19:51			20:29			21:05	17	20:40 (11)	21:27		
22	08:08			07:29		08:07 (18)	07:40			06:45			06:05		20:23 (11)	05:55		
	17:34			18:15	46	08:53 (18)	19:52			20:30			21:06	17	20:40 (11)	21:27		
23	08:07			07:28		08:07 (18)	07:38			06:43			06:05		20:24 (11)	05:55		
	17:35			18:17	45	08:52 (18)	19:53			20:32			21:07	17	20:41 (11)	21:27		
24	08:06			07:26		08:08 (18)	07:36			06:41			06:04		20:24 (11)	05:55		
	17:37			18:18	44	08:52 (18)	19:54			20:33			21:08	17	20:41 (11)	21:27		
25	08:05			07:24		08:08 (18)	07:34			06:40			06:03		20:25 (11)	05:55		
	17:38			18:20	43	08:51 (18)	19:56			20:34			21:09	16	20:41 (11)	21:28		
26	08:04			07:23		08:08 (18)	07:33			06:38			06:02		20:26 (11)	05:56		
	17:39			18:21	42	08:50 (18)	19:57			20:35			21:10	14	20:40 (11)	21:28		
27	08:04			07:21		08:10 (18)	07:31			06:37			06:01		20:27 (11)	05:56		
	17:41			18:22	39	08:49 (18)	19:58			20:36			21:11	12	20:39 (11)	21:28		
28	08:03			07:19		08:11 (18)	07:29			06:35			06:01		20:29 (11)	05:57		
	17:42			18:24	36	08:47 (18)	19:59			20:38			21:12	10	20:39 (11)	21:28		
29	08:02						07:27			06:34			06:00		20:30 (11)	05:57		
	17:43						20:01			20:39			21:13	7	20:37 (11)	21:28		
30	08:01						07:25			06:32			05:59		20:32 (11)	05:58		
	17:45						20:02			20:40			21:13	2	20:34 (11)	21:28		
31	07:59		08:23 (18)				07:23						05:59					
	17:46	14	17:20 (17)				20:03						21:14					
Potential sun hours	288			292			369			403			458			464		
Total, worst case		14			1523			125						247				
Sun reduction		0.62			0.62			0.62						0.66				
Oper. time red.		0.98			0.98			0.98						0.98				
Wind dir. red.		0.72			0.71			0.75						0.74				
Total reduction		0.44			0.43			0.45						0.48				
Total, real		6			652			57						119				

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:
NorthBend_ShadowFlicker_20210413

Description:
North Bend Wind - Shadow Flicker - Mast 4221

Licensed user:
Tetra Tech EC, Inc C/o Shin Ng
3475 E. Foothill Blvd
US-PASADENA, CA 91107
1 617 457 8405
Ted Guertin / ted.guertin@tetratech.com

Calculated:
6/3/2021 10:30 PM/3.4.415

SHADOW - Calendar

Calculation: North Bend Wind - Shadow Flicker -- Cumulative with Triple H - Mast 4221Shadow receptor: 51 - Participant

Assumptions for shadow calculations

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.62	0.62	0.62	0.59	0.66	0.69	0.76	0.74	0.69	0.59	0.51	0.51

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
692	599	479	500	898	1,351	690	334	260	614	1,118	1,048	8,582

Idle start wind speed: Cut in wind speed from power curve

	July		August		September	October		November		December
1	05:58		06:25	20:34 (11)	07:01	07:36		07:16	07:38 (18)	07:54
	21:28		21:06 7	20:41 (11)	20:19	19:23		17:29 67	17:04 (17)	17:01
2	05:59		06:26	20:35 (11)	07:02	07:37		07:17	07:40 (18)	07:56
	21:27		21:05 4	20:39 (11)	20:17	19:21		17:28 64	17:04 (17)	17:01
3	05:59		06:27	20:36 (11)	07:03	07:38		07:18	07:41 (18)	07:57
	21:27		21:04 2	20:38 (11)	20:15	19:19		17:27 61	17:02 (17)	17:00
4	06:00		06:29		07:04	07:40		07:20	07:43 (18)	07:58
	21:27		21:02		20:13	19:17		17:25 57	17:01 (17)	17:00
5	06:00		06:30		07:06	07:41		07:21	07:44 (18)	07:59
	21:27		21:01		20:11	19:16		17:24 51	16:59 (17)	17:00
6	06:01		06:31		07:07	07:42		07:22	07:45 (18)	08:00
	21:26		21:00		20:09	19:14		17:23 46	16:57 (17)	17:00
7	06:02		06:32		07:08	07:43		07:24	07:47 (18)	08:01
	21:26		20:58		20:08	19:12		17:21 43	16:57 (17)	17:00
8	06:02		06:33		07:09	07:45	09:00 (18)	07:25	07:48 (18)	08:02
	21:26		20:57		20:06	19:10 7	09:07 (18)	17:20 37	16:55 (17)	17:00
9	06:03		06:34		07:10	07:46	08:54 (18)	07:26	07:50 (18)	08:03
	21:25		20:56		20:04	19:08 18	09:12 (18)	17:19 31	16:54 (17)	16:59
10	06:04		06:35		07:11	07:47	08:50 (18)	07:28	07:51 (18)	08:04
	21:25		20:54		20:02	19:07 24	09:14 (18)	17:18 24	16:52 (17)	16:59
11	06:05		06:37		07:13	07:48	08:48 (18)	07:29	07:55 (18)	08:05
	21:24		20:53		20:00	19:05 28	09:16 (18)	17:17 14	16:52 (17)	16:59
12	06:05		06:38		07:14	07:50	08:46 (18)	07:30		08:06
	21:24		20:51		19:58	19:03 32	09:18 (18)	17:16		17:00
13	06:06		06:39		07:15	07:51	08:44 (18)	07:32		08:06
	21:23		20:50		19:57	19:01 35	09:19 (18)	17:14		17:00
14	06:07	20:39 (11)	06:40		07:16	07:52	08:43 (18)	07:33		08:07
	21:23 5	20:44 (11)	20:48		19:55	18:58 37	09:20 (18)	17:13		17:00
15	06:08	20:37 (11)	06:41		07:17	07:53	08:42 (18)	07:34		08:08
	21:22 9	20:46 (11)	20:47		19:53	18:56 40	09:22 (18)	17:12		17:00
16	06:09	20:37 (11)	06:42		07:18	07:55	08:41 (18)	07:36		08:09
	21:21 11	20:48 (11)	20:45		19:51	18:54 41	09:22 (18)	17:11		17:00
17	06:10	20:36 (11)	06:43		07:20	07:56	08:39 (18)	07:37		08:09
	21:21 13	20:49 (11)	20:44		19:49	18:53 44	09:23 (18)	17:10		17:00
18	06:11	20:35 (11)	06:45		07:21	07:57	08:39 (18)	07:38		08:10
	21:20 15	20:50 (11)	20:42		19:47	18:51 45	09:24 (18)	17:10		17:01
19	06:12	20:35 (11)	06:46		07:22	07:58	08:38 (18)	07:40		08:11
	21:19 16	20:51 (11)	20:41		19:45	18:49 46	09:24 (18)	17:09		17:01
20	06:13	20:34 (11)	06:47		07:23	08:00	08:37 (18)	07:41		08:11
	21:18 18	20:52 (11)	20:39		19:43	18:48 47	09:24 (18)	17:08		17:02
21	06:14	20:33 (11)	06:48		07:24	08:01	08:37 (18)	07:42		08:12
	21:18 17	20:50 (11)	20:37		19:42	18:46 48	09:25 (18)	17:07		17:02
22	06:15	20:33 (11)	06:49		07:25	08:02	08:37 (18)	07:44		08:12
	21:17 17	20:50 (11)	20:36		19:40	18:44 58	18:01 (17)	17:06		17:03
23	06:16	20:32 (11)	06:50		07:27	08:04	08:36 (18)	07:45		08:13
	21:16 17	20:49 (11)	20:34		19:38	18:43 64	18:03 (17)	17:06		17:03
24	06:17	20:32 (11)	06:52		07:28	08:05	08:36 (18)	07:46		08:13
	21:15 16	20:48 (11)	20:32		19:36	18:41 69	18:05 (17)	17:05		17:04
25	06:18	20:32 (11)	06:53		07:29	08:06	08:36 (18)	07:47		08:14
	21:14 15	20:47 (11)	20:31		19:34	18:40 71	18:06 (17)	17:04		17:04
26	06:19	20:32 (11)	06:54		07:30	08:08	08:37 (18)	07:49		08:14
	21:13 14	20:46 (11)	20:29		19:32	18:38 72	18:07 (17)	17:04		17:05
27	06:20	20:32 (11)	06:55		07:31	08:09	08:36 (18)	07:50		08:14
	21:12 13	20:45 (11)	20:27		19:30	18:37 73	18:07 (17)	17:03		17:06
28	06:21	20:32 (11)	06:56		07:32	08:10	08:36 (18)	07:51		08:15
	21:11 12	20:44 (11)	20:26		19:28	18:35 73	18:07 (17)	17:03		17:06
29	06:22	20:32 (11)	06:57		07:34	08:12	08:37 (18)	07:52		08:15
	21:10 11	20:43 (11)	20:24		19:27	18:34 73	18:08 (17)	17:02		17:07
30	06:23	20:32 (11)	06:59		07:35	08:13	08:37 (18)	07:53		08:15
	21:08 10	20:42 (11)	20:22		19:25	18:32 72	18:07 (17)	17:02		17:08
31	06:24	20:34 (11)	07:00			08:14	08:38 (18)			08:15
	21:07 8	20:42 (11)	20:20			18:31 70	18:06 (17)			17:09
Potential sun hours	470		435		377	341		289		276
Total, worst case	237		13			1187		495		
Sun reduction	0.76		0.74			0.59		0.51		
Oper. time red.	0.98		0.98			0.98		0.98		
Wind dir. red.	0.74		0.74			0.72		0.69		
Total reduction	0.55		0.54			0.41		0.35		
Total, real	131		7			491		171		

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)

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
Response to Staff's Second Data Request

Date of Second Data Request: August 11, 2021

Data Request:

2-4) Refer to the response to Staff data request 1-25, Cumulative Acoustic Analysis_Memo.pdf.

a) The Applicant states there are three participants (NSR IDs 26, 29, and 51) with expected anomalous meteorological sound levels above 45 dBA. Please provide signed waivers from each participant that is expected to exceed 45 dBA.
b) The Applicant states there are three non-participants (NSR IDs 5, 15, and 42) with expected anomalous meteorological sound levels above 40 dBA.
   i. Please explain all efforts the Applicant has made to reduce the sound levels around these residences to below 40 dBA.
   ii. Would the Applicant consider making the turbine locations near these residences alternates in effort to reduce the expected sound levels below 40 dBA? Please explain.

Responses:

The exact language from the Hyde County Zoning Ordinance is shown below. Hughes County has the identical language. Pursuant to the provision in the ordinance, memorandums of easement as signed by the landowners are provided. This includes the following

- NSR 26 – Memorandum of Easement with Arlen Mehrer
- NSR 29 – Memorandum of Easement with Dusty Acres LP (B)
- NSR 51 – Memorandum of Easement with Mark & Mary Klebsch

18. Noise.

Noise level produced by the LWES shall not exceed forty-five (45) decibels of sound at the perimeter of occupied residences existing at the time the permit application is filed, unless a signed waiver or easement is obtained from the owner of the residence. The level, however may be exceeded during short-term events such as utility outages or wind storms.

ENGIE has elected to procure and utilize the low noise, trailing edge (LNTE) option available from GE on the blades to further reduce noise levels generated by the proposed turbine locations. The LNTE option has been factored into the acoustic evaluations for the project.

Given the limited extra alternative locations that have been proposed in conjunction with the permit application for the North Bend Wind Project, ENGIE is not willing to make alternative versus primary

turbine location decisions solely on the basis of further reduction of noise levels as the locations are in compliance with the County's standards.

Response Prepared by:
Casey Willis

#3498
STATE OF SOUTH DAKOTA)
County of Hughes)

Filed for record this 21st day of Oct. 2019
12:00 o'clock P.M. and recorded in
Book 19 Page 1978.

Register of Deeds / Deputy

Fee $30.00 pd.

HUGHES COUNTY SEAL SOUTH DAKOTA

(Space Above this Line for Recorder's Use Only)

PREPARED BY, AND
WHEN RECORDED, RETURN TO:

Triple H Wind Project, LLC
3760 State St., Ste. 200
Santa Barbara, CA 93105
Attn: Land Acquisition Dept.
Phone: (805) 569-6180

MEMORANDUM OF EASEMENT FOR WIND ENERGY DEVELOPMENT

THIS MEMORANDUM OF EASEMENT FOR WIND ENERGY DEVELOPMENT (this "**Memorandum**") is made as of the 21st day of June, 2019 (the "**Effective Date**") by and between Dusty Acres Land Limited Partnership, a South Dakota limited partnership, whose address is c/o Donald Neuharth, 20823 324th Ave, Harrold, SD 57536 (whether one or more, "**Owner**"), and TRIPLE H WIND PROJECT, LLC, a Delaware limited liability company ("**Developer**"), whose address is stated above. Each of Owner and Developer is sometimes referred to individually as a "**Party**" and collectively as the "**Parties.**"

RECITALS

A. Owner and Developer are parties to that certain Easement for Wind Energy Development dated as of the Effective Date (the "**Easement**"), whereby Owner demised and granted an exclusive easement, *in gross*, and right-of-way unto Developer, and Developer took an interest through an Easement from Owner on, over and across that certain real property located in Hughes County, South Dakota, as more particularly described on **Exhibit A** attached hereto and incorporated herein by this reference ("**Owner's Property**").

B. The Parties desire to execute and record this Memorandum for the purpose of putting all persons on notice of Developer's right, title and interest in and to Owner's Property under the Easement.

C. Capitalized terms used but not otherwise defined in this Memorandum shall have the meanings assigned to them in the Easement.

NOW, THEREFORE, in consideration of the mutual promises set forth in the Easement and this Memorandum, and of other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, Owner and Developer agree as follows:

1. Purpose and Scope of Easement. The Easement grants to Developer an exclusive easement, *in gross*, for wind resource assessment and analysis, wind energy conversion, for the collection and transmission of electric power, and certain rights and easements for related and incidental purposes and activities. Owner shall have no ownership or other interest in any windpower facilities installed on the Owner's Property by Developer, and Developer may remove any or all such windpower facilities at any time.

Among other rights and restrictions in the Easement, is the following restriction: Any obstruction to the free flow of the wind by Owner or persons other than Developer or any transferee or assignee of Developer or persons claiming through or under Developer or any transferee or assignee of Developer is prohibited throughout the entire area of Owner's Property, which shall consist horizontally three hundred and sixty degrees (360°) from any point where any Windpower Facilities are or may be located at any time or from time to time (each such location referred to as a "**Site**") and for a distance from each Site to the boundaries of Owner's Property, together vertically through all space located above the surface of Owner's Property, that is, one hundred eighty degrees (180°) or such greater number or numbers of degrees as may be necessary to extend from each point on and along a line drawn along the surface from each point along the exterior boundary of Owner's Property through each Site to each point and on and along such line to the opposite exterior boundary of Owner's Property. Trees, structures and improvements located on Owner's Property as of the Effective Date of this Easement shall be allowed to remain and Developer may not require their removal. After the Effective Date of this Easement, Owner may not place or plant any trees, structures or improvements on Owner's Property exceeding thirty (30) feet in height that may, in Developer's sole judgment, impede or interfere with the flow of wind to any Site or the Windpower Facilities, unless Owner has received prior written approval from Developer for any such trees, structures or improvements.

2. Term. The Easement Term commenced on the Effective Date and shall continue for fifty (50) years thereafter, unless earlier terminated or extended in accordance with the terms and conditions of the Easement.

3. Interpretation. The terms, conditions and covenants of the Easement are incorporated herein by reference as though fully set forth in this Memorandum. This Memorandum does not supersede, modify, amend or otherwise change the terms, conditions or covenants of the Easement, and this Memorandum shall not be used in interpreting the terms, conditions or covenants of the Easement. The purpose of this Memorandum is to give public notice of the existence of the Easement. The terms and conditions of the Easement are incorporated by reference into this Memorandum as if set forth fully herein at length. In the event of any inconsistency between this Memorandum and the terms and conditions of the Easement, the Easement shall prevail. The Easement contains a full description of the real property encumbered by the Easement and the easements and other rights granted therein, which

terms burden the Owner's Property and run with the land. All of the terms and conditions under which the Easement is granted or may be terminated are included within the Easement.

4. Counterparts. This Memorandum may be executed in counterparts and such counterparts shall, when taken together, constitute one and the same agreement.

[Signatures on following pages.]

IN WITNESS WHEREOF, the Parties have executed this Memorandum of Easement for Wind Energy Development, by their duly-authorized representatives, as of the day and year first above written.

OWNER:

Dusty Acres Land Limited Partnership, a South Dakota limited partnership

By: Donald R Neuharth
Name: Donald R. Neuharth
Its: General Partner

STATE OF South Dakota)
) ss
COUNTY OF Hughes)

On May 24, 2019 before me, Dustin A. Haefner (Name, Title of Officer, Notary Public), personally appeared Donald R. Neuharth, as General Partner of Dusty Acres Land Limited Partnership, a South Dakota limited partnership, personally known to me or proved to me on the basis of satisfactory evidence, to be the person whose name is subscribed to the within instrument and acknowledged to me that he executed the same in his authorized capacity and that by his signature on the instrument the person, or the entity upon behalf of which the person acted, executed the instrument.

DUSTIN A. HAEFNER NOTARY Seal PUBLIC STATE OF SOUTH DAKOTA

Dustin A. Haefner
Notary Public
Dustin A. Haefner, Notary Public
My Commission Expires:
January 20, 2021

[Signatures continued on following page]

[Signatures continued from preceding page]

DEVELOPER:

TRIPLE H WIND PROJECT, LLC,
a Delaware limited liability company

By: _____
Name: Brian Wixon
Title: Director of Land Acquisition

A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of that document.

STATE OF CALIFORNIA)
) ss
COUNTY OF SANTA BARBARA)

On June 21, 2019 before me, Katherine A. Dowling, (Notary Public), personally appeared Brian Wixon, as Director of Land Acquisition of Triple H Wind Project, LLC, a Delaware limited liability company, personally known to me or proved to me on the basis of satisfactory evidence, to be the person whose name is subscribed to the within instrument and acknowledged to me that he executed the same in his authorized capacity and that by his signature on the instrument the person, or the entity upon behalf of which the person acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

_____
Notary Public
My commission expires: 11/1/2020



Prepared by Triple H Wind Project, LLC

EXHIBIT A

DESCRIPTION OF OWNER'S PROPERTY

Real property situated in Hughes County, South Dakota described as follows:

The East Half (E½) of Section 11, Township 111 North, Range 74 West of the 5th P.M.

The North Half (N½) of Section 13, Township 111 North, Range 74 West of the 5th P.M.

Subject to all conveyances, restrictions or reservations of record, if any.

Book: 9 E Page: 274 - 279 Doc: 20190387
Hyde County, SD Rec Fee: $30.00 Trans Fee: $0.00
Filed for record on 10/21/2019 at 10:35 AM
Connie Konrad, Register of Deeds Connie Konrad
By _____, Deputy

(Space Above this Line for Recorder's Use Only)

PREPARED BY, AND
WHEN RECORDED, RETURN TO:

North Bend Wind Project, LLC
3760 State St., Ste. 200
Santa Barbara, CA 93105
Attn: Land Acquisition Dept.
Phone: (805) 589-6180

MEMORANDUM OF EASEMENT FOR WIND ENERGY DEVELOPMENT

THIS MEMORANDUM OF EASEMENT FOR WIND ENERGY DEVELOPMENT (this "**Memorandum**") is made as of the 13 day of August, 2019 (the "**Effective Date**") by and between Mark Klebsch and Mary Lee Klebsch, husband and wife, whose address is 20350 326th Street, Holabird, SD 57540 (whether one or more, "**Owner**"), and NORTH BEND WIND PROJECT, LLC, a Delaware limited liability company ("**Developer**"), whose address is stated above. Each of Owner and Developer is sometimes referred to individually as a "**Party**" and collectively as the "**Parties.**"

RECITALS

A. Owner and Developer are parties to that certain Easement for Wind Energy Development dated as of the Effective Date (the "**Easement**"), whereby Owner demised and granted an exclusive easement, *in gross*, and right-of-way unto Developer, and Developer took an interest through an Easement from Owner on, over and across that certain real property located in Hyde County, South Dakota, as more particularly described on **Exhibit A** attached hereto and incorporated herein by this reference ("**Owner's Property**").

B. The Parties desire to execute and record this Memorandum for the purpose of putting all persons on notice of Developer's right, title and interest in and to Owner's Property under the Easement.

C. Capitalized terms used but not otherwise defined in this Memorandum shall have the meanings assigned to them in the Easement.

NOW, THEREFORE, in consideration of the mutual promises set forth in the Easement and this Memorandum, and of other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, Owner and Developer agree as follows:

1. Purpose and Scope of Easement. The Easement grants to Developer an exclusive easement, *in gross*, for wind resource assessment and analysis, wind energy conversion, for the collection and transmission of electric power, and certain rights and easements for related and incidental purposes and activities. Owner shall have no ownership or other interest in any windpower facilities installed on the Owner's Property by Developer, and Developer may remove any or all such windpower facilities at any time.

Among other rights and restrictions in the Easement, is the following restriction: Any obstruction to the free flow of the wind by Owner or persons other than Developer or any transferee or assignee of Developer or persons claiming through or under Developer or any transferee or assignee of Developer is prohibited throughout the entire area of Owner's Property, which shall consist horizontally three hundred and sixty degrees (360°) from any point where any Windpower Facilities are or may be located at any time or from time to time (each such location referred to as a "**Site**") and for a distance from each Site to the boundaries of Owner's Property, together vertically through all space located above the surface of Owner's Property, that is, one hundred eighty degrees (180°) or such greater number or numbers of degrees as may be necessary to extend from each point on and along a line drawn along the surface from each point along the exterior boundary of Owner's Property through each Site to each point and on and along such line to the opposite exterior boundary of Owner's Property. Trees, structures and improvements located on Owner's Property as of the Effective Date of this Easement shall be allowed to remain and Developer may not require their removal. After the Effective Date of this Easement, Owner may not place or plant any trees, structures or improvements on Owner's Property exceeding thirty (30) feet in height that may, in Developer's sole judgment, impede or interfere with the flow of wind to any Site or the Windpower Facilities, unless Owner has received prior written approval from Developer for any such trees, structures or improvements.

2. Term. The Easement Term commenced on the Effective Date and shall continue for fifty (50) years thereafter, unless earlier terminated or extended in accordance with the terms and conditions of the Easement.

3. Interpretation. The terms, conditions and covenants of the Easement are incorporated herein by reference as though fully set forth in this Memorandum. This Memorandum does not supersede, modify, amend or otherwise change the terms, conditions or covenants of the Easement, and this Memorandum shall not be used in interpreting the terms, conditions or covenants of the Easement. The purpose of this Memorandum is to give public notice of the existence of the Easement. The terms and conditions of the Easement are incorporated by reference into this Memorandum as if set forth fully herein at length. In the event of any inconsistency between this Memorandum and the terms and conditions of the Easement, the Easement shall prevail. The Easement contains a full description of the real property encumbered by the Easement and the easements and other rights granted therein, which terms burden the Owner's Property and

run with the land. All of the terms and conditions under which the Easement is granted or may be terminated are included within the Easement.

4. Counterparts. This Memorandum may be executed in counterparts and such counterparts shall, when taken together, constitute one and the same agreement.

[Signatures on following pages.]

IN WITNESS WHEREOF, the Parties have executed this Memorandum of Easement for Wind Energy Development, by their duly-authorized representatives, as of the day and year first above written.

OWNER:

Mark Klebsch and Mary Lee Klebsch, husband and wife

By: Mark Klebsch
Name: Mark Klebsch

By: Mary Lee Klebsch
Name: Mary Lee Klebsch

STATE OF South Dakota)
) ss
COUNTY OF Hyde)

On August 13, 2019 before me, Lynn PeKarek (Name, Title of Officer, Notary Public), personally appeared Mark Klebsch and Mary Lee Klebsch husband and wife, personally known to me or proved to me on the basis of satisfactory evidence, to be the persons whose names are subscribed to the within instrument and acknowledged to me that they executed the same in their authorized capacities and that by their signatures on the instrument the persons, or the entity upon behalf of which the persons acted, executed the instrument.

LYNN PEKAREK NOTARY SEAL PUBLIC SOUTH DAKOTA

Lynn PeKarek
Notary Public
My commission expires: 5-8-2023

[Signatures continued on following page]

[Signatures continued from preceding page]

DEVELOPER:

NORTH BEND WIND PROJECT, LLC,
a Delaware limited liability company

By: _____ DK
Name: Brian Wixon
Title: Director of Land Acquisition

A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of that document.

STATE OF CALIFORNIA)
) ss
COUNTY OF SANTA BARBARA)

On August 28, 2019 before me, Katherine A. Dowling, (Notary Public), personally appeared Brian Wixon, as Director of Land Acquisition of North Bend Wind Project, LLC, a Delaware limited liability company, personally known to me or proved to me on the basis of satisfactory evidence, to be the person whose name is subscribed to the within instrument and acknowledged to me that he executed the same in his authorized capacity and that by his signature on the instrument the person, or the entity upon behalf of which the person acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

_____
Notary Public
My commission expires: 11/1/2020

KATHERINE A. DOWLING
Notary Public - California
Santa Barbara County
Commission # 2166825
My Comm. Expires Nov 1, 2020

Prepared by North Bend Wind Project, LLC
Telephone: 805-569-6180

EXHIBIT A

DESCRIPTION OF OWNER'S PROPERTY

Real property situated in Hyde County, South Dakota described as follows:

The Southwest Quarter (SW¼) of Section 5, Township 111 North, Range 73 West of the 5th P.M.

The South Half (S½) and the Northeast Quarter (NE¼) of Section 7, Township 111 North, Range 73 West of the 5th P.M.

The West Half (W½) of Section 8, Township 111 North, Range 73 West of the 5th P.M.

The Northeast Quarter (NE¼) of Section 18, Township 111 North, Range 73 West of the 5th P.M.

The Northwest Quarter (NW¼) of Section 17, Township 111 North, Range 73 West of the 5th P.M.

Subject to all conveyances, restrictions or reservations of record, if any.

STATE OF SOUTH DAKOTA
County of Hughes

Filed for record this 6th day of Nov. 2017
10:20 O'clock A.M. and recorded in
Book 17 Page 2135.

Marine Lus
Register of Deeds or Deputy

Fee $30.00 pd.

HUGHES COUNTY SEAL SOUTH DAKOTA

(Space Above this Line for Recorder's Use Only)

PREPARED BY, AND
WHEN RECORDED, RETURN TO:

Triple H Wind Project, LLC
3760 State St., Ste. 200
Santa Barbara, CA 93105
Attn: Land Acquisition Dept.
Phone: (805) 569-6180

MEMORANDUM OF EASEMENT FOR WIND ENERGY DEVELOPMENT

THIS MEMORANDUM OF EASEMENT FOR WIND ENERGY DEVELOPMENT (this "**Memorandum**") is made as of the 23rd day of October, 20 17 (the "**Effective Date**") by and between Arlen D. Mehrer, a married person, whose address is 32253 204th St., Harrold, SD 57536 (whether one or more, "**Owner**"), and TRIPLE H WIND PROJECT, LLC, a Delaware limited liability company ("**Developer**"), whose address is stated above. Each of Owner and Developer is sometimes referred to individually as a "**Party**" and collectively as the "**Parties**."

RECITALS

A. Owner and Developer are parties to that certain Easement for Wind Energy Development dated as of the Effective Date (the "**Easement**"), whereby Owner demised and granted an exclusive easement, *in gross*, and right-of-way unto Developer, and Developer took an interest through an Easement from Owner on, over and across that certain real property located in Hughes County, South Dakota, as more particularly described on **Exhibit A** attached hereto and incorporated herein by this reference ("**Owner's Property**").

B. The Parties desire to execute and record this Memorandum for the purpose of putting all persons on notice of Developer's right, title and interest in and to Owner's Property under the Easement.

C. Capitalized terms used but not otherwise defined in this Memorandum shall have the meanings assigned to them in the Easement.

NOW, THEREFORE, in consideration of the mutual promises set forth in the Easement and this Memorandum, and of other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, Owner and Developer agree as follows:

1. Purpose and Scope of Easement. The Easement grants to Developer an exclusive easement, *in gross*, for wind resource assessment and analysis, wind energy conversion, for the collection and transmission of electric power, and certain rights and easements for related and incidental purposes and activities. Owner shall have no ownership or other interest in any windpower facilities installed on the Owner's Property by Developer, and Developer may remove any or all such windpower facilities at any time.

Among other rights and restrictions in the Easement, is the following restriction: Any obstruction to the free flow of the wind by Owner or persons other than Developer or any transferee or assignee of Developer or persons claiming through or under Developer or any transferee or assignee of Developer is prohibited throughout the entire area of Owner's Property, which shall consist horizontally three hundred and sixty degrees (360°) from any point where any Windpower Facilities are or may be located at any time or from time to time (each such location referred to as a "**Site**") and for a distance from each Site to the boundaries of Owner's Property, together vertically through all space located above the surface of Owner's Property, that is, one hundred eighty degrees (180°) or such greater number or numbers of degrees as may be necessary to extend from each point on and along a line drawn along the surface from each point along the exterior boundary of Owner's Property through each Site to each point and on and along such line to the opposite exterior boundary of Owner's Property. Trees, structures and improvements located on Owner's Property as of the Effective Date of this Easement shall be allowed to remain and Developer may not require their removal. After the Effective Date of this Easement, Owner may not place or plant any trees, structures or improvements on Owner's Property exceeding thirty (30) feet in height that may, in Developer's sole judgment, impede or interfere with the flow of wind to any Site or the Windpower Facilities, unless Owner has received prior written approval from Developer for any such trees, structures or improvements.

2. Term. The Easement Term commenced on the Effective Date and shall continue for fifty (50) years thereafter, unless earlier terminated or extended in accordance with the terms and conditions of the Easement.

3. Interpretation. The terms, conditions and covenants of the Easement are incorporated herein by reference as though fully set forth in this Memorandum. This Memorandum does not supersede, modify, amend or otherwise change the terms, conditions or covenants of the Easement, and this Memorandum shall not be used in interpreting the terms, conditions or covenants of the Easement. The purpose of this Memorandum is to give public notice of the existence of the Easement. The terms and conditions of the Easement are incorporated by reference into this Memorandum as if set forth fully herein at length. In the event of any inconsistency between this Memorandum and the terms and conditions of the Easement, the Easement shall prevail. The Easement contains a full description of the real property encumbered by the Easement and the easements and other rights granted therein, which terms burden the Owner's Property and run with the land. All of the terms and conditions under which the Easement is granted or may be terminated are included within the Easement.

4. Counterparts. This Memorandum may be executed in counterparts and such counterparts shall, when taken together, constitute one and the same agreement.

IN WITNESS WHEREOF, the Parties have executed this Memorandum of Easement for Wind Energy Development, by their duly-authorized representatives, as of the day and year first above written.

OWNER:

Arlen D. Mehrer, a married person

By: Arlen D. Mehrer
Name: Arlen D. Mehrer

SPOUSAL CONSENT:

By: Dana Mehrer
Name: Dana Mehrer

STATE OF South Dakota)
) ss
COUNTY OF Hughes)

On October 2nd, 2017 before me, Rachel L. Wyly (Name, Title of Officer, Notary Public), personally appeared Arlen D. Mehrer and Dana Mehrer, husband and wife, personally known to me or proved to me on the basis of satisfactory evidence, to be the persons whose names are subscribed to the within instrument and acknowledged to me that they executed the same in their authorized capacities and that their signatures on the instrument the persons, or the entity upon behalf of which the persons acted, executed the instrument.

RACHEL L. WYLY
Notary Public
SEAL
South Dakota

Rachel L. Wyly
Notary Public

Rachel L. Wyly
My Commission Expires
November 3, 2017

[Signatures continued on following page]

[Signatures continued from preceding page]

DEVELOPER:

TRIPLE H WIND PROJECT, LLC,
a Delaware limited liability company

By: Infinity Power Partners, LLC, a Delaware limited liability company
Its: Sole Member

By: _____
Name: Matt T. Riley
Its: Manager

A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of that document.

STATE OF CALIFORNIA)
) ss
COUNTY OF SANTA BARBARA)

On October 23, 2017 before me, Katherine A. Dowling, (Notary Public), personally appeared Matt T. Riley, Manager of Infinity Power Partners, LLC, a Delaware limited liability company, personally known to me or proved to me on the basis of satisfactory evidence, to be the person whose name is subscribed to the within instrument and acknowledged to me that he executed the same in his authorized capacity and that by his signature on the instrument the person, or the entity upon behalf of which the person acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

_____
Notary Public
My commission expires: 11/1/2020

KATHERINE A. DOWLING
Notary Public - California
Santa Barbara County
Commission # 2166825
My Comm. Expires Nov 1, 2020

Prepared by Infinity Renewables, LLC
Telephone: 805-569-6180

EXHIBIT A

DESCRIPTION OF OWNER'S PROPERTY

Real property situated in Hughes County, South Dakota described as follows:

The North Half of the Northeast Quarter (N½NE¼) of Section 16, Township 111 North, Range 74 West of the 5th P.M.

The Northeast Quarter (NE¼) of Section 15, Township 111 North, Range 74 West of the 5th P.M.

The Northwest Quarter (NW¼) of Section 15, Township 111 North, Range 74 West of the 5th P.M.

The Northwest Quarter (NW¼) and the North Half of the Southwest Quarter (N½SW¼) of Section 16, Township 111 North, Range 74 West of the 5th P.M.

Subject to all conveyances, restrictions or reservations of record, if any.

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
Response to Staff's Second Data Request

Date of Second Data Request: August 11, 2021

Data Request:
2-5) Please provide the Project's COVID 19 mitigation plan during construction.

Responses:
ENGIE's COVID job site protocol is attached to this response.

Response Prepared by:
Casey Willis

ENGIE COVID-19 Jobsite Control Protocol

ENGIE North America
June 2020

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Attachment A: ENGIE COVID 19 Screening Tool
Attachment B: N95 Mask
Attachment C: Nitrile Latex Gloves
Attachment D: Eye Protection
Attachment E: COVID-19 Contact Tracing Guidelines
Attachment F: Timeline of Infection

ENGIE COVID-19 Jobsite Control Protocol

ENGIE North America
June 2020

1.0 Purpose

The purpose of this ENGIE COVID-19 Jobsite Control Protocol (the "Plan") is to strive to mitigate and minimize the spread of coronavirus ("COVID-19") throughout ENGIE North America ("ENGIE") jobsites based on current recommendations from the Centers for Disease Control and Prevention ("CDC") and local health authorities. We are all working together in this difficult time to reduce the spread of this virus. ENGIE remains committed to the health and safety of its employees, contractors and visitors while on the jobsite.

2.0 Scope

This document applies to all Utility-Scale Renewables Projects (the "Project") and all employees, contractors and visitors ("Covered Individuals") while on the Project's premises (the "Jobsite"). These requirements may be modified at any time, with or without notice, at the discretion of the Project management team and/or the Executive Management Team of ENGIE. To the extent that this policy conflicts with applicable laws, regulations or orders, those laws, regulations or orders will govern. All references to a "test" shall mean a PCR test for the detection of the SARS-CoV-2 virus, not an antibody test. Close Contact is defined as someone who was within 6 feet of an infected person for at least 30 minutes starting from 48 hours before illness onset.

3.0 Responsibilities

3.1 The general contractor ("EPC") shall appoint a Lead COVID 19 Coordinator to train and support staff to strive to minimize risk and maintain proper communication throughout the Jobsite.
3.2 Subcontractors shall appoint COVID Coordinators to communicate with their teams and the Lead COVID Coordinator.
3.3 The EPC shall evaluate the need for additional staff to support COVID Coordinators based on the level of staffing and nature of preventative measures recommended.
3.4 The EPC and contractors shall provide updates on COVID-19, including the implementation of prevention and control measures on a daily basis. Such prevention and control measures shall be based on current recommendations from the CDC and local health authorities.
3.5 Any Covered Individual who brings guests onto the Jobsite must inform all such guests about the requirements of this Plan prior to their arrival to the Jobsite.
3.6 Project/Construction Managers shall, as soon as is practical, implement measures to ensure social distancing and shall carefully consider the implementation of the measures outlined below.

4.0 Jobsite Pre-Entry Screening

4.1 Implementation of the ENGIE COVID-19 Screening Tool
4.2 Project management will implement a Response Plan to assign and train specific individuals in the implementation of responsive actions in the event of the identification of a potentially infected person on the Jobsite. Project management shall post signage around job trailers and work areas stating the following information:

If you answer yes to the following questions, please coordinate with the Lead COVID-19 Coordinator and appropriate medical personnel:

- Within the last 14 days, have you been diagnosed with or tested positive for COVID-19?
- Have you traveled outside of the United States or on a cruise ship within the last 14 days?
- Within the past 14 days, have you traveled to/from an area that the CDC has designated as a COVID-19 hot spot (e.g., New York, New Jersey, or Michigan)?
- Have you had close contact with (i.e., within six feet of) or cared for someone diagnosed with, or confirmed to have, COVID-19 within the last 14 days?
- Within the last 14 days, have you knowingly been in close contact with (i.e., within six feet of) anyone who is experiencing the symptoms listed above?
- Have you been in close contact with (i.e., within six feet of) anyone who has traveled outside of the United States or on a cruise ship within the last 14 days?
- Have you experienced any cold or flu-like symptoms in the last 14 days (to include fever, cough, sore throat, respiratory illness, chills, muscle or body aches, shortness of breath or difficulty breathing, fatigue, headache, new loss of taste or smell, congestion or runny nose, nausea or vomiting, diarrhea)?

4.3 Covered Individuals who have not been previously screened must pull over to a check in station.
4.4 Covered Individuals car-pooling shall be considered as one, meaning that if one employee in the car-pool becomes ill or has a positive test for COVID-19 then all employees in the car-pool shall remain off the Jobsite for at least 14 days or until clearance by a medical professional, including negative results from the COVID-19 test, has been shared with ENGIE.

5.0 Cleaning and Disinfecting

5.1 Buses shall be sprayed or wiped down daily with a disinfectant. The designated First Responder Bus shall be sterilized immediately after each use.
5.2 Equipment shall be sprayed or wiped down daily or as needed with a disinfectant.
5.3 The office shall create a cleaning schedule to disinfect the area twice per day.
5.4 Portable toilets shall be cleaned once daily with a disinfectant.
5.5 Hand wash stations shall have fresh water, dry towels, and, if available, hand sanitizer.
5.6 Break areas shall be cleaned and sanitized after each use and all seats shall be at least 6 feet apart.
5.7 Smoking areas should only have one employee at a time unless a 6' distance can be achieved between employees. All cigarette butts must be disposed of inside of the butt can.
5.8 All employees shall be trained on how to safely disinfect all items. Each employee shall confirm his/her understanding of how to protect him/herself from contamination while disinfecting items.
5.9 Each employee shall be supplied appropriate personal protective equipment ("PPE"), as recommended by the CDC, to perform the disinfecting process.
5.10 The Project's management team will develop and post a cleaning schedule with a check sheet to verify that scheduled disinfecting has been conducted timely.
5.11 Only disinfectant products that are EPA-approved for use against COVID-19 shall be used for these purposes.

6.0 On-Site Transportation

6.1 The below requirements for buses are not applicable for projects that do not utilize a bus for on-site transportation
6.2 All bus transportation will load from the back to the front, skipping one empty seat between all employees. All Covered Individuals must maintain social distance from one another while loading, unloading, and riding in a bus. This procedure will help protect all Covered Individuals and help prevent the spread of COVID-19.
6.3 Any Covered Individual who refuses to comply with the bus riding procedures shall not be allowed to ride the bus and may be subject to discipline up to and including termination.
6.4 The office shall use the designated First Responder Bus in the event a Covered Individual on the Jobsite is suspected of having COVID-19. This bus will serve three purposes:
1. To extract a suspected case;
2. To screen Covered Individuals; and
3. If needed, to otherwise respond to emergencies.

7.0 Logistics

When a delivery driver arrives at the Jobsite, keep at least 6 feet of distance from the driver and any other individuals assisting with the delivery. Allow them to remove any straps, tarps, or other items securing the delivered goods. After the driver returns to the cab of the vehicle, assist with any further unloading as necessary, while safely using equipment or gloves to help you avoid touching the delivered goods directly. Finally, one employee shall escort the driver off-site. These procedures shall also be followed for goods that are shipped from the Jobsite.

8.0 Social Distancing

8.1 Social distancing (i.e., maintaining a distance of six feet or two meters between all individuals) must be observed by all Covered Individuals on the Jobsite. If social distancing cannot be observed, other protective measures (including PPE) must be used.
8.2 All Covered Individuals shall wear face coverings at all times when in common areas on the Jobsite.
8.3 Covered Individuals working within their own individual offices shall keep their doors closed whenever feasible.

9.0 Personal Protective Equipment

PPE is a vital part of protecting Covered Individuals from potential exposure to COVID-19. PPE generally includes gloves, face coverings (balaclava, surgical mask, bandanas), and safety glasses. OSHA respirator requirements must be followed for any employee that wears an N95 mask, even if voluntary. First Aid Responders and screening personnel are required to wear advanced PPE such as a respirator, gown, or Tyvek suit and shall be trained on proper use and removal of these items. Never attempt to aid an employee without the proper PPE.

10.0 Training on COVID-19 Signs, Symptoms, and Transmission

All employees shall be trained to recognize the signs and symptoms of COVID-19. According to the CDC, COVID-19 can be transmitted through a sneeze, cough, nose drainage, or from touching materials that an infected individual previously touched. Signs and symptoms, according to the CDC, include sore throat, congestion or runny nose, headache, temperature of 100.4 or greater, chills, muscle or body

aches, fatigue, new loss of taste or smell, nausea or vomiting, diarrhea, and shortness of breath or trouble breathing. Any Covered Individuals experiencing one or more of these symptoms must stay home (or, if on the Jobsite, immediately isolate themselves) and seek care from a medical provider.

11.0 Meetings

Meetings shall be held over the phone or through video conferencing, as opposed to in-person, whenever possible. If necessary, in person meetings should include no more than 10 people, and social distancing shall be observed at all times. Additionally, meeting rooms shall be disinfected before and after each meeting and shall have hand sanitizer, gloves, masks, and disinfectant wipes available. Each attendee must complete the ENGIE COVID-19 Screening Tool prior to attending any in-person meeting.

12.0 Return to Work Policy

Covered Individuals who are advised to work remotely or self-quarantine due to exhibition of COVID-19 symptoms may return to work only after:

- The Covered Individual's fever has abated for at least 72 hours (without the use medicine that reduces fevers); AND
- All other signs/symptoms of COVID-19 have abated for at least 72 hours (for example, when your cough or shortness of breath have improved); AND
- The Covered Individual has received two negative COVID-19 tests in a row, 24 hours apart as confirmed by their treating physician.

Contact/Confirmed Case Traceability Quarantine:

- Covered Individuals who have been in direct contact with an individual who is suspected to have COVID-19 shall be sent home for self-observation until the affected individual is confirmed negative for COVID-19 (assuming that the employee undergoing home observation has not also developed symptoms). Should the affected individual be diagnosed with or test positive for COVID-19, the Covered Individuals that have been in direct contact with the affected individual will remain in self-observation for at least 14 days.
- All such Covered Individuals shall consult with a physician for an evaluation. A physician's return to work note shall be submitted to the Project Safety Manager, who is responsible for reviewing and approving such clearances.

13.0 Safety Monitoring

Each contractor must have a monitor on site to ensure Covered Individuals are not exhibiting symptoms of COVID-19. The monitors shall be trained in social distancing and hygiene protocols. In the event a monitor observes a Covered Individual exhibiting symptoms, the monitor shall immediately inform a member of the Project management team.

14.0 Group Sizes

Meetings between site personnel and project leadership (stretch & bend, all-hands meetings, etc.) shall be limited to groups of 10 or less with at least 6 feet of distance between each attendee at all times.

15.0 Practice Good Hygiene

All Covered Individuals must wash their hands before and after using common areas on the Jobsite,

eating, or touching their eyes, nose, or mouth. Do not touch other employees' personal belongings. Do not share food or drink with anyone. In addition to washing your hands, use hand sanitizer often, especially after handling materials. Upon arriving home each day, you should remove your work clothes and wash them immediately using hot water and detergent.

16.0 Jobsite Entry

Before any Covered Individuals can access the Jobsite, they must be screened with a no-touch thermometer. If a Covered Individual exhibits a temperature of 100.4 degrees Fahrenheit or greater, he or she will not be allowed entry to the Jobsite until further notice. All employees returning from isolation or quarantine must report to the Lead COVID Site Coordinator to assure all return-to-work protocols have been met.

17.0 Investigation Protocol

In the event a Covered Individual exhibits symptoms or is otherwise suspected to have COVID-19 while on the Jobsite, the Lead COVID-19 Coordinator will conduct an investigation as soon as practical. Prior to making any contact with the individual, the Lead COVID-19 Coordinator shall:

1. Ensure the suspected case is isolated from other individuals on the Jobsite.
2. Ensure the investigating employees are wearing all required PPE.
3. If needed, ensure the First Responder Bus is immediately available for extraction.
4. If the Covered Individual displays or informs the investigating employees of any symptoms, instruct the Covered Individual to seek appropriate medical care.
5. Follow the COVID-19 Contact Tracing Guidelines (Attachment E).

18.0 Contact Tracing

Contact tracing shall occur for all suspected and confirmed cases and be recorded within a COVID-19 Tracking Log that should contain the Covered Individuals that have been in contact with the Covered Individual exhibiting symptoms as well as the status of Covered Individual exhibiting symptoms. Entries within the COVID-19 Tracking Log shall be monitored for return-to-work purposes. Contact tracing and information recorded in the COVID-19 Tracking Log must be maintained confidentially and in accordance with applicable law.

Attachment A: ENGIE COVID-19 Screening Tool

The safety of our employees, customers, families, and visitors remains ENGIE North America's ("ENGIE") overriding priority. As the novel coronavirus (COVID-19) outbreak continues to evolve, ENGIE is monitoring the situation closely and will periodically update its guidance and procedures based on current recommendations from the Centers for Disease Control and Prevention ("CDC") and local health authorities.

To help prevent the spread of COVID-19 and reduce the potential risk of exposure to our employees and visitors, we are requiring all employees and visitors to complete this Screening Tool before accessing ENGIE's facilities. Your participation and accurate responses are important to help us take precautionary measures to protect you and everyone in this building. Thank you for your time.

Visitor/Employee Name:	Personal Phone Number (mobile/home):
Company/Organization:	ENGIE Office/Project Location:

If the answer is "yes" to any of the following questions, access to the facility may be denied or further information may be required.

	Self-Declaration by Visitor/Employee
1	Within the last 14 days, have you been diagnosed with or tested positive for COVID-19? ☐ Yes ☐ No
2	Have you traveled outside of the United States or on a cruise ship within the last 14 days? If YES, please list all countries or cruise destinations to which you have traveled below. ☐ Yes ☐ No
2a.	Within the last 14 days, have you traveled to/from an area that the CDC has designated as a COVID-19 hot spot (e.g., New York, New Jersey, or Michigan)? If YES, please list all locations below. ☐ Yes ☐ No
3	Have you had close contact with (i.e., within six feet of) or cared for someone diagnosed with, or confirmed to have COVID-19 within the last 14 days? ☐ Yes ☐ No
4	Within the last 14 days, have you knowingly been in close contact (i.e., within six feet of) anyone who is experiencing the symptoms listed above? ☐ Yes ☐ No
5	Have you been in close contact with (i.e., within six feet of) anyone who has traveled outside of the United States, on a cruise ship, or to/from an area that the CDC has designated as a COVID-19 hot spot within the last 14 days? If YES, please list all such location to/from which the individual traveled below. ☐ Yes ☐ No
6	Have you experienced any cold or flu-like symptoms in the last 14 days (to include fever, cough, sore throat, respiratory illness, chills, muscle or body aches, shortness of breath or difficulty breathing, fatigue, headache, new loss of taste or smell, congestion or runny nose, nausea or vomiting, diarrhea)? ☐ Yes ☐ No

Signature: _____ Date: _____

Note: If you plan to be onsite for consecutive days, please immediately advise your manager if any of your responses change.

Access to facility (circle one): Approved Denied (pending development of further information)

Attachment B: N95 Mask

Health Promotion Board

6

Protect yourself and your loved ones

Six Steps to wearing the N95 MASK



Step 1

Wash your hands before putting on the mask.



Step 2

Select a suitable N95 mask that fits* well.

*Available in different sizes



Step 3

Hold the mask with a cupped hand and place it firmly over your nose, mouth and chin.



Step 4

Stretch and position top band high at the back of head. Stretch and position bottom band under the ears.



Step 5

Press the thin metal wire along the upper edge gently against the bridge of your nose so that the mask fits nicely on your face.



Step 6

Perform a fit check by inhaling and exhaling. During exhalation, check for air leakage around face.

For more information on the above steps, please call HealthLine at 1800 223 1313.

www.hpb.gov.sg
1800 223 1313

MINISTRY OF HEALTH
SINGAPORE

Attachment C: Nitrile Latex Gloves

Gloves for high risk practices

Material	Glove	Description	Time of use	Protection against permeation	Sensitivity to touch	Lenght Thickness	Norms	Aplications
Nitrile		**AachenProtec** Protection against high risk practices. AQL: 1.0	prolonged use (5-6h)			Lenght: 290 ± 5 Grosor: Cuff: 0.16±0.02 Palm: 0.25±0.02 Fingers: 0.35±0.02		Sanitary: -Protection against biological risks -Handling of cytostatics General Industry Food Industry Cleaning Laboratories Automotive industry
Latex		**AachenGrip** Protection against high risk practices. AQL: 1.0	prolonged use (5-6h)			Lenght: 295 ± 0.02 Grosor: Cuff, palm and fingers: 0.33 ± 0.02		Sanitary: -Protection against biological risks -Handling of cytostatics General Industry Cleaning Laboratories
Nitrile		**AachenFortis** Protection against high risk practices. AQL: 1.0	prolonged use (5-6h)			Lenght: 245 ± 10 Grosor: Cuff: 0.11±0.02 Palm: 0.12±0.02 Fingers: 0.15±0.02		Sanitary: -Protection against biological risks -Handling of cytostatics General Industry Food Industry Cleaning Laboratories Automotive industry
Latex		**AachenClean** Protection against high risk practices. AQL: 1.0	prolonged use (5-6h)			Lenght: 300 ± 5 Grosor: Cuff: 0.20±0.02 Palm: 0.28±0.02 Fingers: 0.25±0.02		Sanitary: -Protection against biological risks -Handling of cytostatics General Industry Cleaning Laboratories



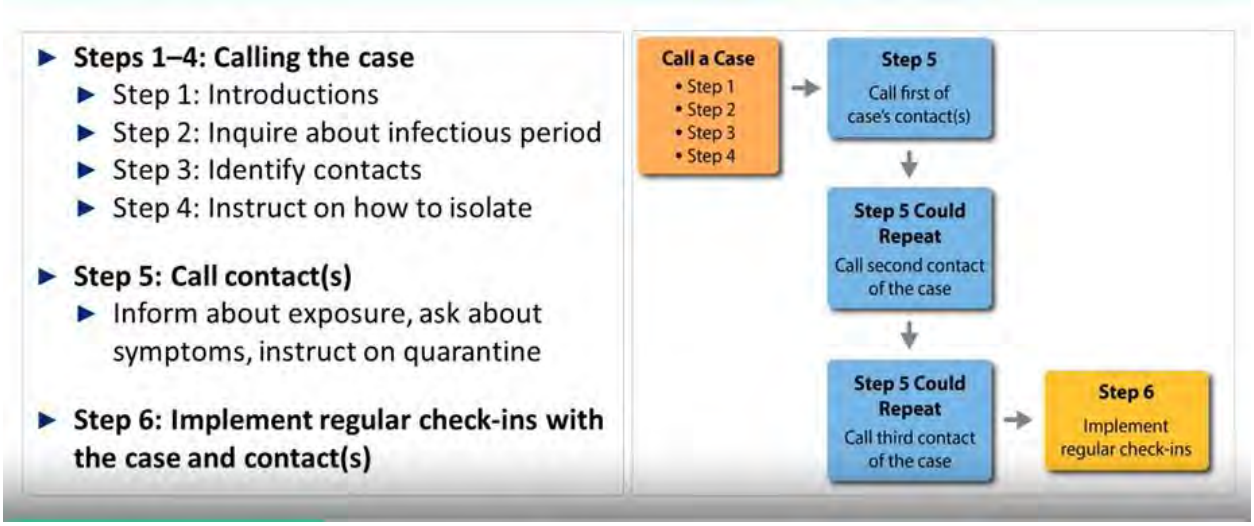
Attachment D: Eye Protection





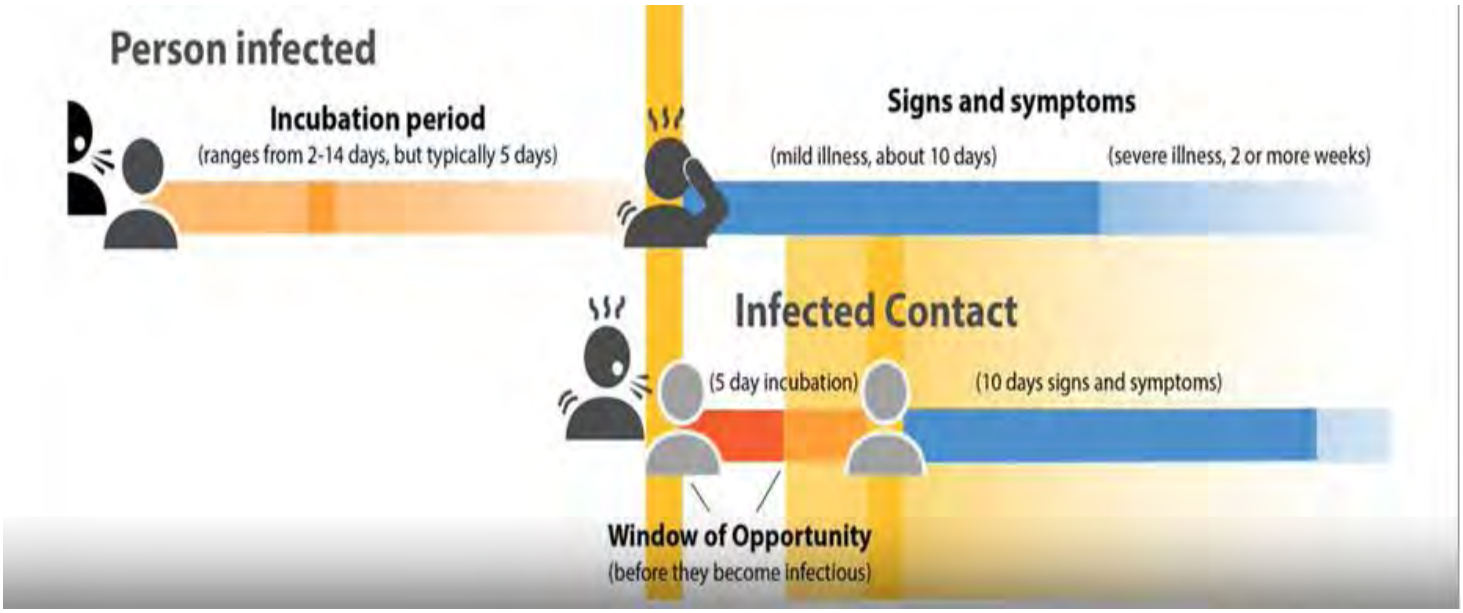
Attachment E: COVID-19 Contact Tracing Guidelines





Cited: John Hopkins University

Attachment F: Timeline of Infection



Cited: John Hopkins University

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
Response to Staff's Second Data Request

Date of Second Data Request: August 11, 2021

Data Request:

2-6) Will the Applicant be able to identify the primary and alternate turbine locations prior to a Commission decision in this docket? Please explain.

Responses:

Yes. ENGIE should have an idea of the final array toward the end of the docket after more advanced engineering is completed. Please note, Hyde County requested and ENGIE agreed to eliminating wind turbine number 47 from the proposed array.

Response Prepared by:

Casey Willis

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
Response to Staff's Second Data Request

Date of Second Data Request: August 11, 2021

Data Request:

2-7) Pursuant to SDCL 49-32-3.1, has the Applicant conducted a planning meeting with the local telecommunications company to discuss the proposed facilities? Please summarize the meeting.

Responses:

A meeting is unlikely to take place prior to the evidentiary hearing. Please note that Engie has identified all utilities in proximity to the project area as we are consulting with these entities on crossing requirements and agreements associated with the Project. Engie will comply with the requirements as outlined in SDCL 49-32-3.1.

Response Prepared by:

Casey Willis

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
Response to Staff's Second Data Request

Date of Second Data Request: August 11, 2021

Data Request:

2-8) Is the Applicant willing to coordinate with agricultural spray applicators by shutting down turbines as needed to facilitate safe and effective spray operation and application? Please explain.

Responses:

Spray applicators generally operate when wind speeds are below 10 miles per hour to limit drift onto adjacent properties. Wind projects generally don't operate at wind speeds when spray application is likely to occur. What occurs in practice is that the wind operators and the spray applicators coordinate on a mutually agreeable timeframe for when the spray applications can occur. This is beneficial to both parties as it gives the spray applicator certainty that turbines in proximity will not be operating and that there's not a loss of production at the wind project. This is done through meteorological forecasting of expected wind conditions to confirm a future window of opportunity a few days in advance.

ENGIE will consider and endeavor to grant requests for coordinated short term turbine shutdowns made by aerial applicators if the requests are made timely and with enough specificity to provide continuity of windfarm output and safety for all involved.

Response Prepared by:

Casey Willis

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
Response to Staff's Second Data Request

Date of Second Data Request: August 11, 2021

Data Request:

2-9) Referring to section 11.5 of the Application, please specify what are "acceptable ranges for avoiding nuisance and/or health hazards" for shadow flicker. Further, please provide support for any ranges.

Responses:

The Project will comply with the Hyde County Zoning Ordinance Section 9-104-A-20 which establishes the following requirements:

> ***SECTION 9-104 -A-20. Flicker Analysis*** *A Flicker Analysis shall include the duration and location of flicker potential for all receptors and road ways within a one (1) mile radius of each turbine within a project. The applicant shall provide a site map identifying the locations of shadow flicker that may be caused by the project and the expected durations of the flicker at these locations from sun-rise to sun-set over the course of a year. The analysis shall account for topography but not for obstacles such as accessory structures and trees. Flicker at any receptor shall not exceed thirty (30) hours per year within an established dwelling and forty (40) hours per year from any occupied structure.*

This ordinance is consistent with the general wind energy industry precedent to limit shadow flicker impact to 30 hours per year at any occupied residence not participating in the project. Due to the significant growth of the wind energy industry in recent years, some states have published model bylaws for local governments to adopt or modify at their own discretion which may include guidance and recommendations for shadow flicker levels and mitigation. These model bylaws are generally consistent with the precedent has been established in the industry in the United States that fewer than 30 hours per year of shadow flicker impacts is acceptable to sensitive receptors in terms of nuisance.

The following are samples of the organizations and governmental agencies that have researched shadow flicker nuisance and health hazards.

1. Massachusetts Department of Environmental Protection
    - **Wind Turbine Health Impact Study: Report of Independent Expert Panel (2012)** https://www.mass.gov/doc/wind-turbine-health-impact-study-report-of-independent-expert-panel/download
    - "Similar to Maine, several states in the US have adopted the German model of 30 hours per year of allowed shadow flicker that was primarily based on the government-sponsored study summarized above. However, other states or localities including Hutchinson, Minnesota have enacted stricter guidelines including no shadow flicker to be allowed at an existing residential structure, and up to 30 hours per year of shadow

flicker allowed on roadways or residentially zoned properties and a computer analysis is required for project approval (NEWEEP, 2011)."

2. University of Manchester School of Earth, Atmospheric and Environmental Sciences
    - **Potential of wind turbines to elicit seizures under various meteorological conditions (2010)**
      https://onlinelibrary.wiley.com/doi/pdf/10.1111/j.1528-1167.2009.02402.x
    - "However, for the 2MW example, with 40 m blades, a wind speed of 20 m/s is required before the flicker frequency reaches 1 Hz, which is close to the typical storm protection shutdown speed of 25 m/s (BWEA 2005). Turbines of this size, therefore, rotate slower than 3 Hz, the lower frequency threshold at which seizures are a potential risk."
    - For comparison, strobe lights used in discos have frequencies that range from about 3 Hz to 10 Hz (1 Hz = one flash per second). The proposed Project's wind turbine blade pass frequency is approximately 0.79 Hz (less than one alternation per second).

3. National Health and Medical Research Council of the Australian Government
    - **Wind Turbines and Health, A Rapid Review of the Evidence (2010)**
      http://canada.wpd.de/fileadmin/pdfs/Australian_National_Health_and_Medical_Research_Council_-__evidence_review__wind_turbines_and_health.pdf
    - "As such it is recommended that to circumvent potential health effects of shadow flicker wind turbines should only be installed if flicker frequency remains below 2.5 Hz under all conditions (Harding, Harding & Wilkins, 2008)."

4. Oregon Health Authority
    - **Strategic Health Impact Assessment on Wind Energy Development in Oregon (2013)**
      https://www.pewtrusts.org/~/media/Assets/2013/03/01/Oregon-Wind-HIA_Final.pdf
    - "Shadow flicker from wind turbines in Oregon is unlikely to cause adverse health impacts in the general population. The low flicker rate from wind turbines is unlikely to trigger seizures in people with photosensitive epilepsy. Further, the available evidence suggests that very few individuals will be annoyed by the low flicker frequencies expected from most modern wind turbines [30, 31, 34]."

5. Wisconsin Wind Siting Council
    - **Wind Turbine Siting-Health Review and Wind Siting Policy Update (2014)**
      https://psc.wi.gov/SiteAssets/windSitingReport2014.pdf
    - "The [National Association of Regulatory Utility Commissioners] report has similar recommendations to those put forward by states, and suggests shadow flicker limits of less than or equal to 30 hours of exposure per year ...[87]"

Response Prepared by:
Ted Guertin/Tetra Tech

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
Response to Staff's Second Data Request

Date of Second Data Request: August 11, 2021

Data Request:

2-10) When does North Bend expect to receive the FAA Determination for the array currently under review?

Responses:

The FAA has approved a prior filing associated with North Bend and issued determinations of no hazard. We would expect the current filing to be processed and determined before the end of the year.

Response Prepared by:

Casey Willis

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
Response to Staff's Second Data Request

Date of Second Data Request: August 11, 2021

Data Request:

2-11) Referring to section 16.4.3.1 of the Application, please explain what transmission facility is included in North Bend's Application in order to trigger the road bond requirement in SDCL 49-41B-38.

Responses:

Section 16.4.3.1 of the Application states: "*The cost estimate to repair roads back to pre-construction conditions will be completed as part of final engineering and will depend on the plans for road upgrades as well as the turbine delivery plan. North Bend Wind will enter road agreements with Hughes and Hyde counties and the impacted townships prior to construction and are expected to provide detailed engineering and financial security. Pursuant to SDCL 49-41B-38, North Bend Wind will furnish an indemnity bond to secure the restoration and repair of roads after construction*". North Bend requests that this statement be removed as it is not applicable to the Project. The Project includes an up to 500-foot transmission line that will connect the collection substation to the adjacent interconnection switching station. This does not meet the definition of a transmission line per SDCL 49-41B-2.1.

Section 16.4.3.1 should be revised as follows: "*The cost estimate to repair roads back to pre-construction conditions will be completed as part of final engineering and will depend on the plans for road upgrades as well as the turbine delivery plan. North Bend Wind will enter road agreements with Hughes and Hyde counties and the impacted townships prior to construction and are expected to provide detailed engineering and financial security."*

Response Prepared by:

Manuela Elizondo/Tetra Tech

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
Response to Staff's Second Data Request

Date of Second Data Request: August 11, 2021

Data Request:

2-12) Referring to table 17-2, is the expected employment specific to North Bend, or, does the table display the number of works that both North Bend and Triple H, combined, will employ?

Responses:

During operation, the Project will employ approximately 8 to 10 full-time personnel as facility managers, site managers and turbine technicians (Table 17-2). These numbers would be in addition to the recently constructed Triple H Wind Project which will employ 15-16 full-time personnel. There are currently a couple of open positions that we are trying to fill at Triple H.

Response Prepared by:

Casey Willis

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
Response to Staff's Second Data Request

Date of Second Data Request: August 11, 2021

Data Request:

2-13) Referring to section 20.1 of the Application, what PPA's have been executed by the Project?

Responses:

Power purchase agreements (PPAs) have yet to be executed for the Project.

Response Prepared by:

Casey Willis

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
Response to Staff's Third Data Request

Date of Third Data Request: August 30, 2021

Data Request:

3-1) Refer to the comment sent by Ms. Judi Bollweg to the Commission on August 10, 2021: https://puc.sd.gov/commission/dockets/electric/2021/EL21-018/comments/JBollwegAttach.pdf.

a) Ms. Bollweg states "in Section 2.2 Project Area, Engie touts how there is sufficient participation within all sections listed in the legal descriptions… The fact is the entire sections of 3, 4, and 9 in Webster Township 111-74 are not part of the project ..." Does Table 4.1 of the Application need to be corrected as Ms. Bollweg asserts? Please explain.

b) Ms. Bollweg states that a crane path is proposed on land that she owns (SW ¼ Section 11 – 111-74). Is this accurate? Please clarify.

c) Ms. Bollweg states that "in the event the crane path travels on any section lines that border their property, there better be an impartial survey completed to determine the middle of the section line."

i. Does the Company use section lines for crane paths?

ii. If the Company uses a section line road that borders Ms. Bollweg's property for a crane path, what actions or permits does the North Bend Wind Project, LLC need to take to ensure compliance with all laws and regulations? Please explain.

Responses:

a) Ms. Bollweg is referencing the Hughes County Conditional Use Permit (CUP) application submitted in June 2021. The table included in the CUP and Table 4.1 of the Facility Permit Application depict the counties, townships, sections, and ranges within the Project Area and does not indicate Project participation. The Project Area encompasses approximately 46,931 acres and is used to describe an area of land that ENGIE engaged for potential development and includes various sections due to their geographic location and ongoing negotiations at the time of configuration. In addition, the CUP section Ms. Bollweg highlights includes a statement indicating that the locations noted in the CUP's table do not imply all landowners within each section have signed an agreement to participate in the Project.

Ms. Bollweg references sections of 3, 4, and 9 in Webster Township 111-74. While they are included in the overall Project Area, no infrastructure is proposed on these sections of land. Project infrastructure has only been sited on land with landowner agreements. Figure 2 of the Facility Permit Application shows this larger Project Area as it compares to the preliminary Project layout.

Table 4-1 of the Facility Permit Application does not require updates as sections of 3, 4, and 9 in Webster Township 111-74 were included as part of the Project Area due to their geographic location and proximity to other participating sections.

b) Final engineering for the project has not been completed. When final engineering is completed for the project, the infrastructure proposed or even temporary impacts such as the use of crane walk paths, will not access the parcels noted by Ms. Bollweg or any non-participating property for that matter.

c) Please see response below. Additional details regarding crane paths can be found in Section 4.2.3 of the Facility Permit Application.

I. ENGIE generally tries to avoid walking cranes on section lines as that would likely require the removal of fencing. Crane walk paths are typically selected adjacent to a section line to avoid the need to remove and then replace fencing.

II. In conjunction with final engineering, the final proposed disturbance areas will factor in surveyed property ownership boundaries in order to ensure that disturbance only occurs on parcels where easements have been signed.

Response Prepared by:
Casey Willis

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
Response to Staff's Third Data Request

Date of Third Data Request: August 30, 2021

Data Request:

3-2) Refer to the comment sent by Mr. Michael Bollweg to the Commission on August 12, 2021: https://puc.sd.gov/commission/dockets/electric/2021/EL21-018/Comments/MBollweg.pdf. Mr. Bollweg states that the proposed placement of turbines near his two quarters of land, SW ¼ Section 11 –111-74 and NE ¼ Section 10 – 111-74, eliminates the ability to safely and effectively apply crop protection products via aerial application from any direction.

a) Does the Company agree that aerial applicators cannot safely fly Mr. Bollweg's two quarters of land with the proposed placement of turbines? If no, please explain how aerial application can be safely completed with the proposed turbine placements.
b) Please refer to the comment from Mike Bollweg, retired aerial applicator pilot filed on August 9, 2021: https://puc.sd.gov/commission/dockets/electric/2021/EL21-018/comments/BollwegAttach.pdf. Please explain how the concerns raised by Mike Bollweg are addressed or are not a concern with the proposed placement of turbines.
c) Does the Company know of any local aerial applicators who have reviewed the proposed turbine placements and are willing to spray Mr. Bollweg's property? If yes, please provide. If no, is the Company willing to research the issue and provide Mr. Bollweg with some aerial applicator contacts that would be willing to fly his property with the proposed turbine placements?

Responses:

This issue is not unique to this area or South Dakota overall. There are over 60,000 wind turbines currently operating in the United States with a substantial number of those being operated within crop land. Aerial application of the crop lands can still occur with participating property owners that have turbines and with non-participating landowners in proximity. ENGIE operates over 2,000 megawatts of wind projects in the United States. Our operations in various States follow closely to the coordination protocol with aerial applicators as laid out in our response to data request 2-8. Utilizing this coordination allows for the continued safe aerial application of herbicides, etc that are necessary for crops that are participating in the property as well as adjacent to the projects.

ENGIE reached out to a participating property owner of the North Bend Wind Project that currently utilizes an aerial applicator to spray fields located in NW/4 of Section 14, Township 11N, R074W. This property is adjacent or close to the properties referenced in the letter noted. Proposed wind turbine number 22 is presently proposed on this parcel. It was conveyed to ENGIE that while it may take a few

additional passes to complete the spray application, it would still be accomplished on this property with the turbine installed. This landowner also tenant farms a property within the Triple H Wind Project that has a turbine installed in NW/4 of Section 21 T111N, R073W who utilizes the same aerial spray applicator on this property with the turbine installed. We would suggest that Mr. Bollweg reach out to Barber's aerial application out of Onida.

ENGIE has also spoken with spoken with a participating landowner in the Triple H Wind Project that is also an aerial applicator. Doug Kroeplin has approximately 17 wind turbine generators on his property. Similar to the feedback noted above, Mr. Kroeplin has indicated that he intends to spray all of the land he farms on his property in full. We would suggest that Mr. Bollweg reach out to Mr. Kroeplin as well.

Response Prepared by:
Casey Willis

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
Response to Staff's Third Data Request

Date of Third Data Request: August 30, 2021

Data Request:

3-3) Refer to the comment sent by Mr. Paul Knox to the Commission on August 12, 2021: https://puc.sd.gov/commission/dockets/electric/2021/EL21-018/comments/Knox.pdf.

a) Please explain how the Company will avoid or mitigate the impacts to cultural resources (such as "tipi rings, markers and burial grounds") identified by Mr. Knox.
b) Mr. Knox indicates that there have been "documented whooping crane sightings in this foot print." How has the Applicant used documented whooping crane sightings in the planning and development of this wind facility?
c) Has North Bend developed a monitoring plan for whooping cranes per the USFWS's February 24, 2021 letter to WAPA? If yes, please provide a copy of the plan. If no, please explain how North Bend intends to address the USFWS's comment regarding whooping cranes.

Responses:

The comments provided by Mr. Knox were previously provided through the WAPA's NEPA scoping process. These comments were forwarded to our archaeological consultant, Beaver Creek Archaeology to evaluate in the field in the event that the locations are near where there would be proposed disturbance associated with the North Bend layout. All eligible sites identified through the surveys being completed by Beaver Creek Archaeology will be avoided completely.

The project is located within the Whooping Crane migratory corridor. There are known stopover locations that periodically occur during the spring and fall migration within the 200 mile migratory corridor, which includes the North Bend area. North Bend intends to implement a shutdown provision in the Bird and Bat Conservation Plan in the event one or more Whooping Cranes stopover within 1 mile of a turbine location. All turbines within 2 mile of the documented stopover will be shut down until the individual(s) move on from the area. The operational considerations are identical to those currently being implemented at the adjacent Triple H Wind Project.

A bird and bat conservation strategy is currently being prepared pursuant to the USFWS wind energy guidelines for the North Bend. Amongst other matters addressed in the BBCS, the monitoring plan will involve training onsite personnel to identify whooping cranes such if they are observed within 2 miles of a turbine(s), those turbines can be temporarily shutdown until the bird or birds has left the area.

- Develop and implement a site-specific worker training plan throughout the operational life of the Project to inform workers of the biological resources present on-site. This training will include whooping crane identification and turbine curtailment procedures to shut down turbines in the event a whooping crane is observed within two mi (3.2 km) of a turbine. All employees and contractors working in the field will be required to participate in the plan prior to working on site

Response Prepared by:
Casey Willis

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
Response to Staff's Third Data Request

Date of Third Data Request: August 30, 2021

Data Request:

3-4) On Page 1-1 of the Application, the Applicant states "the total installed capacity of the wind energy facility will not exceed 200 megawatts (MW) and will include the construction of up to 71 wind turbine generators (turbines)." On Page 5 of the Direct Testimony of Casey Willis, lines 37 – 38, he states "the total installed capacity of the Project is proposed to be 200.22 megawatts (MW)." Please clarify the size of the wind facility the Applicant is requesting.

Responses:

200 MW references the size of the interconnection queue position. The actual nameplate capacity of the facility is proposed to be 200.22 MW based on the use of 71 2.82 MW wind turbines. Electrical line losses would reduce the actual generation such that the generation at the POI would not exceed the 200 MW queue position allowance.

Response Prepared by:

Casey Willis

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
Response to Staff's Third Data Request

Date of Third Data Request: August 30, 2021

Data Request:

3-5) On the cover page of Mr. Casey Willis' testimony, it appears that Engie North America, Inc. submitted the Application rather than North Bend Wind Project, LLC. Please clarify whether the Applicant is North Bend Wind Project, LLC or Engie North America, Inc.

Responses:

The permit application was submitted on behalf of North Bend Wind Project, LLC. I am directly employed by Engie North America, not the project company (North Bend Wind Project, LLC).

Response Prepared by:

Casey Willis

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
Response to Staff's Third Data Request

Date of Third Data Request: August 30, 2021

Data Request:

3-6) Refer to the Direct Testimony of Casey Willis, lines 79 – 82. Mr. Willis state "the Project is expected to employ approximately 400 temporary construction workers, with an average of 130 people working onsite at any one point to support Project construction. It is likely that general skilled labor is available in the surrounding counties or the state to serve the basic infrastructure and site development needs of the Project."

a) Please provide a description of the "general skilled labor" positions that the Applicant intends to hire from the local community.
b) For the Triple H facility that Engie recently constructed in the local area, which positions was Engie able to hire local residents and which positions did Engie hire people from outside the local community? For the positions hired outside the local community, were local residents given an opportunity to apply for those positions? Please explain.

Responses:

Attached are the general laborer and skilled laborer job descriptions that would be used by Wanzek.

For the Triple H Wind Project, all open positions for ENGIE were advertised on multiple job hunting websites, ENGIE's website, South Dakota University job placement boards and via word of mouth locally. There were quite a few local individuals that applied for open positions, but one of the limiting factors was a lack of high voltage experience. Roughly 50% of the positions were hired based on applicants from the area.

Response Prepared by:

Casey Willis

WANZEK
a MasTec company

JOB DESCRIPTION

Job Title: Skilled Laborer – Turbine	**Department:** Construction Teams
Reports To: Leadman/Foreman/Superintendent	**Location:** Field
FLSA Status: Non-exempt	**Pay Grade:** 14
Approved By: Director of Operations	**Approved Date:** 5/1/15

POSITION SUMMARY:
Responsible for assisting other craft workers in the assembly, mechanical completion, repair, maintenance and QC of Wind Turbines. In addition, SKL-Ts may be assigned other tasks as needed during construction of wind projects including any foundation, offload or erection activities.

ESSENTIAL JOB FUNCTIONS:

- Promote and comply with all Company and safety policies and procedures
- Complete all required Safety documentation
- Climb wind turbines daily and perform activities required to assemble and mechanically complete wind turbines
- Uses taglines to control suspended loads during assembly of wind turbine components
- Bolts, nails, aligns, screws, torques, tensions parts associated with wind turbine construction
- Signal operators of construction equipment to facilitate alignment, movement and adjustment of machinery to load, offload, push and pull
- Level earth to fine grade specifications using shovel or other hand tool
- Mix concrete or grout using portable mixer
- Smooth and finish freshly poured concrete using float, trowel or screed
- Position, join, align and connect pumps, motors and other mechanical or metal parts inside a wind turbine
- Mop, brush or spread paints or bituminous compounds over surfaces for protection
- Spray materials such as water, sand, steam, vinyl, paint or stucco through hose to clean, coat or seal surfaces
- Apply caulking compounds by hand or with caulking gun to seal crevices
- Grind, sand or polish surfaces such as concrete and steel, using abrasive tools or machines
- Perform tasks involving use of hands and tools such as torqueing/tensioning bolts and studs, assembling metal parts, building bolt cages, vibrating concrete, sawing lumber, dismantling forms, removing forms from concrete, and demolitions, cleanup, use of jackhammers, etc.
- May be required to travel to different jobsites on limited notice
- Maintain a professional appearance
- Other Duties as assigned

EDUCATION AND WORK EXPERIENCE REQUIREMENTS:

- High school diploma or general education degree (GED
- One to three years of experience in construction and/or equivalent combination of training a and experience
- Training and Certifications:
    - Tower Rescue Training
    - Wanzek Climb training
    - LOTO
    - Tool Drop
    - Confined Space
-

KNOWLEDGE, SKILLS, AND ABILITIES REQUIRED:

- Take reasonable care of your own and others' health and safety and of those who may be affected by the day-to-day delivery of this role by taking personal responsibility for working toward Wanzek's Zero Injury principles

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- Read and interpret documents such as safety rules, operating and maintenance instructions, and procedure manuals
- Add and subtract two-digit numbers and multiply and divide with 10's and 100's; ability to perform these operations using units, weight measurement and volume
- Ability to understand units of force, pressure and torque and apply appropriate tooling adjustments for each
- Common sense understanding to carry out instructions furnished in written or oral form

Physical Demands and Work Environment – ALL CRAFT POSITIONS

WORK ENVIRONMENT

- Regularly exposed to outside weather conditions
- Frequently exposed to moving mechanical parts; high, precarious places; and extreme heat
- Occasionally exposed to fumes or airborne particles and vibration
- Noise level in the work environment is usually loud

PHYSICAL DEMANDS

- Reasonable accommodations may be made to enable individuals with disabilities to perform the essential functions

Key: Duration of Activity **O**ccasionally=0-32% shift; **F**requently=33-65% shift; **C**ontinually=66-100% of shift.
Weight/Load: **V**ery**L**ight=10# max; **L**ight=20# max; **M**edium=40# max; **H**eavy=75# max; **V**ery**H**eavy=over 75#
Check all that apply:

Activity *describe if needed*	**Frequency**
Sitting	☒O ☐F ☐C
Standing	☐O ☐F ☒C
Walking	☐O ☐F ☒C
Stair Climbing	☐O ☐F ☒C
Climb	☐O ☐F ☒C
Twisting at Waist	☐O ☐F ☒C
Strength	
Forceful grip >10#	☐O ☐F ☒C
Forceful grip >20#	☐O ☐F ☒C
Pinch light grip	☐O ☐F ☒C
Static Motions/Prolonged	
Static holding of arms out	☒O ☐F ☐C
Static awkward position of arm	☐O ☒F ☐C
Sustained elbow bending	☐O ☒F ☐C
Stand in place	☐O ☒F ☐C
Bend over bench	☒O ☐F ☐C
Sit at desk	☒O ☐F ☐C
Other:	☐O ☐F ☐C

Activity *describe if needed*	**Frequency**
Crawl	☒O ☐F ☐C
Squat	☐O ☐F ☒C
Kneel	☐O ☐F ☒C
Stoop	☐O ☒F ☐C
Crouch	☐O ☒F ☐C
Overhead Reach	☐O ☒F ☐C
Repetitive Motion	
Keying, data entry	☒O ☐F ☐C
Wrist motion	☐O ☒F ☐C
Forearm turning	☐O ☒F ☐C
Reach above shoulder	☐O ☒F ☐C
Reach behind body	☐O ☒F ☐C
Pinching with fingers	☐O ☒F ☐C
Environment	
Heat >75F	☐O ☐F ☒C
Cold <50F	☐O ☒F ☐C
Exposure to vibration	☐O ☒F ☐C
Other(mechanical moving parts, high places up to 320 feet, fumes, airborne particles, chemicals)	☐O ☐F ☒C

Weight/Load Activities

Activity (start-stop height)	**Frequency**	**Weight/Load**
Floor to Knuckle	☐O ☐F ☒C	☐VL ☐L ☐M ☒H ☐VH
Knuckle to Shoulder	☐O ☐F ☒C	☐VL ☐L ☐M ☒H ☐VH
Shoulder to Overhead	☐O ☒F ☐C	☐VL ☐L ☒M ☐H ☐VH
Carry	☐O ☐F ☒C	☐VL ☐L ☐M ☒H ☐VH
Push	☐O ☒F ☐C	☐VL ☐L ☒M ☐H ☐VH
Pull	☐O ☒F ☐C	☐VL ☐L ☒M ☐H ☐VH
Other:	☐O ☐F ☐C	☐VL ☐L ☐M ☐H ☐VH

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JOB DESCRIPTION

Job Title: Laborer-T	**Department:**
Reports To: Foreman/Superintendent	**Location:** Field
FLSA Status: Non-Exempt	**Pay Grade:** 12
Approved By: Director of Operations	**Approved Date:**

POSITION SUMMARY:
Responsible for performing tasks involving physical labor at wind turbine construction sites. Operating hand and power tools of all types. Cleaning, preparing sites, and assisting other craft workers.

ESSENTIAL JOB FUNCTIONS:
- Promote and comply with all Company and safety policies and procedures
- Complete all required Safety documentation
- Climb wind turbines and perform activities required to assist in assembly, mechanical completion and cleaning of turbines.
- Lift, carry and hold building materials, tools and supplies
- Clean tools, equipment, materials and work areas
- Move trucks and equipment between work areas
- Spend time on one job or may be transferred from task to task as the project progresses to completion
- May be required to travel to different jobsites on limited notice
- Maintain an appropriate appearance
- Other duties as assigned by Foreman or Superintendent

EDUCATION AND WORK EXPERIENCE REQUIREMENTS:
- High school diploma or general education degree (GED) or one to three months related experience and/or training or equivalent combination of education and experience preferred
- Wanzek Climb Training- Wanzek Fall Protection
- LOTO
- Tool Raising and Lowering

KNOWLEDGE, SKILLS, AND ABILITIES REQUIRED:
- Take reasonable care of your own and others' health and safety and of those who may be affected by the day-to-day delivery of this role by taking personal responsibility for working toward Wanzek's Zero Injury principles
- Read and interpret documents such as safety rules, operating and maintenance instructions and procedure manuals
- Add and subtract two-digit numbers and multiply and divide with 10's and 100's ability to perform these operations using units weight measurement and volume
- Apply common sense understanding to carry out instructions furnished in written or oral form
- Be able to work within precise standards of accuracy and follow set procedures and standards

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a MasTec company

Physical Demands and Work Environment – ALL CRAFT POSITIONS

WORK ENVIRONMENT

- Regularly exposed to outside weather conditions
- Frequently exposed to moving mechanical parts; high, precarious places; and extreme heat
- Occasionally exposed to fumes or airborne particles and vibration
- Noise level in the work environment is usually loud

PHYSICAL DEMANDS

- Reasonable accommodations may be made to enable individuals with disabilities to perform the essential functions

Key: Duration of Activity **O**ccasionally=0-32% shift; **F**requently=33-65% shift; **C**ontinually=66-100% of shift.
Weight/Load: **V**ery**L**ight=10# max; **L**ight=20# max; **M**edium=40# max; **H**eavy=75# max; **V**ery**H**eavy=over 75#

Check all that apply:

Activity *describe if needed*	**Frequency**
Sitting	☒O ☐F ☐C
Standing	☐O ☐F ☒C
Walking	☐O ☐F ☒C
Stair Climbing	☐O ☐F ☒C
Climb	☐O ☐F ☒C
Twisting at Waist	☐O ☐F ☒C
Strength	
Forceful grip >10#	☐O ☐F ☒C
Forceful grip >20#	☐O ☐F ☒C
Pinch light grip	☐O ☐F ☒C
Static Motions/Prolonged	
Static holding of arms out	☒O ☐F ☐C
Static awkward position of arm	☐O ☒F ☐C
Sustained elbow bending	☐O ☒F ☐C
Stand in place	☐O ☒F ☐C
Bend over bench	☒O ☐F ☐C
Sit at desk	☒O ☐F ☐C
Other:	☐O ☐F ☐C

Activity *describe if needed*	**Frequency**
Crawl	☒O ☐F ☐C
Squat	☐O ☐F ☒C
Kneel	☐O ☐F ☒C
Stoop	☐O ☒F ☐C
Crouch	☐O ☒F ☐C
Overhead Reach	☐O ☒F ☐C
Repetitive Motion	
Keying, data entry	☒O ☐F ☐C
Wrist motion	☐O ☒F ☐C
Forearm turning	☐O ☒F ☐C
Reach above shoulder	☐O ☒F ☐C
Reach behind body	☐O ☒F ☐C
Pinching with fingers	☐O ☒F ☐C
Environment	
Heat >75F	☐O ☐F ☒C
Cold <50F	☐O ☒F ☐C
Exposure to vibration	☐O ☒F ☐C
Other(mechanical moving parts, high places up to 320 feet, fumes, airborne particles, chemicals)	☐O ☐F ☒C

Weight/Load Activities

Activity (start-stop height)	**Frequency**	**Weight/Load**
Floor to Knuckle	☐O ☐F ☒C	☐VL ☐L ☐M ☒H ☐VH
Knuckle to Shoulder	☐O ☐F ☒C	☐VL ☐L ☐M ☒H ☐VH
Shoulder to Overhead	☐O ☒F ☐C	☐VL ☐L ☒M ☐H ☐VH
Carry	☐O ☐F ☒C	☐VL ☐L ☐M ☒H ☐VH
Push	☐O ☒F ☐C	☐VL ☐L ☒M ☐H ☐VH
Pull	☐O ☒F ☐C	☐VL ☐L ☒M ☐H ☐VH
Other:	☐O ☐F ☐C	☐VL ☐L ☐M ☐H ☐VH

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South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
Response to Staff's Third Data Request

Date of Third Data Request: August 30, 2021

Data Request:

3-7) Referring to lines 111-113 of Mr. Willis' pre-filed direct testimony, please explain what the Restoration Fund is and the funding requirements, including the amount of funding, that North Bend committed to in the easements.

Responses:

The easements for the North Bend Wind Project include a provision to create a restoration fund after operation. The exact language from the easement is noted below. This easement was drafted to create assurances for the landowners of a funding mechanism to decommission and remove the project after the life of the project for the benefit of the landowners. This provision is included in all of our easements and is designed to address end of life issues in States that currently do not require decommissioning plans, bonding, etc.

As noted in the provision below, the restoration fund is not required to be created in the event that a governmental authority requires to Developer to provide a security for decommissioning. The reason for that is that a condition by a governmental agency would unnecessarily duplicate the intent of the creation of the restoration fund. As the South Dakota Public Utilities Commission will require a decommissioning plan and restoration fund be created in the event that the Project is approved, the restoration fund spelled out in Engie's easement would not be created in parallel.

17.3 Restoration Fund. Upon the commencement of the eleventh (11th) year of the Operations Period, Developer shall establish a fund ("**Restoration Fund**") at a federally chartered bank to secure the obligations of Developer under Section 17.2. Upon written request by Owner, Developer shall provide to Owner contact and account information for said federally chartered bank. Developer shall contribute the estimated cost of meeting Developer's restoration obligations for each of the properties in the Project in which Owner's Property is a part, including the obligations to Owner set forth in Section 17.2, net of any estimated salvage value of Developer's equipment, facilities and Improvements located on each of the Project properties in which Owner's Property is a part ("**Net Restoration Amount**"); provided that the Net Restoration Amount shall be re-set every seven (7) years after it is initially set, based on new estimates of the cost of removal and salvage value of Developer's equipment, facilities and Improvements located on the Project properties in which Owner's Property is a part. Notwithstanding anything to the contrary, Developer shall have no obligation to establish or maintain the Restoration Fund if (i) Developer is a regulated public utility, (ii) Developer has a senior unsecured and uncredit-enhanced long term debt rating from Standard & Poor's of at least BBB- (or its equivalent) or from Moody's of at least Baa 3 (or its equivalent), or (iii) a governmental authority requires Developer to provide security for removal or decommissioning of the WTGs on the properties in the Project in which Owner's Property is a part. If Developer fails to complete its restoration obligations pursuant to Section 17.2, Owner shall have the right to demand payment of such amounts in the Restoration Fund for the purpose of performing such restoration obligations itself.

Response Prepared by:
Casey Willis

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
Response to Staff's Third Data Request

Date of Third Data Request: August 30, 2021

Data Request:

3-8) Refer to the Direct Testimony of Mr. Martin Piorkowski, lines 45 – 47. Mr. Piorkowski states "North Bend is working with SDGFP to explore ideas to support ongoing conservation initiatives for grasslands given the layout cannot completely avoid grassland areas found within the Project Area." Please elaborate on the ideas being explored to support ongoing conservation initiatives for grasslands. In addition, what is the timeline for North Bend to make a firm commitment on a conservation measure?

Responses:

Within the Upper Great Plains, a region rich in grasslands, agriculture, and wind resources, grassland birds have received growing concern due to long-term population declines. Based on various peer-reviewed and published study results from the last decade on potential displacement of grassland birds from turbines, state and federal agencies have recommended a hierarchical approach to turbine placement starting with avoiding grasslands. If avoidance is not possible, recommendations are to place turbines in adjacent, disturbed lands (e.g., croplands) or move turbines to the edge of a grassland to minimize disturbance to those grasslands and specifically grassland breeding birds. However, information on the effectiveness of this strategy is lacking. It is possible that grassland birds may respond differently to various wind energy facilities located across a variable landscape.

On July 16, 2021, SDGFP wrote a letter of support to assist North Bend in the development and publication of a novel research study with North Bend. By partnering with SDGFP, North Bend will help provide crucial data to help quantify the effects of management recommendations being employed by state wildlife agencies and to support SDGFP conservation initiatives for grassland birds. The objectives being explored are as follows: 1) Is there breeding grassland bird displacement within grasslands for turbines placed along the edge of croplands? 2) Does turbine placement in relation to edge and patch size of grasslands have an impact on breeding grassland bird displacement?

Response Prepared by:

Martin Piorkowski, WEST

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
Response to Staff's Third Data Request

Date of Third Data Request: August 30, 2021

Data Request:

3-9) Refer to the Direct Testimony of Mr. Wade Burns, line 45. Mr. Burns anticipates completing the archaeological survey for the project this field season.

a) Has BCA completed the archaeological survey for the project? If no, when does BCA expect completing the survey.
b) When does BCA expect to complete the report for the archaeological survey?
c) Can WAPA complete the Environmental Assessment without the referenced archaeological survey? Please explain.

Responses:

Beaver Creek Archaeology has now completed all of the field work associated with the archaeological surveys. At the present time, BCA is currently waiting for SHPO to assign site numbers for the eligible sites that were identified by BCA in the field. After that is completed the final report will be issued. BCA provided an estimate on September 13th that they are targeting completing the report by September 24th.

WAPA has indicated that they need to have the final report in order to issue the Draft Environmental Assessment for public review.

Response Prepared by:

Casey Willis

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
Response to Staff's Third Data Request

Date of Third Data Request: August 30, 2021

Data Request:

3-10) Please identify if any project facilities will be located on land enrolled in CRP, or any other FSA program.

Responses:

The only FSA program that ENGIE is aware of that has the potential to be present is the CRP program. Land enrolled in CRP is governed by a contract between FSA and the landowner. Because ENGIE is not a party to the agreement, we cannot obtain any copies of the agreement without authorization from the landowner. ENGIE is currently reaching out to FSA to figure out how much land generally speaking is enrolled in CRP within the Project.

From the experience at Triple H, there was very little land enrolled in the FSA CRP program. As of writing this response, I still do not know the exact locations where CRP was present within the Triple H Wind Project boundary or even if the Project actually disturbed land within enrolled in CRP. The reason for that, is that FSA allows for areas of land to be carved out and removed from an existing CRP contract. The evaluation of the acreage removed is done by FSA after the project is completed and then the developer is obligated to pay back the cost of what is removed. ENGIE has not received an evaluation of the removal of acreage from CRP associated with Triple H as of yet. We would expect a very similar process to follow associated with the North Bend Wind Project.

Response Prepared by:

Casey Willis

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
Response to Staff's Fourth Data Request

Date of Fourth Data Request: October 6, 2021

Data Request:

4-1) Provide copies of all data requests submitted to North Bend Wind Project, LLC or by North Bend Wind Project, LLC and copies of all responses provided to those data requests. Provide this information to date and on an ongoing basis.

Responses:

ENGIE staff and counsel representing ENGIE acknowledge and will comply with this request.

Response Prepared by:

Casey Willis

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
Response to Staff's Fourth Data Request

Date of Fourth Data Request: October 6, 2021

Data Request:

4-2) Refer to North Bend Wind Project, LLC's response to staff data request 2-1.

a) Please post the decommissioning plan to the docket.
b) Referring to Page A-4 of the Decommissioning Plan, please provide:
   i. The basis for the $95/ton estimated costs for trucking and landfill fees incurred due to wind turbine blade disposal;
   ii. The basis for a $65/ton cost for trucking scrap to a recycler; and
   iii. The basis for the $216/ton estimate for the scrap value.

Responses:

a) The decommissioning plan was submitted to the docket in conjunction with response.
b) Referring to Page A-4 of the Decommissioning Plan, please provide:
   i. Cost includes $65 per ton trucking, and $30 per ton landfill fee. Cost developed by referencing RS Means published pricing, and estimators experience estimating similar scope. Note that these are bare cost's, and do not include the markups added separately in the estimate.
   ii. Cost developed by referencing RS Means published pricing, and estimators experience estimating similar scope. Note that these are bare cost's, and do not include the markups added separately in the estimate.
   iii. Scrap value sourced from pricing published by Steel Benchmarker, a global pricing system used by the steel industry. www.steelbenchmarker.com

Response Prepared by:
Gary Murdoch and Perry Patton, Tetra Tech

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
Response to Staff's Fourth Data Request

Date of Fourth Data Request: October 6, 2021

Data Request:

4-3) Refer to North Bend Wind Project, LLC's response to staff data requests 1-9 and 2-2. Would North Bend Wind Project, LLC be willing to obtain documentation from Hyde County stating that the proposed layout complies with Hyde County Setback #3 in Table 5-1? Please explain.

Responses:

Enclosed are the meeting minutes from Hyde County's November 2 County Commissioner/Board of Adjustment meeting regarding this topic.

Response Prepared by:

Casey Willis

The Hyde County Board of Adjustment convened at 11:00 a.m. on Tuesday November 2, 2021. Present were Mel Buchheim, Vice Chairman; Ronald VanDenBerg, and Randy Olson. Greg Swenson and Randy Hague were absent. Also present: Carrie Stephenson, Robert Bawdon, and Kevin Baloun. Emily Sovell and Casey Willis present via phone.

Vice Chairman Buchheim called the meeting to order. Motion to approve the agenda by VanDenBerg, seconded by Olson. All in favor, motion carried.

Willis, representing North Bend Wind Project, LLC, explained that the PUC has questions regarding Hyde County's exterior boundary standard as it applies to the PUC permit application. North Bend Wind has been asked for clarity twice by the PUC. Willis explained that, in their opinion, the definition of "exterior boundary" is a little unclear and overlaps with other more conservative County standards, namely setbacks tied to road, section lines, highways, etc. Where the "exterior boundary" setback of 500 feet or 1.1 times the system height seems to come into play is only in the instances where there are property lines that are not on section lines, are not along roads and separating participating from non-participating properties. A very finite number of spots because the majority of these areas are covered by the more conservative standard of 750 feet or 1.4 times the tower height standard. Sovell explained to the Board that they must determine whether the standards being used currently comply with the standards set forth in Hyde County Zoning Ordinance. Sovell joined the meeting in person at 11:10 a.m. Buchheim questioned whether non-participating landowners are given the more conservative setback of 750 vs 500 feet as an exterior boundary. Willis confirmed that is the pre-construction plan. Sovell asked the Board if they were comfortable with the more conservative approach that North Bend Wind is taking with the amount of the setback. Olson asked for confirmation that this was the same approach used with the existing towers in the Triple H Wind Project, LLC. Willis confirmed that the setbacks used were the same as Triple H. Motion by VanDenBerg, second by Olson that the Board of Adjustment has reviewed and discussed the information presented by North Bend Wind Project on behalf of the PUC and that the Board deems the pre-construction layout to be in compliance with the Hyde County Zoning Ordinance. Voting Aye: Olson, VanDenBerg. Voting Naye: Buchheim. Absent and not Voting: Swenson and Hague. Motion carried.

Motion by VanDenBerg, second by Olson, that the Board of Adjustment meeting adjourn at 11:17 a.m. All in favor, motion carried.

Hyde County Board of Adjustment

_____
Mel Buchheim, Vice Chairman

ATTEST:

_____,
Marilyn Ring, Hyde County Auditor

Published once at the total approximate cost of _____.

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
Response to Staff's Fourth Data Request

Date of Fourth Data Request: October 6, 2021

Data Request:

4-4) Refer to North Bend Wind Project, LLC's response to staff data request 2-6. Please explain why Hyde County requested that turbine number 47 be removed from the proposed layout.

Responses:

Several members of a family that own property to the east of this location indicated an interest in building a future residence on their property. They expressed concerns about the proximity of this proposed location to the future location where they intend to build the residence. The County approved the CUP for the North Bend Wind Project, but excluded wind turbine number 47.

Response Prepared by:

Casey Willis

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
Response to Staff's Fourth Data Request

Date of Fourth Data Request: October 6, 2021

Data Request:

4-5) Refer to North Bend Wind Project, LLC's response to staff data request 3-9. Please provide the completed archaeological survey report.

Responses:

Enclosed is a copy of the completed archaeological survey. Consistent with prior commitments, further design and engineering on the layout will incorporate the sites noted from the survey such that 100% avoidance will be incorporated into the layout.

Response Prepared by:

Casey Willis

REDACTED: A Level III Intensive Cultural Resource Inventory and Tribal Cultural Property Survey for the North Bend Wind Project in Hughes and Hyde Counties, South Dakota

By:
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State Lands Permit No.: SP-21-006
BCA Project No.: 2021-1304
September 2021

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Abstract

North Bend Wind Project, LLC (the Proponent) has proposed the construction of the North Bend Wind Project in Hughes and Hyde Counties, South Dakota. Western Area Power Administration (WAPA) is the lead agency on this project due to the interconnection between this project and WAPA's existing Fort Thompson to Oahe 230 kilovolt (kV) transmission line. This project is also subject to the jurisdiction of the South Dakota Public Utilities Commission (PUC). Due to the involvement of WAPA, the proponent must comply with Section 106 of the National Historic Preservation Act (NHPA). The NHPA requires the Proponent and/or applicant to consider what effects the undertaking will have on cultural resources within the Area of Potential Effect (APE). The APE is defined as the combined construction area of all project components, and the survey area encompasses the entire APE and buffer.

The Proponent has contracted Beaver Creek Archaeology, Inc. (BCA) to conduct a Level III cultural resource survey and facilitate a Traditional Cultural Property (TCP) inventory of the proposed North Bend Wind Project. This report details the results of the Level III pedestrian inventory along with the results of the tribal coordination and TCP survey arranged by BCA on behalf of the Proponent for the North Bakken Wind Project.

In an effort to ensure cultural property protections, the Proponent sent BCA a preliminary project plan to check for any potential issue areas. The preliminary field review was completed for the North Bend Wind Project from November 16-19, 2020, and covered approximately 359 acres.

The Level I record search for the preliminary field review revealed one prehistoric site and five architectural sites (including three bridges and two buildings) located within a one-mile radius of the preliminary project area. One of the previously recorded cultural resources (39HU78) was located within the preliminary survey area. Isolated find 39HU78 is documented as a Folsom point fragment originally collected in 1939 on a branch of Chapelle Creek. No cultural material was observed within the cultural resource boundary during the preliminary inventory. During the preliminary pedestrian inventory, 12 new cultural resources were documented and included 10 prehistoric stone feature sites and two historic archaeological sites (further discussed in the report).

Following the completion of the preliminary field review, the Proponent provided an updated layout for the proposed project designed to accommodate site avoidance. The updated project layout was successfully designed to avoid all thirteen cultural resources documented within the preliminary project layout; therefore, no specific avoidance measures are recommended for these sites.

The updated project layout was surveyed between August 3-12, 2021, by BCA archaeologists for the Level III pedestrian inventory and representatives from the Crow Creek Sioux Tribe, the Rosebud Sioux Tribe, and the Yankton Sioux Tribe during the concurrent TCP inventory. Additional areas were surveyed for project reroutes between September 1-3, 2021.

The proposed final project alignment is located primarily on private property, with a portion of the proposed project located on State Trust land. As currently planned, there will be 35 miles of access roads, 68 miles of collection lines, and 78 wind turbine locations, of which 7 are alternate locations. The access roads were inventoried with a 150' corridor width. Each wind turbine location was centered within a 5-acre pad. In total, the survey area consists of approximately 2,034 acres.

The Level I record search for the final project alignment revealed one site and three architectural structures located within a one-mile radius of the final proposed project area; however, none of the previously recorded cultural resources were documented within the revised survey area.

During the 2021 intensive pedestrian survey, 13 new cultural resources were encountered, including 11 prehistoric stone feature sites and two architectural sites (further discussed in the report). Each of the stone feature sites has been recommended as eligible for nomination to the National Register of Historic Places (NRHP) and avoidance measures are recommended. The two architectural sites have been recommended as ineligible for nomination to the NRHP and no specific avoidance measures are recommended.

Additionally, 22 TCPs were identified by tribal representatives during the TCP inventory, including both physical and non-physical surface expressions and an isolated find. (further discussed in the report).

The Proponent has rerouted or moved proposed project elements in order to avoid each stone feature site or TCP by a minimum of 50'. Additionally, BCA recommends placing avoidance fencing along the edge of the survey corridor near each of the stone feature sites and TCPs.

As long as these avoidance recommendations are followed, BCA recommends a finding of *No Historic Properties Affected* for this project as surveyed, photographed, mapped, and described herein.

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Acronyms and Abbreviations

AAA: Agricultural Adjustment Act

AMSL: Above Mean Sea Level

AOGHS: American Oil & Gas Historical Society

APE: Area of Potential Effect

ARC: Archaeological Research Center

BCA: Beaver Creek Archaeology, Inc.

BH&FP: Black Hills & Fort Pierre

CCC: Civilian Conservation Corps

CFR: Code of Federal Regulations

CM: Cultural Material

CWA: Civil Works Administration

EIA: Energy Information Administration

Elkhorn: Fremont, Elkhorn & Missouri

EMM: Extended Middle Missouri

FERA: Federal Emergency Relief Administration

FWP: Federal Writers Project

GE: General Electric

GIS: Geographic Information Systems

IMM: Initial Middle Missouri

kV: kilovolt

MHA: Mandan, Hidatsa, and Arikara

Milwaukee Road: Chicago Milwaukee & St. Paul

MW: megawatts

NHPA: National Historic Preservation Act

NIRA: National Industrial Recovery Act

North Western/C&NW: Chicago & North Western

NRCS: Natural Resources Conservation Service

NRHP: National Register of Historic Places

NYA: National Youth Administration

Proponent: North Bend Wind Project, LLC

PUC: Public Utilities Commission

PWA: Public Works Administration

Quad: Quadrangle

R: Range

SCS: Soil Conservation Service

SHPO: State Historic Preservation Office

SHSND: State Historical Society of North Dakota

SOO Line: Minneapolis, St. Paul & Saul St. Marie Railway

T: Township

TCP: Traditional Cultural Property

TCS: Tribal Cultural Specialist

THPO: Tribal Historic Preservation Office

TMM: Terminal Middle Missouri

USDA: United States Department of Agriculture

USGS: United States Geological Survey

WAPA: Western Area Power Administration

WPA: Works Progress Administration

Introduction

North Bend Wind Project, LLC (the Proponent) has proposed the construction of the North Bend Wind Project in Hughes and Hyde Counties, South Dakota (see Figure 1 and Appendix A: Maps). Western Area Power Administration (WAPA) is the lead agency on this project due to the interconnection between this project and WAPA's existing Fort Thompson to Oahe 230 kilovolt (kV) transmission line. This project is also subject to the jurisdiction of the South Dakota Public Utilities Commission (PUC) since it will generate 200 megawatts (MW). Due to the involvement of WAPA, the proponent must comply with Section 106 of the National Historic Preservation Act (NHPA). The NHPA requires the Proponent and/or applicant to consider what effects the undertaking will have on cultural resources within the Area of Potential Effect (APE). The APE is defined as the combined construction area of all project components, and the survey area encompasses the entire APE and buffer.

The Proponent has contracted Beaver Creek Archaeology, Inc. (BCA) to conduct to complete a Level III cultural resource survey and facilitate a Traditional Cultural Property (TCP) inventory of the proposed North Bend Wind Project. The Level III inventory included a Level I record search, a Level III cultural resource survey, and a cultural resource survey report.

The proposed project consists of the construction of up to 71 wind turbine locations, 35 miles of access roads, and 68 miles of collector lines. Including alternate turbine locations, a total of 78 wind turbine locations were inventoried. Each wind turbine location was centered in a 5-acre survey block. The proposed collector lines, crane paths, and access roads were buffered a minimum of 75' on either side of the centerline, resulting in a survey corridor varying between 150-1,165' in width. A total of 2,034 acres were inventoried to Level III standards. See Table 2 for project location details.

Table 1. Project Location

USGS Quad	**REDACTED**
Project Area	**REDACTED**
Sites in Preliminary Field Review Area	**REDACTED**
Sites in Project Area	**REDACTED**
TCPs in Project Area	**REDACTED**

In an effort to ensure cultural property protections, the Proponent sent BCA a preliminary project plan to check for any potential issue areas. The preliminary field review was completed for the North Bend Wind Project from November 16-19, 2020, and covered approximately 359 acres. Following the completion of the preliminary field review, the Proponent provided an updated layout for the proposed project designed to accommodate site avoidance of the cultural resources encountered during the survey.

The updated project layout was surveyed between August 3-12, 2021, by BCA archaeologists for the Level III pedestrian inventory and representatives from the Crow Creek Sioux Tribe, the Rosebud Sioux Tribe, and the Yankton Sioux Tribe during the concurrent TCP inventory. Additional areas were surveyed for project reroutes between September 1-3, 2021.

This report details the results of the of the records search and pedestrian inventory, as well as the environmental and cultural background of the project area. Additionally, this report details the results of the tribal coordination and TCP survey arranged by BCA on behalf of the Proponent for the North Bakken Wind Project. This report will detail the results.

Project Goal

Western Area Power Administration is the lead agency on this project due to the interconnection between this project and the existing WAPA substation. Due to WAPA's participation in the project, the applicant must comply with Section 106 of the National Historic Preservation Act (NHPA). The NHPA requires the federal agency to consider what effects the undertaking will have on historic properties within the survey area. As such, the three central management objectives of this study are: to assist the federal agency with their Section 106 compliance obligations; to identify and assess project impacts to cultural resources located within the survey area; and to provide NRHP recommendations for historic properties encountered within the survey area. In addition, the scientific objective of the study is to gather more comparative information that can be used to answer questions posed in the state plan.

Historic Properties, as defined in the NHPA, consist of any historic or prehistoric district, site, building, structure, or object included in or eligible for inclusion on the NRHP. Cultural resources include archaeological, historical, and architectural sites, as well as properties of traditional, cultural, or religious importance.

Evaluation Criteria

To be eligible for inclusion on the NRHP, a site must usually be more than 50 years old, retain its integrity of location, design, setting, materials, workmanship, feeling, and association and it must meet one of the following criteria:

(a) Associated with events that have made a significant contribution to the broad patterns of our history; or
(b) Associated with the lives of persons significant in our past; or
(c) Embody distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinctions; or
(d) Have yielded, or may be likely to yield, information important in prehistory or history.

In addition, cultural resources that hold traditional, cultural, or religious significance may be eligible for the NRHP as TCP.

Project Description and APE

The proposed North Bend Wind Project is located along the Hughes-Hyde Countyline, approximately 5.5 miles southeast of Harrold and 5.5. miles southwest of Holabird, South Dakota (see Table 2 for location details). The proposed project is located in Hughes and Hyde Counties, South Dakota on private property and state trust land. A map of the proposed project and the 1.5-mile record search radius can be found in Figure 1 in Appendix A.

The project consists of 78 primary and alternative turbine locations, of which up to 71 turbines will be constructed. The Project is considering turbine model layout consisting of 71 General Electric (GE) turbines. The turbine proposed for the Project is the GE 2.82-127 model, which has a rated

power of 2.82 MW. The 200-megawatt North Bend Wind Project will be interconnecting onto the WAPA's existing Fort Thompson to Oahe 230kV transmission line.

Project components will include:

- Up to 71 turbines;
- Access roads to turbines and associated facilities;
- Underground 34.5-kV electrical collector lines connecting the turbines to the collection substation;
- Underground fiber-optic cable for turbine communications collocated with the collector lines;
- A 34.5- to 230-kV collection substation;
- A 230-kV interconnection switching station;
- An Aircraft Detection Lighting System;
- One permanent meteorological tower; and
- Additional temporary construction areas, including crane paths, public road improvements, laydown yard/staging area, and concrete batch plant(s), as needed.

The 2,034-acre survey area, which encompasses the entire APE, was mapped over the center of the proposed construction areas and transportation corridors. A 5-acre survey area was centered on each of the proposed primary and alternative turbine locations. A 150' survey corridor was mapped over the centerline for the proposed collector lines, crane paths, and access roads (measuring 75' on either side of the centerline). The survey areas for any building, laydown or staging area, or batch plant consisted of construction area footprint plus a 200' buffer. As a result, the survey corridor varies in width between 150' to 1,165'.

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North Bend Wind Project
North Bend Wind Project, LLC
Hughes & Hyde County, South Dakota

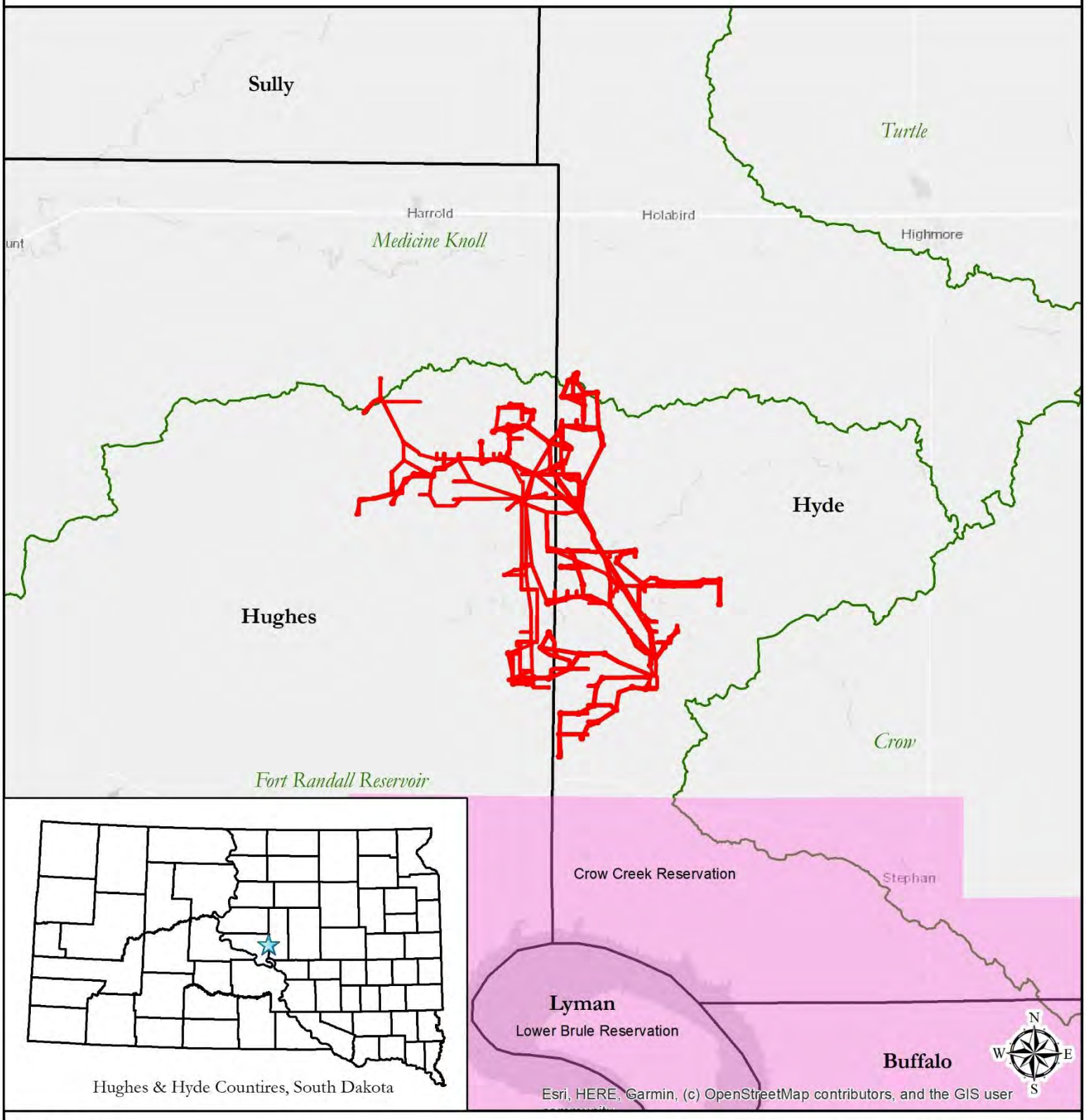


Figure 1. Location of the combined survey areas in Hughes and Hyde Counties, South Dakota.

Base Map: USGS 7.5'
Scale: 1:250,000
UTM NAD83 Zone 14 GE

Environmental Setting

The proposed project area is situated in the Big Bend Archaeological Region (Archaeological Region 13) within the Missouri Trench physiographic region within central South Dakota (Sundstrom 2019:IV-186). The Big Bend Region includes all of Brule and Buffalo Counties, most of Hyde and Lyman Counties, and portions of Aurora, Davison, Hand, Hughes, Jerauld, Jones, Stanley, and Sully Counties. The Missouri Trench is approximately 10 miles wide and cuts through the middle of the Big Bend Region, with the Missouri Coteau to the east (Sundstrom 2019).

There are several intermittent drainages and creeks within Hughes and Hyde Counties, including Medicine Creek, Baloun Creek, Chaney Rush Creek, Crow Creek, Elm Creek, Chapelle Creek, South Chapelle Creek, Arrowhead Spring Creek, Sand Creek, Spring Creek, Chantier Creek, Cherry Creek, Joe Creek, Medicine Knoll Creek, First Creek, Julius Creek, Antelope Creek, Cedar Creek, and LaRoche Creek. The predominant topographic features include glacial till plains with numerous potholes (Natural Resources Conservation Service [NRCS] 2006:144).

Geology

The geology of the area includes Cretaceous Pierre Shale beneath Pleistocene-Upper Wisconsin deposits (NRCS 2006:144). The Pierre Formation is composed of black shale and was deposited during the late Cretaceous (approximately 85 million years ago) while South Dakota was covered with a warm, shallow inland sea (Hoganson 2005). At times, this inland sea connected with the Arctic Ocean and the Gulf of Mexico, and is often referred to as the Western Interior Seaway. Fine-grained sediments, such as silt and clay, were deposited on the floor of this inland sea and have been compacted into shale to form the Pierre Formation (Hoganson 2006). Common invertebrate fossils from this formation include corals, gastropods, bivalves, cephalopods, shrimp, crabs, bryozoans, and echinoderms (Hoganson 2006). Vertebrate fossils are also found in the Pierre Formation such as fish, rays, sharks, and mosasaurs – large swimming reptiles that could reach 12 m or more in length (Hoganson 2005). The large (1 m tall) diving bird *Hesperornis*, as well as the giant (2.5–4 m from snout to tail) sea turtle, *Archelon*, have also been found in the Pierre Formation (Hoganson 2005). The Pierre Formation has a Potential Fossil Yield Classification number of 4 (high potential), indicating that the occurrence of fossils is likely within this formation (Liggett 2015).

Soils

The soils in this region are very deep and are generally well-drained or moderately well-drained (NRCS 2006:144). The Web Soil Survey soils map for the project area (NRCS 2021) indicates that each of the following soils make up the project area.

Hughes County Soils

Au: Nimbro and Wendte soils, channeled, forming floodplains and terraces with a parent material of loamy alluvium.

CdA: Cavo-Demky silt loams, 0-2% slopes, forming till plains with a parent material of clayey till.

DeA: DeGray-Walke silt loams, 0-2% slopes, forming ground moraines with a parent material of periglacial loess over fine-loamy till.

DkA: Demky-Cavo silt loams, 0-2% slopes forming till plains with a parent material of clayey till

ErA: Eakin-Raber complex, 0-2% slopes, forming ground moraines with a parent material of periglacial loess over fine-loamy till.

ErB: Eakin-Raber complex, 2-6% slopes, forming ground moraines with a parent material of periglacial loess over fine-loamy till.

ErC: Eakin-Raber complex, 6-9% slopes, forming ground moraines with a parent material of fine-loamy till.

GhC: Glenham-Hughmore silt loams, 5-9% slopes, forming moraines with a parent material of loamy till.

HgA: Highmore-DeGray silt loams, 0-2% slopes, forming ground moraines with a parent material of periglacial loess over fine-loamy till.

HgB: Highmore-DeGrey silt loams, 2-6% slopes, forming ground moraines with a parent material of periglacial loess over fine-loamy till.

HkA: Highmore silt loam, 0-2% slopes, forming plains with a parent material of periglacial loess over loamy till.

HkB: Highmore silt loam, 2-6% slopes, forming plains with a parent material of periglacial loess over loamy till.

HlB: Highmore-Glenham silt loams, 2-5% slopes, forming plains with a parent material of silty drift over loamy till.

Hn: Hoven silt loam, 0-1% slopes, forming closed depressions with a parent material of local alluvium over loamy till.

Ho: Hoven silt loam, forming closed depressions with a parent material of clayey alluvium.

Ma: Macken silty clay loam, 0-1% slopes, forming depressions with a parent material of local alluvium.

OnA: Mobridge silty loam, 0-2% slopes, forming swales with a parent material of periglacial loess over fine-loamy till.

OoA: Onita-Hoven silt loams, 9-15% slopes, forming swales with a parent material of silty drift.

PeD: Peno-Gettys clay loams, 9-15% slopes, forming ground moraines with a parent material of fine-loamy till.

RaB: Raber-Cavo loams, 2-6% slopes, forming ground moraines with a parent material of fine-loamy till.

RbC: Raber-Peno loams, 6-9% slopes, forming ground moraines with a parent material of fine-loamy till.

Hyde County Soils

Bn: Bon loam, channeled, 0-2% slopes, frequently flooded forming drainageways with a parent material of local alluvium.

CrA: Cava-Jerauld loams, 0-4% slopes, forming plains with a parent material of clayey till.

Cs: Cavo-Stickney loams, forming plains with a parent material of clayey till.

Df: DeGrey-Walke silt loams, 0-2% slopes, forming ground moraines with a parent material of periglacial loess over fine-loamy till.

Du: Durrstein-Egas complex, forming floodplains with a parent material of clayey alluvium.

EpC: Eakin-Peno complex, 6-9% slopes, forming plains with a parent material of silty drift over loamy till.

ErA: Eakin-Raber complex, 0-2% slopes, forming ground moraines with a parent material of periglacial loess over fine-loamy till.

ErB: Eakin-Raber complex, 2-6% slopes, forming ground moraines with a parent material of periglacial loess over fine-loamy till.

HdA: Highmore-DeGrey silt loams, 0-2% slopes, forming ground moraines with a parent material of periglacial loess over fine-loamy till.

HdB: Highmore-DeGray silt loams, 2-6% slopes, forming ground moraines with a parent material of periglacial loess over fine-loamy till.

HeA: Highmore silt loam, 0-2% slopes, forming plains with a parent material of periglacial loess over fine-loamy till.

HeB: Highmore silt loam, 2-6% slopes, forming plains with a parent material of periglacial loess over fine-loamy till.

Ho: Hoven silt loam, 0-1% slopes, forming closed depressions with a parent material of local alluvium over loamy till.

Ma: Macken silty clay loam, 0-1% slopes, forming depressions with a parent material of local alluvium.

OkD: Oko clay loam, 9-20% slopes forming till plains with a parent material of clayey till over residuum weathered form shape.

OnA: Mobridge silty loam, 0-2% slopes, forming swales with a parent material of periglacial loess over fine-loamy till.

Os: Onita-Hoven silt loams, forming swales with a parent material of silty drift.

PgD: Peno-Gettys clay loams, 9-15% slopes, forming ground moraines with a parent material of fine-loamy till.

Pk: Plankinton silt loam, forming potholes with a parent material of clayey alluvium over loamy till.

RcA: Raber-Cavo loams, 0-2% slopes, forming ground moraines with a parent material of fine-loamy till.

RcB: Raber-Cavo loams, 2-6% slopes, forming ground moraines with a parent material of fine-loamy till.

RpB: Raber-Peno loams, 2-6% slopes, forming ground moraines with a parent material of fine-loamy till.

RpC: Raber-Peno loams, 6-9% slopes, forming ground moraines with a parent material of fine-loamy till.

TdD: Talmo-Delmont loams, 3-15% slopes, forming outwash terraces on moraines with a parent material of outwash.

Climate

The climate in the area is semi-arid and temperate, with cold, dry winters and warm summers (Sundstrom 2019:IV-191). Precipitation averages around 17" annually, most of which occurs as rain and snow during the winter months (Bryce et al. 1996; NRCS 2006; Sundstrom 2019:IV-191). On average, the summer temperature is 73°F, with the winter temperature around 20°F (Bryce et al. 1996; Sundstrom 2019:IV-191).

Hydrology

The project area is located within the Fort Randall Reservoir and Medicine Knoll drainage systems. The area drains mostly into Chapelle Creek (which intersects the project area) and ultimately into Lake Sharpe, a reservoir on the Missouri River, which is approximately 5 miles south of the proposed project area.

Flora & Fauna

The native prairie vegetation includes little bluestem, big bluestem, blue grama, sideoats grama, western wheatgrass, needle-and-thread, porcupine grass, prairie rose, cottonwood, western snowberry, sedges, and bur oak. Some of the major wildlife species include whitetail deer, mule deer, antelope, coyote, fox, skunk, raccoon, jackrabbit, prairie dogs, frogs, prairie rattlesnakes, bull snakes, garter snakes, sharp-tailed grouse, prairie chickens, Canadian geese, walleye, bluegill channel catfish, and largemouth bass (NRCS 2006:145).

Land Use

This area of South Dakota is primarily privately-owned agricultural land as pasture or cropland for alfalfa, sorghum, winter wheat, oats, sunflowers, and corn (NRCS 2006:145). As of 2012 (the most recent data available), there are approximately 338 farms in Hughes County with 62.5% of the agricultural land used for cropland and 34.9% of the agricultural land used for pastureland (United States Department of Agriculture [USDA] 2012a). Top crop items, in terms of acres, include wheat for grain, winter wheat for grain, corn for grain, sunflower seed, and sunflower seed oil (USDA 2012a). In addition, top livestock inventory items, in terms of numbers, include cattle and calves, hogs and pigs, sheep and lambs, horses and ponies, and pheasants (USDA 2012a).

Similarly, there are 207 farms in Hyde County, South Dakota with 56.0% of the agricultural land used for pasture and 42.0% of the agricultural land used for cropland (USDA 2012b). Top crop items, in terms of acres, include corn for grain, wheat for grain, winter wheat for grain, forage (land used for all hay and haylage, grass silage, and greenchop), soybeans for beans, and sunflower seed (USDA 2012b). In addition, top livestock inventory items, in terms of numbers, include cattle and calves, colonies of bees, sheep and lambs, and horses and ponies (USDA 2012b).

Cultural Background

The Big Bend Region (Archaeological Region 13) has its own historic context, which describes the different types of prehistoric and historic districts, sites, buildings, structures, and objects known from various times in the past in different parts of the state. This information provides the comparative base needed for the management of cultural resources.

Native American Cultural Background

Archaeological sites found within the Big Bend Region include cultural material (CM) scatters, stone circles, alignments, cairns, animal kill sites, burials, mounds, effigies, campsites (Sundstrom 2019). Depending on the type, these sites are found along rivers and streams, on terraces, hills, and deeps soils. Although not necessarily applicable to this particular project, the general archaeological horizons encountered are as follows:

Paleoindian Period (9500-5500 BC)

In South Dakota, the Paleoindian Period occurred between ca. 9500 to 5500 BC and included such cultural complexes as Clovis, Goshen, Folsom, Plainview, and Plano (Sundstrom 2019:II-1, 3). These complexes are identified by their tool assemblages, specifically projectile point classification. Projectile points from this period are lanceolate (leaf-shaped) spear points, either fluted (a distinctive flake removed from the proximal base) or unfluted, and are observed with or without stemmed bases. Subsistence strategies would rely on the hunting of now-extinct megafauna, such as mastodons, mammoths, and giant bison, as well as smaller animals and wild plants. Sites typically associated with the Paleoindian Period include kill sites, butchering sites, campsites, hearths, food-processing areas, quarries, chipping stations, and isolated finds (Sundstrom 2019). In the Big Bend Region, two Folsom points represent evidence of the Paleoindian period (39HE6 and 39HU78; Sundstrom 2019:IV-194, 202). No buried sites have been found; however, "the region contains sediments of the right age to contain such sites" (Sundstrom 2019:IV-194).

Archaic Period (5500 BC-AD 500 AD)

The Archaic Period has been subdivided into three separate periods: Early, Middle, and Late. The Early Archaic Period dates between ca 5500 to 3500 BC and includes the Hawken, Logan Creek, and Meserve-Dalton complexes (Sundstrom 2019:II-37, 39). Subsistence practices included a mix of big game hunting and generalized foraging (Sundstrom 2019). These people lived in semi-subterranean pit houses that contained many storage pits and were used seasonally (Sundstrom 2019:II-38). Projectile points from this period are typically triangular, side-notched, and utilized with the atlatl.

The Middle Archaic Period, dating between ca. 3500 to 500 BC, includes the Oxbow and McKean (Duncan and Hanna) complexes (Sundstrom 2019:II-51). The variation in projectile points includes smaller, triangular to lanceolate basally-notched forms, with a wide base or stem. Innovations during the Middle Archaic Period include "pit houses, corrals and pounds for communal game procurement, tool and food caches, extensive use of grinding stones, production of microblades and microtools, large rock-filled roasting pits, diverse faunal and floral remains, and features related to pemmican production" (Sundstrom 2019:II-75).

The Late Archaic Period dates from ca. 1100 BC to AD 500 and is largely contemporaneous with the Woodland Period in South Dakota (Sundstrom 2019:II-79). Complexes associated with the Late Archaic Period include Yonkee, Pelican Lake, and Besant (which extends into the Woodland period). The Late Archaic Period reflects a continuation of Middle Archaic practices, including mobile settlement patterns, foraging subsistence, and hunting-based subsistence strategies, such as communal hunting and the use of arroyos, corrals, and jumps, and, but al (Sundstrom 2019:II-81).

Overall, sites typically associated with the Archaic Period include kill sites, game drives, butchering sites, campsites, hearths, food-processing areas, roasting pits, quarries, chipping stations, pit houses, rock art, special-use sites, and isolated finds (Sundstrom 2019: II-39, 52). In the Big Bend Region, identified Archaic sites include Medicine Crow (39BF2), Truman Mound (39BF224), Sitting Crow (39BF223, Side Hill (32BF233), Log Turkey Cabin (39LM212), and Ree Heights (39HD3; Sundstrom 2019:IV-194).

Woodland Period (500 BC-AD 1000)

The Woodland Period has been subdivided into three separate periods: Early, Middle, and Late. Only one Early to Middle Woodland Period (ca. 200 BC to AD 700) site, associated with the Fox Lake Phase, has been identified in South Dakota, as this variant typically occurs in western Minnesota and eastern North Dakota (Sundstrom 2019:II-98, 99). The Middle Woodland Period, dating between ca. AD 100 to 600, includes the Besant and Sonota complexes. The Late Woodland Period dates to ca. AD 600 to 1000 and includes the Arvilla, Great Oasis, and Blackduck-Sandy Lake complexes, as well as the Lake Benton, Loseke Creek, and Randall phases.

The Woodland Period is characterized by thick-walled, cord-roughened, elongated conical and elaborately decorated spherical/globular pottery; medium- to small-sized, corner- and side-notched projectile points; burial mounds with the remains covered in red ocher and consisting of grave goods, and long-distance trade (Sundstrom 2019:II-81, 93, 95). The majority of the sites associated with this period include surface scatters, camps, stone circles, occupation/habitation sites, bison trapping sites, burial mounds, special-use sites, and isolated finds.

Little is known about the settlement patterns during this period, as most of the Woodland Period sites consist of burial mounds and temporary sites. Dwellings appeared to have included simple post-and-daub structures and tipis and were limited to nuclear family groups (Sundstrom 2019:II-93, 106). Subsistence practices included the hunting as well as harvesting of plants such as plum, buffaloberry, dogwood, snowberry, grape, chokecherry, and rose, and the use of corn and squash (Gregg et al. 2016:5.53). Items such as Pacific and Gulf Coast marine shell, copper, obsidian, and Hopewellian pottery influences, indicate local participation in a long-distance trade network (Sundstrom 2019:II-93, 103).

Burial mounds tend to be dome-shaped structures (but become more linear during the Late Woodland period), 30 to 100 m in diameter, roughly 2 m in height, and typically found on ridgetops and stream terraces (Sundstrom 2019:IV-195). Below the floor of the mounds were rectangular chambers containing primary (time of death) or secondary (bone bundle) burials and roofed with logs" (Neuman 1960, 1975; Sundstrom 2019).

Sites identified in the Big Bend Region as Woodland period included Talking Crow (39BF4), Truman Mound (39BF224), Arp (39BR101), Crow Creek (39 BF11), Side Hills Mounds (39BF233), and Old Quarry Mound (39BF234), and Gold Soldier (39LM238; Sundstrom 2019). "Within the Big Bend Region, most excavated Woodland sites are burial mounds. Of the 46 sites listed as Woodland in the region, approximately 19 contain mounds" (Sundstrom 2019:IV-195).

Late Prehistoric Period (AD 450-1800)

The Late Prehistoric Period (ca. AD 500 to 1800), in the western part of the state, is largely a continuation of established practices from the Archaic Period and is identified as the Plains Village period along the Missouri River and the eastern half of the state (Sundstrom 2019:II-131). Cultural traditions associated with the Late Prehistoric Period include the Avonlea Complex and nomadic plains bison-hunting groups (Sundstrom 2019).

The Avonlea Complex (ca. AD 450 to 1000) is characterized by complex, ritualized communal bison procurement, the introduction of the bow and arrow, and small, fine, side-notched projectile points (Johnson and Johnson 1998:221; Sundstrom 2019). The different complexes associated with plains bison-hunting groups (ca. 500-1800) are "recognized primarily on the basis of projectile point styles. Such points are small and may be side-notched or simple unnotched triangles" (Sundstrom 2019:II-140). Settlement patterns are highly mobile and dependent on the seasons with tipi or tipi-like habitation. Subsistence was dependent on communal bison procurement via jumps

or impoundments but was supplemented by smaller game and plant foraging (Sundstrom 2019:II-135).

The majority of the sites associated with this period include surface scatters, camps, stone circles, bison jumps, animal drive lines, trapping sites, special-use sites, rock art, and isolated finds.

Plains Village Period (AD 900-1850)

The Plains Village Period partially overlaps the Late Woodland Period and dates to between ca. AD 900 and 1850 (Sundstrom 2019:IV-197). Several distinct cultural traditions are associated with this period, including the Middle Missouri Tradition, Coalescent Tradition, Central Plains Tradition, and Oneota Tradition (Sundstrom 2019). No sites associated with the Central Plains Tradition have been identified within South Dakota, as they have been documented only in Nebraska and Kansas.

Middle Missouri Tradition - The Middle Missouri Tradition (ca. AD 900 to 1675) was along the Missouri River in North and South Dakota and can be divided into the Initial, Extended, and Terminal Middle Missouri. This tradition is characterized by fortified and unfortified villages, rectangular earthlodges, unnotched or side-notched triangular projectile points, bone tools, and globular, grit-tempered pottery created via paddle and anvil (Sundstrom 2019:IV-198).

The Initial Middle Missouri (IMM) settlements contained 20-30 houses (i.e., earthlodges) arranged in rows with a possible plaza. In contrast, the Extended Middle Missouri (EMM) consisted of less than 20 earthlodges around a central plaza, and the Terminal Middle Missouri (TMM) consisted of around 100 earthlodges set in rows around a central plaza (Sundstrom 2019:IV-144). Earthlodges were long, rectangular, semi-subterranean structures supported by central posts with smaller posts along the walls. The earthlodges also included long entryways and contained a hearth and several bell-shaped storage pits, which were dug beneath the earthlodge floor. Villages were more often fortified during the IMM than the EMM, with ditches, palisades, and bastions, and were situated on high terraces or bluffs. Lower terraces and floodplains were used to cultivate corn, beans, squash, sunflowers, tobacco, and other plants. Besides seasonal, communal bison hunting, which was the primary food source, marginal game species were also hunted on occasion.

Ceramic vessels were globular with grit-temper and have flared or recurved rims (i.e., S-rims) with decorations on the rims and shoulders and were used for storage and cooking (Sundstrom 2019: II-155). The tool assemblage included bison scapula hoes, bone awls, horn scoops, stone knives, end scrapers, mauls, celts, manos and metates, abraders, and bows and arrows (Alex 1981; Lehmer 1954, Sundstrom 2019).

Sites are typically found along major rivers in the eastern part of South Dakota and included villages, hunting camps, and isolated finds (Sundstrom 2019:II-154). The Big Bend Region contains approximately 40 IMM sites, including Jigg Thompson (39LM208), Langdeau (39LM209), Pretty Head (39LM232), Pretty Bull (39BF12), and Stricker (39LM1; Sundstrom 2019:VI-199). There are only a few identified EMM sites (Hickey Brothers [39LM4], Fort Lower Brule [39LM53], Dinhart [39LM33], King [39LM55]) and no TMM sites in the Big Bend Region (Sundstrom 2019:IV-199).

Coalescent Tradition - The Coalescent Tradition (ca. AD 1300 to 1886) was located along the Missouri River in North and South Dakota and can be divided into the Initial, Extended, and Post-Contact Coalescent. The Coalescent and Middle Missouri lifeways were similar, with components "distinguished principally by the ware and types of ceramics that were produced, as well as differences in house types and village organization" (Sundstrom 2019:II-144). Post-Contact Coalescent sites are typically identified by Euro-American trade goods and horse bones (Johnson 1998; Sundstrom 2019: II-228).

Earthlodges and ceramics are similar to those of the Central Plains Tradition to the south, signifying that Central Plains villagers migrated north, possibly due to climate change (Sundstrom 2019:II-199). Smaller than the Middle Missouri Tradition earthlodges, Coalescent Tradition earthlodges were circular or rounded square with four large central posts and smaller posts along the walls. They also include a central hearth and cylindrical or bell-shaped pits. Fortified villages were more common during the Initial Coalescent, as compared to the Extended Coalescent. Additionally, fortified villages consisted of ditches, palisades, and bastions, with the earthlodges in a compact arrangement, whereas earthlodges at unfortified villages were placed randomly and widely spaced (Sundstrom 2019:II-200). Post-Contact Coalescent villages tend to be concentrated at confluences of major rivers and associated tributaries and vary in size, often with an open central plaza and frequently with more than one fortification system (Johnson 1998:321; Sundstrom 2019:II-228).

Bone, stone, and shell tools and ornamentation associated with the Coalescent Tradition include scapula hoes, awls, needles, fishing hooks, beads, pendants, bracelets, gorgets, knives, drills, gravers, endscrapers, manos and metates, mauls, and pipes (Johnson 1998:311). Projectile points are triangular unnotched or side-notched. Euro-American goods replaced many of the bone and stone tools during the Post-Contact Coalescent. Items included glass trade beads, kettle parts, gun parts, metal knives, projectile points, awls, axes, hoes, adzes, chisels, rods, fishhooks, and horse bridles (Johnson 1998:323). Many of the Euro-American goods were remade to suit their purpose (Sundstrom 2019:II-229).

Initial Coalescent pottery consisted of constricted-mouth globular jars, with crushed igneous rock temper and either cord-roughened, simple-stamped, or smoothed exterior (Johnson 1998:311, 316). In contrast, the Extended Coalescent pottery was thin-walled, with little temper, and had straight, flared, or vertical rims with simple-stamped or smooth exterior (Johnson 1998:319; Sundstrom 2019:II-200). Post-Contact Coalescent pottery tends to have thicker walls and more temper, with decoration changing "with the addition of more cord- and finger-impressed lips or rims," more undecorated vessels, and fewer straight or curved rims (Johnson 1998:323).

Like the Middle Missouri Tradition, Coalescent sites are typically permanent to semi-permanent villages located on upper terraces along major rivers in the eastern part of South Dakota with a few hunting camps and quarries located away from core village areas (Johnson 1998:311; Sundstrom 2019:II-200). "The Big Bend Region was the core of the Coalescent Tradition," and sites associated with the Coalescent Tradition include Talking Crow (39BF3), Medicine Creek (39LM2), Crow Creek (39BF11), Clarkstown (39LM47), Two Teeth (39BF204), Black Partizan (39LM2018), Village II (39LM27), and Rattlesnake Keeper (39HU160; Sundstrom 2019:IV-199).

Oneota Tradition - The Oneota Tradition (ca. AD 900-1870) was located along the Upper Mississippi River and is associated with the Upper Mississippian Culture. The Oneota Tradition is found throughout the upper Midwest. In South Dakota, these sites are found in the southeastern portion of the state along the Missouri, James, and Big Sioux rivers and include villages, hunting camps, mounds, burials, and isolated finds (Sundstrom 2019:II-249).

Houses were "generally rectangular wall-trench structures with subterranean basins pole structures of the wigwam and longhouse type," situated in large to small unfortified villages (Henning 1998; Sundstrom 2019:II-247). Like other Plains Village traditions, the Oneota Tradition's subsistence was based on hunting, gathering, and horticulture. Ceramics included decorated, shell-tempered, globular jars with constricted openings (Henning 1998). Tools and ornamentation include bison or elk scapula hoes, awls, side-notched projectile points, side scrapers, endscrapers, manos, abraders, mauls, celts, copper ornaments, catlinite disks and inscribed plaques, and elbow pipes (Henning 1998:348-352; Sundstrom 2019). Burial practices included mounds, flat cemeteries, storage/trash pits, and house floors (Henning 1998; Sundstrom 2019).

Protohistoric Period (AD 1700-1861)

"In northern Great Plains archaeology, the term *Protohistoric* refers to the period after which European goods and species had entered the material culture assemblage but before permanent non-native settlement began" (Sundstrom 2019:II-253). In South Dakota, this period roughly corresponds from AD 1700 to 1861.

The increase in Euro-American contact brought about many changes in the traditional culture of groups of the Northern Plains, including horses, European goods, and disease. Metal tools and implements obtained via trade replaced traditional stone, bone, wood, shell, and clay items. The gun ascended to a place alongside the bow and arrow in basic weaponry. The appearance of horses in the middle of the 18th century influenced the lifeways of nomadic tribes like the Lakota, Dakota, and Assiniboine. The presence of Euro-American artifacts is the primary way of identifying protohistoric and historic sites in the region.

Epidemics of disease introduced by Europeans devastated the settled Plains Village groups and paved the way for more nomadic equestrian groups to gain dominance in the region. These groups would have utilized short-term tipi camps and many of these locations, unless repeatedly reoccupied or marked by stone circles, probably contain little in the way of identifiable material traces in the archaeological record. Subsistence of the Equestrian groups was based on bison, but wild plants, other wild animals, and garden produce received in an exchange with or through raids on settled Village gardeners also were significant components of the diet (Gregg and Bleier 2016a:2.26-2.28).

During the Protohistoric period, intertribal interactions, as well as trade between tribes and Euro-American settlers intensified. Intertribal trade during this period is rooted in prehistoric connections. As a result of trade and Euro-American expansion, historical and ethnographic accounts of the groups using this area complement the archaeological record (Gregg and Bleier 2016b:6.49-51).

Reservation Era (AD 1859-Present)

Between 1850 and 1870, the United States government created reservations to separate Native Americans and the influx of settlers. "The Crow Creek Reservation was established on the east side of the Missouri River below Fort Pierre in 1859. … The Lower Brule Reservation soon followed under a treaty signed in 1865." (Sundstrom 2019:IV-207). Today, all of the Crow Creek Reservation and most of the Lower Brule Reservation are located within the Big Bend Region (Sundstrom 2019).

In 1887, the United States Congress passed the General Allotment Act, known more commonly as the Dawes Act. This brutal piece of legislation provided the federal government with the ability to divide communal tribal land into individual allotments. Some lawmakers, including Henry Dawes (for whom the act is named), believed that forcing Native Americans to adopt agriculture while simultaneously removing the communal element of tribal village life would help assimilate them into mainstream or "civilized" society. They did not view the act of removing cultural traditions and general lifeways as destructive but as a way of saving Native Americans from disappearing altogether, a misguided notion that many people believed. At the same time, other lawmakers saw the commercial potential in selling allotments to non-Indians, something that indeed came to fruition when certain allotments were not sold and therefore deemed "surplus." Today, the Dawes Act is considered the most destructive policy dealing with Native peoples (Mandan, Hidatsa, and Arikara [MHA] Nation 2018; State Historical Society of North Dakota [SHSND] 2008b).

As an additional means of forced integration, Christian missionaries were sent to reservations, and children were taken from their families and placed in boarding schools (Indian schools). Schools

such as the Fort Stevenson Indian School, Bismarck Indian School, and the Carlisle Indian School in Pennsylvania prohibited students from using their language, practices, and culture and were subjected to a curriculum that emphasized European-American culture (MHA Nation 2018; SHSND 2008b).

In 1934, to rectify some of the damage done, the Indian Reorganization Act, which secured certain rights to Native Americans, was established. This included the reversal of the Dawes Act and a return to local self-government on a tribal basis. However, in the late 1940s and early 1950s, the Indian Reorganization Act was disassembled. The plan was to establish a policy that would eliminate tribal status altogether. In 1975, the Indian Self-Determination and Education Assistance Act was enabled. This policy was meant to allow tribal autonomy while still benefitting from government treaty obligations. The American Indian Religious Freedom Act of 1978 was created to protect and preserve the traditional religious rights and cultural practices of Native Americans. In addition to Self-Determination, other laws were passed, such as the Indian Civil Rights Act, the Indian Financing Act, and the Indian Child Welfare Act (SHSND 2008b). Today, reservations have tribal governments, which administer many governmental, economic, health, welfare, and educational programs.

European-American Cultural Background

The area known today as South Dakota was part of the 1803 Louisiana Purchase and was part of the Dakota Territory (1861-1869) until gaining statehood on November 2, 1889, as the 40th state to enter the Union. The types of historic and architectural sites found in the Big Bend Region include depressions, foundations, historic material scatters (e.g., ceramics, glass, metal nails, tin cans, masonry, cast-iron stoves, machinery), cabins, trading posts, forts/encampments, burials, railroads, roads, bridges, homesteads/farmsteads, ranches, privies, windmills, wells, towns, schools, grange hall, sanitarium, whistle stop, grain elevator, gas station, post offices, dump, dam, irrigation, Indian agency, and line camp.

Dakota Territory (1858-1889) – The Dakota Territory consisted of the northernmost part of the land acquired from France in the 1803 Louisiana Purchase, and in 1818, the United States acquired the northeastern portion of the Dakota Territory in a treaty with Great Britain. The Dakota Territory included North Dakota, South Dakota, and much of present-day Montana and Wyoming. After becoming an incorporated territory in 1861, the population was slow to increase due to Indian attacks. Eventually, the population increased during the "Dakota Boom," from 1870 to 1880, because of the railroad growth and the Homestead Act of 1862. Settlers included New England Yankees, Swedes, Czechs, German-Russians, Norwegians, Dutch, Danes, and Germans. The economic base was organized around agriculture, mining, and cattle ranching (Federal Writers Project [FWP] 1938).

Fur Trade – The earliest Europeans and Euro-Americans to venture into the region were looking for trade routes or establishing fur trading posts. Before and after the Lewis and Clark 1804-1806 expedition, notable explorers included Sieur de la Vérendrye, Jean Baptiste Truteau, Jacques d'Englise, David Thompson, Charles Chaboillez, Manuel Lisa, Andrew Henry, William Ashley, and James Dickson. Some Europeans and European-Americans settled in the area, including "Spaniards from St. Louis, Frenchmen from Quebec, Scots and Britons from Hudson's Bay and Montreal, and Americans working either as 'free traders' or *engagés* for a dozen fur companies" (FWP 1938; Lamar 1996:27; Sundstrom 2019:II-274, 275).

Forts – The majority of the forts in the region were constructed in the 19th century. Their purpose included trading outposts, primarily fur trade and military posts, to protect supply routes, trails, trade, and settlers. Before the introduction of the railroad, these forts were located along rivers such as the Missouri, Big Sioux, and James rivers. Some of the more notable forts include Fort Yates,

Fort Bennett, Fort Randall, Fort Pierre, Fort Sully, Fort Thompson, Fort James, Fort Meade, Fort Sisseton, and the Whetstone Agency (FWP 1938; Sundstrom 2019:II-280).

Trails – Two significant trails, the River Trail and the Ridge Trail, branches of the network of Red River Trails in the Red River Valley, originally were Native American trails that Euro-American fur traders later used. The Red River Trails connected fur trading posts, where they hauled furs and goods by ox cart. Later, the trails also connected military posts, where military supplies and men were sent. These military posts (e.g., Fort Abercrombie, Fort Totten, and Fort Ransom) also protected the trails as well as the people traveling up and down the trails. Eventually, the trails and ox carts were replaced by the railroad (Gilman et al. 1979).

A notable trail in the western part of the region is the Fort Pierre-Deadwood Stage Trail (1876-1906). This trail was the main line that ran between Fort Pierre, where steamboats would dock, and the Black Hills gold town of Deadwood in the Dakota Territory. There were transportation and economic booms associated with this trail, and these booms ended when the railroad reached Pierre and an alternate line opened (SHSND 2008a). Other trails include Fort Bennett Army Trail, Old Dupree Trail, Cherry Creek Indian Trail, and Bad River Indian Trail (Pierre Historic Preservation Commission 2020).

Riverboats – The Missouri and Red rivers were essential to the settlement and expansion of the Dakota Territory and were used the most for river transportation. Riverboats such as rafts, sailboats, rowboats, Mackinaws, keelboats, and steamboats brought explorers and fur traders into the Dakota Territory; however, the keelboat and steamboat were probably used more often due to their carrying capacity. "Keelboats were used primarily from 1800 to 1840, when they were replaced by steamboats" (Miller 2012). This type of boat floated high in the water, allowing it to travel on shallow rivers, and was able to carry 15 to 30 tons of cargo. River transportation became increasingly important for transporting goods to outposts and returning furs downstream.

Steamboats eventually replaced the keelboats and were used for cargo and passenger transportation. The riverboat industry became an accessible mode of transportation, as it was much easier to deliver goods to remote areas by boat than overland routes. In addition, "settlers and visitors could also travel much more safely by taking steamboats" (Burns 2004:14). The demise of riverboat transportation occurred for several reasons: (1) less shipping of passengers and cargo, (2) scarcity of wood yards, (3) inconvenient climate, (4) labor unrest, and (5) the railroad. Shipping on the Red River continued until 1912 and until the 1930s on the Missouri River (Burns 2004).

Mining – In the 1860s, there were rumors of gold in the Black Hills. As a result, several expeditions were mounted in search of gold, despite the area being a part of the Great Sioux Reservation. Soon the Black Hills were over-run with Euro-American, African-America, and Chinese prospectors, too many for the United States Army to control (Sundstrom 2019:II-287). Due to increasing conflict with the Lakota and their allies, under Ulysses S. Grant, the United States government coerced the tribes into shrinking their territory and removing the Black Hills from their reservation (Sundstrom 2019).

Mining in western South Dakota "quickly shifted from individual prospectors to heavily capitalized corporate operations" (Sundstrom 2019:II-288). Placer mining was replaced with hard-rock mining and stamp processing, and eventually cyanide processing (Sundstrom 2019).

During the Cold War, uranium was mined from the southern Black Hills, Slim Buttes, and Cave Hills (Sundstrom 2019:II-289). Other forms of mining included coal, bentonite, mica, feldspar, scoria, quartz, quartzite, and oil and gas (Sundstrom 2019).

Railroad - Major development of the railroad in the Dakota Territory occurred in the 1870s and 1880s, with the Northern Pacific Railroad and the Great Northern Railroad facilitating population growth during this time. Federal land grants were given to the Northern Pacific Railroad, which, in turn, sold the land, while the Great Northern Railroad bought its lands from the federal government and promoted settlement along its lines (FWP 1938).

The first railroads in South Dakota were constructed in the southeastern part of the state, including the Chicago, Milwaukee & St. Paul (Milwaukee Road) and the Chicago & North Western (North Western or C&NW) in 1872. The Milwaukee Road was built from Sioux City, Iowa, to Vermillion, South Dakota, while the North Western was built from Marshall, Minnesota to Gary, South Dakota (Hufstetler and Bedeau 2007:79). By the early 1880s, both the Milwaukee Road and North Western railroads reached the Missouri River but were unable to go further west, as the area west of the river was part of the Great Sioux Reservation. In 1879, the Black Hills and Fort Pierre (BH&FP) was chartered by the Homestake Mining Company to transport timber needed for their mining operations and did not go beyond the Black Hills (Hufstetler and Bedeau 2007:10). The Fremont, Elkhorn & Missouri (Elkhorn), a North Western subsidiary, eventually reached western South Dakota in 1885 via Nebraska (Hufstetler and Bedeau 2007).

Between Milwaukee Road and North Western, they controlled approximately 73% of the rail lines in South Dakota (Hufstetler and Bedeau 2007:12). The railroad companies encouraged settlement along their routes, printing promotional brochures, employing immigration agents, discount fares, and exhibition railroad cars filled with promotional items (Hufstetler and Bedeau 2007). Between 1878 and 1887, many of the townsites were platted by the railroad companies or individuals connected with the railroad companies. “The practice of railway-sponsored townsite development helped focus additional residential and commercial development along rail lines” (Hufstetler and Bedeau 2007:13).

However, “the glory years of the American railroad network ended after World War II, as automobiles” became the primary transportation mode in the United States (Hufstetler and Bedeau 2007:4). Over the last several decades, railway segments have been abandoned.

Agriculture – The Federal Homestead Act of 1862 offered free land to anyone over 21 years old who would cultivate and improve his 160 acres of land and live on it for five years. An additional 160 acres could be obtained for a tree claim, and a third tract of land could be acquired before or after the land was surveyed. Crops planted and harvested included spring wheat, durum, flaxseed, barley, oats, sugar beets, corn, hay, red clover, alfalfa, and sweet clover. Ranching of cattle and sheep, poultry raising, and beekeeping was also done on farms (FWP 1938).

During the first Dakota Boom (1878-1887), migrants settled primarily on the east side of the Missouri River (Brooks and Jacon 1994:14). Early settlers either came by riverboat via the Missouri River or overland by ox cart (Witt et al. 2013:6). Prior to the second Dakota Boom, cattle ranchers used the western part of the state for ranching operations and later leased reservation land for open-range ranching. (Witt et al. 2013). The second Dakota Boom (1902-1915), which opened former reservation land for settlement, brought an end to open range grazing as homesteaders protected their lands by erecting fencing (Brooks and Jacon 1994:9, 18; Witt et al. 2013:16). Later, settlers came by railroad, such as the Minneapolis, St. Paul & Saul St. Marie Railway (SOO Line). Most of the settlers were British, Irish, Czech, Danish, Dutch, German, German-Russians, Norwegian, and Swedish immigrants (Brooks and Jacon 1994:9; Witt et al. 2013). “Settlers intent on pursuing an agricultural operation often constructed temporary structure[s] [such as dugouts, log shacks, or sod houses] followed by permanent structures and landscape alterations as time and finances permitted” (Brooks and Jacon 1994:14). Farms included such structures as farmhouses/ranch

houses, privies, barns, chicken coops, windmills, wells, corncribs, corrals, garages/carriage houses, granaries, machine storage buildings, root cellars, and other buildings and structures.

Farm homes in the eastern part of the state were typically small, located close together, and made up of well-painted modernized buildings surrounded by neat lawns and tree groves. They had modern conveniences like electricity, telephones, radios, and cars. In the central part of the state, farms were not as modernized as eastern South Dakota but were well-kept. In western South Dakota, farm homes were often little more than shacks erected to establish residence under the Federal Homestead Act. Many such buildings were still in use in the early twentieth century (FWP 1938).

In general, the east side of the Missouri River was home to crop-growing operations, while the west side of the Missouri River was more suitable for ranching. Because of the semi-arid climate, dry-farming was encouraged, which used such techniques as deep plowing (12-18 inches), cultivating fallow and drought-resistant plant varieties (Ostergren 1983:60). In the 1930s, a severe drought known as the Dust Bowl began, which occurred around the same time the Great Depression reached South Dakota. "One storm in May of 1934 carried away an estimated 300,000 tons of top soil [*sic*] from the Great Plains" (Brooks and Jacon 1994:10). The resultant overgrazing and plowing of soils in areas not suitable for raising crops was the main underlying cause of the Dust Bowl (Brooks and Jacon 1994:11; Witt et al. 2013:3).

In 1935, the Soil Conservation Service (SCS) was established and introduced various methods to fight erosion and soil moisture loss. Techniques included wind strip cropping, contour farming, rough tillage, field windbreaks, shelterbelts, and contour furrowing and pitting (Witt et al. 2013:22-23). In addition, much of the land opened for dry-farming before World War I was reseeded with native grasses and waterholes for cattle were built to revert the area back into grazing land (Brooks and Jacon 1994:11; Grant 2011).

Tourism – "Tourism is South Dakota's principal industry today, with such Black Hills attractions as Custer State Park, Mount Rushmore, Historic Deadwood, the Sturgis Motorcycle Rally, and Crazy Horse Monument, its main drivers" (Sundstrom 2019:II-298). Tourism was aided by the state's interstate system, which provided easy access to the Black Hills, Badlands, National Grasslands, and recreational areas along the Missouri River. Wind Cave National Park was established in 1903 by Theodore Roosevelt. Soon after, South Dakota created its first state park, Custer State Park, established in 1913 and named after Lieutenant Colonel George Armstrong Custer (Sundstrom 2019). Doane Robinson went to Gutzon Borglum with the idea of creating Mount Rushmore in the Black Hills as a way to promote tourism in the state (Wolff 2005:311; Sundstrom 2019). Construction started in 1927 and was completed in 1941. After the completion of Mount Rushmore, Korczak Ziolkowski, who worked on Mount Rushmore under Borglum, was commissioned to create the Crazy Horse Memorial. Construction began in 1948 and continues today.

Federal Relief – The collapse of wartime prices for grain in the 1920s instigated an economic depression in South Dakota that lasted through the 1930s, concurrent with the Great Depression (Dennis 1998:5). In 1931, more banks closed than in any other year, resulting in a wave of farm foreclosures (Dennis 1998). The Great Depression of the 1930s spurred change throughout the state. Rural populations decreased while city populations grew. Because of the price decline of farm produce, cooperatives enjoyed a renewed popularity as farmers banded together to market their products and reduce farming costs. Farmers Unions built local elevators and organized oil cooperatives that served the needs of the rural community. Despite economic problems, crop failures, dust storms, and extreme weather, South Dakota visibly modernized during the 1930s,

shifting to mechanized farming operations and motorized transportation. Federal relief programs improved highways, state parks, and city services throughout the state.

Immediately after Franklin Roosevelt took the oath of office, he began passing a series of laws to put people back to work, restoring faith in the banking system, and shoring up the economy (Dennis 1998; Remele 1989). Among these efforts were the Works Progress Administration (WPA), the Civilian Conservation Corps (CCC), the Federal Emergency Relief Administration (FERA), Agricultural Adjustment Act (AAA), the National Industrial Recovery Act (NIRA), the Public Works Administration (PWA), the Civil Works Administration (CWA), and the National Youth Administration (NYA; Dennis 1998:7-8). Notable New Deal projects include the Black Hills Airport (demolished; FERA), Sioux Falls City Hall (PWA), former Roberts County Jail in Sisseton (PWA), sanitary sewers (PWA), storm sewers (PWA), street improvements (PWA), water systems (PWA), Watertown Regional Airport Hangar (CWA), Dell Rapids City Park Bathhouse (CWA), and Centerville municipal building (FERA; The Living New Deal).

CCC work projects fall into nine classifications and include structural improvements, transportation, erosion control, flood control, forest protection, landscape and recreation, range, wildlife, and miscellaneous (Dennis 1998:14). In South Dakota, most CCC projects were associated with the Forest Service, with accomplishments including forest thinning, creating fire breaks, debris removal, build and staff fire lookouts, creating 1,528 miles of truck and fire trails, constructing 1,400 miles of telephone lines, insect and rodent control, road improvements, bridge construction, dam construction, and the development of recreational facilities (Dennis 1998:17). Examples of CCC projects included the Harney Peak Lookout Tower at Mount Rushmore, Badlands National Park in cooperation with the WPA, Horsethief Lake, Stockade Lake, Bismarck Lake, Center Lake, and Pactola Lake Camp Site (The Living New Deal; Dennis 1998). In association with the SCS, the CCC established wind and water erosion control through conservation practices, including shelterbelts, rock dams, "terraces, pasture furrows, sod waterways, contour lines, strip cropping, and rough tillage" (Dennis 1998:24).

WPA work projects fall under seven categories: municipal engineering, airport and airway, public buildings, highway and roads, conservation, engineer survey, and disaster emergency activities (Dennis 1998:39-41). In South Dakota between 1935 and 1942, the WPA built, improved, or renovated more than 18,780 miles of highways, roads, and streets, 1,303 bridges and viaducts, 11,193 culverts, 309 schools, 107 parks, 89 playgrounds and athletic fields, 15 swimming pools, 61 utility plants, 138 miles of water mains and distribution lines, 115 miles of sewers, 38,818 privies, 14 airport landing fields, 18 airport buildings, and hundreds of small dams (Dennis 1998:43-44). WPA project examples include the Amsden Dam and Lake, Aurora County Courthouse, Camp Rapid, former Governor's Mansion, telephone lines, Rapid City Library, former Spearfish City Hall, Dell Rapids City Park Amphitheater, Dinosaur Park in Rapid City, and Wind Cave National Park in cooperation with the CCC (The Living New Deal; Dennis 1998).

Post-World War II – From the 1940s to the 1960s, South Dakota continued to develop modern agriculture, industry, and infrastructure. Starting in the 1940s, favorable weather and improved crop yields coincided with higher prices stimulated by America's entry into World War II. By the end of the war, farm debt had dropped noticeably. After the war, the state's industrial economy continued to prosper. However, while some small towns prospered during and after World War II, others eventually disappeared (Dennis 2007:6). Starting in the 1940s, many farmers and small-town folk moved to the larger urban centers such as Rapid City, Sioux Falls, Aberdeen, Watertown, and Huron (Dennis 2007). Additionally, with the decreased use of railroad and the construction of Interstate-90 and Interstate-29, urban growth continued (Dennis 2007:10).

"Perhaps the biggest change in South Dakota [following World War II] was the electrification of the rural areas of the state" (Dennis 2007:6). In 1947, only 30% of the farms in South Dakota had electricity; however, by the end of the decade, 60% had power (Thompson 2005; Dennis 2007). And between 1950 and 1960, the percentage of rural South Dakotans with electricity increased to 96% (Dennis 2007:10).

Pick-Sloan Plan – As part of the Pick-Sloan Program (i.e., Missouri River Basin Project), several multi-purpose reservoirs were created, including Fort Randall Dam (construction began in 1946; completed in 1953), Oahe Dam (construction began in 1948; completed in 1962), Gavins Point Dam (construction began in 1952; completed in 1957), and Big Bend Dam (construction began in 1959; completed in 1963). These reservoirs were created as a solution for extreme flooding and irrigation and power development projects. "The construction of these dams resulted in a number of housing projects, including the construction of the town of Pickstown near Fort Randall Dam and the Oahe Addition in Pierre" (Dennis 2007:7). It also flooded lands along the Missouri River, forcing several families and, in some cases, towns to relocate.

Energy – Industrial developments included the beginning of the energy industry; in 1954, oil was discovered within the Williston Basin in the northwestern corner of the state, in Harding County (American Oil & Gas Historical Society [AOGHS] 2017). A year later, oil was found in Custer County, associated with the Powder River Basin (AOGHS 2017). With the completion of the hydro-electric dams along the Missouri River, they supply more electricity to the state (44%) than any other form of electricity: wind energy (24%), coal (21%), and natural gas (11%; Energy Information Administration [EIA] 2020).

Preliminary Field Review

In an effort to ensure cultural property protections, the Proponent sent BCA a preliminary project plan for the North Bend Wind Project to check for any potential issue areas. The preliminary array consisted of 72 turbine pads, each with a 100' diameter survey area, 30 miles of access roads with a 40' wide survey corridor, 56 miles of collection lines with a 20' wide survey corridor, a 5-mile-long general tie-in (i.e., transmission line) with a 50' wide survey corridor, a 3-acre substation location, and a 7-acre POI. A total of 359 acres were inventoried to Level III standards.

Level I Records Search

The Level I records search for the preliminary field review, requested by Brittany Brooks of BCA and provided by Brian Huot from the South Dakota ARC on October 26, 2020, revealed one prehistoric cultural resource and five architectural sites (three bridges and two buildings) as well as two projects within a one-mile radius of the project area. One of the previously recorded cultural resources (39HU78) was located within the preliminary survey area and was visited and updated by BCA staff.

Preliminary Field Survey

Between November 16-19, 2020, BCA archaeologists Alex Atkinson, Reilly Lembo, Liz Cheli, Silas Chapman, Larry Pallozzi, and Russell Red Horn conducted the preliminary field survey for the proposed project. Alex Atkinson served as the Principal Investigator and Wade Burns served as the Project Director.

The survey area was located entirely on private property on both sides of the Hughes-Hyde County line; however, the majority of the array was located within Hughes County. The predominant use of the land is currently agriculture; both rangeland and cropland were encountered during the survey.

The landforms in the survey area consisted of rolling hills, small marshes, and flat tablelands. The vegetation can be divided into two sections, cropland and rangeland. Primary crops were wheat, corn, soybeans, and sorghum. Rangeland consisted of mixed native and non-native grasses, such as crested wheatgrass, blue grama, little bluestem, needle-and-thread, thistle, snowberry, dock, curly cup gumweed, coneflower, yellow-sweet clover, alfalfa, smooth brome, and other shortgrass species. At the time of inventory, the ground surface visibility (GSV) was approximately 30-60% in cropland and 30-40% in rangeland. Weather conditions for the pedestrian survey were clear to partly cloudy, with the temperature varying from 38-60°F. The elevation of the preliminary array ranged from approximately 1,819-2,066' above mean sea level AMSL.

Results and Recommendations

One of the previously recorded cultural resources was located within the preliminary project area and was visited and updated. During the 2020 preliminary field review, a total of 12 cultural resources were identified and recorded. A brief overview of the cultural resources is provided below, and detailed descriptions are provided in Appendix D.

REDACTED

Following the completion of the preliminary field review, the Proponent provided an updated layout for the proposed project that was designed to accommodate site avoidance of the cultural resources encountered during the survey. The updated project layout was successfully designed to avoid all 13 cultural resources documented within the preliminary project layout. As a result, no specific avoidance measures are recommended for this project.

Revised Alignment Level III Pedestrian Inventory

The proposed final project alignment is located primarily on private property, with a portion of the proposed project located on State Trust land.

Level I Record Search

On June 8, 2021, Brittany Brooks of BCA requested a records search from the South Dakota Archaeological Research Center (ARC) in Rapid City, South Dakota, and received the results on June 7, 2021, from Amber Odom. The records search is used to indicate the types, distribution, and density of cultural resources within a 1.5-mile radius of the proposed project area.

South Dakota ARC Records

The records search indicated that four projects had been conducted within a 1.5-mile radius of the survey area. Portions of two of these projects cross into the survey area: ASD-0050 (2018) and ESD-0228 (2000). The manuscripts within the 1.5-mile radius of the project are included in tabular form in Appendix B (Table 4).

The records search also revealed that the site distribution is light and included one prehistoric site and five architectural sites (three bridges and two buildings) on file at the time of the records search. These results are included in tabular form in Appendix B (Table 3). None of the previously recorded cultural resources are within the survey area for the currently planned project alignment.

Level III Pedestrian Survey

The survey area was mapped over the centerline of the proposed project. The records search results, including cultural resources and previous surveys completed within the last 10 years, were then added to this map. This Level III pedestrian survey covered the project area not previously surveyed. When combined with the previous Level III surveys, this inventory covers the project

area, plus a buffer. The purpose of the inspection was to identify, via a pedestrian survey, any cultural resources within the survey area.

Inventory Methodology

Prior to the inventory, the survey area and known cultural resources are mapped onto a Trimble Juno global positioning system (GPS). USGS topographic maps and the Trimble Juno GPS are used by BCA staff to navigate and orient within the survey area.

The survey area is inventoried by the BCA archaeologists and TCSs walking parallel linear pedestrian transects 10 m apart based upon terrain and probability for cultural resources. Throughout the survey, field observations are recorded as field notes in a bound notebook and digital photographs are taken. Should the ground surface visibility (GSV) fall below 30%, intervals are surveyed closer together, and shovel test probes (STPs) are implemented. If a cultural resource is encountered, the location is marked with pin flags, and the surrounding area is intensely scrutinized to determine the nature and extent of the resource. The resource is then plotted on a USGS 7.5' Quad map utilizing a Trimble GPS. Cultural material is not collected.

Project Personnel

Between August 3-12, 2021, BCA archaeologists conducted the Level III cultural resource inventory, with Alex Atkinson serving as the Principal Investigator and Wade Burns serving as the Project Director. The concurrent TCP inventory was conducted by tribal representatives from the three tribes who indicated interest in participating in the project to WAPA. These Tribal Cultural Specialists (TCSs) included Odell St. John, Jr. (Crow Creek Sioux Tribe), Dwight Luxon (Rosebud Sioux Tribe), and Lonnie Provost (Yankton Sioux Tribe).

Additionally, BCA archaeologist/Principal Investigator Alex Atkinson and Rosebud Sioux Tribe TCS David Kills in Water surveyed reroutes to the alignment between September 1-3, 2021.

Survey Conditions

Weather conditions consisted of sunny, hazy, and overcast skies, and the temperature ranging between 78-94°F. The project area was located on the flat plains and rolling hills within the Fort Randall Reservoir and Medicine Knoll drainage systems. The survey area was located within agricultural fields and rangeland. Vegetation in the area consisted of native and non-native grasses, plants, and forbs, including wheat, corn, sorghum, soybean, sunflower, alfalfa, buffalo grass, crested wheatgrass, smooth brome, blue grama, sage, cattails, ball cactus, milkweed, yarrow, sage, Canada thistle, prairie turnip, sideoats grama, thickspike wheatgrass, skeletonweed, yellow and purple coneflower, snowberry, Russian thistle, traveling jenny, morning glory, curly cup gumweed, silver leaf scurfpea, juniper, and green foxtail barley. The elevation of the survey area ranged from 1,850-2,100' above mean sea level (AMSL). During the inventory, the GSV was approximately 30-40% on average within rangeland, 50-60% within growing wheat fields, 75% within the harvested wheat fields, 30-60% within the sunflower fields, 30-40% within the soybean fields, 30-40% within the hay fields, 40-45% within the corn fields, and 30% within the sorghum fields. As a result, no STPs were implemented as a result of low GSV since the GSV never dropped below 30%. Areas of higher visibility, such as erosion features, areas of sparse vegetation, and rodent burrows, were also carefully examined for cultural material. Overview photos of the survey area are included in Appendix B.

Cultural Resource Results and Recommendations

While conducting the pedestrian survey, it was noted that the survey area is presently used for agricultural production, livestock grazing, and wildlife habitat. Previous disturbances include plowing activities, gravel pits, fence lines, overhead and underground utilities, road construction, two-track roads, field-clearing piles, stock ponds, cattle activity, shelter belts, and erosion.

No previously recorded cultural resources were located within or near the survey area. However, 13 cultural resources were discovered during the inventory. A brief overview of the cultural resources is provided below, and detailed descriptions are provided in Appendix D.

REDACTED

Following the pedestrian inventory in August 2021, the Proponent provided BCA with reroutes to avoid the documented cultural resources. These reroutes were surveyed by BCA archaeologist Alex Atkinson and Rosebud Sioux Tribe TCS David Kills in Water between September 1-3, 2021. The reroutes successfully avoid all cultural resources by over 50'. Additionally, BCA recommends placing temporary avoidance fencing along the edge of the survey area near each of the stone feature sites during construction activities.

Traditional Cultural Property Survey

The purpose of the TCP survey was to have TCSs identify cultural heritage finds within the areas surveyed. During this portion of the project, BCA did not identify features or interpret TCP finds; BCA's sole responsibility for this project was to compile the information provided by the TCSs.

In addition, each TCP, along with each of the sites documented by BCA archaeologists during the concurrent Level III pedestrian survey, were revisited by each TCS. These revisits allowed the participating tribes the ability to survey the area within and immediately around the current TCP or site boundaries so they may give their input on how the locations are recorded and avoided. Additionally, it provided the opportunity to identify any additional TCPs within the areas surveyed. All features determined by the TCSs as a TCP were documented by BCA on a South Dakota TCP form and filed with the South Dakota SHPO.

According to WAPA, three tribes expressed an interest in participating in the TCP survey: the Crow Creek Sioux Tribe, the Rosebud Sioux Tribe, and the Yankton Sioux Tribe. The primary TCP survey covered the same locations as and was conducted concurrently with the Level III archaeological pedestrian inventory between August 3-12, 2021. Tribal representatives for the project included Odell St. John, Jr. (Crow Creek Sioux Tribe), Dwight Luxon (Rosebud Sioux Tribe), and Lonnie Provost (Yankton Sioux Tribe). Additionally, Rosebud Sioux Tribe TCS David Kills in Water surveyed reroutes to the alignment with BCA archaeologist Alex Atkinson between September 1-3, 2021.

Survey Methods

In an attempt to provide the reviewing and consulting parties as well as the participating TCSs and archaeologists a standardized approach to the multi-tribal traditional cultural survey, the tribal review meets the South Dakota SHPO's minimum survey standards for archaeologists. This consists of walking parallel linear pedestrian transects between 10 m apart ; however, tighter transects may also be conducted should the TCSs feel it to be appropriate.

United States Geological Survey topographic maps and Trimble Juno GPS units are used by BCA staff to assist with orientation and documentation. If a TCP is identified during the inventory, the location is marked with pin-flags, photographed, and coordinates are taken with a Trimble GPS unit running ArcPad. The surrounding area is intensely scrutinized to determine the nature and extent of the resource. The resource is then plotted on a USGS 7.5' Quad. map utilizing a Trimble GPS unit. The tribes will share the amount of knowledge they feel comfortable to meet these requirements.

In an effort to identify all visible cultural resources within the areas surveyed, the participating TCSs are to apply their specific survey standards and methods in addition to the particular methods

and standards planned for this project. As such, each TCS has the right to survey under their prescribed methodology, as well as to interpret and share whatever information they deem necessary for their portion of their participation in the project.

Field Results

For each cultural heritage find encountered, GPS points of the features and/or boundary were taken. On behalf of the TCSs, the BCA staff documented any specific feature and/or details for which the TCSs wanted disclosed. At the request of the South Dakota SHPO, the information determined by the tribal representatives as allowable for documentation were detailed within a South Dakota TCP form. The TCPs and associated Geographic Information System (GIS) data were submitted to the South Dakota SHPO for their review and processing. Copies of these forms and GIS files will also be forwarded to the Tribal Historic Preservation Offices (THPOs) for their project records.

During the TCP survey, a total of 30 TCPs were identified by tribal representatives. A summary of the recorded TCPs, which have been assigned BCA field codes, is provided below in Table 2. Further information regarding each TCP is provided in Appendix E.

Due to the importance of these locations to local tribes, BCA recommends that each of the TCPs documented during the TCP survey be avoided. Following the original TCP survey in August 2021, the Proponent provided BCA with reroutes to avoid the documented TCPS. These reroutes were surveyed by Rosebud Sioux Tribe TCS David Kills in Water and BCA archaeologist Alex Atkinson between September 1-3, 2021. The reroutes successfully avoid all TCPs by over 50'. Additionally, BCA recommends placing avoidance fencing along the edge of the survey area near each of the TCPs during construction activities.

Table 2. Summary of TCPs identified during the TCP Survey.

TCP Identification Number	# of Features	TCP Summary
REDACTED		

Management Summary

Beaver Creek Archaeology, Inc. conduct a Level III cultural resource survey and facilitated a TCP inventory of the proposed North Bend Wind Project. The concurrent Level III inventory/ TCP survey covered approximately 2,034 acres. The location of the proposed project's survey area can be seen on the map located in Appendix A.

The Level I file search revealed one site and three architectural structures located within a one-mile radius of the final proposed project area. None of the previously recorded cultural resources are located within or near the survey area, and consequently, no previously recorded resources will be impacted by this proposed project.

During the intensive pedestrian survey, 13 new cultural resources were encountered, including 11 prehistoric stone feature sites and two architectural sites. Each of the stone feature sites has been recommended as eligible for nomination to the NRHP and avoidance measures are recommended. The two architectural sites have been recommended as ineligible for nomination to the NRHP and no specific avoidance measures are recommended.

Additionally, 22 TCPs were identified by tribal representatives during the TCP inventory, including both physical and non-physical surface expressions and an isolated find.

The Proponent has rerouted or moved proposed project elements in order to avoid each stone feature site or TCP by a minimum of 50'. Additionally, BCA recommends placing avoidance fencing along the edge of the survey corridor near each of the stone feature sites and TCPs.

As long as these avoidance recommendations are followed, BCA recommends a finding of *No Historic Properties Affected* for this project as surveyed, photographed, mapped, and described herein.

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Appendix A: Map

North Bend Wind Project

North Bend Wind Project, LLC

Legend

- Survey Area (2,034 acres)
- Turbines
- NorthBend Project Substation
- NorthBend POI
- Updated Collection Lines (68 miles)
- Updated Access Roads (35 miles)
- Preliminary Survey Area (359 Acres)
- Previously Surveyed

T110N R73W, T110N R74W
T111N R73W, T111N R74W,
T112N R73W

Fort Randall Reservoir &
Medicine Knoll Drainages

Chapelle Lake, Chapelle Lake NW, Chapelle Lake SE,
Chapelle Lake SW, & De Grey NE Quad. Maps

Hughes County & Hyde County, South Dakota

0 425 850 1,700 2,550 3,400 Meters
0 0.25 0.5 1 1.5 2 Miles

N W E S

Beaver Creek ARCHAEOLOGY

Base Map: USGS 7.5'
Scale: 1:24,000
UTM NAD83 Zone 14

GE

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Appendix B: Survey Area Photographs



Figure 3. Overview of the survey area. View to the east.



Figure 4. Overview of the survey area. View to the west.



Figure 5. Overview of the survey area. View to the north.



Figure 6. Overview of the survey area. View to the south.



Figure 7. Overview of the survey area. View to the northeast.



Figure 8. Overview of the survey area. View to the northwest.



Figure 9. Overview of the survey area. View to the southeast.



Figure 10. Overview of the survey area. View to the southwest.

Appendix C: Records Search

June 8, 2021

REDACTED

Appendix D: Detailed Cultural Resource Descriptions

REDACTED

Appendix E: Detailed Traditional Cultural Property Descriptions

REDACTED

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
Response to Staff's Fourth Data Request

Date of Fourth Data Request: October 6, 2021

Data Request:

4-6) Refer to North Bend Wind Project, LLC's response to staff data request 1-3. Please provide an update on the Hyde and Hughes county permit processes.

Responses:

CUP applications were filed in mid-June to both Hughes and Hyde Counties. Hyde County held a hearing on August 10, 2021 related to the CUP application where it was approved. Hughes County recently notified Engie that their preference would be to review and finalize the road use maintenance agreement (RUMA) before allowing the CUP application to be reviewed in a hearing before the Board of Adjustments. Engie is currently exchanging redline versions of the RUMA with the County at this time. We are hopeful that we can finalize the RUMA in a few weeks that will allow the CUP to be reviewed by the Board of Adjustment in their next meeting toward the end of November.

Response Prepared by:

Casey Willis

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
Response to Staff's Fourth Data Request

Date of Fourth Data Request: October 6, 2021

Data Request:

4-7) Refer to North Bend Wind Project, LLC's response to staff data request 4-2. Mr. Casey Willis was identified as the respondent to staff data request 4-2. Who is the Applicant's expert on the safety of aerial spraying in the vicinity of wind facilities? Please provide their experience, training, and education.

Responses:

The responses provided in response 3-2 are based on experience that I have working in the wind industry. Aerial applicators are presently flying within and in proximity to wind energy projects and have been doing that for years all across the United States. The point being this is not a unique issue to South Dakota, this area or the adjacent parcel owned by Mr. Bollweg. Engie is one of many operators in the wind industry that address safety concerns tied to aerial spraying utilizing a collaborative process as laid out in data response 2-8. Should the docket develop in such a manner as to make clear the need for such a witness in rebuttal, Applicant will consider engaging an expert at such time.

Response Prepared by:

Casey Willis

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
Response to Staff's Fifth Data Request

Date of Fifth Data Request: October 21, 2021

Data Request:

5-1) Refer to North Bend Wind Project, LLC's response to staff data request 3-2.

a) The Applicant suggested that Mr. Bollweg reach out to Barber's aerial application out of Onida. In response to Staff data request 1-2(b) to Mr. Bollweg, Mr. Bollweg stated that Mr. Barber currently sprays the Bollweg farm properties, and Mr. Bollweg intends to call Mr. Barber as a witness to testify "that wind towers either make ag spraying very dangerous or complicated. The airflow off the turbines disrupts the spray patterns off the aircraft, making the spray less effective." Please clarify why it was suggested by the Applicant that Mr. Bollweg contact Mr. Barber.

b) Please explain how the proposed turbine layout provides a safe entrance and exit to aerial spray the SW ¼ Section 11 – 111-74 when a turbine is proposed to be located on all four sides of the property (turbine 8 to the north, turbine 15 to the east, 22 to the south, and turbine 14 to the west).

Responses:

a) PUC staff had requested that Engie reach out to local aerial applicators that spray in the area. The most logical starting point for us was to approach our landowners that have crops to discuss who is currently spraying their property and if there were concerns associated with turbine placement and spraying, should North Bend be approved and constructed.

We approached one of our signed landowners in NW/4 of Section 14, Township 11N, R074W, which is immediately adjacent to the location that Mr. Bollweg has identified. Engie has proposed a turbine within this quarter section (WTG 22). As noted in response 3-2, our landowner conveyed that Barber's aerial application in Onida currently sprays this parcel and the feedback we received was that Barber would continue to do so when the project is constructed. As you indicated in your question, we now understand that Mr. Barber also sprays Mr. Bollweg's property as well.

It is true that operating turbines would create instability of the airflow. It is also true that if aerial applicators were to spray during high wind speeds, that the spray pattern would be less effective and lends itself to the possibility of accidentally spraying on adjacent properties (drift). It is our understanding that spray operations should occur when sustained wind speeds are below 10 miles per hour. The need for application during low wind speed conditions is specifically referenced in the *Aerial Applicator's Manual: A National Pesticide Applicator Certification Study Guide* published by the National Association of State Departments of Agricultural Research Foundation as one example.

As noted in Table 4-2 of the application, the GE 2.82-127 turbine cannot even begin to operate until there are sustained wind speeds at 3 meters per second, or 6.7 miles per hour. Even when the turbines can begin operating in these low wind conditions, they produce very little power until the wind speeds reach at least 15 mph. It is for this reason the industry typically coordinates operational shutdowns during low wind speed conditions. The industry does so in order to provide assurances to aerial applicators so they can safely spray crops, both on properties with turbines and in proximity to land with wind turbines. This gives the aerial applicator assurances that the turbines will not be operating thus limiting the instability in the airflow or other obstructions to allow for the safe application of herbicides on crops.

b) Our position is and has always been, that the location in question and adjacent to the proposed layout is not obstructed by the proposed turbine locations. The applicator that Mr. Bollweg elects to utilize has the ability to coordinate with Engie on a mutually agreeable shutdown time during a low wind condition, such that we can provide assurances that the turbines will not be operating during the period of time when the spray applications are occurring.

As further evidence that we do not view Mr. Bollweg's parcel as unique compared to other property in the area, we have contacted approximately one dozen landowners that grow crops within our Triple H Wind Project to inquire about their experience. This is a sample of landowners that have turbines on the properties or are in proximity to properties that have turbines operating. The overall feedback received was that there have been no issues with the aerial applicators continuing to spray their properties. There were a few comments regarding the need for the applicators to do additional passes in order to adequately spray the properties. Enclosed with this response is a map that illustrates property locations that are currently owned by approximately a dozen landowners that are currently being sprayed by aerial applicators. Of the landowners Engie staff has discussed this matter with, three applicators were identified that are currently flying properties within and in the vicinity of the Triple H Wind Project. These include Agtegra (Harrold), Wilbur-Ellis (Harrold) and Kroeplin (Highmore).

Response Prepared by:
Casey Willis

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
Response to Staff's Fifth Data Request

Date of Fifth Data Request: October 21, 2021

Data Request:

5-2) Please provide a map that shows the distance of the proposed turbines 8, 9, 14, and 21, and 22 from Mr. Donald Bollweg's closest property line of NE ¼ Section 10 – 111-74. Please provide a map similar to Page 88 of 156 of Staff Exhibit_JT-1 in Docket EL18-003 for Ms. Teresa Kaaz (http://puc.sd.gov/commission/dockets/electric/2018/EL18-003/exhibits/staff/s1.pdf).

Responses:

Refer to the attached map for distances from turbines 8, 9, 14, and 21, and 22 from Mr. Donald Bollweg's closest property line of NE ¼ Section 10 – 111-74. The table below also highlights the distances per turbine location.

Turbine	Distance
Turbine 08	877 feet
Turbine 09	3,225 feet
Turbine 14	894 feet
Turbine 21	3,643 feet
Turbine 22	4,033 feet

Response Prepared by:

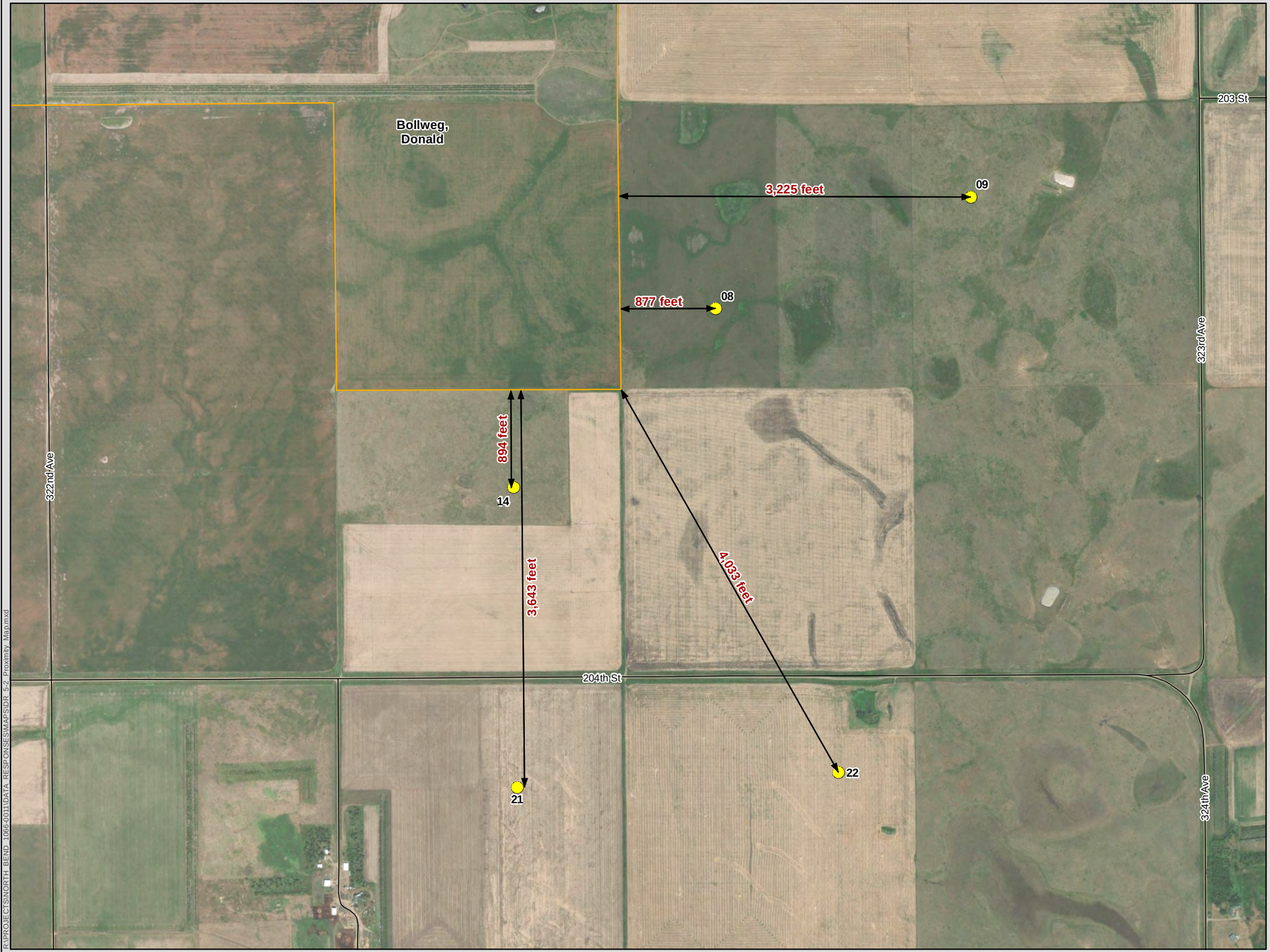
Manuela Elizondo, Tetra Tech

ENGIE

North Bend Wind Project

Donald Bollweg
Turbine Proximity

Hughes and Hyde Counties, SD



Parcel Boundary
Proposed Turbine
Turbine Proximity

N

0 250 500 1,000
Feet



TETRA TECH

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South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
Response to Staff's Fifth Data Request

Date of Fifth Data Request: October 21, 2021

Data Request:

5-3) Please provide a map that shows the distance of the proposed turbines 8, 14, 15, 20, 21, and 22 from Ms. Bollweg's closest property line of SW ¼ Section 11 – 111-74. Please provide a map similar to Page 88 of 156 of Staff Exhibit_JT-1 in Docket EL18-003 for Ms. Teresa Kaaz (http://puc.sd.gov/commission/dockets/electric/2018/EL18-003/exhibits/staff/s1.pdf).

Responses:

Refer to the attached map for distances from turbines 8, 14, 15, 20, 21, and 22 from Ms. Bollweg's closest property line of SW ¼ Section 11 – 111-74. The table below also highlights the distances per turbine location.

Turbine	Distance
Turbine 08	736 feet
Turbine 14	1,017 feet
Turbine 15	768 feet
Turbine 20	4,496 feet
Turbine 21	1,406 feet
Turbine 22	876 feet

Response Prepared by:
Manuela Elizondo, Tetra Tech

ENGIE

North Bend Wind Project

Judi Bollweg
Turbine Proximity

Hughes and Hyde Counties, SD

08
736 feet
768 feet
15
14
1,017 feet
Bollweg, Judi
323rd Ave
322nd Ave
204th St
4,496 feet
1,406 feet
876 feet
20
21
22
324th Ave

Parcel Boundary
Proposed Turbine
Turbine Proximity

N
0 250 500 1,000
Feet



TETRA TECH

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South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
Response to Staff's Fifth Data Request

Date of Fifth Data Request: October 21, 2021

Data Request:

5-4) Please provide a map that shows the distance of the proposed turbines 19 and 27, and permanent met tower 2, from the closest property lines of the 240 acres that Mr. Michael Bollweg and Ms. Bollweg owns of the NE ¼ Section 21 – 111-74 and the south half of the SE ¼ Section 16 – 111-74. Please provide a map similar to Page 88 of 156 of Staff Exhibit_JT-1 in Docket EL18-003 for Ms. Teresa Kaaz (http://puc.sd.gov/commission/dockets/electric/2018/EL18-003/exhibits/staff/s1.pdf).

Responses:

Refer to the attached map for distances from turbines 19 and 27, and permanent met tower 2 from the closest property lines of the 240 acres that Mr. Michael Bollweg and Ms. Bollweg owns of the NE ¼ Section 21 – 111-74 and the south half of the SE ¼ Section 16 – 111-74. The table below also highlights the distances per structure location.

Structure	Distance
Turbine 19	1,742 feet
Turbine 27	694 feet
MET Tower 2	2,665 feet

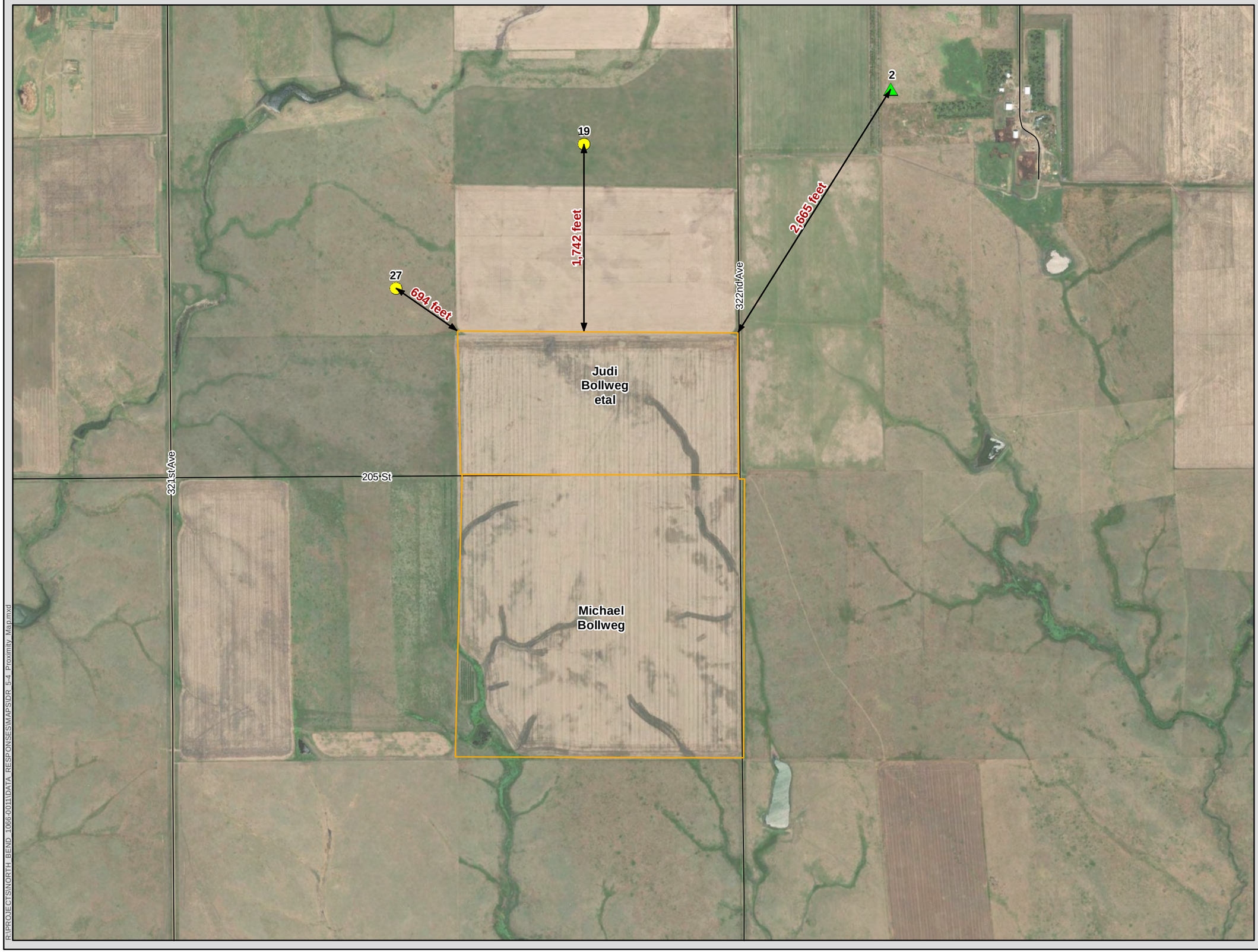
Response Prepared by:
Manuela Elizondo, Tetra Tech

ENGIE

North Bend Wind Project

Michael Bollweg and Judi Bollweg Turbine Proximity

Hughes and Hyde Counties, SD



- Parcel Boundary
- Proposed Turbine
- Permanent Met Tower
- Turbine/Met Tower Proximity

N

0 250 500 1,000

Feet



TETRA TECH

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South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
Response to Staff's Fifth Data Request

Date of Fifth Data Request: October 21, 2021

Data Request:

5-5) What is the distance in feet from proposed turbine 6 to Mr. Bollweg's lodge (Receptor 21 in Appendix D - Acoustic Assessment)? What is the distance in feet from proposed turbine 6 to Donald Bollweg's closest property line as shown in response to staff data request 1-11, page 4 of 8?

Responses:

Refer to the attached map for the distance from turbine 06 to Mr. Bollweg's lodge (Receptor 22). Per the request, Receptor 21 was also included in this request. In addition, turbine 06 is approximately 3,467 feet from Mr. Bollweg's closest property line. The table below also highlights the distances per structure location.

Structure	Distance from Turbine 6
Receptor 21	8,542 feet
Receptor 22	7,933 feet
Property Line	3,467 feet

Response Prepared by:
Manuela Elizondo, Tetra Tech

ENGIE

North Bend Wind Project

Donald Bollweg
Turbine Proximity

Hughes and Hyde Counties, SD

202 St

321st Ave

322nd Ave

Bollweg, Donald

8,542 feet

7,933 feet

3,467 feet

06

- Parcel Boundary
- Receptor 21
- Receptor 22
- Proposed Turbine
- Turbine Proximity

N

0 500 1,000 2,000

Feet



TETRA TECH

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South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
Response to Staff's Fifth Data Request

Date of Fifth Data Request: October 21, 2021

Data Request:

5-6) What is the vertical distance from ground level to the tip of a wind turbine blade when the blade is at its lowest point of the proposed GE 2.82-127 turbine model?

Responses:

The blade at its lowest point would be 25.5 meters or 84 feet from the ground.

Response Prepared by:

Casey Willis

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
Response to Staff's Sixth Data Request

Date of Sixth Data Request: November 23, 2021

Data Request:

6-1) Refer to Appendix B of the Application and North Bend Wind Project, LLC's response to staff data request 1-11.

a) Has the Applicant obtained signed easements for all parcels of land marked participating in response to staff data request 1-11?
b) Please provided a revised Appendix B that starts with same land under easement as reflected in response to staff data request 1-11 and shows the final usable turbine area. Turbines 14 and 56 are not placed on land that is identified as usable turbine area on Appendix B

Responses:

Yes, all easements were executed that are necessary for the North Bend Project. The Appendix B, useable turbine array slides show the locations of WTGs 14 and 56 as unsigned. They were actually signed, but the easements were not recorded until May and June 2021, respectively. We do not show easements as signed in our database until the memorandum of easement is returned from the County Recorder. The maps that were done in Appendix B were generated prior to Engie receiving the recorded easements.

The maps previously provided with response to staff data request 1-11 have been updated to reflect the useable turbine area. Please note that one turbine (WTG 02) is slightly outside of a useable turbine area location. The County requires a 750 foot setback from section lines. Engie adds an additional 50 feet on top of that to be conservative. While the current location is 768 feet from the section line, which complies with the County standard, ENGIE will plan to move it about 30 feet in order to maintain our own standards.

Some of the useable turbine areas polygon areas are small, but we have re-confirmed that with the exception of WTG 02, all turbines are proposed within useable turbine areas.

Response Prepared by:
Casey Willis

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
Response to Staff's Sixth Data Request

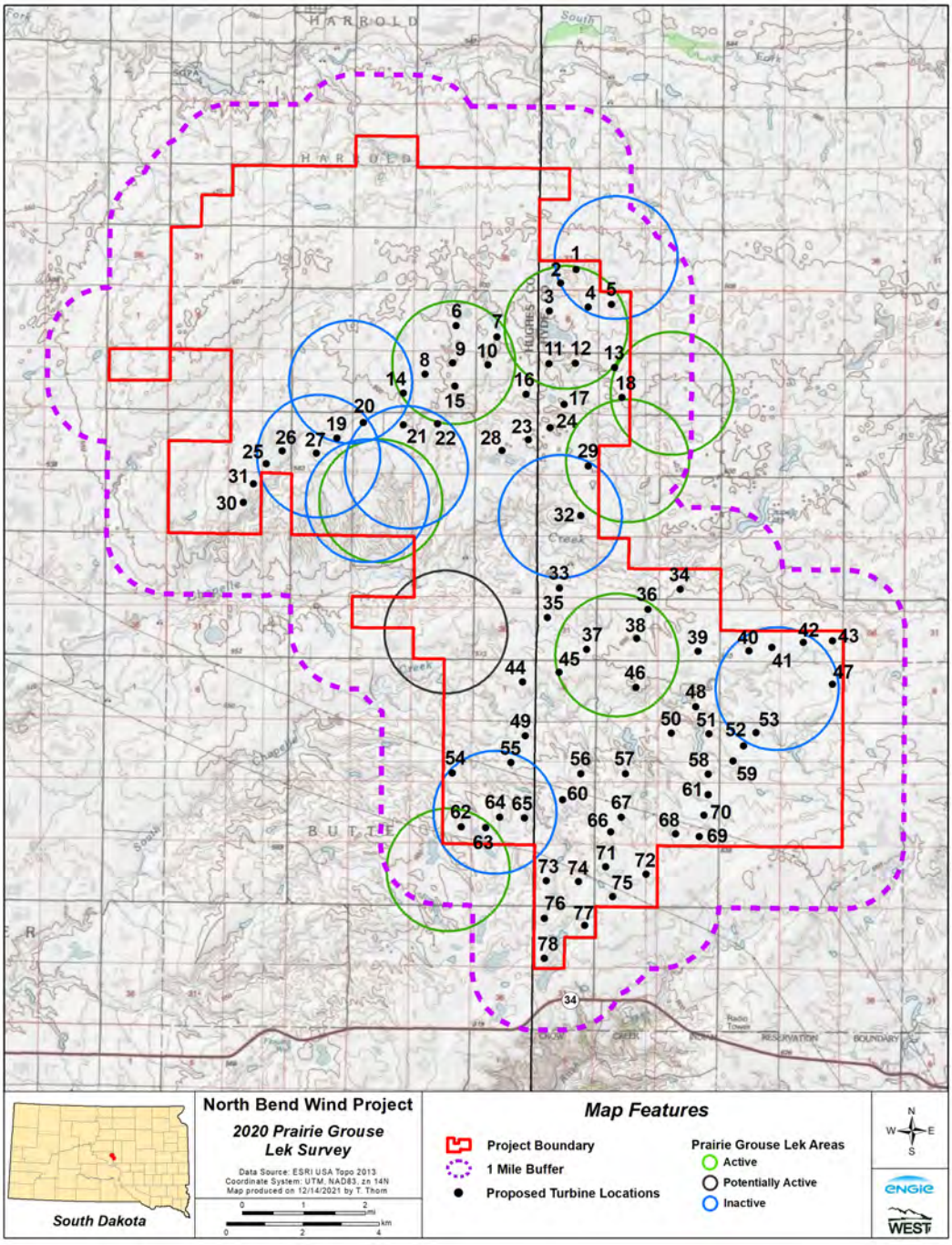
Date of Sixth Data Request: November 23, 2021

Data Request:

6-2) Refer to Page 20 of Appendix C of the Application. Please provide a revised figure that shows the proposed turbine locations in relation to the prairie grouse leks identified in the survey.

Responses:

See Figure below.



Identified prairie grouse leks with associated 1-mile (1.6-kilometer) buffers during survey efforts between 2016 and 2020 in relation to the proposed turbine layout for the North Bend Wind Project in Hughes and Hyde counties, South Dakota. Green buffers indicate active leks during 2020 surveys.

Response Prepared by:
Martin Piorkowski, WEST

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
Response to Staff's Sixth Data Request

Date of Sixth Data Request: November 23, 2021

Data Request:

6-3) Refer to Page 9-19 of the Application. North Bend Wind Project, LLC states "North Bend Wind will employ BMPs as described in SDGFP's Prairie Grouse Management Plan for South Dakota 2017-2021." Pages 16-17 of the referenced Prairie Grouse Management Plan ("PGMP") lists the Best Management Practices ("BMPs") in bulleted form.

a) The PGMP recommends avoiding development (e.g., roads, power lines, structures, energy development) in grasslands within occupied range, especially within 1 mile of lek sites.

i. How many leks are within 1 mile of a proposed development associated with this project?

ii. Please explain why North Bend Wind Project, LLC's proposed layout does follow this BMP.

b) Please identify which BMPs will not be followed and explain.

Responses:

The Project has identified 16 prairie grouse leks within the Project area since the first surveys in 2016. Fourteen of those leks are within 1 mile of some infrastructure. However, of those 14 leks, only six had birds attending the lek in three surveys conducted during the lek season (primarily April) of 2020.

Development of infrastructure (ground disturbance activities) will be conducted outside of the breeding and nesting seasons (March 1 – July 30) to the extent practical. Following the BMPs, any remaining disturbance that may need to occur will be limited to three hours after sunrise and one hour before sunset.

The following BMPs will not be implemented.

- Removal of abandoned buildings which could harbor mammalian nest predators.
    - This BMP will not be followed as the Project has no authority to remove buildings on private property.

- Avoid development (e.g., roads, power lines, structures, energy development) in grasslands within occupied range, especially within 1 mi of lek sites. Where development occurs within occupied range leks within 5 mi of development should be monitored indefinitely.
    - Engie has indicated that they would comply with the majority of this BMP, with the exception of indefinite monitoring. Agreeing to indefinitely doing any action would pose a problem for financing the Project.

      The development of this Project has proposed a total of 62 acres of grasslands that will be permanently altered for the successful operation of this Project. Although the BMPs do not directly state the objective of this effort, we presume that lek persistence is at the heart of the matter. North Bend proposes to develop a collaborative post-construction prairie grouse lek monitoring plan with SDGFP for all identified leks within 1-mi of proposed turbines in addition to any provided by SDGFP within 5-mi of proposed turbines. Similar approaches have been done on other projects (e.g., Prairie Winds SD1, Appendix G of FEIS). North Bend is already working with SDGFP on a Grassland Breeding Bird Displacement Study with the pre-construction first year of surveys that began in the summer of 2021.

Response Prepared by:
Martin Piorkowski, WEST

South Dakota Public Utilities Commission
North Bend Wind Project, LLC
Docket EL21-018
Response to Staff's Seventh Data Request

Date of Seventh Data Request: January 3, 2022

Data Request:

7-1) Refer to North Bend Wind Project, LLC's response to staff data request 1-25, Cumulative Acoustic Analysis Memo, Page 36 of 38. Receptor 5 appears to have an estimated sound level in the 45 – 50 dBA range during anomalous meteorological conditions.

a) Please define anomalous meteorological conditions.

b) Should wind facilities maintain compliance with sound requirements during anomalous meteorological conditions? Please explain.

c) Does the sound model produce results to the nearest tenth of decimal? If so, please provide the estimated sound level for Receptor 5 to the nearest tenth of decimal.

d) Does the Applicant interpret a sound level of 45.1 dBA to be in compliance with the county requirements that states that sound levels "shall not exceed 45 decibels of sound?" Please explain.

Responses:

a) Anomalous meteorological conditions are conditions that occur from time to time that are more favorable to the propagation of sound. The International Organization for Standardization (ISO) 9613-2, "Attenuation of Sound during Propagation Outdoors" standard includes a provision to account for the effects of anomalous meteorological conditions, which includes strong winds or temperature gradients. Temperature gradient effects are uniform in all directions from the source, whereas strong winds affect receptors primarily in the upwind and downwind directions. The classical theory of spherical wave propagation may not hold at very large distances from a sound source. The presence of anomalous meteorological conditions can cause sound rays to curve downward back towards the ground and then reflect upwards towards the gradient, which is then repeated leading to a trapped sound wave. The wave refraction effects due to wind and temperature gradients during downwind conditions result in the convergence of modified cylindrical wave spreading, which has a reduced rate of sound attenuation.

b) It is common engineering practice to assess wind facility sound level compliance assuming meteorological conditions favorable to propagation according to the ISO 9613-2 standard, i.e., downwind sound propagation or during a moderate atmospheric ground level inversion. Analysis of anomalous meteorological conditions was included in the acoustic analysis for the North Bend Wind Project to ensure a conservative assessment; however, it should not be required to successfully demonstrate compliance during those conditions. At short to medium

range distances, corresponding to the nearest and potentially most impacted noise sensitive receptors, and for elevated sound sources such as a wind turbine, the overall effects of anomalous meteorological conditions on sound propagation are relatively small.

c) While decibels are typically reported in terms of whole decibels due to the acceptable level of accuracy, CadnaA does produce results to the nearest tenth of a decimal. The estimated sound level at NSR ID 5 to the nearest tenth of a decimal at maximum rotational speeds during moderate downwind propagation is 44.2 dBA. The estimated sound level at NSR ID 5 to the nearest tenth of a decimal at maximum rotational speeds during anomalous meteorological conditions is 45.1 dBA.

d) The applicable Zoning Ordinance's for both Counties list the threshold as "shall not exceed 45 decibels" as a whole integer. There could have been more specificity included in the ordinance with the threshold at 45.0 or 45.9 to refine the exact threshold, but that was not done in these ordinances and we don't generally see a threshold set at that level of specificity. When assessing potential Project noise impacts at NSRs, the difference between a received sound level of 45 dBA and 45.1 dBA is negliglible. Because the County ordinance dictated the threshold at the integer level, the analysis followed that lead and conducted at the integer level as well, which is consistent with industry practices that are commonly used.

It is industry practice that, due to the logarithmic nature and level of accuracy that can be reasonably achieved, decibel values are reported to the nearest integer. Furthermore, scientific research demonstrates that the following general relationships hold between sound level and human perception for two broadband sound levels with the same or similar frequency characteristics:

- 1 dBA is the practically achievable limit of the accuracy of sound measurement systems and corresponds to an approximate 10 percent variation in sound pressure. A 1 dBA increase or decrease is a non-perceptible change in sound.
- 3 dBA increase or decrease is a doubling (or halving) of acoustic energy and it corresponds to the threshold of perceptibility of change in a laboratory environment. In practice, the average person is not able to distinguish a 3 dBA difference in environmental sound outdoors.
- 5 dBA increase or decrease is described as a perceptible change in sound level and is a discernable change in an outdoor environment.
- 10 dBA increase or decrease is a tenfold increase or decrease in acoustic energy but is perceived as a doubling or halving in sound (i.e., the average person will judge a 10 dBA change in sound level to be twice or half as loud).

Furthermore, as noted in the acoustic study and 7b) above, the maximum rotational analysis utilizes intentional conservative assumptions, such as downwind sound propagation in all directions, surface hardness factor that exceeds what is likely present, moderate atmospheric

ground level inversion, etc. Because of this, the worst case noise instantaneous levels reflected at each receptor is likely an overestimate compared to what will occur under operation.

Response Prepared by:
Tricia Pellerin, Senior Acoustic Engineer, Tetra Tech, Inc.