VISUAL ASSESSMENT

12.14.2021

Benjamins Mill Wind Project

Natural Forces Developments LP
1801 Hollis Street Suite 1205
Halifax, NS B3J 3N4
P +1 (902) 422 9663
F +1 (902) 422 9780

Table of Contents

List of Tables

List of Appendices

1 Introduction

Natural Forces is proposing to develop an up to 28 turbine wind project called the Benjamins Mill Wind Project (the Project) in West Hants Regional Municipality, Nova Scotia

The proposed Project is located on a mix of privately-owned and provincial Crown land. The private lands are currently used for forestry activities and, as such, there are extensive cleared areas and an existing network of forest service roads located throughout the Project site. The Project will have an approximate installed capacity up to 150 MW, which represents up to 28 wind turbines.

This assessment details the perceived visual impacts from the proposed project on the surrounding community. A distance of 2 km from each turbine location has been used to determine a visual zone of influence for shadow flicker impacts at receptors in the area. In addition to a shadow flicker assessment, this report includes a Zone of Visual Influence (ZVI) assessment as well as a photomontage of the Project.

This report outlines background information on the shadow flicker effect, discusses policy and guideline documents, explains the source of shadows and the receptors (homes), provides the prediction methodology, outlines the results and proposes mitigation methods.

As detailed in the document *Guide to Preparing an EA Registration Document for Wind Power Projects in Nova Scotia,* shadow flicker perceived buy a receptor must be limited to 30 hours per year or a maximum of 30 minutes per day based on a "worst case" calculation where mitigation is not feasible. The worst-case calculation is defined in many guidelines and regulations as the maximum shadow conditions between sunrise and sunset on a cloudless day. These conditions have been adopted for this study.

Prior to determining the predicted amount of shadow flicker effect of a project, careful site design is recommended, followed by industry accepted mitigation strategies. This assessment will be used as supporting documentation to demonstrate that shadow flicker is being assessed and that compliance can be reached with careful planning and mitigation. The ZVI assessment and photomontage are additional tools in determining the cumulative visual impacts of a project on the surrounding community.

This shadow flicker analysis, ZVI, and photomontage were conducted using the respective module of the software package, WindPRO version 3.5

1.1 Background

Shadow flicker is caused by incident light rays on a moving object which then casts an intermittent shadow on a receptor. This intermittent shadow, perceived as a change in light intensity by an observer as it pertains to a wind turbine generator (WTG), is referred to as shadow flicker. Shadow flicker is caused by incident sun rays on the rotor blades as they turn.

For shadow flicker to occur, the following criteria must be met:

1. The sun must be shining and not obscured by any cloud cover or fog;
2. The wind turbine must be located between the sun and the shadow receptor;

3. The line of sight between the turbine and the shadow receptor must be clear, a sight-impermeable obstacles, such as vegetation, buildings, awnings etc., will prevent shadow flicker from occurring at the receptor; and
4. The shadow receptor must be close enough to the turbine to be in the shadow of the turbine rotor.

A ZVI assessment develops a grid of polygons showing how many turbines will be visible from a given location on a map. This assessment, while simple, is an excellent representation of the visual impacts to a broader area surrounding a project. ZVI assessments do not consider factors like vegetation cover, existing buildings, or other screening objects, but exclusively consider the location of receptors and turbines in respect to topographical features. Therefore, this assessment represents a worst case.

1.2 Policy and Guidelines

The document *Guide to Preparing an EA Registration Document for Wind Power Projects in Nova Scotia*, as provided by the Environmental assessment Branch. The document states shadow flicker perceived by a receptor must be limited to 30 hours per year or a maximum of 30 minutes per day based on a “worst case” calculation where mitigation is not feasible. The worst-case calculation is defined in many guidelines and regulations as the maximum shadow conditions between sunrise and sunset on a cloudless day. These conditions have been adopted for this study.

This document is aligned with industry standard and other regulators in the maritime provinces.

1.3 Source of Shadow

The turbine model used for the assessment is the Enercon E-160 5.5 MW machine. The E-160 model has a hub height of 120 m and a rotor diameter of 160 m. The geographical coordinates of the 28 proposed turbines are included in Appendix B.

Should an alternate turbine model be selected, a new visual assessment will be conducted.

1.4 Receptors

There are 64 receptors located within 2 km of the turbine locations that consist of year-long dwellings, seasonal dwellings, and local businesses. They have been identified based on online geographical data from the Data Catalogue available from the Nova Scotia Government and cross referenced with aerial photography, as well as site visits. The geographical coordinates of these receptors are included in Appendix B. A map of the project area with the receptors is included in Appendix A.

2 Shadow Flicker Assessment Methodology

The shadow flicker impact was calculated for the proposed Project layout at each of the 64 receptors using the Shadow module of the software package WindPRO version 3.5. This was completed using methodologies for the worst-case, detailed below, to calculate the expected hours per year and maximum minutes per day of shadow flicker from the project for each receptor.

2.1 Worst Case Shadow Flicker Assessment

The worst-case shadow flicker assessment follows a conservative methodology by modelling the Earth's orbit and rotation to provide the astronomical maximum shadow. The astronomical maximum shadow calculation assumes that for every day of the year:

1. The sky is cloudless between sunrise and sunset;
2. The turbines are always in operation; and,
3. The wind direction changes throughout the day such that the rotor plane is perpendicular to the incident sun rays at all times causing the maximum amount of shadow.

The position of the sun relative to the wind turbine rotor plane and the resulting shadow is calculated in steps of one-minute intervals throughout a complete year. If the rotor plane, assumed to be a solid disk equivalent in size to the swept area, shown in **Error! Reference source not found.**, casts a shadow on a receptor window during one of these intervals, it is registered as one minute of potential shadow impact.

TABLE 1: TURBINE CHARACTERISTICS

Turbine Model	Enercon E-160 EP5
Nameplate Capacity	5.5 MW
Hub Height	120 m
Rotor Diameter	160 m
Sweep Area	20106.2 m^2

The impact of shadow flicker on surrounding receptors is limited by two factors in this worst-case scenario. The first factor is that the angle of the sun over the horizon must be greater than 3 degrees, due to optic conditions in the atmosphere that cause the shadow to dissipate before it could potentially reach a receptor. The second factor is that the blade of the wind turbine must cover at least 20% of the incident solar rays to have a noticeable effect.

To further ensure the worst-case scenario is being modelled, each receptor is treated as a greenhouse with 1.5 m high by 1.5 m wide windows for 360° of the building. Furthermore, no topographical or ground cover shielding caused by buildings, barns, trees, awnings, etc. has been considered between the wind turbines and receptors. This worst-case assumption results in a conservative prediction of the potential shadow flicker impacts, meaning that the shadow flicker impacts from the assessment are likely calculated as higher than they would be experienced.

3 Results for Shadow Flicker Assessment

The results of the shadow flicker prediction model at each receptor demonstrate compliance with the selected requirements of no more than 30 hours per year of shadow, and no more than 30 minutes on the worst day of shadow under a worst-case scenario.

The worst-case study of this project demonstrates that all receptors located within 2 km of the 28 WTG Project layout are subject to no more than 30 hr/year and 30 min/day of shadow flicker. The detailed results of the shadow assessment study for all receptors in a worst-case scenario is included in Appendix B. A summary of the impacts on the 10 most impacted receptors are detailed below in Table 2.

TABLE 2: SHADOW FLICKER IMPACT ASSESSMENT SUMMARY FOR THE 10 RECEPTORS MOST IMPACTED.

Receptor ID	Worst Case Shadow Flicker from WTGs [hr/year]	Worst Case Shadow Flicker from WTGs [hr/day]	In Compliance
AF	10:13	0:20	Yes
AM	9:25	0:23	Yes
BG	9:21	0:24	Yes
BC	8:41	0:23	Yes
BK	7:38	0:21	Yes
S	7:17	0:21	Yes
AE	6:54	0:17	Yes
A	0:00	0:00	Yes
B	0:00	0:00	Yes
C	0:00	0:00	Yes

4 Other Visual Assessments

4.1 ZVI

The software package windPRO v3.5 was used to complete the ZVI assessment, specifically the module for ZVI within the package. The ZVI assessment shows the broader extent of visual impacts from the Project on the surrounding landscape. A map showing the results of the assessment is included in Appendix C.

An observations height of 150 cm was selected for the ZVI assessment and 25m was selected for the grid steps between assessment points. The assessment simulates if an individual would be able to perceive any of the WTG's from the location specified on the map.

The mapping shows that while the turbines will be largely visible from much of the surrounding landscape, the areas where the receptors are typically have a lower number of turbines visible according to the ZVI.

4.2 Photomontage

The photomontage was completed using the Photomontage module of windPRO v3.5. A photomontage is a rendering of the proposed turbines on a georeferenced photograph of the existing landscape. The rendering is then altered to remove any sections of the turbines rendered in front of any existing topography the turbines would be behind in a three-dimensional space.

The photomontage photo was taken form the Bent Ridge Winery, the geographical location of which is included in Table 3. On the current photomontage of the 28 turbine layout, 21 turbines are visible from the selected location. This number includes turbines in full and partial view. The photomontage is included in Appendix D.

TABLE 3: PHOTOMONTAGE LOCATION.

Location	Latitude	Longitude
Bent Ridge Winery	44.954722°	-64.177500°

5 Proposed Mitigation

The shadow flicker modelling under worst case conditions demonstrates that the Project is in compliance with the Nova Scotia shadow flicker thresholds. However, should the amount of shadow flicker experienced at nearby receptors become an issue, there are various mitigation measures that can be put in place, which are discussed below.

The ZVI and photomontage assessments were carried out to provide additional information on how the Project will look on the landscape. There are no particular requirements for these assessments, but the visual impact on the landscape is mitigated by the siting of the Project in a remote area and the selection of paint for the WTGs that reduce contrast with the environment and minimizes blade glint.

5.1 Tracking the Shadow Flicker

Should receptors experience shadow flicker that becomes an issue, the complaint will be addressed following a Complaint Resolution Plan. The main steps to resolve the issue will be:

1) Conduct an investigation to understand the conditions under which shadow flicker issues are experienced. The specific date, time, location of observed shadow flicker, and local weather conditions (including wind direction and wind speed) will be noted for each incident of shadow flicker as well as the duration of the event.
2) If it is determined from the investigation that the shadow flicker was caused by the Project, the Operations Team for the Project will work to identify the best mitigation based on the circumstances, such as screening, discussed below.
3) The Operations Team will track any such events along with the supporting data, and will track the success of any mitigation measures employed to inform future resolutions.

5.2 Screening

Screening efforts are a feasible and effective mitigation measure for reducing shadow flicker impact. It is proposed that if receptors experience an annoyingly high amount of shadow flicker impact during operation, the Proponent could use screening methods that will provide shade to buildings and windows, effectively reducing shadow flicker annoyance.

Screening can be accomplished with existing vegetation, revegetation, and planting additional vegetation to the area which is experiencing shadow flicker. Similar, and sometimes better, results can be obtained by installing awnings and window coverings if it would be preferred by those experiencing the impact

6 Discussion and Conclusions

Natural Forces has completed an assessment to evaluate the visual impacts of the proposed Benjamins Mill Wind Project at receptor locations within 2 km of the proposed WTGs for the shadow flicker assessment, and the broader surrounding area for the photomontage and ZVI assessment.

Based on the parameters used in WindPRO shadow flicker prediction model, it has been shown that in the worst-case scenario shadow flicker emitted by the proposed WTG model in the 28-turbine layout is less than 30 hours per year and 30 minutes per day at all receptors. The maximum shadow flicker impact from the 28-turbine layout expected at a receptor is 10 hours and 13 minutes per year and 20 minutes under worst case scenario conditions.

Various measures may be used to mitigate the effect of shadow flicker perceived at receptors if it becomes an issue, including screening using natural barriers, awnings, or other structures.

Natural Forces is confident that receptors will not receive excessive amounts of shadow flicker as demonstrated in the modelled worst-case scenario. However, Natural Forces will work closely with the homeowners and businesses to observe occurrences of real-case shadow flicker impact during operation and apply mitigation as mentioned.

7 References

Enercon GmbH ed. (2004). *Data Sheet – Enercon Wind Energy Converter E-44*. Germany.

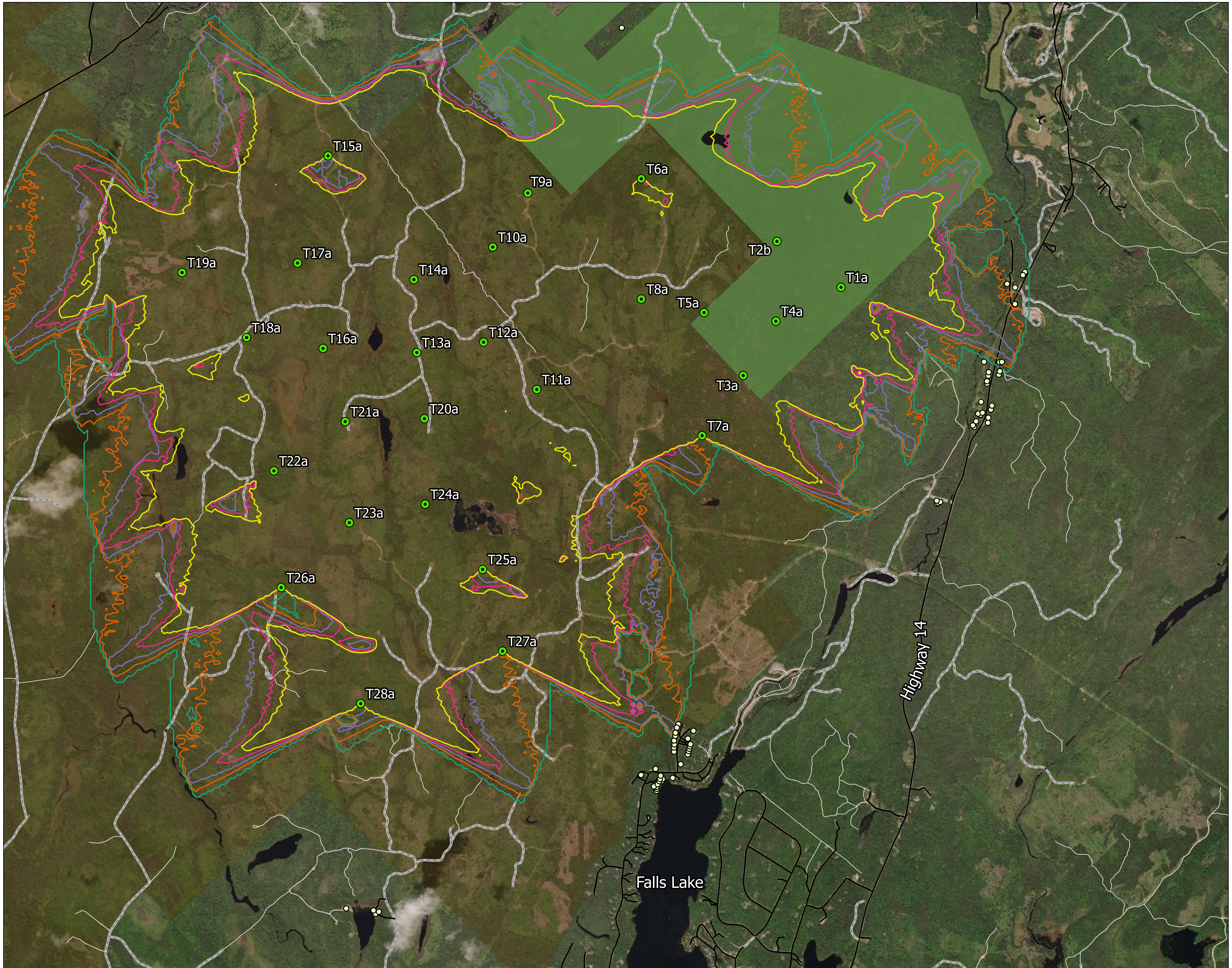
New Brunswick Ministry of Environment and Local Government. *Environmental Impact Assessment Regulation – Clean Environment Act.* New Brunswick.

New Brunswick Ministry of Environment and Local Government. *Additional Information Requirements For Wind Turbines– Clean Environment Act.* New Brunswick.

Nielson, P. (2012). *WindPRO 3.1 user guide*. (1st ed.). Denmark: EMD International A/S.

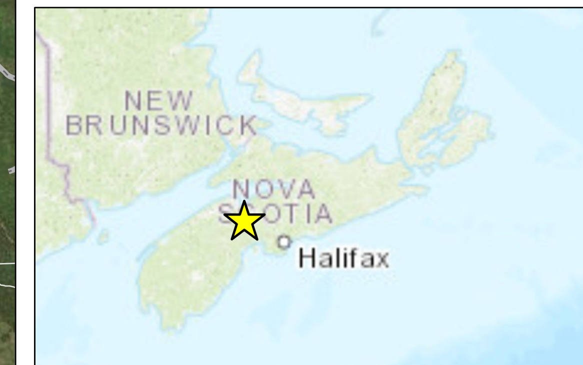
WEA-Schattenwurf-Hinweise (2002). *Hinweise zur Ermittlung und Beurteilung der optischen Immissionen von Windenergianlagen (Notes on the identification and assessment of the optical pollutions of Wind Turbines)*

Appendix A: Project Map with Shadow Flicker Assessment Lines



Benjamins Mill Wind Project

Shadow Flicker Assessment



Legend

- Preliminary Turbine Layout
- Receptors
- Trails
- Existing Resource Roads
- Existing Roads
- Crown Land
- Private Lands

Shadow Flicker Contours

- 0 Hours/Year
- 10 Hours/Year
- 20 Hours/Year
- 30 Hours/Year
- 40 Hours/Year

Notes

1. The threshold for shadow flicker perceived at a receptor from a wind turbine is 30 hours per year as per the Guide to Preparing an *EA Registration Document for Wind Power Projects in Nova Scotia*

Sources

- Basedata provided by the Province of Nova Scotia
- Basemap: Maxar World Imagery

N

1:35,000

0 500 1,000 1,500

Metres

NAD 1983 UTM Zone 20N

Page Size: 11" x 17"

Production Date: Dec 15, 2021

Prepared By:

Natural Forces

Appendix B: WindPRO v.3.5, Shadow Module Calculation Results: Worst Case

SHADOW - Main Result

Calculation: Worst Case Shadow Assessment E-160

Assumptions for shadow calculations

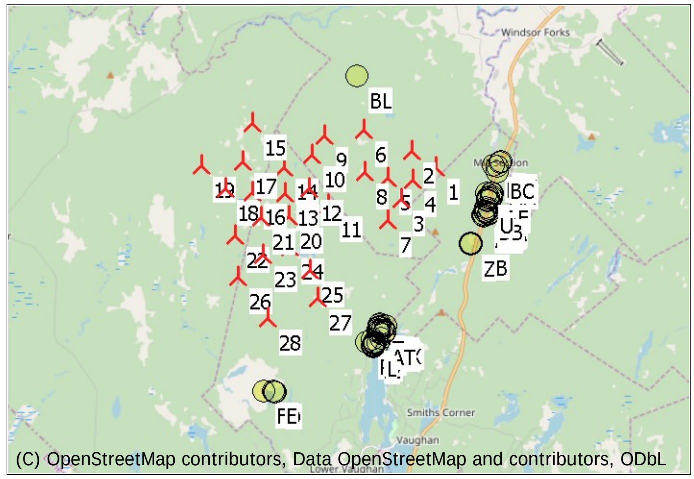
Maximum distance for influence
Calculate only when more than 20 % of sun is covered by the blade
Please look in WTG table

Minimum sun height over horizon for influence	3 °
Day step for calculation	1 days
Time step for calculation	1 minutes

The calculated times are "worst case" given by the following assumptions:
- The sun is shining all the day, from sunrise to sunset
- The rotor plane is always perpendicular to the line from the WTG to the sun
- The WTG is always operating

A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:
Height contours used: Height Contours: CONTOURLINE_ONLINEDATA_7.wpo (1)
Obstacles used in calculation
Receptor grid resolution: 1.0 m

All coordinates are in
Geo [deg]-WGS84



Scale 1:200,000
New WTG   Shadow receptor

WTGs

	Longitude	Latitude	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Shadow data Calculation distance	RPM
			[m]					[kW]	[m]	[m]	[m]	[RPM]
1	-64.225756° E	44.905495° N	240.0	ENERCON E-160 EP5 E2 5500 160.0 !...	Yes	ENERCON	E-160 EP5 E2-5,500	5,500	160.0	119.9	1,781	9.4
2	-64.233462° E	44.909295° N	232.2	ENERCON E-160 EP5 E2 5500 160.0 !...	Yes	ENERCON	E-160 EP5 E2-5,500	5,500	160.0	119.9	1,781	9.4
3	-64.237236° E	44.897905° N	248.4	ENERCON E-160 EP5 E2 5500 160.0 !...	Yes	ENERCON	E-160 EP5 E2-5,500	5,500	160.0	119.9	1,781	9.4
4	-64.233444° E	44.902541° N	240.0	ENERCON E-160 EP5 E2 5500 160.0 !...	Yes	ENERCON	E-160 EP5 E2-5,500	5,500	160.0	119.9	1,781	9.4
5	-64.242003° E	44.903180° N	260.0	ENERCON E-160 EP5 E2 5500 160.0 !...	Yes	ENERCON	E-160 EP5 E2-5,500	5,500	160.0	119.9	1,781	9.4
6	-64.249728° E	44.914417° N	250.0	ENERCON E-160 EP5 E2 5500 160.0 !...	Yes	ENERCON	E-160 EP5 E2-5,500	5,500	160.0	119.9	1,781	9.4
7	-64.242021° E	44.892764° N	250.0	ENERCON E-160 EP5 E2 5500 160.0 !...	Yes	ENERCON	E-160 EP5 E2-5,500	5,500	160.0	119.9	1,781	9.4
8	-64.249506° E	44.904240° N	245.4	ENERCON E-160 EP5 E2 5500 160.0 !...	Yes	ENERCON	E-160 EP5 E2-5,500	5,500	160.0	119.9	1,781	9.4
9	-64.263209° E	44.913060° N	240.0	ENERCON E-160 EP5 E2 5500 160.0 !...	Yes	ENERCON	E-160 EP5 E2-5,500	5,500	160.0	119.9	1,781	9.4
10	-64.267282° E	44.908446° N	239.4	ENERCON E-160 EP5 E2 5500 160.0 !...	Yes	ENERCON	E-160 EP5 E2-5,500	5,500	160.0	119.9	1,781	9.4
11	-64.261780° E	44.896452° N	240.0	ENERCON E-160 EP5 E2 5500 160.0 !...	Yes	ENERCON	E-160 EP5 E2-5,500	5,500	160.0	119.9	1,781	9.4
12	-64.268193° E	44.900384° N	240.0	ENERCON E-160 EP5 E2 5500 160.0 !...	Yes	ENERCON	E-160 EP5 E2-5,500	5,500	160.0	119.9	1,781	9.4
13	-64.276129° E	44.899419° N	250.0	ENERCON E-160 EP5 E2 5500 160.0 !...	Yes	ENERCON	E-160 EP5 E2-5,500	5,500	160.0	119.9	1,781	9.4
14	-64.276611° E	44.905589° N	246.3	ENERCON E-160 EP5 E2 5500 160.0 !...	Yes	ENERCON	E-160 EP5 E2-5,500	5,500	160.0	119.9	1,781	9.4
15	-64.287064° E	44.915942° N	250.0	ENERCON E-160 EP5 E2 5500 160.0 !...	Yes	ENERCON	E-160 EP5 E2-5,500	5,500	160.0	119.9	1,781	9.4
16	-64.287294° E	44.899644° N	250.0	ENERCON E-160 EP5 E2 5500 160.0 !...	Yes	ENERCON	E-160 EP5 E2-5,500	5,500	160.0	119.9	1,781	9.4
17	-64.290491° E	44.906835° N	260.0	ENERCON E-160 EP5 E2 5500 160.0 !...	Yes	ENERCON	E-160 EP5 E2-5,500	5,500	160.0	119.9	1,781	9.4
18	-64.296416° E	44.900460° N	250.0	ENERCON E-160 EP5 E2 5500 160.0 !...	Yes	ENERCON	E-160 EP5 E2-5,500	5,500	160.0	119.9	1,781	9.4
19	-64.304215° E	44.905873° N	240.0	ENERCON E-160 EP5 E2 5500 160.0 !...	Yes	ENERCON	E-160 EP5 E2-5,500	5,500	160.0	119.9	1,781	9.4
20	-64.275101° E	44.893833° N	260.0	ENERCON E-160 EP5 E2 5500 160.0 !...	Yes	ENERCON	E-160 EP5 E2-5,500	5,500	160.0	119.9	1,781	9.4
21	-64.284516° E	44.893480° N	259.6	ENERCON E-160 EP5 E2 5500 160.0 !...	Yes	ENERCON	E-160 EP5 E2-5,500	5,500	160.0	119.9	1,781	9.4
22	-64.292906° E	44.889217° N	260.0	ENERCON E-160 EP5 E2 5500 160.0 !...	Yes	ENERCON	E-160 EP5 E2-5,500	5,500	160.0	119.9	1,781	9.4
23	-64.283837° E	44.884932° N	240.0	ENERCON E-160 EP5 E2 5500 160.0 !...	Yes	ENERCON	E-160 EP5 E2-5,500	5,500	160.0	119.9	1,781	9.4
24	-64.274849° E	44.886597° N	240.0	ENERCON E-160 EP5 E2 5500 160.0 !...	Yes	ENERCON	E-160 EP5 E2-5,500	5,500	160.0	119.9	1,781	9.4
25	-64.267888° E	44.881154° N	240.0	ENERCON E-160 EP5 E2 5500 160.0 !...	Yes	ENERCON	E-160 EP5 E2-5,500	5,500	160.0	119.9	1,781	9.4
26	-64.291824° E	44.879354° N	250.0	ENERCON E-160 EP5 E2 5500 160.0 !...	Yes	ENERCON	E-160 EP5 E2-5,500	5,500	160.0	119.9	1,781	9.4
27	-64.265369° E	44.874268° N	230.0	ENERCON E-160 EP5 E2 5500 160.0 !...	Yes	ENERCON	E-160 EP5 E2-5,500	5,500	160.0	119.9	1,781	9.4
28	-64.282144° E	44.869642° N	250.0	ENERCON E-160 EP5 E2 5500 160.0 !...	Yes	ENERCON	E-160 EP5 E2-5,500	5,500	160.0	119.9	1,781	9.4

Shadow receptor-Input

No.	Longitude	Latitude	Z	Width	Height	Elevation a.g.l.	Slope of window	Direction mode	Eye height (ZVI) a.g.l.
			[m]	[m]	[m]	[m]	[°]		[m]
A	-64.279986° E	44.851866° N	174.6	1.5	1.5	3.0	90.0	"Green house mode"	4.5
B	-64.246943° E	44.864508° N	119.4	1.5	1.5	3.0	90.0	"Green house mode"	4.5
C	-64.243966° E	44.864933° N	113.4	1.5	1.5	3.0	90.0	"Green house mode"	4.5
D	-64.279592° E	44.852052° N	180.0	1.5	1.5	3.0	90.0	"Green house mode"	4.5
E	-64.280237° E	44.852161° N	173.6	1.5	1.5	3.0	90.0	"Green house mode"	4.5

To be continued on next page...

Licensed user:
Natural Forces Development Limited Partnership
1801 Hollis Street, Suite 1205
CA-HALIFAX, Nova Scotia B3J 3N4
902 422 9663
Jill Byrne / jbyrne@naturalforces.ca
Calculated:
12/8/2021 12:52 PM/3.5.552

SHADOW - Main Result

Calculation: Worst Case Shadow Assessment E-160

...continued from previous page

No.	Longitude	Latitude	Z	Width	Height	Elevation a.g.l.	Slope of window	Direction mode	Eye height (ZVI) a.g.l.
			[m]	[m]	[m]	[m]	[°]		[m]
F	-64.283487° E	44.852290° N	180.0	1.5	1.5	3.0	90.0	"Green house mode"	4.5
G	-64.246775° E	44.862645° N	110.0	1.5	1.5	3.0	90.0	"Green house mode"	4.5
H	-64.246762° E	44.862820° N	110.0	1.5	1.5	3.0	90.0	"Green house mode"	4.5
I	-64.246795° E	44.862978° N	110.5	1.5	1.5	3.0	90.0	"Green house mode"	4.5
J	-64.247107° E	44.863024° N	112.7	1.5	1.5	3.0	90.0	"Green house mode"	4.5
K	-64.246665° E	44.863208° N	110.3	1.5	1.5	3.0	90.0	"Green house mode"	4.5
L	-64.246188° E	44.863465° N	110.0	1.5	1.5	3.0	90.0	"Green house mode"	4.5
M	-64.246478° E	44.863465° N	110.7	1.5	1.5	3.0	90.0	"Green house mode"	4.5
N	-64.246085° E	44.863645° N	110.0	1.5	1.5	3.0	90.0	"Green house mode"	4.5
O	-64.246401° E	44.863661° N	112.9	1.5	1.5	3.0	90.0	"Green house mode"	4.5
P	-64.244893° E	44.863763° N	110.4	1.5	1.5	3.0	90.0	"Green house mode"	4.5
Q	-64.246333° E	44.863937° N	112.1	1.5	1.5	3.0	90.0	"Green house mode"	4.5
R	-64.248663° E	44.863972° N	127.2	1.5	1.5	3.0	90.0	"Green house mode"	4.5
S	-64.203879° E	44.907028° N	35.3	1.5	1.5	3.0	90.0	"Green house mode"	4.5
T	-64.244316° E	44.868311° N	120.0	1.5	1.5	3.0	90.0	"Green house mode"	4.5
U	-64.208186° E	44.897521° N	20.0	1.5	1.5	3.0	90.0	"Green house mode"	4.5
V	-64.208213° E	44.897730° N	20.0	1.5	1.5	3.0	90.0	"Green house mode"	4.5
W	-64.208060° E	44.898196° N	20.0	1.5	1.5	3.0	90.0	"Green house mode"	4.5
X	-64.206819° E	44.898302° N	22.8	1.5	1.5	3.0	90.0	"Green house mode"	4.5
Y	-64.213934° E	44.887302° N	30.0	1.5	1.5	3.0	90.0	"Green house mode"	4.5
Z	-64.213786° E	44.887357° N	30.0	1.5	1.5	3.0	90.0	"Green house mode"	4.5
AA	-64.213570° E	44.887456° N	30.0	1.5	1.5	3.0	90.0	"Green house mode"	4.5
AB	-64.213984° E	44.887565° N	30.0	1.5	1.5	3.0	90.0	"Green house mode"	4.5
AC	-64.208021° E	44.898497° N	20.0	1.5	1.5	3.0	90.0	"Green house mode"	4.5
AD	-64.206700° E	44.898591° N	20.0	1.5	1.5	3.0	90.0	"Green house mode"	4.5
AE	-64.206765° E	44.899360° N	20.0	1.5	1.5	3.0	90.0	"Green house mode"	4.5
AF	-64.206471° E	44.899381° N	23.0	1.5	1.5	3.0	90.0	"Green house mode"	4.5
AG	-64.208595° E	44.899371° N	20.0	1.5	1.5	3.0	90.0	"Green house mode"	4.5
AH	-64.209662° E	44.893838° N	23.1	1.5	1.5	3.0	90.0	"Green house mode"	4.5
AI	-64.209813° E	44.893976° N	21.4	1.5	1.5	3.0	90.0	"Green house mode"	4.5
AJ	-64.208032° E	44.894216° N	30.3	1.5	1.5	3.0	90.0	"Green house mode"	4.5
AK	-64.209429° E	44.894324° N	20.0	1.5	1.5	3.0	90.0	"Green house mode"	4.5
AL	-64.207986° E	44.894647° N	29.2	1.5	1.5	3.0	90.0	"Green house mode"	4.5
AM	-64.205016° E	44.904299° N	27.1	1.5	1.5	3.0	90.0	"Green house mode"	4.5
AN	-64.208975° E	44.894828° N	20.0	1.5	1.5	3.0	90.0	"Green house mode"	4.5
AO	-64.208942° E	44.894872° N	20.0	1.5	1.5	3.0	90.0	"Green house mode"	4.5
AP	-64.209211° E	44.894978° N	20.0	1.5	1.5	3.0	90.0	"Green house mode"	4.5
AQ	-64.208681° E	44.895062° N	20.0	1.5	1.5	3.0	90.0	"Green house mode"	4.5
AR	-64.207692° E	44.895328° N	33.2	1.5	1.5	3.0	90.0	"Green house mode"	4.5
AS	-64.243139° E	44.865769° N	116.9	1.5	1.5	3.0	90.0	"Green house mode"	4.5
AT	-64.244782° E	44.865983° N	111.5	1.5	1.5	3.0	90.0	"Green house mode"	4.5
AU	-64.243041° E	44.866054° N	117.4	1.5	1.5	3.0	90.0	"Green house mode"	4.5
AV	-64.242962° E	44.866249° N	117.8	1.5	1.5	3.0	90.0	"Green house mode"	4.5
AW	-64.244794° E	44.866340° N	112.6	1.5	1.5	3.0	90.0	"Green house mode"	4.5
AX	-64.242899° E	44.866448° N	118.1	1.5	1.5	3.0	90.0	"Green house mode"	4.5
AY	-64.244746° E	44.866595° N	113.0	1.5	1.5	3.0	90.0	"Green house mode"	4.5
AZ	-64.242832° E	44.866633° N	118.4	1.5	1.5	3.0	90.0	"Green house mode"	4.5
BA	-64.207579° E	44.895675° N	32.1	1.5	1.5	3.0	90.0	"Green house mode"	4.5
BB	-64.208872° E	44.895978° N	20.0	1.5	1.5	3.0	90.0	"Green house mode"	4.5
BC	-64.205032° E	44.905697° N	23.7	1.5	1.5	3.0	90.0	"Green house mode"	4.5
BD	-64.244798° E	44.866926° N	113.9	1.5	1.5	3.0	90.0	"Green house mode"	4.5
BE	-64.243162° E	44.867109° N	117.6	1.5	1.5	3.0	90.0	"Green house mode"	4.5
BF	-64.244659° E	44.867328° N	115.7	1.5	1.5	3.0	90.0	"Green house mode"	4.5
BG	-64.205990° E	44.905994° N	20.0	1.5	1.5	3.0	90.0	"Green house mode"	4.5
BH	-64.244649° E	44.867585° N	116.6	1.5	1.5	3.0	90.0	"Green house mode"	4.5
BI	-64.242513° E	44.867780° N	120.0	1.5	1.5	3.0	90.0	"Green house mode"	4.5
BJ	-64.244485° E	44.868028° N	118.6	1.5	1.5	3.0	90.0	"Green house mode"	4.5
BK	-64.204126° E	44.906757° N	32.6	1.5	1.5	3.0	90.0	"Green house mode"	4.5
BL	-64.252324° E	44.927168° N	180.0	1.5	1.5	3.0	90.0	"Green house mode"	4.5

Licensed user:
Natural Forces Development Limited Partnership
1801 Hollis Street, Suite 1205
CA-HALIFAX, Nova Scotia B3J 3N4
902 422 9663
Jill Byrne / jbyrne@naturalforces.ca
Calculated:
12/8/2021 12:52 PM/3.5.552

SHADOW - Main Result

Calculation: Worst Case Shadow Assessment E-160

Calculation Results

Shadow receptor

	Shadow, worst case		
No.	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]
A	0:00	0	0:00
B	0:00	0	0:00
C	0:00	0	0:00
D	0:00	0	0:00
E	0:00	0	0:00
F	0:00	0	0:00
G	0:00	0	0:00
H	0:00	0	0:00
I	0:00	0	0:00
J	0:00	0	0:00
K	0:00	0	0:00
L	0:00	0	0:00
M	0:00	0	0:00
N	0:00	0	0:00
O	0:00	0	0:00
P	0:00	0	0:00
Q	0:00	0	0:00
R	0:00	0	0:00
S	7:17	26	0:21
T	0:00	0	0:00
U	0:00	0	0:00
V	0:00	0	0:00
W	0:00	0	0:00
X	0:00	0	0:00
Y	0:00	0	0:00
Z	0:00	0	0:00
AA	0:00	0	0:00
AB	0:00	0	0:00
AC	0:00	0	0:00
AD	0:00	0	0:00
AE	6:54	31	0:17
AF	10:13	38	0:20
AG	0:00	0	0:00
AH	0:00	0	0:00
AI	0:00	0	0:00
AJ	0:00	0	0:00
AK	0:00	0	0:00
AL	0:00	0	0:00
AM	9:25	32	0:23
AN	0:00	0	0:00
AO	0:00	0	0:00
AP	0:00	0	0:00
AQ	0:00	0	0:00
AR	0:00	0	0:00
AS	0:00	0	0:00
AT	0:00	0	0:00
AU	0:00	0	0:00
AV	0:00	0	0:00
AW	0:00	0	0:00
AX	0:00	0	0:00
AY	0:00	0	0:00
AZ	0:00	0	0:00
BA	0:00	0	0:00
BB	0:00	0	0:00
BC	8:41	30	0:23
BD	0:00	0	0:00
BE	0:00	0	0:00
BF	0:00	0	0:00
BG	9:21	30	0:24
BH	0:00	0	0:00
BI	0:00	0	0:00
BJ	0:00	0	0:00
BK	7:38	28	0:21
BL	0:00	0	0:00

Licensed user:
Natural Forces Development Limited Partnership
1801 Hollis Street, Suite 1205
CA-HALIFAX, Nova Scotia B3J 3N4
902 422 9663
Jill Byrne / jbyrne@naturalforces.ca
Calculated:
12/8/2021 12:52 PM/3.5.552

SHADOW - Main Result

Calculation: Worst Case Shadow Assessment E-160

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

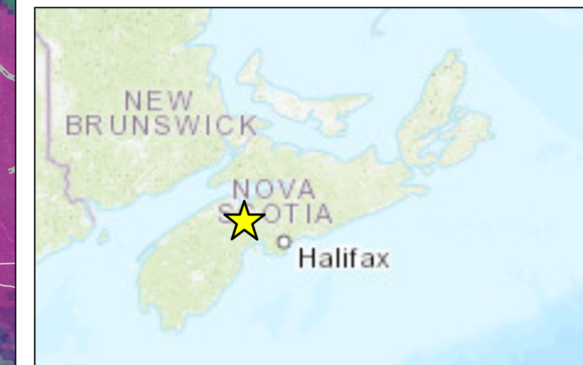
No.	Name	Worst case [h/year]
1	ENERCON E-160 EP5 E2 5500 160.0 !O! hub: 119.9 m (TOT: 199.9 m) (29)	37:36
2	ENERCON E-160 EP5 E2 5500 160.0 !O! hub: 119.9 m (TOT: 199.9 m) (30)	0:00
3	ENERCON E-160 EP5 E2 5500 160.0 !O! hub: 119.9 m (TOT: 199.9 m) (31)	0:00
4	ENERCON E-160 EP5 E2 5500 160.0 !O! hub: 119.9 m (TOT: 199.9 m) (32)	0:00
5	ENERCON E-160 EP5 E2 5500 160.0 !O! hub: 119.9 m (TOT: 199.9 m) (33)	0:00
6	ENERCON E-160 EP5 E2 5500 160.0 !O! hub: 119.9 m (TOT: 199.9 m) (34)	0:00
7	ENERCON E-160 EP5 E2 5500 160.0 !O! hub: 119.9 m (TOT: 199.9 m) (35)	0:00
8	ENERCON E-160 EP5 E2 5500 160.0 !O! hub: 119.9 m (TOT: 199.9 m) (36)	0:00
9	ENERCON E-160 EP5 E2 5500 160.0 !O! hub: 119.9 m (TOT: 199.9 m) (37)	0:00
10	ENERCON E-160 EP5 E2 5500 160.0 !O! hub: 119.9 m (TOT: 199.9 m) (38)	0:00
11	ENERCON E-160 EP5 E2 5500 160.0 !O! hub: 119.9 m (TOT: 199.9 m) (39)	0:00
12	ENERCON E-160 EP5 E2 5500 160.0 !O! hub: 119.9 m (TOT: 199.9 m) (40)	0:00
13	ENERCON E-160 EP5 E2 5500 160.0 !O! hub: 119.9 m (TOT: 199.9 m) (41)	0:00
14	ENERCON E-160 EP5 E2 5500 160.0 !O! hub: 119.9 m (TOT: 199.9 m) (42)	0:00
15	ENERCON E-160 EP5 E2 5500 160.0 !O! hub: 119.9 m (TOT: 199.9 m) (43)	0:00
16	ENERCON E-160 EP5 E2 5500 160.0 !O! hub: 119.9 m (TOT: 199.9 m) (44)	0:00
17	ENERCON E-160 EP5 E2 5500 160.0 !O! hub: 119.9 m (TOT: 199.9 m) (45)	0:00
18	ENERCON E-160 EP5 E2 5500 160.0 !O! hub: 119.9 m (TOT: 199.9 m) (46)	0:00
19	ENERCON E-160 EP5 E2 5500 160.0 !O! hub: 119.9 m (TOT: 199.9 m) (47)	0:00
20	ENERCON E-160 EP5 E2 5500 160.0 !O! hub: 119.9 m (TOT: 199.9 m) (48)	0:00
21	ENERCON E-160 EP5 E2 5500 160.0 !O! hub: 119.9 m (TOT: 199.9 m) (49)	0:00
22	ENERCON E-160 EP5 E2 5500 160.0 !O! hub: 119.9 m (TOT: 199.9 m) (50)	0:00
23	ENERCON E-160 EP5 E2 5500 160.0 !O! hub: 119.9 m (TOT: 199.9 m) (51)	0:00
24	ENERCON E-160 EP5 E2 5500 160.0 !O! hub: 119.9 m (TOT: 199.9 m) (52)	0:00
25	ENERCON E-160 EP5 E2 5500 160.0 !O! hub: 119.9 m (TOT: 199.9 m) (53)	0:00
26	ENERCON E-160 EP5 E2 5500 160.0 !O! hub: 119.9 m (TOT: 199.9 m) (54)	0:00
27	ENERCON E-160 EP5 E2 5500 160.0 !O! hub: 119.9 m (TOT: 199.9 m) (55)	0:00
28	ENERCON E-160 EP5 E2 5500 160.0 !O! hub: 119.9 m (TOT: 199.9 m) (56)	0:00

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

Appendix C: WindPRO v.3.5, Zone of Visual Influence Assessment Results

Benjamins Mill Wind Project

Zone of Visual Influence Assessment



Legend

- Preliminary Turbine Layout
- Receptors
- Trails
- Existing Resource Roads
- Existing Roads
- Crown Land
- Private Lands

Zone of Visual Influence Grid

- 0 to 4 Turbines Visible
- 5 to 10 Turbines Visible
- 11 to 16 Turbines Visible
- 17 to 22 Turbines Visible
- 23 to 28 Turbines Visible

Notes

1.

Sources

- Basedata provided by the Province of Nova Scotia
- Basemap: Maxar World Imagery

N

1:35,000

0 500 1,000 1,500

Metres

NAD 1983 UTM Zone 20N

Page Size: 11" x 17"

Production Date: Dec 15, 2021

Prepared By:

Natural Forces

Appendix D: WindPRO v.3.5, Photomontage form Bent Ridge Winery