Appendix D

REVISED NOISE STUDY REPORT

Grand Renewable Solar Park Project

REVISED NOISE STUDY REPORT

OCTOBER 2014

DILLON CONSULTING

Executive Summary

Grand Renewable Solar LP/ Grand Renewable Solar GP Inc. received approval on September 27, 2013 for the amended Renewable Energy Approval (REA) to develop and operate a 100-megawatt (MW) solar photovoltaic project to be known as the Grand Renewable Solar Park Project (GRS). This project, together with the 148.6 MW wind project known as the Grand Renewable Wind Project (GRW), comprise the Grand Renewable Energy Park (GREP). This revised Noise Study Report (NSR) reflects the final design and technology selection for the solar project and is being submitted to the Ontario Ministry of the Environment and Climate Change (MOECC) for a technical change amendment to the issued REA (REA No. **9560-8UJJXS**), all in accordance with the process as outlined in *Ontario Regulation 359/09.*

The project modifications incorporated in this amendment include: addition of two (2) DSTATCOM units, addition of a Line Reactor, actual transformer noise data and dimensions for the substation transformers, and minor changes to site layout. The layout changes include relocation of some of the dominant noise sources, all of which are within 10 metres of the already approved locations in Schedule B of the Approval.

With the implementation of the noise mitigation measures indicated in this report (i.e., acoustic louvers for the inverter enclosures at all MV stations) the proposed project and all noise sources indicated in this report will be in compliance with the MOECC Publication *NPC-300 Environmental Noise Guideline's* limits for stationary sources in Class 3 Areas (Rural).

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1. Introduction

On September 27, 2013, Grand Renewable Solar LP / Grand Renewable Solar GP Inc. was issued an amended Renewable Energy Approval (REA) to develop and operate a 100-megawatt (MW) solar photovoltaic project to be known as the Grand Renewable Solar Park Project (GRS). This project, together with the 148.6 MW wind project known as the Grand Renewable Wind Project (GRW), comprise the Grand Renewable Energy Park (GREP).

The solar and wind projects will jointly own and share a transformer substation (with separate transformers), an Operations and Maintenance building and a transmission line. At this time, Grand Renewable Solar LP / Grand Renewable Solar GP Inc. is seeking a technical change amendment to the REA issued for the Grand Renewable Solar Park Project.

For the purposes of this report, the solar project is considered independent of the wind project. Based on communications with the Ontario Ministry of the Environment and Climate Change (MOECC), in keeping with the previously submitted and approved Noise Study Reports (NSRs), all dominant noise sources for the neighbouring wind project within 5 km of GRS are included in the assessment herein. The proponent confirmed that at the time of preparing this report no other solar projects exist or are planned within 5 km of GRS.

The project modifications incorporated in this amendment include: addition of two (2) 10 mVAR DSTATCOM units, addition of a Line Reactor, actual transformer noise data for the substation transformers, and minor changes to site layout. The layout changes include relocation of some of the dominant noise sources, all of which are within 10 metres of the already approved locations in Schedule B of the Approval.

This revised Noise Study Report (NSR) reflects the final design and technology selection for the solar project and is being submitted to the MOECC for a technical change amendment to the issued REA (REA No. **9560-8UJJXS**), all in accordance with the process as outlined in *Ontario Regulation 359/09.* This assessment documents compliance of all noise sources indicated in this report at the Grand Renewable Solar Park Project with MOECC Publication *NPC-300 Environmental Noise Guideline's* limits for stationary sources in Class 3 Areas (Rural).

2. The Proponent

CarbonFree Technology is managing and coordinating the approvals process for the Grand Renewable Solar Park Project. Should there be any questions about the minor amendments proposed for the Grand Renewable Solar Project, please contact:

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3. Project Location

The Grand Renewable Solar Project is located on privately owned and Infrastructure Ontario (IO) managed lands within Haldimand County, Ontario, north of the Lake Erie shoreline and west of the Grand River. The solar facility is generally bounded by Mount Olivet Road to the west, Sutor Road to the East, Meadows Road to the north and Haldimand Road 20 to the south.[1]

"Project Location" is defined in *Ontario Regulation 359/09* to be "*a part of land and all or part of any building or structure in, on or over which a person is engaging in or proposes to engage in the project*". **Figure 1** shows the proposed layout and location of all project components. Further information on

[1] Note that a small portion of the facility will be installed south of Haldimand Road 20, as shown in **Figure 1**.

facility components making up the project location is provided in Section 3 of the *Design and Operations Report*, in the REA submission (Stantec Consulting Limited, 2011).

4. Overview of Noise Study

4.1 Summary of Acoustic Environment & Applicable Noise Limits

The background ambient noise, exclusive of that generated by the Grand Renewable Solar Park Project, can be characterized as having qualities of a Class 3 (Rural) area, as described in the Ontario Ministry of the Environment Noise Pollution Control Publication *NPC-300 Environmental Noise Guideline's* limits for stationary sources in Class 3 Areas (Rural). The primary contributor to the background sound during the daytime and nighttime periods are natural sounds and occasional vehicle traffic on nearby roadways.

The NPC-300 Class 3 Areas' exclusionary limits of 45 dBA for daytime (07:00 – 19:00), 40 dBA for evening (19:00 – 23:00) and 40 dBA for nighttime (23:00 - 07:00) were selected to represent the performance limits at noise sensitive receptors [Note: for the purposes of this report, since the limits for evening and nighttime are the same, the nighttime is defined as 19:00 – 07:00].

4.2 Statement of Compliance

The noise modeling for the proposed solar generation project (including the neighbouring wind generation projects) has been completed as per the MOECC's (formerly MOE) applicable noise guidelines, including Ontario Ministry of Environment and Climate Change (MOECC), 2008: *Noise Guidelines for Wind Farms – Interpretation for Applying MOE NPC Publications to Wind Power Generation Facilities*. The modeling was completed for a worst-case noise impact scenario with a conservative assumption of applying the maximum turbine noise level for all wind speeds and comparing the results against the most stringent limit (i.e., 40.0 dBA) which applies to a wind speed of 6m/s at 10m height.

The analysis presented in this report confirms that with the noise sources and their relevant specifications presented in this report, the proposed GRS project complies with the Class 3 Areas (rural) daytime and night-time noise criteria as defined for Class 3 Areas in NPC-300 for all sources assessed in this study.

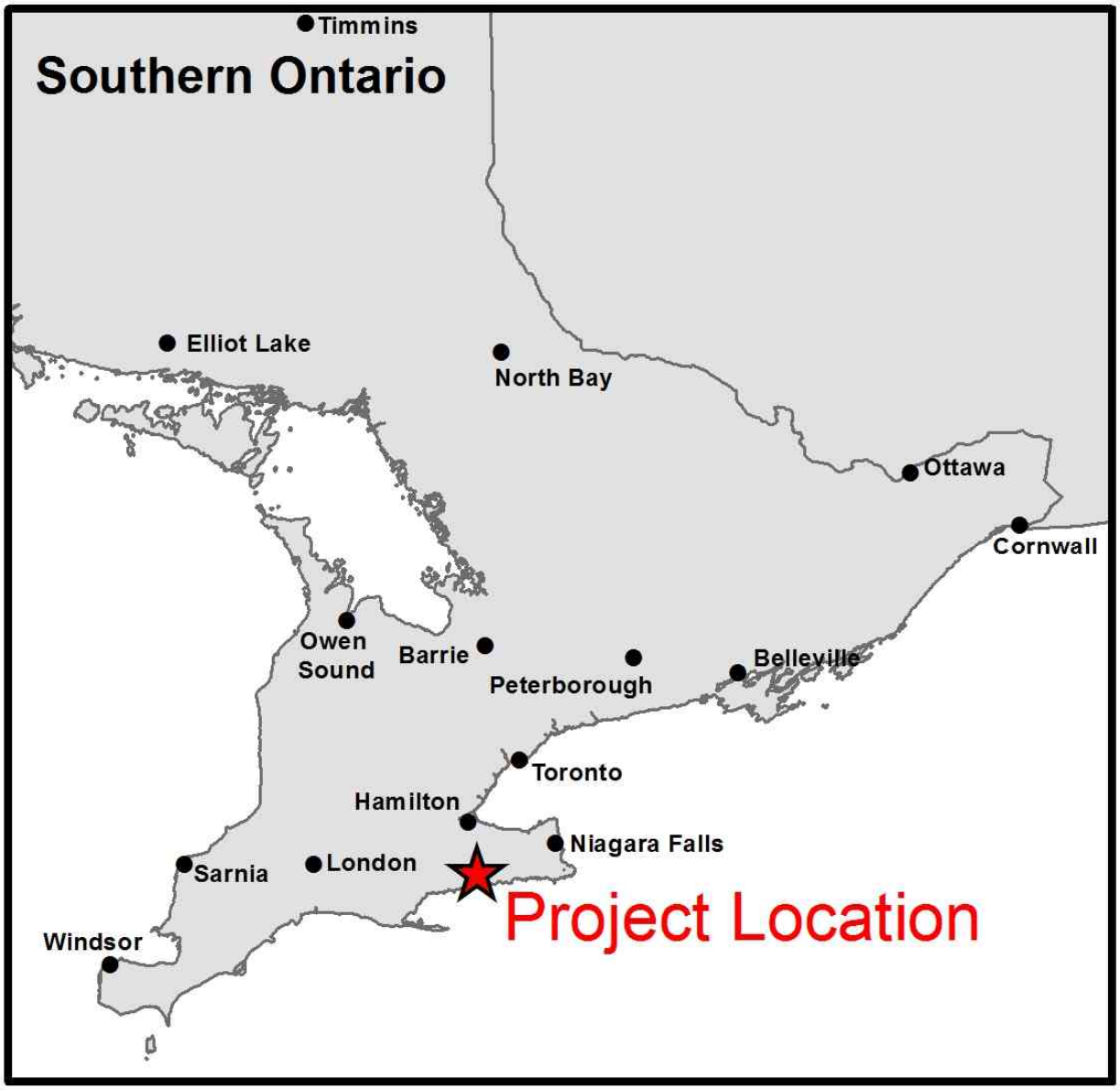


Figure 1: General Location of GRS in Ontario

5. Facility Description

The Grand Renewable Solar Park Project will consist of approximately 440,000 – 450,000 solar photovoltaic (PV) modules. These will be contained in a series of fixed racking systems which will be attached to fixed ground-mounted racking structures organized into 100-1 MW solar arrays. In addition to the modules, medium voltage stations, a main substation, and underground cabling will be installed to convert DC to AC current and boost the voltage for connection to the grid. Detailed site plan drawings are presented in **Appendix C**. The components that emit noise are as follows (Note: the noise sources from the neighbouring GRW project that are located within the same substation are also listed below):

- **Substation Transformers (Source IDs: TRSS, TRSW)**

  The substation transformer for GRS (**Source ID: TRSS**) has a power rating of 108 MVA (max) and will step-up the voltage from 34.5 kV to 230 kV for connection to the grid. The transformer is manufactured by Hyundai Heavy Industries Co. Ltd. The transformer specifications, including sound level test results and calculation of the sound power spectrum are provided in **Appendix A**. The octave spectrum for the substation transformer was calculated using applicable IEEE standard, accounting for 0.3m increase in dimensions. The sound power calculation includes a 5 dB tonal penalty across the octave band.

  The substation transformer for GRW (**Source ID: TRSW**) has a power rating of 166 MVA (max) and will step-up the voltage from 34.5 kV to 230 kV for connection to the grid. The transformer is manufactured by Hyundai Heavy Industries Co. Ltd. The transformer specifications, including sound level test results and calculation of the sound power spectrum are provided in **Appendix A**. The octave spectrum for the substation transformer was calculated using applicable IEEE standard, accounting for 0.3m increase in dimensions. The sound power calculation includes a 5 dB tonal penalty across the octave band.

- **DSTATCOM Inverter System (Source ID: DSTAT1, DSTAT2)**

  The proposed GRS will also include two (2) Distributed STATic COMpensator (DSTATCOM) inverter systems, which will maintain high MVAR output at depressed system voltages. Since the DSTATCOM can maintain constant current over its operating voltage range, the MVAR output of the system is linearly proportional to the system voltage. The DSTATCOM also has a short-term transient current rating, which allows it to provide even more MVAR to assist in the recovery of depressed voltages.

  Each of the DSTATCOM inverter systems includes four (4) inverter blocks which are mounted in a single self-standing frame and are enclosed in a steel container (DSTATCOM container). Each

inverter has its own controls, circuit breaker and a small AC filter used to eliminate any high-frequency harmonic voltages in the output of the PWM waveform coming from the inverter. Each inverter is connected to a 2.5 MVA pad-mounted transformer (a total of four transformers per DSTATCOM inverter system). One of the DSTATCOM systems has a power rating of 10 mVAR and the other 8.75 mVAR. The noise data for the DSTATCOM inverter system was obtained from HGC Engineering report, dated October 21, 2013. A copy of the report is provided in **Appendix A**. Conservatively, noise data for the higher powered system (i.e., 10 mVAR) was used for both DSTATCOM systems.

- **Line Reactor (Source ID: LR)**

  The GRS substation also includes one (1) 3-phase Line Reactor (LR) with a max power rating of 26 mVAR for connection to the grid. The function of the line reactor is to filter out spikes of current that may exist between power generation and load (the grid). The line reactor consists of three isolated inductors, one for each of the three line phases. The noise for the line reactor was calculated using manufacturer specified data and calculation of spectrum similar to that of a transformer. Manufacturer data and calculations are presented in **Appendix A**.

- **Medium Voltage Stations (Source IDs: MV1 – MV65)**

  For the project, there are 65 Medium Voltage (MV) Stations, with each station consisting of two (2) inverters and one (1) inverter transformer, as follows:

  - ***Inverters –*** A total of 130 inverters (to convert DC to AC current) will be used at the project location. Each inverter will have its own cabinet-type enclosure and will be mounted on a concrete platform inside a larger enclosure. Each inverter enclosure will include two (2) inverters. The inverters will be SMA's model SC800CP-CA, rated for up to 800 kW of continuous power output. The manufacturer's noise data for the inverter is provided in **Appendix A**.

  - ***Inverter Transformers –*** A total of 65 inverter transformers will be installed beside the inverter enclosures to boost the AC voltage for connection to the grid. The inverter transformers will have a power rating of up to 1.6 MVA, which will boost the voltage from 360 V to 34.5 kV. The inverter transformers will be located on concrete platforms next to the inverter enclosures.

  The noise data for the MV Station was obtained from previously completed and approved NSR. The data is based on the report prepared by HGC Engineering, dated October 28, 2013, which

provides cumulative noise level spectrum for both 800 kW inverters (x2) and 1.6 MVA inverter transformer (x1) at each station. A copy of the report is provided in **Appendix A**.

Figure 1 identifies the inverter stations and substation transformer. The octave spectra and the overall Sound Power Levels (PWLs) for on-site noise sources for the GRS project are presented in **Table 1**. For source IDs please refer to **Table 4**.

Table 1: Noise Source Summary – Grand Renewable Solar Project

Source		Octave Spectrum (dB)									Overall	
Type	Count	31.5	63	125	250	500	1000	2000	4000	8000	A	lin
GRS Wind Substation (166 MVA)	1	85.3	91.3	93.3	88.3	88.3	82.3	77.3	72.3	65.3	88.7	97.3
GRS Solar Substation Transformer (108 MVA)	1	84.5	90.5	92.5	87.5	87.5	81.5	76.5	71.5	64.5	87.9	96.5
MV Station 10 (2 x 800 kW inverters and 1.6 MVA transformer)	65		93	83	75	73	66	65	64	60	75.5	93.5
DSTATCOM Inverter System 10 mVAR (Overall)	2		93	111	95	91	80	74	84	74	96.6	111.2
Line Reactor	1	78.6	84.6	86.6	81.6	81.6	75.6	70.6	65.6	58.6	82	90.6

Note:
A: A-weighted, Lin: Linear
The manufacturer-specified A-weighted spectra were converted to linear spectra and presented in this table.
The 5 dB tonal penalty is included in the sound power levels for all the units presented above

- **Wind Turbines (Source ID: Txx)**

  As mentioned above, the noise impact from the neighbouring wind projects were included in this assessment. Relevant information regarding the neighbouring wind projects was obtained from the previously submitted and approved NSR, prepared by Zephyr North Ltd., dated September 2013 (Rev. 3). The same noise data and assumptions were considered in this assessment. A total of 34 wind turbines for the GRW project and 19 turbines for the Summerhaven Wind Energy Centre (SWEC) were included in the noise modelling. The wind turbines for the GRS project are Siemens model SWT-2.3-101 wind turbines with two different

maximum power ratings of 2,221 kW and 2,126 kW. The wind turbines for the Summerhaven Wind Project Siemens model SWT-2.3-101 with maximum power rating of 2,221 kW.

As per the approved NSR, all turbines for the GRS project have a hub height of 99.5m while the turbines for the SWEC have a hub height of 80.0m.

The turbine noise emissions are not considered to have audible tonality (i.e., $\Delta L_{a,K} \leq 2$) and therefore no tonal penalty was incorporated in the analysis (see **Appendix A**).

The sound power spectra for the two types of wind turbines, corresponding to integer wind speeds of 6 m/s, 7 m/s, 8 m/s, 9 m/s and 10 m/s (at 10 m above ground) are presented in **Tables 2** and **3**. Also provided in the tables are the adjusted sound power spectra. Based on the analysis completed in the approved NSR (see **Appendix A**) the sound power spectra for the two types of wind turbines that result in the worst case noise impact for all distances correspond to that of 7 m/s winds (at 10 m above ground). As such, the adjusted noise levels (see **Tables 2** and **3**) for 7 m/s was applied to all wind speeds. For source IDs please refer to **Table 4**.

Table 2: Wind Turbine Source Summary Table – Siemens 2,221 kW

Siemens SWT-2.3-101 (Maximum Power = 2,221 kW) GRW Hub Height = 99.5 m SWEC Hub Height = 80.0 m Sound Power Spectra (dB)											
		Manufacturer's Emission Levels					Adjusted Emission Levels				
Wind Speed at 10m Height (m/s)		6	7	8	9	10	6	7	8	9	10
Frequency (Hz)	63	112.5	112.2	111	111.1	110.7	112.2	112.2	112.2	112.2	112.2
	125	106.4	107.7	107.2	106.6	105.7	107.7	107.7	107.7	107.7	107.7
	250	105.1	106.1	105	104.3	103.5	106.1	106.1	106.1	106.1	106.1
	500	100.9	101.5	100.4	100.2	99.8	101.5	101.5	101.5	101.5	101.5
	1000	99.2	99.9	100.1	100	100.2	99.9	99.9	99.9	99.9	99.9
	2000	95.3	96	97.7	97.8	98.2	96	96	96	96	96
	4000	91.2	92.5	92.6	94.4	94.5	92.5	92.5	92.5	92.5	92.5
	8000	78.2	79	81.9	81.8	81.6	79	79	79	79	79
Total Sound Power Level (dBA)		104.2	105	105	105	105	105	105	105	105	105

Note:
GRW: Grand Renewable Wind Project
SWEC: Summerhaven Wind Energy Centre

Table 3: Wind Turbine Source Summary Table – Siemens 2,126 kW

Siemens SWT-2.3-101 (Maximum Power = 2,126 kW) GRW Hub Height = 99.5 m Sound Power Spectra (dB)											
		Manufacturer's Emission Levels					Adjusted Emission Levels				
Wind Speed at 10m Height (m/s)		6	7	8	9	10	6	7	8	9	10
Frequency (Hz)	63	112.2	111.8	110.8	110.8	110.4	111.8	111.8	111.8	111.8	111.8
	125	105.9	107.1	106.8	106.2	105.3	107.1	107.1	107.1	107.1	107.1
	250	105	105.8	103.3	102.6	101.7	105.8	105.8	105.8	105.8	105.8
	500	100.3	100.8	99.5	99.2	98.8	100.8	100.8	100.8	100.8	100.8
	1000	97.7	98.3	99.3	99.2	99.3	98.3	98.3	98.3	98.3	98.3
	2000	93.9	94.5	96.6	96.7	97.2	94.5	94.5	94.5	94.5	94.5
	4000	90.6	91.8	91.5	93.3	93.4	91.8	91.8	91.8	91.8	91.8
	8000	78.1	78.8	80.4	80.3	80.1	78.8	78.8	78.8	78.8	78.8
Total Sound Power Level (dBA)		103.3	104	104	104	104	104	104	104	104	104

Note:
GRW: Grand Renewable Wind Project
SWEC: Summerhaven Wind Energy Centre

5.1 Operating Hours of Facility

The Grand Renewable Solar Park Project is designed to operate 365 days per year. The solar panels are only able to generate electricity when the sun is shining. Similarly, the inverters only operate when the solar panels are generating electricity. Furthermore, the inverters infrequently operate at full power as full power output requires a clear sky when the sun is at peak intensity. For this assessment the inverters and transformers were conservatively assumed to be operational at full power (i.e., maximum noise emission) during both daytime (07:00 – 19:00) and nighttime (19:00 – 07:00) hours [Note: solar nighttime power generation occurs after 19:00 during the summer].

5.2 Site Plan Identifying All Significant Sources

Figure 2 illustrates the project location and identifies all noise sources associated with the facility. **Figure 2** also illustrates all 'Potential Noise Receptors' surrounding the project location. The identified receptors are the same as those included in the previously approved NSR. In addition, as per Ontario Regulation 359/09 and guidance documents from the MOECC, 'Assumed Future Noise Receptors' must be identified on vacant lots measuring at least 100 metres by 100 metres. A total of 47 vacant lots have been identified and included in the analysis.

6. Noise Source Summary

6.1 Noise Source Summary Table

The significant noise sources identified in this noise study are listed in **Table 4**. This table contains sound power levels, source location, sound characteristics, and any noise control measures that already exist as a part of the original equipment.

Table 4: Noise Source Summary

Proposed Project	Noise Source ID	PWL (dBA)	Source Location[1] (I or O)	Sound Characteristics[2] (S,Q,I,B,T,C)	Noise Control Measures[3] (S,A,B,L,E,O,U)	UTM		Height (m)
						X (m)	Y (m)	
Grand Renewable Solar Project	DSTAT1	96.6	O	T	U	596530	4749160	2.5
	DSTAT2	96.6	O	T	U	596550	4749168	2.5
	LR	82	O	T	U	596488	4749144	6.8
	TRSS	87.9	O	T	U	596520	4749123	4
	MV1	75.5	O	T	S	597795	4750476	2
	MV2	75.5	O	T	S	597949	4750345	2
	MV3	75.5	O	T	S	597753	4750345	2
	MV4	75.5	O	T	S	597438	4750502	2
	MV5	75.5	O	T	S	597621	4750265	2
	MV6	75.5	O	T	S	597580	4750029	2
	MV7	75.5	O	T	S	597229	4750502	2
	MV8	75.5	O	T	S	597256	4750423	2
	MV9	75.5	O	T	S	597289	4750324	2
	MV10	75.5	O	T	S	597328	4750210	2
	MV11	75.5	O	T	S	597360	4750117	2
	MV12	75.5	O	T	S	597059	4750331	2
	MV13	75.5	O	T	S	597034	4750161	2
	MV14	75.5	O	T	S	597050	4750114	2
	MV15	75.5	O	T	S	597085	4750011	2
	MV16	75.5	O	T	S	596640	4750281	2
	MV17	75.5	O	T	S	596736	4750039	2
	MV18	75.5	O	T	S	596838	4749789	2

Proposed Project	Noise Source ID	PWL (dBA)	Source Location[1] (I or O)	Sound Characteristics[2] (S,Q,I,B,T,C)	Noise Control Measures[3] (S,A,B,L,E,O,U)	UTM		Height (m)
						X (m)	Y (m)	
	MV19	75.5	O	T	S	596531	4750190	2
	MV20	75.5	O	T	S	596538	4750170	2
	MV21	75.5	O	T	S	596603	4749980	2
	MV22	75.5	O	T	S	596609	4749960	2
	MV23	75.5	O	T	S	596671	4749779	2
	MV24	75.5	O	T	S	596235	4750149	2
	MV25	75.5	O	T	S	596287	4749998	2
	MV26	75.5	O	T	S	596294	4749977	2
	MV27	75.5	O	T	S	596358	4749788	2
	MV28	75.5	O	T	S	596362	4749776	2
	MV29	75.5	O	T	S	595998	4749934	2
	MV30	75.5	O	T	S	596049	4749785	2
	MV31	75.5	O	T	S	596072	4749718	2
	MV32	75.5	O	T	S	596117	4749586	2
	MV33	75.5	O	T	S	596127	4749557	2
	MV34	75.5	O	T	S	596187	4749377	2
	MV35	75.5	O	T	S	596345	4748860	2
	MV36	75.5	O	T	S	596400	4748647	2
	MV37	75.5	O	T	S	596497	4748517	2
	MV38	75.5	O	T	S	596497	4749000	2
	MV39	75.5	O	T	S	596533	4748895	2
	MV40	75.5	O	T	S	596569	4748790	2
	MV41	75.5	O	T	S	596604	4748685	2
	MV42	75.5	O	T	S	596719	4749206	2
	MV43	75.5	O	T	S	596758	4749097	2
	MV44	75.5	O	T	S	596793	4748992	2
	MV45	75.5	O	T	S	596829	4748887	2
	MV46	75.5	O	T	S	596865	4748782	2
	MV47	75.5	O	T	S	596901	4748677	2
	MV48	75.5	O	T	S	596990	4749276	2
	MV49	75.5	O	T	S	597030	4749158	2
	MV50	75.5	O	T	S	597066	4749053	2
	MV51	75.5	O	T	S	597102	4748948	2
	MV52	75.5	O	T	S	597138	4748843	2
	MV53	75.5	O	T	S	597247	4748492	2
	MV54	75.5	O	T	S	597274	4748413	2
	MV55	75.5	O	T	S	597345	4748266	2
	MV56	75.5	O	T	S	597297	4749250	2
	MV57	75.5	O	T	S	597310	4749250	2
	MV58	75.5	O	T	S	597270	4749035	2
	MV59	75.5	O	T	S	597563	4749224	2
	MV60	75.5	O	T	S	597599	4749119	2
	MV61	75.5	O	T	S	597635	4749014	2
	MV62	75.5	O	T	S	597653	4748951	2
	MV63	75.5	O	T	S	597786	4749238	2
	MV64	75.5	O	T	S	597911	4749084	2
	MV65	75.5	O	T	S	597943	4749238	2

Proposed Project	Noise Source ID	PWL (dBA)	Source Location[1] (I or O)	Sound Characteristics[2] (S,Q,I,B,T,C)	Noise Control Measures[3] (S,A,B,L,E,O,U)	UTM		Height (m)
						X (m)	Y (m)	
Grand Renewablle Wind Project	TRSW	88.7	O	T	U	596520	4749101	4
	T5	105	O	T	U	602757	4745791	99.5
	T9	105	O	T	U	600290	4745005	99.5
	T10	104	O	T	U	593994	4748442	99.5
	T11	105	O	T	U	603472	4748075	99.5
	T12	105	O	T	U	601479	4747111	99.5
	T13	105	O	T	U	594663	4751618	99.5
	T14	105	O	T	U	603952	4750047	99.5
	T16	105	O	T	U	594352	4749960	99.5
	T17	105	O	T	U	598648	4747922	99.5
	T20	105	O	T	U	592573	4749463	99.5
	T21	105	O	T	U	602692	4746290	99.5
	T22	105	O	T	U	601756	4751401	99.5
	T23	105	O	T	U	591178	4751634	99.5
	T24	105	O	T	U	592283	4749800	99.5
	T25	105	O	T	U	599133	4750265	99.5
	T27	105	O	T	U	598999	4748313	99.5
	T28	105	O	T	U	591339	4752273	99.5
	T29	105	O	T	U	599967	4750467	99.5
	T35	105	O	T	U	602880	4749652	99.5
	T37	105	O	T	U	602481	4749039	99.5
	T38	105	O	T	U	602608	4749469	99.5
	T39	105	O	T	U	603875	4749401	99.5
	T40	105	O	T	U	604239	4749614	99.5
	T42	105	O	T	U	600381	4750377	99.5
	T44	105	O	T	U	599489	4748483	99.5
	T46	105	O	T	U	590582	4751836	99.5
	T48	105	O	T	U	594126	4750504	99.5
	T51	105	O	T	U	601762	4745085	99.5
	T52	105	O	T	U	599708	4748016	99.5
	T53	105	O	T	U	600301	4748359	99.5
	T55	105	O	T	U	600136	4746677	99.5
	T56	105	O	T	U	598675	4750335	99.5
	T58	104	O	T	U	589733	4750362	99.5
	T68	105	O	T	U	602131	4748909	99.5
Summerhaven Wind Energy Centre	T219	105	O	T	U	590644	4749342	80.0
	T228	105	O	T	U	591259	4748123	80.0
	T232	105	O	T	U	590737	4746531	80.0
	T233	105	O	T	U	594906	4747489	80.0
	T238	105	O	T	U	591475	4744600	80.0
	T239	105	O	T	U	591880	4745113	80.0
	T240	105	O	T	U	592721	4744952	80.0

Proposed Project	Noise Source ID	PWL (dBA)	Source Location[1] (I or O)	Sound Characteristics[2] (S,Q,I,B,T,C)	Noise Control Measures[3] (S,A,B,L,E,O,U)	UTM		Height (m)
						X (m)	Y (m)	
	T241	105	O	T	U	593224	4745318	80.0
	T242	105	O	T	U	593522	4745702	80.0
	T243	105	O	T	U	594899	4745794	80.0
	T244	105	O	T	U	596210	4746279	80.0
	T245	105	O	T	U	596181	4745775	80.0
	T246	105	O	T	U	597119	4745943	80.0
	T247	105	O	T	U	597181	4746416	80.0
	T252	105	O	T	U	593087	4743349	80.0
	T253	105	O	T	U	593930	4743637	80.0
	T254	105	O	T	U	595213	4744131	80.0
	T255	105	O	T	U	596817	4743995	80.0
	T256	105	O	T	U	597076	4743766	80.0

Note: Each MV source consists of two inverters in a secondary enclosure and an inverter transformer. The UTM presented in the table are the centroids of the base for each MV station.

1. Source Locations
O – located/installed outside of a building, including on the roof
I – located/installed inside a building

2. Sound Characteristics
S – Steady
Q – Quasi Steady Impulsive
I – Impulsive
B – Buzzing
T – Tonal
C – Cyclic
Int – Intermittent

3. Noise Control Measures
S – silencer, acoustic louver, muffler
A – acoustic lining, plenum
B – barrier, berm, screening
L – lagging
E – acoustic enclosure
O – other
U – uncontrolled

6.2 Noise Source Specifications

Noise source specifications including manufacturer-specified noise data and calculation of noise levels for the above-mentioned noise sources are provided in **Appendix A**.

6.3 Source Power / Capacity Ratings

Manufacturer data for capacity and operating specifications for primary noise sources can be found in **Appendix A**.

6.4 Noise Control Description & Acoustical Specifications

For all the inverter stations, the inverters will each be contained in a cabinet (as per the specifications presented in **Appendix A**) and a secondary enclosure. The transmission loss for the secondary enclosure (including walls, roof and doors) is provided in **Table 5**.

Table 5: Noise Attenuation Data for Enclosure

Noise Source	Noise Control		Application	TL Spectrum (dB)							
	Type	Manufacturer		63	125	250	500	1000	2000	4000	8000
MV1 – MV65	Enclosure	TBD	walls, roof, doors	8	15	25	25	25	30	40	35

The secondary enclosure will have louvers for ventilation through which noise can propagate to outside. All ventilation openings (i.e., intake and exhaust) for the secondary enclosures for *all* the MV stations will have acoustic louvers. The transmission loss spectra for the acoustic louvers are provided in **Table 6**.

Table 6: Noise Attenuation Data for Acoustic Louver

Noise Source	Noise Control		Application	TL Spectrum (dB)							
	Type	Manufacturer		63	125	250	500	1000	2000	4000	8000
MV1 – MV65	Acoustic Louver	TBD	Intake	9	15	25	31	37	28	29	21
			Exhaust	6	11	18	25	51	51	43	32

GRAND RENEWABLE SOLAR PROJECT

Figure 2
Site Plan

- Highway
- Major Road
- Minor Road
- Fence
- Access Road
- Substation
- Solar Panel
- Inverter

1:12,000

0 50 100 200 300 400 m

MAP CREATED BY: GM
MAP CHECKED BY: MB
MAP PROJECTION: NAD 1983 UTM Zone 17N

FILE LOCATION: I:\GIS\137911 - Grand Renewable Solar\Mapping

DILLON CONSULTING

PROJECT: 137911
STATUS: DRAFT
DATE: 8/25/2014

7. Point of Reception Noise Impact Analysis

7.1 Land Use Designation

The project falls within lands primarily designated by the County of Haldimand Official Plan as agricultural. The surrounding lands are predominately agricultural with scattered residential dwellings.

7.2 Scaled Area Location Plan

Figure 3 is an aerial photo showing the location of the Grand Renewable Solar Park Project as well as the surrounding area. Receptor locations are also presented in **Figure 3**.

7.3 Points of Reception (PORs) List and Description

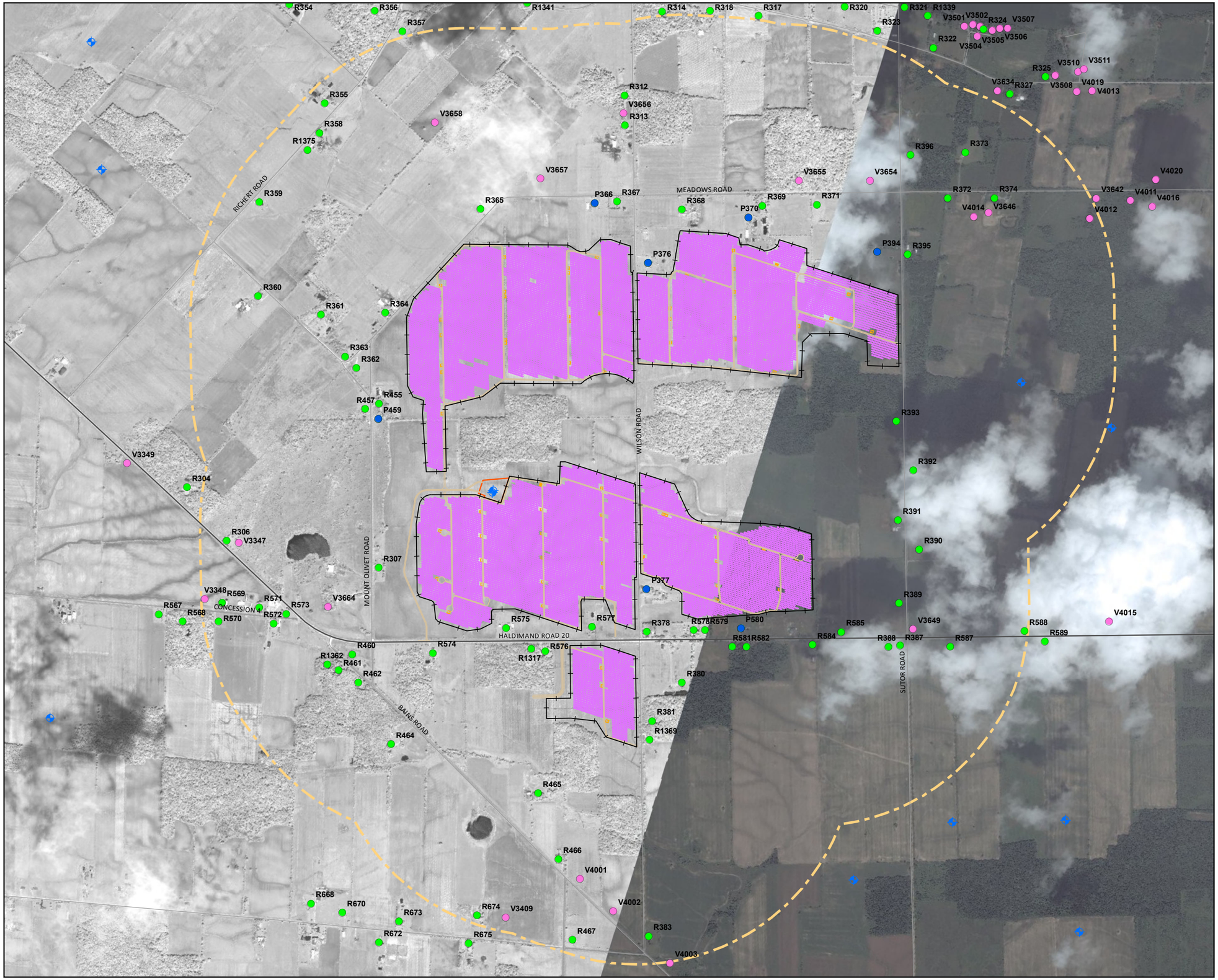
The Model Municipal Noise Control By-Law defines a Point of Reception (POR) / receptor as *"any point on the premises of a person where sound or vibration originating from other than those premises is received."* Noise-sensitive receptors include the following land uses:

- Permanent, seasonal, or rental residences;
- Hotels, motels and campgrounds;
- Schools, universities, libraries and daycare centres;
- Hospitals and clinics, nursing / retirement homes; and
- Churches and places of worship.

Any vacant lot that is zoned for any of the used above is also to be considered as potential future receptor location. A total of 151 receptors, including 47 vacant lot receptors and 7 receptors that are participating in the project (i.e., financially benefiting from the project) were included in the analysis. The receptors, their IDs and types were kept the same as those listed in the already approved NSR. The receptors include those beyond the 1 km radius from the project site and include both single and two-storey dwellings (see **Figure 3**). The receptor heights used in the model reflect single (1.5m) or two-storey (4.5m) residences. The UTM coordinates (NAD83, zone 17) and heights of the receptors used in the noise modelling are summarized in **Table 7**. For the vacant lots, the centroids of the 100 metre x 100 metre lots were chosen to represent the receptor locations (and receptor height of 4.5m), as per relevant MOECC guidelines.

GRAND RENEWABLE SOLAR PROJECT

Figure 3
Scaled Area Location Plan



- Wind Turbine
- Participating Noise Receptor
- Noise Receptor
- Vacant Lot Receptor
- Highway
- Major Road
- Minor Road
- Fence
- Access Road
- Substation
- Solar Panel
- Inverter
- 1000 m Project Location Setback

1:17,000

0 50100 200 300 400 m

MAP CREATED BY: GM
MAP CHECKED BY: MB
MAP PROJECTION: NAD 1983 UTM Zone 17N

FILE LOCATION: I:\GIS\137911 - Grand Renewable Solar\Mapping

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