APPENDIX E

NOISE CALCULATIONS

MITIGATED MVPP SOUND POWER LEVELS

Project Name: Sol-Luce Kingston PV Energy Project
Project Number: TC111406
Location: Kingston ON

Source Description	Octave Band Sound Pressure Level Data (dB)								Total (dBA)	Data Source
	63	125	250	500	1000	2000	4000	8000		
Inverter Sound Power Levels	102.0	87.0	80.0	69.0	60.0	52.0	43.0	50.0	78.4	HGC Report
Tranformer Sound Power Levels	77.2	79.2	74.2	74.2	68.2	63.2	58.2	51.2	74.6	CSA C227.4
Combined Sound Power Levels	102.0	87.7	81.0	75.3	68.8	63.5	58.3	53.6	79.9	Used in Cadna

UNMITIGATED MVPP SOUND POWER LEVELS

Project Name: Sol-Luce Kingston PV Energy Project
Project Number: TC111406
Location: Kingston ON

Source Description	Octave Band Sound Pressure Level Data (dB)								Total (dBA)	Data Source
	63	125	250	500	1000	2000	4000	8000		
Inverter Sound Power Levels	107.0	95.0	93.0	87.0	78.0	70.0	61.0	68.0	89.0	HGC Report
Tranformer Sound Power Levels	77.2	79.2	74.2	74.2	68.2	63.2	58.2	51.2	74.6	CSA C227.4
Combined Sound Power Levels	107.0	95.1	93.1	87.2	78.4	70.8	62.8	68.1	89.2	Used in Cadna

CONVERSION OF SOUND PRESSURE LEVELS TO SOUND POWER LEVELS (MVPP TRANSFORMER)

Project Name: Sol-Luce Kingston PV Energy Project
Project Number: TC111406
Location: Kingston ON

A-WEIGHTING (dB) - Applied to total PWL							
-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1

1/4 WAVELENGTH CRITERION (m)							
1.361	0.686	0.343	0.172	0.086	0.043	0.021	0.011

Source ID	Source Description	Calc Type [1] (A, C, or S)	SPL Ref Distance [2] (S or C) (m)	Length [3] (C only) (m)	Area (A only) (m^2)	Partition Coefficient (S or C) (%)	Net Surface Area [6] (m^2)	Spectral Weighting (A or Flat)	Octave Band Sound Pressure Level Data (dB) [5] 63	125	250	500	1000	2000	4000	8000	Total (dBA)	Sound Power Level Adjustment (dB)	Purpose	Octave Band Sound Power Level Data (dB) 63	125	250	500	1000	2000	4000	8000	Total (dBA)
MVPP_Trans	Inverter Transformers	A			45.3		45.3	Flat	60.6	62.6	57.6	57.6	51.6	46.6	41.6	34.6	58.0			77.2	79.2	74.2	74.2	68.2	63.2	58.2	51.2	74.6

Notes:

1. Calc Type of C, A, or S refer to the source geometry, and represent Cylindrical, Area, or Spherical sources, respectively.
2. SPL Ref Distance refers to the radial distance from the microphone to the acoustic centre of a spherical source or the symmetrical axis of a cylindrical source.
3. Length refers to the length of a cylindrical source or line source. A length of 1.0 m may be used to define a PWL per metre.
4. Net surface area refers to surface area corrected for partition coefficient. Partition coefficient applies only to spherical and cylindrical geometries. Sound power level is estimated using an area correction 10 log A.
5. Tansformer Spectral Shape for 58 dBA overal.

CONVERSION OF SOUND PRESSURE LEVELS TO SOUND POWER LEVELS

amec

Project Name: Sol-Luce Kingston PV Energy Project
Project Number: TC111406
Location: Kingston ON

A-WEIGHTING (dB) - Applied to total PWL							
-26.2	-16.1	-8.6	-3.2	0.0	1.2	1.0	-1.1

1/4 WAVELENGTH CRITERION (m)							
1.361	0.686	0.343	0.172	0.086	0.043	0.021	0.011

Source ID	Source Description	Calc Type [1] (A, C, or S)	SPL Ref Distance [2] (S or C) (m)	Length [3] (C only) (m)	Area (A only) (m^2)	Partition Coefficient (S or C) (%)	Net Surface Area [6] (m^2)	Spectral Weighting (A or Flat)
Sub_Transf	Substation Transformer	A			162.2		162.2	Flat

Source ID	Octave Band Sound Pressure Level Data (dB) [5] 63	125	250	500	1000	2000	4000	8000	Total (dBA)
Sub_Transf	86.6	88.6	83.6	83.6	77.6	72.6	67.6	60.6	84.0

Source ID	Sound Power Level Adjustment (dB)	Purpose	Octave Band Sound Power Level Data (dB) 63	125	250	500	1000	2000	4000	8000	Total (dBA)
Sub_Transf			108.7	110.7	105.7	105.7	99.7	94.7	89.7	82.7	106.1

Notes:

1. Calc Type of C, A, or S refer to the source geometry, and represent Cylindrical, Area, or Spherical sources, respectively.
2. SPL Ref Distance refers to the radial distance from the microphone to the acoustic centre of a spherical source or the symmetrical axis of a cylindrical source.
3. Length refers to the length of a cylindrical source or line source. A length of 1.0 m may be used to define a PWL per metre.
4. Net surface area refers to surface area corrected for partition coefficient. Partition coefficient applies only to spherical and cylindrical geometries. Sound power level is estimated using an area correction 10 log A.
5. Tansformer Spectral Shape for 84 dBA overal.

APPENDIX F

NEIGHBOURING SOLAR PROJECT NOISE REPORTS

Axio Power Canada Inc./
SunEdison Canada

Noise Study Report

For

Kingston Gardiner Hwy 2 South Solar Energy Project

H335467
Rev. 0
January 26, 2012

Report Disclaimer

This report has been prepared by Hatch Ltd. for the sole and exclusive use of Axio Power Canada Inc./ SunEdison Canada (the "Client") for the purpose of assisting the management of the Client in making decisions with respect to the development of a proposed solar photovoltaic project and shall not be (a) used for any other purpose, or (b) provided to, relied upon or used by any third party.

This report contains opinions, conclusions and recommendations made by Hatch Ltd. (Hatch), using its professional judgment and reasonable care. Any use of or reliance upon this report by the Client is subject to the following conditions:

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- the report being read as a whole, with sections or parts hereof read or relied upon in context;
- the conditions of the site may change over time (or may have already changed) due to natural forces or human intervention, and Hatch takes no responsibility for the impact that such changes may have on the accuracy or validity of the observations, conclusions and recommendations set out in this report; and
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Project Report

January 26, 2012

Axio Power Canada Inc./SunEdison Canada
Kingston Gardiner Hwy 2 South Solar Energy Project

Noise Study Report

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Executive Summary

This report presents the results of the noise assessment study required for Solar Facilities under Ontario Regulation 359/09 and 521/10, as part of the Renewable Energy Approval (REA) Process.

Axio Power Canada Inc./SunEdison Canada (the "Client") is proposing to develop a 10-Megawatt (MW) solar photovoltaic (PV) project Kingston Gardiner Hwy 2 South Solar Energy Project (the "Project"). The Project is located on approximately 34 hectares of land on Part of Lot 40, Concession 3, Loyalist Township, County of Lennox and Addington.

This Noise Assessment Report has been prepared based on the document entitled "Basic Comprehensive Certificates of Approval (Air) – User Guide" by the Ontario Ministry of the Environment (MOE, 2004). The sound pressure levels at the points of reception (POR) have been estimated using ISO 9613-2, implemented in the CADNA-A computer code. The performance limits used for verification of compliance correspond to the values for rural areas of 40 dBA. The results presented in this report are based on the best available information at this time. It is the intention that, in the detailed engineering phase of the project, certified noise data based on final plans and designs will confirm the conclusions of this noise study.

The results obtained in this study show that the sound pressure levels at POR will not exceed MOE requirements for rural areas of 40 dBA.

1. Introduction

1.1 Project Description

Axio Power Canada Inc./SunEdison Canada (the "Client") is proposing to develop a 10-Megawatt (MW) solar photovoltaic (PV) project titled Kingston Gardiner Hwy 2 South Solar Energy Project (the "Project"). The Project Location[1] is situated on approximately 34 hectares (ha) of land on Part of Lot 40, Concession 3, Loyalist Township (lower tier municipality), County of Lennox and Addington (upper tier municipality).

The Project is proposed to be constructed on privately owned land that is currently vacant and covered by woodland and seasonal vegetation. The Project is located immediately south of Highway 2 (Regional Road 2) approximately 3.6-km east of the village of Odessa and 5-km west of the City of Kingston.

The proposed Project is a renewable energy generation facility which will use solar photovoltaic technology to generate electricity. Electricity generated by solar photovoltaic panels will be converted from Direct Current (DC) to Alternating Current (AC) by inverter units which will also step-up the voltage to 27.6 kV. A main transformer, located in the substation, will step up the voltage from the inverter units to 44 kV prior to being sent to the existing local distribution line. In order to meet the Ontario Power Authority (OPA)'s Feed-In-Tariff (FIT) Program requirements, a specific percentage of equipment will be manufactured in Ontario.

The construction of the Project will begin once the Renewable Energy Approval (REA) has been obtained and a power purchase agreement is finalized with the OPA. The construction period is estimated to be approximately 6 months. Operationally, the anticipated lifespan of the Project will be 30 years.

1.2 Renewable Energy Approval Legislative Requirements

Ontario Regulation 359/09 and 521/10, made under the Environmental Protection Act identify the Renewable Energy Approval (REA) requirements for green energy projects in Ontario. As per Section 4 of the Ontario Regulation 359/09 and its amendment (Ontario Regulation 521/10), ground mounted solar facilities with a name plate capacity greater than 12 kilowatts (kW) are classified as a Class 3 solar facility, and therefore, require an REA.

Section 13 of the Ontario Regulation 359/09 requires proponents of Class 3 solar facilities to complete a Noise Study Report in accordance with Appendix A of the publication "Basic Comprehensive Certificates of Approval (Air) – User Guide, 2004" by the Ministry of the Environment (MOE, 2004).

The Noise Study Report is to include a general description of the facility, noise sources and points of reception (POR), assessment of compliance, as well as all the supporting information relevant to the Project. A draft of the Noise Study Report must be made available to the public, the local municipality and identified Aboriginal communities, at least 60 days prior to the final public consultation meeting in accordance with Ontario Regulation 359/09 and 521/10.

[1] "Project Location" in the context of this study is an area occupied by the Project infrastructure.

2. Facility Description

The Project will utilize photovoltaic (PV) panels installed on fixed racking structures mounted on the ground. The PV panels generate DC electricity which will be converted to AC electricity by inverter units. The Project layout is based on 10 inverter units (i.e., building enclosures), each one containing two inverters and one medium-voltage transformer, and one 10-MVA/44-kV substation transformer. The 27.6-kV power, collected from the inverter units, will be stepped-up to 44 kV by the substation transformer prior to being sent to the existing local distribution line.

Since the panels will be ground-mounted and the total nameplate capacity is over 12 kW, the Project is considered to be a Class 3 Solar Facility, according to the classification presented in Ontario Regulation 521/10.

Table 2.1 General Project Description

Project Description	Ground-mounted Solar PV, Class 3
System Nameplate Capacity	10 MW AC
Local Distribution Company	Hydro One Networks Inc.

2.1 Project Location

The Project Location consists of undeveloped land totalling approximately 34 hectares, located 3.6 km east of the village of Odessa and 5 km west of the City of Kingston. Figure 2.1 shows the site layout plan while the zoning designation plan (Figure A.1) and area location plan (Figure A.2) drawings are included in Appendix A. 124 points of reception are located within 1.2-km from the Project Site[2] boundary.

2.2 Acoustical Environment

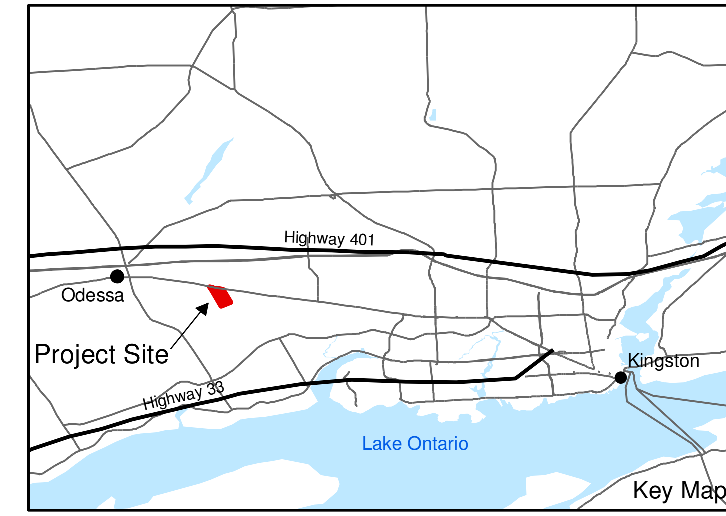
The Project Location is mainly surrounded by farmland, with some wooded areas to the north and south sides. The spot sound measurements taken around the site showed sound pressure levels somewhat above those typical of rural areas (>40 dBA). Traffic noise is perceived from Highway 2 to the north.

No industrial facilities or airports are found within 5-km from the site.

2.3 Life of Project

The expected life of the Project is 30 years. At that time (or earlier if the 20 year power purchase agreement is not extended), the Project will be decommissioned or refurbished depending on market conditions and/or technological changes.

[2] "Project Site" in the context of this study is the complete area designated for the Project but not necessary occupied with the project infrastructure. Project Location is always contained within Project Site.



LEGEND

Existing Features

- Noise Receptor
- Representative Noise Receptor
- Road
- Topographic Contour (5 m interval)
- Watercourse
- Transmission Line
- Parcel

Proposed Project Components

- Communication Tower
- Project Site
- Project Location
- Sub# Substation Transformer
- Inv# Inverter Unit
- Laydown Area
- Panel Layout
- Access Road
- Transmission Line
- Substation
- Connection Point

0 100 200 400 Metres

NORTH

1:7,500

Notes:
1. OBM and NRVIS data downloaded from LIO, with permission.
2. Spatial Referencing UTM NAD 83.
3. Air photos from CRCA, flown Spring 2008, scale 1:2000.

Figure 2.1
Axio Power Canada Inc./SunEdison Canada
Kingston Gardiner Hwy 2 South
Site Layout Plan

HATCH

Path: P:\CANSOLAR\335467\SPECIALIST_APPS\GIS\Hwy 2_South\Hwy 2 South_Noise_SLP_Fig2.1.mxd Date Saved: 1/20/2012 1:28:56 PM

2.4 Operating Hours

Solar PV facilities produce electricity during the daytime hours, when the sun's rays are collected by the panels. After sunset, the facility will not receive solar radiation to generate any electricity. Under these conditions the inverters will not produce any noise and the transformers will be energized, but not in operation (no fans in operation).

2.5 Approach to the Study

The sound pressure levels at the POR were predicted using procedures from ISO 9613-2, which is a widely used and generally accepted standard for the evaluation of noise impact in environmental assessments. The sound power level for the inverter units was provided by the manufacturer while the sound power level for the substation transformer was estimated. The software package CADNA-A, which implements ISO-9613-2, was used to predict the noise levels at the closest POR. This numerical modeling software is able to simulate sound sources as well as sound mitigation measures taking into account atmospheric and ground attenuation. Some of the CADNA-A configurations used in the modeling are shown in Figure 2.2.The height contours for the site were taken from the Ontario Base Maps (OBM).

For modeling purposes, the vegetation that blocks some of the POR from the sources has not been incorporated.

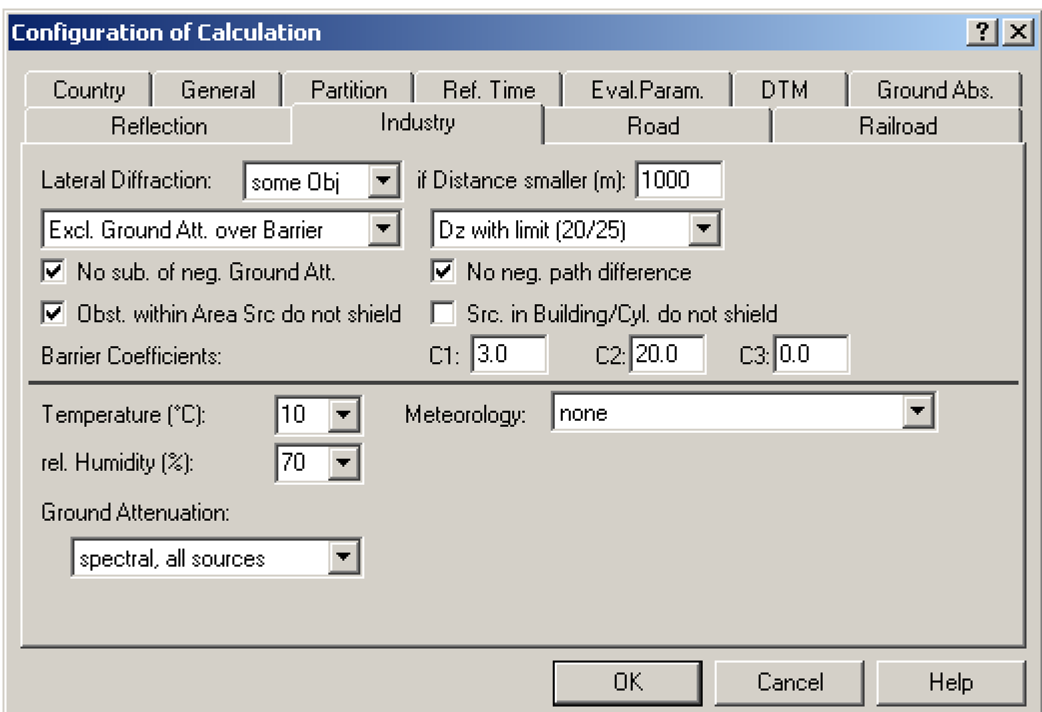


Figure 2.2 CADNA-A Configurations

3. Noise Source

The main sources of noise from the Project will be 10 inverter units, each one containing two inverters and one medium-voltage transformer, and a substation containing the main step up transformer. The Client provided a layout of the solar PV facility (see Figure 2.1). The coordinates of each noise source are presented in Table B.1 of Appendix B.

All noise sources were modeled as non-directional point sources.

Switchgear and a small step-down transformer used for lighting, located at the substation, do not emit any significant noise and consequently have not been considered as sources of noise.

For the purpose of this study it is assumed that all inverters and transformers will be operating 24 hours at full capacity.

3.1 Substation Transformer

A step-up transformer that will step-up the 27.6-kV power to the 44 kV, required by the local distribution company, will be located in the substation. The 27-kV/44-kV/10-MVA transformer will be supplied by Magna Electric Corporation (Figure B.3). The sound power levels resulting from the operation of the transformer were using data from NEMA TRI – 1993 (2000) and 35-m^2 transformer surface area. This standard provides maximum sound level values for transformers, and manufacturers routinely meet this specification. Hence, the results based on NEMA may slightly overestimate the impact on POR since the actual transformer is expected to be quieter.

The NEMA levels were then converted into frequency spectra using empirical correlations for transformer noise (Crocker, 2007). This calculation is available in Figure B.1 of Appendix B.

Power transformers are considered by the MOE to be tonal noise sources. A 5-dB penalty was added to the sound power spectrum, as recommended by Publication NPC-104, "Sound Level Adjustments" for tonality. Table B.2 in Appendix B shows the frequency spectrum used to model the substation transformer. Figure B.3 presents dimensions for this transformer that are expected to be similar to the installed dimensions.

3.2 Inverter Units

The Client will use ten SMA Sunny Central 1000MV (SC1000MV) inverter units in the Project. Each SC1000MV inverter unit comprises of two inverters and one medium voltage transformer contained in an e-house or enclosure (see Appendix B). The main sources of noise are the cooling/ventilation fans, the electrical components of the inverters and the medium-voltage transformer. It is assumed that the current configuration of the SC1000MV unit, as specified in Appendix B, will be modified, where required according to the CADNA-A model, to have the following features: 1) all ventilation openings will be equipped with acoustical louvers (silencers); 2) all external walls will be soundproof (i.e., sound emissions through the walls will be significantly lower than the sound emissions through the louvers).

The installed capacity of each inverter unit is 1 MW. SMA provided third-octave noise data for the SC1000MV unit, which takes into account combined noise emissions from the two inverters and transformer (see Appendix B). The provided third octave spectrum was converted to a full octave spectrum for use with CADNA-A model (calculations are available in Figure B.2 of Appendix B). A

5-dBA penalty was added to the frequency spectrum, as stipulated in Publication NPC-104, "Sound Level Adjustments," to allow for tonality. The frequency spectra used for SC1000MV units is shown in Table B.2, Appendix B.

Although for the modeling purposes it was assumed that the facility will operate 24 hours at full capacity, in reality at night the facility will be idle. Under these conditions the inverters do not produce noise. The transformers (at the substation and clusters) are energized and make some magnetostrictive noise at a reduced level, but no cooling fans are in operation.

3.3 Noise Summary Table

A summary of the sound sources described above, including sound level, characteristics and proposed noise control measures, is presented in Table 3.1.

Table 3.1 Noise Source Summary (Day and Night Time)

Source ID	Description	Total Sound Power Level (dBA)	Source Location	Sound Characteristics	Noise Control Measures
Sub	27-kV/44-kV/10-MVA Substation transformer	90.8	O	S-T	U
Inv1	Sunny Central 1000MV inverter unit	102.2	O	S-T	E-S
Inv2	Sunny Central 1000MV inverter unit	102.2	O	S-T	E-S
Inv3	Sunny Central 1000MV inverter unit	102.2	O	S-T	E-S
Inv4	Sunny Central 1000MV inverter unit	102.2	O	S-T	E-S
Inv5	Sunny Central 1000MV inverter unit	102.2	O	S-T	E-S
Inv6	Sunny Central 1000MV inverter unit	102.2	O	S-T	E-S
Inv7	Sunny Central 1000MV inverter unit	102.2	O	S-T	E-S
Inv8	Sunny Central 1000MV inverter unit	102.2	O	S-T	E-S
Inv9	Sunny Central 1000MV inverter unit	102.2	O	S-T	E-S
Inv10	Sunny Central 1000MV inverter unit	102.2	O	S-T	E-S

Notes:

1. A 5-dBA penalty is included in this table.
2. Location: Inside building (I), Outside building (O).
3. Sound Characteristics: Steady (S), Tonal (T), Impulsive (I), Quasi-Steady Impulsive (QSI).
4. Noise Control: Silencer (S), Acoustic lining (A), Barrier (B), Lagging (L), Enclosure (E), Other (O), Uncontrolled (U).

3.4 Adjacent Solar Projects

To identify the adjacent solar projects Hatch's internal database of solar projects and MOE records available in http://www.ene.gov.on.ca/environment/en/subject/renewable_energy/projects/index.htm were searched (Jan 16, 2011).

There are no POR that are within 1 km of equipment in the Project and any adjacent project. As a result, there are no adjacent projects included in this study.

4. Point of Reception

The POR used in this study were initially identified from the OBM and high resolution aerial photography within 1.2-km distance from the Project Site boundary. Following this, the potential noise receptors located closest to the Project Location were then visually verified during a site visit held in September 2010. Based on this, a number of additional receptors (residential buildings) that were observed at the time of the inspection were added to the model.

The total number of POR considered in this study, within a 1.2-km distance from the Project Site boundary, is 124 (see Figure A.1 and Figure A.2 in Appendix A). Three of these noise receptors, identified in Table 4.1, were chosen as representative receptors for evaluating the noise contribution from each individual source (i.e., the substation and 10 inverters). These three receptors were chosen in order to represent sound pressure level contributions on different areas around the Project Location. The complete set of results for all 124 noise receptors is provided in Table 6.2 with corresponding noise maps from CADNA-A included in Appendix C.

For this study, the elevation above ground used for the POR is 4.5 m. Also, noise compliance was verified within 30-m distance from any given POR located at 1.5 m above the ground level.

Table 4.1 Point of Reception Noise Impact (Day and Night Time)

Source ID	POR 1		POR 7		POR 16	
	Distance (m)	L_{eq} Sound Level (dBA)	Distance (m)	L_{eq} Sound Level (dBA)	Distance (m)	L_{eq} Sound Level (dBA)
Sub	156	35.6	161	35.4	778	20.6
Inv1	264	27.3	202	29.9	581	19.8
Inv2	126	34.7	271	27.0	693	18.1
Inv3	297	26.2	347	24.7	527	20.8
Inv4	219	29.1	407	23.2	658	18.6
Inv5	386	23.7	491	21.4	508	21.1
Inv6	348	24.7	547	20.4	654	18.7
Inv7	502	21.2	635	19.0	531	20.7
Inv8	487	21.5	689	18.2	682	18.3
Inv9	629	19.1	779	17.0	590	19.7
Inv10	628	19.1	833	16.4	737	17.5

5. Mitigation Measures

Mitigation for operation of the solar facility has been modeled and shown to be feasible in the form of soundproof (i.e., sound emissions through the walls will be significantly lower than the sound emissions through the louvers) enclosures with acoustical louvers for all inverter units. The noise reduction and sound transmission characteristics of the acoustical louvers considered in this study are presented in Table B.3 of Appendix B. Technical specifications of the proposed louvers are included in Appendix B as well.

6. Impact Assessment

The purpose of the acoustic assessment report is to demonstrate that the facility is in compliance with the noise performance limits. The Project will be located in a Class 3 Area, based on the classification defined in Publication NPC-232 by the MOE. Class 3 area means a rural area with an acoustical environment that is dominated by natural sounds with little or no traffic noise.

Table 6.1 shows the performance limits set by the MOE for Class 3 Areas, according to Publication NPC-232.

Table 6.1 Performance Limits (One-Hour L_{eq}) by Time of Day for Class 3 Areas

Time of Day	One Hour L_{eq} (dBA) Class 3 Area
07:00 to 19:00	45.0
19:00 to 23:00	40.0
23:00 to 07:00	40.0

The solar facility will be operating during the daylight hours, that is, between 07:00 and 19:00 during most days of the year. However, in the summer months the sun may shine until past 19:00, or before 07:00. As such, during the summer the facility will be operating at the time when the applicable performance limit changes from 45 dBA to 40 dBA. Also, the transformers remain energized at night. In order to account for this the study assumes that the facility will be operating 24 hours and compares the impact from the facility with the 40-dBA limit. In reality, the cooling fans will not be in operation at night.

For this study, the overall ground attenuation coefficient was estimated to be 0.7. Appendix D includes a list of all the parameters used in the CADNA-A model to predict the sound pressure levels at the POR.

The modelling does not consider the effect of the solar panels on the predicted sound pressure levels at the points of reception. The solar panels may act as barriers to further reduce noise at the POR.

6.1 Compliance With Performance Limits

Table 6.2 presents the predicted sound pressure levels for the POR located within 1.2 km from the Project Site. Sound pressure contours at 4.5-m and 1.5-m are available in Figure C.1 and Figure C.2. Appendix D includes a detailed calculation log of the representative POR with the highest sound pressure level.

Effect of the noise emissions at the POR was also accessed by intersecting the 40-dBA sound pressure contours calculated at 1.5 m above ground with 30-m radius circles placed around the POR (Figure C.2). The results show that none of the 30-m radius zones are affected by the noise emissions.

Table 6.2 Calculated Sound Pressure Levels at POR (shaded rows correspond to representative POR) Existing = Existing dwelling

ID	Description	Total Sound Pressure (dBA)	Performance Limit (dBA)	Height (m)	UTM Coordinates NAD83 Zone18			Min dist. to source (m)
					X (m)	Y (m)	Z (m)	
1	Existing	39.7	40.0	4.5	366773	4903320	134.5	126
2	Existing	36.6	40.0	4.5	366859	4903323	134.5	201
3	Existing	35.3	40.0	4.5	366876	4903397	134.5	242
4	Existing	37.9	40.0	4.5	366782	4903432	134.5	153
5	Existing	33.4	40.0	4.5	367019	4903279	134.4	335
6	Existing	33.9	40.0	4.5	366950	4903384	134.5	309
7	Existing	37.7	40.0	4.5	366476	4903421	134.5	161
8	Existing	33.4	40.0	4.5	366973	4903383	134.5	329
9	Existing	32.3	40.0	4.5	367088	4903275	134.3	394
10	Existing	36.3	40.0	4.5	366439	4903427	134.5	198
11	Existing	31.6	40.0	4.5	367172	4903163	133.1	429
12	Existing	34.8	40.0	4.5	366391	4903443	134.5	248
13	Existing	31.5	40.0	4.5	367092	4903373	134.5	436
14	Existing	35.3	40.0	4.5	366449	4903496	134.5	212
15	Existing	30.2	40.0	4.5	367240	4903233	133.5	521
16	Existing	30.0	40.0	4.5	366166	4902770	129.5	508
17	Existing	29.8	40.0	4.5	366157	4902750	129.5	524
18	Existing	29.3	40.0	4.5	366180	4902639	128.5	547
19	Existing	29.1	40.0	4.5	366041	4902939	130.1	563
20	Existing	29.1	40.0	4.5	366034	4902964	130.2	557
21	Existing	29.1	40.0	4.5	366029	4903026	130.7	536
22	Existing	29.0	40.0	4.5	366017	4903032	130.7	545
23	Existing	28.6	40.0	4.5	366018	4902893	129.6	599
24	Existing	28.8	40.0	4.5	365998	4903069	130.9	551
25	Existing	28.7	40.0	4.5	365990	4903082	130.9	555
26	Existing	28.3	40.0	4.5	366304	4902384	126.6	542
27	Existing	28.4	40.0	4.5	366372	4902339	126.3	518
28	Existing	28.2	40.0	4.5	365968	4902982	130.1	609
29	Existing	27.9	40.0	4.5	365963	4902878	129.5	656
30	Existing	28.0	40.0	4.5	365942	4903033	130.4	615
31	Existing	26.9	40.0	4.5	367524	4903182	129.5	761
32	Existing	28.0	40.0	4.5	366039	4903555	134.5	588
33	Existing	27.1	40.0	4.5	365957	4903545	134.1	653
34	Existing	26.6	40.0	4.5	365864	4903408	132.8	687
35	Existing	26.0	40.0	4.5	365769	4903004	129.5	790
36	Existing	25.9	40.0	4.5	365767	4902982	129.5	798
37	Existing	26.4	40.0	4.5	365856	4903450	133.0	707
38	Existing	26.2	40.0	4.5	365899	4903590	134.2	725
39	Existing	25.4	40.0	4.5	366132	4902195	124.5	793
40	Existing	25.8	40.0	4.5	365786	4903405	132.5	762

ID	Description	Total Sound Pressure (dBA)	Performance Limit (dBA)	Height (m)	UTM Coordinates NAD83 Zone18			Min dist. to source (m)
					X (m)	Y (m)	Z (m)	
41	Existing	25.2	40.0	4.5	366115	4902187	124.3	812
42	Existing	26.0	40.0	4.5	365916	4903656	134.5	747
43	Existing	25.6	40.0	4.5	365772	4903432	132.6	782
44	Existing	25.1	40.0	4.5	365675	4903041	129.5	871
45	Existing	24.7	40.0	4.5	366062	4902160	123.6	871
46	Existing	24.7	40.0	4.5	365642	4903198	130.4	885
47	Existing	24.2	40.0	4.5	365751	4902462	124.9	1011
48	Existing	24.8	40.0	4.5	365762	4903627	134.0	863
49	Existing	24.6	40.0	4.5	365686	4903496	132.8	883
50	Existing	23.4	40.0	4.5	367854	4903074	124.5	1023
51	Existing	24.3	40.0	4.5	365602	4903245	130.7	924
52	Existing	24.0	40.0	4.5	365980	4902130	122.8	954
53	Existing	24.5	40.0	4.5	365781	4903713	134.5	890
54	Existing	24.4	40.0	4.5	367146	4904098	138.7	872
55	Existing	23.2	40.0	4.5	367888	4903013	124.5	1035
56	Existing	23.0	40.0	4.5	367909	4903049	124.5	1065
57	Existing	23.5	40.0	4.5	365676	4902425	124.5	1094
58	Existing	24.0	40.0	4.5	365654	4903592	133.4	946
59	Existing	24.0	40.0	4.5	365730	4903727	134.5	941
60	Existing	22.5	40.0	4.5	367926	4903216	124.5	1145
61	Existing	22.7	40.0	4.5	367944	4903078	124.5	1108
62	Existing	23.1	40.0	4.5	365879	4902086	121.9	1061
63	Existing	23.3	40.0	4.5	365489	4903250	130.6	1038
64	Existing	23.3	40.0	4.5	365646	4903743	134.5	1021
65	Existing	23.0	40.0	4.5	367312	4904188	139.5	1046
66	Existing	22.4	40.0	4.5	365807	4902040	121.2	1147
67	Existing	23.0	40.0	4.5	365650	4903811	134.5	1054
68	Existing	22.5	40.0	4.5	366536	4901668	119.3	1046
69	Existing	22.2	40.0	4.5	366382	4901674	119.5	1082
70	Existing	22.6	40.0	4.5	365526	4903684	133.6	1100
71	Existing	22.2	40.0	4.5	366329	4901680	119.5	1096
72	Existing	22.5	40.0	4.5	365500	4903658	133.3	1114
73	Existing	22.2	40.0	4.5	365512	4903779	134.3	1155
74	Existing	21.7	40.0	4.5	366199	4901665	119.1	1166
75	Existing	21.4	40.0	4.5	366245	4901600	117.0	1203
76	Existing	21.3	40.0	4.5	366085	4901666	117.8	1223
77	Existing	21.2	40.0	4.5	366069	4901660	117.4	1237
78	Existing	21.2	40.0	4.5	366190	4901603	116.6	1225
79	Existing	21.5	40.0	4.5	365415	4903793	134.0	1248
80	Existing	21.0	40.0	4.5	366139	4901589	115.5	1261
81	Existing	20.7	40.0	4.5	366016	4901609	115.0	1308
82	Existing	20.8	40.0	4.5	366826	4901429	115.3	1265
83	Existing	20.7	40.0	4.5	365991	4901610	114.8	1322

ID	Description	Total Sound Pressure (dBA)	Performance Limit (dBA)	Height (m)	UTM Coordinates NAD83 Zone18			Min dist. to source (m)
					X (m)	Y (m)	Z (m)	
84	Existing	20.7	40.0	4.5	367679	4901743	114.7	1237
85	Existing	20.4	40.0	4.5	367768	4901816	114.6	1242
86	Existing	20.6	40.0	4.5	366861	4901414	115.5	1282
87	Existing	20.9	40.0	4.5	365339	4903808	134.0	1322
88	Existing	20.3	40.0	4.5	367795	4901814	114.5	1262
89	Existing	20.4	40.0	4.5	367715	4901725	114.0	1274
90	Existing	20.4	40.0	4.5	365815	4901666	115.8	1388
91	Existing	20.4	40.0	4.5	366875	4901385	115.2	1313
92	Existing	20.7	40.0	4.5	365271	4903752	133.5	1361
93	Existing	20.2	40.0	4.5	365766	4901673	116.2	1417
94	Existing	20.6	40.0	4.5	365288	4903813	133.9	1370
95	Existing	20.4	40.0	4.5	365265	4903816	133.9	1393
96	Existing	20.4	40.0	4.5	365270	4903845	134.1	1401
97	Existing	19.4	40.0	4.5	367907	4901809	110.8	1347
98	Existing	20.1	40.0	4.5	365215	4903835	134.0	1446
99	Existing	20.0	40.0	4.5	365213	4903857	134.1	1457
100	Existing	17.9	40.0	4.5	368194	4902084	110.3	1435
101	Existing	19.8	40.0	4.5	365178	4903844	134.0	1483
102	Existing	19.8	40.0	4.5	365123	4903732	133.3	1492
103	Existing	19.6	40.0	4.5	365110	4903782	133.7	1522
104	Existing	18.2	40.0	4.5	368362	4902275	112.2	1523
105	Existing	19.5	40.0	4.5	365135	4903856	134.2	1527
106	Existing	19.4	40.0	4.5	365118	4903868	134.3	1548
107	Existing	17.8	40.0	4.5	368397	4902267	110.8	1559
108	Existing	18.9	40.0	4.5	365041	4903916	134.5	1638
109	Existing	18.7	40.0	4.5	365011	4903913	134.5	1664
110	Existing	18.4	40.0	4.5	364922	4903826	134.2	1713
111	Existing	18.4	40.0	4.5	364942	4903879	134.5	1714
112	Existing	18.2	40.0	4.5	364883	4903837	134.3	1753
113	Existing	18.2	40.0	4.5	364872	4903824	134.2	1759
114	Existing	17.7	40.0	4.5	364823	4903911	134.5	1836
115	Existing	17.7	40.0	4.5	365499	4904756	134.5	1775
116	Existing	17.5	40.0	4.5	364792	4903920	134.5	1868
117	Existing	16.6	40.0	4.5	365182	4904745	134.5	1985
118	Existing	16.6	40.0	4.5	365211	4904781	134.5	1989
119	Existing	16.6	40.0	4.5	364893	4904450	134.5	2037
120	Existing	16.5	40.0	4.5	365148	4904745	134.5	2010
121	Existing	16.4	40.0	4.5	364855	4904442	134.5	2066
122	Existing	16.4	40.0	4.5	364836	4904433	134.5	2077
123	Existing	16.2	40.0	4.5	364677	4904232	134.5	2105
124	Existing	16.2	40.0	4.5	364705	4904280	134.5	2104

In order to account for the potential noise impacts to vacant lots surrounding the Project Location (i.e., those that could have an inhabited building constructed on the lot at a future date), a comparison was made between the Zoning Designation (Figure A.1 in Appendix A), the noise receptors, land parcels surrounding the Project Location and the noise contours shown in Figure C.1 and Figure C.2 in Appendix C. The results from the comparison are summarized in Table 6.3 below and show that the 40-dBA noise contour partially encroaches onto five parcels surrounding the Project Location.

Effect of the noise emissions at the POR was also accessed by intersecting the 40-dBA sound pressure noise contours calculated at 1.5-m above ground with 30-m radius circles placed around the POR (Figure C.2). The results show that none of the 30-m radius zones are affected by the noise emissions.

Table 6.3 Parcels Partially Affected by the Project's noise emission

Parcels ID	PIN	Zoning	Description
PR01	451300047	Rural	Contains an existing noise receptor
PR02	451300049	Rural	Vacant lot
PR03	N/A*	Rural	Contains existing noise receptors
PR04	451300050	Rural	Contains an existing noise receptor
PR05	451300134	Rural	Vacant lot

*(N/A – no parcel PIN information available at time of study)

The noise receptors located on parcels PR01, PR03 and PR04 were included in the CADNA-A model and determined to be compliant with the MOE performance limits.

As described in 1.(4)4. of Ontario Regulation 521/10, a noise receptor on a vacant lot (where no building permit has been issued) is considered to be the location ". . . at which a building would reasonably be expected to be located, having regard to the existing zoning by-law and the typical building pattern in the area . . .". For parcel PR02, a building would reasonably be expected to be located anywhere adjacent to Hwy 2 South outside of the 40-dBA contour line encroachment. Presently there is limited access to the PR05 parcel. However, should more complete access be made available in the future there is sufficient land to build a residence that is unaffected by the 40-dBA contour line. Hence, for both vacant lot parcels, there is sufficient room on the unaffected property for a future dwelling (i.e., noise receptor) to be built on the property, be below 40-dBA and, thus, be compliant with the MOE performance limits.

Based on the above, the results show that all POR are compliant with MOE guidelines based on the performance limits.

7. Conclusions and Recommendations

For the Kingston Gardiner Hwy 2 South Solar Energy Project, the sound pressure levels at the POR have been estimated using the CADNA-A model, based on ISO 9613-2. The performance limits used for comparison correspond to Class 3 areas, with a 40-dBA threshold. Mitigation for operation of the Project has been modeled and shown to be feasible.

Based on the results obtained in this study, it is concluded that the sound pressure levels at the POR resulting from the Project operation will be below MOE requirements for Class 3 areas of 40 dBA at all time.

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Jan 26, 2012

Oleg Belashov, M.A.Sc., P.Eng.

8. References

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IEEE. 2006. C57.12.90-2006: Standard Test Code for Liquid-Immersed, Power and Regulating Transformers. pp 64 to 76.

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International Organization for Standardization (ISO). Standard 1996-1: Description, Measurement and Assessment of Environmental Noise – Part 1: Basic Quantities and Assessment Procedures.

International Organization for Standardization (ISO). Standard 1913-2:Acoustics – Attenuation of sound during propagation outdoors – Part 2: General Method of Calculation.

Appendix A

Land Use Zoning Designation Plan, and Area Location Plan

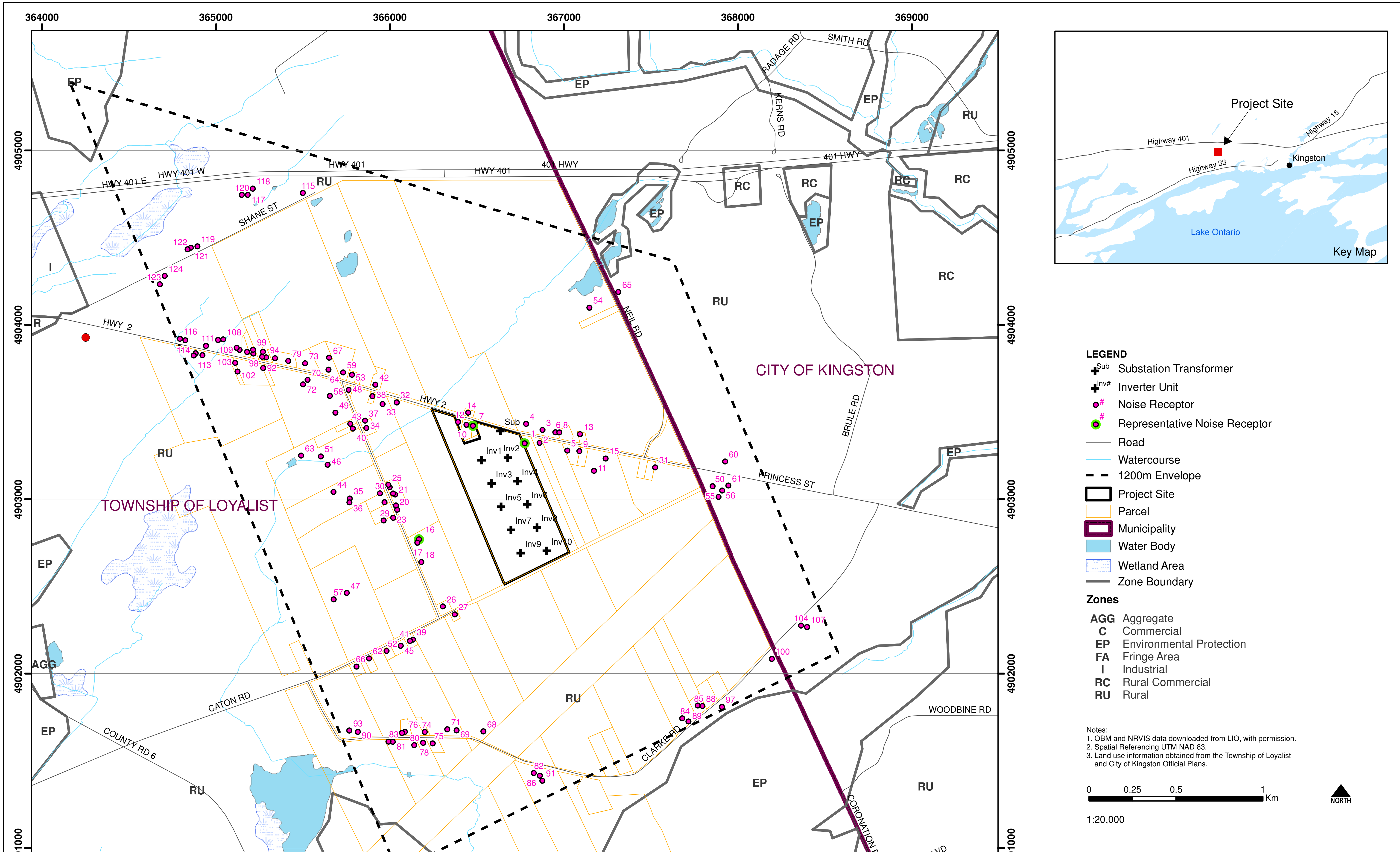

Figure A.1
Axio Power Canada Inc./SunEdison Canada
Kingston Gardiner Hwy 2 South
Land Use Plan

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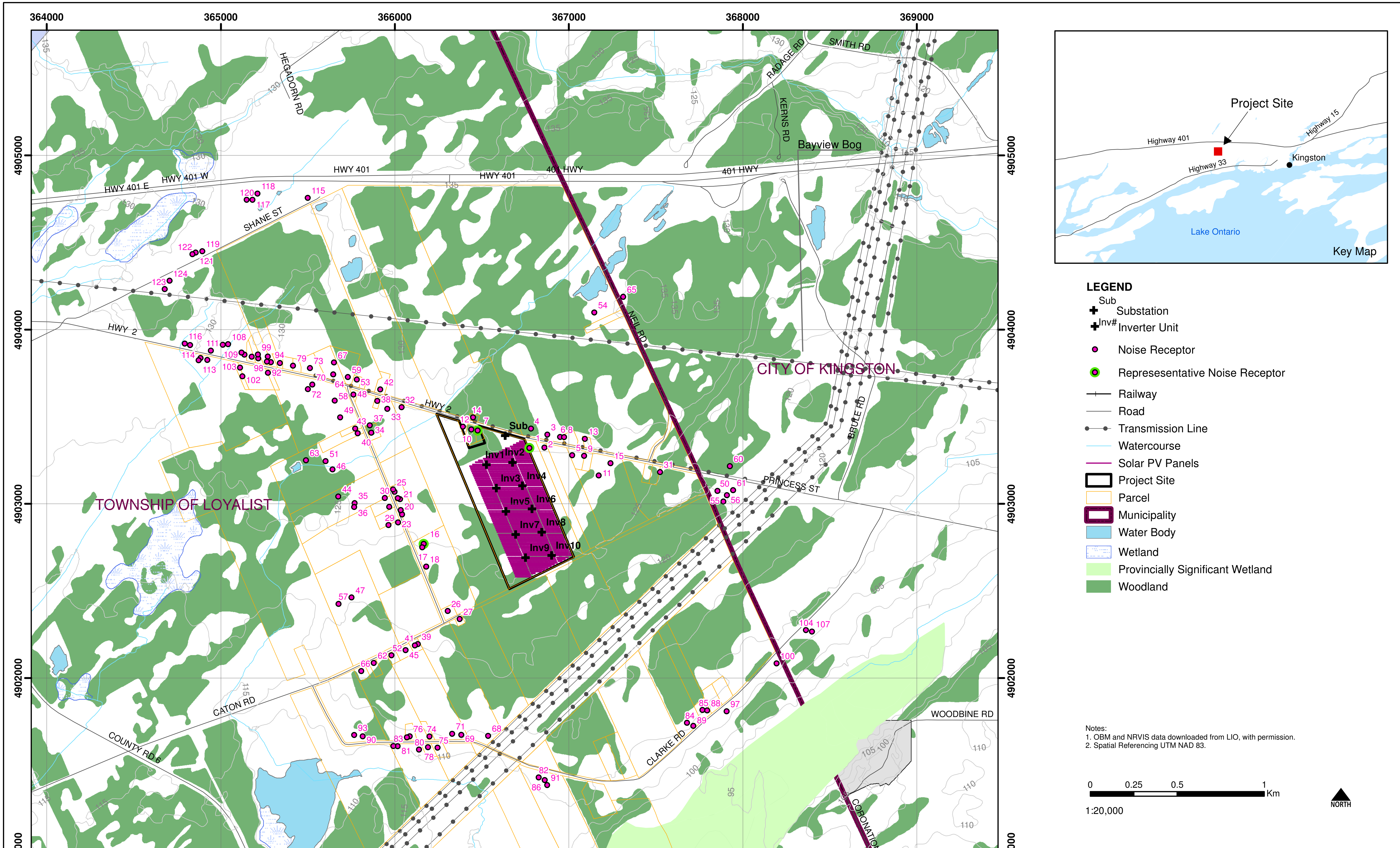

Figure A.2
Axio Power Canada Inc./SunEdison Canada
Kingston Gardiner Hwy 2 South
Area Location Plan

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Appendix B

Noise Sources

Table B.1 Point Sources Used in CADNA-A, Includes Tonality Penalty of 5.0-dBA. NAD83 Zone18.

Source ID	Description	Spectra ID	Total Sound Power Level - 24 Hours (dBA)	Correction - 24 Hours (dBA)	Height (m)	UTM Coordinates (m)		
						X	Y	Z
Sub	44-kV/10-MVA Substation transformer	Transformer10MVA	90.8	5.0	3.0	366634	4903392	133.0
Inv1	Sunny Central 1000MV inverter unit	SC1000MV	102.2	5.0	3.5	366526	4903226	132.8
Inv2	Sunny Central 1000MV inverter unit	SC1000MV	102.2	5.0	3.5	366677	4903239	133.4
Inv3	Sunny Central 1000MV inverter unit	SC1000MV	102.2	5.0	3.5	366584	4903091	131.9
Inv4	Sunny Central 1000MV inverter unit	SC1000MV	102.2	5.0	3.5	366733	4903105	132.3
Inv5	Sunny Central 1000MV inverter unit	SC1000MV	102.2	5.0	3.5	366639	4902958	131.1
Inv6	Sunny Central 1000MV inverter unit	SC1000MV	102.2	5.0	3.5	366789	4902972	131.1
Inv7	Sunny Central 1000MV inverter unit	SC1000MV	102.2	5.0	3.5	366695	4902825	129.9
Inv8	Sunny Central 1000MV inverter unit	SC1000MV	102.2	5.0	3.5	366844	4902839	129.8
Inv9	Sunny Central 1000MV inverter unit	SC1000MV	102.2	5.0	3.5	366751	4902692	128.8
Inv10	Sunny Central 1000MV inverter unit	SC1000MV	102.2	5.0	3.5	366901	4902705	128.6

Table B.2 Frequency Spectra Used for Modelling the Noise Sources, Not Including Tonality Penalty.

Spectra ID	Octave Spectrum (dBA)										
	31.5	63	125	250	500	1000	2000	4000	8000	A	lin
Transformer10MVA	43.0	62.2	74.3	76.8	82.2	79.4	75.6	70.4	61.3	85.8	94.4
SC1000MV		64.8	78.9	93	91.6	90.1	87.6	79.9	65.4	97.2	103.7

Table B.3 Noise Reduction and Sound Transmission Characteristics of the Acoustical Louvers.

Name	Octave Spectrum (dB)								
	31.5	63	125	250	500	1000	2000	4000	8000
Greenheck Louver	0	10	10	12	16	23	18	0	0

SUNNY CENTRAL 800MV / 1000MV / 1250MV

Efficient

- Without low-voltage transformer: greater plant efficiency due to direct connection to the medium-voltage grid

Turnkey Delivery

- With medium-voltage transformer and concrete substation for outdoor installation

Optional

- Medium-voltage switchgear systems for a flexible structure of large solar parks
- AC transfer station with measurement
- Medium-voltage transformers for other grid voltages (deviating from 20 kV)

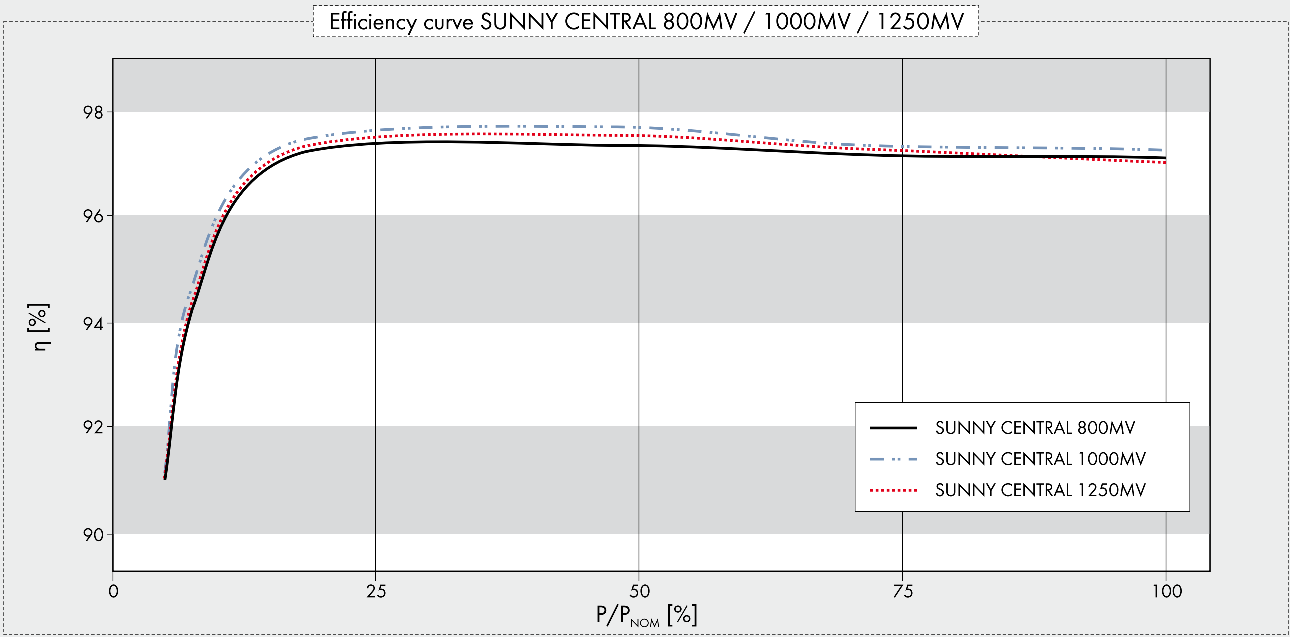
SUNNY CENTRAL for Direct medium-voltage feed-in 800MV / 1000MV / 1250MV

High-performance medium-voltage station

For even more power: Two powerful Sunny Central HE inverters are components of a medium-voltage station (MV) which feeds directly into a shared medium-voltage transformer. In this way, for example, two Sunny Central 630HE inverters are combined into a powerful Sunny Central 1250MV station. The advantage: By removing the need for the low-voltage transformer, the plant operator realizes greater yields and at the same time lower inverter costs. The Sunny Central MV is delivered as a "turnkey" concrete substation for outside installation. On top of that, the Sunny Central MV actively participates in grid management, and thereby fulfils all requirements of the Medium-Voltage Directive valid as of July 2010.

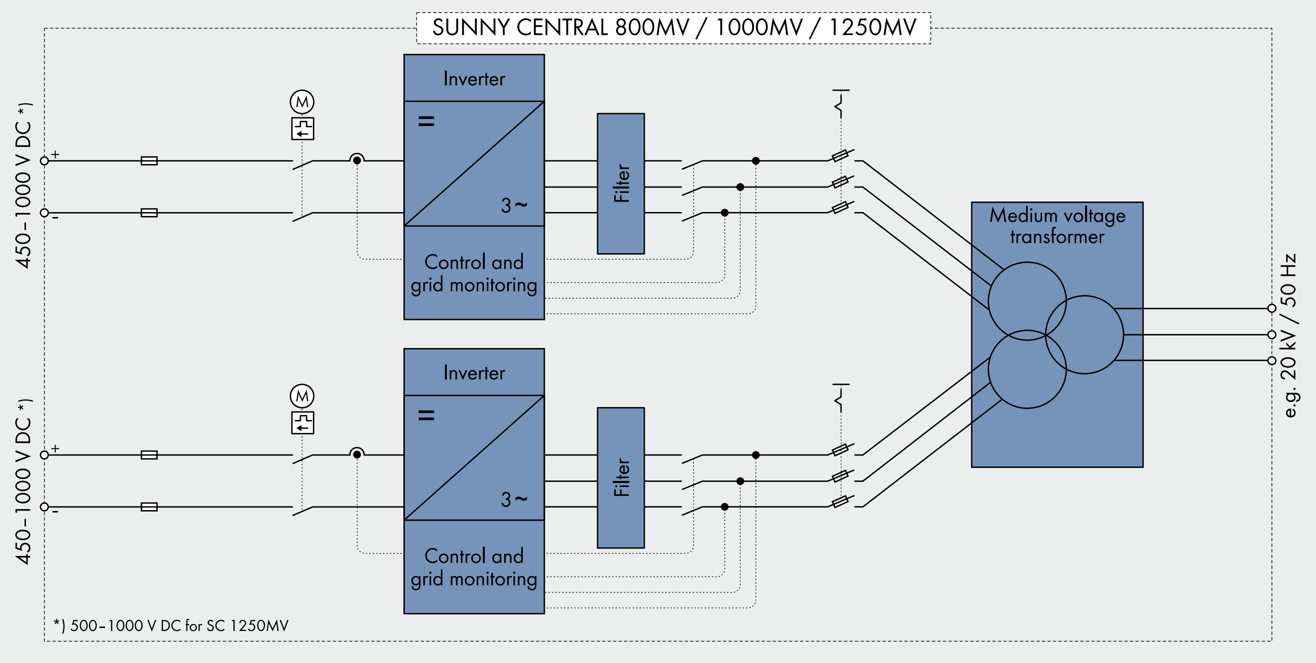
SUNNY CENTRAL 800MV / 1000MV / 1250MV

Technical data	Sunny Central 800MV	Sunny Central 1000MV	Sunny Central 1250MV
Input data			
Nominal DC power	816 kW	1018 kW	1284 kW
Max. DC power	900 kWp [1]	1120 kWp [1]	1410 kWp [1]
MPP voltage range	450 V – 820 V [5]	450 V – 820 V [5]	500 V – 820 V [5] [7]
Max. DC voltage	1000 V	1000 V	1000 V
Max. DC current	1986 A	2484 A	2844 A
Number of DC inputs	(16 + 16) + 4 DCHV	(16 + 16) + 4 DCHV	(16 + 16) + 4 DCHV
Output data			
Nominal AC power @ 45 °C	800 kVA	1000 kVA	1250 kVA
Continuous AC power @ 25 °C	880 kVA	1100 kVA	1400 kVA
Nominal AC voltage	20000 V	20000 V	20000 V
Nominal AC current	23.2 A	28.8 A	36.1 A
AC grid frequency 50 Hz	●	●	●
AC grid frequency 60 Hz	●	●	●
Power factor (cos φ)		0.9 leading ... 0.9 lagging	
Max. THD	< 3 %	< 3 %	< 3 %
Power consumption			
Internal consumption in operation	< 3000 W [4]	< 3000 W [4]	< 3000 W [4]
Standby consumption	< 180 W + 1100 W	< 180 W + 1100 W	< 180 W + 1350 W
External auxiliary supply voltage	3 x 230 V, 50/60 Hz	3 x 230 V, 50/60 Hz	3 x 230 V, 50/60 Hz
External back-up fuse for auxiliary supply	B 20 A, 3-pole	B 20 A, 3-pole	B 20 A, 3-pole
Dimensions and weight			
Height	3620 mm	3620 mm	3620 mm
Width	5400 mm	5400 mm	5400 mm
Depth	3000 mm	3000 mm	3000 mm
Weight	35000 kg	35000 kg	35000 kg
Efficiency [2]			
Max. efficiency	97.7 %	97.9 %	97.8 %
Euro-eta	97.3 %	97.5 %	97.4 %
Protection rating and ambient conditions			
Protection rating (as per EN 60529)	IP54	IP54	IP54
Operating temperature range	–20 °C ... +45 °C	–20 °C ... +45 °C	–20 °C ... +45 °C
Rel. humidity	15 % ... 95 %	15 % ... 95 %	15 % ... 95 %
Fresh air consumption	12400 m³/h	12400 m³/h	12400 m³/h
Max. altitude (above sea level)	1000 m	1000 m	1000 m

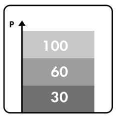


	Sunny Central 800MV	Sunny Central 1000MV	Sunny Central 1250MV
Features			
Display: text line / graphic	●/–	●/–	●/–
Ground fault monitoring	●	●	●
Heating	●	●	●
Emergency stop	●	●	●
Circuit breaker AC side	SI load disconnection switch	SI load disconnection switch	SI load disconnection switch
Circuit breaker DC side	Switch-disconnector with motor	Switch-disconnector with motor	Switch-disconnector with motor
Monitored overvoltage protectors AC / DC	●/●	●/●	●/●
Monitored overvoltage protectors for auxiliary supply	●	●	●
SCC (Sunny Central Control) interfaces			
Communication (NET Piggy-Back, optional)	analog, ISDN, Ethernet	analog, ISDN, Ethernet	analog, ISDN, Ethernet
Analog inputs	10 x A_{in} [3)]	10 x A_{in} [3)]	10 x A_{in} [3)]
Overvoltage protection for analog inputs	○	○	○
Sunny String-Monitor connection (COM1)	RS485	RS485	RS485
PC connection (COM3)	RS232	RS232	RS232
Electrically separated relay (ext. alert signal)	2	2	2
Certificates / listings			
EMC		EN 61000-6-2 EN 61000-6-4	
CE conformity	●	●	●
BDEW-MSRL / FGW / TR8 [6)]	●	●	●
RD 1633 / 2000	●	●	●
Arrêté du 23/04/08	●	●	●
● standard features ○ optional features – not available			
Type designation	SC 800MV-11	SC 1000MV-11	SC 1250MV-11

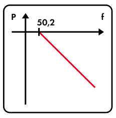
HE: High Efficiency, inverter without galvanic isolation for connection to a medium-voltage transformer (taking into account the SMA specification for the transformer)
1) Specifications apply to irradiation values below STC
2) Efficiency measured without an internal power supply at U_{DC} = 500 V
3) 2x inputs for the external nominal value specification for active power and reactive power, 1x external alarm input, 1x irradiation sensor, 1x pyranometer
4) Internal consumption at nominal power
5) At 1.05 $U_{AC, nom}$ and cos φ = 1
6) With limited dynamic grid support
7) At f_{grid} = 60 Hz: 510 V - 820 V
Please note: in certain countries the substations may differ from the substations shown in the images



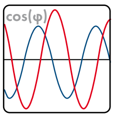
POWERFUL GRID MANAGEMENT FUNCTIONS



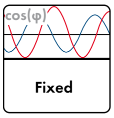
Remote controlled power reduction in case of grid overload
In order to avoid short-term grid overload, the grid operator presets a nominal active power value which the inverter will implement within 60 seconds. The nominal value is transmitted to the inverters via a ripple control receiver in combination with the SMA Power Reducer Box. Typical limit values are 100, 60, 30 or 0 per cent of the nominal power.



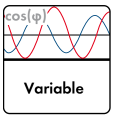
Frequency-dependent control of active power
As of a grid frequency of 50.2 Hz, the inverter automatically reduces the fed-in of active power according to a definable characteristic curve which thereby contributes to the stabilization of the grid frequency.



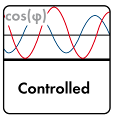
Static voltage support based on reactive power
To stabilize the grid voltage, SMA inverters feed reactive power (leading or lagging) into the grid. Three different modes are available:



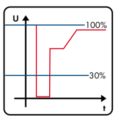
a) Fixed definition of the reactive power by the grid operator
The grid operator defines a fixed reactive power value or a fixed displacement factor between $\cos(\varphi)_{leading}$= 0.90 and $\cos(\varphi)_{lagging}$= 0.90.



b) Definition of a dynamic setpoint of the reactive power by the utility operator
The grid operator defines a dynamic displacement factor - any value between $\cos(\varphi)_{leading}$= 0.90 und $\cos(\varphi)_{lagging}$= 0.90. It is transmitted either through a communication unit the evaluation can e.g. be evaluated and processed by the SMA Power Reducer Box.



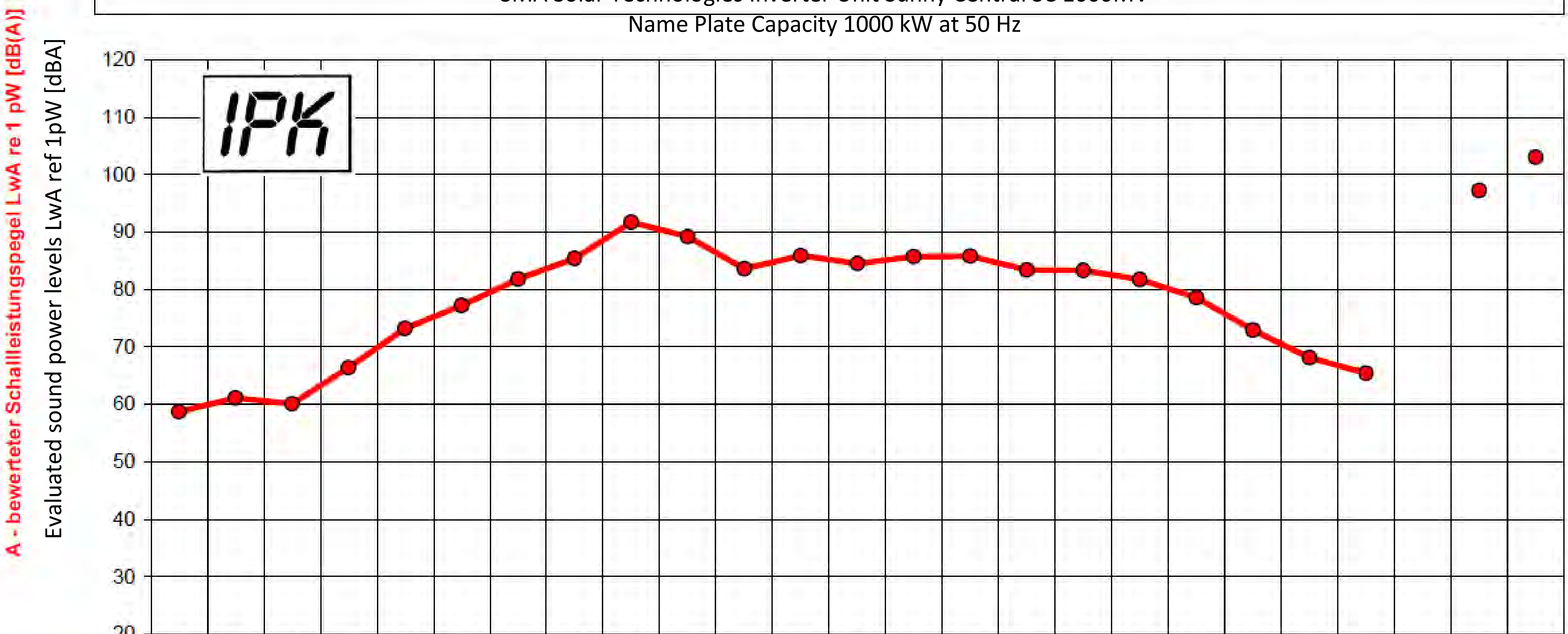
c) Control of the reactive power over a characteristic curve
The reactive power or the phase shift is controlled by a pre-defined characteristic curve – depending on the active power fed into the grid or the grid voltage.



Limited Dynamic Grid Support
The inverter continues to feed to the grid after short term voltage drops – as long as the grid voltage is within a defined voltage window.

SMA Solar Technologie Umrichteranlage Sunny Central SC 1000MV
Betrieb bei Nennleistung und 50 Hz; 1000 KW

SMA Solar Technologies Inverter Unit Sunny Central SC 1000MV
Name Plate Capacity 1000 kW at 50 Hz



	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k		A	Lin
LwA 1	58,7	61,1	60,1	66,4	73,2	77,2	81,8	85,4	91,7	89,2	83,6	85,9	84,5	85,7	85,8	83,4	83,3	81,7	78,6	72,9	68,1	65,4		97,2	103,0

Third octave band frequency [Hz]

Terz - Mittenfrequenz [Hz]

Estimated Frequency Spectra for Transformers

Transformer - 44kV/10MVA

From Handbook of Noise and Vibration Control (Crocker, 2007, page 1335-1336, Eq. 18 and Table 20) and Beranek's old notes (page 7-19)

Average LpA	68 dBA	Based on NEMA TR1-1993 (R2000), Table 0-2
Estimated surface area	35 m^2	Can be assumed, 25% of change will produce a difference of 1 dB on Lw, try to estimate on the high side

Correction factors are in dB

Freq. (Hz)	31	63	125	250	500	1000	2000	4000	8000	Notes
C1	-11.0	-5.0	-3.0	-8.0	-8.0	-14.0	-19.0	-24.0	-31.0	Outdoors, indoors in mechanical room over 140 m^3
C2	-11	-2	3	-2	-2	-11	-19	-24	-31	Indoors
C3	-11	-2	3	2	2	-4	-9	-14	-21	Serious Noise Problems

Sound Power Level calculated as Lw=Average LpA + 10*log(Estimated surface area) + C + 10

Freq. (Hz)	31	63	125	250	500	1000	2000	4000	8000	Combined [dB]
C1 based [dB]	82.4	88.4	90.4	85.4	85.4	79.4	74.4	69.4	62.4	**94.5**
C2 based [dB]	82.4	91.4	96.4	91.4	91.4	82.4	74.4	69.4	62.4	**99.5**
C3 based [dB]	82.4	91.4	96.4	95.4	95.4	89.4	84.4	79.4	72.4	**101.5**

Resulting A-weighted sound power level

Freq. (Hz)	A-Weight	C1 based [dBA]	C2 based [dBA]	C2 based [dBA]
31	-39.4	43.0	52.0	57.0
63	-26.2	62.2	65.2	65.2
125	-16.1	74.3	80.3	80.3
250	-8.6	76.8	82.8	86.8
500	-3.2	82.2	88.2	92.2
1000	0	79.4	82.4	89.4
2000	1.2	75.6	75.6	85.6
4000	1	70.4	70.4	80.4
8000	-1.1	61.3	61.3	71.3
LwA [dBA]		**85.8**	**90.8**	**95.6**

Used in the study

Figure B.1 Sound Power Level Calculation for 44-kV/10-MVA Substation Transformer.

Third octave, as provided		
Freq #	Freq (Hz)	LwA (dBA)
1	25	
2	31.5	
3	40	
4	50	58.7
5	63	61.1
6	80	60.1
7	100	66.4
8	125	73.2
9	160	77.2
10	200	81.8
11	250	85.4
12	315	91.7
13	400	89.2
14	500	83.6
15	630	85.9
16	800	84.5
17	1000	85.7
18	1250	85.8
19	1600	83.4
20	2000	83.3
21	2500	81.7
22	3150	78.6
23	4000	72.9
24	5000	68.1
25	6300	65.4
26	8000	
27	10000	
	Total LwA	97.2

Full octave, as used in CADNA-A model		
Freq #	Freq (Hz)	LwA (dBA)
	31.5	
5	63	64.8
8	125	78.9
11	250	93.0
14	500	91.6
17	1000	90.1
20	2000	87.6
23	4000	79.9
26	8000	65.4
	Total LwA	97.2

$$\rightarrow 10\log\left(10^{\frac{58.7}{10}} + 10^{\frac{61.1}{10}} + 10^{\frac{60.1}{10}}\right) = 64.8dBA$$

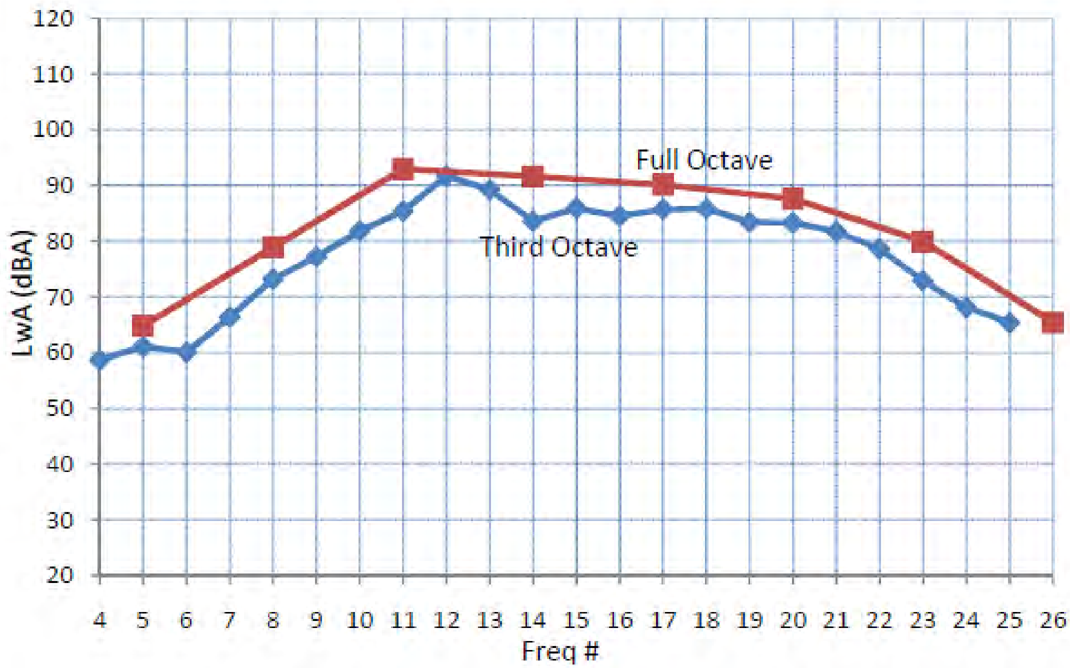
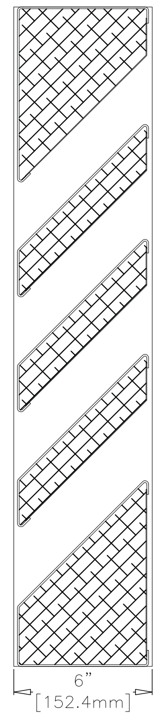


Figure B.2 Sound Power Level Calculation for SMA Sunny Central 1000MV, 100% LOAD.

GREENHECK

AFJ-601

Acoustical Louver
J Blade



AMCA CERTIFIED RATINGS — WATER PENETRATION, SOUND AND AIR PERFORMANCE — AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL, INC.

Application and Design

AFJ-601 is an acoustical weather louver designed to protect air intake and exhaust openings in building exterior walls. Design incorporates J style insulated acoustical blades and high free area to provide maximum resistance to sound transmission, rain and weather while providing minimum resistance to airflow. The AFJ-601 is an extremely efficient louver with **AMCA LICENSED PERFORMANCE DATA** enabling designers to select and apply with confidence.

Standard Construction

Frame . . . . Heavy gauge formed aluminum, 6 in. x 0.080 in. nominal wall thickness

Blades . . . . J style, heavy gauge formed aluminum, 0.080 in. nominal wall thickness, positioned at 45º on approximately 5 in. centers

Construction . . . Mechanically fastened

Acoustical Insulation . . . . . Fiberglass Insulation

Birdscreen . . . . . 3/4 in. x 0.051 flattened expanded aluminum in removable frame, inside mount (rear)

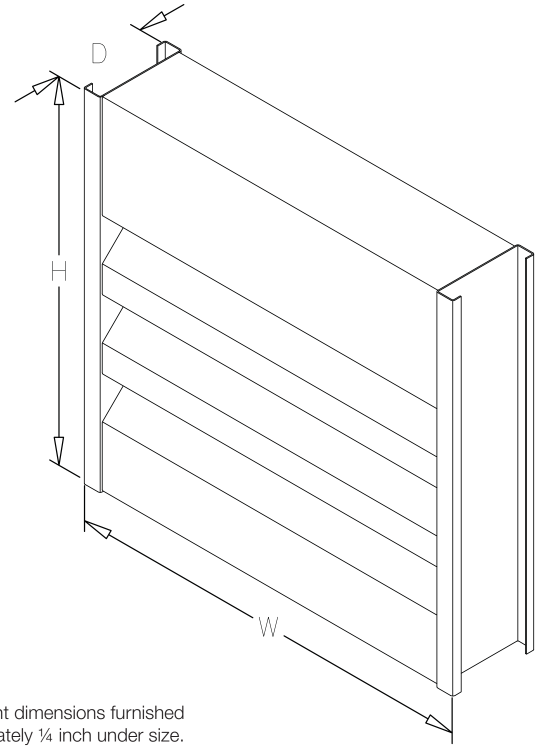
Finish . . . . Mill

Minimum Size . . 12 in. W x 15 in. H

Maximum Single Section Size . . . 60 in. W x 120 in. H

Options *(at additional cost)*

- A variety of bird and insect screens
- Blank off panels
- Clip angles
- Extended sill
- Filter racks
- Flanged frame
- Galvanized steel frame and blade
- Security bars
- A variety of architectural finishes including:
  - Clear anodize
  - Integral color anodize
  - Baked enamel paint
  - Kynar paint



*Width and height dimensions furnished approximately ¼ inch under size.

PERFORMANCE DATA

Free Area Chart (Sq. ft.)

Louver Height Inches	Louver Width Inches 12	18	24	30	36	42	**48**	54	60
15	0.12	0.21	0.29	0.37	0.45	0.53	0.61	0.69	0.77
18	0.25	0.41	0.57	0.74	0.90	1.06	1.22	1.38	1.55
24	0.37	0.62	0.86	1.10	1.35	1.59	1.83	2.08	2.32
30	0.50	0.82	1.15	1.47	1.80	2.12	2.44	2.77	3.09
36	0.62	1.03	1.43	1.84	2.24	2.65	3.05	3.46	3.86
42	0.75	1.24	1.72	2.21	2.69	3.18	3.67	4.15	4.64
48	1.00	1.65	2.30	2.94	3.59	4.24	**4.89**	5.54	6.18
54	1.12	1.85	2.58	3.31	4.04	4.77	5.50	6.23	6.96
60	1.25	2.06	2.87	3.68	4.49	5.30	6.11	6.92	7.73
66	1.37	2.26	3.16	4.05	4.94	5.83	6.72	7.61	8.50
72	1.50	2.47	3.44	4.41	5.39	6.36	7.33	8.30	9.27
78	1.75	2.88	4.02	5.15	6.28	7.42	8.55	9.69	10.82
84	1.87	3.09	4.30	5.52	6.73	7.95	9.16	10.38	11.59
90	2.00	3.29	4.59	5.89	7.18	8.48	9.77	11.07	12.37
96	2.12	3.50	4.88	6.25	7.63	9.01	10.38	11.76	13.14
102	2.25	3.71	5.16	6.62	8.08	9.54	11.00	12.45	13.91
108	2.50	4.12	5.74	7.36	8.98	10.60	12.22	13.84	15.46
114	2.62	4.32	6.02	7.73	9.43	11.13	12.83	14.53	16.23
120	2.75	4.53	6.31	8.09	9.88	11.66	13.44	15.22	17.00

Greenheck Fan Corporation certifies that the AFJ-601 louvers shown herein are licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 511 and comply with the requirements of the AMCA Certified Ratings Program. The AMCA Certified Ratings Seal applies to water penetration, air performance and sound ratings.

Sound Transmission Class

The Sound Transmission Class (STC) is a rating of the effectiveness of an assembly in isolating or reducing airborne sound transmission. STC is a single number that summarizes airborne sound transmission loss data. Assemblies with higher STC ratings are more efficient at reducing sound transmission. STC is determined in accordance with ASTM E413-04.

Transmission Loss

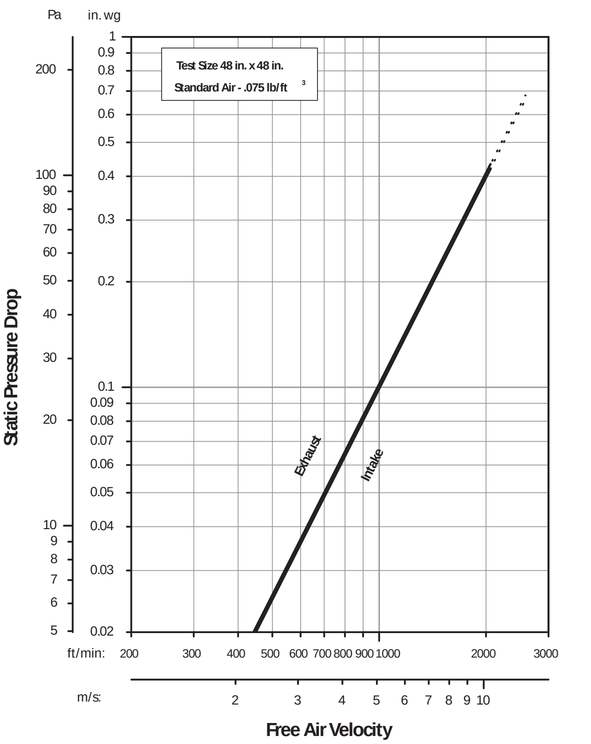
Transmission loss (TL) is a measurement of the reduction of sound power transmission (dB) through an assembly at a given frequency. The more sound power that is reduced, the greater the TL. TL is tested in accordance with ASTM E90-04.

Free Field Noise Reduction in Decibels

Free Field Noise Reduction is determined by adding 6 dB to the Transmission Loss.

Octave Band	2	3	4	5	6	7	STC
Frequency (Hz)	63	125	250	500	1000	2000	10
Transmission Loss (dB)	4	4	6	10	17	12	
Free Field Noise Reduction (dB)	10	10	12	16	23	18	

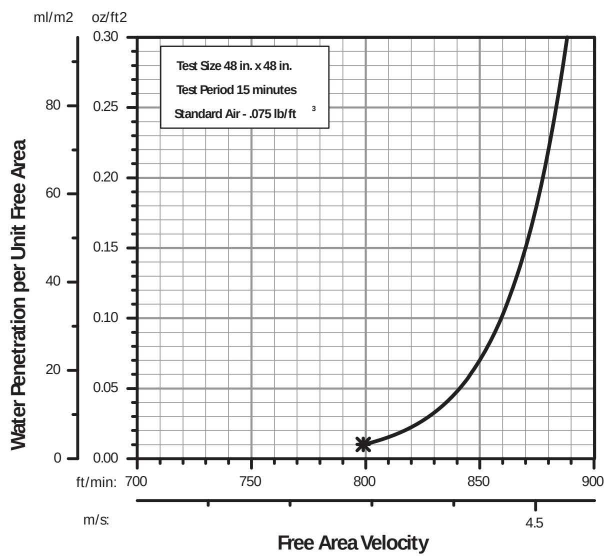
Airflow Resistance (Standard Air - .075 lb/ft³)



Model AFJ-601 resistance to airflow (pressure drop) varies depending on louver application (air intake or air exhaust). Free area velocities (shown) are higher than average velocity through the overall louver size. See louver selection information.

Water Penetration (Standard Air - .075 lb/ft³)

Test size 48 in. x 48 in. Test duration of 15 min.



The AMCA Water Penetration Test provides a method for comparing various louver models and designs as to their efficiency in resisting the penetration of rainfall under specific laboratory test conditions. The beginning point of water penetration is defined as that velocity where the water penetration curve projects through .01 oz. of water (penetration) per sq. ft. of louver free area. ***The beginning point of water penetration for Model AFJ-601 is 799 fpm free area velocity.** These performance ratings do not guarantee a louver to be weatherproof or stormproof and should be used in combination with other factors including good engineering judgement in selecting louvers.

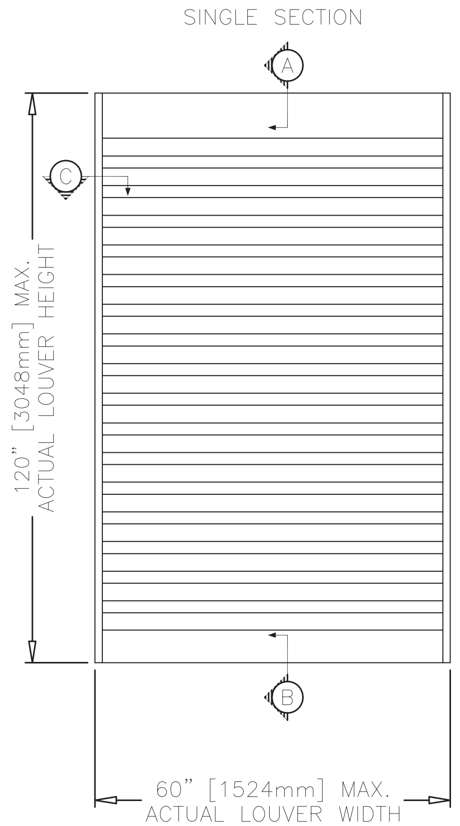
INSTALLATION DETAILS

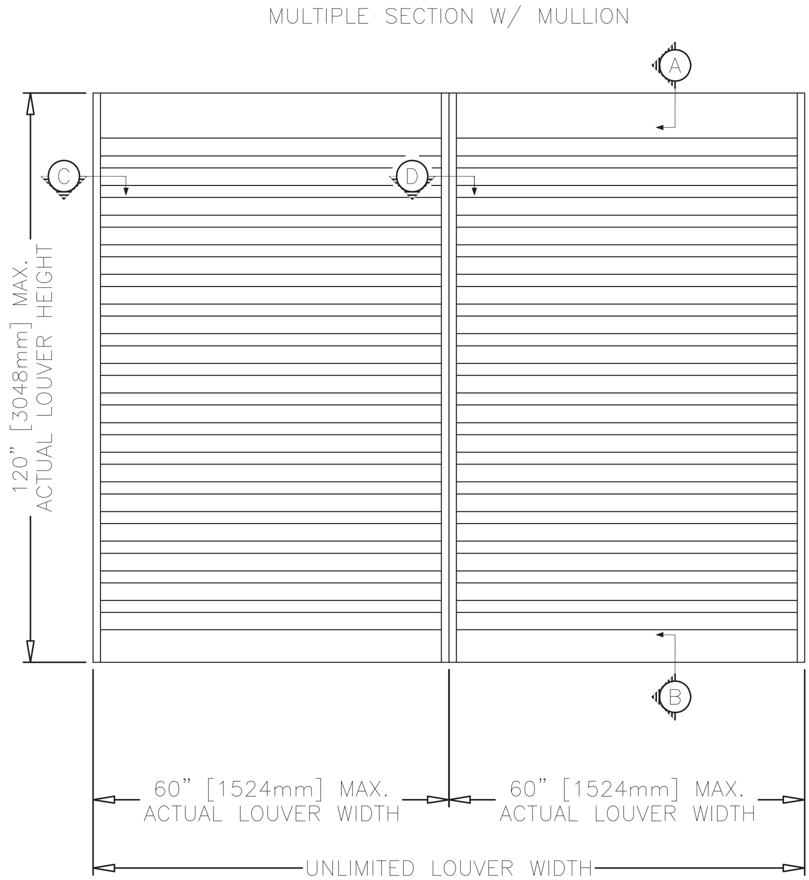
AFJ-601

Maximum Size and Installation Information

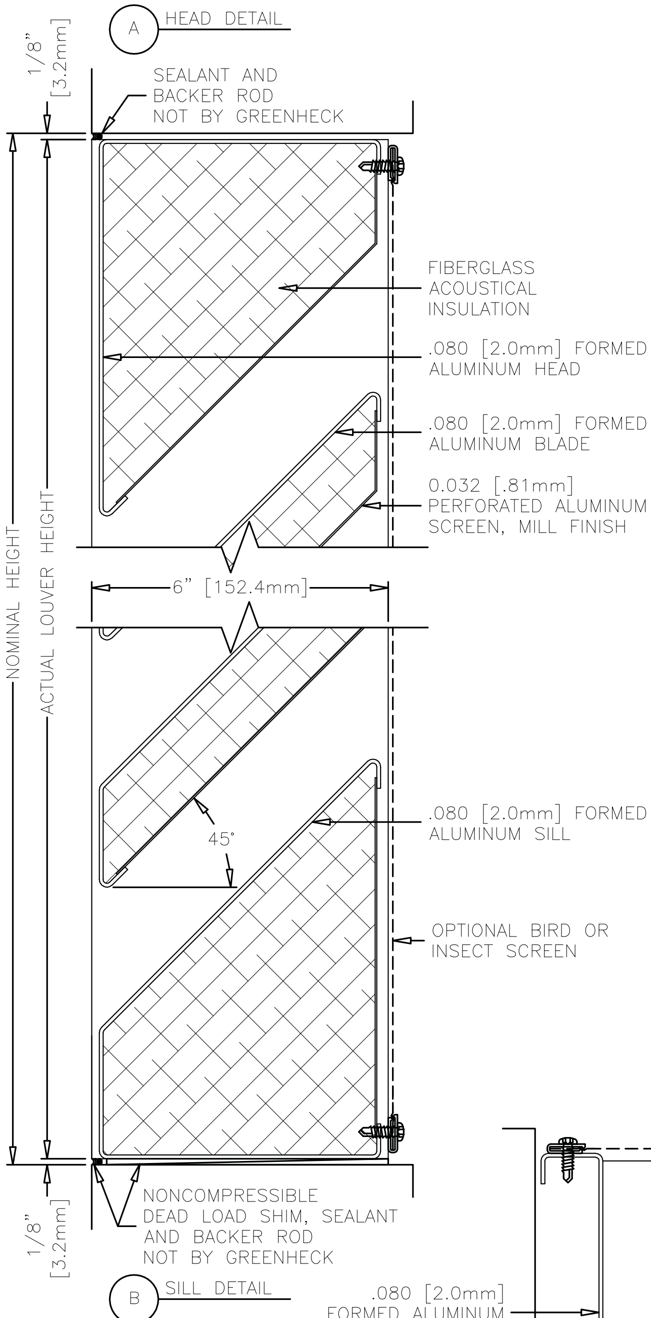
J Blade Acoustical Louver
Formed Aluminum

Maximum single section size for model AFJ-601 is 60 in. W x 120 in. H. Larger openings require field assembly of multiple louver panels to make up the overall opening size. Individual louver panels are designed to withstand a 25 PSF wind-load (please consult Greenheck if the louvers must withstand higher wind-loads). Structural reinforcing members may be required to adequately support and install multiple louver panels within a large opening. Structural reinforcing members along with any associated installation hardware is not provided by Greenheck unless indicated otherwise by Greenheck. Additional information on louver installation may be found in AMCA Publication #501, Louver Application Manual.

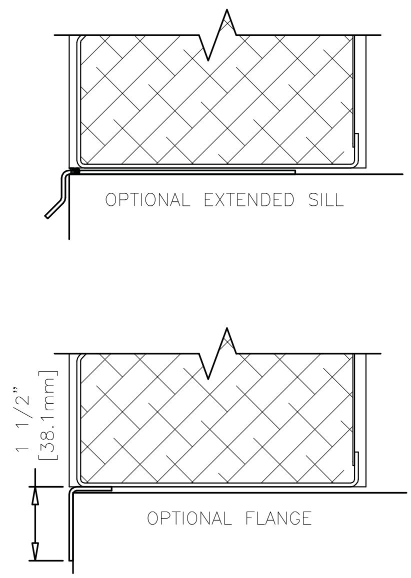




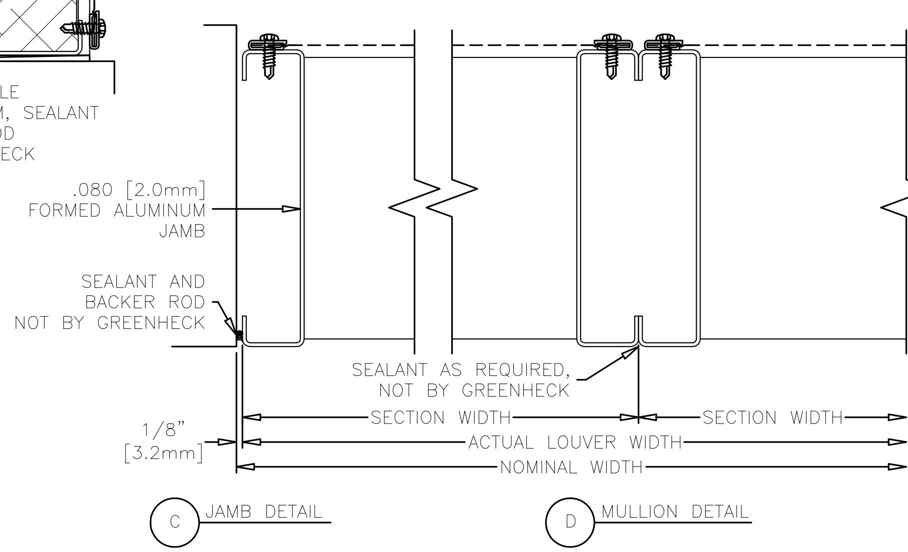
Minimum Single Section Size	Maximum Single Section Size
12 in. W x 15 in. H	60 in. W x 120 in. H



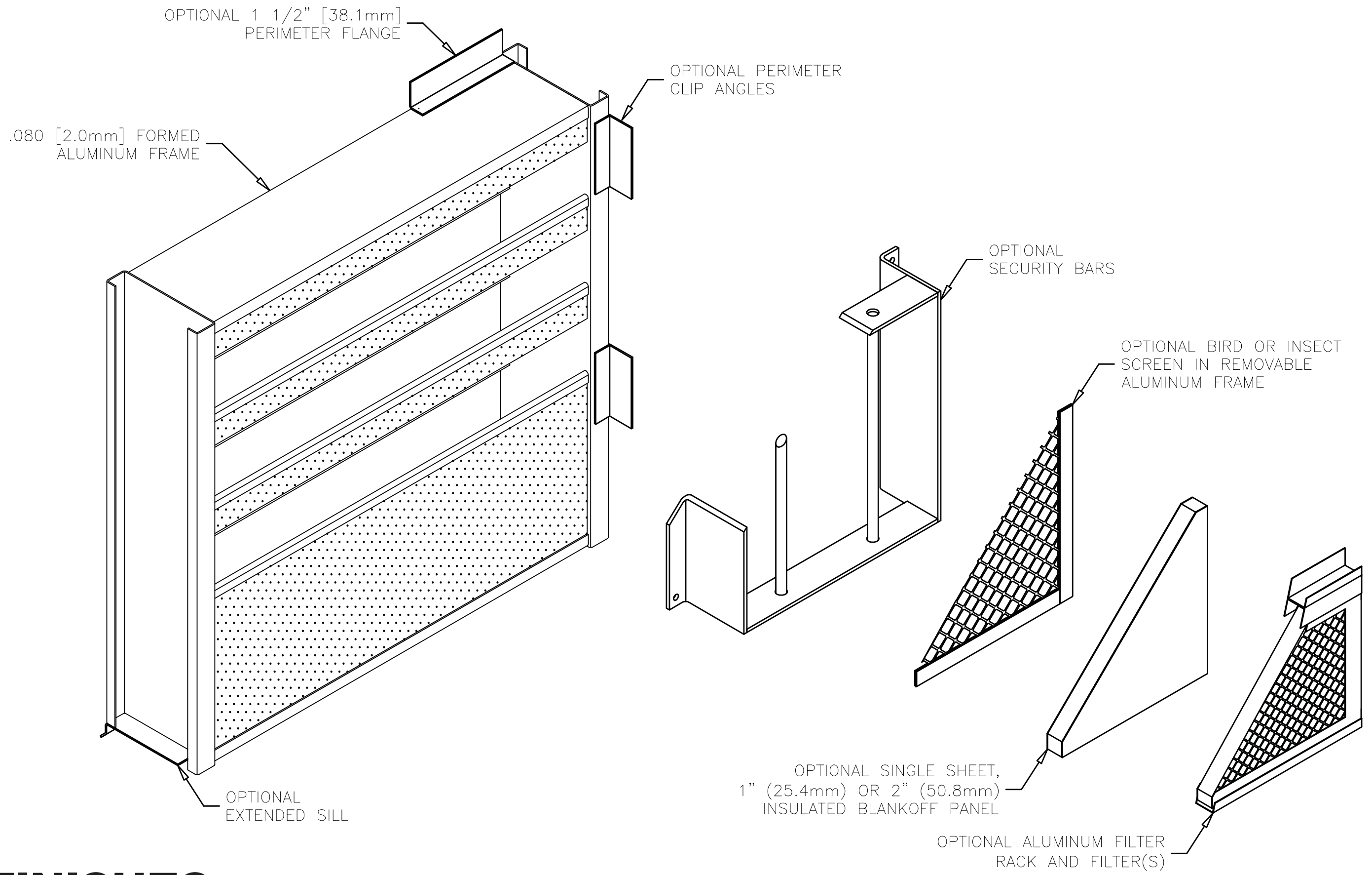
A
HEAD DETAIL
1/8" [3.2mm]
SEALANT AND BACKER ROD NOT BY GREENHECK
FIBERGLASS ACOUSTICAL INSULATION
.080 [2.0mm] FORMED ALUMINUM HEAD
.080 [2.0mm] FORMED ALUMINUM BLADE
0.032 [.81mm] PERFORATED ALUMINUM SCREEN, MILL FINISH
NOMINAL HEIGHT
ACTUAL LOUVER HEIGHT
6" [152.4mm]
45°
.080 [2.0mm] FORMED ALUMINUM SILL
OPTIONAL BIRD OR INSECT SCREEN
NONCOMPRESSIBLE DEAD LOAD SHIM, SEALANT AND BACKER ROD NOT BY GREENHECK
1/8" [3.2mm]
B
SILL DETAIL



OPTIONAL EXTENDED SILL
1 1/2" [38.1mm]
OPTIONAL FLANGE



.080 [2.0mm] FORMED ALUMINUM JAMB
SEALANT AND BACKER ROD NOT BY GREENHECK
SEALANT AS REQUIRED, NOT BY GREENHECK
1/8" [3.2mm]
SECTION WIDTH
SECTION WIDTH
ACTUAL LOUVER WIDTH
NOMINAL WIDTH
C
JAMB DETAIL
D
MULLION DETAIL



FINISHES

Finish Type	Description/Application	Color Selection	Standard Warranty (Aluminum)
2-coat 70% KYNAR 500®/HYLAR 5000® AAMA 2605 – Dry film thickness 1.2 mil. (AKA: Duranar®, Fluoropon®, Trinar®, Flouropolymer, Polyvinylidene Fluoride, PVDF2)	***"Best."*** The premier finish for extruded aluminum. Tough, long-lasting coating has superior color retention and abrasive properties. Resists chalking, fading, chemical abrasion and weathering.	**Standard Colors:** Any of the 24 standard colors shown can be furnished in 70% or 50% KYNAR 500®/HYLAR 5000® or Baked Enamel. **2-Coat Mica:** Greenheck offers 9 standard 2-coat Mica colors. Other colors are available. Consult Greenheck for possible extra cost when selecting non-standard colors or special finishes.	10 Years (Consult Greenheck for availability of extended warranty)
2-coat 50% KYNAR 500®/HYLAR 5000® AAMA 2604 – Dry film thickness 1.2 mil. (AKA: Acroflur®, Acrynar®)	***"Better."*** Tough, long-lasting coating has excellent color retention and abrasive properties. Resists chalking, fading, chemical abrasion and weathering.		5 Years
Baked Enamel AAMA 2603 – Dry film thickness 0.8 mil. (AKA: Acrabond Plus®, Duracron®)	***"Good."*** Provides good adhesion and resistance to weathering, corrosion and chemical stain.		1 Year
Integral Color Anodize AA-M10C22A42 (>0.7 mil)	"Two-step" anodizing is produced by following the normal anodizing step with a second, colorfast process.	Light, Medium or Dark Bronze; Champagne; Black	5 years
Clear Anodize 215 R-1 AA-M10C22A41 (>0.7 mil)	Clear, colorless and hard oxide aluminum coating that resists weathering and chemical attack.	Clear	5 years
Clear Anodize 204 R-1 AA-M10C22A31 (0.4-0.7 mil)	Clear, colorless and hard oxide aluminum coating that resists weathering and chemical attack.	Clear	1 Year
Industrial coatings	Greenheck offers a number of industrial coatings such as Hi-Pro Polyester, Epoxy, and Permatector®. Consult a Greenheck Product Specialist for complete color and application information.		Consult Greenheck
Mill	Materials may be supplied in natural aluminum or galvanized steel finish when normal weathering is acceptable and there is no concern for color or color change.		n/a

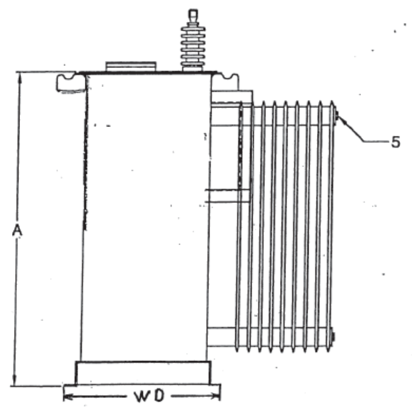
Finishes meet or exceed AAMA 2605, AAMA 2604, and AAMA 2603 requirements. Please consult www.greenheck.com for complete information on standard and extended paint warranties. Paint finish warranties are not applicable to steel products.

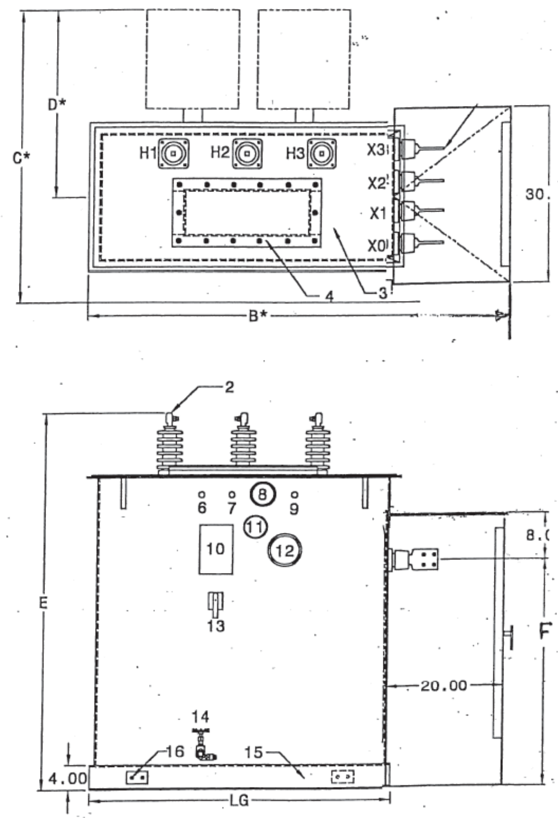
P.O. Box 410 • Schofield, WI 54476-0410 • 715.359.6171 • greenheck.com

STANDARD FEATURES

STANDARD FEATURES

1. L.V. BUSHING
2. H.V. BUSHING
3. TANK WITH WELDED-ON COVER
4. HANDHOLE
5. COOLING PANELS
6. GAS SAMPLING VALVE
7. PRESSURE VACUUM GAUGE
8. PRESSURE RELIEF VALVE
9. 1" FILL PLUG AND FILTER PRESS CONNECTION
10. STAINLESS STEEL NAMEPLATE AND CONNECTION DIAGRAM
11. LIQUID LEVEL GAUGE
12. DIAL-TYPE THERMOMETER
13. DE-ENERGIZED TAPCHANGER
14. 1" DRAIN VALVE WITH 3/8" SAMPLING DEVICE
15. BASE SUITABLE FOR JACKING, SKIDDING, OR ROLLING
16. NEMA GROUND PAD





KVA	Fluid	Cond	HV BIL	LV BIL	WD	LG	A	B	C	D	E	F	Gal Liquid	Weight
10000	O	C	250	150	48	95	111	113	138	TBD	132	82	1530	37597

Figure B.3 Catalogue Dimensions (inches) of Substation Transformer, Obtained from Magna Electric Corporation.

Appendix C

Noise Map from CADNA-A

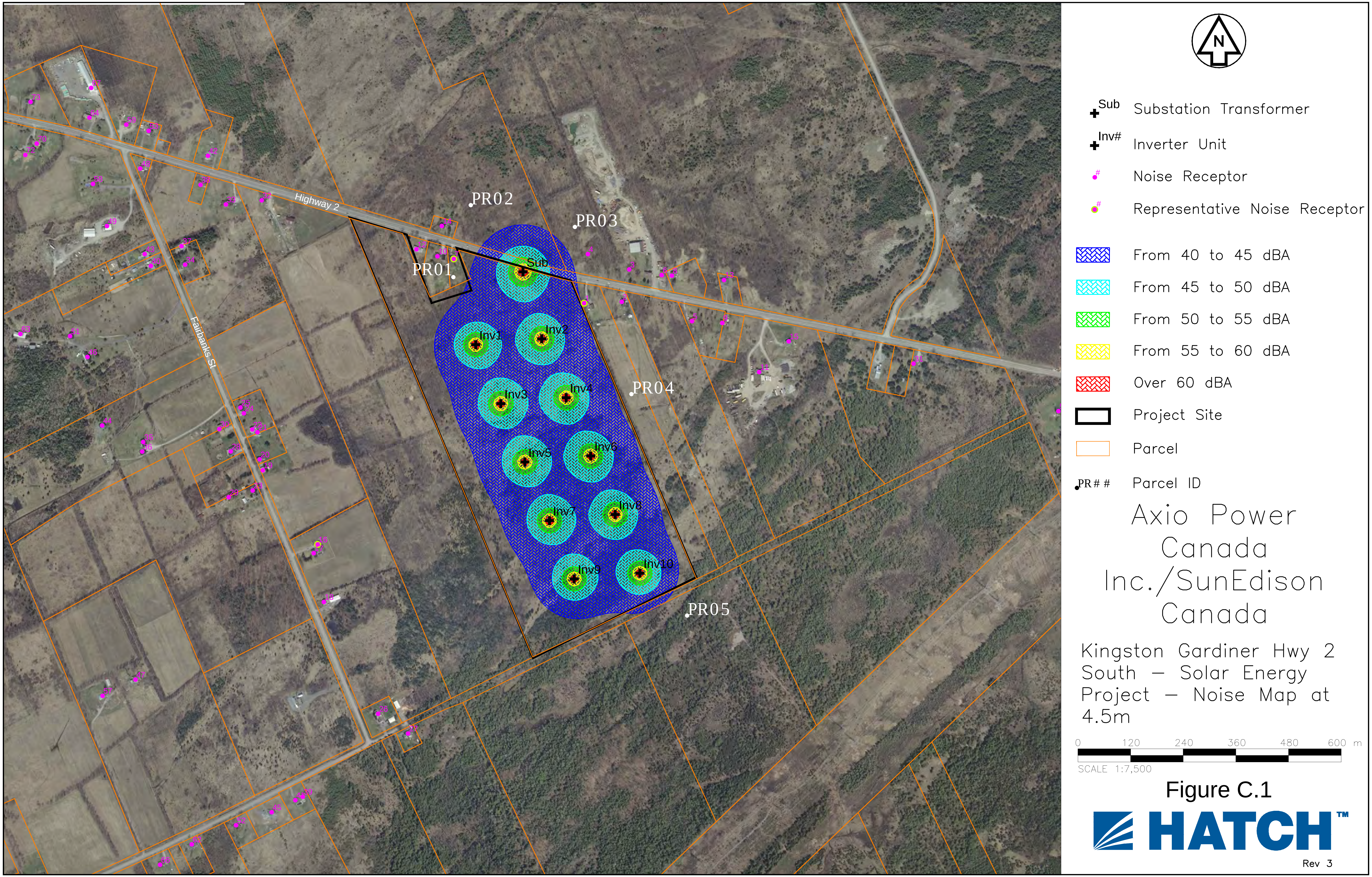

Highway 2
Fairbanks St
PR01
PR02
PR03
PR04
PR05
Sub
Inv1
Inv2
Inv3
Inv4
Inv5
Inv6
Inv7
Inv8
Inv9
Inv10
N
Sub Substation Transformer
Inv# Inverter Unit
Noise Receptor
Representative Noise Receptor
From 40 to 45 dBA
From 45 to 50 dBA
From 50 to 55 dBA
From 55 to 60 dBA
Over 60 dBA
Project Site
Parcel
PR## Parcel ID
Axio Power Canada Inc./SunEdison Canada
Kingston Gardiner Hwy 2 South – Solar Energy Project – Noise Map at 4.5m
0 120 240 360 480 600 m
SCALE 1:7,500
HATCH™
Rev 3

Figure C.1

Axio Power Canada Inc./SunEdison Canada

Kingston Gardiner Hwy 2 South – Solar Energy Project – Noise Map at 1.5m

Figure C.2

HATCH™

Rev

Appendix D

CADNA-A Sample Calculations

Configuration	
Parameter	Value
General	
Country	(user defined)
Max. Error (dB)	0.00
Max. Search Radius (m)	2000.00
Min. Dist Src to Rcvr	0.00
Partition	
Raster Factor	0.50
Max. Length of Section (m)	1000.00
Min. Length of Section (m)	1.00
Min. Length of Section (%)	0.00
Proj. Line Sources	On
Proj. Area Sources	On
Ref. Time	
Reference Time Day (min)	960.00
Reference Time Night (min)	480.00
Daytime Penalty (dB)	0.00
Recr. Time Penalty (dB)	0.00
Night-time Penalty (dB)	0.00
DTM	
Standard Height (m)	3.50
Model of Terrain	Triangulation
Reflection	
max. Order of Reflection	1
Search Radius Src	100.00
Search Radius Rcvr	100.00
Max. Distance Source - Rcvr	1000.00 1000.00
Min. Distance Rvcr - Reflector	1.00 1.00
Min. Distance Source - Reflector	0.10
Industrial (ISO 9613)	
Lateral Diffraction	some Obj
Obst. within Area Src do not shield	On
Screening	Excl. Ground Att. over Barrier
	Dz with limit (20/25)
Barrier Coefficients C1,2,3	3.0 20.0 0.0
Temperature (℃)	10
rel. Humidity (%)	70
Ground Absorption G	0.70
Wind Speed for Dir. (m/s)	3.0
Roads (RLS-90)	
Strictly acc. to RLS-90	
Railways (Schall 03)	
Strictly acc. to Schall 03 / Schall-Transrapid	
Aircraft (???)	
Strictly acc. to AzB	

Receiver
Name: Existing
ID: 1.0
X: 366773.21
Y: 4903320.07
Z: 134.50

Point Source, ISO 9613, Name: "Sub", ID: "Sub"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	366634.21	4903391.76	133.00	0	32	48.0	48.0	0.0	0.0	54.9	0.0	-3.0	0.0	0.0	0.0	0.0	-0.0	-3.9	-3.9
2	366634.21	4903391.76	133.00	0	63	67.2	67.2	0.0	0.0	54.9	0.0	-3.0	0.0	0.0	0.0	0.0	-0.0	15.3	15.3
3	366634.21	4903391.76	133.00	0	125	79.3	79.3	0.0	0.0	54.9	0.1	2.4	0.0	0.0	0.0	0.0	-0.0	21.9	21.9
4	366634.21	4903391.76	133.00	0	250	81.8	81.8	0.0	0.0	54.9	0.2	2.6	0.0	0.0	0.0	0.0	-0.0	24.2	24.2
5	366634.21	4903391.76	133.00	0	500	87.2	87.2	0.0	0.0	54.9	0.3	-0.8	0.0	0.0	0.0	0.0	-0.0	32.8	32.8
6	366634.21	4903391.76	133.00	0	1000	84.4	84.4	0.0	0.0	54.9	0.6	-0.9	0.0	0.0	0.0	0.0	-0.0	29.8	29.8
7	366634.21	4903391.76	133.00	0	2000	80.6	80.6	0.0	0.0	54.9	1.5	-0.9	0.0	0.0	0.0	0.0	-0.0	25.1	25.1
8	366634.21	4903391.76	133.00	0	4000	75.4	75.4	0.0	0.0	54.9	5.1	-0.9	0.0	0.0	0.0	0.0	-0.0	16.3	16.3
9	366634.21	4903391.76	133.00	0	8000	66.3	66.3	0.0	0.0	54.9	18.3	-0.9	0.0	0.0	0.0	0.0	-0.0	-6.0	-6.0

Point Source, ISO 9613, Name: "Inv1", ID: "Inv1"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	366526.42	4903225.77	132.80	0	63	59.8	59.8	0.0	0.0	59.4	0.0	-3.3	0.0	0.0	0.0	0.0	-0.0	3.6	3.6
2	366526.42	4903225.77	132.80	0	125	73.9	73.9	0.0	0.0	59.4	0.1	3.0	0.0	0.0	0.0	0.0	-0.0	11.4	11.4
3	366526.42	4903225.77	132.80	0	250	86.0	86.0	0.0	0.0	59.4	0.3	2.0	0.0	0.0	0.0	0.0	-0.0	24.3	24.3
4	366526.42	4903225.77	132.80	0	500	80.6	80.6	0.0	0.0	59.4	0.5	-1.0	0.0	0.0	0.0	0.0	-0.0	21.6	21.6
5	366526.42	4903225.77	132.80	0	1000	72.1	72.1	0.0	0.0	59.4	1.0	-1.0	0.0	0.0	0.0	0.0	-0.0	12.7	12.7
6	366526.42	4903225.77	132.80	0	2000	74.6	74.6	0.0	0.0	59.4	2.5	-1.0	0.0	0.0	0.0	0.0	-0.0	13.6	13.6
7	366526.42	4903225.77	132.80	0	4000	84.9	84.9	0.0	0.0	59.4	8.7	-1.0	0.0	0.0	0.0	0.0	-0.0	17.8	17.8
8	366526.42	4903225.77	132.80	0	8000	70.4	70.4	0.0	0.0	59.4	30.9	-1.0	0.0	0.0	0.0	0.0	-0.0	-18.9	-18.9

Point Source, ISO 9613, Name: "Inv2", ID: "Inv2"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	366676.93	4903239.06	133.38	0	63	59.8	59.8	0.0	0.0	53.0	0.0	-3.0	0.0	0.0	0.0	0.0	-0.0	9.8	9.8
2	366676.93	4903239.06	133.38	0	125	73.9	73.9	0.0	0.0	53.0	0.1	2.5	0.0	0.0	0.0	0.0	-0.0	18.3	18.3
3	366676.93	4903239.06	133.38	0	250	86.0	86.0	0.0	0.0	53.0	0.1	1.8	0.0	0.0	0.0	0.0	-0.0	31.0	31.0
4	366676.93	4903239.06	133.38	0	500	80.6	80.6	0.0	0.0	53.0	0.2	-0.9	0.0	0.0	0.0	0.0	-0.0	28.2	28.2
5	366676.93	4903239.06	133.38	0	1000	72.1	72.1	0.0	0.0	53.0	0.5	-0.9	0.0	0.0	0.0	0.0	-0.0	19.5	19.5
6	366676.93	4903239.06	133.38	0	2000	74.6	74.6	0.0	0.0	53.0	1.2	-0.9	0.0	0.0	0.0	0.0	-0.0	21.3	21.3
7	366676.93	4903239.06	133.38	0	4000	84.9	84.9	0.0	0.0	53.0	4.1	-0.9	0.0	0.0	0.0	0.0	-0.0	28.7	28.7
8	366676.93	4903239.06	133.38	0	8000	70.4	70.4	0.0	0.0	53.0	14.7	-0.9	0.0	0.0	0.0	0.0	-0.0	3.6	3.6

Point Source, ISO 9613, Name: "Inv3", ID: "Inv3"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	366583.72	4903091.36	131.93	0	63	59.8	59.8	0.0	0.0	60.5	0.0	-3.6	0.0	0.0	0.0	0.0	-0.0	2.9	2.9
2	366583.72	4903091.36	131.93	0	125	73.9	73.9	0.0	0.0	60.5	0.1	3.0	0.0	0.0	0.0	0.0	-0.0	10.3	10.3
3	366583.72	4903091.36	131.93	0	250	86.0	86.0	0.0	0.0	60.5	0.3	1.9	0.0	0.0	0.0	0.0	-0.0	23.3	23.3
4	366583.72	4903091.36	131.93	0	500	80.6	80.6	0.0	0.0	60.5	0.6	-1.0	0.0	0.0	0.0	0.0	-0.0	20.6	20.6
5	366583.72	4903091.36	131.93	0	1000	72.1	72.1	0.0	0.0	60.5	1.1	-1.1	0.0	0.0	0.0	0.0	-0.0	11.6	11.6
6	366583.72	4903091.36	131.93	0	2000	74.6	74.6	0.0	0.0	60.5	2.9	-1.1	0.0	0.0	0.0	0.0	-0.0	12.4	12.4
7	366583.72	4903091.36	131.93	0	4000	84.9	84.9	0.0	0.0	60.5	9.7	-1.1	0.0	0.0	0.0	0.0	-0.0	15.8	15.8
8	366583.72	4903091.36	131.93	0	8000	70.4	70.4	0.0	0.0	60.5	34.7	-1.1	0.0	0.0	0.0	0.0	-0.0	-23.7	-23.7

Point Source, ISO 9613, Name: "Inv4", ID: "Inv4"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	366732.84	4903104.97	132.26	0	63	59.8	59.8	0.0	0.0	57.8	0.0	-3.0	0.0	0.0	0.0	0.0	-0.0	5.0	5.0
2	366732.84	4903104.97	132.26	0	125	73.9	73.9	0.0	0.0	57.8	0.1	2.9	0.0	0.0	0.0	0.0	-0.0	13.1	13.1
3	366732.84	4903104.97	132.26	0	250	86.0	86.0	0.0	0.0	57.8	0.2	2.0	0.0	0.0	0.0	0.0	-0.0	25.9	25.9
4	366732.84	4903104.97	132.26	0	500	80.6	80.6	0.0	0.0	57.8	0.4	-0.9	0.0	0.0	0.0	0.0	-0.0	23.2	23.2

Point Source, ISO 9613, Name: "Inv4", ID: "Inv4"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
5	366732.84	4903104.97	132.26	0	1000	72.1	72.1	0.0	0.0	57.8	0.8	-0.9	0.0	0.0	0.0	0.0	-0.0	14.4	14.4
6	366732.84	4903104.97	132.26	0	2000	74.6	74.6	0.0	0.0	57.8	2.1	-0.9	0.0	0.0	0.0	0.0	-0.0	15.6	15.6
7	366732.84	4903104.97	132.26	0	4000	84.9	84.9	0.0	0.0	57.8	7.2	-0.9	0.0	0.0	0.0	0.0	-0.0	20.8	20.8
8	366732.84	4903104.97	132.26	0	8000	70.4	70.4	0.0	0.0	57.8	25.6	-0.9	0.0	0.0	0.0	0.0	-0.0	-12.1	-12.1

Point Source, ISO 9613, Name: "Inv5", ID: "Inv5"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	366638.51	4902958.14	131.05	0	63	59.8	59.8	0.0	0.0	62.7	0.1	-4.1	0.0	0.0	0.0	0.0	-0.0	1.2	1.2
2	366638.51	4902958.14	131.05	0	125	73.9	73.9	0.0	0.0	62.7	0.2	3.1	0.0	0.0	0.0	0.0	-0.0	7.9	7.9
3	366638.51	4902958.14	131.05	0	250	86.0	86.0	0.0	0.0	62.7	0.4	1.7	0.0	0.0	0.0	0.0	-0.0	21.1	21.1
4	366638.51	4902958.14	131.05	0	500	80.6	80.6	0.0	0.0	62.7	0.7	-1.2	0.0	0.0	0.0	0.0	-0.0	18.3	18.3
5	366638.51	4902958.14	131.05	0	1000	72.1	72.1	0.0	0.0	62.7	1.4	-1.2	0.0	0.0	0.0	0.0	-0.0	9.2	9.2
6	366638.51	4902958.14	131.05	0	2000	74.6	74.6	0.0	0.0	62.7	3.7	-1.2	0.0	0.0	0.0	0.0	-0.0	9.4	9.4
7	366638.51	4902958.14	131.05	0	4000	84.9	84.9	0.0	0.0	62.7	12.7	-1.2	0.0	0.0	0.0	0.0	-0.0	10.8	10.8
8	366638.51	4902958.14	131.05	0	8000	70.4	70.4	0.0	0.0	62.7	45.1	-1.2	0.0	0.0	0.0	0.0	-0.0	-36.2	-36.2

Point Source, ISO 9613, Name: "Inv6", ID: "Inv6"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	366788.51	4902971.99	131.06	0	63	59.8	59.8	0.0	0.0	61.8	0.0	-3.9	0.0	0.0	0.0	0.0	-0.0	1.9	1.9
2	366788.51	4902971.99	131.06	0	125	73.9	73.9	0.0	0.0	61.8	0.1	3.0	0.0	0.0	0.0	0.0	-0.0	8.9	8.9
3	366788.51	4902971.99	131.06	0	250	86.0	86.0	0.0	0.0	61.8	0.4	1.8	0.0	0.0	0.0	0.0	-0.0	22.0	22.0
4	366788.51	4902971.99	131.06	0	500	80.6	80.6	0.0	0.0	61.8	0.7	-1.1	0.0	0.0	0.0	0.0	-0.0	19.2	19.2
5	366788.51	4902971.99	131.06	0	1000	72.1	72.1	0.0	0.0	61.8	1.3	-1.2	0.0	0.0	0.0	0.0	-0.0	10.2	10.2
6	366788.51	4902971.99	131.06	0	2000	74.6	74.6	0.0	0.0	61.8	3.4	-1.2	0.0	0.0	0.0	0.0	-0.0	10.6	10.6
7	366788.51	4902971.99	131.06	0	4000	84.9	84.9	0.0	0.0	61.8	11.4	-1.2	0.0	0.0	0.0	0.0	-0.0	12.8	12.8
8	366788.51	4902971.99	131.06	0	8000	70.4	70.4	0.0	0.0	61.8	40.7	-1.2	0.0	0.0	0.0	0.0	-0.0	-31.0	-31.0

Point Source, ISO 9613, Name: "Inv7", ID: "Inv7"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	366694.57	4902824.65	129.90	0	63	59.8	59.8	0.0	0.0	65.0	0.1	-4.6	0.0	0.0	0.0	0.0	-0.0	-0.7	-0.7
2	366694.57	4902824.65	129.90	0	125	73.9	73.9	0.0	0.0	65.0	0.2	3.3	0.0	0.0	0.0	0.0	-0.0	5.4	5.4
3	366694.57	4902824.65	129.90	0	250	86.0	86.0	0.0	0.0	65.0	0.5	1.6	0.0	0.0	0.0	0.0	-0.0	18.9	18.9
4	366694.57	4902824.65	129.90	0	500	80.6	80.6	0.0	0.0	65.0	1.0	-1.3	0.0	0.0	0.0	0.0	-0.0	16.0	16.0
5	366694.57	4902824.65	129.90	0	1000	72.1	72.1	0.0	0.0	65.0	1.8	-1.4	0.0	0.0	0.0	0.0	-0.0	6.6	6.6
6	366694.57	4902824.65	129.90	0	2000	74.6	74.6	0.0	0.0	65.0	4.8	-1.4	0.0	0.0	0.0	0.0	-0.0	6.1	6.1
7	366694.57	4902824.65	129.90	0	4000	84.9	84.9	0.0	0.0	65.0	16.4	-1.4	0.0	0.0	0.0	0.0	-0.0	4.8	4.8
8	366694.57	4902824.65	129.90	0	8000	70.4	70.4	0.0	0.0	65.0	58.6	-1.4	0.0	0.0	0.0	0.0	-0.0	-51.9	-51.9

Point Source, ISO 9613, Name: "Inv8", ID: "Inv8"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	366844.48	4902838.54	129.83	0	63	59.8	59.8	0.0	0.0	64.8	0.1	-4.5	0.0	0.0	0.0	0.0	-0.0	-0.5	-0.5
2	366844.48	4902838.54	129.83	0	125	73.9	73.9	0.0	0.0	64.8	0.2	3.2	0.0	0.0	0.0	0.0	-0.0	5.7	5.7
3	366844.48	4902838.54	129.83	0	250	86.0	86.0	0.0	0.0	64.8	0.5	1.6	0.0	0.0	0.0	0.0	-0.0	19.1	19.1
4	366844.48	4902838.54	129.83	0	500	80.6	80.6	0.0	0.0	64.8	0.9	-1.3	0.0	0.0	0.0	0.0	-0.0	16.2	16.2
5	366844.48	4902838.54	129.83	0	1000	72.1	72.1	0.0	0.0	64.8	1.8	-1.4	0.0	0.0	0.0	0.0	-0.0	6.9	6.9
6	366844.48	4902838.54	129.83	0	2000	74.6	74.6	0.0	0.0	64.8	4.7	-1.4	0.0	0.0	0.0	0.0	-0.0	6.5	6.5
7	366844.48	4902838.54	129.83	0	4000	84.9	84.9	0.0	0.0	64.8	16.0	-1.4	0.0	0.0	0.0	0.0	-0.0	5.6	5.6
8	366844.48	4902838.54	129.83	0	8000	70.4	70.4	0.0	0.0	64.8	56.9	-1.4	0.0	0.0	0.0	0.0	-0.0	-49.9	-49.9

Point Source, ISO 9613, Name: "Inv9", ID: "Inv9"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	366750.93	4902691.77	128.75	0	63	59.8	59.8	0.0	0.0	67.0	0.1	-4.8	0.0	0.0	0.0	0.0	-0.0	-2.4	-2.4
2	366750.93	4902691.77	128.75	0	125	73.9	73.9	0.0	0.0	67.0	0.3	3.5	0.0	0.0	0.0	0.0	-0.0	3.2	3.2
3	366750.93	4902691.77	128.75	0	250	86.0	86.0	0.0	0.0	67.0	0.7	1.5	0.0	0.0	0.0	0.0	-0.0	16.9	16.9
4	366750.93	4902691.77	128.75	0	500	80.6	80.6	0.0	0.0	67.0	1.2	-1.4	0.0	0.0	0.0	0.0	-0.0	13.8	13.8
5	366750.93	4902691.77	128.75	0	1000	72.1	72.1	0.0	0.0	67.0	2.3	-1.5	0.0	0.0	0.0	0.0	-0.0	4.3	4.3
6	366750.93	4902691.77	128.75	0	2000	74.6	74.6	0.0	0.0	67.0	6.1	-1.5	0.0	0.0	0.0	0.0	-0.0	3.0	3.0
7	366750.93	4902691.77	128.75	0	4000	84.9	84.9	0.0	0.0	67.0	20.6	-1.5	0.0	0.0	0.0	0.0	-0.0	-1.2	-1.2

Point Source, ISO 9613, Name: "Inv9", ID: "Inv9"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
8	366750.93	4902691.77	128.75	0	8000	70.4	70.4	0.0	0.0	67.0	73.5	-1.5	0.0	0.0	0.0	0.0	-0.0	-68.6	-68.6

Point Source, ISO 9613, Name: "Inv10", ID: "Inv10"																			
Nr.	X	Y	Z	Refl.	Freq.	LxT	LxN	K0	Dc	Adiv	Aatm	Agr	Afol	Ahous	Abar	Cmet	RL	LrT	LrN
	(m)	(m)	(m)		(Hz)	dB(A)	dB(A)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	dB(A)	dB(A)
1	366900.68	4902704.83	128.59	0	63	59.8	59.8	0.0	0.0	67.0	0.1	-4.8	0.0	0.0	0.0	0.0	-0.0	-2.4	-2.4
2	366900.68	4902704.83	128.59	0	125	73.9	73.9	0.0	0.0	67.0	0.3	3.5	0.0	0.0	0.0	0.0	-0.0	3.2	3.2
3	366900.68	4902704.83	128.59	0	250	86.0	86.0	0.0	0.0	67.0	0.7	1.5	0.0	0.0	0.0	0.0	-0.0	16.9	16.9
4	366900.68	4902704.83	128.59	0	500	80.6	80.6	0.0	0.0	67.0	1.2	-1.4	0.0	0.0	0.0	0.0	-0.0	13.9	13.9
5	366900.68	4902704.83	128.59	0	1000	72.1	72.1	0.0	0.0	67.0	2.3	-1.5	0.0	0.0	0.0	0.0	-0.0	4.3	4.3
6	366900.68	4902704.83	128.59	0	2000	74.6	74.6	0.0	0.0	67.0	6.1	-1.5	0.0	0.0	0.0	0.0	-0.0	3.0	3.0
7	366900.68	4902704.83	128.59	0	4000	84.9	84.9	0.0	0.0	67.0	20.6	-1.5	0.0	0.0	0.0	0.0	-0.0	-1.2	-1.2
8	366900.68	4902704.83	128.59	0	8000	70.4	70.4	0.0	0.0	67.0	73.4	-1.5	0.0	0.0	0.0	0.0	-0.0	-68.5	-68.5

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Niagara Falls, Ontario, Canada L2E 7J7
Tel 905 374 5200 ◆ Fax 905 374 1157

SunE Westbrook Solar Farm

Acoustic Assessment Report

March, 2012

Prepared for:
SunEdison Canada, LLC
595 Adelaide Street East, Suite 400
Toronto, ON M5A 1N8

Prepared by:
GENIVAR Inc.
600 Cochrane Drive, 5th Floor
Markham, Ontario L3R 5K3

Project No. 111-18734-00

GENIVAR

Project No. 111-18734-00

March 01, 2012

Robert Miller
SunEdison Canada, LLC
945 Princess Street
Kingston, ON K7L 3N6

Re: SunE Westbrook Solar Farm
Draft Acoustic Assessment Report

Dear Mr. Miller:

Please find, attached, a copy of Acoustic Assessment Report carried out for the SunE Westbrook Solar Farm to be located in the area of Westbrook, north of the City of Kingston, Ontario.

If you have any question, please, feel free to call me at 905-475-7270 ext. 18384 or email me at bhuwan.prasad@genivar.com.

Yours truly,
GENIVAR Inc.

LICENSED PROFESSIONAL ENGINEER
B.M. PRASAD
100074903
PROVINCE OF ONTARIO

Bhuwan M. Prasad, P. Eng.
Environmental Engineer

/bp

Executive Summary

GENIVAR Inc. (GENIVAR) was retained by SunEdison to prepare an acoustic assessment report for the SunE Westbrook Solar Farm with an installed capacity of 10 MW to be located in the area of Westbrook, north of the City of Kingston, Ontario in support of the Renewable Energy Approval (REA) application under Ontario Regulation 359/09 (O.Reg.359/09) of the Environmental Protection Act.

According to the project classification scheme outlined in Part II (Classes of Renewable Energy Generation Facilities); Section 4 of O. Reg. 359/09 the SunE Westbrook solar farm is categorized as a Class 3 solar facility. This acoustic assessment report has been prepared in accordance with Appendix A of the publication of the Ontario Ministry of the Environment entitled, "Basic Comprehensive Certificates of Approval (Air) – User Guide", dated April 2004 and subsequent amendments.

The noise analysis was conducted using the CadnaA (Computer Aided Noise Abatement) 3-D acoustical modelling software V4.2 to predict the noise levels at the points of reception, within one (1) km distance around the site boundary in each direction, with all noise sources operating at full load simultaneously. CadnaA is based on ISO Standard 9613-2 "*Acoustics - Attenuation of Sound During Propagation Outdoors – Part 2: General Method of Calculation*". The applicable sound level limits for this Facility are considered to be the exclusionary minimum sound levels for Class 3 areas (45 dBA for daytime and 40 dBA for evening & nighttime).

Based on the results obtained in this noise study, the environmental noise produced by the proposed SunE Westbrook Solar Farm would be well below the applicable MOE noise guidelines at all Points of Reception.

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1. Introduction

SunEdison Canada (SunEdison), through its wholly owned subsidiary, SunE Westbrook LP, is proposing a single Class 3 Solar Facility with a nameplate capacity of 10 MW (AC) in the area of Westbrook, north of the City of Kingston, Ontario. If approved, this facility will convert solar energy into electricity to be fed into the Hydro One distribution grid. The defined study area is presented as Figure 1 in Appendix A, covering approximately 70 hectares (ha). Noise sources include inverters and transformers, with 22 Points of Reception identified as sensitive receptors, and 19 Points of Reception as vacant lots (total of 41 Points of Reception) within one km distance around the site boundary in each direction, for assessment.

SunEdison is a global leader in solar energy generation with a current operating portfolio of more than 350 facilities generating over a combined 120 Megawatts (MW) of solar power across the globe. Active Ontario solar farms currently owned and operated by SunEdison include First Light 1 (9.1 MW) located in Stone Mills, north of Napanee, Norfolk I and II (18 MW combined) located in Norfolk County and Erie Ridge (9.3 MW) in Ridgetown, Chatham-Kent.

Subject to receiving all approvals, the preliminary schedule anticipates that full commercial operation of the SunE Westbrook Solar Farm will be achieved by the end of 2012. The project has received a 20-year FIT contract from the Ontario Power Authority to sell the generated electricity to the Ontario electricity grid. As such, the project is anticipated to operate until at least 2032, at which time it may continue to generate electricity or the site may be decommissioned and the land returned to its former vacant use.

1.1 Report Objectives

GENIVAR Inc. (GENIVAR) was retained by SunEdison to prepare this acoustic assessment report in support of the Renewable Energy Approval (REA) application for the SunE Westbrook Solar Farm in Westbrook, north of the City of Kingston, Ontario.

Ontario Regulation 359/09 (O. Reg. 359/09) of the Environmental Protection Act received Royal Assent on September 24, 2009 and was filed and came into force on October 1, 2009. O. Reg. 359/09 contains the current requirements for approval of a renewable energy project under the REA process. According to the project classification scheme outlined in Part II (Classes of Renewable Energy Generation Facilities); Section 4 of O. Reg. 359/09 the SunE Westbrook solar farm is categorized as a Class 3 solar facility. A Class 3 solar facility is defined as a facility of solar panels situated at any location other than mounted on the roof or wall of a building with a name plate capacity greater than 12 kW.

As required by O. Reg. 359/09 for a Class 3 solar facility, this noise study report has been prepared in accordance with Appendix A of the publication of the Ministry of the Environment entitled, “Basic Comprehensive Certificates of Approval (Air) – User Guide”, dated April 2004 and subsequent amendments.

1.2 Project Location

The project is located on Concession 5, north of the City of Kingston. The area is generally bounded by:

→ Westbrook Road to the east

→ Glenvale Creek along the west

The following coordinates (in UTM NAD 83, Zone 18N coordinate system) define the extremities of the Study Area for the project:

- North-west: Easting 369472 Northing 4907093
- North-east: Easting 369960 Northing 4907118
- South-east: Easting 369994 Northing 4906058
- South-west: Easting 369180 Northing 4906030

The solar farm will be located on privately owned land which has A2 agricultural zoning. The electrical substation of the project will also be located on site. One overhead electrical connection line will run south within the Westbrook Road right-of-way to connect to the existing Hydro One distribution line running east-west along Princess Street.

The noise sources and receptors are shown on Figure 1 in Appendix A and the zoning / land-use information is provided in Appendix B.

2. Facility Description

The Facility will consist of solar modules, inverters, transformers and other ancillary equipment to convert solar energy into electricity (equipment list provided in Appendix C). The modules will be held by a single-axis tracking system which is supported off the ground by vertical posts. The major components of the proposed project are as follows:

- Approximately 40,000 x MEMC solar modules (260 to 300-watt generation capacity)
- Approximately 320 disconnect combiners
- 44 kV Substation including pole-top motor-operated disconnect, 44kV switchgear, 10 MVA oil filled pad-mount transformer, interrupter switches, communication equipment, etc.
- 10 inverter huts, each inverter hut consisting of two 500-kW inverters within an enclosure (or a house) and one corresponding 1000 kVA transformer located outside the enclosure.

The Facility will operate 24 hours per day and 7 days per week to convert sunlight into electricity whenever solar energy is available. During daylight hours, the facility will convert the available energy from the sun’s rays into electricity to be transmitted to the Hydro One grid.

In the absence of sunlight, no electricity generation will take place. This scenario is found at nighttime after sunset, and under these conditions the inverters are not operating and therefore not producing any noise. The medium-voltage transformers are energized from the energy generation process during hours or sunlight, and therefore continue to generate some magnetostrictive noise at reduced levels during the evening, even without the cooling fans in operation.

3. Noise Source Summary

The main sources of noise associated with the Project will be the inverter huts (each hut containing two inverters and one medium-voltage transformer) and the substation containing the main step-up transformer installed on a concrete pad.

Switch gear and a small step-down transformer meant for lighting within the substation are insignificant sources of noise in comparison to above sources. The trackers operate using small motors and only emit noise when moving the panels. This noise is not significant and the motors have not been considered as sources of noise.

3.1 Inverter Huts

The facility will have ten (10) inverter huts, each consisting of a set of two (2) 500 kW inverters and an associated 1 MVA transformer contained within a sound dampening enclosure. Based on the inverter design (Appendix C), each inverter hut has been considered to have two noise components: (a) two (2) 500 kW inverters in an enclosure and (b) 1 MVA transformer located outside of the inverter enclosure (descriptions of which are provided below).

The inverters and associated transformer in each hut are identified by unique identification numbers. For example, H1T is the transformer of Hut 1, while H1|1 and H1|2 are inverter 1 and inverter 2 respectively for Hut 1; H2T is the transformer of Hut 2, while H2|1 and H2|2 are inverter 1 and inverter 2 respectively for Hut 2; etc. The complete list of inverters and associated transformers can be found in Table 2.

3.1.1 Inverters

Noise data has been received for two different 500 kW Inverters: (a) Satcon, the inverters which mostly likely to be used in this facility as given in Appendix C and (b) Solaron as provided in Appendix D by Advanced Energy Industries (AEI). The inverter make and model has not been selected at this time, although it is anticipated that Satcon inverters will be used.

The overall noise level of the Solaron inverter, given in the third-octave band frequency, is higher than that of the Satcon inverter. For modeling purposes and a more conservative estimate, the Solaron noise data has been used to assess the anticipated noise levels of this Project.

The third-octave spectrum noise data, provided for the Solaron 500 unit, Configuration 2 (similar input voltage level as Satcon), was converted into a full octave spectrum for modeling purposes.

The sound power levels include a 5 dB tonal penalty per MOE publication NPC-104 as the MOE considers these sources to be tonal.

As the two inverters for each Hut are within an enclosure, on the advice of Ontario MOE, inverter enclosure attenuation has been applied to the overall sound power levels as per the values provided in Table 1.

.

3.1.2 Transformers

The sound power levels for the 1 MVA transformers were calculated in the same manner as for the substation transformer, details of which are given in Section 3.2 Substation Transformer below. The sound power levels include a 5 dB tonal penalty per MOE publication NPC-104 as the MOE considers these sources to be tonal.

3.2 Substation Transformer

The octave band sound power levels of the transformers are calculated using Equation 7-23 in "*Noise Control for Building and Manufacturing Plants*" report (provided in Appendix E; Reference 1) and National Electrical Manufacturers Association (NEMA) sound data for the transformers (Appendix E):

$$L_w = \text{NEMA Rating} + 10 \log A + C$$

Where, NEMA Rating = the A weighted sound level of the transformer
A = the total surface area of the sidewall of the transformer in ft²
C = octave band correction (Appendix C, Reference 1, Table 7-30)

The sound power levels include a 5 dB tonal penalty per MOE publication NPC-104 as the MOE considers these sources to be tonal.

An overall list of all noise sources of the Facility is shown in Table 2: Noise Source Summary Table, along with the corresponding coordinates as shown on Figure 1 (Appendix A). The height of the substation transformer is modeled as 2.5 metres, where as the heights of the inverters and inverter transformers are modeled as 1.8 metres above the ground so as to model them as point sources.

Two different scenarios have been modeled as per the details given below:

Daytime Scenario: When all the above equipment is in operation.

Nighttime Scenario: When all other equipment is in operation except inverters (i.e. only hut transformers and the substation transformer being in operation).

4. Points of Reception Summary

Forty one (41) Points of Reception (PORs) within a one (1) km distance around the site boundary in each direction were identified for this acoustic assessment as shown on Figure 1 (Appendix A).

With a recent aerial photo, land information and site shape files loaded into the GIS program, ArcMap, the noise receptors and vacant lots were determined by visual review of the composite map. Structures that were identified as potential occupied buildings/houses were plotted on the map as noise receptors. This data was stored and saved into the shapefile entitled, *Noise Receptors*. Once all the potential noise receptors were identified, any lots without noise receptor plots were marked with a vacant lot receptor. Each marker was plotted on the vacant lot where future development would most likely take place (i.e. near the existing road access to the lot). The vacant lot receptors were plotted and saved in a separate shapefile entitled, *Vacant Lots*.

The daytime POR noise impact for each receptor from each individual noise source is shown in Table 3 and includes the distance in metres from each source to each receptor and the sound level at each receptor (Leq in dBA). The nighttime POR noise impact from each individual noise source is not presented since the nighttime noise impacts follow the same trend but with lesser impacts.

To simulate a worst-case scenario, each receptor was set to a height of 4.5 m above ground representing an upper storey window of a two-storey structure since they are most exposed to elevated sources at the subject site and benefit least from ground absorption of sound.

5. Assessment Criteria (Performance Limits)

The solar farm will be located on privately owned land which has A2 agricultural zoning. Therefore, all PORs have been considered to be located in Class 3 rural areas to reflect the rural nature of the area.

In predicting the sound level at each POR due to the proposed solar farm, MOE publication NPC-232 requires the application of the principle of “predictable worst case” noise impact. The predictable worst case impact is defined as the largest noise excess produced by the facility over the applicable limit.

The background sound level is considered to be traffic noise and other sounds in the area excluding the sound from the facility under assessment. The sound level limit for the residential receptors in a Class 3 area can be described as follows:

> *The energy averaged sound level (Leq) produced by a source at a receptor location in any one hour period should not exceed the greater of: the energy averaged background sound level in the same hour period, or 45 dBA in the daytime of 07:00 – 19:00, or 40 dBA in the evening period of 19:00 – 23:00 and 40 dBA in the nighttime period of 23:00 – 07:00.*

The applicable sound level limits for this Facility are considered to be the exclusionary minimum sound levels for Class 3 areas as follows:

Time Period	**Sound Level Limit for POR in Class 3 Area**
Daytime (07:00 – 19:00)	45 dBA
Evening (19:00 – 23:00)	40 dBA
Nighttime (23:00 – 07:00)	40 dBA

6. Impact Assessment

The noise analysis was conducted using the CadnaA (Computer Aided Noise Abatement) 3-D acoustical modelling software V4.2 to predict the noise levels at the Points of Reception with all noise sources operating at full load simultaneously and each noise source modelled as a point source. CadnaA is based on ISO Standard 9613-2 “*Acoustics - Attenuation of Sound During Propagation Outdoors – Part 2: General Method of Calculation*”. The CadnaA configuration settings are summarized in Appendix F.

The attenuation due to atmospheric absorption was based on the atmospheric coefficients for 10 °C temperature and 70% relative humidity. The Ground Attenuation value (G) was calculated using the “General” method in standard ISO 9613-2 (included in the CadnaA software), with a global value ground factor of G = 0.7 being used (this is based on MOE wind farm guidelines for rural areas). G = 1 was used to model the porous soil nearby where the sound energy would be completely absorbed and G = 0 to model for hard surfaces such as paved hard roads where sound energy would be reflected totally.

The predicted sound levels at the receptors for both daytime and nighttime scenarios are provided in Table 4: Acoustic Assessment Summary Table which indicates that the predicted noise levels for all identified PORs are in compliance with the respective performance limits. As a result, no mitigation is required.

Due to the nature of the noise sources, a vibration assessment is not required. The CadnaA noise modeling graphic output for the SunE Westbrook Solar Farm for daytime and nighttime scenarios are shown on Figure 1 and Figure 2, respectively.

It should be noted that the acoustic assessment carried out for this project is conservative since the Sound Power Level used for the Inverters (Advanced Energy Industries) is greater than that of the actual Inverters (Satcon) to be used for the project.

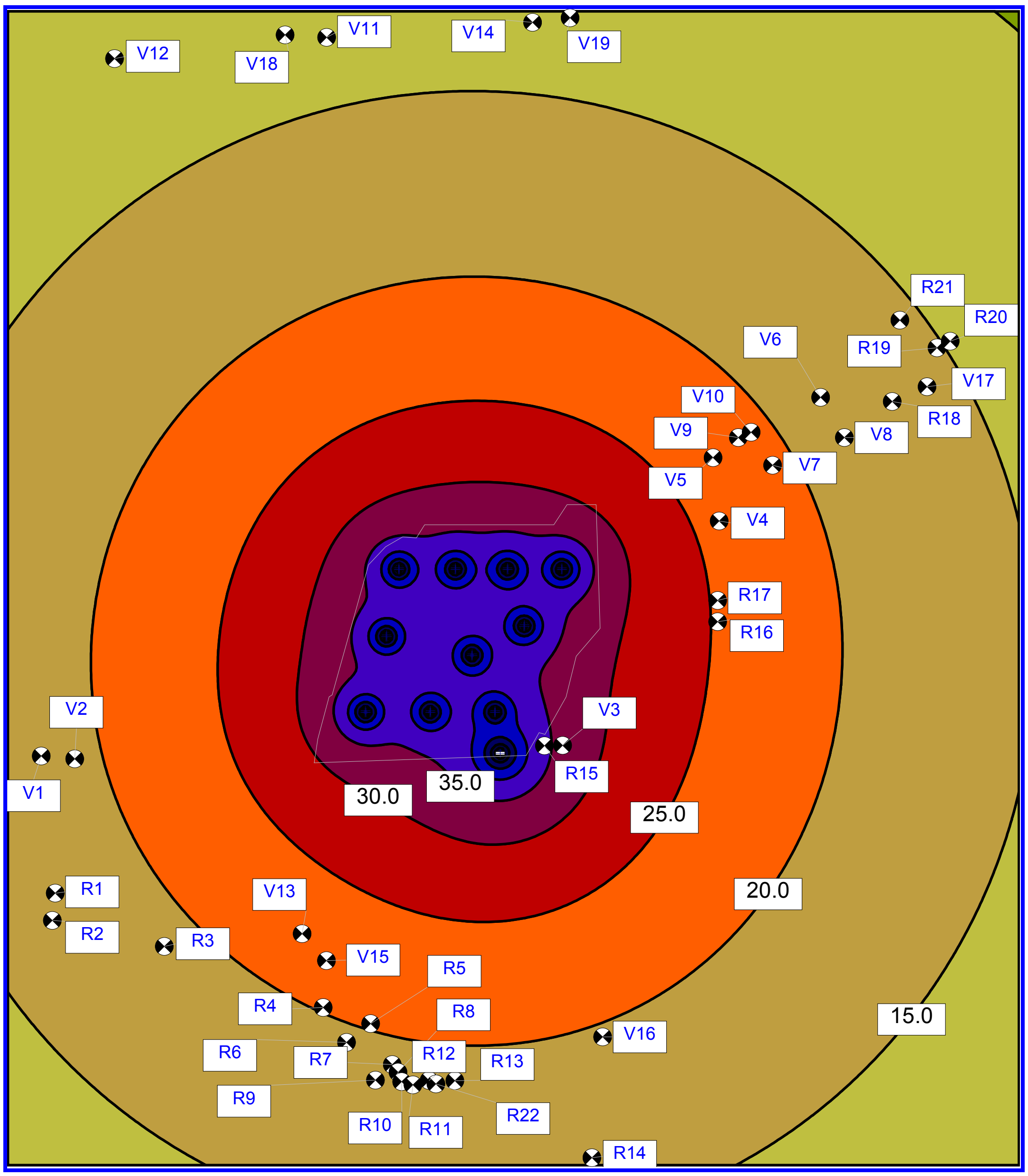


Figure 1 **Westbrook Solar Noise Impact Graphics in dBA for Daytime Scenario**

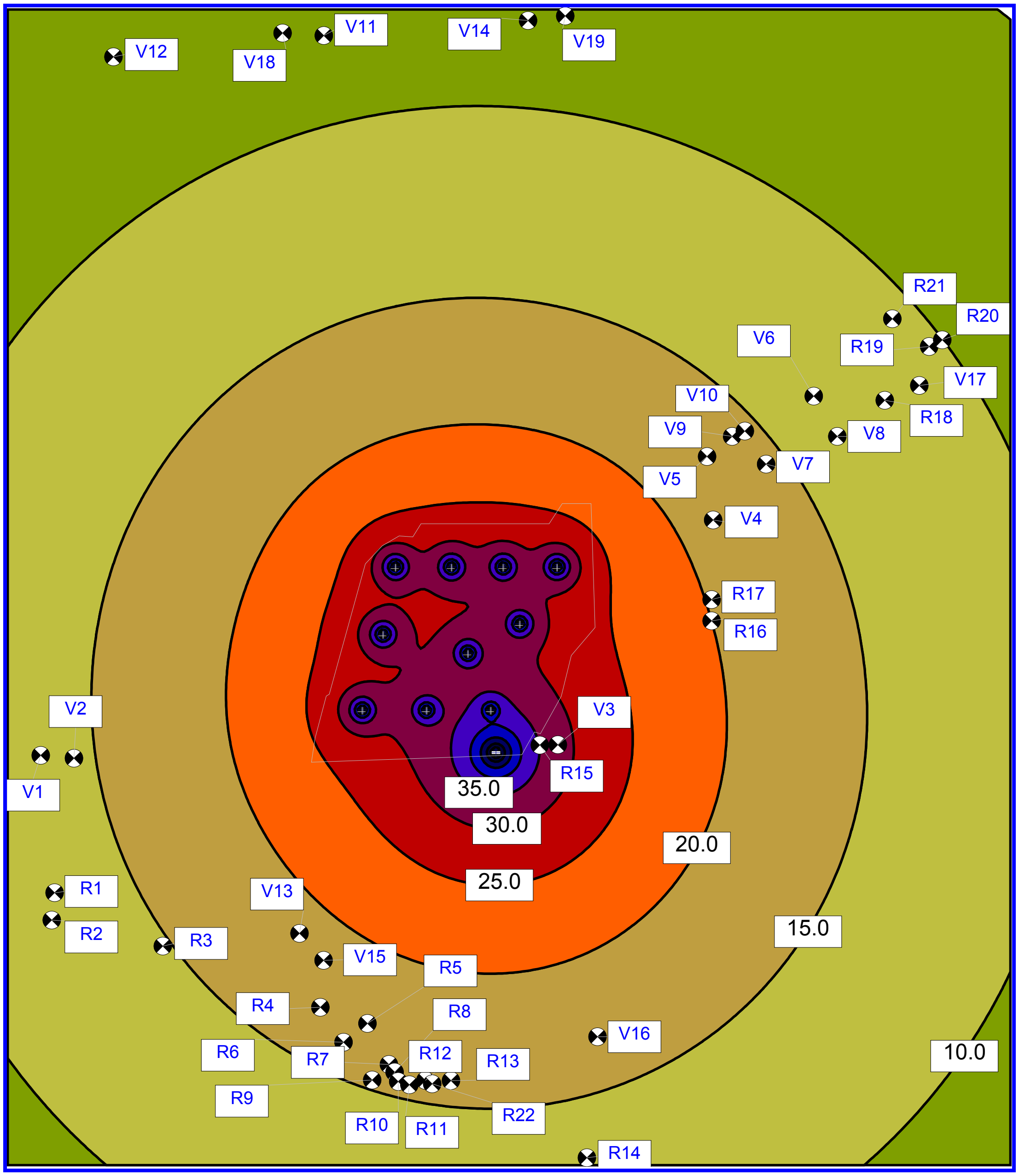


Figure 2 Westbrook Solar Noise Impact Graphics in dBA for Nighttime Scenario

7. Conclusions

For the proposed SunE Westbrook Solar Farm to be located in Westbrook, Ontario, a noise impact study has been carried out by GENIVAR. The study was carried out using CadnaA V4.2 to predict the noise levels at the Points of Reception (PORs), within a one (1) km distance around the site boundary in each direction, with all noise sources operating at full load simultaneously during the daytime scenario and only transformers (without inverters) operating at full load during the nighttime scenario. The applicable sound level limits for this Facility are considered to be the exclusionary minimum sound levels for Class 3 areas (45 dBA for daytime and 40 dBA for evening & nighttime). Based on the results presented in this report, it is concluded that the environmental noise produced by the proposed SunE Westbrook Solar Farm would be well below the applicable MOE noise guidelines at all PORs.

Table 1: Solar Power Inverter and Transformer Sound Levels
SunE Westbrook Solar Farm, Westbrook, Ontario

Inverter - AEI Solaron 500 - based on April 2010 test report (see Appendix D)										
					Octave Band Centre Frequency (Hz)					
Sound Description	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**Sum**	**Description**
AEI Solaron 500 PWL (dB)*	83.4	89.6	81.8	81.0	78.0	73.1	70.3	75.2	**91.9**	Appendix D, Table 1, Configuration 2
AEI Solaron 500 SPL (dB)	75.4	81.6	73.8	73.0	70.0	65.1	62.3	67.2	**83.9**	at 1 m
AEI Solaron 500 PWL (dBA)	57.2	73.5	73.2	77.8	78.0	74.3	71.3	74.1	**83.7**	less than 84 dBA from report
AEI Solaron 500 SPL (dBA)	49.2	65.5	65.2	69.8	70.0	66.3	63.3	66.1	**75.7**	at 1 m - close to other vendors
Tonal Penalty (dB)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		as per NPC-104
Inverter Total PWL (dB)	88.4	94.6	86.8	86.0	83.0	78.1	75.3	80.2	**96.9**	including Tonal Penalty
Inverters Enclosures Attenuation	5.0	6.0	7.0	7.0	8.0	8.0	7.0	7.0		
* Each Octave bands have been normalised with its adjacent 1/3 octave sound power levels, for example, PWL for 63 Hz is log sum of PWLs of 50, 63 & 80 Hz										

Inverter transformer NEMA rating (dBA)	58	(CSA C227.4-06, Table 5, 1,000 kVA)								
Area of four sides (ft²)	175	Based on Satcon Prism MVP1 Transformer								
					Octave Band Centre Frequency (Hz)					
Sound Description	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**Sum**	**Description**
Inverter Transformer PWL (dB) 1,000 kVA	75.4	77.4	72.4	72.4	66.4	61.4	56.4	49.4	**81.2**	Ref. 1, Eq. 7-23 and Table 7-30, C_1 octave band corrections
PWL (dBA)	49.2	61.3	63.8	69.2	66.4	62.6	57.4	48.3	**72.8**	
SPL (dBA) at 1 m	41.2	53.3	55.8	61.2	58.4	54.6	49.4	40.3	**64.8**	
Transformer Total PWL (dB)	80.4	82.4	77.4	77.4	71.4	66.4	61.4	54.4	**86.2**	including Tonal Penalty

Substation transformer NEMA rating (dBA)	68	(CSA-C88-M90, Table 8, 10 MVA)								
Area of four sides (ft²)	251	Estimated based on ABB 3ph 5 MVA unit								
					Octave Band Centre Frequency (Hz)					
Sound Description	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**Sum**	**Description**
Substation Transformer PWL (dB) 10,000 kVA	87.0	89.0	84.0	84.0	78.0	73.0	68.0	61.0	**92.8**	Ref. 1, Eq. 7-23 and Table 7-30, C_3 octave band corrections
PWL (dBA)	60.8	72.9	75.4	80.8	78.0	74.2	69.0	59.9	**84.4**	
SPL (dBA) at 1 m	52.8	64.9	67.4	72.8	70.0	66.2	61.0	51.9	**76.4**	
Transformer Total PWL (dB)	92.0	94.0	89.0	89.0	83.0	78.0	73.0	66.0	**97.8**	including Tonal Penalty

Reference 1: Noise Control for Buildings, Manufacturing Plants, Equipment and Products (19th printing, 2005)

Table 2: Noise Source Summary Table
SunE Westbrook Solar Farm, Westbrook, Ontario

Source ID	Source Description	Sound Power Level	Coordinates		Height	Daytime Source	Nighttime Source	Source Location	Source Characteristics	Noise Control Measures
		(dBA)	X m)	Y (m)	(m)	Yes or No	Yes or No	(1)	(2)	(3)
H1T	Hut 1 Transformer	72.8	369688.2	4906177.7	1.8	Y	Y	O	S, T	U
H1I1	Hut 1 Inverter 1	83.7	369686.9	4906173.0	2.5	Y	N	O	S, T	E
H1I2	Hut 1 Inverter 2	83.7	369689.4	4906173.0	2.5	Y	N	O	S, T	E
H2T	Hut 2 Transformer	72.8	369506.4	4906177.7	1.8	Y	Y	O	S, T	U
H2I1	Hut 2 Inverter 1	83.7	369505.1	4906173.0	2.5	Y	N	O	S, T	E
H2I2	Hut 2 Inverter 2	83.7	369507.7	4906173.0	2.5	Y	N	O	S, T	E
H3T	Hut 3 Transformer	72.8	369324.7	4906177.7	1.8	Y	Y	O	S, T	U
H3I1	Hut 3 Inverter 1	83.7	369323.4	4906173.0	2.5	Y	N	O	S, T	E
H3I2	Hut 3 Inverter 2	83.7	369325.9	4906173.0	2.5	Y	N	O	S, T	E
H4T	Hut 4 Transformer	72.8	369418.6	4906582.7	1.8	Y	Y	O	S, T	U
H4I1	Hut 4 Inverter 1	83.7	369417.3	4906578.0	2.5	Y	N	O	S, T	E
H4I2	Hut 4 Inverter 2	83.7	369419.8	4906578.0	2.5	Y	N	O	S, T	E
H5T	Hut 5 Transformer	72.8	369876.0	4906582.7	1.8	Y	Y	O	S, T	U
H5I1	Hut 5 Inverter 1	83.7	369874.7	4906578.0	2.5	Y	N	O	S, T	E
H5I2	Hut 5 Inverter 2	83.7	369877.2	4906578.0	2.5	Y	N	O	S, T	E
H6T	Hut 6 Transformer	72.8	369770.5	4906421.7	1.8	Y	Y	O	S, T	U
H6I1	Hut 6 Inverter 1	83.7	369769.3	4906417.0	2.5	Y	N	O	S, T	E
H6I2	Hut 6 Inverter 2	83.7	369771.8	4906417.0	2.5	Y	N	O	S, T	E
H7T	Hut 7 Transformer	72.8	369723.6	4906582.7	1.8	Y	Y	O	S, T	U
H7I1	Hut 7 Inverter 1	83.7	369722.3	4906578.0	2.5	Y	N	O	S, T	E
H7I2	Hut 7 Inverter 2	83.7	369724.8	4906578.0	2.5	Y	N	O	S, T	E
H8T	Hut 8 Transformer	72.8	369577.1	4906582.7	1.8	Y	Y	O	S, T	U
H8I1	Hut 8 Inverter 1	83.7	369575.8	4906578.0	2.5	Y	N	O	S, T	E
H8I2	Hut 8 Inverter 2	83.7	369578.3	4906578.0	2.5	Y	N	O	S, T	E
H9T	Hut 9 Transformer	72.8	369383.4	4906392.4	1.8	Y	Y	O	S, T	U
H9I1	Hut 9 Inverter 1	83.7	369382.1	4906387.6	2.5	Y	N	O	S, T	E
H9I2	Hut 9 Inverter 2	83.7	369384.6	4906387.6	2.5	Y	N	O	S, T	E
H10T	Hut 10 Transformer	72.8	369623.8	4906338.7	1.8	Y	Y	O	S, T	U
H10I1	Hut 10 Inverter 1	83.7	369622.5	4906334.0	2.5	Y	N	O	S, T	E
H10I2	Hut 10 Inverter 2	83.7	369625.1	4906334.0	2.5	Y	N	O	S, T	E
ST	Substation Transformer	84.4	369702.9	4906057.0	2.5	Y	Y	O	S, T	U

Notes:

(1) Source Location:
O - located/installed outside the building, including on the roof
I - located/installed inside the building

(2) Sound Characteristics:
S - Steady
Q - Quasi Steady Impulsive
I - Impulsive
B - Buzzing
T - Tonal
C - Cyclic

(3) Noise Control Measures:
S - silencer, acoustic louvre, muffler
A - acoustic lining, plenum
B - barrier, berm, screening
L - lagging
E - acoustic enclosure
O - other
U - uncontrolled

Table 3: Point of Reception Noise Impact (Daytime)
SunE Westbrook Solar Farm, Westbrook, Ontario

Noise Source ID	Point of Reception R1 Distance to R1 (m)	Sound Level at R1 (Leq) (dBA)	Point of Reception R2 Distance to R2 (m)	Sound Level at R2 (Leq) (dBA)	Point of Reception R3 Distance to R3 (m)	Sound Level at R3 (Leq) (dBA)	Point of Reception R4 Distance to R4 (m)	Sound Level at R4 (Leq) (dBA)	Point of Reception R5 Distance to R5 (m)	Sound Level at R5 (Leq) (dBA)	Point of Reception R6 Distance to R6 (m)	Sound Level at R6 (Leq) (dBA)
H1T	1339.2	0.3	1377.8	<1	1144.0	2.1	969.7	3.9	953.0	4.1	1028.4	3.3
H1I1	1336.2	4.0	1374.6	3.6	1140.2	5.8	965.0	7.6	948.1	7.8	1023.5	7.0
H1I2	1338.6	3.9	1376.9	3.6	1142.2	5.7	966.3	7.6	949.1	7.8	1024.6	6.9
H2T	1173.7	1.8	1216.3	1.4	1002.1	3.6	893.3	4.8	902.3	4.7	969.0	3.9
H2I1	1170.5	5.5	1212.9	5.1	998.0	7.2	888.4	8.5	897.5	8.4	964.1	7.6
H2I2	1172.8	5.4	1215.1	5.0	999.9	7.2	889.3	8.5	897.9	8.4	964.7	7.6
H3T	1013.7	3.4	1061.5	2.9	875.1	5.0	849.5	5.4	886.7	4.9	941.5	4.2
H3I1	1010.2	7.1	1057.8	6.6	870.6	8.7	844.7	9.1	882.0	8.6	936.7	7.9
H3I2	1012.4	7.1	1059.9	6.6	872.3	8.7	845.0	9.0	882.0	8.6	936.8	7.9
H4T	1335.4	0.3	1395.0	<1	1259.3	1.0	1264.2	0.9	1294.1	0.7	1353.0	0.2
H4I1	1331.2	4.0	1390.8	3.5	1254.6	4.7	1259.3	4.6	1289.3	4.4	1348.2	3.8
H4I2	1333.0	4.0	1392.5	3.5	1256.0	4.7	1259.8	4.6	1289.5	4.4	1348.5	3.8
H5T	1695.8	<1	1745.2	<1	1548.5	<1	1415.0	<1	1398.9	<1	1474.7	<1
H5I1	1692.2	1.2	1741.5	0.8	1544.3	2.3	1410.3	3.3	1394.1	3.5	1469.9	2.8
H5I2	1694.3	1.2	1743.6	0.8	1546.2	2.2	1411.5	3.3	1395.0	3.5	1471.0	2.8
H6T	1521.8	<1	1568.2	<1	1361.6	0.1	1223.4	1.3	1210.3	1.4	1285.0	0.8
H6I1	1518.3	2.5	1564.6	2.1	1357.5	3.8	1218.6	5.0	1205.4	5.1	1280.2	4.4
H6I2	1520.5	2.4	1566.8	2.1	1359.4	3.8	1219.8	5.0	1206.3	5.1	1281.2	4.4
H7T	1570.1	<1	1622.6	<1	1442.5	<1	1349.5	0.2	1347.7	0.2	1419.0	<1
H7I1	1566.3	2.1	1618.7	1.7	1438.2	3.1	1344.7	3.9	1342.8	3.9	1414.2	3.3
H7I2	1568.4	2.1	1620.7	1.7	1439.9	3.1	1345.6	3.9	1343.6	3.9	1415.0	3.3
H8T	1454.1	<1	1509.9	<1	1349.0	0.2	1300.3	0.6	1313.4	0.5	1379.3	<1
H8I1	1450.1	3.0	1505.8	2.6	1344.5	3.9	1295.4	4.3	1308.6	4.2	1374.4	3.6
H8I2	1452.1	3.0	1507.7	2.5	1346.1	3.9	1296.2	4.3	1309.0	4.2	1375.0	3.6
H9T	1183.9	1.7	1238.8	1.2	1080.9	2.7	1070.6	2.8	1102.2	2.5	1160.0	1.9
H9I1	1179.9	5.4	1234.7	4.9	1076.3	6.4	1065.8	6.5	1097.4	6.2	1155.2	5.6
H9I2	1182.0	5.4	1236.7	4.8	1077.8	6.4	1066.2	6.5	1097.5	6.2	1155.5	5.6
H10T	1353.2	0.2	1399.9	<1	1197.6	1.6	1085.9	2.7	1085.7	2.7	1156.1	2.0
H10I1	1349.7	3.8	1396.2	3.4	1193.4	5.2	1081.0	6.4	1080.8	6.4	1151.2	5.7
H10I2	1351.9	3.8	1398.4	3.4	1195.3	5.2	1082.0	6.3	1081.5	6.3	1152.0	5.6
ST	1311.4	13.2	1343.9	12.9	1090.7	15.3	875.4	17.7	848.1	18.0	926.1	17.1

Table 3: Point of Reception Noise Impact (Daytime)
SunE Westbrook Solar Farm, Westbrook, Ontario

Noise Source ID	Point of Reception R7		Point of Reception R8		Point of Reception R9		Point of Reception R10		Point of Reception R11		Point of Reception R12	
	Distance to R7 (m)	Sound Level at R7 (Leq) (dBA)	Distance to R8 (m)	Sound Level at R8 (Leq) (dBA)	Distance to R9 (m)	Sound Level at R9 (Leq) (dBA)	Distance to R10 (m)	Sound Level at R10 (Leq) (dBA)	Distance to R11 (m)	Sound Level at R11 (Leq) (dBA)	Distance to R12 (m)	Sound Level at R12 (Leq) (dBA)
H1T	1043.8	3.1	1060.1	2.9	1099.4	2.5	1083.5	2.7	1085.1	2.7	1064.2	2.9
H1I1	1038.9	6.8	1055.2	6.6	1094.5	6.2	1078.6	6.4	1080.3	6.4	1059.4	6.6
H1I2	1039.6	6.8	1055.9	6.6	1095.3	6.2	1079.3	6.4	1080.8	6.4	1059.8	6.6
H2T	1008.8	3.5	1028.5	3.3	1058.1	3.0	1054.4	3.0	1061.5	2.9	1048.0	3.1
H2I1	1004.0	7.2	1023.7	7.0	1053.3	6.6	1049.6	6.7	1056.7	6.6	1043.3	6.7
H2I2	1004.3	7.2	1024.0	7.0	1053.7	6.6	1049.8	6.7	1056.9	6.6	1043.3	6.7
H3T	1006.0	3.5	1028.6	3.3	1047.2	3.1	1056.2	3.0	1068.7	2.8	1063.1	2.9
H3I1	1001.4	7.2	1024.0	7.0	1042.5	6.8	1051.7	6.7	1064.2	6.5	1058.7	6.6
H3I2	1001.2	7.2	1023.8	7.0	1042.5	6.8	1051.4	6.7	1063.9	6.5	1058.3	6.6
H4T	1408.3	<1	1429.6	<1	1453.4	<1	1456.4	<1	1465.9	<1	1455.5	<1
H4I1	1403.6	3.4	1424.8	3.2	1448.6	3.0	1451.7	3.0	1461.2	2.9	1450.9	3.0
H4I2	1403.6	3.4	1424.9	3.2	1448.7	3.0	1451.7	3.0	1461.2	2.9	1450.7	3.0
H5T	1486.5	<1	1501.8	<1	1543.4	<1	1524.3	<1	1523.9	<1	1500.1	<1
H5I1	1481.6	2.7	1496.9	2.6	1538.5	2.3	1519.4	2.5	1519.0	2.5	1495.2	2.6
H5I2	1482.4	2.7	1497.7	2.6	1539.4	2.3	1520.1	2.4	1519.7	2.4	1495.9	2.6
H6T	1301.1	0.6	1317.2	0.5	1356.9	0.1	1340.4	0.3	1341.4	0.3	1319.4	0.4
H6I1	1296.2	4.3	1312.3	4.2	1352.1	3.8	1335.5	4.0	1336.5	3.9	1314.6	4.1
H6I2	1297.0	4.3	1313.0	4.2	1352.9	3.8	1336.2	4.0	1337.1	3.9	1315.1	4.1
H7T	1444.9	<1	1462.3	<1	1498.6	<1	1486.4	<1	1489.3	<1	1469.7	<1
H7I1	1440.0	3.1	1457.4	2.9	1493.7	2.7	1481.6	2.7	1484.5	2.7	1464.8	2.9
H7I2	1440.6	3.1	1458.0	2.9	1494.3	2.6	1482.1	2.7	1484.9	2.7	1465.2	2.9
H8T	1419.3	<1	1438.6	<1	1469.1	<1	1464.2	<1	1470.3	<1	1454.9	<1
H8I1	1414.4	3.3	1433.8	3.1	1464.3	2.9	1459.3	2.9	1465.4	2.9	1450.1	3.0
H8I2	1414.8	3.3	1434.1	3.1	1464.7	2.9	1459.6	2.9	1465.7	2.9	1450.3	3.0
H9T	1217.9	1.4	1239.6	1.2	1261.9	1.0	1266.7	0.9	1277.2	0.8	1268.4	0.9
H9I1	1213.2	5.1	1234.9	4.9	1257.1	4.7	1262.0	4.6	1272.6	4.5	1263.8	4.6
H9I2	1213.2	5.1	1234.9	4.9	1257.2	4.7	1262.0	4.6	1272.4	4.5	1263.6	4.6
H10T	1185.5	1.7	1203.6	1.5	1238.0	1.2	1228.4	1.3	1232.6	1.2	1215.0	1.4
H10I1	1180.6	5.4	1198.8	5.2	1233.1	4.9	1223.5	5.0	1227.8	4.9	1210.2	5.1
H10I2	1181.1	5.4	1199.2	5.2	1233.7	4.9	1223.9	5.0	1228.1	4.9	1210.5	5.1
ST	933.1	17.0	948.4	16.8	990.3	16.3	971.0	16.5	971.2	16.5	948.6	16.8

Table 3: Point of Reception Noise Impact (Daytime)

SunE Westbrook Solar Farm, Westbrook, Ontario

Noise Source ID	Point of Reception R13		Point of Reception R14		Point of Reception R15		Point of Reception R16		Point of Reception R17		Point of Reception R18	
	Distance to R13 (m)	Sound Level at R13 (Leq) (dBA)	Distance to R14 (m)	Sound Level at R14 (Leq) (dBA)	Distance to R15 (m)	Sound Level at R15 (Leq) (dBA)	Distance to R16 (m)	Sound Level at R16 (Leq) (dBA)	Distance to R17 (m)	Sound Level at R17 (Leq) (dBA)	Distance to R18 (m)	Sound Level at R18 (Leq) (dBA)
H1T	1054.7	3.0	1295.7	0.7	170.9	20.8	674.2	7.8	699.1	7.4	1418.8	<1
H1I1	1049.8	6.7	1291.4	4.3	169.2	24.6	677.2	11.4	702.3	11.0	1422.8	3.2
H1I2	1050.1	6.7	1290.8	4.4	167.1	24.7	674.9	11.4	700.1	11.0	1420.8	3.2
H2T	1050.9	3.0	1345.7	0.2	335.9	14.6	845.5	5.4	865.5	5.2	1565.8	<1
H2I1	1046.3	6.7	1341.7	3.9	335.7	18.3	848.2	9.0	868.4	8.8	1569.5	2.1
H2I2	1046.1	6.7	1340.8	3.9	333.3	18.4	845.8	9.0	866.0	8.8	1567.4	2.1
H3T	1078.2	2.7	1417.4	<1	512.3	10.6	1020.5	3.4	1037.0	3.2	1719.4	<1
H3I1	1073.9	6.4	1413.8	3.3	512.7	14.2	1022.9	7.0	1039.7	6.8	1723.0	0.9
H3I2	1073.3	6.4	1412.6	3.3	510.2	14.3	1020.4	7.0	1037.3	6.8	1720.8	1.0
H4T	1462.1	<1	1757.4	<1	649.0	8.2	907.9	4.6	899.7	4.7	1463.5	<1
H4I1	1457.5	2.9	1753.3	0.7	646.2	11.9	908.4	8.3	900.5	8.4	1466.2	2.9
H4I2	1457.3	2.9	1752.6	0.7	644.6	11.9	905.9	8.3	898.0	8.4	1463.8	2.9
H5T	1484.4	<1	1673.9	<1	506.5	10.7	463.5	11.6	447.2	11.9	1040.9	3.1
H5I1	1479.5	2.8	1669.2	1.3	501.7	14.4	463.1	15.2	447.5	15.6	1044.2	6.7
H5I2	1480.0	2.8	1669.1	1.3	501.9	14.4	460.7	15.3	445.0	15.6	1041.9	6.8
H6T	1307.3	0.6	1522.7	<1	347.8	14.3	543.0	10.0	547.3	9.9	1211.6	1.4
H6I1	1302.5	4.2	1518.2	2.5	343.4	18.1	544.4	13.6	549.1	13.5	1215.1	5.0
H6I2	1302.8	4.2	1517.8	2.5	343.0	18.1	541.8	13.7	546.6	13.6	1213.0	5.1
H7T	1461.2	<1	1688.5	<1	514.7	10.5	609.4	8.8	597.1	9.0	1178.8	1.7
H7I1	1456.4	3.0	1684.0	1.2	510.3	14.3	609.5	12.5	597.7	12.7	1181.9	5.4
H7I2	1456.6	2.9	1683.6	1.2	509.8	14.3	607.0	12.5	595.2	12.7	1179.5	5.4
H8T	1453.7	<1	1715.2	<1	562.8	9.6	752.1	6.7	742.2	6.8	1314.4	0.5
H8I1	1448.9	3.0	1710.9	1.0	559.2	13.3	752.4	10.3	742.9	10.4	1317.3	4.1
H8I2	1448.9	3.0	1710.3	1.0	558.1	13.4	750.0	10.3	740.4	10.5	1314.9	4.1
H9T	1277.8	0.8	1589.9	<1	543.7	10.0	930.9	4.4	935.3	4.3	1567.2	<1
H9I1	1273.3	4.5	1586.0	1.9	542.0	13.7	932.4	8.0	937.1	7.9	1570.4	2.1
H9I2	1273.0	4.5	1585.0	2.0	539.9	13.7	929.8	8.0	934.5	8.0	1568.1	2.1
H10T	1210.6	1.4	1466.9	<1	330.3	14.8	695.7	7.5	706.1	7.3	1380.1	<1
H10I1	1205.8	5.1	1462.6	2.9	327.4	18.5	697.6	11.1	708.4	10.9	1383.6	3.5
H10I2	1205.9	5.1	1462.0	2.9	325.8	18.6	695.1	11.1	705.9	11.0	1381.5	3.6
ST	936.7	16.9	1174.7	14.4	126.3	36.0	715.4	19.8	748.6	19.3	1485.4	11.8

Table 3: Point of Reception Noise Impact (Daytime)
SunE Westbrook Solar Farm, Westbrook, Ontario

Noise Source ID	Point of Reception R19		Point of Reception R20		Point of Reception R21		Point of Reception R22		Point of Reception V1		Point of Reception V2	
	Distance to R19 (m)	Sound Level at R19 (Leq) (dBA)	Distance to R20 (m)	Sound Level at R20 (Leq) (dBA)	Distance to R21 (m)	Sound Level at R21 (Leq) (dBA)	Distance to R22 (m)	Sound Level at R22 (Leq) (dBA)	Distance to V1 (m)	Sound Level at V1 (Leq) (dBA)	Distance to V2 (m)	Sound Level at V2 (Leq) (dBA)
H1T	1612.6	<1	1653.0	<1	1587.2	<1	1070.8	2.8	1280.7	0.8	1188.4	1.6
H1I1	1616.6	1.7	1657.0	1.4	1591.5	1.9	1065.9	6.5	1278.9	4.5	1186.6	5.3
H1I2	1614.6	1.7	1655.0	1.4	1589.6	1.9	1066.3	6.5	1281.5	4.4	1189.1	5.3
H2T	1756.4	<1	1797.3	<1	1722.1	<1	1058.0	3.0	1100.0	2.5	1008.1	3.5
H2I1	1760.2	0.7	1801.1	0.4	1726.1	0.9	1053.3	6.6	1098.2	6.2	1006.2	7.1
H2I2	1758.1	0.7	1799.0	0.4	1724.2	0.9	1053.3	6.6	1100.7	6.2	1008.7	7.1
H3T	1906.7	<1	1947.9	<1	1865.0	<1	1076.1	2.8	919.7	4.5	828.4	5.6
H3I1	1910.3	<1	1951.5	<1	1868.8	<1	1071.7	6.5	917.8	8.2	826.4	9.3
H3I2	1908.1	<1	1949.4	<1	1866.8	<1	1071.3	6.5	920.3	8.1	828.9	9.3
H4T	1635.0	<1	1676.3	<1	1572.3	<1	1466.5	<1	1137.5	2.1	1059.7	2.9
H4I1	1638.0	1.6	1679.3	1.3	1575.6	2.0	1461.9	2.9	1134.1	5.8	1056.1	6.6
H4I2	1635.7	1.6	1677.0	1.3	1573.3	2.0	1461.7	2.9	1136.4	5.8	1058.3	6.6
H5T	1224.7	1.3	1266.1	0.9	1180.9	1.7	1505.0	<1	1556.3	<1	1471.6	<1
H5I1	1228.2	4.9	1269.6	4.5	1184.7	5.3	1500.2	2.6	1553.5	2.2	1468.6	2.9
H5I2	1226.0	4.9	1267.4	4.6	1182.7	5.3	1500.8	2.6	1555.9	2.2	1471.0	2.8
H6T	1400.0	<1	1441.1	<1	1363.0	0.1	1325.4	0.4	1406.8	<1	1319.0	0.5
H6I1	1403.7	3.4	1444.8	3.0	1367.0	3.7	1320.5	4.1	1404.3	3.4	1316.4	4.1
H6I2	1401.6	3.4	1442.7	3.1	1365.0	3.7	1321.0	4.1	1406.8	3.4	1318.8	4.1
H7T	1358.1	0.1	1399.5	<1	1306.6	0.6	1476.7	<1	1414.1	<1	1331.0	0.3
H7I1	1361.4	3.7	1402.8	3.4	1310.2	4.2	1471.8	2.8	1411.1	3.3	1327.9	4.0
H7I2	1359.1	3.8	1400.6	3.4	1308.0	4.2	1472.2	2.8	1413.5	3.3	1330.3	4.0
H8T	1489.8	<1	1531.2	<1	1432.3	<1	1463.9	<1	1279.6	0.8	1198.6	1.6
H8I1	1492.9	2.7	1534.3	2.3	1435.7	3.1	1459.1	2.9	1276.5	4.5	1195.4	5.2
H8I2	1490.6	2.7	1532.0	2.4	1433.5	3.1	1459.2	2.9	1278.8	4.5	1197.6	5.2
H9T	1747.8	<1	1789.2	<1	1695.9	<1	1280.1	0.8	1028.3	3.3	943.5	4.2
H9I1	1751.1	0.8	1792.5	0.5	1699.5	1.1	1275.5	4.5	1025.6	6.9	940.5	7.9
H9I2	1748.9	0.8	1790.3	0.5	1697.3	1.1	1275.2	4.5	1028.0	6.9	942.9	7.9
H10T	1568.2	<1	1609.3	<1	1529.4	<1	1223.1	1.3	1244.0	1.1	1155.1	2.0
H10I1	1571.8	2.0	1613.0	1.7	1533.4	2.3	1218.3	5.0	1241.7	4.8	1152.7	5.6
H10I2	1569.7	2.1	1610.9	1.8	1531.4	2.4	1218.5	5.0	1244.1	4.8	1155.1	5.6
ST	1681.4	10.3	1721.2	10.0	1663.7	10.4	954.5	16.7	1289.0	13.4	1195.4	14.3

Table 3: Point of Reception Noise Impact (Daytime)
SunE Westbrook Solar Farm, Westbrook, Ontario

Noise Source ID	Point of Reception V3		Point of Reception V4		Point of Reception V5		Point of Reception V6		Point of Reception V7		Point of Reception V8	
	Distance to R25 V3 (m)	Sound Level at V3 (Leq) (dBA)	Distance to V4 (m)	Sound Level at V4 (Leq) (dBA)	Distance to V5 (m)	Sound Level at V5 (Leq) (dBA)	Distance to V6 (m)	Sound Level at V6 (Leq) (dBA)	Distance to V7 (m)	Sound Level at V7 (Leq) (dBA)	Distance to V8 (m)	Sound Level at V8 (Leq) (dBA)
H1T	214.1	18.7	828.2	5.6	943.4	4.2	1275.1	0.8	1045.2	3.1	1250.0	1.1
H1I1	213.2	22.4	832.3	9.2	947.9	7.8	1279.3	4.5	1049.3	6.7	1253.9	4.7
H1I2	210.9	22.5	830.3	9.2	946.2	7.8	1277.5	4.5	1047.4	6.7	1251.9	4.7
H2T	384.8	13.4	973.6	3.9	1070.4	2.8	1411.2	<1	1187.0	1.7	1397.2	<1
H2I1	384.8	17.0	977.3	7.5	1074.5	6.4	1415.1	3.3	1190.8	5.3	1400.9	3.4
H2I2	382.4	17.1	975.2	7.5	1072.7	6.4	1413.2	3.3	1188.7	5.3	1398.8	3.4
H3T	562.4	9.7	1129.5	2.2	1211.4	1.4	1556.6	<1	1338.5	0.3	1551.8	<1
H3I1	562.8	13.3	1132.9	5.8	1215.3	5.0	1560.3	2.1	1342.0	3.9	1555.2	2.2
H3I2	560.3	13.3	1130.7	5.9	1213.2	5.1	1558.2	2.2	1339.8	3.9	1553.0	2.2
H4T	681.8	7.7	909.1	4.6	935.9	4.3	1279.1	0.8	1089.0	2.6	1304.3	0.6
H4I1	679.2	11.4	911.0	8.2	938.7	7.9	1282.1	4.4	1091.5	6.2	1306.9	4.2
H4I2	677.4	11.4	908.5	8.3	936.3	7.9	1279.7	4.4	1089.1	6.3	1304.4	4.2
H5T	503.4	10.8	461.5	11.6	527.3	10.3	872.9	5.1	659.6	8.0	875.2	5.0
H5I1	498.7	14.5	464.1	15.2	531.2	13.9	876.6	8.7	662.9	11.6	878.4	8.6
H5I2	498.7	14.5	461.6	15.3	529.1	13.9	874.5	8.7	660.6	11.6	876.1	8.7
H6T	359.0	14.0	621.3	8.6	710.9	7.2	1052.6	3.0	831.0	5.6	1043.7	3.1
H6I1	354.9	17.8	624.6	12.2	715.0	10.8	1056.5	6.6	834.7	9.2	1047.2	6.7
H6I2	354.1	17.8	622.4	12.3	713.1	10.8	1054.5	6.6	832.6	9.2	1045.0	6.7
H7T	526.6	10.3	609.0	8.8	656.4	8.1	1003.4	3.5	799.2	6.0	1015.5	3.4
H7I1	522.5	14.0	611.3	12.4	659.7	11.7	1006.8	7.1	802.2	9.6	1018.4	7.0
H7I2	521.8	14.0	608.8	12.5	657.5	11.7	1004.5	7.2	799.8	9.6	1016.0	7.0
H8T	586.7	9.2	752.7	6.6	788.3	6.2	1133.9	2.2	937.2	4.3	1153.2	2.0
H8I1	583.3	12.9	754.8	10.3	791.4	9.7	1137.1	5.8	939.9	7.9	1155.9	5.6
H8I2	582.0	12.9	752.3	10.3	789.0	9.8	1134.8	5.8	937.5	7.9	1153.5	5.6
H9T	585.7	9.2	988.9	3.7	1046.2	3.1	1393.2	<1	1186.6	1.7	1402.6	<1
H9I1	584.3	12.9	991.6	7.3	1049.6	6.7	1396.6	3.4	1189.7	5.3	1405.7	3.4
H9I2	582.1	12.9	989.2	7.3	1047.4	6.7	1394.4	3.5	1187.4	5.3	1403.3	3.4
H10T	363.4	13.9	789.8	6.1	876.3	5.0	1219.7	1.4	999.4	3.6	1212.2	1.4
H10I1	361.0	17.6	793.2	9.7	880.3	8.6	1223.5	5.0	1003.0	7.2	1215.7	5.0
H10I2	359.2	17.7	791.0	9.8	878.4	8.6	1221.5	5.0	1000.9	7.2	1213.6	5.1
ST	176.9	32.9	901.1	17.3	1029.5	15.9	1352.1	12.9	1119.0	15.0	1317.2	13.2

Table 3: Point of Reception Noise Impact (Daytime)
SunE Westbrook Solar Farm, Westbrook, Ontario

Noise Source ID	Point of Reception V9		Point of Reception V10		Point of Reception V11		Point of Reception V12		Point of Reception V13		Point of Reception V14	
	Distance to V9 (m)	Sound Level at V9 (Leq) (dBA)	Distance to V10 (m)	Sound Level at V10 (Leq) (dBA)	Distance to V11 (m)	Sound Level at V11 (Leq) (dBA)	Distance to V12 (m)	Sound Level at V12 (Leq) (dBA)	Distance to V13 (m)	Sound Level at V13 (Leq) (dBA)	Distance to V14 (m)	Sound Level at V14 (Leq) (dBA)
H1T	1032.7	3.2	1068.0	2.9	1966.2	<1	2135.1	<1	832.3	5.6	1954.0	<1
H1I1	1037.1	6.8	1072.4	6.4	1970.4	<1	2138.6	<1	827.9	9.3	1958.8	<1
H1I2	1035.4	6.8	1070.7	6.5	1971.0	<1	2139.8	<1	829.6	9.2	1958.7	<1
H2T	1161.0	1.9	1198.0	1.6	1930.5	<1	2050.2	<1	727.3	7.0	1972.2	<1
H2I1	1165.1	5.5	1202.1	5.2	1935.0	<1	2053.9	<1	722.5	10.7	1977.1	<1
H2I2	1163.2	5.5	1200.2	5.2	1935.4	<1	2055.0	<1	723.8	10.7	1976.7	<1
H3T	1302.1	0.6	1340.2	0.3	1911.6	<1	1978.4	<1	656.6	8.1	2006.7	<1
H3I1	1306.0	4.2	1344.0	3.9	1916.2	<1	1982.4	<1	651.7	11.8	2011.6	<1
H3I2	1303.9	4.2	1341.9	3.9	1916.3	<1	1983.3	<1	652.4	11.8	2011.0	<1
H4T	1022.1	3.3	1061.2	2.9	1517.1	<1	1649.9	<1	1072.1	2.8	1591.0	<1
H4I1	1025.0	6.9	1064.1	6.5	1521.6	2.4	1653.4	1.4	1067.2	6.5	1595.9	1.9
H4I2	1022.7	7.0	1061.8	6.6	1522.0	2.4	1654.6	1.4	1067.9	6.5	1595.3	1.9
H5T	618.1	8.7	656.1	8.1	1642.2	<1	1913.6	<1	1267.9	0.9	1548.4	<1
H5I1	621.9	12.3	659.9	11.7	1646.0	1.5	1916.4	<1	1263.3	4.6	1553.0	2.2
H5I2	619.9	12.3	657.8	11.7	1647.0	1.5	1918.0	<1	1264.7	4.6	1553.1	2.2
H6T	801.5	6.0	838.6	5.5	1754.6	<1	1974.6	<1	1075.5	2.8	1707.3	<1
H6I1	805.6	9.6	842.7	9.1	1758.7	0.7	1977.7	<1	1071.0	6.5	1712.0	1.0
H6I2	803.7	9.6	840.7	9.1	1759.5	0.7	1979.1	<1	1072.5	6.4	1712.0	1.0
H7T	745.9	6.7	784.7	6.2	1587.0	<1	1817.2	<1	1186.7	1.7	1547.8	<1
H7I1	749.3	10.3	788.2	9.8	1591.1	1.9	1820.2	0.3	1182.0	5.4	1552.5	2.2
H7I2	747.1	10.4	785.9	9.8	1591.9	1.9	1821.8	0.3	1183.2	5.3	1552.4	2.2
H8T	876.2	5.0	915.3	4.6	1546.4	<1	1732.2	<1	1122.8	2.3	1561.3	<1
H8I1	879.4	8.6	918.4	8.1	1550.6	2.2	1735.4	0.9	1118.0	6.0	1566.1	2.1
H8I2	877.1	8.6	916.1	8.2	1551.2	2.2	1736.8	0.9	1119.0	6.0	1565.8	2.1
H9T	1135.7	2.2	1174.6	1.8	1702.1	<1	1803.6	<1	879.1	5.0	1784.3	<1
H9I1	1139.2	5.8	1178.0	5.4	1706.7	1.1	1807.3	0.4	874.2	8.7	1789.2	0.5
H9I2	1137.0	5.8	1175.8	5.4	1706.9	1.1	1808.4	0.4	874.9	8.7	1788.6	0.5
H10T	967.1	3.9	1004.6	3.5	1794.6	<1	1963.7	<1	925.5	4.4	1798.2	<1
H10I1	971.1	7.5	1008.6	7.1	1798.9	0.4	1967.1	<1	920.8	8.1	1803.0	0.4
H10I2	969.1	7.6	1006.6	7.1	1799.4	0.4	1968.4	<1	922.2	8.1	1802.8	0.4
ST	1117.1	15.0	1151.0	14.7	2086.9	7.6	2247.5	6.7	755.6	19.2	2073.8	7.7

Table 3: Point of Reception Noise Impact (Daytime)
SunE Westbrook Solar Farm, Westbrook, Ontario

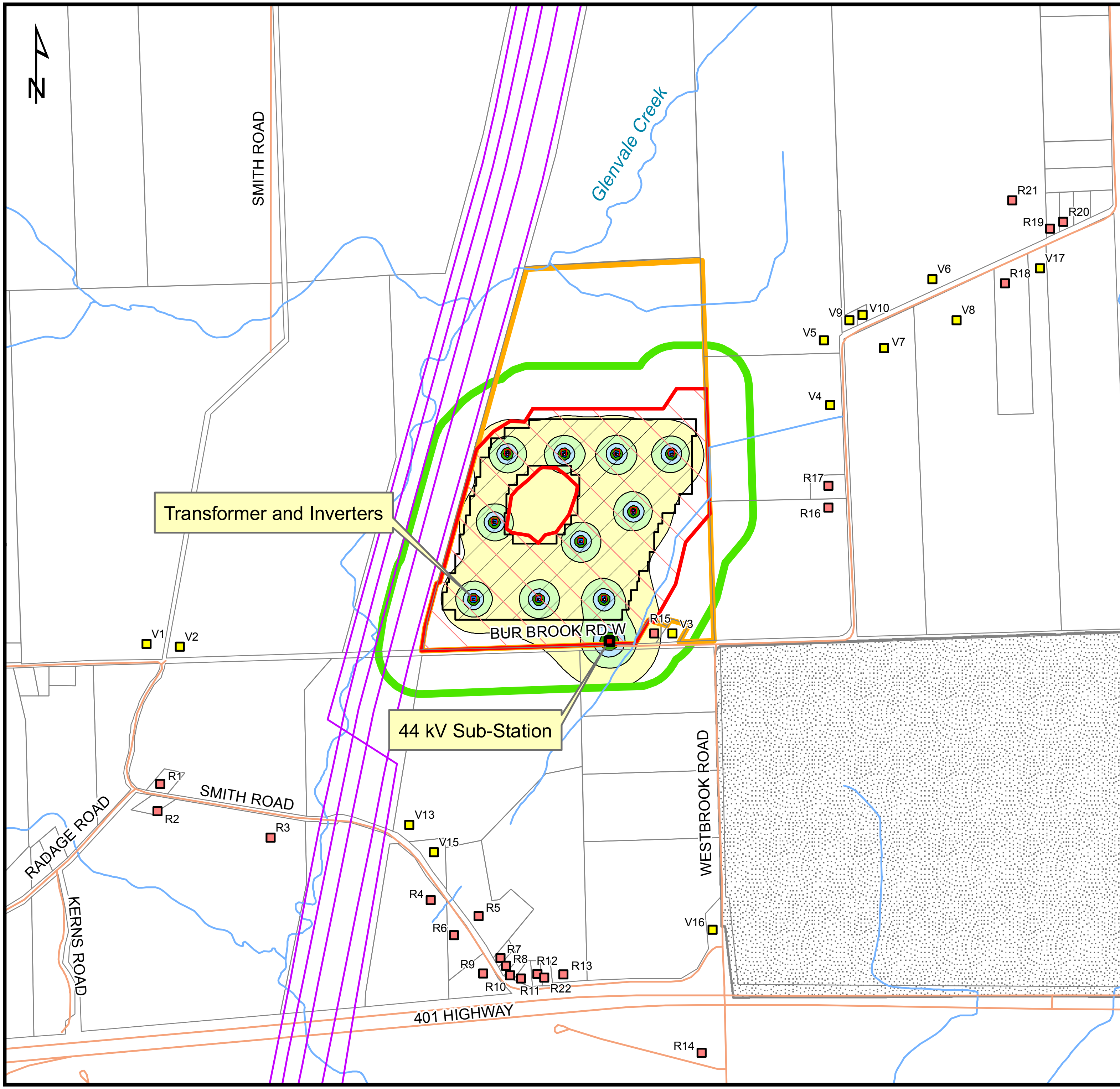
Noise Source ID	Point of Reception V15		Point of Reception V16		Point of Reception V17		Point of Reception V18		Point of Reception V19	
	Distance to V15 (m)	Sound Level at V15 (Leq) (dBA)	Distance to V16 (m)	Sound Level at V16 (Leq) (dBA)	Distance to V17 (m)	Sound Level at V17 (Leq) (dBA)	Distance to V18 (m)	Sound Level at V18 (Leq) (dBA)	Distance to V19 (m)	Sound Level at V19 (Leq) (dBA)
H1T	852.0	5.3	972.9	3.9	1522.1	<1	2004.3	<1	1975.3	<1
H1I1	847.4	9.0	968.8	7.6	1525.9	2.4	2008.4	<1	1980.1	<1
H1I2	848.8	9.0	968.1	7.6	1523.9	2.4	2009.2	<1	1979.8	<1
H2T	766.1	6.5	1043.8	3.1	1670.6	<1	1958.5	<1	2002.9	<1
H2I1	761.3	10.2	1040.2	6.8	1674.3	1.3	1962.9	<1	2007.7	<1
H2I2	762.3	10.1	1039.1	6.8	1672.2	1.3	1963.4	<1	2007.2	<1
H3T	717.0	7.2	1139.5	2.1	1825.2	<1	1928.9	<1	2046.3	<1
H3I1	712.1	10.9	1136.5	5.8	1828.6	0.2	1933.4	<1	2051.2	<1
H3I2	712.5	10.9	1135.0	5.8	1826.5	0.2	1933.7	<1	2050.4	<1
H4T	1132.0	2.2	1447.5	<1	1569.7	<1	1544.1	<1	1631.3	<1
H4I1	1127.2	5.9	1443.7	3.1	1572.5	2.0	1548.5	2.2	1636.2	1.6
H4I2	1127.6	5.9	1442.7	3.1	1570.1	2.1	1549.0	2.2	1635.5	1.6
H5T	1295.0	0.7	1334.7	0.3	1147.2	2.0	1698.9	<1	1559.2	<1
H5I1	1290.3	4.4	1330.1	4.0	1150.5	5.7	1702.5	1.1	1563.9	2.1
H5I2	1291.6	4.3	1329.9	4.0	1148.2	5.7	1703.7	1.1	1563.9	2.1
H6T	1102.7	2.5	1189.3	1.6	1317.1	0.5	1801.6	<1	1724.8	<1
H6I1	1098.0	6.2	1184.9	5.3	1320.6	4.1	1805.5	0.4	1729.6	0.9
H6I2	1099.3	6.2	1184.4	5.3	1318.5	4.1	1806.4	0.4	1729.4	0.9
H7T	1224.2	1.3	1356.3	0.1	1285.3	0.8	1634.8	<1	1568.8	<1
H7I1	1219.4	5.0	1351.9	3.8	1288.4	4.4	1638.7	1.6	1573.7	2.0
H7I2	1220.5	5.0	1351.4	3.8	1286.1	4.4	1639.6	1.5	1573.4	2.0
H8T	1171.0	1.8	1392.6	<1	1420.9	<1	1584.6	<1	1591.9	<1
H8I1	1166.1	5.5	1388.4	3.5	1423.8	3.2	1588.7	1.9	1596.8	1.9
H8I2	1166.9	5.5	1387.7	3.5	1421.4	3.2	1589.4	1.9	1596.3	1.9
H9T	938.4	4.3	1291.1	0.7	1673.7	<1	1724.6	<1	1823.8	<1
H9I1	933.6	8.0	1287.5	4.4	1676.9	1.3	1729.1	0.9	1828.7	0.2
H9I2	934.0	8.0	1286.3	4.4	1674.6	1.3	1729.5	0.9	1827.9	0.2
H10T	960.9	4.0	1146.0	2.1	1485.7	<1	1831.5	<1	1823.9	<1
H10I1	956.0	7.7	1141.9	5.7	1489.2	2.7	1835.7	0.2	1828.8	0.2
H10I2	957.1	7.7	1141.1	5.7	1487.0	2.7	1836.4	0.2	1828.4	0.2
ST	764.0	19.1	854.0	17.9	1586.6	11.0	2124.0	7.4	2093.9	7.6

Table 4: Acoustic Assessment Summary Table
SunE Westbrook Solar Farm, Westbrook, Ontario

Point of Reception ID	Coordinates (height 4.5 m)		Daytime Sound Level at Point of Reception (Leq, dBA)	Verified by Acoustic Audit (Yes/No)	Performance Limit (Leq) (dBA)	Compliance with Performance Limit (Yes/No)	Nithtime Sound Level at Point of Reception (Leq, dBA)	Verified by Acoustic Audit (Yes/No)	Performance Limit (Leq) (dBA)	Compliance with Performance Limit (Yes/No)
	X (m)	Y (m)								
R1	368452.8	4905660.5	19.3	No	45	Yes	15.1	No	40	Yes
R2	368445.2	4905583.4	18.9	No	45	Yes	14.7	No	40	Yes
R3	368759.6	4905509.6	20.8	No	45	Yes	16.9	No	40	Yes
R4	369205.6	4905336.6	22.1	No	45	Yes	18.8	No	40	Yes
R5	369338.7	4905291.1	22.2	No	45	Yes	19.1	No	40	Yes
R6	369271.0	4905237.8	21.4	No	45	Yes	18.2	No	40	Yes
R7	369399.9	4905174.5	21.1	No	45	Yes	18.1	No	40	Yes
R8	369415.8	4905153.2	20.9	No	45	Yes	17.9	No	40	Yes
R9	369352.3	4905130.9	20.6	No	45	Yes	17.4	No	40	Yes
R10	369426.1	4905126.4	20.7	No	45	Yes	17.6	No	40	Yes
R11	369457.7	4905117.3	20.7	No	45	Yes	17.6	No	40	Yes
R12	369503.2	4905129.7	20.8	No	45	Yes	17.8	No	40	Yes
R13	369575.4	4905129.1	20.9	No	45	Yes	17.9	No	40	Yes
R14	369960.6	4904911.0	18.5	No	45	Yes	15.5	No	40	Yes
R15	369827.3	4906078.6	37.4	No	45	Yes	36.3	No	40	Yes
R16	370313.5	4906429.8	26.3	No	45	Yes	21.9	No	40	Yes
R17	370313.5	4906490.2	26.3	No	45	Yes	21.6	No	40	Yes
R18	370804.1	4907053.9	18.8	No	45	Yes	14.1	No	40	Yes
R19	370929.9	4907206.5	17.2	No	45	Yes	12.6	No	40	Yes
R20	370966.9	4907225.3	16.9	No	45	Yes	12.3	No	40	Yes
R21	370825.3	4907285.0	17.5	No	45	Yes	12.8	No	40	Yes
R22	369522.2	4905119.8	20.8	No	45	Yes	17.8	No	40	Yes
V1	368413.9	4906049.3	20.2	No	45	Yes	15.6	No	40	Yes
V2	368507.6	4906041.5	21.1	No	45	Yes	16.5	No	40	Yes
V3	369878.4	4906079.3	34.9	No	45	Yes	33.3	No	40	Yes
V4	370317.9	4906715.7	25.3	No	45	Yes	20.2	No	40	Yes
V5	370300.8	4906895.2	24.2	No	45	Yes	19	No	40	Yes
V6	370602.8	4907066.1	20.3	No	45	Yes	15.4	No	40	Yes
V7	370468.0	4906873.6	22.6	No	45	Yes	17.7	No	40	Yes
V8	370669.6	4906951.8	20.3	No	45	Yes	15.6	No	40	Yes
V9	370371.7	4906951.8	23	No	45	Yes	17.9	No	40	Yes
V10	370407.9	4906966.8	22.6	No	45	Yes	17.5	No	40	Yes
V11	369215.2	4908086.1	15.6	No	45	Yes	10.5	No	40	Yes
V12	368619.8	4908026.3	14.5	No	45	Yes	9.4	No	40	Yes
V13	369146.5	4905545.7	24	No	45	Yes	20.5	No	40	Yes
V14	369793.6	4908128.9	15.6	No	45	Yes	10.5	No	40	Yes
V15	369215.0	4905469.1	23.6	No	45	Yes	20.3	No	40	Yes
V16	369990.6	4905253.0	21.6	No	45	Yes	18.8	No	40	Yes
V17	370902.0	4907096.0	17.9	No	45	Yes	13.3	No	40	Yes
V18	369098.4	4908093.3	15.4	No	45	Yes	10.3	No	40	Yes
V19	369899.0	4908141.7	15.4	No	45	Yes	10.4	No	40	Yes

Appendix A

Site Location Map



Substation Transformer

Transformer

Inverter

Noise Receptor

Vacant Lot Receptor

Hydro Line

Road

Watercourse

Parcel

Pit or Quarry

Project Location

Property Area

120 m Area of Influence

Proposed Solar Panel Area

Hourly Sound Exposure

> 35 dBA

> 40 dBA

> 45 dBA

> 50 dBA

> 55 dBA

> 60 dBA

Sun Edison simplifying solar

GENIVAR

Scale:

0 100 200 300 400 500 m

1:15,000

Project:

SunE Westbrook Solar Farm

Title:

Westbrook Site
Noise Analysis

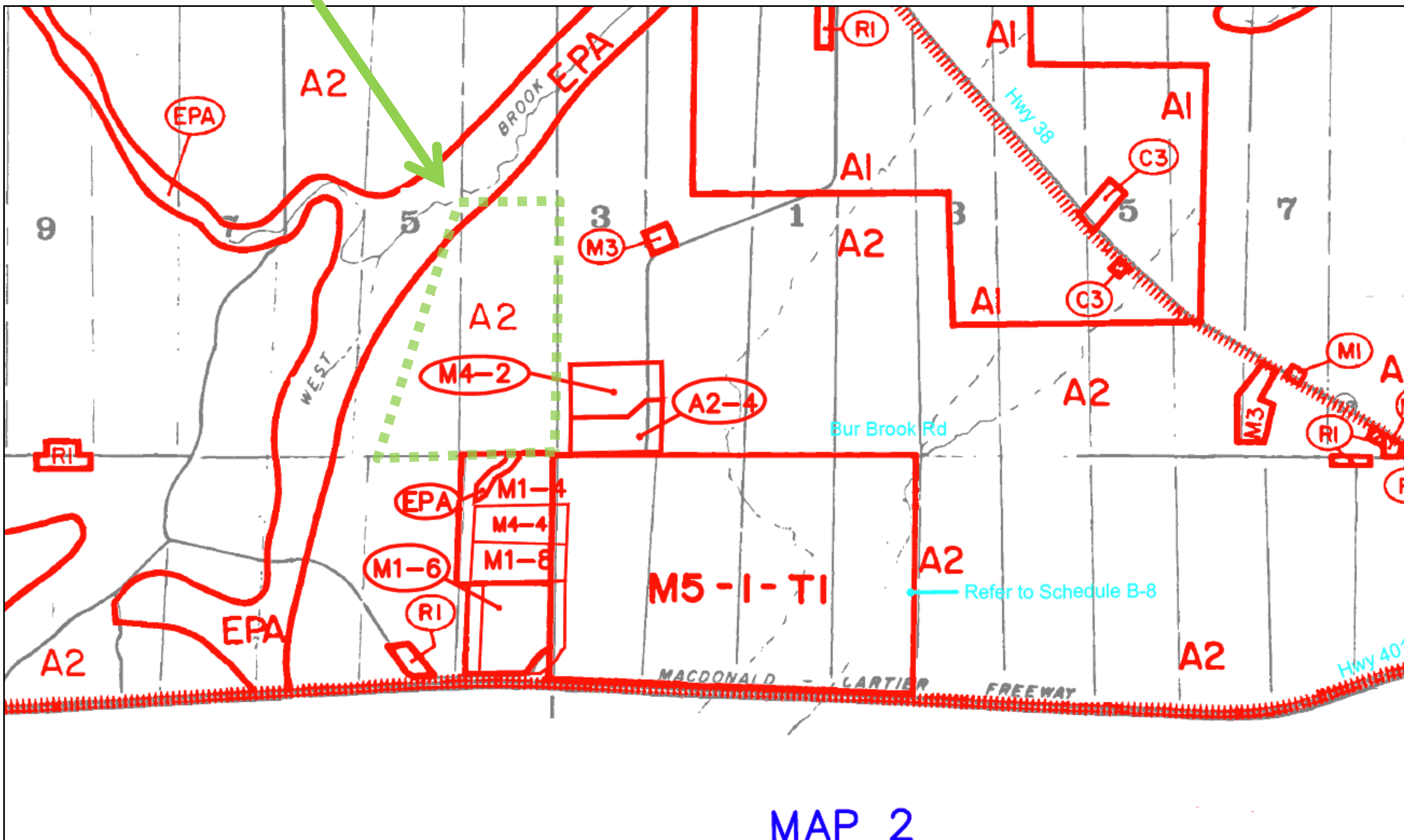
Project No.:	Date:
111-18734-00	January 17, 2012
Revision No.:	Drawing No.:
0	1

Appendix B

Zoning / Land-Use Information

SunE Westbrook Solar Farm

Zoning: A2 and EPA



Appendix C

Satcon 500kW Inverter Datasheets

Satcon®

PVS-500 (MVT)

PVS-500 (480 V)

PVS-500 (265 V) CE

Peak Efficiency 97.6%

Power Efficiency

Power Level	Output Power[1]	Efficiency[2]
10%	50 kW	92.2%
20%	100 kW	95.6%
30%	150 kW	96.2%
50%	250 kW	96.5%
75%	375 kW	96.4%
100%	500 kW	96.0%

[1] 320V minimum [2] 480V model

Power Efficiency without Transformer

Power Level	Output Power[1]	Efficiency
10%	50 kW	97.08%
20%	100 kW	97.52%
30%	150 kW	97.58%
50%	250 kW	97.46%
75%	375 kW	97.09%
100%	500 kW	96.52%

[1] 310V minimum

Unparalleled Performance

With their advanced system intelligence, next-generation Edge™ MPPT technology, and industrial-grade engineering, PowerGate Plus inverters maximize system uptime and power production, even in cloudy conditions.

Edge MPPT

Provides rapid and accurate control that boosts PV plant kilowatt yield

Provides a wide range of operation across all photovoltaic cell technologies

Printed Circuit Board Durability

Wide thermal operating range: -40° C (-40° F) to 85° C (185° F)

Conformal coated to withstand extreme humidity and air-pollution levels

PV Inverters | PowerGate® Plus 500 kW

Profitable PV Power

The Satcon® PowerGate® Plus 500 kW PV inverter has a significant impact on the profitability dynamic of large-scale solar PV systems. With its unparalleled system intelligence, next-generation Edge™ MPPT technology, and industrial-grade engineering, the PowerGate Plus 500 kW inverter maximizes system uptime and power production, even in the harshest environments.

Commercial and Utility Scale

The world's largest solar power installations depend on Satcon PowerGate Plus PV inverters to provide efficient and stable power—even in the harshest climates.

Advanced, Rugged, and Reliable

Engineered from the ground up to meet the demands of large-scale installations, Satcon PV inverters feature an outdoor-rated enclosure, advanced monitoring and control capabilities, and Edge,™ Satcon's next-generation MPPT solution.

Proven Performance

The proven leader in solar PV inverter solutions for commercial installations, Satcon sets the standards for efficient large-scale power conversion.

Increased PV Plant Yield

At the heart of PowerGate Plus is Edge, Satcon's next-generation power optimization solution. With rapid and accurate MPPT control, Edge increases PV plant kilowatt yield by extending the production window of arrays, enabling them to operate at optimal voltage and current levels for longer periods of time—even in varied sun conditions. To maximize efficiency, Edge improves the performance of all PV technologies, including fixed and tracking solar arrays, enabling you to get the most from your investment.

Satcon®

PowerGate® Plus 500 kW

Proven Reliability

Rugged and reliable, PowerGate Plus PV inverters are engineered from the ground up to meet the demands of large-scale installations.

Low Maintenance

Modular components make service efficient

Dual cooling fans

Safety

UBC Seismic Zone 4 compliant

Built-in DC and AC disconnect switches

Integrated DC two-pole disconnect switch isolates the inverter (with the exception of the GFDI circuit) from the photovoltaic power system to allow inspection and maintenance

Protective covers over exposed power connections

PowerGate Plus 500 kW Specifications			UL/CSA	CE
Input Parameters				
Maximum Array Input Voltage	600 VDC		●	
	900 VDC			●
PV Array Configuration	Positive Ground		○	○
	Negative Ground		●	○
	Floating			●
Input Voltage Range (MPPT; Full Power)	320/333–600 VDC	200/208 VAC[1]	●	
	420–850 VDC	265 VAC[1]		●
	320–600 VDC	480 VAC	●	
Maximum Input Current	1,628 ADC/ 1,565 ADC	200/208 VAC[1]	●	
	1,228 ADC	265 VAC[1]		●
	1,628 ADC	480 VAC	●	
Output Parameters				
Output Voltage Range (L-L)	176–220 VAC/ 183-229 VAC	200/208 VAC[1]	●	
	233–292 VAC	265 VAC[1]		●
	422–528 VAC	480 VAC	●	
Nominal Output Voltage	200/208 VAC[1]		●	
	265 VAC[1]			●
	480 VAC		●	
Output Frequency Range	59.3–60.5 Hz		●	
	49.3–50.5 Hz			●
AC Voltage Range (Standard)	-12%/+10%		●	●
Nominal Output Frequency	60 Hz		●	
	50 Hz			●
Number of Phases	3		●	●
Maximum Output Current per Phase	1,443/1,388 A	200/208 VAC[1]	●	
	1090 A	265 VAC[1]		●
	602 A	480 VAC	●	

● Standard ○ Optional

The integrated external transformer is standard on the 480 VAC models only; custom transformer solutions are also available.

Satcon®

PowerGate® Plus 500 kW

Streamlined Design

With all components encased in a single, space-saving enclosure, PowerGate Plus PV inverters are easy to install, operate, and maintain.

Single Cabinet with Small Footprint

Convenient access to all components

Large in-floor cable glands make access to DC and AC cables easy

Rugged Construction

Engineered for outdoor environments

Output Transformer

Provides galvanic isolation

Matches the output voltage of the PV inverter to the grid

Quiet Operation

65 dB(A) standard

PowerGate Plus 500 kW Specifications			UL/CSA	CE
Peak Efficiency	**97.6%**			
CEC-Weighted Efficiency[3]	97%	200/208 VAC[1]	•	
	97%	265 VAC[1]		•
	96%	480 VAC	•	
Maximum Continuous Output Power	500 kW (500 kVA)		•	•
Tare Losses	138.12 W	200/208 VAC[1]	•	
	170 W	265 VAC[1]		•
	138.12 W	480 VAC	•	
Power Factor at Full Load	>0.99		•	•
Harmonic Distortion	<3% THD		•	•
Temperature				
Operating Ambient Temperature Range (Full Power)	-20° C to +50° C		•	•
Storage Temperature Range	-30° C to +70° C		•	•
Cooling	Forced Air		•	•
Noise				
Noise Level	<65 dB(A)		•	•
Combiner				
Number of Inputs and Fuse Rating (2 fuses/input for floating)	20 (160 ADC)		o	
	30 (100 ADC)		o	
	20 (160 ADC)			o
	20 (125 ADC)			o
Transformer				
Integrated External Transformer		480 VAC	•	
Low Tap Voltage[2]	20%		•	
External Transformer[2]			o	o
Inverter and Integrated External Transformer Cabinets				
Enclosure Rating	NEMA 3R		•	
	IP54			•
Enclosure Finish (11 Gauge CRS, painted, base zinc coated)	RAL-7032		•	•
Stainless Steel Finish			o	o
Cabinet Dimensions (Height x Width x Depth)	Inverter		92.6″ x 138.8″ x 43.1″ (235 cm x 352 cm x 109 cm)	92.6″ x 153.8″ x 43.1″ (235 cm x 391 cm x 109 cm)
	Transformer	480 VAC	77″ x 49″ x 30.5″ (195.58 cm x 124.46 cm x 77.47 cm)	
Cabinet Weight	Inverter		5,900 lbs.	2,676 kg
	Transformer	480 VAC	3,200 lbs.	1,451 kg

• Standard o Optional

PowerGate® Plus 500 kW

Satcon®

Output Options

PowerGate Plus 500 kW	
UL/CSA	208 VAC[1] Output
	480 VAC Output
CE	265 VAC[1] Output

[1] External transformer

PowerGate Plus 500 kW Specifications	UL/CSA	CE
Testing and Certification		
UL1741, CSA 107.1-01, IEEE 1547, IEEE C62.41.2, IEEE C62.45, IEEE C37.90.1, IEEE C37.90.2	●	
CE Certification (EN 50178, EN 61000-6-2, EN 61000-6-4)		●
UBC Zone 4 Seismic Rating	●	●
Warranty		
Five Years	●	●
Extended Warranty (up to 10, 15, or 20 years)	○	○
Extended Service Agreement	○	○
Uptime Guarantee	○	○
Intelligent Monitoring		
Satcon PV View® Plus	○	○
Satcon PV Zone	○	○
Third-Party Compatibility	●	●

● Standard
○ Optional

[1] Options designed to be used with external transformer.

[2] The 20% boost tap on the isolation transformer increases the AC voltage output range for applications where the solar array DC operating voltage is at or near the lower end of the DC input range. This boost allows for continued inverter operation at lower DC voltage input levels.

[3] For 265 VAC and 200/208 VAC models efficiency is listed as "Inverter Only" efficiency.

Note: Specifications are subject to change.

PG500210.1

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Prism MVP 1

Two-piece, pre-packaged MV system for grounded 1,000VDC arrays:

- 2 x PVS-500kW NEMA 1 inverters
- Prefabricated weather-tight outdoor enclosure with dual entrances houses inverters
- Corresponding 1000kVA transformer with dual secondary-side windings and integral MV disconnect switch
- Transformer configurable to meet any primary side voltage
- Two-piece installation allows for separation of the inverter and transformer to suit site requirements

Prism MVP 2

One piece, factory integrated MV system for grounded 1,000 VDC arrays:

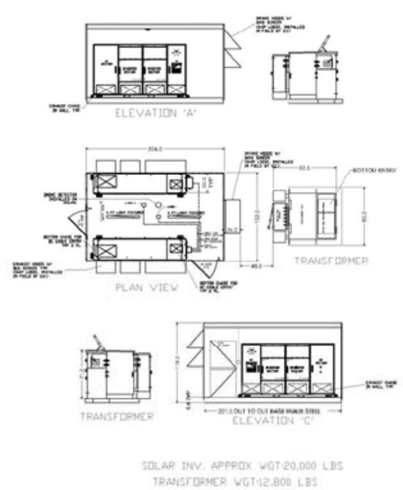
- 2 x PVS-500 kW NEMA 1 inverters
- Prefabricated weather-tight outdoor enclosure with dual entrances houses inverters
- Corresponding 1000 kVA transformer with dual secondary-side windings and integral MV disconnect switch
- Transformer configurable to meet any primary side voltage
- One piece design with inverter and transformer on same transportable chassis allows for "ship and drop" installation with minimal site preparation

Satcon Prism 1 MW Medium Voltage Solution

Satcon Prism a fully integrated one megawatt medium voltage (MV) solution optimized for utility scale solar PV installations. Leveraging Satcon's industry standard setting PowerGate® Plus 500kW solar PV inverters, Prism is a utility grade one megawatt platform, complete with factory integrated step-up transformers, MV disconnect switches, and power conversion electronics.

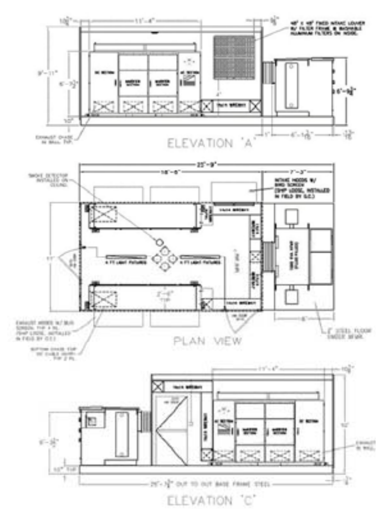
The solution is delivered in two configurations; both complete with an all-climate outdoor enclosure and ready to connect to the PV array and utility grid, enabling rapid installation through a modular prepackaged design.

Satcon Prism MVP 1



Two-Piece, pre-packaged MV system for grounded 1,000VDC array systems

Satcon Prism MVP 2



Pre-packaged, 1MW, integrated, one – piece MV solution for grounded, 1,000VDC PV array systems

● Standard ○ Optional

Appendix D

Inverter Sound Level Testing

VACC, Inc. dba
Vibro-Acoustic Consultants

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San Francisco • CA • 94•02 • USA
Tel / Fax: (+•) 4•5-693-0424 / •398
http://www.va-consult.com

Inverter Sound Power Level Testing

Advanced Energy Industries, Fort Collins, CO

Prepared by: **Tyler Rynberg, PE**

Vibro-Acoustic Consultants

tyler@va-consult.com

Date: **14 April 2010**

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1. Background

Advanced Energy Industries (AEI) wishes to document the sound power levels generated by the Solaron 500, a 500 kW inverter. AEI has requested that the testing of the fuel cell be performed per the ISO 3744•1994 Standard. We visited the AEI facility on Thursday, 1 April 2010, to perform the testing.

Since sound power is a property of the source being tested (rather than the cumulative result of multiple sources interacting with the environment), these data are applicable to many different installation conditions. In this document, we report the measured sound power levels and sound pressure levels and provide commentary on how we would insert this source into computer•based noise propagation models.

2. Description of Inverter

The device under test was designated as Solaron 500 model number 3159500•0000 A1 (with 3R enclosure), a 500 kW inverter, manufactured by AEI in March 2010. The inverter had a serial number of 750385 F/R A1. The inverter was 1.83m wide x 0.97m deep x 2m high.

The inverter was mounted on a rigid wood platform constructed using 2x4 studs and rigid foam. The platform raised the inverter 0.2m off the floor. The reference box established for the inverter had the following dimensions: L1 = 1.83m, L2 = 0.97m, L3 = 2.21m.

The inverter was supplied DC input voltage by power generation equipment located in an adjacent room.

3. General Methodology

We measured the sound pressure levels generated by the inverter per the ISO 3744•1994 Standard. During the measurements, we collected the overall un•weighted equivalent continuous sound level (L_{EQ}), as well as the un•weighted 1/3•octave band spectra from both the inverter and ambient conditions. The measurement duration at each microphone position was 60 seconds.

To measure the inverter, we established a parallelepiped measurement surface 1 meter from the reference box. The resultant measurement surface had the following dimensions: L1 = 3.83m, L2 = 2.97m, L3 = 3.21m, and totaled 55.01 square meters. We used 9 microphone positions, per Figure C2 of the ISO 3744•1994 Standard. For all 9 positions, the fixed microphone position technique was used.

We tested four operating configurations of the inverter. As an exploratory test, we also measured a fifth configuration at only one microphone position. The tested configurations are shown in the following table:

Configuration	Input Voltage	Output Power	Blower Setting
1	790V	100% (500kW)	Maximum
2	850V	100% (500kW)	Maximum
3	730~745V[1]	100% (500kW)	Maximum
4	790V	50% (250kW)	Maximum
5	850V	50% (250kW)	Maximum

[1]During this measurement, the voltage regulator was not operating properly. The input voltage was observed to oscillate between 730V and 745V.

We understand from our discussions with AEI personnel that the operating conditions tested are representative of a real•world installation.

4. Data Collection

4.1 Measurement System Parameters

We measured the sound power levels using our standard testing suite:

Instrument	Make / Model	Identification
Microphone Calibrator	Bruel & Kjaer 4231	S/N 2292439
Noise Meter	Norsonic N-140	S/N 1403581
Microphone Preamplifier	Norsonic N-1209	S/N 12749
Microphone	Norsonic N-1225	S/N 96063

The noise meter was calibrated to 94 dB at 1 kHz before and after the measurements. The microphone windscreen was used. The Norsonic N•140 has an internal correction filter to correct for the effects of the windscreen.

4.2 Measurement Locations and Site Conditions

We collected data in the Solaron testing lab adjacent to the main fabrication area at the AEI facility in Fort Collins, CO. The testing lab measured approximately 13.41m x 19.51m x 3.35m. The floor is an exposed concrete slab; three of the walls are constructed using vinyl•faced gypsum board on stud•framing; the remaining wall was open to the main fabrication area; the ceiling is a suspended grid containing vinyl•faced gypsum board panels. The testing area contains several workstations and other inverters. The inverter was placed near the center of the testing lab space, at least 5.5m from any of the lab walls. No workstations or other inverters were located within 4m of the inverter. However, the top of the inverter was only 1.14m below the suspended gypsum board ceiling. In an effort to reduce the effects of the ceiling on the measurements, several ceiling tiles above the inverter were removed. This roof deck is approximately 2.8m above the suspended ceiling, providing a vertical clearance of 3.9m.

The temperature in the fabrication area was estimated to be 22°C. The relative humidity was typical of an indoor air•conditioned environment.

4.3 Qualification of Acoustical Environment

Ambient Noise Correction Factor K_1

In the majority of 1/3 octave bands, the ambient noise levels were greater than 6 dB below the test conditions. In the 50~80Hz, 630Hz, and 2~6.3kHz 1/3 octave bands, the ambient noise was frequently only 1~4 dB below the test conditions. Generally, the "middle" four measurement positions had a greater signal•to•noise ratio than the "top" five positions.

Acoustical Correction Factor K_2

The reflecting plane extended a minimum of 4.5m from the measurement surface in all directions, which meets the ISO•3744 Standard for the 50 Hz lower boundary of the presented data. The reflecting plane was concrete slab•on•grade and was estimated to have an absorption coefficient of 0.05 or less in the frequency bands of interest.

The Approximate Method was used to determine the environmental correction factor, K_2. Our calculations show that the highest value for K_2 is 9.6 dB and occurs in the 500Hz octave band. The environment does not meet the ISO•3744 Standard requirement of $K_2 < 2$ dB. The following table presents the calculated octave band K_2 values:

	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
Calculated K_2	5.2 dB	4.6 dB	6.8 dB	9.6 dB	9.3 dB	8.6 dB	7.1 dB	6.2 dB

While the values for K_2 exceed the ISO Standard in all octave bands, the Standard allows for compliance by using a maximum correction factor of 2 dB. Values for which the correction factor is limited to 2 dB therefore represent a "worst•case" or upper boundary for the actual performance of the device under test.

4.4 Data Presentation

Data are presented in Tables 1~7. For each configuration, we present the overall A•weighted (LwA) and the un•weighted 1/3 octave band sound power levels in decibels referenced to $1\text{x}10^{-12}$ W. We also present the overall A•weighted (dBA) and the un•weighted 1/3 octave band sound pressure levels in decibels referenced to 20 μPa for each configuration.

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PHONE: (+1) 415•693•0424 • FAX: (+1) 415•693•1398 • INTERNET:http://www.va-consult.com

5. Discussion

Non•Compliance Sound Pressure Levels

The noise generated in the 50~80Hz, 630Hz, and 2~6.3kHz 1/3 octave bands do not exceed the ambient conditions by the minimum 6 dB required by the ISO•3744 Standard. The published levels in these bands should be considered to be the upper boundary of the exact level – the true level is likely to be lower in level than the calculated values. The overall sound power level, LwA, does meet the requirements of the ISO•3744 Standard, in terms of ambient noise. However, the acoustical environment does not meet the ISO•3744 Standard in any of the 1/3 octave bands. Therefore, the published levels in all of the bands, including the overall LwA, should be considered as the upper boundary of the actual level.

Configurations

There was no significant difference in sound power level between the configurations. The only statistically important variation was the amplitude of a 9kHz tone, which was highest with Configuration 2. This tone could be a sub•harmonic of the switching circuitry, which runs at 18kHz.

Noise Modeling

In all of the configurations tested, the relatively broadband noise from the blower dominated the noise character. There is also significant tonality at the 160 Hz band from the blower. The directionality in the noise generation appears to be modest, with all four sides fitting within a 2 dB window. The relatively uniform directivity is due to the presence of air inlets or outlets on all four sides as well as at the bottom of the inverter. As there are no openings in the top of the inverter, the levels at the top typically measured 7 dB lower than the sides of the unit.

With the configurations tested, we would model the unit as a box with uniform directivity at an elevation of approximately 1m.

• • •

Please feel free to call if you have any questions; we may be reached in our San Francisco office by telephone at (+1) 415•693•0424 or via email at tyler@va consult.com.

Sincerely,

Tyler Rynberg, PE

Vibro Acoustic Consultants

Table 1: AEI Solaron 500 Sound Power Measurements – Calculated Sound Power Levels in dB, re: $1x10^{-12}$ W

Configuration	LwA	50 Hz	63 Hz	80 Hz	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.5 kHz	3.15 kHz	4 kHz	5 kHz	6.3 kHz	8 kHz	10 kHz
1	83.5	77.5	81.0	77.0	80.0	84.0	87.5	79.0	75.5	77.0	76.0	77.5	73.0	74.0	74.0	71.0	70.0	68.0	65.0	64.5	64.5	63.0	58.5	67.5	66.5
2	84.0	77.5	80.5	77.0	80.0	84.0	87.5	78.5	75.5	76.5	76.0	78.0	73.5	74.0	74.0	71.0	70.0	68.0	66.0	66.0	65.5	65.0	62.5	72.0	72.0
3	83.5	77.0	80.5	76.5	80.0	83.5	87.5	78.5	75.5	76.5	77.5	78.0	73.5	74.5	74.0	71.5	72.0	69.5	66.5	65.5	64.5	63.0	58.0	63.0	61.5
4	83.0	77.0	77.0	76.5	80.0	83.5	87.5	78.5	73.5	76.5	76.0	77.5	73.5	74.0	74.0	71.0	70.0	67.5	65.0	64.5	64.5	63.0	58.0	61.5	61.5

*The testing environment did not meet the requirements in the ISO-3744 Standard. The presented data in all 1/3 octave bands should be considered as the upper boundary of the exact sound power levels.

Table 2: AEI Solaron 500 Configuration 1 – Measured Sound Pressure Level at 1m in dB, re: 20μPa

Mic Position	dBA	50 Hz	63 Hz	80 Hz	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.5 kHz	3.15 kHz	4 kHz	5 kHz	6.3 kHz	8 kHz	10 kHz
Front	67.7	61.0	69.0	61.0	63.9	68.4	75.2	61.7	57.2	59.5	58.5	59.7	55.9	58.1	57.7	56.1	54.5	51.3	49.5	49.5	48.9	48.1	43.6	52.2	51.1
Left	66.1	59.0	61.1	61.9	65.0	67.4	66.0	59.1	61.0	60.4	61.5	61.9	57.3	56.7	56.4	53.2	52.5	50.3	47.9	46.6	45.8	42.8	39.3	49.3	48.5
Rear	67.8	61.0	65.5	60.1	62.4	65.9	68.3	64.4	59.9	59.4	59.3	59.9	57.3	58.9	60.1	56.3	55.4	52.2	50.7	49.5	49.6	48.7	44.0	54.3	54.7
Right	67.7	58.2	65.6	57.1	63.1	68.7	75.0	66.6	58.9	63.5	58.2	60.8	57.0	56.7	57.1	54.1	52.6	50.2	47.5	46.9	46.9	47.0	41.5	51.9	51.3
Front Top	64.3	60.6	59.4	59.2	61.2	66.7	67.9	56.7	56.2	56.9	57.7	59.5	54.3	55.3	54.5	51.9	51.2	49.3	46.7	45.8	45.5	43.0	39.1	48.2	43.7
Left Top	63.9	60.7	60.6	59.6	59.8	63.0	62.6	55.7	54.2	58.3	56.9	59.7	55.2	55.8	55.0	52.3	50.4	49.3	46.2	45.1	45.0	42.5	38.0	46.7	42.9
Rear Top	64.8	59.5	60.1	57.4	62.5	65.8	62.5	55.8	56.8	58.9	59.3	60.7	55.9	55.1	56.5	52.7	52.2	50.7	46.6	45.9	46.8	45.1	39.7	47.2	43.3
Right Top	64.9	59.8	60.3	56.9	63.4	67.5	67.5	59.4	54.3	56.8	56.3	60.1	55.0	55.4	56.1	52.7	52.7	51.0	47.9	47.2	47.0	46.1	40.9	45.5	43.8
Top	62.3	60.6	59.6	58.3	60.9	64.3	67.7	59.1	57.5	55.8	56.6	56.4	52.5	52.3	52.3	49.9	48.4	49.5	44.4	43.3	46.3	42.7	35.8	41.3	38.5

*The testing environment did not meet the requirements in the ISO-3744 Standard. The presented data in all 1/3 octave bands should be considered as the upper boundary of the exact sound power levels.

Table 3: AEI Solaron 500 Configuration 2 – Measured Sound Pressure Level at 1m in dB, re: 20μPa

Mic Position	dBA	50 Hz	63 Hz	80 Hz	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.5 kHz	3.15 kHz	4 kHz	5 kHz	6.3 kHz	8 kHz	10 kHz
Front	68.3	60.9	67.3	61.5	64.2	68.2	74.7	61.9	57.4	59.1	58.8	61.4	56.7	58.7	57.8	55.8	54.8	51.6	50.7	50.6	49.8	49.4	47.5	57.4	57.6
Left	66.7	58.7	61.1	62.0	65.0	67.5	65.7	58.8	62.6	59.5	62.1	62.1	56.9	57.3	56.7	53.3	52.3	50.3	48.9	48.4	47.4	45.4	44.6	53.9	48.5
Rear	68.1	61.0	65.1	60.2	62.3	64.7	67.4	63.1	58.2	59.0	59.8	60.1	57.7	59.1	59.9	55.9	55.2	52.1	51.3	51.1	50.3	50.6	48.4	57.1	59.5
Right	68.1	58.3	65.5	57.0	63.0	68.5	74.6	66.5	59.6	63.3	58.2	61.0	56.9	56.6	56.8	54.0	52.6	50.3	49.1	49.2	48.3	48.9	46.6	56.9	57.1
Front Top	64.7	60.8	59.2	58.8	61.2	67.0	68.4	56.6	55.7	56.6	57.7	59.9	53.9	55.4	55.0	52.6	51.3	49.6	47.7	47.4	46.2	44.9	43.0	51.8	49.3
Left Top	64.6	59.9	60.7	59.3	58.8	62.2	65.7	57.4	56.0	57.2	57.4	60.6	56.5	54.7	54.7	52.4	50.4	49.5	47.1	47.5	47.0	45.8	43.3	53.0	50.3
Rear Top	65.1	60.2	59.9	57.2	61.8	65.4	62.0	56.9	56.6	59.2	59.2	60.1	56.1	56.1	55.5	52.9	52.4	50.5	48.0	47.6	47.8	46.8	42.9	50.2	49.8
Right Top	65.1	59.5	59.7	56.8	63.7	67.1	68.1	60.1	54.2	57.3	56.3	59.9	55.2	55.5	55.5	52.7	52.9	50.4	48.5	48.4	47.5	47.3	44.2	51.4	49.2
Top	62.5	60.1	58.8	58.2	61.3	63.9	67.6	59.0	56.3	56.2	56.6	57.0	52.5	51.9	52.5	50.3	48.8	49.3	45.1	44.3	46.4	43.5	38.8	48.2	44.7

*The testing environment did not meet the requirements in the ISO-3744 Standard. The presented data in all 1/3 octave bands should be considered as the upper boundary of the exact sound power levels.

Table 4: AEI Solaron 500 Configuration 3 – Measured Sound Pressure Level at 1m in dB, re: 20μPa

Mic Position	dBA	50 Hz	63 Hz	80 Hz	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.5 kHz	3.15 kHz	4 kHz	5 kHz	6.3 kHz	8 kHz	10 kHz
Front	68.0	60.8	67.6	61.4	64.0	68.3	74.8	62.0	57.2	58.7	58.4	60.9	57.0	58.7	58.1	56.2	57.5	52.4	50.9	50.2	48.9	47.6	43.0	48.6	46.1
Left	67.0	58.5	61.2	61.6	64.7	67.1	66.3	59.0	62.3	60.7	63.9	63.5	56.6	56.5	56.7	53.7	54.8	52.5	49.3	47.6	45.8	42.8	38.7	45.2	43.7
Rear	67.9	61.2	65.8	60.2	62.3	64.4	67.4	63.1	58.7	58.6	60.0	60.4	58.0	60.2	59.9	56.4	56.2	55.3	51.3	50.6	49.5	49.0	43.8	49.4	49.0
Right	67.3	58.6	66.1	57.5	62.3	68.2	74.1	66.2	59.6	62.8	58.7	59.5	57.1	57.1	57.0	54.1	53.7	51.5	50.1	48.4	46.9	47.0	41.5	48.0	47.0
Front Top	65.1	60.2	58.7	59.0	61.5	67.3	68.5	56.6	55.8	57.7	59.4	59.9	55.0	55.5	55.1	53.9	53.6	50.9	48.2	46.5	45.3	43.1	38.2	42.9	39.7
Left Top	64.8	59.7	60.3	58.9	58.1	61.9	65.4	58.0	55.6	58.1	58.5	59.8	55.3	55.9	55.2	53.3	55.4	51.0	47.3	46.1	45.6	42.9	37.5	42.6	39.6
Rear Top	65.5	58.5	58.9	55.3	61.3	64.2	61.1	55.3	58.4	59.0	60.0	61.5	56.6	56.8	56.5	53.3	54.1	51.8	48.3	46.5	47.2	45.5	39.3	42.5	39.3
Right Top	65.6	59.0	60.4	56.6	63.1	66.4	67.6	58.9	52.9	58.4	58.9	61.2	55.2	56.1	56.2	54.3	54.3	52.1	48.8	47.5	47.0	46.1	40.9	43.2	40.1
Top	62.7	59.5	58.5	57.7	61.3	64.6	67.6	58.8	56.1	56.3	56.8	57.2	53.2	52.5	53.1	50.3	49.7	50.1	45.1	43.7	45.7	42.4	35.0	37.1	33.7

*The testing environment did not meet the requirements in the ISO-3744 Standard. The presented data in all 1/3 octave bands should be considered as the upper boundary of the exact sound power levels.

Table 5: AEI Solaron 500 Configuration 4 – Measured Sound Pressure Level at 1m in dB, re: 20μPa

Mic Position	dBA	50 Hz	63 Hz	80 Hz	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.5 kHz	3.15 kHz	4 kHz	5 kHz	6.3 kHz	8 kHz	10 kHz
Front	67.5	59.6	62.3	61.0	64.0	68.2	75.2	61.9	55.6	58.9	58.2	60.3	56.0	58.0	57.9	55.8	54.7	51.2	49.1	49.2	49.1	47.8	43.1	46.9	47.5
Left	65.6	57.9	59.9	61.9	64.9	67.1	66.3	58.2	56.8	59.4	61.2	61.3	56.9	56.7	56.1	53.2	52.5	50.2	47.5	46.4	45.8	42.4	38.7	45.5	43.8
Rear	67.0	60.3	61.2	60.0	62.0	64.4	67.6	63.8	59.3	58.2	59.1	59.8	56.8	58.8	59.7	55.9	55.0	51.6	50.1	49.4	49.4	48.5	43.5	47.2	48.8
Right	66.8	56.4	59.8	56.6	62.2	67.6	73.8	65.8	57.7	63.7	58.8	58.8	57.1	56.1	57.0	53.8	52.3	49.7	46.7	46.9	46.8	46.6	41.1	46.3	46.2
Front Top	64.1	60.8	58.7	58.7	61.1	65.5	68.1	56.0	54.7	57.0	57.8	59.5	54.8	56.1	54.7	51.8	50.2	49.1	46.1	45.7	45.3	42.7	37.8	41.4	39.5
Left Top	64.0	59.2	58.6	59.1	58.3	62.1	65.6	57.9	55.7	57.6	57.3	60.1	55.5	55.6	54.7	52.1	50.8	49.0	45.7	45.1	45.7	42.9	37.6	42.7	40.0
Rear Top	64.8	59.8	59.0	58.0	63.1	65.3	63.4	56.7	54.3	57.2	58.1	60.8	56.1	55.5	56.8	53.9	51.8	50.2	46.6	45.7	47.0	46.0	39.4	40.5	38.9
Right Top	65.0	59.8	57.9	57.6	64.4	67.4	68.1	60.3	53.4	57.2	55.4	59.9	57.1	55.6	55.9	54.2	52.9	50.2	47.6	47.0	46.8	46.1	40.5	41.7	40.9
Top	62.3	60.3	58.4	58.4	61.1	63.0	67.1	58.7	53.3	56.1	56.8	57.5	53.0	52.8	53.0	49.6	47.6	49.5	44.2	43.0	45.9	42.3	34.9	35.3	34.3

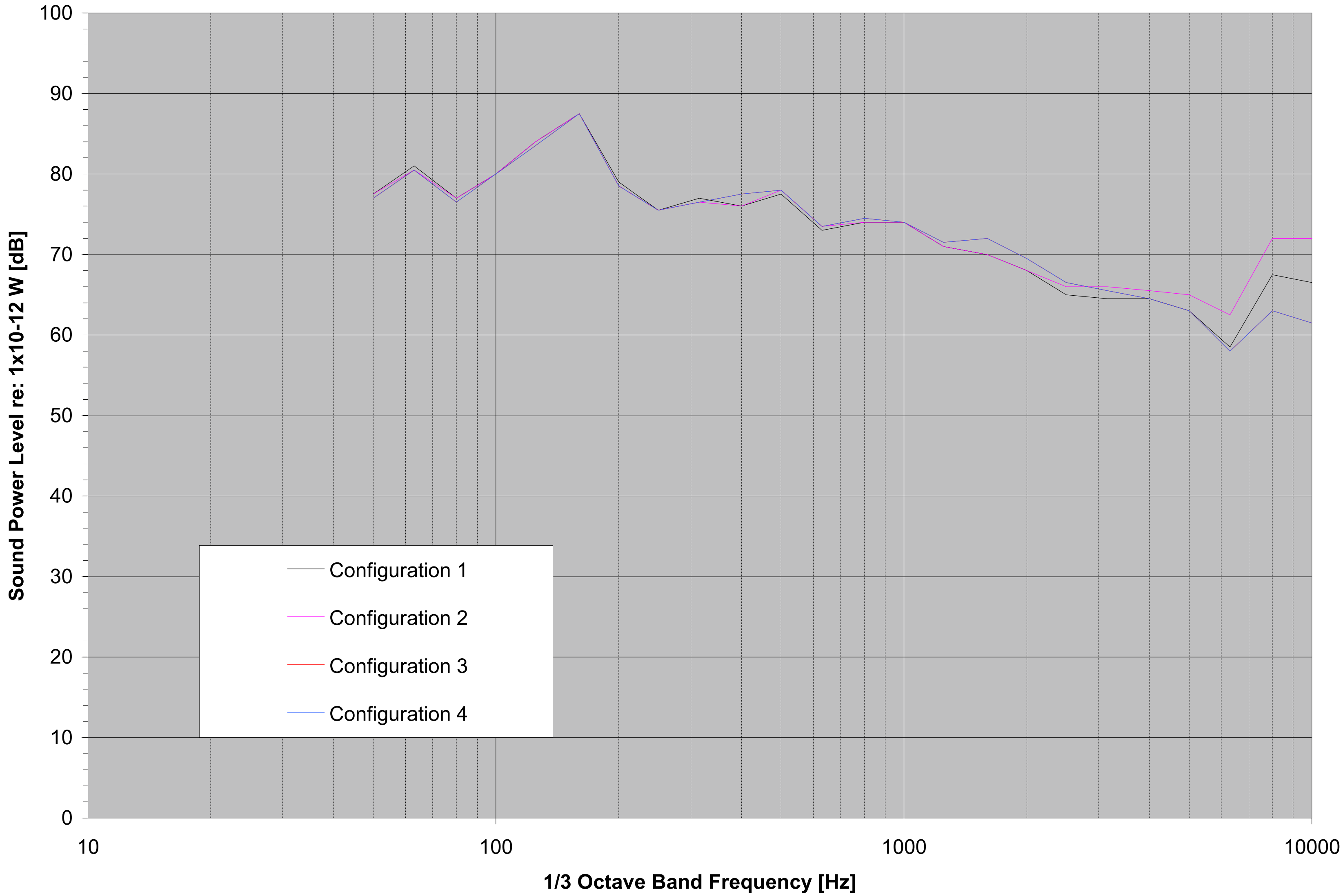
*The testing environment did not meet the requirements in the ISO-3744 Standard. The presented data in all 1/3 octave bands should be considered as the upper boundary of the exact sound power levels.

Table 6: AEI Solaron 500 Configuration 5 – Measured Sound Pressure Level at 1m in dB, re: 20μPa

Mic Position	dBA	50 Hz	63 Hz	80 Hz	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.5 kHz	3.15 kHz	4 kHz	5 kHz	6.3 kHz	8 kHz	10 kHz
Front	67.4	60.5	63.3	61.3	63.9	68.1	74.6	61.9	56.2	58.9	58.5	61.2	56.1	58.2	57.4	55.8	54.8	51.5	49.2	48.8	48.6	47.5	42.6	45.6	45.3

*The testing environment did not meet the requirements in the ISO-3744 Standard. The presented data in all 1/3 octave bands should be considered as the upper boundary of the exact sound power levels.

Table 7: AEI Solaron 500 – 1/3 Octave Band Sound Power Levels in dB, re: $1x10^{-12}$ W



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Preliminary Sound Level Measurements PV GEN II
Measuements are in dBA

Model		No Power		Full Power		Date	NOTES
		1 meter	3 meters	1 meter	3 meters		
30kw	Back	55		58.5	57	10/23/08	LOAD IN WAY
	Right Side	55.1		58.7		10/23/08	WATER NOISE
	Front	55.4		58.7	57.6	10/23/08	
	Left Side	55.2		59.5		10/23/08	LOAD IN WAY
50kw COASTAL	Back	55.7		62.5		10/23/08	LOAD IN WAY
	Right Side	55.1		62.6		10/23/08	EQUIPMENT IN WAY
	Front	54.1		67.2	61.6	10/23/08	
	Left Side	53.2		60.2		10/23/08	EQUIPMENT IN WAY
50kw	Back	53.9	52.9	62.4	60.9	10/24/08	
	Right Side	52.6	52	63.2	58.8	10/24/08	
	Front	52.7	52.2	67.6	63.3	10/24/08	
	Left Side	52.1	51.5	61.2	58.7	10/24/08	
75kw	Back	54.6	53	65.5	63.8	10/24/08	
	Right Side	55.8	52.8	66.5	61.9	10/24/08	
	Front	56.4	55.9	73.8	67.1	10/24/08	
	Left Side	56.2	55.9	65.4	63.3	10/24/08	
100kw	Back						use 75 kw
	Right Side						
	Front						
	Left Side						
135kw	Back	58.5		62.7		10/23/08	LOAD IN WAY WATER NOISE
	Right Side	58.6		62.4		10/23/08	WALL IN WAY WATER NOISE
	Front	56.5		63	60.4	10/23/08	
	Left Side	57.5		61	60.4	10/23/08	
250kw	Back						use 375 kw
	Right Side						
	Front						
	Left Side						
375kw	Front DC	53.7	52.4	70.1	65	10/24/08	
	Front IV	53.8	52.7	70	65.4	10/24/08	
	Front AC	53.4	52.6	69.5	65.8	10/24/08	
	Front TRO	53.5	52.9	68.3	65	10/24/08	
500kw	Back	61.1	63.8	72	71.5	10/21/08	
	Right Side	60	57.6	72.5	68.4	10/21/08	
	Front	58.2	56.9	68.7	68	10/21/08	
	Left Side	60.4	59.6	68	69.5	10/21/08	

Appendix E

Transformer Noise NEMA Ratings

10,000 kVA Transformer Noise Data (10 MVA)

Table 8
Audible Sound Levels for Single- and Three-Phase Transformers and Autotransformers, Equivalent Two-Winding Rating, MV•A(1)

Average sound level, dB A-weighted	High voltage maximum operating kV								
	Up to 72.5			123 and 145			170 and 245		
	a	b	c	a	b	c	a	b	c
60	1.5								
61	2.0								
62	2.5								
63	3.0								
64	4.0								
65	5.0								
66	6.0								
67	7.5								
68	10	7.5							
69	12.5	9.4		7.5					
70	15	12.5		10	7.5		7.5		
71	20	16.7		12.5	9.4		10	7.5	
72	25	20	20.8	15	12.5		12.5	9.4	
73	30	26.7	25	20	16.7		15	12.5	
74	40	33.3	33.3	25	20	20.8	20	16.7	
75	50	40	41.7	30	26.7	25	25	20	20.8
76	60	53.3	50.	40	33.3	33.3	30	26.7	25
77	80	66.7	66.7	50	40	41.7	40	33.3	33.3
78	100	80	83.3	60	53.3	50	50	40	41.7
79	125	107	100	80	66.7	66.7	60	53.3	50
80	150	133	133	100	80	83.3	80	66.7	66.7
81	200	167	167	125	107	100	100	80	83.3
82	250	200	200	150	133	133	125	107	100
83	300	267	250	200	167	167	150	133	133
84	400	333	300	250	200	200	200	167	167
85	500	400	400	300	267	250	250	200	200
86	600	533	500	400	333	300	300	267	250
87		667	600	500	400	400	400	333	300
88		800	800	600	533	500	500	400	400
89			1000		667	600	600	533	500
90					800	800		667	600
91						1000		800	800
92									1000
93									
94									
95									

(Continued)

Table 8 (Concluded)

Average sound level, dB A-weighted	High voltage maximum operating kV								
	300			362			420 to 765		
	a	b	c	a	b	c	a	b	c
60									
61									
62									
63									
64									
65									
66									
67									
68									
69									
70									
71									
72									
73	12.5								
74	15			12.5					
75	20	16.7		15			12.5		
76	25	20	20.8	20	16.7		15		
77	30	26.7	25	25	20	20.8	20	16.7	
78	40	33.3	33.3	30	26.7	25	25	20	20.8
79	50	40	41.7	40	33.3	33.3	30	26.7	25
80	60	53.3	50	50	40	41.7	40	33.3	33.3
81	80	66.7	66.7	60	53.3	50	50	40	41.7
82	100	80	83.3	80	66.7	66.7	60	53.3	50
83	125	107	100	100	80	83.3	80	66.7	66.7
84	150	133	133	125	107	100	100	80	83.3
85	200	167	167	150	133	133	125	107	100
86	250	200	200	200	167	167	150	133	133
87	300	267	250	250	200	200	200	167	167
88	400	333	300	300	267	250	250	200	200
89	500	400	400	400	333	300	300	267	250
90	600	533	500	500	400	400	400	333	300
91		667	600	600	533	500	500	400	400
92		800	800		667	600	600	533	500
93			1000		800	800		667	600
94						1000		800	800
95									1000

Notes:

(1) The equivalent two-winding rating* is one half the sum of the rating of all windings using the principal tap. When a tertiary (stabilizing) winding is present, either with a known rating or "buried", add 17.5% (35% ÷ 2) or half the rating of the tertiary (whichever is larger) to the otherwise calculated equivalent rating of the transformer. For autotransformers use ((N-1) ÷ N) x rated power of the autotransformer for the autoconnected portion (N is the overall ratio of the autotransformer). For intermediate ratings, use the average sound level of the next highest rating.

(2) For ratings less than those shown in Table 8, use the dB A-weighted value for the lowest given rating.

(3) For cooling designations, see Clauses 6.5 and 6.6.

(4) Columns with heading

(a) "a" are applicable to cooling designations: ONAN; ONWF;

(b) "b" are applicable to cooling designations: ONAF; OFAF (first stage of auxiliary cooling); and

(c) "c" are applicable to cooling designations: ONAF; OFAF or ODAF (second stage of auxiliary cooling and single OFAF or ODAF ratings).

(5) For OFWF cooling, use Column "c" minus 1 dB A-weighted.

*The base rating is different from equivalent two-winding rating. Base rating is the equivalent ONAN rating only.

4.4 Loading capabilities

4.4.1
The loading capabilities of transformers shall be in accordance with ANSI/IEEE C57.91.

4.4.2
Leads, terminals, and switches shall not limit the loading capability.

4.5 Off-circuit voltage taps

4.5.1
Transformers without taps are the standard. Taps are included as an option in Clause 10(g).

4.5.2
High-voltage taps, unless otherwise specified, shall be ±2.5% and ±5% of the rated voltage.

4.5.3
When a transformer is connected on a tap below rated voltage, the kV•A capacity shall be reduced in direct proportion to the voltage of the tap. When a transformer is connected on a tap above rated voltage, the capacity shall be the rated kV•A of the transformer.

4.6 Insulation class and preferred voltages

4.6.1 Preferred high-voltage ratings and required BIL ratings
The preferred high-voltage ratings, required BIL ratings, and associated high-voltage terminal components shall be as specified in Table 2.

4.6.2 Preferred low-voltage ratings and required BIL ratings
The preferred low-voltage ratings and the required BIL ratings shall be as specified in Table 3.

4.7 Operating voltage range
Transformers shall be capable of operating continuously at rated kV•A at 10% above or 5% below rated voltage of the connected tap, but not necessarily within the specified performance limits.

4.8 Radio interference
Transformers shall be designed to operate without causing radio interference to exceed the limits set forth in Table 4 when tested in accordance with CAN3-C108.3.1.

4.9 Audible sound
Transformers shall be designed so that the audible sound level, when operated at rated voltage and measured in accordance with ANSI/IEEE C57.12.90, shall not exceed the sound levels specified in Table 5.

4.10 Short-circuit capabilities

4.10.1 General
Transformers shall be built to withstand the mechanical and thermal stresses caused by the short-circuit currents and their corresponding duration as shown in Table 6. Impedance values need not be limited to the minimum values implied by this table except as modified by Clause 4.10.2 when the impedance is over 4%.

Table 5
Audible sound levels
(See Clause 4.9.)

Transformer size, kV•A	Audible sound level, dBA
75	51
150 –300	55
500	56
750 –1000	58
1500	60
2000	61
2500	62
3000	63

Table 6
Short-circuit capability
(See Clauses 4.10.1 and 4.10.2.)

Transformer size, kV•A	Withstand capability per unit of base current (symmetrical)	Duration in cycles
75	40	48
150–300	35	60
500–3000	25	120

Table 7
Minimum transformer impedance
(See Clause 4.11.)

Transformer size, kV•A	Minimum transformer impedance, %
0–150	1.8
225 –300	2.0
500	3.0
750–1000	4.0
>1000	5.0

Table 7-28. Approximate overall PWL in dB of generators, excluding the noise of the driver unit.

Generator Speed, rpm	Overall Sound Power Level, dB Rating of Generator, MW							
	0.2	0.5	1	2	5	10	20	50
600	95	99	102	105	109	112	115	119
1200	97	101	104	107	111	114	117	121
1800	98	102	105	108	112	115	118	122
2400	99	103	106	109	113	116	119	123
3600	100	104	107	110	114	117	120	124
4800	101	105	108	111	115	118	121	125

specified positions. The NEMA sound level for a transformer can be provided by the manufacturer. On the basis of field studies of many transformer installations, the PWL in octave bands has been related to the NEMA rating and the area of the four side walls of the unit. This relationship is expressed by Equation 7-23:

$$L_W = \text{NEMA rating} + 10 \log A + C \quad \text{US units}$$
$$L_W = \text{NEMA rating} + 10 \log A + C + 10 \quad \text{SI units} \qquad (7\text{-}23)$$

where "NEMA rating" is the A-weighted sound level of the transformer provided by the manufacturer, obtained in accordance with NEMA Standards Publication No. TR 1-1968, A is the total surface area of the four side walls of the transformer in ft^2 (m^2), and C is an octave band correction that has different values for different uses, as shown in Table 7-30.

If the exact dimensions of the transformer are not known, an approximation will suffice. If in doubt, estimate the area on the high side. An error of 25% in area will produce a change of only 1 dB in the PWL. Select the most nearly applicable C value from Table 7-30. The C_1 value assumes normal radiation of sound. The C_2 value should be used in regular-shaped confined spaces where standing waves will very likely occur, which typically may produce 6 dB higher sound levels at the transformer harmonic frequencies of 120, 240, 360, 480, and 600 Hz (for 60-Hz line frequency; or other sound frequencies for other line frequencies). Actually, the sound power level of the transformer does not increase in this location, but the sound analysis procedure is more readily handled by presuming that the sound power is increased. The C_3 value is an approximation of the noise of a transformer that has grown noisier (by about 10 dB) during its lifetime. This happens occasionally when the laminations or tie-bolts become loose, and the transformer begins to buzz or rattle. In a highly critical location, it might be wise to use this value. All the Table 7-30 values assume that the transformer initially meets the quoted NEMA sound level rating. Field measurements have shown that transformers may actually have A-weighted sound levels that range from a few decibels (2 or 3 dB) above to as much as 5 or 6 dB below the quoted NEMA value. Quieted transformers that contain various forms of noise control treatments can be pur-

Table 7-29. Frequency adjustments in dB for generators, without drive unit: Subtract these values from the overall PWL (Table 7-28) to obtain octave band and A-weighted PWLs.

Octave Frequency Band, Hz	Value to be Subtracted from Overall PWL, dB
31	11
63	8
125	7
250	7
500	7
1000	9
2000	11
4000	14
8000	19
A-weighted (dBA)	4

chased at as much as 15 to 20 dB below normal NEMA ratings. If a quieter transformer is purchased and used, insert in Equation 7-23 the lowered sound level rating in place of the regular NEMA rating, and then select the appropriate corrections from Table 7-30.

Table 7-30. Octave band corrections in dB to be used in Equation 7-23 for obtaining PWL of transformers in different installation conditions. See notes for details.

Octave Frequency Band, Hz	Octave Band Corrections, dB		
	C_1, see Note 1	C_2, see Note 2	C_3, see Note 3
31	-11	-11	-11
63	-5	-2	-2
125	-3	+3	+3
250	-8	-2	+2
500	-8	-2	+2
1000	-14	-11	-4
2000	-19	-19	-9
4000	-24	-24	-14
8000	-31	-31	-21

Note 1. Use C_1 for outdoor location or for indoor location in a large mechanical room (over about 5000 ft^3 or 140 m^3) containing many other pieces of mechanical equipment that serve as obstacles to diffuse sound and breakup standing waves.

Note 2. Use C_2 for indoor locations in transformer vaults or small rooms (under about 5000 ft^3 or 140 m^3) with parallel walls and relatively few other large-size obstacles that can diffuse sound and breakup standing waves.

Note 3. Use C_3 for any location where a serious noise problem would result if the transformer should become noisy above its NEMA rating, following its installation and initial period of use.

7-22. MULTIPLE SOURCES

When an assembly of equipment is built up from components, such as those listed in this chapter, the PWL or the normalized 3-ft (0.9-m) distance SPL values of the component parts can be added together, band by band, by decibel addition to obtain the total sound for the assembly. Examples of such combinations are a motor-pump, a fan housing, and a fan-drive motor, a steam turbine and a centrifugal compressor, etc. If the SPL at 3 ft (0.9 m) is given for one source and the PWL is given for another source, the values should first be converted to similar forms, either SPL or PWL. Conversion from PWL to SPL at the normalized conditions used in the manual [3-ft (0.9-m) distance and 800-ft^2 (74-m^2) Room Constant] is done by using Equation 4-3 and Figure 4-2 or Table 4-4. Conversion from SPL (at the normalized conditions) to PWL uses the same material but in reverse order; that is, the PWL is calculated from given SPL data.

7-23. NOISE SPECIFICATIONS

The noise level estimates given in this manual will probably equal or exceed the actual noise levels of approximately 80 to 90% of all those types of machinery that will be encountered in typical building use. In many cases, actual noise levels may fall 3 to 6 dB (or more) below the estimates. Thus, there appears to be no shortage of available equipment that will fall at or below the estimated noise levels given in the manual, and it would not be discriminatory or unreasonable to specify that purchased equipment for a particular building be required not to exceed the estimated values given here for that equipment. This is especially true if the actual acoustic design of a wall or floor or room treatment is dependent upon one or two particularly noisy pieces of equipment. A noise specification would not be necessary for relatively quiet equipment that does not dictate noise control design for the MER or the building.

A. WAIVER. If a noise level specification is required to be met for a particular piece of equipment, and this becomes a "hardship" on the manufacturer or the owner in terms of costs or availability, the noise specification could be waived, depending on the response of all the bidders. If some bidders agree to meet the specification while others do not, this could be a valid basis for selecting the quieter equipment. If no bidders can meet the specification, the specification can be waived, but it may be necessary to reevaluate the noise control requirements of the equipment room, if this particular equipment is so noisy that it is responsible for the noise design in the first place. Of course, it is the primary purpose of this manual to prevent just such situations as this, as too many waivers would negate the value of the noise evaluation as a part of the design phase of the building. If the equipment measured for this study represents a fair sampling, it is likely that most of the equipment would meet a noise specification.

Appendix F

CadnaA Configuration Settings

Output from Receiver R15

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Appendix G

CadnaA Electronic Modeling Files

Electronic File sent by email