



McCann Solar Project

Noise Assessment Study Report

December 9, 2011



Northland Power Inc.
on behalf of
Northland Power Solar
McCann L.P.
Toronto, Ontario

Noise Assessment Study Report

McCann Solar Project

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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. Northland Power Solar McCann L.P. (“Northland”) is proposing to develop a 10-Megawatt (MW) solar photovoltaic (PV) project titled McCann Solar Project (the “Project”). The property consists of approximately 40 hectares of agricultural land, located south of Big Rideau Lake within the Township of Rideau Lakes, Ontario.

This Noise Assessment Study 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 impact assessment study.

The results obtained in this study show that the sound pressure levels at POR will not exceed MOE requirements for rural areas. Any noise issues that might arise during commissioning will be manageable and will be resolved by implementing typical remediation measures such as acoustical barriers and enclosures. It is our intention to verify by field measurements taken on completion of installation and during commissioning that the noise levels at the POR resulting from the Project operation are within the 40-dBA limit set by the MOE.

Project Report

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**Northland Power Solar McCann L.P.
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1. Introduction

1.1 Project Description

Northland Power Solar McCann L.P. (“Northland”) is proposing to develop a 10-megawatt (MW) solar photovoltaic (PV) project titled McCann Solar Project (the “Project”). The property consists of approximately 40 hectares of agricultural land, located south of Big Rideau Lake within the Township of Rideau Lakes, Ontario.

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 clusters 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 clusters to 44-kV prior to being transmitted 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 anticipated operational lifespan of the Project is 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 these regulations, 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, 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 Assessment 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.

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 inverters. The Project layout is based on 7 inverter clusters each one containing two inverters and one medium-voltage (27.6-kV/1.6-MVA) transformer, and one 44-kV/10-MVA substation transformer. The 27.6-kV power, collected from the inverter clusters, will be stepped-up to 44 kV by the substation transformer prior to being transmitted 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 Location¹ will be sited on privately owned land totalling approximately 40 ha. The Project Location is zoned as rural land in accordance to the zoning by-law for the Township of Rideau Lakes. Figure A.1 in Appendix A shows the zoning designation plan. Figure A.3 and Figure A.2 present the Project Area Location Plan, as well as the adjacent solar facilities proposed in the vicinity of the Project.

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

2.2 Acoustical Environment

The Project will mostly be surrounded by farmland, with some forested areas to the southwest. The background noise levels are expected to be typical of rural areas, classified as a Class 3 based on Publication NPC-232 by the MOE. However, Some traffic noise is expected from McCann Road (right to the south) and Highway 14 (1 km west), mainly during day hours. There are no airports in the area and no large industrial facilities within 5 km of the Project area.

2.3 Life of Project

The expected life of the Project is 30 years. The manufacturer's warranty on the PV modules is 25 years and the expected life of solar power plants of this type is typically 35 to 40 years. At that time (or earlier if the 20-yr power purchase agreement is not extended), the Project will be decommissioned or refurbished depending on market conditions and/or technological changes.

2.4 Operating Hours

Solar PV facilities produce electricity during the day 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 inverters was provided by the manufacturer while the sound power level for the transformers was estimated. The software package CADNA-A, which implements ISO-9613-2, was used to predict the noise levels at the POR. This numerical modeling software is able to simulate sound sources as well as sound mitigation measures taking into account

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

atmospheric and ground attenuation. Some of the CADNA-A configurations used in the modeling are shown in Figure 2.1. The height contours for the site were taken from the Ontario Base Maps (OBM).

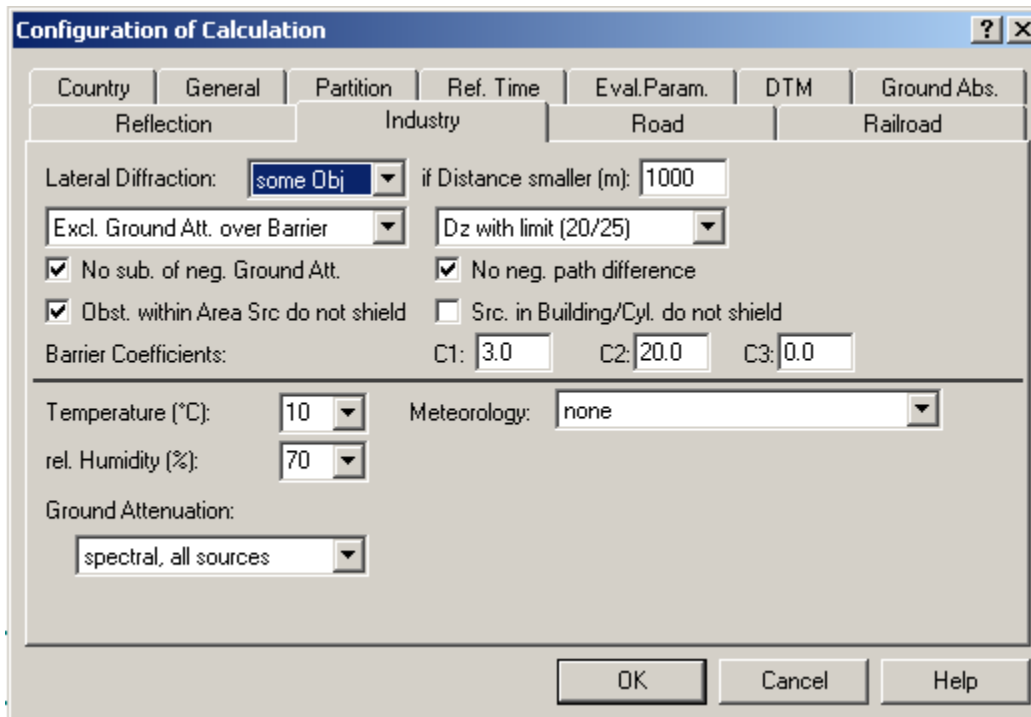


Figure 2.1 CADNA-A Configurations

3. Noise Sources

The main sources of noise from the Project will be seven inverter clusters, each one containing two inverters and one medium-voltage transformer, and a substation containing the main step-up transformer. The Project layout is provided in Figure A.3. 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.

In addition to McCann Solar Project the contribution from two adjacent solar projects was taken into account in the study.

3.1 Substation Transformer

A 10-MVA step-up transformer that will step-up the 27.6-kV power to 44-kV, required by the local distribution company, will be located in the substation. Since the transformer make and model has

not been selected at this point (although it is known that the transformer will be of ONAF (oil natural air forced) type), a conservative estimate of sound power level was based on the data from NEMA TRI – 1993 (2000) and 35-m² 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.3 of Appendix B. The transformer configurations are expected to be similar to those shown in Figure B.2. Noise source height representing the transformer was assumed 3.5-m.

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.3 in Appendix B shows the frequency spectrum used to model the substation transformer.

3.2 Inverter Clusters

Northland is planning to use inverters manufactured by SMA. Seven inverter clusters will be installed as part of the Project. Each cluster comprises of two SMA Sunny Central 800CP inverters and one medium voltage transformer. A schematic layout with approximate dimensions of such cluster is available in Figure 3.1, additional information regarding details of the inverter cluster can be found in Appendix B). The cluster components listed above were modeled as point sources shown in Figure 3.2. Note that the planned enclosure over the inverters was not taken into account as a mitigation measure in the noise model.

The installed capacity of each Sunny Central 800CP inverter is 800-kVA. SMA provided third-octave noise data for the Sunny Central 800CP inverter (Figure B.1 of Appendix B). The provided third octave spectrum was converted to a full octave spectrum and the contribution from two inverters was combined into a single sound power spectrum for use with CADNA-A model (calculations are available in Figure B.4 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 spectrum used to model combined noise emission from the two inverters located next to each other within the same cluster is shown in Table B.3 of Appendix B.

A 1.6-MVA transformer used to step-up the 360-V power from the inverters to 27.6 kV will be located in close proximity to the inverters. Since the transformer make and model have not been selected at this point (although it is known that the transformer will be of ONAN (oil natural air natural) type), the sound power levels resulting from the operation of the transformer were evaluated using data from NEMA TR 1-1993 (R2000) and 14.88-m² transformer surface area. The NEMA levels were then converted into frequency spectrum using empirical correlations for transformer noise (Crocker, 2007). This calculation is available in Figure B.5 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.3 in Appendix B shows the frequency spectrum used to model the transformers located in the clusters.

Although for the modeling purposes it was assumed that the facility will operate 24 h 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.

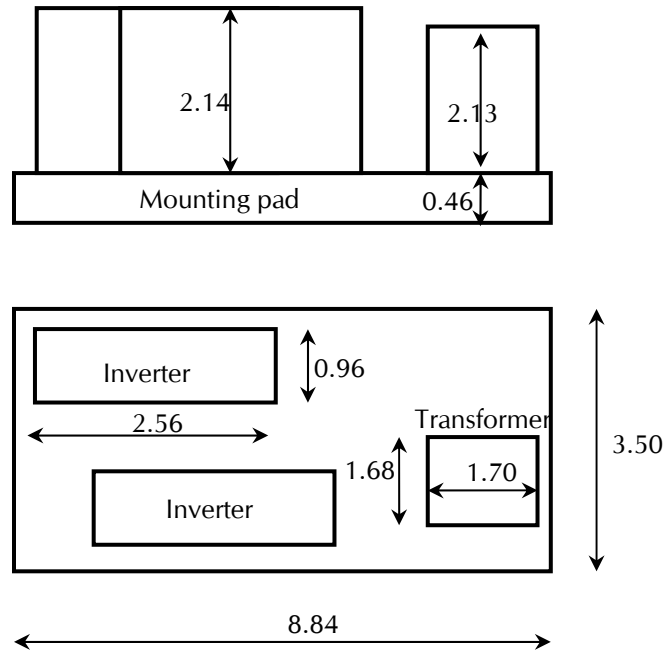


Figure 3.1 Schematic Inverter Cluster Layout
(all dimensions in metres)

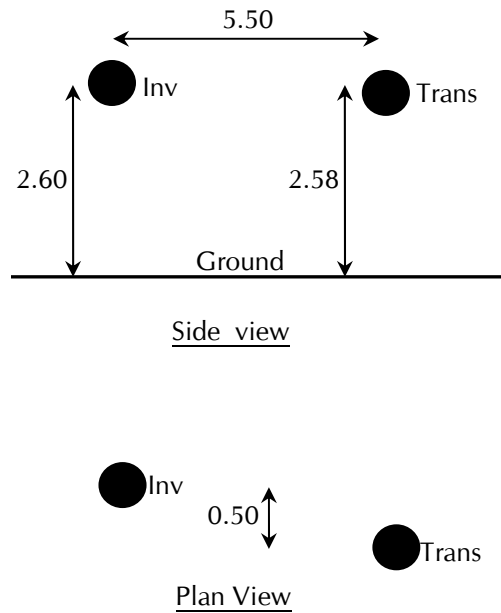


Figure 3.2 Inverter Cluster CADNA-A Acoustical Model

where: Inv = Noise Source Representing Two Sunny Central 800CP Inverters; and Trans = Noise Source Representing 27.6-kV/1.6-MVA Cluster Transformer (all dimensions in metres).

3.3 Noise Summary Table

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

Table 3.1 Noise Source Summary for McCann Solar Project

Source ID	Description	Total Sound Power Level (dBA)	Source Location	Sound Characteristics	Noise Control Measures
Mc_Sub	44-kV/10-MVA substation transformer	90.8	O	S-T	U
Mc_Inv1	Two Sunny Central 800CP inverters at Cluster 1	91.3	O	S-T	U
Mc_Inv2	Two Sunny Central 800CP inverters at Cluster 2	91.3	O	S-T	U
Mc_Inv3	Two Sunny Central 800CP inverters at Cluster 3	91.3	O	S-T	U
Mc_Inv4	Two Sunny Central 800CP inverters at Cluster 4	91.3	O	S-T	U
Mc_Inv5	Two Sunny Central 800CP inverters at Cluster 5	91.3	O	S-T	U
Mc_Inv6	Two Sunny Central 800CP inverters at Cluster 6	91.3	O	S-T	U
Mc_Inv7	Two Sunny Central 800CP inverters at Cluster 7	91.3	O	S-T	U
Mc_Trans1	27.6-kV/1.6-MVA cluster transformer at Cluster 1	80.1	O	S-T	U
Mc_Trans2	27.6-kV/1.6-MVA cluster transformer at Cluster 2	80.1	O	S-T	U
Mc_Trans3	27.6-kV/1.6-MVA cluster transformer at Cluster 3	80.1	O	S-T	U
Mc_Trans4	27.6-kV/1.6-MVA cluster transformer at Cluster 4	80.1	O	S-T	U
Mc_Trans5	27.6-kV/1.6-MVA cluster transformer at Cluster 5	80.1	O	S-T	U
Mc_Trans6	27.6-kV/1.6-MVA cluster transformer at Cluster 6	80.1	O	S-T	U
Mc_Trans7	27.6-kV/1.6-MVA cluster transformer at Cluster 7	80.1	O	S-T	U

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.

There are two solar projects, Crosby and Rideau Lakes, located in the proximity of the McCann Solar Project. Noise sources from these two projects were taken into account in the study. Both projects, owned by Northland with 10-MW capacity each, are identical to McCann Solar Project. Coordinates for the inverter clusters and substation transformers were provided by Northland. All noise sources from these two project were assumed unmitigated and their coordinates as well as sound power levels used for modeling are included in Appendix B.

In addition, SunEdison Canada solar project named Newboro 1 was identified (Figure A.2) within 1 km distance from the McCann Solar Project noise receptors. However, this project is in the design stage when noise source information is not available, thus noise emissions from this project were not considered in the study.

4. Points of Reception

The POR used in this study were identified from the OBM and Google Earth Pro aerial imagery (Sept 2005) as well as Google Earth Pro street view photographs (Sept 2005) within 1 km distance from the Project Site² boundary, and also from visual observations of the Project Site surroundings conducted in August, September 2010.

The POR corresponding to the vacant lots were added based on parcel information provided by First Base Solutions (Teranet Data) and located according to the requirements outlined in Ontario Regulation 359/09, and its amendment (Ontario Regulation 521/10).

The total number of POR within a 1-km distance from the Project Site of McCann Solar Project boundary is 110, including the vacant lots. Three of these noise receptors, identified in Table 4.1, were chosen as representative receptors for evaluating the noise contribution from each individual source. 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 110 noise receptors is provided in Table 6.2 including contribution from each individual project.

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.

A complete list of 255 POR located within 1-km from any of the three solar projects under consideration is provided in Table C.1 of Appendix C.

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.

Table 4.1 Point of Reception Noise Impact from Individual Noise Sources of McCann Solar Project

Source ID	POR 190		POR 200		POR 236	
	Distance (m)	Leq Sound Level (dBA)	Distance (m)	Leq Sound Level (dBA)	Distance (m)	Leq Sound Level (dBA)
Mc_Sub	275	22.4	195	34.0	316	27.2
Mc_Inv1	604	22.0	606	30.7	578	17.2
Mc_Inv2	752	23.9	725	31.1	666	22.8
Mc_Inv3	850	26.4	784	28.1	698	23.0
Mc_Inv4	974	29.9	837	25.1	712	22.6
Mc_Inv5	490	28.9	403	23.0	377	24.1
Mc_Inv6	655	25.7	473	26.6	367	26.7
Mc_Inv7	817	22.9	601	27.8	456	30.6
Mc_Trans1	602	11.0	602	19.9	573	5.9
Mc_Trans2	749	12.9	721	20.4	661	11.9
Mc_Trans3	848	15.4	780	17.2	693	12.1
Mc_Trans4	973	19.0	834	14.2	708	11.7
Mc_Trans5	490	18.2	407	12.1	382	13.1
Mc_Trans6	655	14.8	477	15.7	372	15.7
Mc_Trans7	817	12.0	604	16.8	459	19.7

5. Mitigation Measures

While the analysis indicates that no mitigation will be required, the noise levels will be verified at the closest POR after the Project goes into service. If measurements indicate a need to reduce sound levels to satisfy MOE criteria, mitigation measures will be installed at the sources.

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, such as an agricultural area.

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 Leq) by Time of Day for Class 3 Areas.

Time of Day	One Hour Leq (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 daylight hours; assumed to be until 19:00 during most days of the year. It is noted that in the summer months the sun may shine until past 21:00, however the inverters will be well below 100% loading conditions. As such, during the summer the facility will be operating at the time 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 noise model assumes that the cluster transformers and substation transformer 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-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 assessed 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 within 1 km of McCann Solar Project

(Shaded rows correspond to representative POR)

Existing = Existing dwelling, Vacant = Vacant Lot.

The performance limit is 40.0-dBA. Empty cells represent projects where all sources are further than 3000-m from the POR.

POR ID	Description	Sound Pressure Contribution (dBA) from Projects				Performance Limit (dBA)	POR Height (m)	Min distance to Source (m)	UTM Coordinates NAD 83 (m)		
		Rideau Lake	Crosby	McCann	Total				X	Y	Z
107	Existing	17.7	17.8	23.4	25.3	40.0	4.5	1231	397599	4948651	149.5
113	Vacant	17.1	14.7	24.1	25.3	40.0	4.5	1179	397703	4948833	148.2
116	Existing	19.9	16.3	25.6	27.0	40.0	4.5	934	397876	4948377	145.8
118	Existing	17.3	13.1	26.0	26.7	40.0	4.5	991	397931	4948884	139.5
121	Existing	20.2	15.7	26.9	28.0	40.0	4.5	801	398009	4948385	144.1
122	Existing	20.5	15.8	26.9	28.1	40.0	4.5	793	398021	4948334	143.7
123	Existing	19.7	14.2	27.3	28.2	40.0	4.5	780	398031	4948485	143.8
124	Existing	25.3	16.4	24.1	28.0	40.0	4.5	1058	398078	4947658	135.2
126	Existing	21.3	14.6	27.7	28.7	40.0	4.5	713	398117	4948250	140.2

POR ID	Description	Sound Pressure Contribution (dBA) from Projects				Performance Limit (dBA)	POR Height (m)	Min distance to Source (m)	UTM Coordinates NAD 83 (m)		
		Rideau Lake	Crosby	McCann	Total				X	Y	Z
127	Vacant	20.4	14.1	28.2	29.0	40.0	4.5	688	398122	4948400	140.1
128	Existing	17.2	12.1	27.7	28.2	40.0	4.5	866	398138	4948971	137.4
130	Vacant	20.7	14.0	28.6	29.4	40.0	4.5	648	398164	4948367	139.5
131	Existing	21.8	14.4	28.2	29.3	40.0	4.5	660	398184	4948211	137.0
132	Existing	22.1	14.5	28.0	29.1	40.0	4.5	675	398189	4948156	135.9
133	Vacant	17.0	10.7	27.9	28.3	40.0	4.5	832	398191	4949041	135.3
134	Existing	21.9	14.4	28.2	29.3	40.0	4.5	658	398194	4948189	136.0
135	Vacant	21.2	14.0	28.9	29.7	40.0	4.5	616	398204	4948304	137.8
136	Existing	16.9	10.5	28.1	28.5	40.0	4.5	811	398220	4949064	134.5
137	Vacant	16.7	9.6	28.3	28.6	40.0	4.5	787	398260	4949104	131.9
138	Existing	23.3	14.5	27.9	29.3	40.0	4.5	677	398264	4948021	136.0
139	Vacant	16.5	9.4	28.3	28.7	40.0	4.5	775	398291	4949145	131.6
141	Existing	21.8	13.7	29.9	30.6	40.0	4.5	529	398308	4948254	134.5
142	Existing	16.4	9.2	28.4	28.8	40.0	4.5	761	398319	4949169	132.3
143	Vacant	15.1	4.9	27.1	27.4	40.0	4.5	868	398322	4949366	132.6
145	Existing	16.3	7.0	28.6	28.9	40.0	4.5	743	398360	4949205	131.9
146	Existing	16.2	6.8	28.5	28.8	40.0	4.5	745	398378	4949237	132.7
147	Existing	10.7		25.5	25.6	40.0	4.5	1021	398388	4949637	129.5
148	Existing	27.0	14.6	25.4	29.5	40.0	4.5	895	398399	4947628	134.5
149	Existing	12.0		25.8	26.0	40.0	4.5	988	398399	4949604	129.6
150	Vacant	15.8	4.8	28.1	28.4	40.0	4.5	773	398405	4949316	130.7
151	Existing	10.4		25.2	25.3	40.0	4.5	1058	398429	4949709	129.5
154	Existing	12.0		26.1	26.2	40.0	4.5	963	398451	4949610	129.5
155	Existing	14.9	1.3	28.1	28.3	40.0	4.5	773	398451	4949365	130.0
156	Existing	13.1	0.7	26.6	26.8	40.0	4.5	908	398452	4949543	129.5
157	Existing	17.0	9.5	32.0	32.1	40.0	4.5	524	398478	4948922	129.5
158	Existing	13.3	0.7	27.0	27.2	40.0	4.5	869	398481	4949516	129.5
159	Vacant	16.4	6.9	30.6	30.7	40.0	4.5	588	398483	4949108	129.5
160	Existing	16.9	9.4	32.0	32.2	40.0	4.5	516	398491	4948939	129.5
161	Existing	16.8	7.1	31.3	31.4	40.0	4.5	547	398492	4949038	129.5
162	Existing	14.8	1.1	28.3	28.5	40.0	4.5	747	398510	4949385	129.5
163	Existing	16.6	6.9	31.2	31.3	40.0	4.5	546	398512	4949075	129.5
164	Existing	27.4	14.0	26.0	29.9	40.0	4.5	845	398514	4947631	134.5
165	Existing	27.6	14.0	25.9	30.0	40.0	4.5	863	398517	4947611	134.5
166	Existing	13.3		27.2	27.4	40.0	4.5	845	398524	4949517	129.5
167	Existing	14.6	0.8	28.1	28.3	40.0	4.5	770	398538	4949436	129.5
168	Existing	30.2	14.1	24.1	31.2	40.0	4.5	1065	398540	4947393	137.0
169	Existing	14.1		27.6	27.8	40.0	4.5	815	398544	4949494	129.5
170	Existing	30.0	14.0	24.3	31.1	40.0	4.5	1036	398557	4947418	138.0
172	Vacant	16.1	4.8	30.8	30.9	40.0	4.5	560	398562	4949173	129.5

POR ID	Description	Sound Pressure Contribution (dBA) from Projects				Performance Limit (dBA)	POR Height (m)	Min distance to Source (m)	UTM Coordinates NAD 83 (m)		
		Rideau Lake	Crosby	McCann	Total				X	Y	Z
173	Existing	14.2		28.0	28.2	40.0	4.5	777	398573	4949468	129.5
174	Existing	26.4	13.5	27.5	30.1	40.0	4.5	710	398579	4947751	134.5
175	Existing	15.8	4.6	31.2	31.4	40.0	4.5	528	398600	4949168	129.5
176	Existing	15.4	1.2	30.5	30.6	40.0	4.5	579	398607	4949246	129.5
177	Existing	31.0	14.8	24.0	31.9	40.0	4.5	1086	398612	4947356	139.5
178	Existing	15.6	4.6	31.7	31.8	40.0	4.5	496	398623	4949145	129.5
179	Existing	27.3	13.4	26.9	30.2	40.0	4.5	772	398624	4947674	135.1
180	Existing	15.5	1.5	31.6	31.7	40.0	4.5	499	398628	4949156	129.5
181	Existing	15.2	1.1	31.1	31.3	40.0	4.5	529	398660	4949226	129.5
183	Existing	23.8	12.2	32.2	32.8	40.0	4.5	391	398751	4948037	134.5
184	Existing	23.7	12.1	32.5	33.1	40.0	4.5	373	398755	4948054	134.5
186	Existing	31.8	13.7	24.1	32.5	40.0	4.5	1060	398820	4947363	139.5
187	Vacant	15.7	0.9	34.2	34.2	40.0	4.5	352	398830	4949125	129.5
190	Vacant	16.2	0.6	35.6	35.6	40.0	4.5	295	398920	4949098	130.4
191	Existing	33.6	13.1	23.2	34.0	40	4.5	1154	398944	4947277	139.5
192	Vacant	14.8		32.3	32.4	40	4.5	440	398964	4949297	129.6
193	Vacant	15.0		31.6	31.7	40	4.5	473	398984	4949345	132.6
194	Existing	22.1	8.4	36.9	37.0	40	4.5	260	398999	4948246	137.0
195	Existing	22.1	8.4	36.7	36.9	40	4.5	269	399004	4948238	137.1
196	Existing	21.9	9.8	37.6	37.7	40	4.5	252	399009	4948269	137.3
197	Existing	14.8		30.9	31.0	40	4.5	509	399012	4949395	133.5
198	Existing	21.7	8.2	38.3	38.4	40	4.5	227	399019	4948297	137.1
200	Existing	21.5	8.7	38.8	38.9	40	4.5	189	399056	4948318	138.1
202	Existing	13.4		29.5	29.6	40	4.5	601	399068	4949507	133.7
203	Vacant	8.4		25.8	25.8	40	4.5	755	399075	4949665	129.9
204	Existing	1.5		24.2	24.2	40	4.5	916	399080	4949827	130.2
205	Vacant	6.9		24.6	24.6	40	4.5	874	399085	4949786	130.6
206	Vacant	13.2		27.4	27.6	40	4.5	633	399101	4949545	135.3
207	Existing	1.3		23.8	23.8	40	4.5	947	399109	4949862	132.2
209	Existing	5.3		21.8	21.9	40	4.5	968	399217	4949886	135.2
211	Existing	5.4		22.0	22.1	40	4.5	944	399221	4949862	135.5
213	Existing	5.2		21.6	21.7	40	4.5	986	399249	4949903	135.6
215	Existing	5.2		22.2	22.2	40	4.5	979	399302	4949891	136.6
216	Existing	5.3		23.1	23.2	40	4.5	964	399318	4949875	137.0
218	Existing	5.6		24.1	24.2	40	4.5	916	399377	4949816	138.0
219	Existing	5.8		24.6	24.6	40	4.5	869	399388	4949765	138.2
220	Existing	5.7		24.3	24.3	40	4.5	899	399393	4949795	138.2
221	Existing	5.9		24.6	24.7	40	4.5	860	399401	4949753	138.4
222	Existing	8.8		24.7	24.8	40	4.5	823	399401	4949714	138.4
223	Existing	7.0		24.5	24.6	40	4.5	834	399445	4949713	139.1

POR ID	Description	Sound Pressure Contribution (dBA) from Projects				Performance Limit (dBA)	POR Height (m)	Min distance to Source (m)	UTM Coordinates NAD 83 (m)		
		Rideau Lake	Crosby	McCann	Total				X	Y	Z
224	Existing	1.7		24.3	24.3	40	4.5	860	399448	4949740	139.1
225	Existing	4.9		24.6	24.7	40	4.5	822	399451	4949699	139.2
227	Existing	1.6		24.0	24.1	40	4.5	884	399461	4949761	139.3
229	Existing	4.8		24.5	24.5	40	4.5	839	399470	4949711	139.4
230	Existing	4.9		22.9	23.0	40	4.5	824	399481	4949690	139.5
231	Existing	1.4		22.4	22.4	40	4.5	928	399501	4949794	139.5
235	Existing	1.4		21.3	21.4	40	4.5	950	399541	4949803	139.7
236	Vacant	18.2		35.1	35.2	40	4.5	274	399548	4948495	134.6
239	Vacant	18.6		33.0	33.1	40	4.5	376	399667	4948537	134.5
241	Existing	16.8		30.8	30.9	40	4.5	552	399802	4948830	134.5
243	Vacant	15.1		28.8	29.0	40	4.5	685	399854	4949108	144.8
244	Vacant	16.9		29.9	30.1	40	4.5	602	399876	4948771	134.5
247	Existing	16.0		28.0	28.3	40	4.5	766	400011	4948883	139.8
248	Existing	16.0		27.9	28.1	40	4.5	785	400015	4948923	143.5
249	Existing	16.1		27.9	28.2	40	4.5	771	400027	4948855	138.7
250	Existing	15.1		27.2	27.5	40	4.5	857	400048	4949021	149.2
251	Existing	15.9		27.4	27.7	40	4.5	818	400071	4948871	140.5
252	Existing	14.8		26.2	26.5	40	4.5	948	400146	4949028	149.5
253	Existing	14.8		26.1	26.4	40	4.5	956	400152	4949034	149.5
254	Vacant	12.3		24.7	24.9	40	4.5	1103	400265	4949186	148.3
255	Vacant	13.9		23.1	23.6	40	4.5	1087	400299	4949028	145.2

The results of this study show that all POR are compliant with MOE guidelines based on the performance limit of 40-dBA.

7. Conclusions and Recommendations

For the McCann Solar Project, the sound pressure levels at the POR have been estimated using the CADNA-A model, based on ISO 9613-2. It has been determined that no mitigation measures are needed for the Project operation in accordance with Ontario Regulation 359/09 and 521/10.

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

8. Signatures

Report Prepared By

Auret Basson, Mechanical Engineering Intern

Report Reviewed and Approved By

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

9. References

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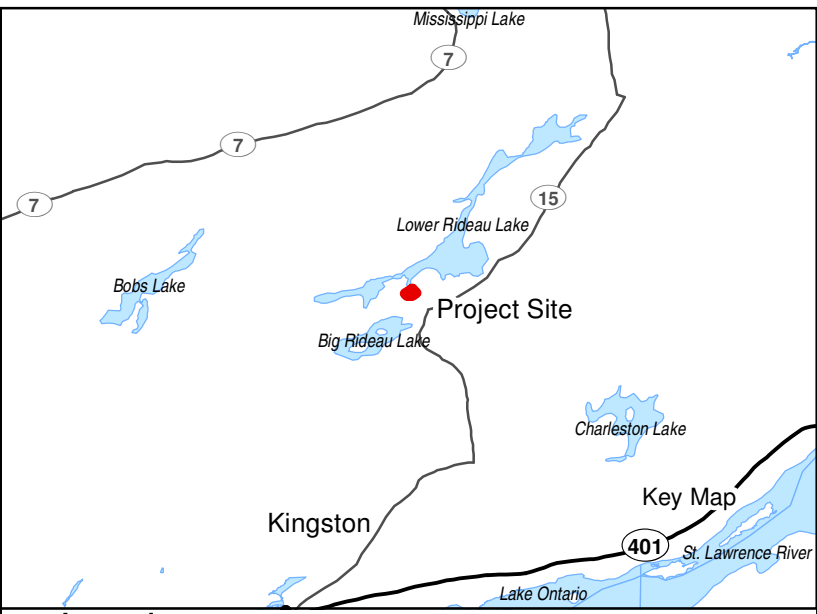
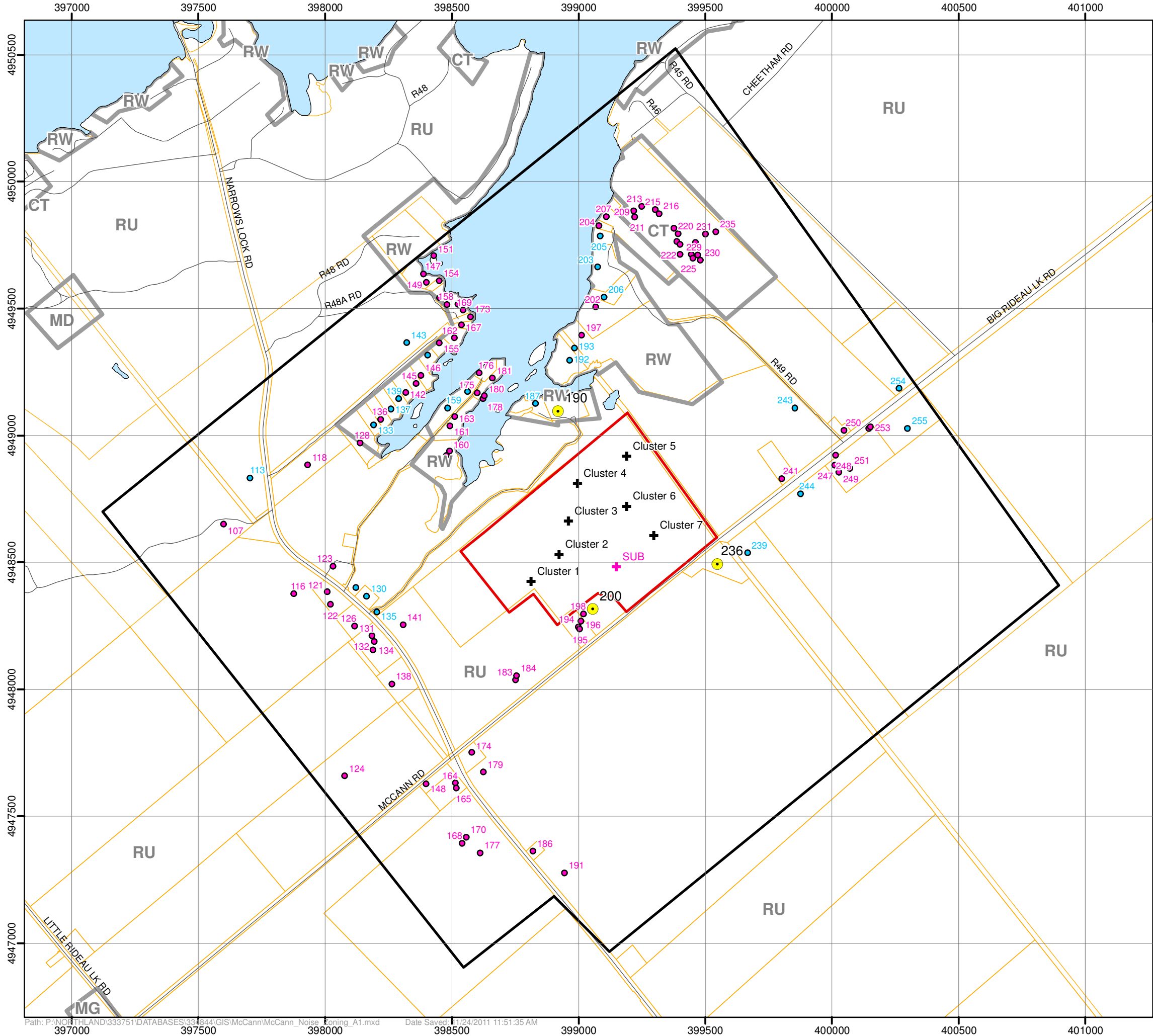
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Appendix A

**Land Use Zoning Designation Plan and
Area Location Plan**



Legend

- Cluster # Inverter Cluster
- SUB Substation Transformer
- # Noise Receptor - Existing
- # Noise Receptor - Vacant
- # Representative Noise Receptor
- Road
- Parcel
- Project Site
- 1000 m from Project Site
- Waterbody

Zones

- RG General Residential
- RW Waterfront Residential
- RMH Mobile Home Park Residential
- CG General Commercial
- CL Local Commercial
- CT Tourist Commercial
- MG General Industrial
- MS Salvage Yard Industrial
- MD Disposal Industrial
- I Institutional
- OS Open Space
- PL Parking Lot
- RU Rural
- A Agriculture
- EX Mineral Aggregate Extraction
- EP-A Environmental Protection - A
- EP-B Environmental Protection - B
- FP Flood Plain

Notes:
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 2. Spatial referencing UTM NAD 83.

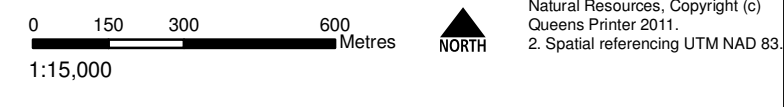
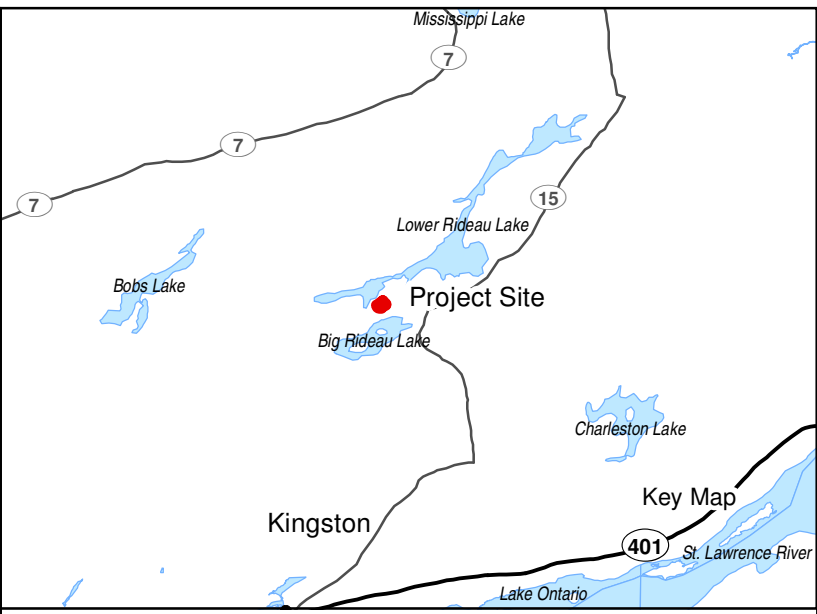
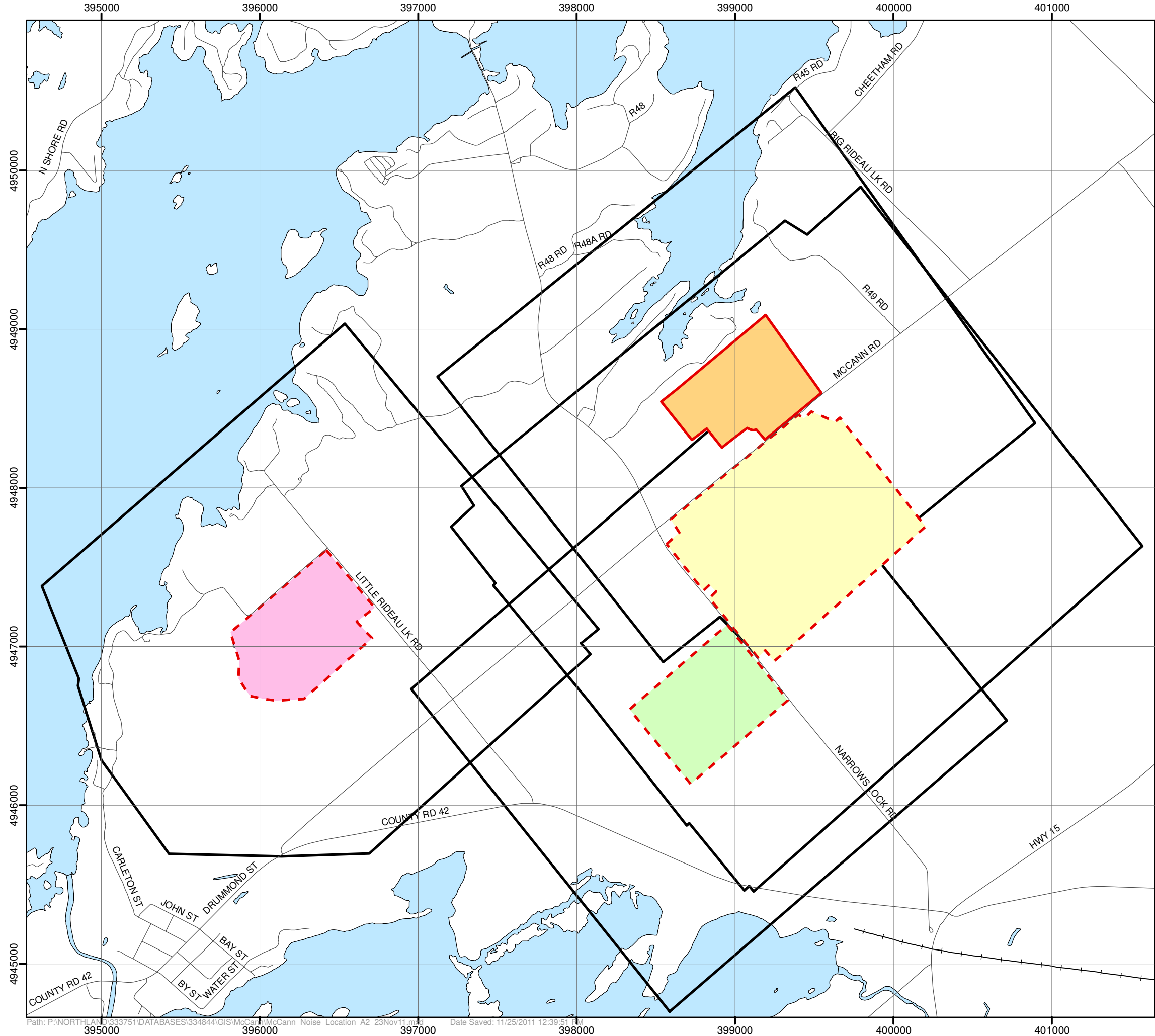







Figure A.1
 Northland Power Inc.
McCann Solar Project
Zoning Designation Plan




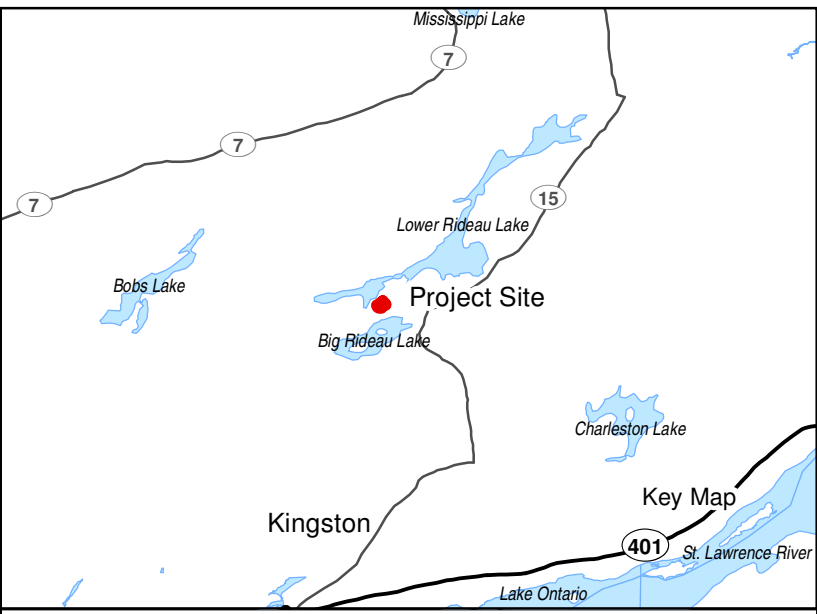
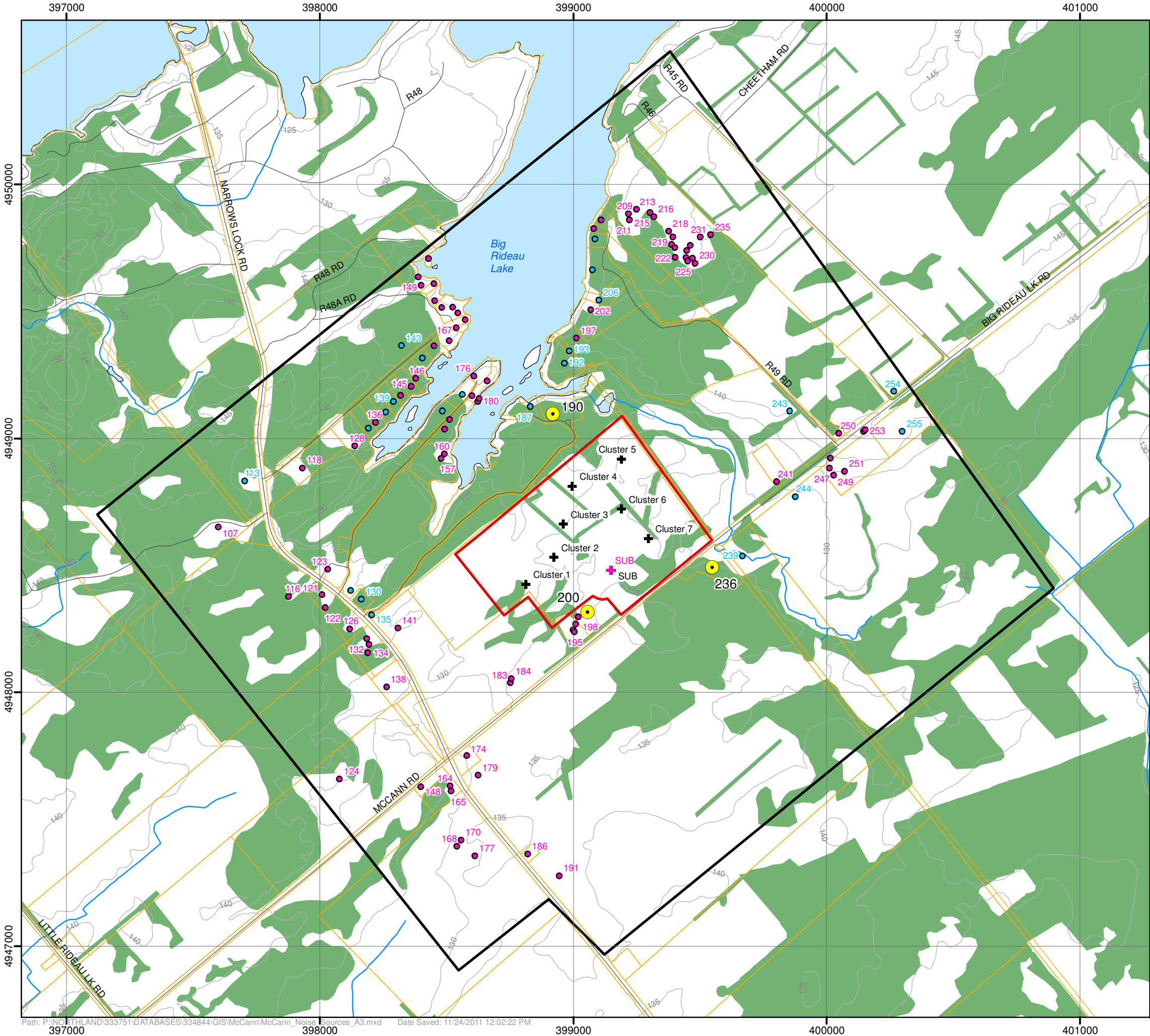
Legend

-  Railway
-  Road
-  McCann Project Site
-  Crosby Project Site
-  Newboro 1 Project Site (SunEdison Canada)
-  Rideau Lakes Project Site
-  1000 m from Project Site
-  Waterbody

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 2. Spatial referencing UTM NAD 83.



Figure A.2
 Northland Power Inc.
McCann Solar Project
Scaled Area Location Plan
- Adjacent Projects 



- Legend**
- Cluster #
 - +
 Inverter Cluster
 - SUB
 Substation Transformer
 - #
 Noise Receptor - Existing
 - #
 Noise Receptor - Vacant
 - #
 Representative Noise Receptor
 -
 Road
 -
 Topographic Contour (5m interval)
 -
 Watercourse
 - ▭
 Parcel
 - ▭
 McCann Project Site
 - ▭
 1000 m from Project Site
 - ▭
 Waterbody
 - ▭
 Wooded Area

Notes:
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 2. Spatial referencing UTM NAD 83.
 3. Due to scale limitations, the three-part inverter unit is represented as a single point.



Figure A.3
 Northland Power Inc.
McCann Solar Project
 Scaled Area Location Plan

Appendix B

Noise Sources

Table B.1 Point Sources from McCann Solar Project Used in CADNA-A, Includes Tonality Penalty of 5.0-dBA.

Source ID	Description	Spectra ID	Total sound power level (dBA)	Correction (dB)	Height (m)	Coordinates, UTM NAD 83		
						X	Y	Z
Mc_Sub	44-kV/10-MVA substation transformer	T44kV_10MVA	90.8	5.0	3.50	399149	4948483	136.2
Mc_Inv1	Two Sunny Central 800CP inverters at Cluster 1	SMA_SC800CPX2	91.3	5.0	2.60	398809	4948423	131.1
Mc_Inv2	Two Sunny Central 800CP inverters at Cluster 2	SMA_SC800CPX2	91.3	5.0	2.60	398918	4948534	132.6
Mc_Inv3	Two Sunny Central 800CP inverters at Cluster 3	SMA_SC800CPX2	91.3	5.0	2.60	398955	4948665	132.4
Mc_Inv4	Two Sunny Central 800CP inverters at Cluster 4	SMA_SC800CPX2	91.3	5.0	2.60	398991	4948812	132.2
Mc_Inv5	Two Sunny Central 800CP inverters at Cluster 5	SMA_SC800CPX2	91.3	5.0	2.60	399195	4948918	132.6
Mc_Inv6	Two Sunny Central 800CP inverters at Cluster 6	SMA_SC800CPX2	91.3	5.0	2.60	399195	4948721	132.6
Mc_Inv7	Two Sunny Central 800CP inverters at Cluster 7	SMA_SC800CPX2	91.3	5.0	2.60	399296	4948602	132.8
Mc_Trans1	27.6-kV/1.6-MVA cluster transformer at Cluster 1	T27.6kV_1.6MVA	80.1	5.0	2.58	398813	4948427	131.1
Mc_Trans2	27.6-kV/1.6-MVA cluster transformer at Cluster 2	T27.6kV_1.6MVA	80.1	5.0	2.58	398923	4948533	132.6
Mc_Trans3	27.6-kV/1.6-MVA cluster transformer at Cluster 3	T27.6kV_1.6MVA	80.1	5.0	2.58	398960	4948664	132.5
Mc_Trans4	27.6-kV/1.6-MVA cluster transformer at Cluster 4	T27.6kV_1.6MVA	80.1	5.0	2.58	398996	4948812	132.4
Mc_Trans5	27.6-kV/1.6-MVA cluster transformer at Cluster 5	T27.6kV_1.6MVA	80.1	5.0	2.58	399190	4948919	132.6
Mc_Trans6	27.6-kV/1.6-MVA cluster transformer at Cluster 6	T27.6kV_1.6MVA	80.1	5.0	2.58	399190	4948722	132.6
Mc_Trans7	27.6-kV/1.6-MVA cluster transformer at Cluster 7	T27.6kV_1.6MVA	80.1	5.0	2.58	399297	4948607	132.7

Table B.2 Point Sources from Crosby and Rideau Lakes Solar Projects Used in CADNA-A, Includes Tonality Penalty of 5.0-dBA.

Source ID	Spectra ID	Total sound power level (dBA)	Correction (dB)	Height (m)	Coordinates, UTM NAD 83		
					X	Y	Z
RL_Sub	T44kV_10MVA	90.8	5.0	3.50	399020	4947013	138.5
RL_Inv1	SMA_SC800CPX2	91.3	5.0	2.60	398641	4946755	137.6
RL_Inv2	SMA_SC800CPX2	91.3	5.0	2.60	398568	4946627	137.6
RL_Inv3	SMA_SC800CPX2	91.3	5.0	2.60	398568	4946515	137.6
RL_Inv4	SMA_SC800CPX2	91.3	5.0	2.60	398640	4946352	137.6
RL_Inv5	SMA_SC800CPX2	91.3	5.0	2.60	398843	4946798	139.4
RL_Inv6	SMA_SC800CPX2	91.3	5.0	2.60	398879	4946626	141.5
RL_Inv7	SMA_SC800CPX2	91.3	5.0	2.60	398879	4946462	139.1
RL_Trans1	T27.6kV_1.6MVA	80.1	5.0	2.58	398646	4946755	137.7
RL_Trans2	T27.6kV_1.6MVA	80.1	5.0	2.58	398573	4946626	137.6
RL_Trans3	T27.6kV_1.6MVA	80.1	5.0	2.58	398573	4946514	137.6
RL_Trans4	T27.6kV_1.6MVA	80.1	5.0	2.58	398645	4946351	137.6
RL_Trans5	T27.6kV_1.6MVA	80.1	5.0	2.58	398838	4946798	139.4
RL_Trans6	T27.6kV_1.6MVA	80.1	5.0	2.58	398874	4946626	141.4
RL_Trans7	T27.6kV_1.6MVA	80.1	5.0	2.58	398874	4946463	139.0
Cr_Sub	T44kV_10MVA	90.8	5.0	3.50	396603	4947196	141.5
Cr_Inv1	SMA_SC800CPX2	91.3	5.0	2.60	396127	4947157	137.6
Cr_Inv2	SMA_SC800CPX2	91.3	5.0	2.60	396085	4947025	135.1
Cr_Inv3	SMA_SC800CPX2	91.3	5.0	2.60	396085	4946901	134.0
Cr_Inv4	SMA_SC800CPX2	91.3	5.0	2.60	396085	4946787	133.3
Cr_Inv5	SMA_SC800CPX2	91.3	5.0	2.60	396403	4946883	137.6
Cr_Inv6	SMA_SC800CPX2	91.3	5.0	2.60	396435	4947022	137.9
Cr_Inv7	SMA_SC800CPX2	91.3	5.0	2.60	396393	4947145	137.6
Cr_Trans1	T27.6kV_1.6MVA	80.1	5.0	2.58	396132	4947156	137.6
Cr_Trans2	T27.6kV_1.6MVA	80.1	5.0	2.58	396090	4947024	135.1
Cr_Trans3	T27.6kV_1.6MVA	80.1	5.0	2.58	396090	4946901	134.2
Cr_Trans4	T27.6kV_1.6MVA	80.1	5.0	2.58	396090	4946787	133.5
Cr_Trans5	T27.6kV_1.6MVA	80.1	5.0	2.58	396398	4946883	137.6
Cr_Trans6	T27.6kV_1.6MVA	80.1	5.0	2.58	396440	4947022	137.9
Cr_Trans7	T27.6kV_1.6MVA	80.1	5.0	2.58	396398	4947145	137.6

Table B.3 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
SMA_SC800CPX2		63.1	73.9	80.5	82.3	78.7	74.1	65.0	72.7	86.3	95.0
T27.6kV_1.6MVA	32.3	51.5	63.6	66.1	71.5	68.7	64.9	59.7	50.6	75.1	83.7
T44kV_10MVA	43.0	62.2	74.3	76.8	82.2	79.4	75.6	70.4	61.3	85.8	94.4

SUNNY CENTRAL 720CP / 760CP / 800CP

SC 720CP-10 / SC 760CP-10 / SC 800CP-10



Economic

- Direct deployment in the field due to outdoor enclosure
- Simplified shipping without concrete substation

Efficient

- Full nominal power at ambient temperatures up to 50 °C
- 10 % additional power for constant operation at ambient temperatures up to 25 °C

Flexible

- Powerful grid management functions (including LVRT)
- DC voltage range configurable

Reliable

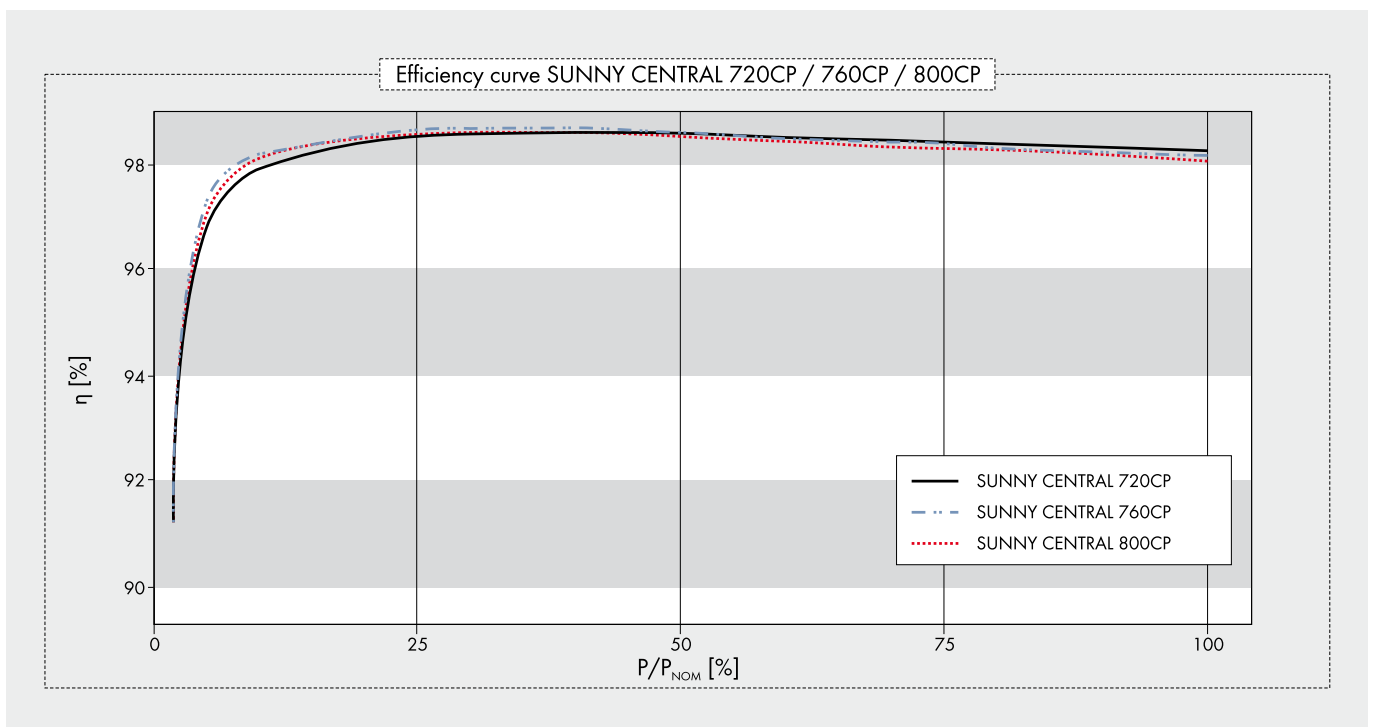
- Easy and safe installation due to a separate connection area
- Optional: extended input voltage range up to 1,100 V

SUNNY CENTRAL 720CP / 760CP / 800CP

High performance as standard

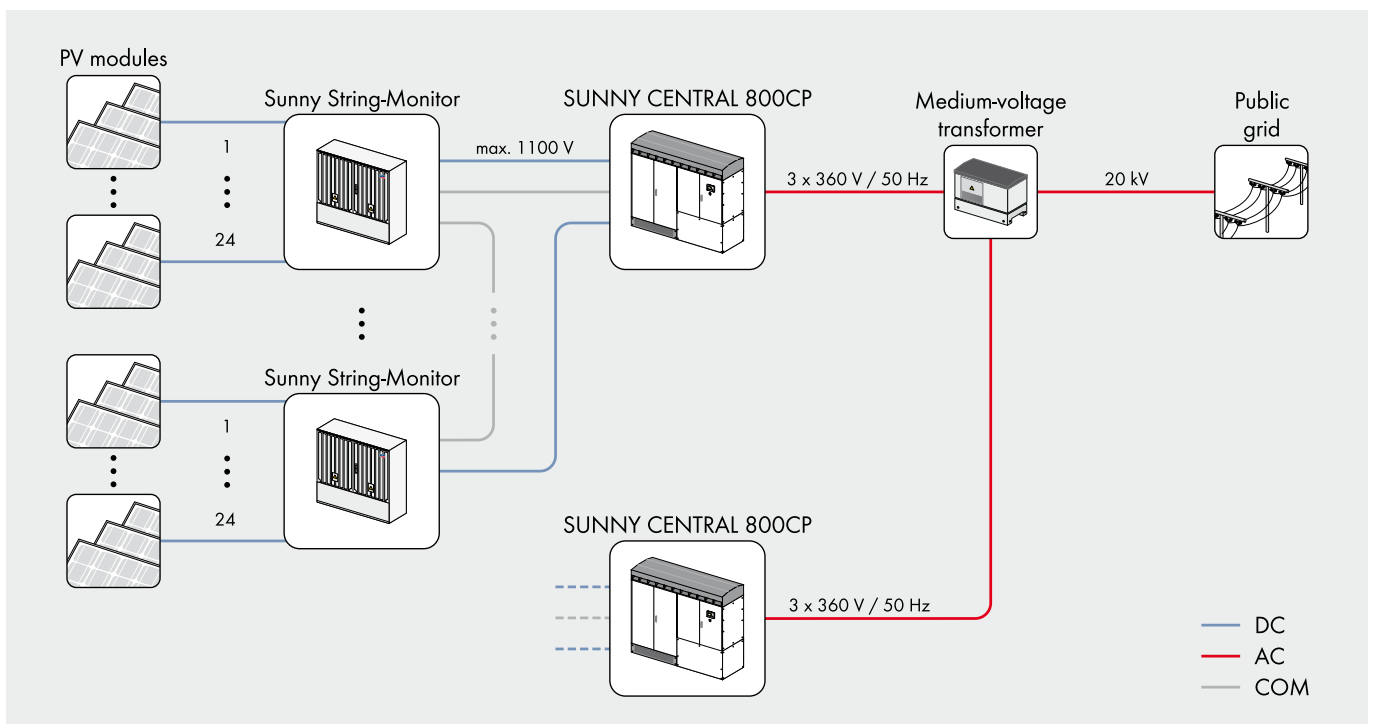
The completely new design of the Sunny Central CP series saves you real money. The compact and weatherproof enclosure is easy to load and transport and can be installed almost anywhere – there is no need for heavy protective concrete substations any longer. The innovative cooling concept OptiCool allows it to operate at full nominal power with ambient temperatures up to 50 °C. With the powerful grid management functions you are perfectly prepared for today's utility requirements as well as those still to come. The intelligent power management is the most important feature: in continuous operation, the Sunny Central 800CP can feed 880 kVA to the grid at ambient temperatures of up to 25 °C – that's 10 % more than the rated nominal power.

Technical data	Sunny Central 720CP	Sunny Central 760CP	Sunny Central 800CP
Input Data			
MPP voltage range	515 V – 820 V ^{3) 5)}	545 V – 820 V ^{3) 5)}	570 V – 820 V ^{3) 5)}
Max. DC voltage	1000 V / 1100 V ¹⁾ Optional		
Max. DC current	1400 A	1400 A	1400 A
Number of DC inputs	9 fused inputs		
Output Values			
Nominal AC output @ 50 °C	720 kVA	760 kVA	800 kVA
Continuous AC power @ 25 °C	792 kVA	836 kVA	880 kVA
Max. AC current	1411 A	1411 A	1411 A
Nominal AC-current	1283 A	1283 A	1283 A
Nominal AC-voltage ±10 %	324 V	342 V	360 V
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	< 1500 W ⁴⁾	< 1500 W ⁴⁾	< 1500 W ⁴⁾
Standby consumption	< 100 W	< 100 W	< 100 W
External auxiliary voltage	3 x 230 V, 50 / 60 Hz	3 x 230 V, 50 / 60 Hz	3 x 230 V, 50 / 60 Hz
Dimensions and Weight			
Dimensions (W / H / D) in mm	2562 / 2279 / 956	2562 / 2279 / 956	2562 / 2279 / 956
Weight	1800 kg	1800 kg	1800 kg
Efficiency ²⁾			
Max. efficiency	98.6 %	98.6 %	98.6 %
Euro ETA	98.4 %	98.4 %	98.4 %
CEC-eta	98.4 %	98.4 %	98.4 %
Protection Rating and Ambient Conditions			
Protection rating (as per IEC 60529)	IP54	IP54	IP54
Protection rating (as per IEC 60721-3-3)	<ul style="list-style-type: none"> • Classification of chemically active substances: 3C2 • Classification of mechanically active substances: 3S2 		
Ambient conditions: fixed location, with protection against wind and weather			
Operation temperature range	-20 °C ... +50 °C	-20 °C ... +50 °C	-20 °C ... +50 °C
Rel. humidity	15 % ... 95 %	15 % ... 95 %	15 % ... 95 %
Fresh air consumption	3000 m ³ /h	3000 m ³ /h	3000 m ³ /h
Max. altitude above sea level	2000 m	2000 m	2000 m

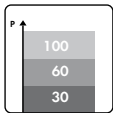


	Sunny Central 720CP	Sunny Central 760CP	Sunny Central 800CP
Features			
Sunny WebBox	●	●	●
Communication	Ethernet (optical fiber optional)	Ethernet (optical fiber optional)	Ethernet (optical fiber optional)
Communication with Sunny String-Monitor	RS485	RS485	RS485
LCD graphic display	●	●	●
Enclosure color	RAL 9016	RAL 9016	RAL 9016
Color of base	RAL 7005	RAL 7005	RAL 7005
Color of roof	RAL 7004	RAL 7004	RAL 7004
Ground fault monitoring / insulation monitoring	●	●	●
Circuit breaker AC side	●	●	●
Motor driven load disconnection switch on DC side	●	●	●
AC overvoltage protector	●	●	●
DC overvoltage protector	●	●	●
Overvoltage protectors for auxiliary supply	●	●	●
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 name	SC 720CP-10	SC 760CP-10	SC 800CP-10

- 1) Startup at DC voltage < 1000 V
- 2) Efficiency measured without internal power supply
- 3) Further AC voltages, DC voltages and power classes can be configured (For detailed information see Technical Information „Innovations_CP“ at www.SMA.de)
- 4) Internal consumption at nominal power
- 5) At $1.05 U_{AC,nom}$ and $\cos \varphi = 1$
- 6) With complete dynamic grid support

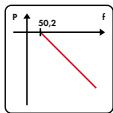


POWERFUL GRID MANAGEMENT FUNCTIONS



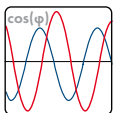
Remote controlled power reduction in case of grid overload

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.



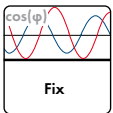
Frequency-dependent control of active power

As 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.



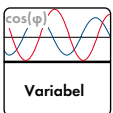
Static voltage support based on reactive power

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



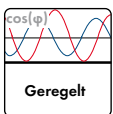
a) Fixed definition of the reactive power by the grid operator

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



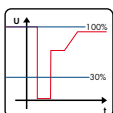
b) Definition of a dynamic setpoint of the reactive power by the utility operator

The grid operator defines a dynamic displacement factor - any value between $\cos(\varphi)_{\text{leading}} = 0.90$ und $\cos(\varphi)_{\text{lagging}} = 0.90$. 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.

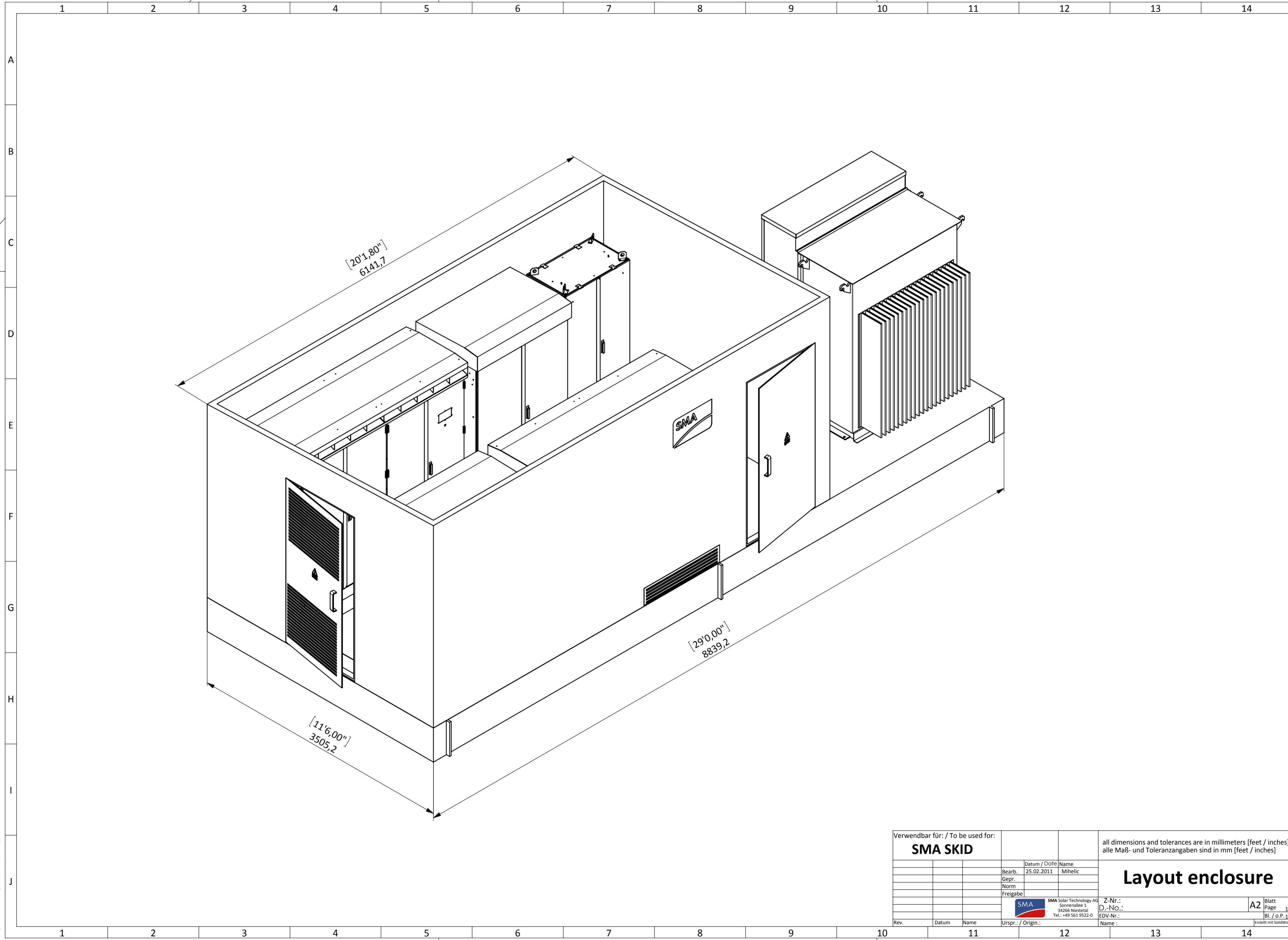


Limited Dynamic Grid Support

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.

Dynamic Grid Support

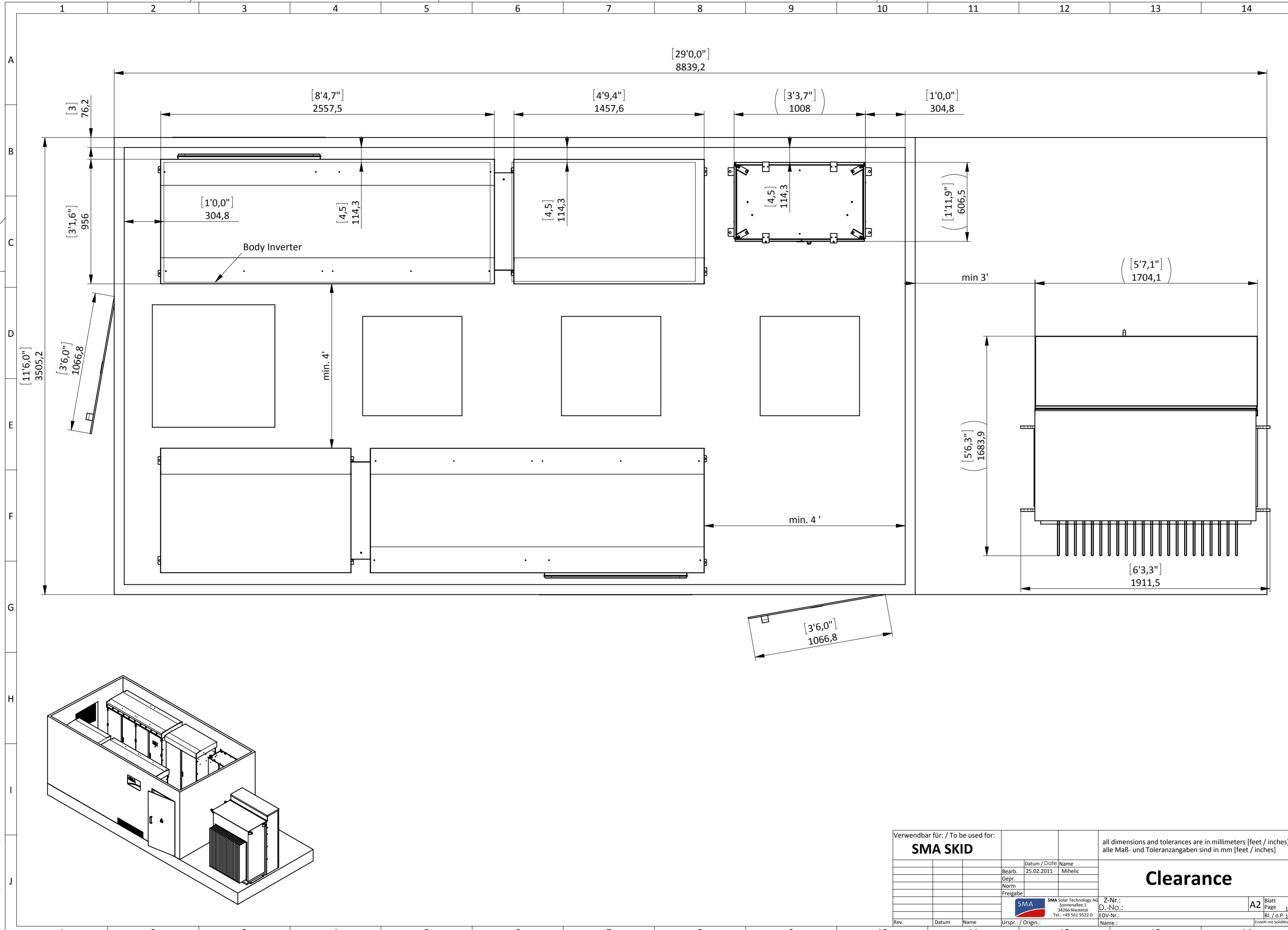
LVRT (Low-Voltage Ride Through): The inverter stays connected to the grid during voltage drops and supports the grid by feeding reactive power.



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Verwendbar für: / To be used for:			SMA SKID		all dimensions and tolerances are in millimeters [feet / inches] alle Maß- und Toleranzangaben sind in mm [feet / inches]			
Rev.	Datum	Name	Urspr.: / Origin:	SMA Solar Technology AG Sonnenallee 1 34266 Niestetal Tel.: +49 561 9522-0		Z-Nr.:	D.-No.:	EDV-Nr.:
				SMA Solar Technology AG Sonnenallee 1 34266 Niestetal Tel.: +49 561 9522-0				
				SMA Solar Technology AG Sonnenallee 1 34266 Niestetal Tel.: +49 561 9522-0				
				SMA Solar Technology AG Sonnenallee 1 34266 Niestetal Tel.: +49 561 9522-0				
				SMA Solar Technology AG Sonnenallee 1 34266 Niestetal Tel.: +49 561 9522-0				
				SMA Solar Technology AG Sonnenallee 1 34266 Niestetal Tel.: +49 561 9522-0				
				SMA Solar Technology AG Sonnenallee 1 34266 Niestetal Tel.: +49 561 9522-0				
				SMA Solar Technology AG Sonnenallee 1 34266 Niestetal Tel.: +49 561 9522-0				
				SMA Solar Technology AG Sonnenallee 1 34266 Niestetal Tel.: +49 561 9522-0				
				SMA Solar Technology AG Sonnenallee 1 34266 Niestetal Tel.: +49 561 9522-0				

Layout enclosure



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8839,2

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2557,5

[4'9,4"]
1457,6

([3'3,7"])
1008

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304,8

[3]
76,2

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114,3

[4,5]
114,3

[4,5]
114,3

([1'11,9"])
606,5

[3'1,6"]
956

Body Inverter

min 3'

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1704,1

[11'6,0"]
3505,2

[3'6,0"]
1066,8

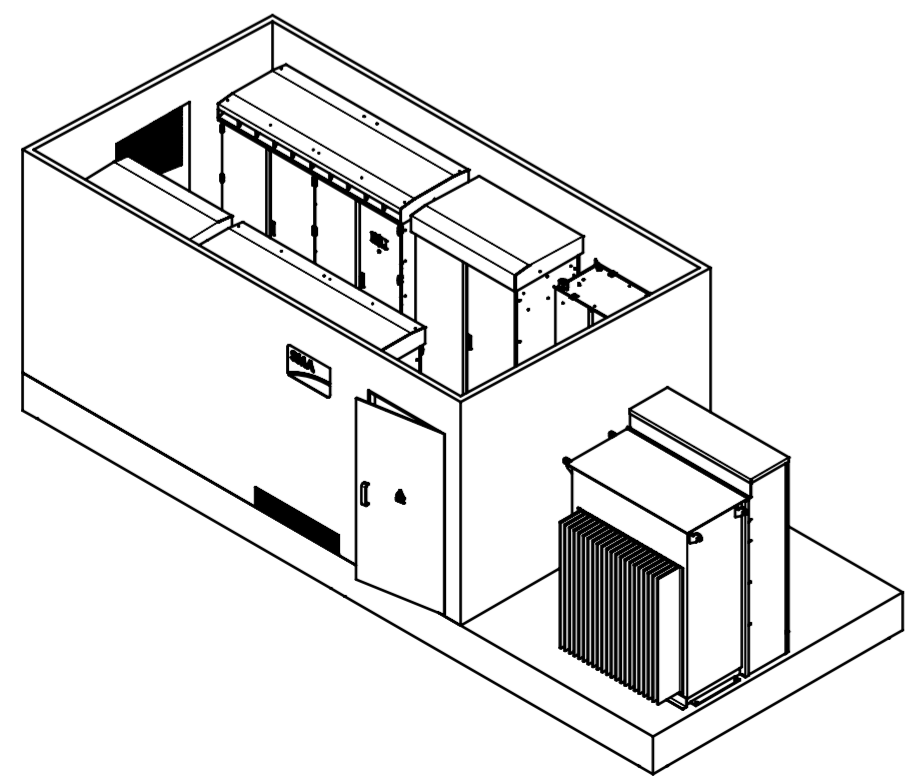
min. 4'

min. 4'

([5'6,3"])
1683,9

[6'3,3"]
1911,5

[3'6,0"]
1066,8



Verwendbar für: / To be used for:			all dimensions and tolerances are in millimeters [feet / inches] alle Maß- und Toleranzangaben sind in mm [feet / inches]				
SMA SKID			<h1>Clearance</h1>				
Rev.	Datum	Name				Datum / Date	Name
						25.02.2011	Mihelic
						Gepr.	
						Norm	
			Freigabe				
			SMA Solar Technology AG Sonnenallee 1 34266 Niestetal Tel.: +49 561 9522-0		Z-Nr.: D.-No.: EDV-Nr.:		
			Name:		A2 Blatt Page 1 Bl. / o.P. 1 <small>Erstellt mit SolidWorks</small>		

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Terz-midle-frequency [kHz]	Soundpower-level L_{xpA} [dB _A]500kW	Soundpower-level L_{xpA} [dB _A]640kW	Soundpower-level L_{xpA} [dB _A]720kW	Soundpower-level L_{xpA} [dB _A]760kW	Soundpower-level L_{xpA} [dB _A]800kW
0,05	63,30	55,30	57,70	67,00	56,50
0,063	60,80	53,10	56,80	63,20	54,00
0,08	63,90	56,30	56,50	59,50	55,20
0,1	64,10	66,20	65,00	66,50	68,10
0,125	65,70	64,50	60,60	65,20	62,00
0,16	72,30	65,80	65,50	63,20	66,40
0,2	67,30	64,60	66,80	64,90	67,80
0,25	66,10	76,20	77,50	70,80	72,40
0,315	78,40	79,80	77,70	82,20	75,10
0,4	73,70	73,90	73,90	72,80	66,70
0,5	77,80	78,70	77,70	77,40	74,70
0,63	78,90	78,90	74,60	77,40	77,00
0,8	70,60	72,50	74,10	70,60	72,00
1	72,20	71,00	70,00	68,90	67,90
1,25	72,40	72,00	71,50	70,80	71,80
1,6	67,30	68,30	76,70	68,60	68,50
2	69,30	66,30	66,50	67,20	65,30
2,5	65,10	66,80	64,60	64,80	63,90
3,15	62,60	64,30	65,00	63,20	61,00
4,0	53,50	54,20	54,70	52,30	53,80
5,0	51,30	49,50	50,50	51,20	49,80
6,3	68,90	72,60	73,50	73,50	69,70

SC800CP at nominal power of 800 kW at 60 Hz

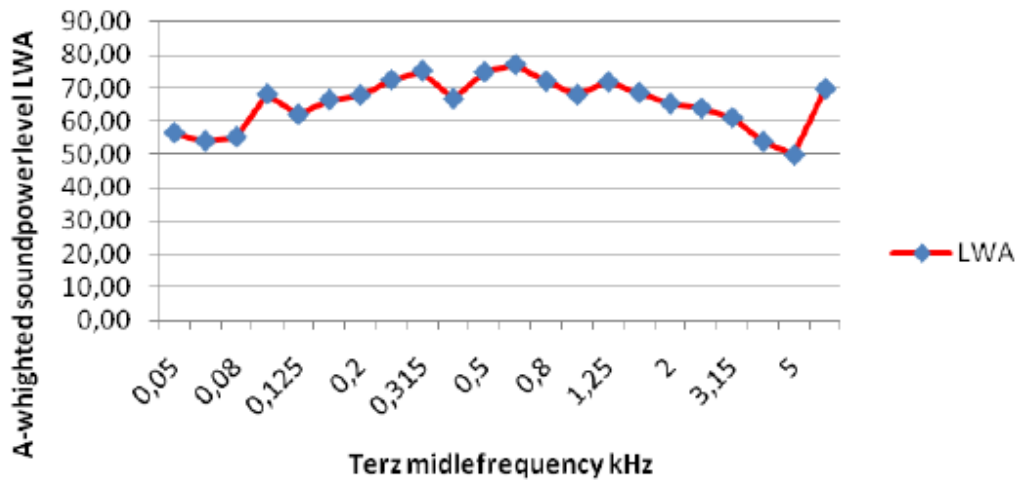
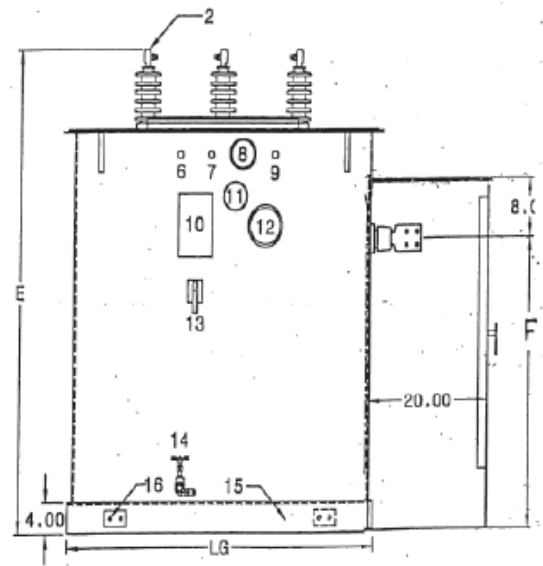
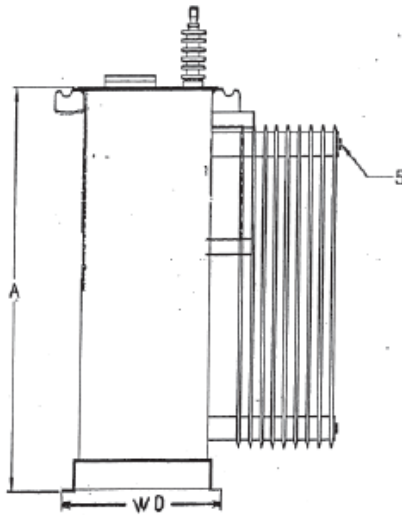
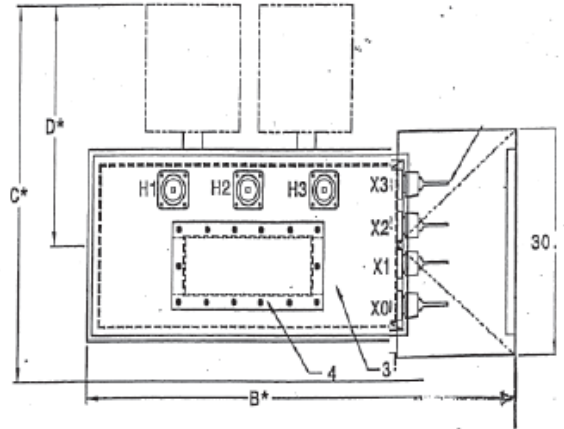


Figure B.1 SC800CP Inverter Sound Power Level as Provided by SMA. Note that the Header in the Table above Represents Various Inverter Models of CS###CP Series.

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.2 44-kVA/10-MVA Substation Transformer Catalogue Dimensions (inches).

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)

Average LpA 68 dBA Based on NEMA TR1-1993 (R2000), Table 0-2
 Estimated surface area 35 m² Estimated based on similar transformer dimensions

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 $L_w = \text{Average LpA} + 10 \cdot \log(\text{Estimated surface area}) + C + 10$

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.3 Sound Power Level Calculation for 44-kV/10-MVA Substation Transformer.

Sound Power Level Calculation for SMA Sunny Central 800CP, 100% LOAD

Third octave, as provided		
Freq #	Freq (Hz)	LwA (dBA)
1	25	
2	31.5	
3	40	
4	50	56.5
5	63	54.0
6	80	55.2
7	100	68.1
8	125	62.0
9	160	66.4
10	200	67.8
11	250	72.4
12	315	75.1
13	400	66.7
14	500	74.7
15	630	77.0
16	800	72.0
17	1000	67.9
18	1250	71.8
19	1600	68.5
20	2000	65.3
21	2500	63.9
22	3150	61.0
23	4000	53.8
24	5000	49.8
25	6300	69.7
26	8000	
27	10000	
Total LwA		83.3

Full octave, as used in CADNA-A model			
Freq #	Freq (Hz)	LwA 1 inverter (dBA)	LwA 2 inverters (dBA)
	31.5		
5	63	60.1	63.1
8	125	70.9	73.9
11	250	77.5	80.5
14	500	79.3	82.3
17	1000	75.7	78.7
20	2000	71.1	74.1
23	4000	62.0	65.0
26	8000	69.7	72.7
Total LwA		83.3	86.3

$$10 \log \left(10^{\frac{56.5}{10}} + 10^{\frac{54.0}{10}} + 10^{\frac{55.2}{10}} \right) = 60.1 \text{ dBA}$$

$$10 \log \left(10^{\frac{60.1}{10}} + 10^{\frac{60.1}{10}} \right) = 63.1 \text{ dBA}$$

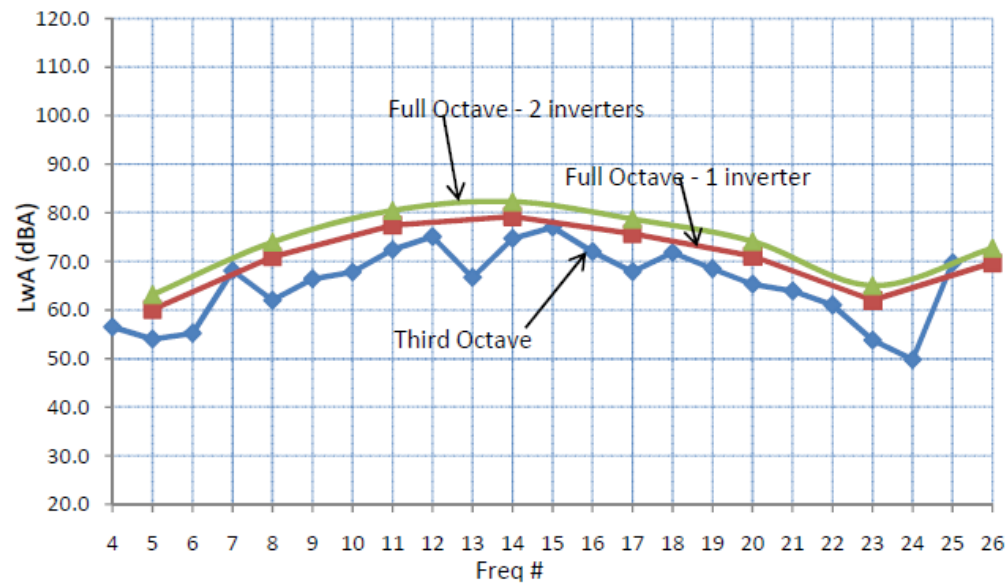


Figure B.4 Sound Power Level Calculation for SMA Sunny Central 800CP, 100% LOAD.

Estimated Frequency Spectra for Transformers

Transformer - 27.6kV/1.6MVA

From Handbook of Noise and Vibration Control (Crocker, 2007, page 1335-1336, Eq. 18 and Table 20)

Average LpA 61 dBA Based on NEMA TR1-1993 (R2000), Table 0-2
 Estimated surface area 14.872 m² Estimated based on client transformer drawings

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 Indoors Serious Noise Problems
C2	-11	-2	3	-2	-2	-11	-19	-24	-31	
C3	-11	-2	3	2	2	-4	-9	-14	-21	

Sound Power Level calculated as $L_w = \text{Average LpA} + 10 \cdot \log(\text{Estimated surface area}) + C + 10$

Freq. (Hz)	31	63	125	250	500	1000	2000	4000	8000	Combined [dB]
C1 based [dB]	71.7	77.7	79.7	74.7	74.7	68.7	63.7	58.7	51.7	83.8
C2 based [dB]	71.7	80.7	85.7	80.7	80.7	71.7	63.7	58.7	51.7	88.8
C3 based [dB]	71.7	80.7	85.7	84.7	84.7	78.7	73.7	68.7	61.7	90.8

Resulting A-weighted sound power level

Freq. (Hz)	A-Weight	C1 based [dBA]	C2 based [dBA]	C2 based [dBA]
31	-39.4	32.3	41.3	46.3
63	-26.2	51.5	54.5	54.5
125	-16.1	63.6	69.6	69.6
250	-8.6	66.1	72.1	76.1
500	-3.2	71.5	77.5	81.5
1000	0	68.7	71.7	78.7
2000	1.2	64.9	64.9	74.9
4000	1	59.7	59.7	69.7
8000	-1.1	50.6	50.6	60.6
LwA [dBA]		75.1	80.1	84.9


 Used in the study

Figure B.5 Sound Power Level Calculation for 27.6-kV/1.6-MVA Cluster Transformer.

Appendix C

Points of Reception Coordinates and Noise Maps from CADNA-A

Table C.1 List of all receptors considered for the combined noise study from the three solar projects

ID	Description	Coordinates UTM NAD83	
		X	Y
1	Existing	394911	4946582
2	Existing	394960	4946823
3	Existing	394962	4946797
4	Existing	394965	4946647
5	Existing	394965	4946753
6	Existing	394966	4946773
7	Existing	394968	4946838
8	Existing	394975	4946859
9	Existing	394982	4946742
10	Vacant	394985	4946774
11	Existing	394991	4946886
12	Existing	395006	4946914
13	Existing	395013	4946940
14	Existing	395015	4946869
15	Vacant	395020	4946778
16	Existing	395026	4946984
17	Existing	395035	4947026
18	Vacant	395045	4946272
19	Existing	395052	4947080
20	Vacant	395055	4946326
21	Existing	395057	4947093
22	Vacant	395067	4946781
23	Vacant	395073	4946367
24	Existing	395088	4947125
25	Existing	395108	4947134
26	Existing	395181	4947140
27	Existing	395328	4947059
28	Existing	395415	4947396
29	Vacant	395436	4947070
30	Existing	395440	4947171
31	Existing	395443	4947368
32	Existing	395474	4947518
33	Existing	395479	4947537
34	Existing	395479	4947624
35	Existing	395492	4947297
36	Existing	395503	4947243

ID	Description	Coordinates UTM NAD83	
		X	Y
37	Existing	395505	4947654
38	Existing	395524	4947656
39	Existing	395553	4947160
40	Existing	395800	4947848
41	Existing	395873	4948193
42	Existing	395879	4948207
43	Existing	395880	4948181
44	Existing	395887	4948171
45	Existing	395891	4948225
46	Existing	395893	4948021
47	Existing	395896	4948048
48	Existing	395896	4948158
49	Existing	395904	4948147
50	Existing	395908	4948239
51	Existing	395914	4948211
52	Vacant	395931	4948234
53	Existing	395935	4948157
54	Existing	395939	4948130
55	Existing	395940	4948187
56	Existing	395957	4948274
57	Existing	395995	4947982
58	Existing	396002	4948363
59	Existing	396023	4948037
60	Existing	396026	4948399
61	Vacant	396056	4948419
62	Existing	396061	4948470
63	Existing	396086	4948505
64	Existing	396110	4947887
65	Existing	396110	4948475
66	Vacant	396114	4945766
67	Vacant	396115	4948367
68	Existing	396125	4945807
69	Existing	396174	4946027
70	Vacant	396178	4948450
71	Existing	396220	4948053
72	Vacant	396233	4948431
73	Existing	396242	4948747
74	Existing	396245	4945943
75	Existing	396251	4945907

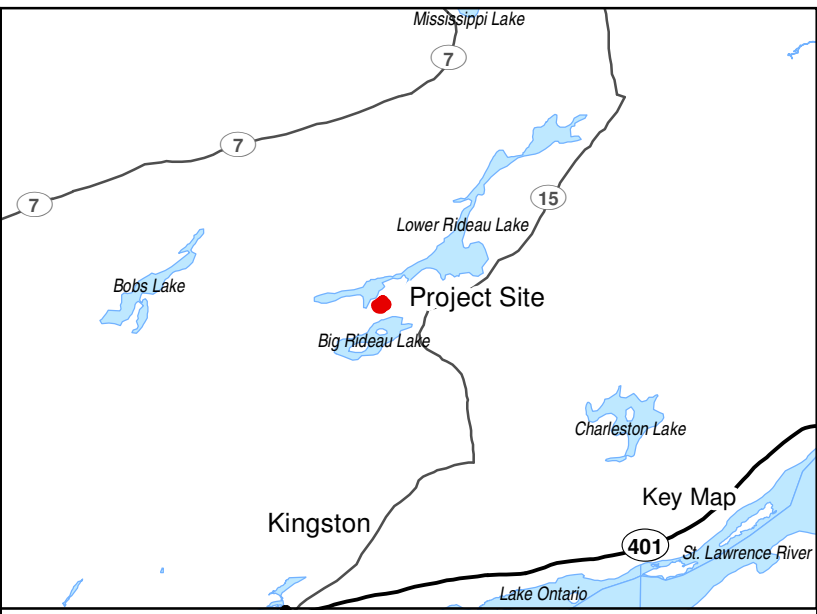
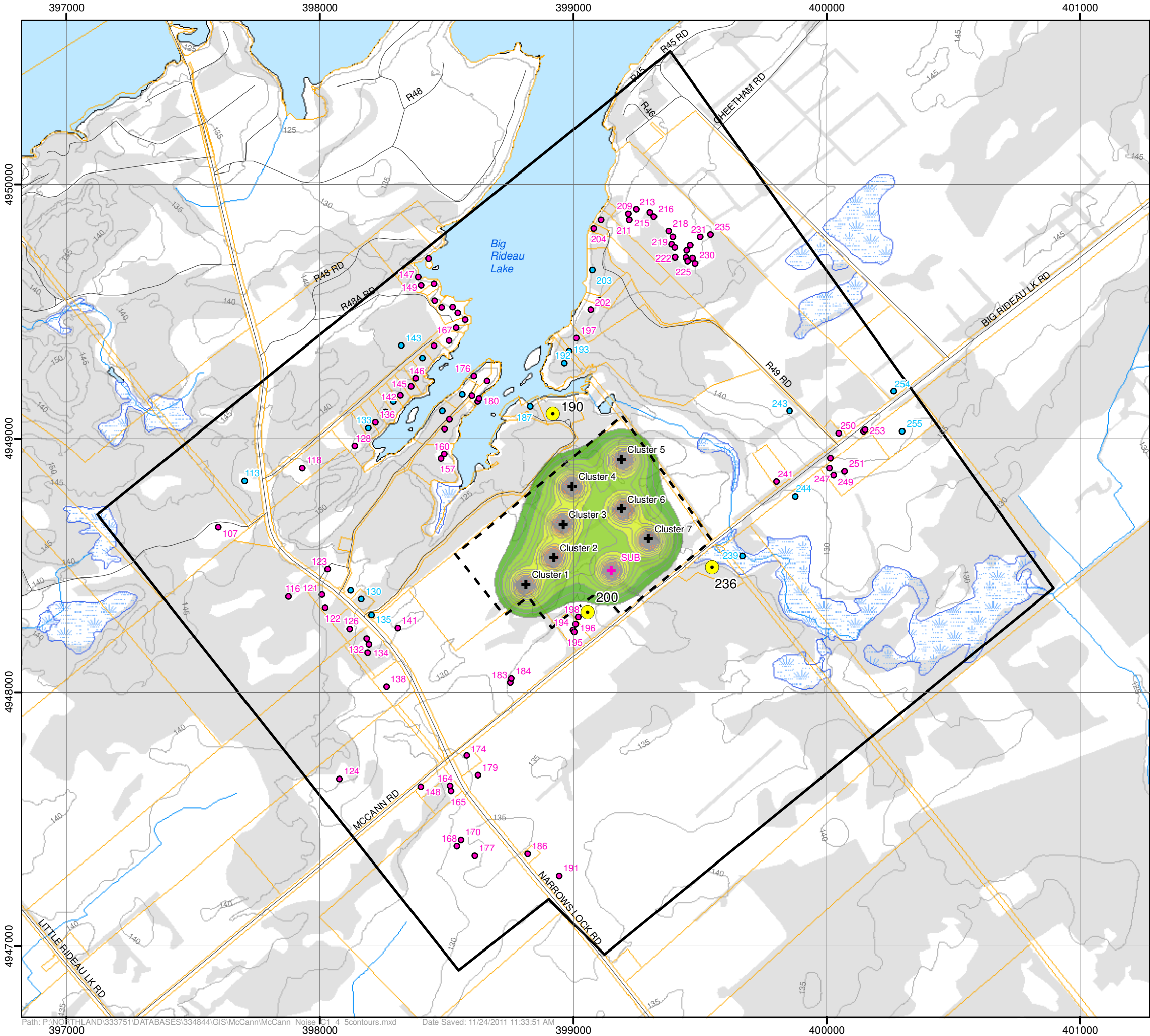
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		X	Y
76	Existing	396255	4948083
77	Existing	396301	4948180
78	Existing	396307	4948076
79	Existing	396313	4948666
80	Existing	396315	4948030
81	Existing	396340	4948572
82	Existing	396365	4945835
83	Existing	396392	4945732
84	Existing	396414	4948298
85	Existing	396426	4945837
86	Existing	396438	4945825
87	Vacant	396541	4946046
88	Vacant	396570	4945753
89	Existing	396594	4947635
90	Existing	396605	4947458
91	Existing	396616	4947485
92	Existing	396802	4947234
93	Existing	396843	4947256
94	Existing	396845	4947224
95	Existing	396908	4947292
96	Existing	396921	4946935
97	Existing	396946	4946892
98	Existing	397006	4947019
99	Existing	397014	4946979
100	Existing	397057	4947029
101	Existing	397096	4946640
102	Existing	397551	4946116
103	Existing	397554	4946085
104	Existing	397556	4946071
105	Existing	397564	4946027
106	Existing	397572	4946113
107	Existing	397599	4948651
108	Existing	397639	4946237
109	Vacant	397654	4945960
110	Vacant	397656	4946186
111	Existing	397674	4946290
112	Existing	397687	4947160
113	Vacant	397703	4948833
114	Existing	397708	4946264

ID	Description	Coordinates UTM NAD83	
		X	Y
115	Existing	397875	4945819
116	Existing	397876	4948377
117	Existing	397928	4945831
118	Existing	397931	4948884
119	Existing	397932	4945999
120	Existing	397941	4946075
121	Existing	398009	4948385
122	Existing	398021	4948334
123	Existing	398031	4948485
124	Existing	398078	4947658
125	Vacant	398103	4945589
126	Existing	398117	4948250
127	Vacant	398122	4948400
128	Existing	398138	4948971
129	Existing	398140	4945801
130	Vacant	398164	4948367
131	Existing	398184	4948211
132	Existing	398189	4948156
133	Vacant	398191	4949041
134	Existing	398194	4948189
135	Vacant	398204	4948304
136	Existing	398220	4949064
137	Vacant	398260	4949104
138	Existing	398264	4948021
139	Vacant	398291	4949145
140	Existing	398306	4947173
141	Existing	398308	4948254
142	Existing	398319	4949169
143	Vacant	398322	4949366
144	Vacant	398340	4945716
145	Existing	398360	4949205
146	Existing	398378	4949237
147	Existing	398388	4949637
148	Existing	398399	4947628
149	Existing	398399	4949604
150	Vacant	398405	4949316
151	Existing	398429	4949709
152	Vacant	398443	4945679
153	Existing	398444	4945819

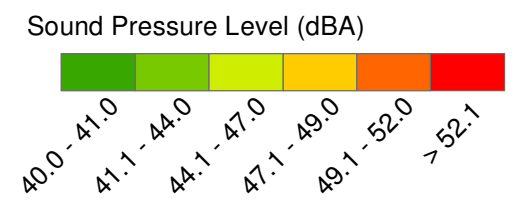
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155	Existing	398451	4949365
156	Existing	398452	4949543
157	Existing	398478	4948922
158	Existing	398481	4949516
159	Vacant	398483	4949108
160	Existing	398491	4948939
161	Existing	398492	4949038
162	Existing	398510	4949385
163	Existing	398512	4949075
164	Existing	398514	4947631
165	Existing	398517	4947611
166	Existing	398524	4949517
167	Existing	398538	4949436
168	Existing	398540	4947393
169	Existing	398544	4949494
170	Existing	398557	4947418
171	Existing	398560	4945651
172	Vacant	398562	4949173
173	Existing	398573	4949468
174	Existing	398579	4947751
175	Existing	398600	4949168
176	Existing	398607	4949246
177	Existing	398612	4947356
178	Existing	398623	4949145
179	Existing	398624	4947674
180	Existing	398628	4949156
181	Existing	398660	4949226
182	Vacant	398738	4945375
183	Existing	398751	4948037
184	Existing	398755	4948054
185	Vacant	398793	4945515
186	Existing	398820	4947363
187	Vacant	398830	4949125
188	Existing	398906	4945657
189	Existing	398918	4945681
190	Vacant	398920	4949098
191	Existing	398944	4947277
192	Vacant	398964	4949297

ID	Description	Coordinates UTM NAD83	
		X	Y
193	Vacant	398984	4949345
194	Existing	398999	4948246
195	Existing	399004	4948238
196	Existing	399009	4948269
197	Existing	399012	4949395
198	Existing	399019	4948297
199	Vacant	399040	4945570
200	Existing	399056	4948318
201	Existing	399060	4945446
202	Existing	399068	4949507
203	Vacant	399075	4949665
204	Existing	399080	4949827
205	Vacant	399085	4949786
206	Vacant	399101	4949545
207	Existing	399109	4949862
208	Existing	399209	4946965
209	Existing	399217	4949886
210	Existing	399218	4946767
211	Existing	399221	4949862
212	Existing	399226	4945419
213	Existing	399249	4949903
214	Vacant	399281	4945401
215	Existing	399302	4949891
216	Existing	399318	4949875
217	Existing	399359	4945405
218	Existing	399377	4949816
219	Existing	399388	4949765
220	Existing	399393	4949795
221	Existing	399401	4949753
222	Existing	399401	4949714
223	Existing	399445	4949713
224	Existing	399448	4949740
225	Existing	399451	4949699
226	Existing	399453	4945487
227	Existing	399461	4949761
228	Existing	399468	4946711
229	Existing	399470	4949711
230	Existing	399481	4949690
231	Existing	399501	4949794

ID	Description	Coordinates UTM NAD83	
		X	Y
232	Existing	399507	4946747
233	Existing	399510	4946528
234	Existing	399537	4946482
235	Existing	399541	4949803
236	Vacant	399548	4948495
237	Vacant	399585	4946296
238	Vacant	399608	4946407
239	Vacant	399667	4948537
240	Vacant	399731	4946099
241	Existing	399802	4948830
242	Existing	399849	4946144
243	Vacant	399854	4949108
244	Vacant	399876	4948771
245	Existing	399908	4945911
246	Existing	399942	4945875
247	Existing	400011	4948883
248	Existing	400015	4948923
249	Existing	400027	4948855
250	Existing	400048	4949021
251	Existing	400071	4948871
252	Existing	400146	4949028
253	Existing	400152	4949034
254	Vacant	400265	4949186
255	Vacant	400299	4949028



- Legend**
- Cluster # Inverter Cluster
 - SUB Substation Transformer
 - # Noise Receptor - Existing
 - # Noise Receptor - Vacant
 - # Representative Noise Receptor
 - Road
 - Topographic Contour (5m interval)
 - Watercourse
 - Parcel
 - Project Site
 - 1000 m from Project Site
 - Waterbody
 - Wetland
 - Wooded Area



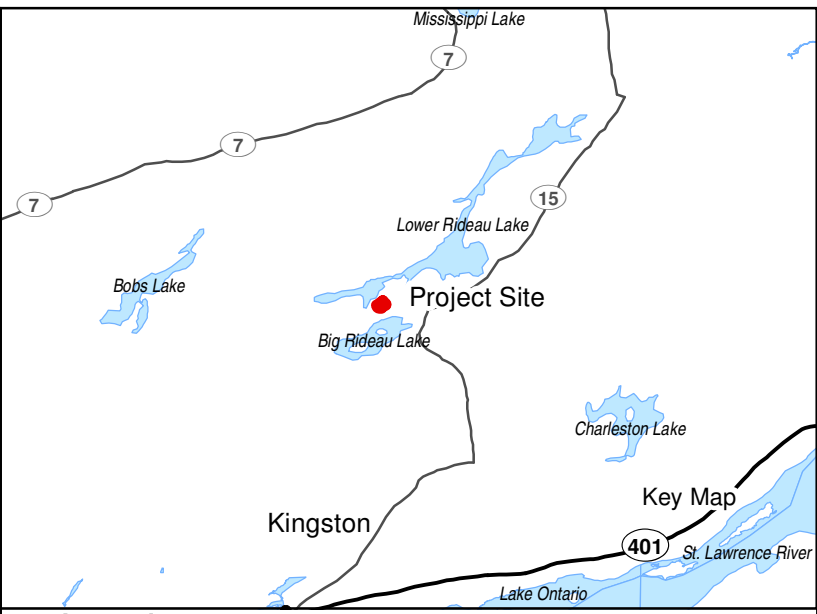
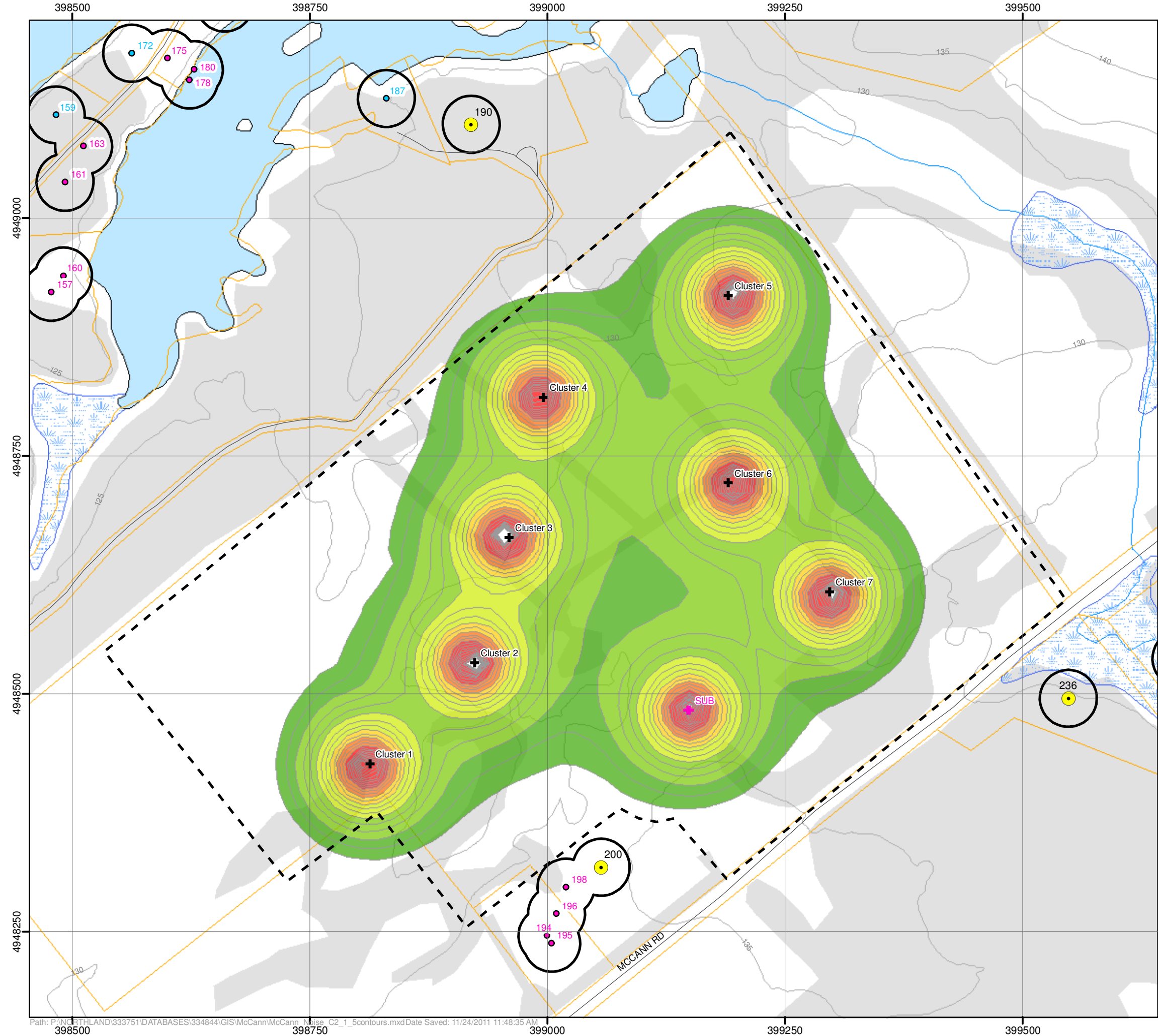
Notes:
 1. Produced by Hatch under licence from Ontario Ministry of Natural Resources, Copyright (c) Queens Printer 2011.
 2. Spatial referencing UTM NAD 83.



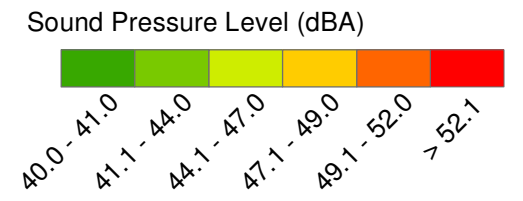
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Figure C.1
 Northland Power Inc.
McCann Solar Project
Noise Contours at 4.5 m





- Legend**
- Cluster # Inverter Cluster
 - SUB Substation Transformer
 - # Noise Receptor - Existing
 - # Noise Receptor - Vacant
 - # Representative Noise Receptor
 - Road
 - Topographic Contour (5m interval)
 - Watercourse
 - Parcel
 - Project Site
 - 30 m from Noise Receptor
 - Wetland
 - Waterbody
 - Wooded Area



Notes:
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 2. Spatial referencing UTM NAD 83.



Figure C.2
 Northland Power Inc.
McCann Solar Project
Noise Contours at 1.5 m



Appendix D

CADNA-A Sample Calculations

Configuration	
Parameter	Value
General	
Country	(user defined)
Max. Error (dB)	0.00
Max. Search Radius (m)	3000.00
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)	0.00
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 Rcvr - 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 (°C)	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	

Point Source, ISO 9613, Name: "RL_Trans_7", ID: "RL_Trans_7"																			
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)
6	398874.10	4946462.84	138.99	0	1000	73.7	73.7	0.0	0.0	76.4	6.8	-1.7	0.0	0.0	4.8	0.0	-0.0	-12.6	-12.6
7	398874.10	4946462.84	138.99	0	2000	69.9	69.9	0.0	0.0	76.4	18.0	-1.7	0.0	0.0	4.8	0.0	-0.0	-27.6	-27.6
8	398874.10	4946462.84	138.99	0	4000	64.7	64.7	0.0	0.0	76.4	61.1	-1.7	0.0	0.0	4.8	0.0	-0.0	-75.9	-75.9
9	398874.10	4946462.84	138.99	0	8000	55.6	55.6	0.0	0.0	76.4	217.9	-1.7	0.0	0.0	4.8	0.0	-0.0	-241.8	-241.8