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ASSESSMENT REPORT - **Project: 18079.00**

Burdett Solar Project
Noise Impact Assessment – RP2
Alberta, Canada

Prepared for:

Burdett Solar GP Corp
Suite 400, 214 – 11 Ave SW,
Calgary, Alberta T2R 0K1

Prepared by:

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June 4, 2018

Applicant Information

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Revision History

Revision Number	Description	Date
1	*Initial NIA Report Submission*	October 27, 2016
2	*NIA Report Amendment (RP2);* Site layout changed – total inverter counts reduced, new 2.5 MVA Inverter unit selected and grouped in pairs. Enclosures are no longer required; administrative noise control put in place.	June 4, 2018

1 Introduction

BluEarth Renewables has retained Aercoustics Engineering Limited on behalf of Burdett Solar GP Corp (the Applicant) to prepare an amendment to an existing Noise Impact Assessment. This Noise Impact Assessment ("NIA") pertains to the Burdett Solar Project. The proposed facility (the "Project") comprises a 20-megawatt alternating current (MWAC) solar facility located roughly 2 km southwest of Burdett, Alberta, on a plot of land measuring roughly 63 hectares.

The purpose of this pre-construction noise impact assessment is to ensure that the predicted nosie levels at critical receptors surrounding the Project area are in compliance with Alberta Utilities Commission ("AUC") Rule 012 [1], dated July 4, 2017. This report serves as an amendment to the existing noise report, dated October 27, 2016, and addresses a change to the site layout; the facility comprises three (3) fewer solar inverters, and a new model of inverter was selected. Due to these changes, noise enclosures for the solar inverters are no longer required. Instead, an administrative noise control measure has been put in place.

2 Facility Description

The Project spans 63 hectares (156 Acres) of land situated roughly two (2) kilometres south of Burdett, Alberta, in the county of Forty Mile No. 8. The specific UTM coordinates of the approximate centre of the Project are 460791 mE, 5518583 mN in Zone 12. The plot of land on which the Project is to be developed is designated SE-15-10-12 W4.

The solar facility will include an array of solar panels with eight (8) associated SC2500 2.5 megavolt-ampere (MVA) inverters in groups of two (2) to form a total of four (4) 5.0 MVA inverter clusters. Each of the four inverter clusters has an associated 5.0 MVA pad-mounted transformer.

Although power production will only occur during daylight hours, both daytime and nighttime operation of the facility have been considered in this assessment. This conservative assumption accounts for days of the year where the sun rises before 07:00 AM.

AUC Rule 012 stipulates that any third-party energy-related facilities within 1.5 km of the Project receptors must be considered in the Noise Impact Assessment and that the cumulative noise impact for all such facilities, together with the ambient contribution, must meet the applicable Permissible Sound Limits (PSLs). Two facilities in the area meet this description. These include an Altalink transformer substation adjacent to the southeast of the Project as well as a Signalta diesel power generation facility located about 100 meters to the southeast of the Project. An overview of the Project study area, including critical receptors and third-party noise sources is available in Figure 1.

3 Noise Sources

3.1 Project Noise Sources

The dominant noise sources associated with sustained operation of the Project are the four (4) 5.0 MVA solar inverter clusters and the four (4) associated 5.0 MVA pad-mounted transformers. Each of the four sets of equipment was modelled as a single point source to represent a Solar Inverter Station with a sound power level equal to the sum of that of the three parts (two inverters, one transformer). The solar panels are supported by a fixed-rack system and are therefor not considered to be a significant noise source. The locations of the Solar Inverter Stations within the Project are detailed in Figure 2.

Spectral sound data for the solar inverters (SMA SC2500 MV-Block 2.5 MVA) is available in Appendix B and was provided in a manufacturer test report [2]. Specifications for the pad-mounted transformers had not been made at the time of this report and therefor associated noise data was unavailable. The assumed sound power levels for the 5 MVA pad-mounted transformers were based on manufacturer data for similarly sized transformer units and adjusted based on NEMA TR 1-2013 [3] and Beranek's *Noise and Vibration Control Engineering* [4]. A summary of this derivation is given in Appendix B.

While the noise from the transformer itself is expected to have tonal components below 250 Hertz, when considered as a component of the noise source pair represented in the model, the tonal character of the transformer is not anticipated to be audible in the presence of low frequency masking noise generated by the inverters. To assess the potential for a Low Frequency Noise condition, a comparison between the A- and C-weighted predicted sound levels from the Project was performed at critical receptors. This analysis is detailed further in Section 6.2 of this report. The sound power spectra for the two noise source components, as well as for the overall Solar Inverter Station, are stated in Table 1 below. Details for noise sources used in the model are summarized in Table 2 below.

Table 1 – Noise source Spectra

Noise Source	Frequency (Hz) 31.5	63	125	250	500	1000	2000	4000	8000	**Total (dBA)**
NEMA Estimate 5.0 MVA Transformer	83	89	91	86	86	80	75	70	63	86
SC2500 Solar Inverter[1] Cluster	94	90	90	91	87	84	84	92	82	95
Combined Source (Solar Inverter Station)	94	93	93	92	89	85	84	93	82	96

[1] – Test Data Provided in *SMA Inspection Report -91:LE4615* [2].

3.2 Third-Party Noise Sources

There are two existing third-party energy-related facilities within 1.5 kilometers of the receptors impacted by the Project. These are an AltaLink transformer substation and a Signalta diesel power generation facility. Sound power data for the transformer substation and diesel power generation facility were provided by AltaLink and Signalta, respectively. Octave data used for each third-party source has been included in Appendix B. A 5 dB positive adjustment has been applied to the AltaLink transformer and capacitor sources as their generated noise is expected to have a tonal characteristic with components below 250Hz.

The location of all noise sources with respect to Project receptors has been included in Figure 1. The location of noise sources with respect to the Project is included in Figure 2. All noise sources considered in this Noise Impact Assessment are summarized in Table 2 below.

Table 2 – Noise Source Summary

Source ID	Source Name	Sound Power Level (dBA)	Source Location
InvStn_1	5.0 MVA Solar Inverter Station	96[1,2]	BSP
InvStn_2	5.0 MVA Solar Inverter Station	96[1,2]	BSP
InvStn_3	5.0 MVA Solar Inverter Station	96[1,2]	BSP
InvStn_4	5.0 MVA Solar Inverter Station	96[1,2]	BSP
Stn3Trans	5.0 MVA Pad Mounted Transformer	86[2]	BSP
TP_cap1	Capacitor 1	87[3]	AltaLink
TP_cap2	Capacitor 2	87[3]	AltaLink
TP_tf1	Transformer 1	96[3]	AltaLink
TP_tf2	Transformer 2	102[3]	AltaLink
TP_tf3	Fan1	101[4]	Signalta
TP_tf4	Fan 2	101[4]	Signalta
TP_f1	Fan 3	101[4]	Signalta
TP_f2	Fan 4	101[4]	Signalta
TP_f3	Fan 5	101[4]	Signalta
TP_f4	Fan 6	101[4]	Signalta
TP_f5	Fan 7	101[4]	Signalta
TP_f6	Fan 8	101[4]	Signalta
TP_f7	Fan 9	101[4]	Signalta

Note: Further documentation in Appendix B.

1. Sound power data for SC2500 Inverter is from SMA Inspection Report -91:LE4615 [2]
2. Assumed sound power data for the 5.0 MVA transformer based on NEMA Standard and measurement data from a comparable unit
3. Sound power data provided by AltaLink – See Appendix B. Final sound power includes 5dB tonal adjustment.
4. Sound power data provided by Signalta – See Appendix B

4 Points of Reception

Residential dwellings within 1.5 kilometres of the BSP site were identified as critical noise receptors. The locations of these receptors are shown in Figure 1 as R01-R08. Receptor R01 is a raised bungalow, with a plane-of-window height of 3 meters confirmed by site observations. All other receptors were assumed to be two-storey residential dwellings.

The most impacted receptors identified were R01 and R02 as shown in Figure 1. R01 and R02 are, respectively, located approximately 60 meters east and 250 meters west from the fence of the BSP site. It is Aercoustics' understanding that the third-party facilities have existed prior to the construction of these dwellings (R01 and R02).

Satisfying AUC Rule 012 Noise Control guidelines at the closest critical receptors will ensure that all other points of reception will be in compliance.

Table 3 summarizes the locations of the nearest points of reception, including the distance and direction from the BSP site.

Table 3 – Receptor Summary Table

Receptor ID	Receptor description	Receptor Height	Approximate Location
R01	raised bungalow dwelling	3 m (plane of window)	60 m east
R02	two-storey dwelling	4.5m (plane of window)	250 m west
R03	two-storey dwelling	4.5m (plane of window)	1000 m north
R04	two-storey dwelling	4.5m (plane of window)	1000 m north-west
R05	two-storey dwelling	4.5m (plane of window)	1200 m north-west
R06	two-storey dwelling	4.5m (plane of window)	1000 m north-west
R07	two-storey dwelling	4.5m (plane of window)	1200 m west
R08	two-storey dwelling	4.5m (plane of window)	800 m south

[1] – Location with reference to the nearest Project noise source, direction from source to receptor.

5 Assessment Criteria

The permissible sound levels used in this study are based on AUC Rule 012. According to this publication, the Permissible Sound Level (PSL) must be decided at the critical receptors per the AUC defined category designation.

All the critical receptors listed above in Section 4 are more than 500 meters from heavily travelled roads or rail lines and not subject to frequent aircraft flyovers. This is consistent with the Category 1 acoustic environment categorization as defined by AUC Rule 012.

The noise level predicted at the closest receptors, R01 and R02, is dominated by the existing third-party facilities (AltaLink and Signalta) as described in Section 2. These third-party facilities existed prior to the dwellings at R01 and R02 and are considered deferred facilities according to the Guidelines. Due to the presence of these deferred facilities, permissible sound level at these effected dwellings is equal to the cumulative sound level existing at the time of construction, as per section 2.3.1 of AUC Rule 012. The construction dates of these third-party facilities is detailed below in Table 4. Construction completion dates of the relevant critical receptors are detailed in Table 5. The permissible nighttime sound levels used for these receptors, as determined by the predicted impact of the third-party sources, is listed below in Table 3. The relevant nighttime PSL at all other receptors is the 40 dBA basic sound level (BSL) fitting a category 1 classification.

Table 4 – Third Party Facility Construction Dates

Facility	Construction Completion Date	Info Source
AltaLink – 368S Substation	1987	AltaLink
Signalta – Westfield 107S Substation	1963	Signalta

Table 5 – Critical Receptor Construction Dates

Receptor	Construction Completion Date	Info Source
R01	October 2014	Resident
R02	November 2016	Resident

An adjustment of 10 dB was applied above the nighttime basic sound level to determine the daytime permissible sound level. The nighttime and daytime permissible sound levels for each receptor are summarized in Table 6. Nighttime and daytime ambient sound levels of 35 dBA and 45 dBA, respectively, were added to the cumulative sound level at each receptor.

Table 6 – Permissible Sound Level Summary Table

Receptor ID	Nighttime (10 p.m. – 7 a.m.)	Daytime (7 a.m. – 10 p.m.)
R01	44	50
R02	42	50
R03	40	50
R04	40	50
R05	40	50
R06	40	50
R07	40	50
R08	40	50

6 Noise Impact Assessment

The noise impact calculations were performed using DataKustik's CadnaA environmental noise prediction software (2017 Version). The calculations are based on established environmental sound prediction methods outlined in *ISO 9613-2: A Standard for Outdoor Noise Propagation* [5]. The noise prediction methodology assumes downwind propagation at 70% relative humidity and 10 degrees Celsius. Flat ground topography and a global ground factor of G=0.5 have been conservatively assumed for this assessment as the area surrounding the Project is flat farmland or grassland. A summary of the calculation terms and methodology has been included in Appendix C.

6.1 Predictable Worst Case

A worst-case operating scenario has been assumed for the assessment. During the daytime, this scenario includes all four Solar Inverter Stations as well as the AltaLink substation and Signalta power generation facility operating at 100% capacity. The nighttime worst-case operating scenario includes both third party facilities operating, plus three of the four Solar Inverter Stations operating at full capacity, and only the transformer of the fourth station operating.

The predicted project-only sound levels corresponding to this worst-case scenario are detailed in Table 7 and Table 8 along with predicted third-party impact and assumed ambient. The cumulative noise impact from these components is compared to the applicable sound level limit at each receptor. Sample calculations including calculation parameters are included in Appendix C. A figure detailing the nighttime noise impact generated by third party sources and the assumed ambient is included in Figure 3. Cumulative noise Impact contours, including the Project, third party sources, and the assumed ambient is included in Figure 4.

Table 7 – Noise Impact Assessment Summary Table – Daytime

ID	Assumed ambient sound level (dBA)	AltaLink Substation alone, Sound Level (dBA)	Signalta Substation alone, Sound Level (dBA)	Burdett Solar Project alone, Sound Level (dBA)	Resultant Cumulative Sound Level (dBA)	Permissible Sound Level (dBA)	Compliance (Yes/No)
R01	45	37	42	37	48	50	Yes
R02	45	35	39	30	47	50	Yes
R03	45	19	25	20	45	50	Yes
R04	45	*	*	20	45	50	Yes
R05	45	*	*	18	45	50	Yes
R06	45	24	*	21	45	50	Yes
R07	45	26	31	21	45	50	Yes
R08	45	32	37	22	46	50	Yes

*- sound level at receptor insignificant

Table 8 – Noise Impact Summary Table – Nighttime

ID	Assumed ambient sound level (dBA)	AltaLink Substation alone, Sound Level (dBA)	Signalta Substation alone, Sound Level (dBA)	Burdett Solar Project alone, Sound Level (dBA)	Resultant Cumulative Sound Level (dBA)	Permissible Sound Level (dBA)	Compliance (Yes/No)
R01	35	37	42	34	44	44	Yes
R02	35	35	39	30	42	42	Yes
R03	35	19	25	18	36	40	Yes
R04	35	*	*	20	35	40	Yes
R05	35	*	*	18	35	40	Yes
R06	35	24	*	20	35	40	Yes
R07	35	26	31	21	37	40	Yes
R08	35	32	37	21	40	40	Yes

*- sound level at receptor insignificant

6.2 Low Frequency Noise Analysis

Low frequency analysis was performed as per section 4.5 of AUC Rule 012. Both the A-weighted and C-weighted impact was determined at each receptor, and the difference between both was calculated. These results are presented inTable 9 below.

Table 9 – Low Frequency Noise Analysis

Receptor ID	Day			Night		
	LAeq [dBA]	LCeq [dBC]	LCeq - LAeq	LAeq [dBA]	LCeq [dBC]	LCeq - LAeq
R01	37	45	8	34	43	9
R02	30	40	10	30	40	10
R03	20	31	12	18	30	11
R04	20	33	12	20	32	12
R05	18	31	13	18	31	13
R06	21	33	12	20	32	12
R07	21	33	12	21	33	12
R08	22	34	12	21	33	12

Given that the difference between the predicted A- and C-weighted sound pressure levels never exceeds 20 dB, the presence of a Low Frequency Noise condition according to the Guidelines is unlikely.

6.3 Noise Control Measures

The following administrative noise control measure must be enacted to ensure compliance with the relevant Permissible Sound Levels. The noise control measures pertaining to construction must be enacted according to Section 2.7.1 of AUC Rule 012.

6.3.1 Limited Nighttime Operation

The inverters associated with Inverter Station 3 may not run outside of the daytime hours of 07:00 – 22:00. It is understood that the associated transformer will generate noise even when the inverters are not active – nighttime operation of this transformer has been accounted for in the modelling and is predicted to comply with the PSL of all critical receptors.

6.3.2 Construction Noise Mitigating Measures

To minimize the impact of the development of the Project on nearby dwellings, the following mitigation measures should be used as described in AUC Rule 012:

a) Conduct construction activity between the hours of 7 a.m. and 10 p.m. to reduce the duration impact from construction noise,

b) Advise nearby residents of significant noise-causing activities and schedule these events to reduce disruption to them,

c) Ensure that all internal combustion engines are well maintained with muffler systems,

d) Should a noise complaint be filed during construction, the licensee must respond expeditiously and take prompt action to address the complaint.

7 Conclusion

Aercoustics Engineering Limited has completed a Noise Impact Assessment for the Burdett Solar Project in Alberta.

It was determined that the predicted cumulative noise impact from the contributing ambient, relevant third-party sources, and the proposed Burdett Solar Project is in compliance with AUC Rule 012.

8 References

[1] Alberta Utilities Commission, "Rule 012 - Noise Control," 2017.

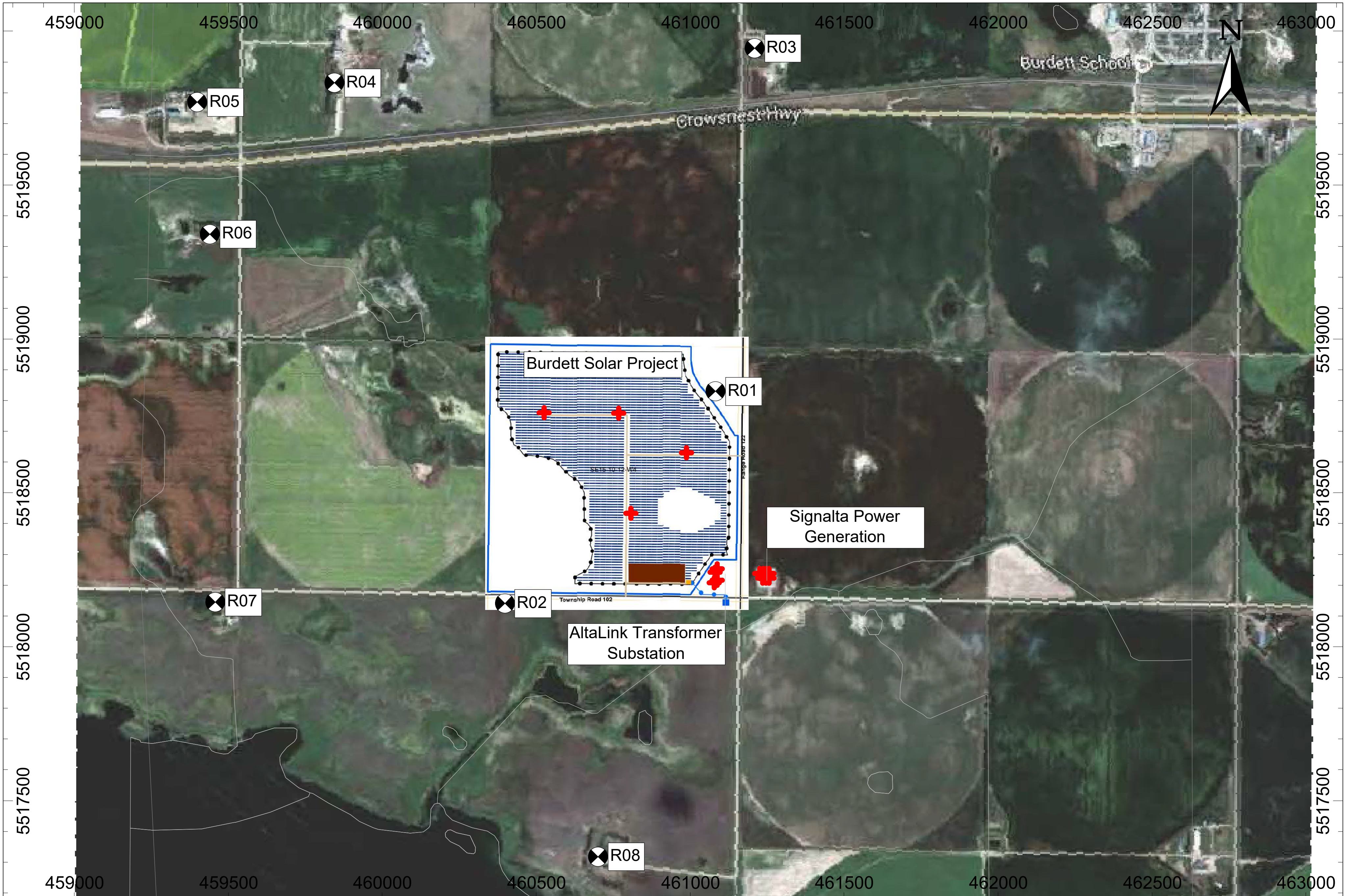
[2] SMA, "SC2500 MV-Block -91:LE4615 Acoustic Environnmental Test Inspection Report," 2016.

[3] National Electrical Manufacturers Association, "NEMA TR 1-2013 - Transformers, Step Voltage Regulators and Reactors," National Electrical Manufacturers Association, Rosslyn, VA, 2014.

[4] L. Beranek, "Noise and Vibration Control Engineering," Institute of Noise Control Engineering, 1992.

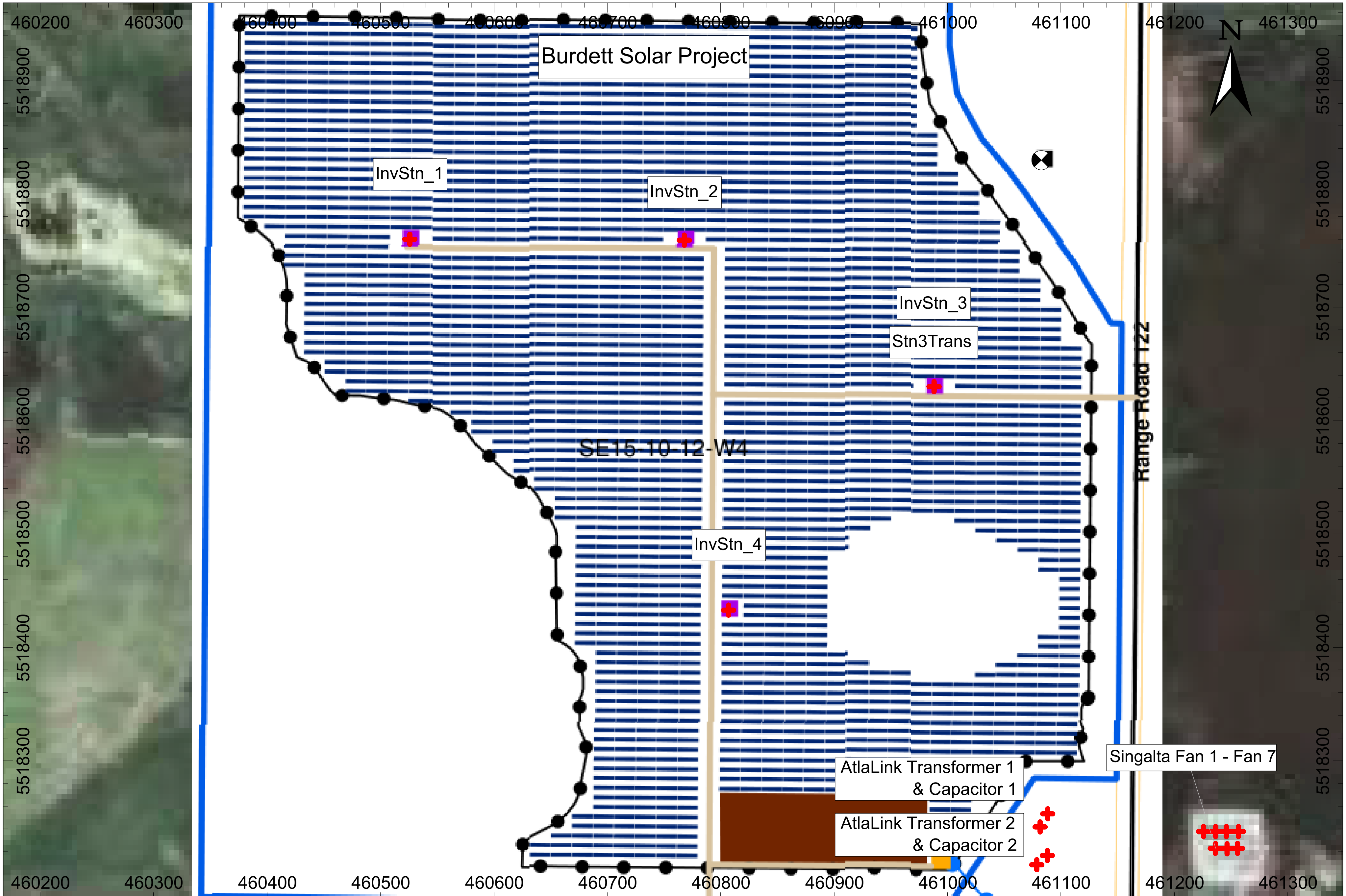
[5] ISO, "International Standard ISO 9613-2 "Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation"," 1996.

FIGURES



aercoustics	Project ID: 18079.00	**Project Name** Burdett Solar Project- Noise Impact Assessment RP2
	Scale: NTS Drawn by: KC Reviewed by: PA Date: May 24, 2018 Revision: 1	**Figure Title** Site Plan

Figure 1



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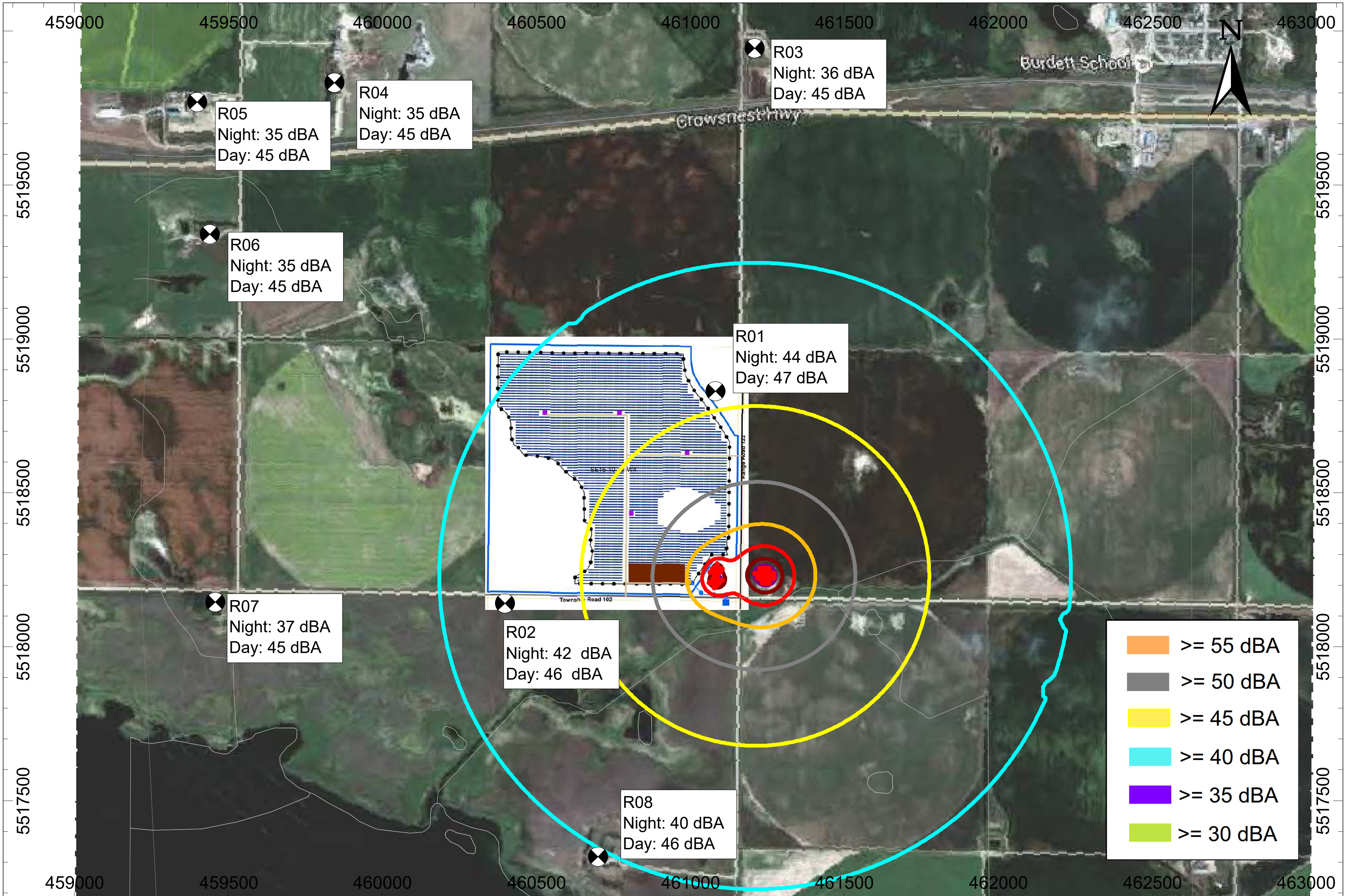
Project ID: 18079.00	**Project Name** Burdett Solar Project- Noise Impact Assessment RP2	
Scale: NTS Drawn by: KC Reviewed by: PA Date: May 24, 2018 Revision: 1	**Figure Title** Noise Source Locations	**Figure 2**



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Project ID: 18079.00

Scale: NTS
Drawn by: KC
Reviewed by: PA
Date: May 24, 2018
Revision: 1

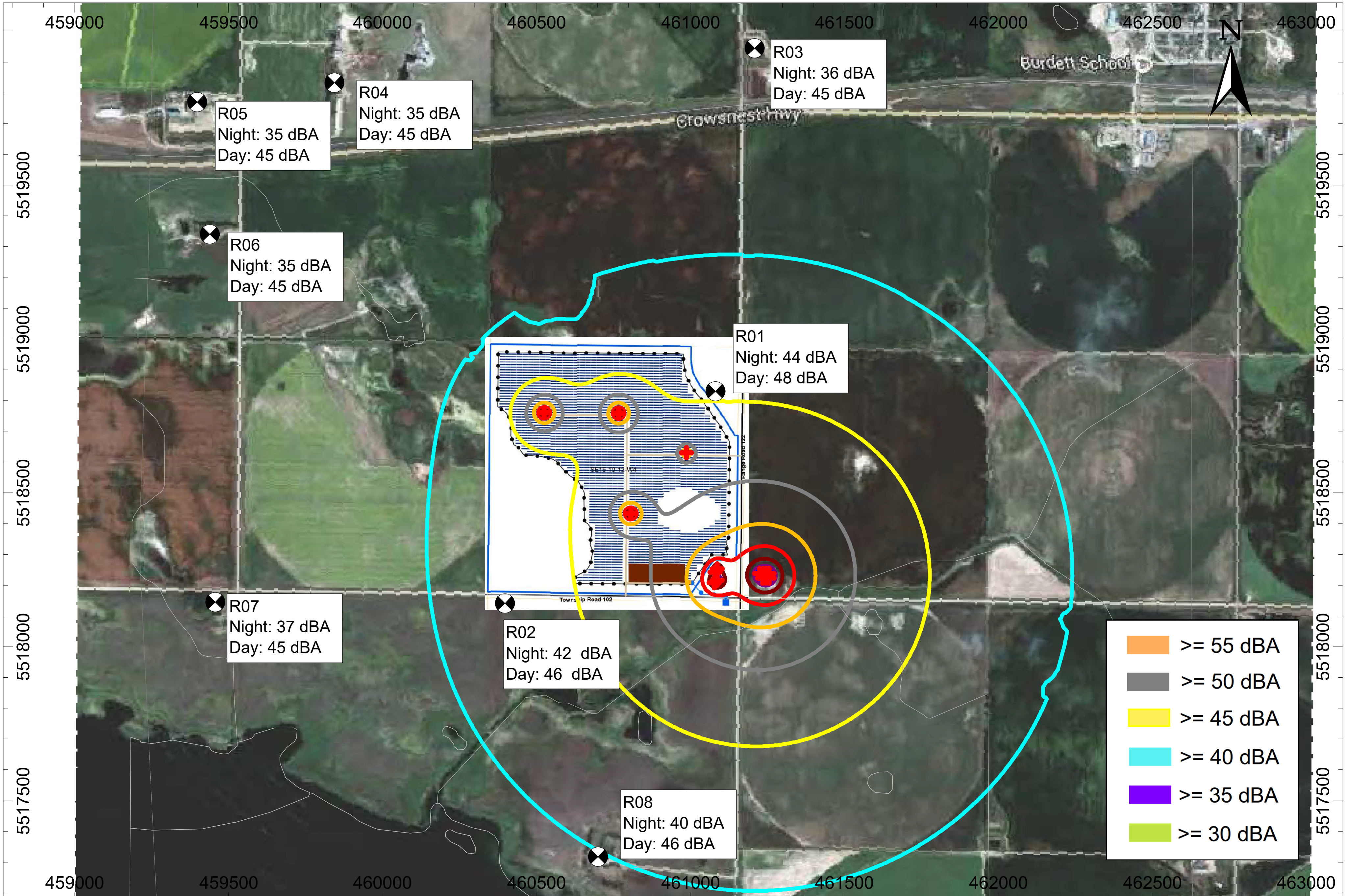
Project Name

Burdett Solar Project- Noise Impact Assessment RP2

Figure Title

Third Party Noise Impact Contours - 4.5m Height - Nighttime

Figure 3



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Project ID: 18079.00

Scale: NTS
Drawn by: KC
Reviewed by: PA
Date: May 24, 2018
Revision: 1

Project Name

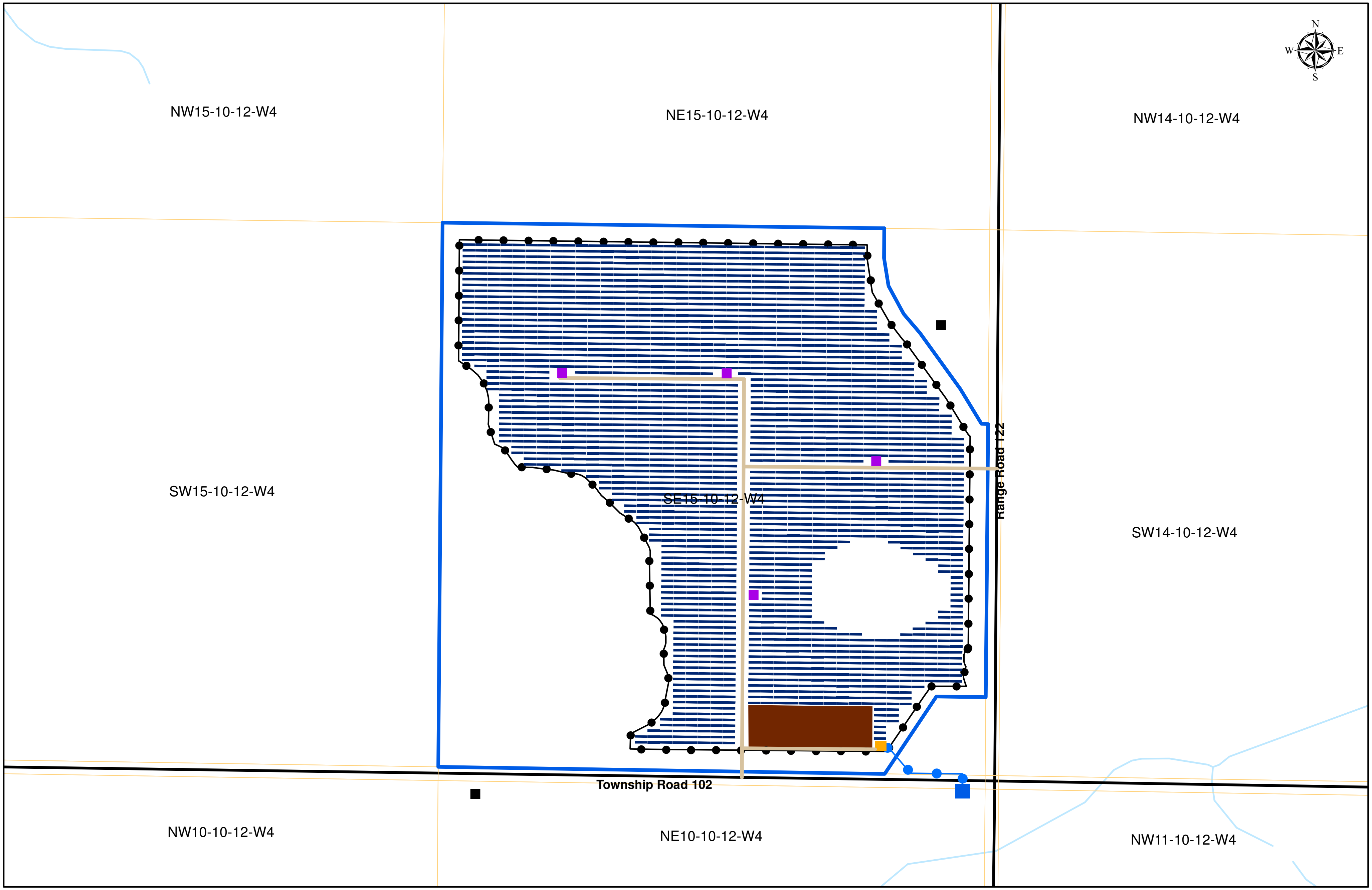
Burdett Solar Project- Noise Impact Assessment RP2

Figure Title

Cumulative Noise Impact Contours - 4.5m Height - Nighttime

Figure 4

APPENDIX A – Site Plan of Burdett Solar Project



Legend

- Inverter
- Road
- Panel
- Project Substation (POCO)
- Project POI
- Connection Line
- Fence*
- Construction Staging
- Overall Project Area
- Quarter Section
- Receptor

Site Plan

Burdett Solar Project

0 45 90 180 m

Coordinate System NAD 1983 UTM Zone 12N
Projection Transverse Mercator
Datum North American 1983
Units Meter

Created: 2018-05-09

APPENDIX B – Sound Data Sheets

APPENDIX VIII

Signalta Diesel
Powergeneration Facility

Noise Level Calculations

INPUT DATA SHEET

(FILL IN SHADED AREAS)

COMPANY **MAXIM ENERGY GROUP LTD.**

SITE **BURDETT POWER GENERATION FACILITY**

S *DIRECTION OF THE MOST IMPACTED LOCATION (N,S,W OR E)*

1600 *DISTANCE TO THE MOST IMPACTED LOCATION (METERS)*

IN GRAY AREA ENTER COOLER FAN HORSE POWER, THE DIRECTION IN WHICH THE COOLER IS FACING AND THE TYPE OF COOLER

TYPE 1 - AXIAL-FLOW BLOW-THROUGH TYPE

TYPE2 - UNDERFLOW FORCED -DRAFT PROPELLER TYPE

UNIT	1	2	3	4	5	6	7	8	9	10
HP	25	25	25	25	25	25	25	25		
(N,S,W OR E)	W	W	W	W	W	W	W	W		
COOLER TYPE	2	2	2	2	2	2	2	2		

PRESS "F9" TO UPDATE THE CALCULATIONS

ESTIMATED READING AT

1600 METER

32.6 DBA

Printing: "Ctrl s" prints INPUT, OUTPUT

"Ctrl l" prints INPUT, OUTPUT, THEORY, STATEMENT

TABLE I

MAXIM ENERGY GROUP LTD.

BURDETT POWER GENERATION FACILITY

DIRECTION OF MOST IMPACTED LOCATION(N,S,W OR E) **N**

DISTANCE TO MOST IMPACTED LOCATION (METERS) **1600**

TOTAL SOUND POWER LEVEL

(VERTICAL PROPELLER FAN ON COOLER)

S.P.L.=P.W.L. - DISTANCE TERM + DIRECTION TERM

TOTAL DBA FOR ALL UNITS 32.1

INDIVIDUAL BREAK DOWN FOR EACH UNIT

HP OF FAN COOLER MOTOR **25** | **UNDERFLOW FORCED DRAFT-TYPE**

DIRECTION FAN COOLER IS FACING **W**

UNIT 1

OCTAVE	TOTAL P.W.L.	DISTANCE TERM	DIRECTION TERM	ESTIMATED S.P.L. (dBA) AT 1600 METERS	"A" SCALE CORRECTION	CORRECTED VALUE
31	102	72	-1	29	-43	0
63	107	72	-1	34	-28	6
125	107	72	-1	34	-18	16
250	102	72	-2	28	-8	20
500	99	76	-2	21	-3	18
1000	95	79	-3	13	0	13
2000	92	87	-3	2	2	4
4000	89	111	-4	-26	1	0
8000	84	145	-4	-65	-1	0

TOTAL DBA 23.6

HP OF FAN COOLER MOTOR **25** | **UNDERFLOW FORCED DRAFT-TYPE**

DIRECTION FAN COOLER IS FACING **W**

UNIT 2

OCTAVE	TOTAL P.W.L.	DISTANCE TERM	DIRECTION TERM	ESTIMATED S.P.L. (dBA) AT 1600 METERS	"A" SCALE CORRECTION	CORRECTED VALUE
31	102	72	-1	29	-43	0
63	107	72	-1	34	-28	6
125	107	72	-1	34	-18	16
250	102	72	-2	28	-8	20
500	99	76	-2	21	-3	18
1000	95	79	-3	13	0	13
2000	92	87	-3	2	2	4
4000	89	111	-4	-26	1	0
8000	84	145	-4	-65	-1	0

TOTAL DBA 23.6

HP OF FAN COOLER MOTOR **25**

DIRECTION FAN COOLER IS FACING **W**

UNDERFLOW FORCED DRAFT-TYPE

UNIT 3

OCTAVE	TOTAL P.W.L.	DISTANCE TERM	DIRECTION TERM	ESTIMATED S.P.L. (dBA) AT 1600 METERS	"A" SCALE CORRECTION	CORRECTED VALUE
31	102	72	-1	29	-43	0
63	107	72	-1	34	-28	6
125	107	72	-1	34	-18	16
250	102	72	-2	28	-8	20
500	99	76	-2	21	-3	18
1000	95	79	-3	13	0	13
2000	92	87	-3	2	2	4
4000	89	111	-4	-26	1	0
8000	84	145	-4	-65	-1	0
					TOTAL DBA	23.6

HP OF FAN COOLER MOTOR **25**

DIRECTION FAN COOLER IS FACING **W**

UNDERFLOW FORCED DRAFT-TYPE

UNIT 4

OCTAVE	TOTAL P.W.L.	DISTANCE TERM	DIRECTION TERM	ESTIMATED S.P.L. (dBA) AT 1600 METERS	"A" SCALE CORRECTION	CORRECTED VALUE
31	102	72	-1	29	-43	0
63	107	72	-1	34	-28	6
125	107	72	-1	34	-18	16
250	102	72	-2	28	-8	20
500	99	76	-2	21	-3	18
1000	95	79	-3	13	0	13
2000	92	87	-3	2	2	4
4000	89	111	-4	-26	1	0
8000	84	145	-4	-65	-1	0
					TOTAL DBA	23.6

HP OF FAN COOLER MOTOR **25** | **UNDERFLOW FORCED DRAFT-TYPE**

DIRECTION FAN COOLER IS FACING **W** | ESTIMATED

UNIT 5

OCTAVE	TOTAL P.W.L.	DISTANCE TERM	DIRECTION TERM	S.P.L. (dBA) AT 1600 METERS	"A" SCALE CORRECTION	CORRECTED VALUE
31	102	72	-1	29	-43	0
63	107	72	-1	34	-28	6
125	107	72	-1	34	-18	16
250	102	72	-2	28	-8	20
500	99	76	-2	21	-3	18
1000	95	79	-3	13	0	13
2000	92	87	-3	2	2	4
4000	89	111	-4	-26	1	0
8000	84	145	-4	-65	-1	0
					TOTAL DBA	23.6

HP OF FAN COOLER MOTOR **25** | **UNDERFLOW FORCED DRAFT-TYPE**

DIRECTION FAN COOLER IS FACING **W** | ESTIMATED

UNIT 6

OCTAVE	TOTAL P.W.L.	DISTANCE TERM	DIRECTION TERM	S.P.L. (dBA) AT 1600 METERS	"A" SCALE CORRECTION	CORRECTED VALUE
31	102	72	-1	29	-43	0
63	107	72	-1	34	-28	6
125	107	72	-1	34	-18	16
250	102	72	-2	28	-8	20
500	99	76	-2	21	-3	18
1000	95	79	-3	13	0	13
2000	92	87	-3	2	2	4
4000	89	111	-4	-26	1	0
8000	84	145	-4	-65	-1	0
					TOTAL DBA	23.6

HP OF FAN COOLER MOTOR **25**

UNDERFLOW FORCED DRAFT-TYPE

DIRECTION FAN COOLER IS FACING **W**

UNIT 7

OCTAVE	TOTAL P.W.L.	DISTANCE TERM	DIRECTION TERM	ESTIMATED S.P.L. (dBA) AT 1600 METERS	"A" SCALE CORRECTION	CORRECTED VALUE
31	102	72	-1	29	-43	0
63	107	72	-1	34	-28	6
125	107	72	-1	34	-18	16
250	102	72	-2	28	-8	20
500	99	76	-2	21	-3	18
1000	95	79	-3	13	0	13
2000	92	87	-3	2	2	4
4000	89	111	-4	-26	1	0
8000	84	145	-4	-65	-1	0
					TOTAL DBA	23.6

HP OF FAN COOLER MOTOR **0**

DIRECTION FAN COOLER IS FACING **0**

UNIT 8

OCTAVE	TOTAL P.W.L.	DISTANCE TERM	DIRECTION TERM	ESTIMATED S.P.L. (dBA) AT 1600 METERS	"A" SCALE CORRECTION	CORRECTED VALUE
31	0	72	-1	-73	-43	0
63	0	72	-1	-73	-28	0
125	0	72	-1	-73	-18	0
250	0	72	-2	-74	-8	0
500	0	76	-2	-78	-3	0
1000	0	79	-3	-82	0	0
2000	0	87	-3	-90	2	0
4000	0	111	-4	-115	1	0
8000	0	145	-4	-149	-1	0
					TOTAL DBA	0.0

NOISE IMPACT STATEMENT BACKGROUND INFORMATION

DEFINITIONS

P.W.L. - Sound power level created by a source
- P.W.L. for propeller type cooling towers of various horsepower are shown in TABLE III

S.P.L. - Sound pressure level measured or calculated at a specified distance from the source
- S.P.L. = P.W.L. - DISTANCE TERM + DIRECTION TERM

DISTANCE TERM - Used for calculating S.P.L. for distances of 100 FT. to 10,000 FT. (TABLE II)

DIRECTION TERM - Correction to S.P.L. for directional effects of cooling towers (TABLE IV)

"A" SCALE - The human ear perceives sound pressure levels of different frequencies as louder or quieter. Low frequencies are perceived as quieter than higher pitched noise of the same sound pressure level. The "A" scale correction converts sound pressure levels in dB to sound pressure levels in dBa so the various frequencies can be added together.

dBa - "A" weighted sound power based on a comparison between the magnitude under consideration and a standard (10^{-12} watts)

DECIBEL ADDITION

$$dBa(total) = 10*LOG[ALOG(dBa_1/10)+ALOG(dBa_2/10)+\ldots\ldots ALOG(dBa_n/10)]$$

Individual dBa levels for each fan cooler are shown in TABLE I

Total dBa level for all fan coolers combined is shown in TABLE I

TABLE II

DISTANCE TERM, INCLUDING ABSORPTION LOSSES,
FOR CALCULATING SPL FOR DISTANCES OF 100 FT. TO 10,000 FT.
FROM A NOISE SOURCE OF POWER PWL
SPL=PWL-DISTANCE TERM
WHERE PWL IS IN db re 10^{-12} watts

DISTANCE D (FT)	DISTANCE TERM (TO NEAREST db) FOR OCTAVE FREQUENCY BAND (Hz)					
	31-250	500	1000	2000	4000	8000
100	38	38	38	38	39	39
112	39	39	39	39	40	41
126	40	40	40	40	41	42
141	41	41	41	41	42	43
158	42	42	42	42	43	44
178	43	43	43	44	44	46
200	44	44	44	45	46	47
224	45	45	45	46	47	48
252	46	46	46	47	48	50
282	47	47	47	48	49	51
316	48	48	48	49	50	53
356	49	49	49	50	52	54
400	50	50	51	51	53	56
448	51	51	52	52	54	57
504	52	52	53	54	56	59
564	53	53	54	55	57	61
632	54	54	55	56	59	63
712	55	56	56	57	60	65
800	56	57	57	58	62	67
900	57	58	58	60	64	70
1000	58	59	59	61	66	72
1120	59	60	61	62	68	75
1260	60	61	62	64	70	78
1410	61	62	63	65	73	81
1580	62	63	64	67	75	85
1780	63	64	66	68	77	89
2000	64	65	67	70	79	93
2240	65	67	68	72	82	97
2520	66	68	70	74	85	102
2820	67	69	71	75	89	108
3160	68	70	72	77	92	114
3560	69	72	74	80	96	120
4000	70	73	76	82	101	128
4480	71	74	77	84	105	136
5040	72	76	79	87	111	145
5640	73	77	81	90	116	154
6320	74	78	83	93	123	165
7120	75	80	85	96	130	178
8000	76	82	87	100	138	191
9000	77	83	90	104	146	207
10000	78	85	92	108	155	222

TABLE III

APPROXIMATE OCTAVE BAND SOUND POWER LEVLES OF PROPELLER TYPE COOLING TOWER IN db re 10-12 watt

OCTAVE FREQUENCY BAND (Hz)	4 TO 8 HP	9 TO 16 HP	17 TO 32 HP	33 TO 64 HP	65 TO 128 HP	129 TO 256 HP
31	96	99	102	105	108	111
63	101	104	107	110	113	116
125	101	104	107	110	113	116
250	96	99	102	105	108	111
500	93	96	99	102	105	108
1000	89	92	95	98	101	104
2000	86	89	92	95	98	101
4000	82	86	89	92	95	98
8000	78	81	84	87	90	93

TABLE IV

APPROXIMATE CORRECTIONS TO AVERAGE SPLs FOR DIRECTIONAL EFFECTS OF COOLING TOWERS INDUCED-DRAFT PROPELLER- TYPE

OCTAVE FREQUENCY BAND	AXIAL FLOW BLOW THROUGH TYPE			UNDERFLOW TYPE
(Hz)	FRONT	SIDE	REAR	ANY SIDE
31	2	1	-3	-1
63	2	1	-3	-1
125	4	1	-4	-1
250	6	-2	-7	-2
500	6	-5	-7	-2
1000	5	-5	-7	-3
2000	5	-5	-8	-3
4000	5	-5	-11	-4
8000	5	-4	-8	-4

Revision History

Document number SC2500 MV-Block	Version and revision type [1])		Comments	Author
-91:LE4615	1.0	A	First version	S. Vorderbruegge

[1]) A: First version or revision due to inaccurate documentation or improvement of the documentation

B: Revision assuring complete or forward compatibility

C: Revision limiting or excluding compatibility

Tested by	19.11.2015 X Manager EMC and Environmental Laboratory Authorized signatory Signiert von: Stephan Vorderbruegge	Released by	28.04.2016 X Senior Manager EMC and Environmental Laboratory Authorized signatory Signiert von: Peter Thomae

2 Overview of Results

The EN 3744:04/2011, EN 9614-2:08/2011 and German Noise Control Guidelines form the testing specification for the thresholds and requirements	**Requirement**		**2500 kW max. fan load [dB$_A$]**
	Standard (Germany)	**SMA**	
EN 9614-2 **sound power L_{WA}** [3]	–	–	**92,32**
EN9614-1 Derived sound pressure level at a distance of 1m via sound power			**76,87**
EN 3744:2011-02 typical value at a distance of 1m; L_{Aeq} averaged [1]	– [5]	– [5]	77,02
Sound pressure level in 10 m L_{xpA10} [4]	–	70	**64,33**
Sound pressure level in 50 m L_{xpA50} [4]	–	–	50,35
§48 of the German Federal Emission Control Act (BImSchG):09-2002 German Noise Control Guidelines; LPA 2)	(A) 70	70	passed
Overall result (if applicable)			*Standard requirements: - **passed**

*** Dependent on the local conditions at the mounting location (distance of 10m standard)**

Please note the detailed description of the measurement environment. See Section 4.3Test Environment

[1] This measurement involves purely informative measured values for development. The result shown is based on an averaged value of all sides of the device to be tested (see Section 5.1.3).

[2] Calculated average sound pressure level over the entire measurement area (see Section 6.1.2).

[3] Acoustic power resulting from sound intensity measurement (see Section 6.1.2).

[4] Calculated sound pressure level at the desired distance (see Section 6.1.3).

Overview of the Acoustic Power

Third octave band center frequency [Hz]	Sound power- level L_{wA} [$dB_{A/pW}$] 2500 kW	Sound power- level L_{wz} [$dB_{A/pW}$] 2500 kW no fan
25 Hz	42,97	-
31.5 Hz	45,72	-
40 Hz	48,71	-
50 Hz	52,45	-
63 Hz	55,56	-
80 Hz	59,50	-
100 Hz	63,83	-
125 Hz	64,83	-
160 Hz	64,57	-
200 Hz	68,49	-
250 Hz	71,54	-
315 Hz	79,94	-
400 Hz	76,96	-
500 Hz	71,97	-
630 Hz	73,50	-
800 Hz	77,20	-
1 kHz	75,50	-
1.25 kHz	71,59	-
1.6 kHz	69,75	-
2 kHz	70,31	-
2.5 kHz	81,21	-
3.15 kHz	90,61	-
4 kHz	70,23	-
5 kHz	68,72	-
6.3 kHz	78,07	-
8 kHz	68,56	-
10 kHz	66,46	-
Acoustic power above the surface	A-rated	Z-rated
	92,32	94.64

Sound Power Used for Analysis - Combined Source

Project: Burdett Solar Project - Noise Impact Assessment RP2
Report ID: 18079.00

Created on: 5/24/2018

5.0 MVA - Medium Voltage Transformer Sound Power Estimate

Rated Capacity	5.0 MVA
NEMA Sound Pressure Estimate [1]	67 dBA
Assumed Surface Area	75 m^2

	31.5	63	125	250	500	1000	2000	4000	8000	Total (dBA)
Frequency Spectrum Adjustment [2]	-3	3	5	0	0	-6	-11	-16	-23	**-**
Sound Power Level (dB)	83	89	91	86	86	80	75	70	63	**86**

[1] Based on NEMA TRI-1993 (R2000), Table 0-2, Immersed Power Transformers

[2] from Beranek, Noise and Vibration Control Engineering, 1992. Table 18.1, Line 28

5.0 MVA Transformer and SC2500 5.0 MVA Inverter Cluster **[5MVA Inverter Station]**

Noise Source	31.5	63	125	250	500	1000	2000	4000	8000	**Total (dBA)**
NEMA Estimate 5 MVA Transformer	83	89	91	86	86	80	75	70	63	**86**
SC2500 5MVA Solar Inverter Cluster	94	90	90	91	87	84	84	92	82	**95**
Combined Source	94	93	93	92	89	85	84	93	82	**96**

APPENDIX C – ISO Calculation

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)	60.00
Reference Time Night (min)	60.00
Daytime Penalty (dB)	0.00
Recr. Time Penalty (dB)	6.00
Night-time Penalty (dB)	10.00
DTM	
Standard Height (m)	760.00
Model of Terrain	Triangulation
Reflection	
max. Order of Reflection	0
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 (°C)	10
rel. Humidity (%)	70
Ground Absorption G	0.50
Wind Speed for Dir. (m/s)	3.0
Roads (RLS-90)	
Strictly acc. to RLS-90	
Railways (Schall 03 (1990))	
Strictly acc. to Schall 03 / Schall-Transrapid	
Aircraft (???)	
Strictly acc. to AzB	

Project: Burdett Solar Project
Project Number: 18079

ISO 9613-2 Equation	$Lr = Lw + K0 - Dc - Adiv - Agr - Afol - Ahous - Abar - Cmet - RL$ [dB(A)]

Acronym	Definition
Refl.	Order of reflections;
Lw	Sound power level
L/A	Length (m) or area (m^2) of source; for point sources = 1
Freq	Band center frequency; entries for the proceeding terms can be split up on a frequency basis or reported together (“A”).
K0	Directivity Index (dB)
Adiv	Attenuation due to geometrical divergence
Agr	The ground attenuation term in absence of a barrier
Abar	Attenuation by screening from a barrier
Aatm	Attenuation from atmospheric absorption
Afo	Attenuation of sound during propagation through foliage
Ahous	Attenuation during propagation through a built-up region of houses
Cmet	A meteorological correction term used to account for the difference in propagational effects over varying meteorological conditions in a study period.
Dc	Directivity correction
RL	Reflection loss
Lr	(partial) receiver level Day/Night (dB[A])

Receiver: R01
Project: Burdett Solar Project
Project Number: 18079

Time Period	Total (dBA)
Night	44

Receiver Name	Receiver ID	X	Y	Z
R01	R01	461082.9	5518829.8	796.0

Source ID	Source Name	X	Y	Z	Refl.	Lw	L/A	Freq	Adiv	K0	Agr	Abar	Aatm	Afol	Ahous	Cmet	Dc	RL	Lr
InvStn_1	5MW Inverter Station	460526.0	5518760.0	790.6	0	96	0.0	A	66.0	0.0	-1.6	6.4	6.2	0.0	0.0	0.0	0.0	0.0	19
TP_cap1	Capacitor1	461078.9	5518208.3	797.1	0	87	0.0	A	66.9	0.0	-1.2	0.0	1.1	0.0	0.0	0.0	0.0	0.0	20
TP_cap2	capacitor2	461081.6	5518241.8	797.8	0	87	0.0	A	66.4	0.0	-1.1	0.0	1.0	0.0	0.0	0.0	0.0	0.0	21
TP_f1	Fan1	461255.9	5518222.9	790.5	0	101	0.0	A	67.0	0.0	-1.5	0.0	2.1	0.0	0.0	0.0	0.0	0.0	34
TP_f2	fan2	461246.3	5518222.5	790.5	0	101	0.0	A	67.0	0.0	-1.5	0.0	2.1	0.0	0.0	0.0	0.0	0.0	34
TP_f3	fan3	461236.2	5518222.7	790.6	0	101	0.0	A	66.9	0.0	-1.5	0.0	2.1	0.0	0.0	0.0	0.0	0.0	34
TP_f4	Fan4	461256.5	5518237.6	790.7	0	101	0.0	A	66.8	0.0	-1.5	0.0	2.1	0.0	0.0	0.0	0.0	0.0	34
TP_f5	Fan5	461245.9	5518237.8	790.7	0	101	0.0	A	66.8	0.0	-1.5	0.0	2.1	0.0	0.0	0.0	0.0	0.0	34
TP_f6	Fan6	461236.4	5518237.5	790.7	0	101	0.0	A	66.7	0.0	-1.5	0.0	2.1	0.0	0.0	0.0	0.0	0.0	34
TP_f7	Fan7	461225.6	5518237.8	790.8	0	101	0.0	A	66.7	0.0	-1.5	0.0	2.1	0.0	0.0	0.0	0.0	0.0	34
InvStn_2	Inverter_transformer	460768.0	5518759.0	795.4	0	96	0.0	A	61.2	0.0	-1.5	0.0	4.9	0.0	0.0	0.0	0.0	0.0	31
InvStn_4	Inverter_transformer	460807.0	5518433.0	791.6	0	96	0.0	A	64.7	0.0	-1.6	0.0	5.9	0.0	0.0	0.0	0.0	0.0	27
Stn3Trans	Stand-alone Transformer	460988.0	5518630.0	795.1	0	86	0.0	A	57.9	0.0	-1.1	0.0	0.7	0.0	0.0	0.0	0.0	0.0	29
TP_tf1	Transformer1	461088.4	5518253.2	791.5	0	96	0.0	A	66.2	0.0	-1.8	0.0	1.7	0.0	0.0	0.0	0.0	0.0	30
TP_tf2	Transformer2	461088.0	5518216.6	791.4	0	102	0.0	A	66.8	0.0	-1.9	0.0	1.8	0.0	0.0	0.0	0.0	0.0	35

Project Contribution (dBA)	34
3rd Party Contribution (dBA)	43
Ambient Contribution (dBA)	35

Receiver: R02
Project: Burdett Solar Project
Project Number: 18079

Time Period	Total (dBA)
Night	42

Receiver Name	Receiver ID	X	Y	Z
R02	R02	460398.2	5518140.5	792.0

Source ID	Source Name	X	Y	Z	Refl.	Lw	L/A	Freq	Adiv	K0	Agr	Abar	Aatm	Afol	Ahous	Cmet	Dc	RL	Lr
InvStn_1	5MW Inverter Station	460526.0	5518760.0	790.6	0	96	0.0	A	67.0	0.0	-1.7	0.0	6.5	0.0	0.0	0.0	0.0	0.0	24
TP_cap1	Capacitor1	461078.9	5518208.3	797.1	0	87	0.0	A	67.7	0.0	-1.2	0.0	1.2	0.0	0.0	0.0	0.0	0.0	19
TP_cap2	capacitor2	461081.6	5518241.8	797.8	0	87	0.0	A	67.8	0.0	-1.2	0.0	1.2	0.0	0.0	0.0	0.0	0.0	19
TP_f1	Fan1	461255.9	5518222.9	790.5	0	101	0.0	A	69.7	0.0	-1.7	0.0	2.7	0.0	0.0	0.0	0.0	0.0	31
TP_f2	fan2	461246.3	5518222.5	790.5	0	101	0.0	A	69.6	0.0	-1.7	0.0	2.6	0.0	0.0	0.0	0.0	0.0	31
TP_f3	fan3	461236.2	5518222.7	790.6	0	101	0.0	A	69.5	0.0	-1.7	0.0	2.6	0.0	0.0	0.0	0.0	0.0	31
TP_f4	Fan4	461256.5	5518237.6	790.7	0	101	0.0	A	69.7	0.0	-1.7	0.0	2.7	0.0	0.0	0.0	0.0	0.0	31
TP_f5	Fan5	461245.9	5518237.8	790.7	0	101	0.0	A	69.6	0.0	-1.7	0.0	2.6	0.0	0.0	0.0	0.0	0.0	31
TP_f6	Fan6	461236.4	5518237.5	790.7	0	101	0.0	A	69.5	0.0	-1.7	0.0	2.6	0.0	0.0	0.0	0.0	0.0	31
TP_f7	Fan7	461225.6	5518237.8	790.8	0	101	0.0	A	69.4	0.0	-1.7	0.0	2.6	0.0	0.0	0.0	0.0	0.0	31
InvStn_4	Inverter_transformer	460807.0	5518433.0	791.6	0	96	0.0	A	65.0	0.0	-1.6	0.0	6.0	0.0	0.0	0.0	0.0	0.0	26
InvStn_2	Inverter_transformer	460768.0	5518759.0	795.4	0	96	0.0	A	68.2	0.0	-1.7	0.0	6.8	0.0	0.0	0.0	0.0	0.0	22
Stn3Trans	Stand-alone Transformer	460988.0	5518630.0	795.1	0	86	0.0	A	68.7	0.0	-1.7	0.0	2.0	0.0	0.0	0.0	0.0	0.0	17
TP_tf1	Transformer1	461088.4	5518253.2	791.5	0	96	0.0	A	67.9	0.0	-2.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	28
TP_tf2	Transformer2	461088.0	5518216.6	791.4	0	102	0.0	A	67.8	0.0	-2.0	0.0	1.9	0.0	0.0	0.0	0.0	0.0	34

Project Contribution (dBA)		30
3rd Party Contribution (dBA)		41
Ambient Contribution (dBA)		35

Receiver: R03

Project: Burdett Solar Project
Project Number: 18079

Time Period	Total (dBA)
Night	36

Receiver Name	Receiver ID	X	Y	Z
R03	R03	461209.3	5519944.5	793.9

Source ID	Source Name	X	Y	Z	Refl.	Lw	L/A	Freq	Adiv	K0	Agr	Abar	Aatm	Afol	Ahous	Cmet	Dc	RL	Lr
InvStn_1	5MW Inverter Station	460526.0	5518760.0	790.6	0	96	0.0	A	73.7	0.0	-1.7	6.4	8.4	0.0	0.0	0.0	0.0	0.0	9
TP_cap1	Capacitor1	461078.9	5518208.3	797.1	0	87	0.0	A	75.8	0.0	-1.5	0.0	2.5	0.0	0.0	0.0	0.0	0.0	10
TP_cap2	capacitor2	461081.6	5518241.8	797.8	0	87	0.0	A	75.6	0.0	-1.5	0.0	2.5	0.0	0.0	0.0	0.0	0.0	10
TP_f1	Fan1	461255.9	5518222.9	790.5	0	101	0.0	A	75.7	0.0	-1.6	6.4	4.3	0.0	0.0	0.0	0.0	0.0	17
TP_f2	fan2	461246.3	5518222.5	790.5	0	101	0.0	A	75.7	0.0	-1.6	6.4	4.3	0.0	0.0	0.0	0.0	0.0	17
TP_f3	fan3	461236.2	5518222.7	790.6	0	101	0.0	A	75.7	0.0	-1.6	6.4	4.3	0.0	0.0	0.0	0.0	0.0	17
TP_f4	Fan4	461256.5	5518237.6	790.7	0	101	0.0	A	75.6	0.0	-1.6	6.4	4.2	0.0	0.0	0.0	0.0	0.0	17
TP_f5	Fan5	461245.9	5518237.8	790.7	0	101	0.0	A	75.6	0.0	-1.6	6.4	4.2	0.0	0.0	0.0	0.0	0.0	17
TP_f6	Fan6	461236.4	5518237.5	790.7	0	101	0.0	A	75.6	0.0	-1.6	6.4	4.2	0.0	0.0	0.0	0.0	0.0	17
TP_f7	Fan7	461225.6	5518237.8	790.8	0	101	0.0	A	75.6	0.0	-1.6	6.4	4.2	0.0	0.0	0.0	0.0	0.0	17
InvStn_2	Inverter_transformer	460768.0	5518759.0	795.4	0	96	0.0	A	73.0	0.0	-1.7	0.0	8.1	0.0	0.0	0.0	0.0	0.0	16
InvStn_4	Inverter_transformer	460807.0	5518433.0	791.6	0	96	0.0	A	74.9	0.0	-1.6	6.4	8.8	0.0	0.0	0.0	0.0	0.0	7
Stn3Trans	Stand-alone Transformer	460988.0	5518630.0	795.1	0	86	0.0	A	73.5	0.0	-1.8	0.0	3.2	0.0	0.0	0.0	0.0	0.0	12
TP_tf1	Transformer1	461088.4	5518253.2	791.5	0	96	0.0	A	75.6	0.0	-2.1	6.9	4.0	0.0	0.0	0.0	0.0	0.0	12
TP_tf2	Transformer2	461088.0	5518216.6	791.4	0	102	0.0	A	75.8	0.0	-2.2	7.0	4.1	0.0	0.0	0.0	0.0	0.0	17

Project Contribution (dBA)	18
3rd Party Contribution (dBA)	26
Ambient Contribution (dBA)	35

Receiver: R04
Project: Burdett Solar Project
Project Number: 18079

Time Period	Total (dBA)
Night	35

Receiver Name	Receiver ID	X	Y	Z
R04	R04	459844.5	5519832.1	796.7

Source ID	Source Name	X	Y	Z	Refl.	Lw	L/A	Freq	Adiv	K0	Agr	Abar	Aatm	Afol	Ahous	Cmet	Dc	RL	Lr
InvStn_1	5MW Inverter Station	460526.0	5518760.0	790.6	0	96	0.0	A	73.1	0.0	-1.7	0.0	8.2	0.0	0.0	0.0	0.0	0.0	16
InvStn_2	Inverter_transformer	460768.0	5518759.0	795.4	0	96	0.0	A	74.0	0.0	-1.7	0.0	8.5	0.0	0.0	0.0	0.0	0.0	15
InvStn_4	Inverter_transformer	460807.0	5518433.0	791.6	0	96	0.0	A	75.6	0.0	-1.6	0.0	9.0	0.0	0.0	0.0	0.0	0.0	13
Stn3Trans	Stand-alone Transformer	460988.0	5518630.0	795.1	0	86	0.0	A	75.4	0.0	-1.7	0.0	3.8	0.0	0.0	0.0	0.0	0.0	9

Project Contribution (dBA)		20
3rd Party Contribution (dBA)		<10
Ambient Contribution (dBA)		35

Receiver: R05
Project: Burdett Solar Project
Project Number: 18079

Time Period	Total (dBA)
Night	18

Receiver Name	Receiver ID	X	Y	Z
R05	R05	459399.5	5519768.9	800.1

Source ID	Source Name	X	Y	Z	Refl.	Lw	L/A	Freq	Adiv	K0	Agr	Abar	Aatm	Afol	Ahous	Cmet	Dc	RL	Lr
InvStn_1	5MW Inverter Station	460526.0	5518760.0	790.6	0	96	0.0	A	74.6	0.0	-1.7	0.0	8.7	0.0	0.0	0.0	0.0	0.0	14
InvStn_2	Inverter_transformer	460768.0	5518759.0	795.4	0	96	0.0	A	75.6	0.0	-1.6	0.0	9.0	0.0	0.0	0.0	0.0	0.0	13
InvStn_4	Inverter_transformer	460807.0	5518433.0	791.6	0	96	0.0	A	76.8	0.0	-1.6	0.0	9.5	0.0	0.0	0.0	0.0	0.0	11
Stn3Trans	Stand-alone Transformer	460988.0	5518630.0	795.1	0	86	0.0	A	76.8	0.0	-1.7	0.0	4.3	0.0	0.0	0.0	0.0	0.0	7

Project Contribution (dBA)		18
3rd Party Contribution (dBA)		<10
Ambient Contribution (dBA)		35

Receiver: R06
Project: Burdett Solar Project
Project Number: 18079

Time Period	Total (dBA)
Night	35

Receiver Name	Receiver ID	X	Y	Z
R06	R06	459439.8	5519340.0	795.8

Source ID	Source Name	X	Y	Z	Refl.	Lw	L/A	Freq	Adiv	K0	Agr	Abar	Aatm	Afol	Ahous	Cmet	Dc	RL	Lr
InvStn_1	5MW Inverter Station	460526.0	5518760.0	790.6	0	96	0.0	A	72.8	0.0	-1.7	0.0	8.1	0.0	0.0	0.0	0.0	0.0	17
TP_cap1	Capacitor1	461078.9	5518208.3	797.1	0	87	0.0	A	77.0	0.0	-1.5	0.0	2.8	0.0	0.0	0.0	0.0	0.0	9
TP_cap2	capacitor2	461081.6	5518241.8	797.8	0	87	0.0	A	76.9	0.0	-1.5	0.0	2.8	0.0	0.0	0.0	0.0	0.0	9
InvStn_2	Inverter_transformer	460768.0	5518759.0	795.4	0	96	0.0	A	74.2	0.0	-1.7	0.0	8.5	0.0	0.0	0.0	0.0	0.0	15
InvStn_4	Inverter_transformer	460807.0	5518433.0	791.6	0	96	0.0	A	75.3	0.0	-1.6	0.0	8.9	0.0	0.0	0.0	0.0	0.0	13
Stn3Trans	Stand-alone Transformer	460988.0	5518630.0	795.1	0	86	0.0	A	75.6	0.0	-1.7	0.0	3.9	0.0	0.0	0.0	0.0	0.0	9
TP_tf1	Transformer1	461088.4	5518253.2	791.5	0	96	0.0	A	76.9	0.0	-2.1	0.0	4.5	0.0	0.0	0.0	0.0	0.0	17
TP_tf2	Transformer2	461088.0	5518216.6	791.4	0	102	0.0	A	77.0	0.0	-2.2	0.0	4.6	0.0	0.0	0.0	0.0	0.0	23

Project Contribution (dBA)		20
3rd Party Contribution (dBA)		24
Ambient Contribution (dBA)		35

Receiver: R07
Project: Burdett Solar Project
Project Number: 18079

Time Period	Total (dBA)
Night	37

Receiver Name	Receiver ID	X	Y	Z
R07	R07	459457.2	5518144.9	793.5

Source ID	Source Name	X	Y	Z	Refl.	Lw	L/A	Freq	Adiv	K0	Agr	Abar	Aatm	Afol	Ahous	Cmet	Dc	RL	Lr
InvStn_1	5MW Inverter Station	460526.0	5518760.0	790.6	0	96	0.0	A	72.8	0.0	-1.7	0.0	8.1	0.0	0.0	0.0	0.0	0.0	17
TP_cap1	Capacitor1	461078.9	5518208.3	797.1	0	87	0.0	A	75.2	0.0	-1.5	0.0	2.4	0.0	0.0	0.0	0.0	0.0	11
TP_cap2	capacitor2	461081.6	5518241.8	797.8	0	87	0.0	A	75.2	0.0	-1.5	0.0	2.4	0.0	0.0	0.0	0.0	0.0	11
TP_f1	Fan1	461255.9	5518222.9	790.5	0	101	0.0	A	76.1	0.0	-1.6	0.0	4.4	0.0	0.0	0.0	0.0	0.0	23
TP_f2	fan2	461246.3	5518222.5	790.5	0	101	0.0	A	76.1	0.0	-1.6	0.0	4.4	0.0	0.0	0.0	0.0	0.0	23
TP_f3	fan3	461236.2	5518222.7	790.6	0	101	0.0	A	76.0	0.0	-1.6	0.0	4.4	0.0	0.0	0.0	0.0	0.0	23
TP_f4	Fan4	461256.5	5518237.6	790.7	0	101	0.0	A	76.1	0.0	-1.6	0.0	4.4	0.0	0.0	0.0	0.0	0.0	23
TP_f5	Fan5	461245.9	5518237.8	790.7	0	101	0.0	A	76.1	0.0	-1.6	0.0	4.4	0.0	0.0	0.0	0.0	0.0	23
TP_f6	Fan6	461236.4	5518237.5	790.7	0	101	0.0	A	76.0	0.0	-1.6	0.0	4.4	0.0	0.0	0.0	0.0	0.0	23
TP_f7	Fan7	461225.6	5518237.8	790.8	0	101	0.0	A	76.0	0.0	-1.6	0.0	4.3	0.0	0.0	0.0	0.0	0.0	23
InvStn_4	Inverter_transformer	460807.0	5518433.0	791.6	0	96	0.0	A	73.8	0.0	-1.7	0.0	8.4	0.0	0.0	0.0	0.0	0.0	15
InvStn_2	Inverter_transformer	460768.0	5518759.0	795.4	0	96	0.0	A	74.2	0.0	-1.7	0.0	8.5	0.0	0.0	0.0	0.0	0.0	15
Stn3Trans	Stand-alone Transformer	460988.0	5518630.0	795.1	0	86	0.0	A	75.1	0.0	-1.7	0.0	3.7	0.0	0.0	0.0	0.0	0.0	9
TP_tf1	Transformer1	461088.4	5518253.2	791.5	0	96	0.0	A	75.3	0.0	-2.1	0.0	3.9	0.0	0.0	0.0	0.0	0.0	19
TP_tf2	Transformer2	461088.0	5518216.6	791.4	0	102	0.0	A	75.3	0.0	-2.2	0.0	3.9	0.0	0.0	0.0	0.0	0.0	25

Project Contribution (dBA)		21
3rd Party Contribution (dBA)		32
Ambient Contribution (dBA)		35

Receiver: R08
Project: Burdett Solar Project
Project Number: 18079

Time Period	Total (dBA)
Night	40

Receiver Name	Receiver ID	X	Y	Z
R08	R08	460701.4	5517317.5	793.1

Source ID	Source Name	X	Y	Z	Refl.	Lw	L/A	Freq	Adiv	K0	Agr	Abar	Aatm	Afol	Ahous	Cmet	Dc	RL	Lr
InvStn_1	5MW Inverter Station	460526.0	5518760.0	790.6	0	96	0.0	A	74.2	0.0	-1.7	0.0	8.5	0.0	0.0	0.0	0.0	0.0	15
TP_cap1	Capacitor1	461078.9	5518208.3	797.1	0	87	0.0	A	70.7	0.0	-1.4	0.0	1.6	0.0	0.0	0.0	0.0	0.0	16
TP_cap2	capacitor2	461081.6	5518241.8	797.8	0	87	0.0	A	71.0	0.0	-1.4	0.0	1.6	0.0	0.0	0.0	0.0	0.0	16
TP_f1	Fan1	461255.9	5518222.9	790.5	0	101	0.0	A	71.5	0.0	-1.7	0.0	3.1	0.0	0.0	0.0	0.0	0.0	29
TP_f2	fan2	461246.3	5518222.5	790.5	0	101	0.0	A	71.5	0.0	-1.7	0.0	3.1	0.0	0.0	0.0	0.0	0.0	29
TP_f3	fan3	461236.2	5518222.7	790.6	0	101	0.0	A	71.4	0.0	-1.7	0.0	3.1	0.0	0.0	0.0	0.0	0.0	29
TP_f4	Fan4	461256.5	5518237.6	790.7	0	101	0.0	A	71.6	0.0	-1.7	0.0	3.1	0.0	0.0	0.0	0.0	0.0	28
TP_f5	Fan5	461245.9	5518237.8	790.7	0	101	0.0	A	71.6	0.0	-1.7	0.0	3.1	0.0	0.0	0.0	0.0	0.0	28
TP_f6	Fan6	461236.4	5518237.5	790.7	0	101	0.0	A	71.5	0.0	-1.7	0.0	3.1	0.0	0.0	0.0	0.0	0.0	29
TP_f7	Fan7	461225.6	5518237.8	790.8	0	101	0.0	A	71.5	0.0	-1.7	0.0	3.1	0.0	0.0	0.0	0.0	0.0	29
InvStn_4	Inverter_transformer	460807.0	5518433.0	791.6	0	96	0.0	A	72.0	0.0	-1.7	0.0	7.8	0.0	0.0	0.0	0.0	0.0	18
InvStn_2	Inverter_transformer	460768.0	5518759.0	795.4	0	96	0.0	A	74.2	0.0	-1.7	0.0	8.5	0.0	0.0	0.0	0.0	0.0	15
Stn3Trans	Stand-alone Transformer	460988.0	5518630.0	795.1	0	86	0.0	A	73.6	0.0	-1.8	0.0	3.2	0.0	0.0	0.0	0.0	0.0	11
TP_tf1	Transformer1	461088.4	5518253.2	791.5	0	96	0.0	A	71.1	0.0	-2.1	0.0	2.7	0.0	0.0	0.0	0.0	0.0	24
TP_tf2	Transformer2	461088.0	5518216.6	791.4	0	102	0.0	A	70.8	0.0	-2.2	0.0	2.6	0.0	0.0	0.0	0.0	0.0	31

Project Contribution (dBA)		21
3rd Party Contribution (dBA)		38
Ambient Contribution (dBA)		35

APPENDIX D – Acoustical Practitioner Information

Aercoustics Engineering Ltd.
1004 Middlegate Road, Suite 1100
Mississauga, ON L4Y 0G1

Tel: 416-249-3361
Fax 416-249-3613
aercoustics.com

kohl clark
BEng

profile

Kohl Clark is an Engineer in Training (EIT) in the Province of Ontario and holds a Bachelor's degree in Mechanical Engineering from McMaster University. He has 1.5 years of experience in the field of Acoustics and has been involved in different aspects of environmental noise and vibration.

education + career milestones

B.Eng., Mechanical Engineering, McMaster University, June 2016
joined Aercoustics full time in 2016 as a noise and vibration consultant.
Member of Professional Engineers of Ontario.

selected projects

Noise modelling and assessment

Oshawa Asphalt Plant	Oshawa, ON
Coleraine Drive Asphalt Plant	Bolton, ON
Derry Heights Commercial Development	Milton, ON
Rogers 333 Bloor Generator Upgrade	Toronto, ON
Loblaws Supermarkets	Various locations within Canada

Wind Farm noise measurements and compliance verification

Headwaters Wind Farm	Randolph County, IN
Snowy Ridge Wind Farm	Kawartha Lakes, ON
Port Ryerse Wind Farm	Port Dover, ON
K2 Wind Project Wind Project	Kincardine, ON
Grey Highlands Wind Projects	Grey County, ON

Aercoustics Engineering Ltd.
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aercoustics.com

payam ashtiani

BASc PEng ASA

profile

Payam Ashtiani is a Professional engineer in good standing, with a Bachelor's degree in Mechanical Engineering from the University of Toronto. He has 8 years of experience in the field of Acoustics with a specific focus on noise from wind turbines. Apart from completing numerous noise assessments for wind projects, and extensive wind turbine noise measurement campaigns, he has authored multiple research papers on the topic and presented at international technical conferences. His experience has included providing expert advice to regulatory bodies such as the Ontario Ministry of Environment, and the Vermont Public Service Department on the topic of wind turbine noise, and has appeared as expert witness in cases such as the Kent Breeze Environmental Review Tribunal, and the Alberta Utilities Commission Hearing for the Bull Creek Wind Farm. Payam also oversees the technical group responsible for carrying out IEC 61400-11 measurements – the only such group accredited to ISO 17025 in Canada.

education + career milestones

B.A.Sc., Mechanical Engineering, University of Toronto, 2005
joined aercoustics in 2006 as a noise and vibration consultant.
Member of

Canadian Acoustical Association,
Professional Engineers of Ontario,
Acoustical Society of America

publications

Detection of Amplitude Modulation in Southern Ontario Wind Farms, Halstead, D., Suban-Loewen, S, **Ashtiani P**, 6th International Conference of Wind Turbine Noise, Glasgow, Scotland, 20-23 April 2015

Spectral discrete probability density function of measured wind turbine noise in the far field. **Ashtiani P** and Denison A (2015). Front. Public Health 3:52. doi: 10.3389/fpubh.2015.00052

Health-based audible noise guidelines account for infrasound and low-frequency noise produced by wind turbines. Berger RG, **Ashtiani P**, Ollson CA, Whitfield Aslund M, McCallum LC, Leventhall G and Knopper LD (2015) Front. Public Health 3:31. doi: 10.3389/fpubh.2015.00031

Generating a better picture of noise immissions in post construction monitoring using statistical analysis, **Ashtiani, P.**, 5th International Conference of Wind Turbine Noise, Denver, Colorado, 28 - 30 August 2013

A new software tool to facilitate NURB based geometries in acoustic design, O'Keefe J., **Ashtiani, P.**, Grant D., International Symposium on Room Acoustics, Toronto, Canada, 9 June 2013

Analysis of noise immission levels measured from wind turbines, **Ashtiani, P.**, Titus, S, Wind Turbine Noise 2011, Rome, Italy, 11-14 April 2011

Improved noise audit technique for wind farms, Titus S., **Ashtiani P.**, INTER-NOISE 2010, Lisbon, Portugal, 13-16 June 2010

Concerns with using simplified wind profiles in determining noise impacts of wind turbines, Gambino, V., **Ashtiani, P.**, Preager, T., Ramakrishnan, R., INTER-NOISE 2009, Ottawa, Canada, August 23-26, 2009

Acoustic Performance Considerations For A "Once Through Steam Generator", Gambino, V., **Ashtiani, P.**, 2006.

selected projects

Noise modelling and assessment

Wolfe Island EcoPower Centre	Wolfe Island, ON
McLeans Mountain Wind Farm	Manitoulin Island, ON
Grand Bend Wind Farm	Grand Bend, ON
Bull Creek Wind Farm	Provost, AB
Ingredion (formerly CASCO) facility NIA	Cardinal, ON
Kraft Foods NIA and noise abatement plans	Various locations within Ontario
Q9 Networks data centres	Various locations within ON, AB, BC
Oldcastle building products (Permacon Group)	Various locations within Ontario

Wind Turbine noise measurements and compliance verification

Kingsbridge wind plant (K1)	Goderich, ON
Melancthon EcoPower Centre	Melancthon, ON
Wolfe Island EcoPower Centre	Wolfe Island, ON
Gosfield Wind Project	Essex County, ON
Comber Wind Project	Essex County, ON
South Kent Wind Project	Chatham-Kent, ON
Port Dover Nanticoke Wind Project	Nanticoke, ON
South Dundas Wind Project	South Dundas, ON
HAF Wind Energy Project	West Lincoln, ON
Wainfleet Wind Energy Project	Wainfleet, ON
Vestas R&D Acoustics Testing	Undisclosed locations
GE R&D Acoustic Testing	Undisclosed locations
Hybridyne wind Systems	Various locations with Ontario

Peer Review, expert witness, and expert advice

Various Wind Turbine Noise submissions to Public Service Board	Montpellier, VT
Ontario Ministry of Environment wind turbine noise measurement protocol	Ontario
Dufferin Wind Power project noise study peer review	Dufferin County, ON
Kent Breeze ERT (Erickson vs. Director)	Chatham-Kent, ON