Dolcy Solar Project

Noise Impact Assessment

Client: Dolcy Solar Inc.
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Dolcy Solar Inc.

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V1.0	June 16, 2023	Final for Issue
V1.1	October 11, 2023	Final for Issue - Updated to reflect latest design revisions and results

Executive Summary

Dolcy Solar Inc. (Dolcy Solar) is developing a solar photovoltaic (PV) project called the Dolcy Solar Project (the Project). The Project site is located approximately 19km northeast of the village of Czar, Alberta. Dolcy Solar retained Green Cat Renewables Canada Corporation (GCR) to conduct a noise impact assessment of the Project that considered ground mounted PV panels, single axis trackers and associated motors, seventy-six inverter/transformer stations, sixty-two BESS units, sixteen BESS transformers, and a Project Substation consisting of three high-voltage (HV) transformers. The inverters, transformers, BESS units, inverter/transformer charger stations, and the Project substation are expected to be the only significant noise producing Project elements. As such, no other Project elements were considered in this assessment. For the purposes of the noise assessment, the noise producing Project elements are assumed to operate at full load.

GCR reviewed aerial imagery of the site, identifying one receptor as having the potential to be affected by the noise from the proposed Project. The area was also checked for regulated third-party energy-related facilities that may produce noise within the vicinity of the Project. In April 2023, Dolcy Solar had a site visit conducted, in consultation with a local landowner, which confirmed that R1 is the only inhabited dwelling within the assessment area.

A software model was used to predict sound levels from the Project to determine compliance with the Alberta Utilities Commission (AUC) Rule 012: Noise Control requirements. The cumulative sound level was found to be less than 3dB below the Permissible Sound Level (PSL) for night-time periods, so a detailed noise assessment was carried out as per the AUC Rule 012, Appendix 3 – Summary report, recommendations.

Where applicable, cumulative sound levels incorporated sound from: approved and existing regulated third-party energy-related facilities; third-party projects; the proposed Project; and ambient sources. The assessment concluded that cumulative sound levels would be compliant with permitted sound levels at the assessed receptor. R1 was identified as the most impacted receptor within the assessment area. A Low Frequency Noise (LFN) assessment determined that sound from the proposed Project was not assessed to contain any significant LFN effects.

The proposed Dolcy Solar Project was therefore assessed to meet the requirements of AUC Rule 012.

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1 Introduction

Dolcy Solar Inc. (Dolcy Solar) retained Green Cat Renewables Canada Corporation (GCR) to conduct a noise impact assessment (NIA) for the proposed Dolcy Solar Project (the Project). The Project will include a 300-megawatt (MW_{AC}) solar photovoltaic (PV) electricity generating facility and a 100MW/200 megawatt-hour (MWh) Battery Energy Storage System (BESS), which will be located approximately 19km northeast of the village of Czar, Alberta. The Project location is shown in **Figure 1-1** below.

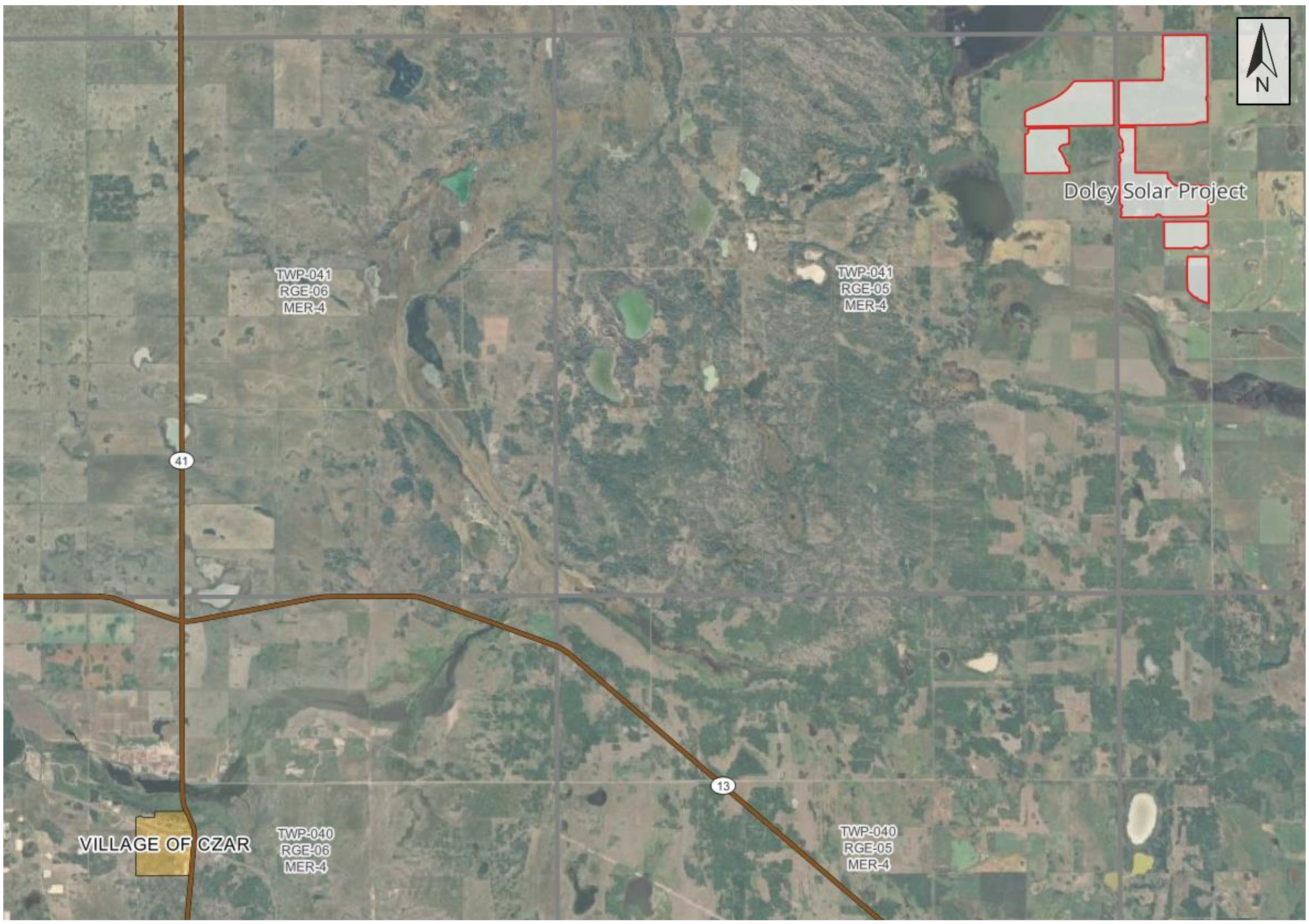


Figure 1-1 – Dolcy Solar Project Location

2 Rule 012 Assessment Process

The assessment process follows Alberta Utilities Commission (AUC) Rule 012 guidelines. The International Standard 'ISO 9613-2: Acoustics – Attenuation of sound during propagation outdoors', was followed in the prediction of noise levels at nearby receptors. A glossary of relevant AUC Rule 012 terms is reproduced in **Appendix A**.

The following steps give an overview of the process followed in identifying potential noise impacts on the most affected receptors.

- Define study area (distance contour at site boundary + 3km)
- Identify active and approved third party regulated energy-related facilities (AUC or Alberta Energy Regulated (AER)) within the study area
- Identify noise receptor(s) within 1.5km of the site boundary, or along the 1.5km boundary criteria (where no noise receptors exist).

For each noise receptor:

- Determine Basic Sound Level (BSL) and Ambient Sound Level (ASL)
- Predict sound level from existing and approved third party regulated energy-related facilities
- Combine facility and Ambient Sound Levels to give baseline sound levels
- Predict sound level from the proposed project
- Assess for Low Frequency Noise (LFN) content due to project
- Calculate Permissible Sound Levels (PSLs)
- Calculate Cumulative Sound Levels
- Assess compliance with AUC Rule 012 requirements

3 Noise Model

All noise propagation calculations were performed using iNoise from DGMR Software (version Enterprise 2023.01). This is quality assured software with full support of ISO/TR 17534-3, which provides recommendations to ensure uniformity in the interpretation of the ISO 9613 method.

DGMR provide the following information on the function of ISO/TR 17534-3[1]: '*The ISO 9613 standard from 1996 is the most used noise prediction method worldwide. Many countries refer to ISO 9613 in their noise legislation. However, the ISO 9613 standard does not contain guidelines for quality assured software implementation, which leads to differences between applications in calculated results. In 2015 this changed with the release of ISO/TR 17534-3. This quality standard gives clear recommendations for interpreting the ISO 9613 method. iNoise fully supports these recommendations. The models and results for the 19 test cases are included in the software...*'.

3.1 Model Parameters

Summer-time climatic conditions were assumed as required by Rule 012. **Table 3-1** shows the modelling parameters that were adopted for all calculations.

Table 3-1 – Model Parameters

Modelling Parameter	Setting
Terrain of Site Area	3m Height Contours[2]
Barrier Effects Included	None
Temperature	10°C
Relative Humidity	70%
Wind	1 – 5ms^{-1} from facility to receptor as per ISO-6913
Ground Attenuation	0.5
Number of Sound Reflections	1
Receptor Height	4.5m (two-storey)
Operation Condition	Full load
Source Height	1.9m for Inverter Stations 1.4m for Transformer Stations 3.3m for Battery Energy Storage System (BESS) units 1.5m for BESS Transformers (8MVA) 1.3m for BESS Transformers (4MVA) 4.00m for Substation Transformers

[1] https://dgmrsoftware.com/products/inoise/
[2] Data obtained from AltaLIS.

4 Baseline

4.1 Study Area

The development site has a total fenced area of approximately 1,263 acres. The study area includes rural/agricultural land and waterbodies.

Within the AUC study area of 1.5km from the project boundary, one dwelling was identified. One (1) dwelling has been assessed for cumulative noise impacts from the Project and other nearby facilities, as required by Rule 012.

4.2 Project Description

The Project will encompass an area of approximately 1,263 acres of land with a total generating capacity of 300MW_{AC}. The solar arrays will utilize ground mounted, single-axis tracker modules which will feed seventy-six (76) inverter/transformer stations. The Project will also consist of sixty-two (62) BESS units accompanied by sixteen (16) BESS transformer stations. A project substation containing one 111MVA transformer and two 167MVA transformers is also included. As detailed in **Section 5**, the single-axis tracker motors are not expected to contribute to project sound levels. As such, the inverters, transformers, BESS units, BESS transformers, and project substation are assessed to be the only significant sources of noise from the Project. No other project elements are considered in this assessment.

Daytime periods are defined as occurring between 07:00-22:00, while night-time periods fall between 22:00-07:00. The Project will largely operate during the defined daytime hours; however, sunrise on the longest days of the year (during summer months) will occur at approximately 05:00, which falls within the night-time period. Therefore, the assessment considers both daytime and night-time operational impacts (i.e., operating 24/7).

4.3 Sensitive Receptors

One (1) residential dwelling located within or bordering the 1.5km study area was identified by GCR as potentially being the most impacted by the Project. **Table 4-1** shows the location details and the height of the receptor.

Table 4-1 – Receptor Details

Receptor ID	UTM Coordinates (NAD 83, Zone 12N)		Dwelling Type	Receptor Height (m)	Relative location from site boundary
	Easting	Northing			
R1[3]	529959	5823547	Two-Storey	4.5	500m S, 600m N, and 1230m E

In April 2023, Dolcy Solar had a site visit conducted, in consultation with a local landowner, which confirmed that R1 is the only inhabited dwelling within the assessment area.

4.4 Existing Third-Party Regulated Energy-Related Facilities

A search for active and approved regulated energy-related facilities and pumping wells within 3km of the Project boundary was conducted in September 2023. The AER's Facilities list (ST102) and Wells list (ST037) were consulted

[3] Portions of the Project are located North, West, and South of R1.

for the AER regulated facilities and wells, and AUC eFiling portal was used to identify any existing and approved AUC regulated facilities. GCR identified three (3) AER regulated facilities and four (4) pumping wells that were considered to have the potential to influence cumulative sound levels. No AUC regulated facilities have been identified within the assessment area.

Table 4-2 lists the third-party energy-related facilities and pumping wells identified within 3km of the Project that have the potential to influence cumulative sound levels. Information was gathered in September 2023 using the AER databases.

Table 4-2 – Third Party Sound Sources

Map Label	Name	Type	Operator Name	UTM Coordinates (NAD 83, Zone 12N)	
				Easting	Northing
AER1	RENAISSANCE DOLCY OIL BATTERY 01-28	Crude Oil Multiwell Proration Battery	Erdol Resources Corp.	533002	5822606
AER2	HUSKY PROVO Gas MWB	Gas Multiwell Group Battery	Bow River Energy Ltd.	533002	5822606
AER3	Gas Gathering System 1-28	Gas Gathering System	Erdol Resources Corp.	533002	5822606
AER4	BOW RIVER DOLCY 10-21-41-4	Pumping Well (OIL)	Erdol Resources Corp.(A8H3)	532847	5821673
AER5	BOW RIVER DOLCY 7-21-41-4	Pumping Well (OIL)	Erdol Resources Corp.(A8H3)	532856	5821535
AER6	BOW RIVER DOLCY 7-21-41-4	Pumping Well (OIL)	Erdol Resources Corp.(A8H3)	532635	5821354
AER7	BOW RIVER DOLCY 9-20-41-4	Pumping Well (OIL)	Erdol Resources Corp.(A8H3)	531544	5821876

All third-party noise sources as well as the 1.5km and 3km study area boundaries are noted on Figure 4-1.[4]

[4] Note that there are several third-party facilities visible from satellite imagery that are either suspended or abandoned and thus have not been included in the noise impact assessment.

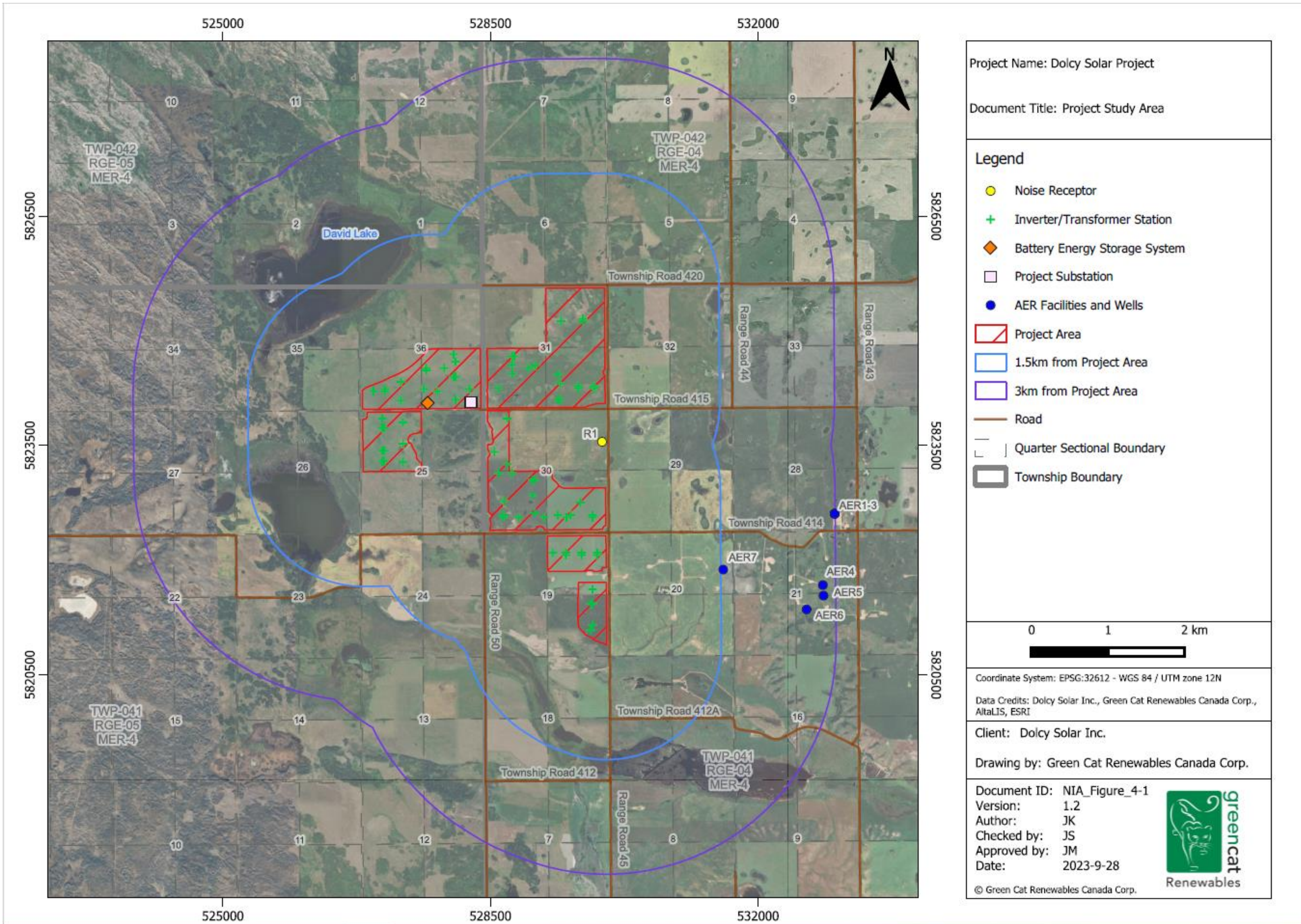


Figure 4-1 – Project Study Area

4.5 Baseline Sound Levels

Baseline sound levels for the receptor incorporates a contribution from all existing and approved AER and AUC facilities with the addition of the Ambient Sound Level (ASL). ASL is determined from the Basic Sound Level (BSL).

4.5.1 Determination of Basic Sound Level (BSL)

Rule 012 criteria for the determination of BSL include: dwelling density; road and rail traffic noise; and aircraft flyovers. In this case, dwelling density and road & traffic noise are the determining factors. Criteria are given in **Table 4-3**.

Table 4-3 – Rule 012 Criteria for determination of Basic Sound Levels (BSL)

Proximity to transportation	Dwelling density per quarter section of land		
	(1) 1 to 8 dwellings; 22:00 - 07:00 (night-time) (dBA Leq)	(2) 9 to 160 dwellings; 22:00 - 07:00 (night-time) (dBA Leq)	(3) >160 dwellings; 22:00 - 07:00 (night-time) (dBA Leq)
Category 1[5]	40	43	46
Category 2[6]	45	48	51
Category 3[7]	50	53	56

The assessed receptor in the study area has been evaluated to determine the category for both dwelling density and proximity to transportation. **Table 4-4** identifies the categories for the assessed receptor.

R1 has been assessed as category 1 for both dwelling density and proximity to transportation.

4.5.2 Determination of Ambient Sound Level (ASL)

The Project is located in an area typical of rural Alberta (including agricultural and oil & gas industries). Rule 012 states that 'In the absence of measurement, the night-time ambient sound level is assumed to be five dB less than the basic sound level and the daytime ambient sound level is assumed to be five dB less than the basic sound level plus the daytime adjustment'.[8] This results in a night-time ASL of 35dB(A) and a daytime ASL of 45dB(A) for the assessed receptor. BSL and ASL for night-times and daytimes for the receptor are given in **Table 4-4**.

4.5.3 Determination of Permissible Sound Level (PSL)

For R1, the PSL is determined using Basic Sound Level (BSL) plus any allowed adjustments. In this case, as no special conditions exist, the PSL is determined as:

Night-Time (NT) Permissible Sound Level = Basic Sound Level

Daytime (DT) Permissible Sound Level = Basic Sound Level + Daytime Adjustment (10dB)

[5] Category 1—dwelling(s) distance is more than or equal to 500 metres (m) from heavily travelled roads or rail lines and not subject to frequent aircraft flyovers.

[6] Category 2—dwelling(s) distance is more than or equal to 30 m, but less than 500 m from heavily travelled roads or rail lines and not subject to frequent aircraft flyovers.

[7] Category 3—dwelling(s) distance is less than 30 m from heavily travelled roads, or rail lines or subject to frequent aircraft flyovers.

[8] The daytime ASL accounts for the addition of the standard 10db(A) daytime adjustment to the night-time ASL for the hours between 7 a.m. and 10 p.m., without any further adjustments, i.e., Class A, B, and C adjustments were not applied.

BSLs, ASL, and PSLs for night-times and daytimes and for the assessed receptor is given in **Table 4-4.**

Table 4-4 – Daytime and Night-time BSL, ASL, and PSL

Dwelling ID	Transportation Category	Dwelling Category	BSL	ASL		PSL	
			NT/DT	NT	DT	NT	DT
R1	1	1	40	35	45	40	50

4.5.4 AER Facility Sound Power Levels

Sound power data for AER regulated energy-related facilities within 3km of the Project were compiled from an internal noise measurement database and third-party NIAs that included measurements of similar facilities. In each case, the quoted sound power levels are the average of at least two similar facilities and are deemed typical and representative of each facility type.

For the purpose of this assessment, all noise producing AER facilities were deemed to operate at full load and produce noise continuously.

Table 4-5 shows the octave band sound power levels for the included AER regulated energy-related facilities within 3km of the Project.

Table 4-5 – Octave Band Sound Power Levels for AER Regulated Facilities

Map Label	Facility	Octave Band Centre Frequency, Hz									Total	
		31.5	63	125	250	500	1000	2000	4000	8000	dB	dB(A)
AER1	Crude Oil Multiwell Proration Battery	105.0	103.1	103.6	100.5	98.5	98.1	95.5	92.1	88.9	110.2	102.9
AER2	Gas Multiwell Group Battery	112.3	108.4	102.8	98.8	96.7	95.4	94.0	88.6	82.9	114.4	100.7
AER3	Gas Gathering System	119.3	119.9	115.1	106.6	103.1	103.2	102.5	99.6	96.8	123.6	109.3
AER4	Pumping Well (OIL)	103.4	96.7	93.3	88.9	90.1	84.9	83.2	83.3	79.5	104.9	92.0
AER5	Pumping Well (OIL)	103.4	96.7	93.3	88.9	90.1	84.9	83.2	83.3	79.5	104.9	92.0
AER6	Pumping Well (OIL)	103.4	96.7	93.3	88.9	90.1	84.9	83.2	83.3	79.5	104.9	92.0
AER7	Pumping Well (OIL)	103.4	96.7	93.3	88.9	90.1	84.9	83.2	83.3	79.5	104.9	92.0

4.6 Total Baseline Sound Levels

Baseline sound levels include the noise contributions from third party energy facilities and the ambient sound level assessed for the local environment. **Table 4-6** shows the cumulative baseline sound levels for night-time (NT) and daytime (DT) periods.

Table 4-6 – Cumulative Baseline Sound Levels for Night-time and Daytime Periods

Dwelling ID	Total Regulated Facilities		ASL		Baseline	
	NT	DT	NT	DT	NT	DT
R1	20.2	20.2	35	45	35.1	45.0

Supplemental noise source information for the assessed receptor is provided in Appendix B.

5 Project Sound Levels

The Project will consist of solar PV arrays using ground-mounted single-axis trackers from NEXTracker Inc[9]. These trackers use a mass balanced system requiring only low wattage motors, with a measured sound power level from the manufacturer of 49.3dB(A), expected to be four orders of magnitude quieter than the inverter/transformer stations, and to operate for a few seconds every few minutes (frequency is dependant on time of year) to adjust the tilt angle of the modules. Considering this, the trackers are not expected to contribute to project sound levels. The potentially significant noise producing Project elements are described below.

The solar arrays will be connected to seventy-six (76) inverter/transformer stations, with a total capacity of up to 300MW_{AC}. The Project also consists of sixty-two (62) BESS units with a total capacity of approximately 100MW/200MWh. Sixteen BESS transformers are included in the Project to accompany the BESS units. Finally, a project substation has been proposed to be included in the project area, consisting of one 111MVA and two 167MVA high voltage (HV) transformers.

For the purposes of this assessment, the noise producing Project elements are assumed to operate at full load. This assumption is conservative for the solar PV facility, which will generally operate when the sun is out during daytime hours. The BESS could operate at any time, but in practice it is not expected to operate continuously at full load.

The sound power level data for the significant noise producing Project elements was used to model sound emissions for both daytime and night-time periods.

5.1 PV Electricity Generating Facility

5.1.1 Inverters

The inverter stations proposed for the PV electricity generating facility are the SMA SC 4000 UP-US units. The sound data measurements for these inverters provided by the equipment manufacturer are shown in **Appendix C**.

Table 5-1 shows the linear, 'A', and 'C' frequency weighted octave band sound power spectra for SMA SC 4000 UP-US.

Table 5-1 – One-Third Octave Band Sound Power Levels for SMA SC 4000 UP-US Inverters

Octave Band Frequency (Hz)	Sound Power (dB)	Sound Power (dBA)	Sound Power (dBC)
25	84.4	39.7	80.0
31.5	87.7	48.3	84.7
40	83.8	49.2	81.8
50	85.6	55.4	84.3
63	87.0	60.8	86.2
80	86.5	64.0	86.0
100	83.9	64.8	83.6
125	90.0	73.9	89.8

[9] https://www.nextracker.com/nx-horizon-solar-tracker

Octave Band Frequency (Hz)	Sound Power (dB)	Sound Power (dBA)	Sound Power (dBC)
160	83.2	69.8	83.1
200	85.6	74.7	85.6
250	87.0	78.4	87.0
315	88.4	81.8	88.4
400	84.5	79.7	84.5
500	81.2	78.0	81.2
630	79.7	77.8	79.7
800	82.0	81.2	82.0
1000	78.6	78.6	78.6
1250	78.0	78.6	78.0
1600	78.1	79.1	78.0
2000	75.8	77.0	75.6
2500	79.9	81.2	79.6
3150	87.8	89.0	87.3
4000	70.7	71.7	69.9
5000	71.1	71.6	69.8
6300	80.9	80.8	78.9
8000	70.8	69.7	67.8
10000	69.3	66.8	64.9
Sum	**98.6**	**93.0**	**97.9**

5.1.2 Transformers

The proposed MV transformers for the PV electricity generating facility are 4 MVA each and the manufacturer is yet to specify transformer sound level. The transformers have been modelled in (non-mineral) Oil Natural Air Natural (KNAN) conditions. KNAN conditions consider the use of a less flammable non-mineral oil to aid in cooling the transformer windings. Transformer sound levels are expected to be an order of magnitude lower than the equivalent inverters, thereby contributing a negligible amount to cumulative sound levels. Nevertheless, a typical transformer of a suitable type was modelled. The linear 'A' and 'C' frequency weighted octave band sound power spectra for the 4.6 MVA transformers used in the Project area is shown in **Table 5-2.**

Table 5-2 – Octave Band Sound Power Levels for the 4 MVA transformers[10]

Octave Band Frequency (Hz)	Sound Power (dB)	Sound Power (dBA)	Sound Power (dBC)
31.5	86.4	47.0	83.4
63	81.4	55.2	80.6
125	83.4	67.3	83.2
250	79.4	70.8	79.4
500	78.4	75.2	78.4
1000	67.4	67.4	67.4
2000	60.4	61.6	60.2
4000	55.4	56.4	54.6
8000	49.4	48.3	46.4
Sum	**89.8**	**77.7**	**88.5**

5.2 BESS

5.2.1 Energy Storage Battery Racks

The proposed battery energy storage units are the Tesla Megapack 2 XL and are designed as an all-in-one system, which includes the required inverters. The product data sheet states that sound power measurements were conducted 10m from the source at all sides of the unit. The primary source of noise arising from the unit will be from the cooling fans. For the purpose of this assessment, it has been assumed that these fans will run at full capacity at all times of day.

Table 5-3 shows the linear, ‘A’, and ‘C’ frequency weighted octave band sound power for the BESS units.

[10] Based on theoretical prediction method (Crocker, 2007).

Table 5-3 – Octave Band Sound Power Levels for the Tesla Megapack 2 XL

Octave Band Frequency (Hz)	Sound Power (dB)	Sound Power (dBA)	Sound Power (dBC)
100	87.3	68.2	87.0
125	82.1	66.0	81.9
160	83.5	70.1	83.4
200	83.0	72.1	83.0
250	86.3	77.7	86.3
315	90.5	83.9	90.5
400	99.9	95.1	99.9
500	85.2	82.0	85.2
630	88.7	86.8	88.7
800	92.1	91.3	92.1
1000	90.8	90.8	90.8
1250	92.1	92.7	92.1
1600	90.6	91.6	90.5
2000	90.2	91.4	90.0
2500	90.3	91.6	90.0
3150	86.6	87.8	86.1
4000	87.0	88.0	86.2
5000	87.4	87.9	86.1
6300	84.6	84.5	82.6
8000	80.6	79.5	77.6
10000	75.7	73.2	71.3
Sum	**103.7**	**101.8**	**103.5**

5.2.2 BESS Transformers

The proposed MV transformers for the BESS are 4MVA and 8MVA in size. Specific sound levels have not been specified by the manufacturer. However, the sound levels arising from the MV transformers are expected to be significantly lower in comparison to the BESS units, contributing a negligible amount to cumulative sound levels. As such, a typical transformer of a suitable type has been modelled.

Table 5-4 and **Table 5-5** shows the linear, ‘A’, and ‘C’ frequency weighted octave band sound power for the 4MVA and 8MVA BESS transformers, respectively.

Table 5-4 – Octave Band Sound Power Levels for the 4MVA BESS Transformers[11]

Octave Band Frequency (Hz)	Sound Power (dB)	Sound Power (dBA)	Sound Power (dBC)
31.5	72.5	33.1	69.5
63	76.5	50.3	75.7
125	79.5	63.4	79.3
250	77.5	68.9	77.5
500	77.5	74.3	77.5
1000	71.5	71.5	71.5
2000	66.5	67.7	66.3
4000	61.5	62.5	60.7
8000	53.5	52.4	50.5
Sum	84.6	77.7	84.2

Table 5-5 – Octave Band Sound Power Levels for the 8MVA BESS Transformers[12]

Octave Band Frequency (Hz)	Sound Power (dB)	Sound Power (dBA)	Sound Power (dBC)
31.5	76.9	37.5	73.9
63	80.9	54.7	80.1
125	83.9	67.8	83.7
250	81.9	73.3	81.9
500	81.9	78.7	81.9
1000	75.9	75.9	75.9
2000	70.9	72.1	70.7
4000	65.9	66.9	65.1
8000	57.9	56.8	54.9
Sum	88.9	82.1	88.6

5.3 Substation

The project substation will be comprised of one 111MVA HV transformer and two 167MVA HV transformers that will be used to transform electricity generated from the BESS and PV systems to grid voltage. Each transformer has been modelled with Oil Natural Air Forced (ONAF) conditions for a conservative prediction. ONAF is an operation that uses

[11] Based on theoretical prediction method (Crocker, 2007).
[12] Based on theoretical prediction method (Crocker, 2007).

second stage cooling for the transformers when there are higher ambient temperatures. Typically, in ONAF mode, the cooling fan is the source of the loudest noise emissions from the transformer. Octave band levels were derived using published ONAF spectral data.

Table 5-6 and Table 5-7 shows the linear, 'A', and 'C' frequency weighted octave band sound power for the 111MVA and 167MVA HV substation transformers, respectively.

Table 5-6 – Octave Band Sound Power Levels for the 111MVA HV Substation Transformer

Octave Band Frequency (Hz)	Sound Power (dB)	Sound Power (dBA)	Sound Power (dBC)
31.5	93.5	54.1	90.5
63	97.5	71.3	96.7
125	100.5	84.4	100.3
250	98.5	89.9	98.5
500	98.5	95.3	98.5
1000	92.5	92.5	92.5
2000	87.5	88.7	87.3
4000	82.5	83.5	81.7
8000	74.5	73.4	71.5
Sum	**105.5**	**98.7**	**105.2**

Table 5-7 – Octave Band Sound Power Levels for the 167MVA HV Substation Transformers

Octave Band Frequency (Hz)	Sound Power (dB)	Sound Power (dBA)	Sound Power (dBC)
31.5	96.0	56.6	93.0
63	100.0	73.8	99.2
125	103.0	86.9	102.8
250	101.0	92.4	101.0
500	101.0	97.8	101.0
1000	95.0	95.0	95.0
2000	90.0	91.2	89.8
4000	85.0	86.0	84.2
8000	77.0	75.9	74.0
Sum	**108.1**	**101.2**	**107.7**

5.4 Modelling Results

Predicted sound levels for the Project are shown in Table 5-8. The results assume full operation 24 hours a day, and they are applicable to night-time and daytime periods.

Table 5-8 – Predicted Project Case Sound Levels

Dwelling ID	Project Sound Level (dBA)
R1	38.1

Receptor R1 is expected to be the receptor most impacted by noise from the Project, having a maximum sound pressure level of 38.1dB(A). Project sound level contours are shown in Appendix D.

5.5 Low Frequency Assessment

Table 5-9 shows the difference between A and C weighted predicted sound levels at the receptor modelled. The results show that the C-weighted and A-weighted receptor levels have differences well below the Rule 012 criterion of 20dB. This indicates that low frequency noise is not expected to be an issue.

Table 5-9 – Low Frequency Noise Assessment

Dwelling ID	Predicted Sound Level (dBA)	Predicted Sound Level (dBC)	Difference dBC – dBA
R1	38.1	46.2	8.1

6 Cumulative Impact Assessment

The cumulative impact assessment incorporates sound level contributions from the baseline and Project case assessments. Compliance with AUC Rule 012 is determined through comparison of cumulative sound levels with PSLs. Table 6-1 shows the results of the cumulative impact and compliance assessment.

Table 6-1 – Cumulative Sound Level Assessment for Night-Time (NT) and Daytime (DT) Periods

Receptor	Baseline Sound Level (dBA)		Project Sound Level (dBA)		Cumulative Sound Level (dBA)		PSL (dBA)		PSL Compliance Margin (dB)	
Dwelling ID	NT	DT	NT	DT	NT	DT	NT	DT	NT	DT
R1	35.1	45.0	38.1	38.1	39.9	45.8	40	50	0	4

The cumulative sound levels at the assessed receptor are shown to meet PSLs by a minimum margin of 0dB during the nighttime periods and by at least 4dB for the daytime periods. Receptor R1 is the most affected by the Project sound levels. The highest baseline sound levels were predicted at R1. Worst-case Project impacts are assessed to be compliant with the requirements of AUC Rule 012.

7 Conclusions

The one receptor located within 1.5km of the Project site boundary was selected to assess potential noise impacts arising from the Project. Worst-case sound power levels were used to model sound emissions from the Project during day and night periods.

While the BESS could operate at anytime, the solar PV electricity generating facility will generally operate when the sun is out during daytime hours; however, AUC Rule 012 defines night-time hours to be from 22:00 to 07:00 all year long. Due to the sun rising prior to 07:00 during summer months, the solar PV electricity generating facility may operate during the defined night-time period. Therefore, the assessment also considered worst-case (full load operation) noise emission levels 24 hours a day. In practice there will be periods when the Project operates in standby mode where sound emissions are much lower than the peak sound output levels assumed throughout this assessment.

Cumulative sound levels at the receptor considered in this NIA were assessed to be below the PSLs at the receptor by a minimum margin of 0 dB. A LFN assessment determined that sound from the proposed Project is not expected to produce any significant LFN effects.

It is therefore concluded that the proposed Dolcy Solar Project would operate in compliance with AUC Rule 012 requirements at the assessed receptor.

8 Acoustic Practitioners' Information

Table 8-1 summarizes the information of the authors and technical reviewer.

Table 8-1 – Summary of Practitioners' Information

Name	Riley Corrigan	Justin Lee	Merlin Garnett	Cameron Sutherland
Title	Renewable Energy (E.I.T)	Renewable Energy (E.I.T)	Principal Noise Consultant	Technical Director
Role	• Noise Impact Assessment (NIA) co-author	• Acoustic noise modelling • Noise Impact Assessment (NIA) co-author	• Discipline lead • Acoustic noise modelling • Fieldwork lead • Noise Impact Assessment (NIA) Technical Reviewer	• Technical Assessment Lead • Noise Impact Assessment (NIA) Technical Reviewer and Approver
Experience	• Experience with acoustic modelling (iNoise) of renewable energy projects in Alberta.	• Experience with acoustic modelling (iNoise & CadnaA) of renewable energy projects in Alberta. • Analyst on multiple noise assessments for renewable energy projects in Alberta. • Current INCE associate.	• Over 11 years of acoustic and environmental consultancy for projects in the U.K. and Alberta. • Completed the UK Institute of Acoustics (IOA) diploma in 2015. • Full member of the IOA. • Author and reviewer of NIAs for multiple renewable energy projects in Alberta (2020-Present).	• 18 years of acoustic and environmental consultancy. • Acoustics (IOA) diploma (2012). • Expert witness experience in wind turbine noise in the UK (2017/18). • Expert witness experience in technical wind and solar development in Canada (2019-23).

Appendix A: Rule 012 Glossary

Ambient sound level (ASL)

The sound level that is a composite of different airborne sounds from many sources far away from and near the point of measurement. The ambient sound level does not include noise from any energy-related facilities or from wind and must be determined without it. The average night-time ambient sound level in rural Alberta is 35 dBA. The ambient sound level can be measured when the sound level in an area is not believed to be represented by the basic sound levels in Table 1[13]. The ambient sound level must be determined under representative conditions and does not constitute absolute worst-case conditions (e.g., an unusually quiet day) but conditions that portray typical conditions for the area.

In the absence of measurement, the night-time ambient sound level is assumed to be 5 dBA less than the basic sound level and the daytime ambient sound level is assumed to be 5 dBA less than the basic sound level plus the daytime adjustment.

A-weighted sound level

The sound level as measured on a sound level meter using a setting that emphasizes the middle frequency components similar to the frequency response of the human ear at levels typical of rural backgrounds in mid frequencies. Sound levels are denoted: dB(A).

Basic sound level (BSL)

The night-time A-weighted Leq sound level commonly observed to occur in the designated land-use categories with industrial presence and is assumed to be five dB(A) above the ambient sound level, as set out in Table 1 of Rule 012.

Comprehensive sound level

The comprehensive sound level includes ambient sound level, noise from existing facilities and energy-related facilities.

Cumulative sound level

The cumulative sound level includes the comprehensive sound level, noise from proposed facilities, energy-related facilities approved but not yet constructed, and the predicted noise from the applicant's proposed facility.

C-weighted sound level

The C-weighting approximates the sensitivity of human hearing at industrial noise levels (above about 85 dBA). The C-weighted sound level (e.g., measured with the C-weighting) is more sensitive to sounds at low frequencies than the A-weighted sound level and is sometimes used to assess the low-frequency content of complex sound environments.

Daytime

Defined as the hours from 7 a.m. to 10 p.m.

Daytime adjustment

An adjustment that allows a 10 dBA increase because daytime ambient sound levels are generally about 10 dBA higher than night-time values.

[13] Table 1. Basic sound levels (BSL) for night-time (AUC Rule 12, Page 5, http://www.auc.ab.ca/Shared%20Documents/Rules/Rule012.pdf)

Density per quarter section

Refers to a quarter section with the affected dwelling at the centre (a 451-metre radius). For quarter sections with various land uses or with mixed densities, the density chosen must be factored for the area under consideration.

Down wind

The wind direction from the noise source towards the receiver (± 45 degrees), measured at either dwelling height or source height. The 45 degrees requirement is consistent with the definition for downwind conditions, as included in ISO 9613-1996, Attenuation of Sound During Propagation Outdoors – Part 2: general method of calculation.

Dwelling

Any permanently or seasonally occupied structure used for habitation for the purpose of human rest; including a nursing home or hospital with the exception of an employee or worker residence, dormitory, or construction camp located within an energy-related industrial plant boundary. Trailer parks and campgrounds may qualify as a dwelling if it can be demonstrated that they are in regular and consistent use.

A permanent dwelling is a fixed residence occupied on a full-time basis.

The most impacted dwelling(s) are those subject to the highest average weighted sound level relative to the permissible sound level.

Energy equivalent sound level (Leq)

The Leq is the average weighted sound level over a specified period of time. It is a single-number representation of the cumulative acoustical energy measured over a time interval. The time interval used should be specified in brackets following the Leq—e.g., Leq (9 hours) is a nine-hour Leq.

Energy-related facility

A facility under the jurisdiction of the Commission or other regulatory agency, used for energy generation, transport (except by road or rail line) and resource extraction. These include mining, extraction, processing, and transportation (except by road or rail line) as well as federally regulated electrical transmission lines and pipelines.

Far field

The far field is that area far enough away from the noise source that the noise emissions can be treated as if they come from a single point or line source and the individual components of the noise source are not apparent as separate sources. This is typically at a distance of at least three to five times the major dimensions of the noise source, such as length, width, height, or diameter.

Heavily travelled road

Includes highways and any other road where 90 or more vehicles travel during the nine-hour night-time period consistently for any one-month period in a year. The following methods to validate the travel volume are acceptable:

Alberta Transportation's Average Annual Summer Daily Traffic (ASDT) value. If the ASDT is not available, the Alberta Transportation's Average Annual Daily Traffic (AADT) value can be used. In the case of using the ASDT or AADT, 10 per cent of the daily traffic volume can be assumed to be the night-time period traffic.

Linear weighting (or Z-weighting)

The sound level measured without any adjustment for the sensitivity of human hearing. It is a direct measure in decibels of the variation in air pressure and is often referred to as the "sound pressure level". This level is sometimes called the “linear weighted level” or “the unweighted level,” as it includes no frequency weighting beyond the tolerances and limits of the sound level meter being used for the measurements.

Low frequency noise

Where a clear tone is present below and including 250 Hz and the difference between the overall C-weighted sound level and the overall A-weighted sound level exceeds 20 dB.

Night-time

Defined as the hours from 10 p.m. to 7 a.m.

No net increase

The concept of no net increase in relation to noise impact assessments may arise when the sound added by an incremental project to the baseline sound level results in a negligible sound level increase.

In cases where an applicant is proposing development of a facility where it is not practical or efficient to characterize baseline sound levels, the applicant may assume baseline compliance with the permissible sound level and use no net increase to justify that the proposed facility will have a negligible impact on cumulative sound levels. However, the predicted cumulative sound level must not exceed the permissible sound level by more than 0.4 dB.

When baseline sound levels are predicted to exceed the permissible sound level by 0.4 dB or less, the applicant is required to assess compliance for its proposed facility by adding noise contribution from its proposed facility to baseline sound levels.

Noise

The unwanted portion of sound.

Permissible sound level (PSL)

The maximum daytime or nighttime sound level as determined in Table 1 at a point 15 m from the dwelling(s) in the direction of the facility. The permissible sound level is the sum of the basic sound level, daytime adjustment, Class A adjustments and Class B adjustment, or Class C adjustments.

Proposed facility

A proposed facility is a facility for which an application has been deemed complete by the Commission but is not yet approved or for which an approval has been issued, but is not yet constructed.

Sound power level

The decibel equivalent of the rate of energy (or power) emitted in the form of noise. The sound power level is an inherent property of a noise source.

Sound pressure level

The decibel equivalent of the pressure of sound waves at a specific location, which is measured with a microphone. Since human reaction and material behaviours vary with frequency, the sound pressure level may be measured using frequency bands or with an overall weighting scale such as the A-weighting system. The sound pressure level depends on the noise sources, as well as the location and environment of the measurement path.

Summertime conditions

Ground cover and temperatures that do not meet the definition for wintertime conditions. These can occur at any time of the year.

Tonal components

The test for the presence of tonal components consists of two parts. The first must demonstrate that the sound pressure level of any one of the slow-response, linear, one-third octave bands between 20 and 250 Hz is 10 dBA or more than the sound pressure level of at least one of the adjacent bands within two one-third octave bandwidths. In addition, there must be a minimum of a 5 dBA drop from the band containing the tone within two bandwidths on the opposite side.

The second part is that the tonal component must be a pronounced peak clearly obvious within the spectrum.

Wind speed

The speed of the wind, expressed in metres per second (m/s), measured in and averaged over 10-minute intervals at the same height as the microphone, but not more than 10 metres above ground level.

Appendix B: Supplemental Noise Source Information

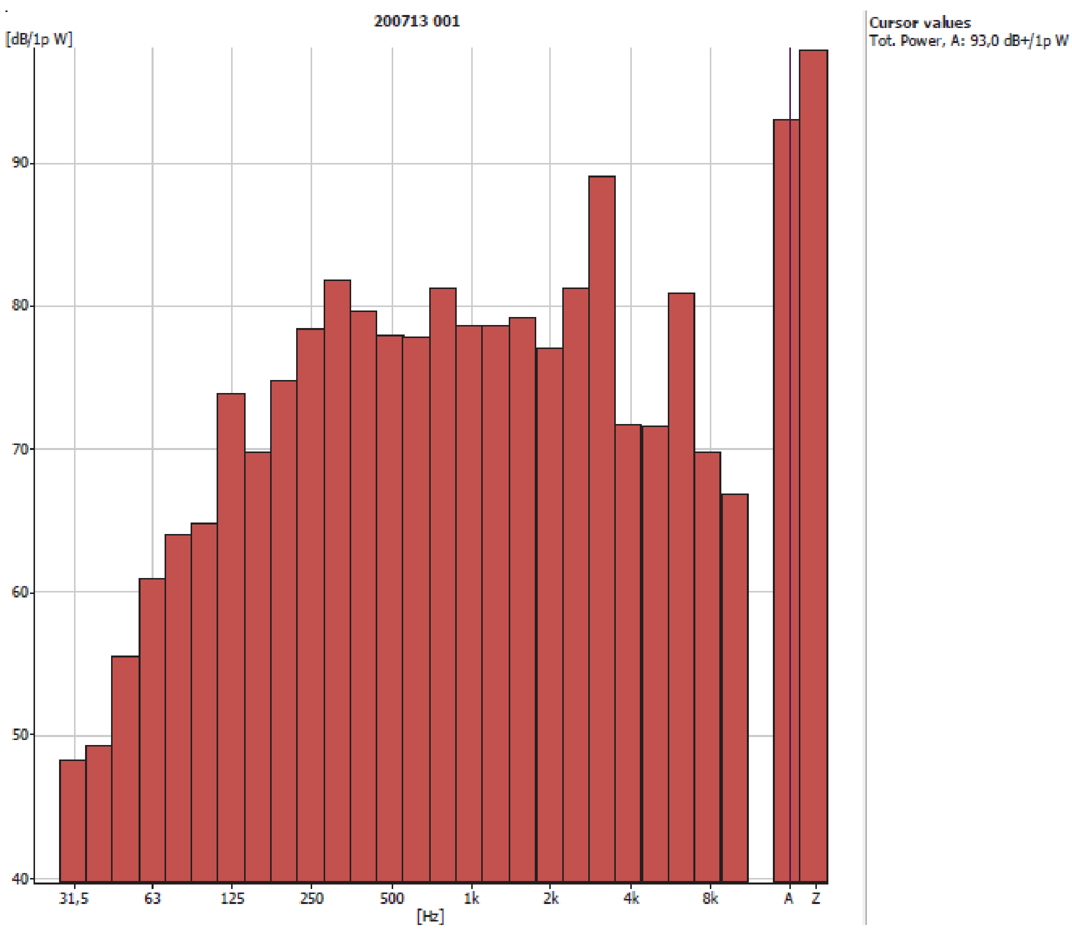
Dwelling ID	Project		Third-Party	
	Nearest Significant Project Noise Source	Distance to Nearest Significant Project Noise Source	Nearest Third-Party Facility Noise Source	Distance to Nearest Third-Party Facility Noise Source
R1	Inverter/Transformer Station	710m N	AER7	2300m SE

Appendix C: Vendor's Sound Power Data (SMA SC 4000)

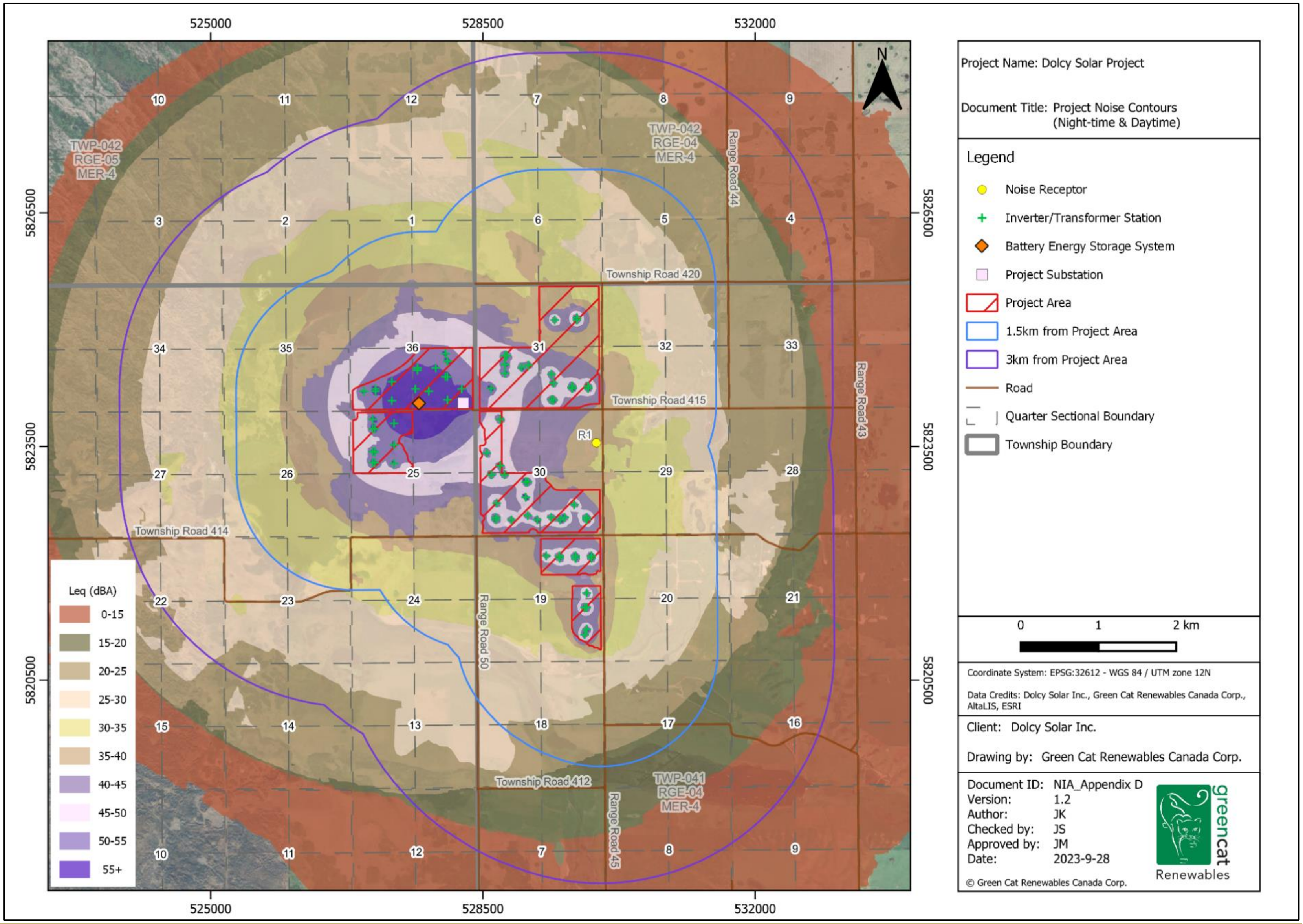
Overview of the Sound Power

Third octave band center frequency [Hz]	Sound - Power- level LwA [dBA/pW] 4600 kW
25 Hz	39,67
31,5 Hz	48,26
40 Hz	49,23
50 Hz	55,43
63 Hz	60,84
80 Hz	63,99
100 Hz	64,8
125 Hz	73,85
160 Hz	69,77
200 Hz	74,69
250 Hz	78,35
315 Hz	81,8
400 Hz	79,65
500 Hz	77,95
630 Hz	77,77
800 Hz	81,19
1 kHz	78,55
1,25 kHz	78,63
1,6 kHz	79,14
2 kHz	76,95
2,5 kHz	81,15
3,15 kHz	88,98
4 kHz	71,66
5 kHz	71,56
6,3 kHz	80,81
8 kHz	69,7
10 kHz	66,83
A	92,97
Z	97,82

Sound Power Levels of the Third Octave Band Frequencies according to EN ISO 9614-2



Appendix D: Project Sound Level Contours



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