Dunmore Solar Power Plant

Noise Impact Assessment

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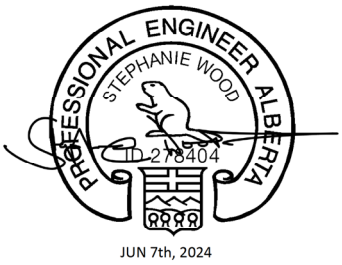

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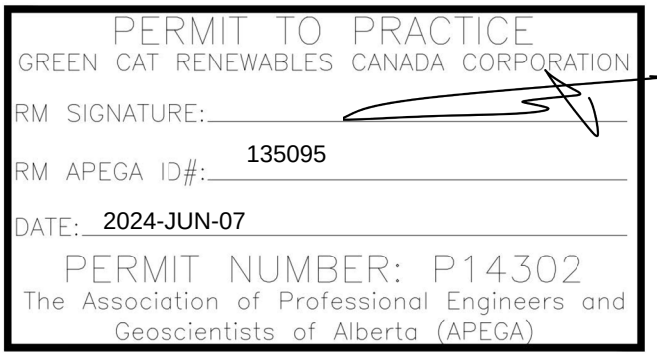

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Executive Summary

Dunmore Solar Power Plant (the Project) is located in Cypress County, Alberta, approximately 9km northeast of the Hamlet of Dunmore.

The Project was submitted to the Alberta Utilities Commission (AUC) as a 173-megawatt (MW_{AC}) photovoltaic (PV) electricity generating power plant by Dunmore Solar Inc. (Dunmore Solar). Green Cat Renewables Canada Corporation (GCR) conducted the Noise Impact Assessment (the 2023 NIA)[1] submitted to the AUC in September 2023, which concluded that the Project was assessed to meet the requirements of AUC Rule 012. The Project obtained AUC approval to construct and operate in November 2023[2].

Following the AUC approval, revisions were made to the permitted design, which includes change in the number of inverter/transformer stations to expand the Project capacity. GCR was then retained by Dunmore Solar to update the NIA based on the expanded Project capacity.

The Project is now proposed to have a grid capacity of 216 MW_{AC}, consisting of ground mounted, single-axis tracking modules, fifty-four inverter/transformer stations, and a Project Substation. The inverter/transformer 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 the same seven receptors previously assessed in the 2023 NIA 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.

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: existing regulated third-party energy-related facilities; third-party projects; the proposed Project; and ambient sources.

The assessment concluded that the updated cumulative sound levels from the Project expansion would still be compliant with permissible sound levels at all receptors assessed. A Low Frequency Noise (LFN) assessment determined that sound from the proposed Project is not expected to contain any significant LFN effects.

The proposed Dunmore Solar Power Plant was therefore assessed to meet the requirements of AUC Rule 012.

[1] Dunmore Solar Power Plant Noise Impact Assessment, Green Cat Renewables Canada Corporation, September 2023 (Exhibit 28506-X0005)
[2] AUC Power Plant Approval #28506-D02-2023

Table of Contents

1 Introduction

The Dunmore Solar Power Plant (the Project) was previously approved by the Alberta Utilities Commission (AUC) in 2023[3] as a 173-megawatt (MW_{AC}) photovoltaic (PV) electricity generating power plant located approximately 10km northeast of the Hamlet of Dunmore in Cypress County, Alberta. After AUC approval of the Project, the permitted Project area has been expanded, resulting in an increase to the Project capacity. Dunmore Solar Inc. (Dunmore Solar) retained Green Cat Renewables Canada Corporation (GCR) to conduct a noise impact assessment (NIA) for the Project with expanded capacity. With the Project expansion, the total generating capacity of the Project will now be 216 MW_{AC}, consisting of ground mounted, single-axis tracker modules, fifty-four (54) inverter/transformer stations, and a project substation. The Project location including the expanded Project area is shown in **Figure 1-1** below. The assessment considered the cumulative impact of existing and proposed noise sources on nearby receptors.

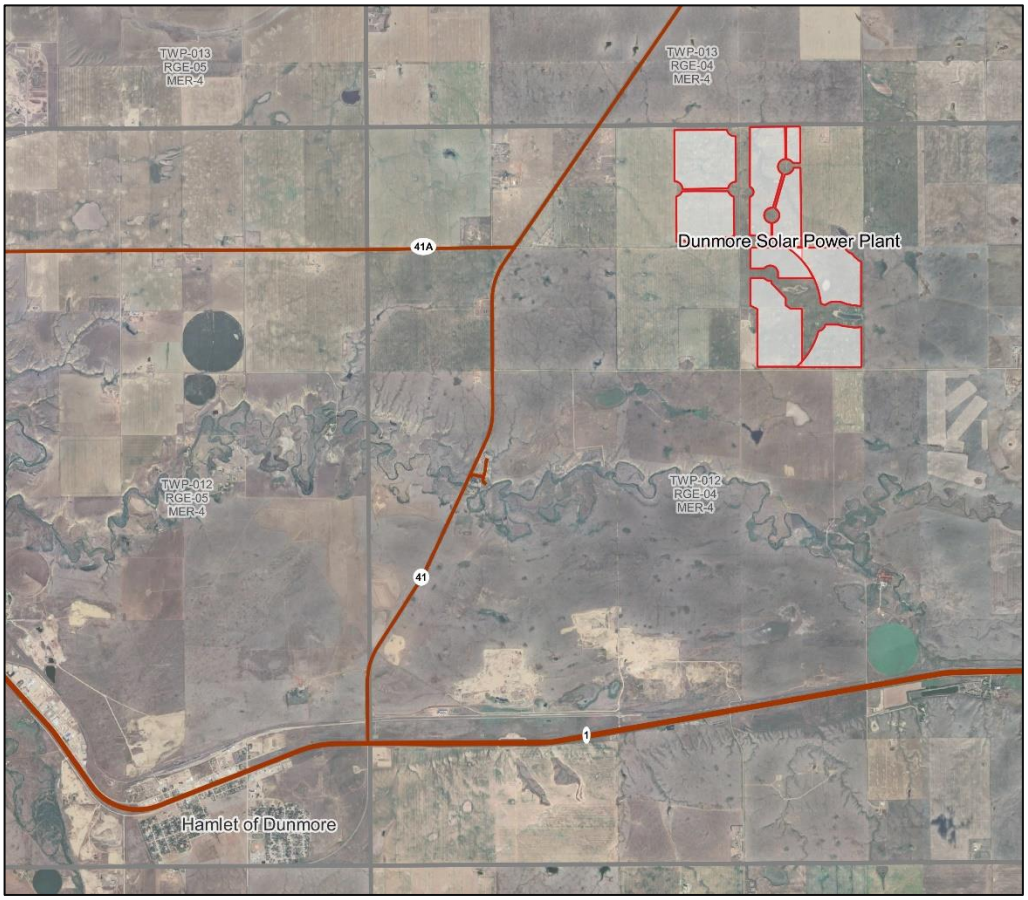


Figure 1-1 – Dunmore Solar Power Plant Location

[3] AUC Power Plant Approval #28506-D02-2023

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)
- Calculate Permissible Sound Levels (PSLs)
- Predict sound level from existing and approved third-party regulated energy-related facilities
- Combine facility and Ambient Sound Levels to give baseline sound levels
  - If baseline sound levels exceed PSLs or if facility sound level data is not available, then the baseline sound level may be set such that it is equivalent to (and therefore compliant with) the PSLs
- Predict sound level from the proposed Project
- Assess for Low Frequency Noise (LFN) content due to the proposed Project
- Calculate Cumulative Sound Levels
- Assess compliance with AUC Rule 012 requirements
  - In the case where baseline sound levels have been set to PSLs, cumulative sound levels are assessed against a 'no net increase' criterion

3 Noise Model

All noise propagation calculations were performed using iNoise from DGMR Software (version Enterprise 2024). 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[4]: '*The ISO 9613 standard 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	Height Contours Interpolated at 3m[5]
Barrier Effects Included	None
Temperature	10°C
Relative Humidity	70%
Wind	1 – 5ms^{-1} from facility to receptor as per ISO-9613
Ground Attenuation	0.5 (default throughout the study area) 0.0 (for water bodies)
Number of Sound Reflections	1
Receptor Height	4.5m (two-storey)
Operation Condition	Full load
Source Height	2.3m for Inverter Stations 1.7m for Transformer Stations 4.0m for Substation Transformers

[4] https://dgmrsoftware.com/products/inoise/
[5] Data obtained from AltaLIS.

4 Baseline

4.1 Study Area

The expanded development site has a total fenced area of approximately 900 acres. The study area includes rural/agricultural land and waterbodies.

The seven (7) dwellings assessed in the 2023 NIA were still considered to be the only potential receptors located within the 1.5 km boundary criterion. Therefore, these receptors have 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 900 acres of land, with the total generating capacity of 216MW_{AC}. The solar arrays will utilize ground mounted, single-axis tracker modules which will feed 54 inverter/transformer stations. A project substation containing one 240MVA transformer is also included. The inverter/transformer stations and project substation are assumed to be the only significant sources of noise from the Project. As such, 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

Seven (7) residential dwellings located within the 1.5km study area were identified by GCR as potentially being the most impacted by the Project. To provide a conservative assessment, all receptors were modelled at a two-storey elevation of 4.5m. Table 4-1 shows the location details and the height of each 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	538152	5543930	Two-Storey	4.5	300m E
R2	535355	5543856	Two-Storey	4.5	840m W
R3	535207	5543602	Two-Storey	4.5	990m W
R4	535283	5543362	Two-Storey	4.5	920m W
R5	536421	5540976	Two-Storey	4.5	870m W
R6	539343	5540247	Two-Storey	4.5	940m SE
R7	539206	5544309	Two-Storey	4.5	1380m NE

4.4 Existing Third-Party Regulated Energy-Related Facilities

A search for active and approved regulated energy-related facilities (both AER and AUC) and pumping wells within 3km of the new Project boundary was conducted in May 2024. The AER's Facilities list (ST102) and Wells list (ST037) were consulted for the AER regulated facilities and wells, and AUC eFiling portal was used to identify any existing and approved AUC regulated facilities. GCR identified one active AER regulated facility.

Table 4-2 lists the AER facility identified within 3km of the Project that have the potential to influence cumulative sound levels. Information was gathered in May 2024 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	CMH 02/06-28-012-04W4 SWB	Gas Single-Well Battery	City Of Medicine Hat	535859	5541421

All noise sources as well as the 1.5km and 3km study area boundaries are shown in Figure 4-1.

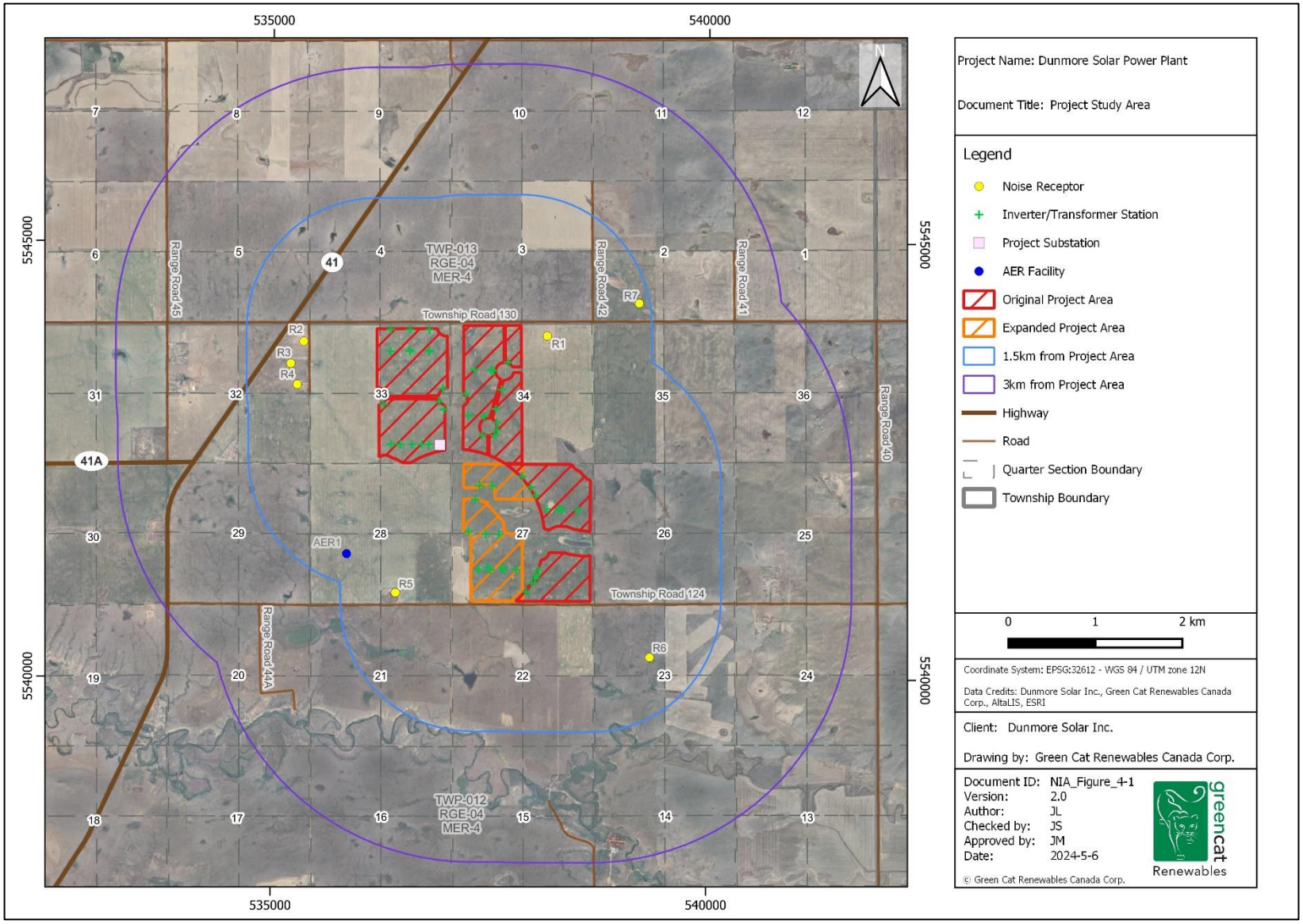


Figure 4-1 – Project Study Area

4.5 Baseline Sound Levels

Baseline sound levels for each receptor should incorporate 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[6]	40	43	46
Category 2[7]	45	48	51
Category 3[8]	50	53	56

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

Receptors R1 and R5-R7 have been evaluated as category one for both dwelling density and proximity to transportation.

Receptors R2-R4 are assessed as category 2 for proximity to transportation. Traffic data collected for Highway 41, collected at the intersection of Highway 41 and Highway 41A, indicates a level of traffic flow that significantly exceeds the Rule 012 'Heavily Travelled Road' criteria of '90 or more vehicles travel during the nine-hour night-time period consistently for any one-month period in a year'. Traffic data is shown in Appendix B.

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'.[9] This results in a night-time ASL between 35-40dB(A) and a daytime ASL between 45-50dB(A) for the assessed receptors. BSL and ASL for night-times and daytimes for each receptor are given in Table 4-4.

[6] 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.
[7] 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.
[8] Category 3—dwelling(s) distance is less than 30 m from heavily travelled roads, or rail lines or subject to frequent aircraft flyovers.
[9] 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.

4.5.3 Determination of Permissible Sound Level (PSL)

For each receptor, 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)

BSLs, ASL, and PSLs for night-times and daytimes and for each location are 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
R2	2	1	45	40	50	45	55
R3	2	1	45	40	50	45	55
R4	2	1	45	40	50	45	55
R5	1	1	40	35	45	40	50
R6	1	1	40	35	45	40	50
R7	1	1	40	35	45	40	50

4.5.4 AER Facility Sound Power Levels

Sound power levels for AER1 was compiled from GCR's measurement database that included measurements of similar facilities. The sound power level of 95.6 dB(A) is deemed to be typical and representative of the Gas Single-Well Battery.

Table 4-5 lists the octave band sound power level for AER1.

Table 4-5 – Octave Band Sound Power Levels for Noise Producing AER Regulated Energy-Related Facilities

Map Label	Octave Band Centre Frequency, Hz									Total	
	31.5	63	125	250	500	1000	2000	4000	8000	dB(A)	dB
AER1	104.9	98.2	95.3	93.6	95.2	87.6	86.0	85.8	80.1	95.6	106.8

4.6 Modelling Results

For the purpose of this assessment, AER1 was deemed to operate at full load and produce noise continuously. Table 4-6 shows the predicted sound levels at each receptor from AER1. Predicted levels less than zero dB(A) are denoted by a dash in the below table.

Table 4-6 – Predicted Sound Levels from AER1

Dwelling ID	Predicted Sound Levels from AER 1 - dB(A)
R1	1.9
R2	6.1
R3	7.2
R4	8.7
R5	24.3
R6	4.3
R7	-

4.7 Total Baseline Sound Levels

Baseline sound levels include the noise contributions from existing/approved AER and AUC facilities and wells as well as the ambient sound level assessed for the local environment.

Table 4-7 shows cumulative baseline sound level for night-time (NT) and daytime (DT) periods. Predicted levels less than zero dB(A) are denoted by a dash in the below table.

Table 4-7 – Cumulative Baseline Sound Levels for Night-time and Daytime Periods

Receptor	Total Regulated Facilities		ASL		Baseline	
Dwelling ID	NT	DT	DT	DT	NT	DT
R1	1.9	1.9	35	45	35.0	45.0
R2	6.1	6.1	40	50	40.0	50.0
R3	7.2	7.2	40	50	40.0	50.0
R4	8.7	8.7	40	50	40.0	50.0
R5	24.3	24.3	35	45	35.4	45.0
R6	4.3	4.3	35	45	35.0	45.0
R7	-	-	35	45	35.0	45.0

Supplemental noise source information for each receptor is provided in Appendix B: Alberta Traffic Volume History

5 Project Sound Levels

The Project will consist of solar PV arrays using ground-mounted single-axis trackers. The solar arrays will be connected to fifty-four inverter/transformer stations, with a total AC capacity of up to 216 MW_{AC}. A Project substation has been proposed to be included in the project area, consisting of one 240MVA high voltage (HV) transformer.

In general, each single-axis tracker is expected to be significantly quieter than the inverter/transformer stations. The single-axis trackers will operate asynchronously across the site for a few seconds every few minutes to adjust the tilt angle of the modules (adjustment frequency is dependent on time of year). Due to the trackers' infrequent and asynchronous operation, and their uniform distribution across the site, they would have limited potential to contribute to overall Project sound levels and would not be considered significant noise producing Project elements.

Therefore, for the purposes of the noise assessment, it has been assessed that the only significant noise producing Project elements are the inverter/transformer stations and the Project substation.

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. The inverter/transformers and the Project substation were assumed to operate at full load, which is an inherently conservative modelling approach for night-time periods at a solar farm.

5.1 Inverters

The inverter/transformer stations proposed for the Project are the Sungrow SG4400UD-MV units. Manufacturer's sound data referenced for the SG4400UD-MV inverter gives values for octave bands from 16Hz to 16kHz as measured on the front, back, left, and right sides of the unit. For the purpose of this assessment, octave band frequency sound power levels from 31.5Hz to 8kHz were included in the sound propagation modelling. The manufacturer's data measurements for the Sungrow SG4400UD-MV inverter are shown in Appendix D.

To derive sound power for the inverter block, an A-weighted sound pressure of 79.9dB(A) was obtained by logarithmically averaging the four side measurements at 1m. Dimensions for the SG4400UD-MV inverter block were estimated based on the dimensions of a single modular inverter unit (i.e. SG1100-UD). Dimensions for the modular inverter unit are shown in Appendix E. A measurement surface area correction of 18.6dB(A) was then added to derive the sound power level of 98.5dB(A) for the inverter block. This sound power level was ascribed to the inverter block only as it was assumed that the contribution from the associated 4.4MVA transformer would be minimal.

Table 5-1 shows the linear, 'A', and 'C' frequency weighted octave band sound power spectra for SG4400UD-MV.

Table 5-1 – Octave Band Sound Power Levels for SG4400UD-MV Inverters

Octave Band Frequency (Hz)	Sound Power (dB)	Sound Power (dBA)	Sound Power (dBC)
31.5	95.9	56.5	92.9
63	91.5	65.3	90.7
125	91.3	75.2	91.1
250	91.8	83.2	91.8
500	93.3	90.1	93.3
1000	89.9	89.9	89.9

Octave Band Frequency (Hz)	Sound Power (dB)	Sound Power (dBA)	Sound Power (dBC)
2000	90.3	91.5	90.1
4000	94.2	95.2	93.4
8000	82.6	81.5	79.6
Sum	**101.8**	**98.5**	**100.9**

5.2 Transformers

The proposed MV transformers for the Project are 4.4MVA each and the manufacturer is yet to specify transformer sound level. The transformers have been modelled in Oil Natural Air Natural (ONAN) conditions. 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 4.4MVA transformers used in the Project is shown in Table 5-2.

Table 5-2 – Octave Band Sound Power Levels for the 4.4MVA Transformers[10]

Octave Band Frequency (Hz)	Sound Power (dB)	Sound Power (dBA)	Sound Power (dBC)
31.5	87.0	47.6	84.0
63	82.0	55.8	81.2
125	84.0	67.9	83.8
250	80.0	71.4	80.0
500	79.0	75.8	79.0
1000	68.0	68.0	68.0
2000	61.0	62.2	60.8
4000	56.0	57.0	55.2
8000	50.0	48.9	47.0
Sum	**90.4**	**78.3**	**89.1**

5.3 Substation

The project substation will be comprised of one 240MVA HV transformer that will be used to transform electricity generated from the PV system 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 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

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

noise emissions from the transformer. Octave band levels were derived using published ONAF spectral data, shown in Table 5-3.

Table 5-3 – Octave Band Sound Power Levels for the Project Substation[11]

Octave Band Frequency (Hz)	Sound Power (dB)	Sound Power (dBA)	Sound Power (dBC)
31.5	98.3	58.9	95.3
63	102.3	76.1	101.5
125	105.3	89.2	105.1
250	103.3	94.7	103.3
500	103.3	100.1	103.3
1000	97.3	97.3	97.3
2000	92.3	93.5	92.1
4000	87.3	88.3	86.5
8000	79.3	78.2	76.3
Sum	**110.4**	**103.5**	**110.0**

5.4 Modelling Results

Predicted sound levels for the Project are shown in Table 5-4. The results assume full operation 24 hours a day, and they are applicable to night-time and daytime periods.

Table 5-4 – Predicted Project Case Sound Levels

Dwelling ID	Project Sound Level (dBA) – 2023 NIA	Project Sound Level (dBA) – with the Project Expansion	Differences (dB)
R1	36.0	36.1	+0.1
R2	30.5	30.6	+0.1
R3	29.5	29.6	+0.1
R4	30.7	30.9	+0.2
R5	30.6	33.8	+3.2
R6	26.9	28.1	+1.2
R7	23.6	24.0	+0.4

The predicted sound levels from the Project have increased at all assessed receptors due to the Project expansion, with R5 having the greatest increase of 3.2 dB. Despite this, R1 remains expected to be the receptor most impacted

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

by noise from the Project, with a maximum sound pressure level of 36.1dB(A). Project sound level contours are shown in Appendix F.

5.5 Low Frequency Assessment

Table 5-5 shows the difference between A and C weighted predicted sound levels at each of the receptors 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 5-5 – Low Frequency Noise Assessment

Dwelling ID	Predicted Sound Level (dBA)	Predicted Sound Level (dBC)	Difference dBC – dBA
R1	36.1	44.9	8.8
R2	30.6	40.3	9.7
R3	29.6	39.7	10.1
R4	30.9	40.8	9.9
R5	33.8	43.6	9.8
R6	28.1	39.4	11.3
R7	24.0	35.9	11.9

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	35.0	45.0	36.1	36.1	38.6	45.5	40	50	1	4
R2	40.0	50.0	30.6	30.6	40.5	50.0	45	55	5	5
R3	40.0	50.0	29.6	29.6	40.4	50.0	45	55	5	5
R4	40.0	50.0	30.9	30.9	40.5	50.1	45	55	4	5
R5	35.4	45.0	33.8	33.8	37.7	45.4	40	50	2	5
R6	35.0	45.0	28.1	28.1	35.8	45.1	40	50	4	5
R7	35.0	45.0	24.0	24.0	35.3	45.0	40	50	5	5

In comparison to the 2023 NIA, the night-time and daytime cumulative sound levels have increased at three receptors. Receptors R1 and R6 experienced increases of up to 0.2 dB in the night-time cumulative sound levels, while R5 saw an increase of 1.4 dB mainly due to its proximity to the expanded Project area.

Despite these increases, the cumulative sound levels at all assessed receptors are still shown to meet the PSLs with the Project operating at full capacity. Receptor R1 remains the most impacted by the Project sound levels. Worst-case Project sound levels are assessed to be compliant with the requirements of AUC Rule 012.

7 Conclusions

The same seven receptors considered in the 2023 NIA were identified to be the only receptors within 1.5km of the expanded project site boundary. As such, these receptors were 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.

The Project 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 Project 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.

The Project expansion considered within this assessment resulted in increased predicted sound levels from the Project at all assessed receptors. However, only three receptors have shown increase in the cumulative sound levels. Receptor R5 experienced the most significant impact from the Project expansion, although R1 was still identified as the most impacted receptor from the Project. Despite these changes, cumulative sound levels at the receptors considered in this NIA were assessed to be below PSLs at all receptors by a minimum margin of 1dB.

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 expansion of the proposed Dunmore Solar Power Plant would operate in compliance with AUC Rule 012 requirements at all assessed receptors.

8 Acoustic Practitioners' Information

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

Table 8-1 – Summary of Practitioners' Information

Name	Justin Lee	Merlin Garnett	Cameron Sutherland
Title	Renewable Energy E.I.T	Principal Noise Consultant	Technical Director
Role	• 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	• 3 years of Experience with acoustic modelling in iNoise to model renewable energy projects in Alberta. • Analyst on multiple noise assessments for renewable energy projects in Alberta. • Current INCE associate	• Over 12 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).	• 19 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 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[12]. 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.

[12] 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.

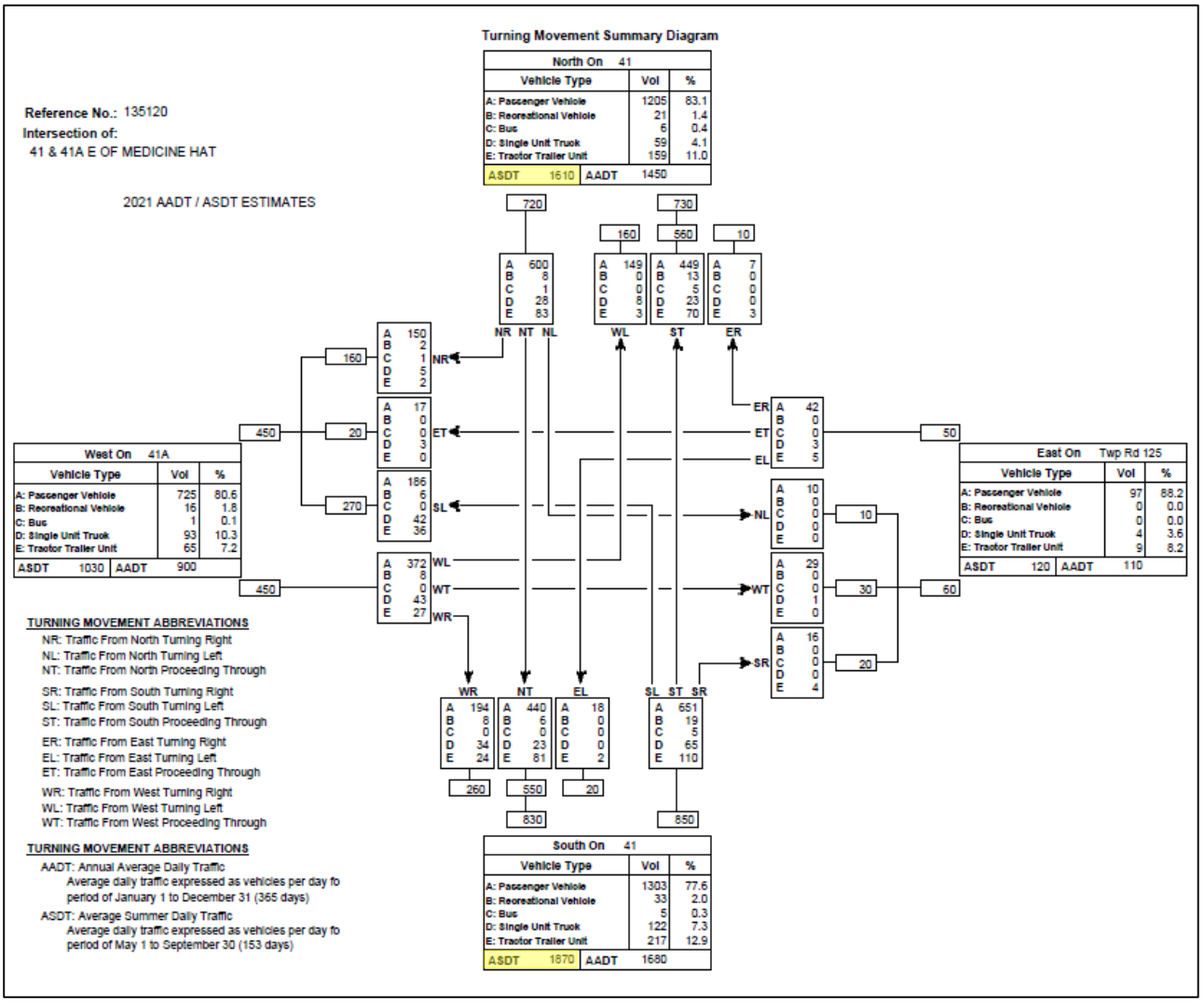
The second part is that the tonal component must be a pronounced peak clearly obvious within the spectrum.

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: Alberta Traffic Volume History

The following chart[13] shows the relevant section of the traffic volume history for the portion of Highway 41 in the proximity of the site. Using the '10% of ASDT' calculation to determine whether the highway is a 'Heavily Travelled Road', the available data show that the Rule 012 criteria of '90 or more vehicles travel during the nine-hour night-time period consistently for any one-month period in a year' is exceeded for vehicles travelling both north and south on Highway 41.



[13] http://www.transportation.alberta.ca/mapping/2021/TM/00135120.pdf

Appendix C: 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	540m SW	AER1	3400m SW
R2	Inverter/Transformer Station	1000m E	AER1	2490m S
R3	Inverter/Transformer Station	1150m E	AER1	2280m S
R4	Inverter/Transformer Station	1010m SE	AER1	2030m S
R5	Inverter/Transformer Station	980m E	AER1	720m NW
R6	Inverter/Transformer Station	1600m NW	AER1	3680m NW
R7	Inverter/Transformer Station	1650m SW	AER1	4420m SW

Appendix D: Sungrow SG4400UD-MV Manufacturer's Sound Data

SUNGROW Public Clean power for all

SUNGROW POWER SUPPLY CO.. LTD
No.1699 Xiyou Rd.,New & High Technology Industrial Development Zone, 230088, Hefei, P. R. China.
Tel: +86-551-65327878
E-mail:_____
www.sungrowpower.com

Noise Test Report

TYPE TEST SHEET

This Type Test sheet shall be used to record the results of the type testing of Generating Unit			
Report reference number	RZ2023040702		
Report version	V1.0		
Date of issue	2023-04-07		
Standard reference	IEC 62109-1_2010		
Generating Unit technology	Grid-connected PV Inverter		
Inverter Type	SG4400UD-MV		
Rated power (KW)	4400		
Rated AC voltage (V)	630		
System supplier name	Sungrow Power Supply Co., Ltd.		
Address	No.1699 Xiyou Rd., New & High Technology Industrial Development Zone, Hefei, P.R. China		
Compiled by	张之翔	Approved by	

Note that testing can be done by the manufacturer of an individual component, by an external test house, or by the supplier of the complete system, or any combination of them as appropriate.

Where parts of the testing are carried out by persons or organisations other than the supplier then the supplier shall keep copies of all test records and results supplied to them to verify that the testing has been carried out by people with sufficient technical competency to carry out the tests.

Report Version	Description
V1.0	Initial

SUNGROW Public Clean power for all

The aim of this test is to determine the noise level when the PV Grid inverter in rated working condition.

Standard requirements: If equipment produces noise at a level that could cause a hazard, the noise shall be measured to determine the maximum sound pressure level that the equipment can produce (except that sound from alarms and from parts located remotely is not included). If the measured sound pressure exceeds 80dBA above a reference sound pressure of 20 μP, at a measurement distance of 1 m, the instructions shall include information regarding the sound pressure level and how to reduce the risk of hearing damage to safe levels, and the product shall be marked with symbol 22 of Annex C.

- **Used settings of the measurement device for Noise measurement:**

Measurement device	Calibration Date	Expire Date
AWA6228+	2023-01-02	2024-01-01

- **The conditions during testing are specified below:**

PV inverter operation mode	Actual operation condition （4839KW）
Voltage range	895-1300V
Grid frequency range	50Hz
Distance	1m、5m、10 m
Testing duration	10min
Date	2023-04-07

- **The system noise level please check the table below:**

1）Actual operation condition（1m@4839KW）

Orientation	Noise (dB)_1m
Front	85.0
Behind	85.0
Left	85.0
Right	84.0
Maximum Noise	85.0

2）Actual operation condition（5m@4839KW）

Orientation	Noise (dB)_5m
Front	73.0
Behind	76.0
Left	73.0
Right	69.0
Maximum Noise	76.0

3）Actual operation condition（10m@4839KW）

Orientation	Noise (dB)_10m
Front	64.0
Behind	72.0
Left	66.0
Right	63.0
Maximum Noise	72.0

SUNGROW Public Clean power for all

Site photos:
Actual operation condition

Actual operation condition	Background noise

1）1m noise photo

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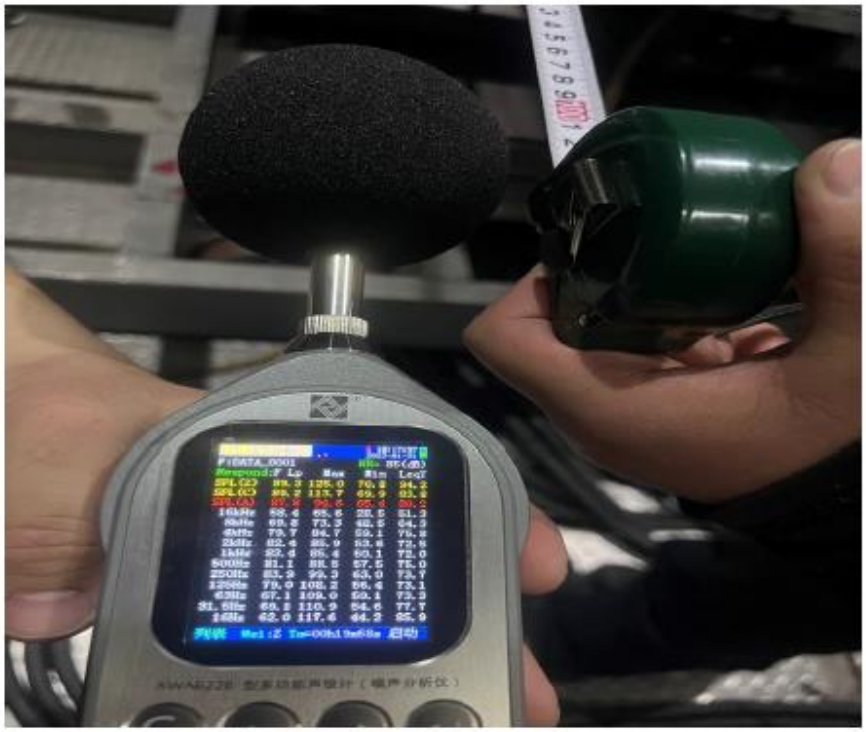
Front



Behind

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Left

Right

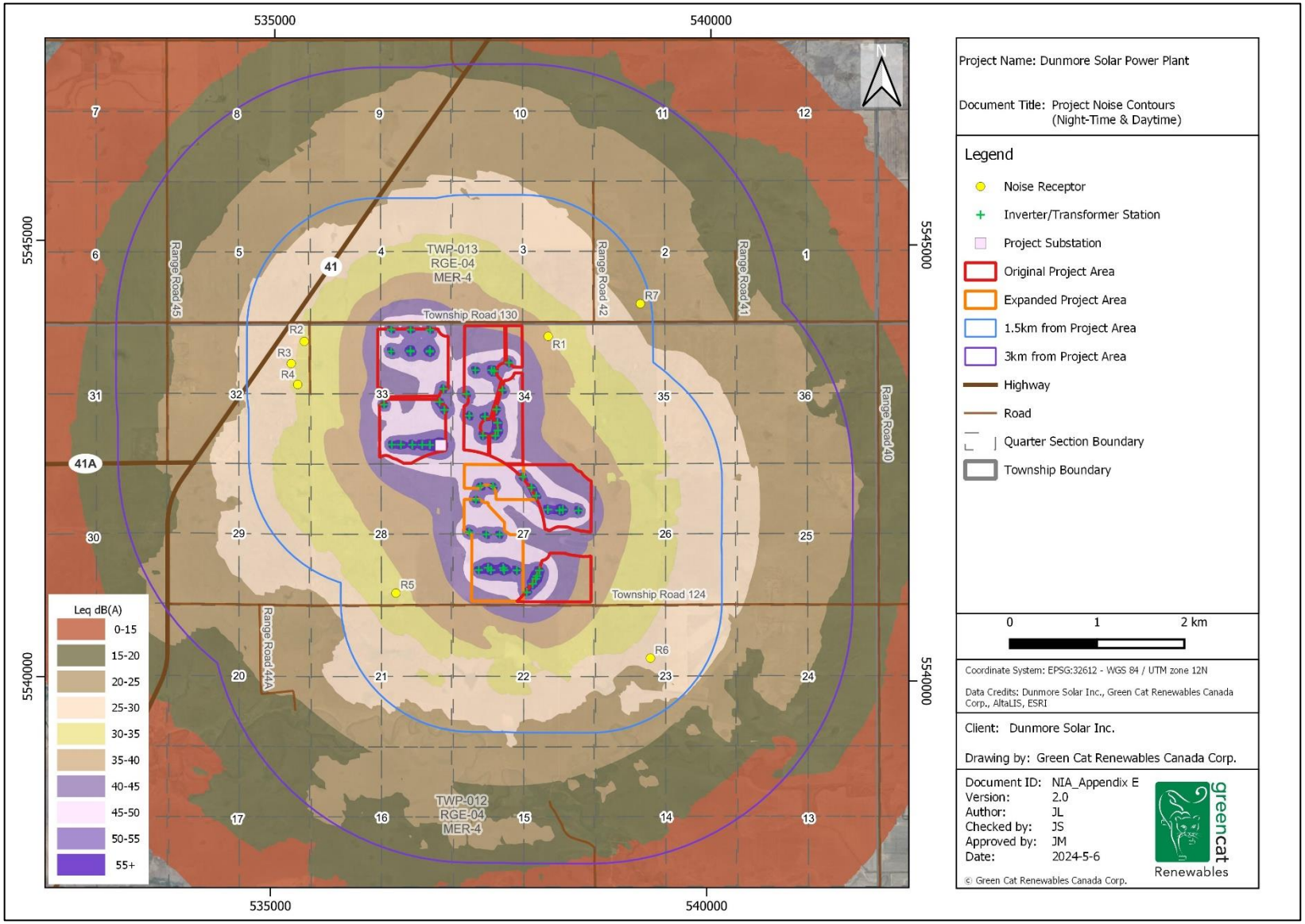
Appendix E: Modular Inverter (SG1100-UD) Manufacturer's Dimensions

"1+X" – MODULAR INVERTER (SG1100-UD)

6

ELECTRICAL DATA	SG1100UD
Max. input voltage	1500 V
MPPT voltage range	895 ... 1500V
No. of MPPTs	1
No. of Inputs DC inputs	5 (optional: 6/7 neg. grounding)
AC output power	1100 kVA @40°C, 1265 kVA @20°C
Max. AC output current	1160 A
Rated grid voltage	630 V
Rated grid frequency	50 Hz / 60 Hz
Adjustable power factor	0.8 (lagging) ... 0.8 (leading)
Max. / European efficiency	99.00 % / 98.70 %
PROTECTION	
DC input protection	Load break switch + fuse
AC output protection	Circuit breaker
Overvoltage protection (SPD)	DC Type II / AC Type II
GENERAL DATA	
Dimensions (W × H × D)	700 x 2235 x 1690 mm
Weight	~ 800 kg
Operating temperature range	-35 ... 60°C (>40°C derating)
Cooling concept	Temperature controlled forced air cooling
Degree of protection	IP65
Max. relative humidity	0 ... 100 %, non-condensing
Max. altitude	4000 m (derating > 3000 m)
Communication port/protocols	Standard: RS485/Modbus, Ethernet, Optional: optical fiber

Appendix F: Project Sound Level Contours



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