# Radiant Dawn Energy Park

## Noise Impact Assessment

**Client:** Clem Geo – Energy Corp.
**Reference:** 24-012
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greencat Renewables

CLEM GEO-ENERGY

**Report Prepared for:**
Clem Geo – Energy Corp.

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This document has been prepared by Green Cat Renewables Canada Corporation. The material and data in this report were prepared under the supervision and direction of the undersigned.

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The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

*The noise impact assessment is being issued with professional engineering authentication. The information contained in this report, to which the engineering authentication is applied, is deemed complete for the intended purpose*

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# Executive Summary

Clem Geo-Energy Corp. (Clem Geo) propose to install a 22.3-megawatts ($MW_{AC}$) photovoltaic (PV) electricity generating power plant located approximately 6km east of the town of Fort Macleod in Municipal District of Willow Creek No.26, Alberta, called Radiant Dawn Energy Park (the Project).

Clem Geo retained Green Cat Renewables Canada Corporation (GCR) to conduct a noise impact assessment (NIA) of the Project that considered ground mounted PV panels, single-axis trackers, six Sungrow SG4400UD-MV inverter/transformer stations, and a switching station. It is understood that the switching station does not include any noise producing elements. As such, the inverter/transformer stations are assumed to be the only significant noise producing Project elements and no other Project elements were considered in this assessment. For the purposes of the noise assessment, the inverter/transformer stations are assumed to operate at full load.

A total of eight receptors, including one future receptor, regarded as having the potential to be the most impacted by the proposed Project were identified by Clem Geo. 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 and the third-party energy-related facilities to determine compliance with the Alberta Utilities Commission (AUC) Rule 012: Noise Control requirements. . The cumulative sound levels were 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; the proposed Project; and ambient sources. The assessment concluded that cumulative sound levels would be compliant with PSLs at all assessed receptors. A Low Frequency Noise (LFN) assessment determined that sound from the proposed Project is not expected to contain any significant LFN effects.

The proposed Radiant Dawn Energy Park was therefore assessed to meet the requirements of AUC Rule 012.

# Table of Contents

# 1 Introduction

Clem Geo-Energy Corp. (Clem Geo) retained Green Cat Renewables Canada Corporation (GCR) to conduct a noise impact assessment (NIA) for the proposed Radiant Dawn Energy Park (the Project). The Project will include a 22.3-megawatts ($MW_{AC}$) solar photovoltaic (PV) electricity generating facility and will be located approximately 6km east of the town of Fort Macleod in Municipal District of Willow Creek No.26, Alberta. The Project location is shown in Figure 1-1 below. The assessment considered the cumulative impact of active and proposed noise sources on nearby receptors.

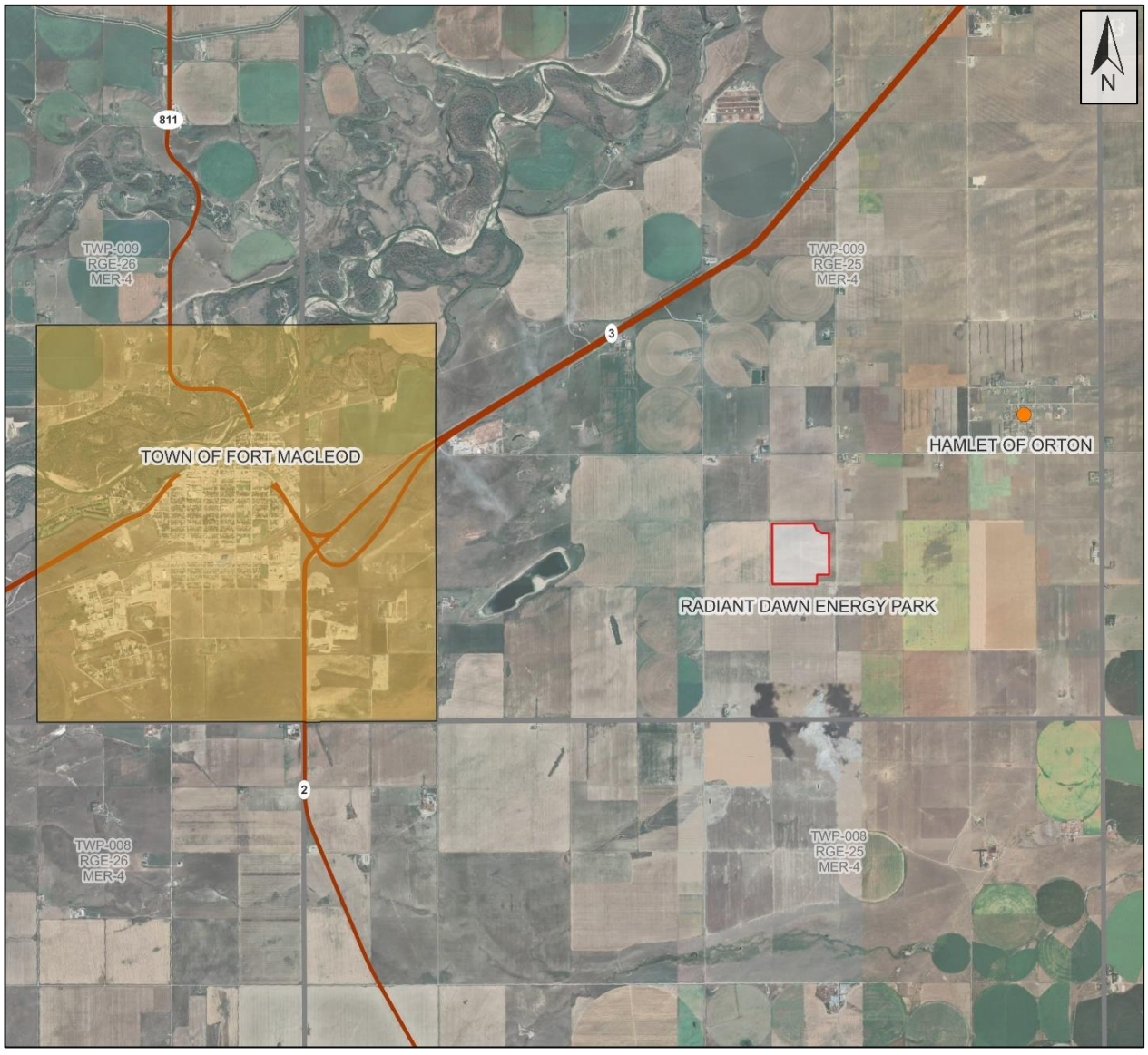


**Figure 1-1 – Radiant Dawn Energy Park Location**

# 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)
- 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 2024.1). 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 | Height Contours Interpolated at 3m[2] |
| 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)<br>0.0 (for water bodies) |
| Number of Sound Reflections | 1 |
| Receptor Height | 1.5m (one-storey)<br>4.5m (two-storey) |
| Operation Condition | Full load |
| Source Height | 2.3m for Inverters<br>1.7m for Project 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 119 acres. The study area includes rural/agricultural land and ephemeral waterbodies.

Five (5) dwellings located within the 1.5km boundary criterion have been assessed for cumulative noise impacts from the Project and other nearby facilities, as required by Rule 012. Additionally, two dwellings outside of the 1.5km boundary has been included in the assessment to provide additional information. One of these receptors is the nearest dwelling to the northeast, representing the residential area for the hamlet of Orton, and the other is the nearest dwelling to the south.

Furthermore, Clem Geo was informed that a new dwelling structure is scheduled to begin construction in Q3/Q4 2024. This future receptor has also been included in the assessment. While the landowner provided the location of this new dwelling, there is some uncertainty about its exact location. Therefore, GCR modelled this receptor at the property line closest to the Project boundary to represent the worst-case scenario.

## 4.2 Project Description

The Project will encompass an area of approximately 119 acres of land, with a total generating capacity of up to 22.3$MW_{AC}$. The solar arrays will utilize ground mounted, single-axis tracker modules which will feed six inverter/transformer stations. A switching station has been included in the Project area, however, it is understood that this switching station does not include any noise producing elements. As such, the inverter/transformer stations are assumed to be the only significant sources of noise from the Project and 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 between approximately 05:25 and 07:00, 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

Residential dwellings regarded as having the potential to be the most impacted by the proposed Project were identified and provided by Clem Geo in March 2024. The heights of the identified dwellings were found to be either one-storey or two-storey. The type of the future receptor, R08, is currently unknown. To ensure a conservative assessment, R08 was modelled at a two-story 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 | | | |
| R01 | 334422 | 5510837 | Two-Storey | 4.5 | 850m N |
| R02 | 333361 | 5510908 | One-Storey | 1.5 | 850m N |

| Receptor ID | UTM Coordinates (NAD 83, Zone 12N) | | Dwelling Type | Receptor Height (m) | Relative location from site boundary |
|---|---|---|---|---|---|
| | Easting | Northing | | | |
| R03 | 333485 | 5510976 | One-Storey | 1.5 | 900m N |
| R04 | 334041 | 5511268 | One-Storey | 1.5 | 1200m N |
| R05 | 334405 | 5511126 | One-Storey | 1.5 | 1120m N |
| R06 | 335586 | 5510711 | One-Storey | 1.5 | 1550m NE |
| R07 | 332905 | 5507780 | One-Storey | 1.5 | 1680m SW |
| R08 | 334212 | 5510094 | Two-Storey | 4.5 | 160m N |

## 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 Project boundary was conducted by GCR in August 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. One active AER regulated facility and one pumping well were identified within the study area.

Table 4-2 lists the third-party energy-related facility and pumping well identified within 3km of the Project that have the potential to influence cumulative sound levels. Information was gathered in April 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 |
| AER01 | MONARCH 16-10-009-25W4 SWB | Crude Oil Single-Well Battery | Tuktu Resources Ltd. | 334234 | 5509222 |
| AER02 | JASPER MINING PEARCE 16-10-9-25 | Pumping Well | Tuktu Resources Ltd. | 334234 | 5509222 |

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

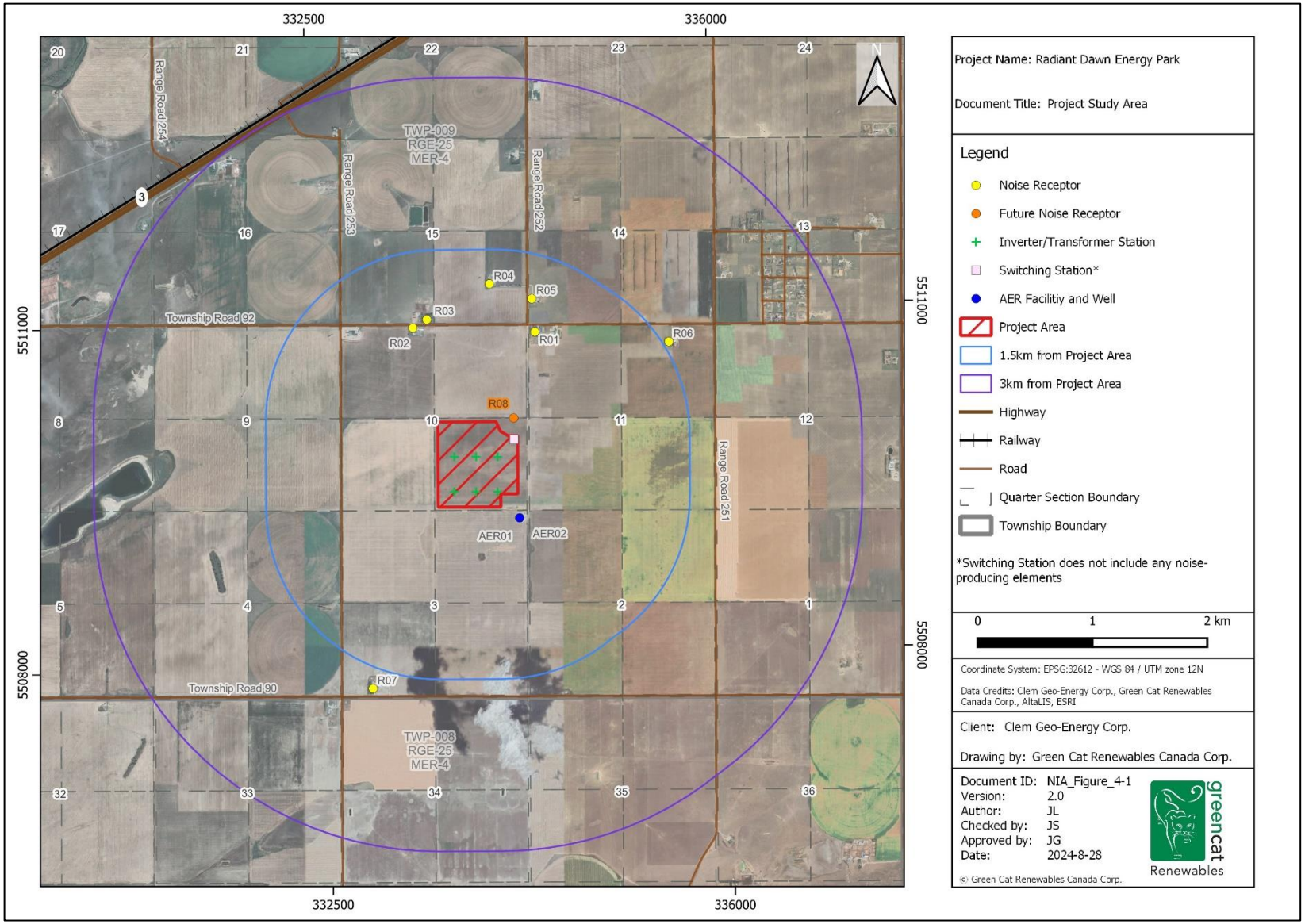


**Figure 4-1 – Project Study Area**

## 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[3] | 40 | 43 | 46 |
| Category 2[4] | 45 | 48 | 51 |
| Category 3[5] | 50 | 53 | 56 |

All dwellings have been evaluated as category one for dwelling density and proximity to transportation. Table 4-4 identifies the categories for the assessed receptors.

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

### 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.

[3] 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.
[4] 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.
[5] Category 3—dwelling(s) distance is less than 30 m from heavily travelled roads, or rail lines or subject to frequent aircraft flyovers.
[6] 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.

**Table 4-4 – Daytime and Night-Time BSL, ASL, and PSL**

| Receptor ID | Transportation Category | Dwelling Category | BSL | ASL | | PSL | |
|---|---|---|---|---|---|---|---|
| | | | NT/DT | NT | DT | NT | DT |
| R01 | 1 | 1 | 40 | 35 | 45 | 40 | 50 |
| R02 | 1 | 1 | 40 | 35 | 45 | 40 | 50 |
| R03 | 1 | 1 | 40 | 35 | 45 | 40 | 50 |
| R04 | 1 | 1 | 40 | 35 | 45 | 40 | 50 |
| R05 | 1 | 1 | 40 | 35 | 45 | 40 | 50 |
| R06 | 1 | 1 | 40 | 35 | 45 | 40 | 50 |
| R07 | 1 | 1 | 40 | 35 | 45 | 40 | 50 |
| R08 | 1 | 1 | 40 | 35 | 45 | 40 | 50 |

### 4.5.4 AER Facility Sound Power Levels

Sound power levels for AER01 and AER02 were compiled from GCR's measurement database and existing NIA data 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, both AER01 and AER02 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 facility and well within 3km of the Project.

**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 |
| AER01 | 102.7 | 97.9 | 96.6 | 94.5 | 94.4 | 90.9 | 89.8 | 86.1 | 79.6 | 96.9 | 105.8 |
| AER02 | 103.4 | 96.7 | 93.3 | 88.9 | 90.1 | 84.9 | 83.2 | 83.3 | 79.5 | 92.0 | 104.9 |

## 4.6 Modelling Results

Table 4-6 shows the predicted sound levels at each receptor from existing AER regulated energy-related facility and pumping well included in this assessment.

**Table 4-6 – Predicted Sound Levels from existing AER Energy-Related Facility and pumping well**

| Receptor ID | Total Active AER Regulated Energy-Related Facility and Well Sound levels - dB(A) |
|---|---|
| R01 | 13.3 |
| R02 | 11.3 |

| Receptor ID | Total Active AER Regulated Energy-Related Facility and Well Sound levels - dB(A) |
|---|---|
| R03 | 11.3 |
| R04 | 10.3 |
| R05 | 11.2 |
| R06 | 10.6 |
| R07 | 10.9 |
| R08 | 20.7 |

## 4.7 Total Baseline Sound Levels

Baseline sound levels include the noise contributions from existing adjacent sound sources and 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.

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

| Receptor ID | Total Regulated Facilities | | ASL | | Baseline | |
|---|---|---|---|---|---|---|
| | NT | DT | DT | DT | NT | DT |
| R01 | 13.3 | 13.3 | 35 | 45 | 35.0 | 45.0 |
| R02 | 11.3 | 11.3 | 35 | 45 | 35.0 | 45.0 |
| R03 | 11.3 | 11.3 | 35 | 45 | 35.0 | 45.0 |
| R04 | 10.3 | 10.3 | 35 | 45 | 35.0 | 45.0 |
| R05 | 11.2 | 11.2 | 35 | 45 | 35.0 | 45.0 |
| R06 | 10.6 | 10.6 | 35 | 45 | 35.0 | 45.0 |
| R07 | 10.9 | 10.9 | 35 | 45 | 35.0 | 45.0 |
| R08 | 20.7 | 20.7 | 35 | 45 | 35.2 | 45.0 |

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

# 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 six inverter/transformer stations, with a total capacity of up to 22.3$MW_{AC}$. A switching station has been included in the Project area, however, it is understood that it does not include any noise producing elements.

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, the only significant noise producing Project elements are the inverter/transformer stations.

The sound power level data for the inverter/transformer stations was used to model sound emissions for both daytime and night-time periods. The inverter/transformers stations 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 stations proposed for the PV electricity generating facility are the Sungrow SG4400UD-MV units. An assessment of the sound power levels for these units was conducted using the manufacturer's noise test report. 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 derived for the Sungrow SG4400UD-MV inverters.

**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 | 94.7 | 55.3 | 91.7 |
| 63 | 90.4 | 64.2 | 89.6 |
| 125 | 90.1 | 74.0 | 89.9 |
| 250 | 90.7 | 82.1 | 90.7 |
| 500 | 92.1 | 88.9 | 92.1 |
| 1000 | 88.7 | 88.7 | 88.7 |
| 2000 | 89.2 | 90.4 | 89.0 |
| 4000 | 93.0 | 94.0 | 92.2 |
| 8000 | 81.4 | 80.3 | 78.4 |
| **Sum** | **100.6** | **97.4** | **99.7** |

## 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[7,8]**

| 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 Modelling Results

Predicted sound levels for the Project are shown in Table 5-3. The results assume full operation 24 hours a day, and they are applicable to night-time and daytime periods.

**Table 5-3 – Predicted Project Case Sound Levels**

| Receptor ID | Project Sound Level (dBA) |
|---|---|
| R01 | 25.2 |
| R02 | 23.6 |
| R03 | 23.3 |
| R04 | 18.8 |

[7] *Handbook of Noise and Vibration Control* (Crocker, M., 2007).
[8] *Toward a Realistic Estimate of Octave Band Sound Levels for Electric Transformer* (Stevens, R. and Hung, C., 2010).

| Receptor ID | Project Sound Level (dBA) |
|---|---|
| R05 | 21.5 |
| R06 | 17.5 |
| R07 | 18.7 |
| R08 | 35.7 |

R08 is expected to be the receptor most impacted by noise from the Project, having a maximum sound pressure level of 35.7 dB(A). Project sound level contours are shown in Appendix D.

## 5.4 Low Frequency Assessment

Table 5-4 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 5-4 – Low Frequency Noise Assessment**

| Receptor ID | Predicted Sound Level (dBA) | Predicted Sound Level (dBC) | Difference dBC – dBA |
|---|---|---|---|
| R01 | 25.2 | 34.7 | 9.5 |
| R02 | 23.6 | 34.3 | 10.7 |
| R03 | 23.3 | 34.1 | 10.8 |
| R04 | 18.8 | 30.3 | 11.5 |
| R05 | 21.5 | 32.9 | 11.4 |
| R06 | 17.5 | 30.0 | 12.5 |
| R07 | 18.7 | 31.4 | 12.7 |
| R08 | 35.7 | 42.5 | 6.8 |

# 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 ID | Baseline Sound Level (dBA) | | Project Sound Level (dBA) | | Cumulative Sound Level (dBA) | | PSL (dBA) | | PSL Compliance Margin (dB) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | NT | DT | NT | DT | NT | DT | NT | DT | NT | DT |
| R01 | 35.0 | 45.0 | 25.2 | 25.2 | 35.5 | 45.0 | 40 | 50 | 5 | 5 |
| R02 | 35.0 | 45.0 | 23.6 | 23.6 | 35.3 | 45.0 | 40 | 50 | 5 | 5 |
| R03 | 35.0 | 45.0 | 23.3 | 23.3 | 35.3 | 45.0 | 40 | 50 | 5 | 5 |
| R04 | 35.0 | 45.0 | 18.8 | 18.8 | 35.1 | 45.0 | 40 | 50 | 5 | 5 |
| R05 | 35.0 | 45.0 | 21.5 | 21.5 | 35.2 | 45.0 | 40 | 50 | 5 | 5 |
| R06 | 35.0 | 45.0 | 17.5 | 17.5 | 35.1 | 45.0 | 40 | 50 | 5 | 5 |
| R07 | 35.0 | 45.0 | 18.7 | 18.7 | 35.1 | 45.0 | 40 | 50 | 5 | 5 |
| R08 | 35.2 | 45.0 | 35.7 | 35.7 | 38.4 | 45.5 | 40 | 50 | 2 | 5 |

The cumulative sound levels at all assessed receptors are shown to below the PSL by a minimum margin of 2dB during the night-time periods and by 5dB for the daytime periods. R08 was identified as being most impacted by the Project sound levels. Worst-case Project impacts are assessed to be compliant with the requirements of AUC Rule 012.

# 7 Conclusions

A total of eight receptors, including one future receptor, were identified as having the potential to be impacted by sound emitted from the proposed Project and/or cumulative sound levels. 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.

Cumulative sound levels at all receptors considered in this NIA were assessed to be below PSLs by a minimum margin of 2dB. R08 was identified as being most impacted by Project sound levels. 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 Radiant Dawn Energy Park 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<br>• Noise Impact Assessment (NIA) co-author | • Discipline lead<br>• Acoustic noise modelling<br>• Fieldwork lead<br>• Noise Impact Assessment (NIA) Technical Reviewer | • Technical Assessment Lead<br>• 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.<br>• Analyst on multiple noise assessments for renewable energy projects in Alberta.<br>• Current INCE associate. | • Over 11 years of acoustic and environmental consultancy for projects in the U.K. and Alberta.<br>• Completed the UK Institute of Acoustics (IOA) diploma in 2015.<br>• Full member of the IOA.<br>• Author and reviewer of NIAs for multiple renewable energy projects in Alberta (2020-Present). | • 19 years of acoustic and environmental consultancy.<br>• Acoustics (IOA) diploma (2012).<br>• Expert witness experience in wind turbine noise in the UK (2017/18).<br>• 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[9]. 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.

[9] 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

| Receptor 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 |
| R01 | Inverter/Transformer Station | 1140m SW | AER01/AER02 | 1630m S |
| R02 | Inverter/Transformer Station | 1180m SE | AER01/AER02 | 1900m SE |
| R03 | Inverter/Transformer Station | 1220m SE | AER01/AER02 | 1910m SE |
| R04 | Inverter/Transformer Station | 1510m S | AER01/AER02 | 2050m S |
| R05 | Inverter/Transformer Station | 1410m SW | AER01/AER02 | 1910m S |
| R06 | Inverter/Transformer Station | 1800m SW | AER01/AER02 | 2010m SW |
| R07 | Inverter/Transformer Station | 1860m NE | AER01/AER02 | 1960m NE |
| R08 | Inverter/Transformer Station | 370m S | AER01/AER02 | 870m S |

# Appendix C: 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 |

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Site photos:
Actual operation condition

| Actual operation condition | Background noise |
|---|---|
|  |  |



1）1m noise photo

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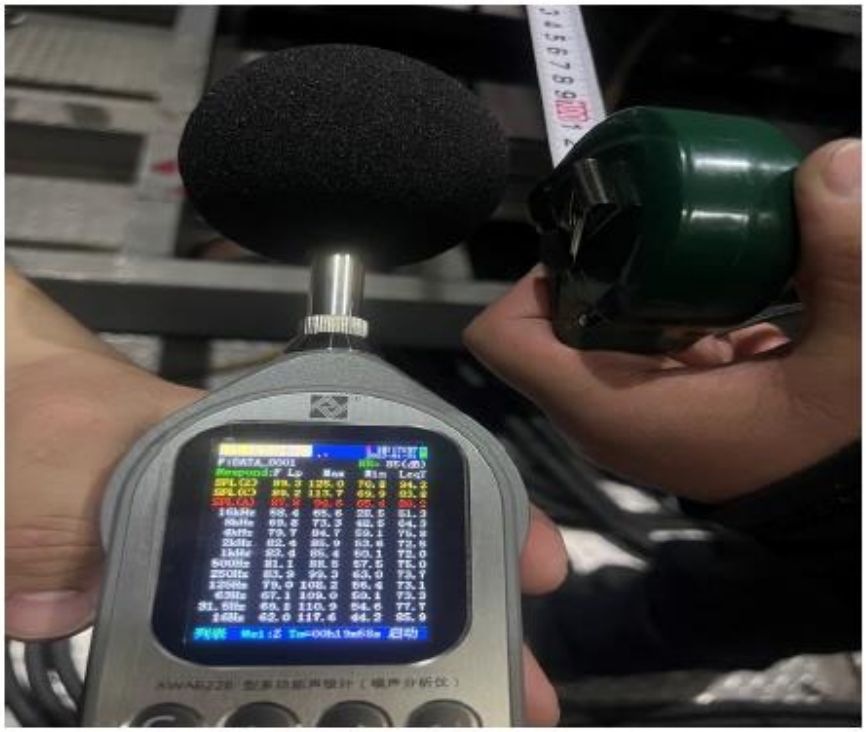
Front



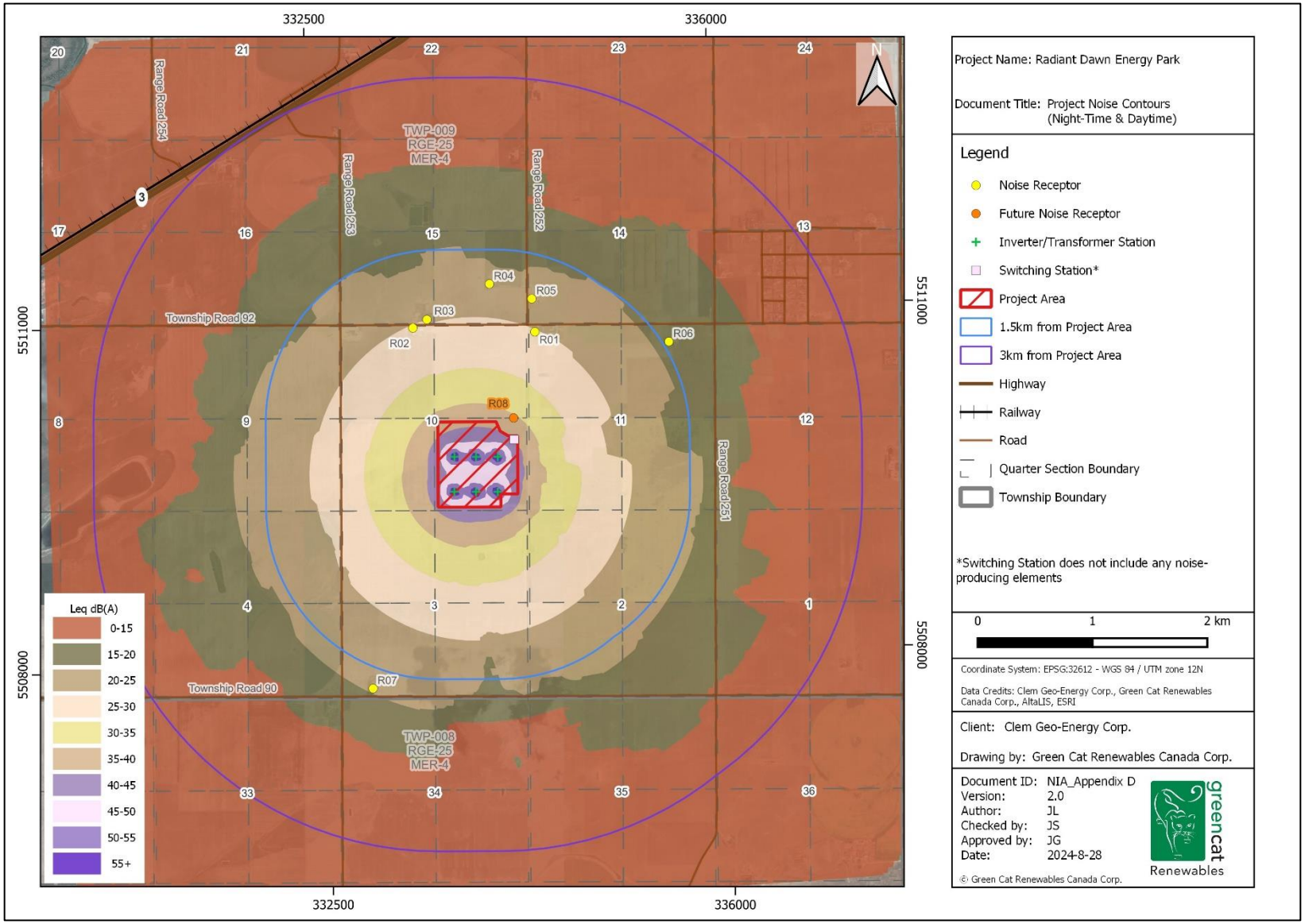
Behind

SUNGROW Public Clean power for all

Left

Right

# Appendix D: Project Sound Level Contours



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