# Iyuhána Solar Project

## Noise Impact Assessment

**Client:** Iyuhána Solar Limited Partnership
**Reference:** 24-015
Version 1.0

November 2024

**Report Prepared for:**
Iyuhána Solar Limited Partnership

| Issue History | Date | Details |
|---|---|---|
| V1.0 | November 6, 2024 | Final for Issue |

| Version History | Author | Reviewed By | Approved By | Issue Date |
|---|---|---|---|---|
| V1.0 | Riley Corrigan | Justin Lee (September 16, 2024) | Cameron Sutherland (September 17, 2024) | November 6, 2024 |

# Executive Summary

Iyuhána Solar Limited Partnership (Iyuhána Solar), a partnership with GSI Management Inc. (GSI) and Ocean Man First Nation (OMFN), is proposing to develop the Iyuhána Solar Project (the Project). The proposed Project is a solar photovoltaic (PV) electricity generating facility of up to 100-megawatts ($MW_{AC}$). The Project will be built on SaskPower land approximately 8km southwest of the City of Estevan and 7km southwest of Boundary Dam Power Station in the Rural Municipality (RM) of Estevan No. 5, Saskatchewan.

Iyuhána Solar retained Green Cat Renewables Canada Corporation (GCR) to conduct a noise impact assessment (NIA) of the Project, which will consist of ground-mounted single-axis tracker PV modules and associated tracker motors, twenty-seven (27) inverter/transformer stations, and a Project substation including one (1) 135MVA high-voltage (HV) transformer. 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.

GCR reviewed aerial imagery of the site, three (3) receptors within or bordering the study area that have the potential to be most 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. GCR conducted a site visit in August 2024 to field verify details of the receptors included in this assessment.

In the absence of applicable noise guidelines in Saskatchewan, this assessment follows *Alberta Utilities Commission (AUC) Rule 012: Noise Control*. Since AUC Rule 012 is considered one of the most comprehensive noise guidelines in Canada for assessing noise impacts from facilities such as a solar PV electricity generating facilities, the application of AUC Rule 012 is considered appropriate for the proposed Project. In addition, the similarities between the landscapes in rural Alberta and Saskatchewan indicates the application of AUC Rule 012 is more appropriate than applying the regulations established in other jurisdictions.

A software model was used to predict sound levels from the Project to determine compliance with the requirements of AUC Rule 012.

Where applicable, cumulative sound levels incorporated sound from: existing regulated third-party energy-related facilities; third-party projects; the proposed Project; and ambient sources.

Cumulative sound levels at all receptors considered in this NIA were assessed to be below the Permissible Sound Levels (PSLs) by a minimum margin of 4dB.

A Low Frequency Noise (LFN) assessment determined that sound from the proposed Project was not likely to produce any significant LFN effects.

As the Project was assessed to meet the requirements of AUC Rule 012, the predicted noise impacts from the Project are considered acceptable for the assessed receptors in rural Saskatchewan.

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# 1 Introduction

Iyuhána Solar Limited Partnership (Iyuhána Solar), a partnership with GSI Management Inc. (GSI) and Ocean Man First Nation (OMFN), is proposing to develop the Iyuhána Solar Project (the Project). The proposed Project is a solar photovoltaic (PV) electricity generating facility of up to 100-megawatts ($MW_{AC}$). The Project will be built on SaskPower land approximately 8km southwest of the City of Estevan and 7km southwest of Boundary Dam Power Station in the Rural Municipality (RM) of Estevan No. 5, Saskatchewan. The Project location is shown in **Figure 1-1**. The assessment considered the cumulative impact of existing energy related facilities and the proposed solar Project noise sources on nearby receptors.

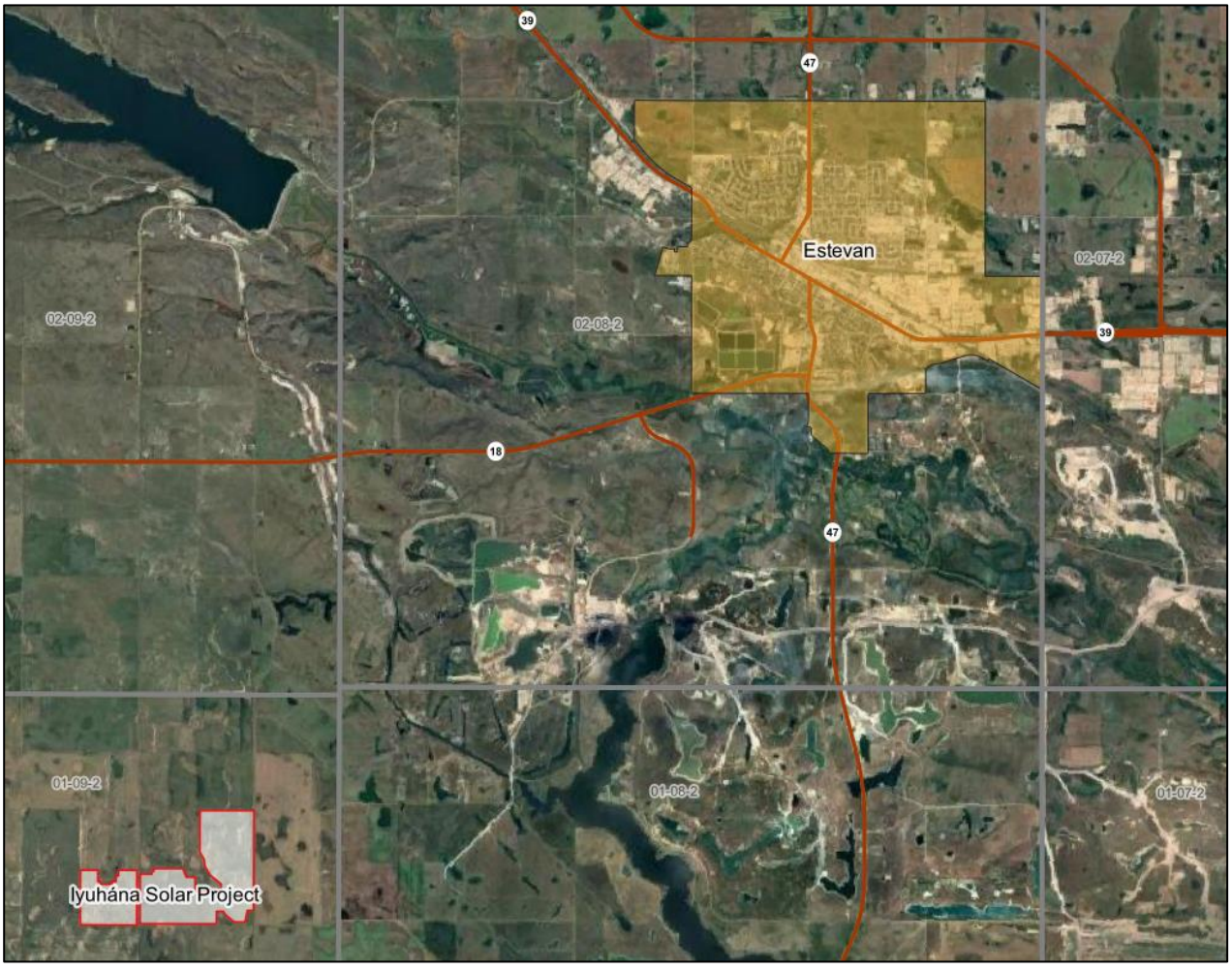


**Figure 1-1: Iyuhána Solar Project Location**

# 2 Noise Guidance

A search for noise guidance relating to energy-related facilities, such as solar PV electricity generating facilities, within the Province of Saskatchewan concluded that no provincially recognized noise guidelines have been established. In the absence of such guidelines in Saskatchewan, this assessment follows *Alberta Utilities Commission (AUC) Rule 012: Noise Control*[1]. Since AUC Rule 012 is considered one of the most comprehensive noise guidelines in Canada for assessing noise impacts from facilities such as a solar PV electricity generating facilities, the application of AUC Rule 012 is considered appropriate for the proposed Project. In addition, the similarities between the landscapes in rural Alberta and Saskatchewan indicates the application of AUC Rule 012 is more appropriate than applying the regulations established in other jurisdictions.

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 (Ministry of Energy and Resources) 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 the 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.

[1] AUC Rule 012 establishes methodologies for assessing noise impacts from a facility by considering any proposed, approved, or existing facilities within the study area of a Project. The objective of AUC Rule 012 is to confirm if the cumulative sound levels at a receptor are in compliance with the associated Permissible Sound Level (PSL).

# 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[2]: '*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 AUC 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 [3] |
| 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 (for waterbodies) |
| 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 Inverter Stations<br>1.7m for Transformer Stations<br>4.0m for the Substation Transformer |

[2] https://dgmrsoftware.com/products/inoise/
[3] Data obtained from Government of Canada Geospatial Data Extraction

# 4 Baseline

## 4.1 Study Area

The development site has a total fenced area of approximately 223 hectares. The study area consists of all land within 3km of the Project boundary. The study area for the Project includes a few detached dwellings in the surrounding area, waterbodies, rural/agricultural land, and regulated third-party energy-related facilities.

Within the guidelines of AUC Rule 012, three (3) dwellings within 1.5km from the Project boundary were identified following field verification and consultation with local stakeholders. These dwellings have been assessed for cumulative noise impacts from the Project and other nearby facilities, as required by AUC Rule 012.

## 4.2 Project Description

The Project will encompass an area of approximately 223 hectares of land, with a total generating capacity of up to 100 $MW_{AC}$. The solar arrays will utilize ground-mounted, single-axis tracker modules, which will feed twenty-seven (27) inverter/transformer stations. A Project substation containing one (1) 135MVA high-voltage (HV) transformer has also been included. The inverters/transformer stations and the Project substation are assessed 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

Three (3) receptors located within 1.5km from the Project boundary were identified as potentially being the most impacted by the Project. Receptor field verification was conducted by GCR in August 2024 to confirm details of the receptors included in this assessment. Note that receptors with heights observed to be closer to 1.5-storeys have been conservatively modelled with an assumed height of 4.5m (i.e., two-storey). 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 13N) | | Receptor Type | Receptor Height (m) | Relative location from site boundary |
|---|---|---|---|---|---|
| | Easting | Northing | | | |
| R01 | 635813 | 5435376 | One-Storey | 1.5m | 780m SW |
| R02 | 635120 | 5435670 | Two-Storey | 4.5m | 1450m W |
| R03 | 638049 | 5438585 | Two-Storey | 4.5m | 1390m N |

## 4.4 Existing Third-Party Regulated Energy Related Facilities

A search for active and approved regulated energy-related facilities within 3km of the Project boundary was conducted. The Government of Saskatchewan Mining and Petroleum GeoAtlas was consulted to identify any active and approved oil and gas wells or facilities within the study area. Based on this review, GCR identified one (1) active facility and one (1) active well within the study area that may influence cumulative sound levels. No other existing or approved regulated energy-related facilities have been identified within the assessment area.

Table 4-2 lists the third-party energy-related facilities identified within 3km of the Project that have the potential to influence cumulative sound levels. Information was gathered using the Mining and Petroleum GeoAtlas.

**Table 4-2: Third-Party Sound Sources**

| Map Label | Name | Type | Operator Name | UTM Coordinates (NAD 83, Zone 13N) | |
|---|---|---|---|---|---|
| | | | | Easting | Northing |
| FAC-1 | EOR Injection Facility | Injection Facility | SASKATCHEWAN POWER CORPORATION | 640290 | 5439557 |
| WELL-1 | PTRC INJ 5-6-2-8 | CO2 Injection Well | SASKATCHEWAN POWER CORPORATION | 640283 | 5439572 |

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

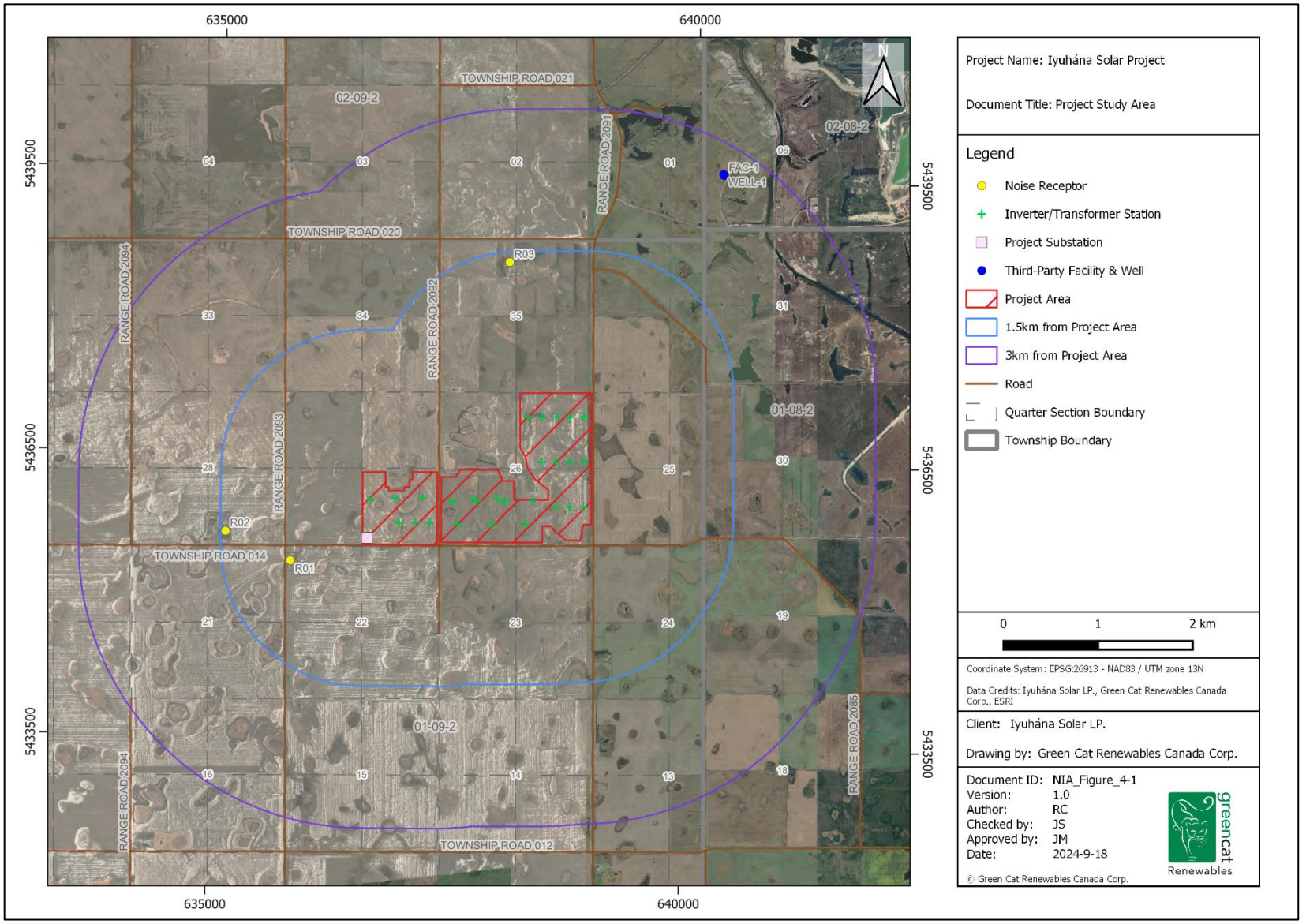


**Figure 4-1: Project Study Area**

## 4.5 Baseline Sound Levels

Baseline sound levels for each receptor should incorporate a contribution from all existing and approved third-party energy-related 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)

AUC 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 proximity to transportation were the determining factors. Criteria are given in Table 4-3.

**Table 4-3: Rule 012 Criteria for Determination of Basic Sound Level (BSL)** [4]

| 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) 161 to 400 dwellings; 22:00 - 07:00 (night-time) (dBA Leq) | (4) 401 to 1,000 dwellings (Suburban); 22:00 - 07:00 (night-time) (dBA Leq) | (5) >1,000 dwellings (Urban); 22:00 - 07:00 (night-time) (dBA Leq) |
| Category 1[5] | 40 | 43 | 46 | 48 | 53 |
| Category 2[6] | 45 | 48 | 51 | 51 | 53 |
| Category 3[7] | 50 | 53 | 56 | 56 | 56 |

The assessed receptors in the study area have been evaluated for both 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 Saskatchewan (including agricultural and oil & gas industries), the conditions of which are considered similar to rural Alberta. AUC 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'. [8,9] 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] Alberta Utilities Commission Rule 012: Noise Control, effective September 30, 2024 (PDF Page 5, Table 1)
[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] Alberta Utilities Commission Rule 012: Noise Control, effective September 30, 2024 (PDF Page 14, Bullet 7)
[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**

| 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 |

### 4.5.4 Third-Party Facility Sound Power Levels

Sound power levels for the third-party facilities included in this assessment were compiled from an internal noise measurement database. In each case, the quoted sound power level is the average of at least two similar facilities and is considered typical and representative for the facility type.

For the purposes of this assessment, all noise producing 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 third-party energy-related facilities within 3km of the Project.

**Table 4-5: Octave Band Sound Power Levels for Active Third-Party Facilities**

| Map Label | Facility | Octave Band Centre Frequency, Hz | | | | | | | | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 31.5 | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 | dB | dB(A) |
| FAC-1 | EOR Injection Facility | 113.5 | 110.4 | 105.2 | 90.9 | 90.7 | 84.4 | 81.2 | 79.3 | 72.1 | 115.7 | 93.8 |
| Well-1 | PTRC INJ 5-6-2-8 | 66.9 | 65.0 | 53.1 | 55.0 | 65.7 | 67.6 | 63.8 | 58.4 | 54.0 | 73.3 | 70.7 |

## 4.6 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 4-6 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[10]

| Receptor ID | Total Regulated Facilities | | ASL | | Baseline | |
|---|---|---|---|---|---|---|
| | NT | DT | NT | DT | NT | DT |
| R01 | - | - | 35 | 45 | 35.0 | 45.0 |
| R02 | - | - | 35 | 45 | 35.0 | 45.0 |
| R03 | 14.1 | 14.1 | 35 | 45 | 35.0 | 45.0 |

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

[10] Sound levels modelled to be below 0dBA at the assessed receptors are denoted by '-'.

# 5 Project Sound Levels

The Project will consist of solar PV arrays using ground-mounted, single-axis trackers. The solar array will be connected to twenty-seven (27) inverter/transformer stations, with a total capacity of up to 100 $MW_{AC}$. The Project will also include a Project substation containing one (1) 135MVA high-voltage (HV) transformer.

In general, each single-axis tracker is expected to be 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 dependant on time of year). Due to the trackers' infrequent and asynchronous operation, and their uniform distribution across solar sites, they would have limited potential to contribute to overall project sound levels and would not be considered significant noise producing Project elements.

For the purposes of the noise assessment, it has been assessed that the only significant noise producing Project elements are the inverters/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 Project elements were assumed to operate at full load, which is an inherently conservative modelling approach for night-time periods at a solar farm.

## 5.1 Solar PV Facility

### 5.1.1 Inverters

The inverter stations proposed for the Project 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 Sungrow 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** |

### 5.1.2 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. Octave band levels were derived using published ONAN spectral data.

The linear 'A' and 'C' frequency weighted octave band sound power spectra for the 4.4MVA transformers used in the Project area is shown in Table 5-2.

**Table 5-2: Octave Band Sound Power Levels for the 4.4MVA Transformers Based on Theoretical Prediction Methods[11,12]**

| 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** |

## 5.2 Substation

The Project substation will be comprised of one (1) 135MVA HV transformer that will be used to transform electricity generated from the PV system to grid voltage. The transformer has been modelled under Oil Natural Air Forced (ONAF) conditions for a conservative prediction. ONAF is an operation that uses second stage cooling for the transformer 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 5-3 shows the linear 'A' and 'C' frequency weighted octave band sound power spectra for the 135MVA substation transformer.

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

**Table 5-3: Octave Band Sound Power Levels for the 166MVA Substation Transformer Based on Theoretical Prediction Methods[13,14]**

| Octave Band Frequency (Hz) | Sound Power (dB) | Sound Power (dBA) | Sound Power (dBC) |
|---|---|---|---|
| 31.5 | 94.7 | 55.3 | 91.7 |
| 63 | 98.7 | 72.5 | 97.9 |
| 125 | 101.7 | 85.6 | 101.5 |
| 250 | 99.7 | 91.1 | 99.7 |
| 500 | 99.7 | 96.5 | 99.7 |
| 1000 | 93.7 | 93.7 | 93.7 |
| 2000 | 88.7 | 89.9 | 88.5 |
| 4000 | 83.7 | 84.7 | 82.9 |
| 8000 | 75.7 | 74.6 | 72.7 |
| **Sum** | **106.7** | **99.9** | **106.4** |

## 5.3 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**

| Receptor ID | Project Sound Level (dBA) |
|---|---|
| R01 | 30.8 |
| R02 | 27.2 |
| R03 | 26.0 |

Receptor R01 is expected to be the receptor experiencing the highest Project sound levels, having a maximum sound pressure level of 30.8dB(A). Project sound level contours are shown in Appendix D.

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

## 5.4 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 AUC 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**

| Receptor ID | Predicted Sound Level (dBA) | Predicted Sound Level (dBC) | Difference dBC – dBA |
|---|---|---|---|
| R01 | 30.8 | 40.9 | 10.1 |
| R02 | 27.2 | 37.6 | 10.4 |
| R03 | 26.0 | 37.4 | 11.4 |

# 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 | 30.8 | 30.8 | 36.4 | 45.2 | 40 | 50 | 4 | 5 |
| R02 | 35.0 | 45.0 | 27.2 | 27.2 | 35.7 | 45.1 | 40 | 50 | 4 | 5 |
| R03 | 35.0 | 45.0 | 26.0 | 26.0 | 35.5 | 45.1 | 40 | 50 | 4 | 5 |

The cumulative sound levels at all receptors are shown to be below the PSL by a minimum margin of 4dB during the night-time periods and by 5dB for the daytime periods. Receptor R01 was identified as being the receptor 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

In the absence of any established noise guidance in Saskatchewan, this assessment followed AUC Rule 012: Noise Control.

Three (3) receptors were identified within 1.5km of the Project boundary. These receptors were selected to assess the cumulative noise impacts from the Project and nearby third-party energy-related facilities. Worst-case sound power levels were used to model sound emissions from the Project during both daytime and night-time 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 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 receptors considered in this NIA were assessed to be below PSLs at all receptors by a minimum margin of 4dB. R01 was assessed to be the receptor most impacted by the Project. 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 Iyuhána Solar Project would operate in compliance with AUC Rule 012 requirements at all assessed receptors. As such, the predicted noise impacts from the Project are considered acceptable for the assessed receptors in rural Saskatchewan.

# 8 Acoustic Practitioners' Information

Table 8-1 summarizes the information of the author(s) and technical reviewer(s).

**Table 8-1: Summary of Acoustic Practitioners' Information**

| Name | Riley Corrigan | Justin Lee | Cameron Sutherland |
|---|---|---|---|
| **Title** | Renewable Energy E.I.T. | Renewable Energy E.I.T. | Technical Director |
| **Role** | • Author<br>• Acoustic noise modelling | • Technical Reviewer | • Technical Reviewer and Approver<br>• Technical Assessment Lead |
| **Experience** | • Experience with acoustic modelling (iNoise & CadnaA) of renewable energy projects in Alberta.<br>• Analyst on multiple noise assessments for renewable energy projects in Alberta (2022-Present). | • Experience with acoustic modelling (iNoise & CadnaA) of renewable energy projects in Alberta and Nova Scotia.<br>• Analyst on multiple noise assessments for renewable energy projects in Alberta (2021-Present).<br>• Current INCE associate. | • Acoustic and environmental consultancy (2005-Present).<br>• Acoustics (IOA) diploma (2012).<br>• Expert witness experience in wind turbine noise in the UK (2017/2018).<br>• Expert witness experience in technical solar development in Canada (2019-2023) |

# Appendix A: Glossary of Rule 012 Terminology

### 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[15]. 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.

[15] 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 | Project Substation | 850m NE | FAC-1 | 6130m NE |
| R02 | Project Substation | 1500m E | FAC-1 | 6470m NE |
| R03 | Inverter/Transformer Station | 1650m S | WELL-1 | 2440m NE |

# 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 | 张文翔 | 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 |

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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

SUNGROW Public Clean power for all

Front

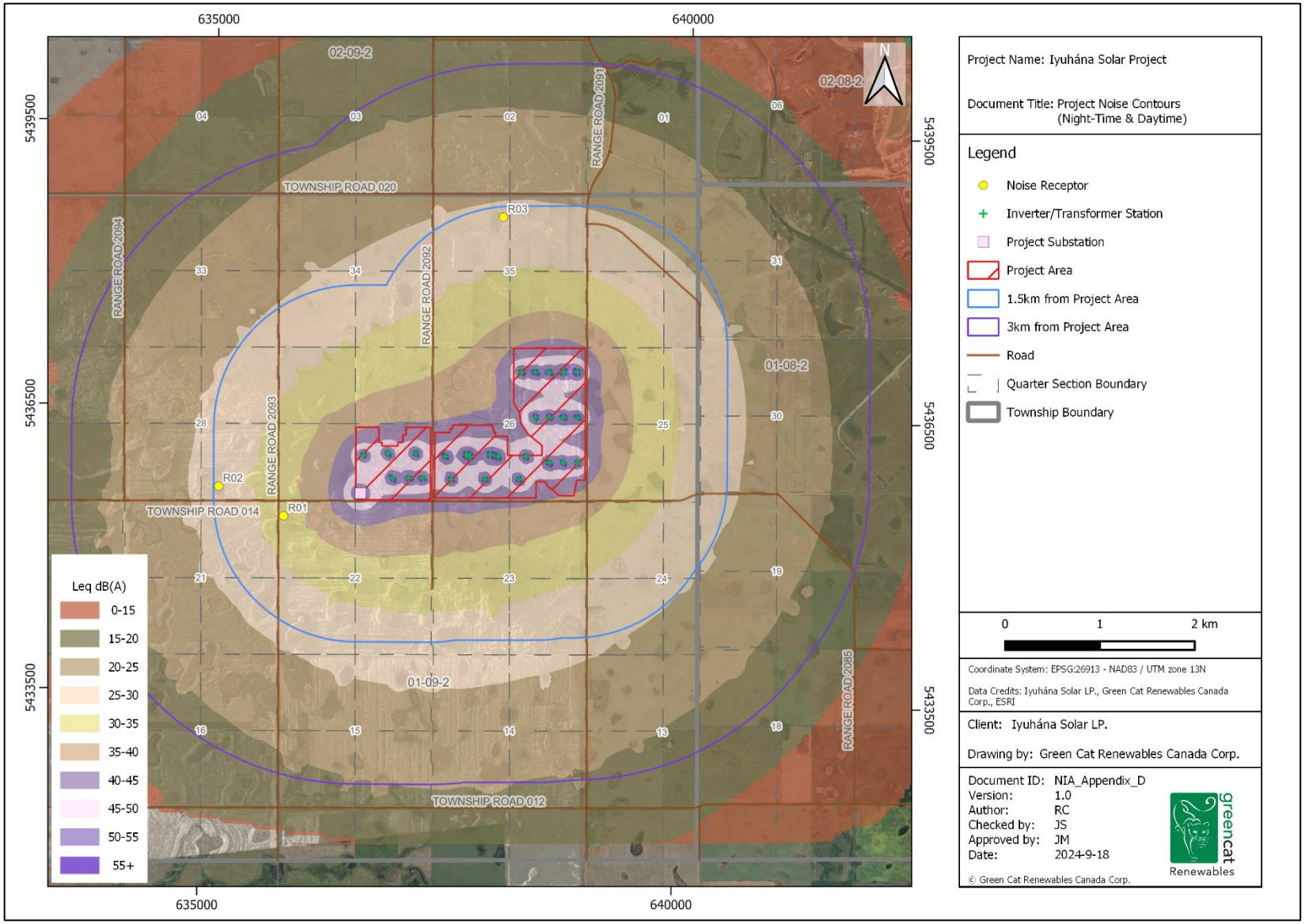
Behind

SUNGROW Public Clean power for all

Left

Right

# Appendix D: Project Sound Level Contours



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