Coaldale Renewable Energy Project

Noise Impact Assessment

Client: Coaldale Renewables GP Inc.
Reference: 23-113
Version 2.0

August 2024

Report Prepared for:
Coaldale Renewables GP Inc.

Issue History	Date	Details
V1.0	July 16, 2024	Draft for Issue
V2.0	August 30, 2024	Layout Updates – Final for Issue

Version History	Author	Reviewed by	Approved by	Issue Date
V1.0	Justin Lee	Merlin Garnett (July 11, 2024)	Cameron Sutherland (July 12, 2024)	July 16, 2024
V2.0	Justin Lee	Merlin Garnett (August 21, 2024)	Cameron Sutherland (August 22, 2024)	August 30, 2024

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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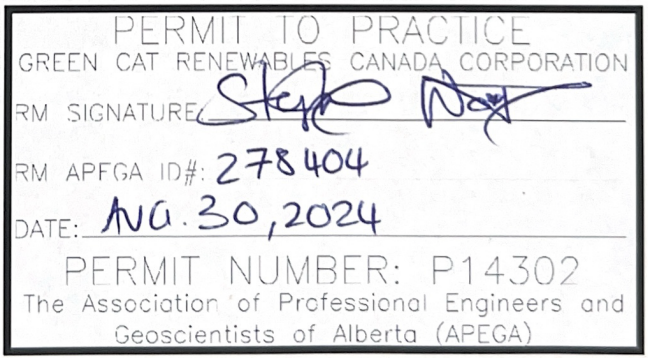

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Executive Summary

Coaldale Renewables GP Inc. (Coaldale Renewables) propose to construct and operate the Coaldale Renewable Energy Project (the Project). The Project is proposed to have a total capacity of up to 40 megawatts (MW_{AC}), comprising five wind turbine generators with a generating capacity of up to 35 MW_{AC}, and a 5 MW_{AC} capacity solar photovoltaic (PV) facility. The Project is located approximately 10km northeast of the Town of Coaldale, Alberta, within Lethbridge County and the Municipal District of Taber. It is understood that the Project will be connected to power the Coaldale Processing Plant (McCain Facility), located within the Project boundary.

Coaldale Renewables retained Green Cat Renewables Canada Corporation (GCR) to conduct a noise impact assessment (NIA) of the Project, which will consist of five wind turbine generators, ground mounted fixed-tilt PV panels, 15 Sungrow SG350HX inverters and a medium voltage (MV) transformer. Coaldale Renewables has not yet finalized the wind turbine generator model to be used for the Project. GCR has evaluated the turbine models under consideration, finding that the Nordex N163 5.9MW turbine has the most significant noise impacts on the assessed receptors. Therefore, the Nordex N163 5.9MW model is considered in this assessment.

The wind turbine generators, the inverters, and the MV transformer are assessed to be the only significant noise producing Project elements, and no other noise producing Project elements are considered in this assessment. For the purposes of the noise assessment, the Project is assumed to operate at full load (i.e., operating 24/7 at full capacity), which is highly conservative for a combined wind and solar project.

GCR identified twenty-four residential dwellings as having the potential to be impacted by the proposed Project. The area was also checked for regulated third-party energy-related facilities that might also produce audible sound within the vicinity of the Project, but no such facilities were identified. The McCain Facility is understood to be non-energy-related facility and therefore has not been considered in this assessment.

A software model was used to predict sound levels from the proposed Project 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: existing and approved 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 receptors assessed during both night-time and daytime periods. A Low Frequency Noise (LFN) assessment determined that sound from the proposed Project was not expected to contain any significant LFN effects.

The proposed Coaldale Renewable Energy Project is therefore assessed to meet the requirements of AUC Rule 012.

Table of Contents

1 Introduction

Coaldale Renewables GP Inc. (Coaldale Renewables) retained Green Cat Renewables Canada Corporation (GCR) to conduct a noise impact assessment (NIA) for the proposed Coaldale Renewable Energy Project (the Project). The Project will have a generation capacity of up to 40 megawatts (MW_{AC}), comprising five wind turbine generators with a generating capacity of up to 35 MW_{AC}, and a 5 MW_{AC} capacity solar photovoltaic (PV) facility. The Project is located approximately 10km northeast of the Town of Coaldale, Alberta, within Lethbridge County and the Municipal District of Taber. The Project location is shown in **Figure 1-1** below with the Solar Project Area highlighted in yellow and the Wind Project Area outlined in red.

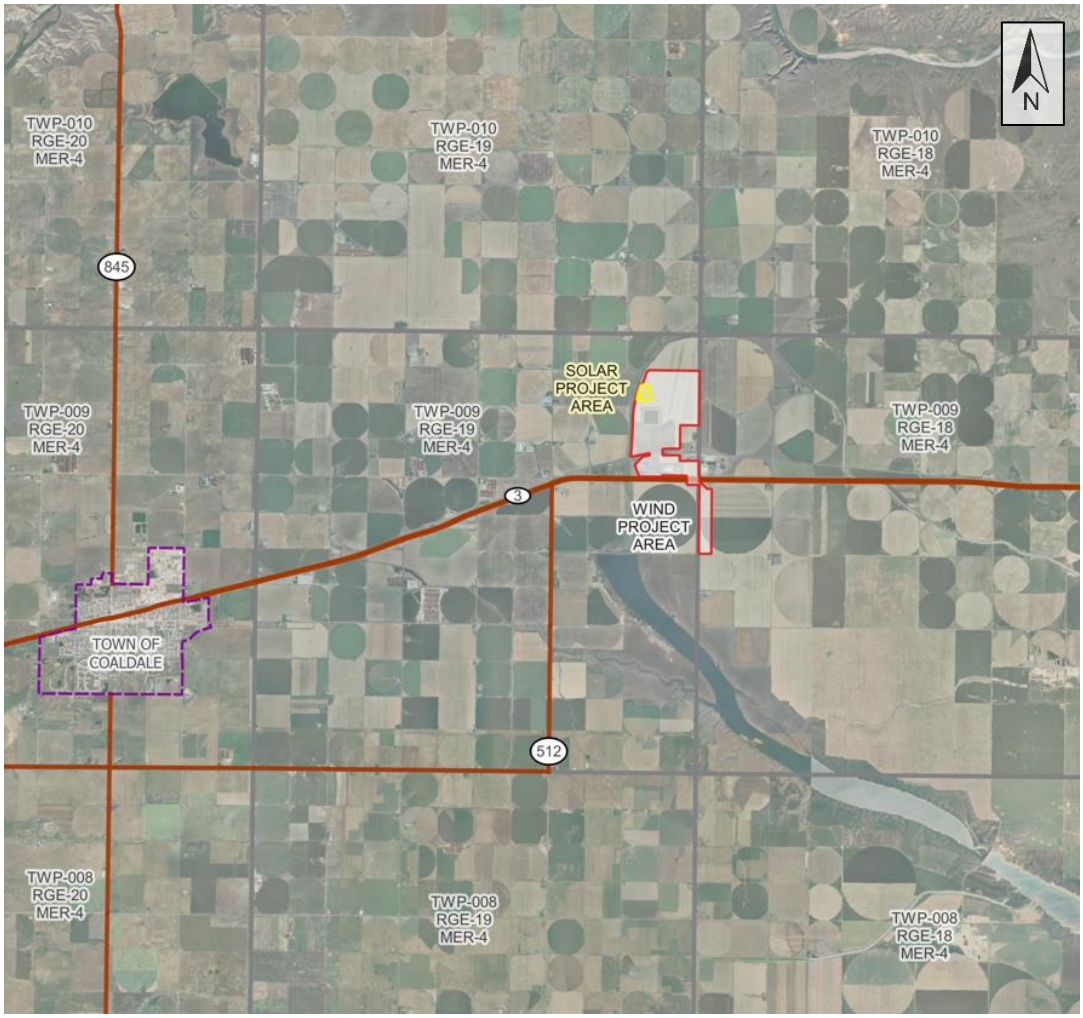


Figure 1-1 – Coaldale Renewable Energy Project Location

2 Rule 012 Assessment Process

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

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

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

For each noise receptor:

- Determine Basic Sound Level (BSL) and Ambient Sound Level (ASL)
- 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 CadnaA v2024 Software from DataKustik GmbH. This quality assured software includes an implementation of the ISO 9613 method that was the basis for all calculations.

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[1] intervals
Barrier Effects Included	None
Temperature	10°C
Relative Humidity	70%
Wind	1 – 5ms^{-1} from facility to receptor as per ISO-9613
Ground Attenuation	0.0 for Water Body, otherwise 0.5[2]
Number of Sound Reflections	1
Receptor Height	1.5m for one-story / 4.5m for two-story
Operation Condition	Full load
Source Height	125m for N163 5.9MW Turbines 0.7m for SG350HX Inverters 1.4m for Medium Voltage (MV) Transformer

[1] Data obtained from AltaLIS.
[2] Ground Attenuation of 0.5 is now the recommended value to be used for wind turbines according to ISO-9613 and represents mixed ground conditions.

4 Baseline

4.1 Study Area

The study area largely consists of rural/agricultural land, waterbodies, and other wetlands.

Twenty-four occupied representative receptors, located within approximately 1.5km from the center point of the tower of the closest Project wind turbine, or approximately 1.5km from the boundary of the solar PV facility, have been assessed for cumulative noise impacts from the Project and other nearby facilities, in accordance with Rule 012. Two of these receptors lie just beyond the 1.5km boundary but have been included in the assessment to account for any potential minor adjustments in the Project layout.

4.2 Project Description

The Project will consist of five Nordex wind turbine generators with a total capacity of up to 35 MW_{AC}. Three of these turbines will be equipped with blades with serrated trailing edges, a technology that reduces the sound power of aerodynamic emission. The trailing edge serrations were specified for the turbines where noise reduction was deemed necessary to lower sound levels at nearby receptors. The solar PV facility will encompass an area of approximately 20 acres of land, with a total generating capacity of up to 5 MW_{AC}. The solar arrays will utilize ground mounted, fixed-tilt modules which will feed 15 Sungrow SG350HX inverters and a MV transformer. The Project turbines, the inverters, and the MV transformer 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 solar PV facility 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 confirmed during a site visit conducted by GCR in June 2024. The heights of the dwellings were also confirmed during the site visit. To provide a conservative assessment, any dwellings with the potential to be considered as higher than a one-storey dwelling were modelled at a two-storey elevation of 4.5m. Table 4-1 shows the location details and the height of each receptor modelled.

Table 4-1 – Receptor Details

Receptor ID	UTM Coordinates (NAD 83, Zone 12N)		Dwelling Type	Receptor Height (m)	Distance to Nearest Project Turbine (to nearest 10m)
	Easting (m)	Northing (m)			
R01	394119	5512826	Two-Storey	4.5m	750m NE
R02	393611	5512771	One-Storey	1.5m	1220m NE
R03	393433	5512761	One-Storey	1.5m	1390m NE
R04	393744	5513421	Two-Storey	4.5m	1000m E

Receptor ID	UTM Coordinates (NAD 83, Zone 12N)		Dwelling Type	Receptor Height (m)	Distance to Nearest Project Turbine (to nearest 10m)
	Easting (m)	Northing (m)			
R05	393653	5513429	One-Storey	1.5m	1090m E
R06	393585	5513465	One-Storey	1.5m	1160m E
R07	394411	5515809	Two-Storey	4.5m	1130m SE
R09	395245	5515720	1.5-Storey	4.5m	930m S
R10	396065	5515868	One-Storey	1.5m	1510m SW
R11	396223	5515608	One-Storey	1.5m	1470m SW
R12	395999	5513529	1.5-Storey	4.5m	1270m S
R13	396038	5513376	Two-Storey	4.5m	1110m S
R14	395905	5513355	Two-Storey	4.5m	1120m S
R15	395795	5513386	Two-Storey	4.5m	1070m W
R16	395691	5513376	One-Storey	1.5m	970m W
R17	395674	5513288	Two-Storey	4.5m	950m W
R18	395846	5513228	One-Storey	1.5m	1030m SE
R19	395956	5513205	1.5-Storey	4.5m	960m SE
R20	396031	5513204	One-Storey	1.5m	940m S
R21	396109	5513037	One-Storey	1.5m	760m S
R22	396115	5512973	One-Storey	1.5m	700m S
R23	397561	5512454	1.5-Storey	4.5m	1300m W
R24	396088	5509996	Two-Storey	4.5m	1200m N
R28	397732	5510895	One-Storey	1.5m	1510m W

4.4 Existing Third-Party Regulated Energy-Related Facilities

A desktop search for active and approved regulated energy-related facilities and pumping wells within the study area was conducted 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. GCR did not identify any active or approved AER regulated facilities, AER regulated pumping wells, or AUC regulated facilities within the study area.

An overview of the Project study area is provided in **Figure 4-1**.

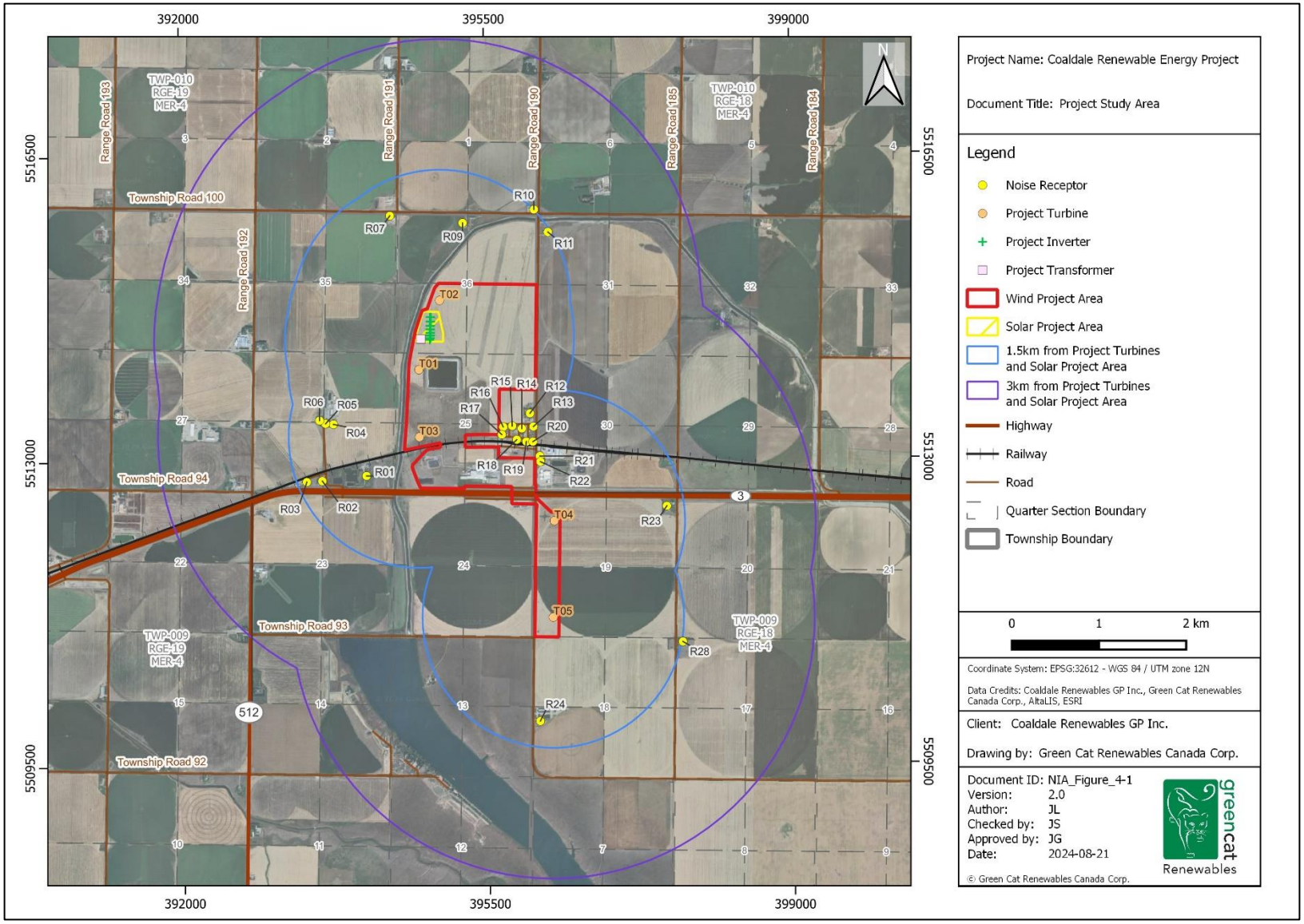


Figure 4-1 – Project Study Area

4.5 Baseline Sound Levels

Baseline sound levels for each receptor should incorporate contributions from all active and approved third-party regulated 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)

Rule 012 criteria for the determination of BSL include: dwelling density; road and rail traffic noise; and aircraft flyovers. In this case, dwelling density as well as road and rail traffic noise are the determining factors. Criteria are given in **Table 4-2**.

Table 4-2 – 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

The assessed receptors within the 1.5km boundary criterion have been evaluated to determine their category for both dwelling density and proximity to transportation. **Table 4-3** identifies the categories for the assessed receptors.

Receptors R04-R11, R24, and R28 have been evaluated as 'Category 1' for both dwelling density and proximity to transportation.

Traffic data collected for Highway 3, collected at the intersection near the Project, indicates a level of traffic flow that 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'. Therefore, receptors located between 30m and 500m from Highway 3 have been assessed as 'Category 2' for proximity to transportation. Traffic data is shown in **Appendix B.** Furthermore, a rail line was identified on the south side of the Hamlet of Chin. GCR consulted with a CP Railway personnel and confirmed that the rail traffic present in this area exceeds the minimum requirements for a 'Rail Line' as defined in Rule 012. Therefore, receptors located between 30m and 500m from the rail line have been assessed as 'Category 2' for proximity to transportation.

Consequently, R01-R03 and R12-R23 have been assessed as 'Category 2' for proximity to transportation.

R04 is approximately 495m from the rail line and could be assessed as "Category 2" for proximity to transportation. However, given the grouping of R04, R05, and R06, it was considered appropriate to assess R04 as 'Category 1' for proximity to transportation. Similarly, R19 and R20 are approximately 25m from the rail line and could be assessed as "Category 3" for proximity to transportation. However, since these are representative of dwellings within the hamlet

[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 30m, but less than 500m from heavily travelled roads or rail lines and not subject to frequent aircraft flyovers.
[5] Category 3—dwelling(s) distance is less than 30m from heavily travelled roads, or rail lines or subject to frequent aircraft flyovers.

of chin, which are mostly located further than 30m away from the rail line, both R19 and R20 receptors are assessed as 'Category 2' for proximity to transportation.

Receptors R12-R22 represent the residential area of the Hamlet of Chin, with 9 to 160 dwellings per quarter section of land. Therefore, these receptors have been assessed as 'Category 2' for dwelling density.

4.5.2 Determination of Ambient Sound Level (ASL)

The Project is located in an area typical of rural Alberta that includes Hamlet of Chin. The surrounding area is typical of a rural farmland environment and includes the McCain Facility. 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 between 35-43dB(A) and a daytime ASL of 45-53dB(A) for the assessed receptors. BSL and ASL for night-times and daytimes for each receptor are given in Table 4-3.

4.5.3 Determination of Permissible Sound Level (PSL)

For each receptor, the PSL is determined using 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, ASLs, and PSLs for night-time (NT) and daytime (DT) for each location are given in Table 4-3.

Table 4-3 – Daytime and Night-time BSL, ASL, and PSL

Receptor ID	Transportation Category	Dwelling Category	BSL	ASL		PSL	
			NT/DT	NT	DT	NT	DT
R01	2	1	45	40	50	45	55
R02	2	1	45	40	50	45	55
R03	2	1	45	40	50	45	55
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
R09	1	1	40	35	45	40	50
R10	1	1	40	35	45	40	50
R11	1	1	40	35	45	40	50
R12	2	2	48	43	53	48	58

[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.

Receptor ID	Transportation Category	Dwelling Category	BSL	ASL		PSL	
			NT/DT	NT	DT	NT	DT
R13	2	2	48	43	53	48	58
R14	2	2	48	43	53	48	58
R15	2	2	48	43	53	48	58
R16	2	2	48	43	53	48	58
R17	2	2	48	43	53	48	58
R18	2	2	48	43	53	48	58
R19	2	2	48	43	53	48	58
R20	2	2	48	43	53	48	58
R21	2	2	48	43	53	48	58
R22	2	2	48	43	53	48	58
R23	2	1	45	40	50	45	55
R24	1	1	40	35	45	40	50
R28	1	1	40	35	45	40	50

4.6 Total Baseline Sound Levels

Baseline sound levels include the noise contributions from adjacent approved and existing third-party energy-related facilities and the ambient sound level assessed for the local environment. Due to the absence of active or approved third-party regulated energy-related facilities located in the study area, the baseline sound levels are equal to the ambient sound levels for both night-time and daytime periods at each receptor. Table 4-4 shows the baseline sound levels for night-time and daytime periods.

Table 4-4 – Cumulative Baseline Sound Levels for Night-time (NT) and Daytime (DT) Periods

Receptor ID	ASL		Baseline	
	NT	DT	NT	DT
R01	40	50	40	50
R02	40	50	40	50
R03	40	50	40	50
R04	35	45	35	45
R05	35	45	35	45
R06	35	45	35	45
R07	35	45	35	45
R09	35	45	35	45

Receptor ID	ASL		Baseline	
	NT	DT	NT	DT
R10	35	45	35	45
R11	35	45	35	45
R12	43	53	43	53
R13	43	53	43	53
R14	43	53	43	53
R15	43	53	43	53
R16	43	53	43	53
R17	43	53	43	53
R18	43	53	43	53
R19	43	53	43	53
R20	43	53	43	53
R21	43	53	43	53
R22	43	53	43	53
R23	40	50	40	50
R24	35	45	35	45
R28	35	45	35	45

5 Project Sound Levels

The wind turbines, the inverters, and the MV transformer are assessed to be the only significant noise producing Project elements. As such, no other Project elements are considered in this assessment. Sound power level data provided for the significant noise producing Project elements was used to model sound emissions for both daytime and night-time periods. For the purposes of this assessment, the noise producing Project elements are assumed to operate at full load 24 hours a day. This assumption is conservative for the solar PV facility, which will generally operate when the sun is out during daytime hours. The wind turbines could operate at any time, but in practice, they are not expected to operate continuously at full load.

5.1 Wind Turbine Generators

The wind turbine generator model to be used for the Project has not yet been finalized. GCR has evaluated the turbine models under consideration and found that the Nordex N163 5.9MW turbines have the most significant noise impacts on the assessed receptors. Therefore, the Nordex N163 5.9MW model, with a hub height of 125m, a rotor diameter of 163m, and rated power of 5.9 MW, was used in this assessment.

Three of the five turbines (T01, T02, T03, as shown in **Figure 4-1**) were modelled with blades featuring trailing edge serration to lower the predicted sound levels at the nearby residences.

According to the one-third octave band data from the manufacturer[7], the maximum sound power level for the Nordex N163 5.9MW turbine is 109.2 dB(A) without trailing edge serration on the blades, and 107.2 dB(A) with this feature. For this assessment, the sound power level at a hub height wind speed of 7m/s was used for turbines without trailing edge serration, while a wind speed of 8m/s at hub height was used for turbines with trailing edge serration, as these conditions represent their respective maximum sound power level. These are very conservative assumptions, as in practice, there will be periods when the Project turbines operate at lower wind speed or are in standby mode, during which the sound emissions from the turbines will be much lower than the peak sound output levels.

5.2 Solar PV Facility

5.2.1 Inverters

The inverter units proposed for the solar PV facility are the Sungrow SG350HX units. The sound power levels of 83.6 dB(A) for the SG350HX units, when operating at 100% power, were provided by the manufacturer[8].

5.2.2 MV Transformer

The proposed MV transformer for the PV electricity generating facility is expected to have a capacity of up to 6 MVA. Although the manufacturer has not yet been selected and specific sound levels for the transformer are currently unavailable, it is anticipated that transformer sound levels will be significantly lower than those of the wind turbine generators, thereby contributing a negligible amount to the cumulative sound levels. Nevertheless, a typical transformer of a suitable type was modelled for the assessment.

[7] Third Octave Sound Power levels Nordex N163/5.X VPC Revision 09, Nordex Energy SE & Co. KG, June 26, 2023

[8] SG320HX (including SG350HX, SG350HX-US, SG200HX-US, SG333HX, SG285HX) Sound Power Level and Sound Pressure Level Test Evaluation Report, Sungrow Power Supply Co., Ltd., Test date: September 21, 2023

The linear 'A' and 'C' frequency weighted octave band sound power spectra for the 6 MVA[9] transformers used in the Project area is shown in Table 5-1.

Table 5-1 – Octave Band Sound Power Levels for the 6 MVA transformers based on theoretical prediction methods[10,11]

Octave Band Frequency (Hz)	Sound Power (dB)	Sound Power (dBA)	Sound Power (dBC)
31.5	89.0	49.6	86.0
63	84.0	57.8	83.2
125	86.0	69.9	85.8
250	82.0	73.4	82.0
500	81.0	77.8	81.0
1000	70.0	70.0	70.0
2000	63.0	64.2	62.8
4000	58.0	59.0	57.2
8000	52.0	50.9	49.0
Sum	**92.4**	**80.3**	**91.1**

5.3 Modelling Results

Predicted sound levels for the Project are shown in Table 5-2. The results assume full load operation 24 hours a day and are applicable to night-time and daytime periods. Predicted levels less than zero dB(A) are denoted by a dash in the below table.

Table 5-2 – Predicted Project Case Sound Levels

Receptor ID	Project Sound Level – Wind Turbines (dB(A))	Project Sound Level – Solar PV Facility (dB(A))	Project Sound Level – Total (dB(A))
R01	39.0	8.6	39.0
R02	33.3	8.1	33.3
R03	32.1	7.5	32.1
R04	37.6	14.2	37.6
R05	35.2	12.5	35.2
R06	34.7	12.2	34.7

[9]Coaldale has not yet finalized the transformer size. For a conservative assessment, a 6 MVA transformer was included in the assessment.
[10]*Handbook of Noise and Vibration Control* (Crocker, M., 2007).
[11]*Toward a Realistic Estimate of Octave Band Sound Levels for Electric Transformer* (Stevens, R. and Hung, C., 2010).

Receptor ID	Project Sound Level – Wind Turbines (dB(A))	Project Sound Level – Solar PV Facility (dB(A))	Project Sound Level – Total (dB(A))
R07	34.7	15.6	34.8
R09	36.4	12.5	36.4
R10	30.4	7.8	30.4
R11	30.8	8.2	30.8
R12	38.0	10.5	38.0
R13	38.4	9.5	38.4
R14	38.8	10.1	38.8
R15	39.0	10.9	39.0
R16	37.9	11.2	37.9
R17	39.6	10.9	39.6
R18	37.8	9.4	37.8
R19	39.4	8.9	39.4
R20	37.8	8.3	37.8
R21	39.2	7.1	39.2
R22	39.9	6.7	39.9
R23	35.5	-	35.5
R24	35.4	-	35.4
R28	32.0	-	32.0

Receptor R22 is expected to be the receptor most impacted by noise from the Project, having a maximum sound pressure level of 39.9dB(A). Project sound level contours are shown in Appendix C.

5.4 Low Frequency Assessment

Table 5-3 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 below the Rule 012 criterion of 20dB. This indicates that low frequency noise is not expected to be an issue.

Table 5-3 – Low Frequency Noise Assessment

Receptor ID	Predicted Sound Level (dB(A))	Predicted Sound Level (dBC)	Difference (dBC – dB(A))
R01	39.0	54.3	15.3
R02	33.3	51.0	17.7
R03	32.1	50.2	18.1
R04	37.6	53.2	15.6

Receptor ID	Predicted Sound Level (dB(A))	Predicted Sound Level (dBC)	Difference (dBC – dB(A))
R05	35.2	52.5	17.3
R06	34.7	52.1	17.4
R07	34.8	51.0	16.3
R09	36.4	52.2	15.8
R10	30.4	48.9	18.5
R11	30.8	49.2	18.4
R12	38.0	53.3	15.3
R13	38.4	53.5	15.1
R14	38.8	53.9	15.1
R15	39.0	54.2	15.2
R16	37.9	54.3	16.4
R17	39.6	54.7	15.1
R18	37.8	54.0	16.2
R19	39.4	54.1	14.7
R20	37.8	53.7	15.9
R21	39.2	54.4	15.2
R22	39.9	54.9	15.0
R23	35.5	50.4	14.9
R24	35.4	50.0	14.6
R28	32.0	48.7	16.7

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 (dB(A))		Project Sound Level (dB(A))		Cumulative Sound Level (dB(A))		PSL (dB(A))		PSL Compliance Margin (dB)	
	NT	DT	NT	DT	NT	DT	NT	DT	NT	DT
R01	40.0	50.0	39.0	39.0	42.5	50.3	45	55	2	5
R02	40.0	50.0	33.3	33.3	40.8	50.1	45	55	4	5
R03	40.0	50.0	32.1	32.1	40.7	50.1	45	55	4	5
R04	35.0	45.0	37.6	37.6	39.5	45.7	40	50	0	4
R05	35.0	45.0	35.2	35.2	38.1	45.4	40	50	2	5
R06	35.0	45.0	34.7	34.7	37.9	45.4	40	50	2	5
R07	35.0	45.0	34.8	34.8	37.9	45.4	40	50	2	5
R09	35.0	45.0	36.4	36.4	38.8	45.6	40	50	1	4
R10	35.0	45.0	30.4	30.4	36.3	45.1	40	50	4	5
R11	35.0	45.0	30.8	30.8	36.4	45.2	40	50	4	5
R12	43.0	53.0	38.0	38.0	44.2	53.1	48	58	4	5
R13	43.0	53.0	38.4	38.4	44.3	53.1	48	58	4	5
R14	43.0	53.0	38.8	38.8	44.4	53.2	48	58	4	5
R15	43.0	53.0	39.0	39.0	44.5	53.2	48	58	4	5
R16	43.0	53.0	37.9	37.9	44.2	53.1	48	58	4	5
R17	43.0	53.0	39.6	39.6	44.6	53.2	48	58	3	5
R18	43.0	53.0	37.8	37.8	44.1	53.1	48	58	4	5
R19	43.0	53.0	39.4	39.4	44.6	53.2	48	58	3	5
R20	43.0	53.0	37.8	37.8	44.1	53.1	48	58	4	5
R21	43.0	53.0	39.2	39.2	44.5	53.2	48	58	3	5
R22	43.0	53.0	39.9	39.9	44.7	53.2	48	58	3	5
R23	40.0	50.0	35.5	35.5	41.3	50.2	45	55	4	5
R24	35.0	45.0	35.4	35.4	38.2	45.5	40	50	2	5

Receptor ID	Baseline Sound Level (dB(A))		Project Sound Level (dB(A))		Cumulative Sound Level (dB(A))		PSL (dB(A))		PSL Compliance Margin (dB)	
	NT	DT	NT	DT	NT	DT	NT	DT	NT	DT
R28	35.0	45.0	32.0	32.0	36.8	45.2	40	50	3	5

The cumulative sound levels at all assessed receptors are determined to be compliant with the requirements of AUC Rule 012, though the PSL compliance margin at the most impacted receptors asd dB. However, the cumulative sound level calculated at all receptors is considered to be conservative, as it assumes the following:

- All five proposed turbines operating at full power output, which only happens for a proportion of the time when hub height wind speed is 7m/s or higher for turbines without trailing edge serration, and 8m/s or higher for turbines with trailing edge serration. In reality, the Project turbines will often operate at lower wind speeds or may even be in standby mode, during which the sound emissions will be significantly lower than the maximum output levels.
- The solar PV facility operating at full load throughout both daytime and night-time hours. In reality, the solar PV facility will never operate at full sound output during the night-time hours due to lower electricity generation as well as lower than average ambient temperature.
- All receptors are simultaneously downwind of all Project infrastructure during operation and therefore receive maximum sound levels. In reality, receptors would not be simultaneously downwind of all nearby Project infrastructure and receptor levels will be attenuated when they are upwind.

7 Conclusions

Twenty-four receptors, located within approximately 1.5km from the center point of the tower of the closest Project wind turbine, or approximately 1.5km from the boundary of the solar PV facility, were identified as having the potential to be impacted by sound emitted from the proposed Project. Worse case sound power levels were used to model sound emissions from the Project during day and night periods.

While the wind turbines could operate at anytime, the solar PV facility generally operates 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 facility may operate during the defined night-time period.

The noise impact assessment is considered to be conservative, as it assumes that all five turbines and the solar PV facility are operating at full power output all day and night. Therefore, the assessment considers worst-case (full load operation) noise emission levels year-round (24/7). In practice, there will be periods when the Project turbines operate at lower wind speed or are in standby mode, and when the solar PV facility is in standby mode. During these times, the sound emissions from both the turbines and the solar PV facility will be much lower than the peak sound output levels assumed throughout this assessment. Additionally, the noise model assumes that all receptors are simultaneously downwind of all Project infrastructure during operation.

Cumulative sound levels at all receptors considered in this NIA were assessed to be at or below PSLs. A LFN assessment determined that the sound from the proposed Project is not expected to produce any significant LFN effects. As such, for all 24 receptors identified and modelled, compliance with AUC Rule 012 requirements was demonstrated.

It is therefore concluded that the proposed Coaldale Renewable Energy Project 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) author	• Discipline lead • Acoustic noise modelling • Fieldwork lead • Noise Impact Assessment (NIA) Technical Checker	• Technical Assessment Lead • Noise Impact Assessment (NIA) Technical Approver
Experience	• 3 years of experience with acoustic modelling in CadnaA to model renewable energy projects in Alberta. • Analyst on multiple noise assessments for renewable energy projects in Alberta (2021-Present). • 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 and wind 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 dB(A). 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 dB(A) less than the basic sound level and the daytime ambient sound level is assumed to be 5 dB(A) 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 dB(A)). 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 dB(A) increase because daytime ambient sound levels are generally about 10 dB(A) 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 dB(A) 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 dB(A) drop from the band containing the tone within two bandwidths on the opposite side.

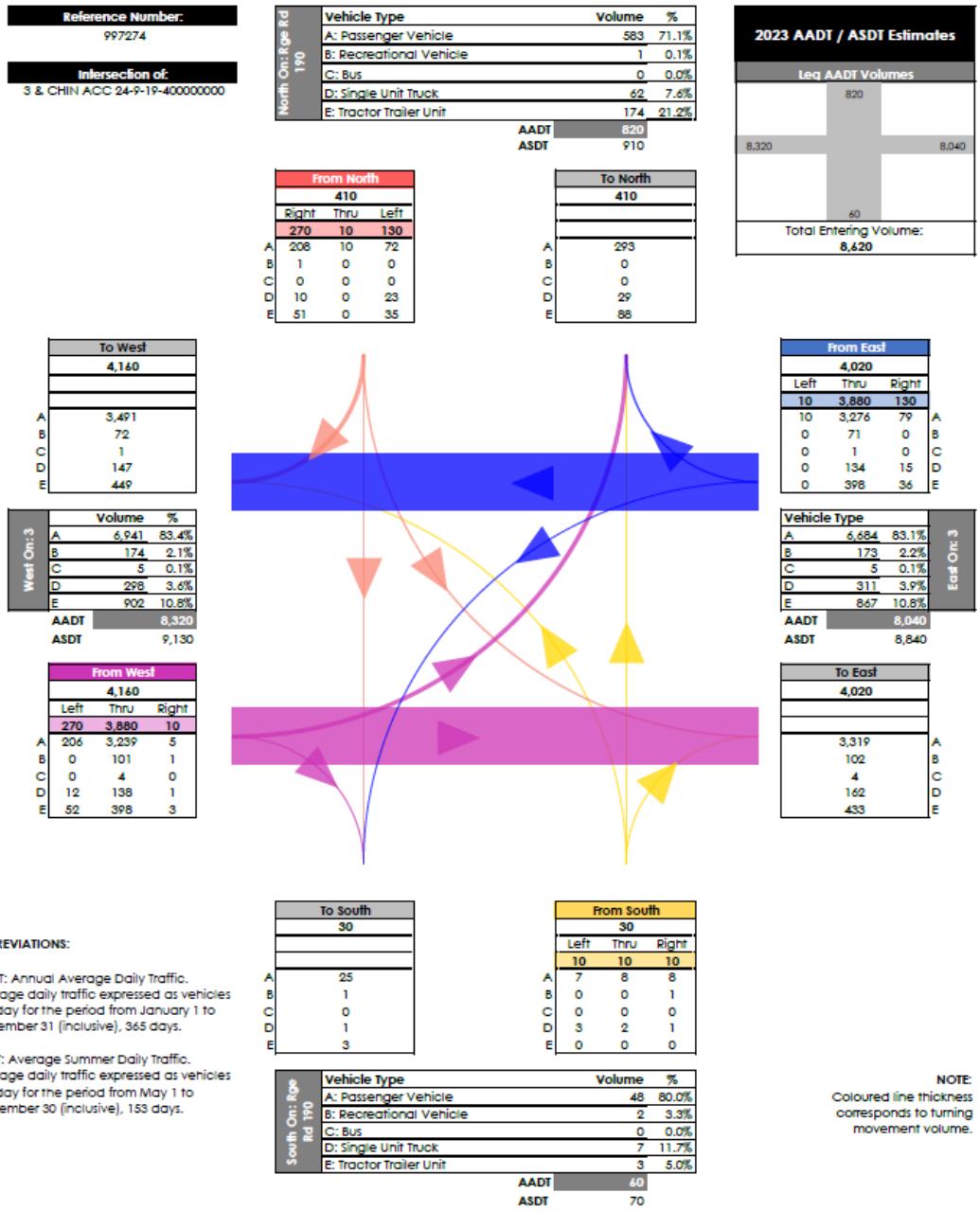
The second part is that the tonal component must be a pronounced peak clearly obvious within the spectrum.

Wind speed

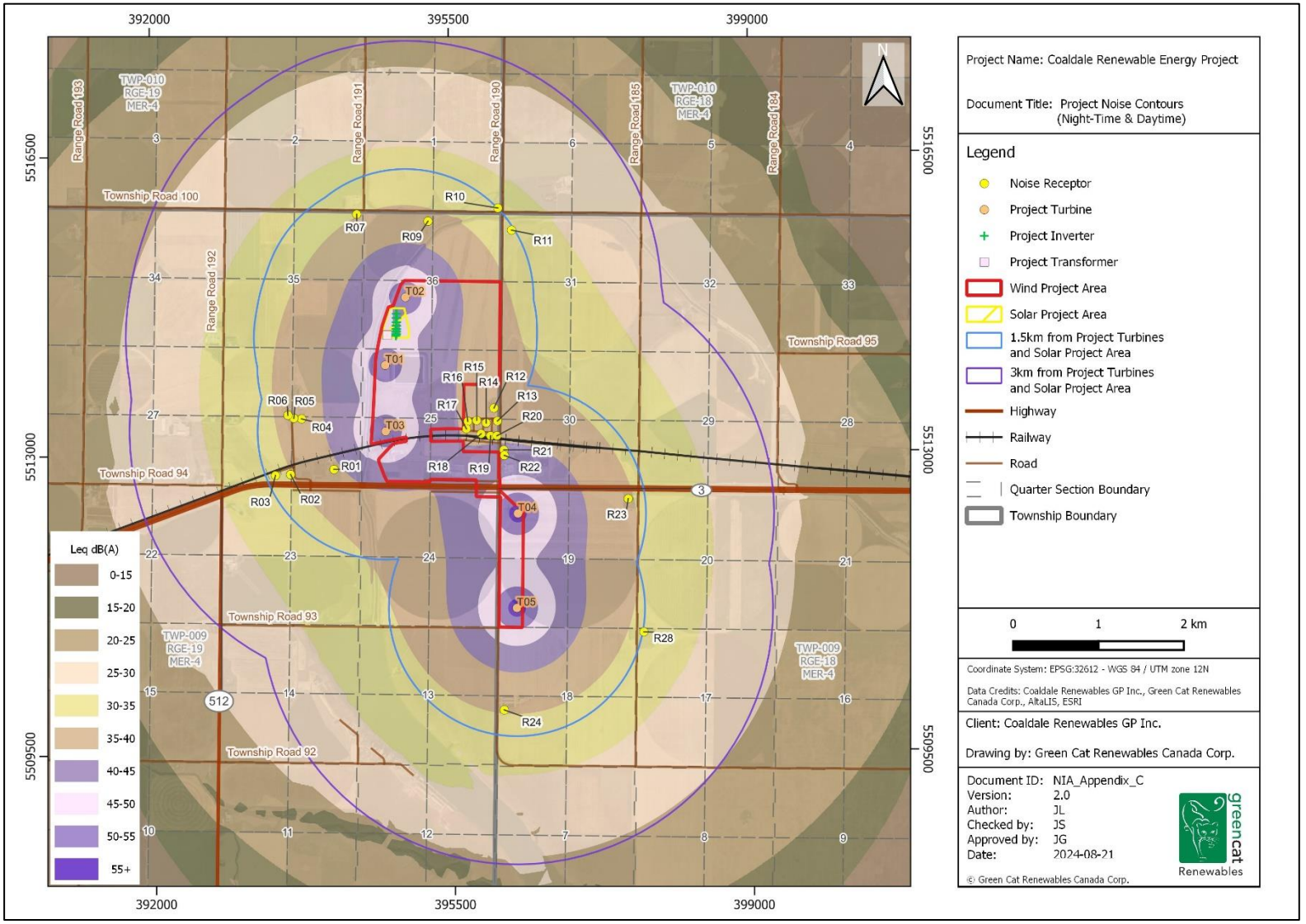
The speed of the wind, expressed in metres per second (m/s), measured in and averaged over 10-minute intervals at the same height as the microphone, but not more than 10 metres above ground level.

Appendix B: Alberta Traffic Volume History

The following chart shows the relevant section of the traffic volume history for the portion of Highway 3 cuts across the site south of the Hamlet of Chin. 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 on Highway 3.



Appendix C: Project Sound Level Contours



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