Northern Valley Wind Project

Noise Impact Assessment

Client: Northern Valley Wind Limited Partnership
Reference: 22-041
Version 1.0

November 2023

Report Prepared for:
Northern Valley Wind Limited Partnership

Author:
Justin Lee

Checked by	Cameron Sutherland	Date	November 2nd, 2023
Reviewed and Approved by	Merlin Garnett	Date	November 2nd, 2023
Issued by	Steph Wood	Date	November 3rd, 2023

Issue History	Date	Details
V1.0	November 3rd, 2023	Final for Issue

Executive Summary

Northern Valley Wind Limited Partnership. (Northern Valley Wind LP) propose to install the Northern Valley Wind Project (the Project), a wind project with a proposed capacity of up to 76.5 megawatts (MW_{AC}), located approximately 9km southeast of the town of Elk Point, Alberta within the municipalities of St. Paul County No. 19, Two Hills County No. 21, and Vermillion River County No. 24.

Northern Valley Wind LP retained Green Cat Renewables Canada Corporation (GCR) to conduct a noise impact assessment (NIA) of the Project, which will consist of up to 17 Vestas V163-4.5 MW wind turbine generators. The wind turbines are assumed to be the only significant noise producing Project elements. As such, no other Project elements are considered in this assessment.

Twenty-four habitable structures were identified within the Project study area; however, only 22 of those structures were found to be dwellings that are noise sensitive. GCR conducted a site visit to verify the location and type of dwellings and verify the status, type and emission levels of all third-party energy related facilities operating within 3km of the Project.

A software model was used to predict sound levels from existing regulated facilities, proposed/existing third-party projects and the proposed Project to determine compliance with the Alberta Utilities Commission (AUC) Rule 012 requirements. As predicted sound levels were less than 3dB below the Permissible Sound Level (PSL) for night-time periods, a detailed noise assessment was carried out as per the AUC Rule 012, Appendix 3 - Summary report, recommendations.

Cumulative sound levels at dwellings were assessed, inclusive of sound from existing and approved regulated third-party energy-related facilities, the proposed Project, and ambient sources. The assessment concluded that the utilization of noise reduction modes at three of the 17 proposed turbine locations will be required for the Project to achieve compliance with the Permissible Sound Levels established in Rule 012, during night-time operation. Noise reduction was not required for daytime operation.

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

Northern Valley Wind LP has confirmed that the three turbine locations identified will be operated in noise reduction modes during the night-time hours. The proposed Northern Valley Wind Project is therefore assessed to meet the requirements of AUC Rule 012.

Table of Contents

1 Introduction

Northern Valley Wind Limited Partnership (Northern Valley Wind LP) retained Green Cat Renewables Canada Corporation (GCR) to conduct a noise impact assessment (NIA) for the proposed Northern Valley Wind Project (the Project). The Project will have a generation capacity of up to 76.5 megawatts (MW_{AC}), located approximately 9km southeast of the town of Elk Point, Alberta. The Project boundary spans across three municipalities: St. Paul County No. 19, Two Hills County No. 21, and Vermillion River County No. 24. The Project location is shown in Figure 1-1 below. The assessment considered the cumulative impact of existing and proposed noise sources on nearby receptors.

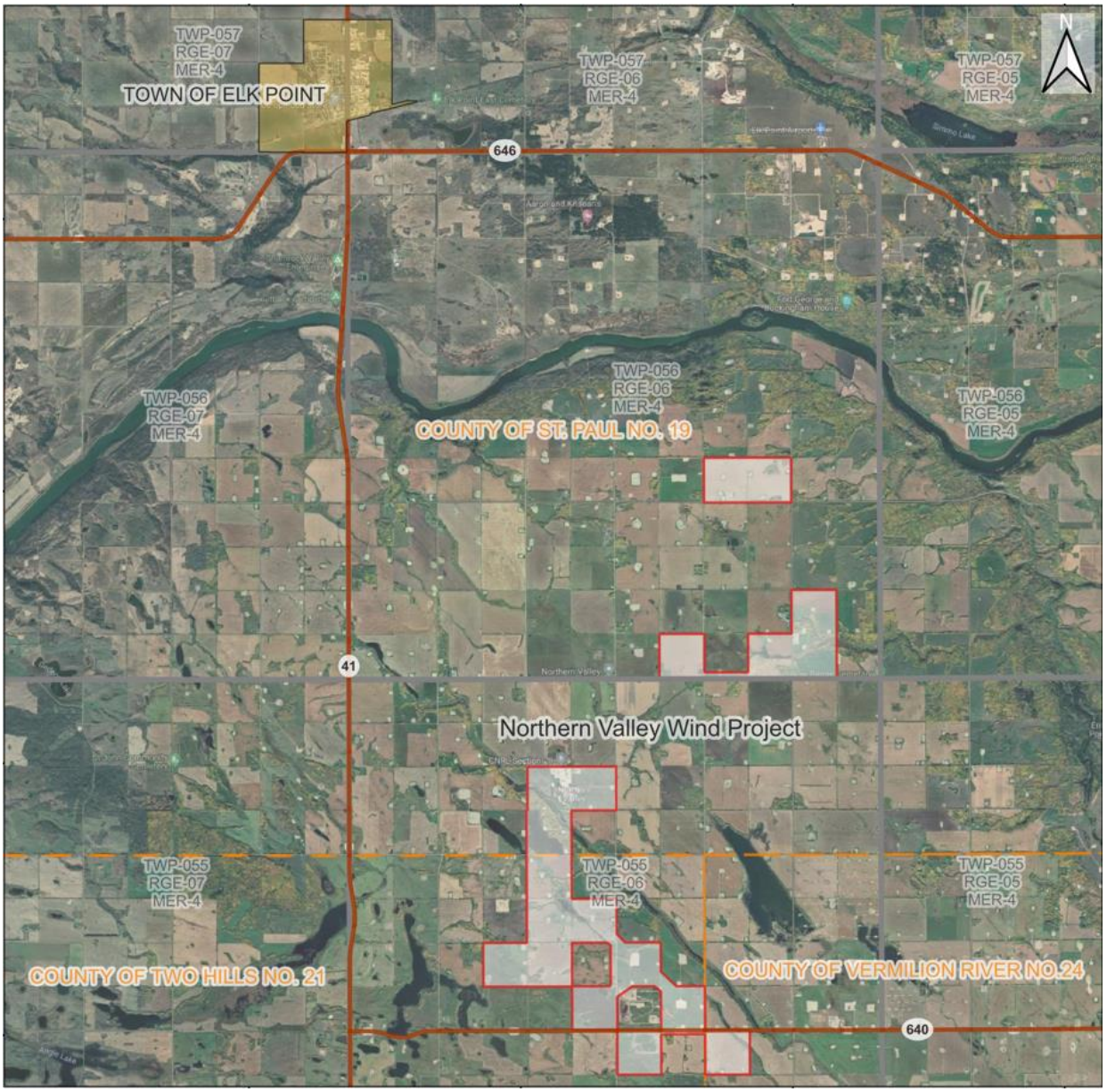


Figure 1-1 – Northern Valley Wind Project Location

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 (3km from the proposed Project turbine locations).
- 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 from the center point of the tower of the closest wind turbine, or from the boundary of a substation.
- In the instance where no noise receptor(s) was identified within 1.5km from the wind turbine or from the boundary of a substation, assess at the 1.5km boundary.

For each noise receptor:

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

3 Noise Model

All noise propagation calculations were performed using CadnaA v2023 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	Yes[2]
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[3]
Number of Sound Reflections	1
Receptor Height	1.5m (for one-story) 4.5m (for two-story)
Operational Condition Assumption	Full load
Source Height	125m for V163-4.5 turbines

Wind turbines typically operate at 30-40% capacity factor and propagation upwind is attenuated compared to downwind propagation. However, the noise model assumed all plant to be operating at full load and for simultaneous downwind propagation between all sources and all receptors. Both of these assumptions are therefore representative of a worst-case scenario that is unlikely to occur in practice.

[1] Data obtained from AltaLIS.

[2] Existing sound attenuation walls installed between the noise producing sources and the nearest receptor at three well pads have been included in the noise model. The effectiveness of these sound attenuation walls was evaluated via field measurement

[3] Ground Attenuation of 0.5 represents mix grounds.

4 Baseline

4.1 Study Area

The study area includes rural/agricultural land, waterbodies, and other wetlands.

24 potentially habitable structures were identified within the 1.5km boundary criterion. Of these 24 structures, 22 meet the definition of a dwelling, as outlined in Rule 012, and have been assessed for cumulative noise impacts from the Project and other adjacent facilities.

The other two structures have been confirmed to be non-residential structures used by operators in the area. The proponent has confirmed with the owners and lessees of the properties, that the structure will not be used for habitation or human rest.

4.2 Project Description

The Project will consist of 17 Vestas V163-4.5MW wind turbine generators with a total capacity of up to 76.5 MW_{AC}. The specified rotor diameter and hub height are 163m and 125m, respectively. All 17 turbines have been assumed to include blades with serrated trailing edges; a technology that reduces the sound power of aerodynamic emissions.

4.3 Sensitive Receptors

Residential dwellings located within 1.5km from the center point of the tower of the closest Project wind turbine, including those that are regarded as having the potential to be the most impacted by the proposed Project, were identified during a site visit conducted by GCR in May 2023. The heights of the identified dwellings were found to be either one-storey or two-storey. To provide a conservative assessment, any dwellings with the potential to be considered as higher than a one-story dwelling were modelled at a two-story elevation of 4.5m. Upon completion of the site visit, twenty-four dwellings located within 1.5km from the center point of the tower of the closest Project wind turbine were identified.

The 22 dwellings, confirmed as being residential, were included in the NIA and assessment positions were placed at each of these dwellings in the noise model. Table 4-1 shows the location details and the height of each dwelling identified during the site visit. Figure 4-1, included at the end of this section, shows the location of dwellings listed in Table 4-1.[4]

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	511831	5957236	Two-Storey	4.5m	700m E
R02	510887	5954965	One-Storey	1.5m	870m SW

[4] Note that R23 and R24 labeled on the map are the two structures identified as non-residential structures, neither are considered dwellings, and neither have been assessed for noise impacts.

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)			
R03	510428	5955129	One-Storey	1.5m	1230m W
R04	508671	5956179	One-Storey	1.5m	1210m W
R05	510028	5959784	Two-Storey	4.5m	1090m W
R06	511801	5954038	Two-Storey	4.5m	1050m SW
R07	514922	5954977	Two-Storey	4.5m	1340m NE
R08	514607	5955158	Two-Storey	4.5m	1160m NE
R09	511667	5961503	One-Storey	1.5m	1130m SW
R10	511817	5962532	One-Storey	1.5m	1190m NW
R11	513312	5963518	Two-Storey	4.5m	1300m N
R12	513288	5960505	Two-Storey	4.5m	1380m SE
R13	516675	5961980	Two-Storey	4.5m	1330m E
R14	514918	5962757	Two-Storey	4.5m	860m SW
R15	515051	5963904	Two-Storey	4.5m	1050m NW
R16	513878	5961511	One-Storey	1.5m	1140m SE
R17	515009	5966394	One-Storey	1.5m	1440m NE
R18	515023	5966446	One-Storey	1.5m	1490m NE
R19	511514	5958355	One-Storey	1.5m	1010m NE
R20	513393	5965843	One-Storey	1.5m	910m N
R21	513402	5963045	One-Storey	1.5m	890m NE
R22	516218	5961422	One-Storey	1.5m	900m SE

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 by GCR in May 2023. The AER's Facilities list (ST102) and Wells list (ST037) were consulted for the AER regulated facilities and wells, and the AUC eFiling portal was used to identify any existing and approved AUC regulated facilities. GCR initially identified over 100 AER regulated facilities and pumping wells within 3km of the Project turbines. Additionally, two AUC regulated facilities have been identified and included in the assessment.

Having completed a desktop search, GCR personnel also conducted a site visit in May 2023 to confirm the location and operational status of the facilities and pumping wells identified. GCR personnel recorded site details and took noise measurements at all active noise producing AER facilities and wells.

During the site visit, GCR found that three well pads containing facilities; AER15, AER18, AER33, AER70, AER89, and AER113, had sound attenuation walls installed between the noise producing sources and the nearest receptor. The effectiveness of these sound attenuation walls was evaluated via measurement and the barriers have been included in the noise model.

Table 4-2 lists the active facilities and pumping wells identified within 3km of the Project through both the AER databases and during the site visit.

Table 4-2 – Third-Party Sound Sources

Label	Operator Name	Type of Active Facilities	UTM Coordinates (NAD 83, Zone 12N)	
			Easting (m)	Northing (m)
AER01	Caltex Trilogy Inc.	Source Not Found During the Site Visit (listed as Crude Bitumen Single-Well battery in ST102)	516468	5960173
AER02	Canadian Natural Resources Limited	Engine Skid	508434	5958442
		Compressor	508415	5958444
AER03	Canadian Natural Resources Limited	Compressor	513652	5961676
AER04	Canadian Natural Resources Limited	Compressor	515732	5965375
AER05	Canadian Natural Resources Limited	Source Not Operating During the Site Visit (listed as Crude Bitumen Multiwell Group battery in ST102)	513469	5961249
AER06	Canadian Natural Resources Limited	Engine Skid	513672	5962489
		Compressor	513662	5962489
AER07	Canadian Natural Resources Limited	Compressor	517100	5965872
AER08	Canadian Natural Resources Limited	Engine Skid	515181	5967519
		Compressor	515178	5967530

Label	Operator Name	Type of Active Facilities	UTM Coordinates (NAD 83, Zone 12N)	
			Easting (m)	Northing (m)
AER09	Canadian Natural Resources Limited	Compressor	510481	5960402
AER10	Canadian Natural Resources Limited	Source Not Operating During the Site Visit (listed as Crude Bitumen Multiwell Group battery in ST102)	513990	5958211
AER11	Canadian Natural Resources Limited	Compressor	508809	5961371
AER12	Canadian Natural Resources Limited	Compressor	510862	5964404
AER13	Canadian Natural Resources Limited	Engine Skid	510622	5956127
		Compressor	510640	5956136
AER14	Canadian Natural Resources Limited	Compressor	508024	5959171
AER15	Canadian Natural Resources Limited	Engine Skid	513812	5959579
AER16	Canadian Natural Resources Limited	Engine Skid	507587	5956614
AER17	Canadian Natural Resources Limited	Compressor	507575	5957024
AER18	Canadian Natural Resources Limited	Compressor	514923	5963635
AER19	Canadian Natural Resources Limited	Engine Skid	507595	5958576
		Compressor	507572	5958562
AER20	Canadian Natural Resources Limited	Compressor	508193	5956982
AER21	Canadian Natural Resources Limited	Engine Skid	509367	5956015
		Compressor	509359	5956019
AER22	Canadian Natural Resources Limited	Engine Skid	508258	5957890
		Compressor	508257	5957877
AER23	Canadian Natural Resources Limited	Compressor	507618	5959204
AER24	Canadian Natural Resources Limited	Engine Skid	510201	5955294
		Compressor	510214	5955300

Label	Operator Name	Type of Active Facilities	UTM Coordinates (NAD 83, Zone 12N)	
			Easting (m)	Northing (m)
AER25	Canadian Natural Resources Limited	Gas Gathering System	510660	5956096
AER26	Canadian Natural Resources Limited	MCCBuilding	508258	5957884
AER27	Canadian Natural Resources Limited	Source Not Operating During the Site Visit (listed as Gas Gathering System in ST102)	510532	5959927
AER28	Canadian Natural Resources Limited	Gas Gathering System	510660	5956096
AER29	Canadian Natural Resources Limited	Gas Gathering System	510660	5956096
AER30	Canadian Natural Resources Limited	Gas Gathering System	510660	5956096
AER31	Canadian Natural Resources Limited	Compressor	507598	5957596
AER32	Canadian Natural Resources Limited	Compressor	515374	5962793
AER33	Canadian Natural Resources Limited	Compressor	515219	5962116
AER34	Canadian Natural Resources Limited	Compressor	509634	5962111
AER35	Canadian Natural Resources Limited	Source Not Operating During the Site Visit (listed as Crude Bitumen Single-Well battery in ST102)	512664	5960143
AER36	Canadian Natural Resources Limited	Compressor	514571	5962247
AER37	Canadian Natural Resources Limited	Source Not Operating During the Site Visit (listed as Crude Bitumen Single-Well battery in ST102)	510916	5959283
AER38	Canadian Natural Resources Limited	Compressor	510926	5959287
AER39	Canadian Natural Resources Limited	Compressor	516170	5962417
AER40	Canadian Natural Resources Limited	Engine Skid	513089	5954775
AER41	Canadian Natural Resources Limited	Source Not Operating During the Site Visit (listed as Crude Bitumen Single-Well battery in ST102)	514548	5960807

Label	Operator Name	Type of Active Facilities	UTM Coordinates (NAD 83, Zone 12N)	
			Easting (m)	Northing (m)
AER42	Canadian Natural Resources Limited	Compressor	508982	5956759
AER43	Canadian Natural Resources Limited	Engine Skid	511145	5958805
AER44	Canadian Natural Resources Limited	Compressor	513919	5954005
AER45	Canadian Natural Resources Limited	Compressor	511315	5956735
AER46	Canadian Natural Resources Limited	Facility Shutdown (listed as Cavern Waste Facility in ST102)	510723	5959732
AER47	Canadian Natural Resources Limited	Facility Shutdown (listed as Cavern Waste Facility in ST102)	511126	5959733
AER48	Canadian Natural Resources Limited	Facility Shutdown (listed as Water Source in ST102)	512335	5965008
AER49	Canadian Natural Resources Limited	Facility Shutdown (listed as Water Source in ST102)	512335	5965008
AER50	Gas Alberta Inc.	Facility Shutdown (listed as Interconnect Receipt in ST102)	512375	5955295
AER51	Gear Energy Ltd.	Source Not Found During the Site Visit (listed as Crude Bitumen Multiwell battery in ST102)	507878	5954459
AER52	Secure Energy Services Inc.	Facility Shutdown (listed as Disposal in ST102)	512375	5955295
AER53	Secure Energy Services Inc.	Facility Shutdown (listed as Tank Farm/Oil Loading and Unloading Terminal in ST102)	512375	5955295
AER54	Secure Energy Services Inc.	Facility Shutdown (listed as Surface Waste Facility in ST102)	512375	5955295
AER55	Secure Energy Services Inc.	Facility Shutdown (listed as Water Source in ST102)	512375	5955295
AER56	Secure Energy Services Inc.	Facility Shutdown (listed as Water Source in ST102)	512375	5955295
AER57	Secure Energy Services Inc.	Facility Shutdown (listed as Water Source in ST102)	512375	5955295
AER58	Secure Energy Services Inc.	Facility Shutdown (listed as Water Source in ST102)	512375	5955295
AER59		Engine Skid	515358	5952580

Label	Operator Name	Type of Active Facilities	UTM Coordinates (NAD 83, Zone 12N)	
			Easting (m)	Northing (m)
	Canadian Natural Resources Limited	Compressor	515362	5952595
AER60	Canadian Natural Resources Limited	Compressor	510774	5966139
AER61	Canadian Natural Resources Limited	Compressor	514782	5960342
AER62	Canadian Natural Resources Limited	Source Not Found During the Site Visit (listed as Crude Bitumen Single-Well battery in ST102)	517764	5960536
AER63	Canadian Natural Resources Limited	Source Not Operating During the Site Visit (listed as Crude Bitumen Single-Well battery in ST102)	515349	5959869
AER64	Gear Energy Ltd.	Source Not Operating During the Site Visit (listed as Crude Bitumen Multiwell battery in ST102)	516796	5966621
AER65	Secure Energy Services Inc.	Source Not Found During the Site Visit (listed as Water Source in ST102)	511503	5966613
AER66	Caltex Trilogy Inc.(A8RK)	Engine Skid	516476	5960180
AER67	Canadian Natural Resources Limited	Engine Skid	513921	5954006
AER68	Canadian Natural Resources Limited	Engine Skid	511328	5956734
AER69	Canadian Natural Resources Limited	Engine Skid	515373	5962805
AER70	Canadian Natural Resources Limited	Engine Skid	515212	5962124
AER71	Canadian Natural Resources Limited	Engine Skid	516166	5962422
AER72	Canadian Natural Resources Limited	Engine Skid	510920	5959276
AER73	Canadian Natural Resources Limited	Engine Skid	508410	5958444
		Engine Skid	508428	5958443
		Compressor	508420	5958443
AER74	Canadian Natural Resources Limited	Engine Skid	511126	5958798
AER75	Canadian Natural Resources Limited	Engine Skid	510626	5956127

Label	Operator Name	Type of Active Facilities	UTM Coordinates (NAD 83, Zone 12N)	
			Easting (m)	Northing (m)
AER76	Canadian Natural Resources Limited	Source Not Operating During the Site Visit (listed as Pumping Well in ST37)	512664	5960143
AER77	Canadian Natural Resources Limited	Engine Skid	510480	5960394
		Wellhead*	510477	5960395
AER78	Canadian Natural Resources Limited	Engine Skid	511171	5964361
		Compressor	511178	5964354
AER79	Canadian Natural Resources Limited	Source Not Operating During the Site Visit (listed as Pumping Well in ST37)	513591	5961253
AER80	Canadian Natural Resources Limited	Engine Skid	508812	5961366
AER81	Canadian Natural Resources Limited	Wellhead*	514137	5960849
		Compressor	514141	5960841
		Compressor	514154	5960830
AER82	Canadian Natural Resources Limited	Engine Skid	513109	5954759
AER83	Canadian Natural Resources Limited	Engine Skid	508202	5957878
AER84	Canadian Natural Resources Limited	Engine Skid	508210	5957871
AER85	Canadian Natural Resources Limited	Engine Skid	508179	5956982
AER86	Canadian Natural Resources Limited	Engine Skid	510828	5964394
AER87	Canadian Natural Resources Limited	Engine Skid	513665	5961694
AER88	Canadian Natural Resources Limited	Engine Skid	513683	5962479
AER89	Canadian Natural Resources Limited	Engine Skid	514912	5963636
AER90	Canadian Natural Resources Limited	Engine Skid	517153	5965863
AER91	Canadian Natural Resources Limited	Engine Skid	517101	5965862

Label	Operator Name	Type of Active Facilities	UTM Coordinates (NAD 83, Zone 12N)	
			Easting (m)	Northing (m)
AER92	Canadian Natural Resources Limited	Engine Skid	515736	5965386
		Wellhead*	515731	5965388
AER93	Canadian Natural Resources Limited	Engine Skid	515190	5967512
AER94	Canadian Natural Resources Limited	Engine Skid	508978	5956752
AER95	Canadian Natural Resources Limited	Source Not Operating During the Site Visit (listed as Pumping Well in ST37)	513909	5958226
AER96	Canadian Natural Resources Limited	Engine Skid	509640	5962118
AER97	Canadian Natural Resources Limited	Source Not Operating During the Site Visit (listed as Pumping Well in ST37)	509416	5953396
AER98	Canadian Natural Resources Limited	Engine Skid	507622	5959211
AER99	Canadian Natural Resources Limited	Engine Skid	507599	5957586
AER100	Canadian Natural Resources Limited	Engine Skid	510434	5952554
AER101	Canadian Natural Resources Limited	Engine Skid	514794	5960337
AER102	Canadian Natural Resources Limited	Engine Skid	514572	5962238
		Wellhead*	514561	5962237
AER103	Canadian Natural Resources Limited	Engine Skid	507571	5956628
AER104	Canadian Natural Resources Limited	Engine Skid	507595	5958568
AER105	Canadian Natural Resources Limited	Engine Skid	508009	5959182
AER106	Canadian Natural Resources Limited	Engine Skid	507558	5958564
AER107	Canadian Natural Resources Limited	Engine Skid	507560	5958547
AER108	Canadian Natural Resources Limited	Engine Skid	507589	5958575

Label	Operator Name	Type of Active Facilities	UTM Coordinates (NAD 83, Zone 12N)	
			Easting (m)	Northing (m)
AER109	Canadian Natural Resources Limited	Engine Skid	508179	5956982
AER110	Canadian Natural Resources Limited	Engine Skid	508021	5959173
AER111	Canadian Natural Resources Limited	Engine Skid	509402	5956054
AER112	Canadian Natural Resources Limited	Engine Skid	509374	5956018
AER113	Canadian Natural Resources Limited	Engine Skid	513827	5959596
AER114	Canadian Natural Resources Limited	Source Not Operating During the Site Visit (listed as Pumping Well in ST37)	513834	5959606
AER115	Canadian Natural Resources Limited	Engine Skid	507554	5957010
AER116	Canadian Natural Resources Limited	Engine Skid	507579	5957012
AER117	Canadian Natural Resources Limited	Engine Skid	510205	5955325
		Engine Skid	510200	5955337
AER118	Canadian Natural Resources Limited	Source Not Operating During the Site Visit (listed as Pumping Well in ST37)	510198	5955319
AER119	Canadian Natural Resources Limited	Engine Skid	510196	5955308
AER120	Gear Energy Ltd.(A2JR)	Engine Skid	507942	5954249
AER121	Canadian Natural Resources Limited	Engine Skid	517768	5960537
AER122	Canadian Natural Resources Limited	Source Not Operating During the Site Visit (listed as Pumping Well in ST37)	515349	5959869
AER123	Canadian Natural Resources Limited	Engine Skid	515359	5952483
AER124	Canadian Natural Resources Limited	Source Not Operating During the Site Visit (listed as Pumping Well in ST37)	515354	5952581
AER125	Canadian Natural Resources Limited	Engine Skid	515357	5952569
AER126		Engine Skid	510784	5966104

Label	Operator Name	Type of Active Facilities	UTM Coordinates (NAD 83, Zone 12N)	
			Easting (m)	Northing (m)
	Canadian Natural Resources Limited	Wellhead*	510792	5966104
AER127	Canadian Natural Resources Limited	Engine Skid	510783	5966120
		Wellhead*	510792	5966118
AER128	Canadian Natural Resources Limited	Engine Skid	510784	5966134
AER129	Canadian Natural Resources Limited	Gas Compressor	516142	5967367
AER130	Canadian Natural Resources Limited	CWL Pump	507579	5958574
AER131	Canadian Natural Resources Limited	Engine Skid	507560	5958535
AUC1	Versorium Energy Ltd.	Natural Gas-Fired Power Plant	510301	5958089
AUC2	ATCO Electric	Electrical Substation	510038	5956619

*Most of the wellheads identified during the site visit were found to be much quieter compared to the engine skids running the wellheads. Only the wellheads that were significant in the context of nearby sources were measured and included in the baseline assessment.

An overview of the Project study area and third-party facilities is provided in Figure 4-1.

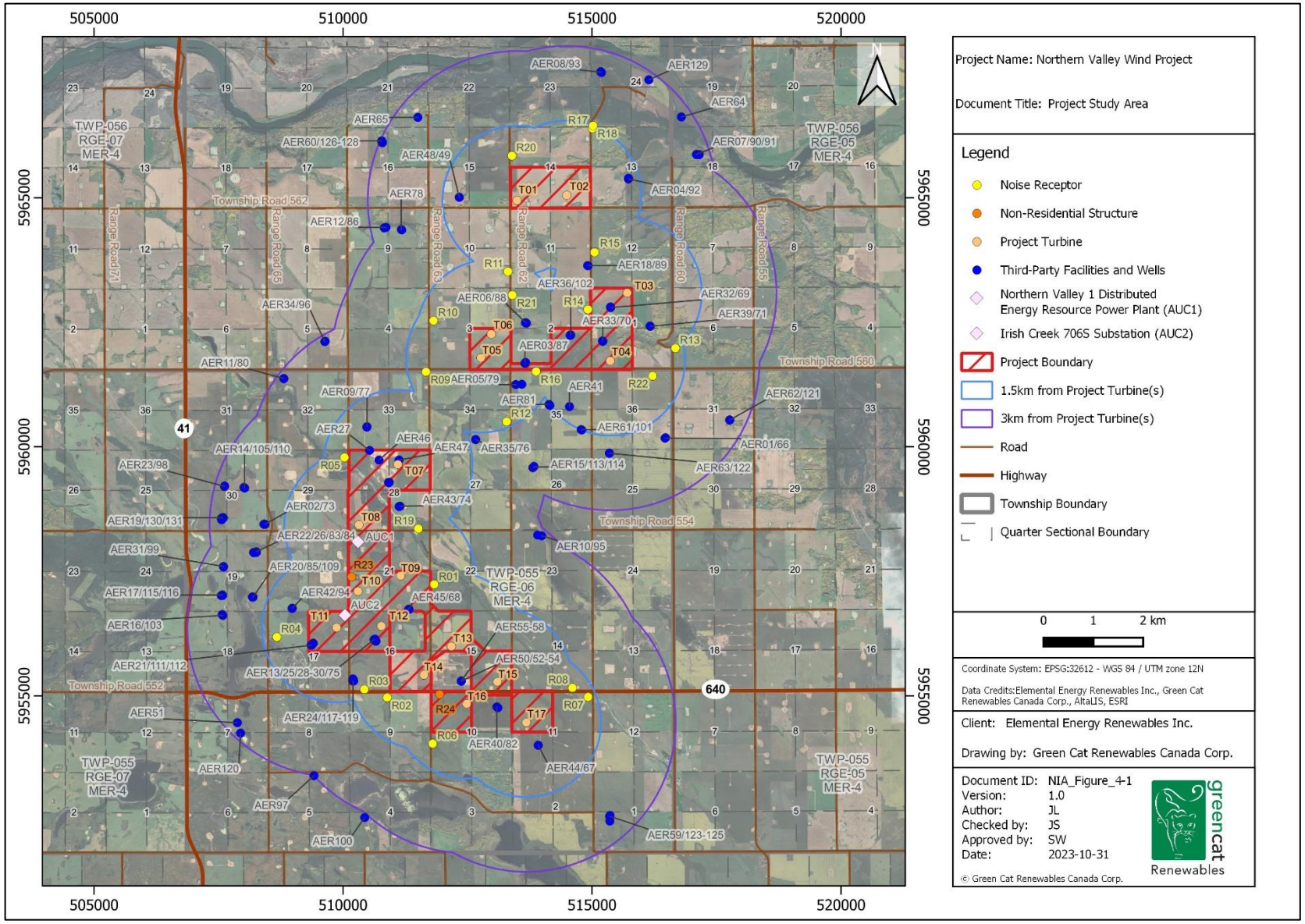


Figure 4-1 – Project Study Area

4.5 Baseline Sound Levels

Baseline sound levels for each receptor should incorporate contributions from all existing and approved AER and AUC facilities plus 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 traffic noise are the determining factors. Criteria are given in Table 4-3.

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

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

All receptors considered in this assessment have been evaluated as 'Category 1' for both dwelling density and proximity to transportation.

4.5.2 Determination of Ambient Sound Level (ASL)

Despite the extensive oil and gas facilities developed in the area, the nearby residential areas are considered to be typical of rural Alberta, primarily agricultural land use with active energy development. Rule 012 states that 'In the absence of measurement, the night-time ambient sound level is assumed to be five dB less than the basic sound level and the daytime ambient sound level is assumed to be five dB less than the basic sound level plus the daytime adjustment'.[8] This results in a night-time ASL of 35dB(A) and a daytime ASL of 45dB(A) for all receptors.

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 4-4.

[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 30m, but less than 500m from heavily travelled roads or rail lines and not subject to frequent aircraft flyovers.
[7] Category 3—dwelling(s) distance is less than 30m from heavily travelled roads, or rail lines or subject to frequent aircraft flyovers.
[8] The daytime ASL accounts for the addition of the standard 10db(A) daytime adjustment to the night-time ASL for the hours between 7 a.m. and 10 p.m., without any further adjustments, i.e., Class A, B, and C adjustments were not applied.

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
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	1	1	40	35	45	40	50
R13	1	1	40	35	45	40	50
R14	1	1	40	35	45	40	50
R15	1	1	40	35	45	40	50
R16	1	1	40	35	45	40	50
R17	1	1	40	35	45	40	50
R18	1	1	40	35	45	40	50
R19	1	1	40	35	45	40	50
R20	1	1	40	35	45	40	50
R21	1	1	40	35	45	40	50
R22	1	1	40	35	45	40	50

4.5.4 AER Facility Sound Power Levels

Sound power levels for 112 AER facilities were calculated based on field measurements conducted during the May 2023 site visit.

Seven AER facilities were found to be operational but are either non-noise producing or significantly quieter compared to the other equipment running at their locations, such that it was not possible to isolate the sound emitted from these sources. As such, these facilities were considered insignificant noise sources and were excluded from the baseline assessment.

While listed as being active in ST102, GCR personnel identified inconsistencies between the AER lists and what was currently in operation during the May 2023 site visit. No noise producing elements were found at AER1, AER51, AER62, and AER65 locations. In addition, twenty-seven AER facilities were not operating at the time of the site visit, and the operator confirmed that these facilities were either suspended or abandoned, meaning that they were either decommissioned or were due to be decommissioned. As a result, an additional thirty-one AER facilities were excluded from the baseline assessment.

AER118 was also found to be inactive at the time of visit. However, the operator on site confirmed that the well has a potential to be operational again but exact timeline was unknown. Therefore, AER118 has been included in the baseline sound levels. In the absence of the measurement, it was assumed that AER118 has the same sound power level as the AER117 (96.1 dB(A)), which was the loudest engine skid located in the same well pad.

A summary of the facilities included and excluded from the baseline assessment is provided in Appendix B.

Table 4-5 shows the octave band sound power levels for the included AER regulated energy-related facilities within 3km of the Project. The sound power levels for the AER regulated energy-related facilities that were excluded from the baseline assessment have been denoted by a dash in the below table.

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

Map Label	Octave Band Centre Frequency, Hz									Total	
	31.5	63	125	250	500	1000	2000	4000	8000	dB(A)	dB
AER01	-	-	-	-	-	-	-	-	-	-	-
AER02	53.8	62.1	79.9	81.7	83.9	83.5	83.6	89.6	75.7	92.8	99.8
	54.4	63.5	77.0	85.0	89.0	87.7	86.2	80.0	74.6	93.6	100.1
AER03	24.9	42.7	52.3	57.1	65.0	65.5	62.8	57.9	49.4	70.0	75.2
AER04	49.1	61.3	75.8	74.2	81.9	83.5	82.1	77.7	72.6	88.4	95.8
AER05	-	-	-	-	-	-	-	-	-	-	-
AER06	58.3	67.9	80.9	82.4	83.3	83.2	82.1	81.0	67.0	90.1	101.9
	56.5	70.7	83.6	87.7	89.8	91.8	88.4	82.6	72.8	96.2	104.2
AER07	62.5	71.3	80.8	80.9	85.3	92.5	87.3	83.4	72.5	95.0	104.8
AER08	59.2	66.4	83.6	85.6	90.9	94.1	91.3	87.4	78.9	98.0	104.4
	58.3	68.6	81.2	88.8	96.6	98.8	94.1	91.1	81.6	102.3	106.0
AER09	49.4	72.1	82.5	90.3	97.9	105.2	101.5	94.6	85.7	107.6	109.1
AER10	-	-	-	-	-	-	-	-	-	-	-
AER11	52.9	66.8	77.8	86.6	93.2	92.1	88.9	84.6	76.0	97.3	102.1
AER12	48.5	53.2	60.3	65.5	71.2	69.6	67.0	60.9	56.2	75.3	89.1
AER13	63.3	64.9	90.3	81.2	83.4	86.6	87.4	90.2	79.2	95.5	108.3
	51.6	60.9	68.1	70.7	83.8	76.5	73.2	64.3	54.4	85.2	94.3
AER14	56.2	64.8	73.3	76.3	90.0	91.8	87.3	83.7	74.9	95.3	100.1

Map Label	Octave Band Centre Frequency, Hz									Total	
	31.5	63	125	250	500	1000	2000	4000	8000	dB(A)	dB
AER15	48.0	73.2	77.5	90.5	85.9	88.6	88.0	81.7	74.1	94.9	103.4
AER16	48.2	59.5	69.4	70.2	78.3	82.0	74.6	67.9	59.5	84.5	92.3
AER17	43.4	58.4	68.6	76.0	87.1	89.0	85.7	79.2	69.7	92.6	95.2
AER18	57.6	67.2	76.6	87.3	91.1	94.6	92.1	85.8	75.7	98.3	103.0
AER19	55.0	71.7	81.0	83.8	81.3	79.6	80.7	79.4	71.4	89.2	102.1
	43.8	68.7	70.3	72.0	73.6	76.2	77.5	71.9	70.2	82.6	96.0
AER20	49.7	57.4	68.8	74.6	81.8	80.5	78.0	72.5	62.4	85.8	93.1
AER21	56.3	70.2	80.7	78.5	81.2	86.3	86.2	85.9	74.0	92.0	101.7
	44.4	57.1	68.5	75.5	75.6	78.9	75.3	71.6	63.3	83.2	90.8
AER22	50.8	66.1	81.0	80.0	84.9	85.2	87.3	86.1	76.2	92.7	100.1
	46.7	61.8	70.8	89.0	87.3	87.7	84.3	80.5	69.2	93.7	99.7
AER23	55.3	63.4	76.9	87.8	87.4	89.7	88.8	85.0	78.0	95.1	101.2
AER24	59.3	68.2	76.7	81.7	83.0	84.4	79.8	77.0	69.1	89.2	101.4
	54.3	63.5	77.8	87.6	87.4	90.4	87.8	82.5	76.1	94.9	101.1
AER25	-	-	-	-	-	-	-	-	-	-	-
AER26	47.7	60.3	76.9	78.7	80.5	76.5	73.8	71.5	62.8	85.1	95.8
AER27	-	-	-	-	-	-	-	-	-	-	-
AER28	-	-	-	-	-	-	-	-	-	-	-
AER29	-	-	-	-	-	-	-	-	-	-	-
AER30	-	-	-	-	-	-	-	-	-	-	-
AER31	-	-	-	-	-	-	-	-	-	-	-
AER32	53.0	66.8	73.8	78.1	87.9	84.9	84.6	80.2	75.4	91.6	98.5
AER33	-	-	-	-	-	-	-	-	-	-	-
AER34	43.3	65.0	73.4	79.4	84.6	90.2	88.3	81.8	71.6	93.6	97.3
AER35	-	-	-	-	-	-	-	-	-	-	-
AER36	56.7	64.9	78.0	81.4	82.3	85.8	82.9	81.1	72.7	90.4	100.0
AER37	-	-	-	-	-	-	-	-	-	-	-
AER38	50.4	58.9	68.1	70.8	71.4	75.5	73.1	67.6	59.8	79.8	92.3
AER39	55.4	63.7	76.3	77.1	82.5	83.1	86.1	81.1	74.8	90.2	98.5
AER40	41.9	58.3	73.7	77.9	83.9	84.2	80.2	78.3	67.8	88.9	94.4

Map Label	Octave Band Centre Frequency, Hz									Total	
	31.5	63	125	250	500	1000	2000	4000	8000	dB(A)	dB
AER41	-	-	-	-	-	-	-	-	-	-	-
AER42	45.8	56.1	66.7	79.3	82.4	81.9	80.8	77.2	68.8	87.8	92.9
AER43	59.1	72.0	79.0	81.1	90.6	90.6	91.2	87.0	79.8	96.5	103.6
AER44	-	-	-	-	-	-	-	-	-	-	-
AER45	44.8	64.5	78.9	87.3	91.6	94.0	90.6	86.3	77.8	97.9	101.9
AER46	-	-	-	-	-	-	-	-	-	-	-
AER47	-	-	-	-	-	-	-	-	-	-	-
AER48	-	-	-	-	-	-	-	-	-	-	-
AER49	-	-	-	-	-	-	-	-	-	-	-
AER50	-	-	-	-	-	-	-	-	-	-	-
AER51	-	-	-	-	-	-	-	-	-	-	-
AER52	-	-	-	-	-	-	-	-	-	-	-
AER53	-	-	-	-	-	-	-	-	-	-	-
AER54	-	-	-	-	-	-	-	-	-	-	-
AER55	-	-	-	-	-	-	-	-	-	-	-
AER56	-	-	-	-	-	-	-	-	-	-	-
AER57	-	-	-	-	-	-	-	-	-	-	-
AER58	-	-	-	-	-	-	-	-	-	-	-
AER59	50.5	70.2	82.6	85.5	84.0	90.1	90.5	87.0	75.7	95.4	102.6
	43.8	62.6	73.1	76.2	80.3	83.0	79.4	73.5	63.4	86.8	94.1
AER60	63.4	68.0	79.8	82.5	90.2	93.5	90.7	88.0	78.2	97.4	105.2
AER61	57.0	63.5	76.9	85.8	91.0	94.5	90.2	84.2	78.0	97.7	102.2
AER62	-	-	-	-	-	-	-	-	-	-	-
AER63	-	-	-	-	-	-	-	-	-	-	-
AER64	-	-	-	-	-	-	-	-	-	-	-
AER65	-	-	-	-	-	-	-	-	-	-	-
AER66	57.3	67.8	72.3	82.1	89.6	88.5	83.9	77.7	69.0	93.2	100.7
AER67	53.8	61.1	76.6	83.8	87.1	88.8	85.8	79.9	71.9	93.1	99.3
AER68	51.8	64.1	81.8	86.5	92.2	93.2	90.5	87.3	80.4	97.9	102.7
AER69	62.2	67.0	83.7	89.4	87.9	86.4	87.5	91.3	79.0	96.2	105.5

Map Label	Octave Band Centre Frequency, Hz									Total	
	31.5	63	125	250	500	1000	2000	4000	8000	dB(A)	dB
AER70	50.5	64.5	75.5	80.1	89.6	96.5	95.4	90.0	82.3	100.0	101.6
AER71	63.5	66.6	82.6	78.7	85.9	83.3	85.9	89.1	74.8	93.2	105.0
AER72	59.1	68.4	81.3	82.8	81.6	84.0	83.4	84.4	72.6	90.9	102.5
AER73	46.9	52.0	64.9	74.2	73.6	74.2	74.4	68.1	59.5	80.6	89.6
	56.0	63.7	75.3	80.3	77.8	78.6	83.1	81.6	75.6	88.2	98.5
	43.5	51.1	64.5	75.8	70.7	69.4	69.9	70.7	64.4	79.3	88.4
AER74	53.5	65.3	78.7	79.1	88.9	90.1	89.0	85.2	79.5	95.0	100.3
AER75	58.6	62.5	71.2	79.4	79.5	81.9	81.6	76.4	66.7	87.3	99.4
AER76	-	-	-	-	-	-	-	-	-	-	-
AER77	50.4	61.0	82.6	80.9	80.8	80.5	80.3	77.8	69.7	88.6	100.1
	37.6	59.5	73.8	81.0	82.6	94.3	90.9	81.1	70.3	96.4	98.1
AER78	55.4	68.7	75.7	87.1	97.4	97.8	96.9	91.7	82.8	102.7	105.3
	55.1	67.9	72.3	88.5	95.6	96.7	94.1	89.2	79.2	101.0	104.2
AER79	-	-	-	-	-	-	-	-	-	-	-
AER80	51.9	64.3	73.4	81.8	82.9	83.7	80.4	76.6	66.5	88.8	97.2
AER81	49.3	61.6	76.4	81.9	92.4	95.3	91.6	86.7	77.1	98.7	101.1
	53.7	61.7	84.3	85.1	92.6	95.6	95.3	94.5	85.5	101.0	104.6
	51.7	67.0	78.1	87.1	93.3	94.1	91.9	86.5	75.1	98.6	102.6
AER82	53.2	57.5	81.0	80.8	80.6	81.2	79.4	76.1	65.4	88.0	99.3
AER83	45.7	59.9	73.7	73.4	78.5	73.7	71.8	67.2	61.8	82.1	93.1
AER84	48.8	60.6	75.8	78.9	77.0	76.4	76.6	73.4	67.0	84.5	95.4
AER85	58.0	64.2	78.6	79.7	83.9	84.7	83.0	81.1	68.7	90.2	100.6
AER86	52.9	64.8	73.1	80.9	89.8	89.3	88.2	85.6	76.4	94.8	99.2
AER87	51.1	65.7	80.7	81.0	84.7	86.2	87.2	81.9	73.3	92.2	100.0
AER88	58.4	64.8	78.5	80.0	83.2	85.3	86.8	82.8	73.7	91.5	100.9
AER89	58.9	68.9	85.2	83.7	81.8	85.6	82.9	81.2	69.8	91.5	104.2
AER90	59.3	62.7	72.8	88.6	91.4	91.9	89.7	84.2	76.2	96.9	102.9
AER91	70.1	70.9	83.4	83.5	89.1	89.9	89.9	87.8	77.8	95.9	110.4
AER92	47.0	60.6	87.9	78.8	80.6	84.1	83.3	79.1	70.3	91.4	104.3
	48.6	58.3	74.0	82.1	84.8	89.8	88.9	84.1	75.7	94.0	97.4

Map Label	Octave Band Centre Frequency, Hz									Total	
	31.5	63	125	250	500	1000	2000	4000	8000	dB(A)	dB
AER93	58.0	69.3	77.3	85.9	90.7	92.5	90.2	86.1	77.9	96.9	102.9
AER94	58.7	63.2	78.4	80.2	81.4	83.2	86.8	87.8	79.2	92.3	100.9
AER95	-	-	-	-	-	-	-	-	-	-	-
AER96	47.6	76.2	81.2	79.2	89.6	93.6	91.6	85.7	77.7	97.3	104.7
AER97	-	-	-	-	-	-	-	-	-	-	-
AER98	51.7	59.9	79.1	81.1	79.6	81.5	81.5	85.9	74.0	90.0	98.3
AER99	52.2	62.9	75.3	84.9	90.6	90.6	88.0	83.2	77.1	95.5	100.1
AER100	69.5	65.4	80.9	78.6	75.9	78.3	79.5	78.0	68.2	86.8	109.3
AER101	54.9	64.0	77.3	78.8	81.2	85.4	91.3	86.6	77.2	93.9	99.3
AER102	57.3	64.9	89.7	78.7	81.3	84.3	85.8	84.6	75.4	93.3	106.6
	53.3	57.1	76.2	74.1	78.6	84.3	79.7	70.5	60.8	87.1	96.5
AER103	49.0	56.2	65.1	74.1	78.4	75.7	77.7	67.3	59.6	83.1	91.5
AER104	57.2	71.9	79.7	84.2	84.7	85.4	83.9	79.8	74.6	91.4	102.5
AER105	62.8	67.4	80.2	80.8	78.7	78.8	83.3	81.1	72.2	88.7	103.9
AER106	46.8	55.5	67.4	72.4	73.6	77.9	73.4	66.9	58.7	81.3	90.2
AER107	52.8	74.9	82.2	81.1	86.9	86.8	82.8	74.7	65.5	91.8	103.8
AER108	48.2	67.3	72.7	79.5	84.0	82.2	80.3	73.3	65.1	88.2	97.0
AER109	58.0	64.2	78.6	79.7	83.9	84.7	83.0	81.1	68.7	90.2	100.6
AER110	50.2	61.3	73.0	77.3	80.8	78.3	78.4	71.5	61.1	85.4	94.9
AER111	53.3	60.4	78.2	75.0	77.4	82.7	80.2	77.2	67.5	87.0	97.5
AER112	52.1	62.7	75.1	79.1	81.2	83.9	82.7	77.3	67.4	88.7	96.8
AER113	51.0	65.5	73.8	80.8	79.1	80.6	80.1	74.8	63.1	86.8	96.8
AER114	-	-	-	-	-	-	-	-	-	-	-
AER115	54.6	63.2	75.4	87.8	85.7	85.5	84.9	82.0	77.1	92.8	100.3
AER116	57.2	63.1	74.5	86.7	81.2	87.2	84.1	84.9	77.4	92.5	100.5
AER117	62.2	64.8	80.4	85.4	86.5	85.3	83.7	81.4	74.5	92.2	103.9
	60.6	63.1	87.0	87.1	87.0	84.8	87.8	91.7	80.7	96.1	105.8
AER118	60.6	63.1	87.0	87.1	87.0	84.8	87.8	91.7	80.7	96.1	105.8
AER119	56.9	65.8	78.3	82.2	82.7	85.0	84.8	84.2	75.6	91.3	100.4
AER120	55.1	75.9	77.8	83.0	84.3	85.5	82.2	80.8	70.6	90.9	103.8

Map Label	Octave Band Centre Frequency, Hz									Total	
	31.5	63	125	250	500	1000	2000	4000	8000	dB(A)	dB
AER121	57.3	66.3	64.8	76.8	84.4	84.7	85.0	81.6	75.5	90.5	99.1
AER122	-	-	-	-	-	-	-	-	-	-	-
AER123	52.8	57.7	70.5	81.9	82.6	82.8	86.4	83.1	79.8	91.1	96.7
AER124	-	-	-	-	-	-	-	-	-	-	-
AER125	52.3	62.2	71.8	78.9	80.8	78.6	79.8	73.7	63.7	86.1	95.8
AER126	56.7	64.0	91.2	78.7	74.8	79.4	78.3	73.8	65.3	92.1	107.8
	49.1	60.0	76.8	75.1	76.0	76.4	75.7	68.8	61.2	83.2	95.4
AER127	74.6	68.5	80.5	82.7	80.6	82.9	81.7	81.0	71.9	89.7	114.2
	62.7	61.5	80.2	75.5	75.9	77.0	75.2	70.7	61.2	84.4	103.4
AER128	63.3	64.9	78.7	79.1	82.2	85.2	88.1	89.8	79.9	93.7	104.1
AER129	62.8	77.9	83.7	83.9	92.9	94.2	90.2	83.6	74.0	98.1	107.9
AER130	52.7	68.5	74.7	81.2	87.2	86.3	83.1	76.5	70.3	91.4	99.3
AER131	48.5	75.1	75.3	84.8	80.6	82.0	78.4	73.9	62.2	88.6	102.6

4.5.5 AUC Facility Sound Power Levels

There are two existing AUC facilities within 3km of the proposed turbine locations. These are the Irish Creek 706S Substation and the Northern Valley 1 Distributed Energy Resource. The sound power levels of these facilities, detailed below, were used to calculate the baseline sound levels for both daytime and night-time periods.

4.5.5.1 Northern Valley 1 Distributed Energy Resource Power Plant

The Northern Valley 1 Distributed Energy Resource Power Plant is a 5 MW natural gas-fired power plant approved[9] to be installed at LSD 13-21-55-06-W4M within the Project boundary. The proposed power plant consists of two (2) 2.5MW Electrical Generation Gensets (natural gas fueled), each equipped with an Engine Exhaust and two (2) radiator cooler fans, and a 5.6 MVA Generator Step-up Transformer. The Sound power levels for these noise producing elements proposed for the power plant were obtained from the Northern Valley 1 Distributed Energy Resource Power Plant NIA[10], and the octave band sound power levels and estimated locations of the noise producing elements are displayed in Table 4-6.

[9] AUC Power Plant Approval #28169-D02-2023

[10] Noise Impact Assessment For The Northern Valley 1 Distributed Energy Resource at LSD 13-21-55-06-W4M, aci Acoustical Consultants Inc., December 8, 2021 (Exhibit 27132-X0014)

Table 4-6 – Octave Band Sound Power Levels for Northern Valley 1 Distributed Energy Resource Power Plant

Map Label	Facility	Location		Octave Band Centre Frequency, Hz									Total	
		E	N	31.5	63	125	250	500	1000	2000	4000	8000	dB(A)	dB
AUC1	Northern Valley 1 Distributed Energy Resource Power Plant													
"	Radiator Fan #1	510299	5958072	66.6	79.8	88.9	93.4	93.8	95	90.2	84.0	75.9	100.0	111.3
"	Radiator Fan #2	510299	5958067	66.6	79.8	88.9	93.4	93.8	95	90.2	84.0	75.9	100.0	111.3
"	Radiator Fan #3	510299	5958056	66.6	79.8	88.9	93.4	93.8	95	90.2	84.0	75.9	100.0	111.3
"	Radiator Fan #4	510299	5958051	66.6	79.8	88.9	93.4	93.8	95	90.2	84.0	75.9	100.0	111.3
"	Engine Exhaust #1	510304	5958070	75.3	74.4	68.2	62.7	58.2	61.8	65.4	68.3	59.0	79.2	114.9
"	Engine Exhaust #2	510305	5958054	75.3	74.4	68.2	62.7	58.2	61.8	65.4	68.3	59.0	79.2	114.9
"	Genset Enclosure #1	510296	5958070	36.8	59.2	78.8	86.1	91.3	96.7	87.4	82.9	94.2	99.9	102.5
"	Genset Enclosure #2	510296	5958053	36.8	59.2	78.8	86.1	91.3	96.7	87.4	82.9	94.2	99.9	102.5
"	Step-Up Transformer (5.6MVA)	510286	5958043	51.0	70.2	82.3	84.8	90.2	87.4	83.6	78.4	69.3	93.8	102.4

4.5.5.2 Irish Creek 706S Substation

Sound power levels for equipment operating at Irish Creek 706S Substation were obtained from the ATCO Electric NIA for the Irish Creek 706S Substation[11]. Table 4-7 lists octave band sound power levels and locations for equipment operating at Irish Creek 706S Substation.

Table 4-7 – Octave Band Sound Power Levels for Irish Creek 706S Substation

Map Label	Facility	Location		Octave Band Centre Frequency, Hz									Total	
		E	N	31.5	63	125	250	500	1000	2000	4000	8000	dB	dB(A)
AUC2	Irish Creek 706S Substation													
"	Transformer 41.6MVA #1	510029	5956606	47.6	61.8	79.9	91.4	95.8	96	93.2	88	79.9	100.8	104.7
"	Transformer 41.6MVA #2	510044	5956607	47.6	61.8	79.9	91.4	95.8	96	93.2	88	79.9	100.8	104.7

[11] Noise Impact Assessment for Irish Creek 706S Substation, ATCO Electric., July 15, 2013 (Exhibit 0008.00.AE-2892)

4.6 Modelling Results

Table 4-8 shows the predicted sound levels at each receptor from the existing/approved AER and AUC regulated energy-related facilities included in this assessment. Predicted levels less than zero dB(A) are denoted by a dash in the below table.

Table 4-8 Predicted Sound Levels from Existing/Approved Third-Party Energy-Related Facilities

Dwelling ID	AER Facilities (dBA)		Northern Valley 1 Distributed Energy Resource Power Plant (dBA)		Irish Creek 706S Substation (dBA)		Total Regulated Facilities (dBA)	
	NT	DT	NT	DT	NT	DT	NT	DT
R01	26.6	26.6	22.7	22.7	17.0	17.0	28.4	28.4
R02	25.2	25.2	15.2	15.2	17.4	17.4	26.2	26.2
R03	27.9	27.9	16.2	16.2	19.7	19.7	28.8	28.8
R04	24.5	24.5	18.2	18.2	20.5	20.5	26.6	26.6
R05	31.6	31.6	22.7	22.7	10.0	10.0	32.2	32.2
R06	17.5	17.5	11.0	11.0	10.3	10.3	19.0	19.0
R07	13.9	13.9	-	-	-	-	13.9	13.9
R08	14.8	14.8	-	-	3.7	3.7	15.1	15.1
R09	23.4	23.4	13.1	13.1	-	-	23.8	23.8
R10	23.5	23.5	9.8	9.8	-	-	23.7	23.7
R11	25.3	25.3	-	-	-	-	25.3	25.3
R12	27.2	27.2	12.6	12.6	-	-	27.3	27.3
R13	24.9	24.9	-	-	-	-	24.9	24.9
R14	31.7	31.7	-	-	-	-	31.7	31.7
R15	34.1	34.1	-	-	-	-	34.1	34.1
R16	34	34	9.1	9.1	-	-	34.0	34.0
R17	24.7	24.7	-	-	-	-	24.7	24.7
R18	25.1	25.1	-	-	-	-	25.1	25.1
R19	29.1	29.1	26.5	26.5	14.6	14.6	31.1	31.1
R20	18.0	18.0	-	-	-	-	18.0	18.0
R21	29.8	29.8	-	-	-	-	29.8	29.8
R22	25.7	25.7	-	-	-	-	25.7	25.7

4.7 Total Baseline Sound Levels

Baseline sound levels include the noise contributions from existing/approved AER and AUC facilities and wells as well as the ambient sound level assessed for the local environment. Table 4-9 shows the cumulative baseline sound levels for night-time and daytime periods.

Table 4-9 – Cumulative Baseline Sound Levels for Night-time (NT) and Daytime (DT) Periods

Receptor ID	Total Regulated Facilities		ASL		Baseline	
	NT	DT	NT	DT	NT	DT
R01	28.4	28.4	35	45	35.9	45.1
R02	26.2	26.2	35	45	35.5	45.1
R03	28.8	28.8	35	45	35.9	45.1
R04	26.6	26.6	35	45	35.6	45.1
R05	32.2	32.2	35	45	36.8	45.2
R06	19.0	19.0	35	45	35.1	45.0
R07	13.9	13.9	35	45	35.0	45.0
R08	15.1	15.1	35	45	35.0	45.0
R09	23.8	23.8	35	45	35.3	45.0
R10	23.7	23.7	35	45	35.3	45.0
R11	25.3	25.3	35	45	35.4	45.0
R12	27.3	27.3	35	45	35.7	45.1
R13	24.9	24.9	35	45	35.4	45.0
R14	31.7	31.7	35	45	36.7	45.2
R15	34.1	34.1	35	45	37.6	45.3
R16	34.0	34.0	35	45	37.5	45.3
R17	24.7	24.7	35	45	35.4	45.0
R18	25.1	25.1	35	45	35.4	45.0
R19	31.1	31.1	35	45	36.5	45.2
R20	18.0	18.0	35	45	35.1	45.0
R21	29.8	29.8	35	45	36.1	45.1
R22	25.7	25.7	35	45	35.5	45.1

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

5 Project Sound Levels

The Project will consist of 17 Vestas V163-4.5MW wind turbine generators with a total capacity of up to 76.5 MW_{AC}. The wind turbines are assumed to be the only significant noise producing Project elements. As such, no other Project elements are considered in this assessment. The sound power level data for the wind turbines was used to model sound emissions for both daytime and night-time periods. For the purposes of the noise assessment, the noise producing Project elements are assumed to operate 24 hours a day in this assessment.

5.1 Wind Turbine Generators

The wind turbine generator model proposed for the Project are the Vestas V163-4.5MW machine with a hub height of 125m, rotor diameter of 163m, and rated power of 4.5 MW.

Published octave band data given for hub height wind speeds show maximum sound power levels of 106.3dB(A) for the V163-4.5MW turbine utilising blades with serrated trailing edges. The sound power levels in one-third octave band frequencies for V163-4.5MW turbines are provided in Appendix D.

Sound power levels at a hub height wind speed of 10m/s were used for all turbines, representing their maximum sound power.

The selected turbine design has the ability to operate pre-determined Sound Optimized (SO) modes to reduce operational noise emission such that compliance with noise regulations is acheived. Spectra for the SO modes is included at Appendix D.

5.2 Modelling Results

The results of modelling showed that, although daytime PSLs could be met, it was not possible for cumulative receptor levels to meet respective night-time PSLs when all 17 turbines operated in Mode 0 (no noise reduction). Therefore, an iterative process was undertaken to assess the requirement for turbines to be operated in noise reduction modes as follows:

1. Receptor locations predicted to show night-time PSL exceedances were identified;

2. The receptor with the highest night-time PSL exceedance was evaluated first;

3. The turbine contributing the highest sound levels at this receptor was adjusted to a lower noise mode and the sound prediction re-run until either:

3.1 The receptor was predicted to meet the night-time PSL, in which case the optimization of that receptor ended, and the process returned to step 1.; or,

3.2 The selected turbine's sound contribution was no longer the greatest at that receptor, in which case the optimization continued from step 3.

This process was repeated until the night-time PSLs were predicted to be compliant at all receptors. SO modes resulting from this iterative process are shown in Table 5-1.

Table 5-1 SO modes of operation for night-time compliance with PSLs

Turbine ID	Mode of operation	PWL (dBA)
T03	SO2	103.5
T09	SO3	100.0
T13	SO2	103.5
Other 14 turbines	Normal Operation	106.3

Project sound levels applicable to night-time (mitigated) and daytime (un-mitigated) periods are shown in Table 5-2.

Table 5-2 – Predicted Project Case Sound Levels

Receptor ID	Project Sound Level (dBA) - NT	Project Sound Level (dBA) - DT
R01	38.3	40.9
R02	37.1	37.4
R03	35.8	36.2
R04	33.2	33.5
R05	36.1	36.3
R06	37.3	37.5
R07	33.8	34.0
R08	35.0	35.2
R09	34.0	34.1
R10	34.1	34.1
R11	36.0	36.1
R12	34.4	34.6
R13	33.3	34.2
R14	37.2	38.5
R15	36.0	37.1
R16	35.4	35.5
R17	30.2	30.4
R18	29.8	30.0
R19	35.7	37.1
R20	35.1	35.1
R21	36.0	36.1
R22	34.4	34.7

Receptor R1 is expected to be the receptor most impacted by noise from the Project, having a maximum sound pressure level of 38.3dB(A) and 40.9dB(A) during night-time and daytime periods, respectively. Project sound level contours are shown in Appendix E, for night-time, and Appendix F, for daytime levels.

5.3 Low Frequency Assessment

Table 5-3 shows the difference between A and C weighted predicted sound levels at each of the receptors modelled during the night-time periods with utilization of SO modes at 3 of the 17 proposed turbine locations.

Table 5-3 – Low Frequency Noise Assessment (Night-Time)

Receptor ID	Predicted Sound Level (dBA)	Predicted Sound Level (dBC)	Difference (dBC – dBA)
R01	38.3	53.9	15.6
R02	37.1	53.6	16.5
R03	35.8	52.7	16.9
R04	33.2	50.4	17.2
R05	36.1	51.6	15.5
R06	37.3	52.7	15.4
R07	33.8	49.5	15.7
R08	35.0	49.5	14.5
R09	34.0	51.0	17.0
R10	34.1	50.7	16.6
R11	36.0	51.5	15.5
R12	34.4	50.5	16.1
R13	33.3	49.0	15.7
R14	37.2	52.2	15.0
R15	36.0	51.4	15.4
R16	35.4	52.1	16.7
R17	30.2	47.3	17.1
R18	29.8	47.0	17.2
R19	35.7	52.8	17.1
R20	35.1	51.5	16.4
R21	36.0	52.5	16.5
R22	34.4	50.7	16.3

Table 5-4 shows the difference between A and C weighted predicted sound levels at each of the receptors modelled during the daytime periods with no SO modes.

Table 5-4 Low Frequency Noise Assessment (Daytime)

Receptor ID	Predicted Sound Level (dBA)	Predicted Sound Level (dBC)	Difference (dBC – dBA)
R01	40.9	55.8	14.9
R02	37.4	54.0	16.6
R03	36.2	53.1	16.9
R04	33.5	50.8	17.3
R05	36.3	51.9	15.6
R06	37.5	52.9	15.4
R07	34.0	49.8	15.8
R08	35.2	49.7	14.5
R09	34.1	51.2	17.1
R10	34.1	50.8	16.7
R11	36.1	51.7	15.6
R12	34.6	50.8	16.2
R13	34.2	49.8	15.6
R14	38.5	53.3	14.8
R15	37.1	52.3	15.2
R16	35.5	52.3	16.8
R17	30.4	47.5	17.1
R18	30.0	47.2	17.2
R19	37.1	53.9	16.8
R20	35.1	51.5	16.4
R21	36.1	52.7	16.6
R22	34.7	51.1	16.4

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.

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	35.9	45.1	38.3	40.9	40.3	46.5	40	50	0	4
R02	35.5	45.1	37.1	37.4	39.4	45.7	40	50	1	4
R03	35.9	45.1	35.8	36.2	38.9	45.6	40	50	1	4
R04	35.6	45.1	33.2	33.5	37.6	45.4	40	50	2	5
R05	36.8	45.2	36.1	36.3	39.5	45.7	40	50	1	4
R06	35.1	45.0	37.3	37.5	39.4	45.7	40	50	1	4
R07	35.0	45.0	33.8	34.0	37.5	45.3	40	50	3	5
R08	35.0	45.0	35.0	35.2	38.0	45.4	40	50	2	5
R09	35.3	45.0	34.0	34.1	37.7	45.4	40	50	2	5
R10	35.3	45.0	34.1	34.1	37.8	45.4	40	50	2	5
R11	35.4	45.0	36.0	36.1	38.7	45.6	40	50	1	4
R12	35.7	45.1	34.4	34.6	38.1	45.4	40	50	2	5
R13	35.4	45.0	33.3	34.2	37.5	45.4	40	50	3	5
R14	36.7	45.2	37.2	38.5	40.0	46.0	40	50	0	4
R15	37.6	45.3	36.0	37.1	39.9	45.9	40	50	0	4
R16	37.5	45.3	35.4	35.5	39.6	45.8	40	50	0	4
R17	35.4	45.0	30.2	30.4	36.5	45.2	40	50	3	5
R18	35.4	45.0	29.8	30.0	36.5	45.2	40	50	4	5
R19	36.5	45.2	35.7	37.1	39.1	45.8	40	50	1	4
R20	35.1	45.0	35.1	35.1	38.1	45.4	40	50	2	5
R21	36.1	45.1	36.0	36.1	39.1	45.6	40	50	1	4
R22	35.5	45.1	34.4	34.7	38.0	45.4	40	50	2	5

The cumulative sound levels at all receptors identified are shown to meet PSLs in all cases. Receptor R1 is shown to be the most impacted by noise from the Project due to proximity to the proposed turbine locations.

The Project sound levels are determined to be compliant with the requirements of AUC Rule 012. The cumulative sound level at all receptors is considered to be conservative, as it assumes that all receptors are simultaneously downwind of all turbines during operation and therefore receive maximum sound levels. In practice, receptor levels will be attenuated when receptors are upwind from turbines.

7 Conclusions

22 receptors, located within 1.5km from the Project turbines were identified as having the potential to be impacted by sound emitted from the proposed Project.

AUC Rule 012 defines night-time hours to be from 22:00 to 07:00 year-round. The Project may operate at any time during the defined daytime and night-time periods. The NIA is considered to be conservative as the Project turbines are assumed to operate at a hub height wind speed of 10m/s representing their maximum sound power during both daytime and night-time hours. Meanwhile, the ambient noise has been assessed at the standard 35dB(A) for night-time rural Alberta, which is applicable at lower wind speeds. Furthermore, the noise model assumes that all receptors are simultaneously downwind of all turbines during operation. In practice, there will be periods when the Project operates at lower wind speed or in standby mode where sound emissions are much lower than the peak sound output levels assumed throughout the assessment.

When utilizing all 17 proposed turbine locations, modelling showed that three turbines would be required to operate in SO modes for cumulative sound levels to meet applicable night-time PSLs. SO modes were not required for cumulative sound to meet daytime PSLs. For all 22 receptors identified and modelled, compliance with AUC Rule 012 requirements was demonstrated, with receptor R1 predicted to be the most affected 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 night-time mitigation would allow proposed Northern Valley Wind Project would operate in compliance with AUC Rule 012 requirements at all assessed receptors. Daytime requirements were met without recourse to operational noise reduction.

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 Reviewer	• Technical Assessment Lead • Noise Impact Assessment (NIA) Technical Reviewer and Approver
Experience	• Experience with acoustic modelling in CadnaA to model renewable energy projects in Alberta. • Analyst on multiple noise assessments for renewable energy projects in Alberta. • Current INCE associate.	• Over 11 years of acoustic and environmental consultancy for projects in the U.K. and Alberta. • Completed the UK Institute of Acoustics (IOA) diploma in 2015. • Full member of the IOA. • Author and reviewer of NIAs for multiple renewable energy projects in Alberta (2020-Present).	• 18 years of acoustic and environmental consultancy. • Acoustics (IOA) diploma (2012). • Expert witness experience in wind turbine noise in the UK (2017/18). • Expert witness experience in technical solar development in Canada (2019-23).

Appendix A: Rule 012 Glossary

Ambient sound level (ASL)

The sound level that is a composite of different airborne sounds from many sources far away from and near the point of measurement. The ambient sound level does not include noise from any energy-related facilities or from wind and must be determined without it. The average night-time ambient sound level in rural Alberta is 35 dBA. The ambient sound level can be measured when the sound level in an area is not believed to be represented by the basic sound levels in Table 1[12]. The ambient sound level must be determined under representative conditions and does not constitute absolute worst-case conditions (e.g., an unusually quiet day) but conditions that portray typical conditions for the area.

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

A-weighted sound level

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

Basic sound level (BSL)

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

Comprehensive sound level

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

Cumulative sound level

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

C-weighted sound level

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

Daytime

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

Daytime adjustment

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

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

Density per quarter section

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

Down wind

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

Dwelling

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

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

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

Energy equivalent sound level (Leq)

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

Energy-related facility

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

Far field

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

Heavily travelled road

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

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

Linear weighting (or Z-weighting)

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

Low frequency noise

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

Night-time

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

No net increase

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

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

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

Noise

The unwanted portion of sound.

Permissible sound level (PSL)

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

Proposed facility

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

Sound power level

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

Sound pressure level

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

Summertime conditions

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

Tonal components

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

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

Wind speed

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

Appendix B: Sound Power Information for AER Facilities and Wells Identified

Map Label	Field Measurement	Insignificant Source	Excluded
AER01			x
AER02	X		
AER03	X		
AER04	X		
AER05			x
AER06	X		
AER07	X		
AER08	X		
AER09	X		
AER10			x
AER11	X		
AER12	X		
AER13	X		
AER14	X		
AER15	X		
AER16	X		
AER17	X		
AER18	X		
AER19	X		
AER20	X		
AER21	X		
AER22	X		
AER23	X		
AER24	X		
AER25		x	
AER26	X		
AER27			x

Map Label	Field Measurement	Insignificant Source	Excluded
AER28		x	
AER29		x	
AER30		x	
AER31		x	
AER32	x		
AER33		x	
AER34	x		
AER35			x
AER36	x		
AER37			x
AER38	x		
AER39	x		
AER40	x		
AER41			x
AER42	x		
AER43	x		
AER44		x	
AER45	x		
AER46			x
AER47			x
AER48			x
AER49			x
AER50			x
AER51			x
AER52			x
AER53			x
AER54			x
AER55			x
AER56			x
AER57			x
AER58			x

Map Label	Field Measurement	Insignificant Source	Excluded
AER59	x		
AER60	x		
AER61	x		
AER62			x
AER63			x
AER64			x
AER65			x
AER66	X		
AER67	X		
AER68	X		
AER69	x		
AER70	x		
AER71	x		
AER72	x		
AER73	x		
AER74	x		
AER75	x		
AER76			x
AER77	x		
AER78	x		
AER79			x
AER80	x		
AER81	x		
AER82	x		
AER83	x		
AER84	x		
AER85	x		
AER86	x		
AER87	x		
AER88	x		
AER89	x		

Map Label	Field Measurement	Insignificant Source	Excluded
AER90	x		
AER91	x		
AER92	x		
AER93	x		
AER94	x		
AER95			x
AER96	x		
AER97			x
AER98	x		
AER99	x		
AER100	x		
AER101	x		
AER102	x		
AER103	x		
AER104	x		
AER105	x		
AER106	x		
AER107	x		
AER108	x		
AER109	x		
AER110	x		
AER111	x		
AER112	x		
AER113	x		
AER114			x
AER115	x		
AER116	x		
AER117	x		
AER118*	x		
AER119	x		
AER120	x		

Map Label	Field Measurement	Insignificant Source	Excluded
AER121	x		
AER122			x
AER123	x		
AER124			x
AER125	x		
AER126	x		
AER127	x		
AER128	x		
AER129	x		
AER130	x		
AER131	x		

*AER118 was not operational at time of site visit; however, the operator confirmed it may be operational again in the future. In the absence of field measurements for AER118, it was modelled with the same sound power level as AER117. The sound power level of AER117 represents the loudest engine skid located on the same well pad as AER118.

Appendix C: 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	Wind Turbine Generator (T09)	700m W	AER68	710m SW
R02	Wind Turbine Generator (T14)	870m NE	AER24	750m NW
R03	Wind Turbine Generator (T14)	1230m E	AER24	270m NW
R04	Wind Turbine Generator (T11)	1210m E	AER94	650m NE
R05	Wind Turbine Generator (T07)	1090m E	AER09	760m NE
R06	Wind Turbine Generator (T16)	1050m NE	AER40	1480m NE
R07	Wind Turbine Generator (T17)	1340m SW	AER67	1390m SW
R08	Wind Turbine Generator (T17)	1160m SW	AER67	1340m SW
R09	Wind Turbine Generator (T05)	1130m NE	AER09	1620m SW
R10	Wind Turbine Generator (T06)	1190m SE	AER06	1850m E
R11	Wind Turbine Generator (T06)	1300m S	AER06	1090m S
R12	Wind Turbine Generator (T05)	1380m NW	AER81	920m NE
R13	Wind Turbine Generator (T04)	1330m W	AER39	670m NW
R14	Wind Turbine Generator (T03)	860m NE	AER32	460m E

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
R15	Wind Turbine Generator (T03)	1050m SE	AER18	300m SW
R16	Wind Turbine Generator (T05)	1140m NW	AER03	280m NW
R17	Wind Turbine Generator (T02)	1440m SW	AER93	1130m N
R18	Wind Turbine Generator (T02)	1490m SW	AER93	1080m N
R19	Wind Turbine Generator (T09)	1010m S	AER43	590m NW
R20	Wind Turbine Generator (T01)	910m S	AER92	2390m E
R21	Wind Turbine Generator (T06)	890m SW	AER06	610m SE
R22	Wind Turbine Generator (T04)	900m NW	AER39	1000m N

Appendix D: Vendor's Sound data (V163-4.5NW)

3.2 Results V163 4.5 MW – PO4500

Frequency	Hub height wind speeds [m/s]												
	3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s	13 m/s	14 m/s	15 m/s
6.3 Hz	18.6	15.8	18.5	22.3	26.2	29.4	30.7	32.7	33.7	33.8	33.6	33.2	32.6
8 Hz	25.0	22.5	25.3	29.0	32.9	36.0	37.2	39.1	39.9	40.0	39.8	39.4	38.8
10 Hz	31.1	28.9	31.6	35.3	39.1	42.2	43.4	45.1	45.9	45.9	45.7	45.3	44.8
12.5 Hz	36.8	34.9	37.6	41.2	45.0	48.1	49.3	50.8	51.5	51.5	51.3	50.9	50.4
16 Hz	42.5	40.9	43.3	46.9	50.6	53.6	54.8	56.2	56.7	56.7	56.5	56.1	55.6
20 Hz	47.9	46.6	48.9	52.1	55.8	58.8	60.0	61.2	61.7	61.6	61.4	61.1	60.6
25 Hz	53.3	52.3	54.3	57.4	61.1	63.7	64.8	65.8	66.2	66.2	66.0	65.6	65.2
31.5 Hz	58.3	57.5	59.6	62.3	66.0	68.5	69.7	70.6	70.9	70.8	70.6	70.3	69.9
40 Hz	62.8	62.2	64.4	67.2	70.9	73.1	74.2	75.0	75.2	75.1	74.9	74.6	74.2
50 Hz	66.7	66.4	68.8	71.7	75.3	77.6	78.7	79.3	79.5	79.5	79.2	79.0	78.6
63 Hz	70.2	70.0	72.6	75.7	79.3	81.6	82.8	83.3	83.4	83.3	83.1	82.9	82.5
80 Hz	73.0	73.0	75.8	79.1	82.7	85.2	86.3	86.7	86.8	86.7	86.5	86.3	86.0
100 Hz	75.4	75.5	78.5	82.0	85.5	88.2	89.4	89.7	89.7	89.6	89.5	89.3	89.0
125 Hz	77.2	77.5	80.7	84.3	87.9	90.7	91.9	92.1	92.1	92.0	91.9	91.7	91.4
160 Hz	78.6	79.0	82.3	86.1	89.6	92.7	93.8	94.0	94.0	93.9	93.7	93.6	93.4
200 Hz	79.5	80.0	83.4	87.3	90.9	94.1	95.2	95.3	95.3	95.2	95.1	94.9	94.8
250 Hz	80.3	81.0	84.1	88.1	91.6	95.0	96.1	96.1	96.1	96.0	95.9	95.8	95.7
315 Hz	80.9	81.6	84.7	88.4	91.9	95.3	96.4	96.4	96.4	96.3	96.3	96.2	96.1
400 Hz	81.5	82.3	85.0	88.7	92.2	95.3	96.4	96.3	96.3	96.2	96.2	96.2	96.1
500 Hz	81.8	82.6	85.3	88.6	92.1	95.2	96.3	96.2	96.2	96.2	96.2	96.2	96.1
630 Hz	81.7	82.5	85.3	88.5	92.0	94.8	95.9	95.8	95.7	95.7	95.8	95.8	95.8
800 Hz	81.3	82.1	84.9	88.1	91.6	94.4	95.5	95.4	95.3	95.4	95.5	95.5	95.6
1 kHz	80.5	81.4	84.1	87.4	90.9	93.6	94.7	94.6	94.6	94.7	94.8	94.9	95.0
1.25 kHz	79.4	80.2	83.0	86.3	89.8	92.5	93.6	93.5	93.6	93.7	93.8	94.0	94.1
1.6 kHz	78.0	78.8	81.5	84.8	88.3	91.1	92.2	92.1	92.2	92.3	92.5	92.7	92.9
2 kHz	76.2	76.9	79.7	83.0	86.5	89.3	90.4	90.3	90.5	90.7	90.9	91.1	91.4
2.5 kHz	74.1	74.7	77.5	80.9	84.4	87.1	88.3	88.2	88.4	88.7	89.0	89.2	89.5
3.15 kHz	71.6	72.2	75.0	78.3	81.9	84.7	85.8	85.8	86.0	86.3	86.7	87.0	87.3
4 kHz	68.8	69.3	72.1	75.5	79.0	81.8	82.9	83.0	83.3	83.7	84.1	84.4	84.8
5 kHz	65.7	66.0	68.9	72.2	75.8	78.6	79.7	79.9	80.3	80.7	81.1	81.5	82.0
6.3 kHz	62.2	62.4	65.3	68.7	72.3	75.1	76.2	76.4	76.9	77.4	77.9	78.3	78.8
8 kHz	58.4	58.5	61.3	64.7	68.4	71.2	72.3	72.6	73.2	73.7	74.3	74.8	75.3
10 kHz	54.2	54.1	57.0	60.5	64.1	67.0	68.1	68.5	69.2	69.8	70.4	70.9	71.5
A-wgt	91.6	92.3	95.2	98.7	102.2	105.2	106.3	106.3	106.3	106.3	106.3	106.3	106.3

Table 2: V163-4.5MW PO4500, expected 1/3 octave band performance
(Blades with serrated trailing edges)

3.3 Results V163 4.5 MW – SO1

Frequency	Hub height wind speeds [m/s]												
	3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s	13 m/s	14 m/s	15 m/s
6.3 Hz	18.9	15.5	18.1	21.8	25.6	28.7	29.5	31.4	32.4	32.5	32.3	31.9	31.3
8 Hz	25.3	22.2	24.9	28.5	32.3	35.3	36.0	37.8	38.6	38.7	38.5	38.1	37.5
10 Hz	31.4	28.6	31.2	34.8	38.5	41.5	42.2	43.8	44.6	44.6	44.4	44.0	43.5
12.5 Hz	37.1	34.6	37.2	40.7	44.4	47.4	48.1	49.5	50.2	50.2	50.0	49.6	49.0
16 Hz	42.8	40.6	42.9	46.4	50.0	52.9	53.6	54.8	55.4	55.4	55.2	54.8	54.3
20 Hz	48.2	46.3	48.5	51.6	55.2	58.1	58.8	59.9	60.4	60.3	60.1	59.7	59.3
25 Hz	53.6	52.0	53.9	56.9	60.5	63.0	63.6	64.5	64.9	64.9	64.7	64.3	63.9
31.5 Hz	58.6	57.2	59.2	61.8	65.4	67.8	68.5	69.3	69.6	69.5	69.3	69.0	68.6
40 Hz	63.1	61.9	64.0	66.7	70.3	72.4	73.0	73.7	73.9	73.8	73.6	73.3	72.9
50 Hz	67.0	66.1	68.4	71.2	74.7	76.9	77.5	78.0	78.2	78.2	77.9	77.7	77.3
63 Hz	70.5	69.7	72.2	75.2	78.7	80.9	81.5	82.0	82.1	82.0	81.8	81.6	81.2
80 Hz	73.3	72.7	75.4	78.6	82.1	84.5	85.1	85.4	85.5	85.4	85.2	85.0	84.7
100 Hz	75.7	75.2	78.1	81.5	84.9	87.5	88.1	88.4	88.4	88.3	88.2	88.0	87.7
125 Hz	77.5	77.2	80.3	83.8	87.3	90.0	90.6	90.8	90.8	90.7	90.6	90.4	90.1
160 Hz	78.9	78.7	81.9	85.6	89.0	92.0	92.5	92.7	92.7	92.6	92.4	92.3	92.1
200 Hz	79.8	79.7	83.0	86.8	90.3	93.4	93.9	94.0	94.0	93.9	93.8	93.6	93.5
250 Hz	80.6	80.7	83.7	87.6	91.0	94.3	94.8	94.8	94.8	94.7	94.6	94.5	94.4
315 Hz	81.2	81.3	84.3	87.9	91.3	94.6	95.1	95.1	95.1	95.0	95.0	94.9	94.8
400 Hz	81.8	82.0	84.6	88.2	91.6	94.6	95.1	95.0	95.0	94.9	94.9	94.9	94.8
500 Hz	82.1	82.3	84.9	88.1	91.5	94.5	95.0	94.9	94.9	94.9	94.9	94.9	94.8
630 Hz	82.0	82.2	84.9	88.0	91.4	94.1	94.5	94.5	94.4	94.4	94.5	94.5	94.5
800 Hz	81.6	81.8	84.5	87.6	91.0	93.7	94.1	94.1	94.0	94.1	94.2	94.2	94.3
1 kHz	80.8	81.1	83.7	86.9	90.3	92.9	93.4	93.3	93.3	93.4	93.5	93.6	93.7
1.25 kHz	79.7	79.9	82.6	85.8	89.2	91.8	92.3	92.2	92.3	92.4	92.5	92.7	92.8
1.6 kHz	78.3	78.5	81.1	84.3	87.7	90.4	90.9	90.8	90.9	91.0	91.2	91.4	91.6
2 kHz	76.5	76.6	79.3	82.5	85.9	88.6	89.1	89.0	89.2	89.4	89.6	89.8	90.1
2.5 kHz	74.4	74.4	77.1	80.4	83.8	86.4	86.9	86.9	87.1	87.4	87.7	87.9	88.2
3.15 kHz	71.9	71.9	74.6	77.8	81.3	84.0	84.5	84.5	84.7	85.0	85.4	85.7	86.0
4 kHz	69.1	69.0	71.7	75.0	78.4	81.1	81.6	81.7	82.0	82.4	82.8	83.1	83.5
5 kHz	66.0	65.7	68.5	71.7	75.2	77.9	78.4	78.6	79.0	79.4	79.8	80.2	80.7
6.3 kHz	62.5	62.1	64.9	68.2	71.7	74.4	74.9	75.1	75.6	76.1	76.6	77.0	77.5
8 kHz	58.7	58.2	60.9	64.2	67.8	70.5	71.0	71.3	71.9	72.4	73.0	73.5	74.0
10 kHz	54.5	53.8	56.6	60.0	63.5	66.3	66.8	67.2	67.9	68.5	69.1	69.6	70.2
A-wgt	91.9	92.0	94.8	98.2	101.6	104.5	105.0	105.0	105.0	105.0	105.0	105.0	105.0

Table 3: V163-4.5MW SO1, expected 1/3 octave band performance
(Blades with serrated trailing edges)

3.4 Results V163 4.5 MW – SO2

Frequency	Hub height wind speeds [m/s]												
	3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s	13 m/s	14 m/s	15 m/s
6.3 Hz	18.9	15.5	18.1	21.8	25.6	26.9	28.1	30.2	30.8	31.0	30.7	30.1	29.5
8 Hz	25.3	22.2	24.9	28.5	32.3	33.5	34.6	36.6	37.1	37.2	36.9	36.4	35.7
10 Hz	31.4	28.6	31.2	34.8	38.5	39.8	40.8	42.6	43.0	43.1	42.8	42.3	41.7
12.5 Hz	37.1	34.6	37.2	40.7	44.4	45.7	46.7	48.2	48.6	48.7	48.4	47.9	47.3
16 Hz	42.8	40.6	42.9	46.4	50.0	51.3	52.2	53.6	53.9	53.9	53.6	53.1	52.6
20 Hz	48.2	46.3	48.5	51.6	55.2	56.5	57.3	58.5	58.8	58.8	58.5	58.1	57.5
25 Hz	53.6	52.0	53.9	56.9	60.5	61.4	62.1	63.2	63.4	63.4	63.1	62.7	62.2
31.5 Hz	58.6	57.2	59.2	61.8	65.4	66.3	66.9	67.9	68.1	68.0	67.7	67.3	66.9
40 Hz	63.1	61.9	64.0	66.7	70.3	70.8	71.4	72.3	72.4	72.3	72.0	71.7	71.2
50 Hz	67.0	66.1	68.4	71.2	74.7	75.4	75.9	76.6	76.7	76.6	76.4	76.0	75.6
63 Hz	70.5	69.7	72.2	75.2	78.7	79.4	79.9	80.6	80.6	80.5	80.3	80.0	79.6
80 Hz	73.3	72.7	75.4	78.6	82.1	83.0	83.4	84.0	84.0	83.9	83.7	83.4	83.1
100 Hz	75.7	75.2	78.1	81.5	84.9	86.1	86.5	86.9	86.9	86.8	86.6	86.4	86.1
125 Hz	77.5	77.2	80.3	83.8	87.3	88.6	88.9	89.3	89.3	89.2	89.0	88.8	88.5
160 Hz	78.9	78.7	81.9	85.6	89.0	90.6	90.9	91.2	91.2	91.0	90.9	90.7	90.5
200 Hz	79.8	79.7	83.0	86.8	90.3	92.0	92.2	92.5	92.5	92.4	92.2	92.1	91.9
250 Hz	80.6	80.7	83.7	87.6	91.0	92.9	93.1	93.3	93.3	93.2	93.1	93.0	92.8
315 Hz	81.2	81.3	84.3	87.9	91.3	93.2	93.5	93.6	93.6	93.5	93.5	93.4	93.3
400 Hz	81.8	82.0	84.6	88.2	91.6	93.2	93.4	93.5	93.5	93.4	93.4	93.4	93.3
500 Hz	82.1	82.3	84.9	88.1	91.5	93.1	93.3	93.4	93.4	93.4	93.4	93.4	93.4
630 Hz	82.0	82.2	84.9	88.0	91.4	92.7	92.8	92.9	92.9	92.9	93.0	93.0	93.1
800 Hz	81.6	81.8	84.5	87.6	91.0	92.3	92.4	92.5	92.5	92.6	92.7	92.7	92.8
1 kHz	80.8	81.1	83.7	86.9	90.3	91.5	91.7	91.8	91.8	91.9	92.0	92.1	92.3
1.25 kHz	79.7	79.9	82.6	85.8	89.2	90.4	90.6	90.7	90.8	90.9	91.1	91.2	91.4
1.6 kHz	78.3	78.5	81.1	84.3	87.7	89.0	89.1	89.3	89.4	89.6	89.8	90.0	90.2
2 kHz	76.5	76.6	79.3	82.5	85.9	87.2	87.3	87.5	87.7	87.9	88.1	88.4	88.7
2.5 kHz	74.4	74.4	77.1	80.4	83.8	85.0	85.2	85.5	85.6	85.9	86.2	86.5	86.8
3.15 kHz	71.9	71.9	74.6	77.8	81.3	82.5	82.7	83.0	83.2	83.6	83.9	84.3	84.6
4 kHz	69.1	69.0	71.7	75.0	78.4	79.7	79.9	80.3	80.5	80.9	81.3	81.7	82.1
5 kHz	66.0	65.7	68.5	71.7	75.2	76.5	76.7	77.2	77.5	77.9	78.4	78.9	79.3
6.3 kHz	62.5	62.1	64.9	68.2	71.7	72.9	73.2	73.7	74.1	74.6	75.1	75.7	76.2
8 kHz	58.7	58.2	60.9	64.2	67.8	69.0	69.3	69.9	70.4	71.0	71.6	72.1	72.7
10 kHz	54.5	53.8	56.6	60.0	63.5	64.8	65.1	65.8	66.3	67.0	67.7	68.3	68.9
A-wgt	91.9	92.0	94.8	98.2	101.6	103.1	103.3	103.5	103.5	103.5	103.5	103.5	103.5

Table 4: V163-4.5MW SO2, expected 1/3 octave band performance

(Blades with serrated trailing edges)

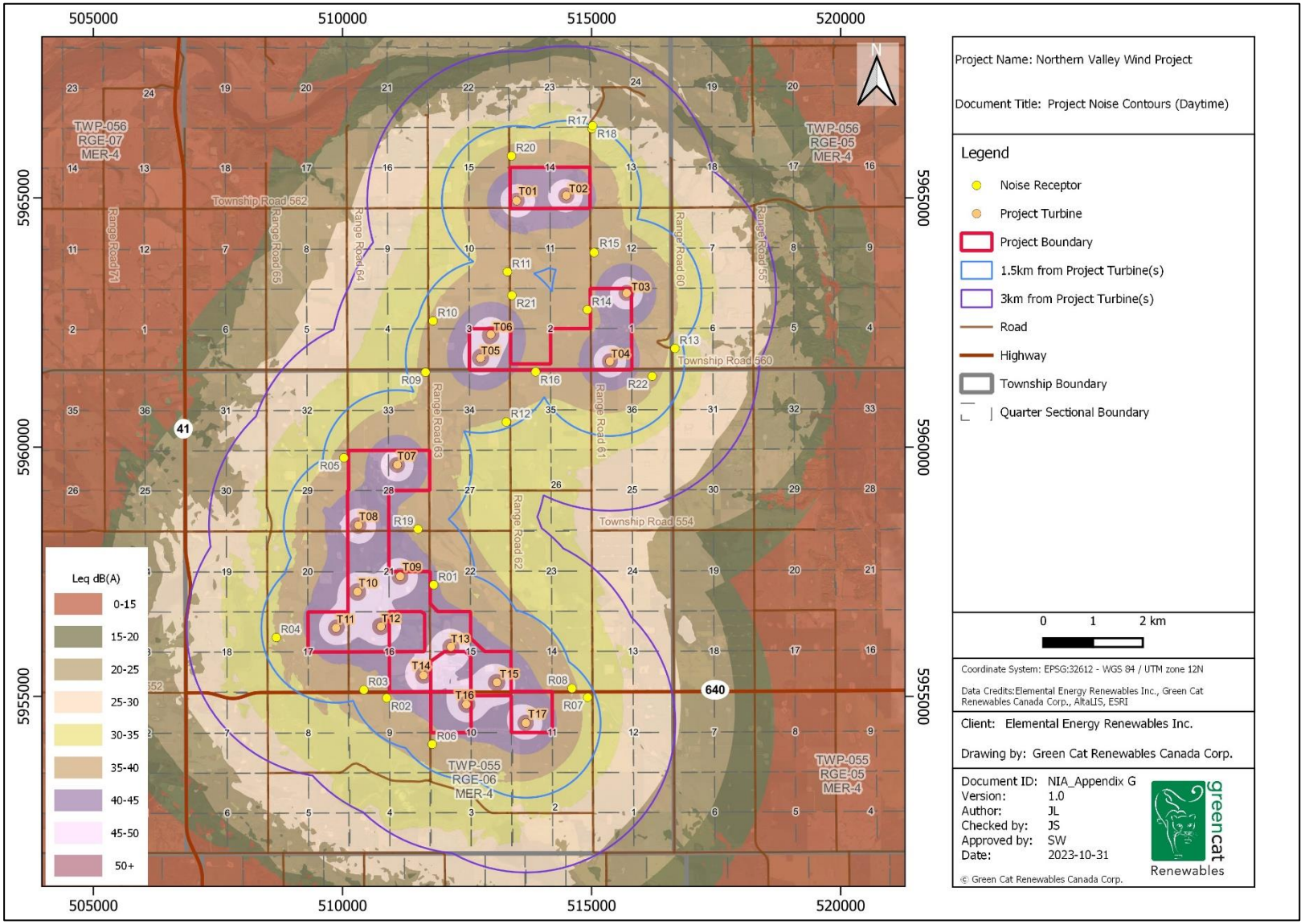
3.5 Results V163 4.5 MW – SO3

Frequency	Hub height wind speeds [m/s]												
	3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s	13 m/s	14 m/s	15 m/s
6.3 Hz	18.9	15.5	18.1	21.8	23.7	23.7	25.2	27.0	27.6	27.5	27.1	26.4	25.6
8 Hz	25.3	22.2	24.9	28.5	30.3	30.3	31.7	33.3	33.8	33.7	33.3	32.7	31.9
10 Hz	31.4	28.6	31.2	34.8	36.6	36.6	37.9	39.3	39.8	39.6	39.2	38.6	37.9
12.5 Hz	37.1	34.6	37.2	40.7	42.6	42.6	43.7	45.0	45.4	45.2	44.8	44.2	43.6
16 Hz	42.8	40.6	42.9	46.3	48.2	48.2	49.2	50.3	50.6	50.5	50.1	49.5	48.9
20 Hz	48.2	46.3	48.5	51.6	53.4	53.4	54.3	55.3	55.5	55.4	55.0	54.5	53.9
25 Hz	53.6	52.0	53.9	56.9	58.7	58.7	59.5	60.4	60.5	60.4	60.0	59.5	58.9
31.5 Hz	58.6	57.2	59.2	61.8	63.6	63.6	64.3	65.1	65.2	65.0	64.7	64.2	63.7
40 Hz	63.1	61.9	64.0	66.7	68.6	68.6	69.2	69.8	69.8	69.7	69.3	68.9	68.4
50 Hz	67.0	66.1	68.4	71.2	73.0	73.0	73.5	74.0	74.1	73.9	73.6	73.2	72.7
63 Hz	70.5	69.7	72.2	75.2	77.0	77.0	77.4	77.8	77.8	77.6	77.3	77.0	76.6
80 Hz	73.3	72.7	75.4	78.6	80.4	80.4	80.8	81.1	81.0	80.9	80.6	80.3	79.9
100 Hz	75.7	75.2	78.1	81.5	83.3	83.3	83.6	83.8	83.8	83.6	83.4	83.1	82.7
125 Hz	77.5	77.2	80.3	83.8	85.6	85.6	85.8	86.0	85.9	85.8	85.6	85.3	85.0
160 Hz	78.9	78.7	81.9	85.6	87.4	87.4	87.5	87.6	87.6	87.4	87.3	87.0	86.8
200 Hz	79.8	79.7	83.0	86.8	88.6	88.6	88.7	88.8	88.7	88.6	88.4	88.3	88.1
250 Hz	80.6	80.7	83.7	87.6	89.4	89.4	89.4	89.4	89.4	89.3	89.2	89.0	88.9
315 Hz	81.2	81.3	84.3	87.9	89.7	89.7	89.7	89.7	89.6	89.5	89.4	89.4	89.3
400 Hz	81.8	82.0	84.6	88.2	90.0	90.0	89.9	89.9	89.8	89.8	89.7	89.7	89.6
500 Hz	82.1	82.3	84.9	88.1	89.9	89.9	89.8	89.8	89.7	89.7	89.7	89.7	89.7
630 Hz	82.0	82.2	84.9	88.0	89.8	89.8	89.8	89.7	89.7	89.7	89.7	89.8	89.8
800 Hz	81.6	81.8	84.5	87.6	89.4	89.4	89.4	89.3	89.3	89.4	89.4	89.5	89.6
1 kHz	80.8	81.1	83.7	86.9	88.7	88.7	88.6	88.5	88.6	88.7	88.8	88.9	89.1
1.25 kHz	79.7	79.9	82.6	85.8	87.6	87.6	87.5	87.5	87.6	87.7	87.9	88.0	88.2
1.6 kHz	78.3	78.5	81.1	84.3	86.1	86.1	86.1	86.0	86.2	86.4	86.6	86.8	87.0
2 kHz	76.5	76.6	79.3	82.5	84.3	84.3	84.3	84.3	84.5	84.7	85.0	85.2	85.5
2.5 kHz	74.4	74.4	77.1	80.4	82.2	82.2	82.1	82.2	82.4	82.7	83.0	83.4	83.7
3.15 kHz	71.9	71.9	74.6	77.8	79.7	79.7	79.6	79.8	80.1	80.4	80.8	81.1	81.5
4 kHz	69.1	69.0	71.7	75.0	76.8	76.8	76.8	77.0	77.4	77.8	78.2	78.6	79.0
5 kHz	66.0	65.7	68.5	71.7	73.6	73.6	73.6	73.9	74.3	74.8	75.3	75.7	76.2
6.3 kHz	62.5	62.1	64.9	68.2	70.0	70.0	70.1	70.4	71.0	71.5	72.0	72.6	73.1
8 kHz	58.7	58.2	60.9	64.2	66.1	66.1	66.2	66.6	67.3	67.9	68.5	69.0	69.6
10 kHz	54.5	53.8	56.6	60.0	61.8	61.8	62.0	62.5	63.2	63.9	64.6	65.2	65.8
A-wgt	91.9	92.0	94.8	98.2	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 5: V163-4.5MW SO3, expected 1/3 octave band performance
(Blades with serrated trailing edges)

Appendix E: Project Sound Level Contours (NT)

Appendix F: Project Sound Level Contours (DT)



Registered Office
Green Cat Renewables Canada Corporation
#855 – 401 9th Avenue SW
Calgary, Alberta
T2P 3C5

+1 866 216 2481

info@greencatrenewables.ca
www.greencatrenewables.ca