Appendix L

Noise Impact Assessment

umwelt

Yathroo Wind Farm

Noise Impact Assessment

FINAL

July 2025

umwelt

Yathroo Wind Farm

Noise Impact Assessment

FINAL

Prepared by
Umwelt (Australia) Pty Limited

On behalf of
Neoen

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Report No.:	24360_R011.5
Date:	July 2025

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Acknowledgement of Country

Umwelt acknowledges the Traditional Owners of Country throughout Australia and their continuing values, culture and connection to the land, waters and sky.

We pay our respects to Elders past and present.

The below image is from the artwork *Yapung Maryiyang* (Pathway Forward) by Saretta Fielding.

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1.0 Introduction

Umwelt was engaged by Neoen Australia Pty Ltd (Neoen) to undertake a Noise Impact Assessment (NIA) for the Yathroo Wind Farm (the Project), located near Cataby, approximately 120 km north of Perth, Western Australia.

This NIA provides an assessment of the potential noise impacts associated with the Project wind turbine generators (WTGs) and Battery Energy Storage System (BESS).

1.1 Overview of Project

The Project Boundary is situated approximately 120 km north of Perth, within the Shire of Dandaragan. It is located in the Wheatbelt region of Western Australia, with the Project Area comprising approximately 15,617 hectares. The Shire of Dandaragan is bounded in the east by the Shires of Moora and Victoria Plains; in the north by the Shire of Coorow; in the south by the Shire of Gingin, and in the west by the Indian Ocean.

The primary infrastructure of the Project includes up to 65 WTGs, an electrical substation, switch yards, a BESS, access roads, office and maintenance buildings, overhead and underground cablings, as well as other types of ancillary construction and operational infrastructure.

The conceptual layout for the Project, showing WTG locations, indicative BESS location and receivers is shown in **Figure 1.1**. WTG coordinates are provided in **Appendix C.**

1.2 Receivers

Receiver locations within 5 km of the Project Boundary were identified and classified by Neoen, with some assistance provided by Umwelt. A total of 48 receivers were identified, comprising 15 involved (associated) and 33 non-involved (non-associated) receivers. As described in **Section 2.3.1**, alternative noise limits have been adopted for receivers associated with the Project (i.e. host properties and/or where an agreement is in place between the landowner and the proponent).

The identified receivers are shown on **Figure 1.1** and receiver coordinates are provided in **Appendix D**.

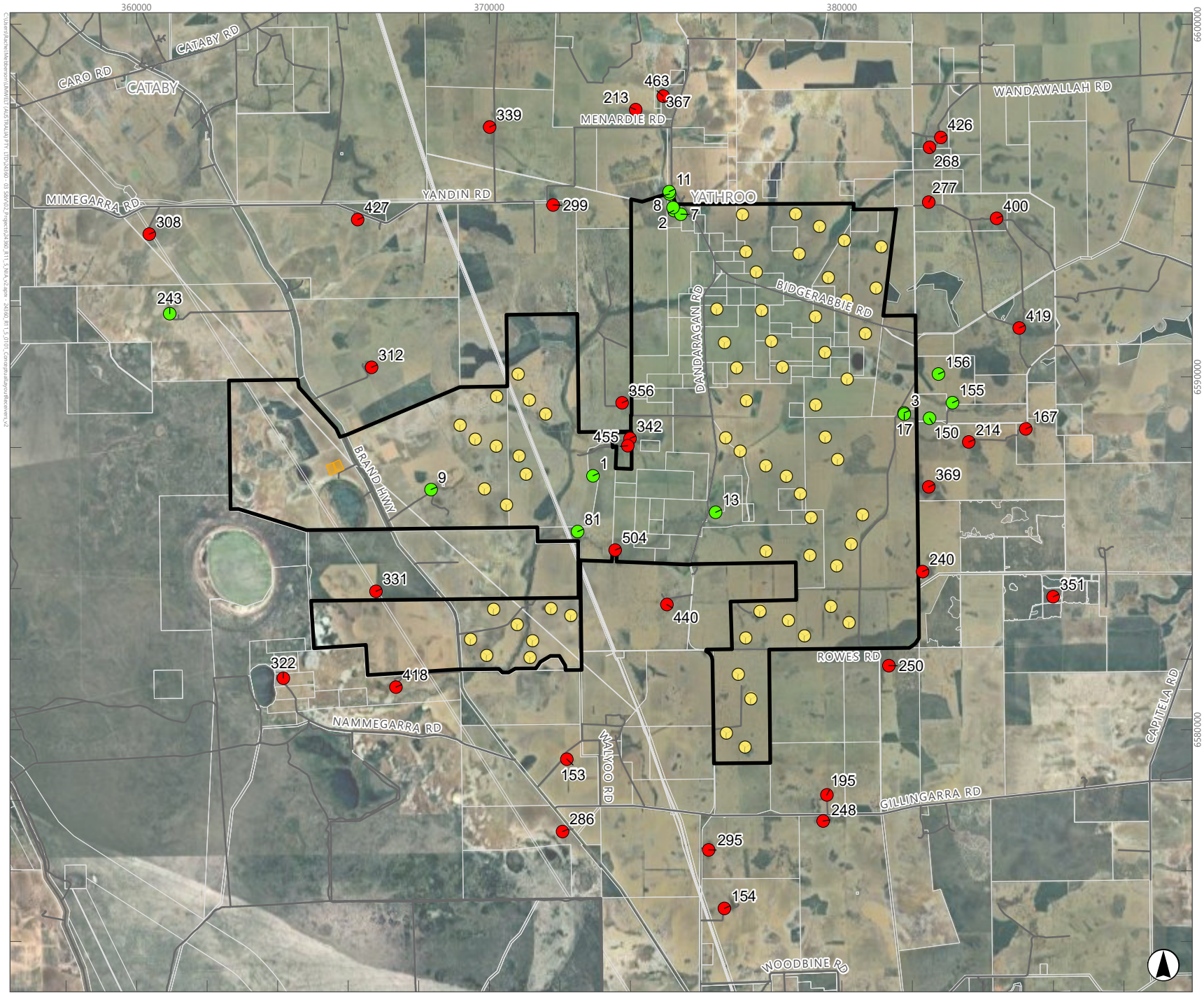

FIGURE 1.1

Conceptual Layout and Receivers

Legend

- Study Area
- BESS Footprint
- Road
- Property Boundary
- Wind Turbine Generators

Sensitive Recievers

- House: Involved
- House: Non-Involved

0 2.5 5

Kilometres

Scale 1:150,000 at A4
GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2024), DBCA (2023), Umwelt (2025), Neoen (2025)

2.0 Assessment Framework

This NIA has been prepared in accordance with the following regulations and guideline requirements:

- Western Australian Planning Commission *Position Statement: Renewable energy facilities* (WAPC, March 2020) ('Position Statement').
- Western Australia Environmental Protection (Noise) Regulations 1997 ('Noise Regulations').
- Western Australia Department of Water and Environmental Regulation *Draft Guideline - Assessment of environmental noise emissions* (DWER, 2021) ('the Guideline').

This NIA has also considered the South Australian Environment Protection Authority *Wind farms environmental noise guidelines* ('SA Guidelines') (SA EPA, July 2009, amended 2021). ('SA Guidelines 2009' / 'SA Guidelines 2021').

2.1 Noise Regulations and the Guideline

The Noise Regulations set the prescribed standard for noise emissions from an activity in the form of Assigned Levels, which vary depending on the type of premises receiving noise. The Guideline provides non-mandatory guidance on what information should be contained within a noise impact assessment.

For noise sensitive premises, the assigned noise levels include the evaluation of an 'influencing factor' which considers the proximity of commercial and industrial zoning and public roads. The influencing factor is determined in accordance with Schedule 3 of the Noise Regulations, which considers the type of zone and public road that are located within a 100 m and 450 m radius of the sensitive premises. The assigned levels in Table 1 of the Noise Regulations are outlined in **Table 2.1**.

Table 2.1 Assigned Levels for All Premises

Type of premises receiving noise	Time of day	Assigned level (dB)		
		LA 10	LA 1	LA max
Noise sensitive premises: highly sensitive area (locations within 15 metres of a building directly associated with a noise sensitive use)	0700 to 1900 hours Monday to Saturday (Day)	45 + influencing factor	55 + influencing factor	65 + influencing factor
	0900 to 1900 hours Sunday and public holidays (Sunday Day)	40 + influencing factor	50 + influencing factor	65 +influencing factor
	1900 to 2200 hours all days (Evening)	40 + influencing factor	50 + influencing factor	55 + influencing factor
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays (Night)	35 + influencing factor	45 + influencing factor	55 + influencing factor
Noise sensitive premises:	All hours	60	75	80

Type of premises receiving noise	Time of day	Assigned level (dB)		
		LA 10	LA 1	LA max
any area other than highly sensitive area (locations further than 15 metres of a building directly associated with a noise sensitive use)				
Commercial premises	All hours	60	75	80
Industrial and utility premises [1]	All hours	65	80	90

Note [1] other than those in the Kwinana Industrial Area

2.1.1 Intrusive Noise Characteristics

If noise emitted from any premises when received at any other premises cannot reasonably and practicably be free of intrusive characteristics of tonality, modulation and impulsiveness, then a series of adjustments must be added to the emitted levels (measured or calculated) and the adjusted level must comply with the assigned level.

The adjustments are detailed in **Table 2.2** and are further defined in Regulation 9 of the Noise Regulations.

Table 2.2 Adjustments to Emitted Noise Level

Noise Characteristic	Tonality [1]	Modulation [2]	Impulsiveness [3]
Adjustment if present [1]	+5 dB	+5 dB	+10 dB

Notes:

[1] Where the difference between the A-weighted sound pressure level in any one third octave band and the arithmetic average of the A-weighted sound pressure levels in the two adjacent one-third octave bands is greater than 3 dB in terms of LAeq,T where the time period T is greater than 10% of the representative assessment period, or greater than 8 dB at any time when the sound pressure levels are determined as LASlow levels.

[2] A variation in the emission of noise that; is more than 3 dB LAFast or is more than 3 dB LAFast in any one third octave band; and is present for at least 10% of the representative assessment period; and, is regular, cyclic and audible.

[3] Present where the difference between the LAPeak and LAmax is more than 15 dB when determined for single representative event.

[4] Where noise emission is not music, these adjustments are cumulative to a maximum of 15 dB.

Intrusive noise characteristics are discussed further in addressed in **Section 4.1.3.**

2.1.2 Cumulative Levels

In accordance with the Noise Regulations, noise emitted from any premises when received at any other premises must not 'significantly contribute to' an exceedance of the assigned levels. It is specified that, noise emissions 'significantly contribute to' a level of noise that exceed a value which is 5 dB below the assigned level at the point of reception.

If the overall noise exceeds assigned levels as a result of other industrial/commercial activities, it is expected that the proposed premises can demonstrate compliance by meeting the '5 dB below' requirement.

2.2 Position Statement

The Position Statement specifies the following in regard to wind turbines:

Noise emissions from renewable energy facilities, including wind turbines, are required to meet the standards prescribed under the Environmental Protection (Noise) Regulations 1997. The South Australian Environmental Protection Authority – Wind Farms Environmental Noise Guidelines (2009) should also be referenced for assessment purposes. These guidelines acknowledge the potential for operation in the presence of higher wind-induced background noise levels.

The Position Statement refers to the SA Guidelines 2009 which were subsequently updated in 2021. The general approach in setting noise limits is consistent between the two versions. The changes primarily relate to the technical data analysis procedure when determining the relationship between background noise levels and wind speed. The procedure within SA Guidelines 2021 is now consistent with the International Standard IEC 61400–11 Edition 3. Whilst the Position Statement refers to the 2009 version, the 2021 version has been referenced for this assessment, as it is the most updated revision.

2.3 SA Guidelines 2021

In accordance with the SA Guidelines 2021:

The predicted equivalent noise level (LAeq,10), adjusted for tonality in accordance with these guidelines, should not exceed:

35dB(A) at relevant receivers in localities which are primarily intended for rural living*

OR

40dB(A) at relevant receivers in localities in other zones

OR

the background noise (LA90,10) by more than 5dB(A).

whichever is the greater, at all relevant receivers for wind speeds from cut-in to rated power of the WTG and each integer wind speed in between. These criteria apply for both day and night time hours, but have been based on conservative night time levels.

**Rural Living*

A rural living zone is for an area intended as rural-residential 'lifestyle' with high amenity requirements. This area should not be used for primary production purposes other than to produce food, crops or keep animals solely for the occupier's own use, consumption and/or enjoyment. It is expected that these zones have amenity that is quieter than urban residential and land uses that promote primary production.

2.3.1 Agreements with Wind Farm Developers

The assigned levels in **Section 2.1** and the noise limits in **Section 2.3** have been developed to minimise the impact on the acoustic amenity of premises that do not have an agreement with wind farm developers (i.e. non-associated receivers).

Wind farm developers commonly enter into agreements with the owners of private land suitable for a wind farm site (i.e. associated receivers).

The agreement provides the developer with the appropriate siting and generally awards the landowner with a level of compensation and diversity in their income stream. Notwithstanding this, as described in the SA Guidelines the SA EPA cannot ignore noise impacts on the basis that an agreement has been made between the developer and the landowner. Developers cannot absolve themselves of their obligations under the EP Act (i.e. the development is not to have an 'adverse effect on an amenity value of an area that ... unreasonably interferes with the enjoyment of the area') by entering into an agreement with a landowner.

It is unlikely that there will be unreasonable interference if:

- A formal agreement is documented between the parties.
- The agreement clearly outlines to the landowner the expected impact of the noise from the wind farm and its effect upon the landowner's amenity.
- The likely impact of exposure will not result in adverse health impacts (eg the level does not result in sleep disturbance or impact sufficient amenity outdoors).

As referenced in The SA Guidelines 2001:

the WHO guidelines for community noise (1999) recommend a 30dB(A) indoor limit to prevent negative effects on sleep.

"The World Health Organisation Environmental Noise Guidelines for the European Region (WHO 2018) includes guidelines for noise from wind farms, and a conditional recommendation to reduce noise levels produced by wind turbines below 45dB Lden. The LAeq,10 is considered a more appropriate measure to reflect immediate impact on residents and adopt for compliance checking".

The WHO 1999, indoor limit of 30 dB(A), translates to an outdoor limit of 40-45 dB(A), based on the WHO estimate of a difference between indoor and outdoor levels of 10 dB for an open window and 15 dB for a tilted or half-open window.

Typically for wind farm noise assessments in WA, an upper outdoor noise level target of 45 dB(A) for associated receivers has historically been adopted (for example as conditioned for the adjacent Yandin wind farm).

2.4 DWER ENB

Following guidance from the WA Department of Water and Environmental Regulation (DWER) Environmental Noise Branch (ENB), the project should be designed to comply with the assigned levels set by the Noise Regulations. While the DWER ENB may take into account a LA90,10 + 5dB(A) background noise criterion developed through a specific analysis procedure different from the SA Guidelines 2021, they have advised that compliance with the assigned levels remains appropriate.

For receivers associated with Yandin Wind Farm a noise criterion of 5 dB(A) below the consented limits was proposed to DWER in February 2025 and has been adopted for this assessment. The approved limit for these receivers by the Shire of Dandaragan[1] is as follows:

Condition 13 – Noise from the operational Wind Farm shall not exceed 45 dB(A) or background +5dB whichever is greater (LA90), at surrounding noise sensitive premises within the wind farm boundary, unless otherwise agreed with the respective landowner.

[1] The Shire of Dandaragan Determination for Yandin Wind Farm RRN12762 Brand Highway, Dandaragan (Our Ref DA:14/11 & 15/11), dated 11 January 2012 and the Shire of Dandaragan Amendment letter (Your Ref: DA 14/2011), dated 31 January 2028

2.5 Nominated Operational Criteria of the Wind Turbines

The Position Statement requires that wind turbines in WA meet the standards prescribed in the Noise Regulations, whilst also referencing the SA Guidelines for assessment purposes.

The Noise Regulations minimum assigned levels of 35 dB(A) at night is also consistent with the baseline target of 35 dB(A) within the SA Guidelines. Further, a wind-dependent criterion of 35 dB(A) would have been determined based on the background noise level monitoring results in **Section 3.0**, which is also equivalent to the minimum assigned level of 35 dB(A) at night.

In accordance with the Position Statement and following DWER ENB advice, noise from the Project wind turbines at the non-involved receivers have been assessed under the Noise Regulations, refer to **Section 2.1**. For associated receivers, 45 dB(A) has been adopted for the WTG noise emissions.

2.6 Nominated Operational Criteria of the BESS

Noise from the Project BESS and ancillary equipment are assessed under the Noise Regulations, refer to **Section 2.1**. For associated receivers, 45 dB(A) has been adopted for the BESS noise emissions.

2.7 Cumulative Criteria

Cumulative noise from the Project BESS and wind turbines have been assessed under the Noise Regulations. For those receivers involved with Yandin Wind Farm a cumulative noise criterion of 40 dB(A) has been adopted.

3.0 Existing Noise Environment

Following a Project constraints noise impact assessment, background (unattended) noise level measurements were conducted at seven (7) locations in proximity to the wind farm from 29 January 2025 to 20 March 2025 (refer **Figure 3.1**). The noise monitoring was conducted for the following purposes:

1. Six (6) locations were chosen to represent receiver locations either within or just outside the 35 dB(A) contour based on preliminary noise modelling predictions (81 x WTG layout [Ref: INFR_WTG_ YTOPRJPA001_20241108_g20 m50]). Following the preliminary noise modelling predictions, the layout has since been updated to a 65 x WTG layout [Ref: YTO-PRJ-WTG-012]. The WTG coordinates for the 65-turbine layout is provided in **Appendix C**.
2. One (1) location was chosen to capture ambient noise levels for the purposes of capturing existing industrial noise and addressing cumulative noise from the Project.

In addition to the noise monitors, two (2) ultrasonic automatic weather stations were installed at monitoring locations 277 and 356 to capture ground level meteorology and rainfall.

Details of the noise monitoring locations are shown in **Table 3.1** and **Figure 3.1.**

Table 3.1 Unattended Noise Monitoring Locations

Monitoring Location [1]	Purpose	Monitoring Location Coordinates, GDA2020 / MGA Zone 50		Monitoring Period	
		Easting	Northing	Start	End
250	Establish baseline noise levels and supplement compliance analysis during the commissioning and operational phases	381342	6581884	6/02/2025 [2]	21/03/2025
277 [3]		382418	6594956	29/01/2025	21/03/2025
342		373998	6588283	29/01/2025	21/03/2025
356 [3]		373798	6589257	29/01/2025	21/03/2025
440		375068	6583564	29/01/2025	21/03/2025
504		373494	6585014	6/02/2025 [2]	21/03/2025
331	Capturing existing industrial noise and addressing cumulative noise from the Project	366663	6583907	6/02/2025 [2]	21/03/2025

Notes: [1] Monitoring was also conducted at Receiver 240 but after a period of 10 days the unit was requested to be removed by the resident. The data is not presented

[2] Monitors were relocated on 6/2/25 and positioned further away from dwellings due to extraneous noise from mechanical plant.

[3] Automatic weather station installed at this location.

The background noise monitoring was undertaken in accordance with the SA Guidelines 2021 and guidance from WA DWER ENB.

Reference was also made to the Institute of Acoustics *A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise* (May 2013) ('IoA Guide'). For Location 331, monitoring was undertaken in accordance with Noise Regulations and the Guideline, using a 'Slow' response and an 'A-weighting' filter.

All noise monitoring instrumentation held current National Association of Testing Authorities (NATA) calibration at the time of use. Field calibration checks were undertaken for the instruments pre and post monitoring and were found to be within 1 dB of the reference signal as required by AS1055:2018.

The LA90 background noise levels for each integer wind speed between 3 m/s and 12 m/s, as referenced to 170 m hub height, are presented in **Table 3.2** for all periods (24 hours) and **Table 3.3** for night-time (7:00pm to 7:00am). For location 331, the noise monitoring results are summarised in **Table 3.4**.

Table 3.2 Background Noise Levels, L_{A90} dB – All Periods

Receiver	Monitoring Location	Parameter L90 (10th Percentile) LA90,10mis	Hub Height Wind Speed, m/s									
			3	4	5	6	7	8	9	10	11	12
240 & 250	**250**	Noise Level, dBA	20	23	23	23	23	23	25	26	28	29
		Valid Data Points	188	243	351	389	533	651	759	660	611	399
277	**277**	Noise Level, dBA	20	21	23	22	23	22	21	22	20	20
		Valid Data Points	210	247	366	396	506	671	832	683	650	465
342	**342**	Noise Level, dBA	22	24	24	25	24	23	23	23	23	23
		Valid Data Points	222	260	404	459	590	764	895	766	695	491
356	**356**	Noise Level, dBA	27	27	28	28	29	29	27	28	28	28
		Valid Data Points	225	259	402	467	603	785	926	797	717	506
440	**440**	Noise Level, dBA	25	27	28	28	27	25	26	26	26	26
		Valid Data Points	215	257	401	443	572	727	863	743	697	499
504	**504**	Noise Level, dBA	21	22	22	23	22	21	21	21	21	21
		Valid Data Points	179	220	327	385	511	624	739	642	595	389

Table 3.3 Background Noise Levels, LA90 dB – Night (7:00pm to 7:00am)

Receiver	Monitoring Location	Parameter L90 (10th Percentile) LA90,10mis	Hub Height Wind Speed, m/s									
			3	4	5	6	7	8	9	10	11	12
240 & 250	250	Noise Level, dBA	20	21	21	21	21	22	22	25	27	28
		Valid Data Points	63	83	94	107	177	292	349	337	389	283
277	277	Noise Level, dBA	20	20	21	21	21	21	20	20	20	20
		Valid Data Points	74	86	78	99	151	271	343	342	430	326
342	342	Noise Level, dBA	20	21	21	22	22	22	21	22	21	22
		Valid Data Points	70	81	97	116	187	327	383	384	450	345
356	356	Noise Level, dBA	26	26	25	26	26	27	25	25	27	27
		Valid Data Points	73	89	106	122	205	349	413	408	463	354
440	440	Noise Level, dBA	23	25	23	24	24	22	21	22	23	24
		Valid Data Points	72	88	100	114	185	317	380	373	449	351
504	504	Noise Level, dBA	20	20	20	20	20	21	20	20	20	21
		Valid Data Points	62	77	81	95	159	266	324	322	375	267

Table 3.4 Noise Monitoring Results for Location 331, dB(A)

Period [1]	Descriptor, dB(A) [1]				
	LAmax	LA1	LAeq	LA10	LA90
Day	58	53	41	46	37
Evening	53	48	40	43	38
Night	53	49	42	45	41

Note: [1] Day period is 7.00 am-700 pm Monday-Saturday and 9.00 am-7.00 pm Sunday and Public Holidays, evening period is 7.00 pm-10.00 pm and night period is 10.00 pm to commencement of the day period.

[2] Noise level is the arithmetic mean over the measurement period.

In accordance with DWER ENB analysis procedure for determining wind-dependant background noise criteria, the monitoring results presented in **Table 3.2** and **Table 3.3** indicate that background noise levels are below 30 dBA and therefore have no influence on the derivation of wind-dependent noise criteria.

For location 331, measurement results and field observations indicated extraneous noise from mechanical plant on the property. The monitor was relocated on 6/2/25, however extraneous noise from additional localised plant still appeared to be affecting captured noise levels, particularly during the night. Consequently, it was not possible to quantify existing industrial noise. Nevertheless, for a conservative assessment, **Section 4.4** assumes the dwelling is affected by existing industrial noise.

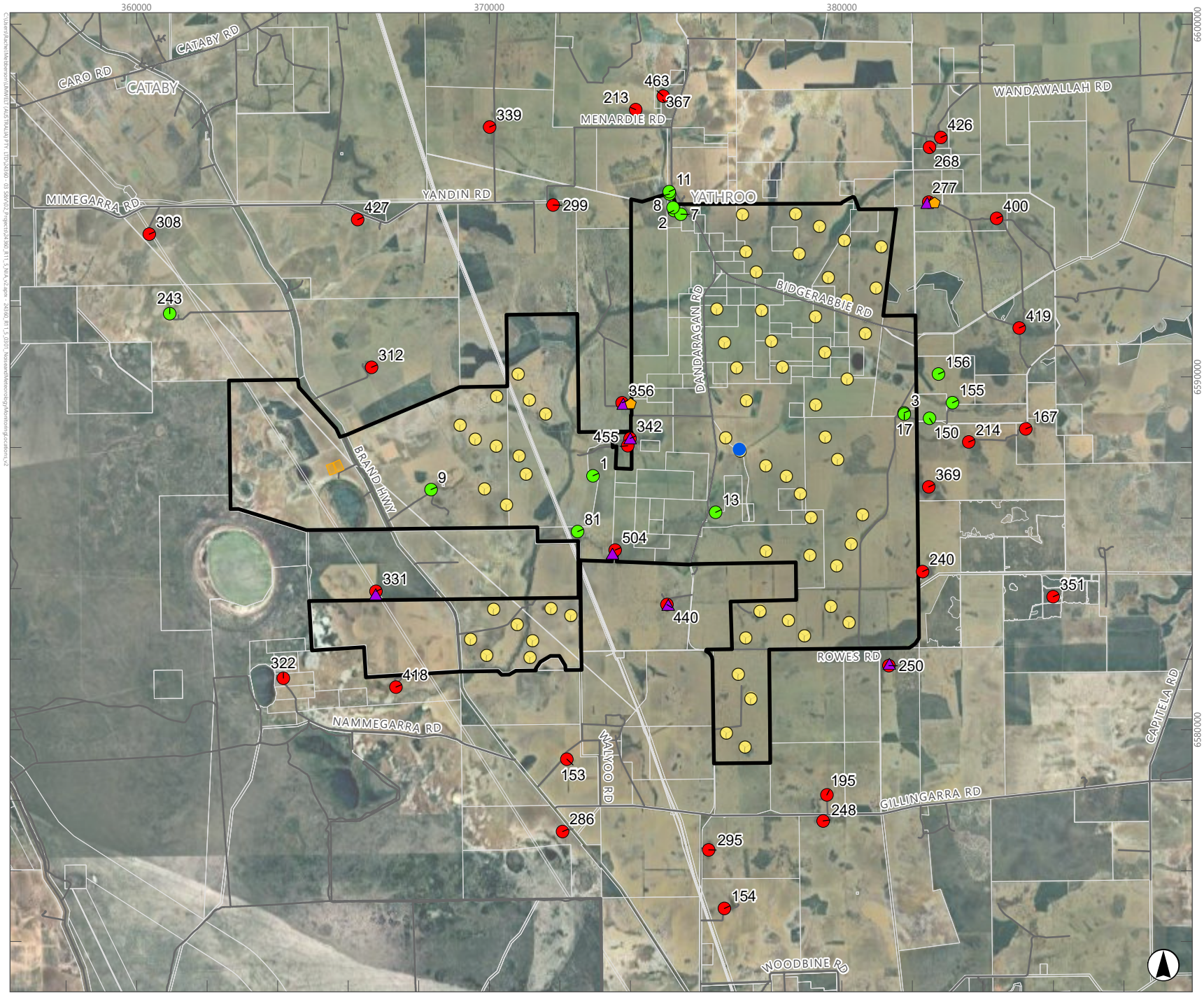

FIGURE 3.1

Noise and Meteorology Monitoring Locations

Legend

- Study Area
- BESS Footprint
- Property Boundary
- Road
- Local Meteorological Monitoring Location
- Meteorological Mast
- Noise Monitoring Location
- Wind Turbine Generators

Sensitive Recievers

- House: Involved
- House: Non-Involved

0 2.5 5

Kilometres

Scale 1:150,000 at A4
GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2024), DBCA (2023), Umwelt (2025), Neoen (2025)

4.0 Noise Assessment

4.1 Wind Turbine Generators

4.1.1 Modelling Methodology

Prediction of the operational noise levels was undertaken with the proprietary noise modelling software SoundPLAN (Version 9.1) using *ISO 9613-2:2024 - Acoustics — Attenuation of sound during propagation outdoors — Part 2* (ISO 9613-2:2024) noise prediction algorithms. The SA Guidelines 2021 and the Guideline both endorse the use of ISO 9613-2.

For the assessment of wind turbine noise, SoundPLAN's implementation of the *Institute of Acoustics (IoA) Windturbines* standard was utilised. The *IoA Windturbines* standard utilises ISO 9613-2, along with additional IoA corrections specific to wind turbines.

The noise model utilises terrain data; source and receiver separation distances and heights; ground attenuation, geometric spreading and atmospheric absorption; source sound power levels (1/3 octave frequency bands) and meteorological conditions favourable to noise propagation to predict noise levels.

4.1.2 Model Inputs and Parameters

In accordance with the SA Guidelines 2021 and guidance from the DWER ENB, the noise model parameters recommended within the Institute of Acoustics - A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise (May 2013) ('IoA Guide') were utilised. The noise prediction model was based on the following inputs:

- Topographic elevation contours (2 m contour interval).
- Receiver locations and classifications. The receiver coordinates are provided **Appendix D**.
- Mixed ground, with a ground absorption factor of 0.5 applied for all areas.
- Project turbine layout with 65 x WTG and a hub height of 170m [Ref: YTO-PRJ-WTG-012]. The WTG coordinates are provided in **Appendix C**.
- A receiver height of 4.0 m above ground level (recommended by the IoA Guide regardless of actual receiver height).
- Atmospheric conditions of 10°C temperature and 70% relative humidity (recommended by IoA Guide).
- No barriers or intervening structures were included, other than those associated with the natural topography. For the wind turbine model, any barrier attenuation attributed to screening by terrain was restricted to a conservative 2 dB(A) (recommended by IoA Guide).
- For concave ground profiles (as defined by the IoA Guide), a correction of +3 dB to be added to calculated noise levels (as implemented by SoundPLAN).
- The wind turbine source levels presented in **Section 4.1.3** and **Appendix B**.

4.1.3 Noise Source Data

For this assessment the following wind turbine was considered:

- Nordex N175_6.X Mode 0 – (Blades with serrated edge)

Neoen provided the reference noise data. All turbines were modelled at a hub height of 170 m above ground level. The noise data was sourced from the Nordex document, *Third Octave Sound Power Levels Nordex N175/6.X (Doc: 9003492), Revision 04, 2024-04-24 (Approved 7-05-2024)*.

The overall sound power levels are presented in **Table 4.1**. The presented sound power levels correspond to wind speeds referenced to the hub height. **Appendix B** provides third octave band spectral data for the full range of wind speeds.

In accordance with the SA Guidelines 2021 the turbine should be assessed to the 'speed of the rated power', which can vary between turbines. For this assessment, the worst-case noise emission and associated spectral data was adopted, which corresponded to 6 to 12 m/s.

Table 4.1 Sound Power Levels at Hub Height Wind Speeds, Lw dB(A)

Turbine	Hub height wind speed m/s									
	3	4	5	6	7	8	9	10	11	12
Nordex N175_6.X Mode 0 (with serrated blades) [1]	97.2	101.1	106.0	107.9	107.9	107.9	107.9	107.9	107.9	107.9

Note: [1] As advised by Neoen, noise levels include a +1 dB(A) uncertainty factor that has been applied to the manufacturer supplied data.

The WTG have been modelled as being free of intrusive noise characteristics (tonality, modulation and impulsiveness) when assessed at receiver locations.

In the event that intrusive noise characteristics (i.e. modulation) are a feature of the turbine, the selected turbine offers significant noise curtailment options and reduced sound power levels for sound optimised modes. It is noted that one of these sound optimised modes could be adopted to offset the presence of a penalty, should a penalty be warranted.

4.1.4 Results

The predicted operational noise levels for the modelled turbine at the identified receivers are shown in **Table 4.2**. Noise level contours are presented in **Appendix E**.

The operational noise levels in **Table 4.2**, are predicted to comply with the day, evening and night-time assigned levels at all existing sensitive receivers. It is noted that Receivers 97 and 124 have been excluded from assessment, as once the Project is operational, these dwellings are anticipated to be uninhabited.

Table 4.2 Turbine Predicted Operational Noise Levels, LA10, dB(A)

Receiver ID	Property Type	Approx. Distance to Nearest Turbine, m	Involvement	Noise Criteria		Predicted Noise Levels LA10, dB(A) [2]
				Sunday Day & Evening [1]	Night [1]	
1	House	1,890	Involved	45	45	36
2	House	1,950	Involved	45	45	34
3	House	1,870	Involved	45	45	36
7	House	1,750	Involved	45	45	35
8	House	2,150	Involved	45	45	33
9	House	1,520	Involved	45	45	36
11	House	2,180	Involved	45	45	33
13	House	1,810	Involved	45	45	38
17	House	1,890	Involved	45	45	36
41	House	1,980	Involved	45	45	34
81	House	2,150	Involved	45	45	36
150	House	2,580	Involved	45	45	34
153	House	3,060	Non-Involved	40	35	30
154	House	4,610	Non-Involved	40	35	24
155	House	3,050	Involved	45	45	32
156	House	2,370	Involved	45	45	34
167	House	5,230	Non-Involved	40	35	28
195	House	2,680	Non-Involved	40	35	30
213	House	4,250	Non-Involved	40 [3]	40 [3]	27
214	House	3,650	Non-Involved	40	35	31
240	House	2,170	Non-Involved	40	35	35
243	House	8,820	Involved	45	45	20
248	House	3,040	Non-Involved	40	35	29
250	House	1,660	Non-Involved	40	35	35
268	House	3,140	Non-Involved	40	35	30
277	House	1,850	Non-Involved	40	35	34
286	House	5,010	Non-Involved	40	35	26
295	House	3,090	Non-Involved	40	35	28
299	House	4,890	Non-Involved	40 [3]	40 [3]	28
308	House	10,350	Non-Involved	40	35	19

Receiver ID	Property Type	Approx. Distance to Nearest Turbine, m	Involvement	Noise Criteria		Predicted Noise Levels LA10, dB(A) [2]
				Sunday Day & Evening [1]	Night [1]	
312	House	3,000	Non-Involved	40 [3]	40 [3]	30
322	House	5,420	Non-Involved	40	35	25
331	House	3,020	Non-Involved	40	35	30
339	House	7,040	Non-Involved	40 [3]	40 [3]	25
342	House	2,490	Non-Involved	40	35	35
351	House	5,830	Non-Involved	40	35	26
356	House	2,190	Non-Involved	40	35	35
367	House	3,960	Non-Involved	40	35	28
369	House	2,030	Non-Involved	40	35	34
400	House	3,370	Non-Involved	40	35	28
418	House	2,510	Non-Involved	40	35	31
419	House	4,210	Non-Involved	40	35	29
426	House	3,540	Non-Involved	40	35	29
427	House	6,310	Non-Involved	40 [3]	40 [3]	23
440	House	2,430	Non-Involved	40	35	35
455	House	2,490	Non-Involved	40	35	35
463	House	4,040	Non-Involved	40	35	27
504	House	2,240	Non-Involved	40	35	35

Notes:[1] Sunday Day: 0900 to 1900 hours Sunday and public holidays; Evening: 1900 to 2200 hours all days; Night: 2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays

[2] Due to the quasi-steady state nature of the WTG and BESS equipment the presented LAeq noise level predictions, which are based on OEM provided LAeq sound power levels, are considered equivalent to the LA10 descriptor and enable comparison with LA10 assigned levels.

[3] Yandin Involved: criterion of 40 dB(A) adopted, which is 5 dB(A) below the Yandin Wind Farm consented noise limits of 45 dB(A).

[4] Receivers 97 and 124 are excluded from assessment, as these dwellings are anticipated to be uninhabited once the project is operational.

4.2 BESS and Ancillary Equipment

The assessment of operational noise from the BESS and ancillary equipment was undertaken by WSP. A briefing note summarising inputs, assumptions, methodology and results is provided in **Appendix F**.

The predicted operational noise levels for the BESS and ancillary equipment at the identified receivers is reproduced in below in **Table 4.3**, for predictions greater than 10 dB(A). The prediction noise levels include a tonality penalty of +5 dB(A). The operational noise levels from the BESS infrastructure, are predicted to comply with the day, evening and night-time assigned levels at all existing sensitive receivers.

Table 4.3 BESS Predicted Operational Noise Levels, LA10, dB(A)

Receiver ID	Property Type	Approx. Distance to Equipment, m	Involvement	Noise Criteria		Predicted Noise Levels LA10, dB(A) [2]	
				Sunday Day & Evening [1]	Night [1]	Sunday Day & Evening	Night
1	house	7,200	Involved	45	45	12	< 10
9	house	2,500	Involved	45	45	34	29
81	house	7,000	Involved	45	45	14	11
243	house	6,100	Involved	45	45	16	13
312	house	2,800	Non-Involved	40 [3]	40 [3]	32	27
331	house	3,600	Non-Involved	40	35	28	24
418	house	6,290	Non-Involved	40	35	16	13

Notes: [1] Sunday Day: 0900 to 1900 hours Sunday and public holidays; Evening: 1900 to 2200 hours all days; Night: 2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays

[2] Due to the quasi-steady state nature of the WTG and BESS equipment the presented LAeq noise level predictions, which are based on `OEM provided LAeq sound power levels, are considered equivalent to the LA10 descriptor and enable comparison with LA10 assigned levels.

[3] Yandin Involved: criterion of 40 dB(A) adopted, which is 5 dB(A) below the Yandin Wind Farm consented noise limits of 45 dB(A).

4.3 Combined Project Noise

Based on the results within **Table 4.2**, and **Table 4.3**, the combined WTG and BESS predicted noise levels are shown in **Table 4.4**. For receivers not included in **Table 4.4**, the predicted BESS noise levels are 10 dB or more below the WTG noise level contribution and therefore are not additive to the overall noise levels.

The operational noise levels presented in **Table 4.4**, are predicted to comply with the day, evening and night-time assigned levels at all existing sensitive receivers.

Further, the noise levels for the turbines and BESS have been predicted under favourable meteorological conditions for noise propagation (i.e. downwind conditions). For Receivers 9, 312, 331 and 418, the combined noise levels are likely lower in practice since they are not expected to be downwind of both sources simultaneously.

Table 4.4 Project Combined Predicted Operational Noise Levels, LA10, dB(A)

Receiver ID	Property Type	Involvement	Noise Criteria		Predicted Noise Levels LA10, dB(A) [2]	
			Sunday Day & Evening [1]	Night [1]	Sunday Day & Evening [1]	Night [1]
1	house	Involved	45	45	36 (WTG 36 / BESS 12)	36 (WTG 36 / BESS <10)
9	house	Involved	45	45	38 (WTG 36 / BESS 34)	37 (WTG 36 / BESS 29)
81	house	Involved	45	45	36 (WTG 36 / BESS 14)	36 (WTG 36 / BESS 11)
243	house	Involved	45	45	22 (WTG 20 / BESS 16)	21 (WTG 20 / BESS 13)
312	house	Non-Involved	40 [3]	40 [3]	34 (WTG 30 / BESS 32)	32 (WTG 30 / BESS 27)
331	house	Non-Involved	40	35	32 (WTG 30 / BESS 28)	31 (WTG 30 / BESS 24)
418	house	Non-Involved	40	35	31 (WTG 31 / BESS 16)	31 (WTG 31 / BESS 13)

Notes: [1] Sunday Day: 0900 to 1900 hours Sunday and public holidays; Evening: 1900 to 2200 hours all days; Night: 2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays

[2] Due to the quasi-steady state nature of the WTG and BESS equipment the presented LAeq noise level predictions, which are based on ` OEM provided LAeq sound power levels, are considered equivalent to the LA10 descriptor and enable comparison with LA10 assigned levels.

[3] Yandin Involved: criterion of 40 dB(A) adopted, which is 5 dB(A) below the Yandin Wind Farm consented noise limits of 45 dB(A).

4.4 Cumulative Noise

Yandin Wind Farm and Cataby Mine are existing industrial operations located to the northwest of the Project. Cumulative noise impacts were investigated, as the Project has the potential to contribute to cumulative noise levels at receivers located in proximity to these other operations.

As a first pass evaluation, receivers located within 4 km of Yandin Wind Farm and/or within 6 km of Cataby Mine were selected for the assessment of cumulative impacts and are shown in **Table 4.5**. With reference to *Condition 14 of the Yandin Consent*[2] and *Section 4.3 of the Cataby Mine EPA Report*[3], these industrial premises are expected to operate well within the assigned levels at these distances, so cumulative impacts at greater distances are not anticipated. Also presented in **Table 4.5** are the Project combined noise level and the adopted noise criteria which was set in accordance with **Section 2.1.2** and **Section 2.7**.

As shown in **Table 4.5**, the combined Project predicted noise levels are anticipated to comply with the established cumulative criteria at all existing sensitive receivers, except at Receiver 331 where a minor exceedance of 1 dB(A) is predicted at night. However, as discussed in **Section 4.3**, this prediction assumes that Receiver 331 is downwind of both the BESS and turbines simultaneously. Given that the BESS is situated to the northwest of the receiver and the nearest turbines are positioned to the east of the receiver, the combination of the predicted noise levels represents an unrealistic scenario. Therefore, based on the predictions, it is anticipated that the highest noise level at Receiver 331 from the Project, would be 30 dB(A) from the turbines. As indicated in **Table 4.4**, noise levels from either the turbines or the BESS alone are predicted to meet the cumulative limits.

Additionally, considering the substantial separation distance and orientation to Cataby Mine (3.6 km to the north) and Yandin Wind Farm (closest turbine 6.2 km to the north), the risk of cumulative noise impacts from other industries is considered low.

Table 4.5 Cumulative Noise Assessment

Receiver ID	Property Type	Approx. Distance to Nearest Project Turbine, m	Involvement	Cumulative Noise Criteria		Predicted Project Combined Noise Levels LA10, dB(A) [2]	
				Sunday Day & Evening [1]	Night [1]	Sunday Day & Evening [1]	Night [1]
1	house	1,890	Involved	40 [3]	40 [3]	36	36
2	house	1,950	Involved	40 [3]	40 [3]	34	
7	house	1,750	Involved	40 [3]	40 [3]	35	
8	house	2,150	Involved	40 [3]	40 [3]	33	
9	house	1,520	Involved	40 [3]	40 [3]	38	37
11	house	2,180	Involved	40 [3]	40 [3]	33	

[2] The Shire of Dandaragan Determination on Application for Planning Approval, Brand Highway 12762RRN, 94 Wind Turbines, Application Date 16 February 2011 (Our Ref DA:14/11 & 15/11), dated 11 January 2012 and The Shire of Dandaragan Amendment letter (Your Ref: DA 14/2011), dated 31 January 2018

[3] Cataby Mineral Sands Project Iluka Resources Limited, Report and Recommendations of the Environmental Protection Authority, Bulleting 1212 December 2005

Receiver ID	Property Type	Approx. Distance to Nearest Project Turbine, m	Involvement	Cumulative Noise Criteria		Predicted Project Combined Noise Levels LA10, dB(A) [2]	
				Sunday Day & Evening [1]	Night [1]	Sunday Day & Evening [1]	Night [1]
41	house	1,980	Involved	40 [3]	40 [3]	34	
81	house	2,150	Involved	40 [3]	40 [3]	36	36
213	house	4,250	Non-Involved	40 [4]	40 [4]	27	
243	house	8,820	Involved	40 [3]	40 [3]	22	21
268	house	3,140	Non-Involved	35 [5]	30 [5]	30	
299	house	4,890	Non-Involved	40 [4]	40 [4]	28	
308	house	10,350	Non-Involved	35 [5]	30 [5]	19	
312	house	3,000	Non-Involved	40 [4]	40 [4]	34	32
331	house	3,020	Non-Involved	35 [5]	30 [5]	32	**31**
339	house	7,040	Non-Involved	40 [4]	40 [4]	25	
426	house	3,540	Non-Involved	35 [5]	30 [5]	29	
463	house	4,040	Non-Involved	35 [5]	30 [5]	27	

Notes: [1] Sunday Day: 0900 to 1900 hours Sunday and public holidays; Evening: 1900 to 2200 hours all days; Night: 2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays

[2] Due to the quasi-steady state nature of the WTG and BESS equipment the presented LAeq noise level predictions, which are based on OEM provided LAeq sound power levels, are considered equivalent to the LA10 descriptor and enable comparison with LA10 assigned levels.

[3] Involved receivers: cumulative criterion of 40 dB(A) adopted, which is 5 dB(A) below the adopted criteria of 45 dB(A).

[4] Yandin Involved: cumulative criterion of 40 dB(A) adopted, which is 5 dB(A) below the Yandin Wind Farm consented noise limits of 45 dB(A)

[5] Non-involved receivers: cumulative criterion set 5 dB(A) below assigned levels.

5.0 Conclusion

An assessment of the potential noise impacts has been prepared for the proposed Yathroo Wind Farm. Potential operational noise levels associated with the Project WTGs and BESS have been assessed in accordance with the Noise Regulations and the SA Guidelines 2021.

The assessment was based on a 65 WTG layout and the Neoen selected turbine, Nordex N175_6.X Mode 0 – Blades with serrated edge. The BESS incorporated 896 Telsa Megapacks, associated transformers and ancillary infrastructure.

The results demonstrated that simultaneous operation of the WTGs and BESS is predicted to comply with the assigned levels at all sensitive receivers and for all periods.

In the event that intrusive noise characteristics (i.e. modulation) are a feature of the turbine, the selected turbine offers significant noise curtailment options and reduced sound power levels for sound optimised modes.

An assessment of cumulative impacts determined that noise emissions from the Project are expected to remain within the acceptable limits stipulated by the Noise Regulations.

6.0 References

Institute of Acoustics - A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise (May 2013) ('IOA Guide')

ISO 9613-2:1996 - Acoustics — Attenuation of sound during propagation outdoors — Part 2 (ISO 9613-2:1996)

ISO 9613-2:2024 - Acoustics — Attenuation of sound during propagation outdoors — Part 2 (ISO 9613-2:2024)

Shire of Dandaragan Determination on Application for Planning Approval, Brand Highway 12762RRN, 94 Wind Turbines, Application Date 16 February 2011 (Our Ref DA:14/11 & 15/11), dated 11 January 2012

Shire of Dandaragan Amendment letter (Your Ref: DA 14/2011), dated 31 January 2018

South Australian Environment Protection Authority Wind farms environmental noise guidelines ('SA Guidelines') (SA EPA, July 2009).

South Australian Environment Protection Authority Wind farms environmental noise guidelines ('SA Guidelines') (SA EPA, November 2021).

Nordex document, Third Octave Sound Power Levels Nordex N175/6.X (Doc: 9003492), Revision 04, 2024-04-24 (Approved 7-05-2024).

Nordex document, Noise Level, Power curves, Thrust curves Nordex N175/6.X (Doc: 9003482), Revision 07, 2025-01-21 (Approved 3-02-2025).

Western Australian Position Statement: Renewable energy facilities (WAPC, March 2020) ('Position Statement')

Western Australia Environmental Protection (Noise) Regulations 1997 ('Noise Regulations').

Western Australia Department of Water and Environmental Regulation Guideline - Assessment of environmental noise emissions (EPA, 2021) ('the Guideline')

WSP report, Yathroo Battery Energy Storage System Environmental Noise Impact Assessment, Revision 0, dated 27/6/25

Appendix A

Glossary

Glossary

Table A1 provides descriptions of terms and abbreviations which may be used in this report.

Table A1 Glossary of Terms and Abbreviations

Term	Description
1/3 Octave	Single octave bands divided into three parts.
Octave	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
Ambient Noise	The noise associated with a given environment. Typically, a composite of sounds from many sources located both near and far where no particular sound is dominant.
A Weighting	A standard weighting of the audible frequencies designed to reflect the response of the human ear to noise.
dB(A), dBA	Decibels A-weighted.
dB(C), dBC	Decibels C-weighted.
dB(Z), dB(L)	Decibels Linear or decibels Z-weighted.
Decibel (dB)	The units of sound level and noise exposure measurement where a step of 10 dB is a ten-fold increase in intensity or sound energy and actually sounds a little more than twice as loud.
Hertz (Hz)	The measure of the frequency of sound wave oscillations per second - 1 oscillation per second equals 1 hertz.
L_{A10}	The percentile sound pressure level exceeded for 10% of the measurement period with 'A' frequency weighting calculated by statistical analysis. Typically used to assess the impact of an existing operation on a receiver area and is referred to as the cumulative noise levels at the receiver attributable to the noise source.
L_{A90}	Background Noise Level. The percentile sound pressure level exceeded for 90% of the measurement period with 'A' frequency weighting calculated by statistical analysis.
L_{Amax}	The maximum of the sound pressure levels recorded over the measurement period.
$L_{Aeq,t}$	Equivalent continuous sound pressure level - The value of the sound pressure level of a continuous steady noise that, a measurement interval of time (t), has the same mean square sound pressure as the sound under consideration whose level varies with time. Usually measured in dB with 'A' weighting.
L_{An}	Percentile level - A measure of the fluctuation of the sound pressure level which is exceeded 'n' percent of the observation time.
Receiver	The noise-sensitive land use at which noise from a development can be heard.
Sleep Disturbance	Awakenings and disturbance to sleep stages.
Sound Pressure Level (dBA)	The basic measure of noise loudness. The level of the root-mean-square sound pressure in decibels given by: $SPL = 10.\log10\ (p/po)^2$

Term	Description
	where p is the rms sound pressure in pascals and po is the sound reference pressure at 20 uPa db.
Sound Power Level	A measure of the energy emitted from a source as sound and is given by: SWL = 10.log10 (W/Wo) where W is the sound power in watts and Wo is the sound reference power at 10^{-12} watts.
Temperature Inversion	An atmospheric condition in which temperature increases with height above the ground.

Appendix B

Equipment Sound Power Levels

umwelt

Table B.1 WTG - Nordex N175_6.X Mode 0 - With Serrated Edge - Sound power level data, Lw dB(A) re 10^{-12}W

1/3 Octave Band Centre Frequency (Hz)	Sound Power Levels for Integer Hub Height Wind Speed (dB(A)) [1]									
	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
10	49	53	58	60	60	60	60	60	60	60
12.5	54	58	63	65	65	65	65	65	65	65
16	59	63	68	70	70	70	70	70	70	70
20	62	66	71	73	73	73	73	73	73	73
25	66	69	74	76	76	76	76	76	76	76
31	67	71	76	78	78	78	78	78	78	78
40	69	73	77	79	79	79	79	79	79	79
50	71	75	79	81	81	81	81	81	81	81
63	75	79	84	86	86	86	86	86	86	86
80	78	82	86	88	88	88	88	88	88	88
100	79	83	88	90	90	90	90	90	90	90
125	82	86	91	93	93	93	93	93	93	93
160	84	88	93	95	95	95	95	95	95	95
200	85	89	94	96	96	96	96	96	96	96
250	85	89	94	96	96	96	96	96	96	96
315	86	90	95	97	97	97	97	97	97	97
400	86	90	95	97	97	97	97	97	97	97
500	86	90	95	97	97	97	97	97	97	97
630	86	90	95	97	97	97	97	97	97	97
800	87	91	96	98	98	98	98	98	98	98
1 k	87	91	96	98	98	98	98	98	98	98
1.25 k	87	91	96	98	98	98	98	98	98	98
1.6 k	86	90	95	97	97	97	97	97	97	97
2 k	85	89	94	96	96	96	96	96	96	96

1/3 Octave Band Centre Frequency (Hz)	Sound Power Levels for Integer Hub Height Wind Speed (dB(A)) [1]									
	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
2.5 k	82	86	91	92	92	92	92	92	92	92
3.15 k	78	82	87	89	89	89	89	89	89	89
4 k	74	78	83	85	85	85	85	85	85	85
5 k	70	74	79	81	81	81	81	81	81	81
6.3 k	63	67	72	74	74	74	74	74	74	74
8 k	55	59	64	66	66	66	66	66	66	66
10 k	46	50	55	57	57	57	57	57	57	57
Overall	97.2	101.1	106.0	107.9	107.9	107.9	107.9	107.9	107.9	107.9

Note: [1] As advised by Neoen, noise levels include a +1 dB(A) uncertainty factor that has been applied to the manufacturer supplied data.

Appendix C

WTG Locations

Table C.1 WTG Coordinates (65 turbines)

WTG ID	Coordinates, GDA2020 / MGA Zone 50	
	Easting, m	Northing, m
1	376712	6588270
2	377122	6587899
3	377845	6587489
4	378428	6587187
5	378825	6586688
6	379131	6586016
7	377851	6585057
8	379094	6584947
9	379856	6584643
10	380266	6585271
11	380592	6586093
12	379882	6587662
13	379533	6588301
14	379260	6589214
15	377297	6589336
16	377018	6590263
17	376674	6590976
18	376457	6591932
19	378314	6590286
20	378006	6591012
21	377728	6591891
22	380157	6589936
23	379524	6590702
24	379256	6591703
25	380671	6591233
26	377577	6592971
27	377285	6593560
28	377185	6594608
29	380142	6592181
30	379621	6592817
31	378790	6593484
32	380973	6592512
33	381116	6593683
34	380073	6593867
35	379367	6594267

WTG ID	Coordinates, GDA2020 / MGA Zone 50	
	Easting, m	Northing, m
36	378695	6594617
37	379691	6583502
38	380207	6583035
39	377684	6583367
40	378489	6583097
41	378942	6582665
42	377278	6582605
43	377064	6581579
44	377422	6580888
45	376727	6579898
46	377260	6579508
47	371755	6583443
48	372315	6583240
49	370131	6583424
50	370795	6582980
51	371236	6582528
52	371162	6582045
53	369475	6582554
54	369932	6582110
55	370493	6586364
56	369869	6586836
57	371048	6587240
58	370852	6587752
59	370202	6588033
60	369608	6588244
61	369175	6588631
62	370216	6589437
63	370824	6590089
64	371142	6589344
65	371606	6588944

Appendix D

Receiver Locations

Table D.1 Receiver Locations

Receiver ID	Property Type	Involvement	Coordinates, GDA2020 / MGA Zone 50	
			Easting, m	Northing, m
1	house	Involved	372942	6587197
2	house	Involved	375236	6594719
3	house	Involved	381764	6588982
7	house	Involved	375433	6594612
8	house	Involved	375113	6595188
9	house	Involved	368351	6586807
11	house	Involved	375103	6595253
13	house	Involved	376419	6586165
17	house	Involved	381770	6588948
41	house	Involved	375212	6594803
81	house	Involved	372506	6585618
150	house	Involved	382486	6588828
153	house	Non-Involved	372201	6579165
154	house	Non-Involved	376669	6574936
155	house	Involved	383135	6589271
156	house	Involved	382739	6590083
167	house	Non-Involved	385214	6588528
195	house	Non-Involved	379576	6578153
213	house	Non-Involved	374153	6597578
214	house	Non-Involved	383598	6588159
240	house	Non-Involved	382289	6584483
243	house	Involved	360941	6591795
248	house	Non-Involved	379468	6577413
250	house	Non-Involved	381332	6581817
268	house	Non-Involved	382485	6596509
277	house	Non-Involved	382462	6594956
286	house	Non-Involved	372079	6577115
295	house	Non-Involved	376223	6576594
299	house	Non-Involved	371810	6594874
308	house	Non-Involved	360360	6594049
312	house	Non-Involved	366664	6590273
322	house	Non-Involved	364162	6581461
331	house	Non-Involved	366788	6583925
339	house	Non-Involved	370012	6597083
342	house	Non-Involved	373994	6588256

Receiver ID	Property Type	Involvement	Coordinates, GDA2020 / MGA Zone 50	
			Easting, m	Northing, m
351	house	Non-Involved	385991	6583771
356	house	Non-Involved	373768	6589267
367	house	Non-Involved	374923	6597857
369	house	Non-Involved	382463	6586885
400	house	Non-Involved	384387	6594496
418	house	Non-Involved	367354	6581209
419	house	Non-Involved	385029	6591388
426	house	Non-Involved	382805	6596790
427	house	Non-Involved	366269	6594461
440	house	Non-Involved	375039	6583550
455	house	Non-Involved	373929	6588050
463	house	Non-Involved	374935	6597961
504	house	Non-Involved	373571	6585094

Notes: Receivers 97 and 124 are excluded from assessment, as these dwellings are anticipated to be uninhabited once the project is operational.

Appendix E

Noise Contours

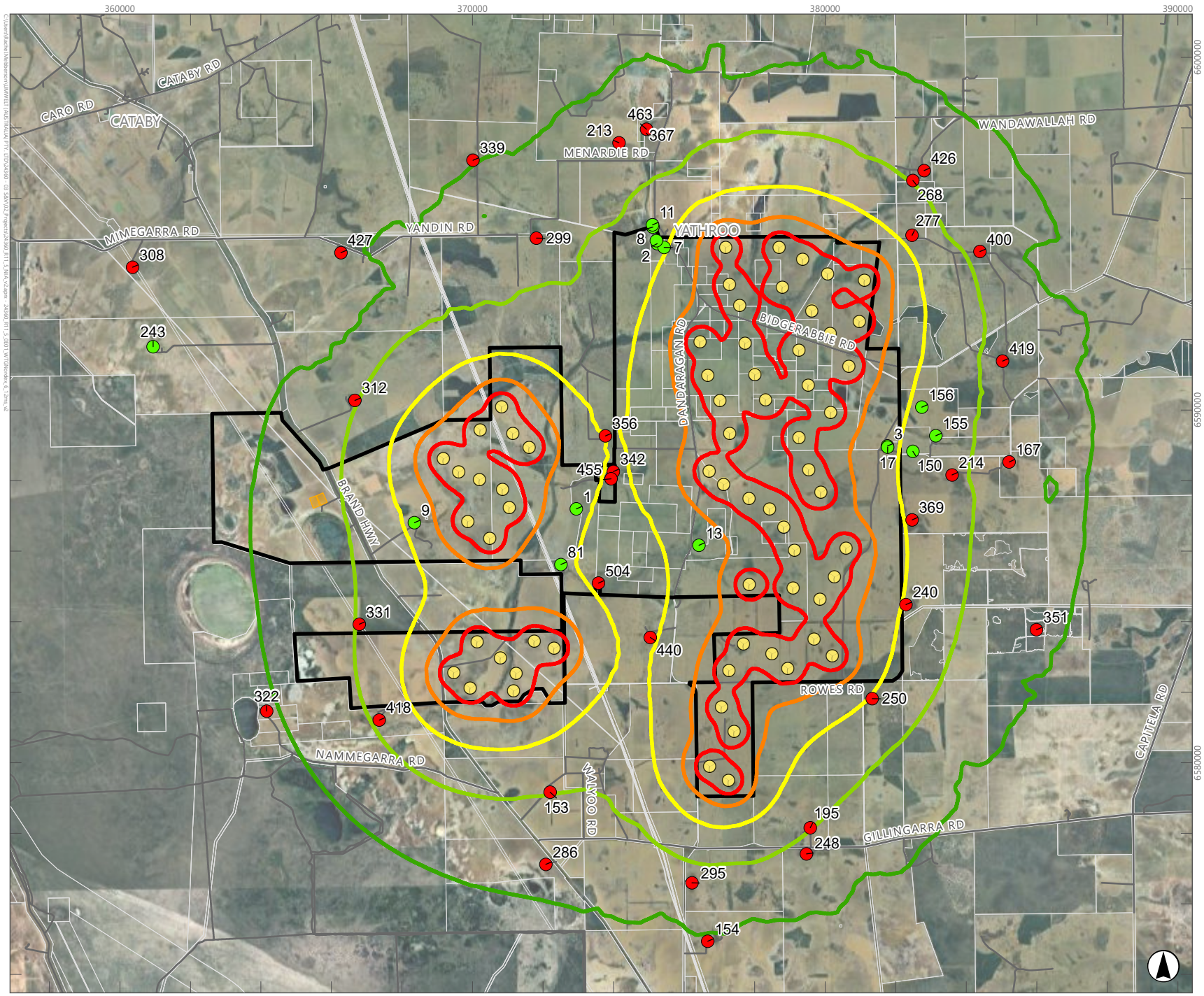

FIGURE E.1

WTG – Nordex N175_6.X Mode 0 (6-12 m/s) – (Blades with serrated edge) - Predicted Noise Level Contours, LAeq10min, dB(A)

Legend

- Study Area
- BESS Footprint
- Property Boundary
- Road
- Wind Turbine Generators

Sensitive Recievers

- House: Involved
- House: Non-Involved

Contours - 25 dB(A) to 45 dB(A)

- 25
- 30
- 35
- 40
- 45

0 2.5 5

Kilometres

Scale 1:150,000 at A4
GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2024), DBCA (2023), Umwelt (2025), Neoen (2025)

Appendix F

WSP BESS Briefing Note

Design
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ENVIRONMENTAL NOISE IMPACT ASSESSMENT

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	Name	Date	Signature
Prepared by:	Matthew Barrett	4/07/2025	
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Approved by:	Zhang Lai	4/07/2025	

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Executive summary

WSP Australia was appointed by NEOEN to conduct an environmental noise impact assessment relating to the proposed Yathroo BESS. The noise assessment was conducted in accordance with the requirements of the Western Australia Environmental Protection (Noise) Regulations 1997.

A summary of the findings is as follows:

- Noise levels from proposed BESS operations at all considered noise-sensitive receivers were predicted to be below the assigned levels during all assessment periods with no noise mitigation in place.
- Predicted maximum noise levels associated with HV circuit breaker activation events indicate compliance with the assigned levels at all the identified nearest noise sensitive receivers with no noise mitigation in place.
- Further review is recommended concerning cumulative impacts of the proposed BESS noise levels in conjunction with other components (proposed Yathroo Wind Farm and potential existing industry).

1 Introduction

WSP has been appointed by NEOEN Australia Pty Ltd (NEOEN) to undertake an environmental noise assessment of a proposed Battery Energy Storage System (BESS) to be located in Mimegarra, Western Australia.

The aims of the study are:

- Provide a description of the proposed BESS based on the project information provided by NEOEN, identifying the main sources of noise associated with the BESS operation.
- Identify nearby potentially noise affected sensitive receivers.
- Provide a description of the environmental noise criteria relevant to the BESS.
- Assess the potential noise impacts associated with the BESS on the nearest sensitive receivers.

It shall be noted that this BESS is part of the proposed Yathroo Wind Farm by NEOEN. The scope of this noise assessment report addresses the BESS component only. A review and assessment of cumulative noise impacts are excluded and is understood to be undertaken by Umwelt (as part of the overarching planning studies for the wind farm project). Results and findings made in this report shall therefore be treated as preliminary.

2 Background information

2.1 Project description

NEOEN proposes to establish a Battery Energy Storage System (BESS) at Lot 3830, 9479 Brand Highway in Mimegarra within the Shire of Dandaragan approximately 125 km north of Perth.

The proposed BESS has a proposed size of 400 MW/ 8 hour and is proposed to be capable of operating during the day, evening or night, seven days per week.

2.2 Project location

The location of the proposed site and nearest noise sensitive receivers are shown in Figure 2.1.

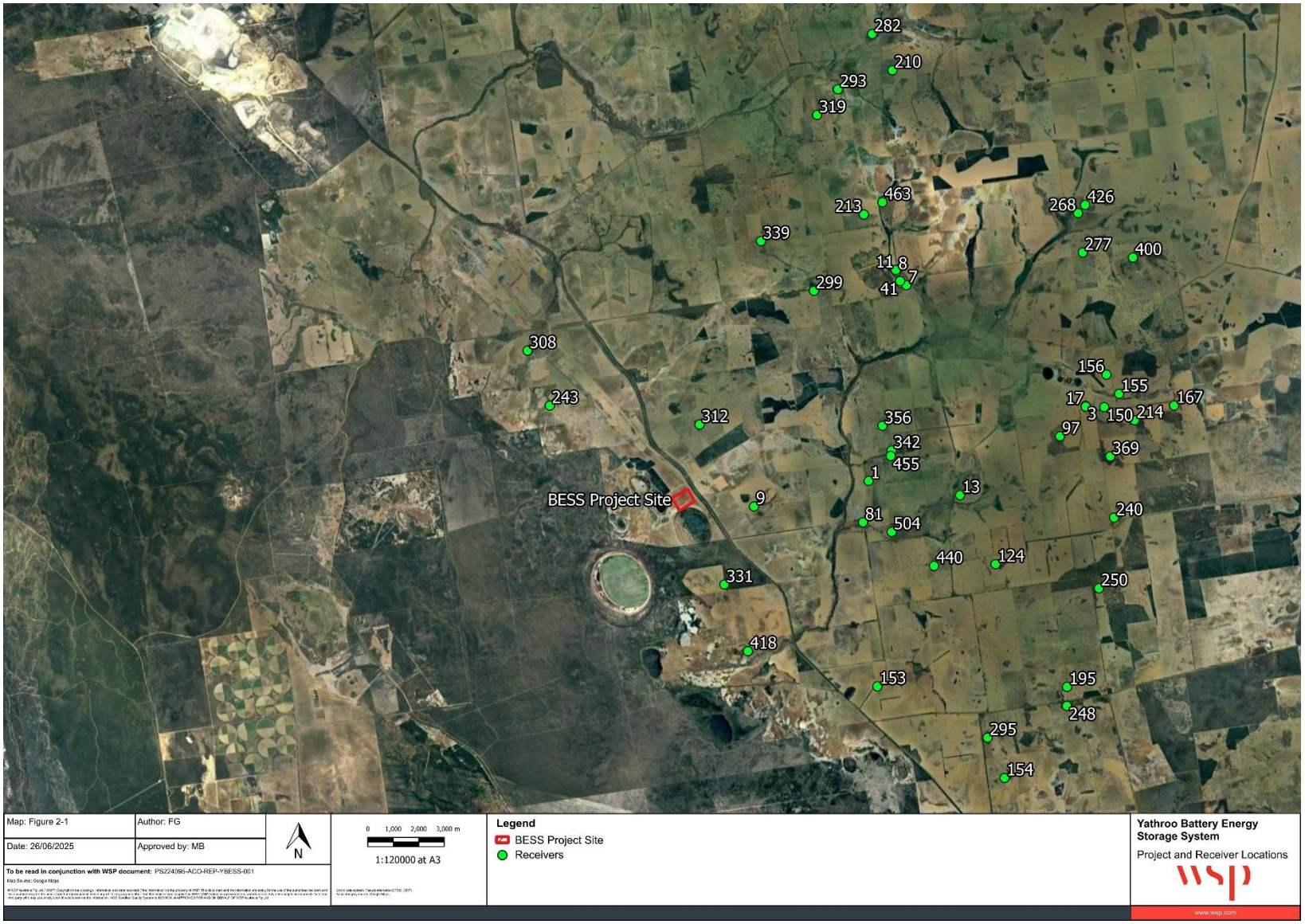


Figure 2.1 Noise sensitive receiver map

3 Noise criteria

The applicable statutory requirements for noise emissions are contained within the Environmental Protection Act 1986 (the Act) and the Environmental Protection (Noise) Regulations 1997 (Noise Regulations).

The Noise Regulations require that noise emitted from any premises must comply with assigned noise levels when received at any other premises and be free of the intrusive characteristics of tonality, modulation and impulsiveness. In addition, the noise emissions must not "significantly contribute" to an exceedance of the assigned levels. A noise emission is generally understood to "significantly contribute" if it is higher than a level which is 5dB below the assigned level at the point of reception.

An acoustic glossary has been included for relevant definitions to the Project in Appendix A1.

Assigned noise levels

Assigned noise levels are the levels of noise allowed to be received at a premises at a particular time of the day.

The assigned levels are specified according to the type of premises receiving the noise. There are different assigned levels for noise sensitive, commercial and industrial premises. The assigned levels for noise sensitive premises vary depending on the time of the day. The assigned noise levels always apply at the premises receiving the noise.

For noise sensitive premises, the assigned levels are adjusted by the addition of an influencing factor to account for the existing acoustic environment. The influencing factor increases with the amount of commercial and industrial premises in the vicinity of the noise sensitive receiver as well as the presence of any major or secondary roads. This is calculated by considering areas within 100 m and 450 m radius of the noise sensitive receiver location.

The table of assigned levels, shown in Table 3-1 identifies three types of assigned levels: L_{Amax}, L_{A1} and L_{A10}.

Table 3-1 Table of assigned noise levels

Type of premises receiving noise	Time of day	Assigned level, dB		
		L_{A10}	L_{A1}	L_{Amax}
Noise sensitive premises at locations within 15 m of a building directly associated with a noise sensitive use	7.00 am to 7.00 pm Monday to Saturday	45 + Influencing factor	55 + Influencing factor	65 + Influencing factor
	9.00 am to 7.00 pm Sunday and public holidays	40 + Influencing factor	50 + Influencing factor	65 + Influencing factor
	7.00 pm to 10.00 pm All days	40 + Influencing factor	50 + Influencing factor	55 + Influencing factor
	10.00 pm on any day to 7.00 am Monday to Saturday and 9.00 am Sunday and public holidays	35 + Influencing factor	45 + Influencing factor	55 + Influencing factor
Noise sensitive premises at locations further than 15 m from a building directly associated with a noise sensitive use	All hours	60	75	80
Commercial premises	All hours	60	75	80

As there are no industrial or commercial premises or applicable roads within 450 m of the nearest noise sensitive receiver the influencing factor is zero and the criteria within Table 3-1 are therefore unchanged.

Intrusive characteristics

If noise emitted from any premises when received at any other premises cannot reasonably be free of intrusive characteristics of tonality (e.g. drone or pitch), modulation (e.g. siren) or impulsiveness (e.g. bang), then a series of adjustments must be added to the emitted levels (measured or calculated) and the adjusted level must comply with the assigned level. The adjustments are detailed in Table 3.2.

Table 3.2 Table of adjustments

Adjustment where noise emission is not music these adjustments are cumulative to a maximum of 15dB		
Where tonality is present	Where modulation is present	Where impulsiveness is present
+5dB	+5dB	+10dB

Representative Assessment Period

The assigned levels are statistical noise levels over a Representative Assessment Period (RAP). As noise associated with the proposed BESS is expected to be relatively constant, a RAP of 15 minutes has been selected as an appropriate period of assessment.

The significant noise emitters at the facility are equipment cooling fans, which will operate during the charging, discharging and several hours after these activities as the residual heat is removed.

Given that fan noise will be constant during the RAP, the L_{A10} noise descriptor will be used for the assessment of general BESS operational noise. The L_{AMax} descriptor will be used for the assessment of circuit breaker noise impact.

Contribution to exceedance of assigned noise levels

Based on a preliminary review of the area surrounding the proposed BESS and the existing noise environment survey conducted by Umwelt for the Project area, it is unclear whether there may be an existing exceedance of the assigned levels at any nearby receivers due to noise impacts from relevant sources under the Regulations.

To this end a conservative approach is to be taken, where the noise emissions from the proposed site are assumed to contribute to an existing exceedance. Therefore, the noise criteria to be met shall be 5dB below the assigned level for every receiver during each assessment period. A further review of these contributions is recommended (based on further details on background noise monitoring undertaken by Umwelt).

4 Methodology

A noise model was prepared using the SoundPLAN 8.2 Industrial Module, a commercial software system developed by Braunstein and Bernt Gmbh in Germany.

The software allows the use of various internationally recognised noise prediction algorithms. The CONCAWE method, developed in the Netherlands for assessment of large industrial plants, has been selected for this assessment as it enables meteorological influences to be assessed.

The CONCAWE algorithm included the typical worst case meteorological parameters outlined in the Western Australian Department of Water and Environmental Regulation Draft Guidelines Assessment of Environmental Noise May 2021. These parameters are highlighted in Table 4.1. The modelling assumed a worst-case scenario wind direction from the source to the receiver.

Table 4.1 Meteorological conditions used in the noise predictions

Time of Day	Temperature	Relative Humidity	Wind Speed	Pasquil Stability Category
Day	20°C	50%	4 m/s	E
Night	15°C	50%	3 m/s	F

The potential for machinery to emit noise is quantified as the sound power level (SWL) expressed in decibels (dB re 1x10 12 W). At the receiver, the noise is quantified as the sound pressure level (SPL) expressed in decibels (dB re 20 µPa).

Key parameters used in establishment of the noise model and execution of the noise predictions are summarised in Table 4.2. Noise emissions of the BESS are dependent on the operational capacities of their cooling system, which are influenced by the charging/ discharging power of the BESS and ambient temperature. The third octave SWLs used in the noise assessment were established based on supplied client information for day and night-time conditions and are detailed in Appendix A2. Where data was provided as broadband SPL's they have been converted to SWL's and a 1/3 octave spectrum applied from generic spectrum data within the WSP database.

The current noise assessment is based on initial reference design and equipment selection to support the DA. It is recommended that a further study is undertaken during detailed design phase when equipment selection is further progressed and complete noise data becomes available for the proposed BESS.

Table 4.2 Noise model - key parameters used

Item	Description
Modelled scenario	One layout modelled with the following number of plant: — 896x integrated battery and inverter containers — 224x MV Transformers — 2x HV Transformers
3-dimensional ground topography data for the future design ground level of the assessment area	5m interval contour data (topography) of site and surroundings surrounding area sourced from ELVIS (Elevation and Depth - Foundation Spatial Data).
Ground absorption	Ground absorption factor of 0.2 has been applied to site. Ground absorption factor of 0.5 has been applied all other areas. (0=hard ground, 1=soft ground)
Noise receivers	Single point receivers modelled 1.5 m above ground level
Equipment noise emissions and layout	Indicative site area outlined in Figure 2.1 and noise data in Appendix A2.
Assumptions used	Batteries, MV and HV Transformers, modelled as a combined area source over proposed Project Site area. Area source modelled at 3.3m AGL. All sources are operating simultaneously and under the conditions outlined within Appendix A2 depending on time of day. All noise sources are assumed to be omnidirectional. The predicted SPLs presented in this report represent the L_{A10} emission level for the RAP. No solid fences/ noise barriers are modelled around the site. No noise-sensitive buildings modelled – predicted noise levels are therefore free-field.

5 Assessment

5.1 Intrusive characteristics

The predicted 1/3 octave band noise levels received at one of the worst affected premises - Receiver 312, as presented in Figure 5.1, have been analysed for intrusive characteristics (tonality, modulation and impulse) as defined by the Noise Regulations.

A potentially intrusive tonal characteristic (as per the definition in the Noise Regulations) has been identified at 250, 315 and 630Hz during the day, and 250Hz during the night. It is possible these frequencies are audible at Receiver 312. To this end, a +5dB tonal penalty is applied to the predicted received noise levels at all nearby noise sensitive receivers for both time periods.

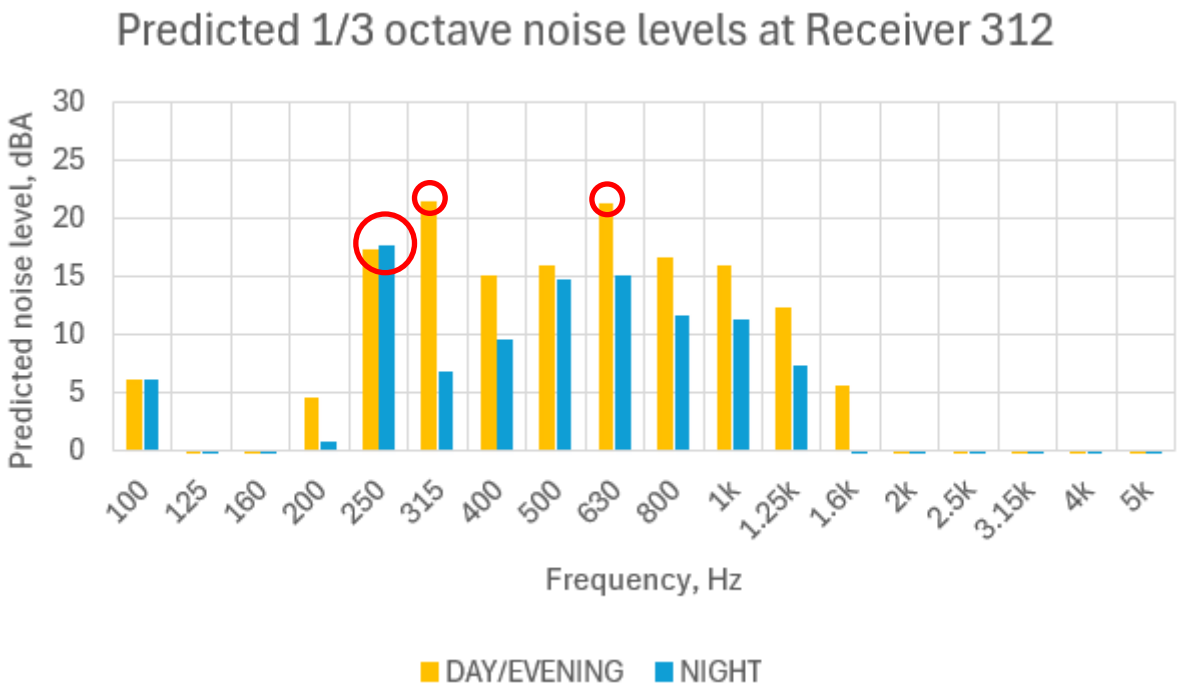


Figure 5.1 Predicted 1/3 octave sound pressure levels received at receiver 312, day/evening and night.

5.2 Assessment against criteria

Predicted noise levels (inclusive of a 5dB penalty for tonality) are shown in Table 5.1. Noise contour maps extending to the nearest residential noise sensitive receivers are shown in Appendix A3.

Table 5.1 Predicted noise levels at noise sensitive receivers

Receiver	**Predicted L_{10} including Tonality Adjustment, dBA**		
	Day 7.00am-7.00pm (Mon-Sat)	Day 9.00am-7.00pm (Sunday + PH) and Evening 7.00pm-10.00pm (Every day)	Night 10.00pm-7.00am (Mon to sat) and Night 10.00pm–9.00am (Sunday + PH)
	Assigned Level, 40dBA	Assigned Level, 35dBA	Assigned Level, 30dBA
1	<10	12	<10
2	<10	<10	<10
3	<10	<10	<10
7	<10	<10	<10
8	<10	<10	<10
9	34	34	29
11	<10	<10	<10
13	<10	<10	<10
17	<10	<10	<10
41	<10	<10	<10
81	14	14	11
97	<10	<10	<10
124	<10	<10	<10
150	<10	<10	<10
153	<10	<10	<10
154	<10	<10	<10
155	<10	<10	<10
156	<10	<10	<10
167	<10	<10	<10
195	<10	<10	<10
210	<10	<10	<10
213	<10	<10	<10
214	<10	<10	<10
240	<10	<10	<10
243	16	16	13

Receiver	Predicted L_{10} including Tonality Adjustment, dBA		
	Day 7.00am-7.00pm (Mon-Sat)	Day 9.00am-7.00pm (Sunday + PH) and Evening 7.00pm-10.00pm (Every day)	Night 10.00pm-7.00am (Mon to sat) and Night 10.00pm–9.00am (Sunday + PH)
	Assigned Level, 40dBA	Assigned Level, 35dBA	Assigned Level, 30dBA
248	<10	<10	<10
250	<10	<10	<10
268	<10	<10	<10
277	<10	<10	<10
282	<10	<10	<10
293	<10	<10	<10
295	<10	<10	<10
299	<10	<10	<10
308	10	10	<10
312	32	32	27
319	<10	<10	<10
331	28	28	24
339	<10	<10	<10
342	10	10	<10
356	10	10	<10
369	<10	<10	<10
400	<10	<10	<10
418	16	16	13
426	<10	<10	<10
440	<10	<10	<10
455	10	10	<10
463	<10	<10	<10
504	10	10	<10

Noise levels from the BESS at the considered noise-sensitive receivers are predicted to be below the assigned levels during all assessment periods.

5.3 Audibility of received noise compared to typical night-time background noise levels

The predicted noise level at one of the closest noise-sensitive receivers (312) during the most sensitive time period (night-time) is 27dB, inclusive of a +5dB penalty to account for any inherent tonal qualities in the received noise. This level of noise could be above typical background noise levels for a rural area such as Yathroo.

To this end, predicted noise levels have the potential to be louder than the background noise levels, and therefore audible, during periods of calm weather and low background noise at nearby noise-sensitive receivers.

5.4 Predicted noise levels – circuit breakers

When triggered, circuit breakers have the potential to induce very short term (< 0.5 seconds each event) but high-level noise impact. The occurrence of the event is unclear and would need to be confirmed as project progresses. In other BESS projects, it is noted that such occurrence is typically in an emergency situation only and typically not more than once per year.

The two circuit breakers associated with the HV transformers of the proposed BESS have each been assessed and the predicted L_{Amax} noise levels (inclusive of a +10dB penalty for impulsiveness) are presented in Table 5.2 at the three closest noise-sensitive receivers.

Table 5.2 Predicted maximum noise levels from circuit breakers

Receiver	Predicted L_{Amax}, dB (IMPULSIVENESS ADJUSTED) from HV Circuit Breaker	Criteria L_{Amax}, dB
9	46	55
312	44	
331	40	

The predicted L_{Amax} noise levels from the proposed BESS site (inclusive of a +10dB impulsiveness penalty) indicates compliance with the assigned levels at all the identified nearest noise sensitive receivers with no noise mitigation in place.

6 Conclusion

WSP Australia was appointed by NEOEN to conduct an environmental noise impact assessment relating to the proposed BESS at Yathroo. The noise assessment was conducted in accordance with the requirements of the Western Australia Environmental Protection (Noise) Regulations 1997.

A summary of the findings is as follows:

- Predicted L_{A10} noise levels at nearby noise sensitive receivers emitted from BESS operational noise were assessed for the proposed operational scenario:
  - 896x integrated battery and inverter containers
  - 224x MV Transformers
  - 2x HV Transformers
- Noise levels at the considered noise-sensitive receivers (inclusive of a +5dB tonality penalty) were predicted to be below the assigned levels during all assessment periods.
- Further review is recommended concerning cumulative impacts of the BESS noise levels in conjunction with other proposed and existing components (proposed Yathroo Wind Farm and potential existing industry).
- The predicted L_{Amax} noise levels (inclusive of a +10dB impulsiveness penalty) from HV circuit breaker activation indicates compliance with the assigned levels at all the identified nearest noise sensitive receivers with no noise mitigation in place.

A1. Acoustic glossary

SOUND PRESSURE LEVEL (SPL)

The basic unit of sound measurement is the sound pressure level. The pressures are converted to a logarithmic scale and expressed in decibels (dB).

SOUND POWER LEVEL (SWL)

The Sound Power of a source is the rate at which it emits acoustic energy. As with Sound Pressure Levels, Sound Power Levels are expressed in decibel units (dB or dBA), but may be identified by the symbols SWL or LW, or by the reference unit 10 -12 W.

The relationship between Sound Power and Sound Pressure may be likened to an electric radiator, which is characterised by a power rating, but influences the surrounding environment that can be measured in terms of a different parameter, temperature.

A-WEIGHTING

A frequency weighting devised to attempt to consider the fact that human response to sound is not equally sensitive to all frequencies; it consists of an electronic filter in a sound level meter, which attempts to build in this variability into the indicated noise level reading so that it will correlate, approximately, with human response.

STATISTICAL NOISE LEVELS

Sounds that vary in level over time, such as road traffic noise and most community noise, are commonly described in terms of the statistical exceedance levels L_{AN}, where L_{AN} is the A-weighted sound pressure level exceeded for N% of a given measurement period. For example, the L_{A1} is the noise level exceeded for 1% of the time, L_{A10} the noise exceeded for 10% of the time, and so on.

Of particular relevance, are:

L_{A1} - The noise level exceeded for 1% of the 15 minute interval.

L_{A10} - The noise level exceeded for 10% of the 15 minute interval. This is commonly referred to as the average maximum noise level.

L_{A90} - The noise level exceeded for 90% of the sample period. This noise level is described as the average minimum background sound level (in the absence of the source under consideration), or simply the background level.

L_{Aeq} - The A-weighted equivalent noise level (basically the average noise level). It is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.

MODULATION

A modulating noise is characterised by a variation in the emission that is regular, cyclic and audible.

TONALITY

Tonal noise contains one or more prominent tones (i.e. distinct frequency components), and is normally regarded as more offensive than “broad band” noise.

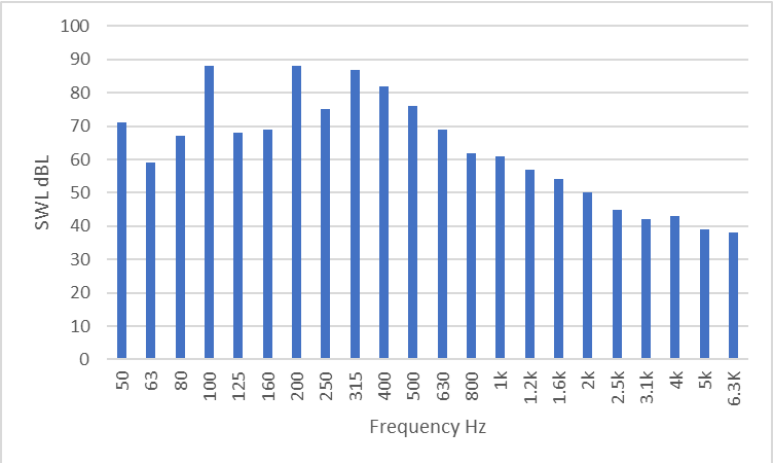
IMPULSIVENESS

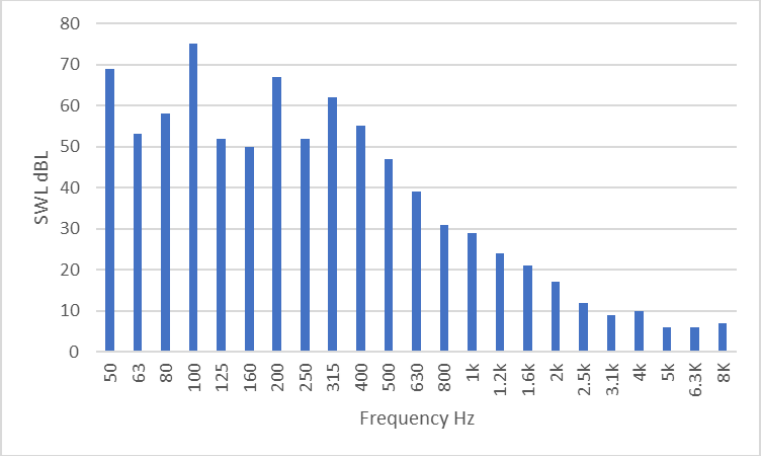
An impulsive noise is characterised by one or more short sharp peaks in the time domain, such as occurs during hammering.

A2. Noise Model Data Inputs

The noise data provided by NEOEN are summarised in the following tables. At this stage these are considered indicative as equipment selections are still to be confirmed.

Table A3 Provided noise data – Yathroo BESS

NOISE SOURCE	REFERENCE NOISE DATA	DIMENSIONS (M) L x W x H
Tesla Megapack 2 XL	Sound Power Levels for Yathroo-specific Tesla Megapack 2XL's provided by Tesla: – Neoen Yathroo BESS – Noise Application Note R0 Case 1; and – Neoen Yathroo BESS – Noise Application Note R0 Case 2. Neoen confirm that Tesla Megapack PE and Battery fan duties are to modelled at 60% during the day and evening, and 50 and 20% respectively for night-time. As per relevant Yathroo BESS Noise Application Notes, this results in the following SWL of Tesla Megapacks (snip below): – Day/Evening - 87.7dBA – Night - 81.5dBA	9.1 x 1.7 x 2.8
HV Transformer	Provided data in Sound Power Levels  HV Circuit breaker activation event taken as 117dBA (Source: WSP Database)	8.7 x 6.4 x 10.5
MV Transformer	Provided data in Sound Power Levels	2.1 x 1.8 x 2.2

NOISE SOURCE	REFERENCE NOISE DATA	DIMENSIONS (M) L x W x H
		

A3. Noise contour maps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455
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BESS Project Site
9
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331
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418
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195
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154
Appendix A4
Author: FG
Date: 26/06/2025
Approved by: MB
N
To be read in conjunction with WSP document: PS224095-ACO-REP-YBESS-001
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Coordinate system: Pseudo-Mercator (EPSG: 3857)
Aerial imagery source: Google Maps
Predicted Noise Level, dBA L10-Day Eve
=<35
36 - 40
41 - 45
46 - 50
51 - 55
56 - 60
61 - 65
=>66
Legend
BESS Project Site
Receivers
Yathroo Battery Energy Storage System
Grid Noise Map
wsp
www.wsp.com


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BESS Project Site
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1:90,000 at A3
Coordinate system: Pseudo-Mercator (EPSG: 3857)
Aerial imagery source: Google Maps
Predicted Noise Level, dBA L10-Night
=<35
36 - 40
41 - 45
46 - 50
51 - 55
56 - 60
61 - 65
=>66
Legend
BESS Project Site
Receivers
Yathroo Battery Energy Storage System
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