

Principal : FRV



Contractor : SAMSUNG C&T



SAMSUNG C&T

AUSTRALIA GNARWARRE BESS PROJECT

189-389 VOLUM ROAD, GNARWARRE LOT 1 ON PS513428A

FRV Services Australia Pty Ltd (ACN 651 342 602)

Gnarwarre BESS Asset Co Pty Ltd (ACN 651 342 602) in its capacity as trustee for the

Gnarwarre BESS Asset Trust (ABN 98 136 806 603)

Samsung C&T Corporation (ABN 49 160 079 470)

Environmental Noise Assessment

PLANNING and ENVIRONMENT ACT
Surf Coast PLANNING SCHEME

INCORPORATED DOCUMENT
ID2403466

Predictive Noise Assessment in accordance with
Condition 13

ENDORSED PLAN

Sheet 1 of 25

Katherine Morton

Signed for
MINISTER FOR PLANNING

Date: 24 September 2025

Document Ref: GNBE-SCT-MEC-REP-001

Revision: C

Document Detail

Document General

Project	Australia GNARWARRE BESS PROJECT
Document Title	Environmental Noise Assessment
Document No.	GNBE-SCT-MEC-REP-001
Revision	C
Discipline	Report

Document Review

Responsibility	Name	Position	Signature
Reviewed by	Yunsik Kim	Yunsik Kim	
Reviewed by	Cesar Zeldá	Design Manager	
Approved by	Taehwan (Tyron) Kim	Project Manager	 Tyron Kim

Document History

Revision	Status	Date
A	Issue For Approval	9 April, 2025
B	Issue For Approval (Comments updated)	16 April, 2025
C	Issue For Approval (minor update)	5 June, 2025

COMMENT RESPONSE SHEET

<i>Date</i>	<i>Rev.</i>	<i>Comment from Principal</i>	<i>Comment by</i>	<i>Response Date</i>	<i>Response</i>	<i>Response by</i>
5 June, 25	C			5 June, 25	Noise Data Updated (Battery Containers / PCS Units)	TK

Gnarwarre BESS

Environmental Noise Assessment

S8049C4

June 2025

sonus.

Sonus Pty Ltd
17 Ruthven Ave
Adelaide SA 5000
Phone: +61 (8) 8231 2100
Email: info@sonus.com.au
www.sonus.com.au

Document Title : Gnarwarre BESS
Environmental Noise Assessment
Document Reference : S8049C4
Date : June 2025
Author : Chris Turnbull, MAAS
Reviewer : Simon Moore, MAAS

© Sonus Pty Ltd. All rights reserved.

This report may not be reproduced other than in its entirety. The report is for the sole use of the client for the particular circumstances described in the report. Sonus accepts no responsibility to any other party who may rely upon or use this report without prior written consent.

1 INTRODUCTION

An environmental noise assessment has been conducted for the proposed Gnarwarre BESS (the **BESS**). The BESS is proposed to be located at 189-389 Volum Road, Gnarwarre, Victoria, which is approximately 20km west of Geelong. The BESS is proposed to have a nominal capacity of 280MW/560MWh.

This assessment considers the noise at the nearby noise sensitive receivers based upon an indicative BESS layout and equipment selection. The project area, indicative layout, and the nearest noise sensitive receivers are shown in Figure 1. The layout of the proposed BESS area is shown in Appendix A.



Figure 1: Proposed BESS Area and Nearest Noise Sensitive Receivers

The predicted noise levels have been compared against the relevant criteria determined in accordance with the *Surf Coast Planning Scheme*, the *Noise Limit and Assessment Protocol for the Control of Noise from Commercial, Industrial and Trade Premises and Entertainment Venues*, the *Environment Protection Regulations 2021*, and the *Noise guidelines: Assessing low frequency noise*.

It is proposed that a construction noise management plan will be prepared, once the construction manager is appointed and the construction details (hours of construction, construction noise sources etc) are known. The construction noise management plan will be developed to achieve the general environmental duty of the *Environment Protection Act 2017* by reference to the *Civil construction, building and demolition guide*. Construction noise is therefore not assessed further in this report.

2 LEGISLATIVE AND POLICY CONTEXT

The BESS and the nearby sensitive receivers are all located within a Farming Zone of the *Surf Coast Planning Scheme* (the **Planning Scheme**). The Planning Scheme makes specific reference to the *Environment Protection Act 2017* (the **Act**), *Environment Protection Regulations* (the **Regulations**) (under the Act) and *Noise Limit and Assessment Protocol for the Control of Noise from Commercial, Industrial and Trade Premises and Entertainment Venues* (Publication 1826, Environment Protection Authority, May 2021) (the **Protocol**).

In addition, the *Noise guidelines: Assessing low frequency noise* (Publication 1996, Environment Protection Authority, June 2021) (the **Guidelines**) has been considered within the assessment.

The provisions considered relevant to the assessment are detailed within Appendix B.

3 EXISTING NOISE ENVIRONMENT

The background noise and existing noise environment was measured between Monday 5 February 2024 and Wednesday 21 February 2024, at the location shown in Figure 2.

In accordance with the Protocol, the background level must, where possible be measured outdoors at the assessment location in the noise sensitive area. Where it is not possible for the measurement to be made at the noise sensitive location, the measurements may be made at a “background equivalent location” which is representative of the likely background level at the assessment location in the noise sensitive area. The background noise monitoring location selected was the closest sensitive receiver where access was granted.

Local weather was measured during the noise monitoring period to exclude days where rain or high winds influenced the measured noise levels.

The background noise levels were heavily influenced by insect noise, particularly around 8pm each night, where an increase in the measured high frequency noise was observed. As this noise may not be present for the full year, background noise levels have been recalculated by removing the specific one-third octave band frequencies at which the insect noise occurred.

Background noise levels have been determined in accordance with EPA Victoria Publication 1997¹ recommendations, which are shown in Table 1.

Table 1: Background Level Monitoring Results

Time of Day	Background Level – With Insects[dB(A)]	Background Level – Without Insects [dB(A)]
<u>Day:</u> Monday to Saturday: 7 am to 6 pm (except public holidays)	35	30
<u>Evening:</u> Monday to Saturday: 6 pm to 10 pm	34	30
<u>Evening:</u> Sunday and Public Holidays: 7 am to 10pm	29	24
<u>Night:</u> Monday to Sunday: 10 pm to 7am the following day	23	21

¹ Technical Guide: Measuring and analysing industry noise and music noise (June 2021)



Figure 2: Background Noise Monitoring Location

4 ASSESSMENT CRITERIA SUMMARY

The noise limits for the BESS, shown in Table 2, have been established based upon the background noise level assessment described in Appendix B.3.2. No other commercial, industrial and trade premises have been considered as relevant to the assessment, and therefore no further reductions to the noise limits have been made based on a cumulative impact to the noise sensitive receivers.

Table 2: BESS Noise Limits

Time of Day	Background Level [dB(A)]	Noise Limit [dB(A)]
<u>Day:</u> Monday to Saturday: 7 am to 6 pm (except public holidays)	30	45
<u>Evening:</u> Monday to Saturday: 6 pm to 10 pm	30	39
<u>Evening:</u> Sunday and Public Holidays: 7 am to 10pm	24	39
<u>Night:</u> Monday to Sunday: 10 pm to 7am the following day	21	34

In addition, the outdoor low frequency threshold criteria are summarised in Table 3.

Table 3: Outdoor Low Frequency Threshold Criteria

One-Third Octave (Hz)	25	31.5	40	50	63	80	100	125	160
L_{eq} (dB)	69	61	54	50	50	48	48	46	44

5 NOISE PREDICTIONS

5.1 Methodology

The noise from the operation of the BESS has been predicted using the *ISO 9613-2:2024 Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation (ISO 9613)* noise propagation model, as implemented in the *SoundPLAN* noise modelling software. The ISO 9613 noise propagation model is widely accepted as an appropriate model for ground-based sources and takes into account relevant influences, including:

- Sound power levels of each individual noise source
- The location of noise sources
- Separation distances between the noise sources and the sensitive receivers
- The influence of barriers
- The influence of the ground
- Atmospheric absorption

The ISO 9613 model is known as a downwind noise model and is based on the meteorological conditions that are favourable to noise propagation and the assumption that the receiver is downwind from the noise source.

The following inputs have been used in the model:

- Ground factor of 0.7, except for the proposed BESS site, which is considered to be intermediate ground, with a factor of 0.5, based upon the inclusion of at least 150mm of unsealed gravel to be used on the surface of the site.
- Temperature of 10°C ²
- Relative humidity of 70%

² 10°C is a conservative assumption as it results in a higher level of sound propagation and therefore higher noise levels at residences. However, at this temperature, the fan speeds are likely to be lower than is being assessed.

5.2 Noise Sources

Sound power levels used for the battery and inverter units were as per manufacturer's data, while the transformers were based on the 'standard' level derived from the Australian/New Zealand Standard *AS/NZS60076.10:2009 Power Transformers Part 10: Determination of sound levels (IEC 60076-10, Ed.1 (2001) MOD) (AS/NZS60076)*.

The following quantity of units has been used based upon an indicative battery supplier (Hithium) model and layout which indicatively includes:

- 112 Battery Containers (5.016MWh each)
- 112 Power Conversion System (**PCS**) Units (4.2MVA each, however not operating above 3.2MVA)
- Four MV Kiosks
- Two Harmonic Filters
- Two Site Transformers (150 MVA each)

The sound power for each unit of the equipment used for the assessment can be seen in Table 4. It is noted that these noise levels can be achieved in all seasons.

Table 4: Noise Data

Noise Source (per unit)	Sound Power Level dB(A)
Battery Containers	89
PCS Units	89
MV Kiosks	93
Harmonic Filters	75
Site Transformer	96

5.3 Predicted Noise Levels

The results of the assessment are shown in Table 5. It is noted that the predicted noise levels presented in Table 5 do not include any adjustments for noise character.

Table 5: Predicted Noise Levels

Noise Sensitive Receiver	Predicted Noise Level [dB(A)]
1	31
2	31
3	28
4	28
5	27
6	26
7	26
8	22
9	26
10	22
11	22
12	20

Before the consideration of the noise characteristics, the predicted noise levels achieve the noise limits at all locations during day, evening and night.

5.4 Noise Characteristics

5.4.1 Duration, Impulse and Intermittency adjustments

It is anticipated that under the worst case operational conditions, the units would operate continuously at their maximum designed capacity for the period. Therefore, no adjustment for duration, impulse or intermittency is applicable.

5.4.2 Tonality Adjustment

The objective tonality assessment methodology of the Protocol has been applied to the predicted noise levels at each of the locations for day, evening and night. Based upon the objective methodology, tonal adjustments are applicable and have been included in Table 6.

Table 6: Predictions Including Tonal Adjustment dB(A)

Noise Sensitive Receiver	Predicted Noise Level [dB(A)]	Adjustment [dB(A)]	Predicted Noise Level Including Penalty [dB(A)]
1	31	2	33
2	31	2	33
3	28	2	30
4	28	2	30
5	27	2	29
6	26	2	28
7	26	2	28
8	22	2	24
9	26	2	28
10	22	2	24
11	22	2	24
12	20	2	22

With the inclusion of tonal adjustments, the predicted noise levels achieve the noise limits at all locations during day, evening and night.

5.4.3 Low Frequency Noise

The noise from the proposed BESS equipment is dominated by many small fans. These fans are not sources of significant low frequency noise but rather produce most noise in the mid-frequencies. Measurements of noise close to the components confirm that low frequency noise is not a significant component. Notwithstanding, the highest predicted noise levels at each receiver have been calculated and are summarised in Table 7.

Table 7: Predicted Low Frequency Noise (dB)

Noise Sensitive Receiver	One third Octave Bands (Hz)								
	25	31.5	40	50	63	80	100	125	160
Threshold Levels L_{eq}	69	61	54	50	50	48	48	46	44
1	37	38	35	41	37	37	32	26	37
2	37	38	35	42	37	37	33	26	37
3	35	36	33	40	35	35	31	24	35
4	36	36	34	40	35	35	31	24	35
5	35	35	33	39	35	34	30	24	34
6	34	35	32	39	34	34	29	23	33
7	34	34	32	38	34	33	29	22	33
8	32	32	29	35	31	31	26	20	30
9	34	34	32	38	33	33	28	22	33
10	31	32	29	35	31	30	25	19	30
11	32	32	30	36	31	31	26	20	30
12	30	31	28	34	30	30	24	18	29

The predicted noise levels are below the threshold levels, confirming the expectation of the major noise sources producing no significant low frequency noise.

6 GENERAL ENVIRONMENTAL DUTY

The BESS has been designed with the reduction of noise as a primary consideration. This has included:

- The location of the site and the site layout being designed to maximise separation distances from sensitive receivers.
- Equipment suppliers being short listed based on the ability to achieve low noise emissions.
- Inclusion of at least 150mm of unsealed gravel to be used on the surface of the site.

Other measures, such as noise barriers and site levels have been considered to reduce noise but have been found to be ineffective. To be effective, the barrier must be located close to the noise source or noise receiver and block line of sight between them. Achieving these conditions is not practical for this BESS because of the large site dimensions of the BESS facility.

The predicted noise levels are no higher than 31 dB(A) with a 2 dB(A) tonal adjustment. These levels are well below the recommendations of the World Health Organisation to protect against health impacts of 40-45 dB(A) at night and 50-55 dB(A) during the day.

The approach to environmental noise has included a conservative assessment of criteria by removing insect noise. Based on this approach, it is considered that all reasonably practical methods of minimising noise pollution have been explored.

7 CONCLUSION

An environmental noise assessment has been conducted for the proposed Gnarwarre BESS (the **BESS**). The BESS is proposed to be located at 189-389 Volum Road, Gnarwarre, Victoria, which is approximately 20km west of Geelong.

The assessment has considered the noise at the closest noise sensitive receivers based on the proposed layout and equipment selections.

The relevant criteria have been determined in accordance with the *Surf Coast Planning Scheme*, the *Noise Limit and Assessment Protocol for the Control of Noise from Commercial, Industrial and Trade Premises and Entertainment Venues*, the *Environment Protection Regulations 2021*, and the *EPA Victoria Publication 1996 Noise guidelines: Assessing low frequency noise*.

The noise levels have been predicted using the *ISO 9613-2:2024* noise model and compared against the relevant criteria. The assessment has shown that the BESS will achieve the criteria after the application of a 2 dB(A) adjustment for tonality. No other noise character adjustments were found to be applicable.

A pre-construction environmental noise assessment should be undertaken to confirm that compliance can be achieved in the event of alternate OEM selections or revised noise levels.

APPENDIX A: PROPOSED BESS LAYOUT

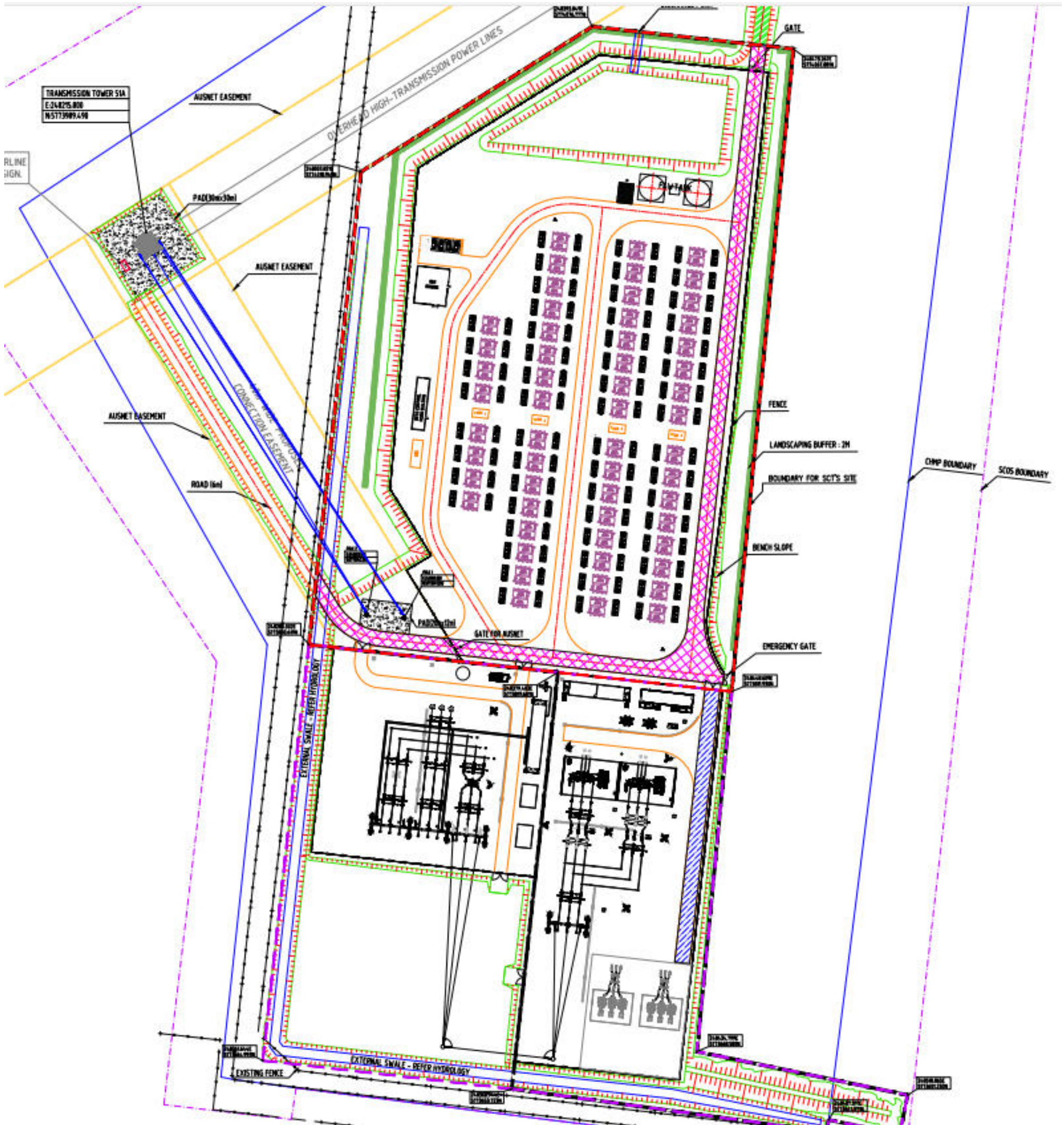


Figure 3: Proposed BESS Layout

APPENDIX B: DETAILED LEGISLATIVE AND POLICY CONTEXT

Appendix B.1: Planning Scheme

The Planning Scheme has been reviewed and the following provisions are considered relevant to noise:

Environmental Risks and Amenity

13.05-1S Noise management

Objective

To assist the management of noise effects on sensitive land uses.

Strategy

Ensure that development is not prejudiced and community amenity and human health is not adversely impacted by noise emissions.

Minimise the impact on human health from noise exposure to occupants of sensitive land uses (residential use, child care centre, school, education centre, residential aged care centre or hospital) near the transport system and other noise emission sources through suitable building siting and design (including orientation and internal layout), urban design and land use separation techniques as appropriate to the land use functions and character of the area.

Policy guidelines

Consider as relevant:

- *The noise requirements in accordance with the Environment Protection Regulations under the Environment Protection Act 2017.*

Policy documents

Consider as relevant:

- *Environment Protection Regulations under the Environment Protection Act 2017*
- *Noise Limit and Assessment Protocol for the Control of Noise from Commercial, Industrial and Trade Premises and Entertainment Venues (Publication 1826, Environment Protection Authority, May 2021)*

Appendix B.2: The Environment Protection Regulations 2021

The objective of the Environment Protection Regulations 2021 (the **Regulations**) is to give effect to the Environment Protection Act 2017 (the **Act**), including specifying matters in relation to noise emissions. The Regulations have been reviewed and the following relevant provisions have been highlighted.

113 Prediction, measurement, assessment and analysis of noise must be in accordance with Noise Protocol

A person who conducts a prediction, measurement, assessment or analysis of noise within a noise sensitive area for the purposes of the Act or these Regulations, other than Division 5 of this Part, must conduct the prediction, measurement, assessment or analysis in accordance with the Noise Protocol.

Note

The Noise Protocol sets out how to conduct the following noise-related assessments—

- (a) noise limits;*
- (b) background levels;*
- (c) alternative assessment criterion at an alternative assessment location, including when the Live music entertainment venues provisions (which include reference to agent of change) set out in the VPPs apply;*
- (d) effective noise levels.*

116 Definitions – Operating time periods

In this Division, in relation to noise emitted from commercial, industrial and trade premises –

day period means Monday to Saturday (except public holidays). From 7 a.m. to 6 p.m.;

evening period means –

- (i) Monday to Saturday, from 6 p.m. to 10 p.m.; and*
- (ii) Sunday and public holidays, from 7 a.m. to 10 p.m.*

night period means 10 p.m. to 7 a.m. the following day.

118 Unreasonable noise from commercial, industrial and trade premises

- (1) *For the purposes of paragraph (b) of the definition of unreasonable noise in section 3(1) of the Act, noise emitted from commercial, industrial and trade premises is prescribed to be unreasonable noise if the effective noise level of the noise exceeds –*
 - (a) *The noise limit that applies at the time the noise is emitted; or*
 - (b) *the alternative assessment criterion that applies at the time the noise is emitted if the assessment of an effective noise level is conducted at an alternative assessment location in accordance with the Noise Protocol.*
- (2) *For the purposes of subregulation (1)(a), the lowest decibel value that may be set as the noise limit (the base noise limit) is –*
 - (a) *In the case of noise emitted in a major urban area –*
 - (i) *During the day period, 45dB(A); or*
 - (ii) *During the evening period, 40dB(A); or*
 - (iii) *During the night period, 35dB(A); and*
 - (b) *In the case of noise emitted in a rural area –*
 - (i) *During the day period, 45dB(A); or*
 - (ii) *During the evening period, 37dB(A); or*
 - (iii) *During the night period, 32dB(A); and*
- (3) *The noise limit for commercial, industrial and trade premises for the night period must noise exceed 55dB(A).*

119 Cumulative Noise

- (1) *If 2 or more commercial, industrial and trade premises (whether existing or proposed) emit, or are likely to emit, noise that contributes to the effective noise level, an person in management or control of one or more of those premises must take all reasonable steps to ensure that the contribution from each of the premises, when combined, does not exceed the noise limit for the noise sensitive area.*
- (2) *For the purposes of subregulation (1), what constitutes a reasonable step must be determined in accordance with the Noise Protocol.*

120 Frequency spectrum

For the purposes of paragraph (a)(v) of the definition of unreasonable noise in section 3(1) of the Act, frequency spectrum is a prescribed factor for noise emitted from commercial, industrial and trade premises.

Appendix B.3: Noise Limit and Assessment Protocol 1826.4

The Protocol, which is referenced by both the Planning Scheme and the Regulations, provides guidance in determining noise limits for new and existing commercial, industrial, and trade premises in Victoria. It is therefore considered that the Protocol provides the appropriate assessment framework.

The Protocol provides two methods for determining appropriate noise limits, an urban method, and a rural method. As per the definition in the Regulations, the area around Gnarwarre is considered a rural area, and as such, the rural area method has been used to determine appropriate noise limits. The objective noise limits for a rural area are based on the planning zones in the vicinity of the site, the type of noise source, and the existing background noise levels in the environment.

Appendix B.3.1: Objective Noise Limits

The noise limit is typically determined by:

- Determining the *zone limit* for each of the day, evening and night periods
- Calculating the *distance adjusted level* by subtracting 1 dB(A) from the zone limit for each 100m of separation between the dwelling and the zone boundary that the noise source is in.
- Conducting a *background level assessment*
- Determining the noise limits based on the distance adjusted level and the background noise assessment.

The noise limit applies to the cumulative noise from all commercial, industrial and trade noise sources.

Section 2.6 of the Protocol provides the noise limits for utilities, such as the BESS, in rural areas. Where the utility and the sensitive receiver are both located within the same contiguous Farming Zone, such as the case for the BESS and the noise sensitive receivers considered in the project, the distance adjusted levels are as shown in Table 8.

Table 8: Utility distance-adjusted noise level

Time	Distance-adjusted noise level
Day 7:00am to 6:00pm Monday to Saturday	45 dB(A)
Evening 6:00pm to 10:00pm Monday to Saturday -7:00am to 10:00pm Sunday and public holidays	39 dB(A)
Night 10:00pm to 7:00am Monday to Sunday	34 dB(A)

Appendix B.3.2: Background Level Assessment

The applicable noise limit is the distance-adjusted level as defined above, unless a background level assessment has been conducted. Where a background level assessment has been conducted, the noise limits are as follows:

- The greater of the distance-adjusted level or the background noise level plus 8 dB for the day period.
- The greater of the distance-adjusted level or the background noise level plus 5 dB for the evening period.
- The greater of the distance-adjusted level or the background noise level plus 5 dB for the night period but not greater than 55 dB(A).

Appendix B.3.3: Noise Character Adjustments

The Protocol, in Clauses 79 to 88 provides methods to adjust the predicted noise level where the noise is short in duration, tonal, impulsive or intermittent.

Duration adjustment (Clauses 79 – 81)

In accordance with the Protocol, *if noise emissions from the commercial, industrial or trade premises investigated do not occur over the whole continuous 30-minute period, the duration adjustment applies.*

The adjustment is based upon the ratio of the total time for which the source is operating over the measurement period, using the following equation:

$$A_{dur} = 10 \log_{10} (\text{total time source operating} / \text{measurement period}) \text{ dB}$$

Tonality adjustment (Clauses 82 – 84)

In accordance with the Protocol, a tonal adjustment is made based upon observations. Where a tonal character is just detectable, an adjustment of +2dB is applied. Where the tonal character is prominent, an adjustment of +5 dB is applied.

An objective method of determining the tonal character is also provided in Annex C of the Protocol. This assessment uses the objective method, but also considers the potential masking effect of background noise where potential tones are low in level.

Impulse Adjustment (Clauses 85 - 86)

As with tonality, if an impulsive characteristic is just detectible, an adjustment of +2 dB is applied, however if the characteristic is prominent, a +5 dB adjustment is applied.

Intermittency Adjustment (Clauses 87 – 88)

An adjustment for intermittency applies where the noise both:

- (a) Increases in level rapidly by at least 5 dB on at least 2 occasions during a 30 minute period; and
- (b) Maintains the higher level for at least a one minute duration

Appendix B.4: EPA Victoria Publication 1996 Noise guidelines: Assessing low frequency noise

EPA Victoria Publication 1996 *Noise guidelines: Assessing low frequency noise* (the **Guidelines**) provides a method for assessing low frequency noise (10Hz to 160 Hz) for commercial, industrial and trade premises. The assessment is separate from an assessment for compliance with other regulatory noise limits, such as from the Regulations and the Protocol. The outdoor criteria are shown in Table 9.

Table 9: Outdoor Low Frequency Threshold Criteria

One-Third Octave (Hz)	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160
L_{eq} (dB)	92	89	86	77	69	61	54	50	50	48	48	46	44

The levels within Table 9 are not set limits, but exceedance would indicate a potential risk of problematic low frequency noise. Where the threshold levels are exceeded, further investigation should be made into the cause and the potential for disturbance at sensitive receivers.

Appendix B.5: General Environmental Duty

Part 3.2 of the Act introduces a general environmental duty, which states the following:

25 General environmental duty

(1) A person who is engaging in an activity that may give rise to risks of harm to human health or the environment from pollution or waste must minimise those risks, so far as reasonably practicable.

Pollution is defined within the Act as follows:

pollution includes any emission, discharge, deposit, disturbance or escape of –

- (a) a solid, liquid or gas, or a combination of a solid, liquid or gas, including but not limited to smoke, dust, fumes or odour; or*
- (b) noise; or*
- (c) heat; or*
- (d) a thing prescribed for the purposes of this definition*

But does not include a thing prescribed not to be pollution for the purposes of this definition;

As noise is included within the definition of pollution, the BESS has a general environmental duty to, so far as reasonably practicable, minimise risks of harm to human health or the environment from the noise associated with its operation.