

Appendix G - Noise Assessment

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Wooreen Battery Energy Storage System (WESS)

Desktop Noise Impact Assessment

EnergyAustralia

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Executive summary

Aurecon has undertaken a preliminary noise impact assessment for the operation of the proposed Wooreen Battery Energy Storage System (WESS) located adjacent to the existing EnergyAustralia Jeeralang Power Station at Bonds Lane, Hazelwood North. The WESS site is proposed to include 350 MW of battery storage together with associated ancillary infrastructure including transformers and inverters.

The site location is in an area which contains a significant amount of existing noise generating infrastructure including the Jeeralang Power Station, and other smaller scale industrial businesses. On this basis, the area is expected to be affected by existing industrial noise sources. From ariel imagery, the closest noise sensitive areas (NSA) have been identified at two residential properties located approximately 1 km and 1.2 km to the northeast and east of the site.

Indicative data for the various noise sources proposed on site has been assumed based on benchmark sound power levels of typical manufacturer data from four BESS manufacturers. A computational noise model of the site has been developed in SoundPLAN 8.1 to predict environmental noise emissions from the site to the nearby noise sensitive areas. The results have been assessed against the night period requirements of the *Environment Protection Act 2017* and Environment Protection Authority's (EPA Vic) *Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues*.

Assessment results of the BESS

The results of the computational noise model show that environmental noise emissions from the benchmarked equipment are predicted to comply with the noise limits at the identified nearby noise sensitive areas. The predicted noise levels at the two noise nearest NSAs are below. The predicted noise levels from the WESS at these properties are 7 dBA and 10 dBA lower than the applicable night period limit respectively.

Based on the benchmarked equipment, noise emissions are predicted to comply with the applicable regulatory requirements without additional treatment. However, as a final equipment supplier has not yet been confirmed, a potential noise wall configuration has been presented in the project documentation which may be used to provide additional noise mitigation from alternate suppliers if required.

Table 1 Predicted noise levels at 30 Church Road

Equipment	Predicted sound pressure level at NSA dBL _{Aeq,30mins}	Night period noise limit dBA L _{eq,30mins}	Complies with noise limit?
HV Transformers	16	38	Yes
LV Transformers	17		
Inverters	30		
Battery containers	21		
Total	31		

Table 2 Predicted noise levels at 545 Tramway Road

Equipment	Predicted sound pressure level at NSA dBL _{Aeq,30mins}	Night period noise limit dBA L _{eq,30mins}	Complies with noise limit?
HV Transformers	15	42	Yes
LV Transformers	17		
Inverters	31		
Battery containers	25		
Total	32		

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Assessment results of the cumulative impacts

Noise contributions from the WESS will need to be managed in a way that does not lead to a cumulative exceedance of the noise limits. A review of cumulative noise emissions from the proposed WESS together with other infrastructure in the area has been undertaken.

The zoning in the surrounding area includes Industrial Zone – Schedule 1 (IN1Z), Industrial Zone – Schedule 2 (IN2Z), and Special Use Zone – Brown Coal (SUZ1), which have different noise limits (as per the Noise Protocol) and in turn means the applicable distance adjusted levels at the NSA are different for each nearby noise generating zone. On this basis, the impact of cumulative noise has been assessed against the highest applicable noise limit, which is IN1Z; at each property during the night period,

After reviewing the surrounding zoning and applicable distance adjusted zoning levels it is apparent that noise generating activities in the nearby IN1Z have higher noise limits than would apply to the SUZ1 in which the project is located. A review of the applicable noise limits from all surrounding generating zones has been undertaken and it has been demonstrated that the proposed WESS would not be expected to lead to a cumulative exceedance of the applicable limits at the nearby NSAs.

Post-contract appointment

As the BESS manufacture contract has not been awarded, EA will undertake a detailed noise assessment post-contact award and prior to construction. In the event of the planning application being approved, EA will provide relevant noise information pertinent to the selected manufacturer. This may result in a reduced extent of noise walls and/or no other mitigation being required. On this basis, the following is proposed:

Prior to the commencement of works, a detailed noise assessment prepared to allow consideration in accordance with the Environment Protection Act 2017, the Environment Protection Regulations 2021 and Noise Protocol requirements must be submitted to the satisfaction of the Responsible Authority. Any noise mitigation measures recommended in the noise assessment must be implemented prior to the commencement of use.

As part of the detailed noise assessment, the requirement of a noise wall will be tested. If a noise wall is still required the exact arrangement (location, length and height) will be identified. This will inform the detailed design and as such the plans that are submitted for Ministerial endorsement.

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1 Introduction

1.1 Project background

Aurecon Australasia Pty Ltd (Aurecon) has been engaged by EnergyAustralia to prepare a preliminary desktop noise impact assessment of the proposed Wooreen Battery Energy Storage System (WESS).

The proposed WESS site is adjacent to the existing Jeeralang Power Station. The following contains an indicative list and quantities of the elements required to enable the WESS to function and is proposed to include:

- Approximately 280 BESS enclosures (or equivalent) equating up to 1400MWh of lithium batteries with low voltage inverters and 33kV to low voltage transformers
- A 220/33kV substation including two 220kV/33kV transformers, 220 kV isolators and auxiliary services such as two 33 kV zig-zag transformers
- One 220kV overhead power line proposed to connect the BESS transformers to the switchyard
- One control room likely located adjacent to the BESS enclosures
- Four 33kV switchrooms likely located adjacent to the BESS enclosures
- Provision of an office, an operation and maintenance shed/room, and two car parking spaces for maintenance staff
- Multiple indicative noise walls approx. 6m in height
- Secondary access from Bonds Lane into the WESS facility
- Installation of fire detection equipment
- Perimeter road encompassing WESS footprint and internal roads for access
- Retention pond and/or water storage tank
- Replace internal fencing and install CCTV
- Temporary construction laydown areas

The indicative design site layout for the site is shown in Figure 1.

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Figure 1 Indicative design site layout for the WESS

For this project, a desktop noise assessment has been undertaken in accordance with the Victorian Environment Protection Regulations 2021 together with Publication 1826.4: Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues.

The scope of this assessment includes:

- Establish noise limits for the development in accordance with the applicable Victorian regulations and guidelines
- Predict noise emissions from the proposed site infrastructure and assess against the defined limits
- Provide high-level options for noise mitigation, if applicable

As vibration dissipates quickly over distance, and there are no vibration intensive sources proposed on the WESS site, vibration from the ongoing operation of the proposed infrastructure is considered negligible and is therefore not assessed in this document.

1.2 Surrounding environment

The proposed WESS is located approximately 5 km southeast of Morwell, Victoria. The surrounding area is characterised by existing industry including Jeeralang power station. And smaller scale industrial sites. Farming and rural residential areas also surround the Project Land.

The following noise sensitive areas (NSAs) have been identified based on review of aerial photos and confirmation during field investigations.

Table 3 NSA addresses

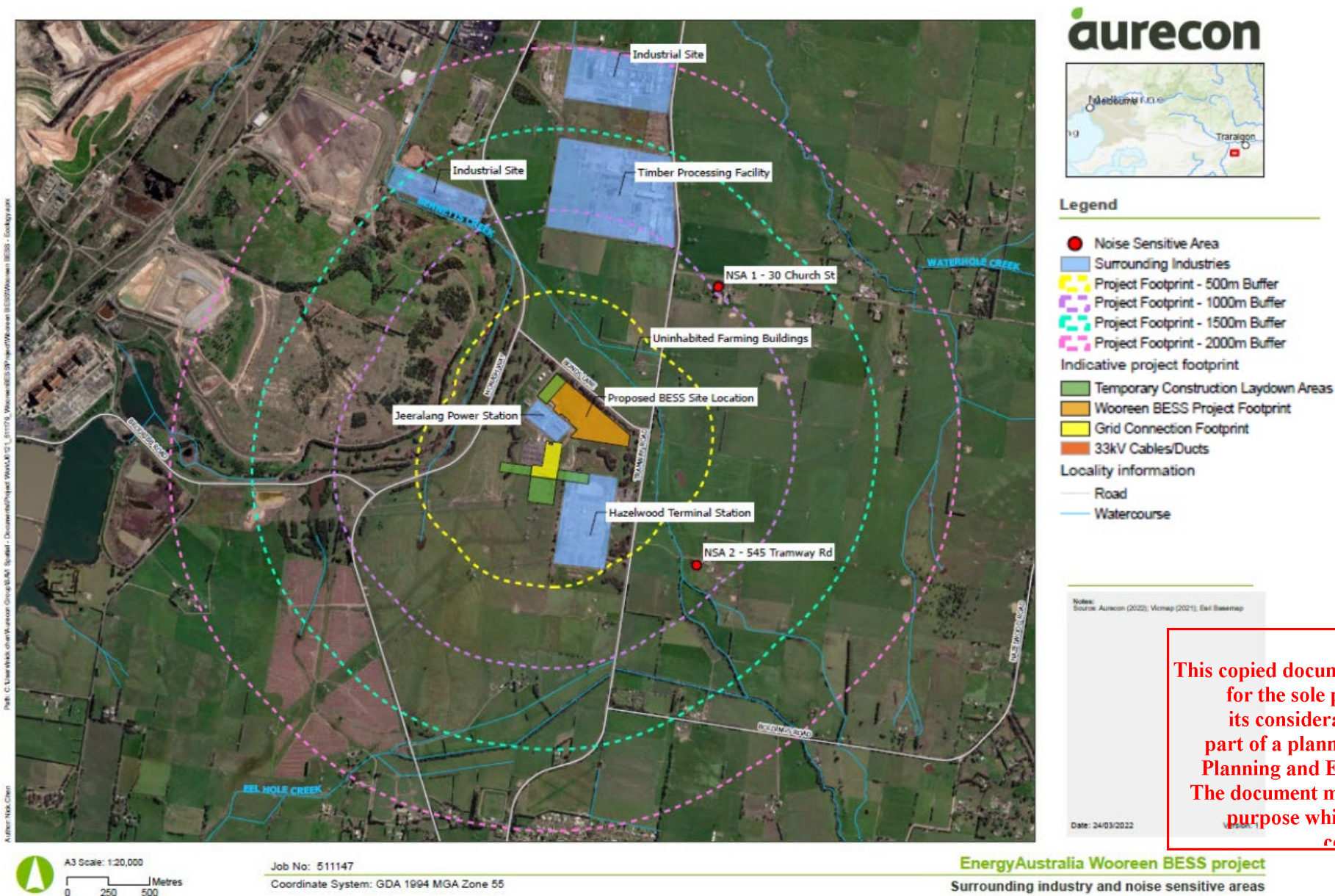
Noise sensitive area	Address (residential uses)	Approximate distance to site
NSA1	30 Church Road, Hazelwood North	1000m
NSA2	545 Tramway Road, Hazelwood North	1200m

The site and surrounds can be seen in Figure 2.

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Figure 2 Surrounding industry and noise sensitive areas

2 Regulatory framework

The following acts and regulations have been used as basis of this assessment

- *Environment Protection Act 2017* (Victoria)
- *Environment Protection Regulations 2021* (Victoria)
- *Victoria EPA, Noise limit and assessment protocol for the control of noise from Commercial, industrial and trade premises and entertainment venues (Noise Protocol)*, Publication 1826.4, May 2021
- *Victoria EPA, Reasonably Practicable*, Publication 1856, November 2020

2.1 Environment Protection Act 2017

The *Environment Protection Act 2017* states ‘any 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’. In addition to the GED, Section 166 of the Act makes it an offence for any individual to emit an *unreasonable noise* or permit an unreasonable noise to be emitted. Unreasonable Noise is defined in Section 3(1) of the Act as noise that *is (a) unreasonable having regard to the following – (i) its volume, intensity or duration; (ii) its character; (iii) the time, place or other circumstances in which it is emitted; (iv) how often it is emitted; (v) any prescribed factors; or (b) is prescribed to be unreasonable noise.*

The requirement to demonstrate that the GED is being complied with is in addition to compliance with the noise limits set out in the EPA’s Noise Limit and Assessment Protocol Publication 1826.4 (2021). Prior to construction commencing, EA will demonstrate that the design of the WESS complies with the GED and the applicable noise limits.

2.2 Victorian Environment Protection Regulations

The Environment Protection Regulations 2021 (Regulations) support the objectives of the Act, that is to prevent or minimise risks of harm to human health or the environment from pollution or waste. The Regulations provide clarity and further detail for duty holders on how to fulfil their obligations and are used to deal with matters in detail and penalties for breaches. The objectives of the Regulations in relation to noise are to further the purposes of, and give effect to, the Act by specifying matters in relation to noise emissions.

The Environment Protection Regulations requires that the prediction, measurement, assessment, or analysis of noise within a noise sensitive area for the purposes of the Act or the Regulations is undertaken in accordance with the Noise Protocol. Noise is assessed at NSAs where the maximum effective noise level occurs or, for proposed premises, is predicted to occur. The legislated noise limits are applicable to the combined level of noise associated with all commerce, industry and trade.

Regulation 117 excludes a number of types of noise from the assessment including noise from mobile farm machinery, aircraft, construction activity and non-commercial vehicles. Extraneous noise must also be excluded from any measured noise levels which includes any noise that is not part of the commercial, industrial or trade premises such as local traffic, insects, or bird chirping.

2.2.1 Cumulative noise

The requirement to assess all sources of industrial and commercial noise cumulatively, is outlined in Regulation 119:

“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, a 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.”

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Therefore, where there is more than one commercial, industrial or trade premises contributing to the noise received at a noise sensitive area, each premises would need to contribute a level lower than the applicable noise limit to avoid the cumulative noise level exceeding the noise limit. The definition of commercial, industrial and trade premises is included in the Regulations.

2.2.2 Time periods

Different noise limits apply during the day, evening and night periods. The time periods are defined in Regulation 116 and are summarised in Table 4.

Table 4 Time periods

Period	Day	Time
Day	Monday to Saturday	7 a.m. to 6 p.m.
Evening	Monday to Saturday	6 p.m. to 10 p.m.
	Sunday / Public Holidays	7 a.m. to 10 p.m.
Night	Monday to Sunday / Public Holidays	10 p.m. to 7 a.m.

2.2.3 Base noise limit

As defined in the Regulation 118(2)(b) the lowest decibel values that may be set as the noise limit in a rural area are outlined in Table 5 below.

Table 5 Rural area base noise limits

	Rural area base noise limit
Day	45 dBA
Evening	37 dBA
Night	32 dBA

Subordinate legislation and part of the Regulations related to noise are described below.

2.2.4 Noise Protocol

Airborne noise from fixed infrastructure must comply with the subordinate legislation EPA Publication 1826.4 *Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues*, May 2021 (Noise Protocol).

The Noise Protocol provides the determining noise limits for new and existing commercial, industrial and trade premises and entertainment venues. It also sets the methodology for assessing the effective noise level to determine unreasonable noise under the Regulations. This is done by setting noise limits for emissions in different urban and rural settings (known as zoning) at certain time periods, as outlined below. The noise limits are applicable to the combined level of noise associated with all commerce industry and trade.

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Urban / Regional area

The Noise Protocol defines different procedures for determining noise limits in rural and urban areas. The EPA provides definitions of Major Urban areas in regional areas. Morwell is defined as a Major Urban Area in regional Victoria and the EPA provides maps detailing the boundary of the Major Urban Area. The site location and nearby noise sensitive areas are outside of the Major Urban Area and therefore the rural method defined in the noise protocol is applicable.

Effective noise levels

The Noise Protocol defines an effective noise level which is determined for commercial, industrial and trade premises as a 30-minute equivalent sound pressure level $L_{Aeq,30\text{ min}}$ adjusted where relevant for duration, noise character and measurement position. Noise character adjustments include factors such as duration, tonality, impulsivity and intermittency.

2.2.5 Guideline 1856 'Reasonably Practicable'

The Victorian EPA Guideline 1856 'Reasonably Practicable' provides guidance on the assessment of proportionate controls to mitigate or minimise the risk of harm. These measures include a hierarchy of controls, defined as follows:

- Eliminate risk: Can you eliminate the risk
- Likelihood of the risk: What's the chance that harm will occur?
- Degree of harm (consequence): How severe could the harm be on human health or the environment?
- State of knowledge: What do you know, or what can you find out, about the risks your activities pose?
- Available suitable controls: What technology, processes or equipment are available to control the risk
What controls are suitable for use in your circumstances?
- Costs of suitable controls: How much does the control cost to put in place compared to how effective it would be in reducing the risk?

Guideline 1856 requires that these factors be considered to determine what is reasonably practicable to control risks of environmental damage.

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3 Noise criteria

Using the Regulations and subordinate guidelines in Section 2, the following sections establish the noise criteria and considerations specific to the WESS site.

3.1 Rural area zoning

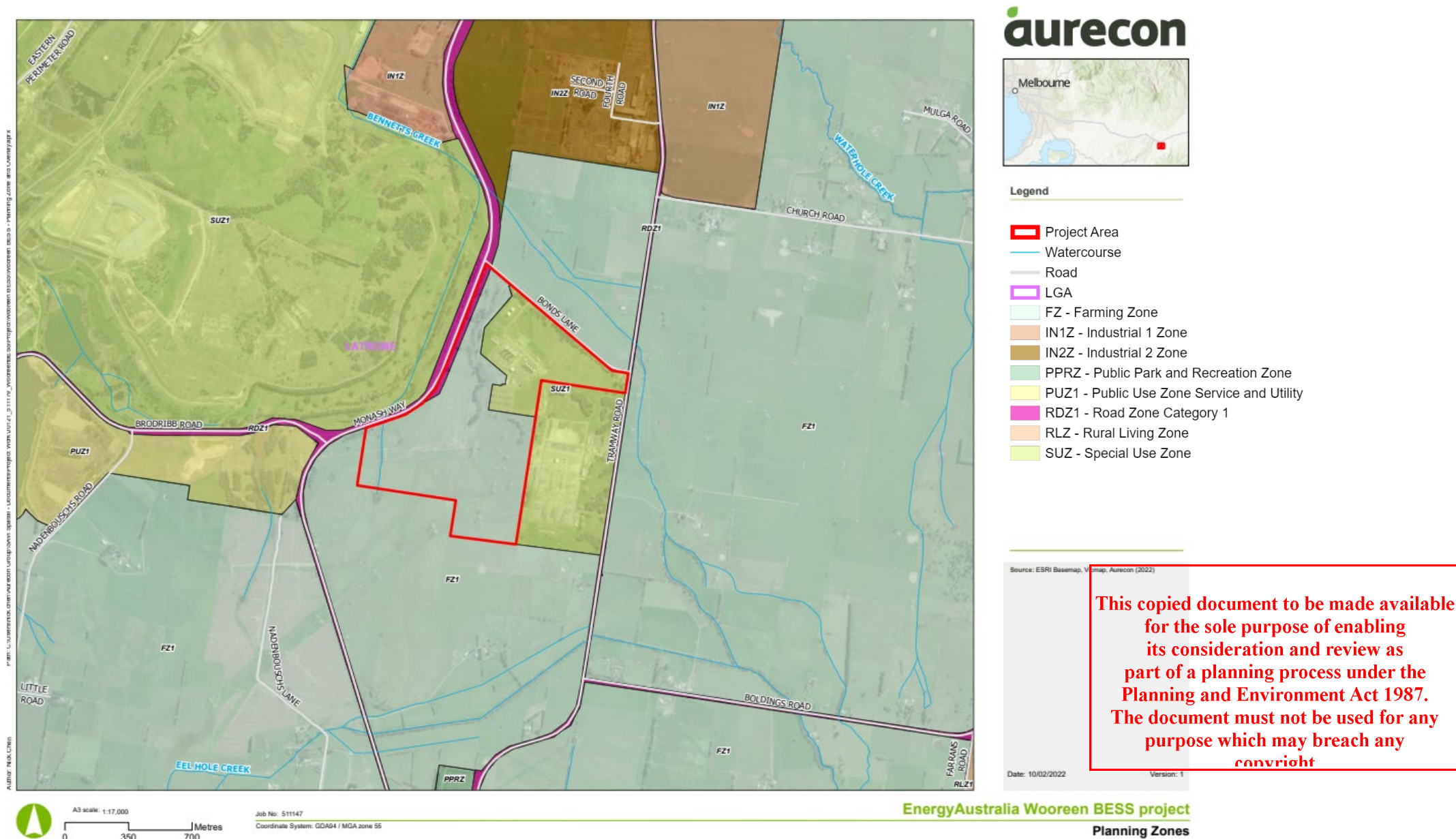
To determine the noise limit, the zone level must first be established using the relevant planning scheme or schemes for the land under consideration.

The proposed WESS site is zoned as Special Use Zone (SUZ1) Group D and surrounding NSAs are zoned as Farming Zone (FZ1) (Refer to Figure 3) The site is outside of the Morwell urban regional boundary and therefore the rural area method as defined in the Noise Protocol is applicable.

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3.2 Background noise levels

A noise survey that was undertaken in the surrounding area by JTA acoustic consultants in March 2021 has been used to establish background noise levels. At this stage Aurecon has not undertaken noise surveys associated specifically with the WESS but considers the previous surveys provide a reliable basis to develop noise criteria for the WESS at all nearby receivers.

Methodologies to measure background noise levels are stipulated in Part 1 Section A4 of the Noise Protocol. The JTA assessment has undertaken the assessment in accordance with the Noise Protocol.

The background level represents the background noise in an NSA, the absence of noise from any commercial, industrial or trade premises which appears more intrusive at the point where the background level is measured. JTA's background noise monitoring was undertaken in accordance with the Noise Protocol and therefore excluded contribution from existing commercial / industrial sources such as Jeeralang Power Station.

The report confirmed that background surveys were undertaken without influence of the Jeeralang power station. Measurement results from the March 2021 survey are provided in Table 6.

Table 6 JTA noise survey results

Location	Period	Background Noise level, L ₉₀ dBA
30 Church Road	Day	38
	Evening	38
	Night	33
545 Tramway Road	Day	40
	Evening	40
	Night	37

A background relevant area is defined in the Noise Protocol as “a noise sensitive area within a rural area where background levels may be higher than usual. This includes areas where freeway or highway traffic is a significant audible background noise source”. The noise monitoring report from JTA consultants confirmed that the following were the main background noise sources:

- Traffic
- Birds and insects
- Slight breeze on vegetation

On this basis it is considered that the site should be considered as a background relevant area.

3.3 Establishing the noise limits

Zone levels are used to establish noise limits for NSAs (e.g. residential properties) in rural areas, as defined in the Noise Protocol and. The Zone levels are adjusted based on the distance between the zone where the noise generator (the WESS) is located, and the location of the noise receiver in the NSA.

The established distance adjustments are provided in Table 7

Table 7 Nearby noise sensitive areas

Noise Sensitive Area address	Approximate distance to SUZ1 boundary	Distance adjustment (dBA)
30 Church Road	1000m	-9

545 Tramway Road	800m	-4
------------------	------	----

The noise limit for the NSA is then defined as the greater of the distance adjusted level or the adjusted background noise level.

The applicable background noise level adjustments are as follows:

- Day: + 8dB
- Evening: + 5dB
- Night: + 5dB

As defined in the Regulations, the noise limit cannot be set lower than the base noise limit (listed in Table 5). Table 8 summarises the applicable noise limits for the site based on the background noise levels and distance adjustment at the identified NSAs.

Table 8 Noise Limits based on zoning

Receiver	Period	Zone levels, dBA	Distance adjusted level, Leq(30min) dBA	Background noise level L90 dBA	Adjusted background noise level dBA	Noise limit Leq(30min) dBA
30 Church Road	Day	53	44	38	46	46
	Evening	48	39	38	43	43
	Night	43	34	33	38	38
545 Tramway Road	Day	53	49	40	48	48
	Evening	48	44	40	45	45
	Night	43	39	37	42	42

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4 Environmental noise emissions modelling

4.1 Indicative project equipment

The proposed development consists of a 350 MW BESS and associated site infrastructure. At this stage the preferred equipment supplier has not been confirmed and therefore, a preliminary schedule of equipment has been developed by the project engineers. This was based on indicative equipment selections, numbers and associated equipment acoustic data from four different BESS suppliers. The indicative equipment is outlined below and illustrated in , while the schedules used for this assessment are summarised in Table 9.

- 64 × LV Transformers
- 2 × HV Transformers
- 300 × Batteries (including associated HVAC)
- 100 × Inverters

Table 9 Equipment sound power level schedule

	Equipment sound power level (dB) at frequency (Hz)								Total, dBA
	63	125	250	500	1000	2000	4000	8000	
HV Transformer	93	95	90	90	84	79	74	67	90
LV Transformer	78	80	75	75	69	64	59	52	75
Battery / HVAC	66	69	71	74	74	73	68	60	79
Inverter (power conversion system)	70	70	83	84	85	86	79	75	91

For the proposed BESS, tonality is considered to be the most likely noise characteristic that may require an adjustment to be applied to the effective noise level. Tonal humming noise is often associated with electrical equipment such as transformers. Where tonal noise is audible at the NSAs, an adjustment of +2 to +5 dBA may need to be applied.

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- LEGEND:
- INDICATIVE BATTERY STORAGE
 - INDICATIVE INVERTER
 - INDICATIVE TRANSFORMER
 - HV TRANSFORMER
 - 33/220kV TRANSFORMER LAYDOWN AREAS
 - CONTROL AND SWITCH ROOMS
 - ACCESS ROAD
 - INDICATIVE NOISE WALL
 - INDICATIVE STORMWATER RETENTION POND
 - EXISTING DRAINAGE PIPE
 - 220kV OHW

WOOREEN SITE PLAN
SCALE 1:2000

GENERAL VISUAL RENDERING ONLY
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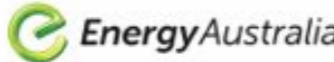
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Figure 4 Indicative layout of BESS equipment

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4.2 Calculation method

A computational noise model has been developed using SoundPLAN 8.1 for the site to predict environmental noise emissions from the site. For the purposes of this assessment, all equipment has been assumed to operate 24/7 and therefore, the most critical period for compliance with the noise limits is the night period from 10.00pm to 7.00am. Noise emissions from the proposed WESS are calculated using ISO 9613-2¹ and the calculation method used incorporates the following:

- Noise attenuation over distance
- Frequency dependent air absorption
- Frequency dependent ground absorption
- 1/1 octave band frequency source noise levels (63 – 8000 Hz)

The following conditions have been incorporated into the environmental noise calculations which represent reasonable favourable conditions for the propagation of noise:

- Air absorption is based on 10°C and 70% relative humidity (most favourable conditions for the propagation of sound)
- Ground absorption factor of 1.0 (absorptive ground) was adopted due to the open farming fields between the source and NSAs. A gravel surface was assumed for the BESS site
- A receptor height of 1.5 m was adopted as per requirements of the *Victorian EPA Technical Guide: Measuring and analysing industry noise and music noise*
- All noise sources on site run concurrently over a 24-hour period

For this assessment, the main limitation is the topography between the source and receiver was not considered however online street view imagery shows the area is relatively flat.

4.3 Noise modelling results

The noise contribution from the WESS is predicted to comply with the applicable Noise Protocol limits at both identified NSA. As noise contributions comply at these properties, it is expected to also comply at other properties further from the development.

The predicted noise levels at 30 Church Road and 525 Tramway Road are 7 dBA and 10 dBA lower than the applicable limit respectively. Results of the computational noise modelling are provided in Table 10 and Table 11.

Table 10 Predicted noise levels at 30 Church Road

Equipment	Predicted sound pressure level at NSA dBL _{Aeq,30mins}	Night period noise limit dBA L _{eq,30mins}	Complies with noise limit?
HV Transformers	16	38	Yes
LV Transformers	17		
Inverters	30		
Battery containers	21		
Total	31		

Table 11 Predicted noise levels at 545 Tramway Road

Equipment	Predicted sound pressure level at NSA dBL _{Aeq,30mins}	Night period noise limit dBA L _{eq,30mins}	Complies with noise limit?
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¹ ISO 9613-2:1996 *Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation*

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HV Transformers	15	42
LV Transformers	17	
Inverters	31	
Battery containers	25	
Total	32	

Yes

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Reviewing the noise contributions from the various noise sources at the NSAs, it is apparent that the contribution from the transformers is insignificant relative to the other sources. The contribution from the transformers is expected to be lower than background noise levels and inaudible at the NSAs. Therefore, tonal adjustments are not expected to be required.

4.4 Cumulative impact assessment

Potential effects of cumulative noise must be considered and reasonable steps undertaken to demonstrate that the combined noise contribution from all commercial, industrial and trade premises does not exceed the noise limit at the NSAs. The two closest existing industrial and commercial premises to the NSA are the Jeeralang Power Station and associated energy infrastructure, and the timber production facility to the north. EA have confirmed that Jeeralang Power Station is a peaking power plant and therefore operates on an 'as required' basis, which may include night periods.

The zoning in the surrounding area includes IN1Z, IN2Z, and SUZ1 and can be seen below in Figure 5.

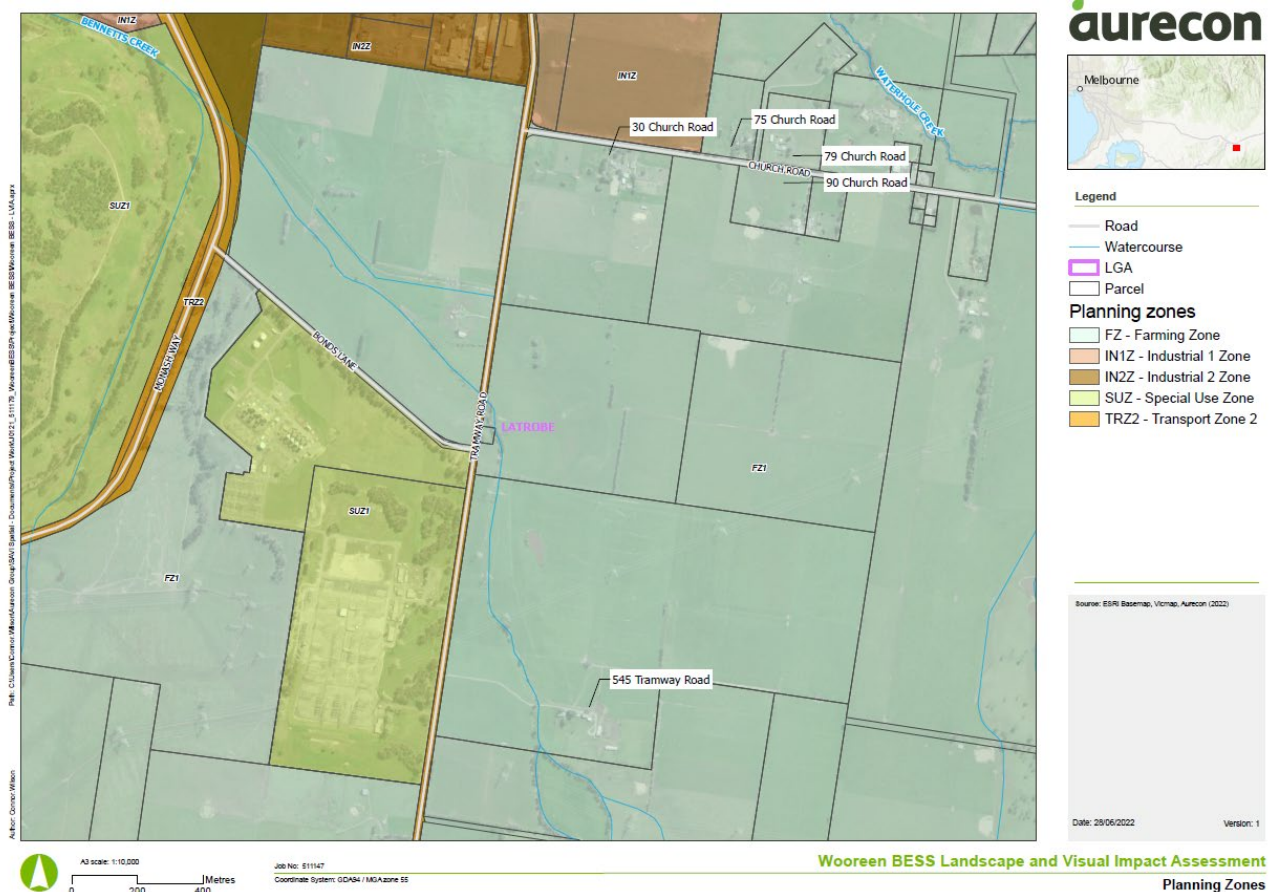


Figure 5 Surrounding zoning and receivers

EPA Publication 1997 *Technical Guide: Measuring and analysing industry noise and music noise* provides methodologies to assess industry noise from multiple premises. For proposed new industry in rural areas, the Guide sets out a 'future proofing approach' in areas where there is a likelihood of further industrial growth. Noting the amount of undeveloped industrial zoned land in the surrounding area, there is a likelihood of future industrial growth and expansion industrial premises in the area. The undeveloped IN1Z land to the north of Church Street is 56 ha which may be developed in future. The Guide notes that the contribution from

an individual site to the noise within a rural NSA should be no greater than the noise limit minus five decibels (for each period of the day).

Reviewing the location of the surrounding receivers, zoning, and the associated Zone Levels as set out in the Noise Protocol, it is apparent that the applicable distance adjusted levels at the NSAs are different for each nearby noise generating zone. A review of the applicable night period distance adjusted levels has been undertaken based on the methodology set out in the Noise Protocol. On this basis, the following night period distance adjusted levels for each generating zone are established at the identified NSAs.

Table 12 Distance adjusted noise levels for different zones

NSA location	Night period zone levels, L_{eq} dBA								
	Noise generating zone								
	IN1Z			IN2Z			SUZ1		
	Zone level	Distance adjustment	Distance adjusted level	Zone level	Distance adjustment	Distance adjusted level	Zone level	Distance adjustment	Distance adjusted level
30 Church Rd	43	0	43	43	3	40	43	9	34
75 Church Rd	43	0	43	43	6	37	43	9	34
79 Church Rd	43	2	41	43	8	35	43	9	34
90 Church Rd	43	3	40	43	9	34	43	9	34
545 Tramway Rd	43	9	34	43	9	34	43	4	39

During the night period, noise limits are set based on the greater of the above distance adjusted levels or the night background level plus 5dB. On this basis, the background noise level would only increase the applicable noise limits.

Due to the proximity of the properties on Church Road to the IN1Z, it can be seen that a significantly higher noise limit applies to noise generators in the IN1Z zone than would be applicable to noise generators in the SUZ1, which is approximately 1000m away.

In considering the potential impacts of cumulative noise it is necessary to undertake a review of potential contributions from all surrounding noise generating areas. Assessing the contribution of noise generating activities in the WESS zone (SUZ1) in isolation would not adequately account for other activities occurring in the area. On this basis the impact of cumulative noise should be assessed against the highest applicable noise limit at each property. The highest applicable night period noise limit at each property, together with the predicted noise levels from the proposed WESS are summarised below in Table 13.

Table 13 Comparison of predicted noise levels against highest applicable noise limit

Receiver location	Night period noise limit, L_{eq} , dBA	Predicted noise level from BESS, L_{eq} , dBA
30 Church Rd	43 ⁽¹⁾	31
75 Church Rd	43 ⁽¹⁾	27
79 Church Rd	41 ⁽¹⁾	26
90 Church Rd	40 ⁽¹⁾	26
545 Tramway Rd	42 ⁽²⁾	32

(1) IN1Z distance adjusted noise level

(2) Existing background noise level +5dB

In all cases, the predicted noise emissions from the proposed WESS is at least 10dB lower than the highest applicable noise limit. Therefore, the noise contribution from the WESS is not predicted to lead to a cumulative exceedance of the applicable limits.

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5 Potential noise mitigation measures

At this stage an equipment supplier for the site has not been confirmed. Although the equipment sound power levels and schedules in Table 9 have been established based on representative selections, it is possible that supplier equipment exceeds the assumed sound power levels used in this assessment.

If alternate equipment selections result in increased noise emissions, it is possible that additional noise mitigation may be required. The performance of a noise wall has been reviewed that would provide additional acoustic shielding between the WESS and the nearby NSAs. The indicative wall layout is provided in Figure 6. The wall heights would be dependent on final equipment schedules and layouts however, indicatively, a 6 metre wall has been tested for this review.

Noise walls should be of solid material with surface density of at least 10kg/m³ (concrete, solid plywood, Colorbond steel etc) and have no gaps at the bottom of the wall or along its length. Sound absorptive treatment to the wall may be required (such as Pyrotek Reapor). Detailed design of the wall would be undertaken as post-contract award and prior to construction.



Figure 6 Potential noise wall layout

The predicted noise contribution from the BESS at the identified NSAs, with the noise wall, are provided in Table 14.

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Table 14 Comparison of predicted noise levels with noise wall against highest applicable noise limit

Receiver location	Predicted noise level, without noise wall L _{eq} , dBA	Predicted noise level, with noise wall L _{eq} , dBA	Noise reduction provided by noise wall, dBA
30 Church Rd	31	28	-4
75 Church Rd	27	24	-3
79 Church Rd	26	23	-3
90 Church Rd	26	24	-2
545 Tramway Rd	32	32	0

On this basis it is considered that should manufacturer equipment levels exceed the assumed values, a noise wall arrangement could be developed that would appropriately reduce noise levels by up to approximately 4dBA. Potential noise wall arrangements would need to be developed during detailed design based on final equipment selections and manufacturer site layouts.

Other approaches to reduce noise levels that could be considered include:

- Requiring suppliers to reselect equipment with lower noise emissions
- Installation of external mitigation to equipment (attenuators or acoustic louvres)
- Adjusting fan speeds to account for reduced cooling capacity overnight

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6 General environmental duty

Table 15 provides commentary on each of the potential control measures from the Victorian EPA Guideline 1856 Reasonably Practicable and considered how to comply with the GED.

Table 15 General environmental duty

Control measure	Comment
Eliminate Risk	BESS activities will inherently generate noise during operation however, mitigation measures will be considered as part of the design including specification of low noise equipment and noise walls.
Likelihood of risk	The site will be designed to minimise the risk that noise impacts from the proposed WESS would lead to an increase in noise levels at the NSAs, in particular cumulative noise. With detailed design and mitigation measures incorporated, noise from the WESS is expected to have a very low likelihood of harm to human health or the environment.
Degree of harm	<p>There are varying degrees of harm associated with noise, ranging from:</p> <ul style="list-style-type: none"> ■ Audibility and annoyance ■ Sleep disturbance ■ Hearing loss / permanent damage <p>The degree of audibility of noise depends on the level of noise emitted together with the ambient background noise levels. Where there is a low level of ambient noise at a receiver location, noise emissions are more likely to be audible at times. This may occur where there is limited surrounding activity from roads and other noise sources. The audibility of noise can be classified as follows²:</p> <ul style="list-style-type: none"> ■ 0 to 3 dB above background noise levels: not audible ■ 3 to 5 dB above background noise levels: marginally audible ■ >5 dB above background noise levels: generally audible <p>Other factors such as the frequency content, tonality, impulsiveness and other characteristics may also impact the audibility of noise. Noise emissions are predicted to be lower than the existing background noise levels and therefore are expected to be generally inaudible.</p> <p>Harm associated with sleep disturbance includes changes in the pattern of sleep stages, reduction in the proportion of REM sleep, reduced perceived sleep quality and after effects such as headache and tiredness. Sleep disturbance is generally only considered to occur when people are exposed to noise levels >30dB $L_{Aeq(8hr)}$ or >45dB L_{Amax} inside bedrooms at night³. Provided that noise levels inside bedrooms do not regularly exceed these levels, impacts on sleep disturbance are generally considered to be acceptable. These levels are not expected to be exceeded at the nearby NSAs.</p> <p>At noise levels exceeding 85 dB $L_{Aeq(8hr)}$ / 140 dB L_{Cmax}, irreversible hearing damage may occur. Harm associated with hearing loss / permanent damage is covered by Worksafe Victoria compliance codes⁴ and is not expected to be exceeded on site. This is not expected at the NSAs.</p>
State of knowledge	<p>Undertaking detailed reviews of environmental noise emissions from the site (such as this report) is part of the GED to understand the likely noise emission from the site and identifying mitigation measures to reduce noise impacts.</p> <p>Further assessments are recommended once the contactor has been appointed.</p>
Available suitable controls	<p>In the event of the planning application being approved, EA will provide relevant noise information pertinent to the selected manufacturer. This may result in a reduced extent of noise walls and/or no other mitigation being required. On this basis, the following permit condition is proposed:</p> <p><i>Prior to the commencement of works, a detailed noise assessment prepared to allow consideration in accordance with the Environment Protection Act 2017, the Environment Protection Regulations 2021 and Noise Protocol requirements must be submitted to the satisfaction of the Responsible Authority. Any noise mitigation measures recommended in the noise assessment must be implemented prior to the commencement of use.</i></p> <p>It is considered that best practice to review available suitable controls to minimise risk associated with noise would be to develop and maintain a site noise management plan.</p>

² Engineering noise control: theory and practice, D Bies and CH Hanson, Fourth Edition, 2009

³ WHO Guidelines for Community Noise, 1999

⁴ Worksafe Victoria Compliance Code Noise, Edition 2, December 2019

	<p>The site noise management plan would include but not be limited to:</p> <ul style="list-style-type: none"> ■ Regular review of available technology assessing whether low-noise alternatives exist ■ Regular equipment maintenance to reduce noise ■ General plans for community consultation and procedures to address noise complaints ■ Noise monitoring plans ■ Training for site staff and equipment operators regarding requirements to minimise risks associated with noise
Cost of suitable controls	Costs associated with low noise equipment will be reviewed as the design progresses. It is considered that with appropriate management measures, risks of environmental harm can be appropriately managed

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7 Discussion

A review of noise emissions from the proposed WESS development has been undertaken. A computational noise model of the site has been developed using SoundPLAN 8.1 to predict the environmental noise emissions to the identified NSAs.

The results of the computational noise modelling indicate that with appropriate equipment noise levels, noise emissions from the WESS are predicted to comply with the applicable noise limits.

In relation to the potential cumulative noise impacts, reviewing the surrounding zoning and applicable distance adjusted zone levels it is apparent that noise generating activities in the nearby IN1Z have higher noise limits that would apply to the SUZ1 in which the project is located. A review of the applicable noise limits from all surrounding generating zones has been undertaken and it has been demonstrated that the proposed WESS would not be expected to lead to a cumulative exceedance of the higher applicable limits at the nearby NSAs.

As this is a preliminary assessment, the BESS layout and operational equipment may change due to design development which could affect noise emissions from the site. Noise walls have been assessed in the planning permit application, should they be required to address an increase noise from the final equipment selected and to address possible cumulative noise.

As the BESS equipment supplier contract has not been awarded, EA will undertake a detailed noise assessment post-contact award and prior to construction. If additional changes occur, further analysis would be required as the design progresses. In the event that manufacturer equipment noise levels exceed those assumed in this assessment, a range of further noise mitigation measures have been identified including a noise wall design.

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Appendix A: Glossary of terms

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Glossary of terms

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Term	Definition
Ambient Noise Level	The prevailing noise level at a location due to all noise sources but excluding the noise from the specific noise source under consideration. Generally measured as a dB(A) noise level.
The Act	Victorian Environment Protection Act 2017
Background Noise Level	The A-weighted sound pressure level that is exceeded for 90 per cent of the measurement period, L_{A90} .
BESS	Battery energy storage system
Background relevant area:	A noise sensitive area within a rural area where background levels may be higher than usual. This includes areas where freeway or highway traffic is a significant audible background noise source.
CCBDG:	Environment Protection Authority, Victoria (EPA VIC) 2020 Publication 1834, Civil construction, building and demolition guide
Commercial, industrial and trade premises	<p>As defined in the Environment Protection Regulations 2021:</p> <p>Any premises except the following —</p> <p>(a) residential premises (other than common plant under the control of an owners' corporation)</p> <p>(b) a street or road, including every carriageway, footpath, reservation and traffic island on any street or road</p> <p>I a railway track used by rolling stock in connection with the provision of a freight service or passenger service—</p> <p>(i) while travelling on a railway track or tramway track; or</p> <p>(ii) while entering or exiting a siding, yard, depot or workshop</p> <p>(d) a railway track used by rolling stock in connection with the provision of a passenger service, while in a siding, yard, depot or workshop and is —</p> <p>(i) powering up to commence to be used in connection with the provision of a passenger service; or</p> <p>(ii) shutting down after being used in connection with the provision of a passenger service</p> <p>I the premises situated at Lower Esplanade, St Kilda and known as "Luna Park" and being the whole of the land more particularly described in Certificate of Title Volume 1204 Folio 109</p> <p><i>Note:</i></p> <p><i>The maintenance, cleaning or loading of rolling stock stabled in a siding, yard, depot or workshop are included within the meaning of commercial, industrial and trade premises.</i></p>
Decibel	Sound pressure levels are expressed in decibels as a ratio between the measured sound pressure level and the reference pressure.
dB(A)	<p>The A-weighted sound pressure level in decibels, denoted dB(A) is the unit generally used for the measurement of environmental, transportation or industrial noise. The A-weighting scale approximates the sensitivity of the human ear when exposed to normal levels and correlates well with subjective perception of typical sounds.</p> <p>An increase or decrease in sound level of approximately 10 dB(A) corresponds to a subjective doubling or halving in loudness. A change in sound level of 3 dB(A) is considered subjectively just noticeable and a change of 1 to 2 dB(A) is subjectively not noticeable.</p>
Frequency	The rate of repetition of a sound wave. The unit of frequency is Hertz (Hz), defined as one cycle per second. Human hearing ranges approximately from 20 Hz to 20,000 Hz. Octave bands are the most commonly used frequency bands. For more detailed analysis each octave band may be split into three one-third octave bands or narrow frequency bands.
FZ1	Farming Zone 1
Habitable Room	Any room of a dwelling or residential building other than a bathroom, laundry, toilet, pantry, walk-in wardrobe, corridor, stair, lobby, photographic darkroom, clothes drying room and other space of a specialised nature occupied neither frequently nor for extended periods.
IN1Z, IN2Z,	Industrial 1 Zone, Industrial 2 Zone
$L_{Aeq,T}$	The equivalent continuous A-weighted sound pressure level is the value of the A-weighted sound pressure level of a continuous steady sound that has the same acoustic energy as a time-varying A-weighted sound pressure level when determined over the same measurement period, T.
L_{A90}	A-frequency weighted sound pressure level, measured using the Fast time-weighting, that is exceeded for 90 per cent of the time interval considered

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Noise Sensitive Area (NSA)	<p>As defined in the Environment Protection Regulations (2021): –</p> <p>(c) that part of the land within the boundary of a parcel of land that is</p> <ul style="list-style-type: none"> • within 10 metres of the outside external walls of any of the following buildings: (A) a dwelling (including a residential care facility but not including a caretaker's house); (B) a residential building; (C) a noise sensitive residential use, or • within 10 m of the outside of the external walls of any dormitory, ward, bedroom, or living room of one or more of the following buildings: (A) a caretaker's house; (B) a hospital; (C) a hotel; (D) a residential hotel; (E) a motel; (F) specialist disability accommodation; (G) a corrective institution; (H) a tourist establishment; (I) a retirement home (J) a residential village • within 10 m of the outside of the external walls of a classroom or any room in which learning occurs in the following buildings (during their operating hours): (A) a childcare centre; (B) a kindergarten; (C) a primary school; (D) a secondary school <p>(b) subject to paragraph (c), in the case of a rural area only, that part of the land within the boundary of (i) a tourist establishment or (ii) a campground or (iii) a caravan park, or</p> <p>In despite paragraph (b), in the case of rural area only, where an outdoor entertainment event or outdoor entertainment venue is being operated, that part of the land within the boundary of the following are not noise sensitive areas for the purposes of that event or venue: (i) a tourist establishment or (ii) a campground or (iii) a caravan park.</p>
NIRV	EPA Victoria Guideline Publication 1411 Noise from industry in regional Victoria, Recommended Maximum noise levels from commerce, industry and trade premises in regional Victoria
Noise Protocol	EPA Victoria Publication 1826.4, Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues, May 2021
Noise Regulations:	Victorian Environment Protection Regulations 2021
SEPP N-1	State Environment Protection Policy (control of noise from industry commerce and trade) No. N 1
Sensitive Room (EPA 1826.2)	Any habitable room (as defined in the Environment Protection Act 2017) within a Noise Sensitive Area or any learning room within a kindergarten, childcare centre, primary or secondary school.
Sound Pressure Level (SPL)	The sound pressure expressed in decibels.
SUZ1	Special Use Zone 1
Technical Guide	Victorian EPA Publication 1997 June 2021 Technical Guide" Measuring and analysing industry noise and music noise
Tonality	Sound containing a prominent discrete frequency or frequencies.

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Appendix B: Site layout

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WOOREEN SITE PLAN
SCALE 1: 2000

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LEGEND:

- INDICATIVE BATTERY STORAGE
- INDICATIVE INVERTER
- INDICATIVE TRANSFORMER
- HV TRANSFORMER
- 33/220kV TRANSFORMER LAYDOWN AREAS
- CONTROL AND SWITCH ROOMS
- ACCESS ROAD
- INDICATIVE NOISE WALL
- INDICATIVE STORMWATER RETENTION POND
- EXISTING DRAINAGE PIPE
- 220kV OHW



CONSULTANT		CLIENT		REV	DATE	REVISION DETAILS	APPROVAL	SCALE	SIZE	PRELIMINARY	PROJECT	WOOREEN ENERGY STORAGE SYSTEM P/511147							
 www.aurecongroup.com				A	11/02/22	ISSUED FOR REVIEW		As indicated	A1			OVERALL SITE PLAN							
										DRAWN		APPROVED	DATE						
										N. LE CORDEUR									
										T. UNDERWOOD									
								CHECKED		A. VAN DER MERWE		DRAWING No.	PROJECT No.	WBS	TRF	ERC	NUMBER	REV	
								K. MEXU				511147	0000	DRG	FF		0102	A	

Appendix C: Noise contours

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ENERGY AUSTRALIA

REV	DATE	REVISION/DETAILS	APPROVAL
1	24/06/22	REVISION A	APPROVED

SCALE	SIZ
NA	NA
DRAWN	
DESIGNED	
VERIFIED	

APPROVED	DATE
APPROVER	24/06/22

PROJECT	WOOREEN BESS
TITLE	ENVIRONMENTAL NOISE CONTOURS
DRAWING No.	PS111147
PROJECT No.	PS111147
REV	KB
DATE	24/06/22
SCALE	NA
SIZE	NA
NO. OF SHEETS	01
TOTAL SHEETS	1

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