Dederang BESS

Environmental Noise Assessment

S7646C10

October 2024

sonus.

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

sonus.

Document Title	: Dederang BESS Environmental Noise Assessment
Client	: Mint Renewables
Document Reference	: S7646C10
Date	: October 2024
Author	: Chris Turnbull, MAAS – Registered Professional Engineer (Victoria)

1 INTRODUCTION

An environmental noise assessment has been conducted for the proposed Dederang Battery Energy Storage System (BESS) (the **Project**), to be located on Dederang Road, south of the Dederang Terminal Station (**DDTS**). The Project is proposed to have a nominal capacity of 400MWh. The final size and footprint of the Project is highly dependent on the environmental constraints of the site (as well as the final selected BESS model).

The project will include:

- BESS units, inverters and transformers;
- Civil and structural works including laying of crushed rock;
- Construction of internal access roads and access (and egress) points;
- Underground cabling (33kV) to provide a connection between the battery units and inverters and on-site substation;
- On-site substation (including transformer to step up from 33 kV to the connection voltage (either 220 kV or 330 kV) and potentially reactive power equipment);
- Underground cabling (220kV or 330kV) to connect the onsite substation to the adjoining DDTS;
- Permanent Operations and Maintenance Facility;
- Water storage (including firefighting water supply and fire water runoff containment);
- Temporary disturbance for construction compound and laydown and work areas;
- Security fencing;
- Car parking; and
- Business identification signage, at site entry.

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 with the closest in each relevant direction (West, North and East) highlighted.

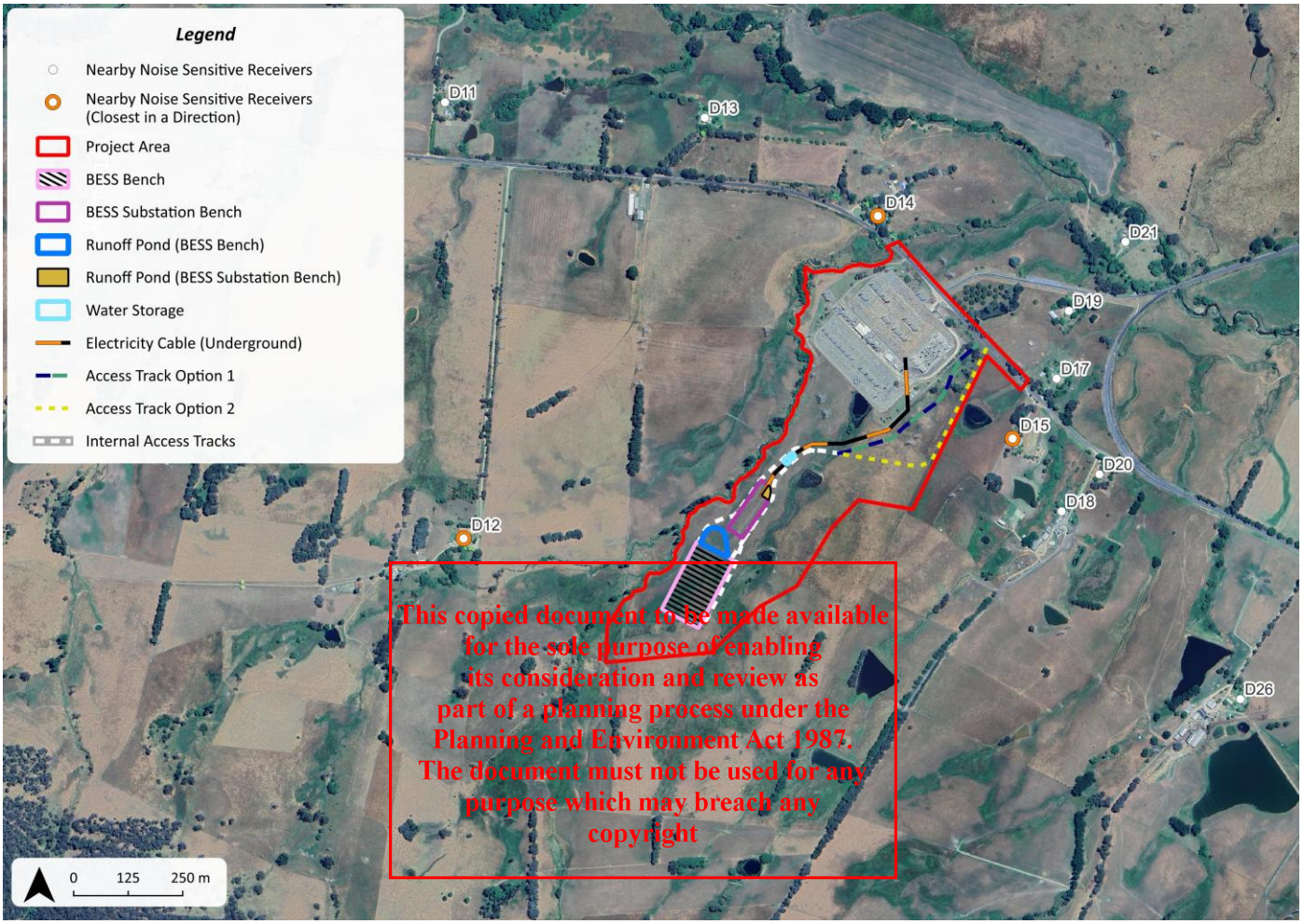

Figure 1: Proposed Project Area and Nearest Noise Sensitive Receivers

The predicted noise levels have been compared against the relevant criteria determined in accordance with the *Alpine Planning Scheme*, the *Noise Limit and Assessment Protocol for the Control of Noise from Commercial, Industrial and Trade Premises,* the *Environment Protection Regulations*, and the *EPA Victoria Publication 1996 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. It 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 Project and the nearby sensitive receivers are all located within a Farming Zone of the *Alpine Planning Scheme* (the **Planning Scheme**).

2.1 Planning Scheme

The Planning Scheme has been reviewed and particular regard has been given to the following relevant provisions:

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)*

2.2 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, 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;

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, 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.

(2) *For the purposes of subregulation (1), what constitutes a reasonable step must be determined in accordance with the Noise Protocol.*

2.3 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 Dederang 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.

2.3.1 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 Project, in rural areas. Where the utility and the sensitive receiver are both located within the same contiguous Farming Zone, the distance adjusted levels are as shown in Table 1.

Table 1: 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)

2.3.2 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).

2.3.3 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:

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

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 3 occasions during a 30 minute period; and

(b) Maintains the higher level for at least a one minute duration

2.4 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 2.

Table 2: 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 2 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.

2.5 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.

3 EXISTING NOISE ENVIRONMENT

The background noise and existing noise environment was measured at three locations on the site over a two week period. 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. Without site access to neighbouring properties, three measurement locations were selected, which are considered to be background equivalent locations to D12 (BG1), D14 (BG2) and D15 (BG3). The locations were chosen to be a similar distance to noise sources (such as roads) as the dwellings and with a similar concentration of trees. The measurement locations are shown in Figure 2.

Analysis has been conducted on the data collected in the week of 29 January to 4 February 2024. This period was selected because there was no rain or high local wind (>5m/s) recorded in the week.

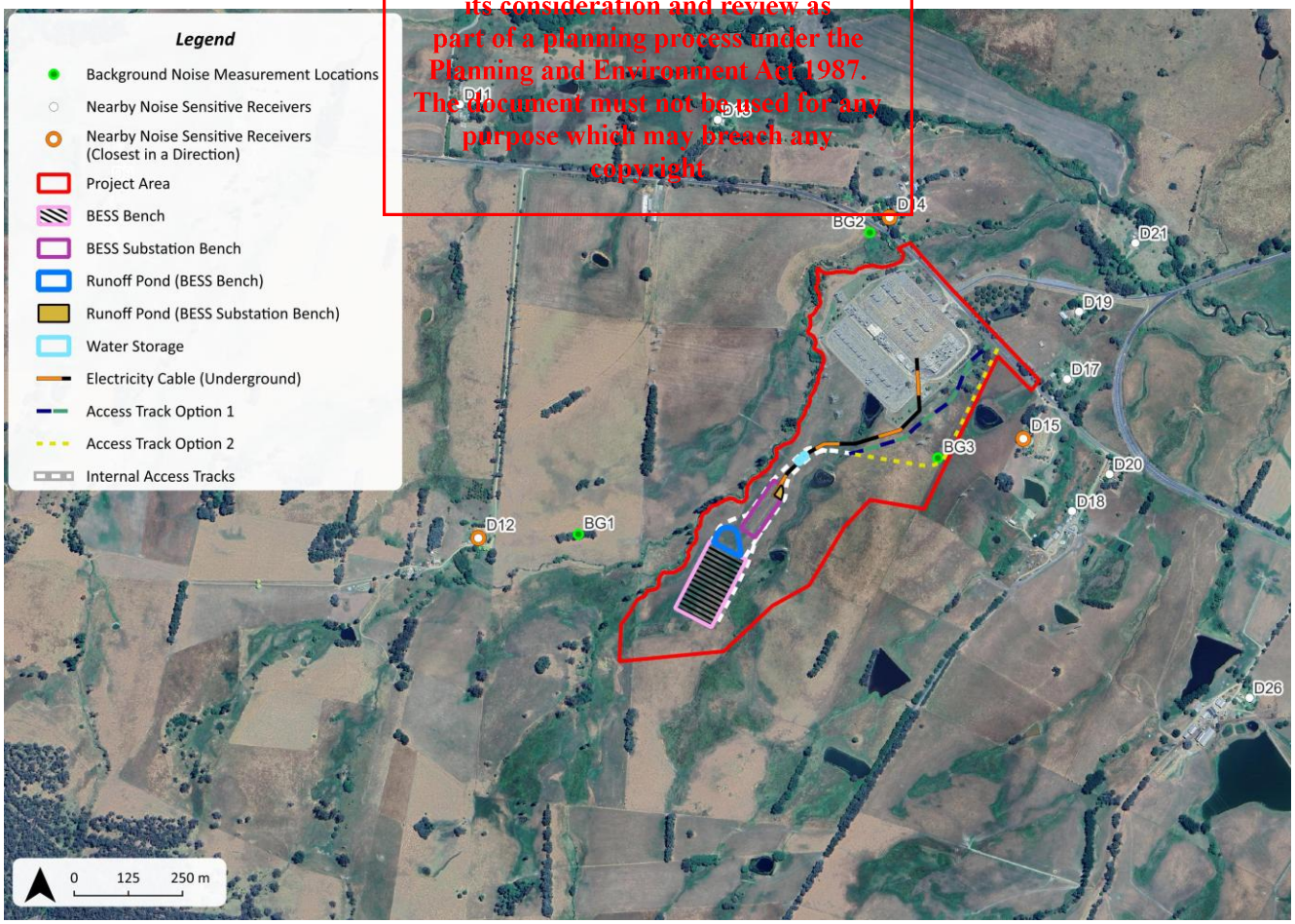

Figure 2: Background Noise Monitoring

The background noise levels at some locations were heavily influenced by insect noise, particularly during the night. As this noise may not be present for the full year, background noise levels have been determined by mathematically removing the frequencies at which the insect noise occurred. The background noise levels with insect noise have been included for information only.

In addition, the noise from the Terminal Station influenced the measurements, particularly the closest measurement to the Terminal Station site (BG2). The influence of the terminal station has been estimated by considering the periods during the noise logging when the frequencies associated with the Terminal Station were most prominent. These estimated levels are considered as part of a cumulative assessment in Section 5.1.

Background noise levels have been determined in accordance with EPA Victoria Publication 1997[1] recommendations.

3.1.1 Closest Western Noise Sensitive Receiver

The background noise levels measured at BG1, with and without the influence of insects, are shown in Table 3.

Table 3: Background Noise Level dB(A) – BG1

Time	Background Noise Level with Insects	Background Noise Level without Insects
Day	33	27
Evening (Monday – Saturday)	43	25
Evening (Sunday)	35	27
Night	38	21

It is estimated that the highest contribution of noise (L_{eq}) from the Terminal Station was 22 dB(A).

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

3.1.2 Closest Northern Noise Sensitive Receiver

The background noise measurements at BG2 are heavily impacted by the terminal station and insect noise, and therefore the background noise (without these sources) at the site could not be isolated. The measured levels without the subtraction of insect or terminal station noise are shown in Table 4.

Table 4: Background Noise Level (dB(A)) – BG2

Time	Measured Background Noise Level
Day	38
Evening (Monday – Saturday)	39
Evening (Sunday)	39
Night	38

Rather than use these levels, a conservative approach (resulting in more onerous criteria) of assuming low background noise levels has been adopted.

It is estimated that the highest contribution of noise (L_{eq}) from the Terminal Station was 41 dB(A). It is noted that this estimate is based on the highest contribution of noise over the measurement period, which is why it is higher than the background noise level (which excludes high noise periods).

3.1.3 Closest Eastern Noise Sensitive Receiver

The measurements taken at the representative location (BG3) were heavily influenced by insect noise. The background noise levels, with and without insect noise removed, are shown in Table 5.

Table 5: Background Noise Level (dB(A)) – BG3

Time	Background Noise Level with Insects	Background Noise Level without Insects
Day	41	27
Evening (Monday – Saturday)	49	29
Evening (Sunday)	44	28
Night	42	28

It is estimated that the highest contribution of noise (L_{eq}) from the Terminal Station was 28 dB(A).

4 NOISE LIMITS

4.1 Background Adjusted Noise Limits

Based upon the measured existing noise environment, noise limits have been established in accordance with the Protocol for each noise sensitive receiver. These are shown in Table 6. Where the background noise could not be isolated, the distance adjusted levels have conservatively been used.

Table 6: Noise Limits (dB(A))

Time	D12 - West		D14 - North		D15 - East	
	Background Noise	Noise Limit	Background Noise[2]	Noise Limit	Background Noise	Noise Limit
Day	27	45	-	45	27	45
Evening (Monday – Saturday)	25	39	-	39	29	39
Evening (Sunday)	27	39	-	39	28	39
Night	21	34	-	34	28	34

[2] The background noise at this location could not be determined due to noise from the terminal station and insects. Refer to Section 3.1.2.

5 CUMULATIVE NOISE

The criteria described above would be appropriate for the Project, if there were no other commercial, industrial or trade premises. However, as there is an existing terminal station and the Kiewa Valley BESS project is proposed, consideration must be given to adjusting the criteria for the Project, to ensure that the cumulative noise achieves appropriate noise levels.

5.1 Dederang Terminal Station

As described within Section 3, the contribution of noise at residences, from the Dederang Terminal Station has been estimated based on the measured noise at representative locations. These estimated levels have been used to consider if any adjustment to the noise limits are appropriate at each residence.

5.1.1 D12 - Western Noise Sensitive Receiver

The highest estimated noise at D12 from the terminal station is 22 dB(A). This level is more than 10 dB(A) below the noise limits for the Project (the lowest noise limit is 34 dB(A) from Section 4.1), and therefore will not influence compliance with the noise limits. That is, when logarithmically adding, 34 dB(A) + 22 dB(A) = 34 dB(A).

5.1.2 D14 - Northern Noise Sensitive Receiver

As the Terminal Station is in a different zone (SUZ3) to the Project, the zone limits are different to the noise limits described above. Based on this zone, the distance adjusted noise limits for the Terminal Station at D14 are shown below in Table 7.

Table 7: Terminal Station Noise Limit (dB(A))

Time	Distance Adjusted Noise Limit
Day	49
Evening	44
Night	39

It is noted that there is the potential for these noise limits to be increased if high background noise levels could be measured without the influence of the terminal station.

To ensure that the noise from the future projects does not impact the ability of the Terminal Station to comply with its noise limits, the noise limit could be adjusted to a level which is 10 dB(A) below the distance adjusted noise limits of the Terminal Station. The additional project noise added to the noise from the terminal station noise at its noise limit would not increase the overall noise level. This adjustment is shown in Table 8.

Table 8: D14 - Northern Adjusted Noise Limit (dB(A))

Time	Terminal Station Noise Limit	Farming Zone Noise Limit	Adjusted BESS Noise Limit
Day	49	45	39
Evening	44	39	34
Night	39	34	29

5.1.3 D15 - Eastern Noise Sensitive Receiver

The measured noise from the terminal station at D15 was estimated to be 28 dB(A). To ensure that the cumulative noise from terminal station and the BESS projects does not result in criteria being exceeded the noise limits should be adjusted as shown in Table 9.

Table 9: D15 - Eastern Adjusted Noise Limit (dB(A))

Time	Estimated Terminal Station Noise	BESS Noise Limit	Adjusted BESS Noise Limit
Day	28	45	45
Evening	28	39	39
Night	28	34	33

5.2 Kiewa Valley Battery Energy Storage System

The proposed Kiewa Valley project (the **Kiewa Valley Project**) is located to the south of the location for the Project. Figure 3 shows the approximate location of the Kiewa Valley Project relative to Dederang BESS.

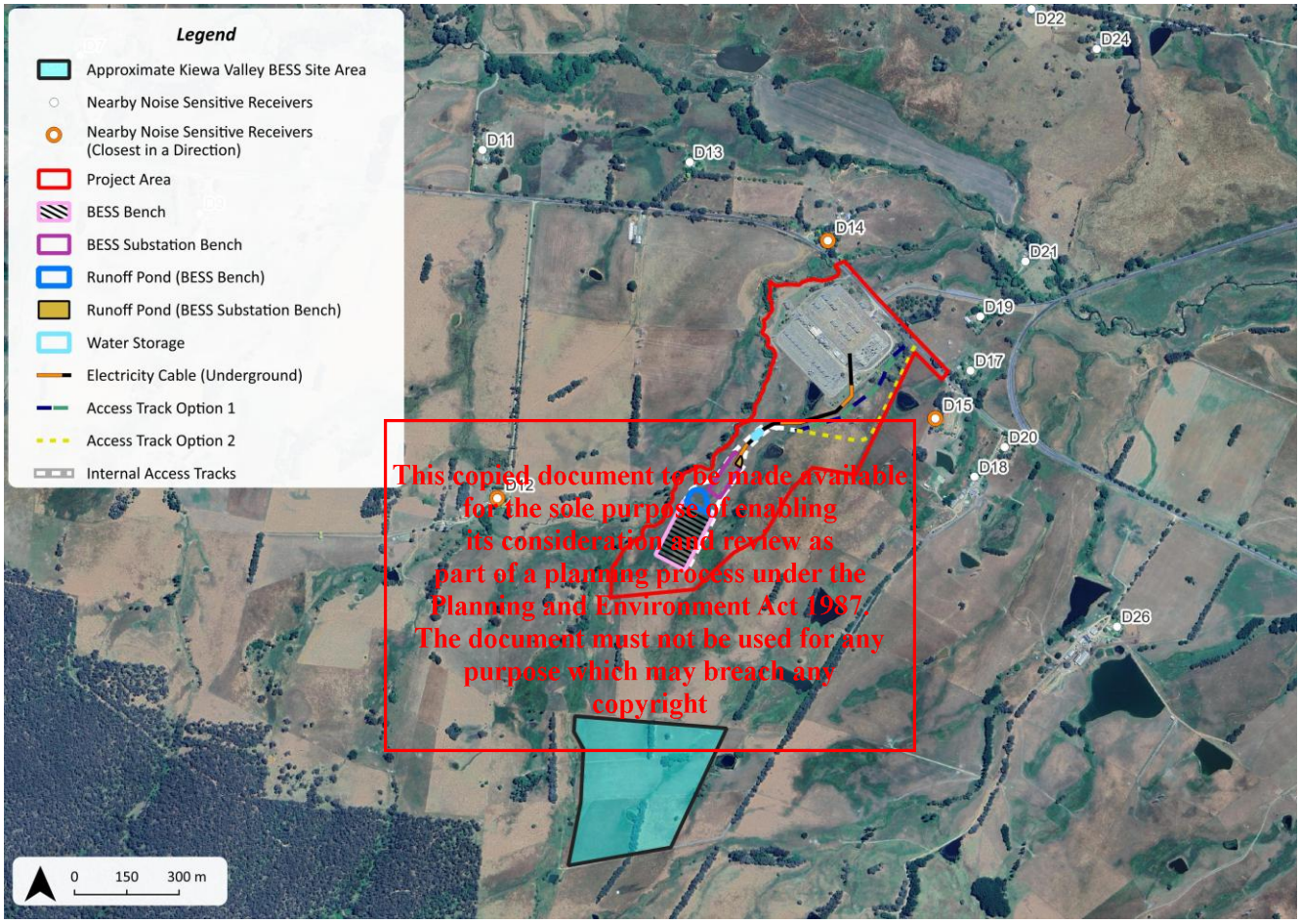

Figure 3: Kiewa Valley BESS Approximate Location

To take all reasonable steps in accounting for the cumulative impact of both the Kiewa Valley Project and the BESS, as required by the Regulations, the EPA Victoria Publication 1997 *Technical guide: Measuring and analysing industry noise and music noise* (the **Technical Guide**) states the following for proposed new industry noise in rural areas:

> *the contribution of the proposed development should then be abated to meet, for each period of the day, a level set below the relevant noise limit by 10 x log10(N) decibels, where N is the total number of existing and likely contributing industrial plant installations.*

Based upon the proximity of the Kiewa Valley Project and the equal sharing principle of the Technical Guide, should the Kiewa Valley Project be approved, the noise from the Project will need to contribute noise at 3 dB(A) below the noise limits derived above. Note that the Kiewa Valley Project will also need to be designed to this principle. Consultation has been conducted with the Kiewa Valley Project team and it is understood that the same approach will be taken. That is, both projects will be designed to achieve criteria which are 3 dB(A) lower than would otherwise apply, so that the cumulative noise from the two projects achieves the Protocol.

6 SUMMARY OF PROPOSED CRITERIA

Based upon the measured background noise levels, the estimated contribution of noise from the Terminal Station and the contribution of noise from the Kiewa Valley Project, the noise limits for the Project at each noise sensitive receiver are summarised in Table 10. If the Kiewa Valley Project does not proceed, the Project noise limits are shown in Table 11.

Table 10: Project Noise Limit Summary – If Kiewa Valley proceeds (dB(A))

Time	D12 - West	D14 - North	D15 - East
Day	42	36	42
Evening	36	31	36
Night	31	26	30

Table 11: Project Noise Limit Summary – If Kiewa Valley does not proceed (dB(A))

Time	D12 - West	D14 - North	D15 - East
Day	45	39	45
Evening	39	34	39
Night	34	29	33

7 NOISE PREDICTIONS

7.1 Methodology

The noise from the operation of the Project has been predicted using the *ISO 9613-2:1996 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
- Directivity of the noise source
- 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
- Temperature of 10°C [3]
- Relative humidity of 70%

[3] 10°C has been chosen as 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 described in Section 7.2.

7.2 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 'reduced' 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**), as the supplier has indicated the reduced levels will be achieved.

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

- 640 Batteries
- 80 Inverters
- 40 Inverter Transformers
- 20 Outdoor Core Telco Enclosures (**OCTE**)
- One 250MVA Site Transformer
- Two three-phase 10 MVAr Harmonic Filters

The sound power of equipment used for the assessment can be seen in Table 12. As shown in the table, the equipment has been designed to operate in a lower noise mode at night, when ambient temperatures are lower. It is noted that these noise levels can be achieved in all seasons.

Table 12: Operating Scenario Noise Data

Operating Scenario	Operating Period	Noise Sources	
A	Day/Evening	Battery	77 dB(A)
		Inverter	83 dB(A)
		Inverter Transformer	70 dB(A)
		Site Transformer	91 dB(A)
		Harmonic Filter	76 dB(A)
		OCTE	76 dB(A)
B	Night	Battery	66 dB(A)
		Inverter	83 dB(A)
		Inverter Transformer	70 dB(A)
		Site Transformer	91 dB(A)
		Harmonic Filter	76 dB(A)
		OCTE	76 dB(A)

7.3 Predicted Noise Levels

The results for each of the operating scenarios are shown in Table 13.

Table 13: Predictions dB(A)

Location	Operating Scenario A	Operating Scenario B
D12 - West	36	30
D14 - North	30	24
D15 - East	29	24

7.4 Noise Characteristics

7.4.1 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.

7.4.2 Tonality Adjustment

The objective tonality assessment methodology of the Protocol has been applied to the predicted noise levels at each of the western, northern and eastern locations for day, evening and night. Based upon the objective methodology, tonal adjustments are applicable and have been included in Table 14.

Table 14: Predictions including tonal penalty dB(A)

Location	Day and Evening (Operating Scenario A)		Night (Operating Scenario B)	
	Prediction	Prediction with Tonal Adjustment	Prediction	Prediction with Tonal Adjustment
D12 - West	36	38	30	35
D14 - North	30	32	24	26
D15 - East	29	31	24	26

The tonal adjustments are associated with a high frequency tone from the indicative inverter.

7.4.3 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 15.

Table 15: Predicted Low Frequency Noise (dB)

One-Third Octave (Hz)	25	31.5	40	50	63	80	100	125	160
D12 - West	32	38	39	41	41	39	35	34	30
D14 - North	27	34	35	37	36	35	30	27	25
D15 - East	25	31	32	35	33	32	31	29	26

8 ASSESSMENT AGAINST CRITERIA

The predicted noise levels are compared with the Project noise limits, (which have been reduced to accommodate an equal contribution from Kiewa Valley) proceeds in Table 16 below.

Table 16: Comparison of predictions with criteria dB(A) [4]

Location	Day and Evening (Operating Scenario A)			Night (Operating Scenario B)		
	Prediction	Prediction with Tonal Adjustment	Lowest Noise Limit	Prediction	Prediction with Tonal Adjustment	Lowest Noise Limit
D12 - West	36	38	36	30	35	31
D14 - North	30	32	31	24	26	26
D15 - East	29	31	36	24	26	30

With the inclusion of tonal penalties, the predicted noise at the western residence exceeds the relevant noise limit during the evening and night and at the northern residence during the evening. These are shown in red above. The predicted noise levels achieve the noise limits at other locations and at other times.

The low frequency predictions for each receiver have been compared to the relevant noise threshold levels in Table 17. As noted above, the main noise sources are small fans, which do not produce significant noise below 25 Hz and therefore noise data are not available below 25Hz. Based on direct observation, it is anticipated that the noise below 25Hz will be well below the threshold levels. The table shows that the predicted levels of low frequency noise are well below the relevant threshold levels.

Table 17: Predicted Low Frequency Noise (dB)

One-Third Octave (Hz)	25	31.5	40	50	63	80	100	125	160
Threshold Levels L_{eq}	69	61	54	50	50	48	48	46	44
D12 - West	32	38	39	41	41	39	35	34	30
D14 - North	27	34	35	37	36	35	30	27	25
D15 - East	25	31	32	35	33	32	31	29	26

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

[4] The predictions within this Table show the noise levels only from the Project. The criteria have been reduced below the standard criteria to account for the potential Kiewa Valley Project. Refer to Section 5.2 and Section 6.

9 MITIGATION

The noise limits are exceeded at the western noise sensitive receiver during the evening and night and at the northern noise sensitive receiver during the evening, as a result of a high frequency (3.15kHz) tone associated with the indicative inverter selection. It is therefore recommended that a reduction in sound power level of 5 dB be achieved in the 2kHz and 3.15kHz one-third octave bands for the inverters. It is anticipated that this reduction could be achieved by one or more of the following:

- Isolating the source of the 3.15kHz tone from the structure of the cabinet using rubber.
- Lining the inside of the cabinet with acoustic insulation. It is anticipated that this would not need to be more than 15mm thick.
- Adding damping and/or mass to the cabinet panels to reduce transmission through the panels.

Discussions are currently being conducted with equipment manufacturers to confirm that the reductions can be achieved. Once the recommendations have been tested and the noise reductions are confirmed, an updated report will be provided with the revised predicted noise levels based on the confirmed noise reductions.

The predictions shown in Table 18 are based upon the recommended noise reduction being achieved.

Table 18: Comparison of predictions (dB(A)) with criteria with inverter noise reduction applied [5]

Location	Day and Evening (Operating Scenario A)			Night (Operating Scenario B)		
	Prediction	Prediction with Tonal Adjustment	Lowest Applicable Criterion	Prediction	Prediction with Tonal Adjustment	Lowest Applicable Criterion
D12 - West	36	36	36	29	31	31
D14 - North	30	30	31	24	26	26
D15 - East	29	29	36	24	26	30

The predictions in the tables show that with the recommended reduction, the noise levels will comply at all noise sensitive receivers at all times.

[5] The predictions within this Table show the noise levels only from the Project. The criteria have been reduced below the standard criteria to account for the potential Kiewa Valley Project. Refer to Section 5.2 and Section 6.

10 GENERAL ENVIRONMENTAL DUTY

The Project 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.
- Manufacturer's attenuation being incorporated into the design.
- Meetings conducted with equipment manufacturers to implement designs which further reduce noise levels.

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 Project because of the higher elevation of the closest receiver and the large dimensions of the BESS facility.

The measures result in noise levels which are no higher than 31 dB(A) during the night and 36 dB(A) during the day and investigations are continuing to further reduce noise from equipment. 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 as well as the use of every practical measure to reduce noise. Based on this approach, it is considered that all reasonably practical methods of minimising noise pollution have been explored. The Project will continue to have an obligation to implement methods of reducing noise.

11 CONCLUSION

An environmental noise assessment has been completed for the proposed Dederang Battery Energy Storage System (the **Project**), to be located south of the Dederang Terminal Station.

The assessment has considered the noise at the three closest noise sensitive receivers (D12, D14 and D15) based on the proposed layout and equipment selections. Achieving the noise limits at the three closest noise sensitive receivers will demonstrate compliance at all other noise sensitive receivers.

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

Background noise measurements have been conducted at representative locations near the noise sensitive receivers to establish noise limits for the assessment. The measurements were heavily influenced by insect noise, as is typical at the time of year the measurements were taken, however may not be typical for the full year. As such, the insect noise has been mathematically removed to establish noise limits.

The noise levels have been predicted using the *ISO 9613-2:1996* noise model and compared against relevant criteria, which take into account the cumulative noise from the existing terminal station and the potential Kiewa Valley BESS project. When considering the potential tonal nature of the predicted noise, the predictions indicate that a reduction in high frequency noise from the inverters is required. Therefore, recommendations have been made to reduce the noise level to achieve the noise limits at all locations.

A pre-construction environmental noise assessment should be undertaken to confirm that compliance can be achieved for the final layout and selected BESS equipment (including any final mitigation measures).