Northern Quartz Campus

Noise Impact Assessment - BESS, Substation and transmission line

Prepared for Solquartz and Private Energy Partners

November 2025

Northern Quartz Campus

Noise Impact Assessment - BESS, Substation and transmission line

Solquartz and Private Energy Partners

E231133 RP1

November 2025

Version	Date	Prepared by	Reviewed by	Comments
V1-0	01/08/2025	I. Smith / T. Robertson	A. Buckeridge	For client review
V2-0	28/08/2025	I. Smith / T. Robertson	A. Buckeridge	For use
V3-0	10/11/2025	I. Smith / T. Robertson	R. Scully	Response to information

Approved by

Rick Scully
Associate Acoustics Consultant
10 November 2025

Level 10 201 Pacific Highway
St Leonards NSW 2065
ABN: 28 141 736 558

Executive Summary

ES1 Project

Solquartz, a wholly owned portfolio company of funds managed by Quinbrook Infrastructure Partners (Quinbrook), and Private Energy Partners Pty Ltd (PEP), an affiliate enterprise of Quinbrook and Quinbrook's dedicated development, delivery and operations service provider, are proposing to develop a BESS, substation and transmission lines to facilitate electricity supply for future Metallurgical Silicon (MG-Si) and Polysilicon (Poly-Si) manufacturing facilities as part of the broader Northern Quartz Campus (NQC) project (prescribed project).

To support the overall program delivery, various components were defined and broken into a four package delivery based on project schedule drivers, investor confidence, and risk profiles:

1. BESS, transmission line and NQC substation (assessed within this impact assessment)
2. Biochar processing facility (Phase 1) (to be assessed within a future application to TCC)
3. A Metallurgical Silicon (MG-Si) plant and Biochar processing facility (Phase 2) (to be assessed within a future application to TCC)
4. Polysilicon plant (to be assessed within a future application to TCC).

This impact assessment accompanies the development application for Package 1 BESS, transmission line and substation (the Project). The Project involves the construction, operation and maintenance of up to 780 megawatts (MW) BESS and substation facility which will be supported by enabling infrastructure including roads, parking, switchgear, transformers, site offices and onsite storage areas. A 275 kV transmission line is proposed between the NQC substation and the Powerlink Calcium substation, the length of this transmission line is 2658 m and includes 21 transmission towers. The Powerlink Calcium substation does not form part of this assessment though the connection of the transmission lines into it does. The BESS is expected to run 24 hours, seven days a week, 365 days a year.

ES2 Impact assessment

This Noise Impact Assessment (NIA) has been prepared by EMM as part of the Project's Development Application. The NIA assesses the potential noise and vibration impacts from the construction and operation of the Project in accordance with the with relevant guidelines and standards.

Baseline background noise monitoring was undertaken to establish existing ambient noise levels in the absence of construction and operational activities. This data provides a reference point against which potential noise impacts from the proposed works can be assessed. The monitoring was carried out in accordance with relevant guidelines and standards to ensure the accuracy and reliability of the collected data.

Noise modelling was undertaken using SoundPLAN 3D modelling software (Version 9.1), to predict noise emissions from the construction and operation of the Project.

Noise from construction of the Project was predicted to exceed noise objectives at four nearby sensitive receptors prior to adoption of mitigation measures.

The road traffic noise associated with the construction of the Project was predicted to comply with the project specific road traffic noise objectives at all sensitive receptors

Noise modelling predictions indicated no adverse impacts during the operation of the Project at all surrounding sensitive receptors during the worst-case night-time period.

No construction and operational vibration impacts are anticipated given the distance between the nearest sensitive receivers to the Project.

All reasonable and feasible mitigation strategies to minimise construction and operational noise and vibration impacts are presented in Section 7.4.

ES3 Request for information response

A request for information issued from Townsville City Council (TCC) Was received on 26 September 2025. Details of responses relevant to this NIA are summarised in the Table below.

Table ES1 Responses relevant to the NIA

Detail	Response	Additional information reference
The applicant is requested to provide a revised Noise Impact Assessment to include: a) The BESS containers are understood to expand and contract as they heat and cool which can lead to cracking noises. Review and assessment of noise levels associated with the expansion and contraction of containers is required	BESS units are typically designed with features that help mitigate thermal-related noises, such as cracking. These include: • Vibration and structural control measures, such as anti-vibration isolators and flexible connectors, to reduce structure-borne sound transmission. • Damping treatments, including constrained-layer damping materials applied to panels, to minimise resonance and absorb impact noise. • Rigid support framing to limit structural flexing during temperature changes. These design features are consistent with standard industry practice and help minimise the potential for cracking or other thermal-related noises to cause impacts at nearby receptors. Based on advice from the manufacturer, the revised BESS unit design does not exhibit cracking noises, consistent with the mitigation measures outlined above.	Refer Section 8.2
b) The predicted Day (L_{Ceq},adj, 11h)/Evening (L_{Ceq},adj,4hr)/Night (L_{Ceq},adj, 9hr) noise levels for low frequency of receptors R10, R11 , R12 R76, R77, R78, R79, R80.	The revised Noise Impact Assessment (Version 3.0, dated 10/11/2025) report has been updated with the latest BESS noise test data since the previous issue of the Noise Impact Assessment (Version 2.0, dated 28/08/2025). The revised noise test data is lower than previously assumed and operational noise was determined to not trigger low frequency or tonality annoying characteristics at any sensitive receptor location. Appendix E of the Noise Impact Assessment (Version 3.0, dated 10/11/2025) provides the low-frequency assessment in accordance with the NSW Noise Policy for Industry (NPfI). The assessment includes an initial screening that compares LCeq and LAeq to identify the potential for low-frequency annoyance. Where LCeq – LAeq exceeded 15 decibels (dB) or more, the predicted low-frequency 1/3 octave noise levels were then compared against the threshold values for low-frequency noise (Table C2, NPfI). This low-frequency check is consistent with the approach adopted by the UK Department for Environment, Food and Rural Affairs (DEFRA).	Refer Appendix E

Detail		Response	Additional information reference
c)	A noise intrusive assessment undertaken of the receptors R11, R12, R76, R77, R78, R79 using the nighttime rating background level plus 5dB(A) as measured over a 15-minute period LAeq (15 minute).	A noise intrusive assessment is not appropriate, as the development is located within a high-impact industrial zone. By virtue of the rezoning of the LEIP to a High impact industrial region, it would be unreasonable to maintain the existing acoustic environment, and there is an expectation for the acoustic characteristic of the area to change. Instead, a cumulative impact assessment using the latest BESS technology has been completed to assess potential background creep, with results provided in Section 7.4. As recommended in the Noise Impact Assessment (Version 2.0, dated 28/08/2025), EMM advised updating the model to incorporate the relevant technology for the 8-hour BESS EnerQB Free-Cooling units. At the time of Version 2.0, Solquartz noted that detailed specifications for these units were not yet available. Updated data is now available and has been incorporated into the revised Noise Impact Assessment (Version 3.0, dated 10/11/2025). The reassessment of associated noise emissions using this accurate data is presented in Section 7.2 of Version 3.0.	Refer Section 6.3.2 and Section 7.4

TABLE OF CONTENTS

Executive Summary **ES.1**

1 Introduction **1**

1.1 Background 1

1.2 Report purpose and assessment requirements 1

1.3 Scope of works 2

1.4 Assumptions and exclusions 3

1.5 Key Terminology 4

2 Project description **5**

2.1 Overview 5

2.2 Site description 5

2.3 Hours of operation 6

3 Sensitive receptors **9**

4 Existing acoustic background **14**

4.1 General methodology 14

4.2 Monitoring locations 14

4.3 Unattended noise monitoring results 15

5 Noise guidelines **19**

5.1 Environmental Protection Regulation (2019) 19

5.2 Environmental Protection Act (1994) 19

5.3 Environmental Protection Policy (Noise) (2019) 19

5.4 DTMR Transport Noise Management Code of Practice Volume 1 – Road Traffic Noise (2013) 21

6 Project specific noise objectives **22**

6.1 Legislative and policy context to the NIA 22

6.2 Construction noise objectives 22

6.3 Operational noise objectives 26

6.4 Road traffic noise objectives 31

6.5 Cumulative operational noise objectives 32

7 Impact assessment **36**

7.1 Construction noise 36

7.2 Operational noise 43

7.3 Road traffic noise 49

7.4 Cumulative operational impacts 58
8 Noise mitigation and management 62
8.1 Construction mitigation and management 62
8.2 Operational mitigation and management 63
9 Conclusion 65
9.1 Modelled outcomes 65
9.2 Mitigation and recommendations 66
10 References 67

Attachments

Attachment A Calibration certificates A.1
Attachment B Unattended noise monitoring charts B.1
Attachment C Equipment sound power levels C.1
Attachment D Noise contour maps D.1
Attachment E Operational noise prediction tonality and low frequency check E.1

Tables

Table ES1 Responses relevant to the NIA 2
Table 1.1 Terminology and abbreviations 4
Table 3.1 Sensitive receptor assessment locations 9
Table 4.1 Noise monitoring locations 15
Table 4.2 Unattended noise summary – Winter 2025 16
Table 4.3 Recorded statistical noise levels – Winter 2025 16
Table 5.1 Schedule 1 Acoustic quality objectives 20
Table 5.2 Road traffic noise criteria at sensitive receptors 21
Table 6.1 Guidelines summary used to determine assessment criteria 22
Table 6.2 Construction noise objectives 23
Table 6.3 Operational noise objectives 27
Table 6.4 Road traffic noise criteria at sensitive receptors 31
Table 6.5 Cumulative operational noise objectives 32
Table 7.1 Construction noise modelling parameter 36
Table 7.2 Construction equipment sound power levels 37
Table 7.3 Noise prediction from construction activities associated with Package 1 39
Table 7.4 Operational noise modelling parameter 43
Table 7.5 Operational noise source sound power levels 44
Table 7.6 Noise prediction from operational activities associated with Package 1 46
Table 7.7 Road traffic noise modelling parameters 50

Table 7.8	Traffic data adjacent to project	51
Table 7.9	Road traffic noise prediction from construction activities associated with Package 1	52
Table 7.10	Predicted noise against cumulative noise objectives	58
Table 8.1	General construction noise mitigation and management strategies	62
Table C.1	Construction 1/1 octave sound power levels	C.2
Table C.2	Operational 1/3 octave sound power levels	C.4
Table E.1	1/3 octave operational noise prediction results	E.2
Table E.2	Threshold values for low frequency penalty	E.8
Table E.3	Low frequency linear dB contribution	E.8
Table E.4	Tonal assessment receptor	E.12

Figures

Figure 2.1	Regional context	7
Figure 2.2	Development site	8
Figure 3.1	Sensitive receptor locations	13
Figure 4.1	Noise monitoring locations	18

1 Introduction

1.1 Background

Solquartz, a wholly owned portfolio company of funds managed by Quinbrook Infrastructure Partners (Quinbrook), and Private Energy Partners Pty Ltd (PEP), an affiliate enterprise of Quinbrook and Quinbrook's dedicated development, delivery and operations service provider, are proposing to develop a BESS, substation and transmission lines to facilitate electricity supply for future Metallurgical Silicon (MG-Si) and Polysilicon (Poly-Si) manufacturing facilities as part of the broader Northern Quartz Campus (NQC) project.

The premises which form the development application is on part of Lot 19 SP321818 and part of Lot 87 on RP911426, near Woodstock in TCC local government area. The development includes the proposed overhead transmission line which traverses south along the western edge of the project premises and connect into the future Powerlink Calcium substation.

1.2 Report purpose and assessment requirements

This Noise Impact Assessment (NIA) supports the development application for Package 1 of the NQC. It documents the existing environment, applicable impact assessment criteria, and sources of noise. The assessment is demonstrated through noise modelling of the Project's associated operational, construction, and traffic activities, and evaluates these impacts relative to criteria.

This NIA has been prepared with the specific objectives to:

- model the noise emissions of the proposed operational and construction impacts for the development
- assess road traffic noise as a result of construction and operational related vehicles on public roads
- discuss compliance against relevant criteria and provide noise mitigation measures where relevant.

This NIA has been prepared in general accordance with the guidelines specified in:

- Australian Standards *AS 1055.2018 Acoustics - Description and measurement of environmental noise*
- DES 2020, *ESR/2015/1838 - Application requirements for activities with noise impacts*
- DES 2020, *Noise Measurement Manual*, 2020 (NMM)
- DESI 2024, *ESR/2020/5305 – Noise and vibration—EIS information guideline*
- DTMR 2023, Transport Noise Management Code of Practice: Volume 2 – *Construction Noise and Vibration*
- Environmental Protection Policy (Noise), 2019 (EPP)
- Environmental Protection Regulation, 2019 (EPR)
- NSW EPA (2017), *Noise Policy for Industry (NPfI)*
- QLD Environmental Protection Act, 1994 (EP Act)
- *Vegetation Management Act 1999* (Qld).

1.3 Scope of works

The scope of work undertaken by EMM for this assessment is summarised below:

Baseline noise monitoring

- Initial desktop review to identify the study area for the assessment and the key noise-sensitive receptors within approximately 4 km of the Project site.
- Desktop review of the surrounding environment using aerial imagery to identify existing or potential noise-sensitive receptors.
- Review of information provided by the client detailing the proposed construction staging, equipment, traffic generation, and operational activities.
- Site survey to confirm noise monitoring locations. Unattended noise monitoring was conducted for a minimum period of one week at two locations representative of the local environment (e.g. nearest residential dwellings) to determine background noise levels at the nearest sensitive receptors.
- Assessment and filtering of invalid noise data due to extraneous noise or adverse weather conditions.

Construction noise impact assessment

- Develop construction scenarios based on construction staging and duration.
- Determine project noise criteria for the key sensitive receptors in the study area based on the relevant noise guidelines.
- Develop a 3D construction noise model to predict impacts at the identified sensitive receptors for each construction scenario.
- Assess predicted noise levels against the relevant construction noise criteria.
- Provide reasonable and feasible noise management and mitigation measures to minimise impacts on the community.
- Assess noise associated with increased road traffic on nominated traffic routes for all construction stages. Recommend mitigation measures, where required, to manage traffic noise impacts.
- Provide in-principle, reasonable, and feasible noise mitigation measures to reduce noise levels to compliant levels, if required.

Operational noise impact assessment

- Review design details and assumptions provided for noise-generating equipment, including any built-in attenuation measures.
- Determine project noise criteria for the key sensitive receptors in the study area based on the relevant noise guidelines.
- Develop a 3D noise model incorporating all key project noise sources, based on provided noise source data and drawings (as agreed).
- Predict noise levels at key sensitive receptors, including consideration of background noise creep, sleep disturbance, and traffic noise.

- Compare predicted operational noise levels with the project noise criteria and identify any exceedances.
- Assess noise impacts associated with increased road traffic from operational deliveries and maintenance staff on nominated traffic routes.
- Where project noise criteria are exceeded, identify feasible and reasonable noise mitigation measures.

1.4 Assumptions and exclusions

The following assumptions and exclusions were relied upon in preparation of the NIA:

- Sensitive receptors were identified using aerial photography and land use planning and may not include all existing or future receptors in the Project area, but are considered representative of receptors.
- Key construction scenarios have been considered in this assessment. Assumed equipment scenarios and noise levels are provided in Section 6.5.
- Construction noise is assessed assuming that each piece of construction equipment is operating concurrently for each scenario.
- Construction plant and equipment is assumed to operate at maximum sound power.
- Sound power levels for all fixed plant operating onsite were obtained from manufacturer data wherever possible. Where this was not possible, sound power levels were sourced from EMM's database of equivalent equipment unit sizes.
- Given the constant nature of the fixed plant noise sources, it has been assumed that L_{eq} values are equivalent to L_{max} levels, therefore assessment of sleep disturbance impacts was not required.
- All fixed BESS plant items are assumed to operate at 100 % duty load. BESS units are expected to run simultaneously and complete one charge and discharge operation per day per unit.
- All fixed BESS units have been modelled at the 480 minute charge cycle point. This was assessed to be the worst case emission scenario.
- All fixed BESS plant items are assumed to operate 24 hours per day.
- All fixed BESS plant items were modelled as individual industrial buildings and point sources, appropriately accounting for unit height, source directivity, and 1/3 octave-band sound power levels to enable a robust assessment of potential annoying noise characteristics.
- Due to the substantial source-to-receptor distance (598 m to the nearest sensitive receptor), vibration impacts are expected to be negligible and have therefore not been assessed as part of this assessment.

1.5 Key Terminology

Some definitions of terms and abbreviations which may be used in this report are provided in Table 1.1.

Table 1.1 Terminology and abbreviations

Term/descriptor	Definition
dB(A)	Noise level measurement units are decibels (dB). The "A" weighting scale is used to approximate how humans hear noise.
L_{Amax}	The maximum root mean squared A-weighted noise level over a time period.
L_{A1}	The A-weighted noise level which is exceeded for 1% of the time.
$L_{AX,1hour}$	The A-weighted noise level which is exceeded for X% of the specified time period of one hour.
L_{A10}	The A-weighted noise level which is exceeded for 10% of the time.
L_{Aeq}	The energy average A-weighted noise level.
L_{A90}	The A-weighted noise level exceeded for 90% of the time, also referred to as the "background" noise level and commonly used to derive noise limits.
L_{Amin}	The minimum A-weighted noise level over a time period.
L_{Ceq}	The energy average C-weighted noise energy during a measurement period. The "C" weighting scale is used to take into account low-frequency components of noise within the audibility range of humans.
Hertz (Hz)	The frequency of fluctuations in pressure, measured in cycles per second. Most sounds are a combination of many frequencies together.
AWS	Automatic weather station used to collect meteorological data, typically at an altitude of 10 m
Day	Means the period after 7:00 am on a day to 6:00 pm on the day.
Evening	Means the period after 6:00 pm on a day to 10:00 pm on the day.
Night	Means the period after 10:00 pm on a day to 10:00 pm on the next day.
The Project	Relating to the total project encompassing all four packages of development stages of the Northern Quartz Campus.
BESS	Battery Energy Storage Solution. Typically discussed in units or as a facility.
PCU	Power Conversion Unit
LEIP	Lansdown Eco-Industrial Precinct
SWL	Sound Power Level, typically depicted as dB or dB(A)

2 Project description

2.1 Overview

The development site is at 132 Bidwilli Road, Calcium Townsville, approximately 40 kilometres (km) south of Townsville within the LEIP (Figure 2.1 and Figure 2.2). The Project is proposed to be located centrally on part of Lot 19 on SP321818 and part of Lot 87 on RP911426.

The development involves the construction and operation of a 780 megawatts (MW) BESS and substation facility which will be supported by enabling infrastructure including roads, parking, switchgear, transformers, site offices and onsite storage areas. The BESS will provide firming for the electricity supply provided to the MG-Si and Poly-Si manufacturing facilities as part of the larger NQC project. A 275 kilovolt (kV) transmission line is proposed between the NQC substation and the Powerlink Calcium substation, the length of this transmission line is 2658 metres (m) and incudes 21 transmission towers. The Powerlink Calcium substation does not form part of this application though the connection of the transmission lines into it does.

Access to the premises during both construction and operation phases will be via the northern LEIP access intersection point which includes Flinders Highway via Glenn Road and Jones Road. The proposed site access on Bidwilli Road will act as a new left-in/right-out driveway as all vehicles will arrive and depart from/to the north. This access will be used during construction and operation.

The BESS components are full encased within a battery storage container similar to a shipping container, with approximate dimensions of 2.4 m wide, 6.1 m long, and 2.9 m high. The dimensions and number of containerised batteries is subject to the choice of provider.

The BESS will link in with the NQC substation, which will include equipment such as switchgear and circuit breakers, protection and control systems and metering and communication systems. The proposed design includes 2 x 2.6 km 275 kV double circuit overhead transmission powerlines between the NQC substation and Calcium substation. The transmission line is proposed to be above ground within the proposed easement with a minimum width of 100 m. The transmission line includes 21 lattice towers standing at a height of 51.1 m and a connection span length of 300 m maximum.

2.2 Site description

The land within, and immediately adjacent to, the Project is predominately rural and agricultural, currently used for fodder crops and cattle grazing. Ambient noise levels would be controlled by natural elements and limited human activity. Limited localised mounds and hills surrounding the Project area provide minimal acoustic shielding between the Project and nearby sensitive receptors. There are 108 non-associated receptors within 4 km of the study area, generally localised in the township of Woodstock and along Flinders Highway.

Much of the land the Project is located on has been cleared of vegetation and is dominated by grasses, grazed grassy land, and some non-remnant vegetation in the northern section. The Project encompasses one homestead, approximately 20 m west of the proposed BESS. This homestead will be removed in the construction of the BESS. There are no waterways within the premises. Four Mile Creek is approximately 200 m south of the premises and considered as “least concern – Remnant” in accordance with the *Vegetation Management Act 1999* (Qld) status.

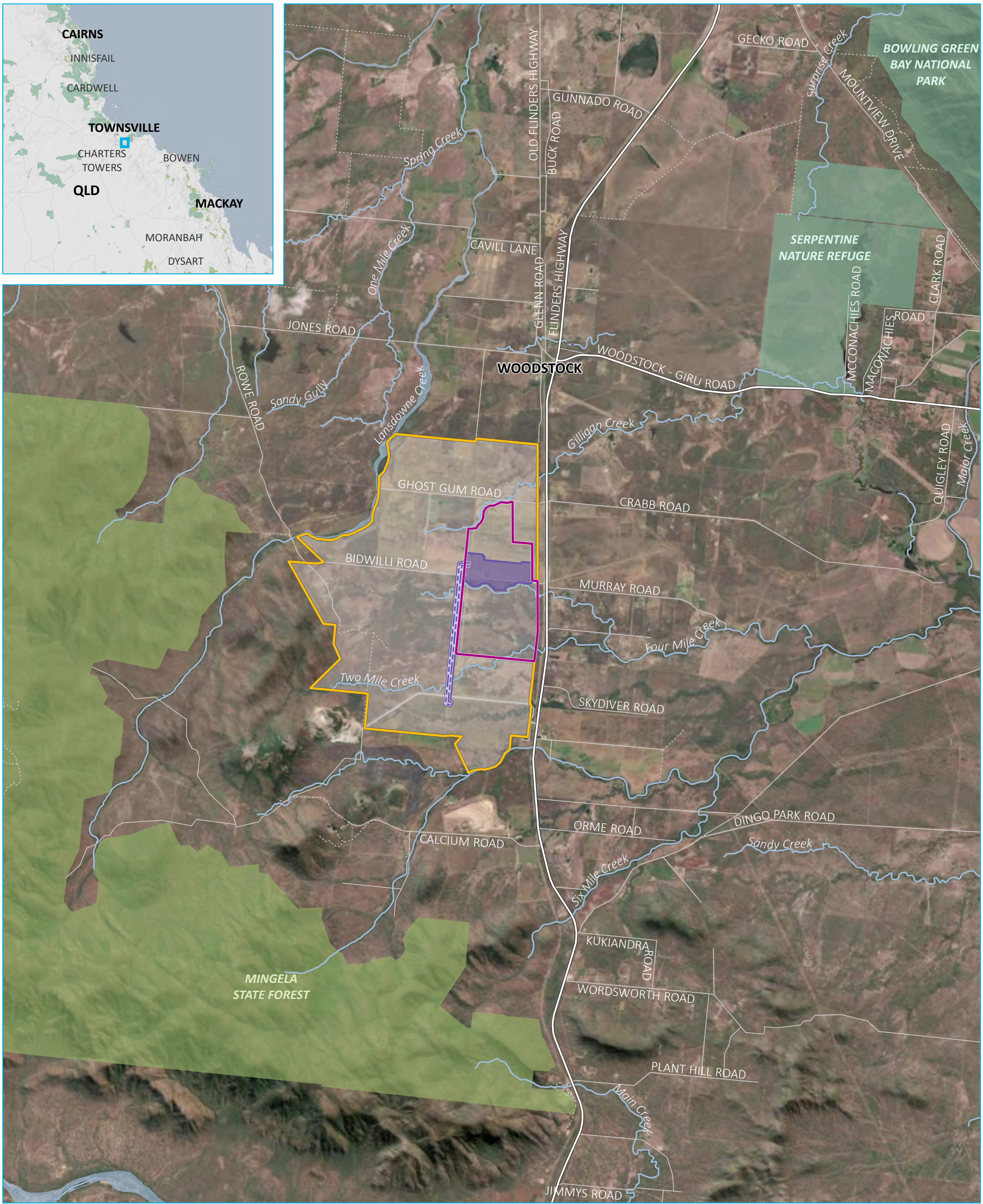
2.3 Hours of operation

2.3.1 Proposed operational hours

The BESS facility is expected to operate 24 hours a day, seven days a week, 365 days a year.

2.3.2 Proposed construction hours

Construction activities are proposed to occur Monday to Saturday, between 6:30 am and 6:30 pm. Audible building works will not be permitted outside these hours.



Source: EMM (2025); ABS (2021); DES (2025); DNRMMRRD (2025); ESRI (2025); GA (2011)

0 2.5 5 km
GDA2020 MGA Zone 55
N

\\emm.local\xdrive\2025\E250401- Project Green Poly MCU DA\GIS\02_Maps_BESS_NIA\NIA001_Pk1RegionalContext\NIA001_Pk1RegionalContext_20250826_02.aprx 26/08/2025

KEY

- Lansdown Eco-Industrial Precinct
- Northern Quartz Campus
- Package 1- Premises
- Package 1- Transmission line

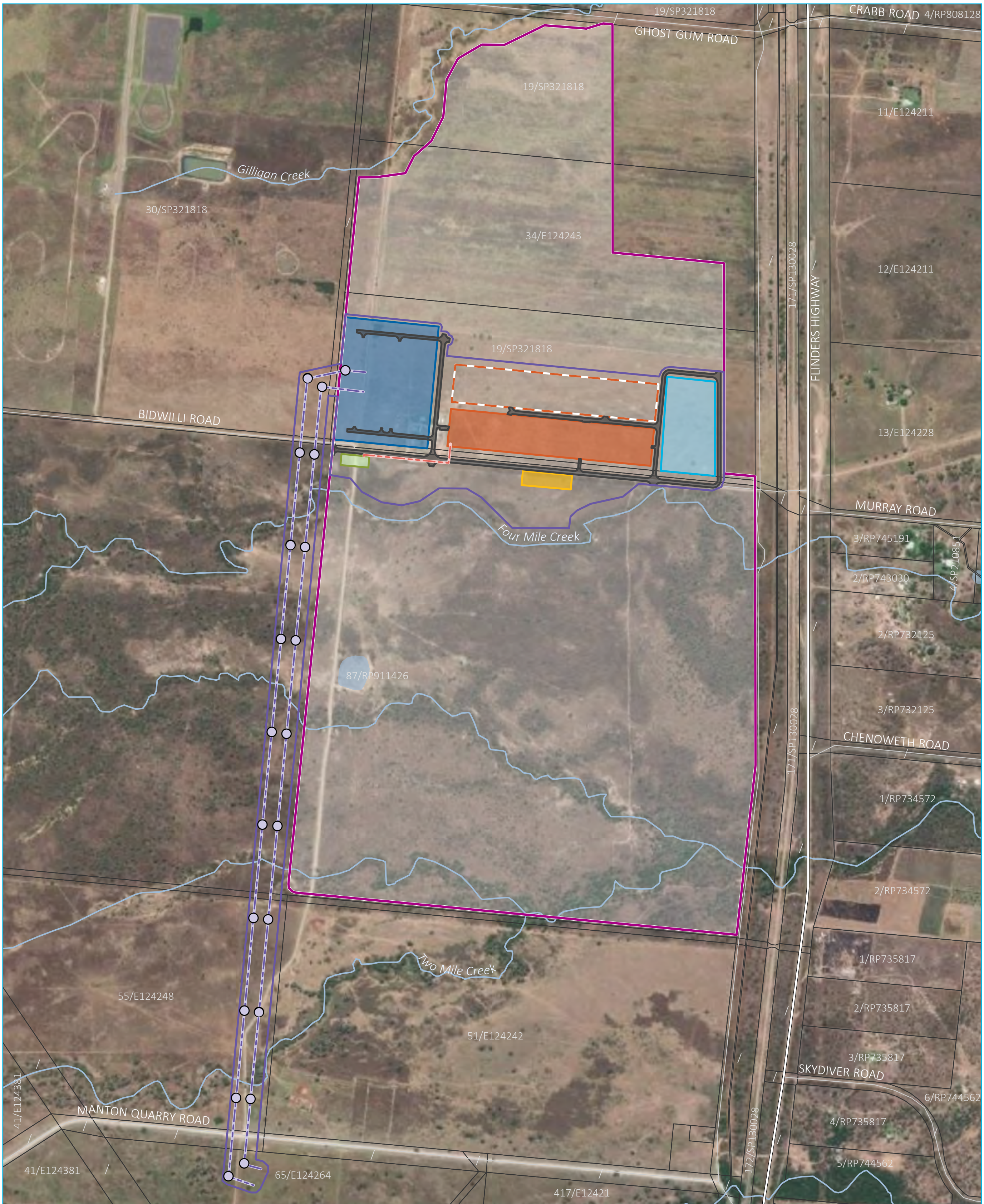
Existing environment

- Major road
- Minor road
- Vehicular track
- Named watercourse
- Named waterbody
- National park/nature reserve
- State forest

Regional context

Northern Quartz Campus
Package 1- BESS, transmission line and substation
Noise Impact Assessment
Figure 2.1

EMM
creating opportunities



Source: EMM (2025); DES (2025); DNRMMRRD (2025); ESRI (2025); GA (2011)

\\emm.local\xdrive\2025\E250401- Project Green Poly MCU DAs\GIS\02_Maps_BESS_NIA\NIA002_Pk1DevelopmentSite\NIA002_Pk1DevelopmentSite_20250826_02.aprx 26/08/2025

KEY

Northern Quartz Campus
Package 1- Premises
Existing environment
Major road
Minor road
Watercourse/drainage line
Waterbody
Cadastral boundary

Package 1 proposed site layout
BESS
BESS expansion area
Substation
Construction laydown area
Water management area
Fire water pad
Internal road

Fire water pipeline
Transmission line
Transmission pole

Development site

Northern Quartz Campus
Package 1- BESS, transmission line and substation
Noise Impact Assessment
Figure 2.2

3 Sensitive receptors

There are five isolated residences within 1 km of the BESS boundary. The nearest residence is located 598 m to the east of the premises, across Flinders Highway.

Woodstock State School, CWA Hall and Donnington Airpark are located approximately 3.4 km, 3.6 km, and 3.1 km north of the BESS respectively. Manton Cemetery is located approximately 2.1 km south of the BESS. Sensitive receptor details are provided in Table 3.1 with locations shown in Figure 3.1.

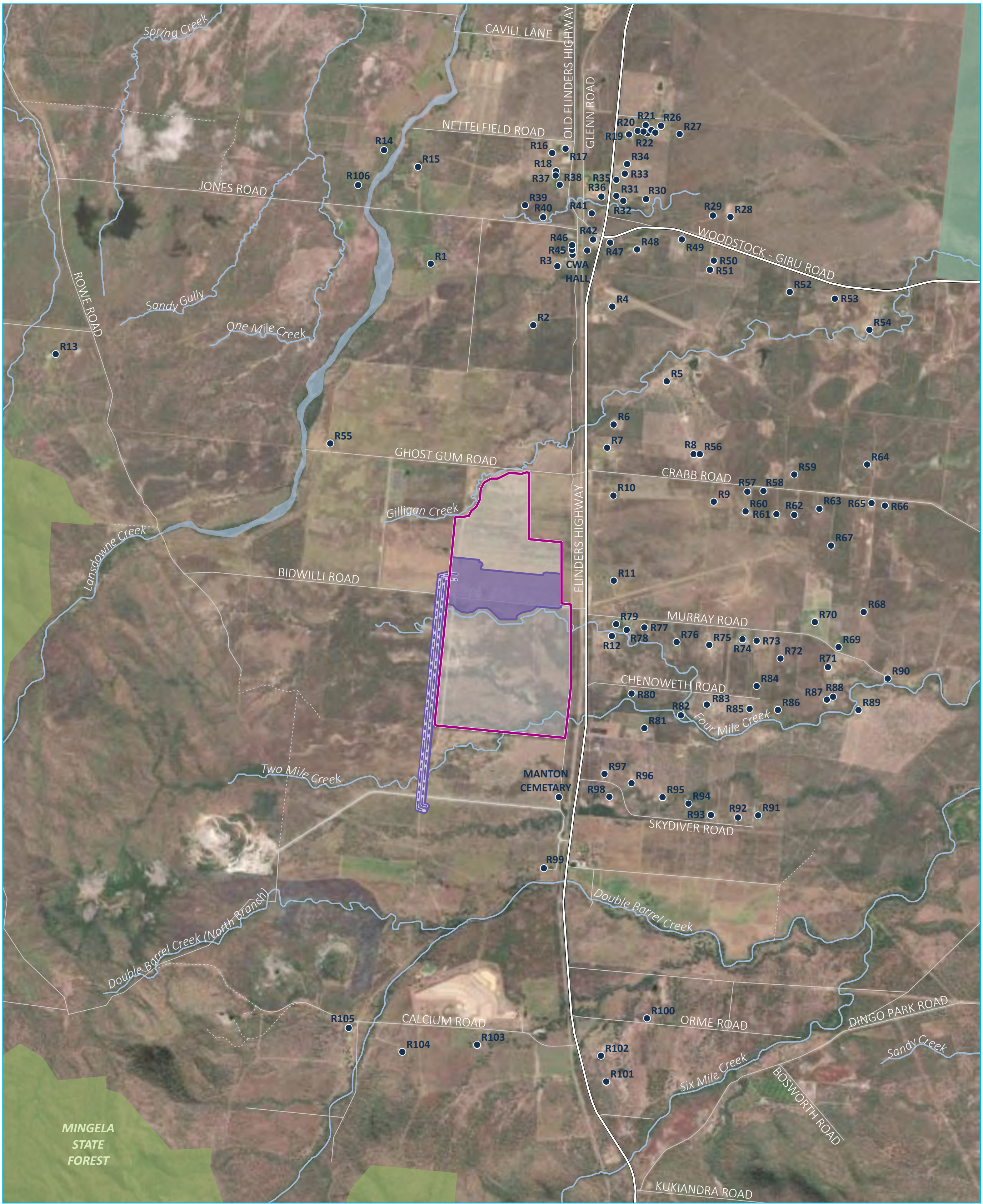
Table 3.1 Sensitive receptor assessment locations

Receptor no.	Receptor address	Receptor type	Coordinates (MGA 55)		Approximate distance to BESS boundary (m)
			Easting	Northing	
R1	105 Jones Road, Woodstock	Residential	481136	7833043	3319
R2	112 Woodstock Avenue, Woodstock	Residential	482274	7832361	2704
R3	Woodstock State School, Woodstock	Educational	482542	7833016	3403
R4	3467 Flinders Highway, Woodstock	Commercial	483153	7832565	3149
R5	3597 Flinders Highway, Woodstock	Residential	483757	7831735	2562
R6	3599 Flinders Highway, Woodstock	Residential	483167	7831258	1888
R7	7 Crabb Road, Woodstock	Residential	483095	7830998	1619
R8	129 Crabb Road, Woodstock	Residential	484055	7830928	2087
R9	140 Crabb Road, Woodstock	Residential	484280	7830400	1951
R10	3663 Flinders Highway, Woodstock	Residential	483164	7830468	1167
R11	3787 Flinders Highway, Woodstock	Residential	483169	7829523	598
R12	3821 Flinders Highway, Woodstock	Residential	483147	7828907	661
R13	791 Rowe Road, Woodstock	Residential	476970	7832037	4998
R14	179 Nettlefields Rd, Woodstock	Residential	480617	7834304	4637
R15	147 Nettlefields Rd, Woodstock	Residential	480994	7834119	4404
R16	25 Nettelfields Rd, Woodstock	Residential	482484	7834272	4620
R17	107 Old Flinders Hwy, Woodstock	Residential	482633	7834319	4694
R18	81 Old Flinders Hwy, Woodstock	Residential	482527	7834069	4428
R19	124 Field Rd, Woodstock	Residential	483337	7834479	5035
R20	132 Field Rd, Woodstock	Residential	483434	7834519	5105
R21	142 Field Rd, Woodstock	Residential	483523	7834582	5195
R22	148 Field Rd, Woodstock	Residential	483544	7834490	5114
R23	148 Field Rd, Woodstock	Residential	483500	7834512	5122
R24	150 Field Rd, Woodstock	Residential	483586	7834526	5157
R25	156 Field Rd, Woodstock	Residential	483630	7834499	5140

Receptor no.	Receptor address	Receptor type	Coordinates (MGA 55)		Approximate distance to BESS boundary (m)
			Easting	Northing	
R26	158 Field Rd, Woodstock	Residential	483693	7834572	5225
R27	172 Field Rd, Woodstock	Residential	483901	7834482	5187
R28	3420 Woodstock - Giru Rd, Woodstock	Residential	484465	7833563	4515
R29	3458 Woodstock - Giru Rd, Woodstock	Residential	484270	7833579	4451
R30	24 Field Rd, Woodstock	Residential	483527	7833759	4395
R31	20 Field Rd, Woodstock	Residential	483197	7833795	4344
R32	20 Field Rd, Woodstock	Residential	483275	7833740	4320
R33	54 Field Rd, Woodstock	Residential	483291	7834041	4607
R34	56 Field Rd, Woodstock	Residential	483317	7834149	4718
R35	40 Field Rd, Woodstock	Residential	483198	7833973	4512
R36	30 Glenn Rd, Woodstock	Residential	483031	7833787	4281
R37	81 Old Flinders Hwy, Woodstock	Residential	482523	7834023	4382
R38	73 Old Flinders Hwy, Woodstock	Residential	482569	7833919	4288
R39	62 Jones Rd, Woodstock	Residential	482183	7833691	4000
R40	38 Jones Rd, Woodstock	Residential	482385	7833559	3900
R41	24 Old Flinders Hwy, Woodstock	Residential	482924	7833603	4073
R42	3380 Flinders Hwy, Woodstock	Residential	482938	7833310	3800
R43	3382 Flinders Hwy, Woodstock	Residential	482873	7833190	3666
R44	36 Woodstock Av, Woodstock	Residential	482707	7833212	3636
R45	38 Woodstock Av, Woodstock	Residential	482705	7833195	3619
R46	30 Woodstock Av, Woodstock	Residential	482706	7833249	3671
R47	3553 Woodstock - Giru Rd, Woodstock	Residential	483129	7833278	3837
R48	3555 Woodstock - Giru Rd, Woodstock	Residential	483427	7833201	3829
R49	3467 Woodstock - Giru Rd, Woodstock	Residential	483925	7833311	4075
R50	3433 Woodstock - Giru Rd, Woodstock	Residential	484279	7833076	3995
R51	3433 Woodstock - Giru Rd, Woodstock	Residential	484237	7832974	3885
R52	3341 Woodstock - Giru Rd, Woodstock	Residential	485124	7832728	4146

Receptor no.	Receptor address	Receptor type	Coordinates (MGA 55)		Approximate distance to BESS boundary (m)
			Easting	Northing	
R53	3291 Woodstock - Giru Rd, Woodstock	Residential	485624	7832655	4419
R54	3380 Woodstock - Giru Rd, Woodstock	Residential	486008	7832307	4463
R55	3251 Woodstock - Giru Rd, Woodstock	Residential	480019	7831046	1909
R56	Landsdown 234 Bidwilli Rd, Calcium	Residential	484125	7830925	2136
R57	129 Crabb Rd, Woodstock	Residential	484652	7830510	2332
R58	184 Crabb Rd, Woodstock	Residential	484831	7830517	2495
R59	196 Crabb Rd, Woodstock	Residential	485173	7830700	2883
R60	219 Crabb Rd, Woodstock	Residential	484632	7830290	2222
R61	184 Crabb Rd, Woodstock	Residential	484975	7830262	2534
R62	212 Crabb Rd, Woodstock	Residential	485174	7830251	2719
R63	236 Crabb Rd, Woodstock	Residential	485453	7830321	3007
R64	262 Crabb Rd, Woodstock	Residential	485983	7830813	3670
R65	315 Crabb Rd, Woodstock	Residential	486032	7830383	3581
R66	320 Crabb Rd, Woodstock	Residential	486180	7830355	3717
R67	328 Crabb Rd, Woodstock	Residential	485582	7829912	3043
R68	276 Crabb Rd, Woodstock	Residential	485945	7829174	3369
R69	305 Murray Rd, Woodstock	Residential	485666	7828784	3124
R70	298 Murray Rd, Woodstock	Residential	485403	7829060	2832
R71	259 Murray Rd, Woodstock	Residential	485548	7828560	3049
R72	298 Murray Rd, Woodstock	Residential	485020	7828658	2513
R73	216 Murray Rd, Woodstock	Residential	484756	7828854	2214
R74	188 Murray Rd, Woodstock	Residential	484598	7828869	2056
R75	178 Murray Rd, Woodstock	Residential	484230	7828809	1710
R76	134 Murray Rd, Woodstock	Residential	483867	7828839	1352
R77	96 Murray Rd, Woodstock	Residential	483509	7829003	963
R78	64 Murray Rd, Woodstock	Residential	483313	7828975	783
R79	46 Murray Rd, Woodstock	Residential	483195	7829039	651
R80	30 Murray Rd, Woodstock	Residential	483366	7828268	1248
R81	44 Chenoweth Rd, Woodstock	Residential	483509	7827882	1642
R82	3933 Flinders Hwy, Woodstock	Residential	483915	7828026	1805
R83	80 Chenoweth Rd, Woodstock	Residential	484203	7828144	1961

Receptor no.	Receptor address	Receptor type	Coordinates (MGA 55)		Approximate distance to BESS boundary (m)
			Easting	Northing	
R84	138 Chenoweth Rd, Woodstock	Residential	484755	7828353	2354
R85	188 Murray Rd, Woodstock	Residential	484678	7828098	2392
R86	170 Chenoweth Rd, Woodstock	Residential	484992	7828084	2679
R87	194 Chenoweth Rd, Woodstock	Residential	485536	7828199	3139
R88	240 Murray Rd, Woodstock	Residential	485605	7828232	3193
R89	240 Murray Rd, Woodstock	Residential	485887	7828084	3507
R90	351 Murray Rd, Woodstock	Residential	486212	7828434	3725
R91	Lamington Park 406 Murray Rd, Woodstock	Residential	484773	7826914	3196
R92	213 Skydiver Rd, Woodstock	Residential	484549	7826891	3063
R93	191 Skydiver Rd, Woodstock	Residential	484247	7826920	2854
R94	163 Skydiver Rd, Woodstock	Residential	483999	7827044	2611
R95	133 Skydiver Rd, Woodstock	Residential	483710	7827115	2401
R96	109 Skydiver Rd, Woodstock	Residential	483365	7827273	2109
R97	59 Skydiver Rd, Woodstock	Residential	483066	7827375	1915
R98	29 Skydiver Rd, Woodstock	Residential	483120	7827122	2174
R99	22 Skydiver Rd, Woodstock	Residential	482392	7826326	2898
R100	81 Orme Rd, Woodstock	Residential	483538	7824661	4664
R101	4321 Flinders Hwy, Woodstock	Residential	483085	7823956	5291
R102	4295 Flinders Hwy, Woodstock	Residential	483026	7824243	5000
R103	66 Calcium Rd, Calcium	Residential	481651	7824365	4920
R104	Lime Hills 113 Calcium Rd, Calcium	Residential	480820	7824287	5037
R105	Lime Hills 113 Calcium Rd, Calcium	Residential	480224	7824552	4876
R106	212 Jones Rd, Woodstock	Residential	480329	7833917	4318
CWA HALL	42 Woodstock Ave, Woodstock	Commercial	482711	7833141	3569
Manton Cemetery	132 Bidwilli Rd, Calcium	Park/Garden	482559	7827117	2102



Source: EMM (2025); DES (2025); DNRMMRRD (2025); ESRI (2025)

0 1 2 km
GDA2020 MGA Zone 55
N

KEY

- Northern Quartz Campus
- Package 1 - Premises
- Package 1 - Transmission line
- Sensitive receptor

Existing environment

- Major road
- Minor road
- Vehicular track
- Named watercourse
- Named waterbody
- National park/nature reserve
- State forest

Sensitive receptor locations

Northern Quartz Campus
Package 1 - BESS, transmission line and substation
Noise Impact Assessment
Figure 3.1

EMM creating opportunities

4 Existing acoustic background

4.1 General methodology

An ambient noise survey was conducted to characterise and quantify the existing acoustical environment in the area surrounding the Project site.

The ambient noise monitoring consisted of continuous unattended noise logging undertaken from 29 May 2025 to 11 June 2025.

Unattended noise measurements were undertaken using Type 1 Acoustic Research Laboratories NGARA environmental noise loggers. These instruments record data that can be processed to provide L_{Amin}, L_{A90}, L_{A10}, L_{A1}, L_{Amax} and noise descriptors and can be processed to generate 1/3 octave sound pressure levels.

Noise levels have been established in general accordance with the DESI (2024). Meteorological data was taken from Mount Stuart's Bureau of Meteorology (BoM) Automatic Weather Station (AWS ID 32195). Periods of wind greater than 3 m/s and precipitation greater than 0.3 mm/h have been excluded from the assessment.

Field calibrations were checked by EMM immediately before and after each set of measurements using a SVAN SV36 calibrator (serial number 154613). In all cases, pre and post calibration checks were within the acceptable range of 94 decibels (dB) +/- 0.5 dB.

All instrumentation used during noise measurements comply with the requirements of AS IEC 61672.1-2013 *Electroacoustics – Sound Level Meters – Specifications*, IEC 60942:2017 *Electroacoustics: sound calibrators* and carry current NATA or manufacturer calibration certificates. Calibration certificates for the sound level meters used during the monitoring period are attached in Attachment A.

4.2 Monitoring locations

EMM conducted background noise monitoring in the winter period of 2025 at two monitoring locations on the Project area:

- Location 1, along Bidwilli Road represents a location that would be impacted by nearby traffic noise from the Flinders Highway.
- Location 2 is located further away from Flinders Highway and is representative of a location more dominated by natural sources of sound.

The noise monitoring locations are detailed in Table 4.1 and shown in Figure 4.1.

Table 4.1 Noise monitoring locations

Monitoring location	Sound level meter Type/Serial No.	Coordinates (MGA 55)		Picture
		Easting	Northing	
Location 1 - Bidwilli Rd	ARL NGARA noise logger/ sn. 878123	482546	7830236	
Location 2 - No-Name Rd	ARL NGARA noise logger / sn. 878017	481502	7829753	

4.3 Unattended noise monitoring results

Background noise levels in the vicinity of the Project and greater regional context show seasonal fluctuations and increased evening noise levels. A general reduction in noise across all periods during the winter period implies that natural sources of noise dominate the region. Acoustic descriptors show a generally higher average in locations that are greater affected by other significant sources of noise, such as traffic along Flinders Highway. The trends observed in the background noise levels of the region are typical of a rural setting that is dominated by natural sources with limited industrial sources.

A summary of the meteorologically filtered background and statistical noise levels is summarised in Table 4.2 and Table 4.3. The unattended noise monitoring data are presented in charts in Attachment B which show periods of data exclusion.

Table 4.2 Unattended noise summary – Winter 2025

Assessment Location	Overall ambient noise levels, $L_{Aeq(period)}$			Rating Background Level (dB(A)) 90th percentile $L_{A90(15min)}$		
	Day	Evening	Night	Day	Evening	Night
Location 1 - Bidwilli Rd	47	52	48	29	34	25[2]
Location 2 - No-Name Rd	43	41	40	26	28	25[2]

Notes: 1. The energy averaged noise level over the measurement period and representative of general ambient noise. The rating background level is the median of the assessment background levels recorded over the monitoring period and has been established in accordance with the NMM.

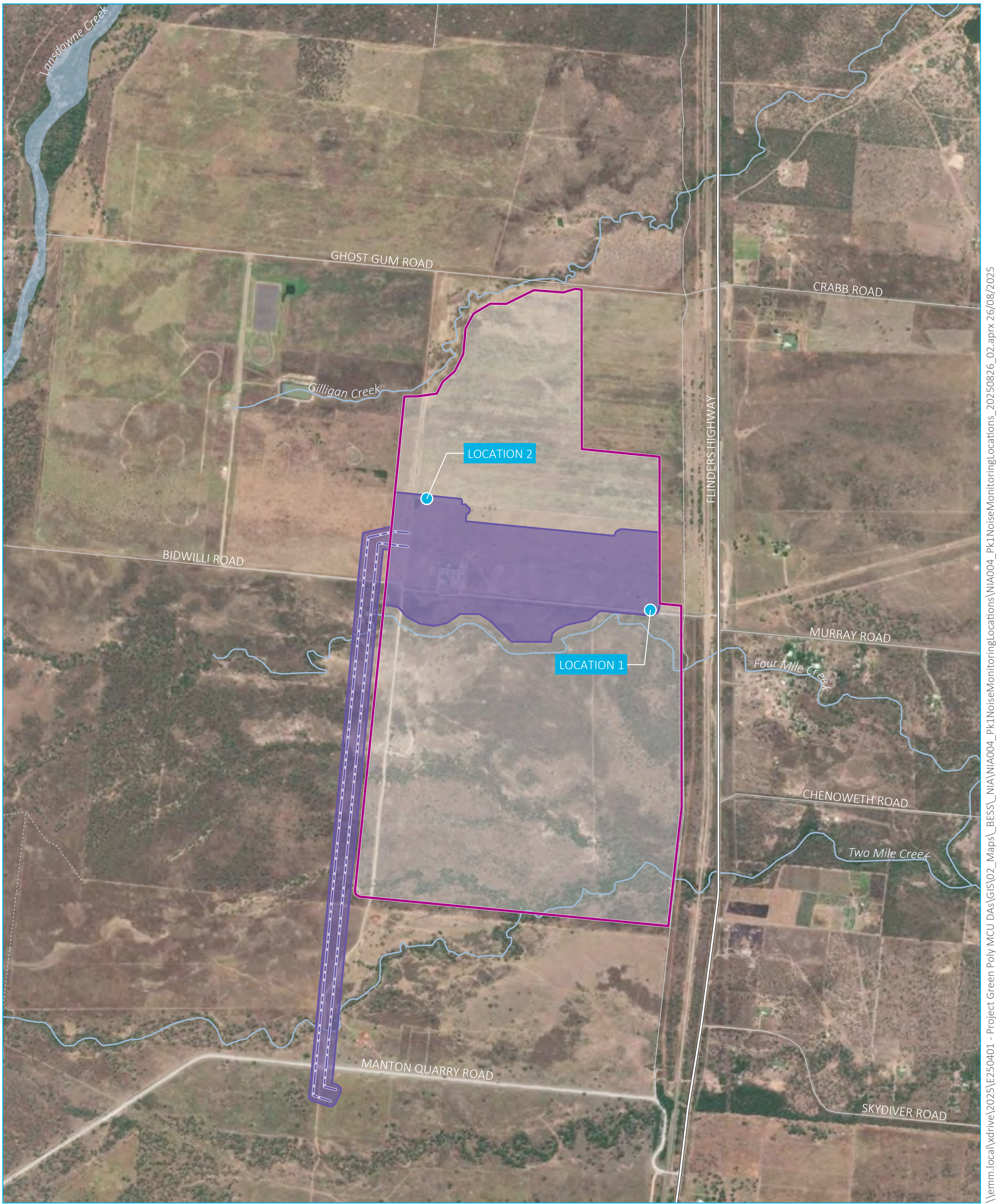
2. The Rating Background Levels for each of the monitoring locations were at or below 25 dB(A) for the night period. The DEHP Guideline: Noise Planning for Noise Control (2016) sets a minimum background noise level threshold of L_{A90} 25 dB(A) for the determination of noise criteria.

Table 4.3 Recorded statistical noise levels – Winter 2025

Location	Acoustic Descriptor, (dB(A)	Period	Minimum	Maximum	Average
Bidwilli Rd	L_{A1}	Day	38	73	56
		Evening	46	69	59
		Night	<25	68	57
	L_{A10}	Day	35	59	50
		Evening	39	60	54
		Night	<25	63	50
	L_{Aeq}	Day	32	57	47
		Evening	37	57	51
		Night	<25	63	47
	L_{A90}	Day	26	45	35
		Evening	<25	55	47
		Night	<25	62	42
No-Name Rd	L_{A1}	Day	34	72	57
		Evening	29	68	51
		Night	25	67	46
	L_{A10}	Day	30	58	44
		Evening	26	49	42
		Night	<25	49	38
	L_{Aeq}	Day	28	62	45
		Evening	25	53	42
		Night	<25	54	37

Location	Acoustic Descriptor, (dB(A)	Period	Minimum	Maximum	Average
	L_{A90}	Day	<25	39	30
		Evening	<25	47	39
		Night	<25	42	32

.



Source: EMM (2025); DES (2025); DNRMMRRD (2025); ESRI (2025)

KEY

Northern Quartz Campus
Package 1 - Premises
Package 1 - Transmission line
Noise monitoring location

Existing environment
Major road
Minor road
Vehicular track
Named watercourse
Named waterbody

Noise monitoring locations

Northern Quartz Campus
Package 1 - BESS, transmission line and substation
Noise Impact Assessment
Figure 4.1

EMM creating opportunities

5 Noise guidelines

5.1 Environmental Protection Regulation (2019)

Under Schedule 8, Part 3, Division 1 of the EP Reg, the Project must be operated in a way that protects the environmental values of the acoustic environment by achieving the performance outcomes for nearby sensitive receptors:

- sound from the activity is not audible at a sensitive receptor, or
- the release of sound to the environment from the activity is managed so that adverse effects on environmental values, including health and wellbeing and sensitive ecosystems, are prevented or minimised.

5.2 Environmental Protection Act (1994)

The *Environmental Protection Act 1994* (EPA 1994) defines the unreasonable or likely interference of noise due to an environmentally relevant activity as an environmental nuisance. Section 440R of the EP Act regulates noise from the construction phase / building work, as follows:

The EP Act default noise standards thus regulate hours for construction works but does not limit the level of noise from the construction work.

440R Building work

(1) A person must not carry out building work in a way that makes an audible noise—

(a) on a business day or Saturday, before 6.30 am or after 6.30 pm; or

(b) on any other day, at any time.

(2) The reference in subsection (1) to a person carrying out building work—

(a) includes a person carrying out building work under an owner-builder permit; and

(b) otherwise does not include a person carrying out building work at premises that are the person's principal place of residence.

5.3 Environmental Protection Policy (Noise) (2019)

To meet the objectives of the EP Reg and minimise sources of environmental nuisances for sensitive receptors, the Environmental Protection Policy (Noise) provides guidelines on protecting the acoustic environment that pertain to values of:

- the protection of health and biodiversity of ecosystems; and
- the protection of human health and wellbeing, ensuring a suitable environment for an individual to–
  - sleep
  - study or learn
  - be involved in recreation, including relaxation and conversation

- the protection of the amenity of the community.

Schedule 1 of the EPP (Noise) defines the acoustic quality objective for sensitive receptors type and the relevant sections are reproduced in Table 5.1.

Table 5.1 Schedule 1 Acoustic quality objectives

Column 1	Column 2	Column 3			Column 4
Sensitive receptor	**Time of day**	**Acoustic quality objectives (measured at the receptor) dB(A)**			**Environmental value**
		$L_{Aeq, adj, 1hr}$	$L_{A10, adj, 1hr}$	$L_{A1, adj, 1hr}$	
residence (for outdoors)	daytime and evening	50	55	65	health and wellbeing
residence (for indoors)	daytime and evening	35	40	45	health and wellbeing
	night-time	30	35	40	health and wellbeing, in relation to the ability to sleep
library and educational institution (including a school, college and university) (for indoors)	when open for business or when classes are being offered	35			health and wellbeing
school or playground (for outdoors)	when the children usually play outside	55			health and wellbeing, and community amenity
commercial and retail activity (for indoors)	when the activity is open for business	45			health and wellbeing, in relation to the ability to converse
park or garden that is open to the public (whether or not on payment of an amount) for use other than for sport or organised entertainment	anytime	the level of noise that preserves the amenity of the existing park or garden			community amenity

Condition 9 of the EPP (Noise) also states the following in relation to background noise creep:

9 Management intent for noise

(1) This section states the management intent for an activity involving noise that affects, or may affect, an environmental value to be enhanced or protected under this policy.

Note— See section 35 of the Environmental Protection Regulation 2019.

(2) To the extent it is reasonable to do so, noise must be dealt with in a way that ensures—

(a) the noise does not have any adverse effect, or potential adverse effect, on an environmental value under this policy; and

(b) background creep in an area or place is prevented or minimised.

(3) Despite subsection (2)(b), if the acoustic quality objectives for an area or place are not being achieved or maintained, the noise experienced in the area or place must, to the extent it is reasonable to do so, be dealt with in a way that progressively improves the acoustic environment of the area or place.

(4) In this section—background creep, for noise in an area or place, means a gradual increase in the total amount of background noise in the area or place as measured under the document called the 'Noise measurement manual' published on the department's website.

5.4 DTMR Transport Noise Management Code of Practice Volume 1 – Road Traffic Noise (2013)

The EPP (Noise) acoustic quality objectives specifically do not apply to "noise from the ordinary use of a public road or State-controlled road. The EPP (Noise) does not provide any assessment criteria relevant to the impact of public road noise from a specific use.

Construction and operational traffic require consideration for potential noise impacts. Road traffic noise has been assessed under the general guidance of the DTMR Transport Noise Management Code of Practice Volume 1 – Road Traffic Noise (2013). Table 5.2 reproduces the categories and criteria for road traffic noise at sensitive receptors relevant to the construction and operation of the Project.

Table 5.2 Road traffic noise criteria at sensitive receptors

Categories	Existing Residences (façade corrected) $L_{A10\ (18hr)}$ dB(A)	Educational, Community, and Health Buildings (façade corrected) $L_{A10\ (1hr)}$ dB(A)	Outdoor Educational and Passive Recreational Areas (including Parks) (free field) $L_{A10\ (12hr)}$ dB(A)
Existing Road – No Roadworks Upgrading existing road	68	65	63
Exposure of Second Row of Buildings	65	60	N/A

6 Project specific noise objectives

6.1 Legislative and policy context to the NIA

Noise criteria for this assessment have been developed in accordance with guidelines and definitions outlined in the EPR, EPA (1994) and EPP (Noise).

The documents used to determine the project specific noise objectives are summarised in Table 6.1 and are detailed in the following sections.

Table 6.1 Guidelines summary used to determine assessment criteria

Impact	Document
Construction airborne noise	Environmental Protection Act 1994 (EPA 1994) Environmental Protection Policy (Noise) (2019) DESI (2024).
Operational airborne noise	Environmental Protection Policy (Noise) (2019) NSW EPA Noise Policy for Industry (NPfI) Environmental Protection Regulation (2019)
Construction and operational road traffic	Department of Transport and Main Roads (DTMR) Transport Noise Management Code of Practice Volume 1 – Road Traffic Noise (2013) Department of Transport and Main Roads (DTMR) 2023, Transport Noise Management Code of Practice: Volume 2 – Construction Noise and Vibration, Queensland Government.

6.2 Construction noise objectives

The EPA (1994) default noise standards thus regulate hours for construction works but does not limit the level of noise from the construction work.

Although not applicable to building work / construction noise, the EPP (Noise) acoustic quality objectives for dwellings, as outlined in Section 5.3, have been applied in this assessment for the purpose of screening potential noise amenity impacts and identifying the need for non-standard noise management measures. The construction acoustic quality objectives are not mandatory and are used solely for noise management purposes.

Construction noise limits are based on the acoustic quality objectives outlined in the EPP (Noise). Construction is expected to run between Monday-Saturday from 6:30 am to 6:30 pm with audible building work not permitted outside of these hours as per Section 440R of the EPA (1994 current as at 27 September 2024) *Building work under the noise standard*. Noise limits for this assessment have been adopted from the daytime and evening acoustic quality objectives outlined in the EPP (Noise), given the majority of construction work will occur within this period. The L_1 noise objectives approximate louder, instantaneous events that are unlikely to occur simultaneously with external developments or over an extended period.

Construction noise limits are provided in Table 6.2. The more stringent, indoor criteria for noise at receptors have been adopted and adjusted by 7 dB to account for the attenuation loss across a façade as per DESI (2024).

Table 6.2 Construction noise objectives

Sensitive Receptor	$L_{Aeq,\ adj,\ 1hr}$ project noise objective (measured at the receptor) dB(A)[1]	$L_{A1,\ adj,\ 1hr}$ project noise emission objective (measured at the receptor) dB(A)
R1	42	52
R2	42	52
R3 (School)	42	-
R4 (Commercial)	52	-
R5	42	52
R6	42	52
R7	42	52
R8	42	52
R9	42	52
R10	42	52
R11	42	52
R12	42	52
R13	42	52
R14	42	52
R15	42	52
R16	42	52
R17	42	52
R18	42	52
R19	42	52
R20	42	52
R21	42	52
R22	42	52
R23	42	52
R24	42	52
R25	42	52
R26	42	52
R27	42	52
R28	42	52
R29	42	52
R30	42	52
R31	42	52

Sensitive Receptor	$L_{Aeq, adj, 1hr}$ project noise objective (measured at the receptor) dB(A)[1]	$L_{A1, adj, 1hr}$ project noise emission objective (measured at the receptor) dB(A)
R32	42	52
R33	42	52
R34	42	52
R35	42	52
R36	42	52
R37	42	52
R38	42	52
R39	42	52
R40	42	52
R41	42	52
R42	42	52
R43	42	52
R44	42	52
R45	42	52
R46	42	52
R47	42	52
R48	42	52
R49	42	52
R50	42	52
R51	42	52
R52	42	52
R53	42	52
R54	42	52
R55	42	52
R56	42	52
R57	42	52
R58	42	52
R59	42	52
R60	42	52
R61	42	52
R62	42	52
R63	42	52

Sensitive Receptor	$L_{Aeq, adj, 1hr}$ project noise objective (measured at the receptor) dB(A)[1]	$L_{A1, adj, 1hr}$ project noise emission objective (measured at the receptor) dB(A)
R64	42	52
R65	42	52
R66	42	52
R67	42	52
R68	42	52
R69	42	52
R70	42	52
R71	42	52
R72	42	52
R73	42	52
R74	42	52
R75	42	52
R76	42	52
R77	42	52
R78	42	52
R79	42	52
R80	42	52
R81	42	52
R82	42	52
R83	42	52
R84	42	52
R85	42	52
R86	42	52
R87	42	52
R88	42	52
R89	42	52
R90	42	52
R91	42	52
R92	42	52
R93	42	52
R94	42	52
R95	42	52

Sensitive Receptor	$L_{Aeq, adj, 1hr}$ project noise objective (measured at the receptor) dB(A)[1]	$L_{A1, adj, 1hr}$ project noise emission objective (measured at the receptor) dB(A)
R96	42	52
R97	42	52
R98	42	52
R99	42	52
R100	42	52
R101	42	52
R102	42	52
R103	42	52
R104	42	52
R105	42	52
R106	42	52
CWA HALL	52	-[2]
Manton Cemetery	-[2]	-[2]

Notes: 1. As per the Noise and Vibration EIS Information Guideline, an outdoor-to-indoor attenuation value of 7 dB, appropriate for typical Queensland buildings with open windows, has been applied to the indoor objectives to determine the outdoor noise objectives for the Project.

2."-" no applicable noise objectives for time period or receptor type.

6.3 Operational noise objectives

6.3.1 Acoustic quality objectives

Operational project noise objectives are set based on the acoustic quality objectives outlined in the EPP (Noise). The limits are described as the more stringent objective for day and evening periods, between 7 am-10 pm.

The more stringent, night-time limits have been adopted and have been adjusted by 7 dB to account for attenuation across building façades.

Given the BESS is expected to operate 24 hours, seven days a week, the more stringent nighttime criteria have been adopted as the noise quality objectives for this assessment.

The resultant noise objectives are provided in Table 6.3.

Table 6.3 Operational noise objectives

Sensitive Receptor	$L_{Aeq, adj, 1hr}$ project noise objective (measured at the receptor) dB(A)		$L_{A1, adj, 1hr}$ project noise objective (measured at the receptor) dB(A)	
	Day and evening[1]	Night[1]	Day and evening[1]	Night[1]
R1	42	37	52	47
R2	42	37	52	47
R3 (School)	42	-	-	-
R4 (Commercial)	52	-	-	-
R5	42	37	52	47
R6	42	37	52	47
R7	42	37	52	47
R8	42	37	52	47
R9	42	37	52	47
R10	42	37	52	47
R11	42	37	52	47
R12	42	37	52	47
R13	42	37	52	47
R14	42	37	52	47
R15	42	37	52	47
R16	42	37	52	47
R17	42	37	52	47
R18	42	37	52	47
R19	42	37	52	47
R20	42	37	52	47
R21	42	37	52	47
R22	42	37	52	47
R23	42	37	52	47
R24	42	37	52	47
R25	42	37	52	47
R26	42	37	52	47
R27	42	37	52	47
R28	42	37	52	47
R29	42	37	52	47
R30	42	37	52	47

Sensitive Receptor	$L_{Aeq, adj, 1hr}$ project noise objective (measured at the receptor) dB(A)		$L_{A1, adj, 1hr}$ project noise objective (measured at the receptor) dB(A)	
	Day and evening[1]	Night[1]	Day and evening[1]	Night[1]
R31	42	37	52	47
R32	42	37	52	47
R33	42	37	52	47
R34	42	37	52	47
R35	42	37	52	47
R36	42	37	52	47
R37	42	37	52	47
R38	42	37	52	47
R39	42	37	52	47
R40	42	37	52	47
R41	42	37	52	47
R42	42	37	52	47
R43	42	37	52	47
R44	42	37	52	47
R45	42	37	52	47
R46	42	37	52	47
R47	42	37	52	47
R48	42	37	52	47
R49	42	37	52	47
R50	42	37	52	47
R51	42	37	52	47
R52	42	37	52	47
R53	42	37	52	47
R54	42	37	52	47
R55	42	37	52	47
R56	42	37	52	47
R57	42	37	52	47
R58	42	37	52	47
R59	42	37	52	47
R60	42	37	52	47
R61	42	37	52	47

Sensitive Receptor	$L_{Aeq, adj, 1hr}$ project noise objective (measured at the receptor) dB(A)		$L_{A1, adj, 1hr}$ project noise objective (measured at the receptor) dB(A)	
	Day and evening[1]	Night[1]	Day and evening[1]	Night[1]
R62	42	37	52	47
R63	42	37	52	47
R64	42	37	52	47
R65	42	37	52	47
R66	42	37	52	47
R67	42	37	52	47
R68	42	37	52	47
R69	42	37	52	47
R70	42	37	52	47
R71	42	37	52	47
R72	42	37	52	47
R73	42	37	52	47
R74	42	37	52	47
R75	42	37	52	47
R76	42	37	52	47
R77	42	37	52	47
R78	42	37	52	47
R79	42	37	52	47
R80	42	37	52	47
R81	42	37	52	47
R82	42	37	52	47
R83	42	37	52	47
R84	42	37	52	47
R85	42	37	52	47
R86	42	37	52	47
R87	42	37	52	47
R88	42	37	52	47
R89	42	37	52	47
R90	42	37	52	47
R91	42	37	52	47
R92	42	37	52	47

Sensitive Receptor	$L_{Aeq, adj, 1hr}$ project noise objective (measured at the receptor) dB(A)		$L_{A1, adj, 1hr}$ project noise objective (measured at the receptor) dB(A)	
	Day and evening[1]	Night[1]	Day and evening[1]	Night[1]
R93	42	37	52	47
R94	42	37	52	47
R95	42	37	52	47
R96	42	37	52	47
R97	42	37	52	47
R98	42	37	52	47
R99	42	37	52	47
R100	42	37	52	47
R101	42	37	52	47
R102	42	37	52	47
R103	42	37	52	47
R104	42	37	52	47
R105	42	37	52	47
R106	42	37	52	47
CWA HALL	52	52	-	-
Manton Cemetery	-	-	-	-

Notes : 1. As per the Noise and Vibration EIS Information Guideline, an outdoor-to-indoor attenuation value of 7 dB, appropriate for typical Queensland buildings with open windows, has been applied to the indoor objectives to determine the outdoor noise objectives for the Project.
2. “-“ no applicable noise objectives for time period or receptor type.

6.3.2 Assessment of background creep

The acoustic quality objectives may not be appropriate noise criteria for the long-term planning assessment of amenity impacts from sources that generate a ‘steady-state’ noise, such as the proposed BESS, at sensitive receptors in locations with low ambient noise levels.

The EPP (Noise) requires background creep of noise in any area to be prevented or minimised where it is reasonable to do so. The EPP (Noise) provides provisions around the management of background noise creep but does not prescribe specific noise criteria to achieve the intent of the policy.

By virtue of the rezoning of the LEIP to a High impact industrial region, it would be unreasonable to maintain the existing acoustic environment, and there is an expectation for the acoustic characteristic of the area to change. In such an instance, protection of existing land use surrounding the Project must be managed through the separate levels of planning controls.

Additionally, the EPP (Noise) allows for the progressive achievement of acoustic quality objectives, whereby in the context of the staged development of this project and subsequent infancy of the operational design of the whole project, progressive achievement and maintenance should be considered.

6.3.3 Annoying characteristics

Where a noise source contains certain characteristics, such as tonality, intermittency, irregularity or dominant low frequency content, there is evidence to suggest that it can cause greater annoyance than other noise at the same noise level.

Annoying characteristics of noise must be prevented in accordance with Qld noise guidelines and regulations. It is noted that Qld guidelines do not provide a prescriptive method for identifying annoying characteristics for low frequency.

Evaluation of annoying characteristics per the NSW EPA NPfI was included in this assessment. Fact Sheet C of the NPfI outlines procedures for assessing annoying characteristics of noise such as tonality (consistent with AS 1055.2018 method 1), intermittency or the low frequency component to determine if correction factors are required to be applied.

These correction factors, also referred to as modifying factors, are applied to predicted or measured noise levels at the assessment location before comparison with relevant noise limits, to account for the additional annoyance caused by these noise characteristics.

6.4 Road traffic noise objectives

The construction and operational road traffic noise objective from the DTMR Transport Noise Management Code of Practice Volume 1 – Road Traffic Noise (2013) at sensitive receptors relevant to the construction and operation of the Project are provided in Table 6.4.

Table 6.4 Road traffic noise criteria at sensitive receptors

Receptors	Receptor type	Road	Criteria
R1, R2, R5 to R106	Residential	Flinders Highway (Townsville-Charter Towers) Jones Road No-Name Road	Upgrading Existing Road – No Roadworks 68 $L_{A10\ (18hr)}$ dB(A) Exposure of Second Row of Buildings 65 $L_{A10\ (18hr)}$ dB(A)
R3	School	Flinders Highway (Townsville-Charter Towers) Jones Road No-Name Road	Upgrading Existing Road – No Roadworks 65 $L_{A10\ (1h)}$
R4, CWA Hall	Commercial	Flinders Highway (Townsville-Charter Towers) No-Name Road Jones Road	Upgrading Existing Road – No Roadworks 65 $L_{A10\ (1h)}$ Exposure of Second Row of Buildings 60 $L_{A10\ (1h)}$
Manton Cemetery	Outdoor recreational area	Flinders Highway (Townsville-Charter Towers) Jones Road No-Name Road	Upgrading existing road – 63 $L_{A10,\ (12Hr)}$

6.5 Cumulative operational noise objectives

EPP (Noise) does not provide noise objectives for assessing or accounting for cumulative impacts. In the absence of specific guidance, the NSW EPA Noise Policy for Industry (NPfI) has been used as a reference.

The NSW EPA (2017) Noise Policy for Industry (NPfI) provides guidelines that accommodate for cumulative impacts and have been employed here to provide some context for total site impacts. The NPfI establishes a criteria for a new development for a receptor impacted by up to four industrial noise sources as the recommended amenity noise level minus 5 dB. This adjustment to the acoustic quality objective has been applied to evaluate the effects of cumulative noise and background creep. As such, the $L_{Aeq,\ adj,1hr}$ limits have been adjusted to consider the cumulative noise impacts on receptors from the development of the Project.

As $L_{A1,\ adj,1hr}$ events occur independently, it is unlikely that these events will occur simultaneously from multiple developments, and as such have not been adjusted for cumulative impacts.

The resultant noise objectives are provided in Table 6.5.

Table 6.5 Cumulative operational noise objectives

Sensitive Receptor	$L_{Aeq,\ adj,1hr}$ project noise objective (measured at the sensitive receptor) dB(A)		$L_{A1,\ adj,1hr}$ project noise objective (measured at the sensitive receptor) dB(A)	
	Day and evening[1]	Night[1]	Day and evening[1]	Night[1]
R1	37	32	52	47
R2	37	32	52	47
R3 (School)	37	-	-	-
R4 (Commercial)	47	-	-	-
R5	37	32	52	47
R6	37	32	52	47
R7	37	32	52	47
R8	37	32	52	47
R9	37	32	52	47
R10	37	32	52	47
R11	37	32	52	47
R12	37	32	52	47
R13	37	32	52	47
R14	37	32	52	47
R15	37	32	52	47
R16	37	32	52	47
R17	37	32	52	47
R18	37	32	52	47
R19	37	32	52	47
R20	37	32	52	47
R21	37	32	52	47
R22	37	32	52	47

Sensitive Receptor	$L_{Aeq, adj,1hr}$ project noise objective (measured at the sensitive receptor) dB(A)		$L_{A1, adj,1hr}$ project noise objective (measured at the sensitive receptor) dB(A)	
	Day and evening[1]	Night[1]	Day and evening[1]	Night[1]
R23	37	32	52	47
R24	37	32	52	47
R25	37	32	52	47
R26	37	32	52	47
R27	37	32	52	47
R28	37	32	52	47
R29	37	32	52	47
R30	37	32	52	47
R31	37	32	52	47
R32	37	32	52	47
R33	37	32	52	47
R34	37	32	52	47
R35	37	32	52	47
R36	37	32	52	47
R37	37	32	52	47
R38	37	32	52	47
R39	37	32	52	47
R40	37	32	52	47
R41	37	32	52	47
R42	37	32	52	47
R43	37	32	52	47
R44	37	32	52	47
R45	37	32	52	47
R46	37	32	52	47
R47	37	32	52	47
R48	37	32	52	47
R49	37	32	52	47
R50	37	32	52	47
R51	37	32	52	47
R52	37	32	52	47
R53	37	32	52	47
R54	37	32	52	47
R55	37	32	52	47
R56	37	32	52	47
R57	37	32	52	47

Sensitive Receptor	$L_{Aeq, adj,1hr}$ project noise objective (measured at the sensitive receptor) dB(A)		$L_{A1, adj,1hr}$ project noise objective (measured at the sensitive receptor) dB(A)	
	Day and evening[1]	Night[1]	Day and evening[1]	Night[1]
R58	37	32	52	47
R59	37	32	52	47
R60	37	32	52	47
R61	37	32	52	47
R62	37	32	52	47
R63	37	32	52	47
R64	37	32	52	47
R65	37	32	52	47
R66	37	32	52	47
R67	37	32	52	47
R68	37	32	52	47
R69	37	32	52	47
R70	37	32	52	47
R71	37	32	52	47
R72	37	32	52	47
R73	37	32	52	47
R74	37	32	52	47
R75	37	32	52	47
R76	37	32	52	47
R77	37	32	52	47
R78	37	32	52	47
R79	37	32	52	47
R80	37	32	52	47
R81	37	32	52	47
R82	37	32	52	47
R83	37	32	52	47
R84	37	32	52	47
R85	37	32	52	47
R86	37	32	52	47
R87	37	32	52	47
R88	37	32	52	47
R89	37	32	52	47
R90	37	32	52	47
R91	37	32	52	47
R92	37	32	52	47

Sensitive Receptor	$L_{Aeq, adj,1hr}$ project noise objective (measured at the sensitive receptor) dB(A)		$L_{A1, adj,1hr}$ project noise objective (measured at the sensitive receptor) dB(A)	
	Day and evening[1]	Night[1]	Day and evening[1]	Night[1]
R93	37	32	52	47
R94	37	32	52	47
R95	37	32	52	47
R96	37	32	52	47
R97	37	32	52	47
R98	37	32	52	47
R99	37	32	52	47
R100	37	32	52	47
R101	37	32	52	47
R102	37	32	52	47
R103	37	32	52	47
R104	37	32	52	47
R105	37	32	52	47
R106	37	32	52	47
CWA HALL	47	-	-	-
Manton Cemetery	-	-	-	-

Notes: 1. As per the Noise and Vibration EIS Information Guideline, an outdoor-to-indoor attenuation value of 7 dB, appropriate for typical Queensland buildings with open windows, has been applied to the indoor objectives to determine the outdoor noise objectives for the Project. In addition, a further correct factor of -5 dB has been applied in accordance with the NPfI (2017) to establishes a criteria for a new development for a receptor impacted by up to four industrial noise sources.

2. "-" no applicable noise objectives for time period or receptor type.

7 Impact assessment

Assessment of the proposed BESS generally follows the guidelines in the DES (2024), Application requirements for activities with noise impacts DES ESR/2015/1838 and the Department of Environment and Resource Management (2020) "Noise Measurement Manual".

Operational and construction noise levels were predicted using a computer-generated model using SoundPLAN 9.1 modelling software and ISO 9613-2 (1996) standards. It considers factors that influence noise propagation such as geometry of the modelled area, sources, receptors, atmospheric absorption, ground effects, topography, and meteorological conditions that enhance noise propagation. The model calculates total noise levels at sensitive receptors from concurrent operation of multiple noise sources.

The model was populated with 3-D topography of the study area and surrounds, extending out past the nearest sensitive receptors. Plant and equipment representing the range of proposed operation scenarios were placed at locations which would represent worst case noise levels throughout the construction and operational scenarios.

7.1 Construction noise

7.1.1 Noise prediction methodology

The construction noise model inputs and assumptions for this assessment are provided in Table 7.1.

Table 7.1 Construction noise modelling parameter

Modelling component	Assumption
Noise model	SoundPLAN version 9.1
Prediction algorithm	ISO 9613-2 (1996)
Terrain	5 m digital elevation model
Modelling period	Typical worst case 1 hour period of operation where each item of equipment is running at full power
Ground absorption coefficient	G = 0.6 for construction zone G = 1 for beyond the construction zone and at receptor locations
Atmospheric absorption	As detailed in Section 7.1.3
Receptor heights	1.5 m above building ground level (ground floor)
Source height	An area source 2 m above ground level. Total sound power located in one point.

7.1.2 Equipment sound power levels

The construction noise impact assessment adopted sound power levels from the EMM database and the UK Department of Environment, Food, and Rural Affairs (DEFRA) for plant and equipment items used for similar works. The proponent has provided an indicative timeline of construction over approximately 18 months. The first six months will be dominated by earthworks, construction of foundational infrastructure, and installation of the first 390 BESS units and 78 PCU's, followed by 12 months of the installation of 780 BESS units and 156 PCU's over two stages. Plant and equipment items, sound power levels and quantities adopted in the noise modelling are summarised in Table 7.2.

Phases have been estimated for the construction of the BESS based on typical scenarios and requirements.

1. Phase 1 is predominately concerned with site establishment including clearing of land and roadworks.

2. Phase 2 concerns the installation of the foundational infrastructure for the BESS units.

3. Phase 3 is concerned with the delivery and installation of the BESS units.

The assumed list of equipment for each phase of construction is representative of a worst-case period of activity for construction of this nature, the plant and equipment quantities may vary from time-to-time to cater for the requirements of the Project's construction. If the actual fleet of plant and equipment required varies significantly from that assumed within Table 7.2, a risk assessment of the proposed works will be undertaken to determine the likelihood of noise impacts on surrounding sensitive receptor locations. Appropriate management and mitigation measures will be used, where required.

Table 7.2 Construction equipment sound power levels

Phase	Equipment	Units	Sound power dB(A)[1]	Overall sound power for Phase dB(A)
Phase 1 – Site establishment and earth works	Bulldozer[2]	2	116	**119**
	Grader[2]	1	105	
	Excavator[3]	2	105	
	Roller[2]	1	103	
	Scraper[2]	1	114	
	Hand tools[3]	2	97	
	Light vehicles[2]	3	103	
Phase 2 – Installation of foundational infrastructure	Bulldozer[2]	2	116	**120**
	Grader[2]	1	105	
	Excavator[3]	2	105	
	Scrapers[2]	1	114	
	Loaders[3]	2	110	
	Dump Trucks[3]	2	110	
	Compactors[3]	1	108	
Phase 3 – Installation of BESS infrastructure	Low loaders[3]	2	107	**110**
	Slew Cranes[3]	1	102	
	Light vehicles[2]	3	103	
	Hand tools[3]	2	97	

Notes: 1. Sound power includes total number of units.
2. Sound power levels are taken from internal EMM database
3. Sound power levels are taken from DEFRA (UK)

i Modifying factor corrections

Construction noise will be characterised by a combination of continuous and intermittent activities. Penalties for intermittent activities have not been accounted for as it is expected for the total noise from construction to be conglomerated and intermittent noise reduced.

To account for annoying characteristics, a 5 dB(A) penalty can be applied to the noise source sound power level for plant items that have special audible characteristics. Plant items and activities that have proven to be particularly annoying to nearby residents include:

- use of 'beeper' style reversing or movement alarms, particularly at night-time
- use of power saws, such as used for cutting timber, rail lines, masonry, road pavement or steel work
- grinding metal, concrete or masonry
- rock drilling
- line drilling
- vibratory rolling
- rail tamping and regulating
- bitumen milling or profiling
- jackhammering, rock hammering or rock breaking
- impact piling.

Since the proposed construction works do not include any of the previously mentioned annoying activities or equipment, no specific plant items have had penalties applied to the sound power levels presented in Table 7.2.

7.1.3 Noise enhancing meteorology

Construction is proposed to occur Monday to Saturday, 6:30am to 6:30pm and has been modelled under ISO 9613-2 (1996).

The noise modelling undertaken considered meteorological conditions as per the methodology of the ISO 9613-2 (1996) standard, with a temperature of 18 degrees Celsius and 78% humidity (2024 annual average winter weather data obtained from Mount Stuart BOM AWS), a temperature inversion and the following wind conditions as per the adverse meteorological assumptions of ISO 9613:

Downwind propagation conditions for the method specified in this part of ISO 9613 are as specified in section 5 of ISO 1996-2:1996, namely

- *Wind direction within an angle of + 45^0 of the direction connecting the centre of the dominant sound source and the centre of the specified receiver region, with the wind blowing from source to receiver, and*
- *Wind speed between approximately 1m/s and 5m/s, measured at a height of 3m to 11m above the ground.*
- *These formulae also hold, equivalently, for average propagation under a well-developed moderate ground-based temperature inversion, such as commonly occurs on clear, calm nights.*

As such, given the above adverse meteorological assumptions, it is considered that the noise modelling represents the resultant noise levels of the proposed development during noise propagation enhancing meteorological conditions.

7.1.4 Construction noise prediction results

Construction noise has been modelled using the equipment and phases outlined in Section 7.1. Construction noise is modelled at the worst-case position for each receptor. Predicted levels for each receptor are presented in Table 7.3 with exceedances of the noise objectives shown in red and bold. Construction noise contour maps are provided in Attachment D.

Results presented in Table 7.3 indicate:

- Phase 1 construction predicted noise levels are compliant with project noise objectives at the majority of sensitive receptors. However, a negligible exceedance of 2 dB(A) is predicted at receptor locations R11, R12, and R79, respectively.
- Phase 2 construction noise levels are predicted to comply with project noise objectives at the majority sensitive receptors. However, a marginal exceedance of 4 dB(A) and 3 dB(A) are predicted at receptor locations R11 and R12 respectively; a marginal exceedance of 3 dB(A) is predicted at receptor R79; and a negligible exceedance of 1 dB(A) is predicted at receptor R78.
- Phase 3 construction predicted noise levels are compliant with project noise objectives at all sensitive receptors.
- Reasonable and feasible mitigation strategies to minimise construction noise impacts are presented in Section 8.1.

It should be noted, although not applicable to building work / construction noise, the EPP (Noise) acoustic quality objectives for dwellings, have been applied in this assessment for the purpose of screening potential noise amenity impacts and identifying the need for non-standard noise management measures. The construction acoustic quality objectives are not mandatory and are used solely for noise management purposes.

Table 7.3 Noise prediction from construction activities associated with Package 1

Receptor	Receptor type	Acoustic Quality Objective ($L_{Aeq, adj, 1hr}$)	Predicted results $L_{Aeq,1Hr}$ dB(A)			Compliance?		
			Phase 1	Phase 2	Phase 3	Phase 1	Phase 2	Phase 3
R1	Residential	42	<25	<25	<25	Yes	Yes	Yes
R2	Residential	42	25	28	<25	Yes	Yes	Yes
R3	School	42	<25	<25	<25	Yes	Yes	Yes
R4	Commercial	52	<25	25	<25	Yes	Yes	Yes
R5	Residential	42	<25	25	<25	Yes	Yes	Yes
R6	Residential	42	30	32	<25	Yes	Yes	Yes
R7	Residential	42	33	34	25	Yes	Yes	Yes
R8	Residential	42	28	30	<25	Yes	Yes	Yes
R9	Residential	42	29	31	<25	Yes	Yes	Yes

Receptor	Receptor type	Acoustic Quality Objective ($L_{Aeq, adj, 1hr}$)	Predicted results $L_{Aeq,1Hr}$ dB(A)			Compliance?		
			Phase 1	Phase 2	Phase 3	Phase 1	Phase 2	Phase 3
R10	Residential	42	37	39	28	Yes	Yes	Yes
R11	Residential	42	**44**	**46**	35	**No**	**No**	Yes
R12	Residential	42	**44**	**45**	34	**No**	**No**	Yes
R13	Residential	42	<25	<25	<25	Yes	Yes	Yes
R14	Residential	42	<25	<25	<25	Yes	Yes	Yes
R15	Residential	42	<25	<25	<25	Yes	Yes	Yes
R16	Residential	42	<25	<25	<25	Yes	Yes	Yes
R17	Residential	42	<25	<25	<25	Yes	Yes	Yes
R18	Residential	42	<25	<25	<25	Yes	Yes	Yes
R19	Residential	42	<25	<25	<25	Yes	Yes	Yes
R20	Residential	42	<25	<25	<25	Yes	Yes	Yes
R21	Residential	42	<25	<25	<25	Yes	Yes	Yes
R22	Residential	42	<25	<25	<25	Yes	Yes	Yes
R23	Residential	42	<25	<25	<25	Yes	Yes	Yes
R24	Residential	42	<25	<25	<25	Yes	Yes	Yes
R25	Residential	42	<25	<25	<25	Yes	Yes	Yes
R26	Residential	42	<25	<25	<25	Yes	Yes	Yes
R27	Residential	42	<25	<25	<25	Yes	Yes	Yes
R28	Residential	42	<25	<25	<25	Yes	Yes	Yes
R29	Residential	42	<25	<25	<25	Yes	Yes	Yes
R30	Residential	42	<25	<25	<25	Yes	Yes	Yes
R31	Residential	42	<25	<25	<25	Yes	Yes	Yes
R32	Residential	42	<25	<25	<25	Yes	Yes	Yes
R33	Residential	42	<25	<25	<25	Yes	Yes	Yes
R34	Residential	42	<25	<25	<25	Yes	Yes	Yes
R35	Residential	42	<25	<25	<25	Yes	Yes	Yes
R36	Residential	42	<25	<25	<25	Yes	Yes	Yes
R37	Residential	42	<25	<25	<25	Yes	Yes	Yes
R38	Residential	42	<25	<25	<25	Yes	Yes	Yes
R39	Residential	42	<25	<25	<25	Yes	Yes	Yes
R40	Residential	42	<25	<25	<25	Yes	Yes	Yes

Receptor	Receptor type	Acoustic Quality Objective ($L_{Aeq, adj, 1hr}$)	Predicted results $L_{Aeq,1Hr}$ dB(A)			Compliance?		
			Phase 1	Phase 2	Phase 3	Phase 1	Phase 2	Phase 3
R41	Residential	42	<25	<25	<25	Yes	Yes	Yes
R42	Residential	42	<25	<25	<25	Yes	Yes	Yes
R43	Residential	42	<25	<25	<25	Yes	Yes	Yes
R44	Residential	42	<25	<25	<25	Yes	Yes	Yes
R45	Residential	42	<25	<25	<25	Yes	Yes	Yes
R46	Residential	42	<25	<25	<25	Yes	Yes	Yes
R47	Residential	42	<25	<25	<25	Yes	Yes	Yes
R48	Residential	42	<25	<25	<25	Yes	Yes	Yes
R49	Residential	42	<25	<25	<25	Yes	Yes	Yes
R50	Residential	42	<25	<25	<25	Yes	Yes	Yes
R51	Residential	42	<25	<25	<25	Yes	Yes	Yes
R52	Residential	42	<25	<25	<25	Yes	Yes	Yes
R53	Residential	42	<25	<25	<25	Yes	Yes	Yes
R54	Residential	42	<25	<25	<25	Yes	Yes	Yes
R55	Residential	42	31	33	<25	Yes	Yes	Yes
R56	Residential	42	28	30	<25	Yes	Yes	Yes
R57	Residential	42	26	28	<25	Yes	Yes	Yes
R58	Residential	42	25	27	<25	Yes	Yes	Yes
R59	Residential	42	<25	<25	<25	Yes	Yes	Yes
R60	Residential	42	27	29	<25	Yes	Yes	Yes
R61	Residential	42	<25	27	<25	Yes	Yes	Yes
R62	Residential	42	<25	26	<25	Yes	Yes	Yes
R63	Residential	42	<25	25	<25	Yes	Yes	Yes
R64	Residential	42	<25	<25	<25	Yes	Yes	Yes
R65	Residential	42	<25	<25	<25	Yes	Yes	Yes
R66	Residential	42	<25	<25	<25	Yes	Yes	Yes
R67	Residential	42	<25	25	<25	Yes	Yes	Yes
R68	Residential	42	<25	<25	<25	Yes	Yes	Yes
R69	Residential	42	<25	<25	<25	Yes	Yes	Yes
R70	Residential	42	<25	26	<25	Yes	Yes	Yes
R71	Residential	42	<25	25	<25	Yes	Yes	Yes

Receptor	Receptor type	Acoustic Quality Objective ($L_{Aeq, adj, 1hr}$)	Predicted results $L_{Aeq,1Hr}$ dB(A)			Compliance?		
			Phase 1	Phase 2	Phase 3	Phase 1	Phase 2	Phase 3
R72	Residential	42	25	27	<25	Yes	Yes	Yes
R73	Residential	42	27	29	<25	Yes	Yes	Yes
R74	Residential	42	28	30	<25	Yes	Yes	Yes
R75	Residential	42	31	33	<25	Yes	Yes	Yes
R76	Residential	42	35	36	26	Yes	Yes	Yes
R77	Residential	42	39	40	30	Yes	Yes	Yes
R78	Residential	42	42	**43**	32	Yes	**No**	Yes
R79	Residential	42	**44**	**45**	34	**No**	**No**	Yes
R80	Residential	42	36	38	28	Yes	Yes	Yes
R81	Residential	42	32	34	<25	Yes	Yes	Yes
R82	Residential	42	27	29	<25	Yes	Yes	Yes
R83	Residential	42	26	28	<25	Yes	Yes	Yes
R84	Residential	42	26	28	<25	Yes	Yes	Yes
R85	Residential	42	25	28	<25	Yes	Yes	Yes
R86	Residential	42	<25	26	<25	Yes	Yes	Yes
R87	Residential	42	<25	<25	<25	Yes	Yes	Yes
R88	Residential	42	<25	<25	<25	Yes	Yes	Yes
R89	Residential	42	<25	<25	<25	Yes	Yes	Yes
R90	Residential	42	<25	<25	<25	Yes	Yes	Yes
R91	Residential	42	<25	<25	<25	Yes	Yes	Yes
R92	Residential	42	<25	25	<25	Yes	Yes	Yes
R93	Residential	42	<25	26	<25	Yes	Yes	Yes
R94	Residential	42	25	27	<25	Yes	Yes	Yes
R95	Residential	42	26	29	<25	Yes	Yes	Yes
R96	Residential	42	28	31	<25	Yes	Yes	Yes
R97	Residential	42	30	32	<25	Yes	Yes	Yes
R98	Residential	42	25	27	<25	Yes	Yes	Yes
R99	Residential	42	<25	26	<25	Yes	Yes	Yes
R100	Residential	42	<25	<25	<25	Yes	Yes	Yes
R101	Residential	42	<25	<25	<25	Yes	Yes	Yes
R102	Residential	42	<25	<25	<25	Yes	Yes	Yes

Receptor	Receptor type	Acoustic Quality Objective ($L_{Aeq, adj, 1hr}$)	Predicted results $L_{Aeq,1Hr}$ dB(A)			Compliance?		
			Phase 1	Phase 2	Phase 3	Phase 1	Phase 2	Phase 3
R103	Residential	42	<25	<25	<25	Yes	Yes	Yes
R104	Residential	42	<25	<25	<25	Yes	Yes	Yes
R105	Residential	42	<25	<25	<25	Yes	Yes	Yes
R106	Residential	42	<25	<25	<25	Yes	Yes	Yes
CWA HALL	CWA HALL	52	<25	<25	<25	Yes	Yes	Yes
Manton Cemetery	Manton Cemetery	-	30	32	<25	N/A	N/A	N/A

7.2 Operational noise

Operational noise associated with Package 1 of the Project will principally be from fixed plant and equipment including battery cubicles, PCUs, and High Voltage (HV) transformers.

7.2.1 Noise prediction methodology

The operational noise model inputs and assumptions for this assessment are provided in Table 7.4.

Table 7.4 Operational noise modelling parameter

Modelling component	Assumption
Noise model	SoundPLAN version 9.1
Prediction algorithm	ISO 9613-2 (1996)
Terrain	5 m digital elevation model
Modelling period	Typical worst case 1 hour period of operation where each item of equipment is running at full power
Ground absorption coefficient	G = 0.3 for BESS site G = 0.6 for project boundary G = 1 for outside of the Project site at receptor locations
Atmospheric absorption	As detailed in Section 7.2.3
Receptor heights	1.5 m above building ground level (ground floor)
Source heights	BESS units constructed as industrial buildings 2.89 m above ground level. All BESS units modelled as individual industrial buildings taking into account directionality PCU units constructed as point sources 2.89 m above ground level. Transformers constructed as point sources 7 m above ground level.
All three nodes (1170 BESS units +234 inverters) All BESS duty load	All operating simultaneously 100%

7.2.2 Equipment specifications

Noise impacts from the operation of the Project were considered at the sensitive receptors outlined in Table 3.1. The specific design of noise-generating infrastructure of the BESS will consider the distance to nearby sensitive receptors. Where practicable, this design will minimise operational noise impacts from the Project.

The operation of the BESS at a 780 MW capacity requires 1170 BESS container units, 234 PCUs, and 3 high voltage (HV) transformers, with sound power data being provided by the client in third- and single-octave bands. It is expected the BESS will operate at 100% utilisation including the concurrent operation of batteries, PCUs, and transformers and has been modelled at 100% load. The specific sound power levels are outlined in Table 7.5. Third- and single-octave data can be found in Attachment C.

Solquartz has advised that data for the proposed 8-hour BESS units for the site are still in the development phase. Preliminary sound power data for these units has been provided but it has been noted that additional testing data will be available in early 2026. It is expected that the additional sound power data will not change significantly than that modelled, and Solquartz is confident that the proposed units with mitigation (as required) will meet the relevant criteria.

Table 7.5 Operational noise source sound power levels

Noise Source	No. of units	Sound power level, dB(A)	
		Single	Combined Total
BESS Units (silenced)[1]	1170	81	111
PCUs[1]	234	83	107
HV Transformer[2]	3	97	102

Notes: 1. Sound power spectrum data provided by Solquartz.

2. Sound power spectrum data sourced from EMM internal database.

7.2.3 Transmission line operational noise

Modelling was not performed for the transmission line, as it was assumed that the only noise generated by the proposed line would be due to the corona effect. This noise is characterised by a low-frequency tone accompanied by crackling or buzzing, and typically worsens under adverse weather conditions such as rain, fog, and high humidity. Reported noise levels under these conditions are of the order of L_{Aeq} 50–54 dB(A) at a distance of 15 m from a 400 kV transmission line (Engel & Wszolek 1995). Historical data for the project region indicate relative humidity peaked at 99% during the 2024 calendar year and averaged 78%. Corona noise should therefore be considered under worst-case conditions.

Under good weather conditions, transmission line noise usually fluctuates within the range of L_{Aeq} 34–36 dB(A) at 15 m from a 400 kV line. However, local variations can occur, with levels sometimes reaching L_{Aeq}45 dB(A) at 15 m (Engel & Wszolek 1995).

The potential noise level will be significantly attenuated with distance. The closest sensitive residential receptor to the proposed transmission line is 1,472 m away. Based on the worst-case corona noise levels (L_{Aeq} 50–54 dB(A)) and transmission line noise under normal conditions (L_{Aeq} 45 dB(A)) at 15 m, a distance calculation (notwithstanding additional attenuation factors) was applied from the noisiest point-source 'bundles' of the transmission lines and generated the following:

- Corona noise levels L_{Aeq} <25 dB(A) at the nearest sensitive receiver under worst-case conditions, and
- Transmission line noise levels L_{Aeq} <25 dB(A) at the nearest sensitive receiver under normal conditions.

Therefore, at all nearby sensitive residential receptor locations, noise levels due to the corona effect are predicted to remain well below both day/evening and night-time acoustic quality objectives. Corona noise contributions would be considered negligible in relation to total site noise levels.

It is noted that the predicted corona noise levels were based on a 400 kV transmission line, which is a higher voltage than the proposed 275 kV lines. Corona noise can also vary with the age of the transmission lines, dust build-up over time, and the material design of the lines. The basis of this assessment has therefore been conservative, and corona noise impacts at sensitive receptors are expected to be lower than predicted.

7.2.4 Noise enhancing meteorology

The noise modelling undertaken considered meteorological conditions as per the methodology of the ISO 9613 (1996) standard, with a temperature of 18 degrees Celsius and 78% humidity (2024 annual average winter weather data obtained from Mount Stuart BOM AWS), a temperature inversion and the following wind conditions as per the adverse meteorological assumptions of ISO 9613:

Downwind propagation conditions for the method specified in this part of ISO 9613 are as specified in section 5 of ISO 1996-2:1996, namely

- *Wind direction within an angle of + 45^0 of the direction connecting the centre of the dominant sound source and the centre of the specified receiver region, with the wind blowing from source to receiver, and*

- *Wind speed between approximately 1m/s and 5m/s, measured at a height of 3m to 11m above the ground.*

These formulae also hold, equivalently, for average propagation under a well-developed moderate ground-based temperature inversion, such as commonly occurs on clear, calm nights.

As such, given the above adverse meteorological assumptions, it is considered that the noise modelling represents the resultant noise levels of the proposed development during noise propagation enhancing meteorological conditions.

7.2.5 Operational noise prediction results

Concurrent operations of the BESS are modelled at the worst-case position for each receptor. Individual results for each receptor are presented in Table 7.6. The operational noise contour maps are provided in Attachment D.

The BESS and its associated infrastructure are characterised by a steady-state noise source and are unexpected to have loud, instantaneous noise events. As such, results have only been established for a 1-hour period and the L_{A1} has been assumed to be equivalent to the L_{Aeq}. Predictions highlighted in red and bolded indicate sensitive receptors where the acoustic quality objectives have been exceeded.

Results presented in Table 7.6 indicate:

- operational BESS predicted noise levels are compliant with the project noise objectives during all periods at all sensitive receptors.

- reasonable and feasible mitigation strategies to minimise operational noise impacts are presented in Section 8.2.

Table 7.6 Noise prediction from operational activities associated with Package 1

Receptor	Receptor Type	Acoustic Quality Objectives $L_{Aeq, adj, 1hr}$ dB(A)		Predicted noise levels $L_{Aeq, adj, 1hr}$ dB(A)	Annoying characteristics trigger		Compliance?	
		Day/evening	Night		Tonal?	Low Frequency?	Day/evening	Night
R1	Residential	42	37	<25	No	No	Yes	Yes
R2	Residential	42	37	<25	No	No	Yes	Yes
R3	School	42	-	<25	No	No	Yes	Yes
R4	Commercial	52	52	<25	No	No	Yes	Yes
R5	Residential	42	37	<25	No	No	Yes	Yes
R6	Residential	42	37	<25	No	No	Yes	Yes
R7	Residential	42	37	<25	No	No	Yes	Yes
R8	Residential	42	37	<25	No	No	Yes	Yes
R9	Residential	42	37	<25	No	No	Yes	Yes
R10	Residential	42	37	27	No	No	Yes	Yes
R11	Residential	42	37	31	No	No	Yes	Yes
R12	Residential	42	37	30	No	No	Yes	Yes
R13	Residential	42	37	<25	No	No	Yes	Yes
R14	Residential	42	37	<25	No	No	Yes	Yes
R15	Residential	42	37	<25	No	No	Yes	Yes
R16	Residential	42	37	<25	No	No	Yes	Yes
R17	Residential	42	37	<25	No	No	Yes	Yes
R18	Residential	42	37	<25	No	No	Yes	Yes
R19	Residential	42	37	<25	No	No	Yes	Yes
R20	Residential	42	37	<25	No	No	Yes	Yes
R21	Residential	42	37	<25	No	No	Yes	Yes
R22	Residential	42	37	<25	No	No	Yes	Yes
R23	Residential	42	37	<25	No	No	Yes	Yes
R24	Residential	42	37	<25	No	No	Yes	Yes
R25	Residential	42	37	<25	No	No	Yes	Yes
R26	Residential	42	37	<25	No	No	Yes	Yes
R27	Residential	42	37	<25	No	No	Yes	Yes
R28	Residential	42	37	<25	No	No	Yes	Yes
R29	Residential	42	37	<25	No	No	Yes	Yes
R30	Residential	42	37	<25	No	No	Yes	Yes

Receptor	Receptor Type	Acoustic Quality Objectives $L_{Aeq, adj, 1hr}$ dB(A)		Predicted noise levels $L_{Aeq, adj, 1hr}$ dB(A)	Annoying characteristics trigger		Compliance?	
		Day/evening	Night		Tonal?	Low Frequency?	Day/evening	Night
R31	Residential	42	37	<25	No	No	Yes	Yes
R32	Residential	42	37	<25	No	No	Yes	Yes
R33	Residential	42	37	<25	No	No	Yes	Yes
R34	Residential	42	37	<25	No	No	Yes	Yes
R35	Residential	42	37	<25	No	No	Yes	Yes
R36	Residential	42	37	<25	No	No	Yes	Yes
R37	Residential	42	37	<25	No	No	Yes	Yes
R38	Residential	42	37	<25	No	No	Yes	Yes
R39	Residential	42	37	<25	No	No	Yes	Yes
R40	Residential	42	37	<25	No	No	Yes	Yes
R41	Residential	42	37	<25	No	No	Yes	Yes
R42	Residential	42	37	<25	No	No	Yes	Yes
R43	Residential	42	37	<25	No	No	Yes	Yes
R44	Residential	42	37	<25	No	No	Yes	Yes
R45	Residential	42	37	<25	No	No	Yes	Yes
R46	Residential	42	37	<25	No	No	Yes	Yes
R47	Residential	42	37	<25	No	No	Yes	Yes
R48	Residential	42	37	<25	No	No	Yes	Yes
R49	Residential	42	37	<25	No	No	Yes	Yes
R50	Residential	42	37	<25	No	No	Yes	Yes
R51	Residential	42	37	<25	No	No	Yes	Yes
R52	Residential	42	37	<25	No	No	Yes	Yes
R53	Residential	42	37	<25	No	No	Yes	Yes
R54	Residential	42	37	<25	No	No	Yes	Yes
R55	Residential	42	37	<25	No	No	Yes	Yes
R56	Residential	42	37	<25	No	No	Yes	Yes
R57	Residential	42	37	<25	No	No	Yes	Yes
R58	Residential	42	37	<25	No	No	Yes	Yes
R59	Residential	42	37	<25	No	No	Yes	Yes
R60	Residential	42	37	<25	No	No	Yes	Yes
R61	Residential	42	37	<25	No	No	Yes	Yes

Receptor	Receptor Type	Acoustic Quality Objectives $L_{Aeq, adj, 1hr}$ dB(A)		Predicted noise levels $L_{Aeq, adj, 1hr}$ dB(A)	Annoying characteristics trigger		Compliance?	
		Day/evening	Night		Tonal?	Low Frequency?	Day/evening	Night
R62	Residential	42	37	<25	No	No	Yes	Yes
R63	Residential	42	37	<25	No	No	Yes	Yes
R64	Residential	42	37	<25	No	No	Yes	Yes
R65	Residential	42	37	<25	No	No	Yes	Yes
R66	Residential	42	37	<25	No	No	Yes	Yes
R67	Residential	42	37	<25	No	No	Yes	Yes
R68	Residential	42	37	<25	No	No	Yes	Yes
R69	Residential	42	37	<25	No	No	Yes	Yes
R70	Residential	42	37	<25	No	No	Yes	Yes
R71	Residential	42	37	<25	No	No	Yes	Yes
R72	Residential	42	37	<25	No	No	Yes	Yes
R73	Residential	42	37	<25	No	No	Yes	Yes
R74	Residential	42	37	<25	No	No	Yes	Yes
R75	Residential	42	37	<25	No	No	Yes	Yes
R76	Residential	42	37	<25	No	No	Yes	Yes
R77	Residential	42	37	28	No	No	Yes	Yes
R78	Residential	42	37	29	No	No	Yes	Yes
R79	Residential	42	37	30	No	No	Yes	Yes
R80	Residential	42	37	26	No	No	Yes	Yes
R81	Residential	42	37	<25	No	No	Yes	Yes
R82	Residential	42	37	<25	No	No	Yes	Yes
R83	Residential	42	37	<25	No	No	Yes	Yes
R84	Residential	42	37	<25	No	No	Yes	Yes
R85	Residential	42	37	<25	No	No	Yes	Yes
R86	Residential	42	37	<25	No	No	Yes	Yes
R87	Residential	42	37	<25	No	No	Yes	Yes
R88	Residential	42	37	<25	No	No	Yes	Yes
R89	Residential	42	37	<25	No	No	Yes	Yes
R90	Residential	42	37	<25	No	No	Yes	Yes
R91	Residential	42	37	<25	No	No	Yes	Yes
R92	Residential	42	37	<25	No	No	Yes	Yes

Receptor	Receptor Type	Acoustic Quality Objectives $L_{Aeq, adj, 1hr}$ dB(A)		Predicted noise levels $L_{Aeq, adj, 1hr}$ dB(A)	Annoying characteristics trigger		Compliance?	
		Day/evening	Night		Tonal?	Low Frequency?	Day/evening	Night
R93	Residential	42	37	<25	No	No	Yes	Yes
R94	Residential	42	37	<25	No	No	Yes	Yes
R95	Residential	42	37	<25	No	No	Yes	Yes
R96	Residential	42	37	<25	No	No	Yes	Yes
R97	Residential	42	37	<25	No	No	Yes	Yes
R98	Residential	42	37	<25	No	No	Yes	Yes
R99	Residential	42	37	<25	No	No	Yes	Yes
R100	Residential	42	37	<25	No	No	Yes	Yes
R101	Residential	42	37	<25	No	No	Yes	Yes
R102	Residential	42	37	<25	No	No	Yes	Yes
R103	Residential	42	37	<25	No	No	Yes	Yes
R104	Residential	42	37	<25	No	No	Yes	Yes
R105	Residential	42	37	<25	No	No	Yes	Yes
R106	Residential	42	37	<25	No	No	Yes	Yes
CWA HALL	Commercial	52	52	<25	No	No	Yes	Yes
Manton Cemetery	Park/Garden	-	-	<25	No	No	Yes	Yes

Notes: 1. As per the Noise and Vibration EIS Information Guideline, an outdoor-to-indoor attenuation value of 7 dB, appropriate for typical Queensland buildings with open windows, has been applied to the indoor objectives to determine the outdoor noise objectives for the Project.

2. "-" no applicable noise objectives for time period or receptor type.

The operational noise prediction results presented in Table 7.6 were analysed for annoying characteristics such as tonality and low frequency. The assessment was in line with the guidelines set out in the NPfI in the absence of Queensland specific guidance. Operational noise was determined to have no low frequency annoying characteristics and tonality was not identified at any sensitive receptor location.

The 1/3 octave noise prediction results for each receptor location are presented in Attachment E.

7.3 Road traffic noise

Road traffic noise predictions were carried out using the UK Department of Transport, Calculation of Road Traffic Noise (CoRTN 1988) algorithms incorporated in the SoundPLAN (Version 9.1) noise modelling software. The modelling allows for traffic volume and mix, type of road surface, vehicle speed, road gradient, reflections off building surfaces, ground absorption and shielding from ground topography and physical barriers.

7.3.1 Noise prediction methodology

The construction and operational noise model inputs and assumptions for this assessment are provided in Table 7.7.

Table 7.7 Road traffic noise modelling parameters

Modelling component	Assumption
Noise model	SoundPLAN 9.1
Prediction algorithm	CoRTN
Terrain	5 m digital elevation model
Traffic parameters	As detailed in Section 7.3.2
Road Surface	Flinders Highway: Modelling has assumed a pavement surface of dense grade asphalt indicating a correction factor of 0 dB(A) to be applied to all modelling scenarios Local no name road: +4 dB unsealed roads Jones Road: +4 dB(A) chip sealed
Ground Absorption	G = 0.3 for BESS site G = 0.6 for project boundary G = 1 for outside of the Project site at receptor locations
Correction to CoRTN for Australian Conditions	-1.7 dB(A) CoRTN correction for Australian conditions (for facade corrected receiver points located within 1 metre of a receiver building)
Façade correction	+ 2.5 dB(A)
Receiver Height	1.5 m above ground level
Road source height	0.5 m above pavement level

7.3.2 Traffic volumes

Road traffic movements with construction and operation of the Project have been referenced from the Traffic Impact Assessment (EMM 2025) and adapted to suit DMTR assessment requirements.

Construction workforce vehicles are anticipated to originate primarily from regional centres Woodstock and Townsville, Qld. They are expected to travel to the development along Flinders Highway and arrive prior to, and leave post, each construction shift. The following peak construction vehicle movements are anticipated to occur in month 11 of the construction phase. Vehicle movements are characterised by:

- up to 93 light vehicles per day (93 in and 93 out) during the construction phase; and
- up to 10 heavy vehicles per day (10 in and 10 out) during the construction works phase.

The operational workforce will comprise 1-2 people. The construction activities thus provide a worst-case scenario for road traffic impacts from the development site and as such, operational activity has not been modelled.

The traffic volume data that has been used in the assessment of road traffic by the Project is summarised in Table 7.8.

Table 7.8 Traffic data adjacent to project

Scenario	Road segment/name	Sign posted Speed (km/h)	AADT	Heavy vehicles %	18 Hours (6:00 am to 12:00 pm)		
					Total	Light vehicles	Heavy vehicles
Existing (2023)	14A - Flinders Highway (Townsville-Charter Towers)	110	2570	27	2416	1763.7	652.3
	Jones Road	100	45	13	450	391.5	58.5
	Local Road (No-name)	50	-	-	-	-	-
Existing (2023) + construction	14A - Flinders Highway (Townsville-Charter Towers)	110	2776	26	2622	1940.3	681.7
	Jones Road	100	251	13	580	504.6	75.4
	Local Road (No-name)	50	206	10	206	185.4	20.6

Notes: 1. 18 hour traffic volumes assumed to equal to AADT x 94%

2. AADT traffic volumes assumed to equal peak hourly x 10.

7.3.3 Traffic noise prediction results

Road traffic noise levels from the Project have been assessed by calculating existing and existing plus Project traffic at sensitive receptors using the CoRTN method.

The results of road traffic noise calculations are provided in Table 7.9. The road traffic noise contour maps are provided in Attachment D.

Table 7.9 Road traffic noise prediction from construction activities associated with Package 1

Receptor	Receptor Type	Noise prediction, $L_{10, 18hr}$ dB(A)		Noise prediction, $L_{10, 1hr}$ dB(A)		Noise Criteria			Compliance?		
		Without Construction	With Construction	Without Construction	With Construction	$L_{10, 18hr}$ dB(A)	$L_{10, 1hr}$ dB(A)	$L_{10, 12hr}$ dB(A)	$L_{10, 18hr}$ dB(A)	$L_{10, 1hr}$ dB(A)	$L_{10, 12hr}$ dB(A)
R1	Residential	35	38	38	40	68	-	-	Yes	N/A	N/A
R2	Residential	37	39	39	40	68	-	-	Yes	N/A	N/A
R3	School	43	44	45	46	-	65	-	N/A	Yes	N/A
R4	Commercial	42	43	44	44	-	65	-	N/A	Yes	N/A
R5	Residential	32	33	34	35	68	-	-	Yes	N/A	N/A
R6	Residential	34	35	35	36	68	-	-	Yes	N/A	N/A
R7	Residential	34	35	35	36	68	-	-	Yes	N/A	N/A
R8	Residential	30	31	32	33	68	-	-	Yes	N/A	N/A
R9	Residential	26	27	27	29	68	-	-	Yes	N/A	N/A
R10	Residential	31	33	33	34	68	-	-	Yes	N/A	N/A
R11	Residential	27	30	28	31	68	-	-	Yes	N/A	N/A
R12	Residential	29	31	31	32	68	-	-	Yes	N/A	N/A
R13	Residential	<25	<25	<25	<25	68	-	-	Yes	N/A	N/A
R14	Residential	32	33	34	35	68	-	-	Yes	N/A	N/A
R15	Residential	33	35	36	37	68	-	-	Yes	N/A	N/A
R16	Residential	43	44	45	46	68	-	-	Yes	N/A	N/A
R17	Residential	45	45	47	47	68	-	-	Yes	N/A	N/A

Receptor	Receptor Type	Noise prediction, $L_{10, 18hr}$ dB(A)		Noise prediction, $L_{10, 1hr}$ dB(A)		Noise Criteria			Compliance?		
		Without Construction	With Construction	Without Construction	With Construction	$L_{10, 18hr}$ dB(A)	$L_{10, 1hr}$ dB(A)	$L_{10, 12hr}$ dB(A)	$L_{10, 18hr}$ dB(A)	$L_{10, 1hr}$ dB(A)	$L_{10, 12hr}$ dB(A)
R18	Residential	45	45	46	47	68	-	-	Yes	N/A	N/A
R19	Residential	54	54	55	55	68	-	-	Yes	N/A	N/A
R20	Residential	50	51	52	52	68	-	-	Yes	N/A	N/A
R21	Residential	48	49	50	50	68	-	-	Yes	N/A	N/A
R22	Residential	48	48	49	49	68	-	-	Yes	N/A	N/A
R23	Residential	49	49	50	50	68	-	-	Yes	N/A	N/A
R24	Residential	47	47	48	49	68	-	-	Yes	N/A	N/A
R25	Residential	46	46	47	48	68	-	-	Yes	N/A	N/A
R26	Residential	45	45	46	47	68	-	-	Yes	N/A	N/A
R27	Residential	42	42	43	44	68	-	-	Yes	N/A	N/A
R28	Residential	36	37	38	38	68	-	-	Yes	N/A	N/A
R29	Residential	37	38	39	40	68	-	-	Yes	N/A	N/A
R30	Residential	46	47	48	48	68	-	-	Yes	N/A	N/A
R31	Residential	58	59	60	60	68	-	-	Yes	N/A	N/A
R32	Residential	53	53	55	55	68	-	-	Yes	N/A	N/A
R33	Residential	54	54	55	56	68	-	-	Yes	N/A	N/A
R34	Residential	53	54	55	55	68	-	-	Yes	N/A	N/A
R35	Residential	60	60	61	62	68	-	-	Yes	N/A	N/A
R36	Residential	58	58	59	60	68	-	-	Yes	N/A	N/A

Receptor	Receptor Type	Noise prediction, $L_{10, 18hr}$ dB(A)		Noise prediction, $L_{10, 1hr}$ dB(A)		Noise Criteria			Compliance?		
		Without Construction	With Construction	Without Construction	With Construction	$L_{10, 18hr}$ dB(A)	$L_{10, 1hr}$ dB(A)	$L_{10, 12hr}$ dB(A)	$L_{10, 18hr}$ dB(A)	$L_{10, 1hr}$ dB(A)	$L_{10, 12hr}$ dB(A)
R37	Residential	45	46	47	47	68	-	-	Yes	N/A	N/A
R38	Residential	46	47	48	49	68	-	-	Yes	N/A	N/A
R39	Residential	47	49	50	51	68	-	-	Yes	N/A	N/A
R40	Residential	53	55	56	58	68	-	-	Yes	N/A	N/A
R41	Residential	54	55	56	57	68	-	-	Yes	N/A	N/A
R42	Residential	55	56	57	58	68	-	-	Yes	N/A	N/A
R43	Residential	49	50	51	52	68	-	-	Yes	N/A	N/A
R44	Residential	48	48	50	51	68	-	-	Yes	N/A	N/A
R45	Residential	47	48	49	50	68	-	-	Yes	N/A	N/A
R46	Residential	48	49	51	52	68	-	-	Yes	N/A	N/A
R47	Residential	53	54	55	56	68	-	-	Yes	N/A	N/A
R48	Residential	45	46	47	48	68	-	-	Yes	N/A	N/A
R49	Residential	41	41	43	44	68	-	-	Yes	N/A	N/A
R50	Residential	37	38	39	40	68	-	-	Yes	N/A	N/A
R51	Residential	37	37	39	39	68	-	-	Yes	N/A	N/A
R52	Residential	31	32	33	33	68	-	-	Yes	N/A	N/A
R53	Residential	29	30	31	32	68	-	-	Yes	N/A	N/A
R54	Residential	31	32	32	33	68	-	-	Yes	N/A	N/A
R55	Residential	27	29	28	31	68	-	-	Yes	N/A	N/A

Receptor	Receptor Type	Noise prediction, $L_{10,\ 18hr}$ dB(A)		Noise prediction, $L_{10,\ 1hr}$ dB(A)		Noise Criteria			Compliance?		
		Without Construction	With Construction	Without Construction	With Construction	$L_{10,\ 18hr}$ dB(A)	$L_{10,\ 1hr}$ dB(A)	$L_{10,\ 12hr}$ dB(A)	$L_{10,\ 18hr}$ dB(A)	$L_{10,\ 1hr}$ dB(A)	$L_{10,\ 12hr}$ dB(A)
R56	Residential	30	31	32	33	68	-	-	Yes	N/A	N/A
R57	Residential	28	29	30	31	68	-	-	Yes	N/A	N/A
R58	Residential	29	30	31	32	68	-	-	Yes	N/A	N/A
R59	Residential	30	31	32	33	68	-	-	Yes	N/A	N/A
R60	Residential	25	26	26	28	68	-	-	Yes	N/A	N/A
R61	Residential	25	27	27	28	68	-	-	Yes	N/A	N/A
R62	Residential	27	29	29	30	68	-	-	Yes	N/A	N/A
R63	Residential	27	28	29	30	68	-	-	Yes	N/A	N/A
R64	Residential	28	29	30	31	68	-	-	Yes	N/A	N/A
R65	Residential	25	26	27	28	68	-	-	Yes	N/A	N/A
R66	Residential	25	26	27	28	68	-	-	Yes	N/A	N/A
R67	Residential	27	28	28	29	68	-	-	Yes	N/A	N/A
R68	Residential	26	27	28	29	68	-	-	Yes	N/A	N/A
R69	Residential	26	28	28	30	68	-	-	Yes	N/A	N/A
R70	Residential	27	29	29	31	68	-	-	Yes	N/A	N/A
R71	Residential	27	28	29	30	68	-	-	Yes	N/A	N/A
R72	Residential	28	29	30	31	68	-	-	Yes	N/A	N/A
R73	Residential	29	31	31	32	68	-	-	Yes	N/A	N/A
R74	Residential	29	30	31	32	68	-	-	Yes	N/A	N/A

Receptor	Receptor Type	Noise prediction, $L_{10, 18hr}$ dB(A)		Noise prediction, $L_{10, 1hr}$ dB(A)		Noise Criteria			Compliance?		
		Without Construction	With Construction	Without Construction	With Construction	$L_{10, 18hr}$ dB(A)	$L_{10, 1hr}$ dB(A)	$L_{10, 12hr}$ dB(A)	$L_{10, 18hr}$ dB(A)	$L_{10, 1hr}$ dB(A)	$L_{10, 12hr}$ dB(A)
R75	Residential	30	31	32	33	68	-	-	Yes	N/A	N/A
R76	Residential	29	31	31	32	68	-	-	Yes	N/A	N/A
R77	Residential	30	32	32	33	68	-	-	Yes	N/A	N/A
R78	Residential	29	31	31	32	68	-	-	Yes	N/A	N/A
R79	Residential	29	31	30	32	68	-	-	Yes	N/A	N/A
R80	Residential	28	29	29	31	68	-	-	Yes	N/A	N/A
R81	Residential	28	29	30	31	68	-	-	Yes	N/A	N/A
R82	Residential	26	28	28	30	68	-	-	Yes	N/A	N/A
R83	Residential	28	30	30	31	68	-	-	Yes	N/A	N/A
R84	Residential	28	29	30	31	68	-	-	Yes	N/A	N/A
R85	Residential	28	30	30	31	68	-	-	Yes	N/A	N/A
R86	Residential	27	29	29	30	68	-	-	Yes	N/A	N/A
R87	Residential	27	28	29	30	68	-	-	Yes	N/A	N/A
R88	Residential	27	28	29	30	68	-	-	Yes	N/A	N/A
R89	Residential	26	27	28	29	68	-	-	Yes	N/A	N/A
R90	Residential	25	27	27	28	68	-	-	Yes	N/A	N/A
R91	Residential	27	28	28	29	68	-	-	Yes	N/A	N/A
R92	Residential	27	28	28	29	68	-	-	Yes	N/A	N/A
R93	Residential	27	28	29	30	68	-	-	Yes	N/A	N/A

Receptor	Receptor Type	Noise prediction, $L_{10, 18hr}$ dB(A)		Noise prediction, $L_{10, 1hr}$ dB(A)		Noise Criteria			Compliance?		
		Without Construction	With Construction	Without Construction	With Construction	$L_{10, 18hr}$ dB(A)	$L_{10, 1hr}$ dB(A)	$L_{10, 12hr}$ dB(A)	$L_{10, 18hr}$ dB(A)	$L_{10, 1hr}$ dB(A)	$L_{10, 12hr}$ dB(A)
R94	Residential	27	28	29	30	68	-	-	Yes	N/A	N/A
R95	Residential	27	29	29	30	68	-	-	Yes	N/A	N/A
R96	Residential	26	28	28	30	68	-	-	Yes	N/A	N/A
R97	Residential	27	29	29	30	68	-	-	Yes	N/A	N/A
R98	Residential	26	27	27	29	68	-	-	Yes	N/A	N/A
R99	Residential	<25	25	<25	26	68	-	-	Yes	N/A	N/A
R100	Residential	<25	<25	<25	<25	68	-	-	Yes	N/A	N/A
R101	Residential	<25	<25	<25	<25	68	-	-	Yes	N/A	N/A
R102	Residential	<25	<25	<25	<25	68	-	-	Yes	N/A	N/A
R103	Residential	<25	<25	<25	<25	68	-	-	Yes	N/A	N/A
R104	Residential	<25	27	<25	28	68	-	-	Yes	N/A	N/A
R105	Residential	<25	<25	<25	<25	68	-	-	Yes	N/A	N/A
R106	Residential	32	34	35	36	68	-	-	Yes	N/A	N/A
CWA HALL	Commercial	46	47	49	50	-	65	-	N/A	Yes	N/A
Manton Cemetery	Park/Garden	<25	27	26	29	-	-	58	N/A	N/A	Yes[1]

Notes: 1. Compliance was assessed against the predicted $L_{10,1hr}$ dB(A), assuming that traffic flows are evenly distributed and the 1-hour value is consistent and therefore representative of the 12-hour daytime period.

7.4 Cumulative operational impacts

Potential cumulative noise from the Project must be assessed against the acoustic quality objectives at the sensitive receptors. The cumulative nose assessment considers the approved projects located within LEIP, this includes DriveIT, Queensland Pacific Metals and Edify Energy. To account for the cumulation of noise from the Project and contribution from other industrial or commercial noise sources, acoustic quality objectives were reduced by 5 dB as per the guidelines in the NPfI (2017) for assessing cumulative noise.

Cumulative estimated results have been summarised in Table 7.10.

Results presented in Table 7.10 indicate:

- cumulative predicted noise levels are compliant the project noise objectives during all periods and at all sensitive receptors
- reasonable and feasible mitigation strategies to minimise operational noise impacts are presented in Section 8.2.

Table 7.10 Predicted noise against cumulative noise objectives

Receptor	Classification	Acoustic quality objectives $L_{Aeq, adj,1hr}$ dB(A)		Predicted noise level $L_{Aeq, adj,1hr}$ dB(A)	Compliance?	
		Day/evening	Night		Day/evening	Night
R1	Residential	37	32	<25	Yes	Yes
R2	Residential	37	32	<25	Yes	Yes
R3	School	37	-	<25	Yes	Yes
R4	Commercial	47	-	<25	Yes	Yes
R5	Residential	37	32	<25	Yes	Yes
R6	Residential	37	32	<25	Yes	Yes
R7	Residential	37	32	<25	Yes	Yes
R8	Residential	37	32	<25	Yes	Yes
R9	Residential	37	32	<25	Yes	Yes
R10	Residential	37	32	27	Yes	Yes
R11	Residential	37	32	31	Yes	Yes
R12	Residential	37	32	30	Yes	Yes
R13	Residential	37	32	<25	Yes	Yes
R14	Residential	37	32	<25	Yes	Yes
R15	Residential	37	32	<25	Yes	Yes
R16	Residential	37	32	<25	Yes	Yes
R17	Residential	37	32	<25	Yes	Yes
R18	Residential	37	32	<25	Yes	Yes
R19	Residential	37	32	<25	Yes	Yes

Receptor	Classification	Acoustic quality objectives $L_{Aeq, adj,1hr}$ dB(A)		Predicted noise level $L_{Aeq, adj,1hr}$ dB(A)	Compliance?	
		Day/evening	Night		Day/evening	Night
R20	Residential	37	32	<25	Yes	Yes
R21	Residential	37	32	<25	Yes	Yes
R22	Residential	37	32	<25	Yes	Yes
R23	Residential	37	32	<25	Yes	Yes
R24	Residential	37	32	<25	Yes	Yes
R25	Residential	37	32	<25	Yes	Yes
R26	Residential	37	32	<25	Yes	Yes
R27	Residential	37	32	<25	Yes	Yes
R28	Residential	37	32	<25	Yes	Yes
R29	Residential	37	32	<25	Yes	Yes
R30	Residential	37	32	<25	Yes	Yes
R31	Residential	37	32	<25	Yes	Yes
R32	Residential	37	32	<25	Yes	Yes
R33	Residential	37	32	<25	Yes	Yes
R34	Residential	37	32	<25	Yes	Yes
R35	Residential	37	32	<25	Yes	Yes
R36	Residential	37	32	<25	Yes	Yes
R37	Residential	37	32	<25	Yes	Yes
R38	Residential	37	32	<25	Yes	Yes
R39	Residential	37	32	<25	Yes	Yes
R40	Residential	37	32	<25	Yes	Yes
R41	Residential	37	32	<25	Yes	Yes
R42	Residential	37	32	<25	Yes	Yes
R43	Residential	37	32	<25	Yes	Yes
R44	Residential	37	32	<25	Yes	Yes
R45	Residential	37	32	<25	Yes	Yes
R46	Residential	37	32	<25	Yes	Yes
R47	Residential	37	32	<25	Yes	Yes
R48	Residential	37	32	<25	Yes	Yes
R49	Residential	37	32	<25	Yes	Yes
R50	Residential	37	32	<25	Yes	Yes
R51	Residential	37	32	<25	Yes	Yes
R52	Residential	37	32	<25	Yes	Yes

Receptor	Classification	Acoustic quality objectives $L_{Aeq, adj,1hr}$ dB(A)		Predicted noise level $L_{Aeq, adj,1hr}$ dB(A)	Compliance?	
		Day/evening	Night		Day/evening	Night
R53	Residential	37	32	<25	Yes	Yes
R54	Residential	37	32	<25	Yes	Yes
R55	Residential	37	32	<25	Yes	Yes
R56	Residential	37	32	<25	Yes	Yes
R57	Residential	37	32	<25	Yes	Yes
R58	Residential	37	32	<25	Yes	Yes
R59	Residential	37	32	<25	Yes	Yes
R60	Residential	37	32	<25	Yes	Yes
R61	Residential	37	32	<25	Yes	Yes
R62	Residential	37	32	<25	Yes	Yes
R63	Residential	37	32	<25	Yes	Yes
R64	Residential	37	32	<25	Yes	Yes
R65	Residential	37	32	<25	Yes	Yes
R66	Residential	37	32	<25	Yes	Yes
R67	Residential	37	32	<25	Yes	Yes
R68	Residential	37	32	<25	Yes	Yes
R69	Residential	37	32	<25	Yes	Yes
R70	Residential	37	32	<25	Yes	Yes
R71	Residential	37	32	<25	Yes	Yes
R72	Residential	37	32	<25	Yes	Yes
R73	Residential	37	32	<25	Yes	Yes
R74	Residential	37	32	<25	Yes	Yes
R75	Residential	37	32	<25	Yes	Yes
R76	Residential	37	32	<25	Yes	Yes
R77	Residential	37	32	28	Yes	Yes
R78	Residential	37	32	29	Yes	Yes
R79	Residential	37	32	30	Yes	Yes
R80	Residential	37	32	26	Yes	Yes
R81	Residential	37	32	<25	Yes	Yes
R82	Residential	37	32	<25	Yes	Yes
R83	Residential	37	32	<25	Yes	Yes
R84	Residential	37	32	<25	Yes	Yes
R85	Residential	37	32	<25	Yes	Yes

Receptor	Classification	Acoustic quality objectives $L_{Aeq, adj,1hr}$ dB(A)		Predicted noise level $L_{Aeq, adj,1hr}$ dB(A)	Compliance?	
		Day/evening	Night		Day/evening	Night
R86	Residential	37	32	<25	Yes	Yes
R87	Residential	37	32	<25	Yes	Yes
R88	Residential	37	32	<25	Yes	Yes
R89	Residential	37	32	<25	Yes	Yes
R90	Residential	37	32	<25	Yes	Yes
R91	Residential	37	32	<25	Yes	Yes
R92	Residential	37	32	<25	Yes	Yes
R93	Residential	37	32	<25	Yes	Yes
R94	Residential	37	32	<25	Yes	Yes
R95	Residential	37	32	<25	Yes	Yes
R96	Residential	37	32	<25	Yes	Yes
R97	Residential	37	32	<25	Yes	Yes
R98	Residential	37	32	<25	Yes	Yes
R99	Residential	37	32	<25	Yes	Yes
R100	Residential	37	32	<25	Yes	Yes
R101	Residential	37	32	<25	Yes	Yes
R102	Residential	37	32	<25	Yes	Yes
R103	Residential	37	32	<25	Yes	Yes
R104	Residential	37	32	<25	Yes	Yes
R105	Residential	37	32	<25	Yes	Yes
R106	Residential	37	32	<25	Yes	Yes
CWA HALL	Commercial	47	-	<25	Yes	N/A
Manton Cemetery	Park/Garden	-	-	<25	N/A	N/A

Notes: 1. As per the Noise and Vibration EIS Information Guideline, an outdoor-to-indoor attenuation value of 7 dB, appropriate for typical Queensland buildings with open windows, has been applied to the indoor objectives to determine the outdoor noise objectives for the Project. In addition, a further correct factor of -5 dB has been applied in accordance with the NPfI (2017) to establishes a criteria for a new development for a receptor impacted by up to four industrial noise sources.

2. "-" no applicable noise objectives for time period or receptor type.

8 Noise mitigation and management

8.1 Construction mitigation and management

Construction noise levels are predicted to exceed the relevant guidelines at the closest residential receivers; therefore, additional noise mitigation measures are required.

It should be noted that, although not applicable to building work or construction noise, the acoustic quality objectives for dwellings outlined in the EPP (Noise) have been applied in this assessment to screen potential noise amenity impacts and identify the need for non-standard noise management measures. These construction acoustic quality objectives are not mandatory and are used solely for noise management purposes.

Notwithstanding this, the potential for noise emissions will be minimised through consideration of the following general strategies (but not limited to), as detailed in Table 8.1.

Table 8.1 General construction noise mitigation and management strategies

Strategy	Measure	Method
Universal Work Practices	Minimise avoidable noise	Train workers, include noise clauses in contracts, display noise-related approvals
	Reduce behavioural noise	Avoid shouting, radios, slamming doors, idling, PA overuse
	Minimise night-time disruption	Avoid impulsive/metallic noise, reduce reversing, schedule trucks away from sensitive areas
Consultation and Notification	Inform affected community	Letterbox drops, signage, multilingual notices, websites, newsletters
	Maintain communication	Appoint liaison officer, toll-free line, on-site info board, community meetings
	Manage complaints	Accessible contact point, escalation procedure, response tracking and resolution
Plant and Equipment	Use quieter work methods	Hydraulic splitters, chemical cracking, delayed load-out
	Choose quieter equipment	Compare noise-labelled tools, rent/buy low-noise models, use silencers and dampers
	Operate efficiently	Idle reduction, reduce throttle, line bins with damping material
	Maintain equipment	Check mufflers, enclosures, seals; repair or return noisy hired plant
On-site Location and Barriers	Maximise plant separation	Locate plant/vehicle entrances away from receptors, restrict mobile plant areas
	Avoid reversing alarms	Site layout planning, smart/multi-frequency alarms (OH&S compliant)
	Shield noise sources	Use sheds, stockpiles, enclosures, natural landforms; retain existing structures
Work Scheduling	Schedule to reduce impact	Work during high ambient noise periods or when receptors are absent
	Optimise logistics	Amalgamate loads, designate routes/times, provide off-site truck holding areas

Strategy	Measure	Method
Transmission Path	Block direct noise pathways	Erect solid barriers (hoardings, containers, site sheds) without gaps
	Increase shielding effectiveness	Build barriers early, address multi-storey impacts, consult on mitigation effectiveness

8.2 Operational mitigation and management

Predicted operational noise levels comply with the acoustic quality objectives at all sensitive receptor locations under the provided current operational capacity, equipment list, and sources of noise for Package 1 of the Project.

8.2.1 Hierarchy of management

To ensure operational activities comply with the adopted acoustic quality objectives, recommendations have been made in accordance with the noise management hierarchy outlined in the EPP (Noise). In the following preference, noise should be managed by:

1. The avoidance of noise by not locating an industrial activity near a sensitive receptor.
2. The minimisation of noise through careful design of a project, including:
    a) facing noisy equipment away from sensitive receptors
    b) the selection of the best equipment available.
3. The management of noise through construction of barriers and using heavy equipment during daytime only.

8.2.2 Recommended noise mitigation strategies

Operational noise is expected to comply with the acoustic quality objectives at all sensitive receptors under Package 1 (based on the units modelled to date). Based on the current assessment of the BESS, it is recommended that the general mitigation measures outlined in Section 8.2.3 also be considered to further reduce potential noise impacts from the Project.

8.2.3 General considerations

General strategies can include:

- Sourcing low-emission equipment.
- Regular audits of transmission lines to ensure dust build up is kept at a minimum.
- Reorienting or relocating BESS units to direct noise away from sensitive areas, particularly in centralised layouts.
- Acoustic enclosures and louvres help reduce emissions while maintaining ventilation.
- Localised noise barriers
- Variable fan speeds can lower noise, especially at night, though this requires detailed thermal and weather analysis.

- Collaboration with manufacturers allows for early-stage acoustic improvements, such as quieter components or redesigns.
- Rescheduling charge/discharge to avoid night-time operation may help but often compromises project feasibility.
- Regulatory relief may be pursued based on the Project's strategic importance.
- Weather-adaptive noise management involving weather monitoring and conditional shutdowns may be needed where adverse conditions are frequent, demanding complex modelling and operational flexibility.
- BESS units are typically designed with features that help mitigate thermal-related noises, such as cracking. These include:
  - Vibration and structural control measures, such as anti-vibration isolators and flexible connectors, to reduce structure-borne sound transmission.
  - Damping treatments, including constrained-layer damping materials applied to panels, to minimise resonance and absorb impact noise.
  - Rigid support framing to limit structural flexing during temperature changes.

These design features are consistent with standard industry practice and help minimise the potential for cracking or other thermal-related noises to cause impacts at nearby receptors. Based on advice from the manufacturer, the revised BESS unit design does not exhibit cracking noises, consistent with the mitigation measures outlined above.

9 Conclusion

This NIA has been prepared to support Package 1 of the development application for the Northern Quartz Campus 3 km south of the township of Woodstock, Qld.

This assessment has led to the conclusions below, which are subject to the limitations outlined in Section 1.

9.1 Modelled outcomes

Noise models were quantified potential impacts of the construction and operation of Package 1 BESS on nearby sensitive receptors. A conservative approach was taken to each modelling scenario, and it is likely that noise impacts at sensitive receptors will be less than predicted.

9.1.1 Construction noise

Construction activities associated with Phase 1 are predicted to exceed at the three sensitive receptors R11, R12, and R79. Construction activities associated with Phase 2 of construction activities are predicted to exceed at the four sensitive receptors R11, R12, R78, and R79. All other sensitive receptors are predicted to comply with noise objectives related to construction activities. Construction activities associated with Phase 3 of construction are predicted to comply with noise objectives at all sensitive receptors.

Activities were predicted under a worst-case scenario and noise impacts at receptors are <u>expected to be lower</u>. Fluctuations in construction activities as the site requires, should therefore not result in considerable changes to impacts at sensitive receptor locations.

9.1.2 Operational noise

Operational noise comply with the acoustic quality objectives outlined in the EPP (Noise) at all sensitive receptor locations. Operational noise incorporates fixed equipment that include 1170 battery containers, 234 PCU's, and three HV transformers. The impacts were predicted under noise-enhancing conditions and represent a worst-case scenario. <u>It is anticipated that noise levels at sensitive receptors will be lower</u>.

9.1.3 Road traffic noise

Construction road traffic from peak construction activities was modelled against current traffic from the AADT. Construction traffic is expected to include an additional 93 light vehicles and 10 heavy vehicles per day. The addition of construction vehicles will have negligible, if any, change on the noise impacts from Flinders Highway on nearby sensitive receptors. <u>Additional traffic is predicted to comply with noise objectives at all sensitive receptors.</u>

9.1.4 Cumulative noise

Consideration of cumulative noise has been assessed against a 5 dB reduction in acoustic quality objectives as per guidelines in the NPfI. Under these conditions, cumulative noise emissions are expected to comply with the adjusted acoustic quality objectives at all residential sensitive receptors.

The impacts were predicted under noise-enhancing conditions and represent a worst-case scenario. It is anticipated that noise levels at sensitive receptors will be lower, however noise mitigation measures have been recommended.

9.2 Mitigation and recommendations

Noise mitigation measures have been recommended based on the modelled outcomes of Package 1. Recommendations have been made in accordance with the noise management hierarchy in the EPP (Noise). These include the consideration of equipment specifications, location, orientation, and noise barriers to minimise noise propagation to sensitive receptors. These recommendations have been made with the consideration to potential future development within NQC project area.

10 References

Audible Noise of Transmission Lines Caused by the Corona Effect: Analysis, Modelling, Prediction, Zbigniew Engel & Tadeusz Wszolek, 1995.

Australian Standards *AS 1055.2018 Acoustics - Description and measurement of environmental noise*

EMM Consulting Traffic Impact Assessment dated 2025

Department of Environment and Science (DES) 2020, ESR/2015/1838 – Application requirements for activities with noise impacts, Queensland Government.

Department of Environment and Science (DES) 2020, Noise Measurement Manual (NMM), Queensland Government.

Department of Environment, Science and Innovation (DESI) 2024, ESR/2020/5305 – Noise and vibration: EIS information guideline, Queensland Government.

Department of Transport and Main Roads (DTMR) Transport Noise Management Code of Practice Volume 1 – Road Traffic Noise (2013)

Department of Transport and Main Roads (DTMR) 2023, Transport Noise Management Code of Practice: Volume 2 – Construction Noise and Vibration, Queensland Government.

Environmental Protection (Noise) Policy 2019 (EPP), Queensland Government.

Environmental Protection Regulation 2019 (EPR), Queensland Government.

Environmental Protection Act 1994 (EP Act), Queensland Government.

New South Wales Environment Protection Authority (NSW EPA) 2017, Noise Policy for Industry (NPfI), NSW Government.

UK Department of Environment, Food, and Rural Affairs (DEFRA)

UK Department of Transport, Calculation of Road Traffic Noise (CoRTN 1988)

Vegetation Management Act 1999, Queensland Government.

Attachment A

Calibration certificates

creating opportunities

Acoustic Research Labs Pty Ltd
Unit 36/14 Loyalty Rd
North Rocks NSW AUSTRALIA 2151
Ph: +61 2 9484 0800 A.B.N. 65 160 399 119
www.acousticresearch.com.au

Sound Level Meter
IEC 61672-3:2013
Calibration Certificate

Calibration Number C24877

Client Details	EMM Consulting Suite 9.10, Level 9, 454 Collins Street Melbourne VIC, 3000
Equipment Tested/ Model Number :	ARL Ngara
Instrument Serial Number :	878017
Microphone Serial Number :	21991
Pre-amplifier Serial Number :	27806
Firmware Version :	v12.6

Pre-Test Atmospheric Conditions		Post-Test Atmospheric Conditions	
Ambient Temperature :	24.7 °C	**Ambient Temperature :**	24.8 °C
Relative Humidity :	48.4 %	**Relative Humidity :**	48.2 %
Barometric Pressure :	101.25 kPa	**Barometric Pressure :**	101.22 kPa

Calibration Technician :	Jeff Yu	**Secondary Check:**	Cooper Sallway
Calibration Date :	20 Nov 2024	**Report Issue Date :**	25 Nov 2024

Approved Signatory : Ken Williams

Clause and Characteristic Tested	Result	Clause and Characteristic Tested	Result
12: Acoustical Sig. tests of a frequency weighting	*Pass*	17: Level linearity incl. the level range control	*N/A*
13: Electrical Sig. tests of frequency weightings	*Pass*	18: Toneburst response	*Pass*
14: Frequency and time weightings at 1 kHz	*Pass*	19: C Weighted Peak Sound Level	*N/A*
15: Long Term Stability	*Pass*	20: Overload Indication	*Pass*
16: Level linearity on the reference level range	*Pass*	21: High Level Stability	*Pass*

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed.

However, no general statement or conclusion can be made about conformance of the sound level meter to the full requirements of IEC 61672-1:2013 because evidence was not publicly available, from an independent testing organisation responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013 and because the periodic tests of IEC 61672-3:2013 cover only a limited subset of the specifications in IEC 61672-1:2013.

Uncertainties of Measurement -

Acoustic Tests		Environmental Conditions	
125Hz	*±0.13 dB*	*Temperature*	*±0.1 °C*
1kHz	*±0.13 dB*	*Relative Humidity*	*±1.9 %*
8kHz	*±0.14 dB*	*Barometric Pressure*	*±0.11 kPa*
Electrical Tests	*±0.13 dB*		

All uncertainties are derived at the 95% confidence level with a coverage factor of 2.

This calibration certificate is to be read in conjunction with the calibration test report.

Acoustic Research Labs Pty Ltd is NATA Accredited Laboratory Number 14172.
Accredited for compliance with ISO/IEC 17025 - Calibration.

The results of the tests, calibrations and/or measurements included in this document are traceable to SI units.

NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration and inspection reports.

Acoustic Research Labs Pty Ltd
Unit 36/14 Loyalty Rd
North Rocks NSW AUSTRALIA 2151
Ph: +61 2 9484 0800 A.B.N. 65 160 399 119
www.acousticresearch.com.au

Sound Level Meter
IEC 61672-3:2013
Calibration Certificate

Calibration Number C23794

Client Details EMM Consulting
Ground Floor, Suite 01, 20 Chandos Street
St Leonards NSW 2065

Equipment Tested/ Model Number : Ngara
Instrument Serial Number : 878123
Microphone Serial Number : 20271
Pre-amplifier Serial Number : 28217
Firmware Version : V12.5

Pre-Test Atmospheric Conditions		Post-Test Atmospheric Conditions	
Ambient Temperature :	25.3 °C	**Ambient Temperature :**	25.3 °C
Relative Humidity :	38.9 %	**Relative Humidity :**	36.8 %
Barometric Pressure :	99.95 kPa	**Barometric Pressure :**	100.01 kPa

Calibration Technician : Max Moore
Calibration Date : 31 Oct 2023
Secondary Check: Dhanush Bonu
Report Issue Date : 6 Nov 2023

Approved Signatory : Ken Williams

Clause and Characteristic Tested	Result	Clause and Characteristic Tested	Result
12: Acoustical Sig. tests of a frequency weighting	*Pass*	17: Level linearity incl. the level range control	*N/A*
13: Electrical Sig. tests of frequency weightings	*Pass*	18: Toneburst response	*Pass*
14: Frequency and time weightings at 1 kHz	*Pass*	19: C Weighted Peak Sound Level	*N/A*
15: Long Term Stability	*Pass*	20: Overload Indication	*Pass*
16: Level linearity on the reference level range	*Pass*	21: High Level Stability	*Pass*

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed.

However, no general statement or conclusion can be made about conformance of the sound level meter to the full requirements of IEC 61672-1:2013 because evidence was not publicly available, from an independent testing organisation responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013 and because the periodic tests of IEC 61672-3:2013 cover only a limited subset of the specifications in IEC 61672-1:2013.

Uncertainties of Measurement -

Acoustic Tests		Environmental Conditions	
125Hz	*±0.13 dB*	*Temperature*	*±0.1 °C*
1kHz	*±0.13 dB*	*Relative Humidity*	*±1.9 %*
8kHz	*±0.14 dB*	*Barometric Pressure*	*±0.11 kPa*
Electrical Tests	*±0.13 dB*		

All uncertainties are derived at the 95% confidence level with a coverage factor of 2.

This calibration certificate is to be read in conjunction with the calibration test report.

Acoustic Research Labs Pty Ltd is NATA Accredited Laboratory Number 14172.
Accredited for compliance with ISO/IEC 17025 - Calibration.

The results of the tests, calibrations and/or measurements included in this document are traceable to SI units.

NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration and inspection reports.

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: C54254

EQUIPMENT TESTED : Acoustic Calibrator

Make & Model: Svantek SV 36 **Serial No:** 154613
Class: 1
Owner: EMM Consulting
The Forum, Level 10/201 Pacific Hwy
St Leonards NSW 2065
Tests Performed: Measured Output Pressure level, Frequency & Distortion
Comments: See Details and Class Tolerance overleaf.

CONDITION OF TEST:

Ambient Pressure	1011	hPa ±1 hPa	**Date of Receipt :**	13/06/2025
Temperature	21	°C ±1° C	**Date of Calibration :**	16/06/2025
Relative Humidity	41	% ±5%	**Date of Issue :**	16/06/2025

Acu-Vib Test Procedure: AVP02 (Calibrators)
Test Method: AS IEC 60942 - 2017

CHECKED BY: A. Nowosadzka **AUTHORISED SIGNATURE:** H. Soe

Accredited for compliance with ISO/IEC 17025 - Calibration
Results of the tests, calibration and/or measurements included in this document are traceable to SI units through reference equipment that has been calibrated by the Australian National Measurement Institute or other NATA accredited laboratories demonstrating traceability.

This report applies only to the item identified in the report and may not be reproduced in part.

The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

Acu-Vib Electronics
ACOUSTICS AND VIBRATIONS
Head Office & Calibration Laboratory
Unit 14, 22 Hudson Avenue, Castle Hill NSW 2154
(02) 9680 8133
www.acu-vib.com.au

NATA
WORLD RECOGNISED ACCREDITATION
Accredited Laboratory No. 9262
Acoustic and Vibration Measurements

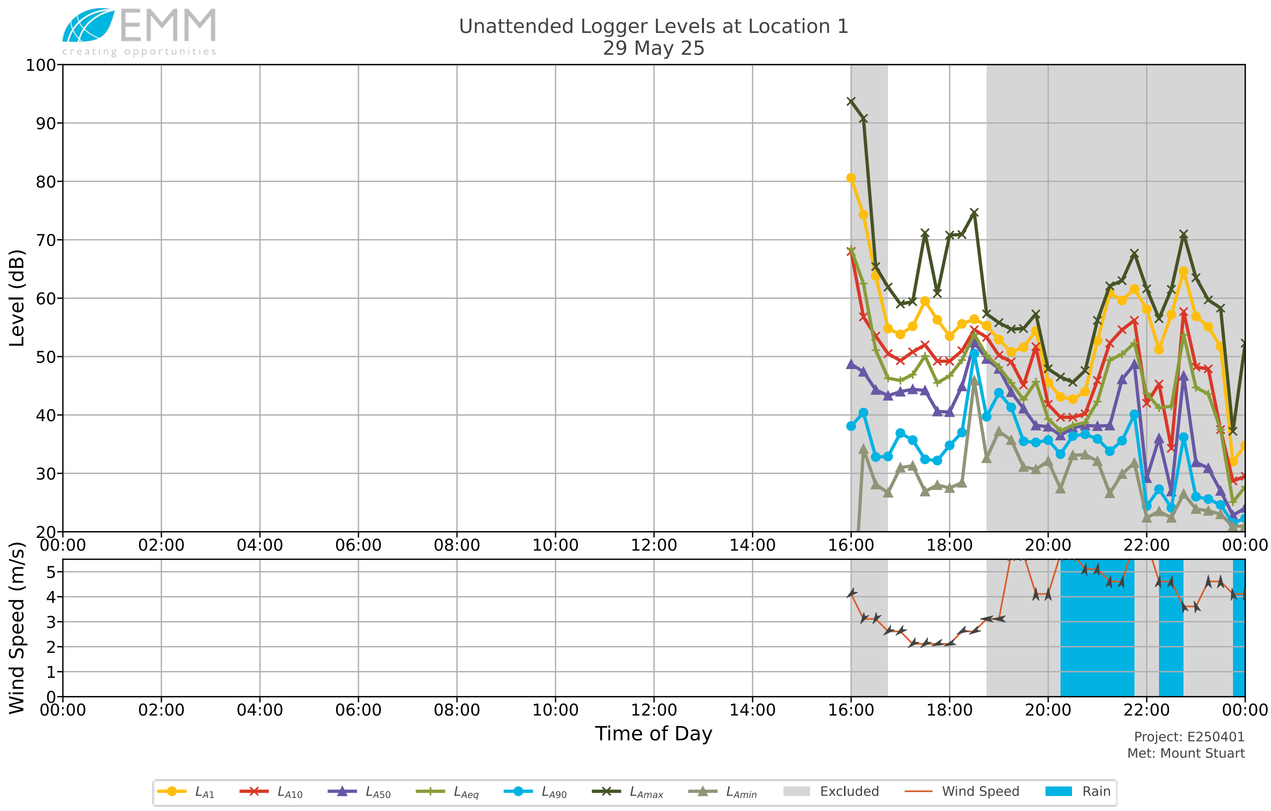
Attachment B

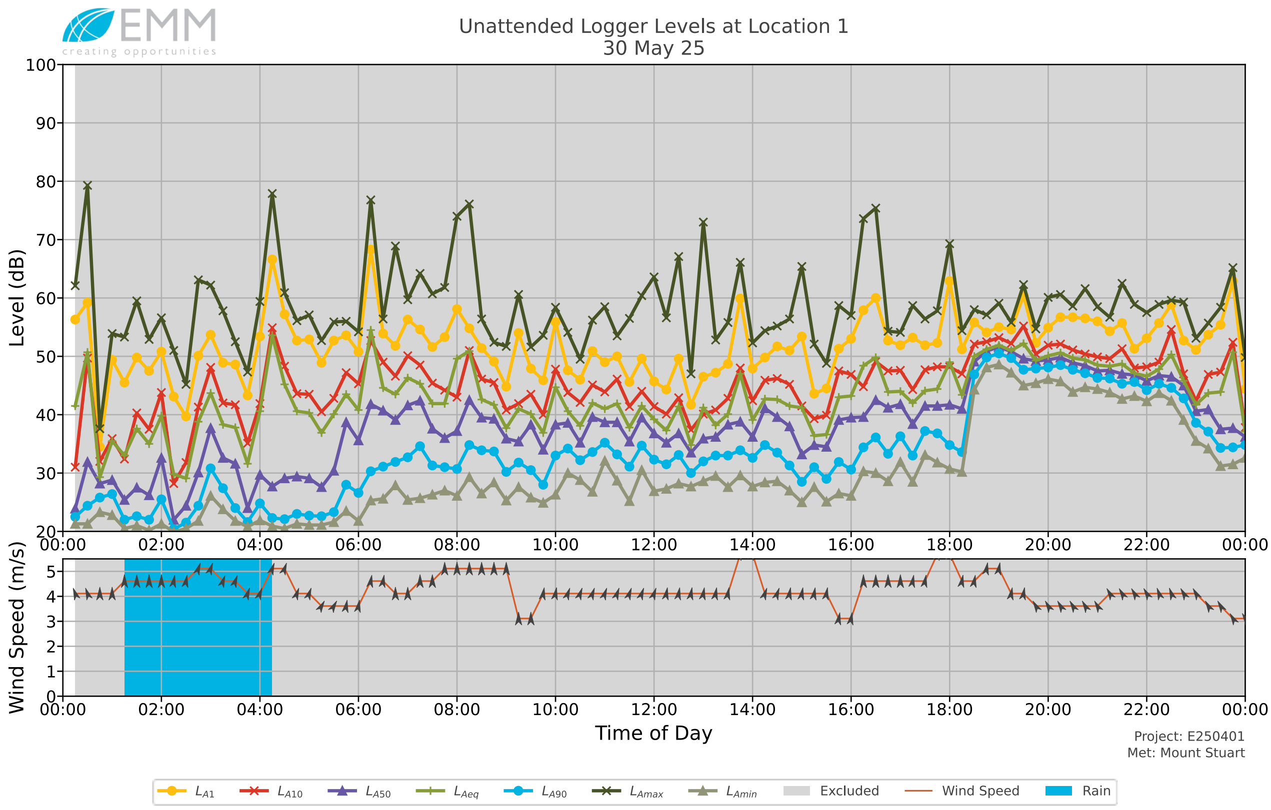
Unattended noise monitoring charts

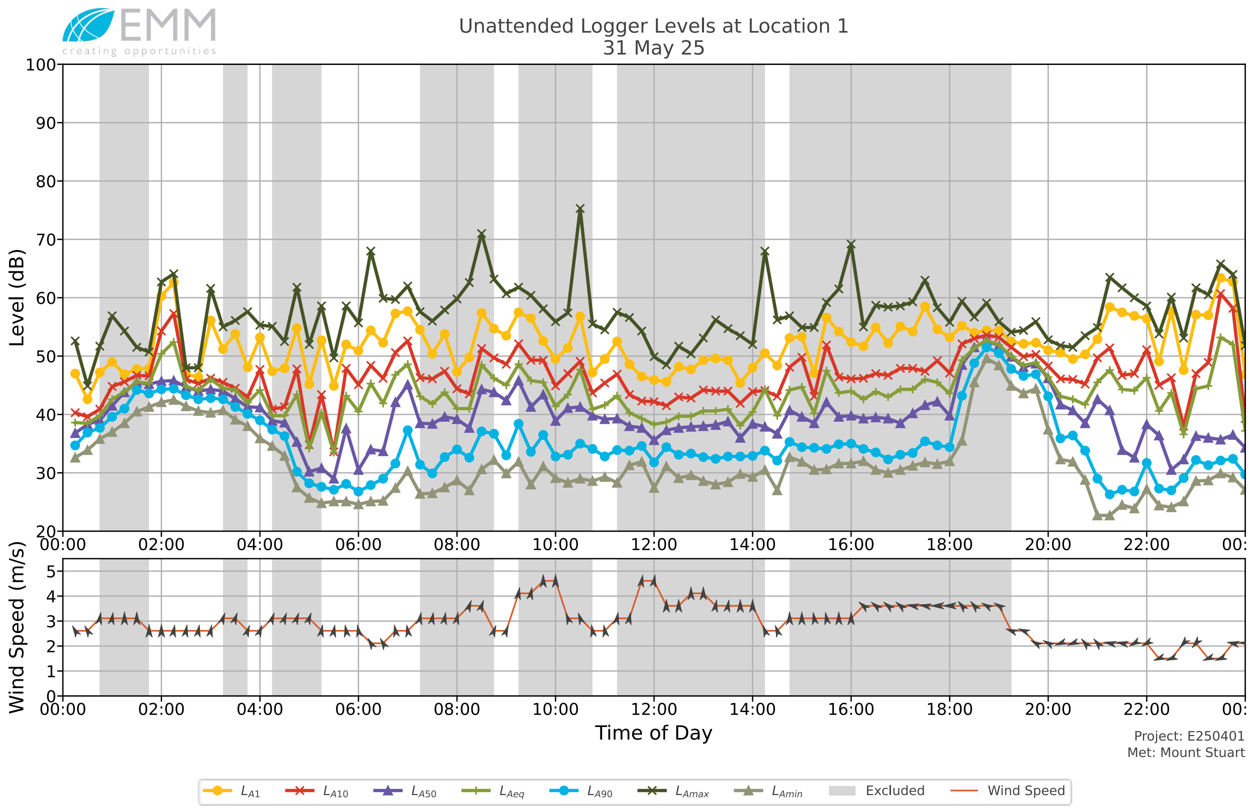
EMM
creating opportunities

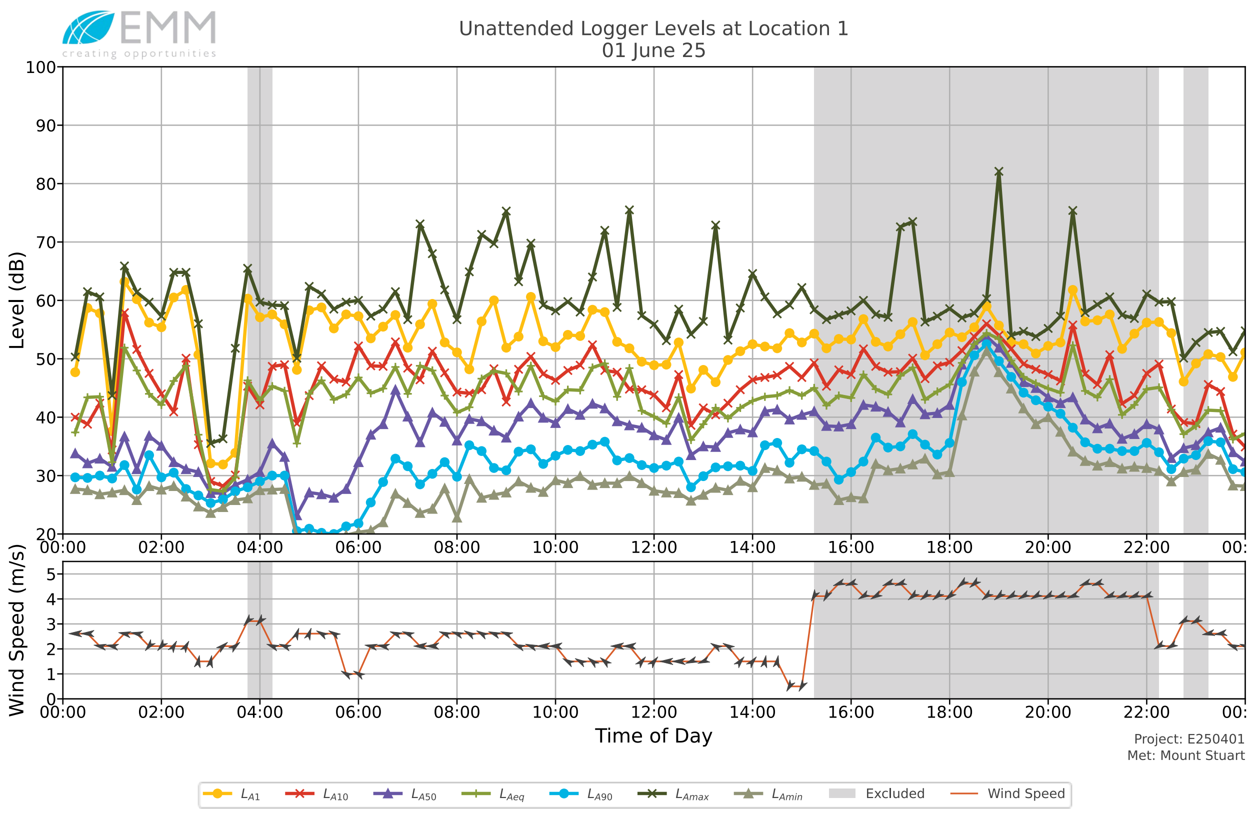
B.1 Unattended noise monitoring – Winter 2025

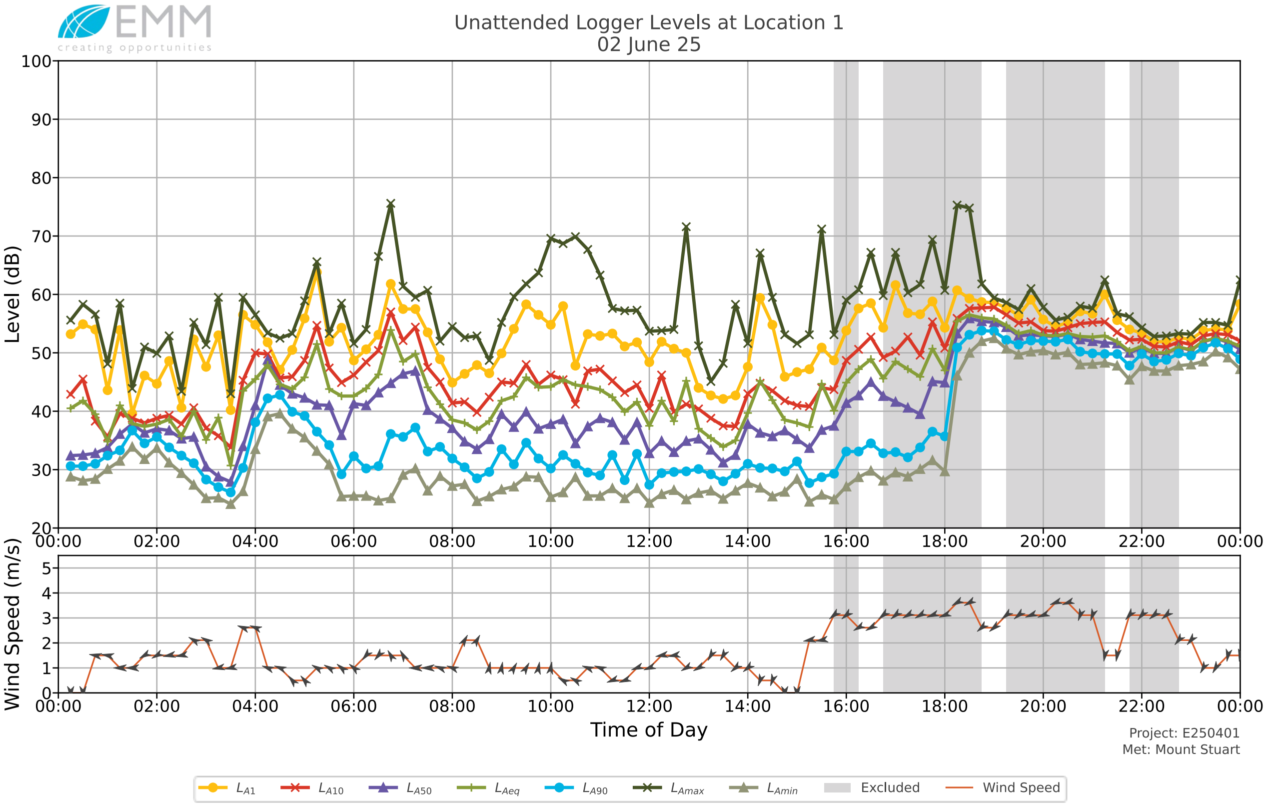
B.1.1 Location 1 - Bidwilli Rd



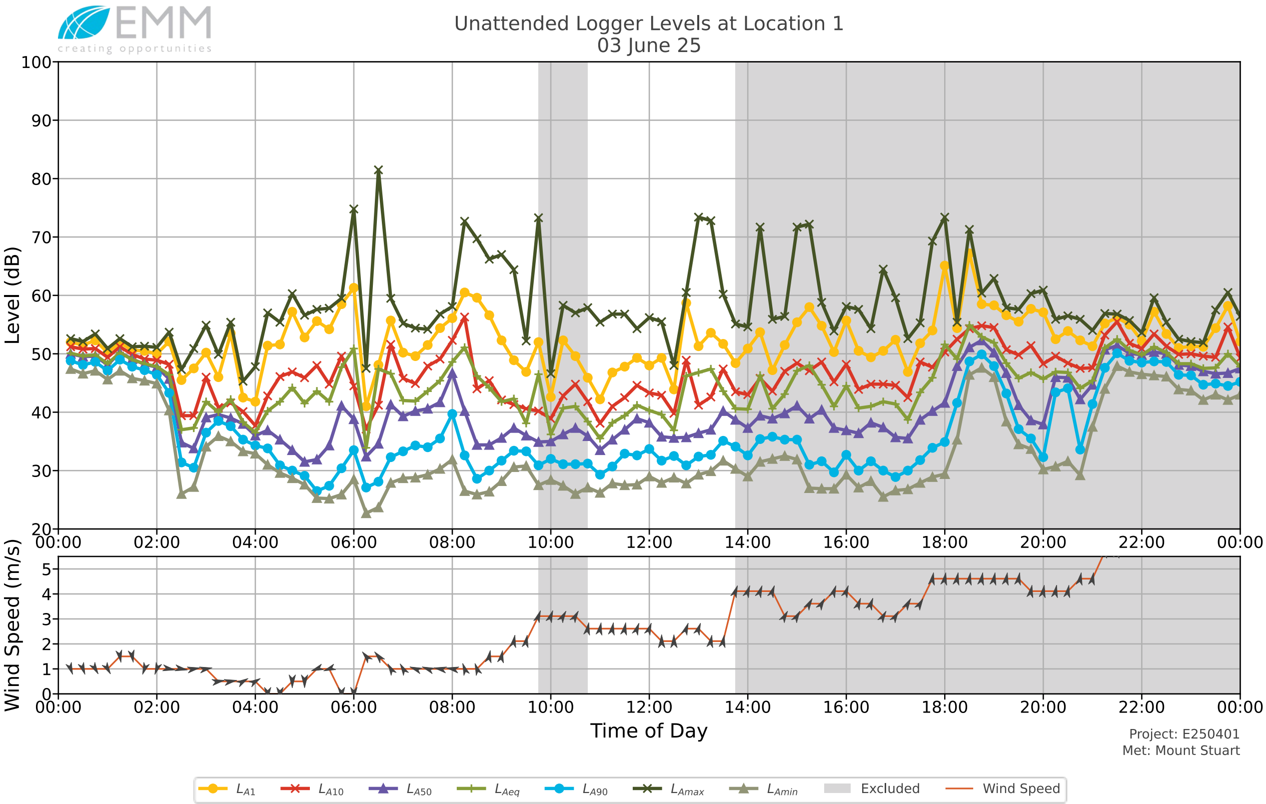



EMM
creating opportunities
Unattended Logger Levels at Location 1
31 May 25
Level (dB)
Wind Speed (m/s)
Time of Day
Project: E250401
Met: Mount Stuart
L_{A1} L_{A10} L_{A50} L_{Aeq} L_{A90} L_{Amax} L_{Amin} Excluded Wind Speed

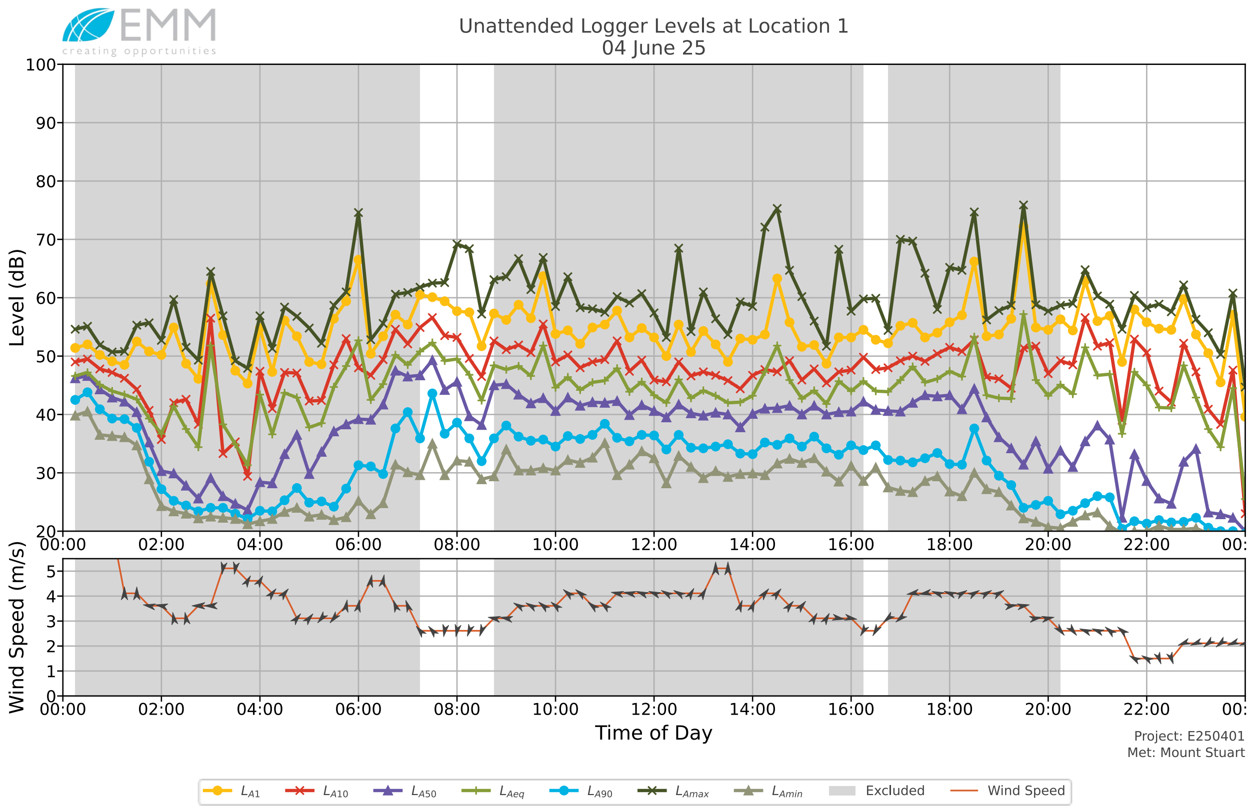

EMM
creating opportunities
Unattended Logger Levels at Location 1
01 June 25
Level (dB)
Wind Speed (m/s)
Time of Day
Project: E250401
Met: Mount Stuart
L_{A1} L_{A10} L_{A50} L_{Aeq} L_{A90} L_{Amax} L_{Amin} Excluded Wind Speed

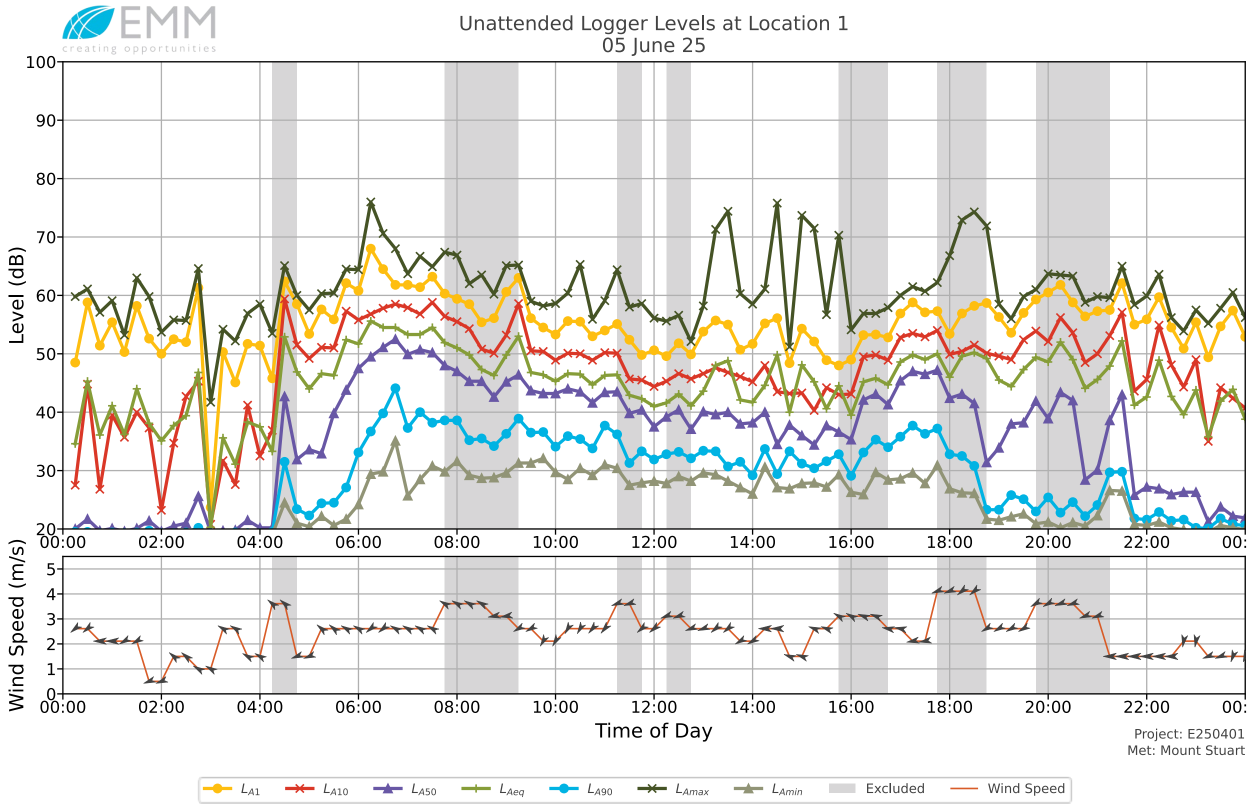


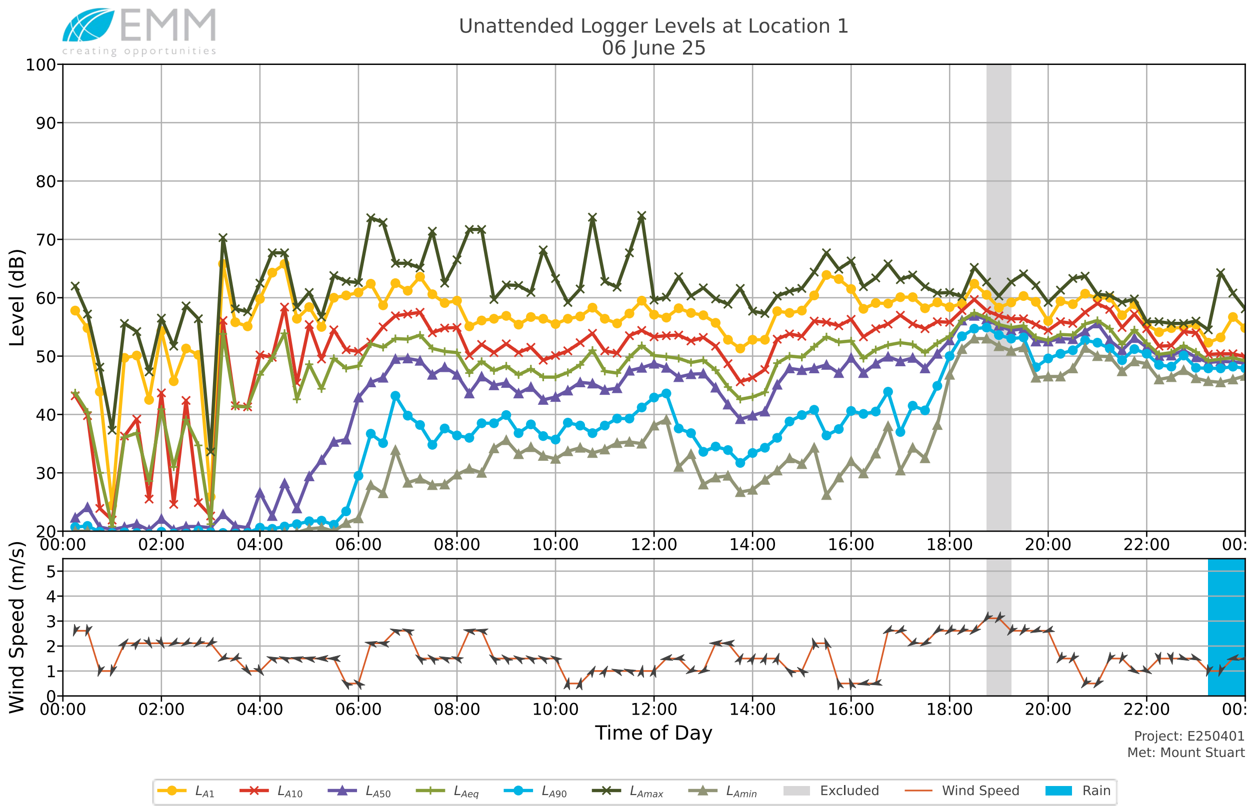
Unattended Logger Levels at Location 1
02 June 25
Level (dB)
Wind Speed (m/s)
Time of Day
Project: E250401
Met: Mount Stuart
L_{A1} L_{A10} L_{A50} L_{Aeq} L_{A90} L_{Amax} L_{Amin} Excluded Wind Speed



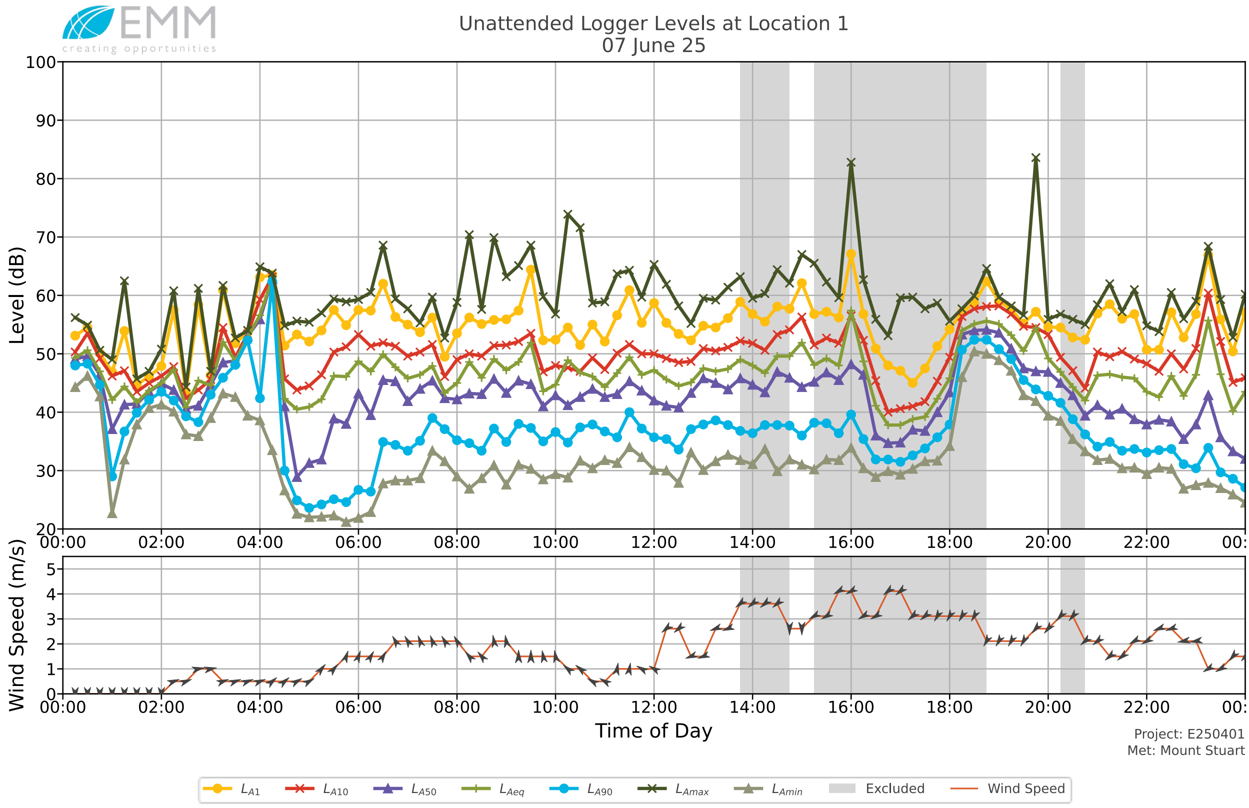
Unattended Logger Levels at Location 1
03 June 25
Level (dB)
Wind Speed (m/s)
Time of Day
Project: E250401
Met: Mount Stuart
L_{A1} L_{A10} L_{A50} L_{Aeq} L_{A90} L_{Amax} L_{Amin} Excluded Wind Speed


EMM
creating opportunities
Unattended Logger Levels at Location 1
04 June 25
Level (dB)
Wind Speed (m/s)
Time of Day
Project: E250401
Met: Mount Stuart
L_{A1} L_{A10} L_{A50} L_{Aeq} L_{A90} L_{Amax} L_{Amin} Excluded Wind Speed

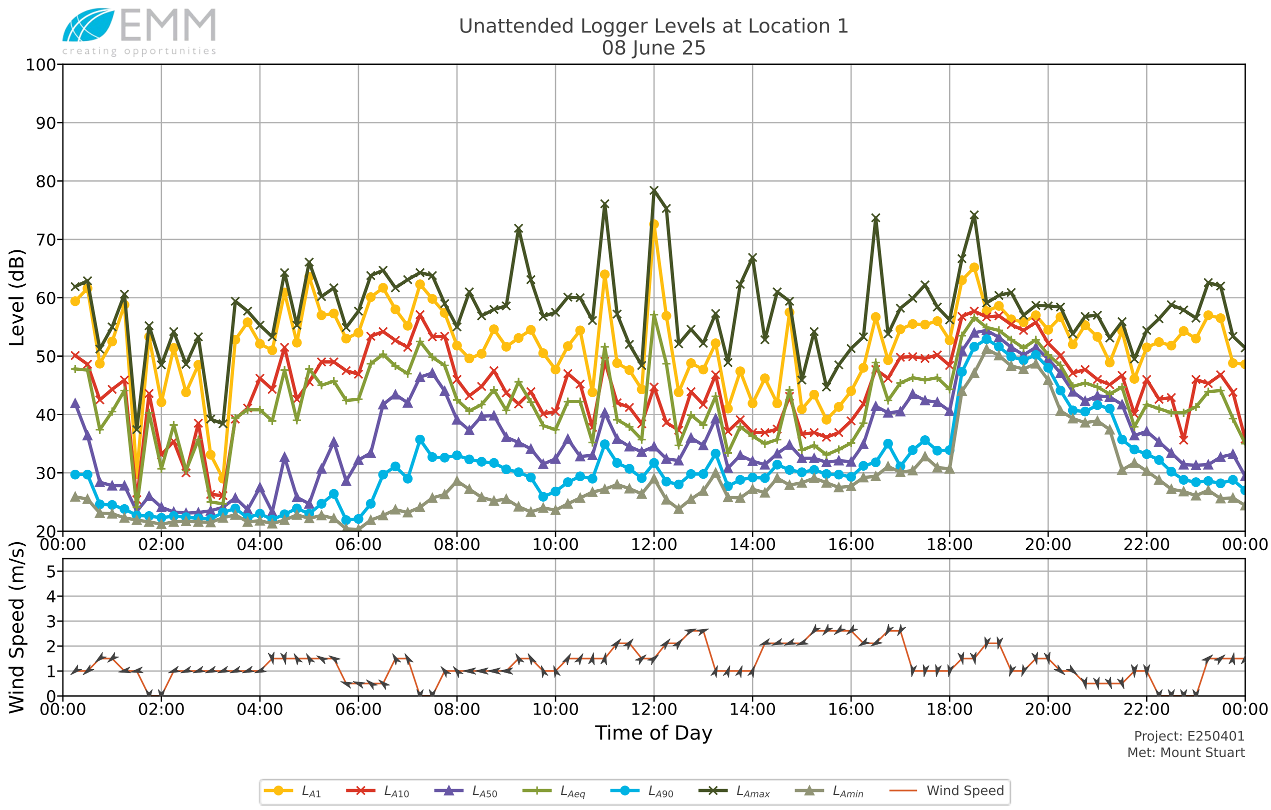

EMM
creating opportunities
Unattended Logger Levels at Location 1
05 June 25
Level (dB)
Wind Speed (m/s)
Time of Day
Project: E250401
Met: Mount Stuart
L_{A1} L_{A10} L_{A50} L_{Aeq} L_{A90} L_{Amax} L_{Amin} Excluded Wind Speed

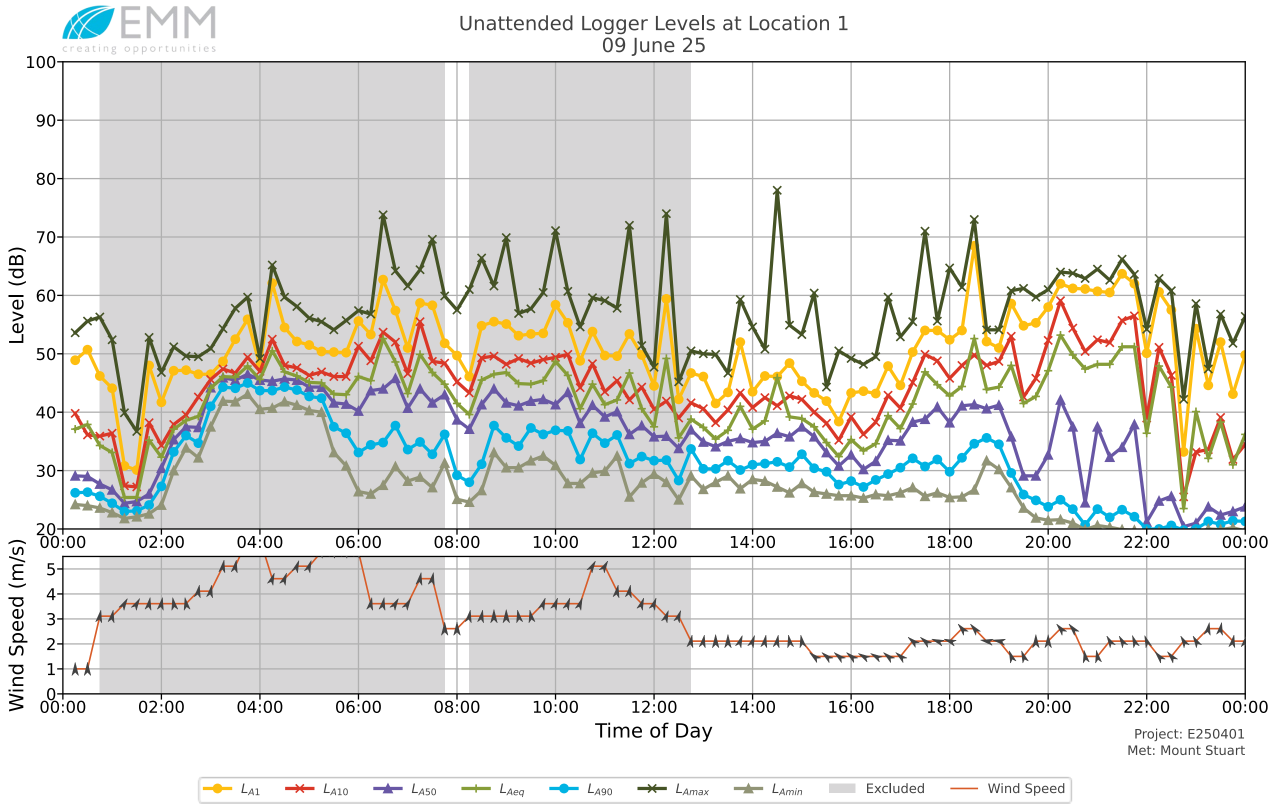


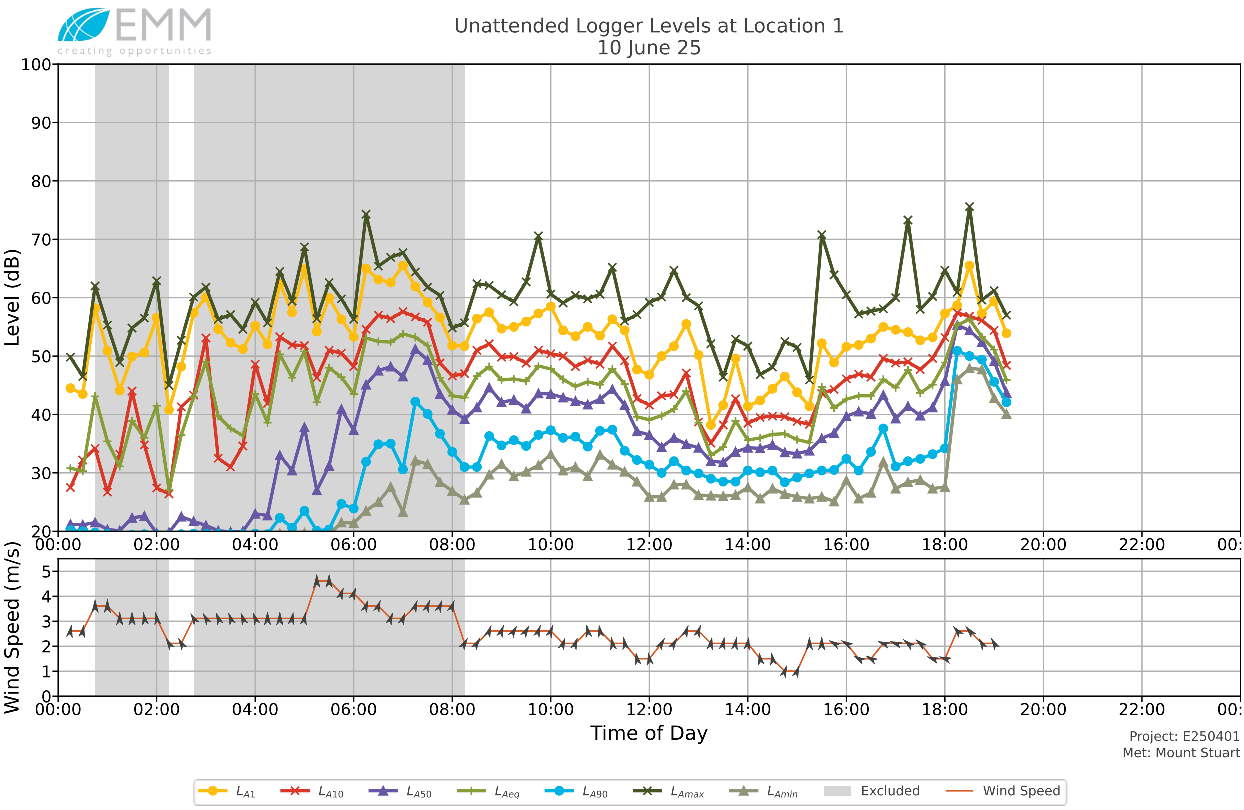
EMM
creating opportunities
Unattended Logger Levels at Location 1
06 June 25
Level (dB)
Wind Speed (m/s)
Time of Day
Project: E250401
Met: Mount Stuart
L_{A1}
L_{A10}
L_{A50}
L_{Aeq}
L_{A90}
L_{Amax}
L_{Amin}
Excluded
Wind Speed
Rain



EMM
creating opportunities
Unattended Logger Levels at Location 1
07 June 25
Level (dB)
Wind Speed (m/s)
Time of Day
Project: E250401
Met: Mount Stuart
L_{A1}
L_{A10}
L_{A50}
L_{Aeq}
L_{A90}
L_{Amax}
L_{Amin}
Excluded
Wind Speed

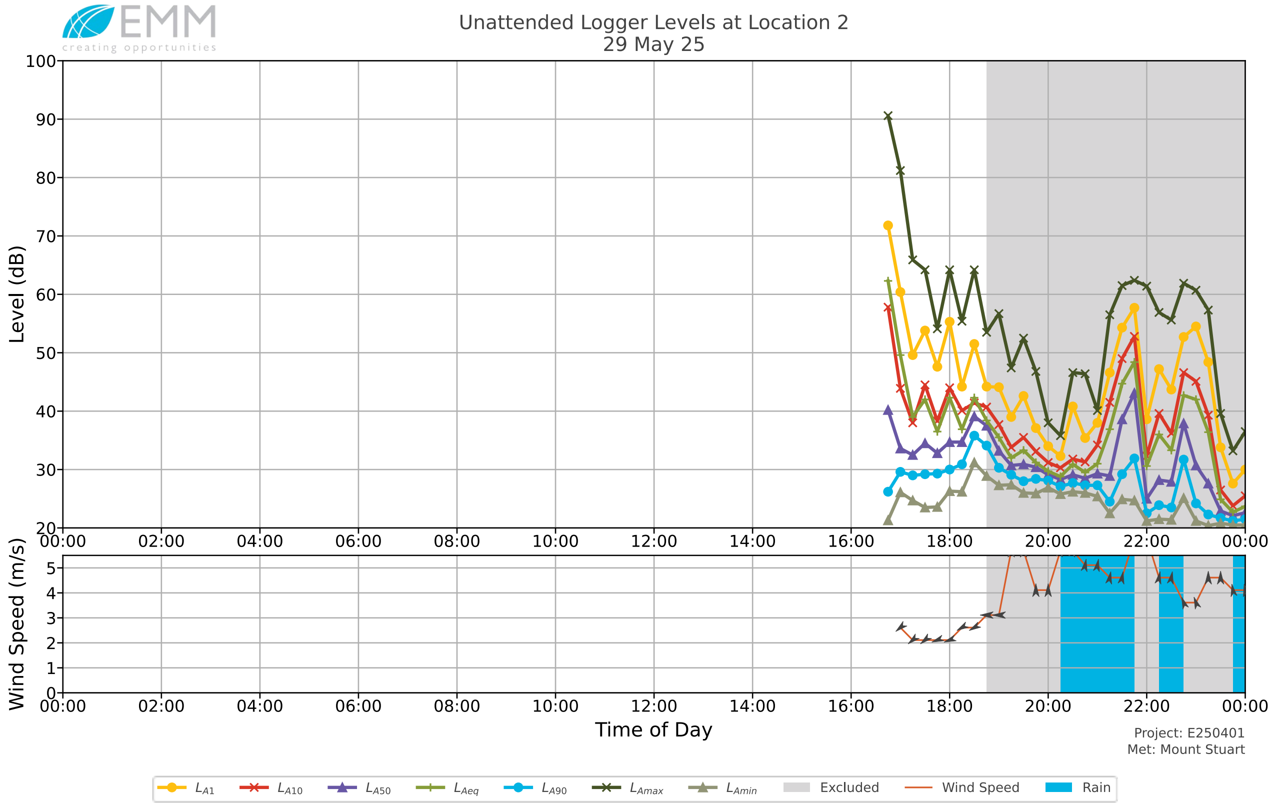

EMM
creating opportunities
Unattended Logger Levels at Location 1
08 June 25
Level (dB)
Wind Speed (m/s)
Time of Day
Project: E250401
Met: Mount Stuart
L_{A1}
L_{A10}
L_{A50}
L_{Aeq}
L_{A90}
L_{Amax}
L_{Amin}
Wind Speed

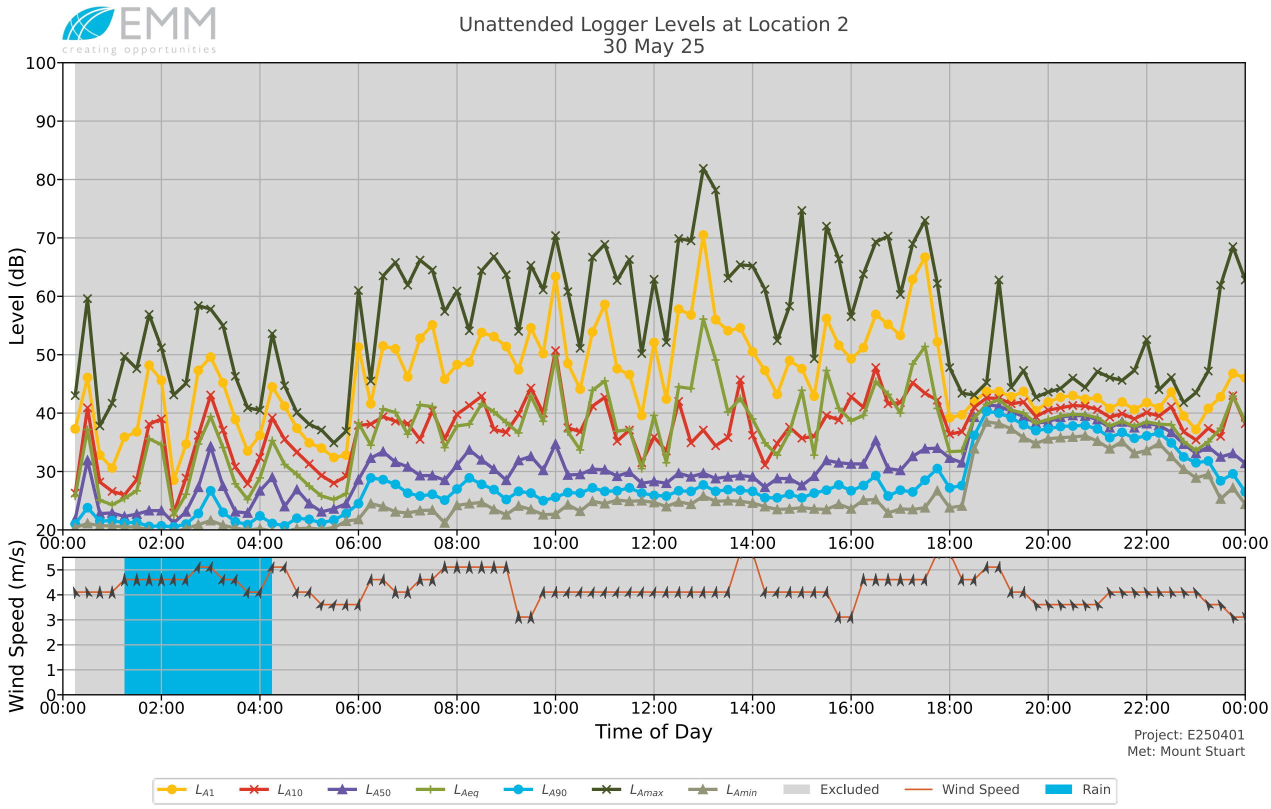

EMM
creating opportunities
Unattended Logger Levels at Location 1
09 June 25
Level (dB)
Wind Speed (m/s)
Time of Day
Project: E250401
Met: Mount Stuart
L_{A1}
L_{A10}
L_{A50}
L_{Aeq}
L_{A90}
L_{Amax}
L_{Amin}
Excluded
Wind Speed

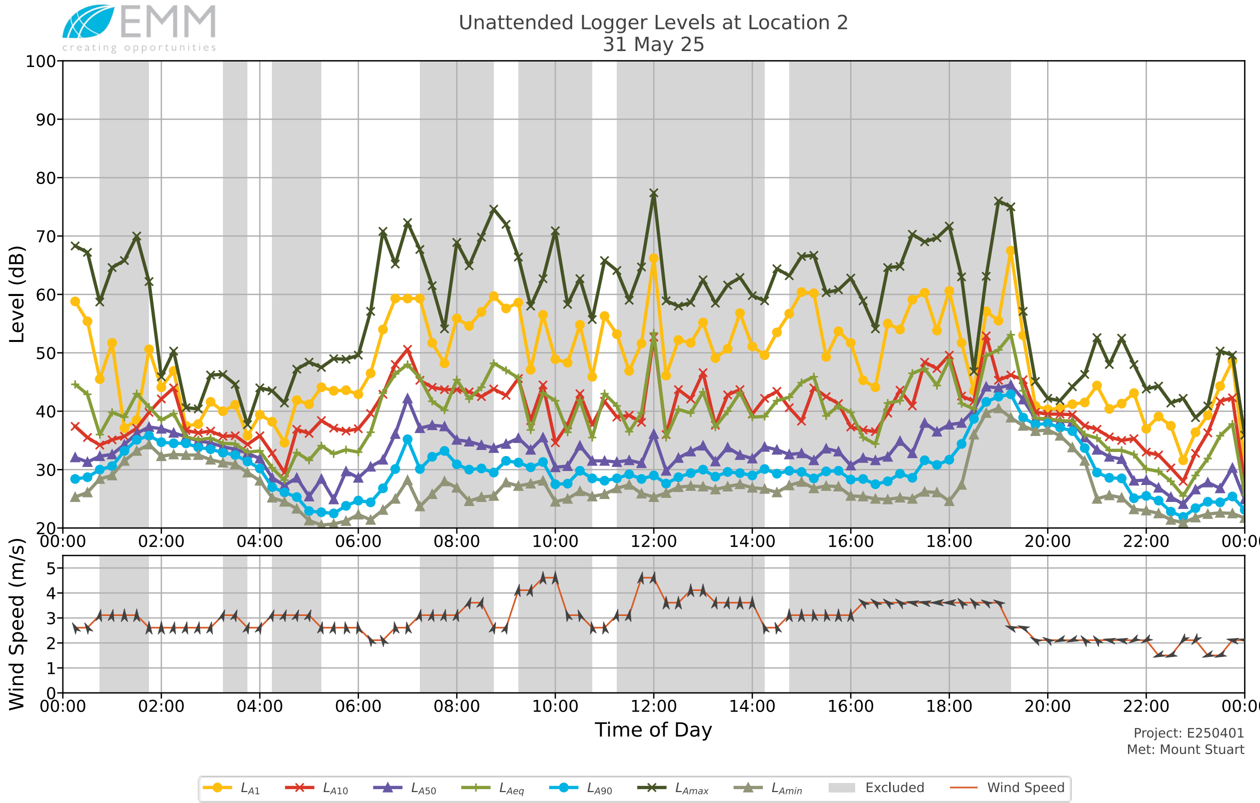


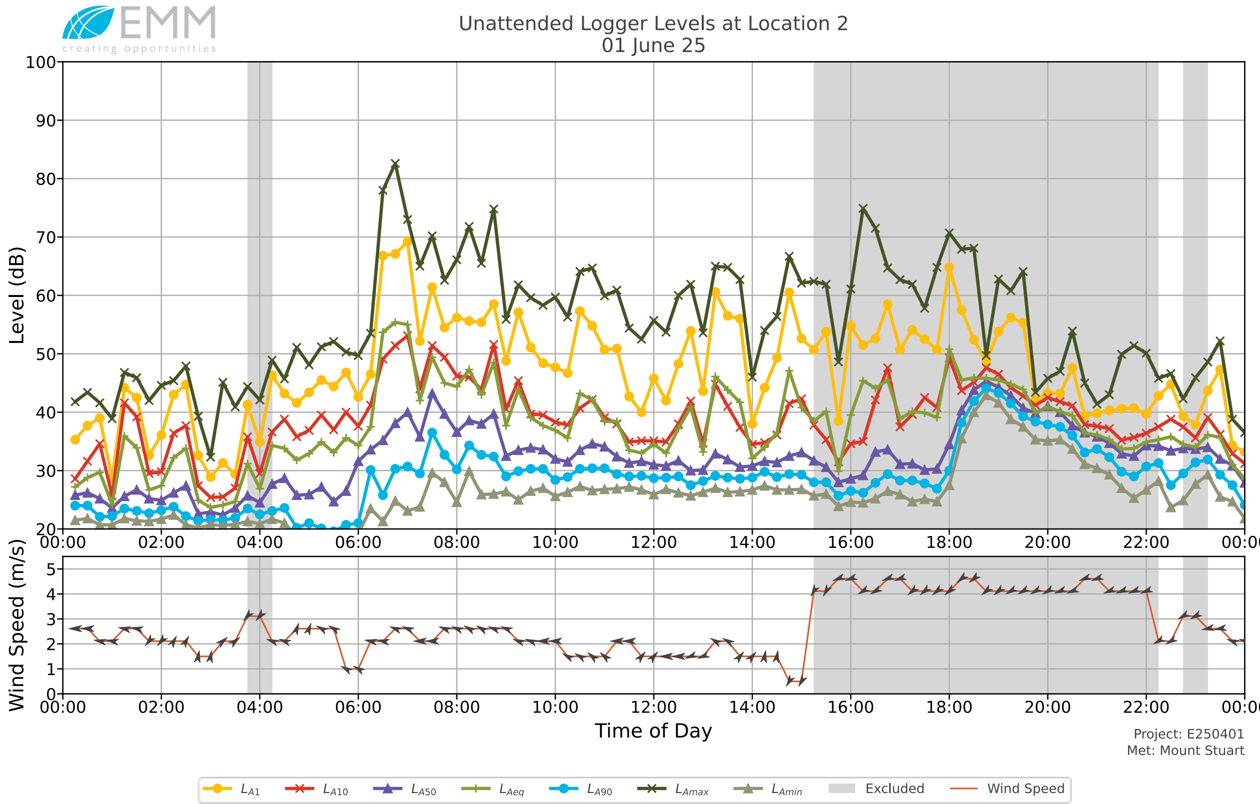
Unattended Logger Levels at Location 1
10 June 25
Level (dB)
Wind Speed (m/s)
Time of Day
Project: E250401
Met: Mount Stuart
L_{A1}
L_{A10}
L_{A50}
L_{Aeq}
L_{A90}
L_{Amax}
L_{Amin}
Excluded
Wind Speed

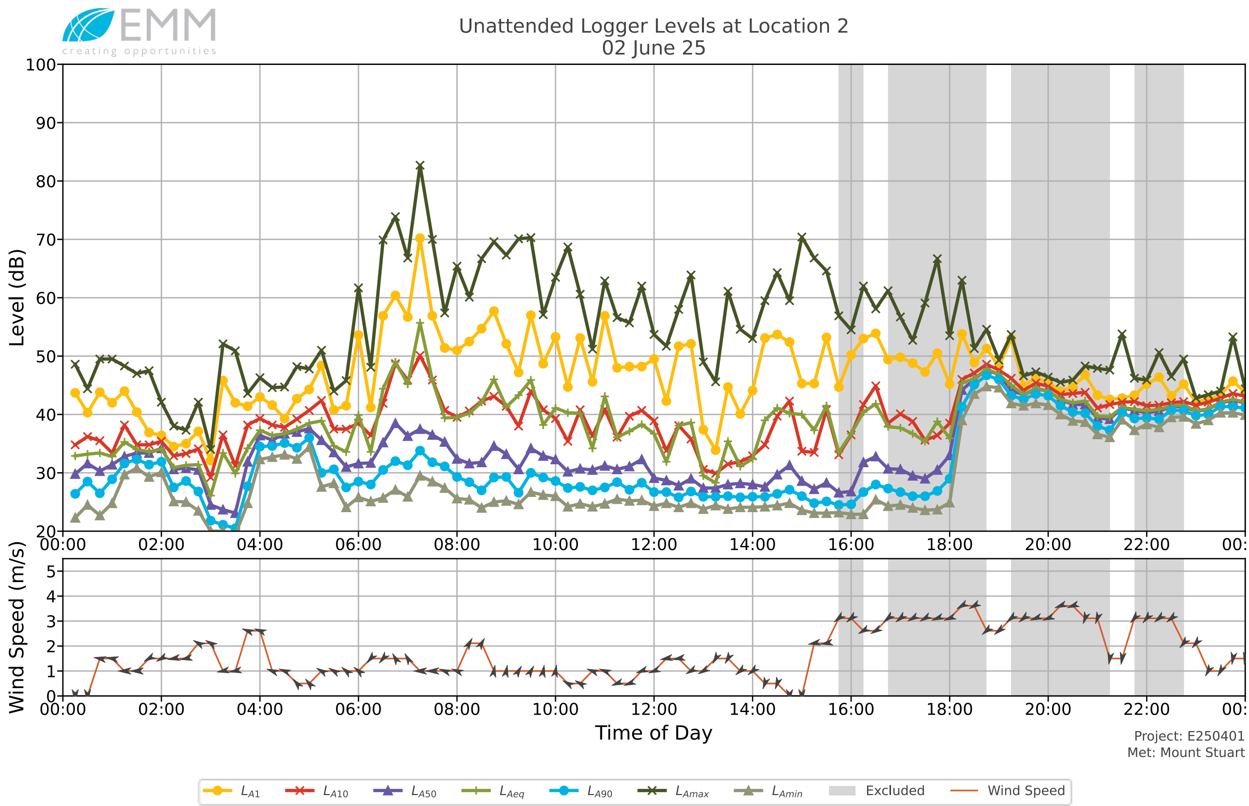
B.1.2 Location 2 – No-Name Rd

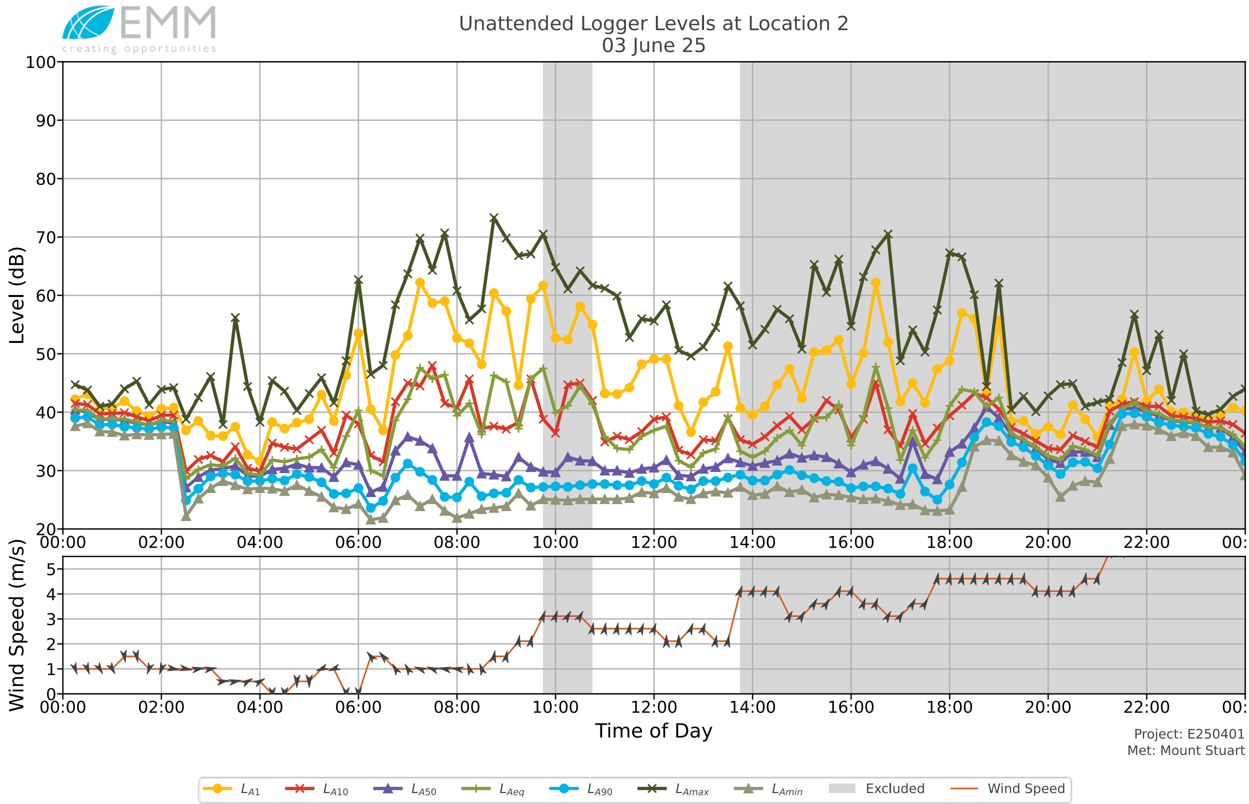


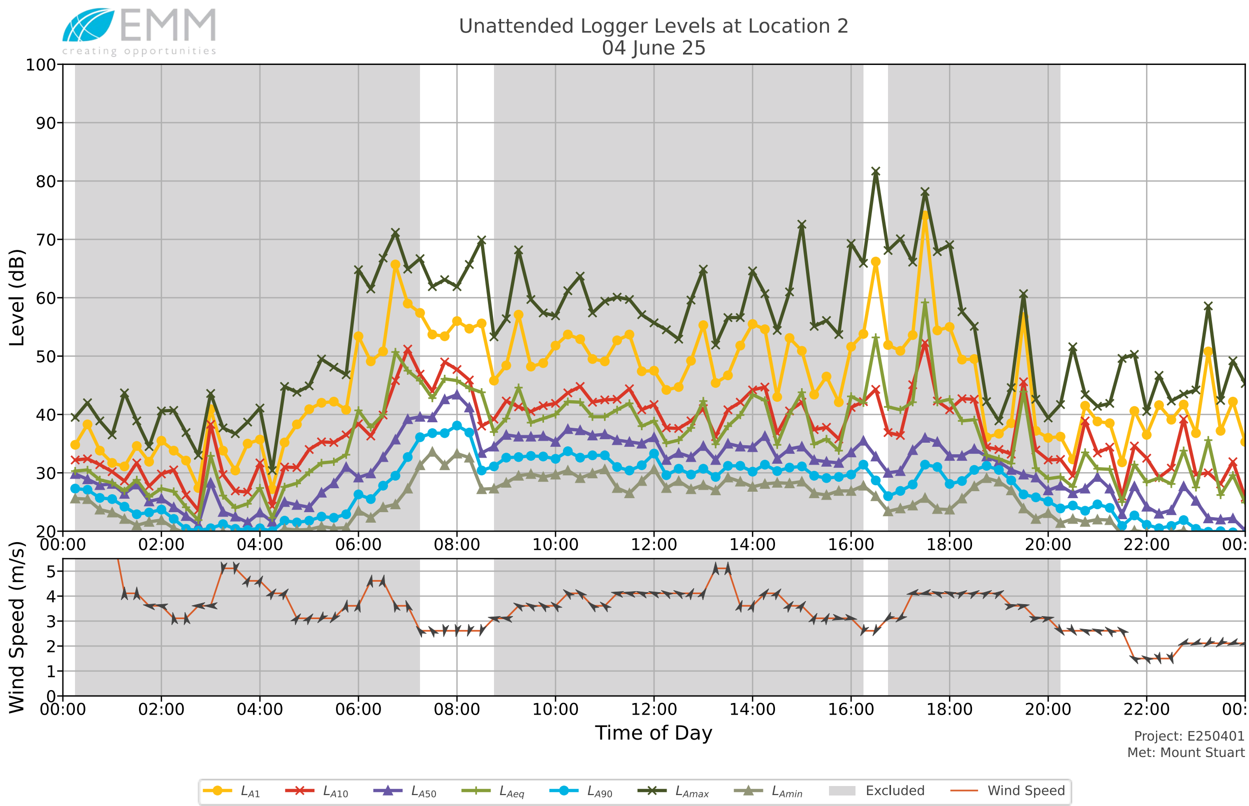


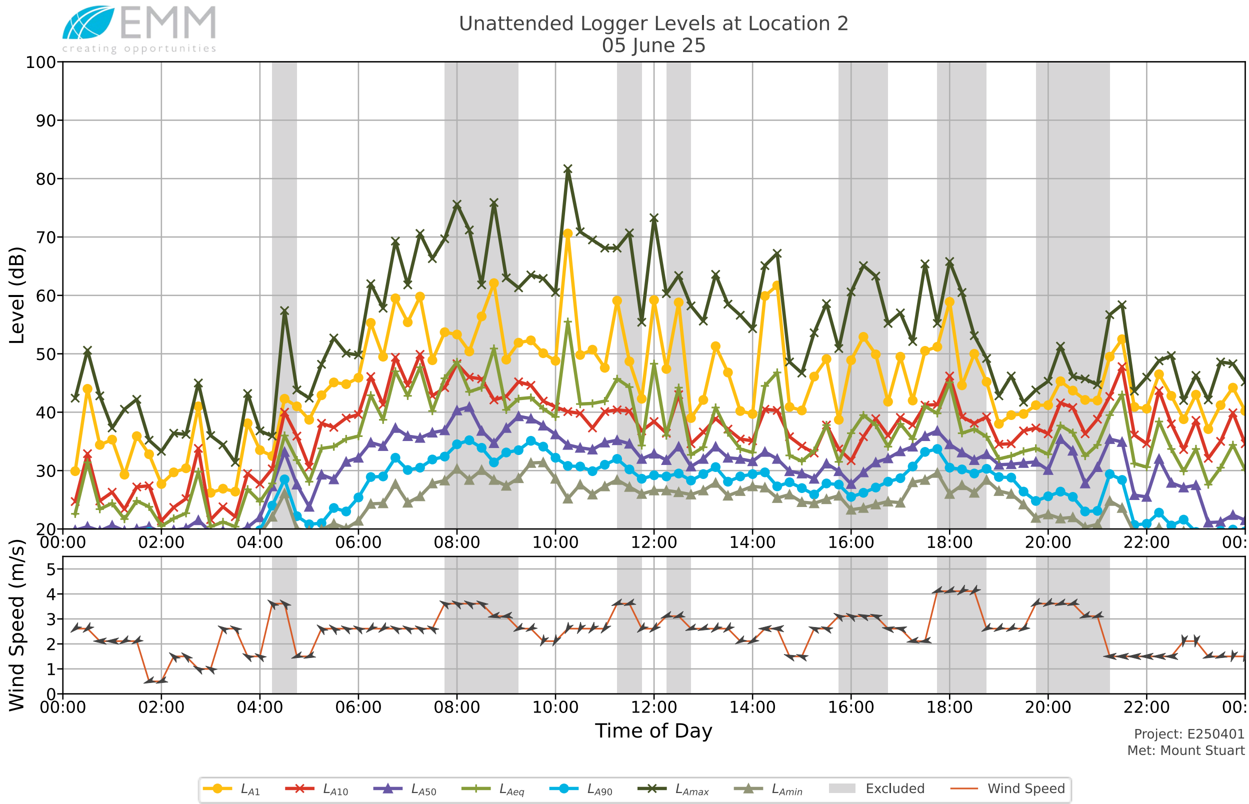

EMM
creating opportunities
Unattended Logger Levels at Location 2
31 May 25
Level (dB)
Wind Speed (m/s)
Time of Day
Project: E250401
Met: Mount Stuart
L_{A1} L_{A10} L_{A50} L_{Aeq} L_{A90} L_{Amax} L_{Amin} Excluded Wind Speed

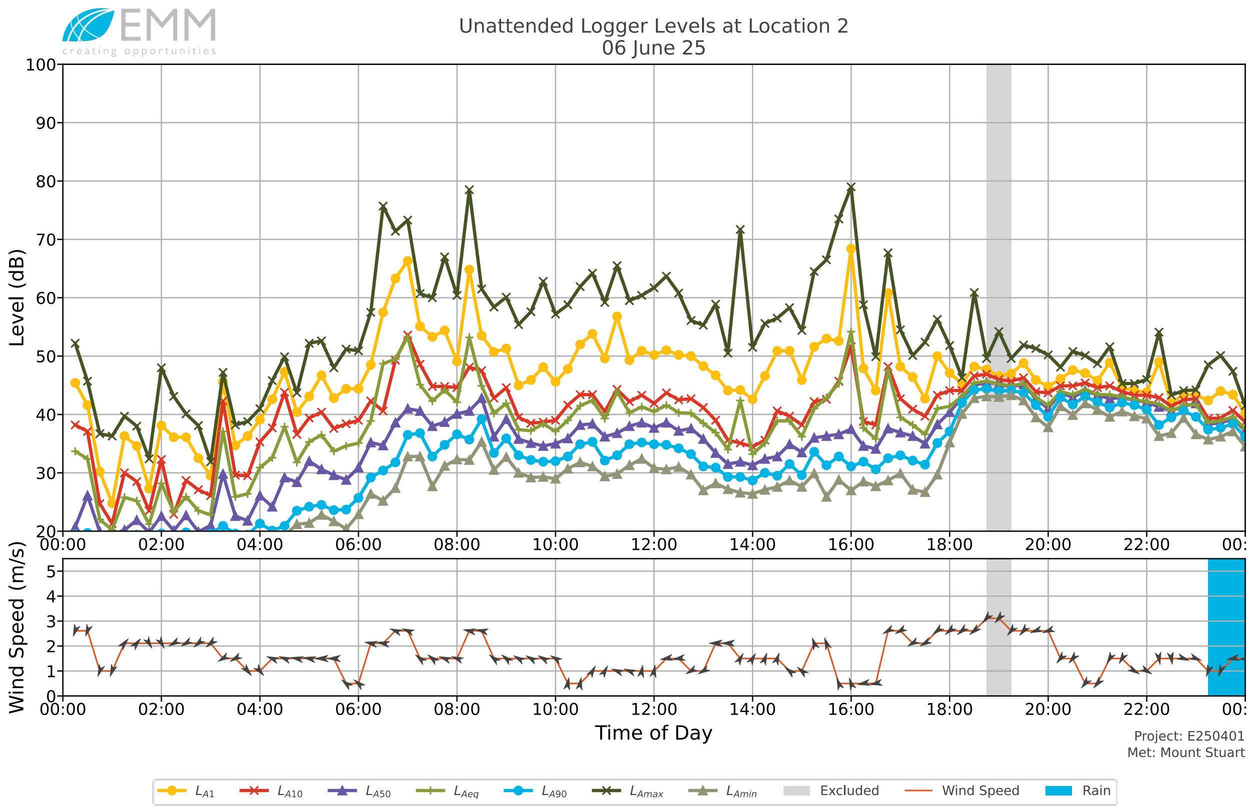

EMM
creating opportunities
Unattended Logger Levels at Location 2
01 June 25
Level (dB)
Wind Speed (m/s)
Time of Day
Project: E250401
Met: Mount Stuart
L_{A1} L_{A10} L_{A50} L_{Aeq} L_{A90} L_{Amax} L_{Amin} Excluded Wind Speed


Unattended Logger Levels at Location 2
02 June 25
Level (dB)
Wind Speed (m/s)
Time of Day
Project: E250401
Met: Mount Stuart
L_{A1} L_{A10} L_{A50} L_{Aeq} L_{A90} L_{Amax} L_{Amin} Excluded Wind Speed

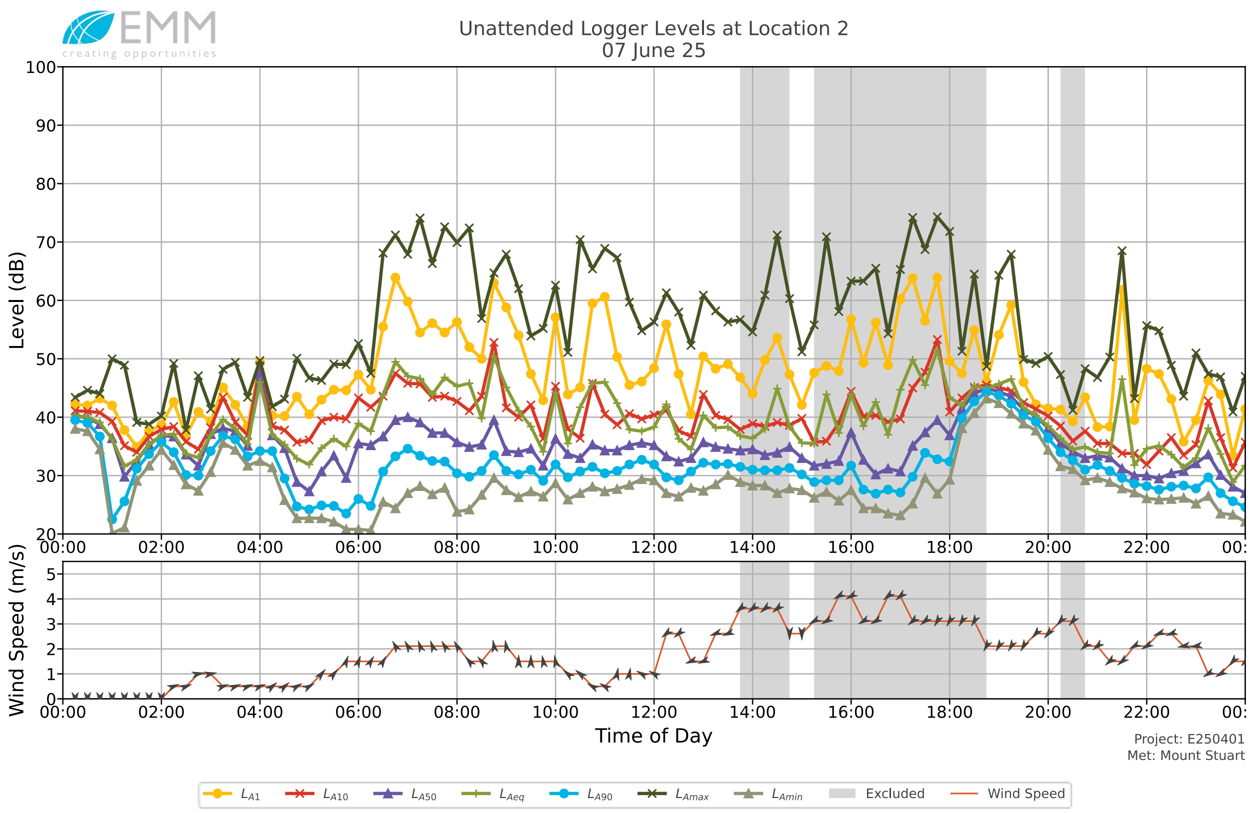

Unattended Logger Levels at Location 2
03 June 25
Level (dB)
Wind Speed (m/s)
Time of Day
Project: E250401
Met: Mount Stuart
L_{A1} L_{A10} L_{A50} L_{Aeq} L_{A90} L_{Amax} L_{Amin} Excluded Wind Speed


EMM
creating opportunities
Unattended Logger Levels at Location 2
04 June 25
Level (dB)
Wind Speed (m/s)
Time of Day
Project: E250401
Met: Mount Stuart
LA1
LA10
LA50
LAeq
LA90
LAmax
LAmin
Excluded
Wind Speed

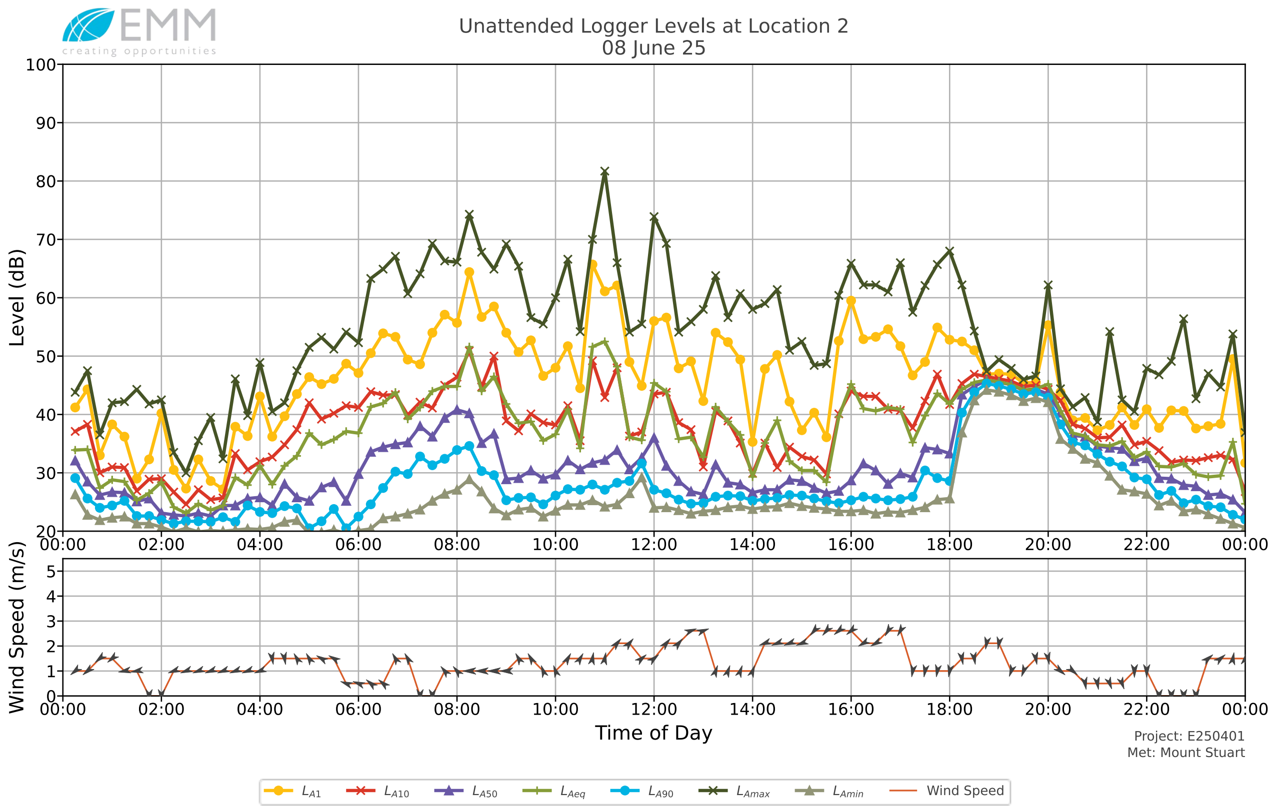

EMM
creating opportunities
Unattended Logger Levels at Location 2
05 June 25
Level (dB)
Wind Speed (m/s)
Time of Day
Project: E250401
Met: Mount Stuart
LA1
LA10
LA50
LAeq
LA90
LAmax
LAmin
Excluded
Wind Speed



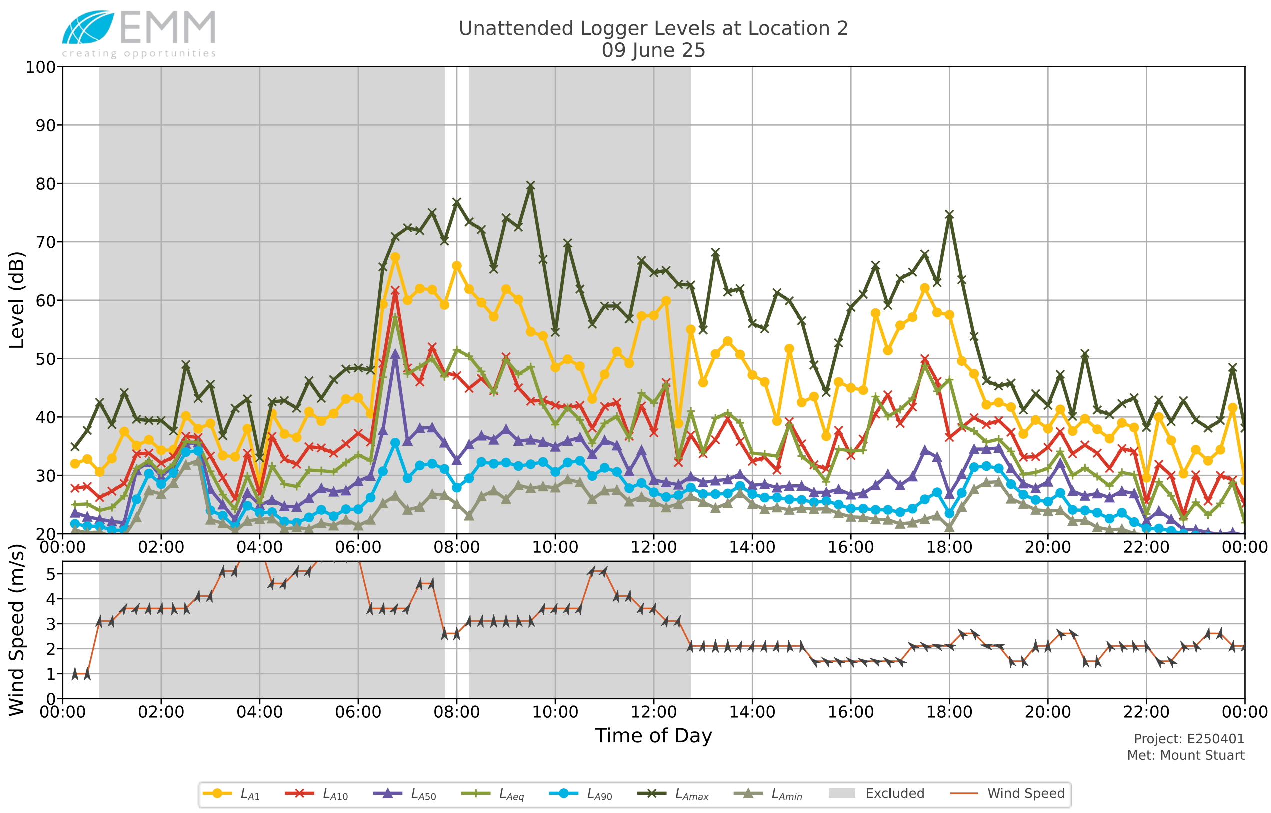
Unattended Logger Levels at Location 2
06 June 25
Level (dB)
Wind Speed (m/s)
Time of Day
Project: E250401
Met: Mount Stuart
L_{A1} L_{A10} L_{A50} L_{Aeq} L_{A90} L_{Amax} L_{Amin} Excluded Wind Speed Rain



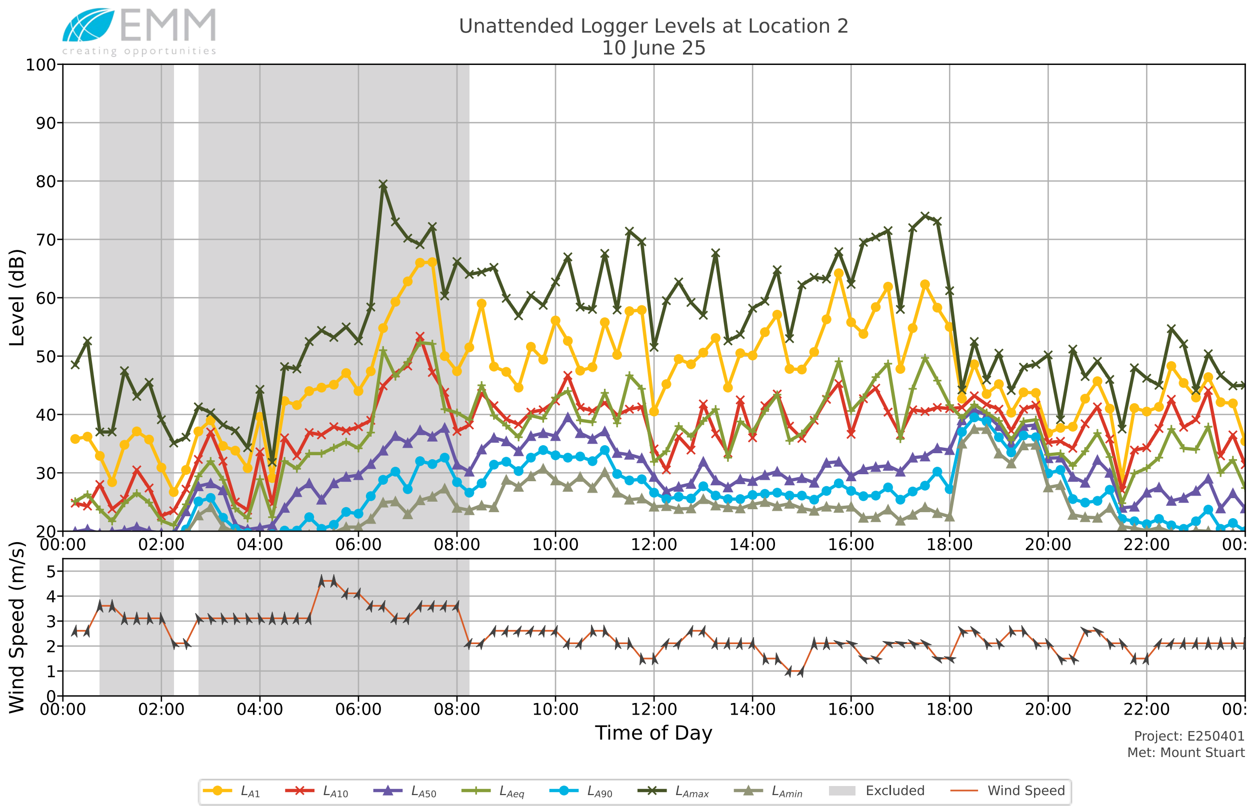
Unattended Logger Levels at Location 2
07 June 25
Level (dB)
Wind Speed (m/s)
Time of Day
Project: E250401
Met: Mount Stuart
L_{A1} L_{A10} L_{A50} L_{Aeq} L_{A90} L_{Amax} L_{Amin} Excluded Wind Speed



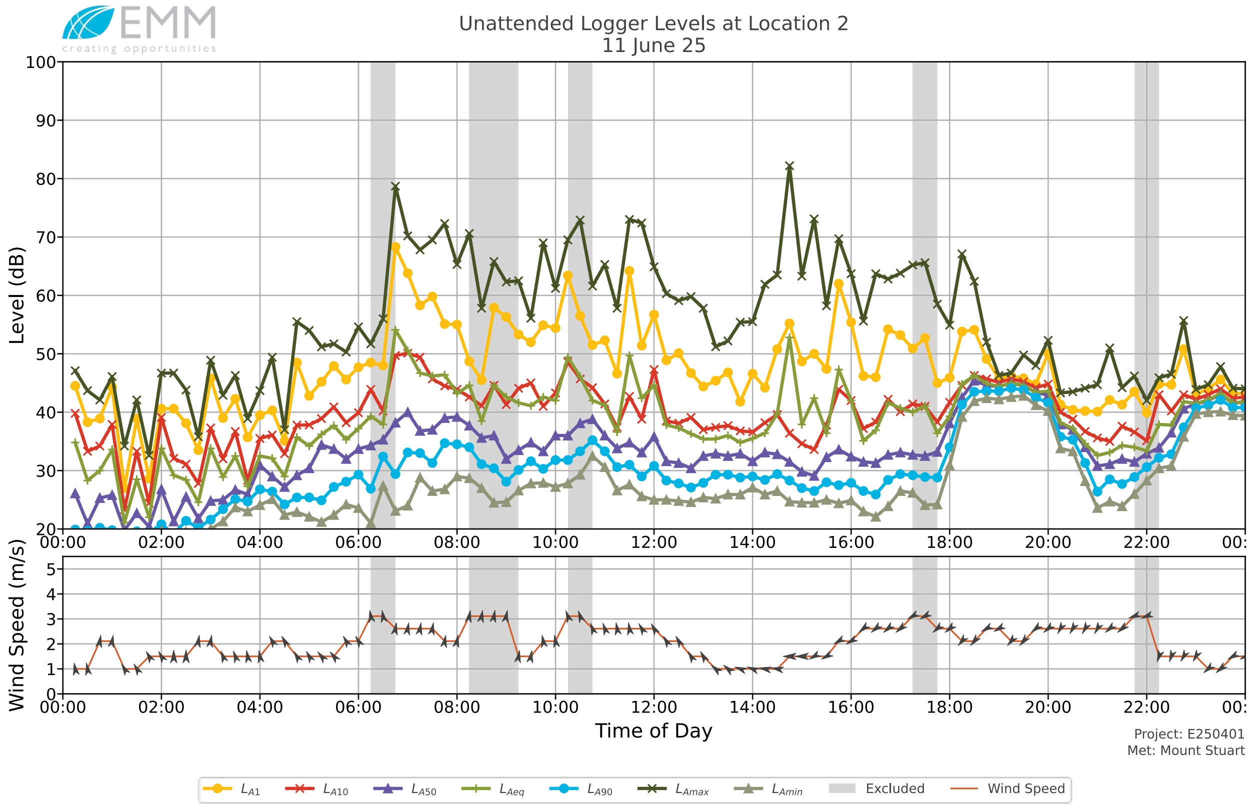
Unattended Logger Levels at Location 2
08 June 25
Level (dB)
Wind Speed (m/s)
Time of Day
Project: E250401
Met: Mount Stuart
L_{A1} L_{A10} L_{A50} L_{Aeq} L_{A90} L_{Amax} L_{Amin} Wind Speed



Unattended Logger Levels at Location 2
09 June 25
Level (dB)
Wind Speed (m/s)
Time of Day
Project: E250401
Met: Mount Stuart
L_{A1} L_{A10} L_{A50} L_{Aeq} L_{A90} L_{Amax} L_{Amin} Excluded Wind Speed



EMM
creating opportunities
Unattended Logger Levels at Location 2
10 June 25
Level (dB)
Wind Speed (m/s)
Time of Day
Project: E250401
Met: Mount Stuart
L_{A1} L_{A10} L_{A50} L_{Aeq} L_{A90} L_{Amax} L_{Amin} Excluded Wind Speed



EMM
creating opportunities
Unattended Logger Levels at Location 2
11 June 25
Level (dB)
Wind Speed (m/s)
Time of Day
Project: E250401
Met: Mount Stuart
L_{A1} L_{A10} L_{A50} L_{Aeq} L_{A90} L_{Amax} L_{Amin} Excluded Wind Speed

Attachment C

Equipment sound power levels

EMM
creating opportunities

C.1 Construction and operational sound power levels

The sound power levels utilised in the construction and operational noise predictions are presented in Table C.1 and Table C.2, respectively.

Table C.1 Construction 1/1 octave sound power levels

Construction Phase	Description	Plant equipment	Number of Units	1/1 octave sound power levels L_{Aeq} dB(A)								
				63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	Total dB(A)
Phase 1	Site establishment of BESS	Bulldozer	2	82	101	97	103	113	112	105	97	116
		Grader	1	72	88	97	99	101	98	91	83	105
		Excavator	2	86	92	96	98	101	98	92	86	105
		Roller	1	71	86	92	96	100	94	87	94	103
		Scraper	1	76	101	99	104	108	110	100	87	114
		Hand tools	2	47	51	60	73	86	95	90	88	97
		Light vehicles	3	35	65	81	90	97	100	94	82	103
		Total		**88**	**104**	**104**	**108**	**115**	**115**	**107**	**100**	**119**
Phase 2	Installation of foundation for BESS	Bulldozer	2	82	101	97	103	113	112	105	97	116
		Grader	1	72	88	97	99	101	98	91	83	105
		Excavator	2	86	92	96	98	101	98	92	86	105
		Scrapers	1	76	101	99	104	108	110	100	87	114
		Loaders	2	92	97	99	106	104	102	96	87	110
		Dump Trucks	2	93	99	97	101	106	104	100	90	110
		Compactors	1	81	95	90	100	106	99	96	94	108
		Total		**96**	**106**	**106**	**111**	**116**	**115**	**108**	**100**	**120**

Construction Phase	Description	Plant equipment	Number of Units	1/1 octave sound power levels L_{Aeq} dB(A)								
				63 Hz	**125 Hz**	**250 Hz**	**500 Hz**	**1000 Hz**	**2000 Hz**	**4000 Hz**	**8000 Hz**	**Total dB(A)**
Phase 3	Installation of BESS infrastructure	Low loaders	2	89	94	96	103	101	99	93	84	107
		Slew Cranes	1	72	88	94	95	97	96	91	80	102
		Light vehicles	3	35	65	81	90	97	100	94	82	103
		Hand tools	2	47	51	60	73	86	95	90	88	97
		Total		**89**	**95**	**98**	**104**	**104**	**104**	**98**	**91**	**110**

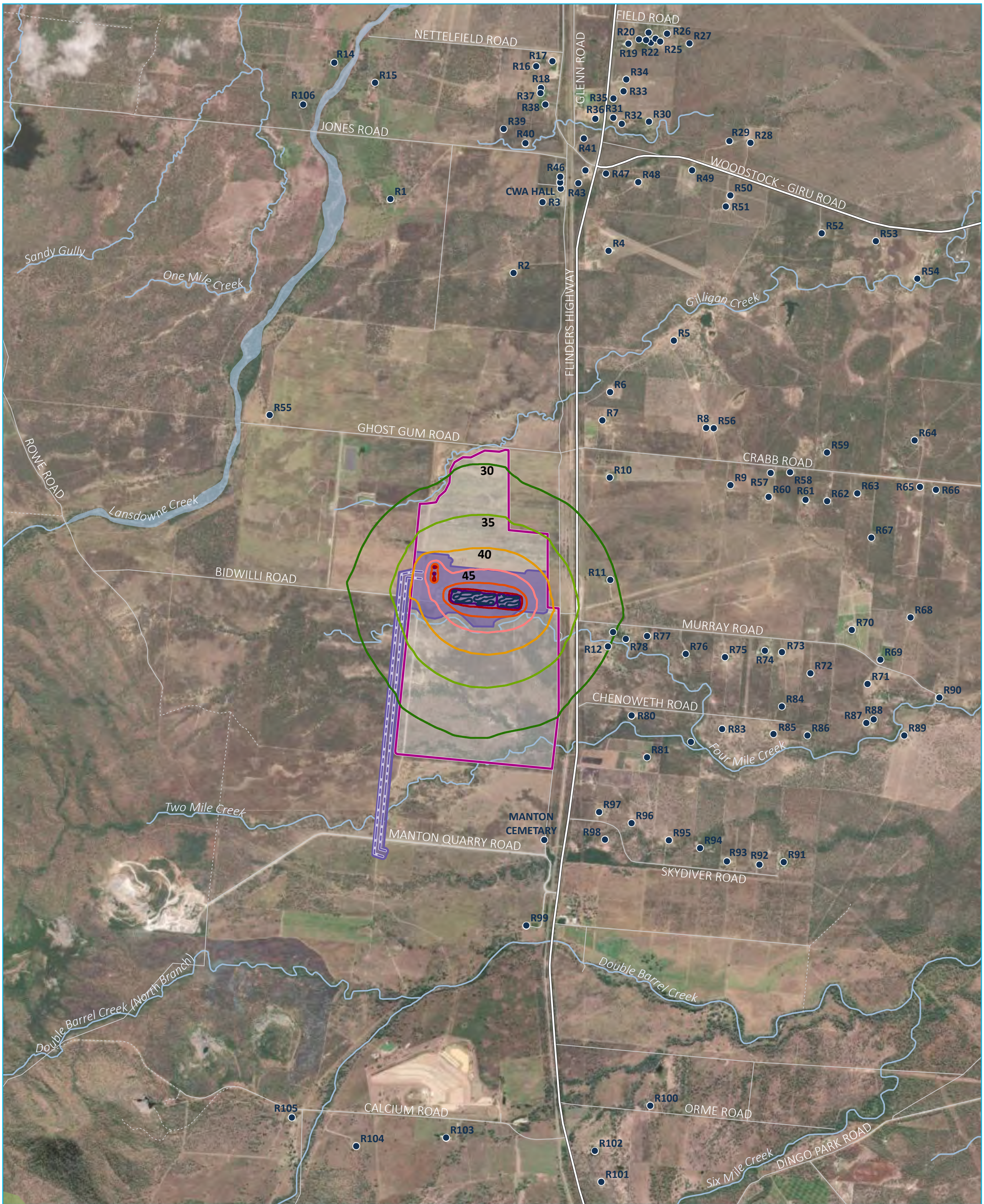
Table C.2 Operational 1/3 octave sound power levels

Frequency (Hz)	1/3 octave sound power levels L_{Aeq} dB(A)		
	BESS Unit (silenced)	PCU	HV Transformer
25	31	31	-
31.5	36	39	-
40	42	43	-
50	48	52	71
63	45	55	75
80	54	57	74
100	59	65	94
125	67	59	74
160	70	59	70
200	68	63	90
250	67	65	76
315	68	70	87
400	69	64	88
500	70	64	82
630	70	65	79
800	70	64	72
1000	68	64	72
1250	67	61	70
1600	65	59	65
2000	62	58	63
2500	60	72	61
3150	57	81	58
4000	59	61	56
5000	54	64	57
6300	53	74	59
8000	74	66	57
10000	51	66	57
Total dB(A)	**81**	**83**	**97**

Attachment D

Noise contour maps

EMM
creating opportunities



Source: EMM (2025); DES (2025); DNRMMRRD (2025); ESRI (2025)

KEY

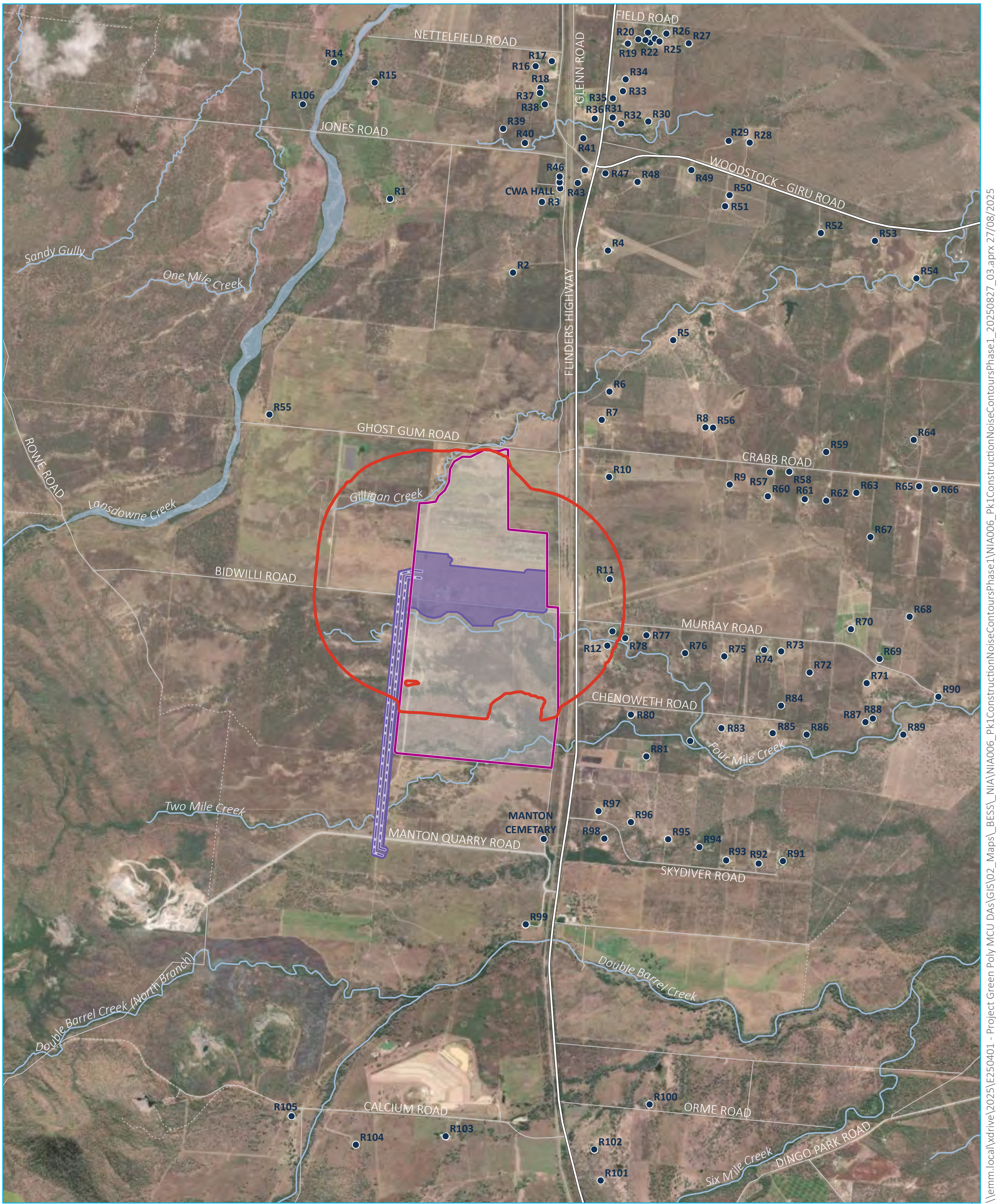
Northern Quartz Campus
Package 1 - Premises
Package 1 - Transmission line
Sensitive receptor

Operational noise contour dB(A)
30
35
40
45
50
55
60
65

Existing environment
Major road
Minor road
Vehicular track
Named watercourse
Named waterbody
State forest

Operational noise contours

Northern Quartz Campus
Package 1 - BESS, transmission line and substation
Noise Impact Assessment
Figure D.1



Source: EMM (2025); DES (2025); DNRMMRRD (2025); ESRI (2025)

0 1 2 km
GDA2020 MGA Zone 55
N

KEY

- Northern Quartz Campus
- Package 1 - Premises
- Package 1 - Transmission line
- Sensitive receptor

Construction noise contour dB(A)

- 42

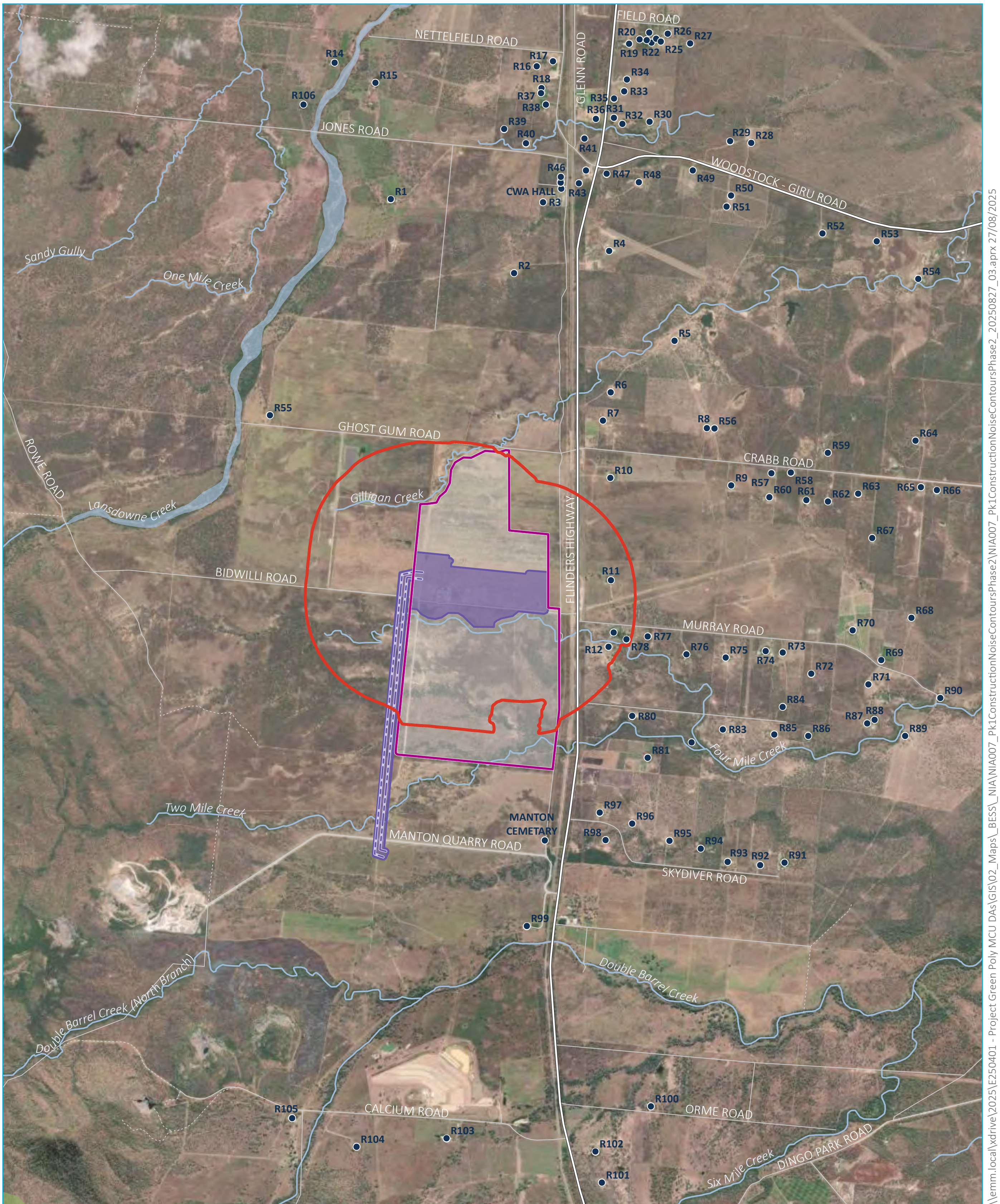
Existing environment

- Major road
- Minor road
- Vehicular track
- Named watercourse
- Named waterbody
- State forest

Construction noise contours - Phase 1

Northern Quartz Campus
Package 1 - BESS, transmission line and substation
Noise Impact Assessment
Figure D.2

creating opportunities



Source: EMM (2025); DES (2025); DNRMMRRD (2025); ESRI (2025)

0 1 2 km

GDA2020 MGA Zone 55

N

KEY

Northern Quartz Campus

Package 1 - Premises

Package 1 - Transmission line

Sensitive receptor

Construction noise contour dB(A)

42

Existing environment

Major road

Minor road

Vehicular track

Named watercourse

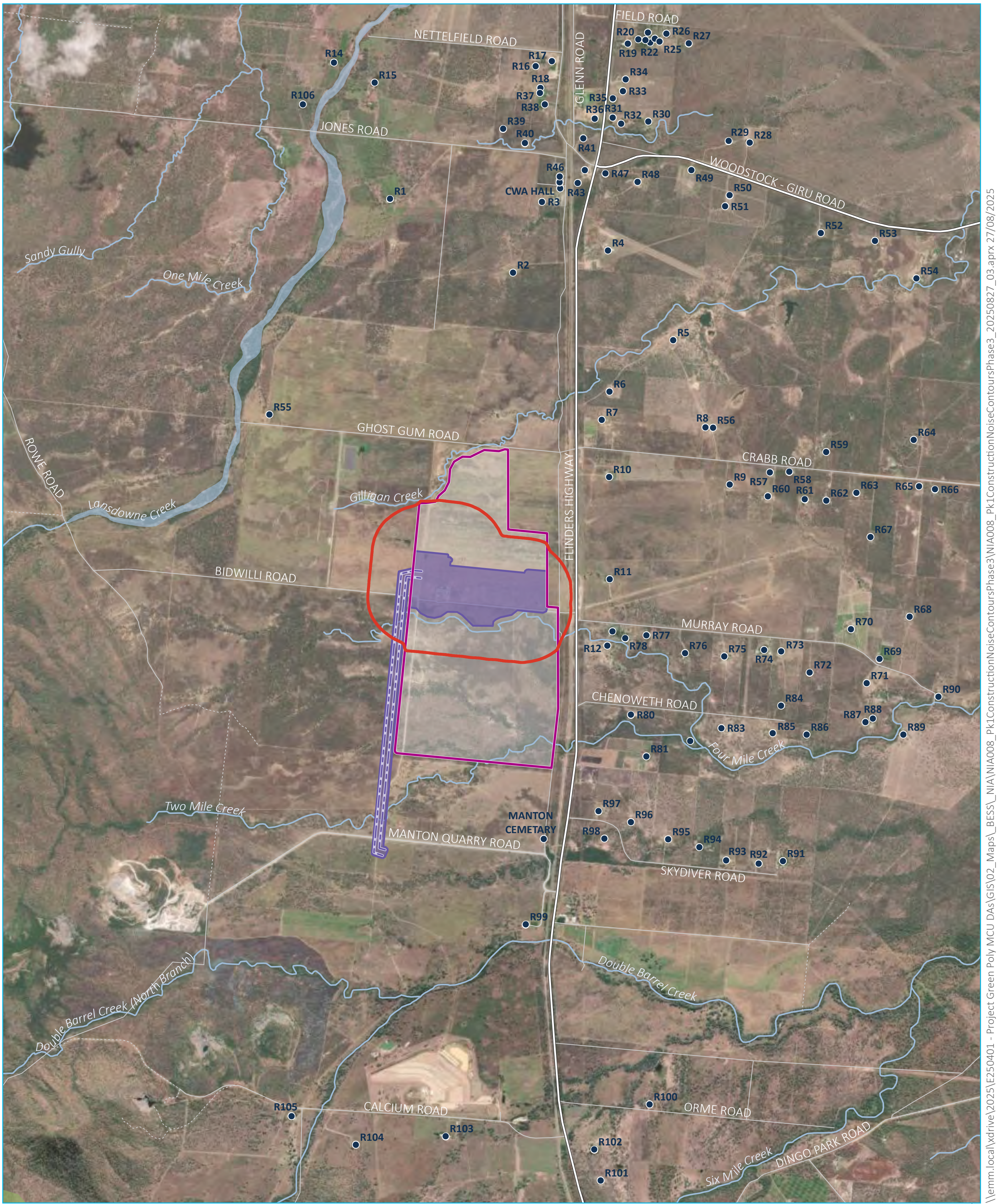
Named waterbody

State forest

Construction noise contours - Phase 2

Northern Quartz Campus
Package 1 - BESS, transmission line and substation
Noise Impact Assessment
Figure D.3

EMM creating opportunities



Source: EMM (2025); DES (2025); DNRMMRRD (2025); ESRI (2025)

0 1 2 km
GDA2020 MGA Zone 55
N

KEY

- Northern Quartz Campus
- Package 1 - Premises
- Package 1 - Transmission line
- Sensitive receptor

Construction noise contour dB(A)

- 42

Existing environment

- Major road
- Minor road
- Vehicular track
- Named watercourse
- Named waterbody
- State forest

Construction noise contours - Phase 3

Northern Quartz Campus
Package 1 - BESS, transmission line and substation
Noise Impact Assessment
Figure D.4

EMM creating opportunities

Attachment E

Operational noise prediction tonality and low frequency check

EMM
creating opportunities

E.1 1/3 octave operational noise prediction results - Linear frequency contributions

Table E.1 1/3 octave operational noise prediction results

Receptor	Frequency (Hz)																				
	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150
R1	24.8	24.9	26.9	29.4	25.7	27.9	22.9	25.6	22.7	16.7	12.9	10.7	8.9	5.1	1.9	-	-	-	-	-	-	-
R2	28.1	28.1	30.1	32.5	28.4	30.5	25.1	28.0	25.2	19.4	15.9	14.0	12.8	9.4	6.7	4.4	-	-	-	-	-	-
R3	25.4	25.4	27.4	29.9	26.1	28.3	23.1	25.9	23.0	17.0	13.3	11.1	9.4	5.7	2.5	-	-	-	-	-	-	-
R4	27.1	27.2	29.2	31.1	27.2	29.4	23.8	26.7	23.8	17.9	14.3	12.3	10.9	7.4	4.4	1.6	-	-	-	-	-	-
R5	26.8	27.0	29.1	31.4	27.9	30.0	25.1	28.0	25.3	19.5	16.1	14.1	12.7	9.5	6.9	4.3	-	-	-	-	-	-
R6	30.3	30.4	32.4	34.5	30.8	33.0	27.8	30.9	28.2	22.6	19.4	17.9	16.9	14.1	11.9	10.0	5.5	1.7	-	-	-	-
R7	31.2	31.4	33.4	35.5	31.9	34.0	29.0	32.1	29.5	24.0	20.8	19.4	18.5	15.8	13.8	12.1	7.8	4.2	0.3	-	-	-
R8	28.7	28.7	30.9	33.1	29.4	31.6	26.5	29.6	27.0	21.2	17.9	16.2	15.1	12.3	9.9	7.7	2.9	-	-	-	-	-
R9	28.9	28.9	30.9	33.3	29.7	31.8	26.9	29.8	27.4	21.7	18.4	16.7	15.6	13.1	10.8	8.9	4.3	0.4	-	-	-	-
R10	32.7	32.8	35.0	37.1	33.5	35.8	31.0	34.2	31.7	26.2	23.2	21.9	21.0	18.7	17.0	15.6	11.5	8.4	5.0	-	1.5	3.4
R11	36.1	35.9	37.9	40.2	36.4	38.5	34.3	37.4	35.4	29.4	26.8	25.5	24.8	23.4	22.2	21.8	18.1	15.6	13.1	8.7	9.2	12.7
R12	35.6	35.5	37.4	39.7	36.1	38.1	34.0	37.0	35.0	29.1	26.6	25.3	24.5	22.9	21.7	21.2	17.4	14.6	11.8	7.2	9.9	13.9
R13	21.1	21.2	23.1	25.4	21.8	23.8	19.0	21.4	18.4	11.9	7.5	4.5	1.5	-	-	-	-	-	-	-	-	-
R14	22.3	22.3	24.4	26.8	23.0	25.2	19.9	22.5	19.4	13.1	8.9	6.1	3.6	-	-	-	-	-	-	-	-	-
R15	22.7	22.7	24.8	27.2	23.5	25.6	20.4	23.0	20.0	13.7	9.5	6.8	4.4	0.0	-	-	-	-	-	-	-	-
R16	22.6	22.7	24.7	27.1	23.4	25.5	20.2	22.9	19.8	13.5	9.3	6.6	4.3	-	-	-	-	-	-	-	-	-
R17	23.1	23.1	25.1	27.6	23.6	25.7	20.1	22.8	19.7	13.4	9.2	6.5	4.3	-	-	-	-	-	-	-	-	-
R18	24.2	24.2	26.1	28.6	24.4	26.5	20.7	23.4	20.3	14.1	10.0	7.4	5.4	1.1	-	-	-	-	-	-	-	-

Receptor	Frequency (Hz)																				
	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150
R19	22.6	22.6	24.6	26.9	23.0	25.1	19.6	22.2	19.0	12.7	8.4	5.5	3.2	-	-	-	-	-	-	-	-	-
R20	22.4	22.4	24.4	26.7	22.8	25.0	19.4	22.1	18.9	12.5	8.2	5.3	3.0	-	-	-	-	-	-	-	-	-
R21	22.2	22.2	24.2	26.6	22.7	24.8	19.3	21.9	18.7	12.3	8.0	5.1	2.7	-	-	-	-	-	-	-	-	-
R22	22.1	22.2	24.2	26.6	22.8	24.9	19.4	22.1	18.9	12.5	8.2	5.3	2.9	-	-	-	-	-	-	-	-	-
R23	22.2	22.2	24.3	26.6	22.8	24.9	19.4	22.0	18.9	12.5	8.2	5.3	2.9	-	-	-	-	-	-	-	-	-
R24	22.0	22.1	24.1	26.5	22.7	24.9	19.3	22.0	18.8	12.4	8.1	5.2	2.8	-	-	-	-	-	-	-	-	-
R25	22.0	22.0	24.1	26.5	22.7	24.9	19.3	22.0	18.8	12.4	8.1	5.2	2.8	-	-	-	-	-	-	-	-	-
R26	22.0	22.1	24.1	26.4	22.6	24.8	19.2	21.8	18.6	12.2	7.9	5.0	2.5	-	-	-	-	-	-	-	-	-
R27	22.5	22.5	24.5	26.7	22.8	25.0	19.2	21.9	18.7	12.2	7.9	5.0	2.7	-	-	-	-	-	-	-	-	-
R28	22.5	22.7	24.8	27.1	23.5	25.6	20.3	23.0	19.9	13.7	9.6	6.8	4.5	0.2	-	-	-	-	-	-	-	-
R29	22.7	22.9	24.9	27.2	23.6	25.7	20.4	23.1	20.1	13.8	9.8	7.0	4.7	0.4	-	-	-	-	-	-	-	-
R30	23.6	23.7	25.7	28.0	24.3	26.4	20.8	23.5	20.4	14.2	10.2	7.6	5.6	1.3	-	-	-	-	-	-	-	-
R31	23.2	23.3	25.4	27.8	24.1	26.2	20.9	23.6	20.6	14.4	10.4	7.8	5.7	1.5	-	-	-	-	-	-	-	-
R32	23.3	23.4	25.4	27.9	24.1	26.3	21.0	23.7	20.7	14.5	10.5	7.9	5.9	1.6	-	-	-	-	-	-	-	-
R33	22.8	22.9	24.9	27.4	23.6	25.8	20.4	23.1	20.0	13.7	9.6	6.9	4.8	0.3	-	-	-	-	-	-	-	-
R34	22.9	23.0	25.0	27.4	23.5	25.7	20.2	22.9	19.7	13.4	9.3	6.6	4.4	-	-	-	-	-	-	-	-	-
R35	22.9	23.0	25.0	27.5	23.7	25.9	20.6	23.3	20.2	14.0	9.9	7.2	5.1	0.7	-	-	-	-	-	-	-	-
R36	23.3	23.4	25.4	27.9	24.2	26.3	21.0	23.7	20.7	14.5	10.5	8.0	5.9	1.6	-	-	-	-	-	-	-	-
R37	24.3	24.3	26.3	28.7	24.5	26.6	20.8	23.5	20.4	14.2	10.1	7.6	5.6	1.3	-	-	-	-	-	-	-	-
R38	24.5	24.5	26.4	28.9	24.7	26.8	21.0	23.7	20.7	14.5	10.4	7.9	6.0	1.7	-	-	-	-	-	-	-	-

Receptor	Frequency (Hz)																				
	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150
R39	24.2	24.4	26.3	28.8	25.0	27.1	21.6	24.3	21.3	15.2	11.2	8.8	7.0	2.9	-	-	-	-	-	-	-	-
R40	25.2	25.2	27.2	29.6	25.5	27.6	21.8	24.6	21.6	15.5	11.6	9.2	7.5	3.5	-	-	-	-	-	-	-	-
R41	23.7	23.7	25.8	28.2	24.5	26.6	21.5	24.2	21.2	15.0	11.1	8.6	6.5	2.4	-	-	-	-	-	-	-	-
R42	24.3	24.3	26.4	28.9	25.1	27.3	22.1	24.9	21.9	15.9	12.0	9.7	7.8	3.8	0.5	-	-	-	-	-	-	-
R43	24.6	24.6	26.7	29.2	25.4	27.6	22.5	25.2	22.3	16.3	12.5	10.2	8.4	4.5	1.2	-	-	-	-	-	-	-
R44	25.8	25.9	27.8	30.1	26.1	28.2	22.5	25.3	22.4	16.4	12.6	10.3	8.6	4.8	1.5	-	-	-	-	-	-	-
R45	25.8	25.9	27.8	30.1	26.1	28.2	22.6	25.4	22.4	16.4	12.6	10.4	8.7	4.8	1.5	-	-	-	-	-	-	-
R46	25.7	25.8	27.7	30.0	26.0	28.1	22.4	25.2	22.3	16.3	12.4	10.2	8.5	4.6	1.3	-	-	-	-	-	-	-
R47	24.2	24.3	26.3	28.8	25.1	27.2	22.0	24.8	21.8	15.8	11.9	9.5	7.5	3.6	0.3	-	-	-	-	-	-	-
R48	24.2	24.3	26.3	28.8	25.1	27.2	22.0	24.8	21.8	15.8	11.9	9.5	7.7	3.8	0.4	-	-	-	-	-	-	-
R49	24.6	24.7	26.7	28.7	24.9	27.0	21.4	24.1	21.1	15.0	11.1	8.6	6.8	2.7	-	-	-	-	-	-	-	-
R50	24.5	24.6	26.6	28.6	24.9	27.0	21.5	24.3	21.2	15.2	11.2	8.8	6.9	2.8	-	-	-	-	-	-	-	-
R51	24.7	24.8	26.8	28.8	25.2	27.2	21.7	24.5	21.5	15.5	11.6	9.2	7.4	3.3	-	-	-	-	-	-	-	-
R52	23.0	23.3	25.4	27.7	24.1	26.1	21.0	23.8	20.7	14.6	10.5	7.9	5.8	1.7	-	-	-	-	-	-	-	-
R53	22.5	22.7	24.8	27.1	23.4	25.5	20.4	23.1	20.0	13.8	9.7	6.9	4.6	0.4	-	-	-	-	-	-	-	-
R54	22.4	22.5	24.7	27.0	23.3	25.4	20.2	23.0	19.9	13.6	9.5	6.7	4.3	0.2	-	-	-	-	-	-	-	-
R55	27.9	28.0	30.2	32.6	29.0	31.1	26.7	29.6	26.9	21.3	17.8	16.2	15.0	11.8	9.3	7.0	2.3	-	-	-	-	-
R56	28.5	28.5	30.8	32.9	29.2	31.4	26.3	29.4	26.8	21.0	17.7	15.9	14.8	12.0	9.5	7.3	2.5	-	-	-	-	-
R57	27.8	27.8	29.8	32.0	28.5	30.5	25.5	28.4	25.9	20.1	16.7	14.9	13.6	10.9	8.4	6.2	1.3	-	-	-	-	-
R58	27.5	27.4	29.4	31.6	28.0	30.0	25.0	27.9	25.4	19.5	16.1	14.1	12.8	10.0	7.4	5.1	0.1	-	-	-	-	-

Receptor	Frequency (Hz)																				
	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150
R59	25.5	25.6	27.5	30.0	26.4	28.5	23.7	26.5	24.0	17.9	14.4	12.2	10.5	7.5	4.7	1.9	-	-	-	-	-	-
R60	28.1	28.1	30.1	32.3	28.7	30.7	25.8	28.7	26.3	20.4	17.2	15.3	14.1	11.5	9.1	7.1	2.3	-	-	-	-	-
R61	27.3	27.3	29.2	31.4	27.7	29.7	24.8	27.6	25.2	19.2	15.8	13.9	12.5	9.8	7.2	5.1	-	-	-	-	-	-
R62	27.1	27.0	28.9	31.0	27.3	29.2	24.2	27.0	24.6	18.5	15.1	13.1	11.7	8.9	6.1	4.0	-	-	-	-	-	-
R63	26.4	26.3	28.2	30.3	26.5	28.4	23.4	26.2	23.7	17.5	14.0	11.9	10.4	7.4	4.5	2.1	-	-	-	-	-	-
R64	23.8	23.9	25.8	28.2	24.6	26.6	21.7	24.4	21.8	15.6	11.8	9.3	7.2	3.9	0.5	-	-	-	-	-	-	-
R65	23.9	24.0	25.9	28.3	24.7	26.6	21.8	24.4	22.0	15.6	11.9	9.4	7.3	4.2	0.9	-	-	-	-	-	-	-
R66	23.7	23.7	25.7	28.1	24.4	26.3	21.6	24.1	21.6	15.3	11.6	9.0	6.9	3.6	0.3	-	-	-	-	-	-	-
R67	26.4	26.2	28.1	30.4	26.5	28.5	23.3	26.1	23.6	17.3	13.8	11.5	9.9	7.0	4.2	1.9	-	-	-	-	-	-
R68	27.3	26.8	28.3	30.4	26.8	28.5	22.6	25.4	22.8	16.4	12.8	10.4	9.0	5.7	3.1	0.4	-	-	-	-	-	-
R69	27.3	26.9	28.6	30.8	27.3	28.9	23.3	26.1	23.5	17.2	13.7	11.3	9.8	6.6	4.0	1.5	-	-	-	-	-	-
R70	29.7	29.6	31.0	33.0	29.6	30.7	24.1	26.9	24.4	18.1	14.7	12.5	11.4	8.4	6.1	3.9	-	-	-	-	-	-
R71	26.4	26.4	28.3	30.4	26.7	28.6	23.4	26.3	23.7	17.4	13.9	11.6	9.9	6.9	4.1	1.6	-	-	-	-	-	-
R72	27.8	27.7	29.6	31.8	28.2	30.0	25.0	27.8	25.4	19.2	15.9	13.8	12.4	9.6	7.2	5.1	0.0	-	-	-	-	-
R73	29.0	29.0	30.8	33.0	29.4	31.2	26.0	28.9	26.5	20.4	17.2	15.2	13.9	11.3	9.3	7.4	2.5	-	-	-	-	-
R74	29.5	29.4	31.3	33.4	29.8	31.6	26.5	29.4	27.1	21.0	17.9	16.0	14.7	12.3	10.3	8.5	3.7	-	-	-	-	-
R75	30.4	30.3	32.2	34.4	30.8	32.7	27.8	30.8	28.5	22.5	19.5	17.7	16.6	14.3	12.4	11.0	6.5	2.9	-	-	-	-
R76	31.8	31.7	33.6	35.8	32.2	34.2	29.4	32.4	30.2	24.3	21.4	19.8	18.7	16.8	15.1	14.0	9.8	6.5	2.8	-	-	-
R77	33.9	33.8	35.7	37.9	34.3	36.2	31.7	34.7	32.6	26.7	24.0	22.5	21.6	19.8	18.4	17.7	13.7	10.8	7.8	2.6	3.3	5.8
R78	34.9	34.8	36.7	38.9	35.3	37.3	32.9	35.9	33.9	27.9	25.3	23.9	23.0	21.5	20.2	19.6	15.8	13.0	10.1	5.3	6.7	10.1

Receptor	Frequency (Hz)																				
	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150
R79	35.8	35.8	37.7	39.9	36.3	38.3	34.0	37.1	35.0	29.0	26.5	25.1	24.2	22.7	21.5	21.1	17.4	14.7	12.0	7.5	9.2	13.2
R80	32.1	32.1	34.3	36.6	32.9	35.1	30.5	33.7	31.3	25.7	22.9	21.3	20.4	18.2	16.4	15.1	11.1	7.9	4.6	-	1.3	3.0
R81	30.5	30.5	32.8	35.0	31.3	33.5	28.7	31.9	29.4	23.8	20.8	19.1	18.0	15.5	13.5	11.9	7.5	4.0	0.5	-	-	-
R82	28.9	29.0	31.0	33.6	30.0	32.0	27.6	30.6	28.3	22.6	19.5	17.7	16.4	14.0	11.9	9.9	5.5	1.7	-	-	-	-
R83	28.3	28.4	30.4	32.8	29.3	31.4	26.8	29.8	27.5	21.6	18.6	16.7	15.5	13.0	10.8	8.8	4.2	0.2	-	-	-	-
R84	28.0	27.9	29.9	32.1	28.4	30.4	25.4	28.2	25.9	19.8	16.6	14.7	13.3	10.7	8.4	6.4	1.4	-	-	-	-	-
R85	27.9	27.8	29.7	32.0	28.2	30.3	25.3	28.3	25.8	19.8	16.6	14.7	13.4	10.7	8.2	6.1	1.1	-	-	-	-	-
R86	27.1	27.0	28.9	31.2	27.5	29.4	24.4	27.2	24.8	18.7	15.4	13.3	11.9	9.1	6.4	4.2	-	-	-	-	-	-
R87	26.0	25.9	27.9	30.0	26.3	28.2	23.2	25.9	23.4	17.0	13.5	11.3	9.6	6.5	3.7	1.2	-	-	-	-	-	-
R88	25.9	25.8	27.7	29.9	26.2	28.1	23.0	25.7	23.2	16.9	13.4	11.0	9.3	6.3	3.4	0.8	-	-	-	-	-	-
R89	25.3	25.1	27.1	29.2	25.4	27.4	22.2	24.9	22.3	15.9	12.3	9.9	8.0	4.8	1.7	-	-	-	-	-	-	-
R90	23.8	24.0	25.9	28.3	24.8	26.5	21.7	24.4	21.8	15.3	11.6	8.9	6.8	3.3	0.2	-	-	-	-	-	-	-
R91	25.7	25.6	27.9	30.1	26.3	28.5	23.3	26.3	23.5	17.6	14.0	11.7	10.0	6.6	3.5	0.7	-	-	-	-	-	-
R92	26.0	26.0	28.3	30.5	26.7	28.9	23.7	26.7	23.9	18.1	14.5	12.3	10.7	7.3	4.4	1.6	-	-	-	-	-	-
R93	26.6	26.7	28.9	31.1	27.3	29.5	24.3	27.4	24.6	18.8	15.4	13.2	11.7	8.5	5.7	3.0	-	-	-	-	-	-
R94	27.3	27.4	29.6	31.7	28.0	30.2	25.1	28.3	25.5	19.8	16.4	14.3	12.9	9.8	7.2	4.7	-	-	-	-	-	-
R95	28.0	28.1	30.3	32.4	28.8	30.9	25.9	29.0	26.4	20.7	17.4	15.4	14.1	11.1	8.6	6.4	1.6	-	-	-	-	-
R96	29.1	29.2	31.3	33.5	29.9	32.0	27.1	30.2	27.9	22.1	18.9	17.1	15.8	13.0	10.7	8.8	4.3	0.4	-	-	-	-
R97	30.1	30.2	32.3	34.4	30.8	33.0	28.2	31.3	29.0	23.2	20.1	18.4	17.2	14.5	12.3	10.8	6.4	2.9	-	-	-	-
R98	28.3	28.5	30.6	32.9	29.4	31.6	27.0	30.0	27.9	21.9	18.7	16.8	15.3	12.5	10.3	8.4	3.9	0.2	-	-	-	-

Receptor	Frequency (Hz)																				
	25	**31.5**	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**	**800**	**1000**	**1250**	**1600**	**2000**	**2500**	**3150**
R99	28.2	28.2	30.3	32.3	28.5	30.6	25.2	28.2	25.6	19.6	16.3	14.3	12.8	9.6	6.9	4.8	-	-	-	-	-	-
R100	23.7	23.7	25.8	27.8	23.8	26.0	20.4	23.2	20.4	13.9	9.9	7.1	5.0	0.6	-	-	-	-	-	-	-	-
R101	23.0	23.0	25.2	27.0	23.0	25.1	19.3	22.0	18.9	12.4	8.2	5.2	2.8	-	-	-	-	-	-	-	-	-
R102	23.4	23.4	25.6	27.5	23.4	25.6	19.9	22.6	19.6	13.1	9.0	6.1	3.9	-	-	-	-	-	-	-	-	-
R103	22.5	22.5	24.5	26.9	23.2	25.3	20.1	22.8	19.8	13.4	9.3	6.4	3.6	-	-	-	-	-	-	-	-	-
R104	23.8	23.7	25.8	27.8	23.6	25.7	19.9	22.6	19.5	13.1	8.9	6.0	3.8	-	-	-	-	-	-	-	-	-
R105	23.6	23.6	25.7	27.7	23.7	25.8	20.0	22.8	19.7	13.3	9.1	6.3	4.2	-	-	-	-	-	-	-	-	-
R106	22.7	22.8	24.8	27.1	23.5	25.6	20.5	23.1	20.0	13.8	9.7	7.0	4.7	0.2	-	-	-	-	-	-	-	-
CWA HALL	25.8	25.8	27.8	30.1	26.1	28.2	22.7	25.5	22.6	16.6	12.8	10.5	8.9	5.1	1.8	-	-	-	-	-	-	-
Manton Cemetery	30.3	30.4	32.4	34.5	30.7	32.9	27.9	31.0	28.8	22.9	19.9	18.1	16.8	14.0	11.9	10.4	6.1	2.6	-	-	-	-

E.2 Low frequency analysis

In accordance with the NPfI, Low frequency has been triggered where the L_{Ceq} minus the L_{Aeq} value is greater than 15, and the frequency contribution exceeds the threshold values in Table E.2 :

Table E.2 Threshold values for low frequency penalty

Hz/dB (Z)	One-third octave $L_{Zeq,\ 15\ minute}$ threshold level								
Frequency (Hz)	**25**	**31.5**	**40**	**50**	**63**	**80**	**100**	**125**	**160**
dB (Z)	69	61	54	50	50	48	48	46	44

Table E.3 Low frequency linear dB contribution

Receptor	L_{Ceq} – L_{Aeq}	Frequency (Hz)								
		25	**31.5**	**40**	**50**	**63**	**80**	**100**	**125**	**160**
R1	**19**	25	25	27	29	26	28	23	26	23
R2	**18**	28	28	30	32	28	31	25	28	25
R3	**19**	25	25	27	30	26	28	23	26	23
R4	**19**	27	27	29	31	27	29	24	27	24
R5	**18**	27	27	29	31	28	30	25	28	25
R6	**17**	30	30	32	34	31	33	28	31	28
R7	**17**	31	31	33	35	32	34	29	32	29
R8	**18**	29	29	31	33	29	32	27	30	27
R9	**17**	29	29	31	33	30	32	27	30	27
R10	**16**	33	33	35	37	33	36	31	34	32
R11	**15**	36	36	38	40	36	38	34	37	35
R12	**15**	36	36	37	40	36	38	34	37	35
R13	**19**	21	21	23	25	22	24	19	21	18
R14	**19**	22	22	24	27	23	25	20	23	19
R15	**19**	23	23	25	27	23	26	20	23	20
R16	**19**	23	23	25	27	23	26	20	23	20
R17	**20**	23	23	25	28	24	26	20	23	20
R18	**20**	24	24	26	29	24	26	21	23	20
R19	**20**	23	23	25	27	23	25	20	22	19
R20	**20**	22	22	24	27	23	25	19	22	19
R21	**20**	22	22	24	27	23	25	19	22	19
R22	**20**	22	22	24	27	23	25	19	22	19

Receptor	$L_{Ceq} - L_{Aeq}$	Frequency (Hz)								
		25	31.5	40	50	63	80	100	125	160
R23	**20**	22	22	24	27	23	25	19	22	19
R24	**20**	22	22	24	27	23	25	19	22	19
R25	**20**	22	22	24	26	23	25	19	22	19
R26	**20**	22	22	24	26	23	25	19	22	19
R27	**20**	22	23	25	27	23	25	19	22	19
R28	**19**	23	23	25	27	23	26	20	23	20
R29	**19**	23	23	25	27	24	26	20	23	20
R30	**19**	24	24	26	28	24	26	21	23	20
R31	**19**	23	23	25	28	24	26	21	24	21
R32	**19**	23	23	25	28	24	26	21	24	21
R33	**19**	23	23	25	27	24	26	20	23	20
R34	**19**	23	23	25	27	23	26	20	23	20
R35	**19**	23	23	25	27	24	26	21	23	20
R36	**19**	23	23	25	28	24	26	21	24	21
R37	**20**	24	24	26	29	25	27	21	24	20
R38	**20**	24	24	26	29	25	27	21	24	21
R39	**19**	24	24	26	29	25	27	22	24	21
R40	**19**	25	25	27	30	25	28	22	25	22
R41	**19**	24	24	26	28	25	27	21	24	21
R42	**19**	24	24	26	29	25	27	22	25	22
R43	**19**	25	25	27	29	25	28	22	25	22
R44	**19**	26	26	28	30	26	28	23	25	22
R45	**19**	26	26	28	30	26	28	23	25	22
R46	**19**	26	26	28	30	26	28	22	25	22
R47	**19**	24	24	26	29	25	27	22	25	22
R48	**19**	24	24	26	29	25	27	22	25	22
R49	**19**	25	25	27	29	25	27	21	24	21
R50	**19**	24	25	27	29	25	27	21	24	21
R51	**19**	25	25	27	29	25	27	22	25	22
R52	**19**	23	23	25	28	24	26	21	24	21
R53	**19**	22	23	25	27	23	26	20	23	20
R54	**19**	22	22	25	27	23	25	20	23	20

Receptor	$L_{Ceq} - L_{Aeq}$	Frequency (Hz)								
		25	31.5	40	50	63	80	100	125	160
R55	**17**	28	28	30	33	29	31	27	30	27
R56	**18**	28	28	31	33	29	31	26	29	27
R57	**18**	28	28	30	32	28	31	26	28	26
R58	**18**	27	27	29	32	28	30	25	28	25
R59	**18**	25	26	28	30	26	28	24	26	24
R60	**18**	28	28	30	32	29	31	26	29	26
R61	**18**	27	27	29	31	28	30	25	28	25
R62	**18**	27	27	29	31	27	29	24	27	25
R63	**18**	26	26	28	30	27	28	23	26	24
R64	**19**	24	24	26	28	25	27	22	24	22
R65	**19**	24	24	26	28	25	27	22	24	22
R66	**19**	24	24	26	28	24	26	22	24	22
R67	**19**	26	26	28	30	27	29	23	26	24
R68	**19**	27	27	28	30	27	28	23	25	23
R69	**19**	27	27	29	31	27	29	23	26	24
R70	**20**	30	30	31	33	30	31	24	27	24
R71	**19**	26	26	28	30	27	29	23	26	24
R72	**18**	28	28	30	32	28	30	25	28	25
R73	**18**	29	29	31	33	29	31	26	29	26
R74	**18**	29	29	31	33	30	32	27	29	27
R75	**17**	30	30	32	34	31	33	28	31	28
R76	**17**	32	32	34	36	32	34	29	32	30
R77	**16**	34	34	36	38	34	36	32	35	33
R78	**16**	35	35	37	39	35	37	33	36	34
R79	**15**	36	36	38	40	36	38	34	37	35
R80	**16**	32	32	34	37	33	35	30	34	31
R81	**17**	31	31	33	35	31	34	29	32	29
R82	**17**	29	29	31	34	30	32	28	31	28
R83	**17**	28	28	30	33	29	31	27	30	27
R84	**18**	28	28	30	32	28	30	25	28	26
R85	**18**	28	28	30	32	28	30	25	28	26
R86	**18**	27	27	29	31	27	29	24	27	25

Receptor	L_{Ceq} – L_{Aeq}	Frequency (Hz)								
		25	31.5	40	50	63	80	100	125	160
R87	**19**	26	26	28	30	26	28	23	26	23
R88	**19**	26	26	28	30	26	28	23	26	23
R89	**19**	25	25	27	29	25	27	22	25	22
R90	**19**	24	24	26	28	25	27	22	24	22
R91	**18**	26	26	28	30	26	28	23	26	24
R92	**18**	26	26	28	30	27	29	24	27	24
R93	**18**	27	27	29	31	27	29	24	27	25
R94	**18**	27	27	30	32	28	30	25	28	26
R95	**18**	28	28	30	32	29	31	26	29	26
R96	**17**	29	29	31	34	30	32	27	30	28
R97	**17**	30	30	32	34	31	33	28	31	29
R98	**17**	28	29	31	33	29	32	27	30	28
R99	**18**	28	28	30	32	28	31	25	28	26
R100	**19**	24	24	26	28	24	26	20	23	20
R101	**20**	23	23	25	27	23	25	19	22	19
R102	**20**	23	23	26	27	23	26	20	23	20
R103	**19**	22	23	24	27	23	25	20	23	20
R104	**20**	24	24	26	28	24	26	20	23	19
R105	**20**	24	24	26	28	24	26	20	23	20
R106	**19**	23	23	25	27	24	26	20	23	20
CWA HALL	**19**	26	26	28	30	26	28	23	25	23
Manton Cemetery	**17**	30	30	32	35	31	33	28	31	29

E.3 Tonal analysis

In accordance with the NPfI, tonality has been triggered where the level of one-third octave bands exceeds the level of the adjacent bands on both sides by:

- 5 dB or more if the centre frequency of the band containing the tone is in the range 500-10,000 Hz, or
- 8 dB or more if the centre frequency of the band containing the tone is in the range 160–400 Hz, or
- 15 dB or more if the centre frequency of the band containing the tone is in the range 25–125 Hz.

Table E.4 Tonal assessment receptor

Receptor	Frequency Range (Hz)																			
	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500
R1	-	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-
R2	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-
R3	-	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-
R4	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-
R5	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-
R6	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-
R7	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-
R8	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-
R9	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-
R10	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-
R11	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
R12	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
R13	-	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-	-	-
R14	-	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-	-	-
R15	-	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-	-
R16	-	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-	-	-
R17	-	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-	-	-
R18	-	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-	-
R19	-	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-	-	-

Receptor	Frequency Range (Hz)																				
	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500
R20	-	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-	-	-
R21	-	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-	-	-
R22	-	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-	-	-
R23	-	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-	-	-
R24	-	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-	-	-
R25	-	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-	-	-
R26	-	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-	-	-
R27	-	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-	-	-
R28	-	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-	-
R29	-	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-	-
R30	-	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-	-
R31	-	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-	-
R32	-	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-	-
R33	-	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-	-
R34	-	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-	-	-
R35	-	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-	-
R36	-	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-	-
R37	-	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-	-
R38	-	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-	-
R39	-	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-	-

Receptor	Frequency Range (Hz)																				
	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500
R40	-	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-	-
R41	-	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-	-
R42	-	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-
R43	-	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-
R44	-	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-
R45	-	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-
R46	-	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-
R47	-	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-
R48	-	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-
R49	-	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-	-
R50	-	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-	-
R51	-	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-	-
R52	-	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-	-
R53	-	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-	-
R54	-	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-	-
R55	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-
R56	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-
R57	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-
R58	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-
R59	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-

Receptor	Frequency Range (Hz)																				
	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500
R60	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-
R61	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-
R62	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-
R63	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-
R64	-	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-
R65	-	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-
R66	-	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-
R67	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-
R68	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-
R69	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-
R70	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-
R71	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-
R72	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-
R73	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-
R74	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-
R75	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-
R76	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-
R77	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
R78	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
R79	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

Receptor	Frequency Range (Hz)																				
	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500
R80	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-
R81	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-
R82	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-
R83	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-
R84	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-
R85	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-
R86	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-
R87	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-
R88	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-
R89	-	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-
R90	-	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-
R91	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-
R92	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-
R93	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-
R94	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-
R95	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-
R96	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-
R97	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-
R98	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-
R99	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-

Receptor	Frequency Range (Hz)																				
	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500
R100	-	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-	-
R101	-	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-	-	-
R102	-	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-	-	-
R103	-	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-	-	-
R104	-	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-	-	-
R105	-	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-	-	-
R106	-	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-	-
CWA HALL	-	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-	-	-	-
Manton Cemetery	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	-	-	-

Australia

SYDNEY
Level 10 201 Pacific Highway
St Leonards NSW 2065
T 02 9493 9500

NEWCASTLE
Level 3 175 Scott Street
Newcastle NSW 2300
T 02 4907 4800

BRISBANE
Level 1 87 Wickham Terrace
Spring Hill QLD 4000
T 07 3648 1200

CANBERRA
Suite 2.04 Level 2
15 London Circuit
Canberra City ACT 2601

ADELAIDE
Level 4 74 Pirie Street
Adelaide SA 5000
T 08 8232 2253

MELBOURNE
Suite 9.01 Level 9
454 Collins Street
Melbourne VIC 3000
T 03 9993 1900

PERTH
Suite 3.03
111 St Georges Terrace
Perth WA 6000
T 08 6430 4800

Canada

TORONTO
2345 Yonge Street Suite 300
Toronto ON M4P 2E5
T 647 467 1605

VANCOUVER
2015 Main Street
Vancouver BC V5T 3C2
T 604 999 8297

CALGARY
700 2nd Street SW Floor 19
Calgary AB T2P 2W2

linkedin.com/company/emm-consulting-pty-limited

emmconsulting.com.au