KINGSWOOD BATTERY ENERGY STORAGE SYSTEM

Appendix E
Noise and Vibration Impact Assessment

June 2024

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Kingswood BESS EIS

EIS Noise and Vibration Assessment

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Glossary

BESS	Battery Energy Storage System
EPA	Environment Protection Authority
EIS	Environmental Impact Statement
ICNG	Interim Construction Noise Guideline
NML	Noise Management Level
NPI	Noise Policy for Industry
NSW	New South Wales
OOHW	Out-of-Hours Work
PPV	Peak Particle Velocity
Project Area	Refers to the BESS site, substation and electrical transmission line
RBL	The RBL is the overall single figure background level representing each assessment period (day, evening and night) over the whole monitoring period (as opposed to over each 24-hour period used for the ABL). This is the level used for assessment purposes. It is the median value of: • All the day assessment background levels over the monitoring period for the day; • All the evening assessment background levels over the monitoring period for the evening; or • All the night assessment background levels over the monitoring period for the night.
RNP	Road Noise Policy
SPL	Sound Pressure Level
SWL	Sound Power Level
TfNSW	Transport for NSW
VC	Generic Vibration Criterion
VDV	Vibration Dose Values
VML	Vibration Management Level

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1 Introduction

1.1 Project overview

Iberdrola Australia Development Pty Limited (the Proponent) is seeking development consent for the construction, operation and maintenance of a large-scale Battery Energy Storage System (BESS) at 744 Burgmanns Lane, Kingswood in New South Wales (NSW) 2340 (Lot 43 DP1064582) (the Project Site). The BESS will have a capacity of up to 270 Megawatts (MW) and provide up to 1080 Megawatt-hours (MWh) of battery storage capacity (the Project).

The Project is considered to meet the definition of State Significant Development under Clause 2.6 of the State Environmental Planning Policy (Planning Systems) 2021. The Project will be for electricity generating works on land that is permitted with development consent under Clause 2.35 of the State Environmental Planning Policy (Transport and Infrastructure) 2021 and will have a capital investment value greater than $30 million.

The Proponent is seeking State Significant Development (SSD) approval for the Project under Part 4, Division 4.7 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The Project Site is within the Tamworth Regional Local Government Area (LGA), around six kilometres southeast of Tamworth and two kilometres west-south-west of Calala town centre and borders the suburb of Calala. The regional setting is presented in Figure 1-1.

The Project will involve construction and operation of the following:

- BESS including battery enclosures, inverters, transformers, switch gear and control building
- Onsite 33/330 kV substation to convert electricity between the high voltage transmission network and medium voltage BESS
- High voltage transmission connection (above ground and/or below ground) between the BESS and the Tamworth substation
- Ancillary infrastructure and mitigative features including:
  - Site access to the BESS from Ascot-Calala Road
  - Internal site access road and parking
  - Permanent office and staff amenities
  - Operations and maintenance building
  - Stormwater management infrastructure
  - Services and utilities
  - Lighting, fencing and security devices
  - Noise acoustic barriers
  - Asset protection zone
  - Landscaping and screening vegetation.

The BESS will operate 24 hours a day, seven days a week and be monitored remotely, with infrastructure maintenance undertaken onsite. An overview of the Project is shown in Figure 1-2.

1.2 Assessment framework and purpose

The purpose of this Noise and Vibration Assessment (NVIA) is to estimate, evaluate and mitigate potential noise and vibration impacts resulting from the Project. The assessment was prepared in accordance with the requirements of the NSW Department of Planning and Environment (DPE) (now Department of Planning, Housing and Infrastructure (DPHI)), which are set out in the Secretary's Environmental Assessment Requirements (SEARs) (SSD 59325460) for the Project, issued on 30 October 2023.

The SEARs identify matters which must be addressed in the Project Environmental Impact Statement (EIS). This NVIA responds to SEARs relating to noise and vibration. Table 1-1 lists requirements for the Project relevant to this assessment and references where they are addressed in this report.

Table 1-1 SEARs for the assessment of noise and vibration

Requirement	Reference
Noise and vibration	
An assessment of the construction noise impacts of the development in accordance with the *Interim Construction Noise Guideline* (ICNG), operational noise impacts in accordance with the *NSW Noise Policy for Industry* (2017), cumulative noise impacts (considering other operations in the area) and a draft noise management plan if the assessment shows construction noise is likely to exceed applicable criteria	Chapter 6 (construction noise) Chapter 7 (operational noise) Section 6.1.4 (construction cumulative noise) Section 7.6 (operational cumulative noise) Appendix J – Draft Construction Noise and Vibration Management Plan

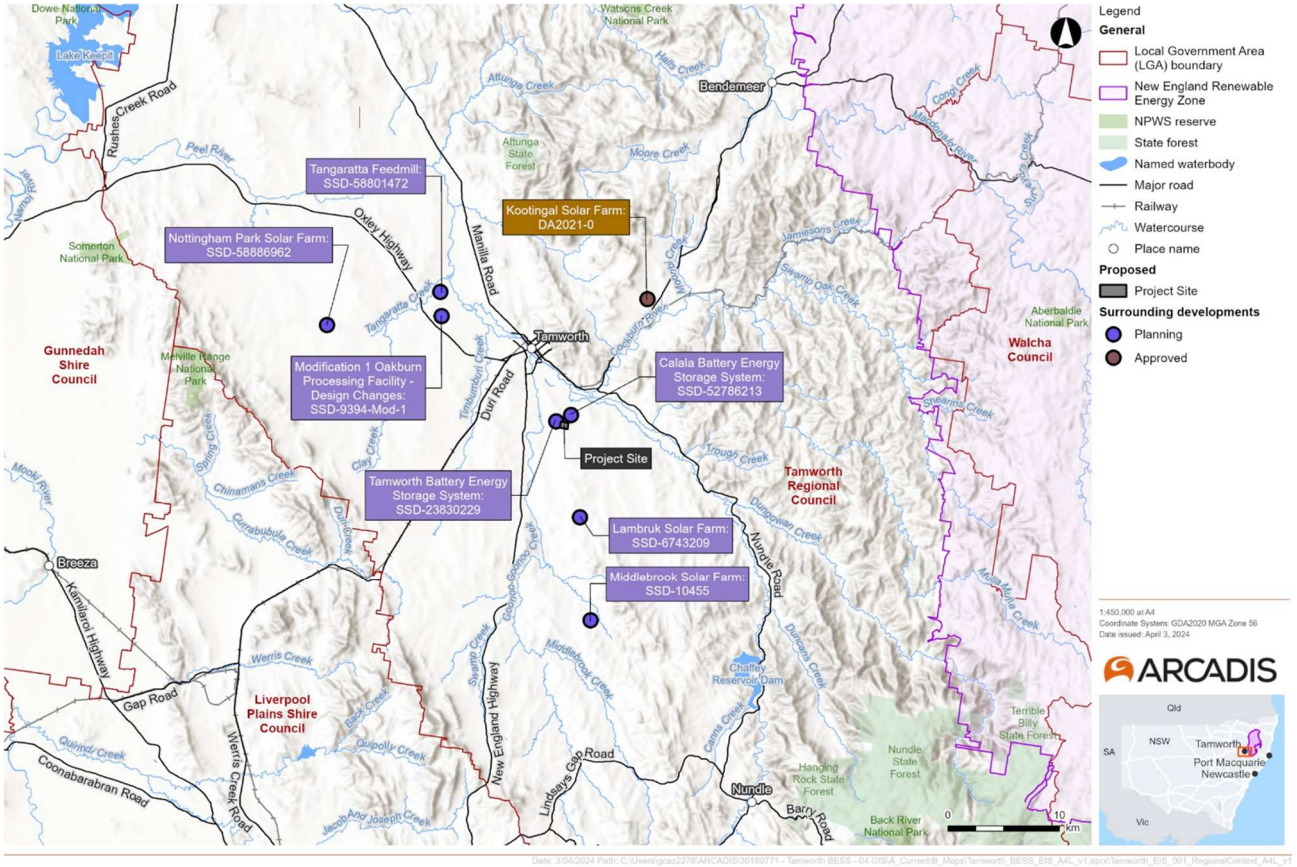


Figure 1-1 Regional

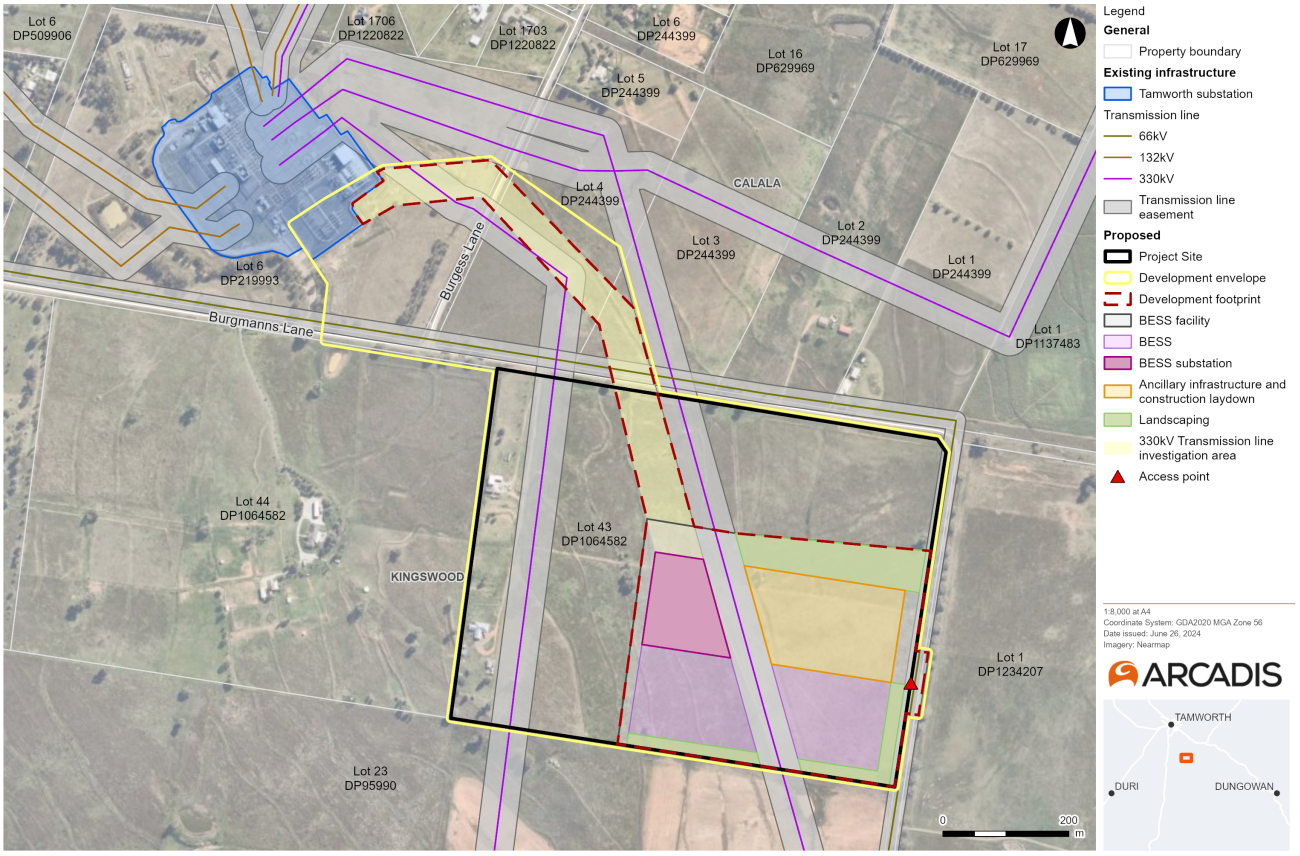


Figure 1-2 Project overview

2 Project description

2.1 Locality

The Project Site is located within the Tamworth Regional LGA and in the suburb of Kingswood. The Project Site is located around six kilometres southeast of Tamworth and two kilometres west-south-west of Calala town centre and borders the suburb of Calala. The Project Site is also around 400 metres southeast of the existing Tamworth Transgrid substation (Tamworth substation). The Project Site is roughly rectangular in shape, covering around 40 hectares. The location of the Project Site is shown in Figure 1-1. The proposed transmission line would transect land between the Project Site and the Tamworth substation.

There is an existing residential dwelling within the Project Site, however, this is a receiver associated with the Project. The nearest dwelling has been identified to be 795 Burgmanns Lane Calala, which is located approximately 320 m to the north of the nearest BESS facility boundary and adjoins the Project Site boundary to the north. There are 38 receivers (including associated) within approximately 1 km of the Project Site. In addition to the residential receivers, there is one non-residential receiver which is located at a distance of approximately 2 km from the Project BESS facility. This receiver, the NSW DPI - Tamworth Agricultural Institute, is classified as commercial / industrial. It should be noted that this receiver is not listed in Table 2-1 as it is more than 1 km away from the Project Site, .

2.2 Noise sensitive receivers

The closest potentially impacted sensitive receivers identified in the vicinity of the Project area are listed in Table 2-1 and are shown in Figure 2-1.

Table 2-1 Nearest noise sensitive receivers within 1 km from the Project Site

Receiver ID	Address	Receiver type	Coordinates (MGA 56), metre	
			Easting	Northing
Associated[1]	744 Burgmanns Lane Kingswood 2340	Residential	305081	6551573
R2	795 Burgmanns Lane Calala 2340	Residential	305618	6551927
R3	781 Burgmanns Lane Calala 2340	Residential	305624	6552028
R4	696 Burgmanns Lane Kingswood 2340	Residential	304816	6551712
R5	111 Burgess Lane Calala 2340	Residential	305933	6552433
R6	59 Falcon Drive Calala 2340	Residential	305538	6552508
R7	57 Falcon Drive Calala 2340	Residential	305250	6552527
R8	99 Burgess Lane Calala 2340	Residential	305293	6552518
R9	910 Ascot-calala Road Calala 2340	Residential	305138	6550835
R10	55 Falcon Drive Calala 2340	Residential	306231	6552591
R11	51 Falcon Drive Calala 2340	Residential	305042	6552596
R12	93 Burgess Lane Calala 2340	Residential	305358	6552596
R13	68 Falcon Drive Calala 2340	Residential	305152	6552621
R14	66 Falcon Drive Calala 2340	Residential	305020	6552655

Receiver ID	Address	Receiver type	Coordinates (MGA 56), metre	
			Easting	Northing
R15	94 Burgess Lane Calala 2340	Residential	305232	6552654
R16	877 Ascot-calala Road Kingswood 2340	Residential	304925	6550659
R17	49 Falcon Drive Calala 2340	Residential	305092	6552684
R18	64 Falcon Drive Calala 2340	Residential	305358	6552737
R19	87 Burgess Lane Calala 2340	Residential	304302	6552710
R20	47 Falcon Drive Calala 2340	Residential	304969	6552751
R21	652 Burgmanns Lane Kingswood 2340	Residential	305109	6551872
R22	9 Whipbird Street Calala 2340	Residential	305404	6552726
R23	62 Falcon Drive Calala 2340	Residential	305019	6552807
R24	633 Burgmanns Lane Calala 2340	Residential	305313	6552429
R25	198 Marsden Park Road Calala 2340	Residential	305118	6550664
R26	69 Burgess Lane Calala 2340	Residential	305526	6552797
R27	68 Burgess Lane Calala 2340	Residential	304399	6552820
R28	7 Whipbird Street Calala 2340	Residential	304722	6552819
R29	651 Burgmanns Lane Calala 2340	Residential	305338	6552243
R30	45 Falcon Drive Calala 2340	Residential	304840	6552884
R31	5 Whipbird Street Calala 2340	Residential	304229	6552872
R32	10 Whipbird Street Calala 2340	Residential	305022	6552779
R33	625 Burgmanns Lane Calala 2340	Residential	305129	6552605
R34	60 Falcon Drive Calala 2340	Residential	304861	6552919
R35	57 Burgess Lane Calala 2340	Residential	304428	6552877
R36	62 Burgess Lane Calala 2340	Residential	304645	6552918
R37	8 Whipbird Street Calala 2340	Residential	304689	6552862

(1) Residential receiver associated with the Project.

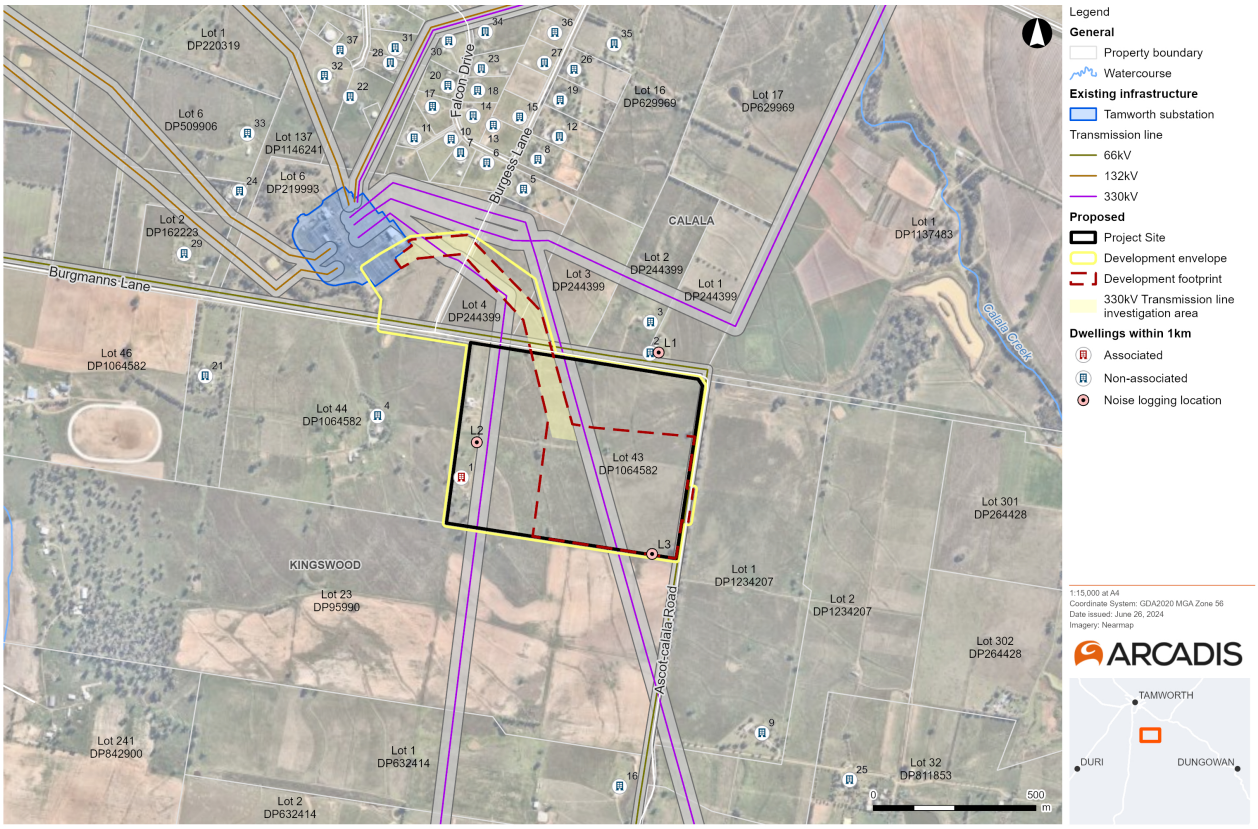


Figure 2-1 Project Site location, noise monitoring locations and surrounding receivers

2.3 Hours of operation

The Project will be operational 24 hours a day, seven days a week.

2.4 Construction hours

The construction period for the Project is expected to be up to 18 months. Construction is proposed to occur within the EPA's *Interim Construction Noise Guideline*'s 'standard hours' period. The 'standard hours' period is as follows:

- Monday – Friday: 7 am to 6 pm
- Saturday: 8 am to 1 pm
- No work on Sundays and public holidays.

In general, no construction activities will occur outside of standard hours, i.e. overnight, on Sundays or public holidays, however exceptions to these hours may be required on limited occasions, for example:

- The delivery of materials as requested by the NSW Police Force or other authorities for safety reasons and/or to minimise disruption to local traffic;
- Augmentation works to the substation, which may require a temporary power outage, such that the impact on power supplies to the local community is minimised; and
- Emergency work to avoid the loss of life, property and/or material harm to the environment.

The local council, surrounding landholders and other relevant authorities will be notified of any exceptions prior to the works being undertaken.

3 Baseline noise survey

3.1 Unattended noise monitoring

In order to characterise the existing acoustical environment of the area, unattended noise monitoring was conducted between the dates of Tuesday 31 October and Wednesday 22 November 2023 at the logging locations shown in Figure 2-1. Noise monitoring was conducted at 781 Burgmanns Ln, Calala NSW 2340 (noise logging location L1) and 744 Burgmanns Ln, Kingswood NSW 2340 (noise logging location L2).

The logger locations were selected with consideration to other noise sources which may influence readings, security issues for noise monitoring equipment and gaining permission for access from residents and landowners.

The noise loggers provide noise measurements of the baseline background noise environment, which would be used to establish the construction noise management levels and the operational noise criteria.

Instrumentation for the unattended survey comprised of two Rion NL-42 and one Rion NL- 21 environmental noise loggers (serial numbers: 709535 installed at L1, 946978 installed at L2 and 946981 installed at L3) fitted with microphone windshield. Calibration of the loggers were checked prior to and following measurements. Drift in calibration did not exceed ±0.5 dB(A). All equipment carried appropriate and current NATA (or manufacturer) calibration certificates.

The measured noise data was filtered to remove data affected by inclement weather conditions including precipitation and wind speeds greater than five m/s at an elevation of 1.5 metres. 15-minute weather data from the nearest Bureau of Meteorology (BoM) automatic weather station at Tamworth Airport (055325), located approximately 11 kilometres north-west of the site, were used to perform this filtering. Noting that the wind speed data that was collected at this station is at the standard instrument height of 10 metres, the method outlined in *Converting Bureau of Meteorology Wind Speed Data to local Wind Speeds at 1.5m Above Ground Level,* (Gowan, Karantonis and Rofail, 2004) was used to convert this information to equivalent wind speeds 1.5 metres above ground level. The results were processed into the relevant metrics for assessment. The weather data used in processing the measured noise data has been presented in the noise logger data graphs in Appendix B.

The loggers determine L_{A1}, L_{A10}, L_{A90} and L_{Aeq} levels of the ambient noise. L_{A1}, L_{A10}, L_{A90} are the levels exceeded for 1%, 10% and 90% of the sample time respectively (see Acoustic Terminology for definitions in Appendix A). Detailed results at the monitoring locations are presented in graphical format in Appendix B. The graphs show measured values of L_{A1}, L_{A10}, L_{A90} and L_{Aeq} for each 15-minute monitoring period.

3.2 Data processing of unattended monitoring results

The noise data obtained from the noise loggers have been processed in accordance with the procedures contained in the NSW EPA's *Noise Policy for Industry* (NPI, 2017) to establish representative noise levels at the monitoring location. The monitored noise levels are detailed in Table 3-1 below.

Table 3-1 Unattended noise monitoring results

Logger Location	Measurement Descriptor	Measured Noise Level – dB(A) re 20 µPa		
		Day 7:00 am - 6:00 pm	Evening 6:00 pm - 10:00 pm	Night 10:00 pm - 7:00 am
L1	L_{Aeq} (1)	47 (3)	47 (3)	41 (3)
	RBL (L_{A90}) (2)	35 (3) (4)	31 (3)	30 (3) (5)
L2	L_{Aeq} (1)	49 (3)	54 (3)	47 (3)
	RBL (L_{A90}) (2)	35 (3) (4)	30 (3) (5)	30 (3) (5)
L3	L_{Aeq} (1)	44 (3)	48 (3)	42 (3)
	RBL (L_{A90}) (2)	35 (3) (4)	30 (3) (5)	30 (3) (5)

(1) L_{Aeq} – Equivalent continuous (energy average) A-weighted sound pressure level. It is defined as the steady sound level that contains the same amount of acoustic energy as the corresponding time-varying sound;

(2) L_{A90} – Noise level present for 90% of time (background level). The average minimum background sound level (in the absence of the source under consideration); and

(3) All values expressed as dB(A) and rounded to nearest 1 dB(A).

(4) The measured daytime RBL is below the NPI minimum daytime RBL, therefore the daytime RBL has been set to 35 dB(A).

(5) The measured night-time RBL is below the NPI minimum night-time RBL, therefore the night-time RBL has been set to 30 dB(A).

4 Noise and vibration policies, guidelines and standards

The construction and operational assessments presented in this report have been conducted with due regard to and in general accordance with the following policy, guidelines and standards.

4.1 NSW Interim Construction Noise Guideline

The NSW Department of Environment and Climate Change – *Interim Construction Noise Guideline* (ICNG), presents an accepted method by which construction noise impacts may be assessed for a range of receptor types for works completed in NSW. It provides a set of recommended standard hours of construction, as reproduced below:

- Monday to Friday: 7 am to 6 pm.
- Saturday: 8 am to 1 pm.
- No work on Sundays or public holidays.

The ICNG encourages works to occur within the recommended standard hours of construction unless justification is provided. It focuses on minimising construction noise impacts, rather than only on achieving numeric noise levels, and recognises that some noise from construction sites is inevitable.

The ICNG encourages organisations involved with construction, maintenance or upgrading works (e.g. large scale contractors or Government agencies) to develop their best-practice techniques for managing construction noise and vibration, and implementing feasible and reasonable mitigation measures.

In this case, the ICNG is the suitable guideline document to quantitatively assess potential noise emissions and impacts associated with project construction. The ICNG assessment methodology has been adopted to develop project-specific construction noise management levels (refer Section 5.1), assess potential impacts (refer Chapter 6) and recommend any necessary mitigation, management measures or provisions for monitoring (refer Chapter 6).

Table 4-1 details the construction noise management levels guidance for residential noise sensitive receptors developed in accordance with ICNG. Construction noise management levels for other sensitive receivers are detailed in Table 4-2.

Table 4-1 Construction airborne noise management levels for residential receivers

Time of Day	Noise Management Level, $L_{Aeq,\ 15\ minute}$ – dB(A)(1)	How to Apply
Recommended standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or Public Holidays	Noise affected Rating Background Level (RBL) + 10 dB(A)	The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured $L_{eq,\ 15\ minute}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. • The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dB(A)	The highly noise affected level represents the point above which there may be a strong community reaction to noise. • Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: 1. times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences 2. if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside recommended standard hours	Noise affected Rating Background Level (RBL) + 5 dB(A)	• A strong justification would typically be required for works outside the recommended standard hours. • The proponent should apply all feasible and reasonable work practices to meet the noise affected level. • Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community. • For guidance on negotiating agreements see Section 7.2.2 of the ICNG.

(1) Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m of the residence. Noise levels may be higher at upper floors of the noise affected residence.

Table 4-2 Construction airborne noise management levels for other sensitive receivers

Land use	Where objective applies	Noise Management Level, $L_{Aeq,\ 15\ minute}$ – dB(A)[1]
Commercial premises	External noise level	70
Industrial premises	External noise level	75

(1) Noise management level applies when receiver is in use only.

(2) Where some nearby receivers may operate as both commercial/industrial and residential land uses, the more stringent NML should be applied. For this project, the residential NMLs are more stringent.

4.2 Noise Policy for Industry

Responsibility for the control of noise emissions in NSW is typically vested in Local Government and the NSW Environment Protection Authority (EPA). The *Noise Policy for Industry* (NPI) and relevant application notes provide a framework and methodology for deriving limit conditions for project consent and environment protection licence conditions.

The NPI is designed for large and complex industrial sources and outlines processes designed to strike a feasible and reasonable balance between the operations of industrial activities and the protection of the community from noise levels that are intrusive or unpleasant.

The NPI measurement and evaluation methodology to quantify existing ambient and background noise levels has been adopted for this assessment, with the baseline values utilised to derive construction noise criteria. The NPI assessment terminology is outlined in more detail in Appendix A of this report.

4.2.1 Assessment of prevailing weather conditions

The NPI 'Fact Sheet D: Accounting for noise-enhancing weather conditions' states:

> Two options are available to a proponent to consider meteorological effects:
>
> 1. Adopt the noise-enhancing meteorological conditions for all assessment periods for noise impact assessment purposes without an assessment of how often these conditions occur – a conservative approach that considers source-to-receiver wind vectors for all receivers and F-class temperature inversions with wind speeds up to 2 m/s at night.
>
> Or
>
> 2. Determine the significance of noise enhancing conditions.

Noise emissions from the proposed development have been assessed in accordance with NPI Option 1 using 'noise enhancing' meteorological conditions. This ensures a conservative assessment and where compliance under 'worst-case' conditions are predicted then compliance during other scenarios is expected.

4.2.2 Potential sleep disturbance issues

As stated in the NPI the potential for sleep disturbance from maximum noise level events generated by premises during the night-time period needs to be considered. The term "sleep disturbance" is considered to be both awakenings and disturbance to sleep stages.

To evaluate potential sleep disturbance or awakening issues associated with the construction of the Project the NPI screening method has been adapted as follows. There is limited potential for sleep disturbance or awakening issues to occur, where:

- The predicted project night-time noise level ($L_{eq,\ 15\ minute}$ in dB(A)) at any residential receptor remains below 40 dB(A) (or the prevailing night-time background noise level plus 5 dB(A)), whichever is the greater.
- The predicted project night-time noise level (L_{max} in dB(A)) at any residential receptor remains below 52 dB(A) (or the prevailing night-time background noise level plus 15 dB(A)), whichever is the greater.

These screening method features have been adopted for likely maximum noise level events from construction vehicles associated with the Project.

4.3 NSW Road Noise Policy

The *NSW Road Noise Policy* (RNP) outlines the range of measures needed to minimise road traffic noise and its impacts. It is intended for use by acoustics specialists as well as:

- Road project proponents.
- Determining authorities and regulators involved in the approval and construction of road projects and land use developments that generate additional traffic on existing roads.
- City and transport planners and policymakers dealing with issues such as route corridors, heavy vehicle transport and building codes.

The RNP aims to identify the strategies that address the issue of road traffic noise from existing roads, new road projects, road redevelopment projects and new traffic-generating developments. In this case, the RNP is considered the suitable document to qualitatively assess potential noise emissions and impacts associated with construction traffic using public roads.

The RNP target noise criteria vary based on road type and are dependent on the development being assessed. The criteria values from the RNP were considered in the assessment of potential construction noise impacts. They are used to provide guidance on potential short-term and temporary impacts associated with heavy vehicle haulage and/or other like vehicles that may be required as part of the construction.

4.4 Vibration guidelines and standards

The effects of vibration on buildings can be divided into three main categories: human comfort (annoyance), building damage (cosmetic/structural) and sensitive equipment (scientific/medical). An overview of the applicable standards and guidelines is provided below.

- **Human Comfort (annoyance)**: The NSW Vibration Guideline provides guidance for assessing human exposure (comfort or annoyance issues) to vibration. The publication is based on British Standard (BS 6472–1992) – Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz), dated 1992.

- **Cosmetic and Structural Damage**: There is currently no Australian policy or guideline for assessing the potential for building damage (cosmetic and structural) from vibration. The British Standard BS 7385 Part 2-1993 'Evaluation and measurement for vibration in buildings Part 2' has been considered for project works where applicable. BS 7385 provides safe limit guideline values, below which vibration is considered insufficient to cause structural or cosmetic damage to buildings. If a heritage building or structure is found to be structurally unsound a more conservative standard has been adopted i.e. German Standard DIN4150 Part 3-1999 (DIN4150-3) – Structural Vibration - Effects of Vibration on Structures, dated 1999. DIN4150-3 presents a set of safe limit values below which cosmetic or structural damage is unlikely to occur.

  The NSW Vibration Guideline, BS7385 and DIN 4150-3 criteria vary based on vibration type, receptor type and are dependent on the component frequency of the vibration event. The criteria values from the NSW Vibration Guideline, BS7385 and DIN 4150-3 were considered in the assessment of potential impacts but are not reproduced here.

- **Sensitive Scientific and Medical Equipment**: Some scientific equipment (e.g. electron microscopes and microelectronics manufacturing equipment) can require more stringent objectives than those applicable to human comfort.

Where manufacturer's data for the identified vibration sensitive scientific and/or medical instruments are not available, generic vibration criterion (VC) curves will be adopted as vibration goals.

However, as there is no sensitive scientific and medical equipment housed in nearby buildings, the assessment of vibration impacts on sensitive scientific and medical equipment is not relevant and will not be conducted in this study.

Given the distance between the proposed works and the nearest residential noise sensitive receiver, the potential vibration impacts during construction are more concerned with the impact on Human Comfort.

5 Project specific noise and vibration criteria

5.1 Construction noise and vibration

5.1.1 Construction noise management levels

The Project-specific construction "Noise Management Levels" (NML), for works within and outside the recommended standard hours for construction, are presented in Table 5-1 below.

These NMLs have been established with due regard to the requirements of the ICNG for all identified residential (dwelling) and other sensitive (non-residential) receptors. NML for all periods are provided for completeness despite construction works limited to the recommended standard hours for construction presented in the ICNG.

The NML for residential (dwelling) receptors presented in Table 5-1. are based on the lowest measured RBL values shown in Table 3-1.

Table 5-1 Project-specific construction noise management levels (NML)

Receiver type	Construction noise management levels, $L_{eq,\ 15\ minute}$, dB(A)				High noise affected, $L_{eq,\ 15\ minute}$, dB(A)
	Standard hours	Out-of-Hours			
	Day	Day	Evening	Night	
Residential receivers	45	40	35	35	75
Commercial	70	70	70	70	-(1)
Industrial	75	75	75	75	-(1)

(1) Dash "-" indicates that this criterion does not apply to that receiver type.

Construction activities would only be carried out during daytime period. Therefore, construction noise impacts will only be assessed against the daytime standard hours NMLs.

5.1.2 Construction vibration management levels

Impacts from vibration can be considered both in terms of effects on building occupants (human comfort) and the effects on the building structure (building damage). Of these considerations, the human comfort limits are the most stringent. Therefore, for occupied buildings, if compliance with human comfort limits are achieved, it will follow that compliance will be achieved with the building damage objectives.

Human comfort

The NSW Vibration Guideline provides guidance for assessing human exposure to vibration. These documents are based on *British Standard (BS 6472–1992) – Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz) dated 1992*. The vibration dose values recommended in BS 6472-1992 for which various levels of adverse comment from occupants may be expected are presented in Table 5-2.

Table 5-2 Human comfort – vibration dose values (BS 6472)

Location	Assessment period	Preferred values		Maximum values	
		z axis	x and y axes	z axis	x and y axes
Continuous vibration (m/s^2)					
Critical Areas	Daytime or Night-time	0.005	0.0036	0.010	0.0072
Residences	Daytime	0.010	0.0071	0.020	0.014
	Night-time	0.007	0.005	0.014	0.010
Offices, schools, educational institutions and places of worship	Daytime or Night-time	0.020	0.014	0.040	0.028
Workshops	Daytime or Night-time	0.040	0.029	0.080	0.058
Impulsive vibration (m/s^2)					
Critical Areas	Daytime or Night-time	0.005	0.0036	0.010	0.0072
Residences	Daytime	0.30	0.21	0.60	0.42
	Night-time	0.10	0.071	0.20	0.14
Offices, schools, educational institutions and places of worship	Daytime or Night-time	0.64	0.46	1.28	0.92
Workshops	Daytime or Night-time	0.64	0.46	1.28	0.92
Intermittent vibration (m/s$^{1.75}$)					
Critical Areas	Daytime or Night-time	0.10		0.20	
Residences	Daytime	0.20		0.40	
	Night-time	0.13		0.26	
Offices, schools, educational institutions and places of worship	Daytime or Night-time	0.40		0.80	
Workshops	Daytime or Night-time	0.80		1.60	

(1) Daytime is 7am-10pm and Night-time is 10pm-7am.

(2) For continuous and impulsive vibration, the preferred and maximum values are weighted acceleration values (Wg for z-axis and Wd for x and y-axis)

(3) For intermittent vibration, the preferred and maximum values are Vibration Dose Values (VDVs), based on the weighted acceleration values

Building damage

German Standard DIN 4150-3-1999 Structural Vibration – Part 3 Effects of vibration on structures provides methods for evaluating the effects of vibration on structures in the absence of an Australian Standard.

The recommended limits (guide values) from DIN 4150 for transient vibration to ensure minimal risk of cosmetic damage to residential and industrial buildings are presented in Table 5-3.

Table 5-3 Guideline vibration values for short term vibration on structures (mm/s)

Type of building	Guideline values for velocity (mm/s)			
	1 to 10 Hz	10 to 50 Hz	50 to 100 Hz	Vibration at horizontal plane of highest floor at all frequencies
Commercial and Industrial Building	20	20-40	40-50	40
Dwellings and buildings of similar occupancy or design	5	5-15	15-20	15
Structures that, because of their particular sensitivity to vibration cannot be classified under lines 1 and 2 and are of great intrinsic value	3	3-8	8-10	8

5.2 Operational noise

The NPI was released in 2017 and sets out the NSW EPA's requirements for the assessment and management of noise from industry in NSW.

5.2.1 Trigger levels

The NPI describes 'trigger levels' which indicate the noise level at which feasible and reasonable noise management measures should be considered. Two forms of noise criteria are provided – one to account for 'intrusive' noise impacts and one to protect the 'amenity' of particular land uses.

- The intrusiveness of an industrial noise source is generally considered acceptable if the L_{Aeq} noise level of the source, measured over a period of 15 minutes, does not exceed the background noise level by more than 5 dB. Intrusive noise levels are only applied to residential receivers. For other receiver types, only the amenity levels apply.
- To limit continual increases in noise levels from the use of the intrusiveness level alone, the ambient noise level within an area from all industrial sources should remain below the recommended amenity levels specified in the NPI for that particular land use.

For this assessment, the area surrounding the proposal is considered to be 'rural'.

5.2.2 Project specific noise criteria

The criteria for industrial noise generated by the facility are provided in Table 5-4. The Project Noise Trigger Level (PNTL) is the lowest value of the intrusiveness or amenity noise level for each period and are shown in Table 5-4 below in bold.

Table 5-4 NPI noise criteria (rural amenity area)

Receiver	Period	Noise level – dB(A)			
		Recommended amenity noise level L_{eq}	Lowest measured background noise level	Project noise trigger level $L_{eq(15minute)}$	
			RBL[1]	Intrusiveness	Amenity[2],[3]
Residential receivers	Daytime	50	35	**40**	48
	Evening	45	30	**35**	43
	Night-time	40	30	**35**	38
Commercial	When in use	65	n/a	n/a	**63**
Industrial	When in use	70	n/a	n/a	**68**

(1) RBL = Rating Background Level

(2) A -5 dB(A) correction has been applied to the amenity noise levels as there are existing industries present.

(3) The Project amenity noise level has been converted to a 15-minute level by +3 dB.

(4) The most stringent project trigger levels are bold.

5.2.3 Annoying noise characteristics corrections

Sources of industrial noise can cause greater annoyance where they contain certain characteristics, such as tonality, impulsiveness, intermittency, irregularity or dominant low-frequency content. The NPI provides the following modifying factors, shown in Table 5-5, which are to be applied to the predicted receiver noise levels.

Table 5-5 NPI modifying factor corrections

Factor	Assessment / measurement	When to apply	Correction[1]
Tonal noise	One-third octave band analysis using the objective method for assessing the audibility of tones in noise – simplified method (ISO1996.2-2007 – Annex D).	Level of one-third octave band 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 • 8 dB or more if the centre frequency of the band containing the tone is in the range 160–400 Hz • 15 dB or more if the centre frequency of the band containing the tone is in the range 25–125 Hz	5 dB[2]

Factor	Assessment / measurement	When to apply	Correction[1]
Low-frequency noise	Measurement of source contribution C-weighted and A-weighted level and one-third octave measurements in the range 10– 160 Hz	Measure / assess source contribution C and A weighted $L_{eq,t}$ levels over same time period. Correction to be applied where the C minus A level is 15 dB or more and: • where any of the one-third octave noise levels in Table C2 are exceeded by up to and including 5 dB and cannot be mitigated, a 2 dB(A) positive adjustment to measured/predicted A-weighted levels applies for the evening/night period • where any of the one-third octave noise levels in Table C2 are exceeded by more than 5 dB and cannot be mitigated, a 5-dB(A) positive adjustment to measured/predicted A-weighted levels applies for the evening/night period and a 2 dB(A) positive adjustment applies for the daytime period.	2 or 5 dB[2]
Intermittent noise	Subjectively assessed but should be assisted with measurement to gauge the extent of change in noise level	The source noise heard at the receiver varies by more than 5 dB and the intermittent nature of the noise is clearly audible.	5 dB

(1) Corrections to be added to the measured or predicted levels, except in the case of duration where the adjustment is to be made to the criterion.

(2) Where a source emits tonal and low-frequency noise, only one 5 dB correction should be applied if the tone is in the low-frequency range, that is, at or below 160 Hz.

(3) Where narrow-band analysis using the reference method is required, as outlined in column 5, the correction will be determined by the ISO1996-2:2007 standard.

5.2.4 Sleep disturbance criteria

As the construction works will be undertaken during the day period there will be no sleep disturbance or night-time noise impacts as a result of these works.

During normal operation of the BESS, the operational noise of the battery racks, inverters and transformers will be assessed against the sleep disturbance and night time noise criteria.

In accordance with the NPI, the sleep disturbance noise criteria for assessing the Project are presented in Table 5-6 below.

Table 5-6 Sleep disturbance noise criteria

Receiver type	$L_{eq,\ 15minute}$ dB(A)	L_{max} dB(A)
Residential receivers	40	52

5.3 Road traffic noise

The RNP provides guidance, criteria and procedures for assessing noise impacts from existing, new and redeveloped roads and traffic generating developments. The assessment of road traffic noise impacts on public roads is assessed under the RNP.

Road traffic generated by the operation of the Project will not generate additional traffic on existing surrounding public roads, and as such, there will be no increase to the existing road traffic. Hence, road traffic noise impact due to operational noise will not be assessed in this study.

The construction of the Project will generate additional traffic on surrounding public roads, such as construction worker car movements and delivery and construction vehicle movements. Once construction is complete, project traffic is expected to return to levels similar to the current situation.

The RNP details a number of noise assessment criteria for various road categories and land uses. Road access to the facility will be via Ascot-Calala Road, Whitehouse Lane and Burgmanns Lane from New England Highway which is a NSW state highway. Ascot-Calala Road and Whitehouse Lane would be classified as a local road and New England Highway would be classified as a freeway.

The Application Notes for the RNP state that;

> *'for existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level as a result of the development should be limited to 2 dB above that of the noise level without the development. This limit applies wherever the noise level without the development is within 2 dB of, or exceeds, the relevant day or night noise assessment criterion.'*

If road traffic noise during the Project construction is within 2 dB(A) of current levels then the objectives of the RNP are met and no specific mitigation measures are required. Where the Project road traffic noise levels exceed 2 dB(A) of current levels than the consideration should be given to the actual noise levels associated with construction traffic and whether or not these levels comply with the RNP criteria as presented in Table 5-7.

Table 5-7 RNP residential road traffic noise criteria

Road Category	Type of Project/Land Use	Assessment criteria(1) – dB(A)	
		Day 7am to 10pm	Night 10pm to 7am
Freeway/arterial/ sub-arterial roads	Existing residences affected by additional traffic on existing freeways/arterial/sub-arterial roads generated by land use developments.	$L_{Aeq,15hr}$ 60 (external)	$L_{Aeq,9hr}$ 55 (external)
Local roads	Existing residences affected by additional	$L_{Aeq,1hr}$ 55 (external)	$L_{Aeq,1hr}$ 50 (external)

(1) The assessment criteria for external noise levels apply at 1 metre from the facade of any affected residential receiver

6 Construction noise and vibration assessment

This section details the assessment of the construction noise and vibration impacts from the Project. Construction noise impacts predicted at nearest residential receivers have been assessed against the adopted ICNG noise management levels. Road traffic noise from the construction of the Project have been assessed against the RNP noise criteria.

6.1 Construction noise

6.1.1 Construction stages

To assess the potential noise and vibration impacts during construction, the following construction scenarios have been used in this assessment. Typical plant and equipment for each scenario have been developed based on Resonate's past project experiences. The likely noise impacts are summarised in Table 6-1 and the construction equipment is summarised in Appendix C. The range from low to high shows that noise impacts during a stage can vary pending on what plant is being used. Low noise levels represent quieter plant items, while high noise levels represent all plant items operating simultaneously.

Specific details of the construction program and the number, type, and duty of the construction plant to be used would be determined during when a construction contractor has been selected.

It is understood that all construction works are proposed to be carried out during standard daytime periods (7.00 am to 6.00 pm Monday to Friday and 8.00 am to 1.00 pm on Saturdays).

Table 6-1 Construction stages and equipment sound power levels

Stage	Scenario	Individual Stage L_{eq} sound power level – dB(A)	
		Low	High
1	Mobilisation and site establishment	100	115
2	Clearing and bulk earthworks(1)	103	124
3	Establishment of hardstand areas(1)	101	122
4	Permanent environmental management and pollution control measures(1)	104	119
5	Delivery and installation and BESS substation	103	119
6	Construction of BESS facility (1)	95	119
7	Connection to BESS substation	95	116
8	Roadside works(1)	101	119
9	Landscaping	106	118
10	Installation of cabling to the Transgrid substation	94	114

(1) Denotes "annoying" item of equipment as defined in the ICNG (i.e. contains characteristics such as impulsiveness, tonality etc.), and as such includes a +5 dB penalty adjustment to predictions.

6.1.2 Construction noise assessment methodology

Prediction of construction noise impacts from the Project has been undertaken through the use of the SoundPLAN (version 9.0) noise propagation modelling software.

The most significant factors in determining the level of noise received from construction activities are the receiver's distance from the Project Site, shielding, ground absorption and source heights. The parameters used and values adopted in the noise modelling are presented in Table 6-2 below.

Table 6-2 Construction noise modelling parameters

Parameter	Input data
Receivers	• Receivers provided by project team in shapefile format and imported into SoundPLAN • Receivers have been modelled as point receivers • Height of receivers modelled as 1.5 m above ground
Terrain	1 s ground contour from Geoscience Australia.
Ground surface / absorption	The agricultural land surrounding the site has been conservatively modelled with a ground cover factor of 0.75 representative of grassland/vegetation.
Source heights	Construction plant and equipment heights are modelled to be 1.5 m above ground
Sources	All equipment has been modelled as point sources and all equipment have been modelled to operate simultaneously.
SoundPLAN prediction method	ISO 9613-2: 1996
Met condition	Neutral meteorological condition has been modelled as construction activities will only be conducted during standard daytime period.

6.1.3 Predicted construction noise levels

Appendix D presents the predicted noise levels associated with each stage of works along with a comparison with the daytime and highly noise affected construction noise management levels (refer to Table 5-1). Assessment against the evening and night-time NMLs has not been undertaken because construction works of the BESS would be carried out during daytime standard hours. The assessment is limited to the identified receivers within an approximate 1 km radius from the Project Site (refer to Figure 2-1). Predicted noise levels have been based on continuous operation of the noise sources identified for each construction stage. Predictions are therefore considered to represent the worst-case potential noise impacts. The predicted noise levels presented in Appendix D would typically be short-term, lasting for the duration of the construction period when works are conducted.

The following Table 6-3 summarises standard hours exceedances and highly noise affected NML exceedances for each construction scenario. The summary represents the results of the high noise impact scenarios with all plant operating simultaneously and the individual columns show following information:

- Number of receivers exceeding the standard hours NML during a construction stage.
- The average NML exceedance for receivers that exceed the standard hours NML during a construction stage.
- The highest exceedance of the standard hours NML predicted during a construction stage.
- The receiver(s) with the highest exceedance of the standard hours NML during a construction stage.

No receivers are predicted to be highly noise-affected due to sufficient distance attenuation between the construction noise source and receiver. Appendix D shows the detailed results per receiver.

Table 6-3 Standard hours construction noise level summary

Stage	Scenario	Number of receivers exceeding standard hours NML	Average exceedance of standard hours NML (dB)	Maximum exceedance of standard hours NML (dB)	Receiver with maximum NML exceedance
1	Mobilisation and site establishment	3	5	9	R2
2	Clearing and bulk earthworks	36	5	18	R2
3	Establishment of hardstand areas	24	4	16	R2
4	Permanent environmental management and pollution control measures	10	4	13	R2
5	Delivery and installation and BESS substation	10	4	13	R2
6	Construction of BESS facility	10	4	13	R2
7	Connection to BESS substation	10	4	13	R2
8	Roadside works	10	4	13	R2
9	Landscaping	5	6	12	R2
10	Installation of cabling to the Transgrid substation	20	4	8	R5,R6,R7

In addition to the above summary in Table 6-3, construction noise impact levels at the NSW DPI - Tamworth Agricultural Institute are predicted to be within the criteria specified for commercial and industrial premises.

Based on the assessed exceedances of potential construction activities at residential receivers identified in Appendix D, construction noise management and mitigation measures are provided in Section 6.4 and a draft construction noise and vibration management plan is presented in Appendix J.

6.1.4 Cumulative construction noise

There is a possibility that the construction noise of the proposed Kingswood BESS may generate cumulative noise impact with the following nearby BESS developments:

- Tamworth BESS (at planning stage) (SSD-23830229).
- Calala BESS (at planning stage) (SSD-52786213).

The receivers that would potentially be impacted by the cumulative construction noise of the Project and other proposed BESS projects are receivers in proximity to Kingswood BESS and in-between other BESS developments. A worst-case scenario has been considered which would cover the instance that the Project, Tamworth BESS and Calala BESS were constructed at the same time.

The nearest noise sensitive receivers that would potentially be impacted by the cumulative construction noise of all three developments are receivers R2, R3, R4 and R5, which are located north-west and west of the Project, and located to the north-east of the proposed Tamworth BESS, and to the west and south of the proposed Calala BESS. These receivers are located approximately 450 m to 800 m from the Project BESS facility and approximately 500 m to 550 m to the proposed Tamworth BESS and Calala BESS. Whilst other noise sensitive receivers identified in Figure

2-1 would receive cumulative impacts as well, it is predicted that the above mentioned receivers would likely be the most affected by cumulative impacts.

Construction noise predictions associated with the Project have been discussed in Section 6.1.3. The Project's construction noise levels have been predicted to exceed the 45 dB(A) NML at receivers R2, R3, R4 and R5. Assuming a worst-case scenario whereby the works at the other BESS developments generate the same level of noise as those at the Project area, the predicted cumulative construction noise levels would be in the range of 3 – 5 dB higher than those presented in Appendix D. This would result in a potential worst case cumulative noise levels of between 51 dB(A) and 68 dB(A). No receivers are predicted to be highly noise-affected due to cumulative noise impacts.

Due to the predicted exceedances of cumulative construction noise at the receivers, construction noise management and mitigation measures recommended in Section 6.4 would need to be implemented.

6.2 Construction road traffic noise

6.2.1 Construction road traffic noise generated by the Project

The route for the construction traffic is to follow the New England Highway, before taking a turn onto Whitehouse Lane and ultimately reaching the Project Site via Ascot-Calala Road. In addition, some light vehicles will travel via Burgmanns Lane.

Table 6-4 shows the anticipated increase in traffic due to construction noise extracted from the Project's Traffic Impact Assessment (TIA), dated May 2024.

Table 6-4 Anticipated ADT increase on the surrounding road network

Road	Existing AADT (two-way) (1)	Existing peak hour volumes (two-way) (2)	Anticipated ADT increase (two-way) (3)
Ascot-Calala Road	78	8	280 (359% increase)
Whitehouse Lane	593	59	248 (42% increase)
Goonoo Goonoo Road / New England Highway	6,289	628	280 (4% increase)
Burgmanns Lane	1,348	135	32 (2% increase)

(1) Existing traffic volumes (2023) with applied traffic growth factor (see TIA for details).

(2) Peak hour volumes assumed to be 10% of daily peak hour traffic.

(3) Average vehicles per day multiplied by two consider two-way trips.

Per the road traffic noise criteria in Section 5.3, a detailed assessment is required if the noise levels increase by more than 2 dB due to increased construction traffic or the overall level exceed the RNP criteria at the nearest sensitive receiver. To trigger an increase of more than 2 dB, a traffic increase of more than 60% due to construction movements would be required. It can be seen in Table 6-4 that the increase in traffic is significantly below the 60% treshold for Whitehouse Lane, Goonoo Goonoo Road / New England Highway and Burgmanns Lane. Therefore, no further assessment is required for these roads.

The traffic increase on Ascot-Calala Road, due to the low existing traffic, is significant and will likely exceed the 2 dB(A) increase threshold. Hence, the traffic noise impacts were assessed further for this road. Table 6-5 shows the existing traffic and proposed construction traffic for this road during the daytime period. Note that the proposed traffic movements shown in the table are peak volumes and do not represent the expected average that would occur for the majority of the Project . The Transport for NSW's (TfNSW) Road Traffic Noise Estimator has been used to undertake construction road traffic noise predictions. Screenshots of the calculation predictions are shown in Appendix E.

Table 6-5 Construction road traffic noise predictions

Table **Road name**	**Road type**	**Daytime criteria dB(A)**	**Period**	**Existing traffic volume (daytime 7 am to 10 pm)**		**Construction traffic volume (daytime 7 am to 10 pm)**		**Predicted noise level – dB(A)**	
				Light	**Heavy**	**Light**	**Heavy**	**Existing**	**Future**
Ascot-Calala Road	Local Road	55	1 hour	7(1)	1(1) (2)	10(1)	8(1) (2)	40	48

(1) Traffic volume derived from the Project's traffic study provided by Arcadis and interpolated traffic predictions for relevant periods.

(2) Heavy vehicle volumes have been assumed to be 15% of the hourly traffic volumes.

Based on the above traffic noise predictions, the following construction road traffic noise levels have been assessed. Proposed construction traffic along Ascot-Calala Road during the worst case 1-hour traffic flows during daytime period is predicted to increase the existing traffic noise levels by more than 2 dB at the nearest residential buildings. This is due to very low existing traffic flow. However, the noise impact due to the proposed construction traffic and existing traffic during daytime period is predicted to be within the noise criteria set out in the RNP.

Construction road traffic noise is predicted to be within the RNP criteria and would be a temporary impact (with peak traffic volumes occurring for a relatively short time), the implementation of management and mitigation measures will not be necessary.

6.2.2 Cumulative construction traffic noise

Construction road traffic noise predictions associated with the Project have been carried out in Section 6.2.1. Based on the likely construction traffic routes, cumulative construction traffic noise impacts could occur along Burgmanns Lane and Goonoo Goonoo Road / New England Highway. The Project's construction road traffic along those roads has been predicted to not result in an increase of the existing traffic noise levels by more than 2 dB. The other roads for construction traffic, Ascot-Calala Road and Whitehouse Lane would likely only be utilised for the Projects construction traffic as these routes would result in a detour for the other BESS projects.

In summary the cumulative construction noise impacts are as follows:

- Goonoo Goonoo Road / New England Highway
  - Due to high existing traffic flows, it is unlikely that the additional traffic flows would increase the noise levels by more than 2 dB.
- Burgmanns Lane
  - Based on the TIA, this road is only used for a limited number of light vehicles for the Project. Based on the current cumulative traffic movements shown in the TIA, it is unlikely that the additional traffic flows would increase the noise levels by more than 2 dB.

At this stage no additional management and mitigation measures will be necessary due to cumulative construction traffic noise.

It should be noted that the construction traffic movements could change as the design of all BESS designs is still progressing. If all three BESS projects are to be constructed concurrently and if the cumulative construction road traffic noise levels would result in an increase of more than 2 dB and exceed the RNP criteria at the nearest sensitive receiver, a detailed construction road traffic noise impact assessment would be carried out. This would enable appropriate noise mitigation measures to be developed.

6.3 Construction vibration

No vibration intensive activities are proposed to occur near any receiver. Hence, no impacts are expected to occur given the significant distance to the nearest receiver building, which is approximately 300 m from the site boundary.

6.4 Construction noise management and mitigation measures

The management measures have been informed from guidance provided in the ICNG which promotes principles of best management practice and community notification of likely noise impacts.

It will be important for the contractor to undertake all reasonable and feasible measures to reduce noise impacts and minimise impact potential through programming works to minimise duration and liaise with affected landowners and local communities throughout the construction program. All Contractors commissioned by the client to undertaken construction works associated with the Project are recommended to adhere to all noise management and mitigation measures recommended.

Construction works should adopt Best Management Practice (BMP) and Best Available Technology Economically Achievable (BATEA) practices as addressed in the ICNG. BMP includes factors discussed within this report and encouragement of a project objective to reduce noise emissions. BATEA practices involve incorporating the most advanced and affordable technology to minimise noise emissions. The principles and proactive noise management measures presented in Table 6-6 are to be considered for implementation.

Table 6-6 Recommended construction noise management and mitigation measures

Construction phase	Recommended measure
Planning	Construction works are to be undertaken during the ICNG standard daytime construction hours (i.e. 7.00 am to 6.00 pm Monday to Friday and 8.00 am to 1.00 pm on Saturdays)
	Where possible, consider the application of alternative, low-impact construction techniques. For example, Ripping or cutting/sawing and grinding instead of rock hammering, or vacuum excavation instead of small scale earthworks
	A Construction Noise and Vibration Management Plan (CNVMP) should be developed to manage noise and vibration issues during construction.
Layout	Entry and exit points will be located as far as possible from sensitive receivers, taking into account the importance of safe access.
	Trucks will not queue up outside residential properties. No trucks will arrive on site or be permitted to queue near sensitive receivers prior to the 7:00 am start time unless required by road safety considerations.
	Training will be provided to all project personnel, including relevant sub-contractors on noise and vibration requirements from this plan through inductions, toolboxes and targeted awareness training.
	All relevant staff and sub-contractors will be informed of areas and work practises where potential noise impacts have been identified.
Training	Keep horn signals between drivers to a minimum.
	Delivery vehicles to be fitted with straps rather than chains for unloading, wherever possible.
	Truck drivers will limit compression braking as far as practicable.

Construction phase	Recommended measure
Contractor management	Switch off generators when not in use.
Noise source mitigation	Dampen or line metal trays as necessary.
	Shut down or throttle down machinery when not in operation.
	Avoid simultaneous operation of noisy plant within discernible range of a sensitive receiver
	Ensure equipment is operated in the correct manner including replacement of engine covers, repair of defective silencing equipment, tightening of rattling components, repair of leakages in compressed air lines and shutting down equipment not in use.
	Direct noise sources such as vent outlets, generators, etc. will be located and orientated away from the residences
	Plant will be fitted with noise control devices, where practicable, including acoustic lining of engine bays and air intake / discharge silencers
	Ensure that all doors/hatches are shut during operation of plant and equipment.
	Check hatches/enclosures regularly to ensure that seals are in good working order and doors close properly against seals.
	Avoid dropping materials from height.
	Use residential-grade mufflers on plant.
	Use dampened bits on impulsive tools such as jackhammers to avoid 'ringing' noise.
	Ensure truck movements are kept to a minimum, i.e. that trucks are fully loaded on each trip.
	Use temporary screening around immobile plant. Acoustic screens may be constructed from either a layer of 10 kg/m^2 loaded vinyl acoustic curtain (product name Wavebar from Pyrotek Noise Control) or minimum 9 mm thick plywood hoarding. Gaps at joints of the acoustic screen are to be sealed by overlapping the loaded vinyl or plywood, or with silicon mastic on the plywood hoarding.
Community consultation	Provide at least five and not more than 14 days' notice to affected receivers prior to starting works.
	Provide signage detailing who is undertaking the works and a 24-hour contact number.
	Where there are complaints about noise from an identified work activity, review and implement, where feasible and reasonable, action additional control measures.
	Consult with adjacent utility owners regarding the minimal risk of vibration impacts associated with the proposal.
	In consultation with the community, preference may be given to avoiding cumulative impacts by avoiding the con-current completion of phases of construction. Alternatively, impacted receivers may prefer a shorter works duration where this requires con-current completion of construction phases.

7 Operational noise and vibration assessment

This section details the assessment of the operational noise and vibration impacts from the Project. Operational noise impacts predicted at nearest residential receivers have been assessed against the adopted NPI noise criteria.

7.1 BESS operational noise

Operational noise source levels were developed based on a review of available manufacturer data noting that the preferred battery technology supplier has not been confirmed. These noise source levels and the number of plant items (i.e. number of enclosures and inverters) will be validated during the detailed design phase once the selected vendor technical data sheets for the selected equipment are confirmed. The modelled source noise levels and associated plant numbers are presented in Table 7-1. The 1/1 octave band frequency noise levels of each plant item are presented in Table 7-2.

Table 7-1 Estimated equipment sound power levels

Equipment	Number of plant item	Sound power level Leq – dB(A) (Individual plant item)
Battery enclosure	224	83
Battery inverter	112	93
HV transformer	2	84

Table 7-2 Equipment sound power spectra

Equipment	Sound Power Level in dB at Octave Band Centre Frequency (Hz)								Sound Power Level, dB L_{WA}
	63	125	250	500	1000	2000	4000	8000	
Battery enclosure	91	89	79	76	76	70	65	57	80
Battery inverter	92	92	93	87	84	83	88	82	93
HV transformer	91	93	88	87	82	77	72	62	88

It is understood that the charge and discharge rates of typical BESS facilities generally do not occur at the rated capacity of the BESS. The maximum utilisation for a BESS is typically 80% of peak system capacity during day and evening periods, and usually 40% during the night-time period. However, to undertake a conservative operational noise impact assessment the worst case 100% operational utilisation has been assessed for all periods.

The noise emissions from the BESS operations are continuous and do not emit peak noise levels for an instant or very short time period. Therefore, the operational noise from the Project will only be assessed against the sleep disturbance L_{Aeq} criterion and not the L_{Amax} criterion.

7.1.1 Methodology

In order to determine the acoustical impact of the Project, a computer model incorporating all significant noise sources; the closest potentially affected residential properties, and the intervening terrain has been prepared.

The computer model was prepared using the SoundPLAN noise propagation modelling software (Version 9.0) Industrial Module which allows the use of various internationally recognised noise prediction algorithms. The

CONCAWE algorithm, which is suitable for the assessment of large industrial plants, has been selected for this assessment because it also enables meteorological influences to be assessed.

The parameters used and values adopted in the noise modelling are presented in Table 7-3 below.

Table 7-3 Operational noise modelling parameters

Parameter	Input data
Receivers	• Receivers provided by project team in shapefile format and imported into SoundPLAN • Receivers have been modelled as point receivers • Height of receivers modelled as 1.5 m above ground
Terrain	1 s ground contour from Geoscience Australia.
Ground surface / absorption	The agricultural land surrounding the site has been conservatively modelled with a ground cover factor of 0.75 representative of grassland/vegetation.
Sources	• Noise emission sources associated with the Project as detailed in Table 7-1. • All noise emitting equipment has been modelled to operate simultaneously.
SoundPLAN prediction method	CONCAWE
Meteorological condition	Neutral meteorological conditions for all periods. • Pasquill category D • No wind • 70% relative humidity • 20°C temperature • 1013 mbar air pressure
	Noise enhancing meteorological conditions for daytime and evening periods. • Pasquill category D • 3 m/s • 70% relative humidity • 20°C temperature • 1013 mbar air pressure
	Noise enhancing (temperature inversion) meteorological conditions for night-time period. • Pasquill category F • 2 m/s • 70% relative humidity • 10°C temperature • 1013 mbar air pressure

7.1.2 Modifying factors

Table 7-4 shows that the predicted noise levels of the Project at the nearest sensitive receivers have been assessed for annoying noise characteristics.

Table 7-4 Modifying factor corrections

Modifying factor	Applicable	Justification
Tonal noise	No	• Noise from the transformers and inverters can be tonal in nature. However, the assessment of the 1/3 octave date of the equipment showed that tonal noise at the receiver locations would be unlikely given the distance between source and receiver. Therefore, no penalty has been applied to the predicted noise levels at the receivers in accordance with Table C.1 of the NPI.
Low-frequency noise	No	• The C weighted minus A weighted source contribution level difference is predicted to be less than 15 dB. • The noise spectrum at the nearest sensitive receivers does not exceed any of the one-third octave low-frequency noise threshold levels shown in NPI Table C2. Noise data for the equipment was limited to 50 Hz and above but due to the size and type of equipment it is unlikely that frequencies below 50 Hz could exceed the noise levels shown in NPI Table C2.
Intermittent noise	No	• Minimal intermittent noise is predicted due to the nature of the steady operation of the equipment. Hence, No correction for intermittent noise was applied.
Duration	No	• It is likely that the site is operating continuously. Hence, no correction factor was applied.

As per the justifications in Table 7-4 it was determined that no modifying factors were required to be applied.

7.1.3 Predicted operational noise levels

The predicted operational noise levels for the day, evening and night-time periods are presented in Appendix F and the operational noise contours are presented in Appendix G.

The highest predicted operational noise level during neutral weather condition is 39 dB(A) at residential receivers R2 during all periods.

The highest predicted operational noise level during noise enhancing meteorological conditions is 44 dB(A) at residential receiver R2 during all periods.

7.1.4 Discussion

The following discusses the predicted operational noise levels at surrounding receivers.

- Neutral weather condition:
  - Operational noise impacts at all receivers have been predicted to comply with the daytime criterion.
  - The BESS operation during the evening is expected to exceed the NPI evening 35 dB(A) criterion at residential receivers R2 and R3. The evening operational noise levels during neutral weather condition are predicted to exceed the evening criterion by up to 4 dB(A).
  - The BESS operation during the night-time is expected to exceed the NPI night-time 35 dB(A) criterion at residential receivers R2 and R3. The night-time operational noise levels during neutral weather condition are predicted to exceed the night-time criterion by up to 4 dB(A).
  - Operational noise impacts at all receivers have been predicted to comply with the sleep disturbance L_{Aeq} criterion.
- Noise enhancing meteorological conditions (adverse wind during day and evening, and temperature inversion during night-time):

- The BESS operation during the daytime is expected to exceed the NPI daytime 40 dB(A) criterion at residential receivers R2 and R3. The evening operational noise levels during neutral weather condition are predicted to exceed the evening criterion by up to 4 dB(A).
- The BESS operation during the evening is expected to exceed the NPI evening 35 dB(A) criterion at receiver R2, R3, R9 and R16. The evening operational noise levels during noise enhancing meteorological conditions are predicted to exceed the evening criterion by up to 9 dB(A).
- The BESS operation during the night-time is expected to exceed the NPI night-time 35 dB(A) criterion at receiver R2, R3, R9 and R16. The night-time operational noise levels during noise enhancing meteorological conditions are predicted to exceed the night-time criterion by up to 9 dB(A).
- The night-time operational noise levels have been predicted to exceed the sleep disturbance L_{Aeq} 40 dB(A) criterion at receivers R2 and R3. The night-time operational noise levels during noise enhancing meteorological conditions are predicted to exceed the sleep disturbance criterion by up to 4 dB(A).

In addition to the above summary, operational noise impact levels at the NSW DPI - Tamworth Agricultural Institute are predicted to be within the criteria specified for commercial and industrial premises.

Based on the assessed exceedances, noise mitigation measures have been recommended and are presented in Section 7.4.

7.2 Operational road traffic noise

The Project Site is primarily operated remotely. During maintenance activities, only a few vehicle movements would occur, similar to the ones happening for the existing TransGrid substation. From our understanding, the infrequent traffic movements in comparison to the existing traffic on local roads do not necessitate a detailed assessment.

7.3 Operational vibration

No vibration intensive plant/equipment or activities are proposed to occur during standard operation onsite, therefore no vibration impacts are anticipated.

7.4 Recommended operational noise mitigation measures

The following additional design refinements have been considered in the noise assessment to further reduce noise levels and potential noise criteria exceedances.

These design refinements are based on the quantities and sound power levels of the indicative battery solution and are intended to demonstrate that acceptable noise outcomes could realistically be achieved. The final layout including the location of equipment and noise walls would be further refined during detailed design and would aim to achieve compliance with the predicted noise levels and criteria in this assessment. In the unlikely event that compliance with the project specific noise criteria is unable to be achieved through detailed design, the Project would be operated with limitations on fan duty and/or adjustment of total MW or MWh, to ensure full compliance.

7.4.1 Source controls (reduction in sound power level)

The major contributing factor to the noise emissions from the current configuration is the battery inverter. To further optimise acoustic predictions, the supplier advised that the inverter can be installed with a silencer. Table 7-2 shows the sound power data for this configuration (i.e. inverter with silencer).

Table 7-5 Equipment sound power spectra

Equipment	Sound Power Level in dB at Octave Band Centre Frequency (Hz)								Sound Power Level, dB L_{WA}
	63	125	250	500	1000	2000	4000	8000	
Battery inverter [1]	91	89	92	85	83	81	84	79	90

(1) The inverter selection includes a silencer provided by the supplier

7.4.2 Site layout

The site layout could be further optimised during the detailed design stage when the exact number and footprint of the plant items is known. The final layout may vary subject to detailed design and would aim to comply with the NPI criteria identified in this report.

7.4.3 Path controls (noise barriers or mounds)

Based on the indicative battery solution, the BESS site would require solid noise barrier with a minimum surface mass of 15kg/m^2 around the premise as shown in Figure 7-1. Sound absorptive treatment, such as a perforated metal with an absorptive material behind, to the internal side if the barrier will be required to reduce noise reflection from BESS equipment. The indicative heights range between 3 – 8 metres and are shown in Figure 7-1. The relative benefit of various noise barrier heights was assessed. The final noise barrier solution would be refined as part of the detailed design process when specific battery, inverter and transformer types are defined.

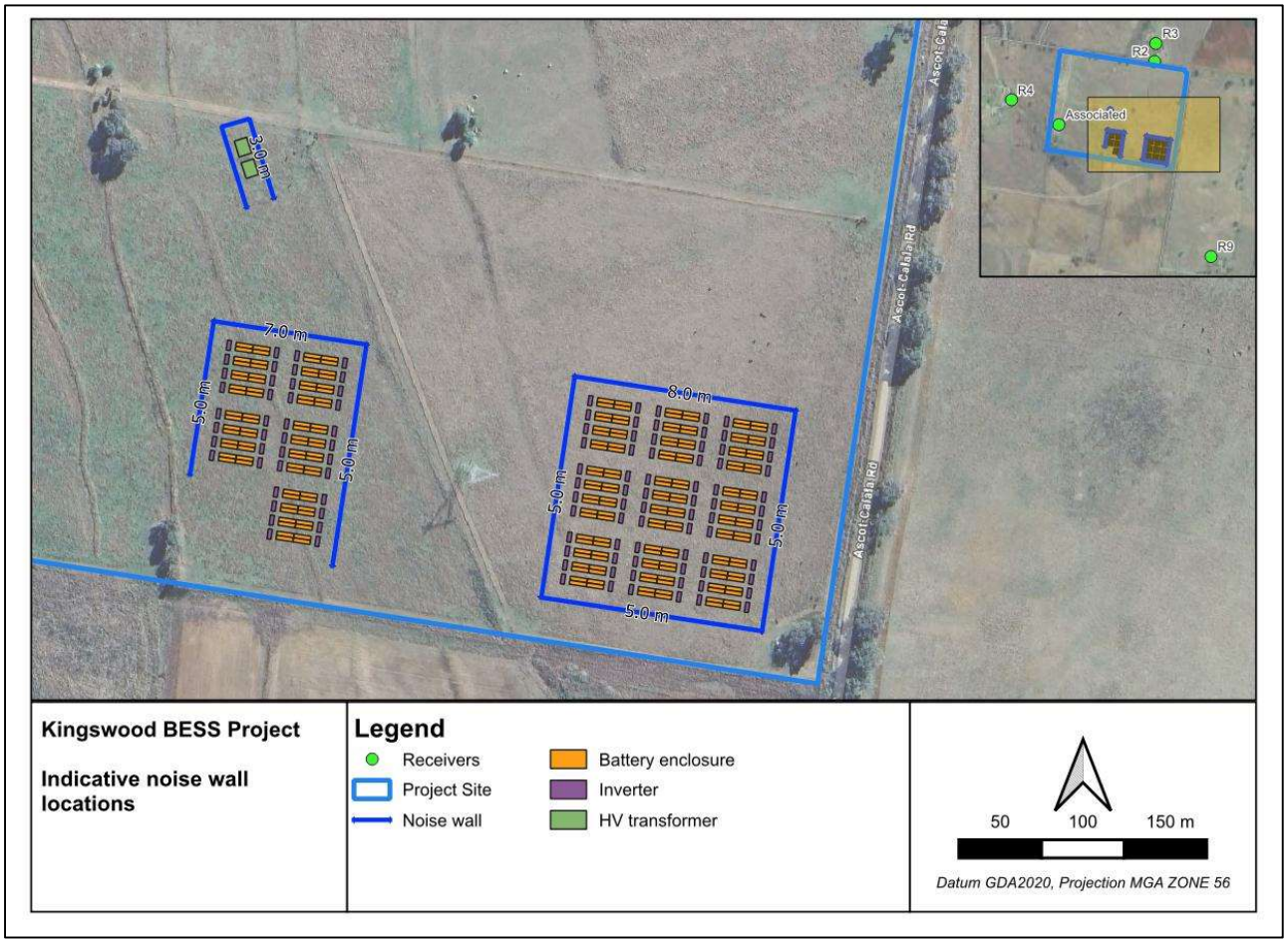


Figure 7-1 Indicative battery and noise wall layout

7.5 Predicted operational noise levels with design refinements

The noise mitigation measures shown in Section 7.4 have been included in the noise model and the predicted results during noise enhancing meteorological conditions are presented in Appendix H and the noise contours are presented in Appendix I.

Operational noise impacts at all receivers have been predicted to comply during all periods with the implemented mitigation measures.

It is also recommended that the agreed mitigation measures should be further developed during the detailed design stage of the Project when the equipment selection for the Project is finalised.

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

- Requiring suppliers to reselect equipment with fewer sound sources (quantity) and lower noise emissions.
- Modified noise barriers or mounds around the BESS.
- Adjusting fan speeds to account for reduced cooling capacity overnight.

7.6 Cumulative operational noise

The operational noise of the proposed Kingswood BESS may generate cumulative noise impact with the following possible nearby BESS developments:

- Tamworth BESS (at planning stage)
- Calala BESS (at planning stage)

The receivers that would potentially be impacted by the cumulative operational noise of the Project and other proposed BESS and the existing substation are receivers in proximity to Kingswood BESS and in-between other BESS developments. Receivers R2, R3, R4 and R5 are deemed to be most impacted by cumulative operational noise. Receivers further away would likely experience lower overall noise impacts or the noise impact would be controlled by the nearest development from the individual receivers.

7.6.1 Other BESS projects

Currently available information from the other two BESS projects has been reviewed and compared with the noise impact predictions of the Project. This was based on the following:

- Predicted noise impacts from Calala BESS were extracted from the publicly available report EIS Noise and Vibration Assessment Rp 001 20220648 dated 18 August 2023.
- No public data was available for Tamworth BESS. Therefore, a high level prediction has been undertaken based on distance between Project Site and receiver.

Under noise enhancing meteorological conditions it is possible that noise levels could exceed up to approximately 2 dB(A) during evening and night-time. However, the following should be considered:

- The above qualitative assessment assumes the worst-case downwind direction meaning that the wind direction would be from the noise source to receiver for all developments. In reality, receivers would not receive worst case downwind direction for all developments at the same time. Wind analysis over the period of one year revealed that the most occurring wind directions are SSE and SE.
- Predictions are based on noise enhancing meteorological conditions which occur during limited days of the year.
- Marginal exceedances of 1 to 2 dB(A) are deemed to have negligible impact as ≤ 2 dB exceedance is typically not discernible by the average human ear. Therefore, predicted levels that exceed the noise criteria by 2 dB or less are considered to achieve compliance with the criteria.
- All BESS projects in the area are at the planning stage and the equipment selection and layouts are not finalised. Therefore, it is currently not feasible to offer comprehensive predictions on the cumulative impact.

Nevertheless, noise mitigation measures recommended in Section 7.4 would need to be implemented to ensure that surrounding receivers are not adversely impacted.

It is recommended to evaluate cumulative noise impacts further as part of the detailed design process when specific battery, inverter and transformer types are defined and more detailed information on all nearby developments is available.

8 Conclusion

This report presents the results of the assessment of the potential noise impacts associated with the Project. This assessment has been carried out in accordance with NSW regulatory requirements identified in the SEARs issued for the development.

8.1 Construction noise and vibration

The construction noise and vibration assessment was undertaken using plant and equipment representative of the construction methodologies for the Project. The assessment identifies the following regarding the Project's construction activities:

- Construction activities would likely exceed the construction noise management levels at up to 36 residences for the noisiest construction stage 2.
- Worst case predicted construction noise level is 63 dB(A) at residential receiver R2.
- Exceedances of up to 18 dB have been predicted.
- There are no highly noise affected receivers.
- Due to the predicted exceedances, construction noise management and mitigation measures have been recommended in this report and should be considered for implementation.
- The non-residential receiver, NSW DPI - Tamworth Agricultural Institute is predicted to be within the specified criteria.
- A draft construction noise and vibration management plan has been prepared and presented in Appendix J.
- Construction road traffic noise levels along Whitehouse Lane, Burgmanns Lane and New England Highway have been predicted to not increase the existing road traffic noise by more than 2 dB. This is based on the increase in traffic flows shown in the TIA, dated May 2024.
- Construction road traffic and existing road traffic noise levels along Ascot-Calala Road have been predicted to be within the RNP criteria at the most affected receivers.
- Construction road traffic noise is not predicted to increase by more than 2 dB or road noise impacts are predicted to be within the criteria set in the RNP. Therefore, management and mitigation measures to control construction road traffic noise would not be necessary.
- Cumulative construction road traffic noise is not predicted to increase by more than 2 dB or road noise impacts are predicted to be within the criteria set in the RNP. Therefore, management and mitigation measures to control construction road traffic noise would not be necessary. However, it is noted that construction traffic movements could change with the finalisation of all BESS projects. If an exceedance of the criteria were to be predicted, a detailed construction road traffic noise impact assessment would be carried out to allow for appropriate noise mitigation measures to be developed.
- No vibration impacts are expected to occur given the significant distance to the nearest receiver building, which is approximately more than 300 m from the site boundary.

8.2 Operational noise and vibration

Operational noise levels of the Project are predicted to comply with the noise criteria during all time periods and meteorological conditions. It should be noted that:

- Without noise mitigation measures, the noise levels are predicted to exceed the criteria at four receivers by up to 4 dB(A) under standard meteorological conditions.
- Without noise mitigation measures the noise levels are predicted to exceed the criteria at four receivers by up to 9 dB(A) under noise enhancing meteorological conditions.
- With mitigation measures, the operational noise impacts at all receivers have been predicted to comply with the sleep disturbance L_{Aeq} criterion.
- The non-residential receiver, NSW DPI - Tamworth Agricultural Institute is predicted to be within the specified criteria.

Based on the assessed exceedances, noise mitigation options have been developed and presented in Section 7.4. Operational noise mitigation measure would consist of:

- Installing battery inverters with a silencer.
- Installing noise walls with indicative height from 3 – 8 metres. Noise barriers should be of solid material with surface density of at least 15 kg/m3. Sound absorptive treatment, to the internal side of the barrier will likely be required.

It is noted that the agreed mitigation measure will be further developed during the detailed design stage of the Project when the equipment selection for the Project is finalised.

Currently available information from two other BESS projects (Tamworth BESS, Calala BESS) that are at planning stage, has been reviewed and compared with the noise impact predictions of the Project. Whilst there is publicly available information, for Calala BESS, there was no information available for Tamworth BESS. Therefore, a high level prediction has been undertaken based on distance between Project Site and receiver.

Under noise enhancing meteorological conditions it is possible that noise levels could exceed up to approximately 2 dB(A) at the most impacted receivers during the evening and night-time periods. However, the following should be considered:

- The above qualitative assessment assumes the worst-case wind direction meaning that the wind direction would be from noise source to receiver for all developments. In reality, receivers would not receive worst case wind direction for all developments at the same time. Wind analysis over the period of one year revealed that the most occurring wind directions are SSE and SE.
- Predictions are based on noise enhancing meteorological conditions which occur during limited days of the year.
- Marginal exceedances of 1 to 2 dB(A) are deemed to have negligible impact as ≤ 2 dB exceedance is typically not discernible by the average human ear. Therefore, predicted levels that exceed the noise criteria by 2 dB or less are considered to achieve compliance with the criteria.
- All BESS projects in the area are at the planning stage and the equipment selection and layouts are not finalised. Therefore, it is currently not feasible to offer comprehensive predictions on the cumulative impact.

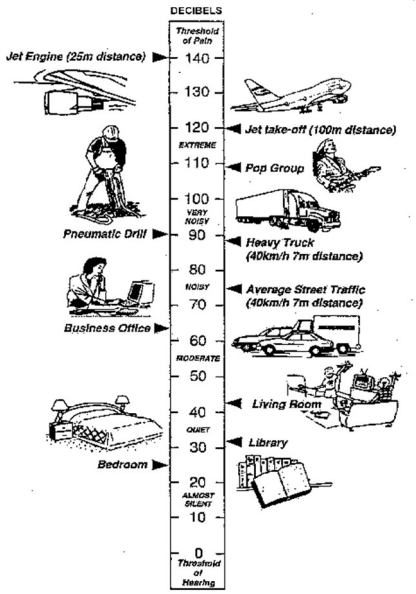
It is recommended to evaluate cumulative noise impacts further as part of the detailed design process when specific battery, inverter and transformer types are defined and more detailed information on all nearby developments is available.

No vibration intensive plant/equipment or activities are proposed to occur during standard operation onsite, therefore no vibration impacts are anticipated.

Appendix A – Acoustic terminology

A-weighted sound pressure	The human ear is not equally sensitive to sound at different frequencies. People are more sensitive to sound in the range of 1 to 4 kHz (1000 – 4000 vibrations per second) and less sensitive to lower and higher frequency sound. During noise measurement an electronic '*A-weighting*' frequency filter is applied to the measured sound level *dB(A)* to account for these sensitivities. Other frequency weightings (B, C and D) are less commonly used. Sound measured without a filter is denoted as linear weighted dB(linear).
Ambient noise	The total noise in a given situation, inclusive of all noise source contributions in the near and far field.
Community annoyance	Includes noise annoyance due to: • character of the noise (e.g. sound pressure level, tonality, impulsiveness, low-frequency content) • character of the environment (e.g. very quiet suburban, suburban, urban, near industry) • miscellaneous circumstances (e.g. noise avoidance possibilities, cognitive noise, unpleasant associations) • human activity being interrupted (e.g. sleep, communicating, reading, working, listening to radio/TV, recreation).
Compliance	The process of checking that source noise levels meet with the noise limits in a statutory context.
Cumulative noise level	The total level of noise from all sources.
dB(A)	dB(A) denotes a single number sound pressure level that includes a frequency weighting ("A-weighting") to reflect the subjective loudness of the sound level. The frequency of a sound affects its perceived loudness. Human hearing is less sensitive at low and very high frequencies, and so the A-weighting is used to account for this effect. An A-weighted decibel level is written as dB(A).
Extraneous noise	Noise resulting from activities that are not typical to the area. Atypical activities may include construction, and traffic generated by holiday periods and by special events such as concerts or sporting events. Normal daily traffic is not considered to be extraneous.
Feasible and reasonable measures	Feasibility relates to engineering considerations and what is practical to build; reasonableness relates to the application of judgement in arriving at a decision, taking into account the following factors: • Noise mitigation benefits (amount of noise reduction provided, number of people protected). • Cost of mitigation (cost of mitigation versus benefit provided). • Community views (aesthetic impacts and community wishes). • Noise levels for affected land uses (existing and future levels, and changes in noise levels).

Impulsiveness	Impulsive noise is noise with a high peak of short duration or a sequence of these peaks. Impulsive noise is also considered annoying.
Low frequency	Noise containing major components in the low-frequency range (20 to 250 Hz) of the frequency spectrum.
Noise criteria	The general set of non-mandatory noise levels for protecting against intrusive noise (for example, background noise plus 5 dB) and loss of amenity (e.g. noise levels for various land use).
Noise level (goal)	A noise level that should be adopted for planning purposes as the highest acceptable noise level for the specific area, land use and time of day.
Noise limits	Enforceable noise levels that appear in conditions on consents and licences. The noise limits are based on achievable noise levels, which the proponent has predicted can be met during the environmental assessment. Exceedance of the noise limits can result in the requirement for either the development of noise management plans or legal action.
Performance-based goals	Goals specified in terms of the outcomes/performance to be achieved, but not in terms of the means of achieving them.
Rating Background Level (RBL)	The rating background level is the overall single figure background level representing each day, evening and night time period. The rating background level is the 10th percentile min L_{A90} noise level measured over all day, evening and night time monitoring periods.
Receptor	The noise-sensitive land use at which noise from a development can be heard.
Sleep disturbance	Awakenings and disturbance of sleep stages.
Sound and decibels (dB)	Sound (or noise) is caused by minute changes in atmospheric pressure that are detected by the human ear. The ratio between the quietest noise audible and that which should cause permanent hearing damage is a million times the change in sound pressure. To simplify this range the sound pressures are logarithmically converted to decibels from a reference level of 2 x 10-5 Pa. The picture below indicates typical noise levels from common noise sources.



dB is the abbreviation for decibel – a unit of sound measurement. It is equivalent to 10 times the logarithm (to base 10) of the ratio of a given sound pressure to a reference pressure.

Sound power Level (SWL)

The sound power level of a noise source is the sound energy emitted by the source. Notated as SWL, sound power levels are typically presented in *dB(A)*.

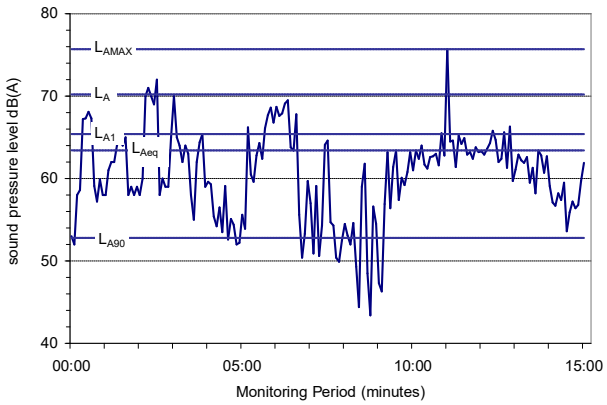
Sound Pressure Level (SPL)

The level of noise, usually expressed as SPL in *dB(A)*, as measured by a standard sound level meter with a pressure microphone. The sound pressure level in *dB(A)* gives a close indication of the subjective loudness of the noise.

Statistic noise levels

Noise levels varying over time (e.g. community noise, traffic noise, construction noise) are described in terms of the statistical exceedance level.

A hypothetical example of A weighted noise levels over a 15 minute measurement period is indicated in the following figure:



Key descriptors:

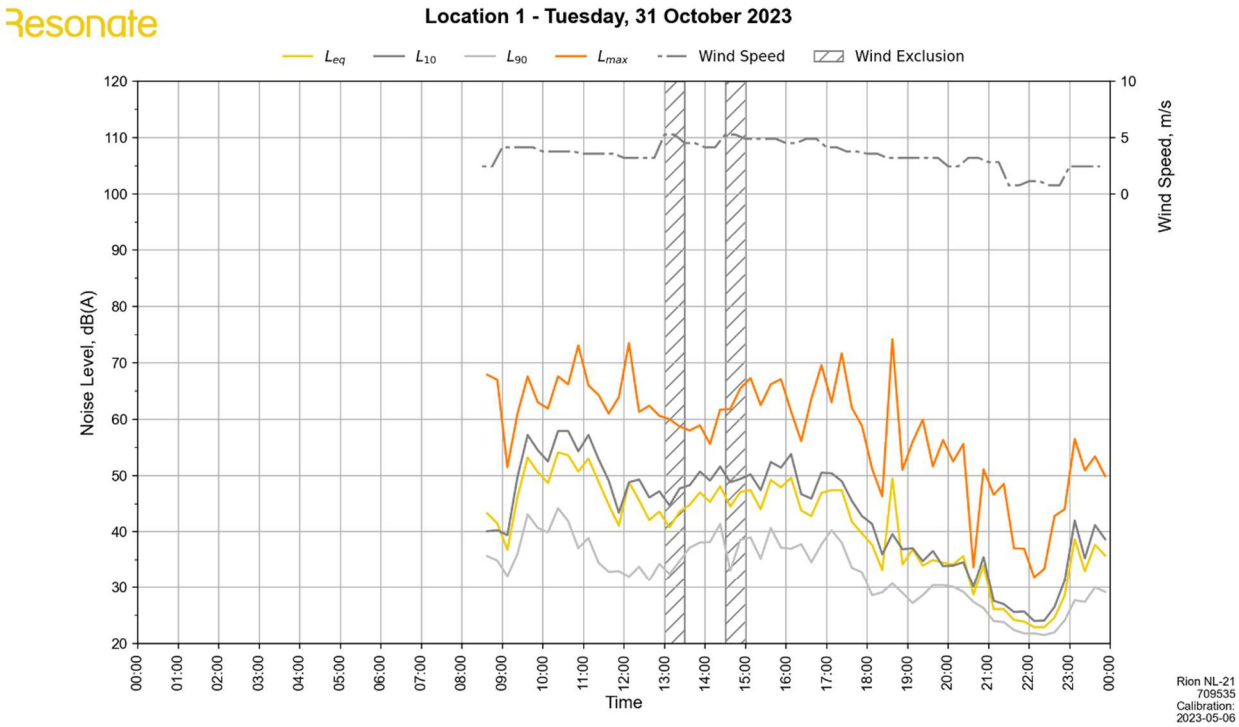
- L_{Amax}: Maximum recorded noise level.
- L_{A1}: The noise level exceeded for 1% of the 15 minute interval.

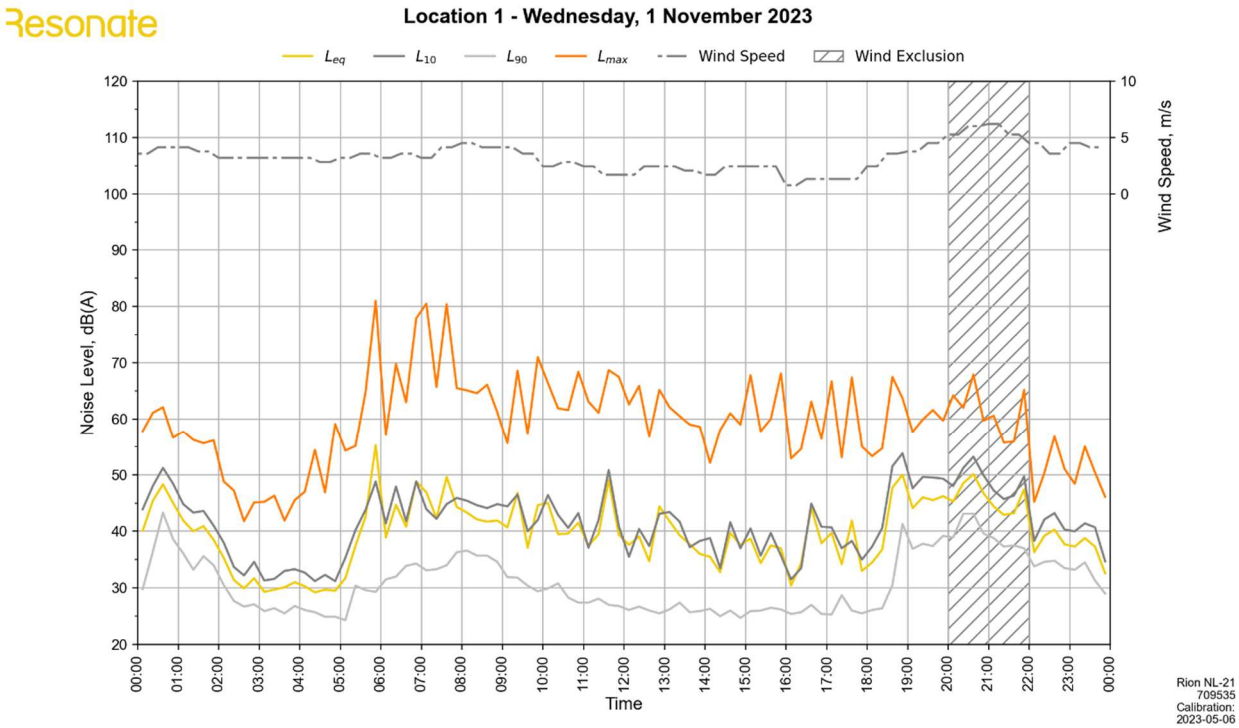
- L_{A10}: Noise level present for 10% of the 15 minute interval. Commonly referred to the average maximum noise level.
- L_{Aeq}: Equivalent continuous (energy average) A-weighted sound pressure level. It is defined as the steady sound level that contains the same amount of acoustic energy as the corresponding time-varying sound.
- L_{A90}: Noise level exceeded for 90% of time (background level). The average minimum background sound level (in the absence of the source under consideration).

Threshold	The lowest sound pressure level that produces a detectable response (in an instrument/person).
Tonality	Tonal noise contains one or more prominent tones (and characterised by a distinct frequency components) and is considered more annoying. A 2 to 5 dB(A) penalty is typically applied to noise sources with tonal characteristics

Appendix B – Noise logging graphs

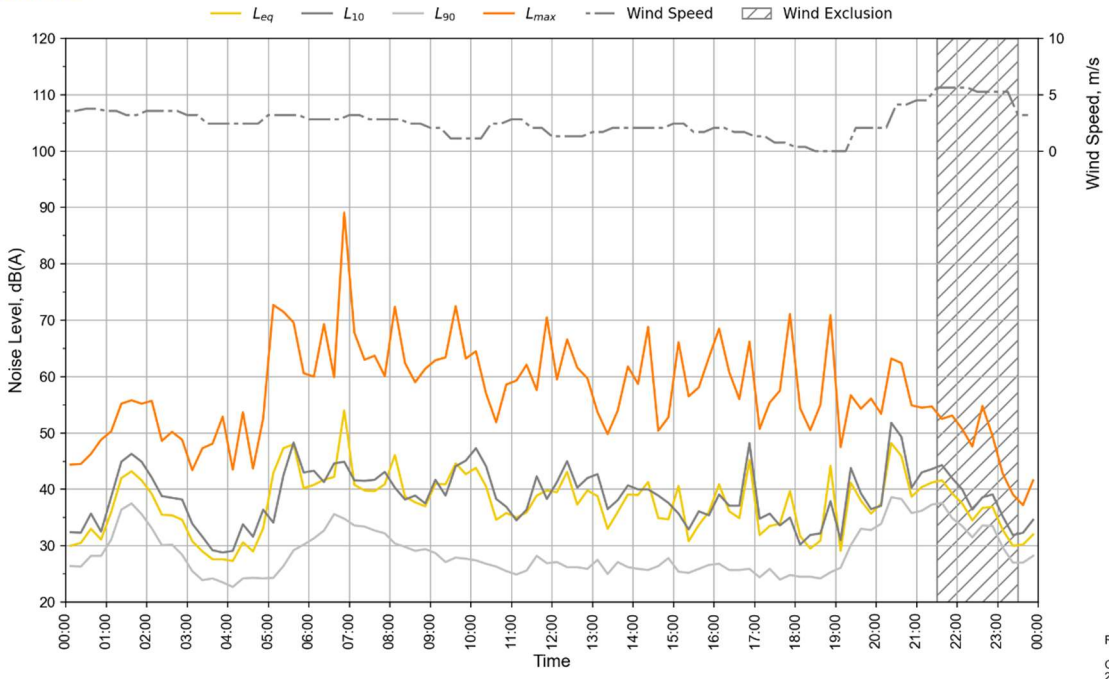
Logger Location 1





Resonate

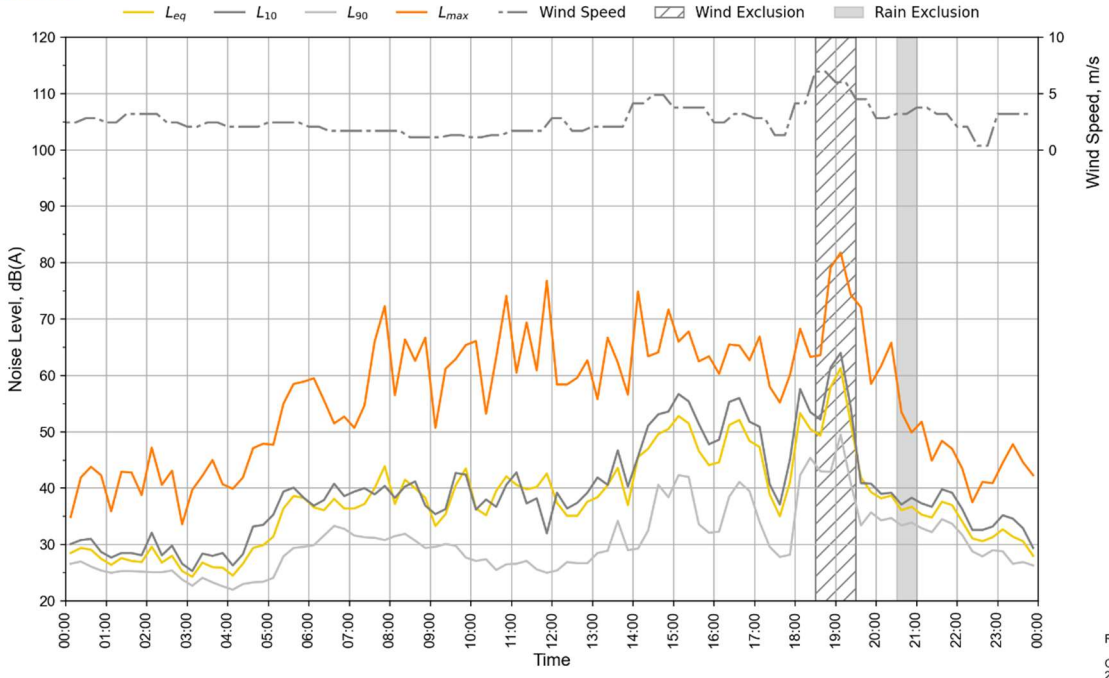
Location 1 - Thursday, 2 November 2023



Rion NL-21
709535
Calibration:
2023-05-06

Resonate

Location 1 - Friday, 3 November 2023



Rion NL-21
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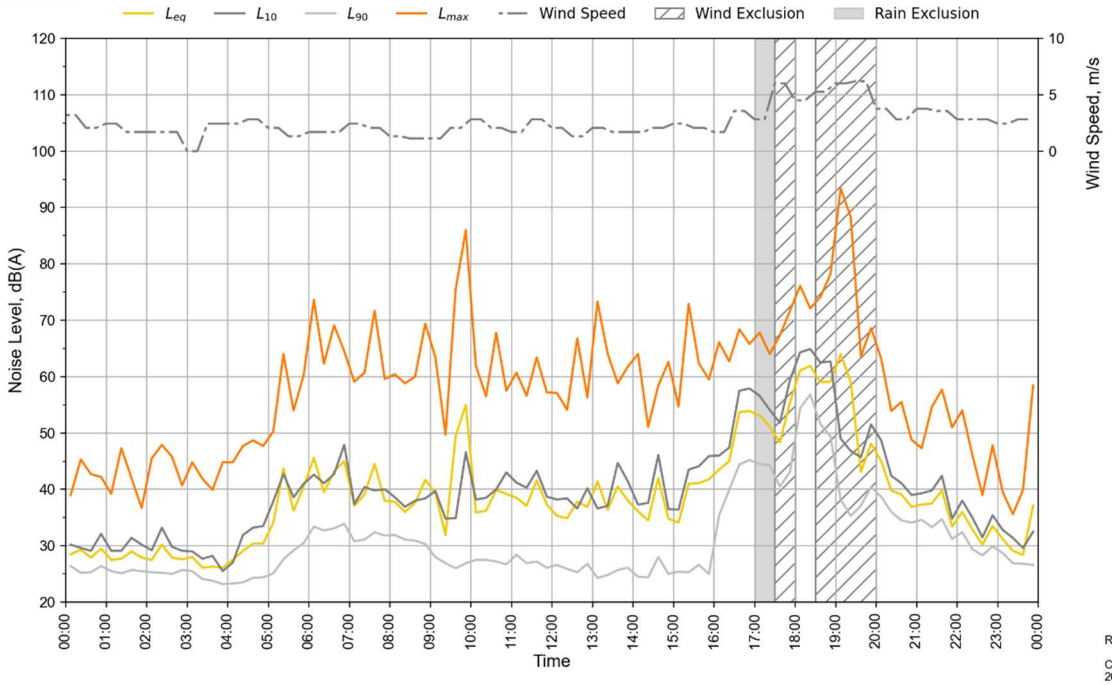
Calibration:
2023-05-06

Resonate

Location 1 - Saturday, 4 November 2023



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Calibration:
2023-05-06

Resonate

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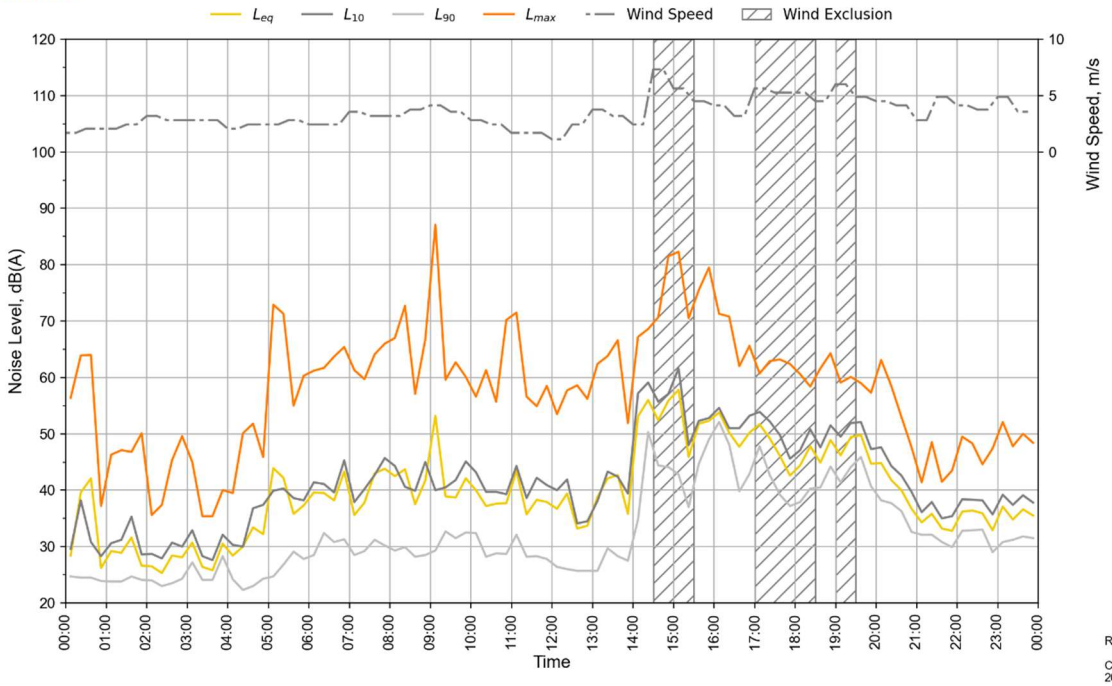

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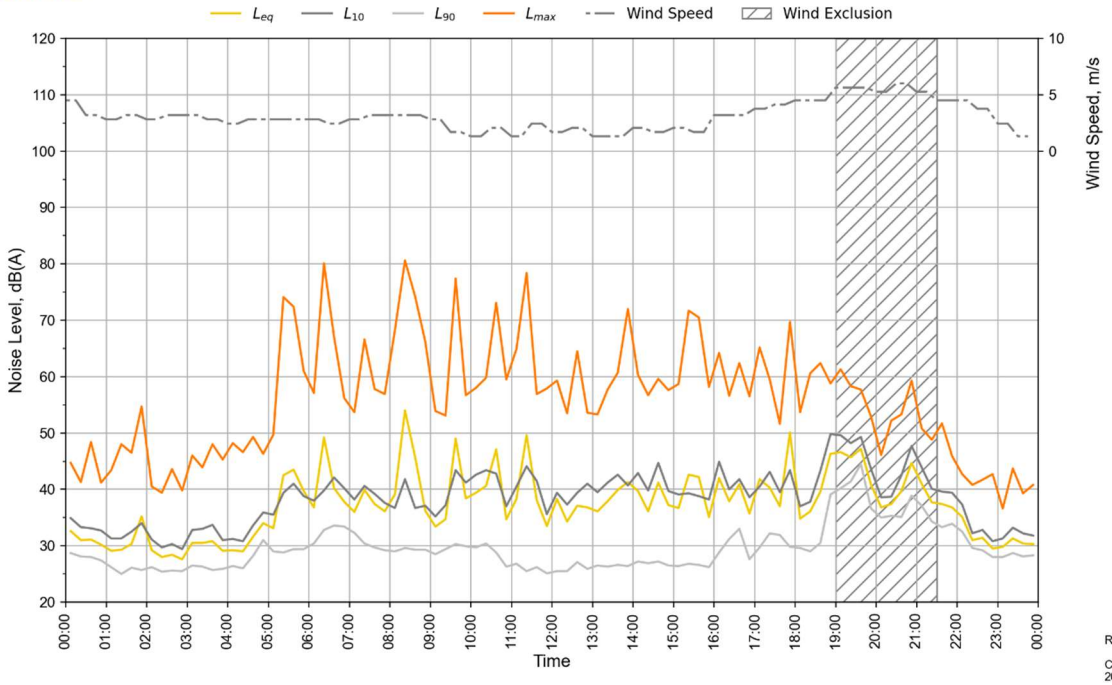
Calibration:
2023-05-06

Resonate

Location 1 - Monday, 6 November 2023



Rion NL-21
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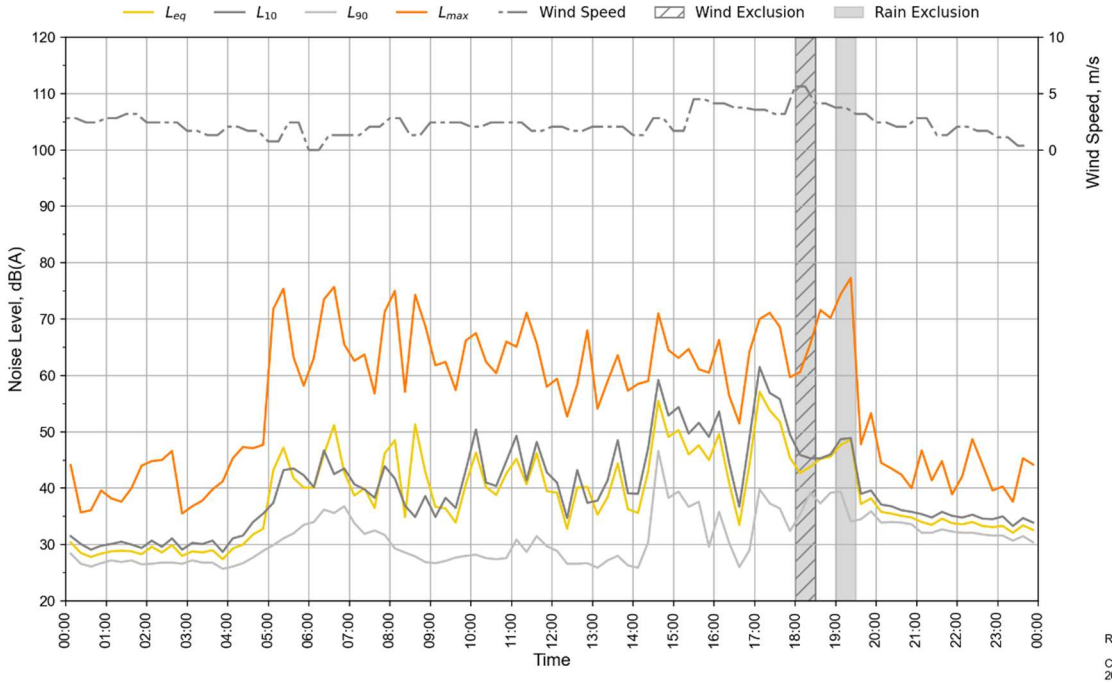
Calibration:
2023-05-06

Resonate

Location 1 - Wednesday, 8 November 2023



Rion NL-21
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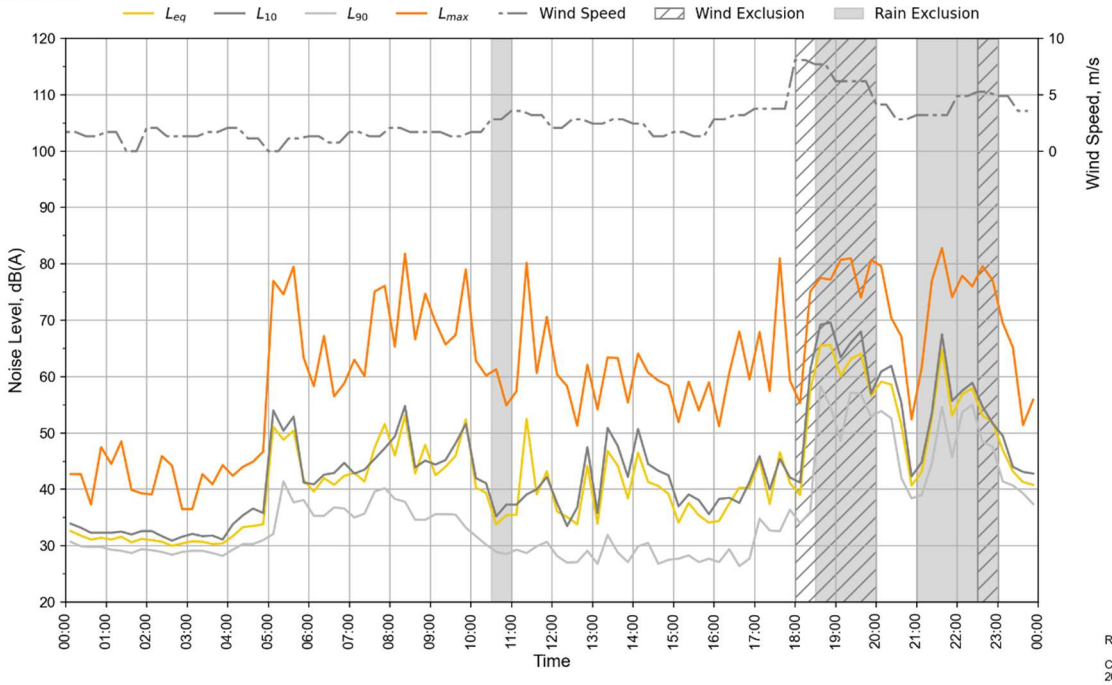
Calibration:
2023-05-06

Resonate

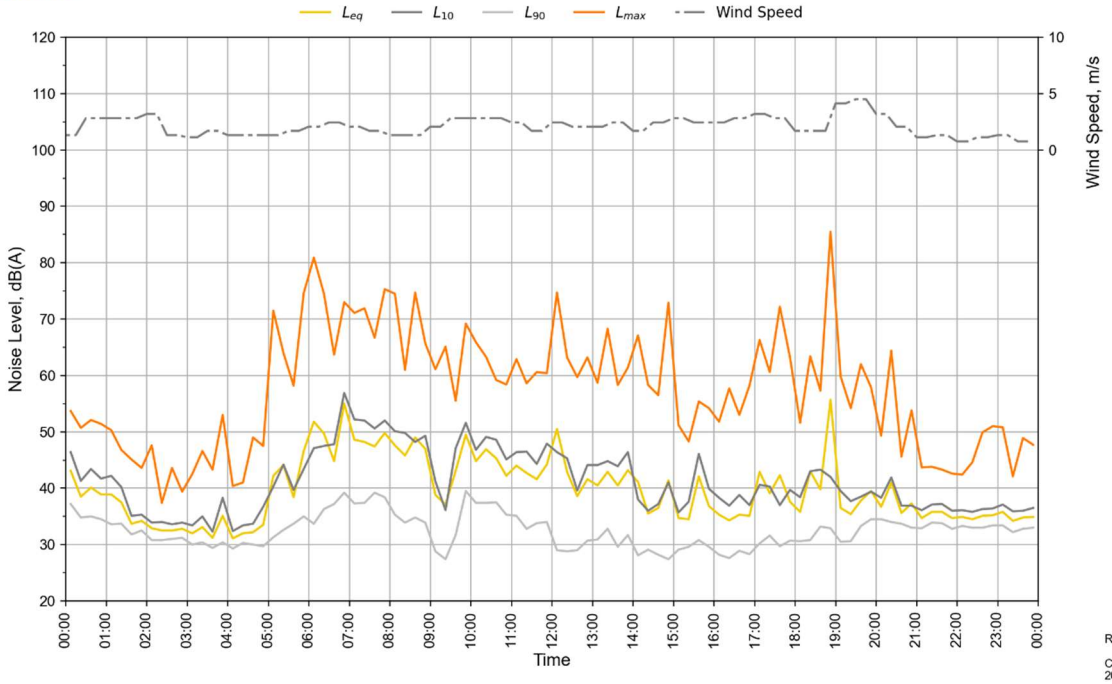
Location 1 - Thursday, 9 November 2023



Rion NL-21
709535
Calibration:
2023-05-06

Resonate

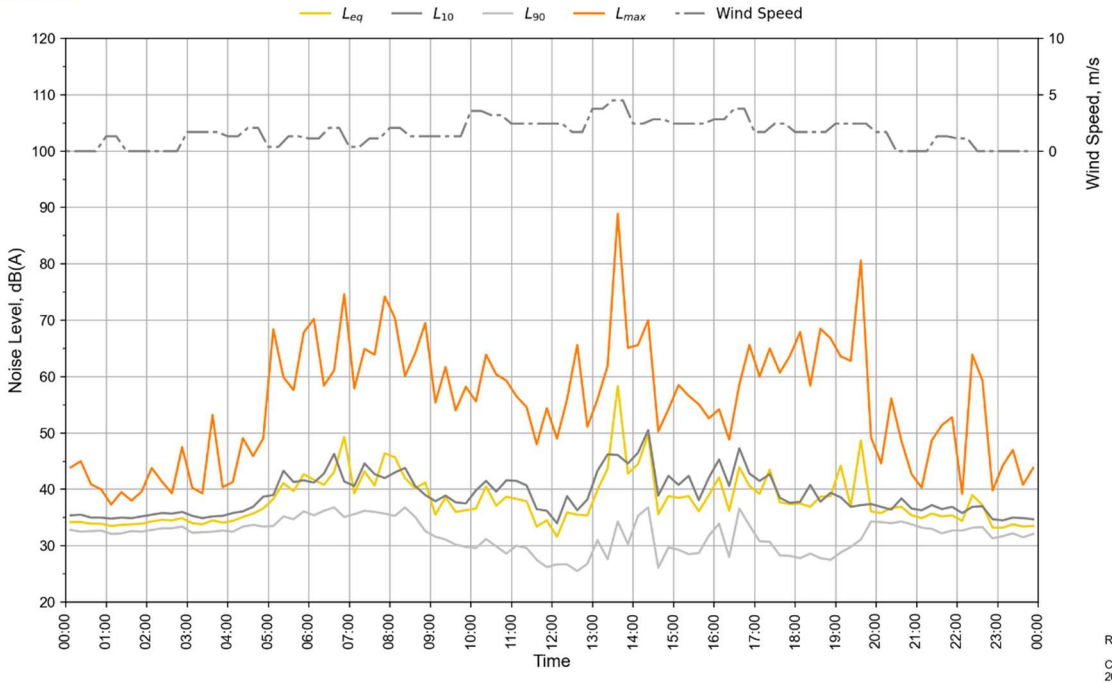
Location 1 - Tuesday, 14 November 2023



Rion NL-21
709535
Calibration:
2023-05-06

Resonate

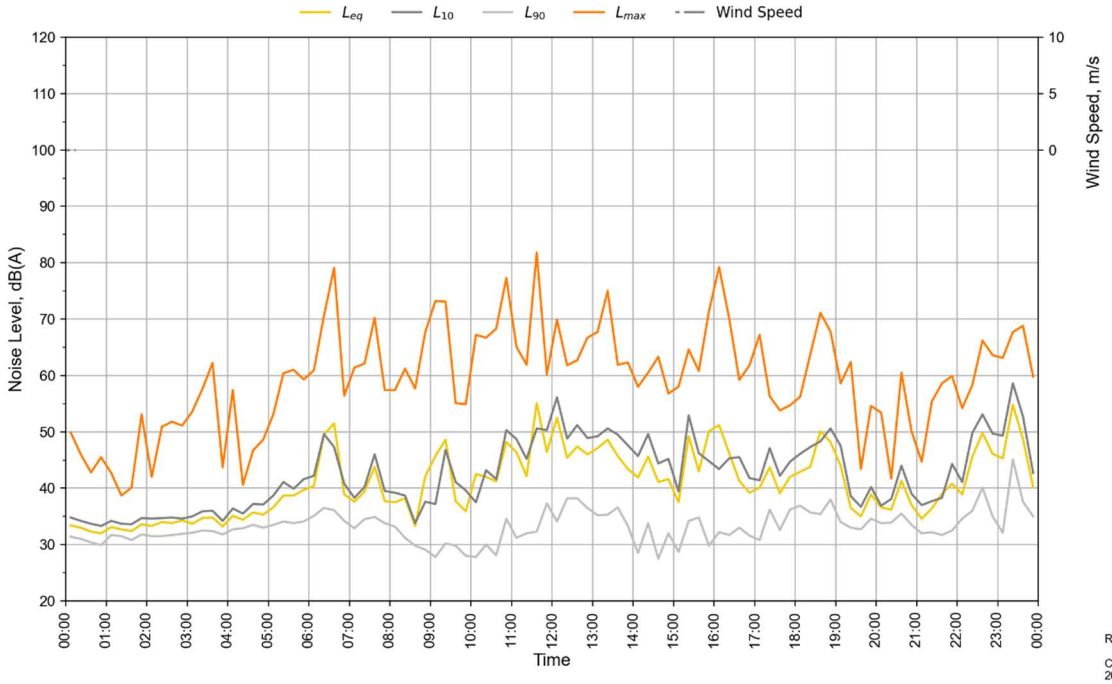
Location 1 - Wednesday, 15 November 2023



Rion NL-21
709535
Calibration:
2023-05-06

Resonate

Location 1 - Thursday, 16 November 2023



Rion NL-21
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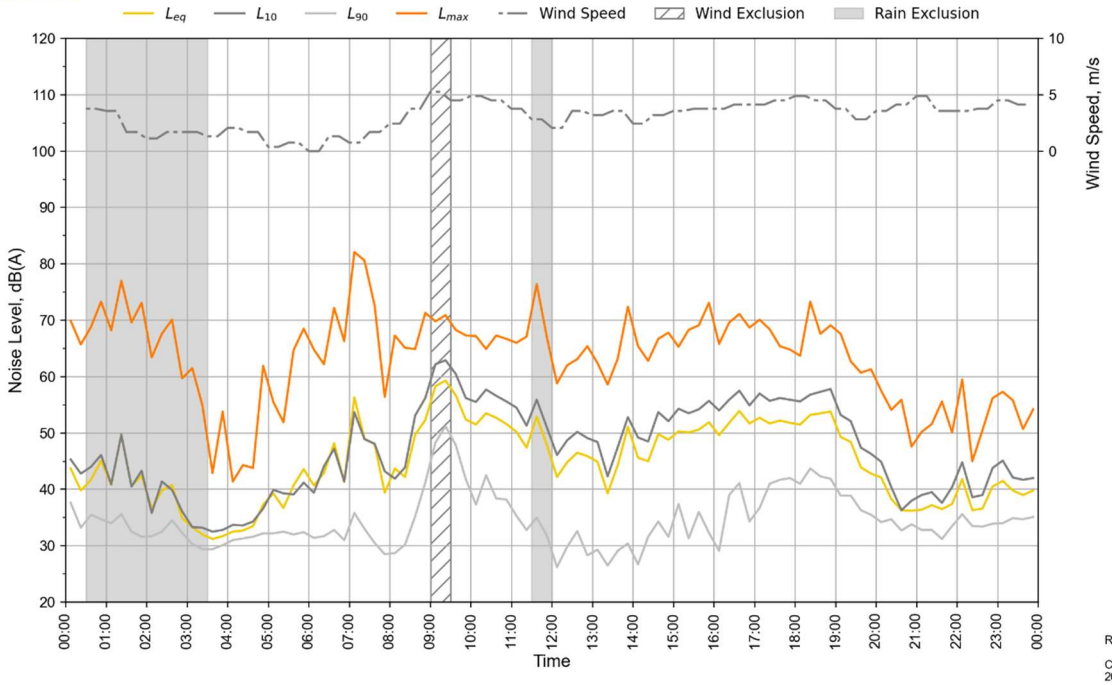
Calibration:
2023-05-06

Resonate

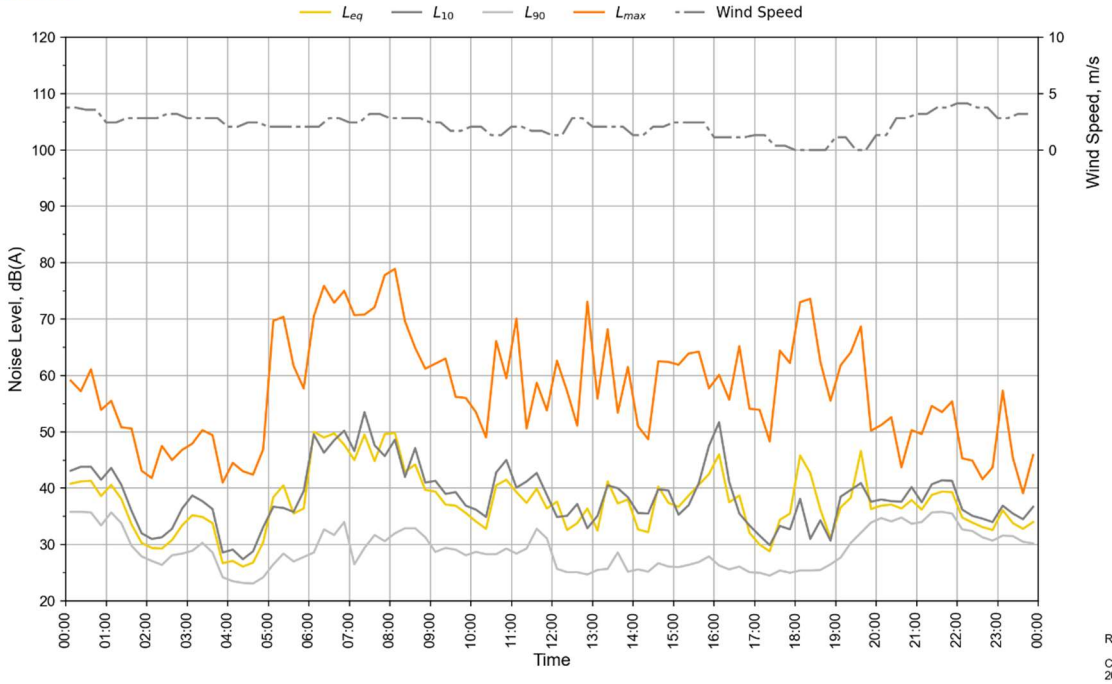
Location 1 - Friday, 17 November 2023



Rion NL-21
709535
Calibration:
2023-05-06

Resonate

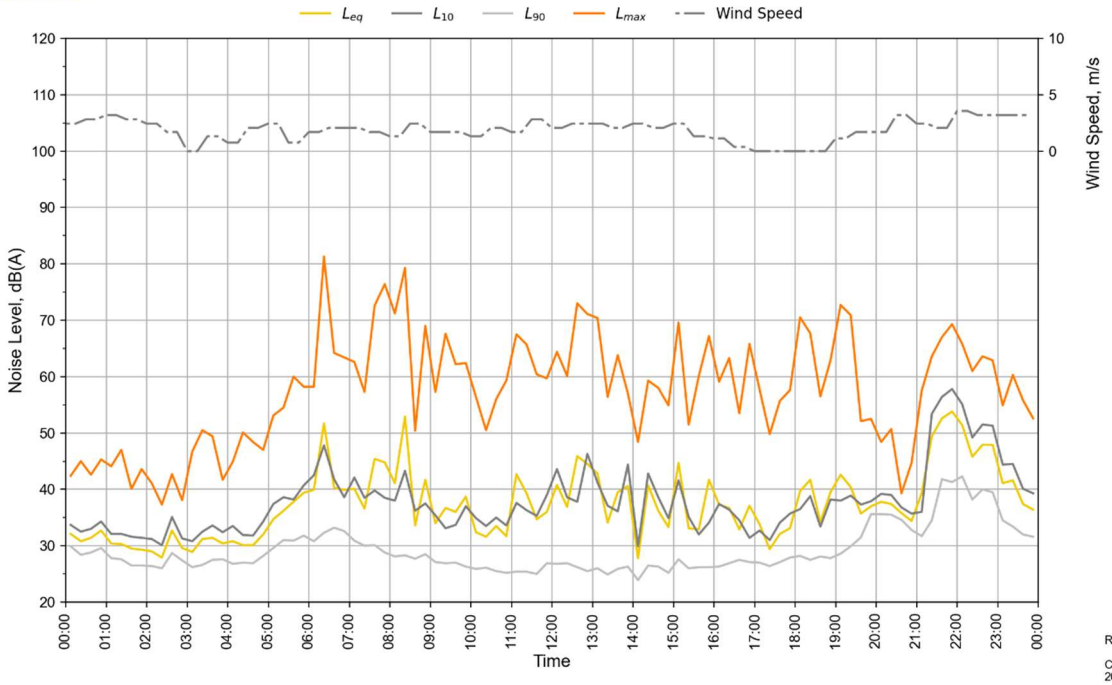
Location 1 - Saturday, 18 November 2023



Rion NL-21
709535
Calibration:
2023-05-06

Resonate

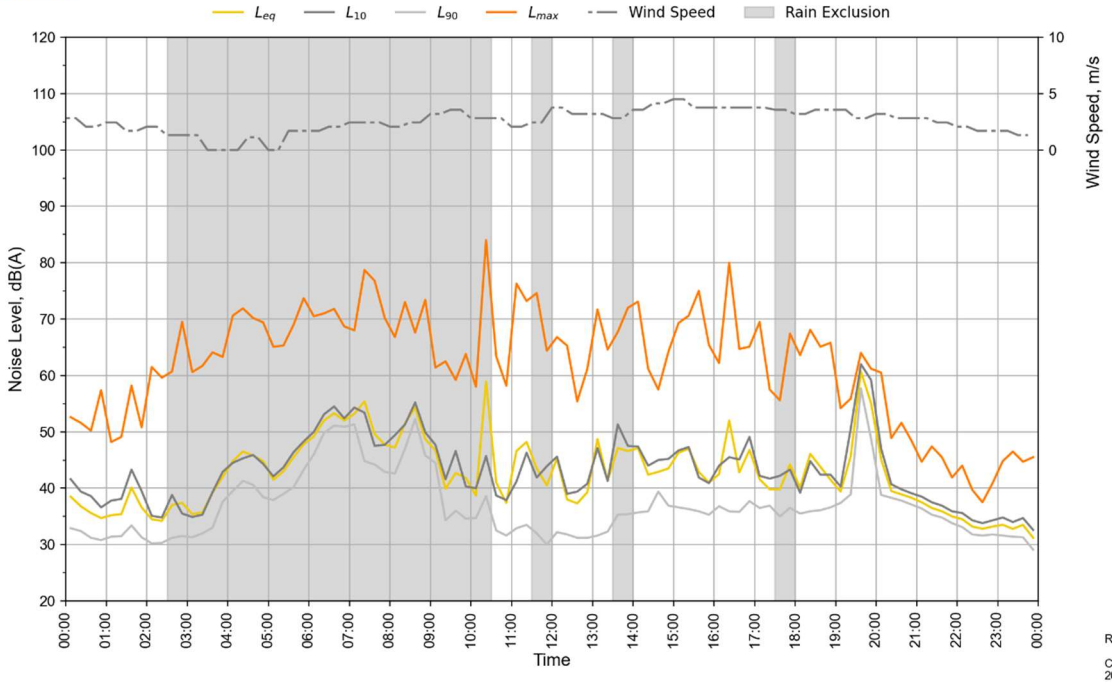
Location 1 - Sunday, 19 November 2023



Rion NL-21
709535
Calibration:
2023-05-06

Resonate

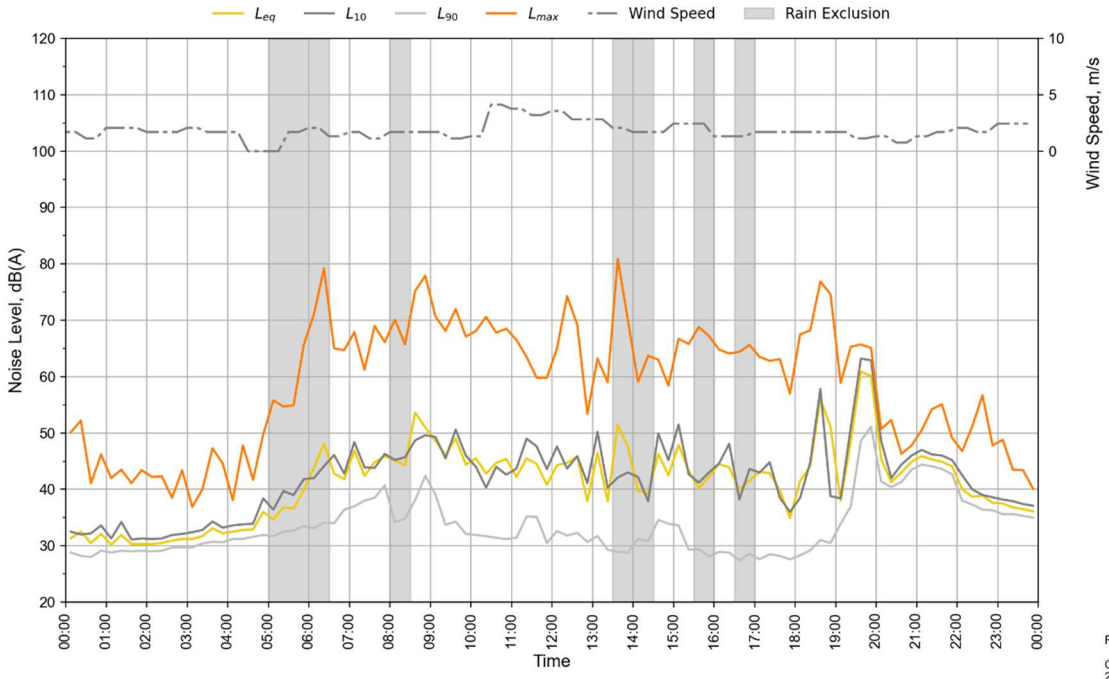
Location 1 - Monday, 20 November 2023



Rion NL-21
709535
Calibration:
2023-05-06

Resonate

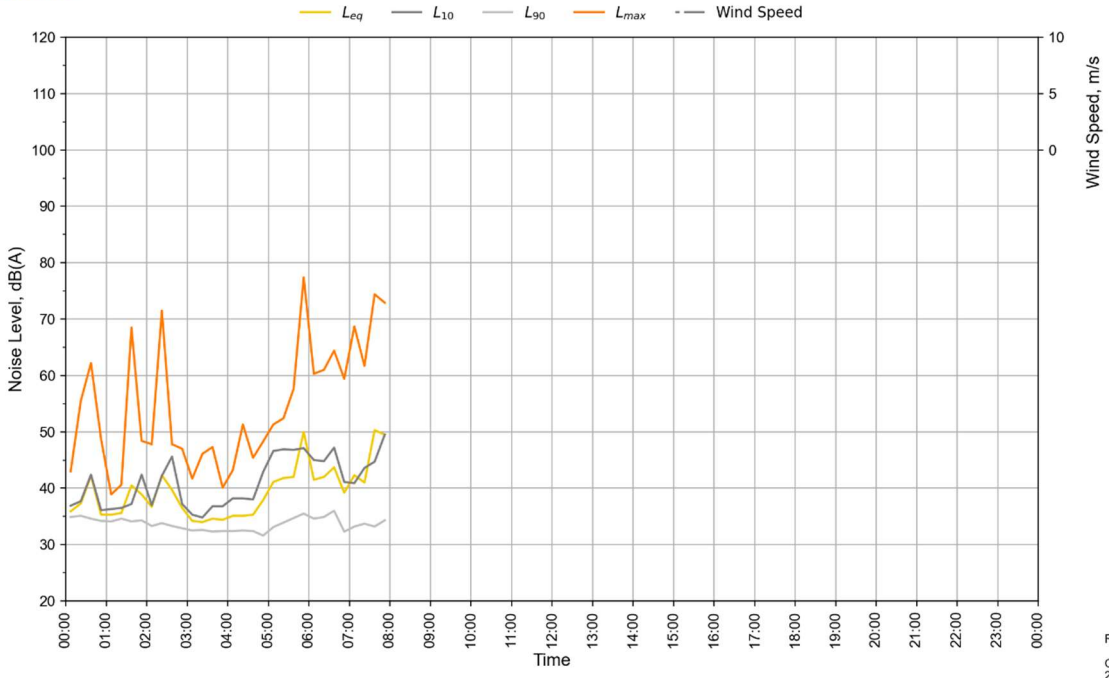
Location 1 - Tuesday, 21 November 2023



Rion NL-21
709535
Calibration:
2023-05-06

Resonate

Location 1 - Wednesday, 22 November 2023



Rion NL-21
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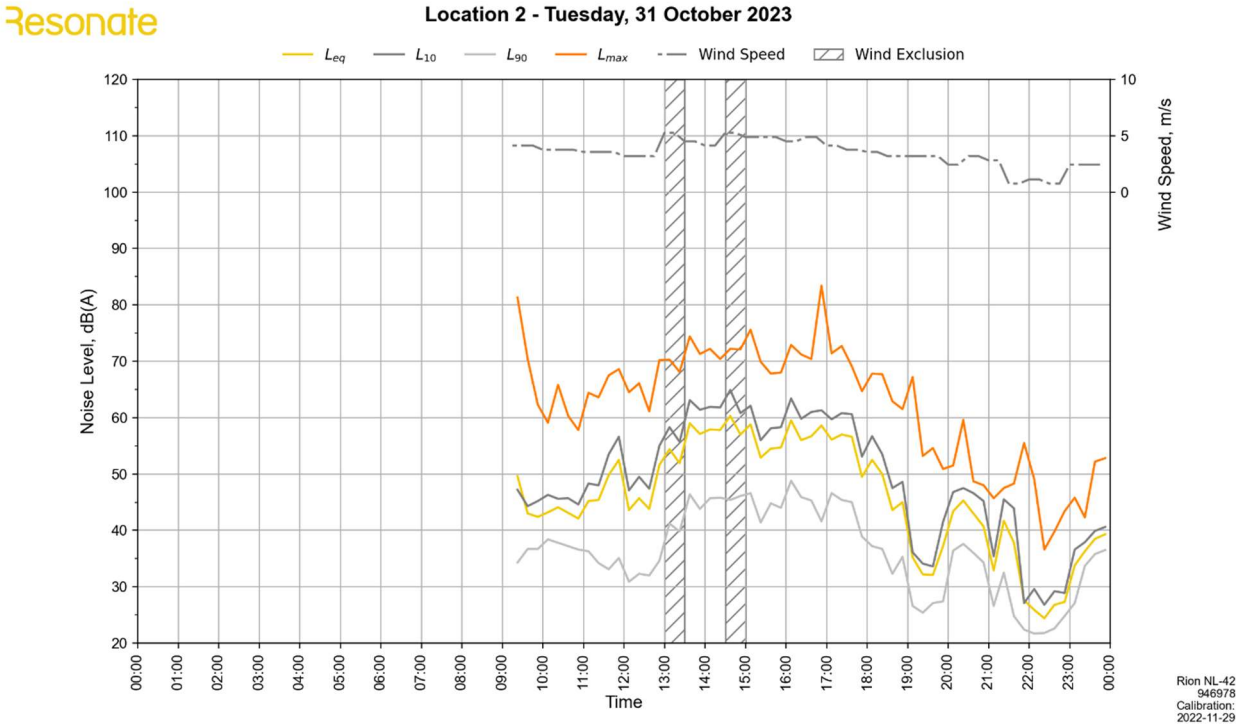
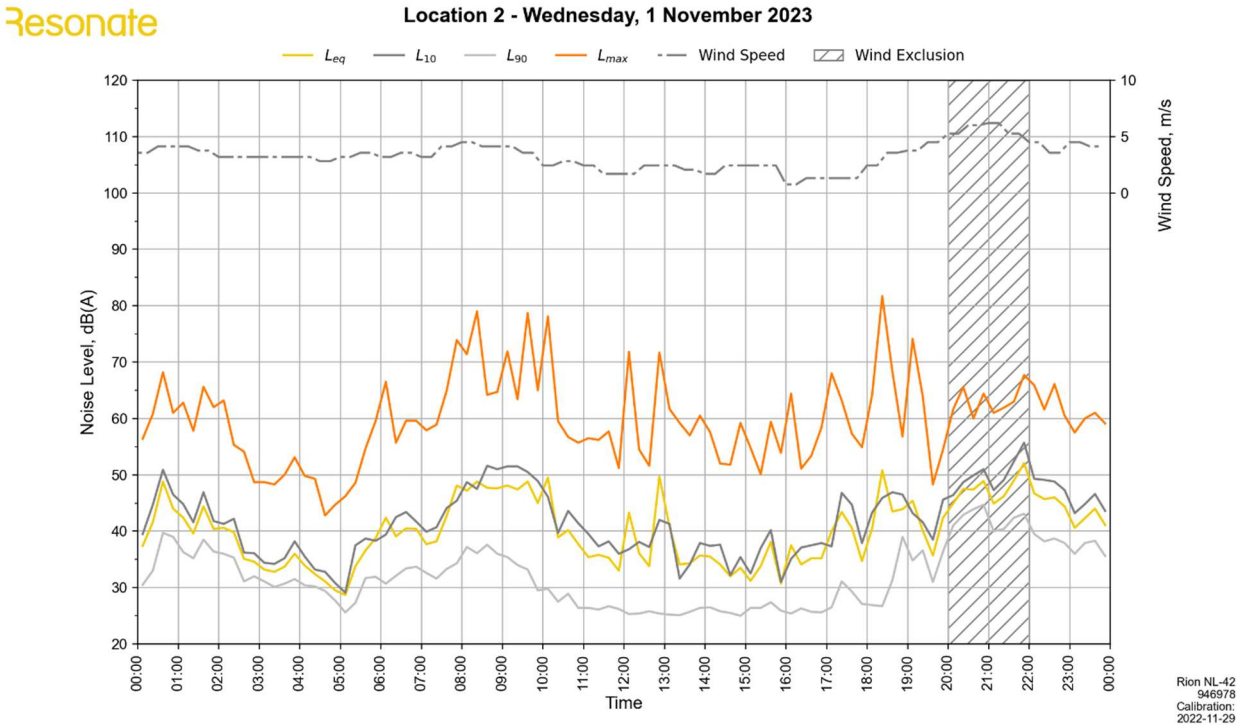
Calibration:
2023-05-06

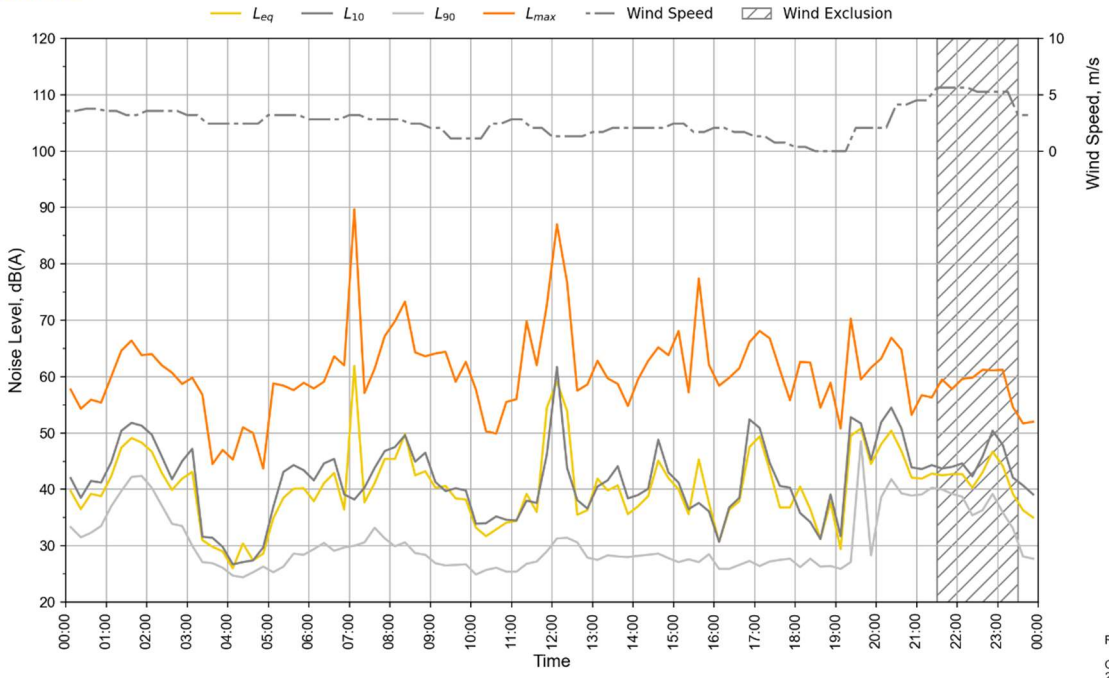
Logger Location 2





Resonate

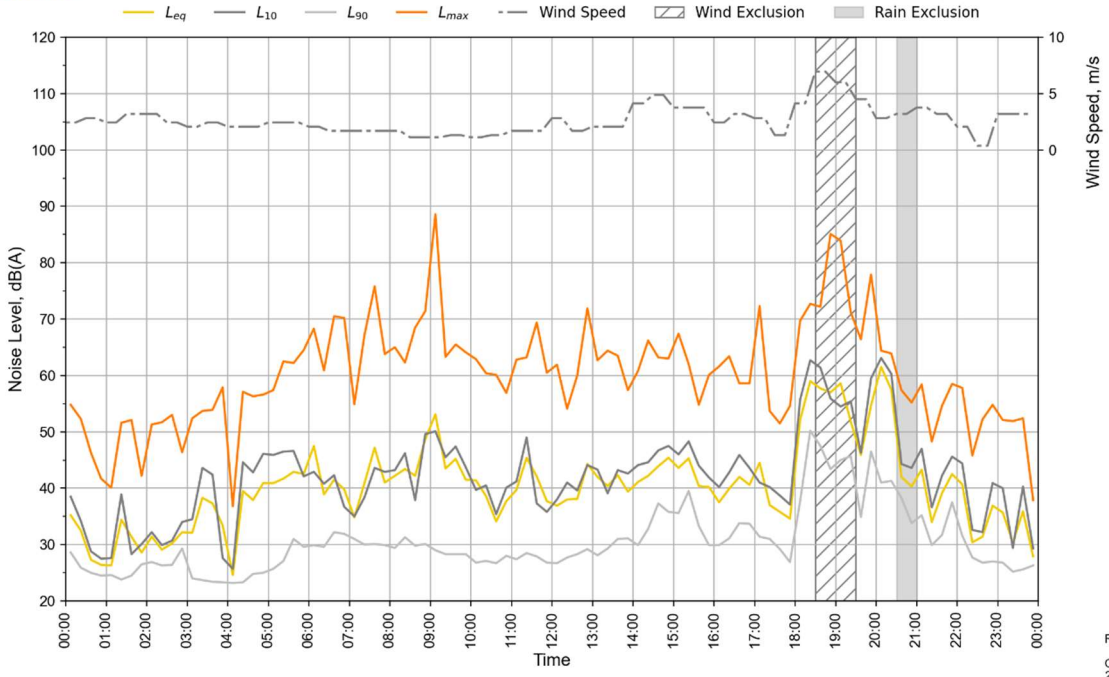
Location 2 - Thursday, 2 November 2023



Rion NL-42
946978
Calibration:
2022-11-29

Resonate

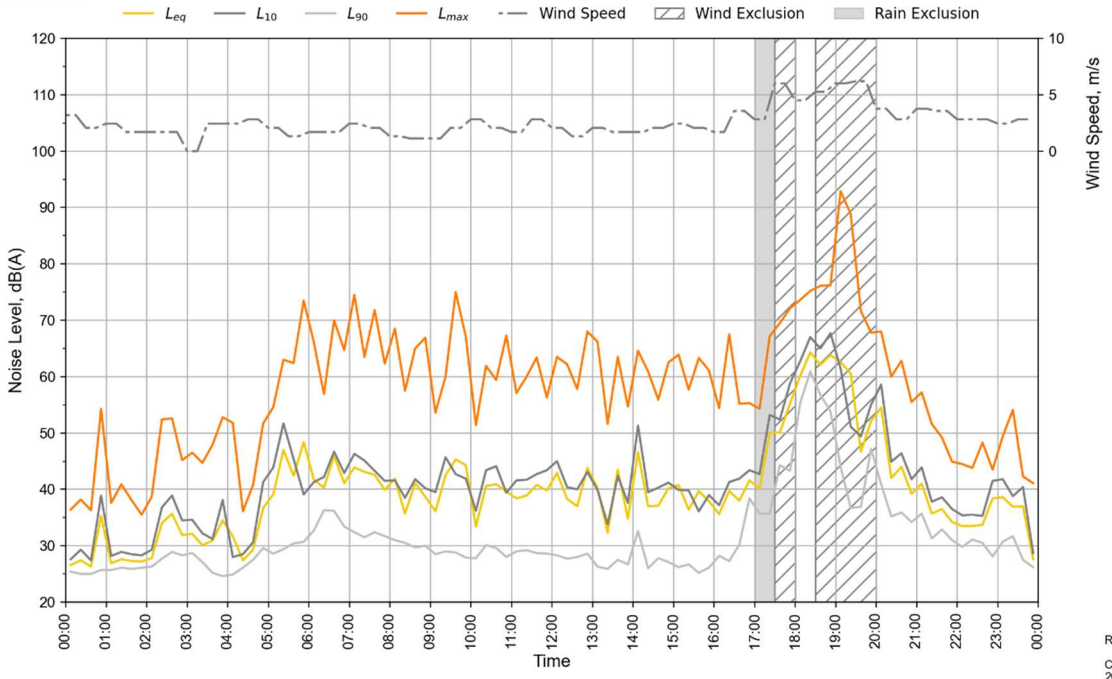
Location 2 - Friday, 3 November 2023



Rion NL-42
946978
Calibration:
2022-11-29

Resonate

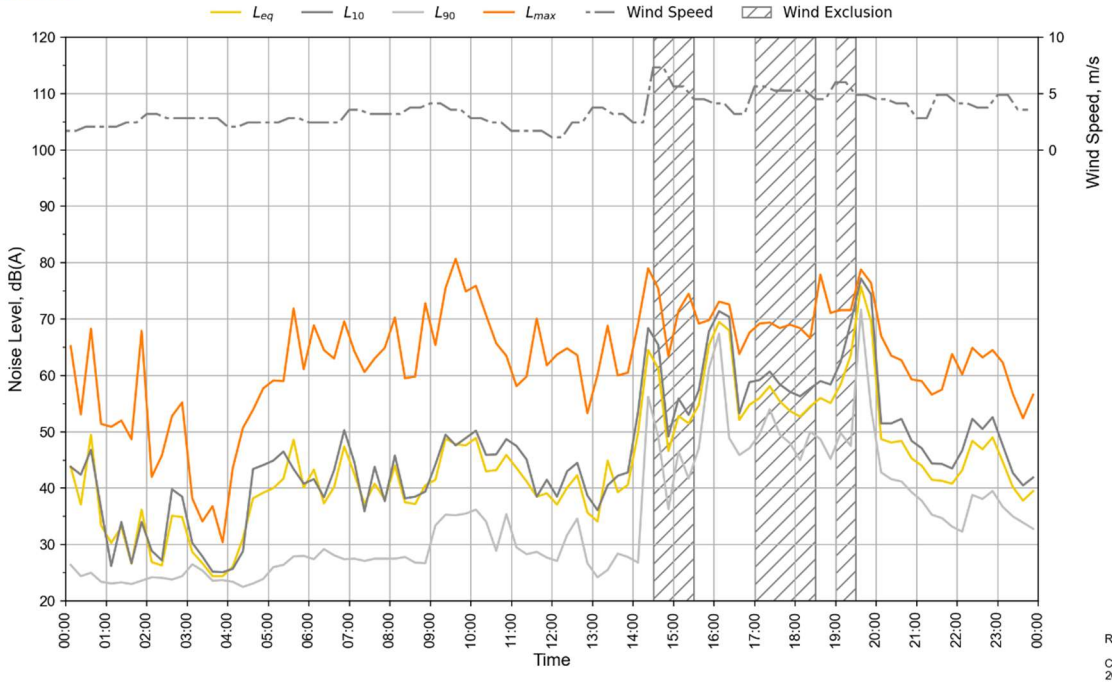
Location 2 - Saturday, 4 November 2023



Rion NL-42
946978
Calibration:
2022-11-29

Resonate

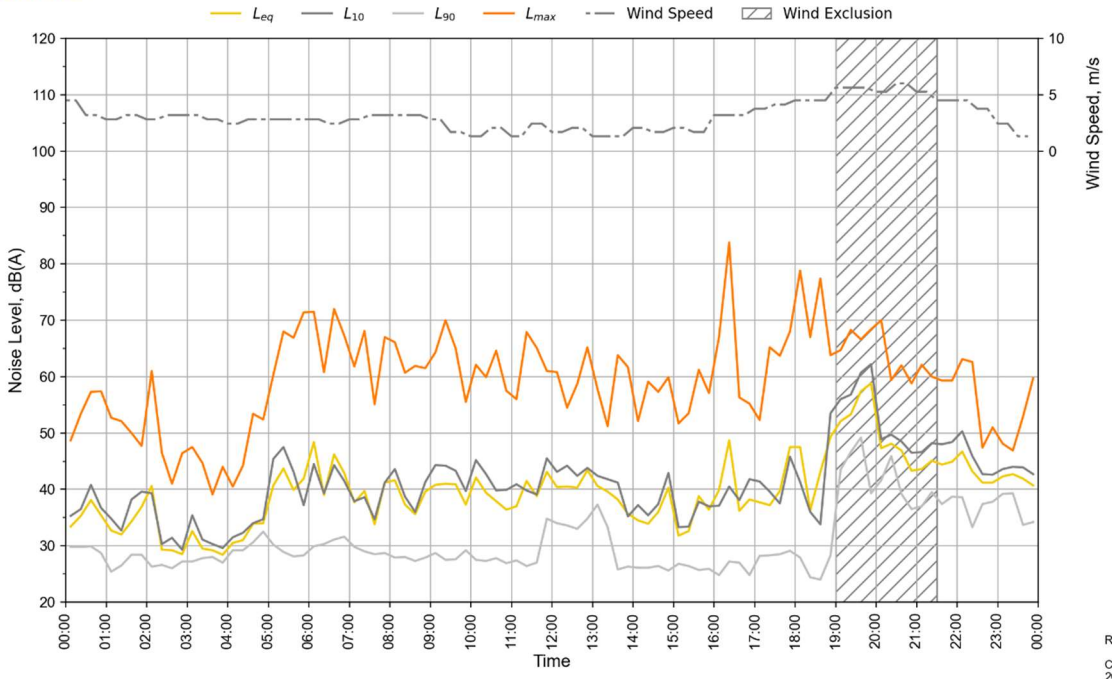
Location 2 - Sunday, 5 November 2023



Rion NL-42
946978
Calibration:
2022-11-29

Resonate

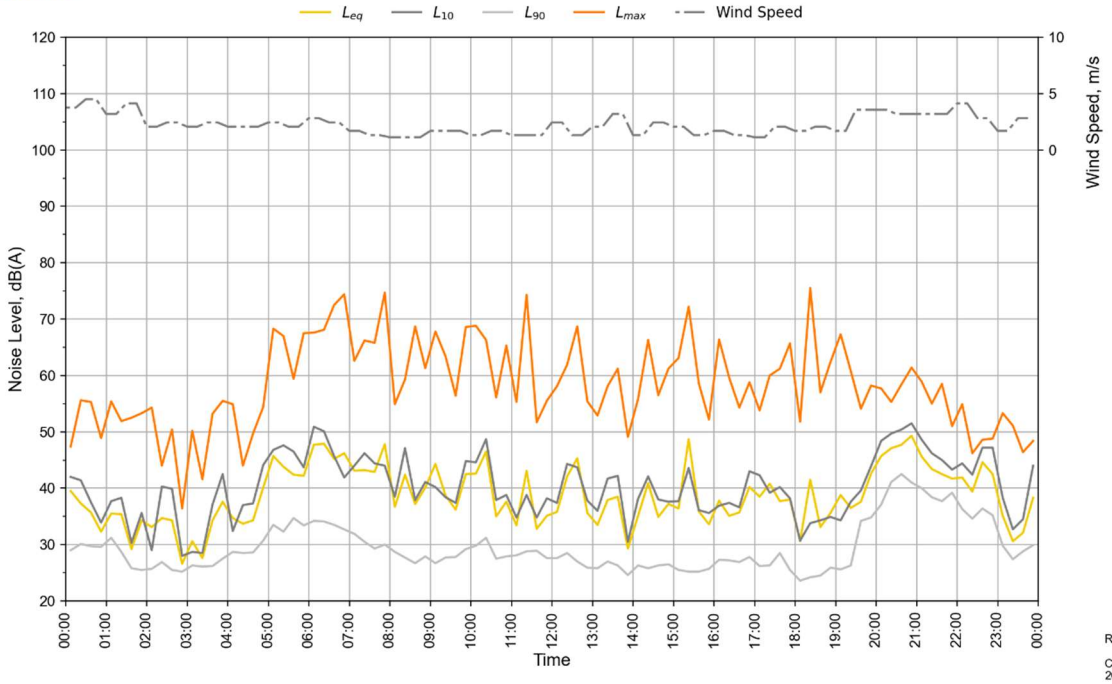
Location 2 - Monday, 6 November 2023



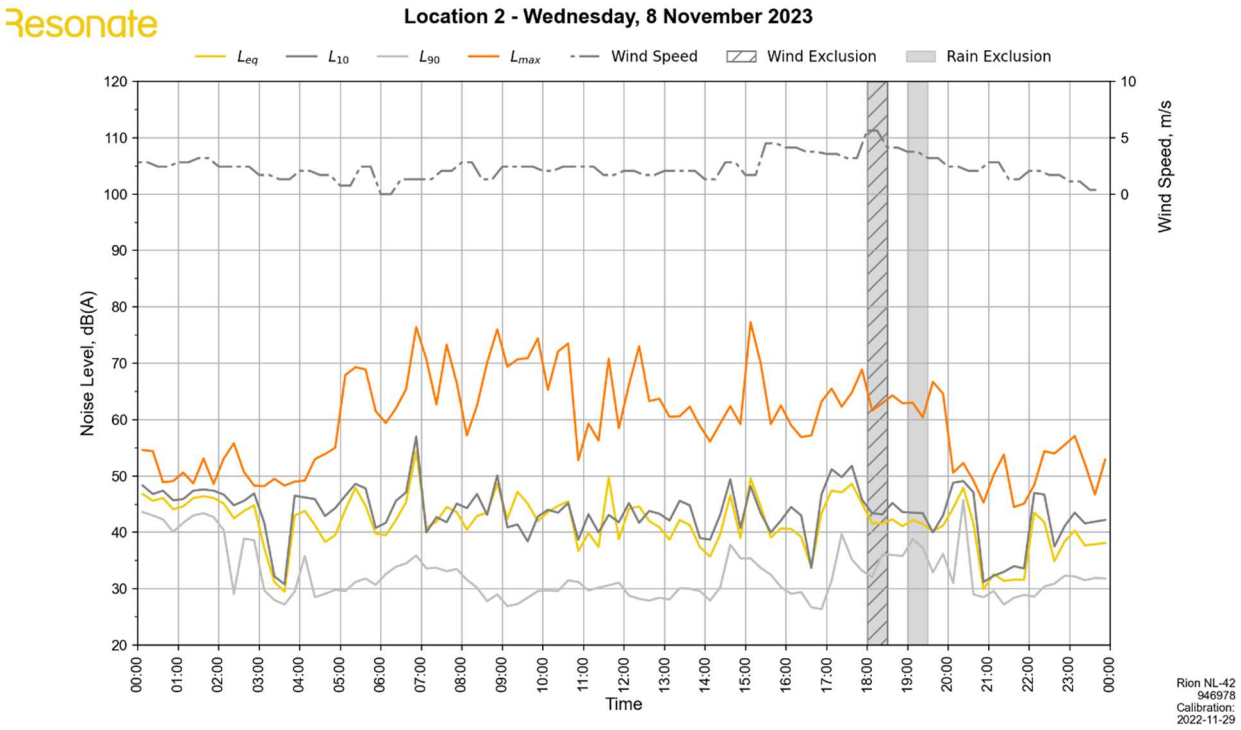
Rion NL-42
946978
Calibration:
2022-11-29

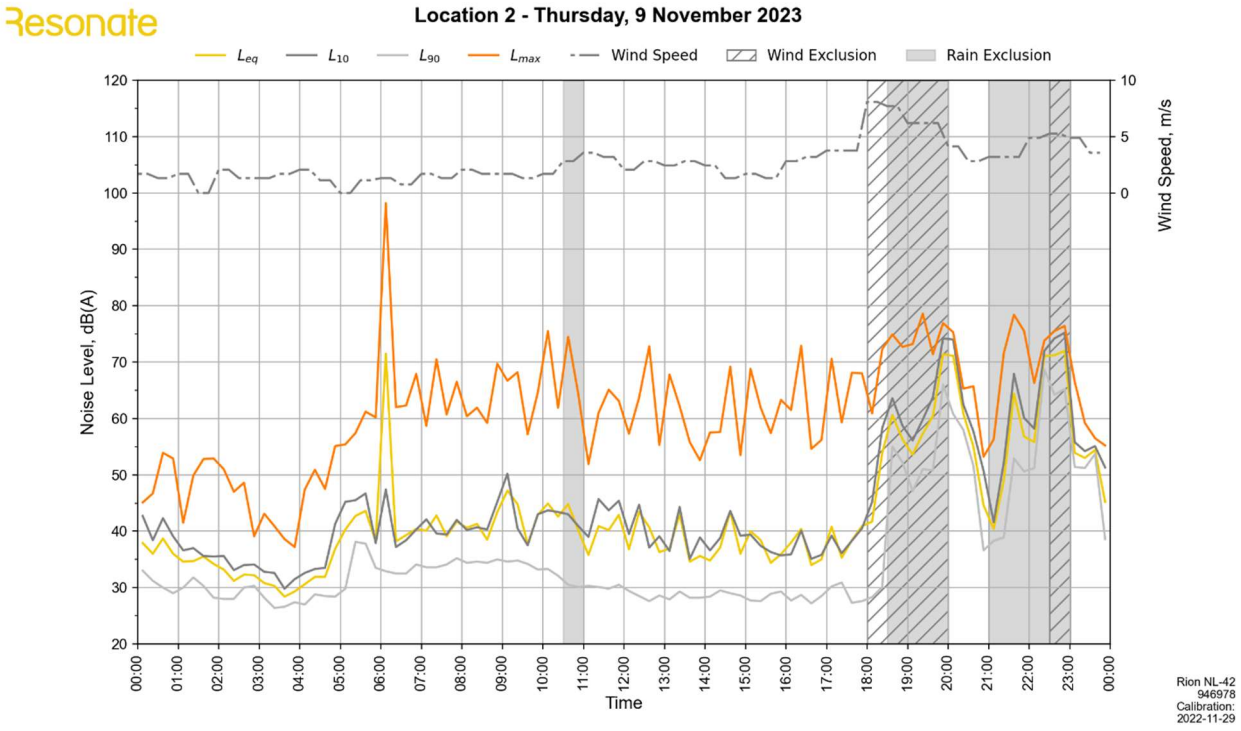
Resonate

Location 2 - Tuesday, 7 November 2023



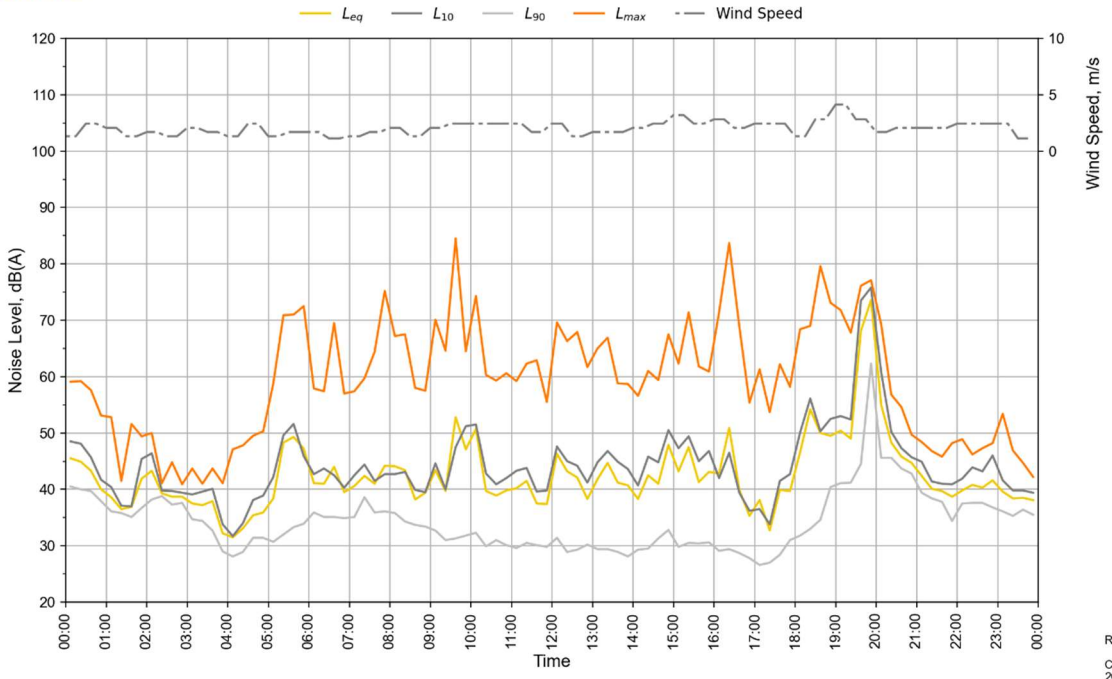
Rion NL-42
946978
Calibration:
2022-11-29


Resonate
Location 2 - Wednesday, 8 November 2023
L_{eq} L_{10} L_{90} L_{max} Wind Speed Wind Exclusion Rain Exclusion
Noise Level, dB(A)
Wind Speed, m/s
Time
Rion NL-42
946978
Calibration:
2022-11-29


Resonate
Location 2 - Thursday, 9 November 2023
L_{eq} L_{10} L_{90} L_{max} Wind Speed Wind Exclusion Rain Exclusion
Noise Level, dB(A)
Wind Speed, m/s
Time
Rion NL-42
946978
Calibration:
2022-11-29

Resonate

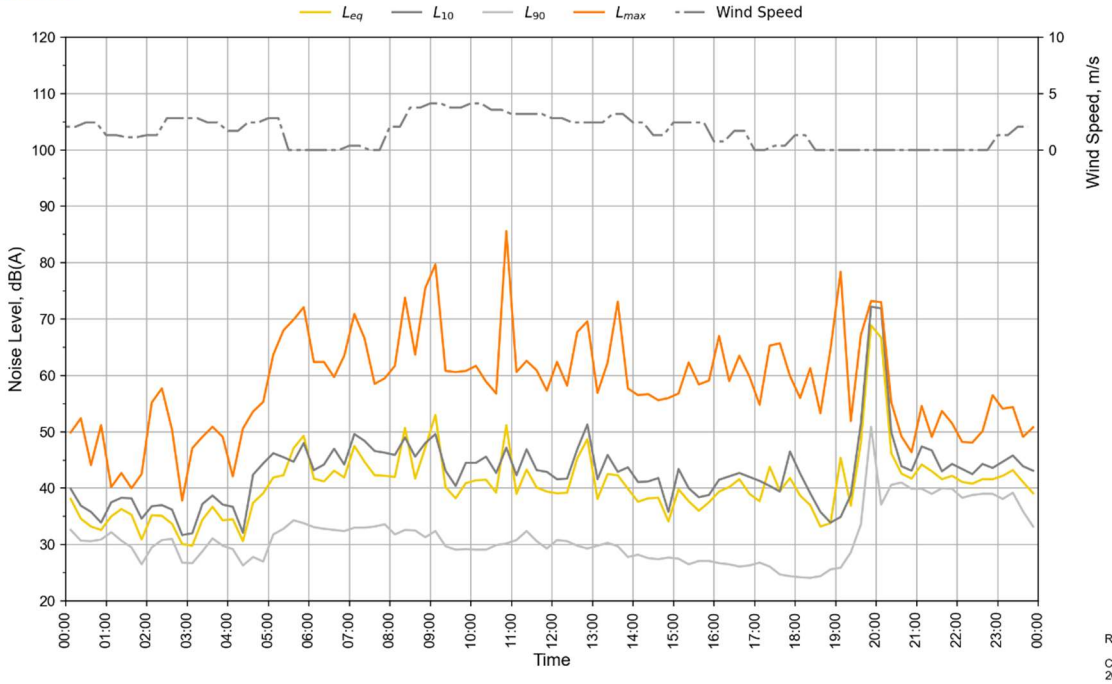
Location 2 - Friday, 10 November 2023



Rion NL-42
946978
Calibration:
2022-11-29

Resonate

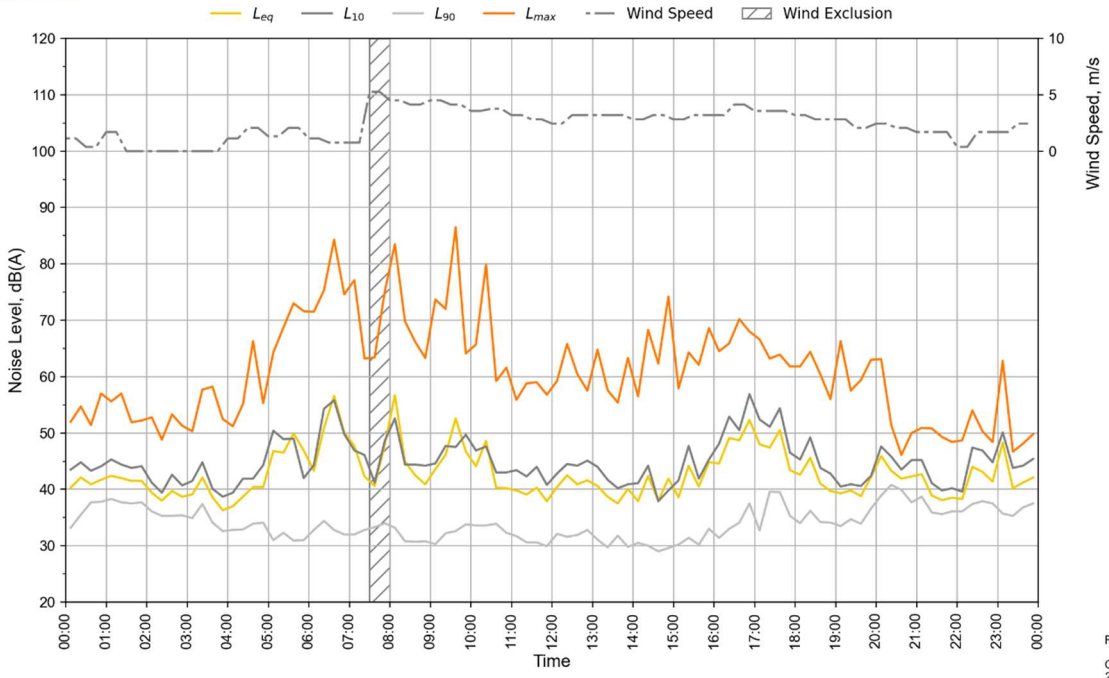
Location 2 - Saturday, 11 November 2023



Rion NL-42
946978
Calibration:
2022-11-29

Resonate

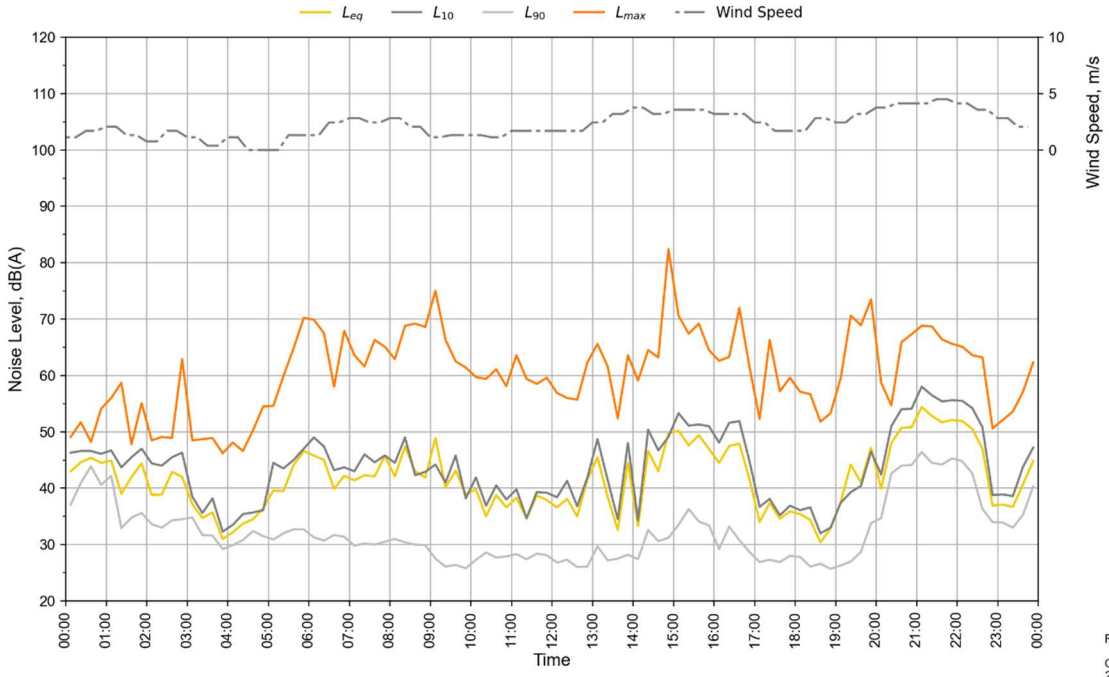
Location 2 - Sunday, 12 November 2023



Rion NL-42
946978
Calibration:
2022-11-29

Resonate

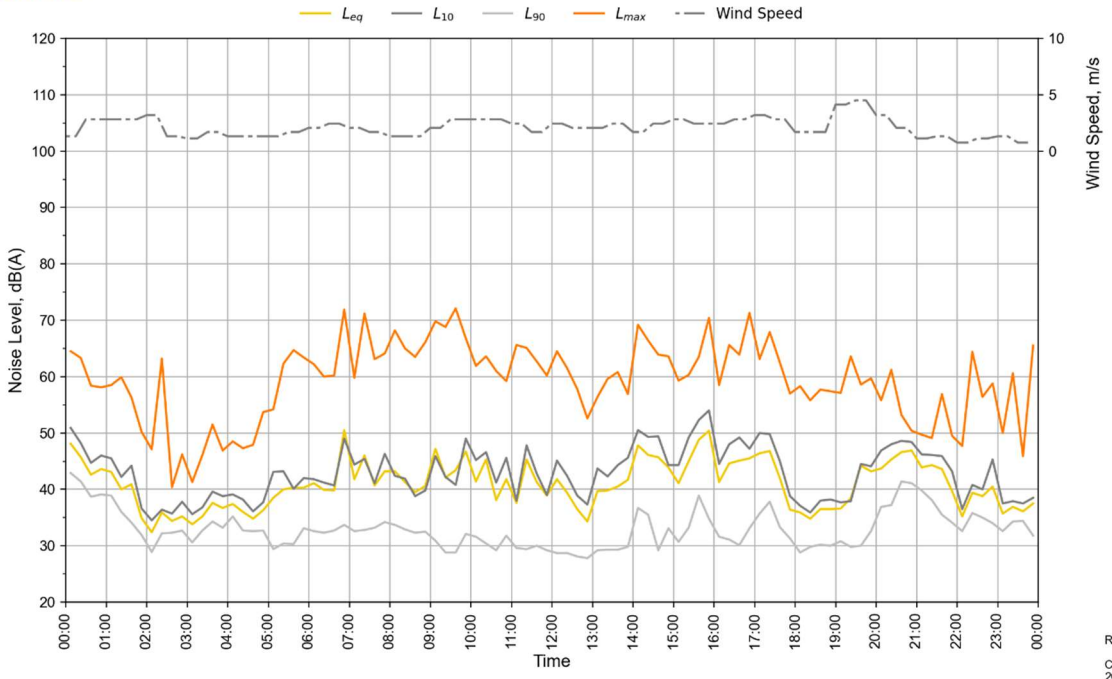
Location 2 - Monday, 13 November 2023



Rion NL-42
946978
Calibration:
2022-11-29

Resonate

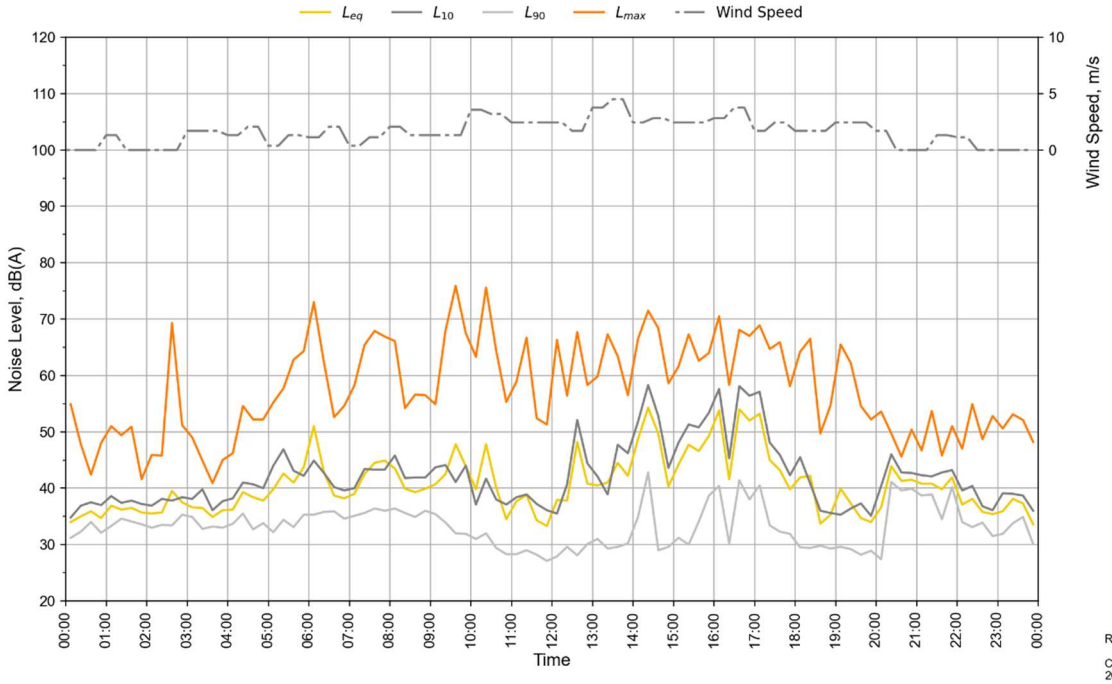
Location 2 - Tuesday, 14 November 2023



Rion NL-42
946978
Calibration:
2022-11-29

Resonate

Location 2 - Wednesday, 15 November 2023



Rion NL-42
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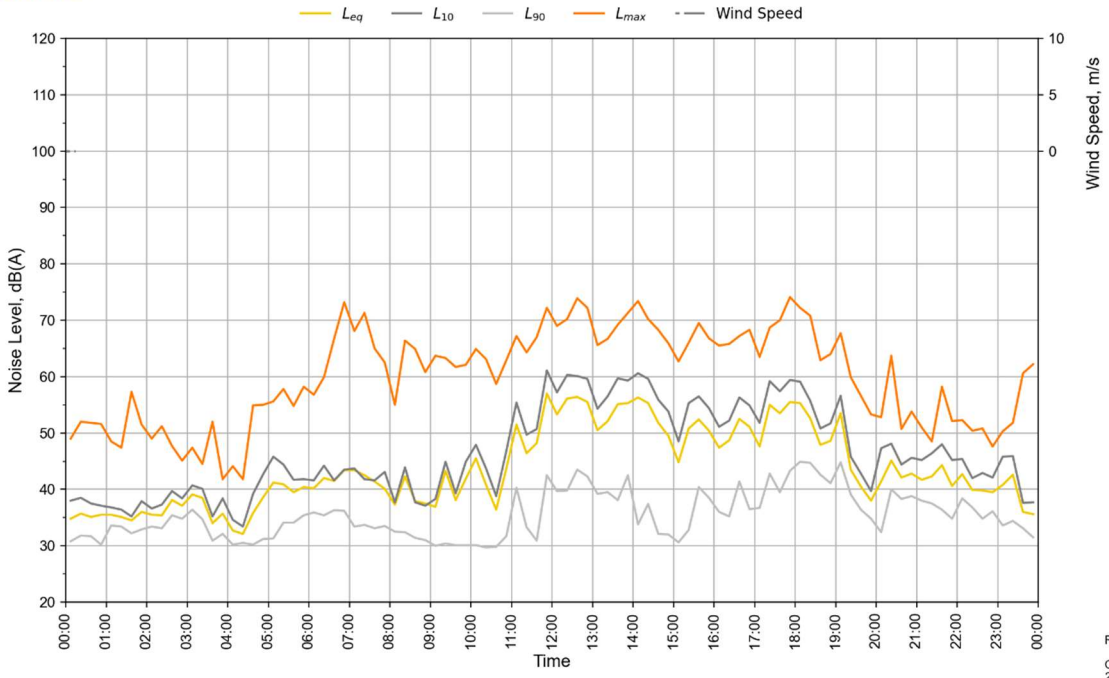
Calibration:
2022-11-29

Resonate

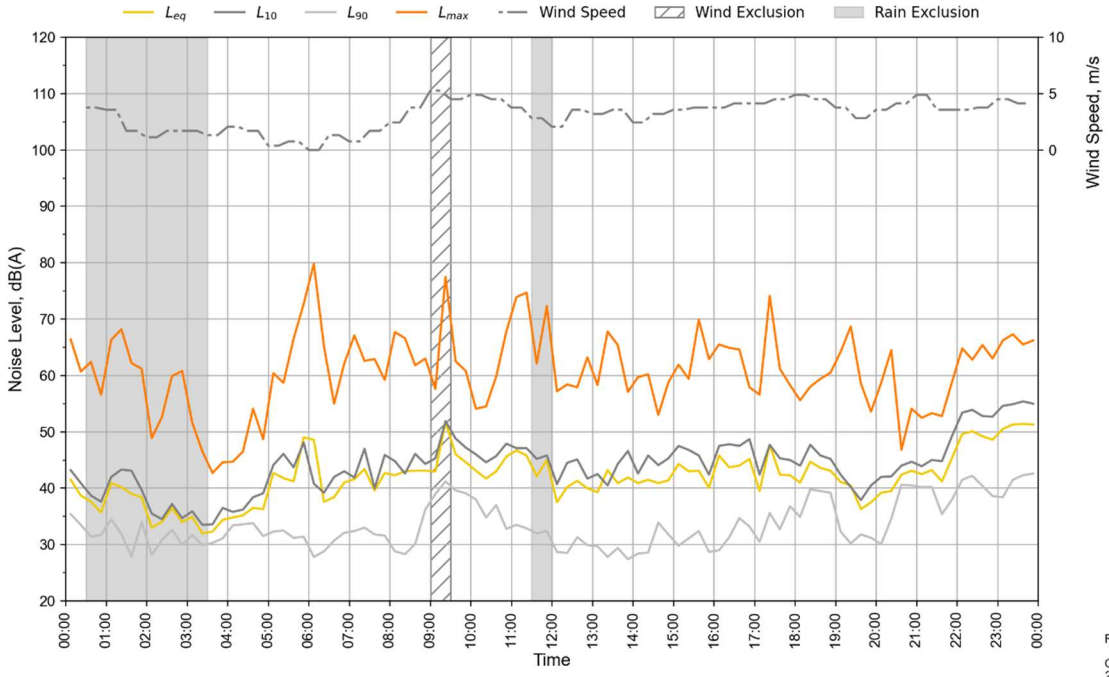
Location 2 - Thursday, 16 November 2023



Rion NL-42
946978
Calibration:
2022-11-29

Resonate

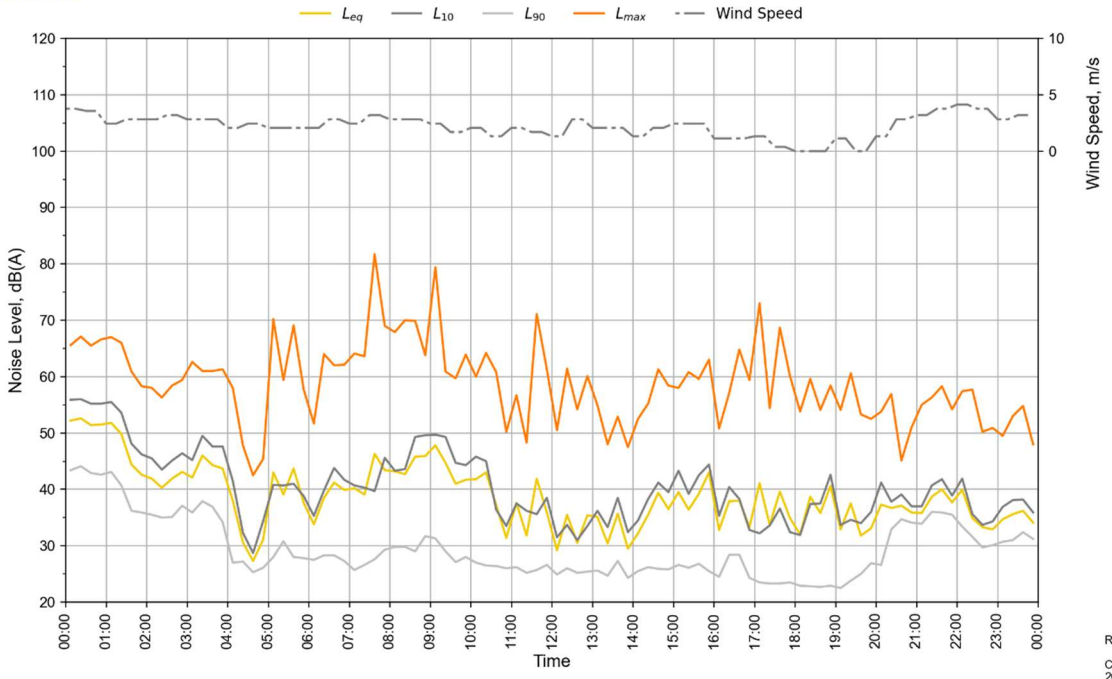
Location 2 - Friday, 17 November 2023



Rion NL-42
946978
Calibration:
2022-11-29

Resonate

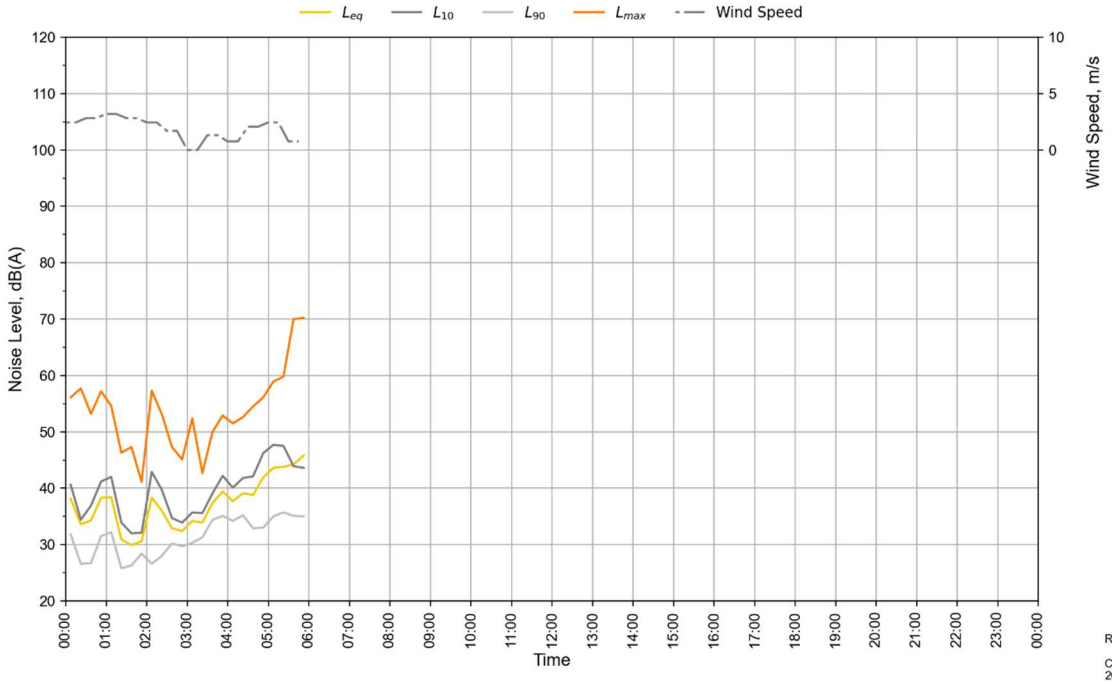
Location 2 - Saturday, 18 November 2023



Rion NL-42
946978
Calibration:
2022-11-29

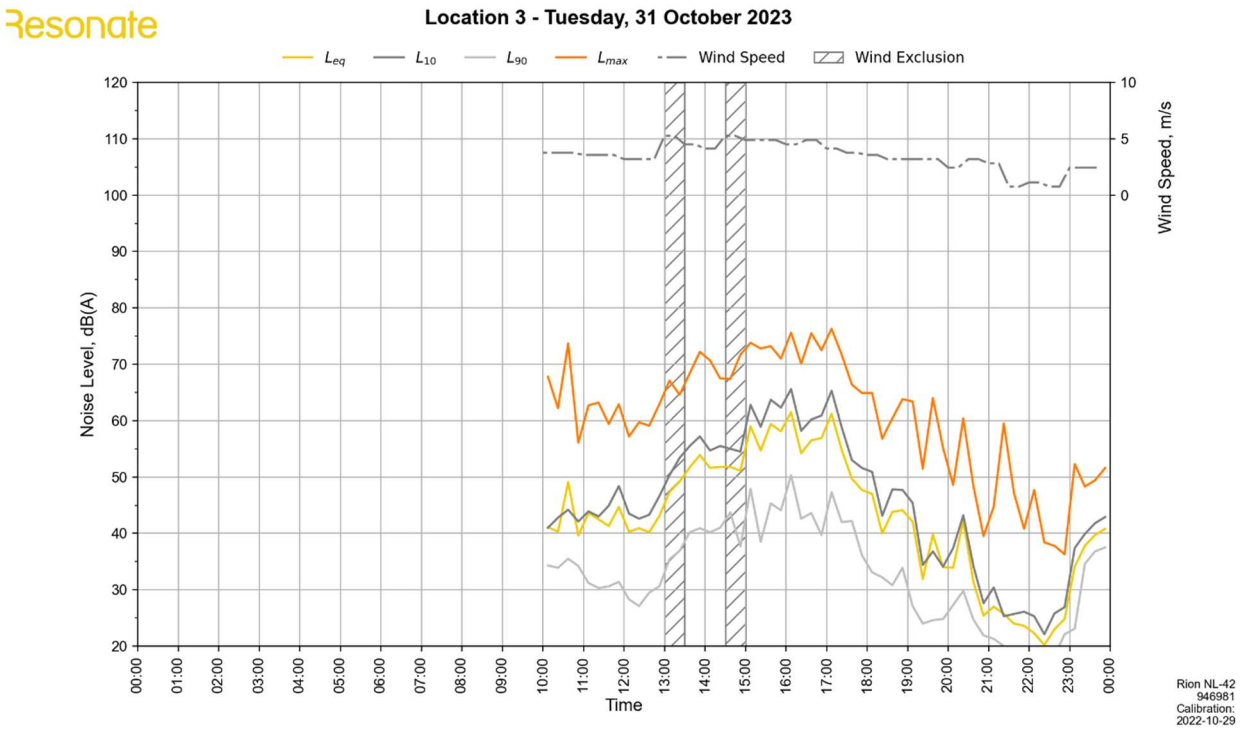
Resonate

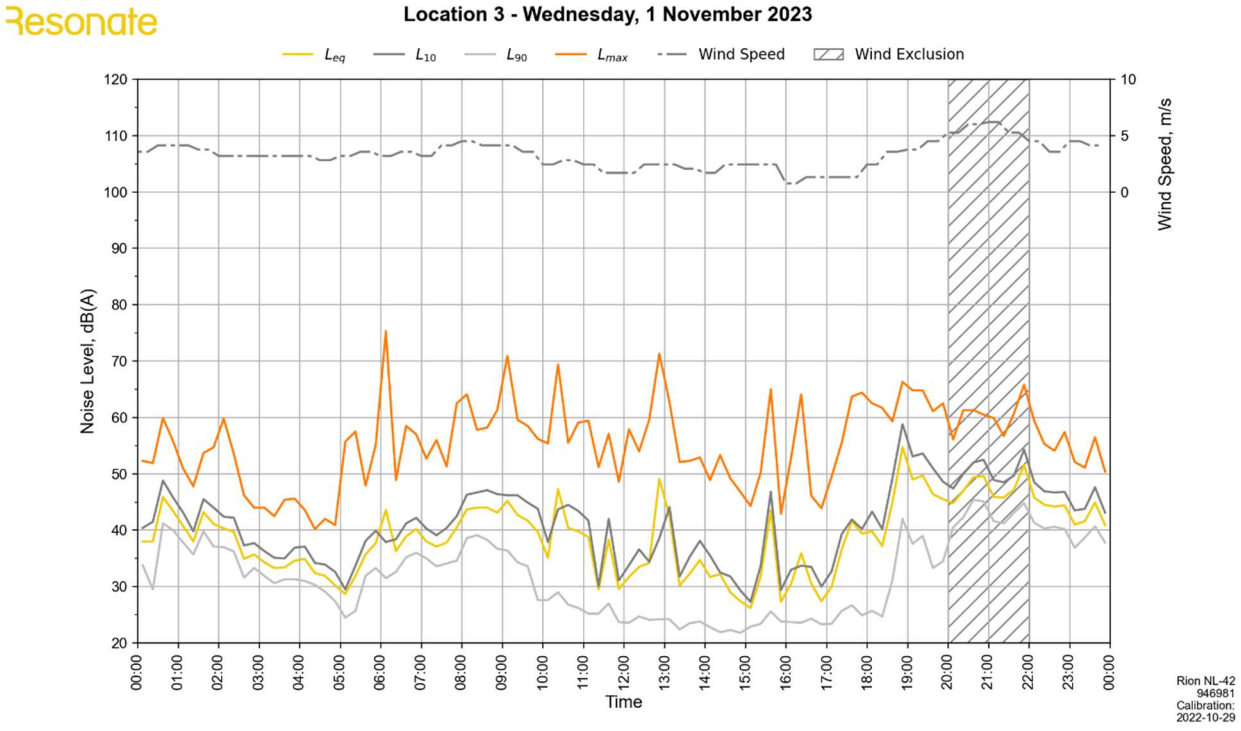
Location 2 - Sunday, 19 November 2023



Rion NL-42
946978
Calibration:
2022-11-29

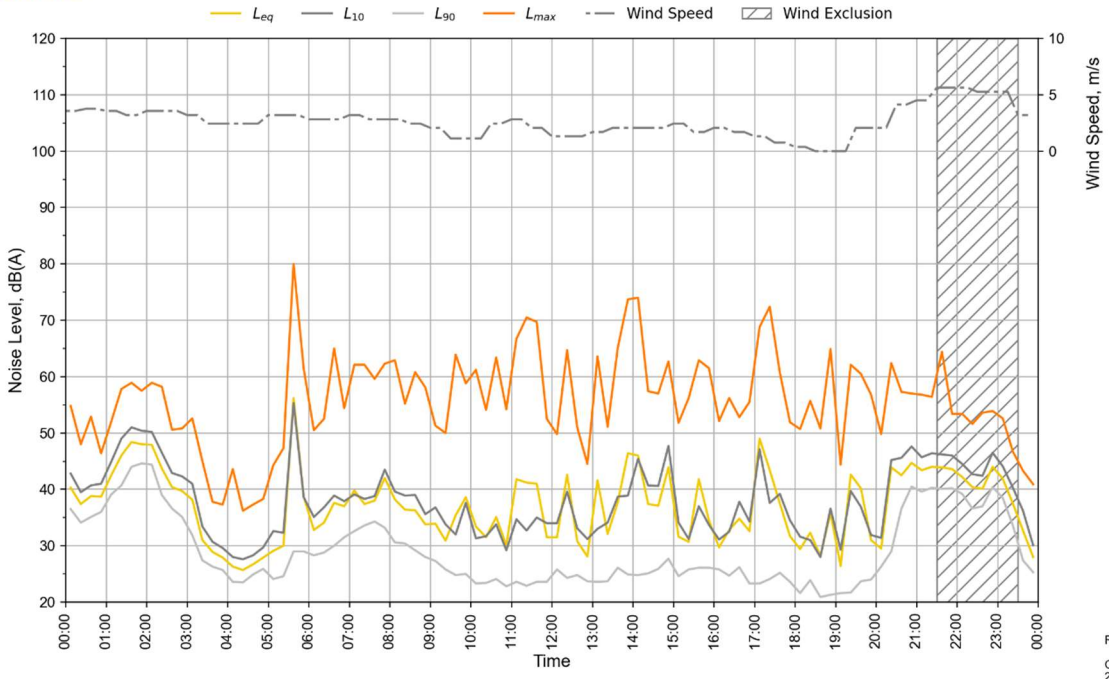
Logger Location 3





Resonate

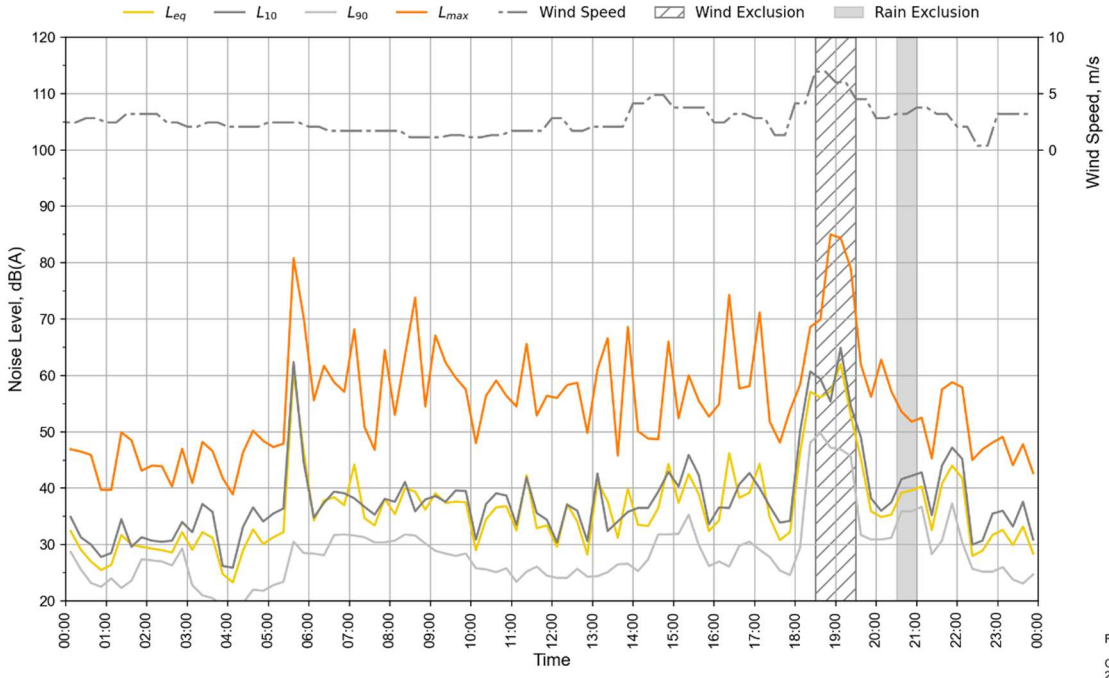
Location 3 - Thursday, 2 November 2023



Rion NL-42
946981
Calibration:
2022-10-29

Resonate

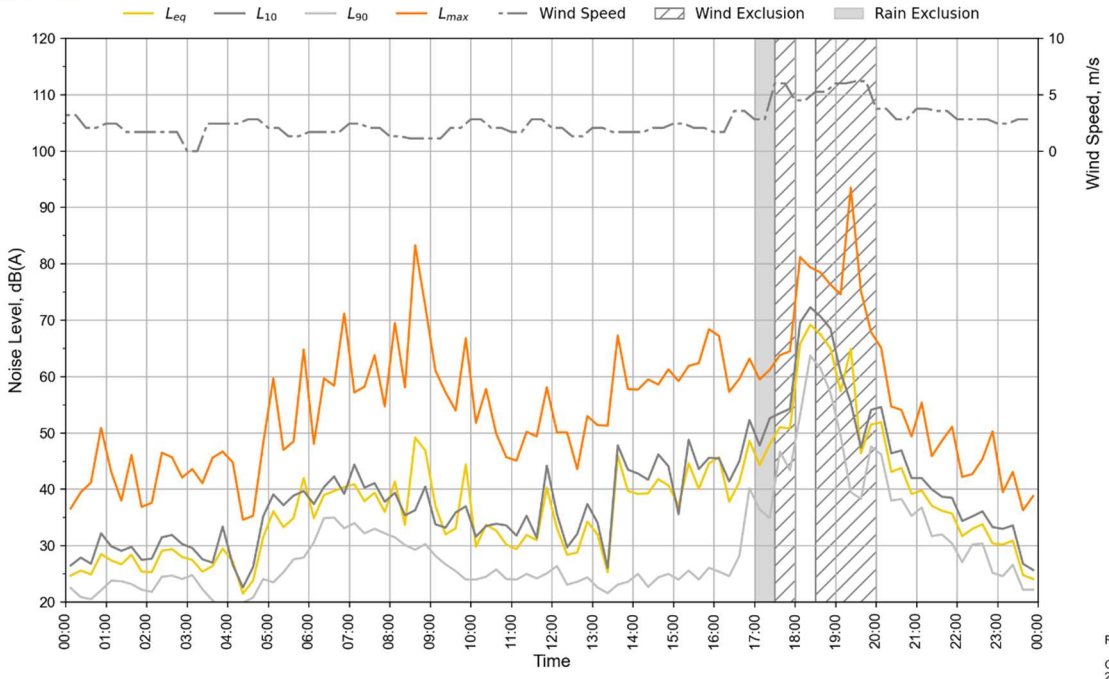
Location 3 - Friday, 3 November 2023



Rion NL-42
946981
Calibration:
2022-10-29

Resonate

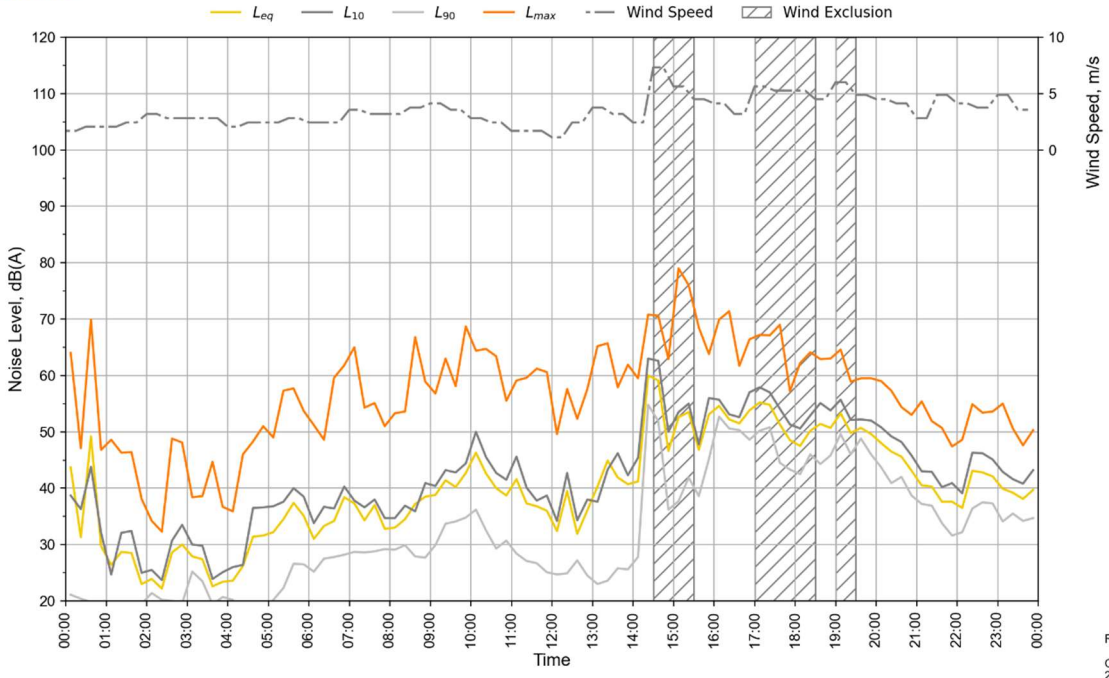
Location 3 - Saturday, 4 November 2023



Rion NL-42
946981
Calibration:
2022-10-29

Resonate

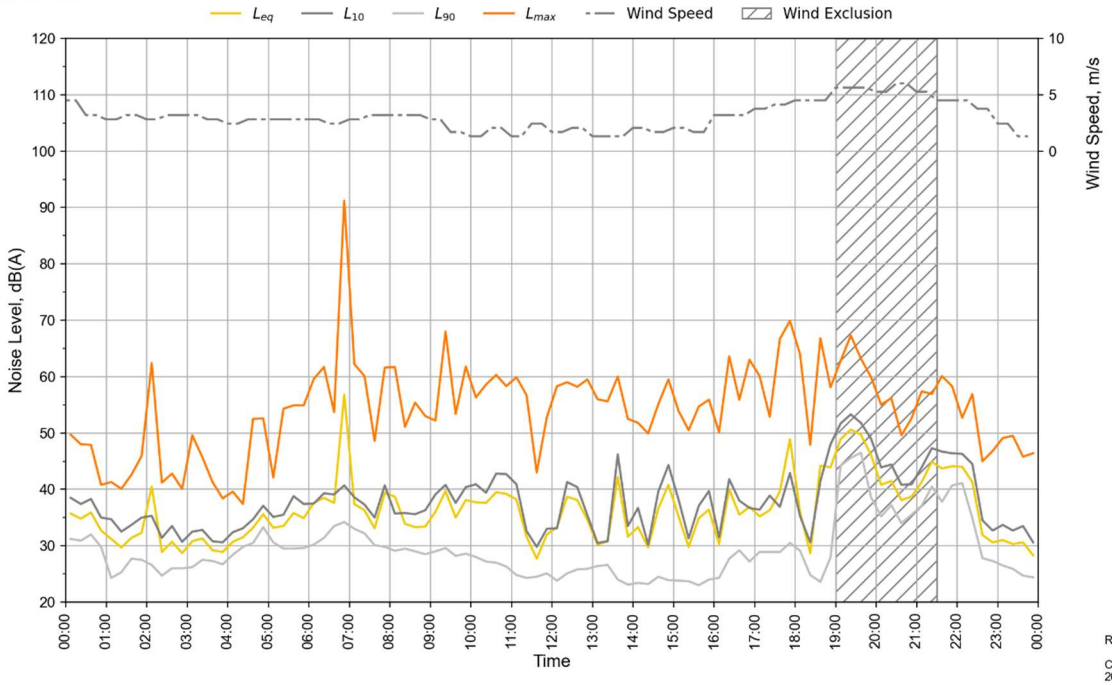
Location 3 - Sunday, 5 November 2023



Rion NL-42
946981
Calibration:
2022-10-29

Resonate

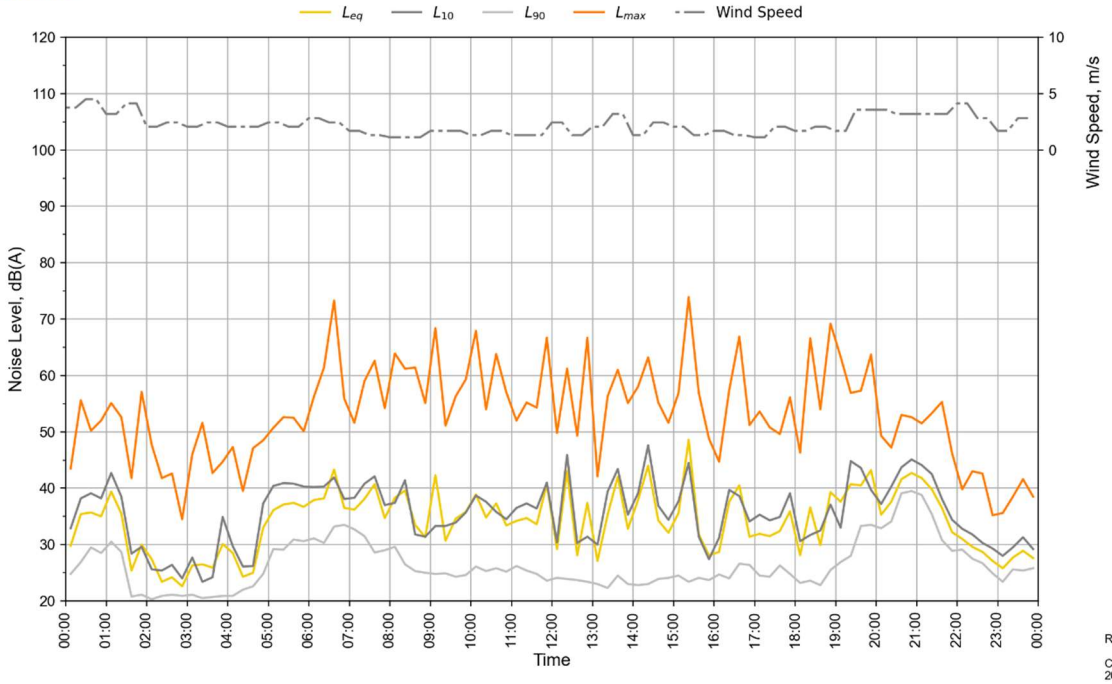
Location 3 - Monday, 6 November 2023



Rion NL-42
946981
Calibration:
2022-10-29

Resonate

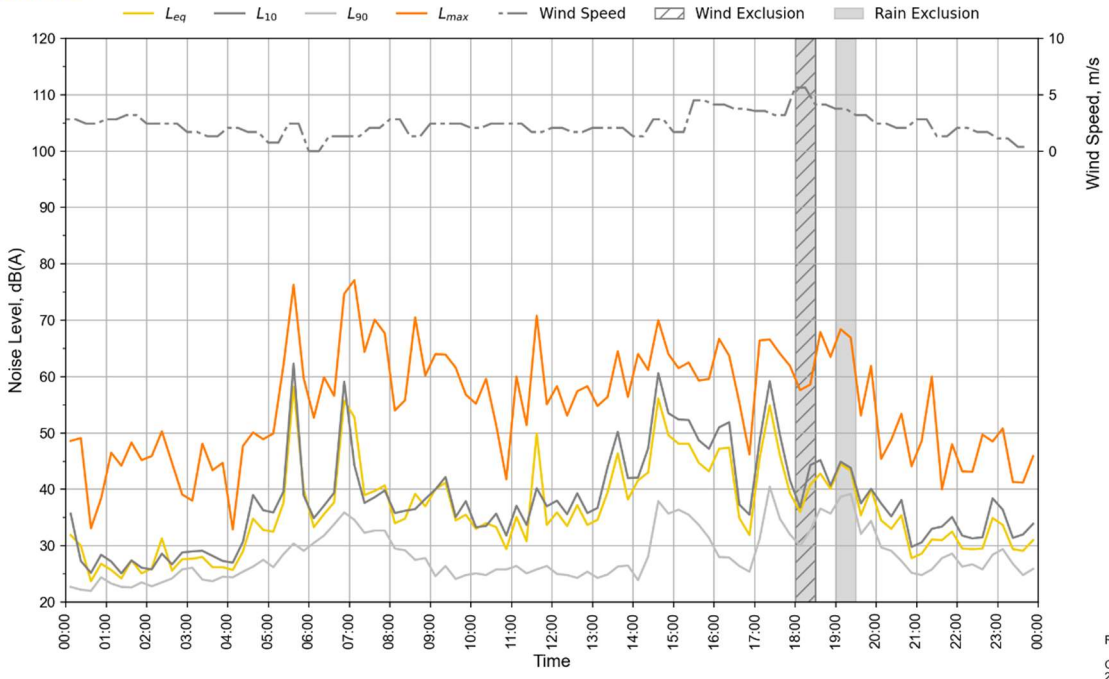
Location 3 - Tuesday, 7 November 2023



Rion NL-42
946981
Calibration:
2022-10-29

Resonate

Location 3 - Wednesday, 8 November 2023



Rion NL-42
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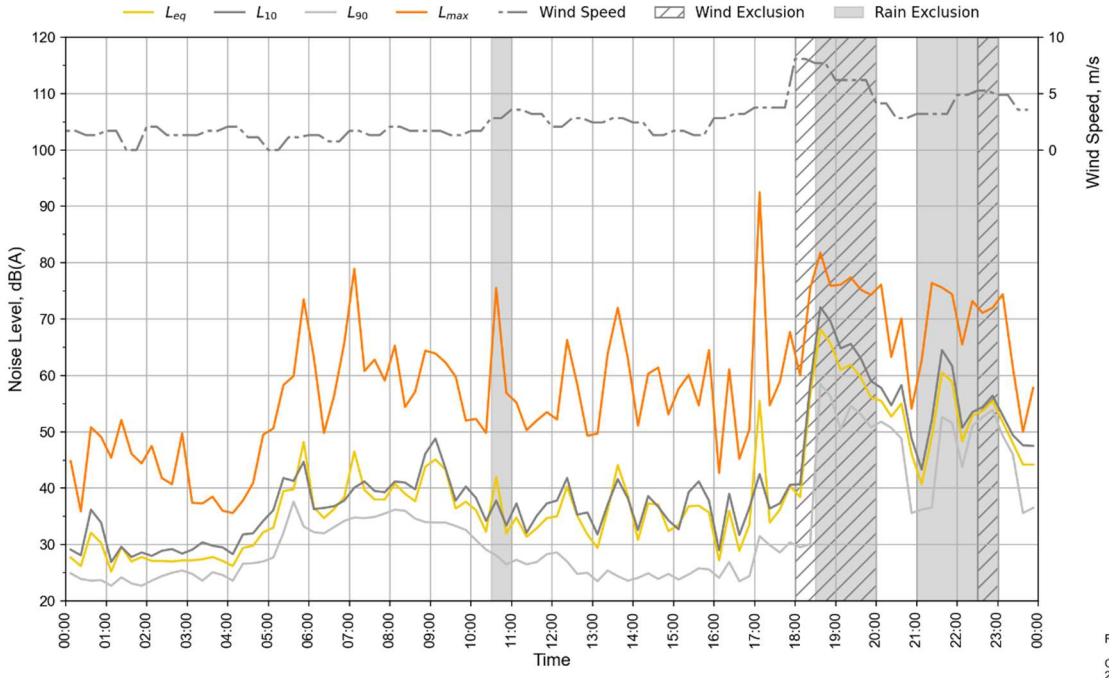
Calibration:
2022-10-29

Resonate

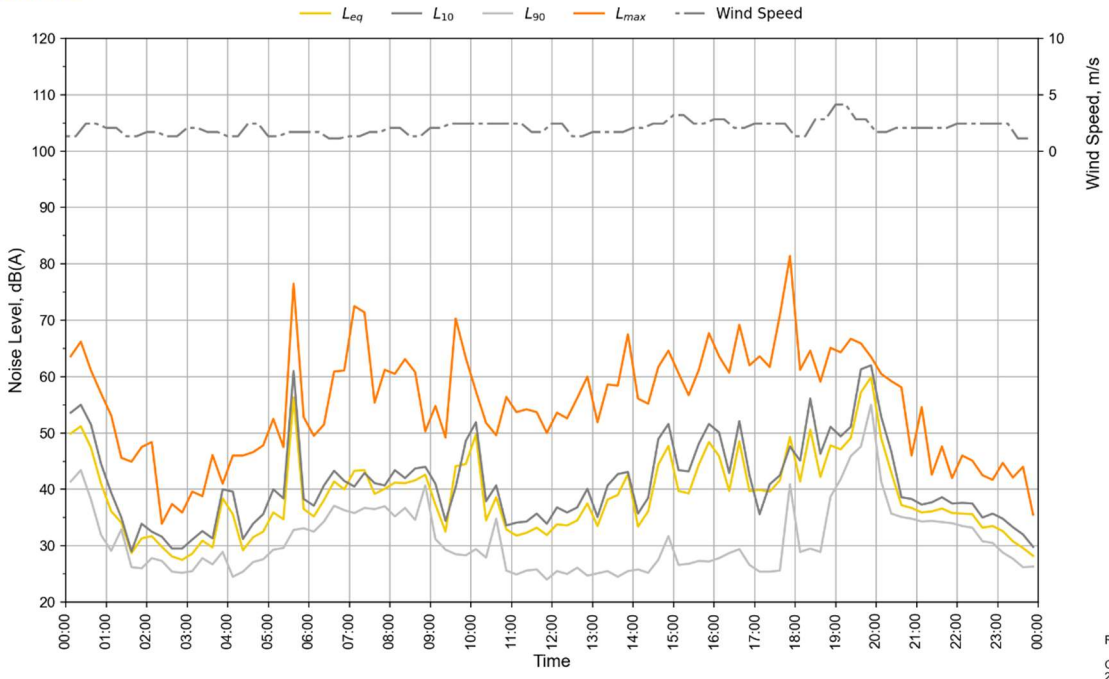
Location 3 - Thursday, 9 November 2023



Rion NL-42
946981
Calibration:
2022-10-29

Resonate

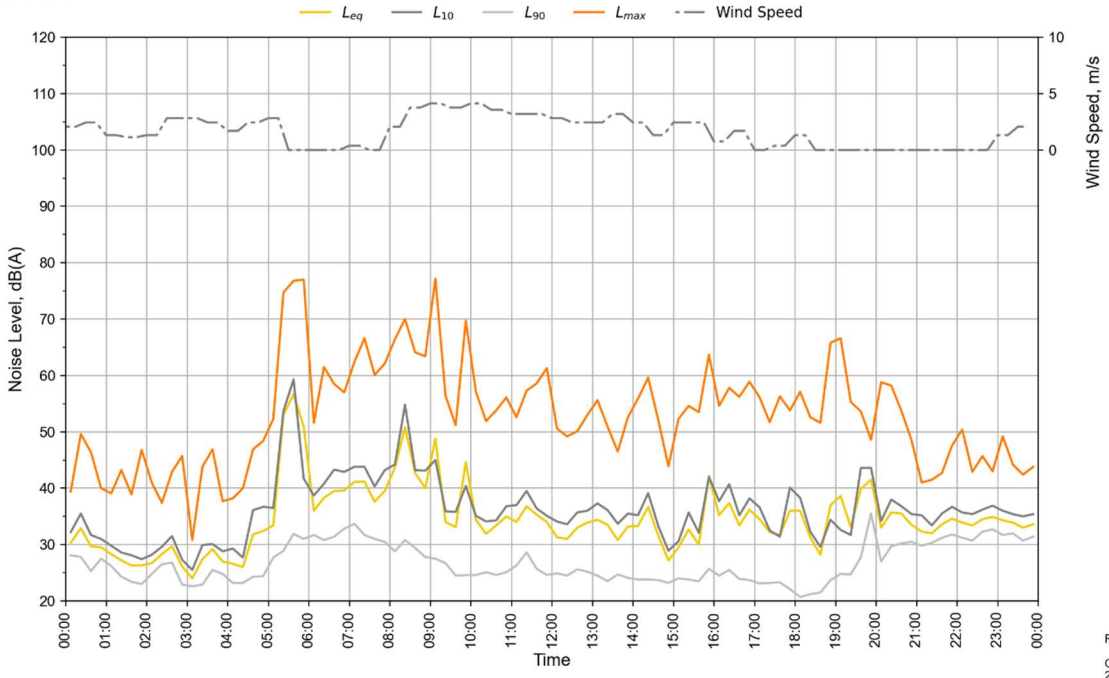
Location 3 - Friday, 10 November 2023



Rion NL-42
946981
Calibration:
2022-10-29

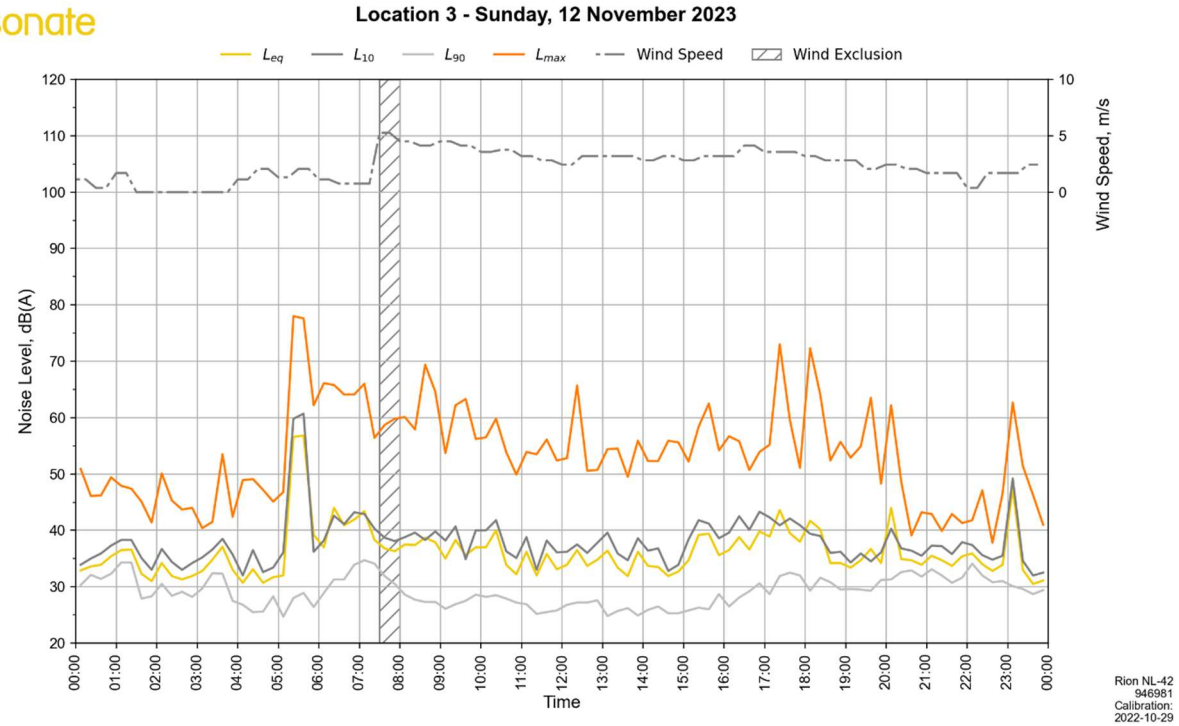
Resonate

Location 3 - Saturday, 11 November 2023

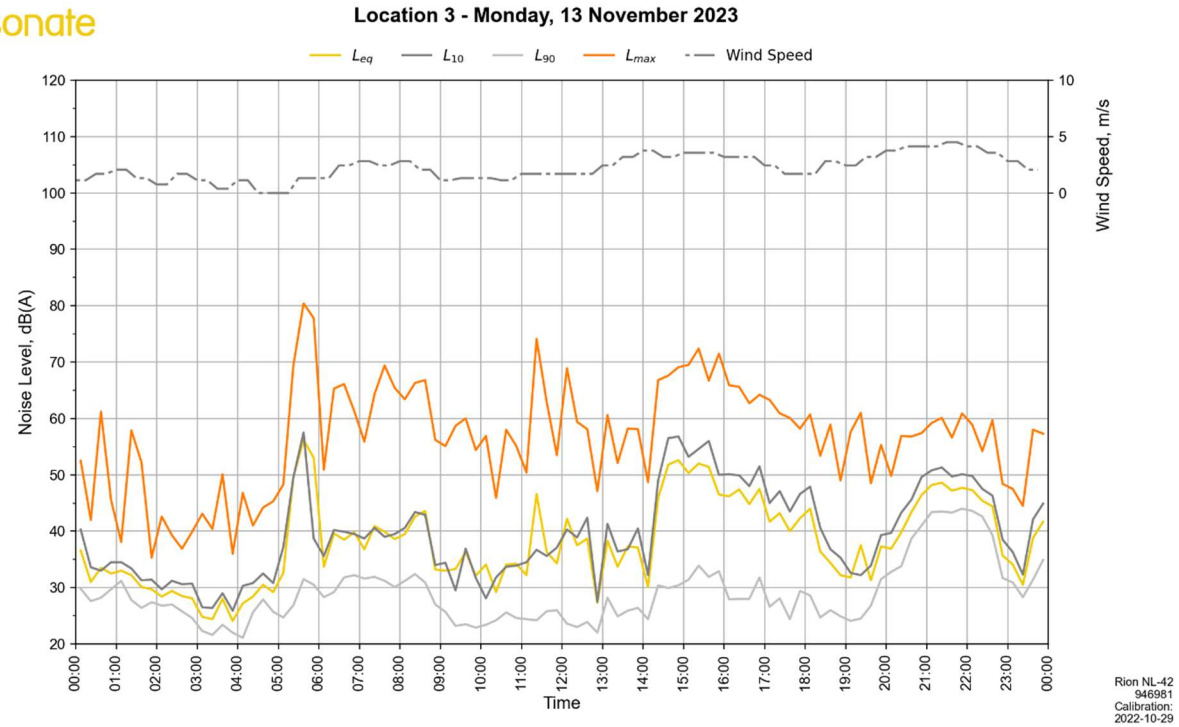


Rion NL-42
946981
Calibration:
2022-10-29

Resonate

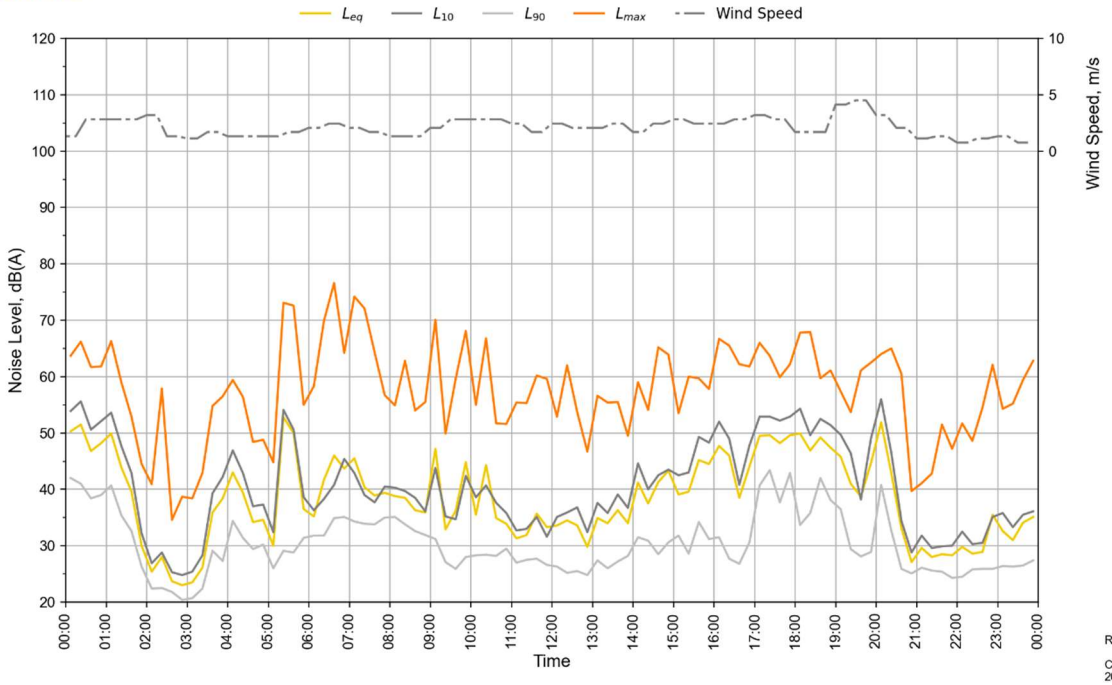


Resonate



Resonate

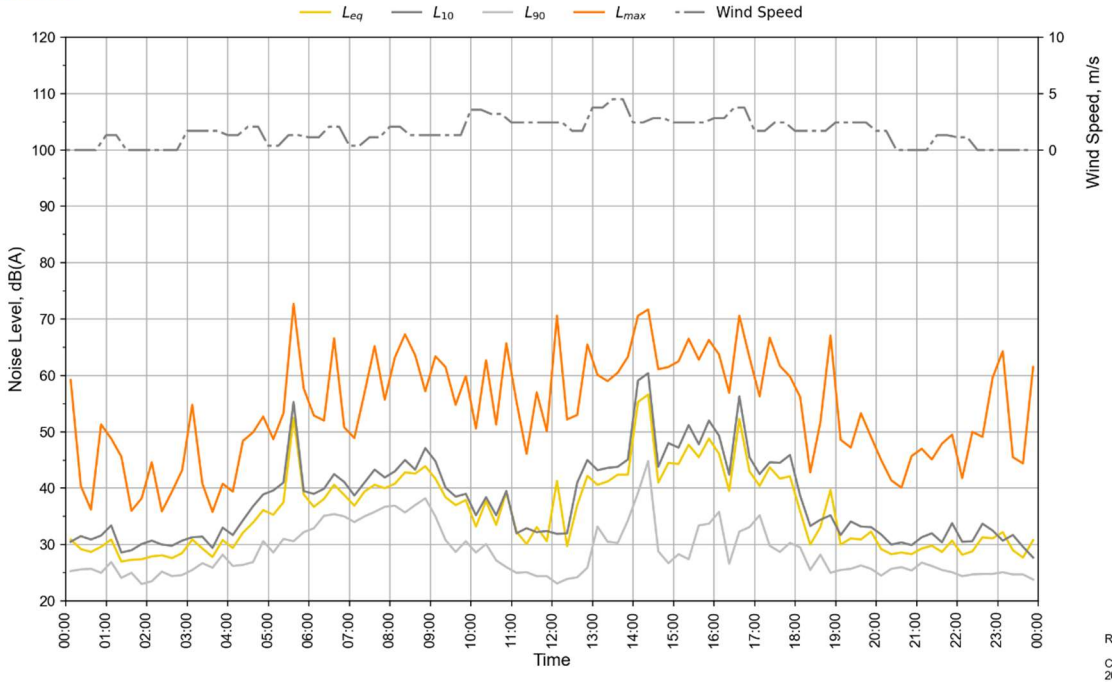
Location 3 - Tuesday, 14 November 2023



Rion NL-42
946981
Calibration:
2022-10-29

Resonate

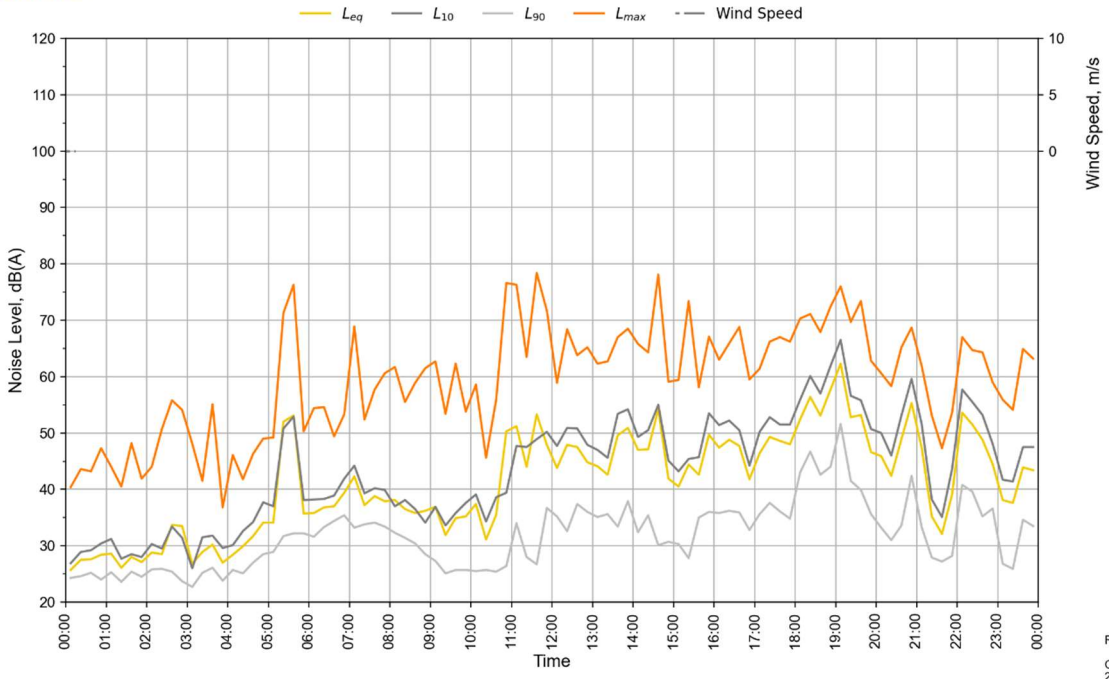
Location 3 - Wednesday, 15 November 2023



Rion NL-42
946981
Calibration:
2022-10-29

Resonate

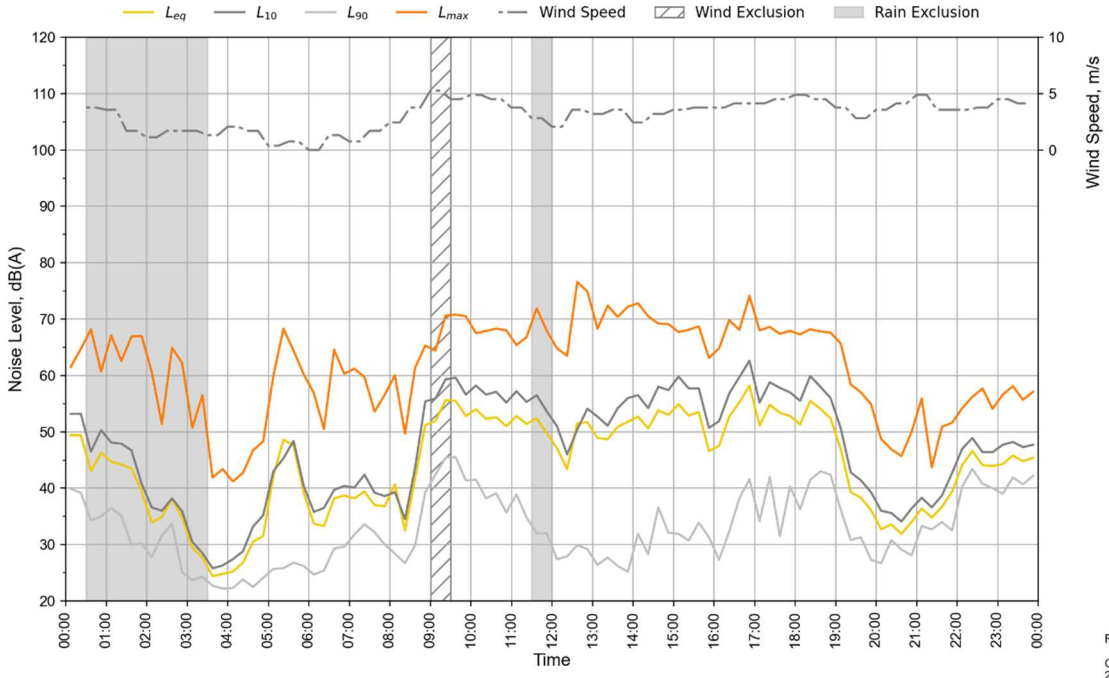
Location 3 - Thursday, 16 November 2023



Rion NL-42
946981
Calibration:
2022-10-29

Resonate

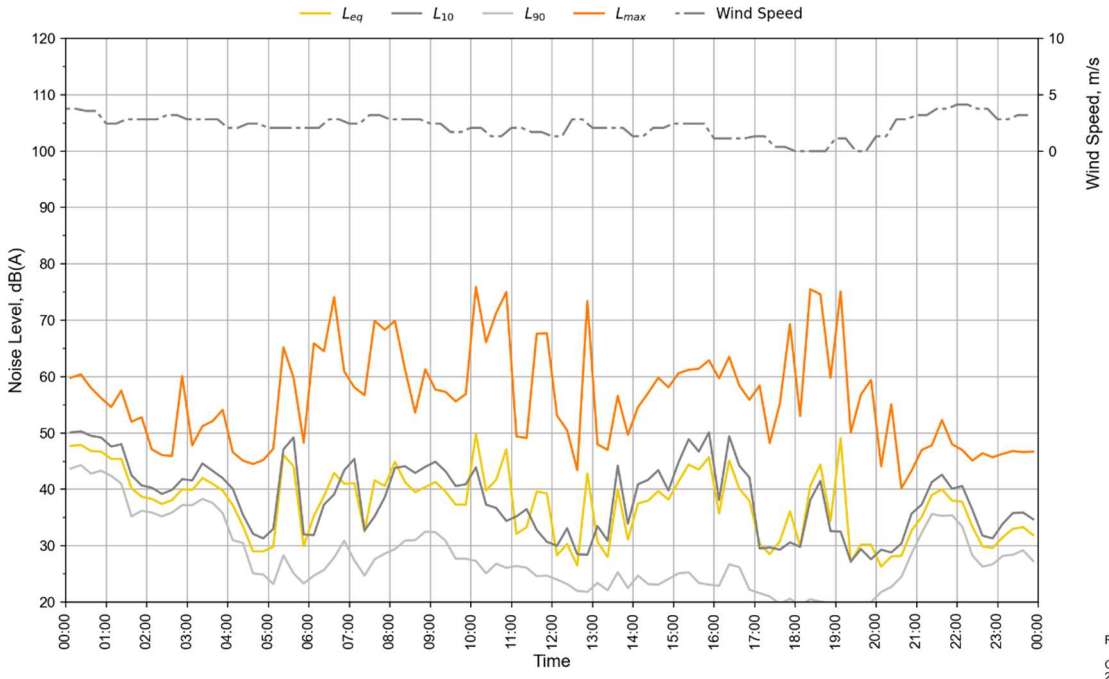
Location 3 - Friday, 17 November 2023



Rion NL-42
946981
Calibration:
2022-10-29

Resonate

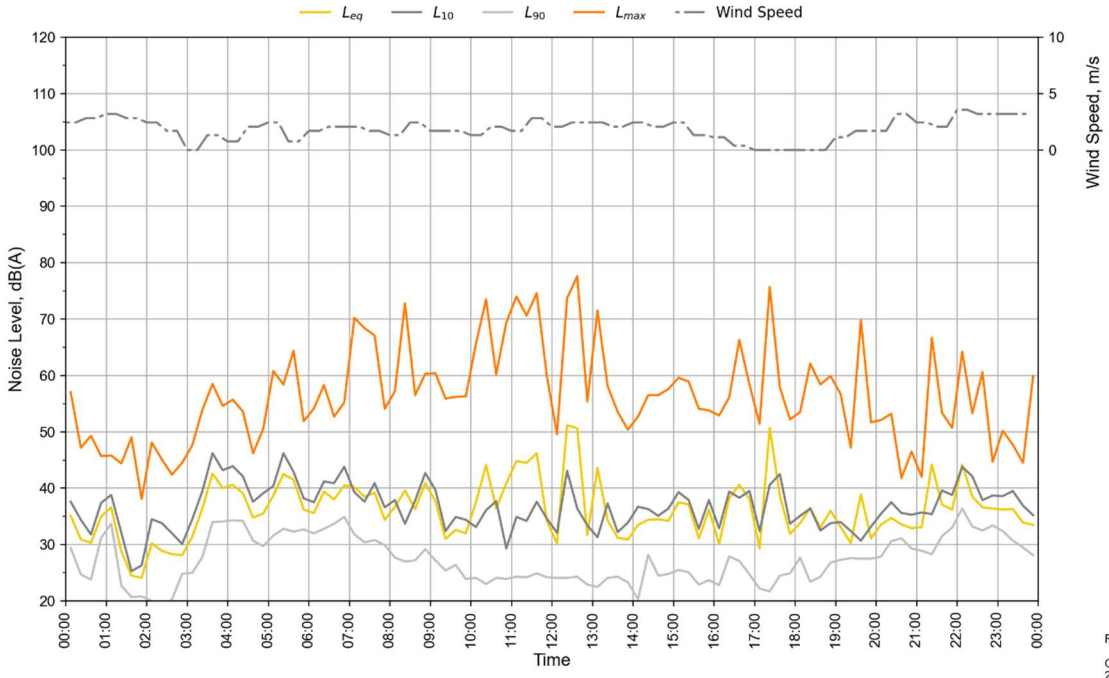
Location 3 - Saturday, 18 November 2023



Rion NL-42
946981
Calibration:
2022-10-29

Resonate

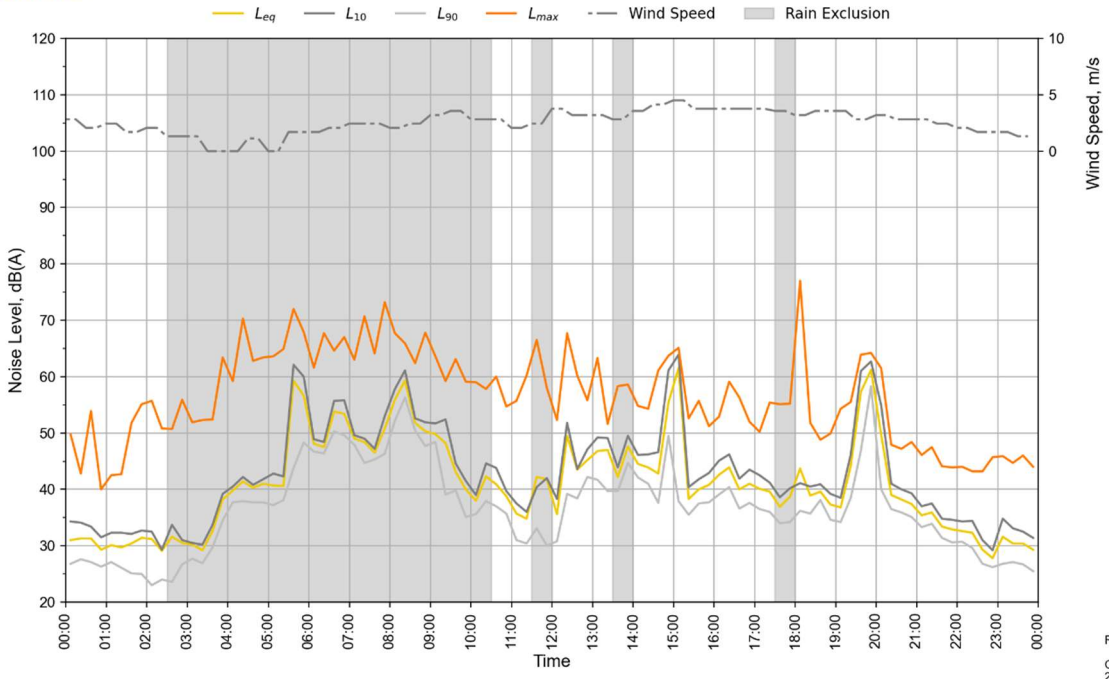
Location 3 - Sunday, 19 November 2023



Rion NL-42
946981
Calibration:
2022-10-29

Resonate

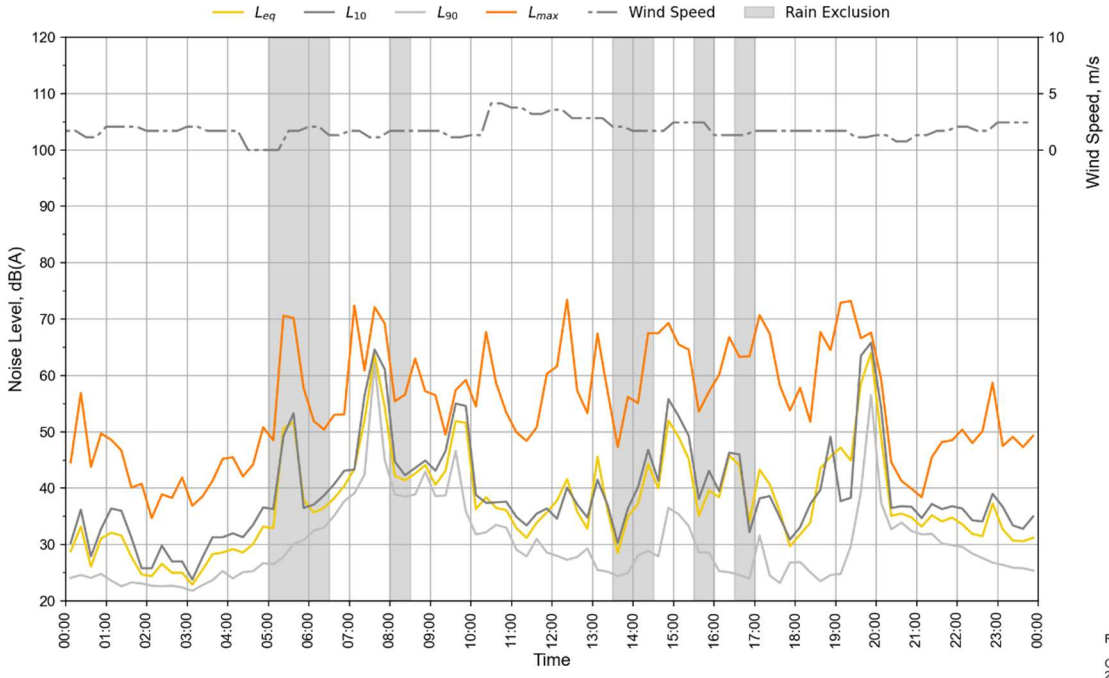
Location 3 - Monday, 20 November 2023



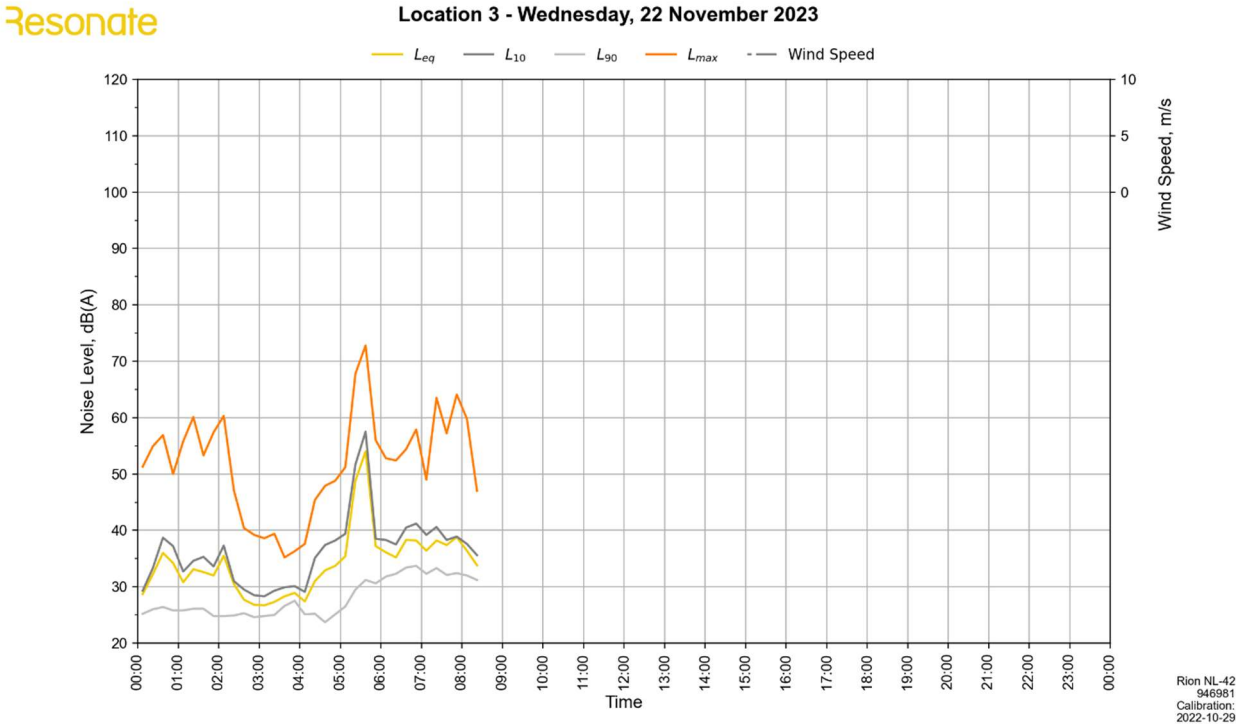
Rion NL-42
946981
Calibration:
2022-10-29

Resonate

Location 3 - Tuesday, 21 November 2023



Rion NL-42
946981
Calibration:
2022-10-29


Resonate
Location 3 - Wednesday, 22 November 2023
L_{eq}
L_{10}
L_{90}
L_{max}
Wind Speed
Noise Level, dB(A)
Wind Speed, m/s
Time
120
110
100
90
80
70
60
50
40
30
20
10
5
0
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
09:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
00:00
Rion NL-42
946981
Calibration:
2022-10-29

Appendix C – Construction equipment, work stages and acoustic data

The assessed construction activities and associated plant and equipment are presented in Table 8-2. The overall activity sound power level is calculated as a logarithmic sum incorporating indicative operation time in a 15-minute period.

It should be noted that the modelling approach is conservative in that the high noise impact scenario assumes all plants are operational simultaneously and in one location. In reality, plant and equipment would move around the site and not be used simultaneously at the same time and location.

The sound power levels were obtained from the following sources:

- Construction Noise and Vibration Guideline, 2016
- TfNSW Construction Noise and Vibration Strategy, 2019
- AS 2436-2010 Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites
- BS 5228-1:2009 Code of practice for noise and vibration control on construction and open sites

The SWLs in the table below summarise the noise emissions associated with the operating equipment.

Table 8-1 Construction plant/equipment sound power data

Plant	Sound power level, dB(A)
Asphalt paver	110
Backhoe with auger	106
Bulldozer	107
Cable laying trailer & tractor	103
Chainsaw	117
Concrete pump truck	109
Crew truck	103
Dump truck	113
Excavator	107
Forklift	95
Generator	103
Grader	111
Hand tools	102
Light vehicle	94
Mobile crane	113
Roller (vibratory)	107
Tipper truck	103
Tree mulcher	116
Trenching machine	95
Water cart	107

The sound power levels for various construction tasks have been calculated based on a standard set of equipment used for each task. However, the actual equipment and its numbers for each task are not yet confirmed, so the

equipment list provided here is not a final or definitive one. It is just an estimate of the expected noise levels during construction. The high-range sound power levels for each task are provided in Table 8-2 and assume that all equipment associated with the task will operate during the assessment period.

Table 8-2 Overall sound power levels of construction phases

Stage	Scenario	Plant/Equipment	Individual Stage L_{eq} sound power level – dB(A)	
			Low	High
1	Mobilisation and site establishment	2 x excavators, 1 x generator, 1 x mobile crane, 1 x Tipper truck, 3 x crew truck, 1 x hand tools	100	115
2	Clearing and bulk earthworks(1)	2 x excavators, 1 x bulldozer, 2 x chainsaw, 1 x tree mulcher, 5 Light vehicle, 1 x dump truck	103	124
3	Establishment of hardstand areas(1)	3 x excavators, 1 x grader, 3 x dump truck, 3 x crew truck, 3 x 1 x asphalt paver, 1 x water cart, 1 x roller (vibratory), 1 x concrete pump truck	101	119
4	Permanent environmental management and pollution control measures(1)	2 x excavators, 1 x crane mobile, 1 x concrete pump truck, 1 x water cart, 3 x crew truck, 1 x dump truck	104	119
5	Delivery and installation and BESS substation	2 x excavators, 1 x crane mobile, 1 x concrete pump truck, 1 x water cart, 3 x crew truck, 1 x dump truck, 1 x hand tools	103	119
6	Construction of BESS facility(1)	1 x backhoe with auger, 1 x roller (vibratory) 1 x trenching machine, 1 x forklift, 1 x grader, 2 x excavators, 1 x crane mobile, 1 x concrete pump truck, 1 x water cart, 3 x crew truck, 1 x hand tools	95	119
7	Connection to BESS substation	1 x trenching machine, 1 x front end loader, 2 x excavators, 3 x crew truck, 1 x hand tools, road truck 39t, 1 x dump truck	95	116
8	Roadside works(1)	2 x excavator, 1 x crane mobile, 1 x roller (vibratory), 1 x tipper truck, 3 x crew truck	101	119
9	Landscaping	2 x excavator, 1 x crane mobile, 1 x grader, 1x front end loader, 1 x tipper truck, 3 x crew truck, 1 x hand tools	106	118
10	Installation of cabling to the Transgrid substation	1 x trenching machine, 1x front end loader, 1 x cable laying trailer & tractor, 3 x crew truck	94	114

(1) Denotes “annoying” item of equipment as defined in the ICNG (i.e. contains characteristics such as impulsiveness, tonality etc.), and as such includes a +5 dB penalty adjustment to predictions.

Appendix D – Predicted construction noise levels

Receiver ID	Predicted L_{eq} range – dB(A)		Standard hours			"Highly Noise Affected"		
	Low	High	NML – dB(A)	Exceedance – dB(A)	Compliance Yes / No	NML – dB(A)	Exceedance – dB(A)	Compliance Yes / No
1 Mobilisation and site establishment								
R02	39	54	45	9	No	75	0	Yes
R03	36	51	45	6	No	75	0	Yes
R04	27	42	45	0	Yes	75	0	Yes
R05	28	43	45	0	Yes	75	0	Yes
R06	27	42	45	0	Yes	75	0	Yes
R07	27	42	45	0	Yes	75	0	Yes
R08	27	42	45	0	Yes	75	0	Yes
R09	31	46	45	1	No	75	0	Yes
R10	26	41	45	0	Yes	75	0	Yes
R11	26	41	45	0	Yes	75	0	Yes
R12	26	41	45	0	Yes	75	0	Yes
R13	26	41	45	0	Yes	75	0	Yes
R14	25	40	45	0	Yes	75	0	Yes
R15	26	41	45	0	Yes	75	0	Yes
R16	29	44	45	0	Yes	75	0	Yes
R17	25	40	45	0	Yes	75	0	Yes
R18	25	40	45	0	Yes	75	0	Yes
R19	25	40	45	0	Yes	75	0	Yes
R20	24	39	45	0	Yes	75	0	Yes
R21	24	39	45	0	Yes	75	0	Yes
R22	23	38	45	0	Yes	75	0	Yes
R23	24	39	45	0	Yes	75	0	Yes
R24	23	38	45	0	Yes	75	0	Yes
R25	27	42	45	0	Yes	75	0	Yes
R26	24	39	45	0	Yes	75	0	Yes
R27	24	39	45	0	Yes	75	0	Yes
R28	23	38	45	0	Yes	75	0	Yes
R29	22	37	45	0	Yes	75	0	Yes
R30	23	38	45	0	Yes	75	0	Yes
R31	23	38	45	0	Yes	75	0	Yes
R32	22	37	45	0	Yes	75	0	Yes
R33	22	37	45	0	Yes	75	0	Yes
R34	23	38	45	0	Yes	75	0	Yes

Receiver ID	Predicted L_{eq} range – dB(A)		Standard hours			"Highly Noise Affected"		
	Low	High	NML – dB(A)	Exceedance – dB(A)	Compliance Yes / No	NML – dB(A)	Exceedance – dB(A)	Compliance Yes / No
R35	23	38	45	0	Yes	75	0	Yes
R36	23	38	45	0	Yes	75	0	Yes
R37	22	37	45	0	Yes	75	0	Yes
2 Clearing and bulk earthworks								
R02	42	63	45	18	No	75	0	Yes
R03	39	60	45	15	No	75	0	Yes
R04	30	51	45	6	No	75	0	Yes
R05	31	52	45	7	No	75	0	Yes
R06	30	51	45	6	No	75	0	Yes
R07	30	51	45	6	No	75	0	Yes
R08	30	51	45	6	No	75	0	Yes
R09	34	55	45	10	No	75	0	Yes
R10	29	50	45	5	No	75	0	Yes
R11	29	50	45	5	No	75	0	Yes
R12	29	50	45	5	No	75	0	Yes
R13	29	50	45	5	No	75	0	Yes
R14	28	49	45	4	No	75	0	Yes
R15	29	50	45	5	No	75	0	Yes
R16	32	53	45	8	No	75	0	Yes
R17	28	49	45	4	No	75	0	Yes
R18	28	49	45	4	No	75	0	Yes
R19	28	49	45	4	No	75	0	Yes
R20	27	48	45	3	No	75	0	Yes
R21	27	48	45	3	No	75	0	Yes
R22	26	47	45	2	No	75	0	Yes
R23	27	48	45	3	No	75	0	Yes
R24	26	47	45	2	No	75	0	Yes
R25	30	51	45	6	No	75	0	Yes
R26	27	48	45	3	No	75	0	Yes
R27	27	48	45	3	No	75	0	Yes
R28	26	47	45	2	No	75	0	Yes
R29	25	46	45	1	No	75	0	Yes
R30	26	47	45	2	No	75	0	Yes
R31	26	47	45	2	No	75	0	Yes
R32	25	46	45	1	No	75	0	Yes
R33	25	46	45	1	No	75	0	Yes

Receiver ID	Predicted L_{eq} range – dB(A)		Standard hours			"Highly Noise Affected"		
	Low	High	NML – dB(A)	Exceedance – dB(A)	Compliance Yes / No	NML – dB(A)	Exceedance – dB(A)	Compliance Yes / No
R34	26	47	45	2	No	75	0	Yes
R35	26	47	45	2	No	75	0	Yes
R36	26	47	45	2	No	75	0	Yes
R37	25	46	45	1	No	75	0	Yes
3 Establishment of hardstand areas								
R02	40	61	45	16	No	75	0	Yes
R03	37	58	45	13	No	75	0	Yes
R04	28	49	45	4	No	75	0	Yes
R05	29	50	45	5	No	75	0	Yes
R06	28	49	45	4	No	75	0	Yes
R07	28	49	45	4	No	75	0	Yes
R08	28	49	45	4	No	75	0	Yes
R09	32	53	45	8	No	75	0	Yes
R10	27	48	45	3	No	75	0	Yes
R11	27	48	45	3	No	75	0	Yes
R12	27	48	45	3	No	75	0	Yes
R13	27	48	45	3	No	75	0	Yes
R14	26	47	45	2	No	75	0	Yes
R15	27	48	45	3	No	75	0	Yes
R16	30	51	45	6	No	75	0	Yes
R17	26	47	45	2	No	75	0	Yes
R18	26	47	45	2	No	75	0	Yes
R19	26	47	45	2	No	75	0	Yes
R20	25	46	45	1	No	75	0	Yes
R21	25	46	45	1	No	75	0	Yes
R22	24	45	45	0	Yes	75	0	Yes
R23	25	46	45	1	No	75	0	Yes
R24	24	45	45	0	Yes	75	0	Yes
R25	28	49	45	4	No	75	0	Yes
R26	25	46	45	1	No	75	0	Yes
R27	25	46	45	1	No	75	0	Yes
R28	24	45	45	0	Yes	75	0	Yes
R29	23	44	45	0	Yes	75	0	Yes
R30	24	45	45	0	Yes	75	0	Yes
R31	24	45	45	0	Yes	75	0	Yes
R32	23	44	45	0	Yes	75	0	Yes

Receiver ID	Predicted L_{eq} range – dB(A)		Standard hours			"Highly Noise Affected"		
	Low	High	NML – dB(A)	Exceedance – dB(A)	Compliance Yes / No	NML – dB(A)	Exceedance – dB(A)	Compliance Yes / No
R33	23	44	45	0	Yes	75	0	Yes
R34	24	45	45	0	Yes	75	0	Yes
R35	24	45	45	0	Yes	75	0	Yes
R36	24	45	45	0	Yes	75	0	Yes
R37	23	44	45	0	Yes	75	0	Yes
4 Permanent environmental management and pollution control measures								
R02	43	58	45	13	No	75	0	Yes
R03	40	55	45	10	No	75	0	Yes
R04	31	46	45	1	No	75	0	Yes
R05	32	47	45	2	No	75	0	Yes
R06	31	46	45	1	No	75	0	Yes
R07	31	46	45	1	No	75	0	Yes
R08	31	46	45	1	No	75	0	Yes
R09	35	50	45	5	No	75	0	Yes
R10	30	45	45	0	Yes	75	0	Yes
R11	30	45	45	0	Yes	75	0	Yes
R12	30	45	45	0	Yes	75	0	Yes
R13	30	45	45	0	Yes	75	0	Yes
R14	29	44	45	0	Yes	75	0	Yes
R15	30	45	45	0	Yes	75	0	Yes
R16	33	48	45	3	No	75	0	Yes
R17	29	44	45	0	Yes	75	0	Yes
R18	29	44	45	0	Yes	75	0	Yes
R19	29	44	45	0	Yes	75	0	Yes
R20	28	43	45	0	Yes	75	0	Yes
R21	28	43	45	0	Yes	75	0	Yes
R22	27	42	45	0	Yes	75	0	Yes
R23	28	43	45	0	Yes	75	0	Yes
R24	27	42	45	0	Yes	75	0	Yes
R25	31	46	45	1	No	75	0	Yes
R26	28	43	45	0	Yes	75	0	Yes
R27	28	43	45	0	Yes	75	0	Yes
R28	27	42	45	0	Yes	75	0	Yes
R29	26	41	45	0	Yes	75	0	Yes
R30	27	42	45	0	Yes	75	0	Yes
R31	27	42	45	0	Yes	75	0	Yes

Receiver ID	Predicted L_{eq} range – dB(A)		Standard hours			"Highly Noise Affected"		
	Low	High	NML – dB(A)	Exceedance – dB(A)	Compliance Yes / No	NML – dB(A)	Exceedance – dB(A)	Compliance Yes / No
R32	26	41	45	0	Yes	75	0	Yes
R33	26	41	45	0	Yes	75	0	Yes
R34	27	42	45	0	Yes	75	0	Yes
R35	27	42	45	0	Yes	75	0	Yes
R36	27	42	45	0	Yes	75	0	Yes
R37	26	41	45	0	Yes	75	0	Yes
5 Delivery and installation and Switchyard fitout								
R02	42	58	45	13	No	75	0	Yes
R03	39	55	45	10	No	75	0	Yes
R04	30	46	45	1	No	75	0	Yes
R05	31	47	45	2	No	75	0	Yes
R06	30	46	45	1	No	75	0	Yes
R07	30	46	45	1	No	75	0	Yes
R08	30	46	45	1	No	75	0	Yes
R09	34	50	45	5	No	75	0	Yes
R10	29	45	45	0	Yes	75	0	Yes
R11	29	45	45	0	Yes	75	0	Yes
R12	29	45	45	0	Yes	75	0	Yes
R13	29	45	45	0	Yes	75	0	Yes
R14	28	44	45	0	Yes	75	0	Yes
R15	29	45	45	0	Yes	75	0	Yes
R16	32	48	45	3	No	75	0	Yes
R17	28	44	45	0	Yes	75	0	Yes
R18	28	44	45	0	Yes	75	0	Yes
R19	28	44	45	0	Yes	75	0	Yes
R20	27	43	45	0	Yes	75	0	Yes
R21	27	43	45	0	Yes	75	0	Yes
R22	26	42	45	0	Yes	75	0	Yes
R23	27	43	45	0	Yes	75	0	Yes
R24	26	42	45	0	Yes	75	0	Yes
R25	30	46	45	1	No	75	0	Yes
R26	27	43	45	0	Yes	75	0	Yes
R27	27	43	45	0	Yes	75	0	Yes
R28	26	42	45	0	Yes	75	0	Yes
R29	25	41	45	0	Yes	75	0	Yes
R30	26	42	45	0	Yes	75	0	Yes

Receiver ID	Predicted L_{eq} range – dB(A)		Standard hours			"Highly Noise Affected"		
	Low	High	NML – dB(A)	Exceedance – dB(A)	Compliance Yes / No	NML – dB(A)	Exceedance – dB(A)	Compliance Yes / No
R31	26	42	45	0	Yes	75	0	Yes
R32	25	41	45	0	Yes	75	0	Yes
R33	25	41	45	0	Yes	75	0	Yes
R34	26	42	45	0	Yes	75	0	Yes
R35	26	42	45	0	Yes	75	0	Yes
R36	26	42	45	0	Yes	75	0	Yes
R37	25	41	45	0	Yes	75	0	Yes
6 Construction of BESS compound/compound removal								
R02	34	58	45	13	No	75	0	Yes
R03	31	55	45	10	No	75	0	Yes
R04	22	46	45	1	No	75	0	Yes
R05	23	47	45	2	No	75	0	Yes
R06	22	46	45	1	No	75	0	Yes
R07	22	46	45	1	No	75	0	Yes
R08	22	46	45	1	No	75	0	Yes
R09	26	50	45	5	No	75	0	Yes
R10	21	45	45	0	Yes	75	0	Yes
R11	21	45	45	0	Yes	75	0	Yes
R12	21	45	45	0	Yes	75	0	Yes
R13	21	45	45	0	Yes	75	0	Yes
R14	20	44	45	0	Yes	75	0	Yes
R15	21	45	45	0	Yes	75	0	Yes
R16	24	48	45	3	No	75	0	Yes
R17	20	44	45	0	Yes	75	0	Yes
R18	20	44	45	0	Yes	75	0	Yes
R19	20	44	45	0	Yes	75	0	Yes
R20	19	43	45	0	Yes	75	0	Yes
R21	19	43	45	0	Yes	75	0	Yes
R22	18	42	45	0	Yes	75	0	Yes
R23	19	43	45	0	Yes	75	0	Yes
R24	18	42	45	0	Yes	75	0	Yes
R25	22	46	45	1	No	75	0	Yes
R26	19	43	45	0	Yes	75	0	Yes
R27	19	43	45	0	Yes	75	0	Yes
R28	18	42	45	0	Yes	75	0	Yes
R29	17	41	45	0	Yes	75	0	Yes

Receiver ID	Predicted L_{eq} range – dB(A)		Standard hours			"Highly Noise Affected"		
	Low	High	NML – dB(A)	Exceedance – dB(A)	Compliance Yes / No	NML – dB(A)	Exceedance – dB(A)	Compliance Yes / No
R30	18	42	45	0	Yes	75	0	Yes
R31	18	42	45	0	Yes	75	0	Yes
R32	17	41	45	0	Yes	75	0	Yes
R33	17	41	45	0	Yes	75	0	Yes
R34	18	42	45	0	Yes	75	0	Yes
R35	18	42	45	0	Yes	75	0	Yes
R36	18	42	45	0	Yes	75	0	Yes
R37	17	41	45	0	Yes	75	0	Yes
7 Connection to substation switchyard								
R02	42	58	45	13	No	75	0	Yes
R03	39	55	45	10	No	75	0	Yes
R04	30	46	45	1	No	75	0	Yes
R05	31	47	45	2	No	75	0	Yes
R06	30	46	45	1	No	75	0	Yes
R07	30	46	45	1	No	75	0	Yes
R08	30	46	45	1	No	75	0	Yes
R09	34	50	45	5	No	75	0	Yes
R10	29	45	45	0	Yes	75	0	Yes
R11	29	45	45	0	Yes	75	0	Yes
R12	29	45	45	0	Yes	75	0	Yes
R13	29	45	45	0	Yes	75	0	Yes
R14	28	44	45	0	Yes	75	0	Yes
R15	29	45	45	0	Yes	75	0	Yes
R16	32	48	45	3	No	75	0	Yes
R17	28	44	45	0	Yes	75	0	Yes
R18	28	44	45	0	Yes	75	0	Yes
R19	28	44	45	0	Yes	75	0	Yes
R20	27	43	45	0	Yes	75	0	Yes
R21	27	43	45	0	Yes	75	0	Yes
R22	26	42	45	0	Yes	75	0	Yes
R23	27	43	45	0	Yes	75	0	Yes
R24	26	42	45	0	Yes	75	0	Yes
R25	30	46	45	1	No	75	0	Yes
R26	27	43	45	0	Yes	75	0	Yes
R27	27	43	45	0	Yes	75	0	Yes
R28	26	42	45	0	Yes	75	0	Yes

Receiver ID	Predicted L_{eq} range – dB(A)		Standard hours			"Highly Noise Affected"		
	Low	High	NML – dB(A)	Exceedance – dB(A)	Compliance Yes / No	NML – dB(A)	Exceedance – dB(A)	Compliance Yes / No
R29	25	41	45	0	Yes	75	0	Yes
R30	26	42	45	0	Yes	75	0	Yes
R31	26	42	45	0	Yes	75	0	Yes
R32	25	41	45	0	Yes	75	0	Yes
R33	25	41	45	0	Yes	75	0	Yes
R34	26	42	45	0	Yes	75	0	Yes
R35	26	42	45	0	Yes	75	0	Yes
R36	26	42	45	0	Yes	75	0	Yes
R37	25	41	45	0	Yes	75	0	Yes
8 Roadside works								
R02	40	58	45	13	No	75	0	Yes
R03	37	55	45	10	No	75	0	Yes
R04	28	46	45	1	No	75	0	Yes
R05	29	47	45	2	No	75	0	Yes
R06	28	46	45	1	No	75	0	Yes
R07	28	46	45	1	No	75	0	Yes
R08	28	46	45	1	No	75	0	Yes
R09	32	50	45	5	No	75	0	Yes
R10	27	45	45	0	Yes	75	0	Yes
R11	27	45	45	0	Yes	75	0	Yes
R12	27	45	45	0	Yes	75	0	Yes
R13	27	45	45	0	Yes	75	0	Yes
R14	26	44	45	0	Yes	75	0	Yes
R15	27	45	45	0	Yes	75	0	Yes
R16	30	48	45	3	No	75	0	Yes
R17	26	44	45	0	Yes	75	0	Yes
R18	26	44	45	0	Yes	75	0	Yes
R19	26	44	45	0	Yes	75	0	Yes
R20	25	43	45	0	Yes	75	0	Yes
R21	25	43	45	0	Yes	75	0	Yes
R22	24	42	45	0	Yes	75	0	Yes
R23	25	43	45	0	Yes	75	0	Yes
R24	24	42	45	0	Yes	75	0	Yes
R25	28	46	45	1	No	75	0	Yes
R26	25	43	45	0	Yes	75	0	Yes
R27	25	43	45	0	Yes	75	0	Yes

Receiver ID	Predicted L_{eq} range – dB(A)		Standard hours			"Highly Noise Affected"		
	Low	High	NML – dB(A)	Exceedance – dB(A)	Compliance Yes / No	NML – dB(A)	Exceedance – dB(A)	Compliance Yes / No
R28	24	42	45	0	Yes	75	0	Yes
R29	23	41	45	0	Yes	75	0	Yes
R30	24	42	45	0	Yes	75	0	Yes
R31	24	42	45	0	Yes	75	0	Yes
R32	23	41	45	0	Yes	75	0	Yes
R33	23	41	45	0	Yes	75	0	Yes
R34	24	42	45	0	Yes	75	0	Yes
R35	24	42	45	0	Yes	75	0	Yes
R36	24	42	45	0	Yes	75	0	Yes
R37	23	41	45	0	Yes	75	0	Yes
9 Landscaping								
R02	45	57	45	12	No	75	0	Yes
R03	42	54	45	9	No	75	0	Yes
R04	33	45	45	0	Yes	75	0	Yes
R05	34	46	45	1	No	75	0	Yes
R06	33	45	45	0	Yes	75	0	Yes
R07	33	45	45	0	Yes	75	0	Yes
R08	33	45	45	0	Yes	75	0	Yes
R09	37	49	45	4	No	75	0	Yes
R10	32	44	45	0	Yes	75	0	Yes
R11	32	44	45	0	Yes	75	0	Yes
R12	32	44	45	0	Yes	75	0	Yes
R13	32	44	45	0	Yes	75	0	Yes
R14	31	43	45	0	Yes	75	0	Yes
R15	32	44	45	0	Yes	75	0	Yes
R16	35	47	45	2	No	75	0	Yes
R17	31	43	45	0	Yes	75	0	Yes
R18	31	43	45	0	Yes	75	0	Yes
R19	31	43	45	0	Yes	75	0	Yes
R20	30	42	45	0	Yes	75	0	Yes
R21	30	42	45	0	Yes	75	0	Yes
R22	29	41	45	0	Yes	75	0	Yes
R23	30	42	45	0	Yes	75	0	Yes
R24	29	41	45	0	Yes	75	0	Yes
R25	33	45	45	0	Yes	75	0	Yes
R26	30	42	45	0	Yes	75	0	Yes

Receiver ID	Predicted L_{eq} range – dB(A)		Standard hours			"Highly Noise Affected"		
	Low	High	NML – dB(A)	Exceedance – dB(A)	Compliance Yes / No	NML – dB(A)	Exceedance – dB(A)	Compliance Yes / No
R27	30	42	45	0	Yes	75	0	Yes
R28	29	41	45	0	Yes	75	0	Yes
R29	28	40	45	0	Yes	75	0	Yes
R30	29	41	45	0	Yes	75	0	Yes
R31	29	41	45	0	Yes	75	0	Yes
R32	28	40	45	0	Yes	75	0	Yes
R33	28	40	45	0	Yes	75	0	Yes
R34	29	41	45	0	Yes	75	0	Yes
R35	29	41	45	0	Yes	75	0	Yes
R36	29	41	45	0	Yes	75	0	Yes
R37	28	40	45	0	Yes	75	0	Yes
10 Installation of cabling to the Transgrid substation								
R02	31	51	45	6	No	75	0	Yes
R03	30	50	45	5	No	75	0	Yes
R04	29	49	45	4	No	75	0	Yes
R05	33	53	45	8	No	75	0	Yes
R06	33	53	45	8	No	75	0	Yes
R07	33	53	45	8	No	75	0	Yes
R08	30	50	45	5	No	75	0	Yes
R09	20	40	45	0	Yes	75	0	Yes
R10	31	51	45	6	No	75	0	Yes
R11	30	50	45	5	No	75	0	Yes
R12	28	48	45	3	No	75	0	Yes
R13	30	50	45	5	No	75	0	Yes
R14	29	49	45	4	No	75	0	Yes
R15	28	48	45	3	No	75	0	Yes
R16	20	40	45	0	Yes	75	0	Yes
R17	28	48	45	3	No	75	0	Yes
R18	27	47	45	2	No	75	0	Yes
R19	26	46	45	1	No	75	0	Yes
R20	27	47	45	2	No	75	0	Yes
R21	24	44	45	0	Yes	75	0	Yes
R22	26	46	45	1	No	75	0	Yes
R23	26	46	45	1	No	75	0	Yes
R24	26	46	45	1	No	75	0	Yes
R25	17	37	45	0	Yes	75	0	Yes

Receiver ID	Predicted L_{eq} range – dB(A)		Standard hours			"Highly Noise Affected"		
	Low	High	NML – dB(A)	Exceedance – dB(A)	Compliance Yes / No	NML – dB(A)	Exceedance – dB(A)	Compliance Yes / No
R26	24	44	45	0	Yes	75	0	Yes
R27	25	45	45	0	Yes	75	0	Yes
R28	25	45	45	0	Yes	75	0	Yes
R29	24	44	45	0	Yes	75	0	Yes
R30	25	45	45	0	Yes	75	0	Yes
R31	24	44	45	0	Yes	75	0	Yes
R32	24	44	45	0	Yes	75	0	Yes
R33	25	45	45	0	Yes	75	0	Yes
R34	24	44	45	0	Yes	75	0	Yes
R35	22	42	45	0	Yes	75	0	Yes
R36	23	43	45	0	Yes	75	0	Yes
R37	23	43	45	0	Yes	75	0	Yes

Appendix E – Construction road traffic noise calculations

Ascot-Calala Road Calculation

Transport Roads & Maritime Services

Road Traffic Noise Estimator

Please input information into yellow cells	
Please pick from drop-down list in orange cells	

Ground type	Undeveloped green fields (rural areas with isolated dwellings)
Road surface	DGA
Road type	Local road

Note that a road is new if a road's functional class changes during construction. For example, rerouting traffic from an arterial road temporarily to a collector road changes the functional class of the collector road for the duration of the temporary reroute.

	Day	Night
Noise criteria (residences)	55	50
Existing speed	60	60
Speed during construction	60	60

	Day (7am to 10pm)		Night (10pm to 7am)		Worst Case 1-hour Day		Worst Case 1-hour Night	
Existing traffic	Light vehicles	Heavy vehicles	Light vehicles	Heavy vehicles	Light vehicles	Heavy vehicles	Light vehicles	Heavy vehicles
Direction (1)	[illegible]	[illegible]	[illegible]	[illegible]	4	0	1	1
Direction (2)	8000	700	3420	380	3	1	1	1
Additional traffic								
Direction (1)	0	0	0	0	5	4	0	0
Direction (2)	0	0	0	0	5	4	0	0

	Day	Night
Change in noise levels (dBA)	7.9	0.0
Mitigation level (dBA)	55	50
Is the change in noise level greater than 2.0 dBA?	Yes	No
Require consideration of additional mitigation measures?	Yes	No
Mitigation distance (m)	19	

To assess noise impacts from construction traffic or a temporary reroute due to a road closure or both an initial screening test should be undertaken by evaluating whether noise levels will increase by more than 2dB(A). Where increases are 2dBA or less then no further assessment is required. Where noise levels increase by more than 2dBA (2.1dBA) and noise levels exceed the controlling criterion then the receiver qualifies for consideration of noise mitigation under the Noise Mitigation Guideline. [note: the assessment methodology is similar to minor works so in any instance the only trigger for noise mitigation under the NMG shall be due to noise level increase]

Mitigation Measures

Management of construction related traffic or traffic reroutes noise should as a minimum include the following controls:
- Scheduling and routing of vehicle movements
- Speed of vehicles
- Driver behaviour and avoidance of the use of engine compression brakes
- Ensuring vehicles are adequately silenced before allowing them to access the site

Where noise impacts are greater than one year then consideration should be given to the following measures where feasible and reasonable:
- temporary noise barriers
- at-receiver noise mitigation

Feasible and reasonable considerations should also include:
- time of day of the noise increase and exceedance of criteria
- time of use of affected receivers
- how many decibels the noise levels are to increase
- how long the mitigation will provide benefit to the receiver during the project

Calculating noise level at the receiver

Distance to receiver (m)		
Direction (1)	60	
Direction (2)	60	
	Day	Night
Predicted noise levels (dBA) @ 1m from the façade	47.9	42.7

Note:
(1) Noise reports present noise levels rounded to the nearest integer and differences between two noise levels rounded to a single decimal place.
(2) noise barriers more than 3 metres high, if designed using Roads and Maritime guidelines, would generally provide an insertion loss of around 5 dB(A) at the most affected residence.
(3) noise barriers more than 5 metres high, if designed using Roads and Maritime guidelines, would generally provide an insertion loss of around 10 dB(A) at the most affected residence.

Appendix F – Predicted operational noise levels

Table 8-3 Operation at 100% duty during standard meteorological conditions

Receiver ID	Daytime period				Evening period				Night-time period			
	Predicted dB(A)	Criteria dB(A)	Exceedance dB(A)	Compliance? (Yes / No)	Predicted dB(A)	Criteria dB(A)	Exceedance dB(A)	Compliance? (Yes / No)	Predicted dB(A)	Criteria dB(A)	Exceedance dB(A)	Compliance? (Yes / No)
R2	39	40	0	Yes	39	35	4	No	39	35	4	No
R3	37	40	0	Yes	37	35	2	No	37	35	2	No
R4	22	40	0	Yes	22	35	0	Yes	22	35	0	Yes
R5	29	40	0	Yes	29	35	0	Yes	29	35	0	Yes
R6	28	40	0	Yes	28	35	0	Yes	28	35	0	Yes
R7	27	40	0	Yes	27	35	0	Yes	27	35	0	Yes
R8	28	40	0	Yes	28	35	0	Yes	28	35	0	Yes
R9	34	40	0	Yes	34	35	0	Yes	34	35	0	Yes
R10	27	40	0	Yes	27	35	0	Yes	27	35	0	Yes
R11	26	40	0	Yes	26	35	0	Yes	26	35	0	Yes
R12	27	40	0	Yes	27	35	0	Yes	27	35	0	Yes
R13	27	40	0	Yes	27	35	0	Yes	27	35	0	Yes
R14	26	40	0	Yes	26	35	0	Yes	26	35	0	Yes
R15	26	40	0	Yes	26	35	0	Yes	26	35	0	Yes
R16	33	40	0	Yes	33	35	0	Yes	33	35	0	Yes

Receiver ID	Daytime period				Evening period				Night-time period			
	Predicted dB(A)	Criteria dB(A)	Exceedance dB(A)	Compliance? (Yes / No)	Predicted dB(A)	Criteria dB(A)	Exceedance dB(A)	Compliance? (Yes / No)	Predicted dB(A)	Criteria dB(A)	Exceedance dB(A)	Compliance? (Yes / No)
R17	26	40	0	Yes	26	35	0	Yes	26	35	0	Yes
R18	26	40	0	Yes	26	35	0	Yes	26	35	0	Yes
R19	26	40	0	Yes	26	35	0	Yes	26	35	0	Yes
R20	25	40	0	Yes	25	35	0	Yes	25	35	0	Yes
R21	13	40	0	Yes	13	35	0	Yes	13	35	0	Yes
R22	24	40	0	Yes	24	35	0	Yes	24	35	0	Yes
R23	25	40	0	Yes	25	35	0	Yes	25	35	0	Yes
R24	23	40	0	Yes	23	35	0	Yes	23	35	0	Yes
R25	29	40	0	Yes	29	35	0	Yes	29	35	0	Yes
R26	24	40	0	Yes	24	35	0	Yes	24	35	0	Yes
R27	25	40	0	Yes	25	35	0	Yes	25	35	0	Yes
R28	24	40	0	Yes	24	35	0	Yes	24	35	0	Yes
R29	19	40	0	Yes	19	35	0	Yes	19	35	0	Yes
R30	24	40	0	Yes	24	35	0	Yes	24	35	0	Yes
R31	24	40	0	Yes	24	35	0	Yes	24	35	0	Yes
R32	22	40	0	Yes	22	35	0	Yes	22	35	0	Yes
R33	22	40	0	Yes	22	35	0	Yes	22	35	0	Yes
R34	24	40	0	Yes	24	35	0	Yes	24	35	0	Yes

Receiver ID	Daytime period				Evening period				Night-time period			
	Predicted dB(A)	Criteria dB(A)	Exceedance dB(A)	Compliance? (Yes / No)	Predicted dB(A)	Criteria dB(A)	Exceedance dB(A)	Compliance? (Yes / No)	Predicted dB(A)	Criteria dB(A)	Exceedance dB(A)	Compliance? (Yes / No)
R35	24	40	0	Yes	24	35	0	Yes	24	35	0	Yes
R36	23	40	0	Yes	23	35	0	Yes	23	35	0	Yes
R37	22	40	0	Yes	22	35	0	Yes	22	35	0	Yes

Table 8-4 Operation at 100% duty during noise enhancing meteorological conditions

Receiver ID	Daytime period				Evening period				Night-time period			
	Predicted dB(A)	Criteria dB(A)	Exceedance dB(A)	Compliance? (Yes / No)	Predicted dB(A)	Criteria dB(A)	Exceedance dB(A)	Compliance? (Yes / No)	Predicted dB(A)	Criteria dB(A)	Exceedance dB(A)	Compliance? (Yes / No)
R2	44	40	4	No	44	35	9	No	44	35	9	No
R3	42	40	2	No	42	35	7	No	42	35	7	No
R4	27	40	0	Yes	27	35	0	Yes	27	35	0	Yes
R5	34	40	0	Yes	34	35	0	Yes	34	35	0	Yes
R6	33	40	0	Yes	33	35	0	Yes	33	35	0	Yes
R7	33	40	0	Yes	33	35	0	Yes	33	35	0	Yes
R8	33	40	0	Yes	33	35	0	Yes	33	35	0	Yes
R9	40	40	0	Yes	40	35	5	No	40	35	5	No
R10	32	40	0	Yes	32	35	0	Yes	32	35	0	Yes
R11	31	40	0	Yes	31	35	0	Yes	31	35	0	Yes

Receiver ID	Daytime period				Evening period				Night-time period			
	Predicted dB(A)	Criteria dB(A)	Exceedance dB(A)	Compliance? (Yes / No)	Predicted dB(A)	Criteria dB(A)	Exceedance dB(A)	Compliance? (Yes / No)	Predicted dB(A)	Criteria dB(A)	Exceedance dB(A)	Compliance? (Yes / No)
R12	32	40	0	Yes	32	35	0	Yes	32	35	0	Yes
R13	32	40	0	Yes	32	35	0	Yes	32	35	0	Yes
R14	32	40	0	Yes	32	35	0	Yes	32	35	0	Yes
R15	31	40	0	Yes	31	35	0	Yes	31	35	0	Yes
R16	38	40	0	Yes	38	35	3	No	38	35	3	No
R17	31	40	0	Yes	31	35	0	Yes	31	35	0	Yes
R18	31	40	0	Yes	31	35	0	Yes	31	35	0	Yes
R19	31	40	0	Yes	31	35	0	Yes	31	35	0	Yes
R20	31	40	0	Yes	31	35	0	Yes	31	35	0	Yes
R21	18	40	0	Yes	18	35	0	Yes	18	35	0	Yes
R22	29	40	0	Yes	29	35	0	Yes	29	35	0	Yes
R23	31	40	0	Yes	31	35	0	Yes	31	35	0	Yes
R24	28	40	0	Yes	28	35	0	Yes	28	35	0	Yes
R25	34	40	0	Yes	34	35	0	Yes	34	35	0	Yes
R26	29	40	0	Yes	29	35	0	Yes	29	35	0	Yes
R27	30	40	0	Yes	30	35	0	Yes	30	35	0	Yes
R28	29	40	0	Yes	29	35	0	Yes	29	35	0	Yes
R29	24	40	0	Yes	24	35	0	Yes	24	35	0	Yes

Receiver ID	Daytime period				Evening period				Night-time period			
	Predicted dB(A)	Criteria dB(A)	Exceedance dB(A)	Compliance? (Yes / No)	Predicted dB(A)	Criteria dB(A)	Exceedance dB(A)	Compliance? (Yes / No)	Predicted dB(A)	Criteria dB(A)	Exceedance dB(A)	Compliance? (Yes / No)
R30	30	40	0	Yes	30	35	0	Yes	30	35	0	Yes
R31	29	40	0	Yes	29	35	0	Yes	29	35	0	Yes
R32	28	40	0	Yes	28	35	0	Yes	28	35	0	Yes
R33	27	40	0	Yes	27	35	0	Yes	27	35	0	Yes
R34	29	40	0	Yes	29	35	0	Yes	29	35	0	Yes
R35	29	40	0	Yes	29	35	0	Yes	29	35	0	Yes
R36	29	40	0	Yes	29	35	0	Yes	29	35	0	Yes
R37	28	40	0	Yes	28	35	0	Yes	28	35	0	Yes

Appendix G – Operational noise contours

Kingswood BESS Project

Appendix G1
Predicted operational noise contours

BESS daytime, evening and night-time operation at 100% duty during standard meteorological conditions

Without noise mitigation

Date: 09/04/2024
Client: Arcadis
Prepared by: MS

N

Datum GDA 2020, Projection MGA ZONE 56

0 250 500 m

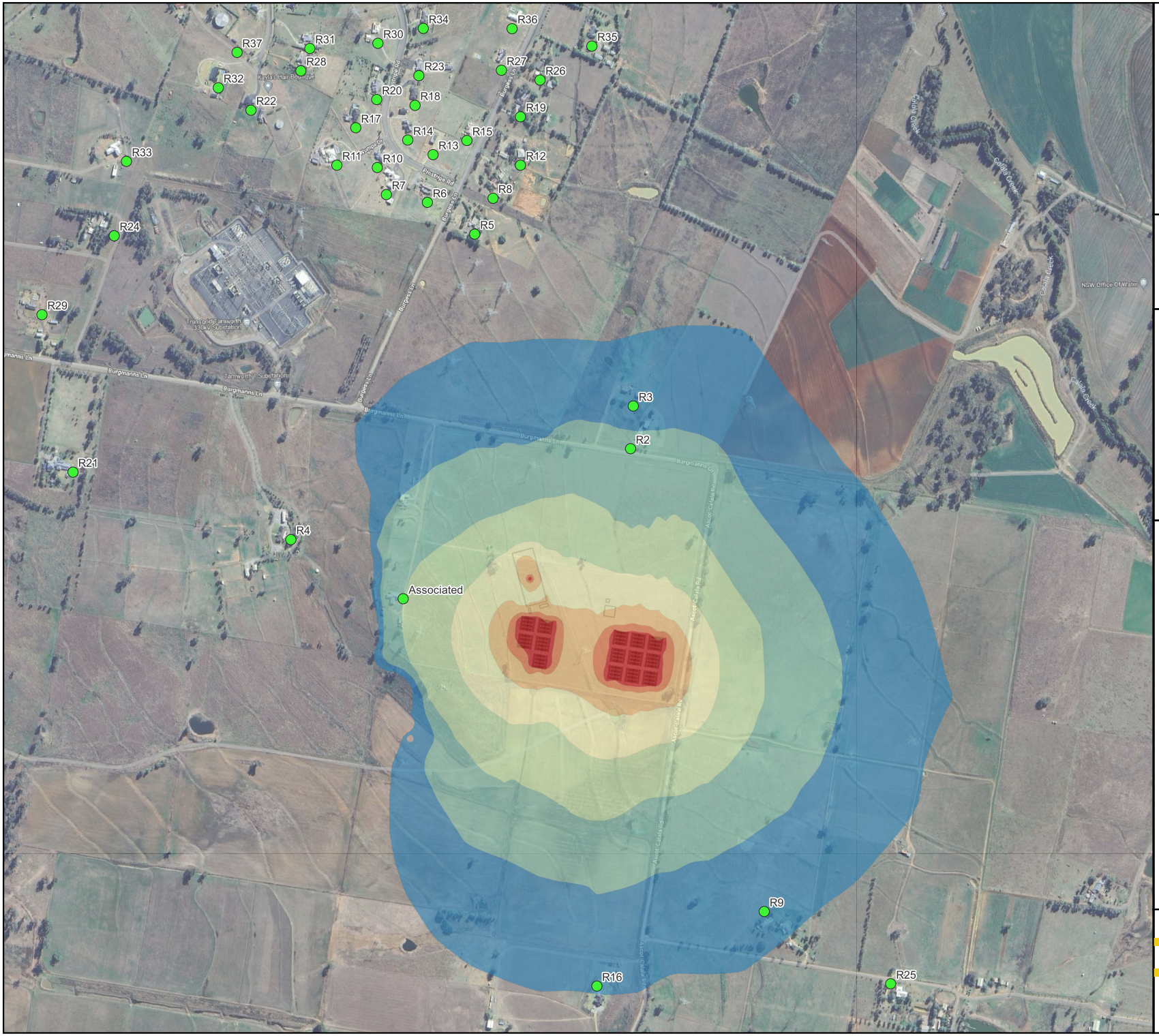
Legend

- Receivers

Operational noise contours - dB(A)

- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- > 65

Resonate



Kingswood BESS Project

Appendix G2
Predicted operational noise contours

BESS daytime, evening and night-time operation at 100% duty during noise-enhancing meteorological conditions

Without noise mitigation

Date: 09/04/2024
Client: Arcadis
Prepared by: MS

N

Datum GDA 2020, Projection MGA ZONE 56

0 250 500 m

Legend

Receivers

- Receivers

Operational noise contours - dB(A)

- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- > 65

Resonate

Appendix H – Predicted operational noise levels with noise mitigation

Table 8-5 100% duty factor operations during noise enhancing meteorological conditions with noise mitigation measures

Receiver ID	Daytime period				Evening period				Night-time period			
	Predicted dB(A)	Criteria dB(A)	Exceedance dB(A)	Compliance? (Yes / No)	Predicted dB(A)	Criteria dB(A)	Exceedance dB(A)	Compliance? (Yes / No)	Predicted dB(A)	Criteria dB(A)	Exceedance dB(A)	Compliance? (Yes / No)
R2	34	40	0	Yes	34	35	0	Yes	34	35	0	Yes
R3	32	40	0	Yes	32	35	0	Yes	32	35	0	Yes
R4	23	40	0	Yes	23	35	0	Yes	23	35	0	Yes
R5	27	40	0	Yes	27	35	0	Yes	27	35	0	Yes
R6	26	40	0	Yes	26	35	0	Yes	26	35	0	Yes
R7	26	40	0	Yes	26	35	0	Yes	26	35	0	Yes
R8	26	40	0	Yes	26	35	0	Yes	26	35	0	Yes
R9	33	40	0	Yes	33	35	0	Yes	33	35	0	Yes
R10	25	40	0	Yes	25	35	0	Yes	25	35	0	Yes
R11	25	40	0	Yes	25	35	0	Yes	25	35	0	Yes
R12	25	40	0	Yes	25	35	0	Yes	25	35	0	Yes
R13	25	40	0	Yes	25	35	0	Yes	25	35	0	Yes
R14	25	40	0	Yes	25	35	0	Yes	25	35	0	Yes
R15	24	40	0	Yes	24	35	0	Yes	24	35	0	Yes
R16	33	40	0	Yes	33	35	0	Yes	33	35	0	Yes

Receiver ID	Daytime period				Evening period				Night-time period			
	Predicted dB(A)	Criteria dB(A)	Exceedance dB(A)	Compliance? (Yes / No)	Predicted dB(A)	Criteria dB(A)	Exceedance dB(A)	Compliance? (Yes / No)	Predicted dB(A)	Criteria dB(A)	Exceedance dB(A)	Compliance? (Yes / No)
R17	24	40	0	Yes	24	35	0	Yes	24	35	0	Yes
R18	24	40	0	Yes	24	35	0	Yes	24	35	0	Yes
R19	24	40	0	Yes	24	35	0	Yes	24	35	0	Yes
R20	24	40	0	Yes	24	35	0	Yes	24	35	0	Yes
R21	15	40	0	Yes	15	35	0	Yes	15	35	0	Yes
R22	23	40	0	Yes	23	35	0	Yes	23	35	0	Yes
R23	23	40	0	Yes	23	35	0	Yes	23	35	0	Yes
R24	22	40	0	Yes	22	35	0	Yes	22	35	0	Yes
R25	28	40	0	Yes	28	35	0	Yes	28	35	0	Yes
R26	23	40	0	Yes	23	35	0	Yes	23	35	0	Yes
R27	23	40	0	Yes	23	35	0	Yes	23	35	0	Yes
R28	23	40	0	Yes	23	35	0	Yes	23	35	0	Yes
R29	21	40	0	Yes	21	35	0	Yes	21	35	0	Yes
R30	23	40	0	Yes	23	35	0	Yes	23	35	0	Yes
R31	23	40	0	Yes	23	35	0	Yes	23	35	0	Yes
R32	22	40	0	Yes	22	35	0	Yes	22	35	0	Yes
R33	22	40	0	Yes	22	35	0	Yes	22	35	0	Yes
R34	22	40	0	Yes	22	35	0	Yes	22	35	0	Yes

Receiver ID	Daytime period				Evening period				Night-time period			
	Predicted dB(A)	Criteria dB(A)	Exceedance dB(A)	Compliance? (Yes / No)	Predicted dB(A)	Criteria dB(A)	Exceedance dB(A)	Compliance? (Yes / No)	Predicted dB(A)	Criteria dB(A)	Exceedance dB(A)	Compliance? (Yes / No)
R35	22	40	0	Yes	22	35	0	Yes	22	35	0	Yes
R36	22	40	0	Yes	22	35	0	Yes	22	35	0	Yes
R37	22	40	0	Yes	22	35	0	Yes	22	35	0	Yes

Appendix I – Operational Noise Contours with Noise Mitigation Options

Kingswood BESS Project

Appendix I1
Predicted operational noise contours

BESS daytime, evening and night-time operation at 100% duty during standard meteorological conditions

With noise mitigation

Date: 09/04/2024
Client: Arcadis
Prepared by: MS

N

Datum GDA 2020, Projection MGA ZONE 56

0 250 500 m

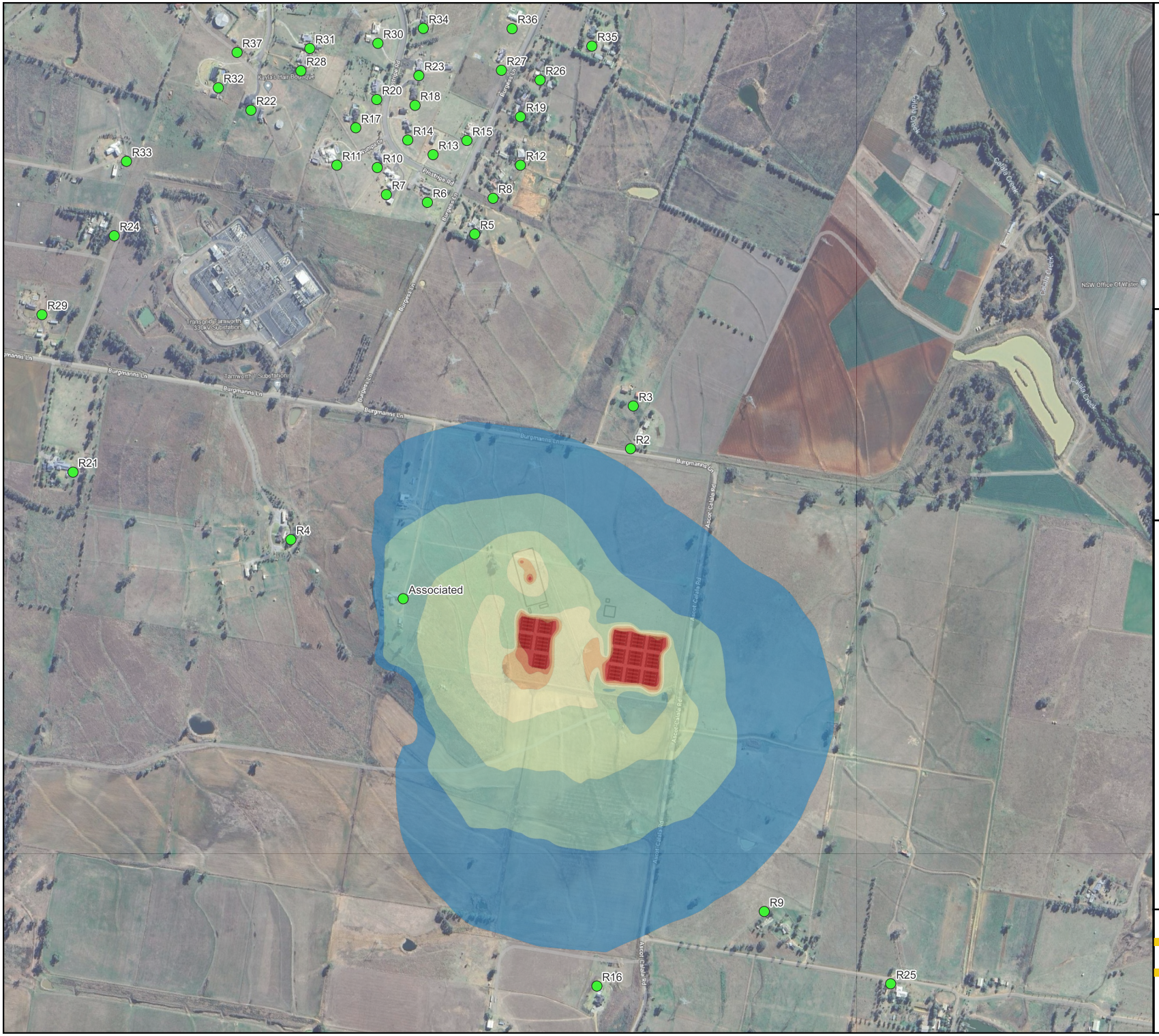
Legend

- Receivers

Operational noise contours - dB(A)

- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- > 65

Resonate



Kingswood BESS Project

Appendix I2
Predicted operational noise contours

BESS daytime, evening and night-time operation at 100% duty during noise-enhancing meteorological conditions

With noise mitigation

Date: 09/04/2024
Client: Arcadis
Prepared by: MS

N

Datum GDA 2020, Projection MGA ZONE 56

0 250 500 m

Legend

Receivers

- Receivers

Operational noise contours - dB(A)

- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- > 65

Resonate

Appendix J – Draft Construction Noise and Vibration Management Plan

This Construction Noise and Vibration Management Plan (CNVMP) forms part of the Construction Environmental Management Plan for the Project. This CNVMP has been prepared to address the construction noise and vibration requirements listed in the Development Consent.

Purpose

The purpose of this CNVMP is to describe how the contractor proposes to manage potential noise and vibration impacts during construction of the Project.

Objective

The key objective of the CNVMP is to ensure that project noise and vibration impacts on nearby sensitive receivers are minimised and within the scope permitted by the planning approval. This includes management procedures to appropriately respond to complaints from the community and stakeholders relating to noise and vibration.

To achieve this objective, the contractor will undertake the following:

- Ensure appropriate controls and procedures are implemented during construction activities to avoid or reduce noise and vibration impacts and potential adverse impacts to neighbouring sensitive receivers.
- Ensure reasonable and feasible mitigation measures are implemented with the aim of achieving the requirements in the Development Consent and the management levels detailed in this CNVMP in accordance with the NSW EPA's *Interim Construction Noise Guideline*.
- Ensure complaints from community and stakeholders are reduced.

Construction hours

Standard construction hours

Construction, including the delivery of materials to and from the site, may only be carried out between the following hours:

(a) between 7 am and 6 pm, Mondays to Fridays inclusive; and
(b) between 8 am and 1 pm, Saturdays
(c) No work may be carried out on Sundays or public holidays

Out of hours work

Activities may be undertaken outside of the hours if required:

(a) by the Police or a public authority for the delivery of vehicles, plant or materials; or
(b) in an emergency to avoid the loss of life, damage to property or to prevent environmental harm; or
(c) where the works are inaudible at the nearest sensitive receivers; or
(d) where a variation is approved in advance in writing by the Planning Secretary or his nominee if appropriate justification is provided for the works.

Notification of such activities must be given to affected residents before undertaking the activities or as soon as practical afterwards.

Noise and vibration management measures

This section outlines noise management measures that will be implemented as part of the construction works, including consultation and complaint handling procedures.

It may not be feasible to adopt all management measures at all times during construction, and identification of all reasonable and feasible mitigation methods will be conducted by the site supervisor and/or environmental representative on a regular basis during noisy works near sensitive land uses.

In relation to the implementation of mitigation measures, feasibility addresses engineering consideration regarding what is practical to build. Reasonableness relates to the application of judgment in arriving at a decision, taking into account the following factors:

- work hours
- noise reduction achieved
- number of people or other uses benefited
- cost of the measure
- delay to schedule and whether the measure will prolong exposure to noise
- community views
- pre-construction noise levels at receivers

While the management measures presented will not necessarily result in mitigating all noise impacts at all times, they are expected to reduce impacts to levels most stakeholders should find acceptable considering the anticipated benefits of the completed project as a whole.

The noise management measures presented in Table 8-6 will be implemented throughout the construction of the Project where reasonable and feasible:

Table 8-6 Noise and vibration management measures

Subject	Reference	Management measures	Responsibility
Complaints	NV1	All potentially affected residences will be informed of the construction works including working hours to be adhered to, and the level and duration of noise to expect during construction at least five days and not more than 14 days prior to the noise event.	Site Construction & Environmental Compliance Officer
	NV2	All potentially affected residences will be kept informed of any significant changes to construction activities.	Site Construction & Environmental Compliance Officer
	NV3	Any complaints received related to noise or vibration will be dealt with.	Site Construction & Environmental Compliance Officer

Subject	Reference	Management measures	Responsibility
	NV4	All site personnel will be instructed during a general induction as to their responsibilities in minimising noise and adhering to the noise minimisation measures.	Site Construction & Environmental Compliance Officer
Timing	NV5	Works to be undertaken during Standard Construction Hours where possible.	Site Construction & Environmental Compliance Officer
	NV6	Ensure deliveries are within the standard hours of 7:00 am to 6:00 pm.	Site Construction & Environmental Compliance Officer / Site Foreman
Equipment	NV7	Equipment operators are to report any faulty equipment.	Site Foreman
	NV8	There will be no dropping of materials from heights, throwing of metal items, or slamming of doors.	All site personnel
	NV9	Any equipment not in use for extended periods during construction work will be switched off.	All site personnel
	NV9	All vehicles and equipment will be regularly serviced, as per manufactures instructions and maintained in proper working order.	Site Construction & Environmental Compliance Officer
	NV10	Simultaneous operation of noisy plant will be avoided wherever practicable.	Site Foreman
	NV11	Wherever practicable, noisy equipment will be: a) Positioned behind structures that act as barriers to identified receptors. b) Positioned at the greatest distance from identified receptors. c) Oriented to directed noise emissions away from identified receptors.	Site Construction & Environmental Compliance Officer
	NV12	“Quiet” practices will be employed wherever practicable when operating equipment. Examples of quiet practices include (but are not limited to) avoiding unnecessary revving of engines, preventing forklift tines or excavator buckets from impacting on the ground, minimising the use of horns and/or public address systems where possible.	Site Foreman
	NV13	Any noisy construction activities will be completed in the shortest time possible.	All site personnel
Site personnel management	NV14	The induction of site staff will include a reference to potential noise impacts and the identification of noise-sensitive land uses.	Site Construction & Environmental Compliance Officer

Subject	Reference	Management measures	Responsibility
	NV15	'Toolbox talks' will include a reference to any noise management measures being implemented on site at the time.	Site Foreman

Training and awareness

All Project personnel, subcontractors, consultants, and visitors will receive inductions prior to commencing on site. Project induction and training will fall under the following categories:

- General project induction; and
- Visitor induction.

Information specific to construction noise and vibration will be included in the general project induction and will include:

- Relevant approval conditions;
- Relevant legislation;
- All relevant project specific and standard noise and vibration mitigation measures;
- Location of nearest sensitive receptors;
- Designated loading/unloading areas and procedures;
- Standard construction hours (including deliveries); and
- Environmental incident and complaint procedures.

All inductions will be recorded in the training register held by the Site Construction & Environmental Compliance Officer.

Non-conformances

Non-conformances will be dealt with and documented in accordance with the complaints management system provided with the Project Construction Environmental Management Plan.

Complaints management

Any complaints received from the community regarding noise shall be addressed in accordance with the Complaints Handling Procedures provided in the Project Construction Environmental Management Plan.

Monitoring and reporting

Where a complaint is unable to be resolved to the satisfaction of the complainant, noise monitoring shall be undertaken to determine the contribution of noise from construction activities at the complainant's premises.

The noise monitoring will be undertaken by competent personnel who have received training in environmental noise monitoring. The measurements will be conducted in accordance with the procedures outlines in Australian Standard

AS 1055 “Acoustics – Description and measurement of environmental noise” and the NSW Industrial Noise Policy (INP). The following points should be followed when conducting noise monitoring:

- A field calibration should be conducted before and after measurements;
- The sound level meter must be set to an A-weighting and Fast;
- The sound level meter sample period should be set to 15-minutes;
- The following descriptors should be measured as a minimum: LA1, LAeq and LA90; and
- Measurements should be conducted a minimum of three metres from the nearest façade and/or solid fence/wall. If it is not possible to do this, corrections for façade reflection should be applied to the measurement results.

The results of the noise monitoring shall quantify the contribution of noise from construction works at complainant premises and assist in determining what corrective actions, if any, are required to address the complaint.