

Noise Impact Assessment

Steel River East Battery Energy Storage System

28-Mar-2025
Steel River East Battery Energy Storage System
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Noise Impact Assessment

Steel River East Battery Energy Storage System

Client: Ausgrid

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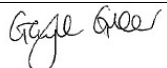
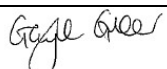
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Glossary of terms and abbreviations

Term	Definition																						
Sound power level	The total sound emitted by a source.																						
Sound pressure level	The amount of sound at a specified point.																						
Decibel [dB]	The measurement unit of sound.																						
A Weighted decibels [dB(A)]	The A weighting is a frequency filter applied to measured noise levels to represent how humans hear sounds. The A-weighting filter emphasises frequencies in the speech range (between 1 kHz and 4 kHz) which the human ear is most sensitive to, and places less emphasis on low frequencies at which the human ear is not so sensitive. When an overall sound level is A-weighted it is expressed in units of dB(A).																						
Decibel scale	The decibel scale is logarithmic in order to produce a better representation of the response of the human ear. A 3 dB(A) increase in the sound pressure level corresponds to a doubling in the sound energy. A 10 dB(A) increase in the sound pressure level corresponds to a perceived doubling in volume. Examples of decibel levels of common sounds are as follows: <table> <tr> <td>0 dB(A)</td><td>Threshold of human hearing</td></tr> <tr> <td>30 dB(A)</td><td>A quiet country park</td></tr> <tr> <td>40 dB(A)</td><td>Whisper in a library</td></tr> <tr> <td>50 dB(A)</td><td>Open office space</td></tr> <tr> <td>70 dB(A)</td><td>Inside a car on a freeway</td></tr> <tr> <td>80 dB(A)</td><td>Outboard motor</td></tr> <tr> <td>90 dB(A)</td><td>Heavy truck pass-by</td></tr> <tr> <td>100 dB(A)</td><td>Jack hammer / subway train</td></tr> <tr> <td>110 dB(A)</td><td>Rock concert</td></tr> <tr> <td>115 dB(A)</td><td>Limit of sound permitted in industry</td></tr> <tr> <td>120 dB(A)</td><td>747 take off at 250 metres.</td></tr> </table>	0 dB(A)	Threshold of human hearing	30 dB(A)	A quiet country park	40 dB(A)	Whisper in a library	50 dB(A)	Open office space	70 dB(A)	Inside a car on a freeway	80 dB(A)	Outboard motor	90 dB(A)	Heavy truck pass-by	100 dB(A)	Jack hammer / subway train	110 dB(A)	Rock concert	115 dB(A)	Limit of sound permitted in industry	120 dB(A)	747 take off at 250 metres.
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120 dB(A)	747 take off at 250 metres.																						
Frequency [f]	The repetition rate of the cycle measured in Hertz (Hz). The frequency corresponds to the pitch of the sound. A high frequency corresponds to a high-pitched sound and a low frequency to a low pitched sound.																						
Equivalent continuous sound level [L _{eq}]	The constant sound level which, when occurring over the same period of time, would result in the receiver experiencing the same amount of sound energy.																						
Insertion loss	Reduction in noise by inserting a barrier between the source and receiver.																						
L _{max}	The maximum sound pressure level measured over the measurement period.																						
L _{min}	The minimum sound pressure level measured over the measurement period.																						
L ₁₀	The sound pressure level exceeded for 10% of the measurement period. For 10% of the measurement period it was louder than the L ₁₀ .																						
L ₉₀	The sound pressure level exceeded for 90% of the measurement period. For 90% of the measurement period it was louder than the L ₉₀ .																						
Ambient noise	The all-encompassing noise at a point composed of sound from all sources near and far.																						

Term	Definition
Background noise	The underlying level of noise present in the ambient noise when extraneous noise (such as transient traffic and dogs barking) is removed. The L_{90} sound pressure level is used to quantify background noise.
Traffic noise	The total noise resulting from road traffic. The L_{eq} sound pressure level is used to quantify traffic noise.
Day	Construction noise: The period from 0700 to 1800 h Monday to Saturday and 0800 to 1800 h Sundays and Public Holidays. Road traffic noise: The period from 0700 to 2200 h every day of the week.
Evening	Construction noise: The period from 1800 to 2200 h Monday to Sunday and Public Holidays. Road traffic noise: Not applicable.
Night	Construction noise: The period from 2200 to 0700 h Monday to Saturday and 2200 to 0800 h Sundays and Public Holidays. Road traffic noise: The period from 2200 to 0700 h every day of the week.
Standard construction hours	Monday to Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays and public holidays
Assessment background level [ABL]	The overall background level for each day, evening and night period for each day of the noise monitoring.
Rating background level [RBL]	The overall background level for each day, evening and night period for the entire length of noise monitoring.
Noise management level [NML]	The level which represents the point above which there may be some community reaction to noise.

1.0 Introduction

Ausgrid proposes to construct, operate and maintain a 200 megawatts (MW) (2-hour duration, i.e. 400 MWh) battery energy storage system (BESS) adjacent to the Mayfield West zone substation, in the Steel River East industrial precinct (the Project). The Project would comprise a BESS to store energy from the grid, releasing it during high demand periods. The BESS would also perform other ancillary services for the grid.

AECOM Australia Pty Ltd (AECOM) has been commissioned to undertake a noise and vibration impact assessment for the Project. The assessment considers construction and operational noise and vibration.

1.1 Project overview

Key features of the Project would include the construction, operation, and maintenance of a BESS with a 200 MW maximum power output capacity with a 2-hour duration consisting of:

- Containerised battery units (112 Megapacks) and associated infrastructure, including inverters and 56 medium voltage transformers
- 33 kV underground cable connection from the battery units to Mayfield West zone substation infrastructure
- Combined switch room and control room building
- Eight ring main units (RMU)
- Onsite workshop facility
- Two auxiliary transformers
- Backup diesel generator
- Other ancillary infrastructure including fire suppression, stormwater management, 2.4 m high boundary security chain wire fencing, lighting and CCTV.

Access to the site would be via an existing Ausgrid-owned, shared driveway off McIntosh Drive. McIntosh Drive is a sealed single lane, two way council-owned road which connects to Steel River Boulevard and onward to the Industrial Drive (A43).

The BESS is intended to operate for 50 years with component replacements. At the end of this period, the BESS would be decommissioned and the site rehabilitated. Any extension to the life of the BESS would be subject to a separate approval at the time.

The BESS would operate 24 hours a day, seven days a week as an unmanned facility. Staff activity at the site would be limited to planned and unplanned maintenance only.

1.2 Site description

The site is located within Lot 16, DP 270249 being 1 McIntosh Drive, Mayfield West, NSW 2304. The site currently houses an Ausgrid substation that services the local industrial and residential area, as well as a data centre operated by Leading Edge Data Centres. The Project would be located in the eastern extent of the property.

The site is within the Newcastle City Council Local Government Area and is located within an existing general industrial precinct, on land zoned E4 General Industrial under the *Newcastle Local Environment Plan 2012*. The closest residential dwellings are located south of the site along Groongal Street, Simpson Court and Gregson Avenue, approximately 400 metres away.

The area proposed to be used for the BESS is located on the eastern side of the site. The site location is shown in Figure 1-1.

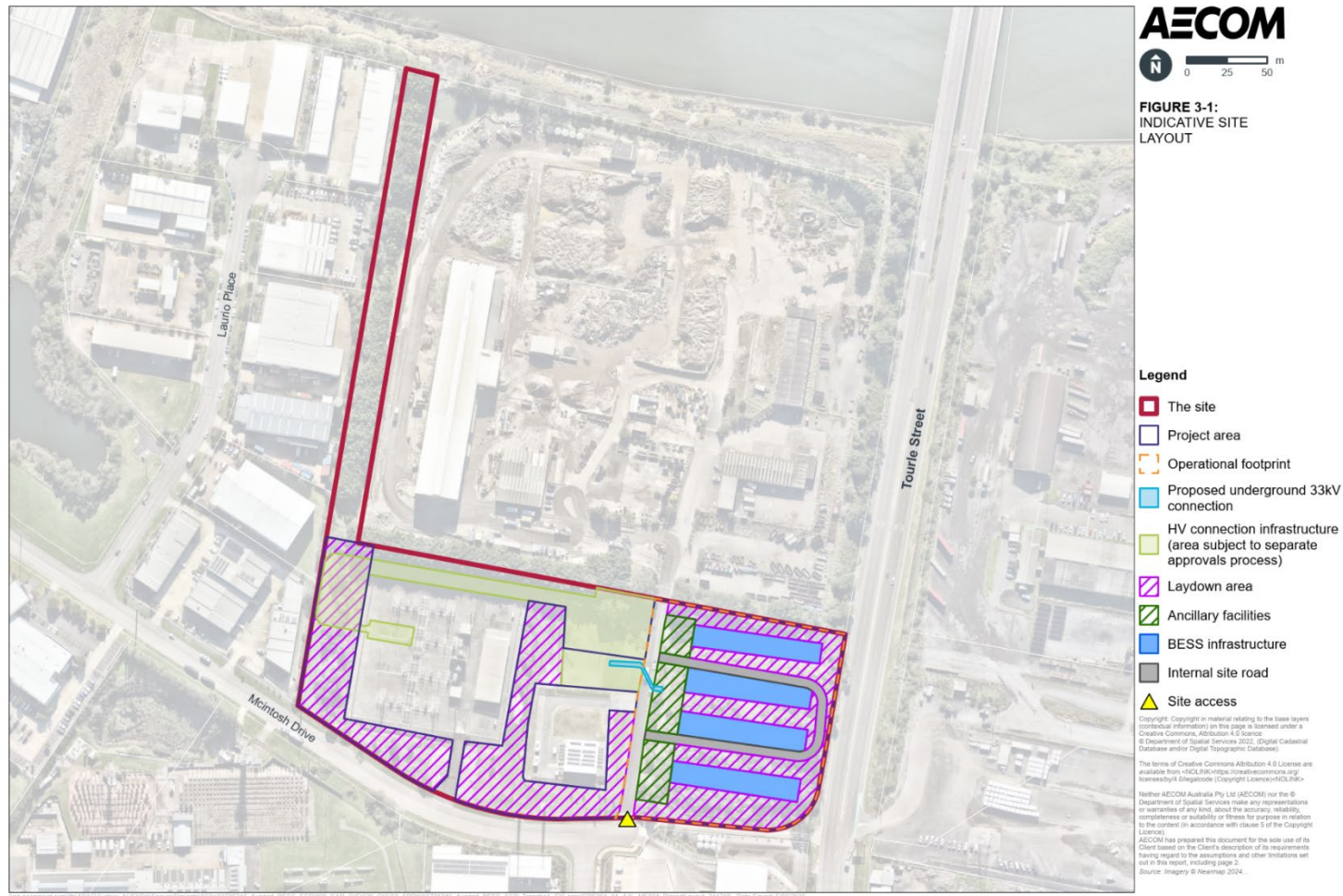


Figure 1-1 Site location

1.3 Purpose of this report

1.3.1 Assessment objectives

The objectives of this noise and vibration impact assessment are to:

- Identify nearby noise-sensitive receivers potentially impacted by the construction and operation of the Project
- Conduct site work (including ambient noise monitoring) to determine the relevant construction noise management levels and operational noise criteria for identified sensitive receivers
- Identify potential noise impacts from the construction and operation of the Project
- Outline mitigation measures, if required, relating to noise and vibration during construction and operational phases of the Project.
- It is noted that no vibration intensive equipment is proposed for use either during construction or operation of the Project, therefore a vibration impact assessment has not been completed.

1.4 Secretary's Environmental Assessment Requirements (SEARs)

SEARs for the Project were issued on 20 November 2024. The SEARs presented in Table 1-1 have informed the preparation of this noise impact assessment.

Table 1-1 SEARs - noise

Relevant SEARs	
Noise	Where addressed
The EIS must address the following specific matters: Noise – including an assessment of the construction noise impacts (including impacts from proposed road upgrades) of the development in accordance with the <i>Interim Construction Noise Guideline</i> (ICNG), operational noise impacts in accordance with the <i>NSW Noise Policy for Industry</i> (2017), traffic noise in accordance with the <i>NSW Road Noise Policy</i> (DECCW, 2011) and cumulative noise impacts (considering other developments in the area), including (where appropriate): • Details of noise monitoring survey, background noise levels and amenity noise levels at the most-affected residential receivers; • Identification of impacts associated with construction, site emission and traffic generation at noise affected sensitive receivers, including the provision of operational noise contours; • An assessment of 'worst case' noise emission scenarios during periods of discharging and charging; • Consideration of annoying characteristics of noise and prevailing meteorological conditions in the study area; • Details of the likely daily charging/discharging load profile, manufacturer specifications for plant and equipment and a noise source inventory (including intensity, quantity, location, directivity and frequency information); and	The assessment presented in this report is in accordance with the relevant guidelines as detailed in Section 1.5. Details of noise monitoring measurements, construction noise criteria and operational noise criteria is presented in Section 2.0 to Section 4.0. The assessments for the construction and operational impacts are detailed in Section 5.0 and Section 6.0 respectively. Noise contours for the construction and operational assessment results are presented in Appendix B and Appendix C respectively. The equipment specifications, sound power levels, equipment layout and charging/discharging load profile for the BESS is detailed in Section 6.2.

Relevant SEARs	
Noise	Where addressed
Details and analysis of the effectiveness of proposed management and mitigation measures to adequately manage identified impacts, including a clear identification of residual noise and vibration impacts following application of these mitigation measures and details of any proposed compliance monitoring programs.	Management and mitigation measures outlined in Section 7.0 would be included in a Construction Noise Management Plan for the Project, where feasible and reasonable. Noise monitoring plans for the construction and operation of the BESS site have also been presented in Section 7.0.

1.5 Relevant guidelines

Construction

- Interim Construction Noise Guideline*, Department of Environment and Climate Change, NSW (DECC 2009)
- Assessing Vibration: a technical guideline*, Department of Environment and Conservation (DEC 2006)
- Construction Noise and Vibration Guideline (Public Transport Infrastructure)*, Transport for NSW (TfNSW 2023)
- NSW Road Noise Policy*, Department of Environment, Climate Change and Water NSW (DECCW 2011).

Operation

- NSW Protection of the Environment Operations Act 1997* (POEO Act 1997)
- NSW Noise Policy for Industry*, NSW Environment Protection Authority (EPA 2017)
- NSW Road Noise Policy*, Department of Environment, Climate Change and Water NSW (DECCW, 2011).

2.0 Existing acoustic environment

2.1 Assessment receivers

The existing acoustic environment is largely defined by general industrial noise and road traffic noise from Industrial Drive and Tourle Street. Figure 1-1 shows the nearby noise sensitive receivers which could potentially be affected by the Project that have been assessed within this report. The closest residential receivers are located approximately 400 m to the south of the site. The closest non-residential noise sensitive receivers are located to the southwest and south of the site, and include a childcare centre (around 340 m from the site), places of worship (around 350 m from the site), and a school (around 520 m from the site).

The receivers selected for modelling consist mostly of residential dwellings. The assessment receiver locations, along with the land use classification of each receiver (as defined in the *Noise Policy for Industry*), are presented in Table 2-1 and shown in Figure 2-1.

Table 2-1 Assessment receiver locations

Receiver	Distance from project area	Address	Land use classification
R1	568 m	118 Woodstock Street, Mayfield	Residential
R2	475 m	33 Simpson Court, Mayfield	Residential
R3	447 m	7 Simpson Court, Mayfield	Residential
R4	435 m	5A Simpson Court, Mayfield	Residential
R5	436 m	3 Simpson Court, Mayfield	Residential
R6	437 m	1 Simpson Court, Mayfield	Residential
R7	414 m	3 Groongal Street, Mayfield West	Residential
R8	411 m	13 Groongal Street, Mayfield West	Residential
R9	415 m	33 Groongal Street, Mayfield West	Residential
R10	429 m	43 Groongal Street, Mayfield West	Residential
R11	450 m	53 Groongal Street, Mayfield West	Residential
R12	453 m	35 Gregson Avenue, Mayfield West	Residential
R13	561 m	62 Gregson Avenue, Mayfield West	Residential
R14	588 m	80 Gregson Avenue, Mayfield West	Residential
R15	985 m	77 Stevenson Avenue, Mayfield West	Residential
R16	978 m	79 Stevenson Avenue, Mayfield West	Residential
R17	498 m	8 Simpson Court, Mayfield	Residential
R18	464 m	2 Groongal Street, Mayfield West	Residential
R19	465 m	36 Groongal Street, Mayfield West	Residential
A1	677 m	Strikers Softball Club, 62/78 Stevenson Avenue, Mayfield West	Active Recreation
A2	763 m	Stevenson Park Baseball Field	Active Recreation
E1	336 m	Imagine Early Learning & Childcare, 9 Murray Dwyer Circuit, Mayfield West	Child Care Centre
E2	536 m	Mayfield West Public School, 7 Gregson Avenue, Mayfield West	Education
P1	370 m	The Grainery Church, 11 Murray Dwyer Circuit, Mayfield West	Place of Worship

Receiver	Distance from project area	Address	Land use classification
P2	452 m	Mayfield Church of Christ, 31 Gregson Avenue, Mayfield West	Place of Worship

Compliance with the relevant criteria at the nearest receivers outlined in Table 2-1 means compliance at other residential and non-residential receivers located further away.

There are a number of non-noise sensitive receivers such as industrial and commercial receivers close to the site. These receivers have less stringent criteria than the noise sensitive receivers listed above, however they are also considered in this assessment.



Steel River East BESS - Assessment Receivers

- Assessment Receivers
- ▭ BESS site



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Source: Neemap 2024.

Figure 2-1 Assessment receiver locations

2.2 Noise measurement methodology

Long term unattended and short term attended measurements were undertaken to establish the existing ambient and background noise environment at potentially affected receivers.

All the acoustic instrumentation employed during the noise measurements comply with the requirements of AS IEC 61672.1-2004 *Electroacoustics - Sound level meters - Specifications* and were within their current National Association of Testing Authorities, Australia (NATA) certified in-calibration period (i.e. calibration in the last two years).

2.2.1 Unattended noise measurement methodology

Unattended noise measurements were conducted with a Rion NL-52 noise logger at one location adjacent to Industrial Drive (at the northern boundary of 19 Groongal Street, Mayfield West) from 4 April 2024 to 24 April 2024. Figure 2-2 shows the unattended noise logging location.

In accordance with the EPA's NSW *Noise Policy for Industry*, noise data over the monitoring period affected by adverse weather conditions or extraneous noise events were excluded from the monitoring data. The *Noise Policy for Industry* advises that data may be affected where adverse weather, such as wind speeds higher than 5 m/s or rain, occurs. Weather data was acquired from the Bureau of Meteorology's Newcastle Nobbys weather station (station number 094774).

The logger measured the noise levels over the sample period and determined L_{A1} , L_{A10} , L_{A90} , and L_{Aeq} levels of the noise environment. The L_{A1} , L_{A10} and L_{A90} noise levels are the levels exceeded for 1%, 10% and 90% of the measurement period respectively. The L_{A90} is taken as the background level. The L_{A1} is indicative of the maximum noise levels due to individual noise events such as the pass-by of a heavy vehicle. The L_{Aeq} level is the equivalent continuous sound level and has the same sound energy over the sample period as the actual noise environment with fluctuating sound levels.

The L_{A90} noise levels were analysed to determine a single assessment background level (ABL) for each day, evening and night period in accordance with the *Noise Policy for Industry*. The ABL is established by determining the lowest ten-percentile level of the L_{A90} noise data acquired over each period of interest. The background noise level or rating background level (RBL) representing the day, evening and night-time assessment periods is based on the median of individual ABLs determined over the entire monitoring period.



Steel River East BESS - Noise Logger Location

- BESS site
- Attended Measurement & Logger Location
- Attended Measurement Location



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Figure 2-2 Noise monitoring locations

2.2.2 Attended noise measurement methodology

Attended noise measurements were conducted at the unattended monitoring location and near the existing substation at 1 McIntosh Drive on 24 April 2024, during the daytime period, see Figure 2-2. Each measurement was conducted over a 15-minute period. Weather conditions were clear on the day of monitoring, with very light winds.

Attended noise measurements were conducted using a Brüel & Kjær Type 2250 sound level meter. The sound level meter used is designated as a Class 1 instrument and has accuracy suitable for laboratory and field use. The sound level meter was calibrated before and after the measurements with no drift in calibration exceeding ± 0.5 dB.

2.3 Noise measurement results

2.3.1 Unattended noise measurement results

Table 2-2 presents the existing overall representative L_{Aeq} ambient noise level and the background L_{A90} noise levels for the day, evening and night-time periods, in accordance with the *Noise Policy for Industry*. The overall representative L_{Aeq} noise levels were determined by logarithmically averaging each assessment period for the entire monitoring period.

Some periods of noise logging were excluded due to adverse weather. The data were processed in accordance with Fact Sheet B of the *Noise Policy for Industry*.

The results for each day and the graphical noise logging results are presented in Appendix A.

Table 2-2 Existing background (L_{A90}) and ambient (L_{Aeq}) noise levels

Noise logger ID	Location	L_{A90} background rating noise level, dB(A)			Log average noise (ambient) L_{Aeq} levels dB(A)		
		Day	Evening	Night	Day	Evening	Night
NL1	Industrial Drive, northern boundary of 19 Groongal Street	57	53	46	75	73	70

Notes:

1. Day is defined as 7:00 am to 6:00 pm, Monday to Saturday and 8:00 am to 6:00 pm Sundays & Public Holidays. Evening is defined as 6:00 pm to 10:00 pm, Monday to Sunday & Public Holidays. Night is defined as 10:00 pm to 7:00 am, Monday to Saturday and 10:00 pm to 8:00 am Sundays & Public Holidays.

2.3.2 Attended noise measurements

The results of the attended noise monitoring are presented in Table 2-3. The daytime measurements indicated that residential receivers are generally affected by road traffic noise.

Table 2-3 Attended noise measurements

Location	Date and time	L_{Aeq} dB(A)	L_{A90} dB(A)	Comments
Industrial Drive, northern boundary of 19 Groongal Street	24/04/2024 2:02pm	76	66	Road traffic noise on Industrial Drive dominant, 65-78 dB(A). Police car pass-by with sirens on, 87 dB(A). Cars accelerating on Industrial Drive, 75 dB(A).
1 McIntosh Drive	24/04/2024 2:44pm	66	53	Road traffic noise dominant. Car pass-bys on McIntosh Drive, 55-68 dB(A). Distant industrial noise from the north. Shovelling and scraping at the rear of Qualtest Laboratory. Concrete truck pass-by on McIntosh Drive, 75-77 dB(A). No audible noise heard from existing substation.

Refer to Figure 2-2 for the unattended noise logging location.

2.4 Noise catchment areas

Noise catchment areas (NCAs) are used to group residential receivers within a similar noise environment and define appropriate construction NMLs. Generally, NCAs are defined based on the unattended noise monitoring locations. Unattended noise monitoring for the Project was conducted at one location only. The background noise levels measured at this location are not considered representative for residential receivers within the study area located further away from major roads such as Industrial Drive and the Pacific Highway (Maitland Road). Therefore, two NCAs have been determined for the Project and are defined in Table 2-4.

Table 2-4 Noise catchment areas

NCA	Description of NCA	L _{A90} background rating noise levels used
1	Residential receivers with line of sight to Industrial Drive and Pacific Highway (Maitland Road)	Measured L _{A90} noise levels for NL1
2	All other residential receivers (no line of sight to Industrial Drive and Pacific Highway (Maitland Road))	Measured L _{A90} noise levels for NL1 – 5 dB(A) ¹

Notes:

1. The L_{A90} background rating noise levels for NCA 2 have been determined by subtracting 5 dB(A) from the measured L_{A90} noise levels for NL1 in order to account for shielding provided by the first row of residential buildings in NCA 1.

Refer to Figure 2-3 below for the Project NCAs.



Steel River East BESS - NCAs

- NCA 1
- NCA 2
- BESS site
- Project area

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Source: Hearmap 2024

Figure 2-3 Noise catchment areas

3.0 Construction noise criteria

3.1 Construction noise

The *Interim Construction Noise Guideline* is a NSW Government document that sets out ways to deal with the impacts of construction noise on residences and other sensitive land uses. It presents assessment approaches tailored to the scale of the construction project and identifies practices to minimise noise impacts. As the proposed works are expected to continue for a period of more than three weeks, a quantitative assessment, based on worst-case construction scenarios, has been carried out for construction works.

Noise levels resulting from construction activities that are predicted at noise sensitive receivers (e.g. residences, schools, hospitals, places of worship, and active recreation areas) are compared to the noise management levels (NMLs) determined in accordance with the *Interim Construction Noise Guideline*. Where an exceedance of the NMLs is predicted, the *Interim Construction Noise Guideline* advises that receivers can be considered 'noise affected' and the proponent should apply all feasible and reasonable work practices to minimise the noise impact. The proponent should also inform all potentially affected residents of the nature of the works to be carried out, the expected noise level and duration, as well as contact details should they wish to make a complaint.

If construction noise levels at the receiver reach 75 dB(A), residential receivers are considered to be 'highly noise affected' and the proponent should, in consultation with the community, consider restrictions to the hours of construction to provide respite periods.

The *Interim Construction Noise Guideline* defines what is feasible and reasonable as follows:

- Feasible – a work practice or abatement measure is feasible if it is capable of being put into practice and is practical to build given project constraints such as safety and maintenance requirements
- Reasonable – selecting reasonable measures from those that are feasible involves making a judgment to determine whether the overall noise benefits outweigh the overall adverse social, economic, and environmental effects, including the cost of the measure.

The construction NMLs for residential and other sensitive land uses are detailed in Section 3.1.1 and 3.1.2 below. These NMLs will be used to guide the management of construction noise throughout construction.

3.1.1 Residential receivers

Guidance for setting construction NMLs for residential receivers is summarised in Table 3-1.

Table 3-1 Interim Construction Noise Guideline residential noise management levels

Time of day	NML, $L_{Aeq,15min}$, 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’ level RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise: - Where the predicted or measured $L_{Aeq,15min}$ 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 work, the expected noise levels and duration, as well as contact details.
	‘Highly noise Affected’ level 75 dB(A)	The highly noise affected level represents the point above which there may be 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: - Times identified by the community when they are less sensitive to noise (such as before and after school for work near schools, or mid-morning or mid-afternoon for work near residences) - 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’ level RBL + 5 dB	- 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 still more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community - The <i>Interim Construction Noise Guideline</i> provides guidance on negotiating agreements.

Notes:

- Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 metres above ground level. If the property boundary is more than 30 metres from the residence, the location for measuring or predicted noise levels is at the most noise-affected point within 30 metres of the residence.

Table 3-2 presents the NMLs applicable to residential receivers nearby to this development.

Table 3-2 Construction noise management levels - Residential receivers

Noise catchment area	Construction NML $L_{Aeq,15min}$, dB(A)			
	Standard hours (RBL + 10)	Outside standard hours (RBL + 5)		Highly noise affected level
	Day	Evening	Night	
NCA 1	67	58	51	75
NCA 2	62	53	46	

The *Construction Noise and Vibration Guideline (Public Transport Infrastructure)* sets out community perceptions of construction noise dependent upon the level of exceedance of the RBLs and NMLs. These are presented in Table 3-3.

Table 3-3 Community perception of construction noise

Perception	dB(A) above RBL	dB(A) above NML – Standard hours	dB(A) above NML – Out of hours
Noticeable	5 – 10	0	0 - 5
Clearly audible	10 – 20	0 - 10	6 – 15
Moderately intrusive	21 – 30	11 – 20	16 – 25
Highly intrusive	> 30	> 20	> 25

3.1.2 Non-residential receivers

Construction NMLs recommended by the *Interim Construction Noise Guideline* for non-residential sensitive land uses, such as schools, community centres or places of worship, are provided in Table 3-4. Construction NMLs for commercial and industrial premises are provided in Table 3-5.

Table 3-4 Construction noise management levels - Non-residential sensitive land uses

Land use	Construction NML, $L_{Aeq,15\text{ min}}$
Education (classrooms at schools and other educational institutions and childcare centres)	External noise level 55 dB(A) ¹
Medical (hospital wards and operating theatres)	External noise level 55 dB(A) ¹
Places of worship	External noise level 55 dB(A) ¹
Active recreation areas (characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion)	External noise level 65 dB(A)
Passive recreation areas (characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, for example, reading, meditation)	External noise level 60 dB(A)
Community centres	External noise level 55 dB(A) ²

Notes:

1. Based on an internal noise level of 45 dB outlined in the *Interim Construction Noise Guideline*, where a conservative estimate of 10 dB has been assumed between internal and external noise levels.
2. Based on the design sound level for "Municipal buildings – Function spaces" from AS/NZS 2107:2016 *Acoustics – Recommended design sound levels and reverberation times for building interiors*. A conservative estimate of 10 dB has been assumed between internal and external noise levels.

Table 3-5 Construction noise management levels - Industrial and commercial land uses

Land use	Construction NML, $L_{Aeq,15\text{ min}}$
Industrial premises	External noise level 75 dB(A)
Commercial premises (offices, retail outlets)	External noise level 70 dB(A)

3.1.3 Construction road traffic

Noise from construction traffic on public roads is not covered by the *Interim Construction Noise Guideline*. However, the *Interim Construction Noise Guideline* does refer to the *Road Noise Policy* for the assessment of noise arising from traffic on public roads.

In accordance with the *Road Noise Policy*, to assess noise impacts from construction traffic, an initial screening test should be undertaken by evaluating whether existing road traffic noise levels would increase by more than 2 dB(A). Where the predicted noise increase is 2 dB(A) or less, then no further assessment is required. Where the predicted noise level increase is greater than 2 dB(A), and the predicted road traffic noise level exceeds the road category specific criteria, then noise mitigation should be considered for those receivers affected. The road category specific criteria are presented in Table 3-6 below. The *Road Noise Policy* does not require assessment of construction road traffic noise impacts to commercial or industrial receivers.

Table 3-6 Road traffic noise assessment criteria

Road category	Type of land use	Assessment criteria, dB(A)	
		Day (7am – 10pm)	Night (10pm – 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} (15 hour) 60 dB(A)	L _{Aeq} (9 hour) 55 dB(A)
Local roads	Existing residences affected by additional traffic on existing local roads generated by land use developments	L _{Aeq} (1 hour) 55 dB(A)	L _{Aeq} (1 hour) 50 dB(A)

4.0 Operational noise criteria

4.1 Environment Protection Authority – NSW Noise Policy for Industry

Operational industrial noise has the potential to affect nearby noise sensitive receivers. The *Noise Policy for Industry* sets out a procedure to determine project noise trigger levels relevant to a development. If it is predicted that the development is likely to result in noise levels which exceed the project noise trigger levels at existing noise sensitive receivers, then mitigation measures need to be considered to reduce the predicted noise level.

The assessment procedure for industrial noise sources has two components that must be satisfied:

- Controlling intrusive noise impacts in the short term for residences
- Maintaining noise level amenity for residences and other land uses.

Both components are assessed at the most affected point on or within the property boundary of the noise sensitive receiver site. These criteria apply to environmental noise emissions from any plant installed as part of the Project, and for residential receivers, represent the lower of the intrusive or amenity criteria.

4.1.1 Intrusive noise impacts

The *Noise Policy for Industry* states that the intrusiveness of an industrial noise source may generally be considered acceptable if the level of noise from the source (L_{Aeq} level), measured over a 15-minute period, does not exceed the background noise level measured by more than 5 dB. The RBL is the background noise level to be used for assessment purposes and is determined by the methods given in Section 3.1 of the *Noise Policy for Industry*.

The Project intrusive noise criteria are shown in Table 4-1 (based on unattended noise measurements conducted at the NL1 location)

Table 4-1 Recommended $L_{Aeq, 15 \text{ minute}}$ intrusive noise criteria levels from industrial noise sources

Time of day ¹	RBL ($L_{A90, 15 \text{ minute}}$)	Intrusive criterion RBL + 5 ($L_{Aeq, 15 \text{ minute}}$)
Day	57	62
Evening	53	58
Night	46	51

Notes:

1. Day is defined as 7:00 am to 6:00 pm, Monday to Saturday and 8:00 am to 6:00 pm Sundays and Public Holidays. Evening is defined as 6:00 pm to 10:00 pm, Monday to Sunday and Public Holidays. Night is defined as 10:00 pm to 7:00 am, Monday to Saturday and 10:00 pm to 8:00 am Sundays and Public Holidays.

4.1.2 Protecting noise amenity

To limit continuing increases in noise levels from the application of the intrusiveness level alone, the maximum ambient noise level resulting from industrial noise sources should not normally exceed the recommended amenity noise levels specified in Table 2.2 of the *Noise Policy for Industry*.

The relevant amenity criteria are shown in Table 4-4.

Table 4-2 Recommended L_{Aeq} amenity noise levels from industrial noise sources

Type of Receiver	Time of Day	Recommended L_{Aeq} Noise Level dB(A)
Residence - Urban	Day	60
	Evening	50
	Night	45
Commercial premises	When in use	65
Industrial premises	When in use	70

The site is located in an area dominated by high road traffic noise from major roads – Industrial Drive and Tourle Street. In some cases, the level of road traffic noise may be high enough to make noise from an industrial source effectively inaudible, even though the L_{Aeq} noise level from the industrial source may exceed the project amenity noise level. In such cases, the *Noise Policy for Industry* states that the project amenity noise level may be derived from the $L_{Aeq,period(traffic)}$ minus 15 dB(A).

The *Noise Policy for Industry* specifies that the high traffic project amenity noise levels may be applied if all the following apply:

- Traffic noise is identified as the dominant noise source at the site
- The existing traffic noise level is 10 dB or more above the recommended amenity noise level for the area
- It is highly unlikely traffic noise levels will decrease in the future.

As all of the above conditions apply to the Project area, the high traffic project amenity noise levels have been adopted. Table 4-3 presents the high traffic project amenity noise levels for residential receivers. As per the *Noise Policy for Industry*, the project amenity level is converted to a 15-minute period by adding 3 dB(A).

Table 4-3 High traffic project amenity noise levels for residential receivers from industrial sources

Time of day ¹	L_{Aeq} road traffic noise level $L_{Aeq,15\text{ minute}}$, dB(A)	Amenity criterion Ambient noise level – 15 + 3 ($L_{Aeq, 15\text{ minute}}$, dB(A))
Day	75	63
Evening	73	61
Night	70	58

Notes:

1. Day is defined as 7:00 am to 6:00 pm, Monday to Saturday and 8:00 am to 6:00 pm Sundays and Public Holidays. Evening is defined as 6:00 pm to 10:00 pm, Monday to Sunday and Public Holidays. Night is defined as 10:00 pm to 7:00 am, Monday to Saturday and 10:00 pm to 8:00 am Sundays and Public Holidays.

The relevant amenity criteria for non-residential receivers that may be affected by the operation of the Project are shown in Table 4-4.

Table 4-4 Recommended L_{Aeq} amenity noise levels for non-residential receivers from industrial sources

Type of Receiver	Time of Day	Recommended L_{Aeq} Noise Level dB(A)
School classroom - Internal	Noisiest 1-hour period when in use	40 ¹
Hospital ward – Internal	Noisiest 1-hour	35
Hospital ward – External	Noisiest 1-hour	50

Type of Receiver	Time of Day	Recommended L_{Aeq} Noise Level dB(A)
Place of worship – Internal	When in use	40
Active recreation area	When in use	55
Commercial premises	When in use	65
Industrial premises	When in use	70

Notes:

1. In the case where existing schools are affected by noise from existing industrial noise sources, the acceptable L_{Aeq} noise level may be increased to 40 dB $L_{Aeq(1hr)}$.

4.1.3 Project specific noise criteria

A summary of the environmental noise criteria for the Project is presented in Table 4-5.

Table 4-5 Project specific noise levels

Receiver	Period ¹	RBL ($L_{A90, 15 \text{ min}}$)	Intrusive criterion ($L_{Aeq, 15 \text{ min}}$)	Amenity criterion ($L_{Aeq, 15 \text{ min}}$)	Project specific noise criteria, ($L_{Aeq, 15 \text{ min}}$) ²
Residential	Day	57	62	63	62
	Evening	53	58	61	58
	Night	46	51	58	51

Notes:

1. Day is defined as 7:00 am to 6:00 pm, Monday to Saturday and 8:00 am to 6:00 pm Sundays and Public Holidays. Evening is defined as 6:00 pm to 10:00 pm, Monday to Sunday and Public Holidays. Night is defined as 10:00 pm to 7:00 am, Monday to Saturday and 10:00 pm to 8:00 am Sundays and Public Holidays.
2. Project specific noise levels determined as the lowest of the intrusive and amenity criteria.

4.1.4 Applying the Noise Policy for Industry to existing sites

Section 6.1 of the *Noise Policy for Industry* acknowledges that many existing industrial sites were designed for higher noise emission levels than the project noise trigger levels noted in Table 4-4 above. Industrial sites may have existed before any noise-sensitive developments occurred in the area, or may have been designed before noise control legislation was introduced.

The *Noise Policy for Industry* notes there is no ‘one-size-fits-all’ approach to determine noise impacts from existing industry. However, it notes that the following governing principles should be applied when determining the project noise trigger levels and/or assessment requirements for existing industry:

“The project noise trigger levels should not be applied as mandatory noise limits. The project noise trigger level is the level used to assess noise impact and drive the process of assessing all feasible and reasonable control measures.

Where an existing industry has been in operation for more than 10 years and existing site operations exceed the project amenity noise level, the project amenity noise level may be adopted as the project noise trigger level to assess existing, and existing plus proposed site operations, as relevant.

Where a development proposal involves a discrete process, and premises-wide mitigation has or is to be considered outside of the development proposal, a project noise trigger level for noise from new/modified components (not the whole site) of the operation may be set at 10 dB(A) or more below existing site noise levels or requirements. This approach means that the increase in noise from the whole site is minimised and provides scope for existing components to achieve noise reductions over time”

An assessment of existing operations presented in Section 6.2.1 shows that existing noise levels are currently below the relevant project noise trigger levels in Section 4.1.3 above. Therefore, the project noise trigger levels were used as the basis for determining any reasonable and feasible control measures for the operational BESS.

4.1.5 Tonality and *Noise Policy for Industry* modifying factors

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

Fact Sheet C in the *Noise Policy for Industry* sets out corrections for annoying characteristics. The corrections are to be applied having regard to:

- The contribution noise level from the premises when assessed/measured at a receiver location
- The nature of the noise sources and its characteristics.

Table 4-6 presents the annoying characteristic corrections potentially applicable to the Project.

Table 4-6 Modifying factor corrections (Noise Policy for Industry Factsheet C, Table C1)

Factor	Assessment/measurements	When to apply	Correction ¹	Comments
Tonal	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 ^{2,3}	Third octave measurements should be undertaken using unweighted or Z-weighted measurements. Note: Narrow-band analysis using the reference method in ISO1996-2:2007, Annex C may be required by the consent/regulatory authority where it appears that a tone is not being adequately identified, e.g. where it appears that the tonal energy is at or close to the third octave band limits of contiguous bands.
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 C2⁴ are exceeded by up to and including 5 dB and cannot be mitigated, a 2 dB 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	A difference of 15 dB or more between C- and A-weighted measurements identifies the potential for an unbalance spectrum and potential increased annoyance. The values in Table C2 are derived from Moorhouse (2011) for the UK Department for Environment, Food & Rural Affairs (DEFRA) fluctuating low-frequency noise criteria with corrections to reflect external assessment locations.

Notes:

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.
4. Table C2 is reproduced as Table 4-7 overleaf.

Table 4-7 presents the low frequency noise thresholds from the *Noise Policy for Industry*.

Table 4-7 One-third octave low-frequency noise thresholds (*Noise Policy for Industry* Factsheet C Table C2)

Hz/dB(Z)	One-third octave $L_{Zeq, 15min}$ threshold level												
Frequency (Hz)	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160
dB(Z)	92	89	86	77	69	61	54	50	50	48	48	46	44

4.1.6 Maximum noise level assessment

The *Noise Policy for Industry* requires the potential for sleep disturbance to be assessed by considering maximum noise levels events during the night-time period.

Where the subject development/premises night-time noise levels at a residential location exceed the following screening levels a detailed maximum noise level event assessment should be undertaken:

- $L_{Aeq, 15min}$ 40 dB(A) or the prevailing RBL plus 5 dB(A), whichever is the greater, and/or
- L_{AFmax} 52 dB(A) or the prevailing RBL plus 15 dB(A), whichever is the greater.

The detailed assessment should cover the maximum noise level, the extent to which the maximum noise level exceeds the rating background noise level, and the number of times this happens during the night-time period.

Based on the measured background noise levels during the night, the sleep disturbance criteria required for compliance for the nearest noise sensitive residential receivers are presented in Table 4-8.

Table 4-8 Night-time sleep disturbance screening levels

Location	Measured night-time RBL, $L_{A90, 15min}$ dB(A)	Sleep disturbance screening levels for compliance, dB(A)	
		$L_{Aeq, 15min}$	$L_{AF, max}$
Residential receivers	46	51	61

The Project is proposed to operate during all periods of the day. Noise from the BESS and other equipment on-site is predicted to be steady-state and non-impulsive and therefore $L_{AF, max}$ noise levels are likely to be very similar to the $L_{Aeq, 15min}$ noise levels. Given this, compliance to the EPA's project noise trigger levels will imply compliance to sleep disturbance criteria for these steady-state noise sources.

4.2 Operational road traffic noise criteria

To assess noise impacts from increases in operational traffic, an initial screening test should be undertaken by evaluating whether existing road traffic noise levels will increase by more than 2 dB(A). Where the predicted noise increase is 2 dB(A) or less, then no further assessment is required. Where the predicted noise level increase is greater than 2 dB(A), and the predicted road traffic noise level exceeds the road category specific criterion then noise mitigation should be considered for those receivers affected. The *Road Noise Policy* does not require assessment of noise impact to commercial or industrial receivers.

4.3 Operational vibration

As noted in Section 1.3.1, the Project is not expected to generate operational vibration as the operation would not involve vibration generating activities that would create significant vibration levels at nearby sensitive receivers or adjacent properties. Therefore, an assessment of the operational vibration impacts is not required.

5.0 Construction noise assessment

5.1 Construction noise modelling scenarios

Table 5-1 provides a summary of the construction noise scenarios, including the proposed construction plant/equipment for each scenario and their associated sound power levels. The three noisiest construction scenarios were assessed:

- Scenario 1 – Site establishment
- Scenario 2 – Civil works for BESS
- Scenario 5 – Landscaping.

All scenarios were assessed as standard hours construction work. All major construction work is expected to be completed during standard hours only.

Electrical fit-outs inside the control room and megapacks may be carried out during out-of-hours and on weekends. These works, which would mainly be conducted using hand tools, are unlikely to be noisy and would be unlikely to result in exceedances at nearby sensitive receivers. Therefore, this scenario has not been considered.

Table 5-1 Construction assessment stages and scheduling

Phase	Construction stage	Equipment	SWL per unit, dB(A)
Scenario 1	Site establishment	Excavator (5 t)	93
		Front end loader	104
		Truck – dump	110
		Grader	114
		Truck – road	108
		Compactor	101
		Truck – water	113
		Light vehicle (4WD)	103
		Diesel generator	103
		Total	118
Scenario 2	Civil works for BESS	Hand tools	94
		Crane – franna ¹	97 ¹
		Diesel generator	103
		Pump – concrete	109
		Front end loader	104
		Bobcat	104
		Truck – dump	110
		Excavator (5t)	93
		Grader	114
		Compactor	101
		Truck – water	113
		Truck – concrete	109
		Elevated work platform	97

Phase	Construction stage	Equipment	SWL per unit, dB(A)
		Saw – concrete ^{1,2}	118 ^{1,2}
		Backhoe	111
		Light vehicle (4WD)	103
		Total	122
Scenario 3	Electrical works	Hand tools	94
		Diesel generator	103
		Crane – franna ¹	97 ¹
		Light vehicle (4WD)	103
		Total	107
Scenario 4	Operational equipment	Hand tools	94
		Diesel generator	103
		Crane – franna ¹	97 ¹
		Light vehicle (4WD)	103
		Elevated work platform	97
		Total	107
Scenario 5	Landscaping	Excavator (5 t)	93
		Crane – franna ¹	98
		Diesel Generator	103
		Truck – road	108
		Light vehicle (4WD)	103
		Total	110

Notes:

- Sound powers are time weighted (i.e. expected utilisation percentage per 15 minute period) in accordance with the following:
 - Concrete saw – 33%
 - Franna – 75%
- Equipment with special audible characteristics, likely to cause annoyance due to tonality, low frequency noise, impulsive or intermittent noise events. Penalty of +5 dB included in the sound power level.

5.2 Noise modelling methodology

Noise levels due to the construction activities shown in Section 5.1 have been predicted at nearby noise sensitive receivers using SoundPLAN 8.2 noise modelling software. The noise model was created to represent 'reasonable' worst-case periods of construction works. The following features were included in the noise model:

- Ground topography
- Ground absorption and reflection
- Receivers
- Construction noise sources.

It is noted that there may be differences between predicted and measured noise levels due to variations in instantaneous operating conditions, plant/equipment in operation during the measurement and also the location of the plant/equipment. The acoustic shielding calculated in the model due to fixed building structures would also vary as the construction plant/equipment moves around the site.

5.2.1 Construction modelling assumptions

The following assumptions have been made in modelling all construction noise scenarios:

- For all construction scenarios, all equipment would be operating at the same time, which is unlikely, and is a conservative assumption
- Plant/equipment is assumed to be operating at the Project area boundary at the closest point to each receiver, in order to present the worst-case scenario for each receiver. In reality, the plant/equipment would only be at the closest point to each receiver for limited periods
- Neutral atmospheric conditions, i.e. relatively calm, no wind.

5.3 Predicted construction noise levels

Construction noise levels at the identified residential and non-residential receivers have been assessed against the standard hours NMLs. The level of impact may change depending on the final construction methodology and further assessment would be undertaken if required.

Construction noise contours calculated at 1.5 m above ground level are presented in Appendix B.

Table 5-2 presents the construction noise modelling results for residential and non-residential receivers.

Table 5-2 Predicted construction noise levels with highlighted exceedances – standard hours

Receiver	Standard hours NML	Highly affected level	Construction phase			Compliant (Y/N)
			Site establishment	Civil works	Landscaping	
R1	67	75	49	53	41	Y
R2	67	75	48	52	40	Y
R3	67	75	52	56	44	Y
R4	67	75	51	55	43	Y
R5	67	75	52	56	44	Y
R6	67	75	52	56	44	Y
R7	67	75	45	49	37	Y
R8	67	75	43	47	35	Y
R9	67	75	45	49	37	Y
R10	67	75	52	56	44	Y
R11	67	75	47	50	39	Y
R12	67	75	44	48	36	Y
R13	67	75	47	51	39	Y
R14	67	75	49	53	41	Y
R15	67	75	45	49	37	Y
R16	67	75	45	49	37	Y
R17	62	75	51	55	43	Y
R18	62	75	50	54	42	Y
R19	62	75	51	55	43	Y
A1	65	-	48	52	40	Y
A2	65	-	46	50	38	Y
E1	55	-	49	53	41	Y

Receiver	Standard hours NML	Highly affected level	Construction phase			Compliant (Y/N)
			Site establishment	Civil works	Landscaping	
E2	55	-	49	54	41	Y
P1	55	-	50	55	42	Y
P2	55	-	49	53	41	Y

The results above show that construction noise levels are not predicted to exceed the NMLs during standard hours at any residential or non-residential receiver. There are no receivers predicted to be 'highly affected' for the construction scenarios assessed.

5.4 Construction traffic assessment

The predicted construction traffic volumes required for the Project during the peak construction period include the following:

- Average of 20 heavy vehicles per day
- Average of 10 oversized vehicles per day.

It has been conservatively assumed that all construction vehicle movements would occur during a 1-hour period. The construction traffic volumes were assumed to be evenly distributed across day and night periods.

Table 5-3 Existing traffic flows and additional construction traffic flows

Period	Route	Existing traffic		Additional traffic		Relative noise increase, dB(A)
		Light	Heavy	Light	Heavy	
AM off peak hour	Industrial Drive	483	93	68	9	0.5
PM off peak hour		106	28	68	9	1.6

Considering the existing traffic on the main access road (Industrial Drive), the additional road traffic would not increase overall road traffic noise levels by more than 2 dB(A). An increase of up to 2 dB(A) represents a minor impact that is considered barely perceptible to the average person. As such no consideration of noise mitigation measures is required.

5.5 Construction vibration assessment

As noted in Section 1.3.1, from the indicative construction equipment listed in Table 5-1, there is no vibration-intensive equipment proposed to be used for any construction scenario. In addition, the nearest sensitive receiver is located approximately 350 m from the Project. Therefore, a construction vibration assessment is not deemed necessary and has not been considered further in this report.

6.0 Operational noise assessment

The operational noise sources that have the potential to affect nearby receivers include the batteries, inverters and transformers.

6.1 Modelling methodology

6.1.1 General modelling assumptions

Noise levels due to the operational activities at the site were predicted at nearby noise sensitive receivers using SoundPLAN version 8.2 (industry standard) noise modelling software. The operational noise levels were predicted using an implementation of the CONCAWE propagation algorithm with both neutral and noise-enhancing meteorological conditions.

6.1.2 Modelling conditions

The noise modelling includes:

- Neutral and noise-enhancing meteorological conditions
- Ground topography
- Buildings and structures
- Megapack 2XL sources modelled as vertical area sources, calibrated to measured Tesla data
- Transformers behaving as point sources
- Ground absorption.

The noise model considers significant noise sources and locations, screening effects, receiver locations, ground topography and noise attenuation due to geometrical spreading, air absorption, ground absorption and the effects of the prevailing weather conditions. All predicted noise levels are free-field levels, assessed at the most affected point within the residential boundary, 1.5 m above ground level.

6.2 Modelled operational scenario

The location, quantity, and specification of equipment is subject to change during the detailed design stage. This operational noise assessment should be treated as a proof of concept for the overall noise levels generated by the Project, and the type of equipment to be installed.

6.2.1 Existing operational scenario

No audible noise was observed from the existing substation during attended measurements. Local industrial noise and road traffic noise made it difficult to determine the noise contribution from the substation. Hence, previously tested sound power levels of the substation transformers were used in modelling the existing substation noise. These are presented in Table 6-1 below.

Table 6-1 Existing plant items sound power levels

Plant item/operation	Sound power level, L_{Aeq} , dB(A)
Existing Tx1 – P0759D	71
Existing Tx1 – P0759C	72

6.2.2 Future operational scenario

To assess a reasonable worst-case operational scenario, modelling assumes that all of the proposed equipment within the site would operate at full capacity, 24 hours per day, seven days per week. This is a conservative assumption as time periods where equipment would generate the highest noise levels are not known and therefore this methodology ensures that operational noise impacts are not underpredicted.

Compliance with the night-time project noise trigger level would demonstrate compliance for all residential receivers during all periods of the day.

The operational equipment is generally categorised as steady-state or quasi steady-state noise sources which typically produce continuous and consistent noise levels.

To achieve the stated capacity for the Project, it is expected that the electrical equipment would be required in the following numbers:

- 112 x Megapack 2XL battery enclosures, including inverters
- 56 x medium voltage (MV) transformers.

The sound power levels for the electrical equipment were provided by the respective manufacturers and have been used to model the noise emission from the site. The location of the proposed BESS infrastructure is shown in Figure 1-1.

The sound power level inputs presented in Table 6-2, provided by the manufacturers, were used in the noise modelling and were assumed to be operating continuously for an entire 15-minute assessment period.

Table 6-2 Plant items sound power levels

Plant item/operation	Number of items	Sound power level, L_{Aeq} , dB(A)
Megapack 2XL (2-hour 9 fan configuration)	112	96 ¹
MV transformer	56	77

Notes:

1. Sound power levels have been taken from 'Tesla Megapack 2XL Sound Data – Quiet Version' provided in Q3 2024.

The likely load profile for the BESS would comprise of charging during the day and discharging in the evening peak period. If there is a network incident or high demand from the grid, the charging and discharging profile would change to periods outside of these times.

6.2.3 Maximum noise levels

In AECOM's experience, L_{Amax} sound power levels of electrical equipment are typically not greater than 5 dB above L_{Aeq} sound power levels. Given that the sleep disturbance criterion is 10 dB less stringent than the project noise trigger level, compliance with the project noise trigger level would result in compliance with the sleep disturbance criteria. Therefore, no further consideration has been given to the sleep disturbance assessment.

6.3 Existing operational noise levels

Existing operational noise levels were predicted at nearby sensitive receivers using the methodology outlined in Section 6.1, and the inputs from Section 6.2.1 under noise enhancing conditions. This scenario has been assessed against the project amenity noise levels shown in Section 4.1.2 in accordance with Section 4.1.3 to determine the suitability of using the project noise trigger levels for future compliance.

Table 6-3 Existing operational noise levels

Receiver	Project amenity noise levels, $L_{Aeq,15minute}$, dB(A)	Predicted noise levels, dB(A)	Exceedance, dB(A)
R1	58	< 20	-
R2	58	< 20	-
R3	58	< 20	-
R4	58	< 20	-
R5	58	< 20	-
R6	58	< 20	-
R7	58	< 20	-

Receiver	Project amenity noise levels, $L_{Aeq,15minute}$, dB(A)	Predicted noise levels, dB(A)	Exceedance, dB(A)
R8	58	< 20	-
R9	58	< 20	-
R10	58	< 20	-
R11	58	< 20	-
R12	58	< 20	-
R13	58	< 20	-
R14	58	< 20	-
R15	58	< 20	-
R16	58	< 20	-
R17	58	< 20	-
R18	58	< 20	-
R19	58	< 20	-
A1	58	< 20	-
A2	58	< 20	-
E1	43	< 20	-
E2	43	< 20	-
P1	43	< 20	-
P2	43	< 20	-

The one third octave noise levels at the worst affected residential receivers were assessed against the modifying factor criteria in Table 4-6 and were not found to contain tonal or low frequency components.

6.3.1 Discussion of results

The results in Table 6-3 indicate that existing noise emissions from the substation are currently compliant with the project amenity noise levels. As a result, the future operation of the project should be assessed against the project noise trigger levels in accordance with Section 6.1 of the *Noise Policy for Industry*.

6.4 Predicted operational noise levels

Predicted noise levels at nearby noise sensitive receivers are presented in Table 6-4. Operational noise contours calculated at 1.5 m above ground level are provided in Appendix C. These contours are indicative only and should not be referred to for noise levels at specific receiver locations. Operational noise levels and contours presented in this report have been calculated under adverse weather conditions.

The one third octave noise levels at the worst affected residential receiver were assessed against the modifying factor criteria in Table 4-6 to check for tonal or low frequency components. The noise levels were found to contain tonal characteristics, and therefore a 5 dB(A) correction was added to the predicted L_{Aeq} noise levels for all assessed receivers.

Table 6-4 Predicted operational noise levels

Receiver	Project noise trigger levels, $L_{Aeq,15min}$, dB(A)			Predicted L_{Aeq} noise levels, dB(A) ¹	Exceedance, dB(A)
	Day	Evening	Night		
R1	62	58	51	46	-
R2				47	-
R3				50	-
R4				50	-
R5				50	-
R6				49	-
R7				46	-
R8				39	-
R9				39	-
R10				50	-
R11				46	-
R12				38	-
R13				40	-
R14				42	-
R15				37	-
R16				38	-
R17				49	-
R18				49	-
R19				49	-
A1	55	N/A	N/A	41	-
A2				38	-
E1	50	N/A	N/A	48	-
E2				49	-
P1	50	50	N/A	40	-
P2				40	-

Notes:

1. Predicted results include a +5 dB(A) correction to account for tonality.
2. For educational facilities and places of worship, the criteria are based on internal noise levels. A conservative minimum outside-to-inside attenuation of 10 dB(A), on the basis of open windows for natural ventilation, has been assumed to allow for an external noise assessment at the other sensitive receivers. Criteria have been adjusted accordingly.

6.4.1 Discussion of results

It can be seen in Table 6-4 that the predicted operational noise emissions from the Project do not exceed the project noise trigger levels at any of the assessment noise sensitive receivers during any period of the day.

From the contours in Appendix C it can be seen that operational noise levels are less than 65 dB(A) at commercial receivers and less than 70 dB(A) at industrial receivers.

6.5 Operational road traffic noise

Periodic asset management staff and contractors are expected to visit the site but for the most part the site will not be occupied permanently by staff. Minimal traffic movement generation is expected as a result of the operation of the BESS. Therefore, noise impacts arising from operational traffic need not be considered any further as an increase of more than 2 dB(A) would not occur. An increase of up to 2 dB(A) represents a minor impact that is considered barely perceptible.

7.0 Mitigation measures

7.1 Construction noise mitigation measures

7.1.1 Construction Noise Management Plan

A construction noise management plan (CNMP) would be developed and implemented for the Project. The CNMP would include feasible and reasonable safeguards to manage noise emissions from the Project and complaints received in relation to construction noise. The CNMP should include, as a minimum, the following:

- identification of nearby residences and other sensitive land uses
- description of approved hours of work
- description and identification of all construction activities, including work areas, equipment, and duration
- description of what work practices (generic and specific) would be applied to minimise noise
- a complaints handling process
- noise monitoring procedures
- overview of community consultation required for identified high impact work.

Construction work should be planned and carried out during standard construction hours wherever possible. Table 7-1 presents a summary of the standard mitigation measures which should be considered as mitigation measures within the CNMP where feasible and reasonable.

Table 7-1 Transport Construction Noise and Vibration Guideline (Public Transport Infrastructure) standard mitigation measures

Action required	Safeguard details
Management measures	
Implement stakeholder consultation measures	Periodic notification (monthly letterbox drop and website notification) detailing any night-time works, with the exception of electrical fitout works, at least seven days prior to the commencement of works.
Site inductions	All employees, contractors and subcontractors would receive an environmental induction.
Behavioural practices	No swearing or unnecessary shouting or loud stereos/radios on site. No dropping of materials from height, throwing of metal items and slamming of doors. No excessive revving of plant and vehicle engines.
Source controls	
Construction hours and scheduling	Where feasible and reasonable, construction would be carried out during the standard daytime working hours. Work generating high noise levels would be scheduled during less sensitive time periods as far as practicable. This would include the use of demolition saws, coring machines, grinders, impact drills and jackhammers.
Equipment selection	Quieter construction methods should be used where feasible and reasonable (e.g. rubber wheeled instead of steel tracked plant). Equipment would be regularly inspected and maintained to ensure it is in good working order.
Maximum noise levels	The noise levels of plant and equipment would have operating sound power or sound pressure levels that would meet the predicted noise levels.

Action required	Safeguard details
Rental plant and equipment	Noise emissions would be considered as part of the selection process.
Use and siting of plant	The offset distance between noisy plant and adjacent sensitive receivers would be maximised. Plant used intermittently would be throttled down or shut down. Plant and vehicles would be turned off when not in use. Noise-emitting plant would be directed away from sensitive receivers where reasonable and feasible.
Plan work site and activities to minimise noise	Traffic flow, parking and loading/unloading areas would be planned to minimise reversing movements within the site. Truck drivers would be advised of designated vehicle routes, parking locations, acceptable delivery hours or other relevant practices (i.e. minimising the use of engine brakes, and no extended periods of engine idling).
Non-tonal reversing alarms	Non-tonal reversing beepers (or an equivalent mechanism) would be fitted and used on all construction vehicles and mobile plant regularly used on site and for any out-of-hours work.
Minimise disturbance arising from delivery of goods to construction sites	Loading and unloading of materials/deliveries would occur as far as possible from sensitive receivers. Dedicated loading/unloading areas would be shielded if close to sensitive receivers. Delivery vehicles would be fitted with straps rather than chains for unloading, wherever possible.
Silencers on mobile plant	Where possible, noise from mobile plant would be reduced through additional fittings including: - residential grade mufflers - silencing air parking brake engagement.
Construction related traffic	Vehicle movements would be routed away from sensitive receivers and scheduled during less sensitive times where possible. The speed of vehicles would be limited and the use of engine compression brakes would be minimised. On-site storage capacity would be maximised to reduce the need for truck movements during sensitive times.
Path controls	
Shield stationary noise sources such as pumps, compressors, fans etc.	Stationary noise sources would be enclosed or shielded to the greatest extent possible whilst ensuring that the occupational health and safety of workers is maintained.
Shield sensitive receivers from noisy activities	Structures to shield residential receivers from noise such as site shed placement; earth bunds; fencing.

7.1.2 Noise monitoring plan

7.1.2.1 Location

To verify compliance, attended measurements are recommended to be undertaken at the commencement of Project operation. In addition, attended measurements should be made in response to any complaints.

7.1.2.2 Procedure

The attended measurements will be conducted in accordance with the procedures outlined in Australian Standard AS 1055 *Acoustics – Description and measurement of environmental noise* and in accordance with methods outlined in the NSW *Noise Policy for Industry*. The following points should be followed when conducting noise monitoring:

- a field calibration should be conducted before and after measurements
- the sound level meters must be set to an A-weighting and Fast
- the sound level meters sample period should be set to 15 minutes
- the following descriptors should be measured as a minimum: L_{A1} , L_{Aeq} and L_{A90} , and
- measurements should be conducted a minimum of 3 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.

7.1.2.3 Equipment

All acoustic instrumentation employed throughout the monitoring programme will comply with the requirements of AS IEC 61672.1-2004 *Electroacoustics - Sound level meters - Specifications*. All sound level meters must have current calibration certificate from a NATA accredited laboratory in accordance with NATA guidelines. Instrument calibration shall be checked before and after each measurement survey, with the variation in calibrated levels not exceeding ± 0.5 dB.

7.1.2.4 Reporting

The following information must be included in the monitoring report:

- Field calibration results (before and after measurements)
- Measurement times and dates
- Qualitative description of the noise environment during the measurements
- L_{A1} , L_{Aeq} and L_{A90} levels
- Meteorological conditions during the measurements. and
- Estimation of or recorded noise contribution from any other major noise sources.

7.1.2.5 Record keeping

A system of records which provides full documentation of all noise monitoring results, complaint handling and responses to non-compliances should be maintained.

7.1.3 Community consultation and complaints handling

Residents and sensitive receivers impacted by noise levels from the Project during construction activities, should be notified prior to the commencement.

The information provided to the residents would include:

- programmed times and locations of construction work
- the hours of proposed work
- construction noise and vibration impact predictions
- construction noise and vibration mitigation measures being implemented on site.

Community consultation regarding construction noise and vibration would be detailed in a Community and Stakeholder Engagement Plan for the construction of the Project and would include a 24-hour hotline and complaints management process.

8.0 Conclusion

A construction and operational Noise Impact Assessment has been completed for the proposed Steel River East battery energy storage system (BESS) (the Project).

Nearby noise sensitive receivers were identified. Attended and unattended noise measurements were completed to characterise the existing noise environment. The measured noise levels were used to establish operational project noise trigger levels and construction noise management levels in accordance with the *Noise Policy for Industry and Interim Construction Noise Guideline* respectively.

Construction noise impacts were assessed at nearby representative residential and other noise sensitive receivers. Predicted construction noise levels were below the applicable noise management levels for all receivers. The use of vibration intensive equipment is not proposed and was not assessed.

An Environmental Management Plan (EMP) should be developed for the Project and implemented prior to commencement of construction activities. The EMP would include a Construction Noise Management Plan (CNMP) which would include all feasible and reasonable safeguards to manage the noise emissions from the site and any complaints which may occur due to construction noise. Implementation of mitigation measures described would aim to minimise and manage noise impacts where possible.

Significant operational noise sources for the Project include batteries, inverters and transformers. Operational noise from the site was modelled and compared against established project noise trigger levels. This showed that the operation of the BESS complies with the established project noise trigger levels at all noise sensitive receivers, and commercial/industrial receivers.

The impact of both construction and operational traffic noise generated by the Project is considered acceptable according to the NSW EPA's *Road Noise Policy*.

Appendix A

Unattended Noise Monitoring Results

Noise Logger Report

Industrial Drive, Mayfield West

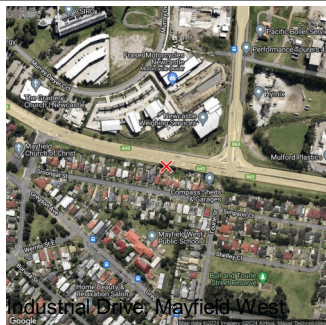


Item	Information
Logger Type	NL-52
Serial number	1043455
Address	Industrial Drive, Mayfield West
Location	Industrial Drive, Mayfield West
Facade / Free Field	Free Field
Environment	Traffic noise on Industrial Drive, 65-78 dB. Police car passby with sirens on, 87 dB. Cars accelerating on Industrial Drive, 70-75 dB.

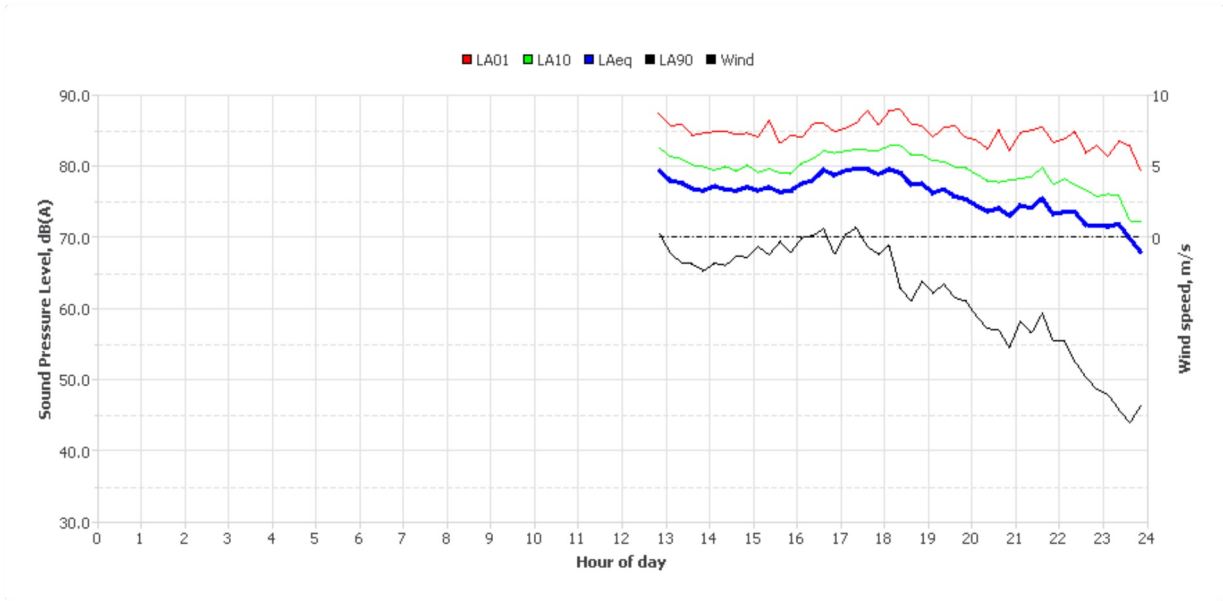
Measured noise levels

Logging Date	L _{Aeq,day} 7am-6pm	L _{Aeq,evening} 6pm-10pm	L _{Aeq,night} 10pm-7am	ABL Day 7am-6pm	ABL Eve 6pm-10pm	ABL Night 10pm-7am	L _{Aeq,15hr} 7am-10pm	L _{Aeq,9hr} 10pm-7am
Thu Apr 4 2024	78	76	72	-	55	-	77	72
Fri Apr 5 2024	79	76	73	66	60	45	78	73
Sat Apr 6 2024	73	73	71	57	53	49	73	71
Sun Apr 7 2024	72	70	67	-	49	43	71	67
Mon Apr 8 2024	75	72	69	-	52	42	74	69
Tue Apr 9 2024	75	-	69	-	-	-	75	69
Wed Apr 10 2024	-	72	69	-	51	-	72	69
Thu Apr 11 2024	75	71	70	-	-	-	74	70
Fri Apr 12 2024	75	72	70	-	54	39	75	70
Sat Apr 13 2024	73	71	68	55	53	47	73	68
Sun Apr 14 2024	72	70	67	53	52	46	72	67
Mon Apr 15 2024	76	73	69	-	53	46	75	69
Tue Apr 16 2024	76	73	70	-	51	45	75	70
Wed Apr 17 2024	76	73	70	63	53	44	75	70
Thu Apr 18 2024	76	73	70	-	-	47	75	70
Fri Apr 19 2024	76	-	70	-	-	-	76	70
Sat Apr 20 2024	74	-	70	-	-	-	74	70
Sun Apr 21 2024	73	69	68	-	-	-	73	68
Mon Apr 22 2024	76	73	69	-	55	46	74	69
Tue Apr 23 2024	76	70	69	-	-	46	76	69
Wed Apr 24 2024	76	-	68	-	-	-	76	68
Summary	75	73	70	57	53	46	75	70

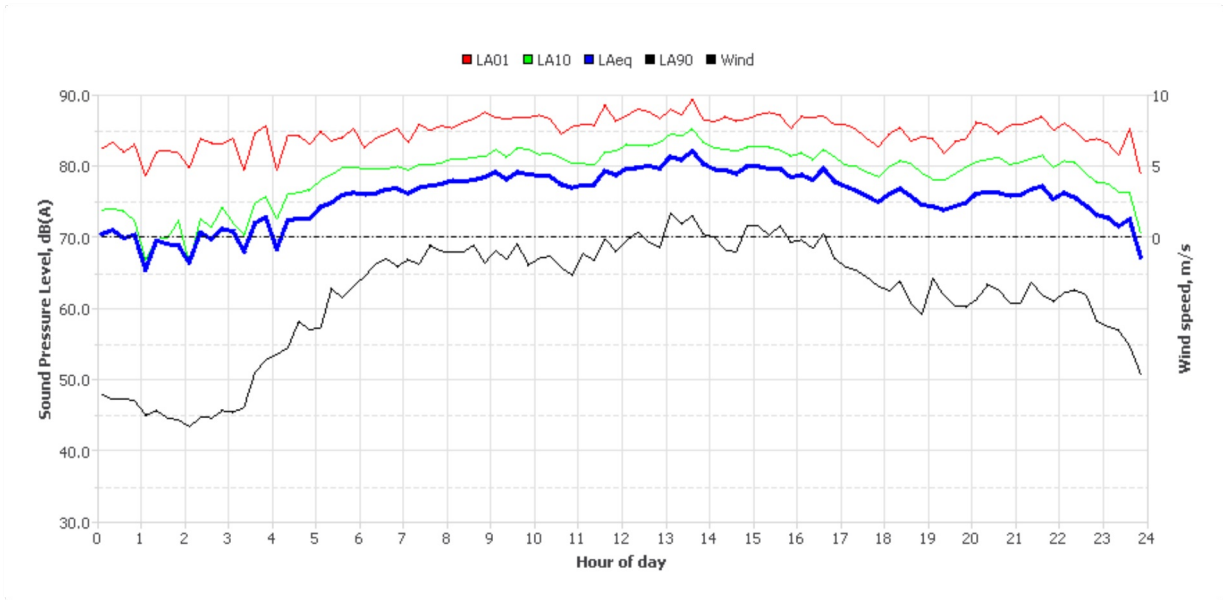
Note: Results denoted with '-' do not contain enough valid data for a value to be calculated. The data has been excluded either manually or automatically as a result of adverse weather conditions.

Logger Location	Logger Deployment Photo
	

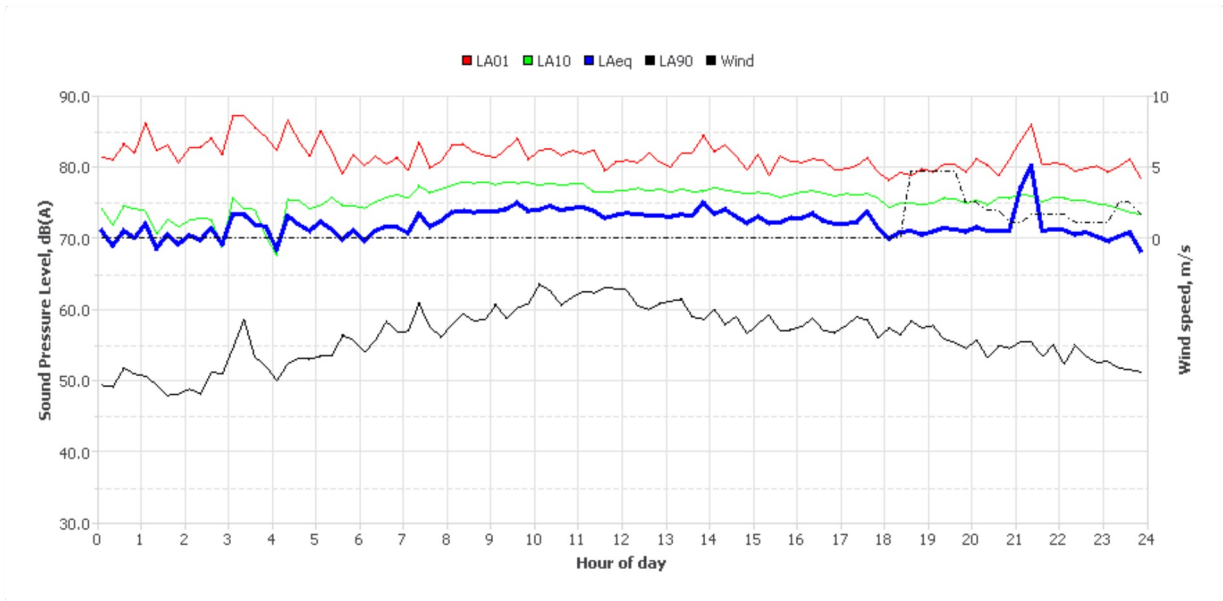
Thursday, 04 Apr 2024



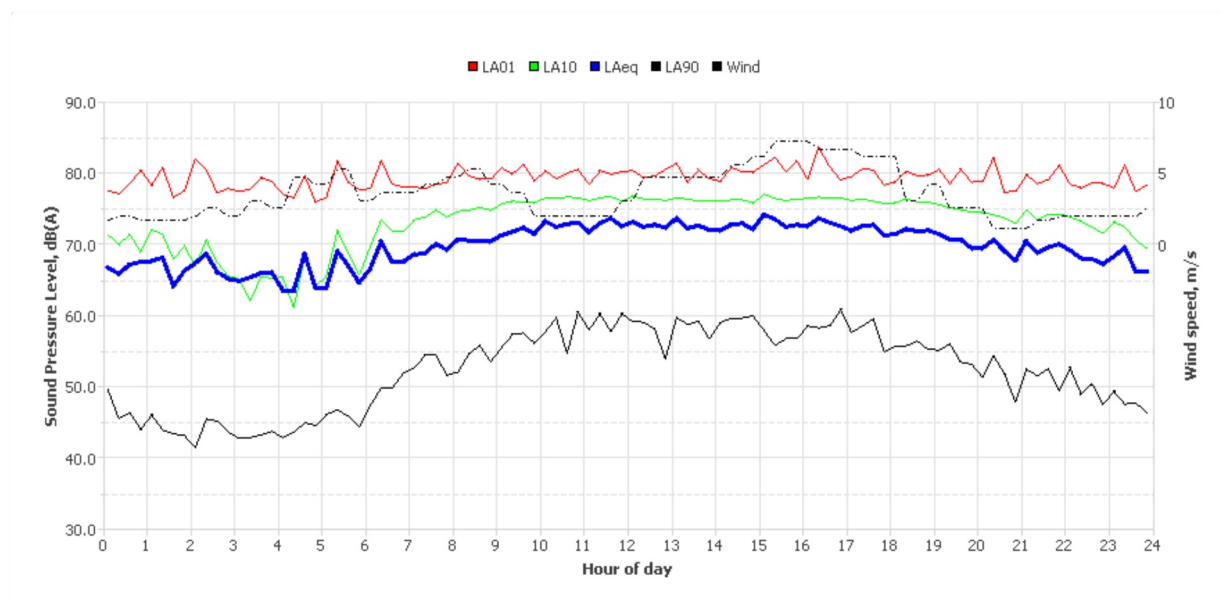
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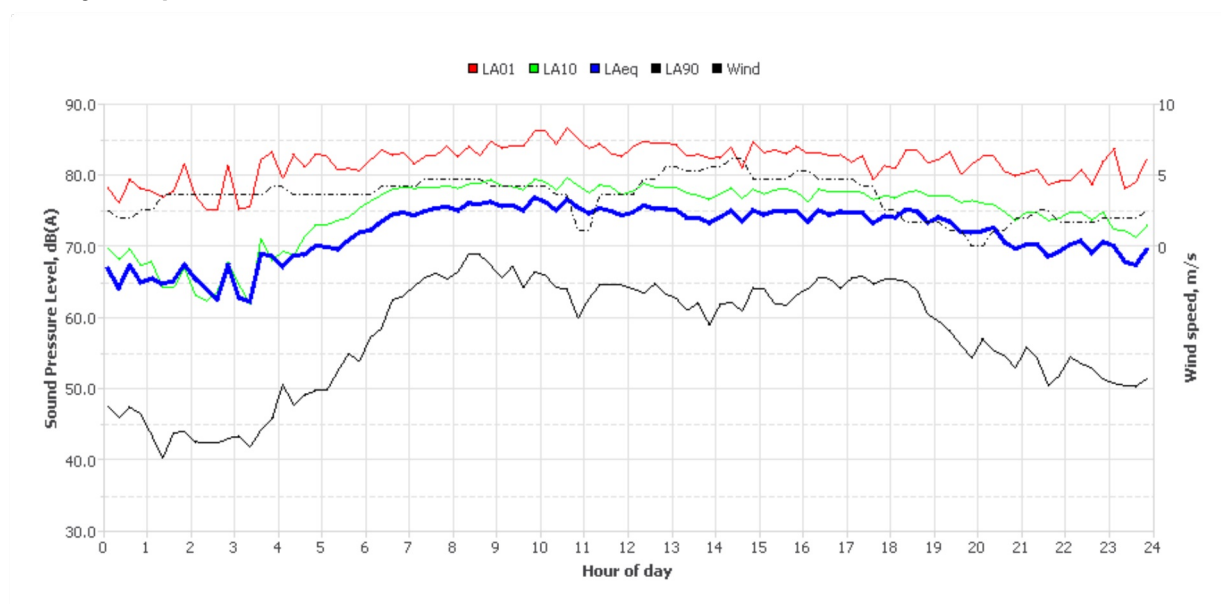
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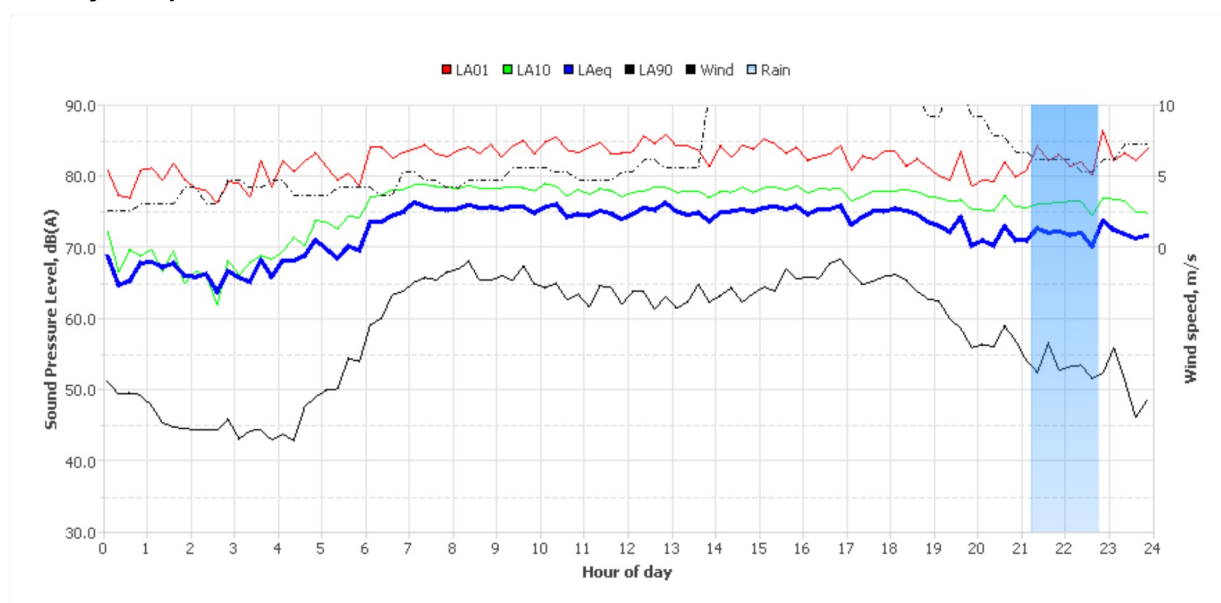
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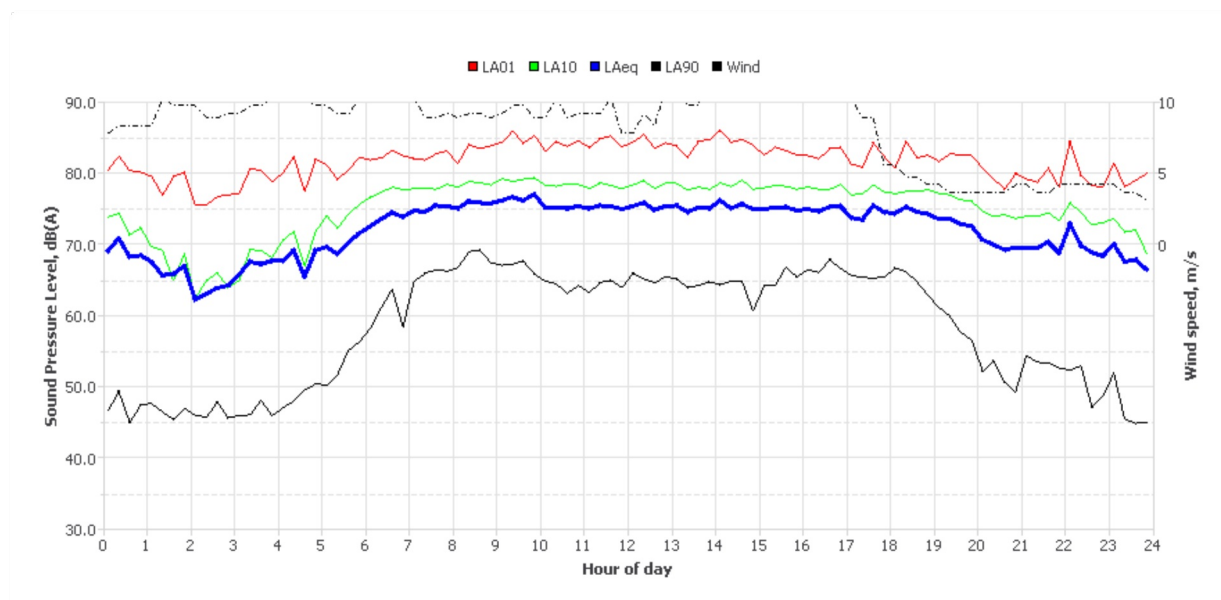
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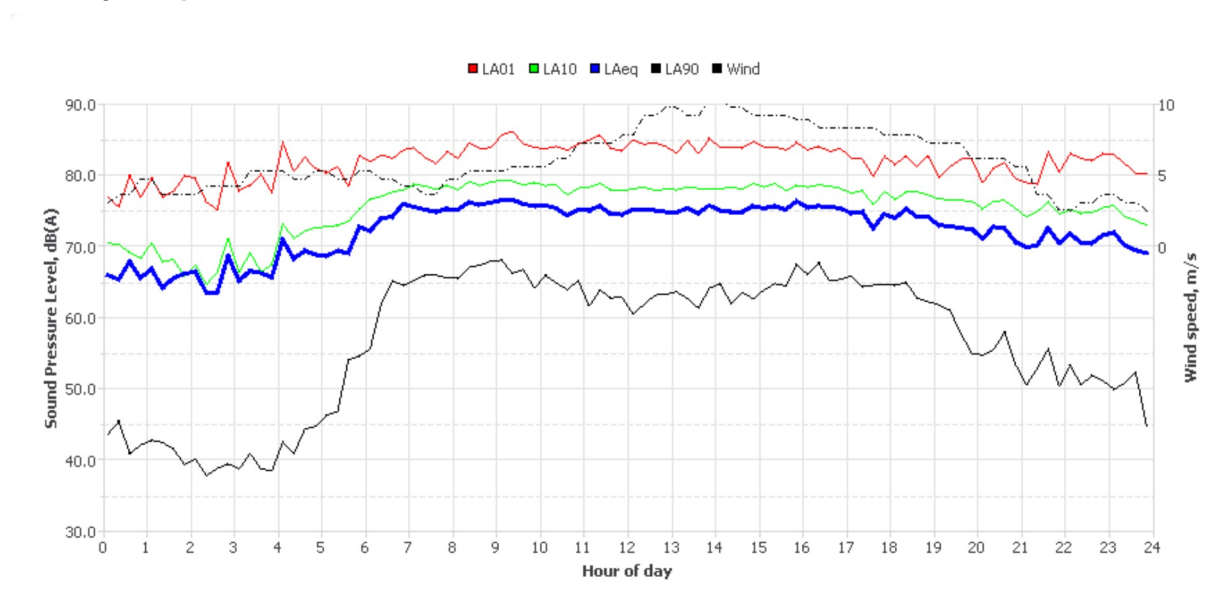
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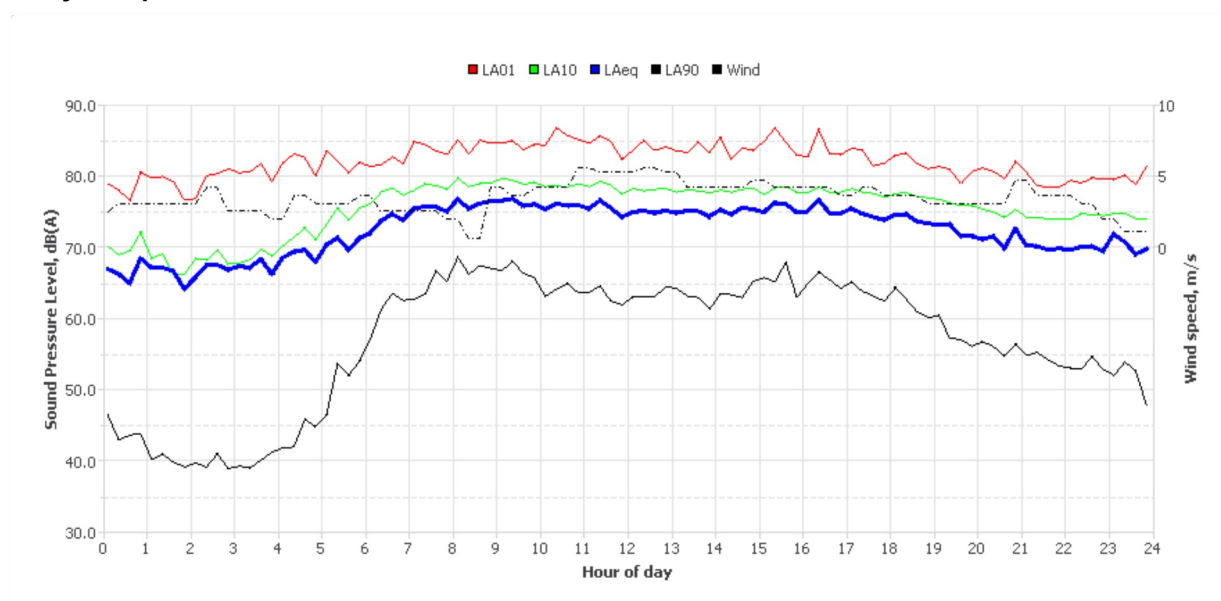
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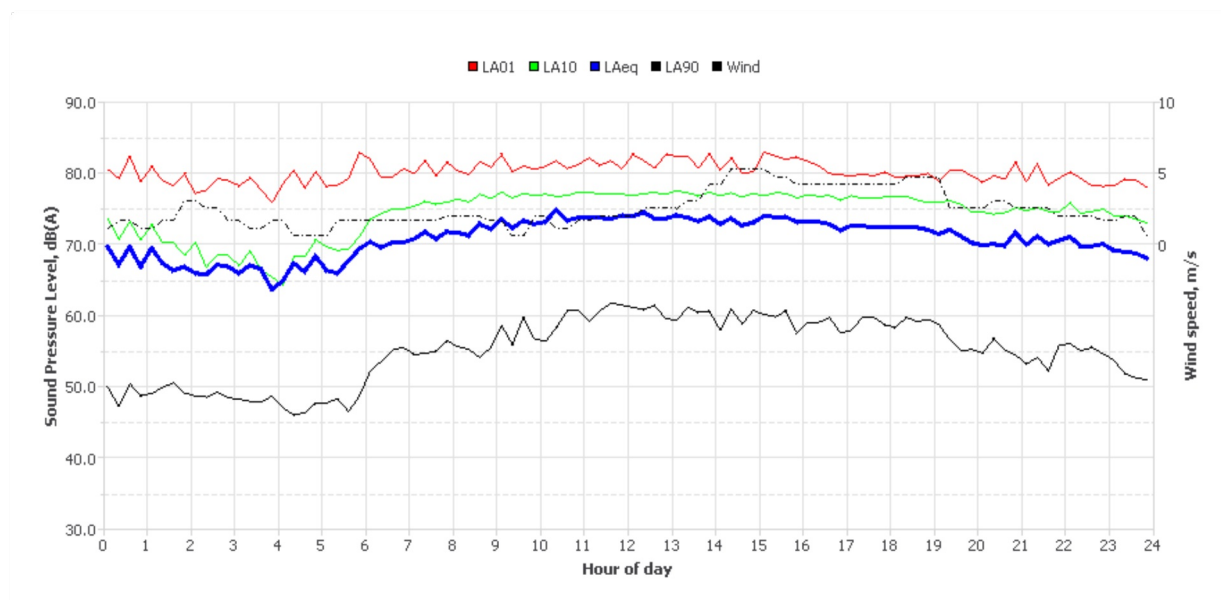
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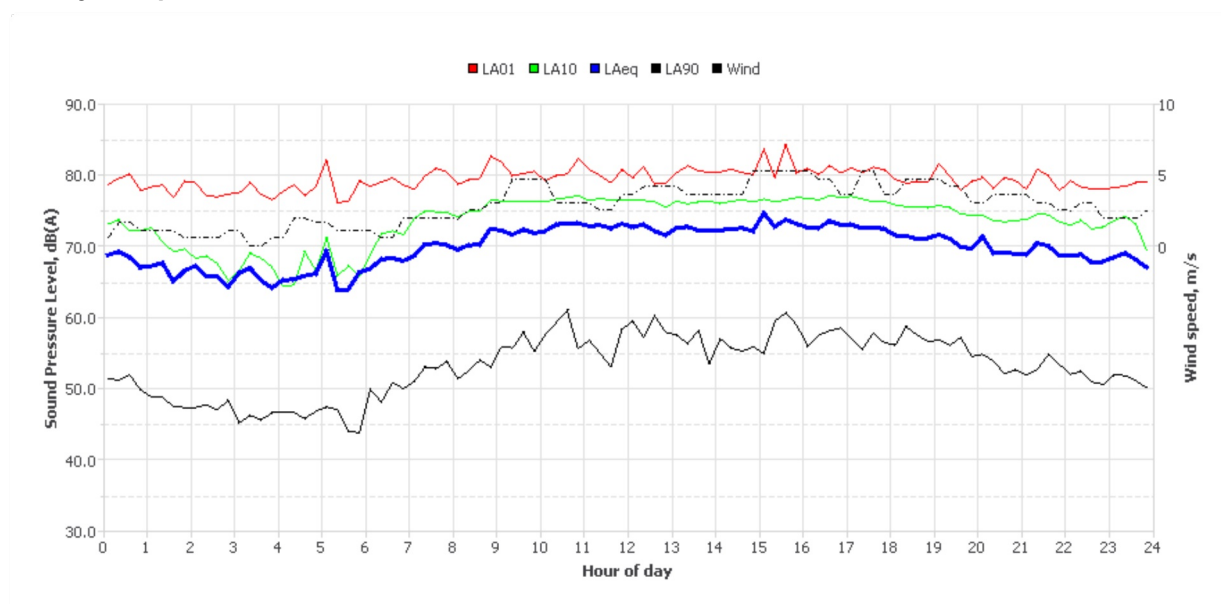
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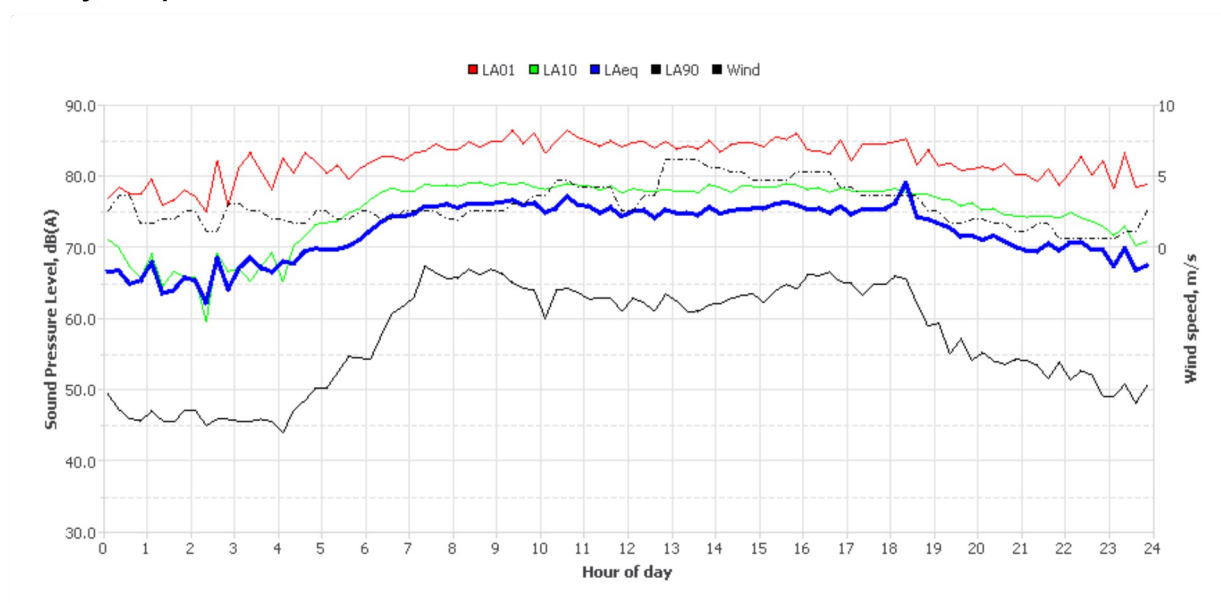
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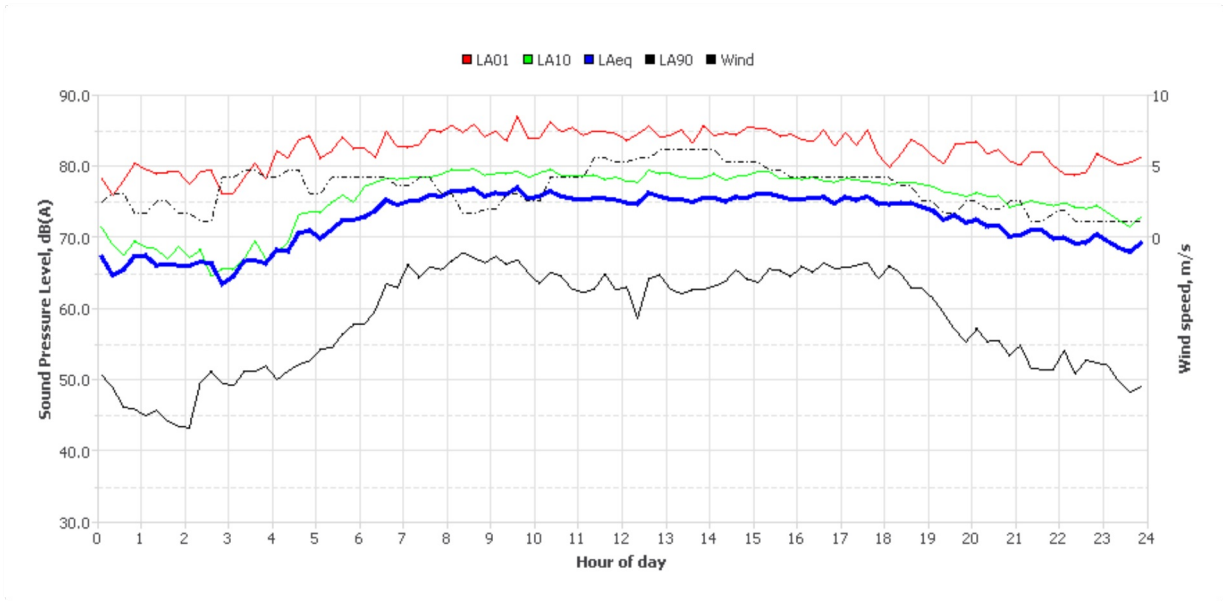
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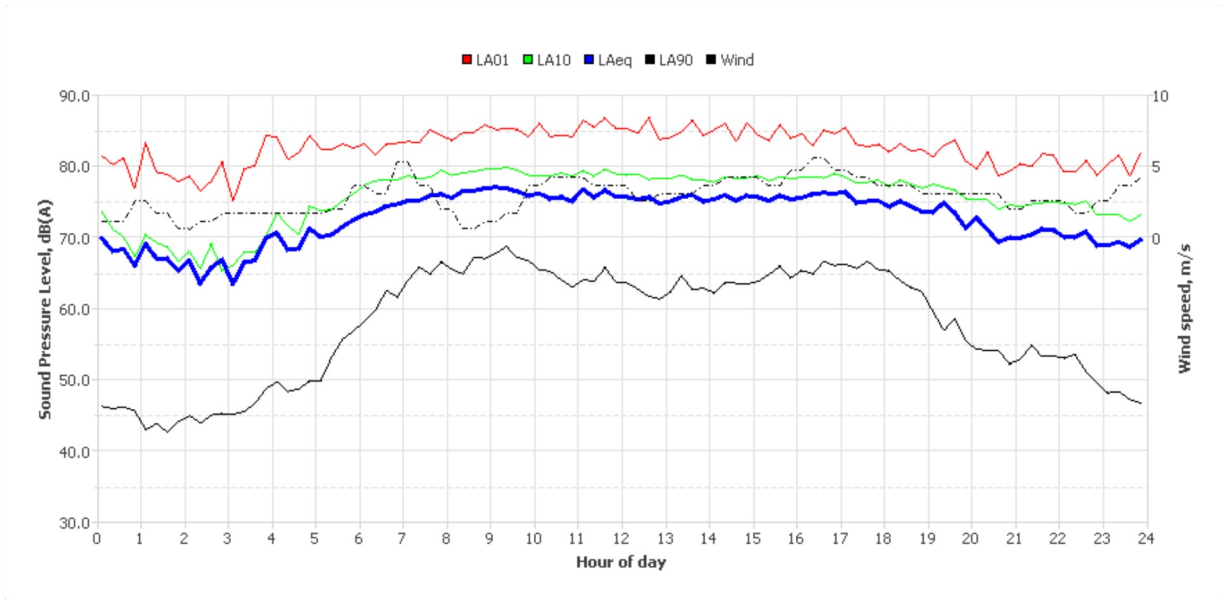
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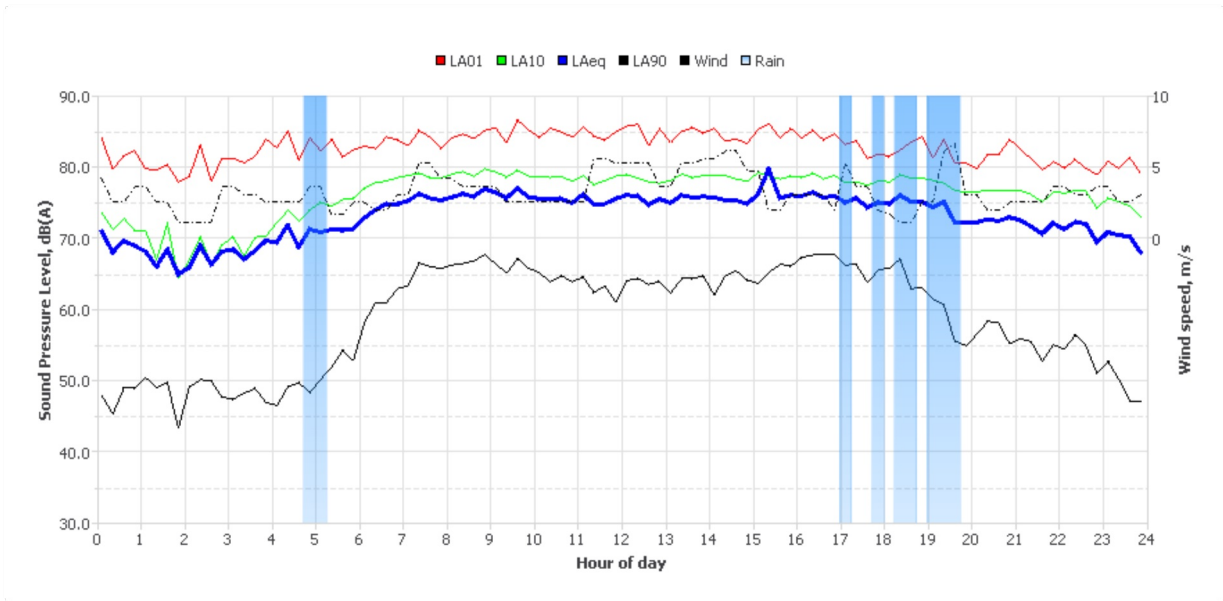
Tuesday, 16 Apr 2024



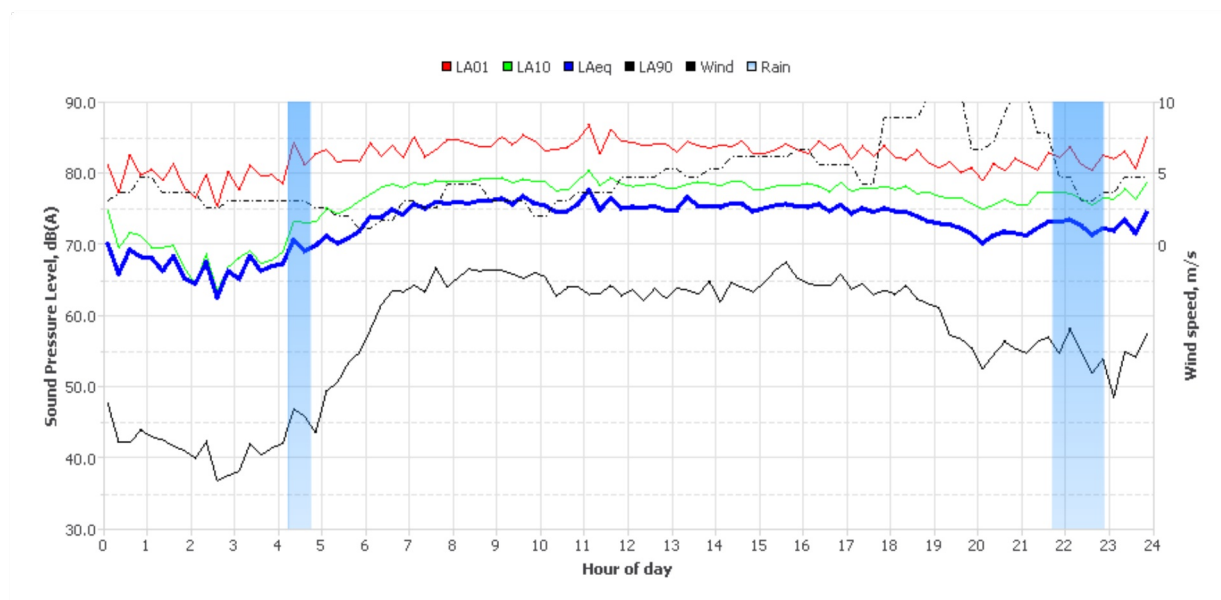
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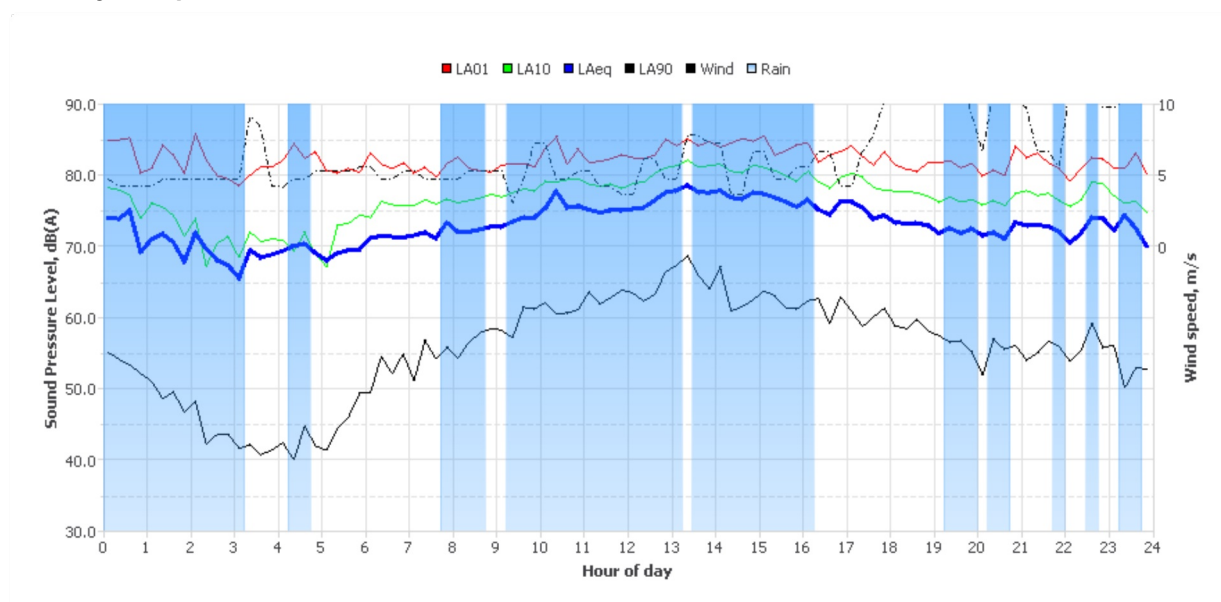
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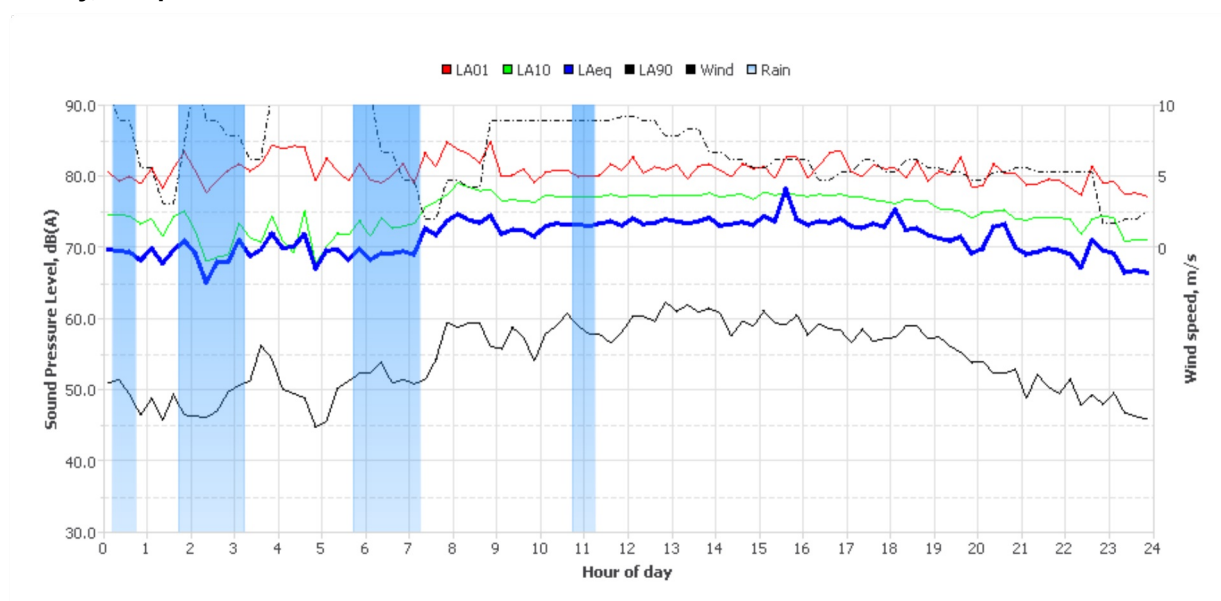
Friday, 19 Apr 2024



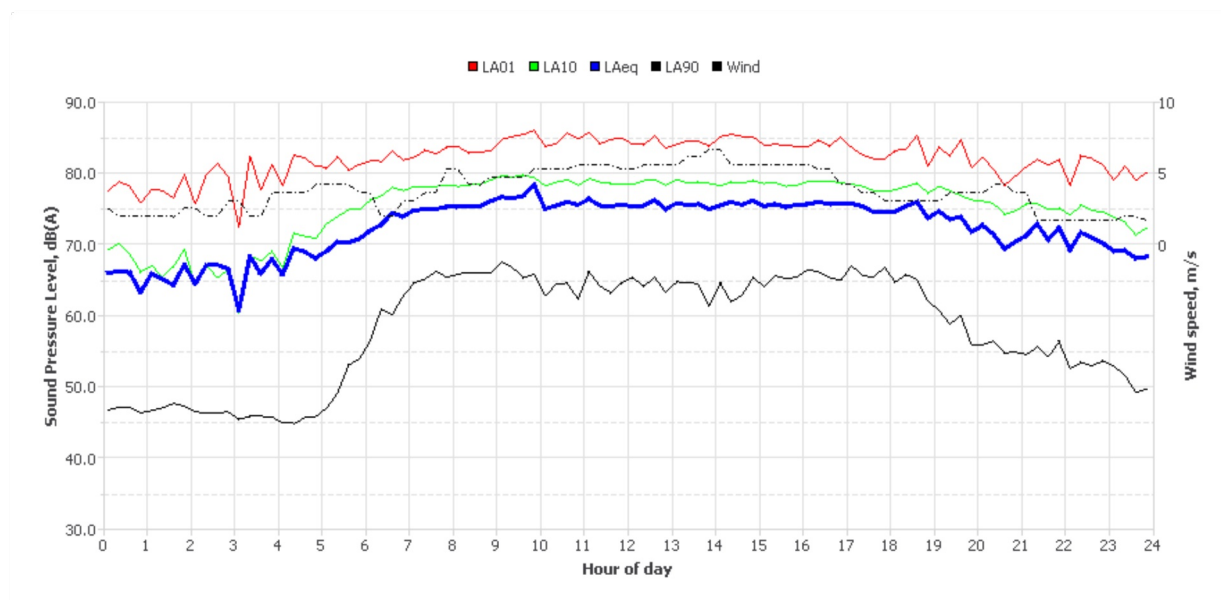
Saturday, 20 Apr 2024



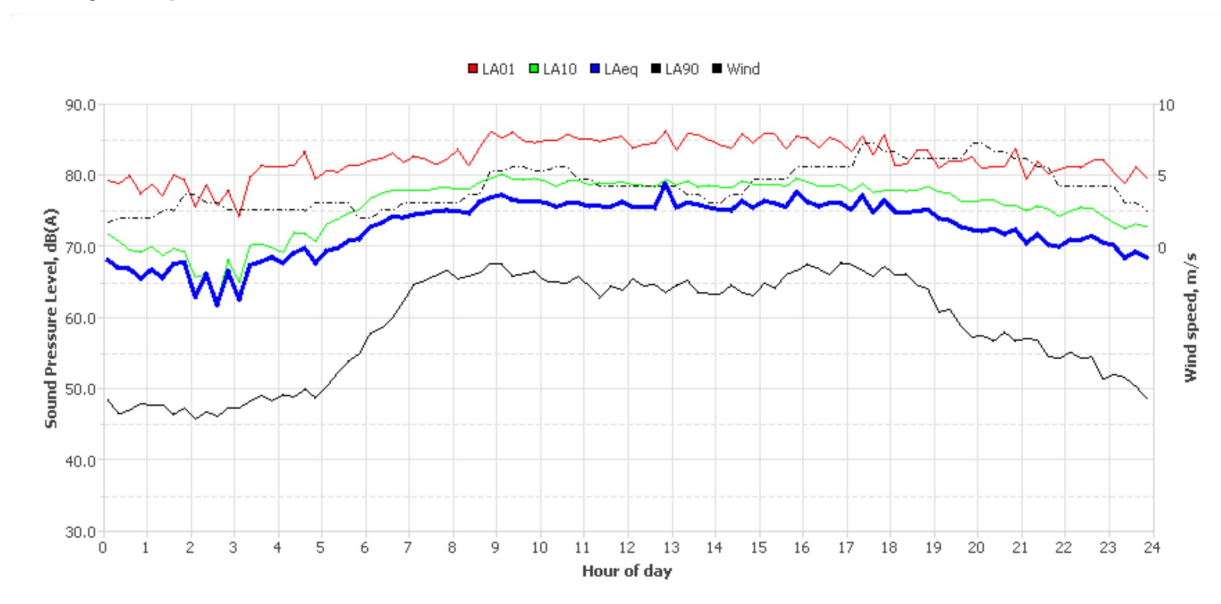
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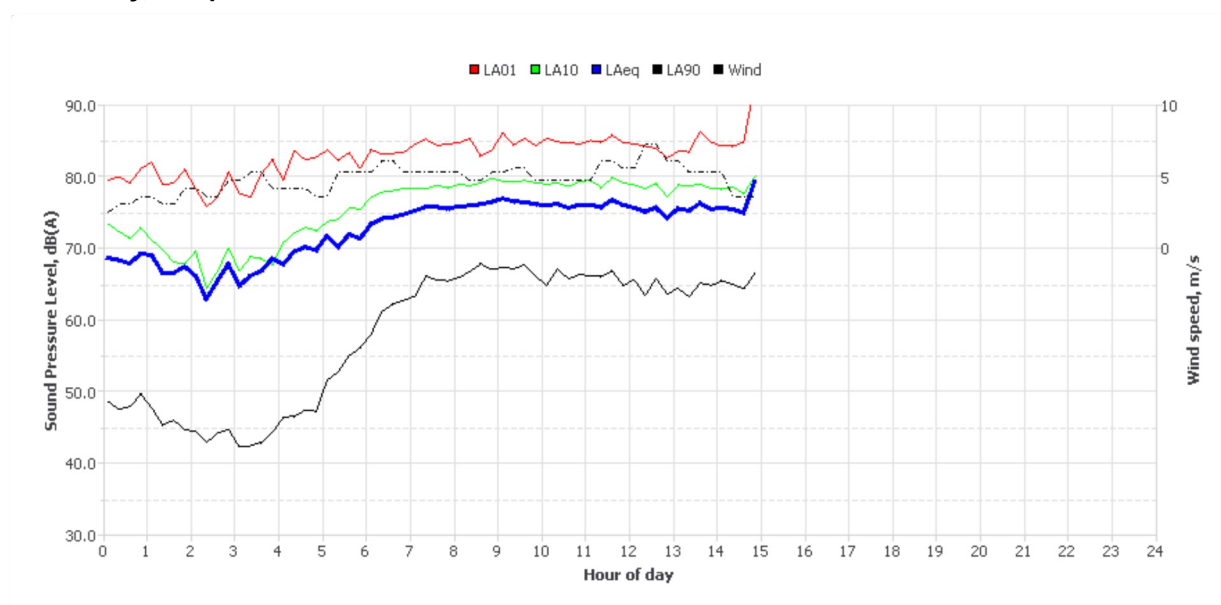
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Tuesday, 23 Apr 2024

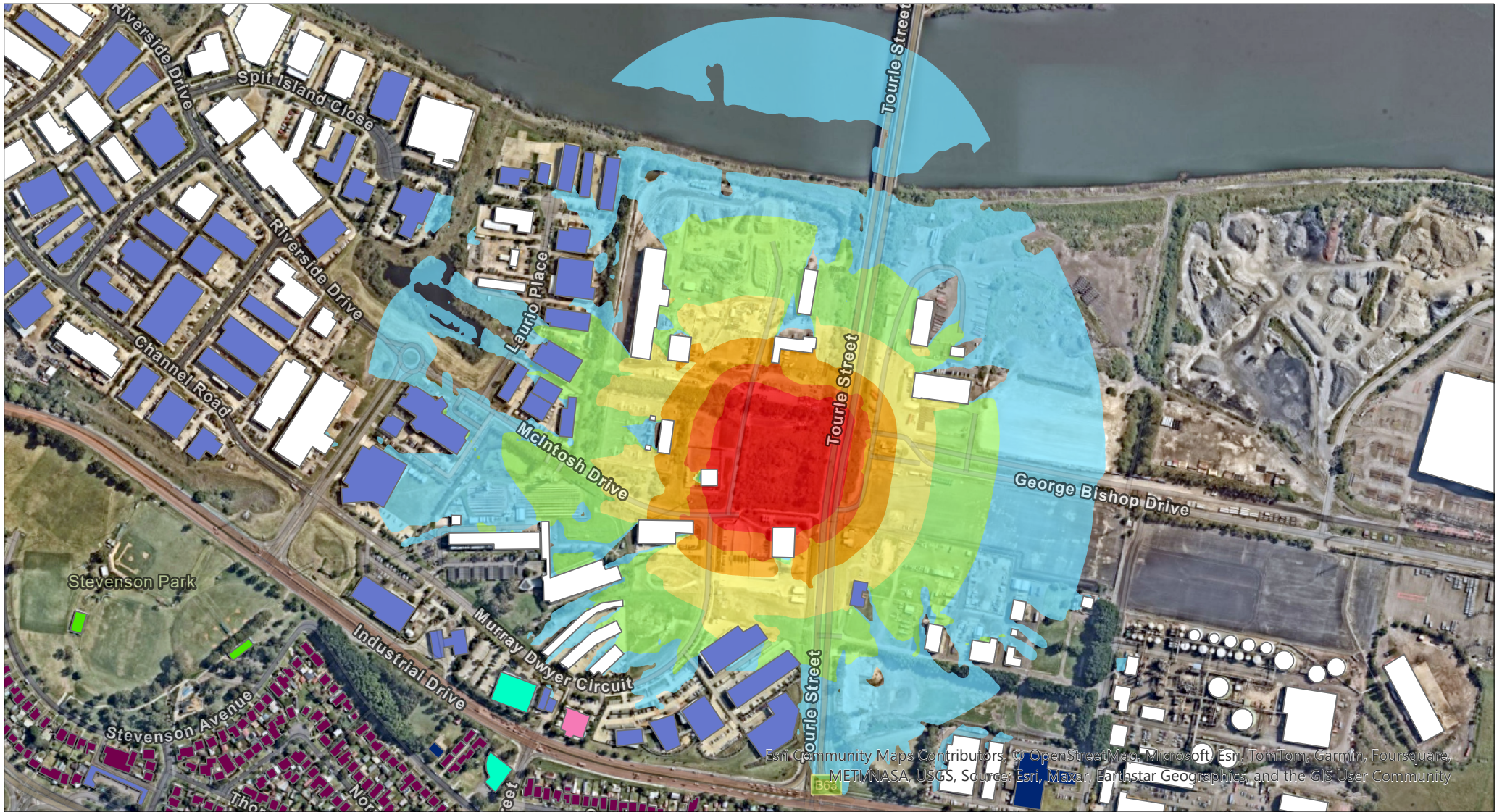


Wednesday, 24 Apr 2024



Appendix B

Construction Noise Contour Maps



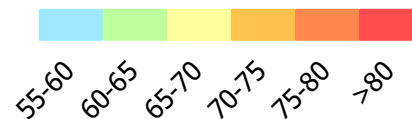
Steel River East BESS - Construction Noise Contours Scenario 1 - Site Establishment

Building Usage

- Residential
- Child Care Centre
- Place of Worship

- Active Recreation
- Commercial
- Community
- Industrial

Predicted Noise Level $L_{Aeq,15min}$ dB(A)



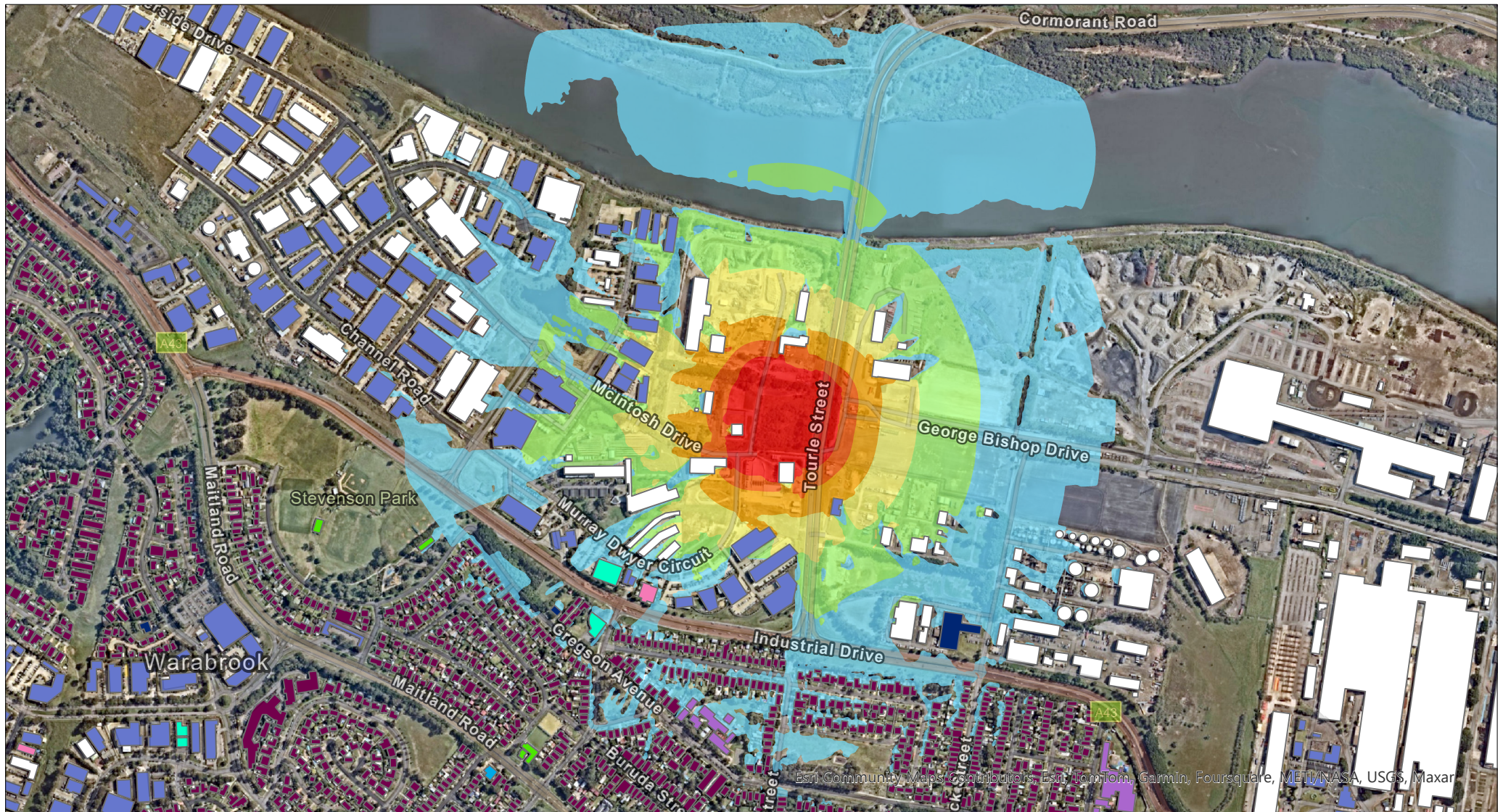
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Source: Nearmap 2024.



Steel River East BESS - Construction Noise Contours Scenario 2 - Civil Works

Building Usage

- Residential
- Education
- Child Care Centre
- Place of Worship

- Active Recreation
- Medical
- Commercial
- Community
- Industrial

Predicted Noise Level $L_{Aeq,15min}$ dB(A)



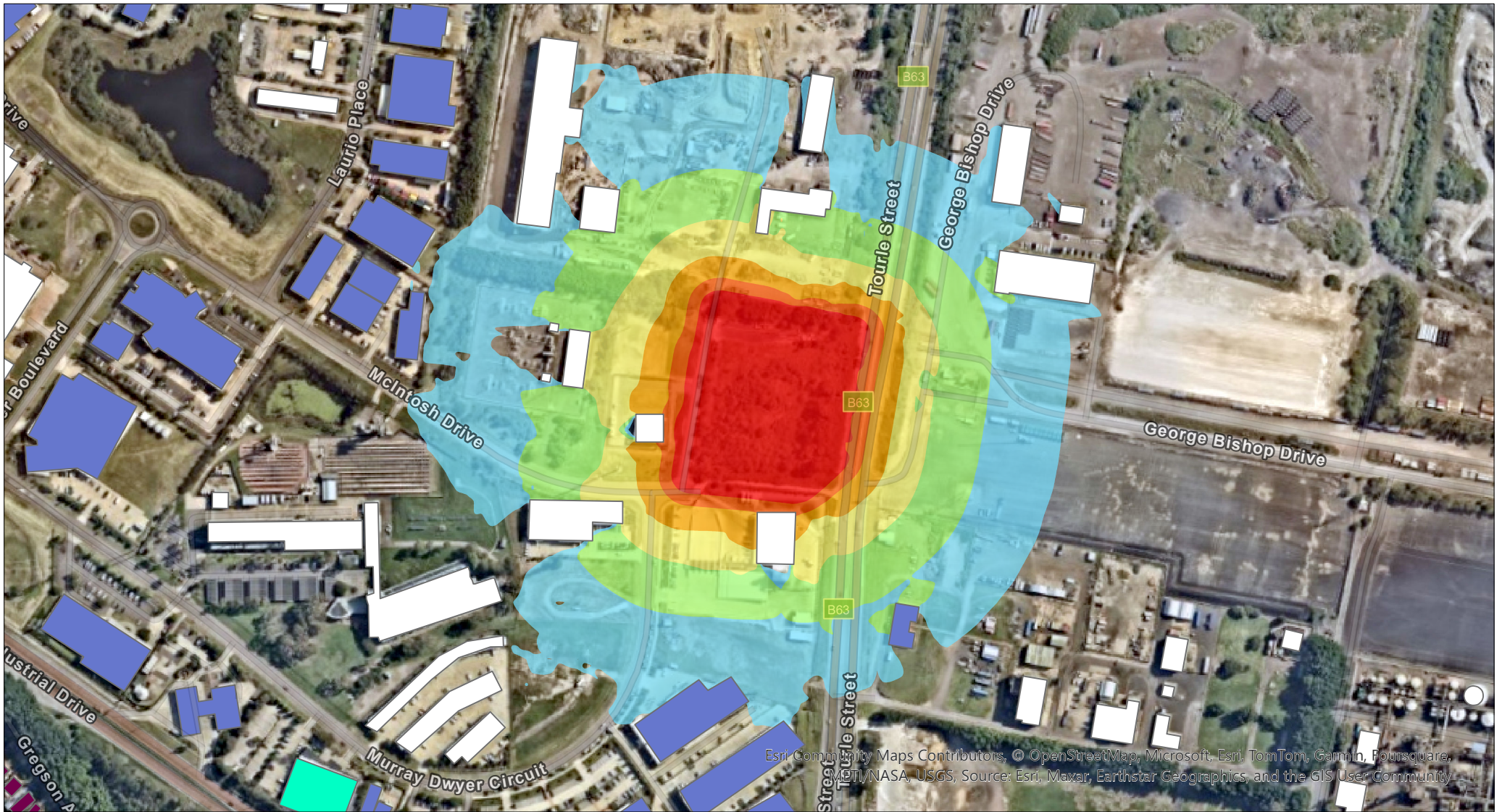
AECOM

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Source: Nearmap 2024.

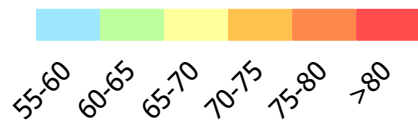


Steel River East BESS - Construction Noise Contours Scenario 3 - Landscaping

Building Usage

- Residential
- Place of Worship
- Commercial
- Industrial

Predicted Noise Level $L_{Aeq,15min}$ dB(A)



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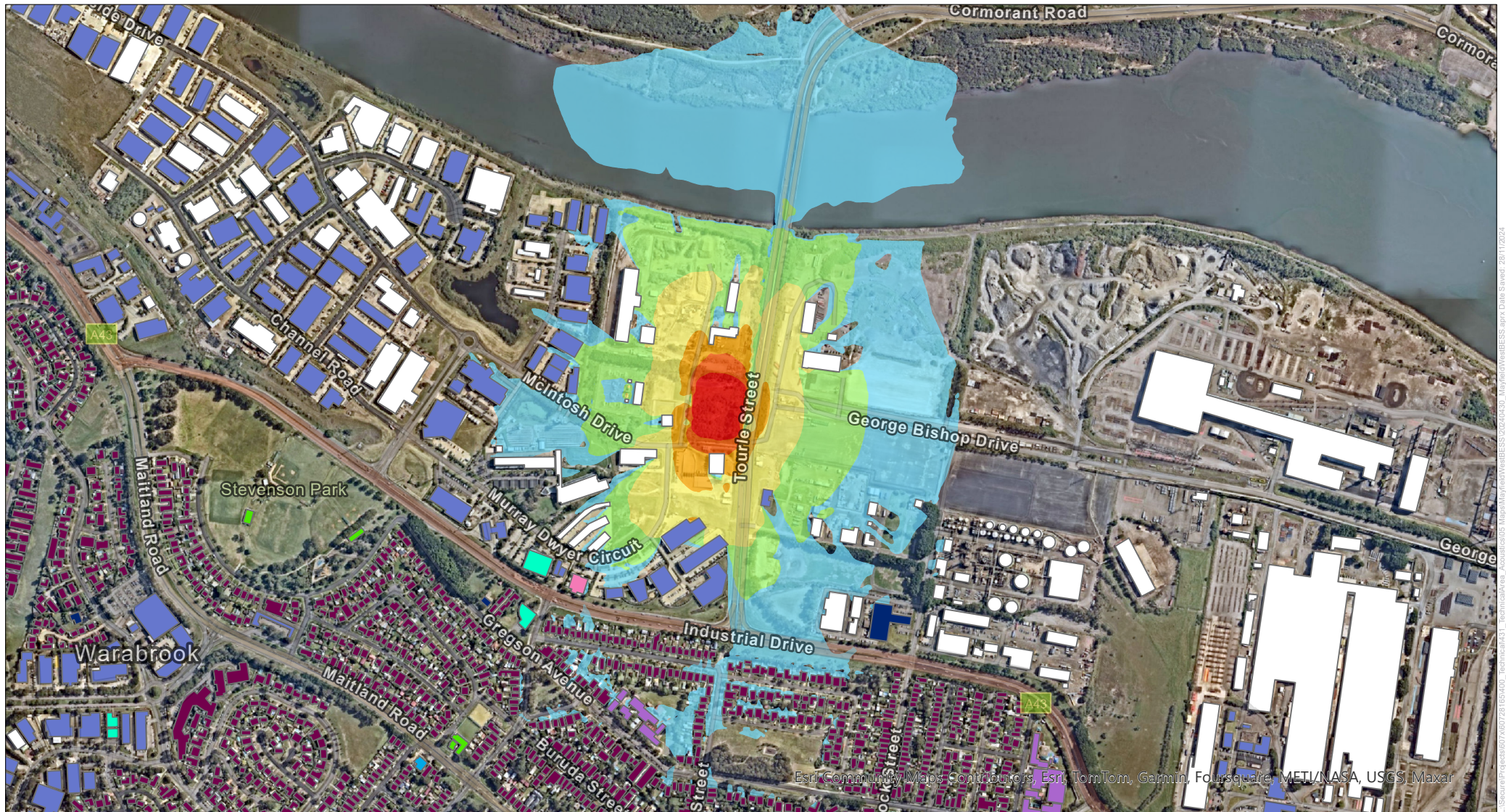
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Source: Nearmap 2024.

Appendix C

Operational Noise Contour Maps



Steel River East BESS, 1 McIntosh Drive Operational Contours (Day) - 2h 9-fan Configuration, 100% Duty Cycle

Building Usage

- Residential
- Education
- Child Care Centre
- Place of Worship

- Active Recreation
- Medical
- Commercial
- Community
- Industrial

Predicted Noise Level $L_{Aeq,15min}$ dB(A)



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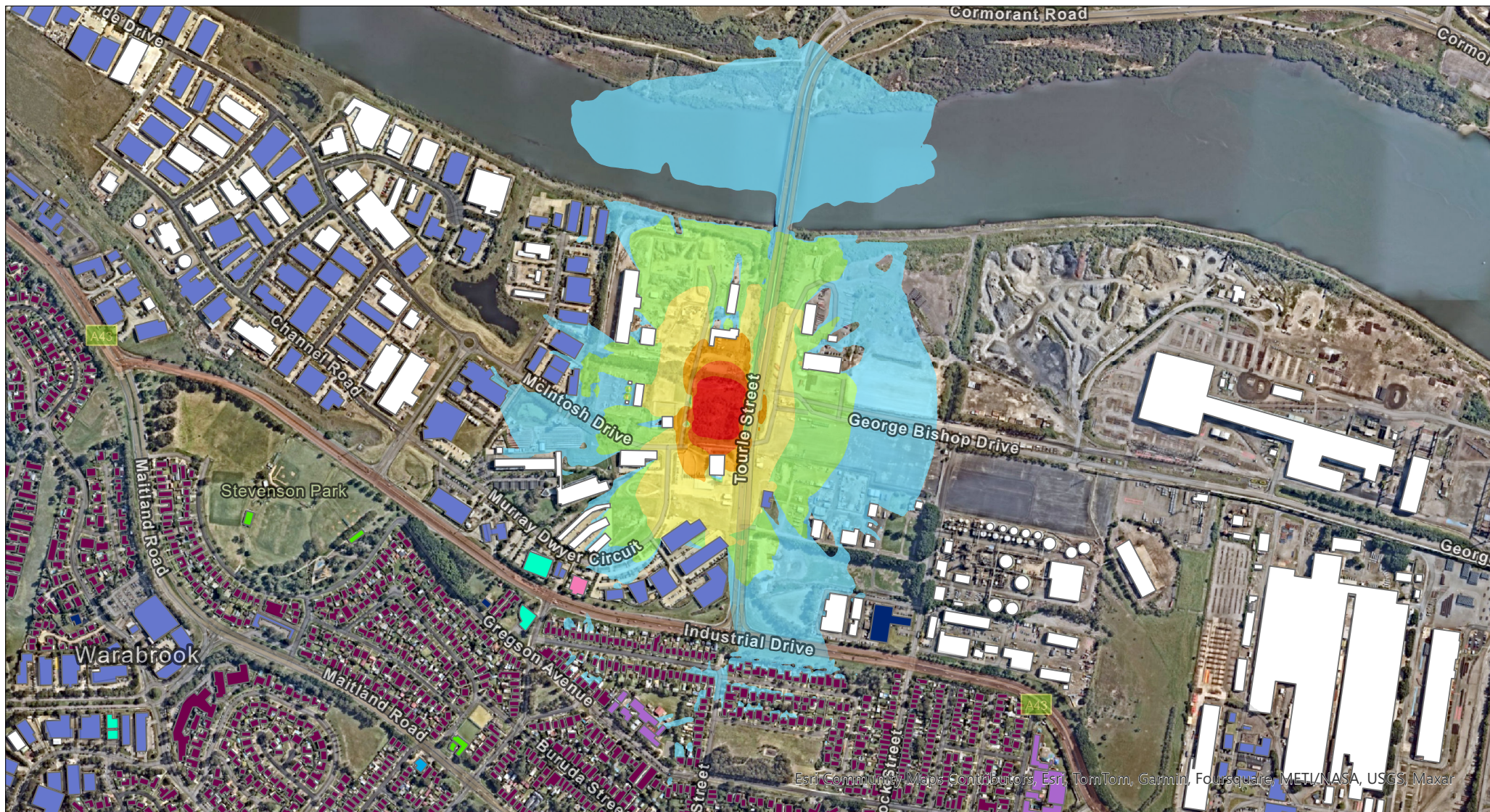
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Source: Nearmap 2024

Note: Contours have been calculated under adverse weather conditions and include a +5dB(A) tonality correction.



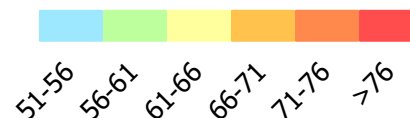
Steel River East BESS, 1 McIntosh Drive Operational Contours (Night) - 2h 9-fan Configuration, 100% Duty Cycle

Building Usage

- Residential
- Education
- Child Care Centre
- Place of Worship

- Active Recreation
- Medical
- Commercial
- Community
- Industrial

Predicted Noise Level $L_{Aeq,15min}$ dB(A)



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Source: Nearmap 2024

Note: Contours have been calculated under adverse weather conditions and include a +5dB(A) tonality correction.